

2022/23

# ANNUAL REPORT

*Agricultural Research Council*



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# PART A:

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# GENERAL INFORMATION

## 1. GENERAL INFORMATION

REGISTERED NAME:	Agricultural Research Council
REGISTRATION NUMBER:	Agricultural Research Act 86 of 1990 (as amended)
PHYSICAL ADDRESS:	1134 Park Street, Hatfield, Pretoria, 0083
POSTAL ADDRESS:	PO Box 8783, Pretoria, 0001
TELEPHONE NUMBER:	+27 12 427 9700
FAX NUMBER:	+27 12 430 5814
EMAIL ADDRESS:	<a href="mailto:enquiry@arc.agric.za">enquiry@arc.agric.za</a>
WEBSITE ADDRESS:	<a href="http://www.arc.agric.za">www.arc.agric.za</a>
EXTERNAL AUDITORS:	Auditor General of South Africa
BANKERS:	Standard Bank
COMPANY SECRETARY:	Ms. Tshililo Mabirimisa (Acting)

## 2. LIST OF ACRONYMS

4IR	Fourth Industrial Revolution	DFFE	Department of Forestry, Fisheries and the Environment
A&R	Audit and Risk	DIRCO	Department of International Relations and Cooperation
AAMP	Agriculture and Agro-processing Master Plan	DIVAGRI	Revenue Diversification in Africa through bio-based and circular Agricultural Innovations
AATF	African Agricultural Technology Foundation	DLDD	Desertification, Land Degradation and Drought
ADEWS	Agricultural Drought Early Warning System	DNA	Deoxyribonucleic Acid
AFOHNet	Africa One Health Network	DPME	Department of Planning, Monitoring and Evaluation
Africa CDC	Africa Centres for Disease Control and Prevention	DS	Diagnostic Services
Af-RSME	Africa-Regional Subject Matter Expert	DSI	Department of Science and Innovation
AGP	Antibiotic growth promoters	DT	Duration Determinate
AGRF	Africa's Food Systems Forum	DTIC	Department of Trade Industry and Competition
AgriSETA	Agricultural Sector Education Training Authority	DTRA US	Defence Threat Reduction Agency
AGSA	Auditor General of South Africa	EE	Employment Equity
AHT	Animal Health Technician	EMC	Executive Management Committee
AP	Animal Production	EPs	Extension Practitioners
APP	Annual Performance Plan	EPV	Epidemiology Vectors and Parasites
ARC	Agricultural Research Council	EU	European Union
ASLM	African Society for Laboratory Medicine	EVMS	Electronic Visitor Management System
ASBVd	Avocado Sunblotch Viroid	FAMWES	Fall Army Worm Monitoring and Early
AU MS	African Union Member States	FAO	Food and Agricultural Organisation
BARP	BRICS Agricultural research Platform	FAW	Fall Army Worm
B-BBEE	Broad-Based Black Economic Empowerment	FBIB	Foundational Biodiversity Information Programme
BBSA	Biodiversity Biobanks of South Africa	FCM	False Codling Moth
BG	Boer Goat	FHB	Fusarium Head Blight
BSU	Biological Service Unit	FMD	Foot-and-mouth Disease
BtMV	Beet Mosaic Virus	FMDV	FMD virus
BTP	Biotechnology Platform	FPAR	Fraction of Photosynthetically Active Radiation
BUAN	University of Agriculture and Natural Resources	FRAC	Fungicide Resistance Action Committee
CBD	Cannabidiol	FS	Financial Statements
CCARDESA	Centre For Coordination of Agricultural Research and Development for Southern Africa	FTB	Fig Tree Borer
CEC	Contaminants of Emerging Concern	GC	Grain Crops
CEO	Chief Executive Officer	GDP	Gross Domestic Product
CERMC	Corporate Enterprise Risk Management Committee	GMO	Genetically Modified Organism
CFO	Chief Financial Officer	GPS	Global Positioning System
CIAT	International Center for Tropical Agriculture	GRAP	Generally Recognised Accounting Practice
CIMMYT	International Maize and Wheat Improvement Center	GT	Thukela Genetics Mbuzi Club
CIRAD	Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement	GWAS	Genome Wide Association Study
CoC	Collaborative Centre for Economics of Agricultural Research & Development	HSRC	Human Sciences Research Council
Code	Code of Ethics and Business Conduct	IA	Internal Audit
COVID-19	Coronavirus disease-19	IC	Industrial Crops
CPD	Reserve Bank Corporation for Public Deposits	I-CAIRE	Integrity, Commitment, Accountability, Innovation, Respect, Excellence
CREA	Council for Agricultural Research and Economics	ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
CSIR	Council for Scientific and Industrial Research	ICT	Information and Communication Technology
DAFF	Department of Agriculture, Forestry and Fisheries	IFBA	International Federation for Biosafety Association
DALRRD	Department of Agriculture, Land Reform and Rural Development	IGIK	Institute of Geodesy and Cartography
DBM	Diamondback Moth	IIA	Institute of Internal Auditors
DDM	District Development Model	IITA	International Institute of Tropical Agriculture
DEA	Department of Environmental Affairs	INRAE	French Institute National de Recherche Pour l'agriculture, l'alimentation et l'environnement
		INTERGIS	Integrated Registration and Genetic Information System

IP	Intellectual Property	QC	Quality Control
IPL	Insect Pathology Laboratory	QTL	Qualitative Trait Loci
IPM	Integrated Pest Management	R&D	Research and Development
IRM	Insect Resistance Management	RHD	Rabbit Haemorrhagic Disease
IRRI	International Rice Research Institute	RNA	Ribonucleic acid
IUCN	International Union for Conservation of Nature	ROI	Return on Investment
IVG	Indigenous Veld Goat	RPL	Recognition of Prior Learning
KM	Knowledge Management	RT-PCR	Reverse Transcription Polymerase Chain Reaction
KNP	Kruger National Park	SAAAHT	South African Association for Animal Health Technicians (
KyD	Kaonafatso ya Dikgomo	SADC	Southern African Development Community
KZN	KwaZulu Natal	SAHPRA	South African Health Products Regulatory Authority
LAFR	Locally Available Feed Resources	SAID	South African Identity Document
LIMS	Laboratory Information Management Systems	SANAS	South African National Accreditation System
LSD	Lumpy Skin Disease	SANBI	South African Biodiversity Institute
LST	Land Surface Temperature	SANBio	Southern Africa Network for Biosciences
LST-TA	Difference of Surface and Air Temperature	SAPOL4Crop	South Africa-Polish collaborative crop growth monitoring and yield assessment project
LWP	Leaf Water Potential	SARCC	South African Rhizobium Culture Collection
MACH	Magaliesberg Association for Culture and Heritage	SARS-CoV-2	Severe Acute Respiratory Syndrome Corona Virus 2
MaYMV	Maize yellow mosaic virus	SAVC	South African Veterinary Council
MD	Medium Duration	SAVL	South African Vehicle License
MDP	Management Development Programme	SC	Stomatal Conductance
MIG	Maize Information Guide	SCM	Supply Chain Management
MLND	Maize Lethal Necrosis Disease	SDG	Sustainable Development Goals
MoA/U	Memorandum of Agreement/ Understanding	SDS	Sudden death syndrome
MOLM	Moringa oleifera leaf meal	SET	Sector Education Training
MRSV	Macadamia Ringspot-associated Virus	SG	Small Grain
MTAs	Material Transfer Agreements	SHAD	Smallholder Agricultural Development
NARS	National Agricultural Research System	SIM	Strategic Information Management
NARYSEC	National Rural Youth Service Corps	SKAS	Square Kilometre Array
NCEP	National Cultivar Evaluation Programme	SLA	Service Level Agreement
NCF	South African National Collection of Fungi	SMME	Small, Medium and Micro Enterprise
NDT	Duration Non-Determinate	SNL	Sandia National Laboratories
NDVI	Normalised Difference Vegetation Index	SPCA	Society for the Prevention of Cruelty to Animals
NEMBA	National Environmental Management Biodiversity	SPI	Standardised Precipitation Index
NGOs	Non-Governmental Organisations	SPVGA	Sweet Potato Vine Growers Association
NHLS	National Health Laboratory Services	SRAP	Sequence-Related Amplified Polymorphism
NICD	National Institute for Communicable Diseases	TA	Air Temperature
NKPs	National Key Points	TAD	Transboundary Diseases
NRE	Natural Resources and Engineering	TB	Tuberculosis
NRF	National Research Foundation	TETA	South African Transport Education Training Authority
NPGA	National Public Goods Assets	TGPP	Total Grains Per Not
NSCF	Natural Science Collections Facility	THC	Tetrahydrocannabinol
NVB	Infruitec-Nietvoorbij	TSARA	Transforming Food Systems and Agriculture through Research in Partnership with Africa
OBP	Onderstepoort Biological Products	TSC	Tropical and Subtropical Crops
OFSP	Orange Fleshed Sweet Potato	UAV	Unmanned Aerial Vehicle
OHSA	Occupational Health and Safety Act	VDD	Vaccine and Diagnostic Development
OIE	Office International des Epizooties	UNIVEN	University of Venda
OL	Organised Labour	VP	Vaccine Production
OVR	Onderstepoort Veterinary Research	VPN	Veterinary Procedural Notice
P&DM	Public & Development Management	WEMA	Water Efficient Maize for Africa
PAW	Plant Available Water	WOAH	World Organisation for Animal Health
PBR	Plant Breeders' Rights	WRC	Water Research Commission
PC4IR	Presidential Commission on the Fourth Industrial Revolution	VIMP	Vegetables, Industrial and Medicinal Plants
PCR	Polymerase Chain Reaction	VOP	Vegetable and Ornamental Plants
PDP	Professional Development Programme	VPP	Veterinary Paraprofessionals
PFMA	Public Finance Management Act (no1 of 1999)	VUV	Vacuum Ultraviolet
PG	Parliamentary Grant		
PHZ	Public Health and Zoonoses		
PKI	Public Key Infrastructure		
POPI	Protection of Personal Information		
PWD	People with Disabilities		



### 3. ARC 2022/23 COUNCIL MEMBERS



**Ms. Joyene Isaacs**  
CHAIRPERSON



**Dr. Monodowafa Mashaba**  
DEPUTY CHAIRPERSON



**Dr. Litha Magingxa**  
PRESIDENT & CEO



**Prof. Raymond Auerbach**



**Ms. Nalini Maharaj**



**Dr. Poncho Mokaila**



**Mr. Goodman Gcaba**



**Prof. Nic Olivier**



**Prof. Phatu Mashela**



**Dr. Konanani Liphadzi**



**Dr. Naude Malan**



**Dr. Saskia van Oosterhout**



**Dr. Steven Cornelius**

## 4. 2022/23 EXECUTIVE MANAGEMENT



**Dr. Litha Magingxa**  
President and CEO



**Ms. Besa Muthuri**  
Acting Group Executive:  
Human Capital Management  
(01 April 2022 - 01 November 2022)



**Dr. Hilton Vergotine**  
Acting Group Executive:  
Human Capital Management  
(17 February 2023 - Current)  
General Manager:  
Risk and Planning



**Dr. Tebogo Sethibe**  
Group Executive:  
Information Systems



**Dr. Andrew Magadlala**  
Group Executive:  
Animal Sciences



**VACANT:**  
Group Executive:  
Research & Innovation  
Systems



**Mr. Abdul Carim**  
Chief Financial Officer  
(Commencement Date:  
01 August 2022)



**Mr. Kolobe Mashala**  
Acting Chief Financial Officer  
(01 April 2022 - 31 July 2022)



**Dr. Petronella Chaminuka**  
Acting Group Executive:  
Impact & Partnerships  
(01 April 2022 - Current)



**Dr. Nthabiseng Motete**  
Group Executive:  
Crop Sciences

## 5. FORWARD BY THE CHAIRPERSON

The Agricultural Research Council (ARC) has delivered outstanding research and technology options in the past financial year. The challenges for the organisation remain and have proven to be systemic in nature. The Council has realised that a concerted effort and commitment from both the management and staff as well as the shareholder and stakeholders will be required to address these challenges. The changes required are not parallel processes but an inter-disciplinary, interconnected and complex web of fundamental shifts.

In order to enact and effect change, Council has accepted the report and recommendations of the Institutional Review completed in August 2022 and the implementation plan that was approved at the May 2023 Council meeting. To reiterate, the purpose of the Institutional Review is to assess the extent to which the organisation's pre-determined objectives and targets — as outlined in the five-year and annual strategic plans covering the period 2015 to 2020, and particularly from the perspective of how planning, implementation, and monitoring — has enabled the organisation to fulfil its mandate.

The ARC implemented an array of strategic human capital interventions underpinned by sound and effective skills development, professional development, internships, recognition of prior learning programmes, while cultivating sound labour health, equitable workforce, performance monitoring in the workplace. The ARC was independently audited and certified as a Top Employer organisation in South Africa for the year 2023. In this regard, greater efforts will be made during the year to sustain this remarkable achievement.

In enabling research capacity of ARC as an organisation to be 'fit for purpose', with improved agility and operational efficiency, an organisational re-design process is underway as a commitment towards a high-performance culture in line with the Institutional Review Recommendations. ARC has equally prioritised human resource retention and recruitment strategies, and succession planning in mitigating the key strategic risk of losing critical scarce skills.

The ARC has reported a significant (27%) improvement in the total revenue generated from exchange transactions when compared to the previous financial year. The highest contributor (22%) to total revenue is income generated from rendering of services. This is a demonstration that the ARC continues to play its strategic role as a provider of key diagnostic and other scientific services for the benefit of the sector.

The organisation was able to contain the overall increase in expenditure at 7%, despite excessive increases in the cost of electricity and other consumables and further reduced inventory losses by 85%. Employee costs remain a huge challenge and strict measures are being put in place to contain high employee costs. The liquidity of the entity is sound, and the organisation is able to meet its short-term obligations.

A Supply Chain Management (SCM) turnaround strategy was approved by Council. It is envisaged that the SCM turnaround strategy will provide effective solutions to inefficiencies emanating from supply chain management processes. The timely interventions should assist to improve procurement challenges as well as bring the much-needed agility in procurement. The ARC received a qualified audit for the financial year reported on, and the challenges remain within the realm of the asset register and management.

The organisation has fully embraced digital transformation. Testimony to this is the rollout of an Enterprise Resource Planning (ERP) system, where this system seeks to bring about the much-needed efficiencies in terms of operational processes. ARC has a vast property and infrastructure portfolio, which requires continuous maintenance and protection. Despite the organisation having developed a comprehensive facilities and infrastructure maintenance plan, the implementation of the plan has remained a challenge and it will be further exacerbated by the imminent budget cut of 10%



**Ms. Joyene Isaacs**  
Chairperson of the ARC Council

across government entities. More effort needs to be put in place to ensure that allocated CAPEX is used to address issues of infrastructure maintenance.

The ARC is cognisant of fiscal pressures and sluggish economic growth. To this end, the organisation is exploring the diversification of the revenue streams through research and development as well as nurturing customer value proposition (where stakeholder management is a key strategy).

The Social, Ethics and Governance Committee that was established in 2021 has met regularly as part of the meetings the Council organises to oversee the governance of the ARC. The establishment of this committee is a feat in itself, and this is necessary in a context where decisions and judgements are clouded by poverty, inequality and climate change, amongst others. The ARC is committed to responding to these issues, and others, with integrity and foresight.

The Social, Ethics and Governance Committee has developed a work plan and procedures to which it conforms and builds upon all legislation applicable to a Social, Ethics and Governance Committee. We will be expanding our reach and we will draw on further recommendations, mainly from the King reports on corporate governance, in strengthening this Committee and the work it performs. The Social, Ethics and Governance Committee reports to the Council, and in this reporting, we have oversight of many aspects of the workings of the ARC. This is strengthened by various initiatives in the ARC itself, from the development of training and information materials to the development of an ethical culture in the ARC. Ethics and Oversight are good for the organisation itself, as ethics and reflection, and improved conduct on the part of our people, is good for the country. We look forward in strengthening this endeavour in the next 3 years.

The 5-year research and development trend analysis indicates an increase of 9% of targets met, i.e., 68% in 2018/19 and 76% in 2022/23. The steady progressive achievement of targets is highly commendable.

Some of the research highlights during the reporting period were:

- The ARC remains a key role player and national leader in addressing the declining wheat production challenge in South Africa through the National Cultivar Evaluation Programme (an important programme for the wheat and oats industries). The 2023 annual cultivar evaluation meeting was held at ARC-Small Grain Institute in February where the results of the Rice Adaptation Trials were also presented.
- Some of the plant breeders rights granted to the ARC included four (4) sweet potato cultivars, (3 orange-fleshed and 1 cream fleshed, and two (2) wheat varieties.
- In contributing to building resilience in the agricultural sector, the ARC had previously developed four (4) live blood vaccines against economically important tick-borne diseases prevalent in the eastern regions of South Africa. The ARC-developed FMD vaccine tailor made for the South African market was registered for use in cattle in May 2022.
- Continued excellent performance in servicing the international partnerships and multi-year collaborations such as the South African-Polish collaboration crop growth monitoring and yield assessment project (SAPOL4Crop) was sustained.
- SANAS annual accreditation of the ARC-Animal Production Analytical Services Laboratory was retained, making the ARC the service provider of choice for government, industry, and academia.
- There is a dedicated effort and focus on targeting women, youth and people with disability when delivering various services, e.g., NRE celebrated World Wetland Day at Colbyn Valley Wetland where 170 learners from various schools in the City of Tshwane visited and learned about the importance of protecting wetlands and restoring them.
- An independent evaluation of the PDP programme by Mthente Research and Consulting found the programme to have a significant positive impact, a high return on the investment and sustained impact for the individuals, the ARC and the agricultural sector at large.
- NIPMO and Council approved the ARC IP policy with updated terms in regulating the sharing of benefits derived from commercialisation of the research output, during the reporting period. This will stimulate and encourage creativity and innovation amongst the researchers.
- In line with the recommendations from the institutional review of increasing the marketing and communication of ARC products and services, the first ARC Inter-Campus Hybrid Research Conference was held in March 2023 under the theme 'The heat is on'.
- Another significant and noteworthy achievement is that over the past 10 years, the number of journal articles published increased by 40%.



- The ARC was commended by DALRRD for significant contribution towards the development and operationalisation of the Agriculture and Agro-Processing Master Plan and the Cannabis Master Plan.

The road ahead will be difficult and hard choices will have to be made, but the ARC must work for the agricultural sector.

I would like to thank the CEO for steering the organisation, and making hard choices to ensure that the ARC remains relevant. He and the management team have delivered on the research and services, and the Council appreciates this tremendously.

It would be amiss of Council not to also thank the staff of the ARC as their hard work has brought amazing results and outputs.

To all the stakeholders that maintained a working relationship with the ARC, thank you and we as Council appreciate your commitment and invite you to continue working with us, for the ARC, with the ARC for the agricultural sector.



Ms. Joyene Isaacs  
Chairperson of the ARC Council

## 6. CHIEF EXECUTIVE OFFICER'S OVERVIEW

On behalf of the Executive and Senior Management of the ARC, I hereby submit through the ARC Council, to the Executive Authority, the Minister of Agriculture, Land Reform and Rural Development (DALRRD): Hon. Ms. A. Thoko Didiza, this Annual Report, associated performance information and the audited annual financial statements of the organisation for the financial year ending 31 March 2023.

As stipulated in the mandate of the ARC, the Agricultural Research Act, 1990 (Act No. 86 of 1990 as amended by Act No. 27 of 2001), and as required in accordance with the Public Finance Management Act (PFMA), 1999 (Act No. 1 of 1999 as amended by Act No. 29 of 1999), the organisation has delivered its outputs as contracted at the beginning of the financial year.

The mission of the ARC is to conduct research, develop partnerships and human capital to foster innovation for a sustainable agriculture sector. The intended outcome is sustainable agricultural systems for agrarian transformation as well as food and nutrition security.

The organisation's long term planning framework, the ARC Vision 2050 outlines key focus areas as follows:

1. Genetic improvement of crops and livestock to enable increased productivity;
2. Anticipation and mitigation of agricultural risks to enable resilience to climate change;
3. Promotion of ecosystem sustainability to enable effective natural resources conservation;
4. Solutions, processes and technologies to reduce post-harvest losses and develop new products; and
5. Inclusive market-oriented agricultural development to reduce malnutrition and hunger.

The organisation's 5-year Strategic Plan for the period 2020/21 to 2024/25 reflects the commitment to serve its role as the country's principal institution in employing scientific research tools for the development of solutions for the nation's most enduring challenge of food insecurity while supporting a thriving and internationally competitive agricultural sector. All these important functions must be performed in an environment that espouses good governance and compliance even under a consistently challenging environment for both the sector and the organisation.

The outputs reflected in this Annual Report are in accordance with the predetermined objectives that are contained in the Annual Performance Plan for financial year 2022/23 as approved by Council and tabled in Parliament by the Executive Authority.

During the financial year 2023, the ARC deeply collaborated and received sustained support from the Department of Agriculture, Land Reform and Rural development (DALRRD). A new Service Level Agreement (SLA) has been concluded, creating an environment that allows the ARC to play its critical role as the country's premier agricultural research institution. This strong collaboration has clearly demonstrated unlimited possibilities for the benefit of the agricultural sector. As a science council, the ARC also benefits from support through the Department of Science and Innovation (DSI).



**Dr. Litha Magingxa**  
ARC President and CEO

Other departments that the ARC works closely with include the Department of Forestry, Fisheries, and the Environment (DFFE) and the Department of Trade Industry and Competition (DTIC). The ARC appreciates the continued support received from these departments. In addition, the ARC also expresses appreciation for financial support received from various other stakeholders, particularly industry bodies that work with the ARC in generating knowledge and developing technologies that benefit the sector. As an organisation with a global network of partnerships, a valued amount of support is also received from international institutions.

The reporting period was marked with an increased risk of poor agricultural production and productivity because of frequent outbreaks of pests and diseases (e.g., FMD, Fall Armyworm (FAW), locust swarms, etc.) as well as adverse weather conditions. These occurrences often limit the ability of research personnel to conduct visits at agricultural enterprises or experimental sites and they are unable to provide farmer training because of limitations that may be imposed by regulatory management of such outbreaks. These challenges have a direct impact on the ARC's ability to fulfil its mandate and affect progress on projects, resulting in reduced external revenue from research and advisory services. While adverse conditions in the operational environment do affect the ARC, it is important that the ARC sustains its work under both favourable and adverse conditions. Research and innovation are critical elements for enabling sustainable and competitive agriculture enterprises.

During the reporting period, the ARC has developed and released crop cultivars with a range of specific attributes to ensure increased yield, productivity, improved nutritional quality and resilience to pests, diseases and drought. Eleven (11) new cultivars were registered in the past financial year. These include sweet potato, wheat, peaches, proteas, citrus and granadilla. The pipeline of new cultivars is solid, and these will be released as soon as registration through government authorities has been finalised. Further, the ARC has continued to provide research services aimed at disseminating data and information about suitability of various cultivars, mainly through National Cultivar Evaluation trials. The organisation also provides a range of diagnostic and analytical services to growers, winemakers and technical advisors to assist with decision-making and to help ensure sustainable, economically viable farming.

Livestock agriculture is one of the key sectors of the economy and contributes almost half of the agricultural gross domestic product (GDP). At the ARC, research and development involves development and transfer of new technologies and agricultural knowledge in order to ensure sustainable livestock production in the era of climate change and other emerging threats such as pandemics. Whenever possible, the ARC partners industry or provincial departments in its research and development activities. As an example, the collaborative efforts between ARC and KZN Department of Agriculture and Rural Development (KZN DARD) to implement Kaonafatso Ya Dikgomo (KyD) Farmer Support Scheme in order to improve market access among smallholder livestock farmers are starting to bear fruits. A new Black-owned auction company has been established and it hosted its inaugural auction events at Kortnek village in uPhongolo and Ezwati village in AbaQulusi Local Municipality. An evaluation of the KyD programme was conducted in 2023 and it is also the subject of a PhD study.

In addition, the ARC drives other industry wide livestock industry support initiatives such as the National Milk Recording Scheme and INTERGIS, amongst others. etc. The ARC also continues to sustain its work of hosting major industry events such as ARC National Beef Performers Awards and the ARC Master Dairyman Awards and collaborates with industry in other events aimed at supporting and encouraging development and excellence in the sector.

The year under review has been marked by significantly increased activity levels in accelerating the development of an FMD Vaccine Production Facility. The design phase has been completed and signed off and the resultant costing informs the latest resource provisions currently being confirmed through the governance processes. While the preparations for breaking ground for the state-of-the art facility are underway, 38 000 doses have been made available to DALRRD to deal with the recent outbreaks. Further, a process to prepare for “mid-scale” level production, which will provide approximately 200 000 doses is underway and projected to be completed by middle of 2024.

In advancing the ARC's capacity development objectives, a total number of 3 068 farmers were trained against a target of 1 004. Gender disaggregation of services and support provided to farmers and beneficiaries shows proportional representation of more women supported, followed by males and youth at a ratio of about 47% women, 30% men and 23% youth.

A very crucial development during the reporting period is the completion of the organisational Institutional Review, a legislated process carried out every five years. The implementation plan for the 2023 Institutional Review recommendations identifies a set of strategic initiatives towards a more effective and efficient organisation as envisaged in the recommendations. One of the critical elements is elevating the research activity towards being more integrated to participate prominently in discussions around the most pertinent global challenges. Some of the activities in that regard include the Inter-campus research conference as well as other research integrating initiatives. A more comprehensive approach is to embed these initiatives within the organisation as part of organisational way of doing things.

With regards to human capital management, a significant achievement was reached in the reporting period with the certification of the ARC as a Top Employer in 2023. This is a reflection of the organisation's commitment to ensure an environment where policies and processes support excellence and caring for staff. There is room for improvement in a number of areas and this independent audit is an opportunity for the ARC to continuously improve as an organisation where people can thrive and perform at their best. A new audit that will cover 2024 has been scheduled and the Human Capital Management Division is progressing in managing the timelines in light of the various other strategic projects underway.

Several international discussions are ongoing in support of the renewed Africa focus. In the period under review, the ARC formalised relations with institutions in African countries such as Botswana and Malawi. The ARC is also implementing a project supported by the Department of International Relations and Cooperation (DIRCO) in the Cabo Delgado Province of Mozambique. Additional opportunities in the rest of the world are being pursued and the ARC remains a partner to many international institutions across the globe. The ARC has also taken opportunity to leverage the BRICS platform through the BRICS Agricultural research Platform (BARP) as well as build on existing bilateral relations with institutions in the BRICS countries. Multi-lateral institutions and agencies such as AUDA-NEPAD, UN-FAO and the World Food Programme also remain an ongoing focus area.

### **Looking to the future**

The ARC is an organisation in transition in many respects. The term of Council ended on 30 June 2023 and a new Council was constituted with some members from the previous group, for continuity. With the Institutional Review recently concluded, a process is underway to align and integrate the implementation plan with other ongoing initiatives such as the Financial and Sustainability Turnaround Plan as well as other recently approved strategies. This combination will support the organisational turnaround journey which is firmly underway.

Stakeholders remain a critical focus area for the ARC and the organisation is continuously exploring new ways of supporting the programmes of DALRRD and other aligned departments, including the crucial relationship with National Treasury.

I would like to end by acknowledging the effort of ARC colleagues and the management team under the guidance and oversight of the ARC Council for the commendable work of the ARC over the financial year. Challenges remain, but the ARC has begun to gather pace towards being a more effective and efficient organisation, in touch with its stakeholders.



## GENERAL FINANCIAL OVERVIEW

Figures in Rand Thousand	FY2023	Restated FY2022	Variance (R')	Variance (%)
<b>Financial Performance Overview</b>				
Revenue from exchange transactions	464 872	365 069	99 802	27.34%
Government Grants	1 061 835	1 029 146	32 689	3.18%
Total expenditure	1 293 177	1 207 196	85 981	7.12%
<b>Operating Surplus</b>	<b>233 529</b>	<b>187 019</b>	<b>46 511</b>	<b>24.87%</b>
<b>Surplus/(Deficit) for the year</b>	<b>215 324</b>	<b>157 921</b>	<b>57 402</b>	<b>36.35%</b>
<b>Financial Position Overview</b>				
Current Assets	1 315 420	937 321	378 098	40.34%
Non-current Assets	1 964 947	1 983 650	(18 703)	(0.94%)
<b>TOTAL ASSETS</b>	<b>3 280 367</b>	<b>2 920 971</b>	<b>359 396</b>	<b>12.30%</b>
Current Liabilities	411 861	259 493	(152 368)	(58.72%)
Non-current Liabilities	488 600	496 339	7 739	1.58%
<b>TOTAL LIABILITIES</b>	<b>900 460</b>	<b>755 832</b>	<b>(144 629)</b>	<b>(19.14%)</b>
<b>NET ASSETS</b>	<b>2 379 906</b>	<b>2 165 139</b>	<b>214 767</b>	<b>9.92%</b>
<b>Cash Flows Overview</b>				
Cash flows from operating activities	468 802	345 094	123 707	35.85%
Cash flows from investing activities	60 759	50 288	10 472	20.82%
<b>Cash balance at the end of the year</b>	<b>1 205 012</b>	<b>796 969</b>	<b>408 042</b>	<b>51.20%</b>

\*(-) negative variance = unfavourable

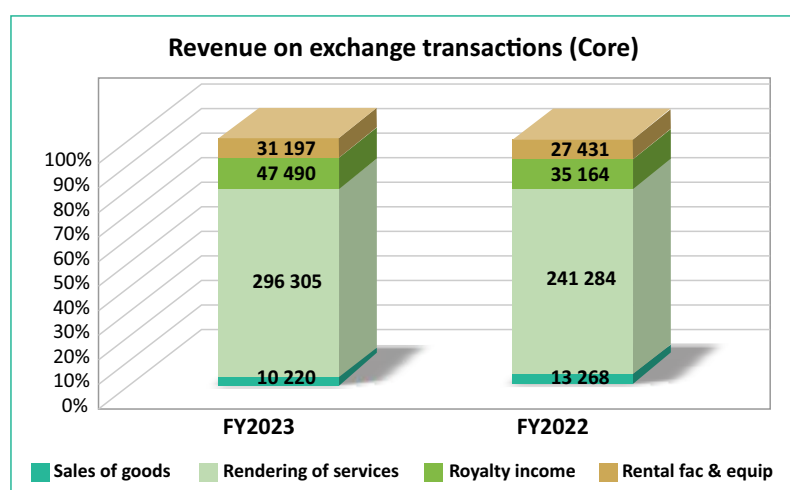
\*(+ ) positive variance = favourable

### FINANCIAL PERFORMANCE OVERVIEW

#### Revenue:

Government grants of R1 billion represent a 3.18% growth compared to the prior year due to a 3% baseline budget allocation increase from DALLRD. Conditional grant recognised on the FMD project for the current financial year amounted to R1.6 million rand.

The Revenue from exchange transactions earned for the FY2023 is R464.9 million, an increase of 27.34% compared to the prior year. Performance on the top revenue drivers is outlined:



Performance has been influenced positively by the following revenue streams, namely:

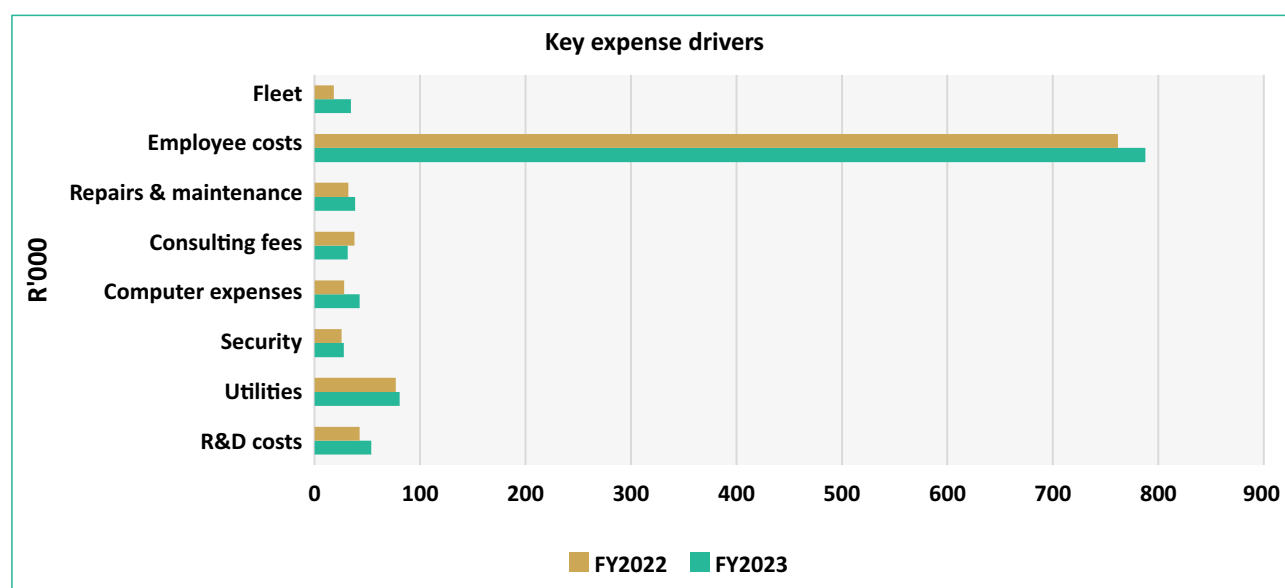
- Interest received [R61.9 million (2022: 31.0 million)]; influenced by the interest earned from mainly the investment of the funds allocated for the Foot and Mouth Disease (FMD) vaccine project.
- Rendering of services (+R55.0 million); mainly due to the impact of the SLA signed with DALRRD;
- Royalty income (+R12.3 million); increased royalties collected (i.e. SANSOR, SACTA, NADOR);
- Rental of facilities and equipment (+R3.8 million); this was mainly influenced by new intake and reduced rental relief measures related to the Covid-19 regulations in the past, which restricted the use of facilities; and
- Other income (+R7.5 million) due to increased sales of blood vaccines.

Performance on the following revenue streams has decreased compared to the prior year's performance:

- Sale of goods in agricultural activities (-R3.0 million); less take-up of ARC agricultural products;
- Dividends received (-R14 thousand); due to the economy still being under strain, especially the wine industry; and
- Recoveries (-R6.5 million); reduced recoveries from previously written off customer debt.

### Expenditure

The total Operating Expenditure reported is R1.3 billion which represents a 7.12% year-on-year increase. The spending trend compares as follows on the key expense drivers:



The increase is mainly attributable to:

- Employee-related costs. Overall increase of R25.9 million. The cost increase is attributable to salaries and wages increase of 3% across the board and performance bonus for the financial year 2022 and the leave pay provision charge, which increased by R2.5 million year-on-year;
- R&D costs and fleet costs (R27.4 million year-on-year increase), direct costs to support research activities;
- IT computer expenses costs (R14.7 million increase), more effort towards business continuity to guard against the impact of loadshedding and
- Repairs and maintenance (R6.5 million unfavourable variance), campuses spending improved and prior year backlogs reduced. This was due to centralised control of the budget.

**An overall surplus of R215.3 million for the year achieved was achieved, which represents a 36.35% year-on-year growth.**

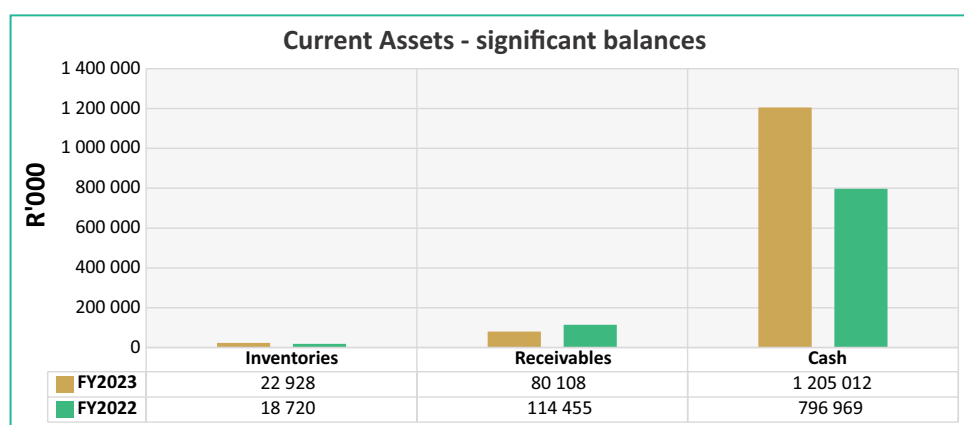
## FINANCIAL POSITION OVERVIEW

The Net Assets of the Agricultural Research Council are at R2.4 billion and the year-on-year results have been influenced by the following:

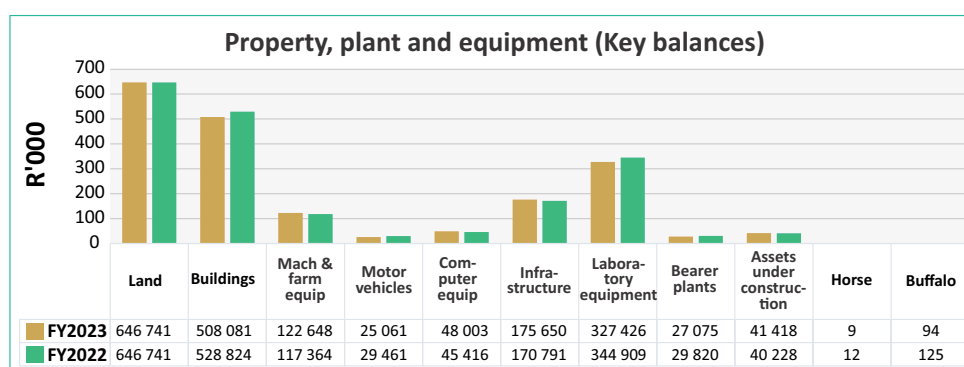
The current assets of R1,315.4 mil have shown a 40.34% growth year-on-year. The following have influenced the favourable performance:

- Inventories reported at R22.9 mil represent a 22% year-on-year increase. The increase was due to the increased consumables for research.
- Receivables from exchange transactions of R80.1 mil, decreased year-on-year by 30%. This is impacted by improved collection of outstanding debts.
- At year-end, the cash and cash equivalents balance was R1,205 mil, representing 51% year-on-year growth, mainly due to the FMD funding received and invested at the Reserve Bank Corporation for Public Deposits (CPD) and other funds received in advance from DALRRD.

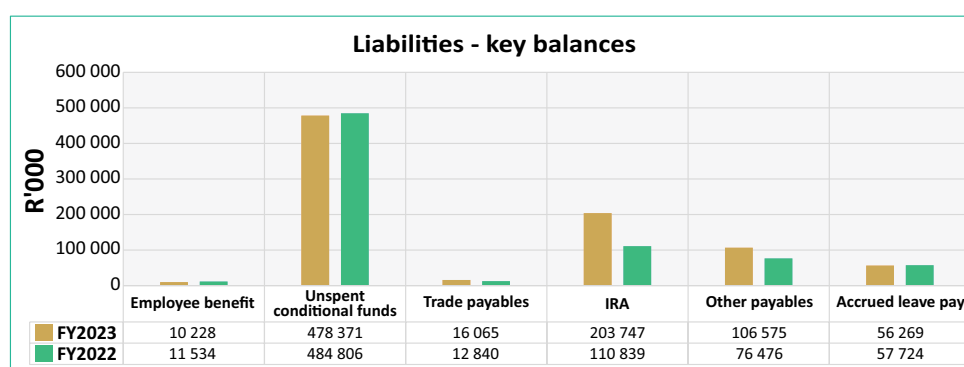
The graph below depicts the year-on-year comparison:



The Non-Current Assets remained largely flat at R2 billion, and the results are mainly influenced by the Property, Plant and Equipment (PPE). The PPE year-on-year comparison is outlined below:



The total liabilities of the organisation were at R900.5 mil balance, which represents an 16% growth year-on-year. The growth is significantly influenced by the accrual for benefit sharing and funds received from DALRRD.



## REQUESTS FOR ROLL – OVER OF FUNDS

Section 53(3) of the Public Finance Management Act (PFMA) requires a public entity, which submits a budget in terms of section 53(1) of the PFMA, not to budget for a deficit and not to accumulate surpluses, unless prior written approval of the National Treasury has been obtained. The ARC will submit a request to the National Treasury for the roll-over of surplus funds. It should however be noted that majority of the Cash and Cash Equivalents at the end of the year represents the FMD funds which have been ring-fenced at the CPD as well as income received in advance from DALRRD. The unspent conditional grant relating to the FMD project was R478.4 mil and R484.8 mil, for the FY2023 and FY2022 respectively.

## SUPPLY CHAIN MANAGEMENT

The ARC has a Council approved Supply Chain Management Policy in place. The Standard Operating Procedures as approved by the Executive Management Committee (EMC) are in place. The organisation has submitted the FY2022/23 Procurement Plan and related addendums within the prescribed timelines as outlined in the National Treasury Instruction No. 2 of 2016/17. Performance on the Procurement Plan was reported on a quarterly basis to the DALRRD and National Treasury.

## AUDIT REPORT MATTERS IN THE PREVIOUS YEAR

The Agricultural Research Council had an Audit Improvement Plan, which was approved by Council in place. Implementation of the Audit Improvement Plan has been monitored by the Audit and Risk Committee. Progress on the Audit Improvement Plan has been audited by the Internal Audit department. The ARC continues to address property, plant and equipment qualification areas which has contributed negatively to the modified audit opinion from the Auditor General of South Africa.

## OUTLOOK / PLAN FOR THE FUTURE TO ADDRESS THE FINANCIAL CHALLENGES

The ARC has developed a Sustainability and Financial Turnaround plan which was approved by Council in February 2019, which outlines the initiatives required for improving the financial position of the organisation. The Plan is monitored by management and Council on a continuous basis. As at 31 March 2023, the ARC is considered to be solvent as its assets exceeded the liabilities by R2.4 billion. The liquidity assessment conducted also concluded that the ARC will be able to meet its financial obligations as and when they are due. As thus it was affirmed that the ARC will continue as a going concern, for the foreseeable future. The ARC has budgeted an operational surplus for the MTEF period FY2023/24 to FY2025/26 which has been articulated in its Annual Performance Plan which is based on the assumptions that the targeted external income and cost efficiencies will be achieved as planned.

Re a leboha, le ka moso  
 Re a leboga, le kamoso  
 Re a leboga, le gosasa  
 Siyabulela, nangamso  
 Siyabonga, naksasa  
 Siyathokoza, nangamoso  
 Ha khensa, aswive tano na mudzuku  
 Ria livhuwa, khazwiralo na matshelo  
 Baie dankie  
 Thank you



Dr. Litha Magingxa  
 ARC President and CEO  
 Date: 31 August 2023



## 7. STATEMENT OF RESPONSIBILITY AND CONFIRMATION OF ACCURACY FOR THE ANNUAL REPORT

To the best of my knowledge and belief, I confirm the following:

- All information and amounts disclosed in the Annual Report are consistent with the Annual Financial Statements audited by the Auditor-General;
- The Annual Report is complete, accurate and is free from any omissions;
- The Annual Report has been prepared in accordance with the guidelines for the Annual Report as issued by National Treasury and Department of Planning, Monitoring and Evaluation (DPME);
- The Annual Financial Statements (Part F) have been prepared in accordance with the Public Finance Management Act, 1999 (Act No.1 of 1999) (PFMA) standards applicable to the public entity;
- The accounting authority is responsible for the preparation of the Annual Financial Statements and for the judgements made in this information;
- The accounting authority is responsible for establishing and implementing a system of internal control that has been designed to provide reasonable assurance as to the integrity and reliability of the performance information, the Human Resources information and the Annual Financial Statements; and
- The external auditors are engaged to express an independent opinion on the Annual Financial Statements.

In our opinion, the Annual Report fairly reflects the operations, the performance information, the Human Resources information and the financial affairs of the public entity for the financial year (FY) ended 31 March 2023.

Yours faithfully,



Dr. Litha Magingxa  
ARC President and CEO

Date: 31 August 2023



Ms. Joyene Isaacs  
Chairperson of the ARC Council

Date: 31 August 2023



## 8. STRATEGIC OVERVIEW

### 8.1 VISION

Excellence in research and innovation for sustainable agricultural systems and economic development.

### 8.2 MISSION

The ARC is a premier science institution that conducts research, develops partnerships and human capital, to foster innovation for a sustainable agriculture sector.

### 8.3 VALUES

#### ICAIRE

##### **I** – INTEGRITY:

We conduct our business in a transparent, honest, truthful, consistent and ethical manner to ensure we foster trust among our employees and stakeholders.

##### **C** – COMMITMENT:

We commit ourselves to live the values of the ARC.

##### **A** – ACCOUNTABILITY:

We honour our commitments towards our employees and stakeholders in a responsible and reliable manner, taking ownership of our work and decisions.

##### **I** – INNOVATION:

We conduct our business in a way that fosters innovation to improve the growth of the organisation and the agricultural sector.

##### **R** – RESPECT:

We treat our colleagues and stakeholders with respect and dignity in an equitable manner whilst embracing diversity.

##### **E** – EXCELLENCE:

We conduct our work in an efficient, effective, professional manner to ensure we create highest quality and value.

## 9. LEGISLATIVE AND OTHER MANDATES

The ARC was established as a Public Entity on 1 December 1990, under the then Ministry of Agriculture (now reconfigured as the Ministry of Agriculture, Land Reform and Rural Development).

- The ARC is listed as a Schedule 3A Public Entity in terms of the PFMA (No.1 of 1999), and is required to ensure full compliance with all prescripts and regulations arising from the PFMA.

Specifically, the ARC was established in terms of the Agricultural Research Act (No. 86 of 1990), from which it derives its core mandate. The objectives of the ARC outlined in the Act are to conduct research, drive R&D, drive technology development and transfer (dissemination) information, in order to:

- promote agriculture and industry;
- contribute to better quality of life;
- facilitate/ensure natural resource conservation; and
- alleviate poverty.

### The Act defines:

- *Research* as the furtherance, accumulation and improvement of knowledge in the agricultural and related sciences through original and other investigations and methods of a scientific nature with the advancement of agriculture as its object;
- *Technology Development* as activities by which knowledge acquired through research is utilised; and
- *Technology Transfer* as transfer of knowledge, techniques and processes for application thereof.

Further, the Act states that in order to achieve its objectives, the ARC may:

- undertake and promote research, development and technology transfer in connection with:
  - *the optimal utilisation of the agricultural resources and the improvement of the production capacity of such resources;*
  - *the rehabilitation and improvement of the agricultural resources;*
  - *the opening of possibilities and the generation of new knowledge to solve particular problems;*
  - *the improvement of the nutritional value and quality of agricultural products;*
  - *the pollution of the environment and the*

- *prevention thereof in respect of agriculture; and*
- *the improvement of existing techniques and the creation of new techniques for the processing of agricultural products, and to improve the keeping quality of perishable agricultural products;*
- utilise the technological expertise in its possession and make it generally available;
- publish information concerning its objectives and functions, and establish facilities for the collection and dissemination of information in connection with R&D;
- establish and control facilities in those fields of research, development and technology transfer which the Council may from time-to-time determine;
- promote cooperation between the Republic and other countries with regard to research, development and technology transfer; and
- cooperate with persons, institutions and associations undertaking research, development and technology transfer in other countries.

The ARC performs its functions through several research campuses that are predominantly commodity-based and are strategically located throughout the country. Further, research at these facilities is complemented by on-field experimental sites distributed throughout every province of South Africa. In addition, selected farm fields are utilised to study the performance of ARC research technologies under actual farm production environments.

The Council of the ARC is the Accounting Authority in terms of the PFMA, and provides strategic direction and leadership to enhance shareholder value and ensure the long-term sustainable development and growth of the Entity. In fulfilling its responsibilities, the Council is supported by the ARC President and CEO and the Executive and Senior Management team in implementing the approved strategic and corporate plans and policies. The ARC seeks to operate on sound business principles and practices, and to this end, strives at all times to comply with the principles contained in the King Code on Corporate Governance in South Africa (2016) (King IV) and other corporate governance guidelines and standards.

## 9.1 LEGISLATIVE MANDATE

In delivering on its core mandate, the ARC is responsible for performing its functions in line with the following key legislation, which thus directly informs the various day-to-day operations of the organisation:

LEGISLATION	OBJECTIVE OF THE ACT	ARC RESPONSIBILITY
<b>Animal Disease Act, 1984, (Act No. 35 of 1984)</b>	This Act provides for control measures for the prevention of diseases and parasites, and for schemes to promote animal health. The Directorate of Veterinary Quarantine and Human Health is responsible for the enforcement thereof.	No specific delegation in terms of the Act. However, the ARC provides various services (diagnostic and analytical) to fulfil the aims of the Act, including through OIE Reference Laboratories.
<b>Animal Identification Act, 2002 (Act No. 6 of 2002)</b>	Provide for the identification of animals and procedures to be followed when applying for an identification mark. The Directorate of Animal Production and Veterinary Quarantine, and Human Health are responsible for the administration of this Act.	No delegation to ARC. However, certain aspects of animal identification are contained in the implementation of an Integrated Registration and Genetic Information System (INTERGIS). The INTERGIS is delegated to the ARC.
<b>Animal Improvement Act, 1998 (Act No. 62 of 1998)</b>	To provide for the breeding, identification and utilisation of genetically superior animals in order to improve the production and performance of animals in the interest of the Republic. The Directorate of Animal Production and Veterinary Quarantine, and Human Health are responsible for the administration of this Act.	Certain services that are discharged under this Act are managed by the ARC: <ul style="list-style-type: none"> <li>Animal improvement services, including collection of animal data, as well as management of National Databank (INTERGIS);</li> <li>Section 20 of the Act on the establishment of the Schemes; and</li> <li>Declaration of the Schemes Notice 29516 of 2007 Section 5(1)(a)(iii) - the Schemes shall ensure that all recorded data must be submitted to the Integrated Registration and Genetic Information System (INTERGIS).</li> </ul> Furthermore, Section 44 of the Declaration stipulates that: <ul style="list-style-type: none"> <li>The Schemes will be managed by the ARC, a statutory body established in terms of Section 2 of the Agricultural Research Act, 1990 (Act No. 86 of 1990);</li> <li>The ARC will exercise the powers and perform duties conferred to it in terms of the Schemes; and</li> <li>The ARC may make rules relating to the Schemes in consultation with the Department.</li> </ul>
<b>Agricultural Pests Act, 1983 (Act No. 36 of 1983)</b>	This Act introduces measures for the prevention and combating of agricultural pests. The Directorate of Plant Health is responsible for the enforcement thereof.	ARC serves on the National Steering Committees to address specific pest problems. Responsibilities include: <ul style="list-style-type: none"> <li>Calibration of aircraft for control of migratory pests; and</li> <li>Identification services and registered testing laboratories.</li> </ul> The insect quarantine service is rendered through a contract with the Department of Agriculture, Land Reform and Rural Development (DALRRD).

LEGISLATION	OBJECTIVE OF THE ACT	ARC RESPONSIBILITY
Animal Protection Act, 1962 (Act No. 71 of 1962)	This Act provides for the maintenance of proper standards of hygiene, and in the handling of animals and the prevention of cruelty to animals. The Society for the Prevention of Cruelty to Animals (SPCA) is responsible for the enforcement thereof. The Directorate Animal Production is responsible for the administration of this Act.	There is no delegation to ARC. However, the organisation has to comply with the requirements of the Act.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)	This Act provides for control over the utilisation of natural agricultural resources in order to promote the conservation of soil, water sources and vegetation, and the combating of weeds and invader plants. The Directorate of Land Use and Soil Management and the Engineering Directorate are responsible for the enforcement thereof.	No delegation. Certain aspects of the Act are contained within the mandate of the ARC.
Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947)	The registration of fertilisers, farm feeds, agricultural remedies, stock remedies, sterilising plants and pest control operators are regulated by this Act. Provision is also made for control over the acquisition, disposal, sale and use of fertilisers, farm feeds, agricultural remedies and stock remedies. The Directorate Food Safety and Quality Assurance is responsible for the administration of this Act.	There is no specific delegation for the ARC. However, on assignment, the organisation conducts analytical, testing and advisory services to enable regulatory decisions by DALRRD.
Genetically Modified (GM) Organisms Act, 1997 (Act No. 15 of 1997)	To provide measures to promote the responsible development, production, use and application of Genetically Modified Organisms (GMO); <ul style="list-style-type: none"> <li>To ensure that all activities involving the use of GMO (including importation, production, release and distribution) shall be carried out in such a way as to limit possible harmful consequences to the environment;</li> <li>To give attention to the prevention of accidents and the effective management of waste; to establish common measures for the evaluation and reduction of the potential risks arising out of activities involving the use of GMO;</li> <li>To lay down the necessary requirements and criteria for risk assessments;</li> <li>To establish a Council for GMO;</li> <li>To ensure that GMO are appropriate and do not present a hazard to the environment; and</li> <li>To establish appropriate procedures for the notification of specific activities involving the use of GMO.</li> <li>The Directorate Bio-Safety is responsible for the administration of this Act.</li> </ul>	No delegation to ARC. However, ARC expertise, facilities and scientific data/information are utilised to support decision-making.
Intellectual Property (IP) Rights from Publicly-funded R&D Act, 2008 (Act No. 51 of 2008)	Seeks to ensure that all publicly-funded research gets IP protection for the purposes of commercialisation. It further places an onus on the ARC to establish an IP Management Office.	The ARC has established a functional IP Management Office, along with associated internal policies to ensure compliance to licensing agreements.



LEGISLATION	OBJECTIVE OF THE ACT	ARC RESPONSIBILITY
<b>Intellectual Property (IP) Rights from Publicly-funded R&amp;D Act, 2008 (Act No. 51 of 2008)</b>	Provide for measures to prevent pollution and ecological degradation; <ul style="list-style-type: none"> <li>Promote conservation; and</li> <li>Secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development.</li> </ul> The Department of Forestry, Fisheries and the Environment (DFFE) is responsible for the administration of the Act.	ARC supports by hosting of national collections and developing data used for conservation and management of natural resources. Baseline biodiversity data is essential for policy-makers regarding conservation and sustainable use of natural resources.
<b>National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)</b>	To provide for the management and conservation of South Africa's biodiversity within the framework of the National Environmental Management Act, 1998; <ul style="list-style-type: none"> <li>The protection of species and ecosystems that warrant national protection;</li> <li>The sustainable use of indigenous biological resources; and</li> <li>The fair and equitable sharing of benefits arising from bioprospecting involving indigenous biological resources.</li> </ul> The DFFE is responsible for the administration of the Act.	As outlined above in respect of National Environmental Management: Biodiversity (NEMBA).
<b>Plant Breeders' Rights Act, 2018 (Act No. 12 of 2018)</b>	This Act regulates the granting of certain rights relating to the new varieties of certain kinds of plants, the protection of such rights and the issue of licences in respect of the exercising of the rights. The Directorate of Plant Production is responsible for the enforcement thereof.	The ARC provides services to the Registrar to enable evaluation of material for granting of PBR in recognition of new varieties. The ARC must comply with the requirements of the Act.
<b>Plant Improvement Act, 2018 (Act No. 11 of 2018)</b>	This Act provides for: <ul style="list-style-type: none"> <li>The registration of establishments where plants and propagation material are sold and packed;</li> <li>The introduction of schemes for the certification of certain propagation material;</li> <li>The requirements to which plants and propagation material sold for the purposes of cultivation must conform; and</li> <li>Quality control (QC) over plants and propagation material imported or exported.</li> </ul> The Directorate of Plant Production is responsible for the enforcement thereof.	Registered testing laboratories (nematology, mycology, virology, bacteriology - American Foulbrood Disease) provide diagnostic services to government in terms of seed/plant quality (free from pests and pathogens), as well as nurseries and other plant propagation material.
<b>Public Finance Management Act, 1999 (Act No. 1 of 1999)</b>	<ul style="list-style-type: none"> <li>To regulate financial management in the national government and provincial governments;</li> <li>To ensure that all revenue, expenditure, assets, and liabilities of those governments are managed efficiently and effectively; and</li> <li>To provide for the responsibilities of persons entrusted with financial management in those governments.</li> </ul>	Adherence to all sections of the PFMA relevant to the ARC.

The above-mentioned legislation is not exhaustive, and it is recognised that the ARC is subject to, and must comply with, all national and provincial legislation and regulations, and all municipal by-laws, applicable to its functions or the areas in which it operates.

## 9.2 POLICY MANDATE

Whereas the above legislation and regulations define the scope of the mandate and regulate how the ARC must operate, various national policy and strategy frameworks give effect to how the mandate should be implemented, and have direct bearing on the priorities and focus areas of the ARC for the 2020/21-2024/25 period of its Strategic Plan.

## 9.3 COMPLIANCE WITH LAWS AND REGULATIONS

The ARC is fully committed to complying with the PFMA, 1999 (Act No. 1 of 1999) as well as other key legislation that are applicable to the operations of the ARC. In fulfilling its mandate through its core divisions, the ARC have several important legislations that requires granting

of authorisations (permits, licences, and other authorisations) by various issuing authorities from across all spheres of government.

To effectively carry out regulatory compliance with the applicable compliance obligations, the ARC has established an independent Compliance Function within the Legal Services. In collaboration with management, the function is responsible for identifying applicable compliance obligations, assessing compliance risk faced by the ARC, managing the risk and monitoring and reporting on the level of compliance.

On a quarterly basis the PFMA quarterly checklist is completed by various divisions within the ARC and submitted to DALRRD. The recommendations emanating from the 2021/22 FY Internal Audit POPIA Compliance Report were implemented resulting in an improved compliance to the Act.

# 10. ORGANISATIONAL STRUCTURE



\* Chief Financial Officer - CFO (Mr. K Mashala, 01 April 2022 - 31 July 2022, Mr. A Carim, 01 August 2022)

\*\* Acting Group Executive: Human Capital Management (Ms. B Muthuri, 01 April 2022 - 01 November 2022, Dr. H Vergotine, 17 February 2023 - current)

# PART B:

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# PART B:

## PERFORMANCE INFORMATION

### 1. AUDITOR'S REPORT: PREDETERMINED OBJECTIVES

The AGSA currently performs the necessary audit procedures on the performance information to provide reasonable assurance in the form of an audit opinion. The audit opinion on the performance against predetermined objectives is included in the management report. Refer to page 183 - 194 of the Report of the Auditor-General, published as Part E: Financial Information.

### 2. SITUATION ANALYSIS

#### 2.1 SERVICE DELIVERY ENVIRONMENT

The ARC continuously strives towards deriving optimal value from all resources (financial, human, infrastructure, natural etc.) available to conduct R&D as well as associated services towards fulfilment of its mandate.

Conducting business in the FY2016/17 to FY2022/23 was difficult for the ARC as there were various limitations, particularly resources. As a national public entity, the ARC is exposed to many factors that adversely impact upon its performance, such as the state of the economy, underperforming agriculture enterprises, unfavourable climatic conditions (e.g. severe drought in parts of the country, delayed summer rainfall, locust outbreaks, plant and animal diseases) and ageing infrastructure, to mention a few. These challenges directly impacted upon the ARC's ability to fulfil its mandate and resulted in reduced external revenue for research and advisory services.

The ARC operating environment during FY2022/23 included the following risks:

1. Sustainability as a going concern (with potential risk of loss of skilled personnel, inability to fulfil financial obligations that could have consequences for existence of the organisation);
2. Increased risk of poor agricultural production and productivity as a consequence of frequent, uncontrollable outbreaks of pests and diseases (e.g. FMD, Fall Armyworm (FAW), drought, locust swarms, etc.);
3. Increased risk of food insecurity, particularly malnutrition); and
4. Increased risk of failed agricultural enterprises, particularly commercial agriculture with concomitant unemployment among others.

#### 2.2 ORGANISATIONAL ENVIRONMENT

***This Annual Report serves as the third year of implementation of the approved five-year (2020 to 2025) Strategic Plan in pursuit of the ARC Vision 2050. Research focus areas serve as the organising framework towards the attainment of ARC Vision 2050 and are outlined as follows:***

1. Genetic improvement of crops and livestock to enable increased productivity;
2. Anticipation and mitigation of agricultural risks to enable resilience to climate change;
3. Promotion of ecosystem sustainability to enable effective natural resources conservation;
4. Solutions, processes and technologies to reduce post-harvest losses and develop new products; and
5. Inclusive market-oriented agricultural development to reduce malnutrition and hunger.

**Performance was, in accordance with pre-determined outcomes, outlined as follows:**

1. Increased agricultural production and productivity;
2. Sustainable ecosystems and natural resources;
3. Improved nutritional value, quality and safety of agricultural products;
4. Skilled and capable agriculture sector;
5. Enhanced resilience of agriculture; and
6. A high performing and sustainable organisation.

**During the financial year, the ARC considered and conducted business cognisant of the challenges outlined above. Further, reduced financial resources during the year had the following impact on the organisation:**

1. ARC scientists reduced their time conducting laboratory or field research, instead focused on data analyses, that resulted in high quality peer-reviewed scientific publications;
2. Reductions in field and laboratory research activities limited the outputs of technologies, resulting in reductions in the number of cultivars released or registered for PBR;
3. There was limited output in vaccine R&D;
4. In the same period, the ARC implemented a moratorium on vacancies for unskilled personnel, and reprioritised recruitment of highly skilled scientists that are essential to fulfil its mandate; and
5. To ensure organisational viability, the ARC continued to implement the Financial Sustainability and Turnaround Plan to the extent possible.

## 2.3 KEY POLICY DEVELOPMENTS AND LEGISLATIVE CHANGES

During the financial year, the ARC has not been subject to policy changes to its mandate as stipulated in the approved five-year Strategic Plan. As a public entity, the ARC must comply the constitution of the Republic of South Africa 1996, national and provincial legislation, municipal by-laws and subordinate legislation applicable to the organisation's business.

## 2.4 STRATEGIC OUTCOMES

ARC OUTCOME	RESEARCH AND/OR DELIVERY OUTPUTS
<b>1. Increased agricultural production and productivity</b>	<ol style="list-style-type: none"> <li>1) Generation of knowledge through research;</li> <li>2) Development of new technologies;</li> <li>3) Scientific services rendered; and</li> <li>4) Information dissemination.</li> </ol>
<b>2. Sustainable ecosystems and natural resources</b>	<ol style="list-style-type: none"> <li>1) Generation of knowledge through research;</li> <li>2) Development of new technologies;</li> <li>3) Scientific services rendered; and</li> <li>4) Information dissemination.</li> </ol>
<b>3. Improved nutritional value, quality and safety of agricultural products</b>	<ol style="list-style-type: none"> <li>1) Generation of knowledge through research;</li> <li>2) Development of new technologies;</li> <li>3) Scientific services rendered; and</li> <li>4) Information dissemination.</li> </ol>
<b>4. A skilled and capable agriculture sector</b>	<ol style="list-style-type: none"> <li>1) Generation of knowledge through research;</li> <li>2) Development of new technologies;</li> <li>3) Scientific services rendered;</li> <li>4) Information dissemination;</li> <li>5) Agriculture skills and capacity development;</li> <li>6) Agriculture R&amp;D information communicated/disseminated to stakeholders; and</li> <li>7) Stakeholder management.</li> </ol>
<b>5. Enhanced resilience of agriculture</b>	<ol style="list-style-type: none"> <li>1) Generation of knowledge through research;</li> <li>2) Technologies released to agriculture sector;</li> <li>3) Scientific services rendered.</li> </ol>
<b>6. A high-performing and sustainable organisation</b>	<ol style="list-style-type: none"> <li>1) Improved post-graduate Sector Education Training (SET) base;</li> <li>2) Improved staff profile;</li> <li>3) Optimal investment in training and development;</li> <li>4) Funding and revenue generation;</li> <li>5) Applied Information technologies; and</li> <li>6) Optimal utilisation of assets.</li> </ol>



### 3. PERFORMANCE INFORMATION BY OUTCOME

#### 3.1 OUTCOME 1: INCREASE AGRICULTURAL PRODUCTION AND PRODUCTIVITY

The focus of Outcome 1 is to generate knowledge and technologies (intellectual property and tools) that will diversify, improve the quality and increase the value of crop and animal based agricultural production and related processes and products; enhance productivity towards increased food security, commercial exports and income for the agricultural sector, and enabling farmers and producers to maximise their efficiency and productivity.

The Outcome focuses on improving the productivity, competitiveness and sustainability of both commercial and smallholder agriculture through research and development in:

- 1) Crop research and development: including a wide range of grains, vegetables, indigenous ornamental plants, medicinal plants, deciduous fruit and grapes, tropical and subtropical fruits and niche crops, such as herbal teas. Industrial crops research and development will focus on fibre crops, such as cotton and hemp.
- 2) Livestock-based agriculture: through research and technology in areas related to animal health, production and improvement, as well as secondary production processes. The research and development is focused on both production and companion animals, and increasingly in the areas of aquaculture and wildlife.

**Outcome 1** is the focus of the following ARC Divisions:

- 1) ***Crop Sciences; and***
- 2) ***Animal Sciences.***





*Outcomes, Outputs, Output Indicators, Targets and Actual Achievement*

OUTCOME 1: INCREASED AGRICULTURAL PRODUCTION AND PRODUCTIVITY							
OUTPUT	OUTPUT INDICATOR	AUDITED ACTUAL PERFORMANCE 2020/2021	ACTUAL ACHIEVEMENT 2021/2022	PLANNED ANNUAL TARGET 2022/2023	ACTUAL ACHIEVEMENT 2022/2023	DEVIATION FROM PLANNED TARGET TO ACTUAL ACHIEVEMENT 2022/2023	REASONS FOR DEVIATIONS
Crop technologies developed and information dissemination	Number of cultivars registered	2	1	11	7	(4)	Final registration of cultivars being awaited from registrar
	Number of field trials	311	289	204	230	26	More field trials due to favourable weather conditions
	Number of technical reports	271	209	174	316	142	Increase in reports generated for clients by the ARC
	Number of cultivar evaluations	68	70	39	78	39	Higher demand from industry for cultivar evaluations
Animal improvement services	Number of farmers participating in each of the animal improvement schemes	190	213	220	191	(29)	Lower than anticipated participation in the animal improvement schemes
	Number of technical reports	781	875	1 000	763	(237)	Fewer reports generated due to lower participation in the animal improvement scheme

### ***Significant achievements of targets***

The ARC remains an important and leading national crop breeding organisation in collaboration with partners to increase production and productivity of crop-based agriculture, hence, the importance of National Cultivar Evaluation Programmes (NCEPs) for respective crop commodities. In the year under review, the wheat cultivar evaluation programme performed relatively well. The programme tests the adaptability, yield and quality of wheat and oats cultivars released by all seed companies in South Africa, and the ARC-Small Grain has a mandate to conduct cultivar evaluation in various small grain production regions of South Africa. The 2023 outcome included results of Rice Adaptation Trials. Newly released cultivars, of which at least two years of performance trials were conducted, are commercially available to producers during the 2023 wheat planting season. This is summary of significant achievement of targets in the context of how the achievement contributes to service delivery to producers under Outcome 1, with specific reference to Outcome Indicators of number of field trials, number of technical reports, and number of cultivar evaluations.

### ***Prioritisation of women, youth and persons with disabilities***

The ARC collaborates with industry partners and role players to support and increase participation of designated groups as beneficiaries of increased production and productivity of crop-based agriculture. Increased efforts include collaboration with Provincial Departments of Agriculture for increased training opportunities for women and youth farmers. Gender mainstreaming is also included as a specific area of multi-disciplinary research approach where results indicate that women and youth farmers are even willing to pay for scientific solutions and technologies that have proven to work because they are driven by entrepreneurial success. As a result, crop breeding programmes also include important aspects of demand-led breeding. For example, the participation of women in the breeding programme for African leafy vegetables that includes participatory crop selection and evaluation in KwaZulu-Natal (Nkandla, Empangeni and Richards Bay) resulted in 96% of women farmer participation.

The ARC serviced a number of livestock farmers through its animal improvement schemes (i.e. beef, dairy and smallstock) in order to improve national the productivity of the national herds and flocks. In this effort there was gender-balance among the farmers serviced with 56% of the farmers serviced being female while 44% being male. Furthermore, a small percentage, 7%, of the livestock farmers serviced were from the youth category.

### ***Strategy to overcome areas of under performance***

- **Number of cultivars registered**

A notable area of under-performance is the number of cultivars registered, and while registration of plant breeders' rights (PBRs) is completely outside of the control of the ARC, it is important to note that ARC researchers have a steady pipeline of technologies that can be released on an annual basis, subject to approval by the regulator. Furthermore, the ARC has engaged the regulator to address the current back-log of PBR registrations. As a result of these engagement, there is now an appreciable progress confirmed by the reported number of PBR registered relative to the previous reporting period of 2021/22. Internal coordination issues in the ARC have also received attention to ensure improved efficiencies going forward.

- **Number of farmers participating in each of the animal improvement schemes**

The projected demand for services decreased, in particular, due to the Foot-and-Mouth Disease (FMD) outbreaks in several localities that the country experienced, which resulted in imposed restrictions on the movement of animals and officials handling animals. Furthermore, the emergence of a few private bull test centres contributed to the decreased demand for our services. The ARC-AP team has embarked on more aggressive marketing strategies in an effort to stimulate demand for our services. The longer term vision in this regard aims at improving the quality and quantity of our value addition service offerings to make them more appealing to the livestock keepers.

- **Number of technical reports**

In line with the decrease in demand for animal improvement services, the number of technical reports supplied to our farmers was less than initially anticipated. The ARC-AP team is embarking on aggressive marketing of the animal improvement services to enhance performance in this area.

**Linking performance with budgets**

OUTCOME	2022/2023			2021/2022		
	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000
<b>Outcome 1</b>	93 725	84 744	8 981	87 800	79 891	7 909
<b>TOTAL</b>	<b>93 725</b>	<b>84 744</b>	<b>8 981</b>	<b>87 800</b>	<b>79 891</b>	<b>7 909</b>

## 3.2 OUTCOME 2: SUSTAINABLE ECOSYSTEMS AND NATURAL RESOURCES

The focus of Outcome 2 is to generate knowledge and technologies (intellectual property and tools) that will conserve natural resources and sustain agriculture.

The Outcome focuses on improving the productivity, competitiveness and sustainability of both commercial and smallholder based agriculture through research and technology in areas related to efficient energy utilisation, water management and irrigation practices; the rehabilitation, utilisation, development and protection of natural agricultural resources; new and improved conservation and climate-smart agriculture systems; improved monitoring and characterisation systems for natural resources and genetic material; and mechanised farming and irrigation practices, techniques, equipment and machinery.

**Outcome 2** is the focus of the following ARC Divisions:

- 1) *Crop Sciences; and*
- 2) *Research and Innovation Systems.*



*Outcomes, Outputs, Output Indicators, Targets and Actual Achievement*

OUTCOME 2: SUSTAINABLE ECOSYSTEMS AND NATURAL RESOURCES							
OUTPUT	OUTPUT INDICATOR	AUDITED ACTUAL PERFORMANCE 2020/2021	ACTUAL ACHIEVEMENT 2021/2022	PLANNED ANNUAL TARGET 2022/2023	ACTUAL ACHIEVEMENT 2022/2023	DEVIATION FROM PLANNED TARGET TO ACTUAL ACHIEVEMENT 2022/2023	REASONS FOR DEVIATIONS
Natural Resource Management	Number of technical reports	86	82	78	103	25	Increase in reports generated for clients by the ARC
	Number of field trials	76	75	59	60	1	More field trials due to favourable weather conditions
	Number of services rendered	436	780	559	663	104	Higher demand from the sector for ARC services
	Number of bio-logical control solutions developed	Not measured	2	0	0	0	–
Soil and Water Science	Number of samples analysed for soil health and water quality	157	411	144	523	379	Higher demand from the sector for ARC services
	Number of scientific solutions	0	0	0	0	0	–
	Number of technical reports	62	42	19	42	23	Increase in reports generated for clients by the ARC
	Number of services rendered	488	557	400	487	87	Higher demand from the sector for ARC services
Weed Science	Number of technical reports	7	14	12	12	0	–
	Number of services rendered	13	7	5	6	1	Higher demand from the sector for ARC services
Ecosystem services	Number of technical reports	11	7	4	6	2	Increase in reports generated for clients by the ARC
	Number of services rendered	7	2	0	0	0	–



### Significant achievements of targets

It is noteworthy that all targets under Outcome 2 were either achieved or surpassed. All research teams in Crop Sciences and Natural Resources and Engineering (ARC-NRE) are committed to deliver outstanding outputs for substantial recovery of research services from impacts of Covid-19 pandemic. This level of performance is not passively demand driven as increasing number of clients are collaboration partners pursue engagement with the ARC. It is in fact enabled by tremendous effort in the ARC to market service offerings, and it is important to maintain this momentum into the future, considering prevailing economic conditions in South Africa and globally.

A number of projects that yielded these results emanate from international partnerships with multi-year funding arrangements and very high performance standards expected. Other projects that are funded from within South Africa are also multi-year projects, thus, implying good client satisfaction ratings for the ARC. By way of example, the South Africa-Polish collaborative crop growth monitoring and yield assessment project (SAPOL4Crop), funded by the National Research Foundation (NRF) concluded in fourth quarter of 2022/23 FY, with a visit to South Africa by partners from the Institute of Geodesy and Cartography (IGIK) in Poland. ARC-NRE and IGIK have been collaborating for over 3 years to develop suitable crop monitoring and risk warning systems for South Africa and Poland (risk alerts for extreme weather conditions such as drought, floods and extreme temperatures).

Several feedback seminars on this project were presented to farmers and producers in the Free State Province, including maize farmers in Bothaville and winter wheat farmers and agricultural insurance companies in Reitz. The farmers made requests to receive such information on new technology and research outputs more often, with some indicating their willingness to invite researchers to their farms and to collaborate on field data collection during crop studies. Further collaboration opportunities are under consideration to ensure continued service delivery in this high impact area of research services. There was an increase in the number of services demanded from ARC - Biotechnology Platform (ARC-BTP) by clients predominantly from universities for genomic services in soil and water services. This demonstrates an uptake of genomic technologies and its application in natural resources management.

### Prioritisation of women, youth and persons with disabilities

Research programmes delivered under Outcome 2 with strong focus on Sustainable Ecosystems and Natural Resources are endowed with national and global commemorative days such as World Wetlands Day is celebrated annually on 2 February 2023, World Water Day celebrated on 22 March 2023 and World Meteorological Day on 23 March 2023, to mention a few. Commemorations are strategic awareness and outreach opportunities to engage society about environmental issues highlighted by these special days. For instance, the ARC-NRE celebrated Wetlands Day with other stakeholders at events held in both Gauteng and the Western Cape during February 2023, about 170 children who visited the Colbyn Wetland Nature Reserve in Pretoria to learn about wetlands and the imperative to restore and protect them. School children and youth groups across the City of Tshwane (Pretoria) were invited. The Colbyn Valley Wetland is conserved within the nature reserve which was proclaimed in June 2014 and is managed by the City of Tshwane, and it includes areas of peat which is a relatively rare occurrence in South African wetlands. Other events focused on the Onrus palmiet peatland in the greater Hermanus area in the Western Cape where ARC-NRE has worked extensively with landowners and other stakeholders within the Onrus River catchment. Latest research findings for peatland restoration emanating from the Onrus peatland case study were shared with stakeholders at the Overstrand Environmental Conference, followed by commemoration activities of the Western Cape Wetlands Forum event held at the Onrus peatland. These events deliberately target the participation of designated groups of women, youth and persons with disabilities.

### Linking performance with budgets

OUTCOME	2022/2023			2021/2022		
	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000
Outcome 2	251 245	227 169	24 076	235 364	214 162	21 202
TOTAL	251 245	227 169	24 076	235 364	214 162	21 202

### 3.3 OUTCOME 3: IMPROVED NUTRITIONAL VALUE, QUALITY AND SAFETY OF AGRICULTURAL PRODUCTS

The focus of Outcome 3 is to generate knowledge, solutions and technologies for food safety, quality and improved efficiencies in the agriculture value chain, with particular focus on agro-processing, pre and post-harvest processing biotechnology and informatics, each cross-cutting across different areas of the agricultural value chain and intended to be applied to the full value chain of crops, animals and agricultural system research.

**Outcome 3** is the focus of the following ARC Divisions:

- 1) *Crop Sciences; and*
- 2) *Research and Innovation Systems*





*Outcomes, Outputs, Output Indicators, Targets and Actual Achievement*

OUTCOME 3: IMPROVED NUTRITIONAL VALUE, QUALITY AND SAFETY OF AGRICULTURAL PRODUCTS							
OUTPUT	OUTPUT INDICATOR	AUDITED ACTUAL PERFORMANCE 2020/2021	ACTUAL ACHIEVEMENT 2021/2022	PLANNED ANNUAL TARGET 2022/2023	ACTUAL ACHIEVEMENT 2022/2023	DEVIATION FROM PLANNED TARGET TO ACTUAL ACHIEVEMENT 2022/2023	REASONS FOR DEVIATIONS
Broadening the food base	Number of cultivars registered	0	0	4	4	0	–
	Number of field trials	5	6	3	13	10	More field trials due to favourable weather conditions
	Number of technical reports	131	102	69	151	82	Increase in reports generated for clients by the ARC
	Number of cultivar evaluations	105	41	64	48	(16)	Lower demand from industry for cultivar evaluations
	Number of new products developed	1	0	6	2	(4)	Delays in finalisation of product development process
	Number of services rendered	16	44	15	38	23	Higher demand from the sector for ARC services
Post-harvest handling and agro processing	Number of cultivars developed with improved shelf life	0	0	0	0	0	–
	Number of solutions for controlled atmosphere	1	1	1	2	1	Higher demand from industry for controlled atmosphere solutions
	Number of services rendered	59	55	33	58	25	Higher demand from the sector for ARC services

### ***Significant achievements of targets***

Nutrition security is fundamental to research programmes delivered under Outcome 3, hence, crop breeding programmes under this outcome focuses on nutrient dense crops like sweet potato. Thus, all the four plant breeders' rights granted under this Outcome were for three new orange-fleshed sweet potato varieties characterised by smooth appearance and better keeping ability than previous released varieties of Bophelo and Khumo, although the dry matter content is a bit lower. The fourth release is a cream-fleshed variety with cream skin which falls into the dry cream group of Ndou and Monate, but with an attractive round shape. The varieties are currently in the final year of evaluation trials at various sites in five provinces whereafter cultivar recommendations will be made to farmers per production area.

Agro-processing is another important area of significant achievement under the Outputs Indicator of number of technical reports that is directly linked to microscopic analysis (Methylene Blue Staining) done for clients in the wine industry for which different reports are provided for each Bottle/Tank sample submitted by clients.

The ARC-BTP has developed genomic tools to support breeding and improvement of marginalised animals (goats and sheep) and crops sorghum and sunflower to mainstream them in the food value chain. In addition, the ARC-BTP is working on alternative protein sources such as mopane worms focusing on characterisation and development of genomic tools to manage their optimal utilisation and conservation.

### ***Prioritisation of women, youth and persons with disabilities***

Programme activities with highest impact among designated groups include school feeding and school garden projects, which provide leverage for women and youth producers and entrepreneurs to collaborate meaningfully with local schools and sometimes primary health care facilities such as local clinics to promote nutrient dense crops. Some of the women who participate in these programmes have received recognition awards as community builders of note in their communities.

### ***Strategy to overcome areas of under performance***

- **Number of cultivar evaluations**

The ARC is engaging relevant stakeholders in the deciduous fruit industry to reach consensus modalities for cultivar evaluations. In the year under review, the ARC received less phase-one selections for evaluation because the selections are now managed by a third party on behalf of the industry. This situation constrains the ARC's ability to accurately determine the target in the annual performance plan.

- **Number of new products developed**

New products under this Output Indicator refer to Moringa teabag prototypes that have been developed and are currently being analysed at a sensory laboratory in a different business unit of the ARC. Underperformance will be addressed going forward, and the outputs will be reported in the next reporting cycle and lessons learned are important for future projects.

### ***Linking performance with budgets***

OUTCOME	2022/2023			2021/2022		
	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000
Outcome 3	39 149	35 397	3 751	36 674	33 370	3 304
TOTAL	39 149	35 397	3 751	36 674	33 370	3 304

### 3.4 OUTCOME 4: A SKILLED AND CAPABLE AGRICULTURE SECTOR

The focus of Outcome 4 is to provide strategies, analysis and information to develop and grow a competitive, productive and diverse agricultural sector, and provide support services to identify and develop the commercial potential of agricultural research and development, so as to address smallholder and commercial farmer constraints.

Agricultural excellence depends on the organisation's skilled human resources and this is important for establishing sustainable growth in the South African agricultural economy. In order for the ARC to achieve this, specialist and postgraduate training of students and staff is crucial and underpins the diagnostic and research activities of the ARC. This capacity development will ensure that the ARC has a critical mass of scientists to contribute to the continuity of the research and development agenda of the organisation.

The Outcome further focuses on the implementation of initiatives to address smallholder farmer constraints in terms of access to resources (technology, information, etc.). This includes the packaging, exploitation and licensing of ARC research and development outputs to enhance the capacity and skills of farmers, extension personnel, processors and enterprises through facilitating the utilisation of ARC intellectual property.

The ARC is dedicated to providing unparalleled personalised education and training for the farming sector in addition to conveying management solutions to assist the wide spectrum of veterinary and associated professions.

This will ensure that the ARC is better placed to disseminate and transfer the knowledge generated to farmers and extension agents for a sustainable agricultural sector and a food secure South Africa. The dissemination of the generated knowledge through scientific and other popular publications is a key output of the ARC and will ensure an informed society, thereby enhancing the visibility of the organisation.

**Outcome 4** is the focus of the following ARC Divisions:

- 1) *Crop Sciences;*
- 2) *Animal Sciences;*
- 3) *Research and Innovation Systems; and*
- 4) *Impact and Partnerships*



## Outcomes, Outputs, Output Indicators, Targets and Actual Achievement

OUTCOME 4: A SKILLED AND CAPABLE AGRICULTURE SECTOR							
OUTPUT	OUTPUT INDICATOR	AUDITED ACTUAL PERFORMANCE 2020/2021	ACTUAL ACHIEVEMENT 2021/2022	PLANNED ANNUAL TARGET 2022/2023	ACTUAL ACHIEVEMENT 2022/2023	DEVIATION FROM PLANNED TARGET TO ACTUAL ACHIEVEMENT 2022/2023	REASONS FOR DEVIATIONS
Skills development	Number of people trained	1 808	1 375	497	939	442	Higher demand for training
	Number of Post-graduate students supported by ARC	44	52	46	63	17	More students completed their degrees than anticipated
Technology Transfer	Number of technologies/IP registered/developed	2	2	3	7	4	More solutions registered than anticipated
	Number of enterprises supported	6	6	5	5	0	–
	Number of technologies transferred under license	12	137	30	0	(30)	Lower demand for ARC technologies
Smallholder farmer supported	Number of farmers trained	851	1 246	1 004	3 068	2 064	Higher demand for ARC training
	Number of technical assessments for commercial readiness	25	30	40	44	4	Higher demand for technical assessments for establishing commercial readiness
	Number of smallholder farmers participating in KyD	4 834	7 096	4 500	4 646	146	Higher participation than anticipated
	Number of services rendered	191	179	54	152	98	Higher demand for ARC services
	Number of farmer field days	5	5	6	5	(1)	Lower demand for farmer field days
Farmer support	Number of farm assessments	0	19	25	1	(24)	Lower demand for farm assessments
	Number of farmers supported	311	420	238	748	510	Higher demand for ARC support
	Number of farmer field days	26	37	18	71	53	Higher demand from farmers
	Number of services rendered	379	112	103	164	61	Higher demand for ARC services
Knowledge generated and dissemination	Number of scientific publications	446	479	249	428	179	More manuscripts were accepted earlier than anticipated
	Number of popular publications	317	251	187	236	49	More publishing houses extended an opportunity for ARC researchers to publish work
	Number of public awareness events	96	187	80	171	91	More opportunities than expected

### ***Significant achievements of targets***

Broad areas of significant achievement of targets include services and support include number of people trained, smallholder farmers supported, service delivery initiatives undertaken in the form study group meetings for farmer development and support, as well as analytical and diagnostic services.

A total of 428 scientific publications was achieved during the FY2022/23, compared to a target of 249. This demonstrates the research expertise and knowledge of ARC staff in their particular areas of research and the fact that the peer-reviewed publications were published in high impact factor journals demonstrate the high-level science undertaken by the scientists. The majority of the publications were published in open access to ensure a reach out to a broader audience. A significant number of publications included national, regional and international co-authors.

The other area where the ARC performed well is the number of farmers supported and trained. A total number of 3 068 farmers were trained compared to a target of 1 004.

The collaborative efforts between ARC and KZN Department of Agriculture and Rural Development (KZN DARD) to implement Kaonafatso Ya Dikgomo (KyD) Farmer Support Scheme in order to improve market access among smallholder livestock farmers are starting to bear fruits. The duo unveiled a new Black-owned auction company, which hosted its inaugural auction events at Kortnek village in uPhongolo and Ezwati village in AbaQulusi Local Municipality. In addition to providing job opportunities for local communities, the auctions attracted local small businesses and hawkers who sold a variety of goods at the events - an important step towards invigorating the rural economy.

These historic auctions were a resounding success in that over 300 head of cattle were sold. More importantly, the Ezwati auction generated R2 439 100, with an average price of R9 756 per head, which is comparable to the benchmark set by established auction houses. Similarly the Kortnek auction raised the bar by generating R956 000, with an average price of R11 815 per head.

### ***Prioritisation of women, youth and persons with disabilities***

Gender disaggregation of services and support provided to farmers and beneficiaries shows proportional representation of more women supported, followed by males and youth at ratios of about 47% women, 30% men, and 23% youth. These proportions highlight the need to promote targeted service delivery interventions for persons with disabilities.

The ARC continued to support women, the youth and people living with disabilities who are involved in agriculture during the 2022/23 FY. KyD conducted 21 farmers' days in four provinces during the first and second quarters of the 2022/23 FY and 1 820 farmers attended these events. Women constituted 32.6% of the audience while youth and people living with disabilities constituted 22.7 % and 1.5%, respectively. Furthermore, KyD conducted 32 farmers' days in 38 Local Municipalities across the country (except Limpopo and the Western Cape) during quarter 4 of the 2022/23 FY. On average, women comprised 35% of the audience and persons with disabilities 1%. All farmers' day events addressed priorities identified by the KyD team in a specific province, local extension officers, and farmers. The scope of topics covered during these farmers' days included the application of DNA to deter stock theft, animal nutrition, rangeland management, breeding and selection, artificial insemination as well animal health management.

A total of 13 training courses for extension agents and interns and 8 training events for farmers during the period under review. Of all the attendees of the 13 training courses, 32 were female and 27 youth. From the 8 farmer training events, 150 were female and 172 youth. The ARC is looking into ways to increase the participation of people with disabilities in the various training opportunities offered.

### Strategy to overcome areas of under performance

- Number of farmer field days**  
 Going forward, it is important to encourage field trials to be conducted on fields of smallholder farmers, so that this category of farmers may host farmer field days using the concept of farmer field schools.
- Number of farm assessments**  
 The number of farm assessments reported for the past year has been low. The Agrimetrics unit has, despite efforts in marketing the service, not been able to create sufficient interest. ARC is in discussions with Department of Correctional Services and DALRRD to demonstrate the importance of the tool and stimulate interest and demand. A major limitation remains the capacity in terms of human resources, which will be addressed. Farm assessments are generally very costly undertakings that are aligned to long-term farm planning projects. The ARC is extensively marketing services in this area and the Agriculture and Agro-processing Master Plan (AAMP) is regarded as an opportune vehicle for farm assessment services.
- Number of technologies transferred under license**  
 The ARC will embark on different means to attract and market the ARC technologies. Calls for expression will be done per technology per campus. We also intend to publish the expressions of interest in different media to reach potential partners.

### Linking performance with budgets

OUTCOME	2022/2023			2021/2022		
	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000
<b>Outcome 4</b>	294 005	265 831	28 173	275 421	250 610	24 811
<b>TOTAL</b>	<b>294 005</b>	<b>265 831</b>	<b>28 173</b>	<b>275 421</b>	<b>250 610</b>	<b>24 811</b>

## 3.5 OUTCOME 5: ENHANCED RESILIENCE OF AGRICULTURE

The focus of Outcome 5 is to enhance the resilience of the Agriculture sector to factors such as Climate Change. The weather variability and climate change have a direct impact on food security, especially in semi-arid and arid countries.

The Outcome focuses on climate monitoring for agriculture and the effective maintenance of an operational national agro-climate weather station network for effective provision of weather and climate related services

In addition, infectious animal disease agents including bacteria, viruses and parasites, evolve in response to pressures that include immunologic and antimicrobial agents. We provide effective and efficient diagnostic and analytical services and a wide range of applied research and consultancy services on livestock diseases at local, provincial, national and regional levels. The world-class veterinary research focuses on the development and improvement of diagnostic and analytical services and applying the latest biological techniques. The development of vaccines to improve the health of the national herd through the prevention of key important diseases for the region is vital.

**Outcome 5** is the focus of the following ARC Divisions:

- 1) **Crop Sciences;**
- 2) **Animal Sciences; and**
- 3) **Research and Innovation Systems**



## Outcomes, Outputs, Output Indicators, Targets and Actual Achievement

OUTCOME 5: ENHANCED RESILIENCE OF AGRICULTURE							
OUTPUT	OUTPUT INDICATOR	AUDITED ACTUAL PERFORMANCE 2020/2021	ACTUAL ACHIEVEMENT 2021/2022	PLANNED ANNUAL TARGET 2022/2023	ACTUAL ACHIEVEMENT 2022/2023	DEVIATION FROM PLANNED TARGET TO ACTUAL ACHIEVEMENT 2022/2023	REASONS FOR DEVIATIONS
Climate resilient solutions	Number of drought tolerant cultivars	0	0	2	0	(2)	Final registration of cultivars beyond the control of ARC
	Number of services rendered	6	6	0	0	0	–
	Number of technical reports	31	12	10	8	(2)	Fewer reports were generated for ARC clients
	Number of field trials	105	107	105	129	24	Higher demand from clients
	Number of tools for measuring climate change	433	419	400	410	10	Higher demand for tools measuring climate change
Vaccine production	Number of blood vaccine doses produced	198 052	49 890	65 000	186 481	121 481	Higher demand for ARC vaccine doses
	Number of different types of vaccines developed	0	0	0	0	0	–
	Number of FMD vaccine doses produced	0	0	0	0	0	–
	Number of vaccine clinical trials	0	0	2	1	(1)	Fewer trials than anticipated
	Number of test reports issued for animal health	16 781	22 344	14 208	21 573	7 365	Higher demand for the sector for ARC services
Laboratory services	Number of tests performed for food and feed	3 293	3 008	2 310	2 943	633	Higher demand for the sector for ARC services
	Number of services rendered	139	231	150	302	152	Higher demand for the sector for ARC services
	Number of technical reports	13	21	0	15	15	Increase in reports generated for clients by the ARC

### ***Significant achievements of targets***

Resilience of the agriculture sector is one of the most important cross-cutting programmes in the ARC, and collaboration with partners is regarded as an important leverage to achieve this resilience. Some of the notable significant achievements include ARC-NRE's continued collaboration with the National Disaster Management Centre on the provision of climate-related and vegetation data. The collaboration incorporates development of a hydrological drought and Standardised Precipitation Index (SPI) forecast. This is a multi-year project that will continue to deliver value to clients across the agriculture sector.

Tick-borne diseases are prevalent over a large area of the eastern region of South Africa with cattle, goats and sheep being more at risk to Heartwater. Cattle are also at risk to both the redwater diseases (Asiatic & African redwater) and to anaplasmosis (gall sickness). A major defence against these tick-borne diseases is blood vaccines. The four live blood vaccines against these economically important tick-borne diseases are produced by the ARC but marketed by OBP. A total of 186 481 blood vaccine doses were produced against a target of 65 000 for the 2022/23 FY. This was mainly due to a higher demand from our client, OBP for the Anaplasmosis vaccine, Asiatic redwater vaccine and African redwater vaccine during the reporting period.

A total of 21 573 test reports for animal health against a target of 14 208 were issued to clients. This achievement can mostly be attributed to the FMD, ASF and AI outbreaks that have been hitting South Africa during the 2022/23 FY.

The ARC-Animal Production (ARC-AP) Analytical Services Laboratory in Irene and Elsenburg underwent an annual compliance audit conducted by the South African National Accreditation System (SANAS). SANAS is the only national body responsible for carrying out accreditations in respect of conformity assessment in line with the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act (Act 19 of 2006). Our laboratories retained the accreditation making us the service provider of choice for government, industry and academia.

The ARC-BTP conducted whole genome sequencing of brucella, African horse sickness and avian influenza from disease outbreaks and endemic areas. The whole genome sequencing allowed deep characterization of sources of infection, differences between outbreaks and informed control strategies like vaccine development.

The ARC-BTP has established a food borne pathogen and microbial profiling workflow based on next generation sequencing. Services were offered to support the DALRRD surveillance programs as well as external clients from universities.

### ***Prioritisation of women, youth and persons with disabilities***

Focus on training of agricultural engineers is an important intervention on skills development that seeks to empower youth in a high impact area of service delivery. Other initiatives include on-going collaboration with universities on agricultural mechanisation projects, an example of which involves students from UNISA receiving training on Agricultural Mechanisation at the ARC-NRE Silverton campus in Pretoria. Growing networks of collaborators are creating much needed leverage of resources and collaborating institutions.

### ***Strategy to overcome areas of under performance***

- **Number of drought tolerant cultivars**

The ARC collaborates with partners to develop drought resilient cultivars with a pipeline of technologies that has sufficient material for annual release of cultivars. However, registration of cultivars is beyond the control of the ARC, and on-going engagements with the regulator are expected to yield positive feedback, considering positive reported feedback on number of plant breeders rights registered under Outcomes 1 and 3 in the financial year under review.

- **Number of technical reports**

Advisory services to clients are in many instances conveyed as formal technical reports requested by client, and the advisory in the reports is informed by data collected from specific research experiments. In this particular instance, under performance occurred because experiments that would inform the technical reports were still underway and will be reported to the client in the subsequent reporting cycle.

- **Number of vaccine clinical trials**

Control measures in the FMD control areas include movement restrictions and vaccination in the portion of the Protection Zone immediately adjacent to the Infected Zone. The availability of an effective vaccine is central to the control of the disease. To address this need, the ARC developed a new FMD vaccine tailored to the South African market. Evaluation of the FMD vaccine has shown it to be efficacious and able to protect both cattle and goats from challenge with infectious FMD virus (FMDV) under controlled conditions. Experimental exposure of vaccinated cattle to FMD challenge confirm that the animals are protected 12 months after vaccination. The vaccine has also been shown to protect cattle against FMD strains currently circulating in South Africa. In May 2022 the ARC registered the FMD vaccine for use in cattle. The next steps involves assessing the efficacy of the vaccine under a variety of field conditions and circulating strains to strengthen efficacy claims. This will improve the marketability of the vaccine in South Africa and beyond. An application to evaluate the vaccine in Limpopo was submitted to the Directorate of Animal Health. The Department raised several concerns which were addressed by the development of Standard Operating Procedures.

#### **Linking performance with budgets**

OUTCOME	2022/2023			2021/2022		
	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000
<b>Outcome 5</b>	440 745	398 511	42 235	412 886	375 692	37 194
<b>TOTAL</b>	<b>440 745</b>	<b>398 511</b>	<b>42 235</b>	<b>412 886</b>	<b>375 692</b>	<b>37 194</b>

## **3.6 OUTCOME 6: A HIGH PERFORMING AND SUSTAINABLE ORGANISATION**

Outcome 6 is the platform for delivery against the ARC mission and the realisation of the ARC impact. The focus of Outcome 6 is to ensure:

- 1) Addressing the current working capital gap and financial position through the implementation of a targeted and robust Sustainability and Turnaround Plan; and
- 2) Ensuring excellence in scientific research and development through enhanced capacity, capabilities and appropriate organisational technology and infrastructure.

The Outcome focuses on improving organisational effectiveness and efficiency towards a sustainable ARC. It includes promoting public accountability, achieving high standards of corporate governance and efficient resource utilisation, strengthened revenue generation and productivity, and good stakeholder engagement to ensure optimal organisational performance, visibility and service delivery.

**Outcome 6** is delivered by the Corporate Support Divisions of the ARC, namely:

- 1) **Office of the CEO;**
- 2) **Human Capital Management;**
- 3) **Impact and Partnerships;**
- 4) **Finance; and**
- 5) **ICT and Infrastructure.**

## Outcomes, Outputs, Output Indicators, Targets and Actual Achievement

OUTCOME 6: A HIGH PERFORMING AND SUSTAINABLE ORGANISATION							
OUTPUT	OUTPUT INDICATOR	AUDITED ACTUAL PERFORMANCE 2020/2021	ACTUAL ACHIEVEMENT 2021/2022	PLANNED ANNUAL TARGET 2022/2023	ACTUAL ACHIEVEMENT 2022/2023	DEVIATION FROM PLANNED TARGET TO ACTUAL ACHIEVEMENT 2022/2023	REASONS FOR DEVIATIONS
Infrastructure Management	Number of business cases developed for implementation of assets management plan	1	3	1	4	3	Focused approach on the implementation of recommendations from prior assessment
	Increase in Rand value of rental income	3.48%	3.25%	1%	5.9%	4.9%	Post COVID-19 demand on property rental
ICT Strategy Implementation	Number of digital transformation projects implemented	Not measured	5	3	4	1	Higher demand on digitisation
	Number of Stabilisation projects implemented	Not measured	4	2	2	0	–
	Number of Optimisation projects implemented	Not measured	4	3	4	1	Increase in interest from ARC projects
Human Resources Management	Vacancy rate	9.72%	12.8%	10%	12.20%	(2.20%)	Challenges with regards to filling of vacancies
	Support employees as percentage of total staff	22.70%	19.8%	16.70%	20.70%	(4%)	
	Percentage increase of Employment equity ratio in the designated groups in the core business, in respect of: - Women at Senior Management level	46%	46%	46%	50%	4%	Recruitment of more women than anticipated
	- People with Disabilities Employed	0.57%	0.51%	1.55%	0.41%	(1.14%)	Recruiting PWD is challenging
	Improve the leadership dimensions of 360° results of Management, Senior and Executive Management	3.42%	3.45	4	Not undertaken during the financial year	(4)	Tender process were undertaken to appoint the supplier. Process is ongoing
Performance Management	Alignment of organisational values	93.51%	96%	100%		(100%)	Low staff morale and high level of uncertainties
	Percentage implementation of change management strategies linked to culture survey and 360° leadership processes	Culture survey completed	96%	100%		(100%)	

*Outcomes, Outputs, Output Indicators, Targets and Actual Achievement*

OUTCOME 6: A HIGH PERFORMING AND SUSTAINABLE ORGANISATION							
OUTPUT	OUTPUT INDICATOR	AUDITED ACTUAL PERFORMANCE 2020/2021	ACTUAL ACHIEVEMENT 2021/2022	PLANNED ANNUAL TARGET 2022/2023	ACTUAL ACHIEVEMENT 2022/2023	DEVIATION FROM PLANNED TARGET TO ACTUAL ACHIEVEMENT 2022/2023	REASONS FOR DEVIATIONS
Human resource development	Number of employees appointed with Masters degrees	8	5	20	17	(3)	Fewer applications with master's degrees
	Number of employees appointed with Doctoral degrees	9	15	10	19	9	More applicants with doctoral degrees
	Number of employees with Masters degrees	199	187	200	185	(15)	Challenges in retaining staff
	Number of employees with Doctoral degrees	232	238	240	241	1	More staff acquiring Doctoral degrees
	Percentage staff turnover	3.32%	4.61%	3.5%	3.8%	(0.3%)	Higher staff turnover
	Total spend on PDP stipend and registration	R 8.85 mil	R 5.8 mil	R 21.1 mil	R 1.76 mil	R 19.34 mil	Termination of students from PG funding
	Training spend as a % of salary bill	0.4%	1%	1%	1%	0	–
Commercialisation of ARC solutions	Establishment of an ARC commercialisation entity	Not approved	0	Entity approved	Not Finalised	(not met)	Delays in the finalisation process
Exhibitions and sponsorships	Number of exhibitions, sponsorships	0	0	5	34	29	More exhibitions than anticipated
International partnerships	Number of new international partnerships	2	2	2	4	2	More opportunities than anticipated
Governance	Audit opinion	Unqualified audit	Unqualified audit	Unqualified audit	Qualified		The ARC continue to address property, plant and equipment qualification areas which has contributed negatively to the modified audit opinion from the Auditor General of South Africa. The Action Plan for FY2023/24 will be workshopped with the Audit Committee and AGSA to ensure it addresses the root causes.

### Outcomes, Outputs, Output Indicators, Targets and Actual Achievement

	Zero Deficit	Zero deficit	Zero deficit	Zero deficit	Zero deficit	Zero deficit	-	No variance
Funding and revenue generation	B-BBEE rating	Level 8	Non-compliant	Level 5	Non-compliant			The ARC could not document the evidence to satisfactory support skills development. A workshop was organised to align and clarify the BEE requirements.
	External income as % of total revenue	21%	21%	35%	23%		12%	Generation of external income was negatively impacted by the delay in the kick-off projects due to both.
	Rand value of royalty income	R 39 mil	R 35 mil	R 23 mil	R 47 mil		R 24 mil	
	Reduction in fixed cost	1%	2%	5%	(-10%)		(15%)	The consolidation of the Pretoria Campuses is still delayed due to limited funding needed
Cost efficiencies	Personnel costs as % of Operational PG	91%	83%	75%	83%		(8%)	The organisation review exercise is still ongoing and will provide the ARC with the optimal organisational structure moving forward.



## ***Significant achievements of targets***

### **Infrastructure:**

The implementation of the new Facilities Management Model marked a significant change in the way the organisation operates and manages its facilities. This shift aimed to improve operational efficiency and streamline management practices, resulting in notable improvements across various aspects of ARC's infrastructure and facilities operations.

Concurrently, a comprehensive Land and Property Management Plan was developed for the financial year 2022/2023. The primary objective of this plan was to enhance the oversight of ARC's land and property portfolio. A specific emphasis was placed on refining the leasing portfolio, which likely includes properties or land that ARC leases out to external parties.

Understanding the importance of external lease agreements, ARC proactively undertook initiatives to ensure that its rental agreements with external parties align with market values. Furthermore, ARC took a forward-looking approach by devising a Facilities Maintenance Plan that spans the next five years. The primary goal of this plan is to strengthen ARC's infrastructure by minimising breakdowns and disruptions. By proactively addressing maintenance needs, ARC aims to create a more reliable and robust operational environment. This maintenance plan is also designed to synergistically support the core business functions of ARC, ensuring that facilities are well-maintained to facilitate smooth business operations.

In summary, these initiatives collectively demonstrate ARC's commitment to enhancing its operational efficiency, optimising its real estate assets, and ensuring the reliability of its facilities. The organization's proactive and forward-looking approach suggests a strategic mindset aimed at achieving long-term sustainability and success.

### **ICT:**

The ICT department has been actively working on several projects in line with its three main strategic objectives: Stabilization, Optimization, and Digitisation. To ensure its ICT strategy remains relevant and aligned with the organisation's broader business objectives.

During the past financial year, a notable achievement was the implementation of an electronic document and records management system (EDRMS). This system streamlined the management of documents, content, and records within the organisation. Significantly, this system was developed in compliance with NARSA guidelines, which address the end-to-end management of the document lifecycle. This indicates a commitment to maintaining regulatory compliance and efficient document management practices.

The existing ICT infrastructure of ARC had reached the end of its operational life, which meant that it could no longer support the modern and contemporary requirements of the business. To address this challenge, the ICT department implemented Infrastructure-as-a-Service (IaaS). This implementation brought about stabilisation and optimisation of the current systems, allowing ARC to align its infrastructure with current technological trends. By adopting IaaS, the ICT department was able to meet the demands of the business and computing needs, resulting in improved service delivery and a better customer experience.

In addition, the ICT division continued to contribute to the organisation by delivering various research applications. These applications are designed to assist farmers with production guidelines, management strategies, and disease control for different farming areas. This highlights the role of ICT in supporting the core business functions of the ARC, demonstrating how technology can directly impact and enhance operational outcomes.

Overall, the ICT department's efforts reflect a comprehensive approach to modernising infrastructure, optimising systems, and leveraging technology to support both internal processes and external stakeholders like farmers. The alignment with strategic objectives showcases a proactive approach to addressing the organisation's evolving needs.

## ***Prioritisation of women, youth and persons with disabilities***

Rigorous transformation in the public sector demands continued long-term commitment on creating human capital pool through investing in people, EE and skills development, especially the prioritisation of women, PWD and youth. The ARC will endeavour to achieve the following:

**Prioritisation: Women**

With the enhanced EVP, the ARC will broaden its search criteria in reaching critical mass to attract women, PWD and youth in its recruitment drive. We are currently prioritising designated group when conducting our recruitment processes through our social platforms as well as through partnerships and providing a work environment that encourages and caters for women needs.

**Prioritisation: Youth**

Improving youth employment outcomes is vital for growth and social cohesion across the country, the ARC will increase more youth intake as a way of investing in skills to cater for the 4IR in the internships, PDP's and other programmes thereby building a pool to draw from when filling roles in ARC, where possible.

**Prioritisation: People with disability**

The ARC will continuously improve its environment to be friendlier to PWD and to partner with organisations that can assist in the development of industry specific learnerships and programmes suitable for PWD, thereby increasing a pool of fully trained PWD's that can be absorbed.

**Strategy to overcome areas of under performance**

- Commercialisation of ARC solutions**

ARC had envisaged establishment of an ARC Commercialisation entity to enable more agility, and varied approaches to IP exploitation for profit. At the end of the financial year, ARC was still in discussion with DALRRD and Treasury on the proposal for the entity.

The Human Capital Management has developed strategies to ensure achievement of the set targets for the FY2023/24. The introduction of success profiles as part of talent acquisition and management. The implementation of a competitive EVP and the planned hybrid work model to avoid unnecessary usage of paid time off as well as the prioritisation of employee wellness and employee development.

**Linking performance with budgets**

OUTCOME	2022/2023			2021/2022		
	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000	Budget R'000	Actual Expenditure R'000	(Over)/Under Expenditure R'000
Outcome 6	331 497	299 731	31 776	310 543	282 568	27 974
TOTAL	331 497	299 731	31 776	310 543	282 568	27 974

## 4. REVENUE COLLECTION

	2022/2023			2021/2022		
Sources of Revenue	Estimate	Actual Amount Collected	Over/ (Under) Collection	Estimate	Actual Amount Collected	Over/ (Under) Collection
Government grants	1 060 278 607	1 061 835 096	1 556 489	1 002 288 000	1 029 145 971	26 857 971
Sale of goods in agricultural services	40 457 833	10 219 775	(30 238 058)	34 148 376	13 268 195	(20 880 181)
Rendering of services	368 989 974	296 305 149	(72 684 825)	293 733 721	241 283 545	(52 450 176)
Royalty income	17 465 931	47 489 609	30 023 678	33 560 910	35 163 711	1 602 801
Rental of facilities and equipment	35 132 595	31 196 748	(3 935 847)	53 118 940	27 430 655	(25 688 285)
Recoveries	-	1 350 043	1 350 043	19 324	7 871 680	7 852 356
Other income	5 478 928	16 387 910	10 908 982	26 114 045	9 048 177	(17 065 868)
Interest received	37 053 992	61 922 271	24 868 279	27 800 000	30 989 689	3 189 689
Dividends	-	-	0	31 235	13 511	(17 724)
<b>TOTAL</b>	<b>1 564 857 860</b>	<b>1 526 706 601</b>	<b>(38 151 259)</b>	<b>1 470 814 551</b>	<b>1 394 215 134</b>	<b>(76 599 417)</b>

## 5. CAPITAL INVESTMENT

### Infrastructure Capital investment 2022– 2023

Aging Infrastructure and equipment remain one of the key risks in our risk register; this impedes seamless research work, thus compromising our competitive edge in the research and development sector. Several projects were implemented to upgrade and maintain dilapidated buildings and Infrastructure supporting research in the past financial year .

### Capital Investment Project

For FY 2022-23, Infrastructure received **R57,9** mil for capital investment projects, of which **R54,5** mil was committed. From a corporate perspective, the capital investment projects focused on renewable energy, farming equipment, and fleet replacement.

- Infrastructure invested **R11.5** mil in Solar as part of the renewable energy project.
- Infrastructure invested **R7.4** mil in procuring new Tractors to support farming and research.
- **R10.7** mil was invested in procuring fleet vehicles (4x4 Double Cap) to address the need to support research projects.

Other capital investment projects include the procurement of farm implements, office furniture, generators, and UPSs; renovation of buildings, greenhouses, and glasshouses; refurbishment of irrigation dams; installation of security cameras and biometric access control solutions and the procurement of research equipment like ovens, hotplates, and humidification systems.

### Maintenance Projects

Implementing planned maintenance continues to be challenging due to limited operational funding. For FY 2022-23, the allocated opex budget for Infrastructure and Facilities Management amounted to **R164 792 901.87**, with a maintenance allocation of only **R29 455 854.43**, after **R72 989 458.05** was requested based on the ARC Maintenance Management plan for 2022-2026.

This reduces the useful life of Infrastructure, plant, and equipment as maintenance cannot be carried out according to the Original Equipment Manufacturers' requirements, thus resulting in plant and equipment breakdowns. Furthermore, this reduces the reliability and availability of Infrastructure, plant, and equipment, thus resulting in frequent downtime. This has a negative impact on research and productivity.

## FOOT-AND-MOUTH DISEASE FACTORY PROJECT

### *Current status of the ARC FMD vaccine production efforts*

After South Africa's sole FMD vaccine production facility at the ARC's Onderstepoort Campus ceased functioning due to a variety of reasons, the ARC undertook to develop a process for the production of FMD vaccines for use in Southern Africa. These efforts have culminated in the establishment of the technical expertise and infrastructure to consistently produce FMD antigens at 20 liter scale using suspension production technologies. The FMD vaccine was registered on 20 May 2022, as a stock remedy under Act 36 of 1947. The registration certificate is valid for/renewable after 3 years. The ARC can now use its vaccine as part of DALRRD's FMD prevention programme. To that end, the ARC has completed the formulation of 20 000 doses of pentavalent FMD vaccines using the stockpiled antigen for supply to the DALRRD to be deployed at its discretion.

Efforts to scale the production process to an industrial scale and to build a facility to house the process are underway. A dedicated project manager to manage the design and construction processes of the project for the ARC was appointed. He is dealing with various building preparatory measures like management of land rights including necessary zoning, environmental, infrastructural/external services, legal requirements in relation to such land rights (e.g., facilitating the release of the title deed, Surveyor General diagram, municipal account approval, etc. for the building site). After going through the ARC's Supply Chain Management processes, all the built environment service providers for Electrical Engineering, Civil and Structural Engineering, Mechanical Engineering, Architecture, Process Engineering and Quantity Surveying have been appointed to design and oversee various aspects of the project. The process of appointment of Wet Services Engineering to look into critical water usage, steam usage and all other domestic water usage matters and Fire Engineering Services to look at a rational fire design and fire protection infrastructure and equipment requirements is at advanced stages. The appointed service providers and the ARC vaccine project team are busy with the planning and design phases of the project. The ARC project team and some of the service providers are busy with the flow process design. The service providers and ARC project team have bi-weekly meetings on the project and tracking progress. The ARC FMD project team is thus in project planning and design as well as contract management and monitoring of the service providers for the FMD vaccine factory building project.

However, owing to the recurrent FMD outbreaks in the country and the rest of the SADC region, and the high likelihood of introduction of the O serotype into the country, there is an urgent need to supply the DALRRD with a local vaccine, to bring the spread of outbreaks under control as soon as possible. As an interim measure, whilst the new factory is being constructed, the ARC undertook to increase production from the current 20 liter to 200 liter scale. Permission was granted to proceed with the procurement of the necessary infrastructure to produce the vaccine at 200 liter scale. The process of procuring the required infrastructure is also underway and is expected to take about 10 to 12 months because of prevailing Supply Chain Management challenges in the world as most of the required infrastructure and equipment will be imported. It is now estimated that production of the vaccine will start by about the middle of 2024. In that manner, the ARC will be producing vaccine to take care of the needs of the country whilst the construction of the state-of-the-art facility which will have a much higher production capacity is in progress.



## 6. RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# ANIMAL PRODUCTION

South Africa is richly endowed with natural resources to support crop and livestock production. About 71% of South Africa's agricultural land is only suitable for livestock farming. Thus, livestock agriculture is one of the key sectors of the economy and contributes almost half of the agricultural gross domestic product (GDP). Livestock production also plays an important role in supporting rural livelihoods. Accordingly, the work of ARC-Animal Production (ARC-AP) is important for sustainable growth in the livestock sector.

Animal Production (AP) conducts research and development in all areas of animal production and processing at its Irene main research campus and several satellite stations strategically located in different national agro-ecological regions. The mandate of the campus is to develop and transfer new technologies and agricultural knowledge in order to ensure sustainable livestock production in the era of climate change and other emerging threats such as pandemics.

The campus conducts its work throughout the entire value chain from primary production to tertiary agriculture and thus, its research is organised along the following focus areas:

- Animal Nutrition;
- Germplasm Conservation and Reproductive Biotechnology;
- Animal Breeding and Genetics;
- Meat Science and Technology;
- Range and Forage Sciences; and
- Quantitative and Qualitative Analysis.

The campus also manages the National Animal Recording and Improvement Schemes (e.g. Beef, Dairy, Smallstock and Kaonafatso Ya Dikgomo) and the National Animal Database (INTERGIS) on behalf of the DALRRD. Furthermore, AP is also a custodian of herds and flocks of adapted indigenous livestock, national forage genebank and animal biobank as well as national culture collection of beneficial gastrointestinal and food fermentation organisms. These national assets are key for new scientific discoveries of agricultural solutions for the livestock sector and the bio-economy.

The work of the campus is aligned with the following outcomes of the ARC:

- **OUTCOME 1: Increased agricultural production and productivity**
- **OUTCOME 4: A skilled and capable agriculture sector**
- **OUTCOME 5: Enhanced resilience of agriculture**

The campus made significant progress in the delivery of the mandate of the ARC during the year under review. This section presents highlights of the key achievements of the Animal Production Campus. These achievements contributed immensely towards addressing national imperatives such as food security as well as the triple national challenges facing South Africa e.g. inequality, poverty and unemployment. The highlights are presented in accordance with Outcomes of the ARC.





## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

**OUTCOME 1:****INCREASED AGRICULTURAL PRODUCTION AND PRODUCTIVITY****THE 2022 ARC VIRTUAL NATIONAL MASTER DAIRYMAN AWARDS**

The 2022 ARC Annual National Master Dairyman Award ceremony was held on 17 November 2022 as a hybrid event at Groot Pheasantekraal Estate in Cape Town. This prestigious competition celebrates outstanding performance by South Africa's top commercial and smallholder dairy farmers. The event was hosted by Agri-Expo, on behalf of the National Milk Recording and Improvement Scheme of the ARC.

The ARC President and CEO, Dr. Litha Magingxa, congratulated the winners and thanked them for their confidence in scientific innovation to improve productivity and food security. "Dairy farmers are unique and arguably the most hardworking members of our society, and as such, they should always be treasured," Dr. Magingxa said. Ms. Joyene Isaacs, Chairperson of the ARC Council, emphasised the importance of recognising dairy farmers as food providers. "We all have a role to play, and because we play that role, we have food," Ms. Isaacs explained.

The event was made possible through collaboration with partners including the DALRRD, Nedbank, Nova Feeds, Agri-Expo, AFGRI, Meadow Feeds, Semex South Africa and World Wide Sires South Africa.



*From Left to Right: Ms. Joyene Isaacs (ARC Board Chairperson), Mr. PE Loubser in the middle with his family by his sides (2022 ARC National Master Dairyman Winner) and Dr. Litha Magingxa, President and CEO of the ARC*



*From Left to Right: Ms. Danielle Durr from Nedbank, Ms. Nompe Zim (2022 ARC Small-scale Master Dairyman of the year), Dr. Litha Magingxa (President and CEO of the ARC)*

**THE 2022 ARC NATIONAL BEEF PERFORMERS AWARDS**

The ARC's prestigious National Beef Performers Awards has become one of the highlights in our country's agricultural calendar and is widely supported and recognised by stakeholders in the industry. The awards event has become a showcase for the ARC's leadership role in research, technology development and service delivery to all sectors of the beef industry. The motto of the awards is to "Acknowledge excellence through scientific innovation", something that the ARC's National Beef Recording and Improvement Scheme has been focusing on for more than 63 years. This virtual event allowed farmers and key stakeholders from across the country and abroad to access the event at no cost. No less than seven award categories were presented that showcased the best of the best.

Farmers received awards in the following categories:

- ARC National Special Performance Test Class sponsored by PlaasMedia/Stockfarm.
- ARC National Kaonafatso ya Dikgomo Province of the Year Award sponsored by Molatek.
- ARC National Best Elite Cow Awards sponsored by Farmer's Weekly.
- ARC National Platinum Bull Awards sponsored by GMPBasic.
- ARC National Emerging Farmer of the Year Award sponsored by PlaasMedia/Stockfarm.
- ARC National Beef Cattle Improvement Herd of the Year Award sponsored by PlaasMedia/Stockfarm.
- ARC National Mentor of the Year Award sponsored by Molatek.

In the Elite Cow category, no less than 22 cows from different breeds received top honours, while seven bulls were awarded Platinum status in the Platinum Bull Awards category. KwaZulu-Natal again walked away with the first prize in the category KyD Province of the Year and received the Platinum Status in this highly contested award category.

The first prize for National Emerging Beef Farmer of the Year went to Ms. Selina Hlabedi of Bakwa-Hlabedi in Farming, in Gauteng, while the prize for Mentor of the



Mrs. Selina Hlabedi of Bakwa-Hlabedi in Farming, - 2022 ARC National KyD Beef farmer of the year



Mr. Mpho Munyai of Vhanyai Boran - Mentor of the Year



Mr. Gert Brits, a Santa Gertrudis breeder - Mentor of the Year



Mr. Stefan Terblanche (Stud Manager), Fredericksburg Angus/Wagyu Stud of L'Ormarins (Pty) Ltd - 2022 ARC National Beef Cattle Improvement Herd of the year

## OUTCOME 4:

### A SKILLED AND CAPABLE AGRICULTURE SECTOR

#### **PARTICIPATORY INVENTORY AND NUTRITIONAL EVALUATION OF LOCAL FORAGE RESOURCES FOR SMALLHOLDER FREE RANGE BEEF PRODUCTION IN SEMI-ARID AREAS OF SOUTH AFRICA.**

Feed shortages is a major challenge facing free-range beef farming in semi-arid areas. Low quality and quantity of forage in rangelands and higher feeding costs are the main constraints limiting smallholder free-range beef farmers' participation in mainstream beef markets.

A total of 40 free-ranging commercially-orientated smallholder beef farmers were interviewed using semi-structured questionnaires and tasked to identify locally available feed resources (LAFRs) in the Cradock and Middelburg areas of the Eastern Cape, South Africa. Feed shortage was ranked by more than 53% of the respondents as the main constraint to smallholder beef production.

Regardless of the farming area, crude protein content of *Vachellia Karroo* (V. Karroo) leaves and pods averaging 18.8% and 19.5% respectively, was higher than other LAFRs. However, *Vachellia Karroo* pods had relatively lower ash content than other forages in both farming areas. *Opuntia ficus-indica* attained high in vitro neutral detergent fibre digestibility at 12, 24 and 48 hr incubation periods, due to low neutral detergent fibre, acid detergent fibre and acid detergent lignin. Integration of participatory inventory and chemical analysis proved to be reliable in identifying LAFRs, with V. Karroo leaves and *O. ficus-indica* cladodes being the main potential forage resources for inclusion in beef cattle diets.



Cactus fruits

## **NITROGEN FERTILIZATION INCREASES THE GROWTH AND NUTRITIONAL QUALITY OF THE FORAGE LEGUME, *CALOBOTA SERICEA* – A PRELIMINARY INVESTIGATION**

*Calobota sericea* has a potential as a forage for drought-stressed areas. A greenhouse trial was established to determine the impact of N-fertilization levels (0, 25, 50, 75, and 100 kg/ha) on the growth and nutritional quality of *C. sericea* plants. Three-month-old plants were harvested and root and shoot length as well as the branching intensity of each plant, was determined. The shoots were then separated into leaves and stem and all plant parts were oven dried for dry mass determination. After weighing, the leaves and stems for each plant were combined and the dried shoots were used for nutrient determination.

Results indicated that increased N-fertilization application levels is positively correlated with improved *C. sericea* growth. Similarly, mineral nutrient uptake increased significantly under all the N-fertilization treatments and crude protein content increased from 9.6% to 18.6%. Plant growth was only statistically significantly ( $p < 0.05$ ) improved when N-fertilization was applied at rates of 50 kg/ha and more, but crude protein content increased from the lowest N-fertilization application rates (25 kg/ha). The improved growth and nutrient uptake could primarily be explained by improved resource allocation under N-fertilization. Therefore, appropriately fertilized *C. sericea* can result in improved forage production and improved quality forages when N-fertilization is applied at high enough rates.



*Naturally occurring Calobota sericea*



*Sheep browsing C. sericea*

## **DROWNING IN DATA, THIRSTY FOR INFORMATION AND STARVED FOR UNDERSTANDING: A BIODIVERSITY INFORMATION HUB FOR COOPERATIVE ENVIRONMENTAL MONITORING IN SOUTH AFRICA**

Data availability primes the research and discovery engine driving biodiversity conservation. South Africa is poised to become a world leader in biodiversity conservation. However, continent-wide resource limitations hamper the establishment of inclusive technologies and robust platforms and tools for biodiversity informatics. This work considered opinions of 37 co-authors from 20 different departments, across 10 SA universities, 7 national and provincial conservation research agencies, and various institutes and private conservation, research and management bodies, in the process of developing a way forward for biodiversity informatics in SA.



*ARC experts conducting fieldwork*

The study emphasised the importance of developing a culture of cooperation, collaboration and interoperability among custodians of biodiversity data to establish operational workflows for data synthesis. However, our biggest challenges are misgivings around data sharing and multidisciplinary collaboration. This work recommended a system that is free, user friendly, functional, stable, integrative and designed to cater for different data access agreement levels. Sharing data through this pipeline will directly advance the science and practice of conservation, giving multiple stakeholders and decision-makers access to valuable biodiversity data to support research and biodiversity conservation.



## **REPRODUCTIVE PERFORMANCE OF EXTENSIVELY MANAGED BEEF HEIFERS MATED AT 14 OR 26 MONTHS IN THE CENTRAL BUSHVELD BIOREGION**

In South Africa, extensively kept heifers are usually mated for the first time at 26 months of age. This is in contrast with few previous studies advocating the mating of heifers one year earlier (14 months). The advantage in early mating lies mainly in the potential increase in lifetime productivity and the expectation of an extra calf. However, in South Africa, limited local information is available on the value of early mating of extensively kept beef heifers. In contrast, international information is mainly restricted to dairy cattle and intensive production systems.

A study was undertaken to evaluate the calving percentage of Bonsmara heifers mated for the first time in an extensively managed beef herd at either 14 or 26 months. At 14 months 50% of the heifers were mated, while the other 50% were mated at 26 months for 90 days during the summer mating season (January to March). The research was conducted over a period of six years. Results indicated that calving percentage of heifers mated at 26 months was significantly higher than heifers mated at 14 months. It seems unlikely that mating heifers at 14 months of age can improve on the traditional extensive system of mating heifers at 26 months on natural veld in the Central Bushveld Bioregion.



*Cows with calves in the bushveld region*

## **SMALLHOLDER FARMER SUPPORTED**

The Kaonafatso ya Dikgomo Scheme, a special-purpose vehicle to facilitate active participation of smallholder farmers in the mainstream livestock economy, held its historic launch of live animal auctions conducted by a black-owned auctioneering company on 24 March 2023 at Kortnek village outside Pongola and on 29 March 2023 at Ezwati village outside Vryheid in northern KZN. The Kortnek maiden sale set a new average price record of R11 815.00 compared to R9 000.00 for previous KyD auctions.

Experienced sellers flocked the Ezwati auction with more than 300 heads of cattle on 29 March 2023 resulting in the auction being extended to the second day to sell 255 head of cattle. This was the first time the KyD mobile facilities were used in an auction sale.

Furthermore, the KyD Scheme provided different services to smallholder farmers across the country. Specifically, the Scheme conducted 32 farmers' days in 38 local municipalities across the country. On average, women comprised 35% of the audience, youth, 27%, and persons with disabilities 1%. All farmers' day events addressed priorities identified by KyD team in a specific province, local extension officers, and farmers. The scope of topics covered during these farmers' days included the application of DNA to deter stock theft, animal nutrition, rangeland management, breeding and selection, artificial insemination as well as animal health management.



*ARC presenting a live-animal auction in KZN*

## Summary of KyD farmers' days

PROVINCE	LOCAL MUNICIPALITY	VENUE	DATE	NUMBER OF FARMERS				
				Female	Male	Youth	PWD	Total
Eastern Cape	Amahlathi	Dohne Research Centre	06/10/2022	7	21	10	0	28
Sub-total				7	21	10	0	28
Free State	Phumelela	Mhlabunzima Memorial Hall	19/09/2022	45	54	24	0	99
	Mantsopa	Town Hall	20/09/2022	20	28	8	0	48
	Setsotho	Ficksburg Town Hall	21/09/2022	19	27	21	0	46
	Nketoane	Ntha Hall	22/09/2022	14	21	11	0	35
	Dihlabeng	Town Hall	23/09/2022	16	41	26	0	57
	Maluti a Phofoung	Mutli Purpose Hall	26/09/2022	12	11	4	0	23
	Nketoane	Arlington Hall	28/09/2022	33	23	10	0	56
	Maluti a Phofoung	Makwane Hall QwaQwa	30/09/2022	43	34	27	0	77
	Mantsopa	NG Kerk	27/10/2022	18	41	9	0	59
Sub-total				220	280	140	0	500
Gauteng	Merafong	Carletonville Civic Centre	24/10/2022	17	28	0	0	45
	Lesedi	Portion 4 of 323, Langzee Koegat Farm	09/03/2023	25	104	22	2	129
	City of Tshwane	Temba Agricultural Offices	10/03/ 2023	30	0	0	0	30
Sub-total				72	132	22	2	204
Kwa -Zulu Natal	Umhlabuyalingana	Vukamabaso Community Hall	14/11/22	46	149	25	3	195
	Hlabisa	Mpembeni	15/11/22	15	61	18	0	76
	Dr Nkosazana Dlamini Zuma	Msamaneni	21/02/2023	41	87	56	3	128
	uMzimkhulu	Schoemanshoek Hall	22/02/2023	59	77	71	0	136
	Kokstad	Jafta Area	23/02/2023	55	92	86	2	147
Sub-total				216	466	256	8	682
Mpumalanga	Bushbuckridge	Hluvukani	30/08/2022	16	46	7	0	62
	Thaba cheuw	Moremela	01/09/2022	42	72	7	0	114
	Steve Tshwete	G3 Farm Abattoir	20/09/2022	11	62	18	0	73
	Msukaligwa	Ermelo	21/09/2022	26	36	36	0	62
	Mbombela	Barberton Environmental Center	04/10/2022	31	27	8	0	58
	Nkomazi	Masibekela	06/10/2022	10	32	7	0	42
	Govan Mbeki	Kinross	17/11/2022	15	40	11	0	55
	Dipaleseng	Balfour Community Hall	28/02/2023	14	29	33	1	43
Sub-total				165	344	127	1	509
Northern Cape	Joe Morolong	Tsineng	08/11/2022	6	20	0	0	26
	Joe Morolong	Perth	09/11/2022	18	30	0	0	48
	Joe Morolong	Glenred	10/11/2022	6	17	0	0	23
	Siyancuma	Schmidsdrift	23/02/2023	7	40	0	0	47
	Dikgatlong	Barkely West	24/02/2023	7	40	0	0	47
Sub-total				44	147	0	0	191
North West	Madibeng	Segwelane	16/03/2023	25	22	18	0	47
Sub-total				25	22	18	0	47
TOTAL				749	1412	573	11	2161



## OUTCOME 5:

### ENHANCED RESILIENCE OF AGRICULTURE

#### LABORATORY SERVICES

In order to ensure the provision of high-quality analytical services, the ARC Animal Production Analytical Services Laboratories successfully underwent a SANAS re-assessment audit during the year under review. Continued accreditation has been granted by SANAS to ARC Analytical Services in accordance with ISO/IEC17025:2017 (T0063).

The laboratory provides feed and food analytical laboratory services to ARC's internal research community, academia, and private industry. During the year under review, ARC-AP Analytical Services at Irene successfully changed the Laboratory Information Management Systems (LIMS) from the old ARCLab to the new Labware system. The laboratories went live with the new system on 01 February 2023, and the transition has since been relatively smooth.

Furthermore, the laboratory provided 2 930 scientific services to clients. This favourable performance is attributable to the increase in the number of samples received from clients as the economy makes some strides

toward recovery from the recent pandemic. The laboratory managed to achieve this outstanding performance despite the difficult operating environment related to the ongoing load-shedding and other internal challenges.

The sensory evaluation laboratory managed to secure new projects for food quality testing and the laboratory is currently busy with the process of attaining its accreditation. The sensory laboratory featured in the SABC1 *"The Working Land"* programme.



*ARC researchers explaining sensory evaluation techniques to Plaas Media TV crew*

#### KNOWLEDGE DISSEMINATION

Some of the knowledge dissemination interventions for 2022/23 included the following:

##### JOURNAL ARTICLES

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## RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# ONDERSTEPSPOORT VETERINARY RESEARCH

The ARC-Onderstepoort Veterinary Research (ARC-OVR) Campus plays an important role in maintaining the health of our national herd and wildlife. It focuses on executing veterinary research to improve existing vaccines, diagnostic products and to develop new ones. It provides scientific support for the National and Provincial Veterinary Services in effective risk management for quality of life for all in South Africa.

The ARC-OVR promotes animal health and welfare by providing an effective and efficient diagnostic service and producing vaccines against foot-and-mouth and tick-borne diseases. ARC-OVR is the Collaborating Centre for the World Organisation for Animal Health (WOAH) founded as the OIE - Surveillance and Control of Animal Diseases in Africa. It is also the Food and Agriculture Organisation (FAO) of the United Nations Collaborating Centre on Emergency Preparedness for Transboundary Animal Diseases and Helminth-Antihelmintic Resistance and Biological Control for Africa. In addition, OVR hosts eight (8) WOAH Reference Laboratories for economically important viral diseases namely: African Horse Sickness, Bluetongue, Foot-and-Mouth Disease, Lumpy Skin Disease, Rift Valley Fever, Rabies, Sheep pox and Goat pox and African Swine Fever, and three (3) FAO Reference Centres namely: African swine fever, Foot-and-mouth disease and Vector and vector-borne diseases. Through its diagnostic and research activities the ARC-OVR plays a key role in the One Health space. One Health is an integrated, unifying approach to balance and optimize the health of people, animals and the environment. It is important to prevent, predict, detect, and respond to global health threats. The One Health approach is particularly relevant for food and water safety, nutrition, the control of zoonoses (diseases that can spread between animals and humans, such as flu, rabies and Rift Valley fever),

pollution management, and combatting antimicrobial resistance (the emergence of microbes that are resistant to antibiotic therapy). Dr. Misheck Mulumba, the head of OVR serves as the Chair of the Steering Committee of Africa One Health Network (AfOHNet).

The Government of South Africa, through the DALRRD and the DSI has mandated the ARC to manage and maintain National Public Goods Assets (NPGA). These provide important sources of genetic material for research and development, scientific reference, as well as rehabilitation of planting and breeding stock for national recovery from natural disasters. The current NPGA's are housed in the following units: Transboundary animal diseases, Blood vaccines production, rabies laboratory, diagnostic services and the national insect collections.

The work of the campus is aligned with the following outcomes of the ARC:

- **Outcome 4: A skilled and capable agriculture sector**
- **Outcome 5: Enhanced resilience of agriculture**

The Campus made significant progress in the delivery of the mandate of the ARC during the year under review. This annual report presents highlights of the key achievements of the Campus that contributed towards vaccine and diagnostic development; vaccine production; diagnostic and analytical services; addressing smallholder constraints in terms of access to resources such as technology, information and training; provide customised solutions to specific farmer groups, supporting enterprise growth and development leading to food security, sustainable profitability and competitiveness; and delivering training and information to farmers and extension personnel for skills development, better decision making and risk mitigation.



## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

**OUTCOME 4:****A SKILLED AND CAPABLE AGRICULTURAL SECTOR****FARMER FIELD DAYS & PUBLIC AWARENESS**

Smallholder farmers contribute to the national economy and food and nutrition security through livestock production. Most of these farmers lack the necessary knowledge and skills required for livestock production and control of diseases. In line with this, Drs Itumeleng Matle, Nomakorinte Gcebe, Tiny Hlokwe, Andrew Potts and Siphesihle Nxumalo from the Diagnostic services (DS) Programme at ARC-OVR hosted a farmer's day event on 10 March 2023 at Temba, Hammanskraal, Gauteng Province. The purpose of the event was to bring together the farmers and empower them with knowledge and provide information on animal and veterinary public health and disease control. The focus was on foodborne and zoonotic diseases, covering anthrax, bovine tuberculosis (TB), brucellosis and other reproductive diseases such as Rift valley fever.



ARC at the TETA EmpowaYouth Weekend Summit

EmpowaYouth is a movement aimed at developing robust solutions towards ameliorating unemployment, inequality and poverty in South Africa. The South African Transport Education Training Authority (TETA) and EmpowaYouth converged in Mahikeng, North-West Province from 30 March to 1 April 2023, for the TETA EmpowaYouth Weekend Summit, where over 3000 unemployed youth were in attendance. ARC-OVR contributed at this event. Expert guests included individuals from the agriculture, transport, mining and tourism industries. Keynote addresses, masterclasses, open panel discussions and funding opportunities were some of the activities for the day, offering a holistic experience for the youth. They learned about gaps and opportunities in the various industries, as well as feasible avenues for entrepreneurs to develop themselves.

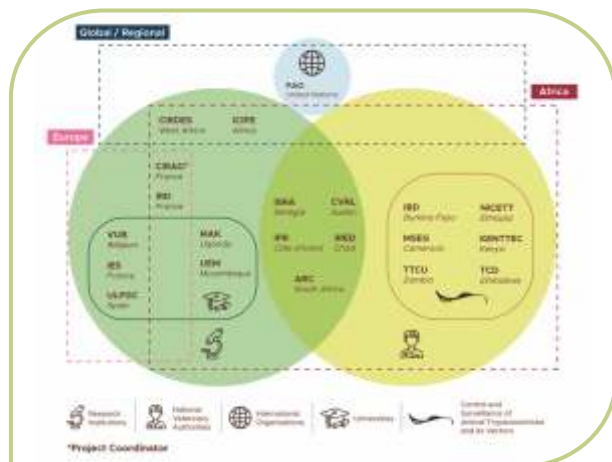
Dr. Sihle Nxumalo of the ARC-OVR DS Programme opened the Agriculture session with a keynote address under the agenda item: Touchpoints in the Agriculture journey. Where are the gaps for youth? Dr. Daniel Motiang of the ARC-AP participated in a panel discussion titled: Gaps for youth in the agri-processing space. The session highlighted the broadness of the agricultural sector, ongoing demand for safe, nutritious produce, and strategic points of entry into the markets.

**DIAGNOSTICS AND RESEARCH ON PARASITES AND VECTORS TO SERVE THE AGRICULTURAL SECTOR**

The Epidemiology, Parasites and Vectors (EPV) Programme of the ARC-OVR serve the Agricultural sector by providing diagnostics for blood-borne pathogens and external parasites such as Helminths. More than 8000 samples were tested for clients in the last year, testing for important diseases such as Corridor disease in buffalo and cattle, canine piroplasmosis, equine piroplasmosis, heartwater in ruminants, and leishmaniasis. This diagnostics is important for disease control and for movement of animals on a National and International level. In addition, identification services for vectors are provided that includes ticks and insects such as midges, mosquitoes and tsetse flies.

The programme houses three National Collections. These Collections catalog biodiversity and comprise the National Collection for Animal Helminths, the National

Collection for Ticks and the National Collection for Insects of Veterinary Importance. Cataloging biodiversity is an important basic science since species identification is at the heart of epidemiology surveillance, determination of geographic distribution of vectors of important pathogens, distribution modeling, predictions of how climate change will affect vector distribution and investigation into vectors of zoonotic agents. Differentiation between species include taxonomic placement and entail description of new species and genera and placing these within a larger systematic context of various biological lineages. For this cutting edge molecular and morphological technologies are used.



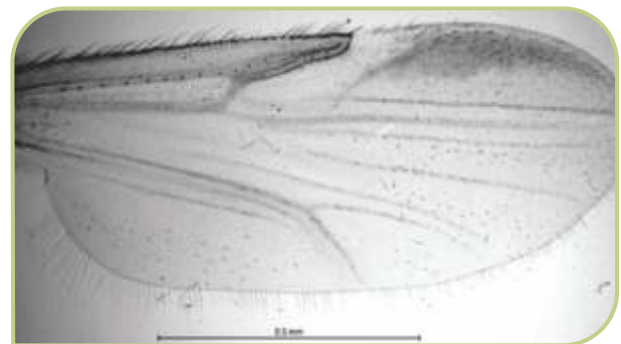
*The ARC is considered a major player in the EU funded COMBAT project (controlling and progressively minimizing the burden of vector-borne animal trypanosomosis in Africa), straddling both realms as a research institution as well as an institution that serve the National Veterinary Authorities as a Centre for control and surveillance of Animal trypanosomosis and its vectors.*

The programme also focuses on control of vectors and diseases, notably tsetse fly and nagana control through sterile insect technique, tick control via anti-tick vaccines and disease control via improvement of current live

vaccines such as redwater and heartwater. Within the above framework a number of studies were published that focus on a skilled and capable agriculture sector.

Notably, 6 papers were published that dealt primarily with taxonomy and resulted in the description of 6 species and 1 new genus; 6 papers that deals primarily with systematics, integrating both morphological and molecular data and using cutting edge advances such as next-generation sequencing technologies; 4 papers that dealt with parasite ecology, host interaction and epidemiology; 8 papers that dealt with pathogens, parasites and vectors involved in zoonosis; 1 paper that detailed results from an inactivated vaccine against heartwater and 1 paper that dealt with bioinformatic analysis and annotation of tick transcriptome databases.

The stakeholders that benefit from the activities of this programme include State Veterinarians involved in disease control, farmers that benefit from diagnostic knowledge, clients that use the diagnostic results for animal movement and commerce, international and national scientists and policymakers that can use the published data for future experimentation, scientific discovery, and risk or feasibility assessments.



*The wing pattern from the most recent described Culicoides midge species in South Africa, Culicoides truuskae named in honor of Dr. Truuske Gerdes (an eminent retired employee of the ARC-OVR) in recognition of her work on arboviral diseases of veterinary importance in South Africa.*



## FOOT-AND-MOUTH DISEASE RESEARCH

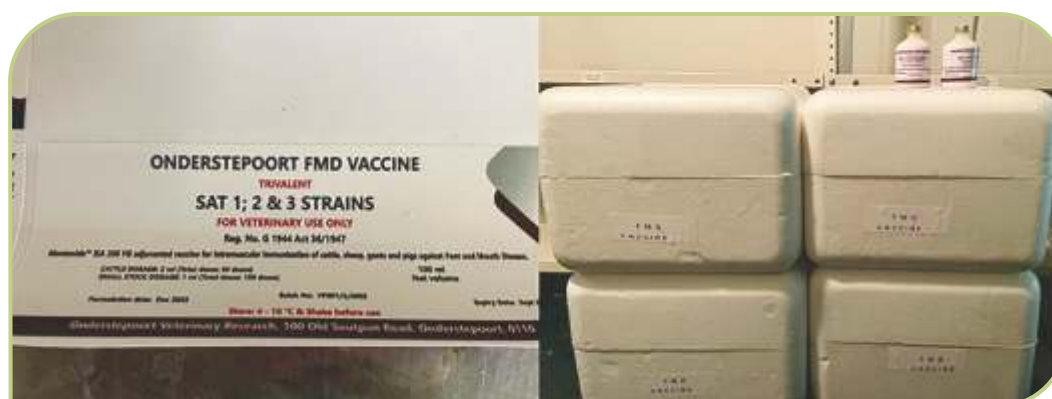
Foot-and-mouth disease (FMD) remains a compulsory notifiable disease according to the WOAHA (founded as the OIE), with the causative agent, FMD virus (FMDV), having a restricted distribution in the world. FMD is a state-controlled animal disease in South Africa according to the Animal Diseases Act (Act 35 of 1984), with control measures prescribed by the Animal Diseases Regulations (R.2026 of 1986) and FMD Veterinary Procedural Notice (VPN) of 2014. The epidemiology of FMD in southern Africa differs from the disease in other parts of the world, such as South America, the Middle East and Asia, as the SAT types uniquely involve wildlife. African buffalo are the natural maintenance hosts of FMDV and provide a potential source of infection for other wildlife and domestic livestock in endemic areas. The persistence of FMDV in wildlife is a continual threat to the livestock industry. The wildlife–livestock interface presents unique challenges for FMD control with livestock farming communities within the proximity of the Kruger National Park (KNP), and adjacent game reserves especially at risk.

In South Africa, several FMD outbreaks have occurred since 2000 and outbreaks in the FMD-free zone without vaccination in 2019 have led to the suspension of the FMD-free status. The source of infections for most of these outbreaks were associated with the wildlife–domestic animal interface. Cattle in the FMD Protection Zone with Vaccination surrounding the Greater KNP Area are vaccinated every four months with a chemically inactivated trivalent vaccine. Despite these efforts, several outbreaks of FMD have still occurred in the Protection Zone in the last few years, with an apparent increase in frequency. After South Africa discontinued national vaccine production prior to 2008, FMD outbreaks increased in numbers suggesting that the current vaccine for southern Africa includes antigens that are less efficient in eliciting protective immune responses against circulating field viruses. Since May 2021, South Africa suffered three outbreaks events in the previously FMD-free zone without vaccination. The first event

occurred in northern Kwazulu-Natal, with the second and third events affecting Limpopo, Gauteng, North West, Free State and Mpumalanga.

The Transboundary diseases (TAD) facility at the ARC-OVR is responsible for the diagnosis and control of economically important animal diseases that have the potential to spread across international borders. Transboundary animal diseases are often highly infectious and as such, the unit is housed in a high-containment bio-security facility adjacent to the ARC-OVR campus. Currently, research and diagnostics at the TAD facility focuses primarily on FMD and African swine fever. The TAD diagnostic laboratory works in close collaboration with the DALRRD to ensure the effective control of both diseases in South Africa. It is the only laboratory in South Africa capable of receiving and testing samples collected by the provincial veterinary services to confirm cases of FMD. During 2022, samples were submitted from 200 outbreaks across the affected provinces, resulting in the laboratory receiving samples from 89 000 animals. The laboratory performed more than 215 000 tests for FMD representing a 400% increase in the number of test performed annually. The timeous delivery of accurate and reliable diagnostic services has contributed significantly to halting the spread of the disease.

In addition to the provision of diagnostic services, the units are also actively involved in scientific research to develop novel strategies to control transboundary animal disease. The development and production of veterinary vaccines are at the forefront of these efforts. Over the past decade, the ARC has been striving to establish the capacity to produce FMD vaccines locally. This culminating in the development of a highly efficacious FMD vaccine tailor-made for South African conditions. In 2022, the vaccine received SAHPRA approval and was registered under the Stock Remedies Act (Act 36 of 1947) for use in South Africa. The ARC has embarked on commercialisation of the vaccine and intends to satisfy the national requirements for FMD vaccine by 2024.



*Limited research batches of the SAHPRA approved Onderstepoort FMD vaccine*

## **LEARNING FROM THE PAST: CAPACITATING VETERINARY LABORATORIES IN SOUTHERN AFRICA TO RESPOND TO PANDEMIC SITUATIONS**

Emerging and re-emerging infectious diseases pose a serious public health challenge to most countries in Africa. New diseases continue to appear in most regions of Africa, due to the complex local and ecological factors that favour their occurrence and spread. With the ever-increasing threat of new diseases appearing on the African continent due to the favourable conditions, and most of the region lacking the capabilities to detect these pathogens; it is vital to ensure there is sufficient capacity for early detection and prevention of potential zoonotic pathogens. The ARC-OVR offers several training courses to participants on with topics ranging from disease outbreak response, handling infectious material to risk management in disease outbreak situations. The training courses are dual-format with some of the training being theoretical training and the other part of the training being hands-on laboratory training. During the 2022/23 FY the ARC-OVR hosted training events for participants from all across the SADC region (Eswatini, Lesotho, Madagascar, Malawi, Mozambique, South Africa, Zambia and Zimbabwe) as well as Budapest, Ethiopia, and Russia. These training courses demonstrated that participants had a better understanding of biosafety and biosecurity principles, as well as handling and testing samples with zoonotic potential. This has resulted in a larger number of veterinary diagnostic laboratories being able to provide support service to human public health laboratories if a pandemic situation were to arise in the future. The training courses highlighted the importance of environmental factors, potential reservoirs and hosts species in the spread of infectious diseases, and the role veterinary laboratories can have in responding to disease outbreaks if sufficient capacity is developed within the region. Future projects are being planned to ensure all laboratories in the region are fully capable of early detection of pathogens, these projects will include backstopping missions of laboratories in the region as well as regular refresher courses and the preparation proficiency testing schemes for various diseases.



*Strengthening regional capacities to address negative impacts of COVID-19 on the animal health sector in Africa workshop.*

## **RESEARCHERS SUPPORT DIAGNOSTIC LABORATORIES TO IDENTIFY THE FIRST REPORT CASES OF HIGHLY CONTAGIOUS RABBIT HAEMORRHAGIC DISEASE IN SOUTH AFRICA**

In November 2022, the DALRRD received reports of die-offs of wild rabbits and hares from the Karoo areas in the Western and Northern Cape provinces. It was suspected that this could be the start of a rabbit haemorrhagic disease outbreak. Rabbit haemorrhagic disease (RHD) is a highly infectious and lethal form of viral hepatitis that affects both domestic and wild rabbits. The disease has been found to have affected all rabbits in Europe, Asia, North and South America as well as the Oceania region but had never been detected in Africa. Samples (ranging from organs to entire carcasses) from the infected areas were collected and submitted to ARC-OVR for diagnostic purposes.



*Diagnostic samples received at the laboratory at ARC-OVR.*

The ARC diagnostic laboratories, supported by the research team, investigated the possible causes of die-offs in these numbers. The PCR laboratory was able to detect the RHD virus in the samples and the research team proceeded to sequence these samples to determine the lineage of the virus. Rabbit haemorrhagic disease is a preventable virus by means of vaccination, however, South Africa did not have a vaccine available as there had never been an outbreak of the disease in the country. Through the work done at ARC on the samples, in detecting and typing the virus, the Centre for Wildlife Management (UP) was able to use the strain information to source the correct vaccine required to control the disease. The vaccine has been imported into the country and is now available at the Exotic Bird and Animal Clinic at UP.



## **BIORISK MANAGEMENT AT ARC-OVR: AFRICA-REGIONAL SUBJECT MATTER EXPERT (AF-RSME)**

Africa Centres for Disease Control and Prevention (Africa CDC) working with African Union Member States (AU MS) developed a home grown, implementable and accessible professional training and certification program (Africa CDC Biosafety and Biosecurity Initiative 2025), that is both recognized and endorsed by African Union Member States which was officially launched on 12 April 2022 in Addis Ababa, Ethiopia.



*Mr. Chris Brandt receiving his training certificate for the Africa-Regional Subject Matter Expert (Af-RSME) - Biorisk-Management.*

Mr. Christopher Brandt from ARC-OVR was selected and certified in January 2023 as an Africa-Regional Subject Matter Expert (Af-RSME) - Biorisk-Management, for the Regional Training and Certification Program for Biosafety and Biosecurity Professionals. His selection followed a competitive process where a committee of 15 Experts from 9 African Union Member States, Africa CDC, African Society for Laboratory Medicine (ASLM) and International Federation for Biosafety Association (IFBA) reviewed applications in response to the initiative. Mr Brandt also received training through Sandia National Laboratories (SNL) on behalf of the US Defense Threat Reduction Agency (DTRA) in South Africa Biorisk Management Trainer Development Program Workshop to capacitate laboratory professionals with training techniques in biorisk management. Biosafety and biosecurity training is available and practised at the national reference laboratories (NICD and ARC-OVR), laboratories of the NHLS (medical) and veterinary diagnostic laboratories.

Working with pathogens in the laboratory is vital to ensuring that the global community possess a robust set of tools—such as drugs, diagnostics, and vaccines—to counter the ever-evolving threat of infectious diseases. Biosecurity is important in order to secure infectious agents against those who would deliberately misuse them to harm people, animals, plants, or the environment. The collections of dangerous agents has long been consolidated and centralized at the national reference laboratories, namely the NICD and ARC-OVR. These institutions have a great deal of knowledge with regards to biorisk management, and are regarded as experts nationally and internationally. These laboratories

(agencies) also handle and store the dangerous biological material. Biosafety and Biosecurity Professionals certified through this initiative are well equipped to assist and mentor candidates through different levels to become biosafety and biosecurity professionals and aid in building capacity and strengthen the legal framework for the region.

The Biological Service Unit (BSU) at ARC-OVR is the unit that has been used for the storage of biological materials that play a pivotal role in the short, medium and long-term activities of the ARC, both as a foundation for the majority of research projects and providing strategic support to national objectives such as biosafety and biosecurity. Through a collaboration with the SANDIA laboratories and Defense Threat Reduction Agency (DTRA) from the USA, the laboratory Head for BSU Mrs. Puseletso Johnston was certified as a Professional in Biorisk Management.



*The Biological Service Unit laboratory*

## **NEW GENERATION DIAGNOSTIC REAGENTS FOR ANIMAL HEALTH**

Antibodies are special molecules made by antibody-producing cells of humans or animals during an immune response to foreign substances such as bacteria and viruses entering their bodies. These antibodies can interact very specifically with viruses and bacteria and can be visualised by scientists in the laboratory. Scientists exploit this interaction not only to find solutions to problems related to animal and human health, but also to develop diagnostic tests. In the past, experimental animals have been used to make antibodies against viruses and bacteria. The Vaccine and Diagnostic Development (VDD) Programme are working on sustainable antibody production methods that depend as little as possible on animal use. One way of meeting this objective is to exploit phage display technology, which was worthy of a Nobel Prize for Chemistry in 2018. This technology uses bacteriophages, which are viruses of bacteria, as the workhorses to produce antibodies of interest. Because the antibodies are made in the laboratory and not by the immune systems of humans or animals, they are called recombinant antibodies. Although the genetic material for making these antibodies come from animals or humans, there is no further use of live subjects after the first step of this technology. The trademarked Nkuku® and Inshi® libraries (a library of recombinant antibodies derived from chicken and ostrich immunoglobulin genes respectively), are

universal, readily-accessible pools of recombinant antibodies. The construction of such a library briefly entails taking cells from birds that produce antibodies, such as cells in the blood, bone marrow and spleen. The genetic material used for antibody production is then extracted from these cells and transferred to the phage display system to make an antibody library. Such a library or antibody pool consists of billions of bacteriophages, each with a different antibody on its surface, and each antibody having a specificity of its own. A process called affinity selection, analogous to finding a needle in a haystack, is then used to isolate antibodies from the library against viruses, bacteria or even parts of these microorganisms that are manufactured in the laboratory and referred to as recombinant proteins. The most attractive feature of these phage displayed antibodies is that an antibody and the genetic information essential for its production are both present on and in the bacteriophage. This feature allows scientists to repeatedly produce large quantities of an isolated recombinant antibody without using laboratory animals. From these libraries, useful antibodies have been found against important veterinary diseases such as Rift Valley fever, African horse sickness, bluetongue, foot and mouth disease, bovine ephemeral fever, equine encephalosis, bovine tuberculosis and the equine babesiosis. These well-characterised antibodies are of unlimited supply, compared to those from experimental animals which are finite. Antibodies can now be produced in-house instead of importing them at great expense or using experimental animals to produce them. Some have been incorporated into diagnostic assays for Rift Valley fever, bluetongue, African horse sickness along with their corresponding in-house produced recombinant proteins. These assays are being validated for approval to use as diagnostic tests. These resources enable us to rapidly respond to a need for serodiagnostic reagents not only for the veterinary community, but any client with a suitable target requiring an antibody.

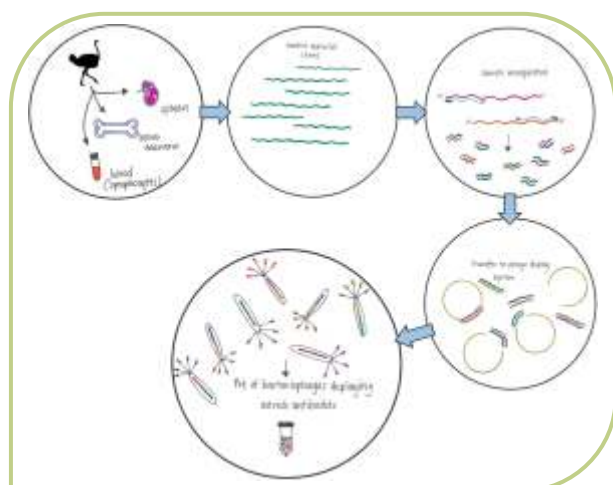


Diagram showing the steps in constructing a phage displayed antibody library based on the genetic material of an ostrich.

## ARC COUNCIL OVR CAMPUS TOUR

Council members met with the OVR management team on the 24 February 2023. This was followed by a tour of the OVR campus. The aim of this engagement was to ascertain the status of the Campus and to also engage with staff in order to familiarise council members with the work done by the ARC-OVR. Council commended staff members for the hard work and commitment to the ARC's mandate. Council noted some of the challenges experienced by staff members in the execution of their tasks and directed Management to address those issues and update Council of the interventions made. Council noted further that there is an opportunity for ARC-OVR to communicate its work more effectively and in a simplified form so as to accommodate those that are not directly involved in agricultural research.



Council members touring the ARC-OVR campus. Visit to the Blood vaccine animal heard.

Tour of the Arnold Theiler Museum.

The Council members also visited the National Veterinary Museum hosted in one of the original buildings, which was opened in 1908 as the Veterinary Bacteriological Laboratory of Transvaal. The South African national veterinary museum was opened on 6 October 2008 as part of the OVI's centenary celebrations. During the open day, held on 28 October, the National Veterinary Museum was presented with a Blue Plaque from the Magaliesberg Association for Culture and Heritage (MACH), in recognition of the museum's contribution to preserving the history of the Onderstepoort Veterinary Institute and veterinary science in South Africa. The Blue Plaque will be mounted on side of the museum that is open to the public by appointment only, since the ARC-OVR has been recognized as a national key point.

The museum stretches over six rooms and contains 17 information panels, old equipment used in veterinary sciences as well as books on a varied subject matter. Two rooms are devoted to Sir Arnold Theiler, the founder of the Onderstepoort Veterinary Institute and the driving force behind the establishment of the Faculty of Veterinary Sciences at the University of Pretoria. Tours through the museum takes about an hour to 90 minutes and appointments can be made by contacting the ARC Public Relations Office.

## KNOWLEDGE DISSEMINATION

Some of the knowledge dissemination interventions for 2022/23 included the following:

### JOURNAL ARTICLES

- Achatz, T., Chermak, T.P., Junker, K. & Tkach V.V. 2022. Integration of morphological and molecular data reveals further unknown diversity of the Proterodiplostomidae in crocodilians. *Systematics and Biodiversity* 20, 2051212. <https://doi.org/10.1080/14772000.2022.2051212>.
- Achatz, T.J., Martens, J.R., Kudlai, O., Junker, K., Boe, N.W., Tkach, V.V. 2022. A new genus of diplostomids (Digenea: Diplostomoidea) from the Nile crocodile in South Africa with a key to diplostomid genera. *Journal of Parasitology* 108, 453-466. <http://doi.org/10.1645/22-23>.
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- Carroll, L.M., Pierneef, R., Mathole, A.I., Atanda, A. & Matle, I. 2022. Genomic Sequencing of *Bacillus cereus* Sensu Lato Strains Isolated from Meat and Poultry Products in South Africa Enables Inter- and Intranational Surveillance and Source Tracking. *Microbiology Spectrum* 10(3):e0070022. <https://doi.org/10.1128/spectrum.00700-22>.
- Chitimia-Dobler, L., Dunlop, J.A., Pfeffer, T., Würzinger, F., Handschuh, S. & Mans, B.J. 2022. Hard ticks in Burmese amber with Australasian affinities. *Parasitology* 150, 157-171. <https://doi.org/10.1017/S0031182022001585>.
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<https://doi.org/10.1016/j.ttbdis.2022.101908>.

#### THESES AND DISSERTATIONS

None

#### CHAPTERS IN BOOKS

**Van Heerden, J. & Mulumba, M.** 2023. Science, Technology and Innovation (STI): Its Role in South Africa's Development Outcomes and STI Diplomacy. In: Ittekkot, V., Baweja, J.K. (eds) *Science, Technology and Innovation Diplomacy in Developing Countries. Research for Development*. Springer, Singapore, pp. 141-154. [https://doi.org/10.1007/978-981-19-6802-0\\_9](https://doi.org/10.1007/978-981-19-6802-0_9).

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Lubisi, B.A. 2022. Susceptibility of Sus Scrofa to Rift valley fever virus: Implications for animal and human health in Africa. Doctor of Philosophy (Ph.D.) in Zoology, Faculty of Natural and Agricultural Sciences, University of Pretoria.

Maboko, B.B. 2022. Whole genome sequencing and characterisation of Theileria parva in South Africa. Doctor of Philosophy: Veterinary Science, University of Pretoria.

Mareledwane, V.E. 2022. Prevalence and characterisation of Mycobacterium species in cattle and sheep at Gauteng abattoirs. Doctor of Philosophy (Ph.D.) Production Animal Studies, Faculty of Veterinary Science, University of Pretoria.

Peta, F.M.R. 2022. Downstream processing of antigens for the preparation of Foot and Mouth disease vaccines in the Republic of South Africa. Doctor of Philosophy: Medical Virology, Sefako Makgatho Health Sciences University.

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# RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

## BIOTECHNOLOGY PLATFORM

The mandate of the ARC- Biotechnology Platform (ARC-BTP) is to create high-throughput resources and technologies required for application in genomics, metagenomics- or next generation sequencing based on diagnostic applications, quantitative genetics, genomics assisted selection and breeding, plant phenomics and bioinformatics to support participants in the agricultural sector, i.e from small smallholder and commercial producers, to seed companies, food processing facilities and universities working in associated fields.

The ARC-BTP is established as both a research and service driven division, providing an environment in which highly skilled researchers and postgraduate students can be hosted and trained to undertake world class research paralleled with provision of genomics and bioinformatics services to agriculture and other sectors .

### RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

## OUTCOME 5:

### ENHANCED RESILIENCE OF AGRICULTURE

#### **GENOMICS ASSISTED COMMUNITY-BASED BREEDING: TECHNOLOGIES BRINGING CHANGE IN THE LIVES OF SMALLHOLDER FARMERS**

KwaZulu-Natal is one of the major goat producing provinces in South Africa where more than half of the goat population is kept by resource and marginalised smallholder farmers – both in rural and peri-urban areas. The agro-ecological landscape, cultural roles and market demand are major players in the type of breed that is kept, with the majority being the Indigenous Veld Goat (IVG) breed of the Nguni/iMbuzi ecotype. This breed is popular due to its short production turnaround times, low production input demand, tolerance to

diseases and parasites as well as its superior adaptability to harsh environmental conditions prevailing across the South African landscape. In 2021 the ARC-BTP started a collaboration with the Thukela Genetics Mbuzi Club (TG) from KwaZulu-Natal to implement a community-based breeding program and ensure that farmers benefit directly from research efforts to promote an economically viable goat production systems.

In this project, ram testing was done to establish the breed composition and purity of breeding bucks to use as breeding stock within the CBBP and potentially a conservation nucleus for future in situ and ex situ conservation programs. To achieve this, phenotypic data (age, head profile, and scrotal circumference), as well as genetic material (ear tissue clipping) were collected from 40 rams kept by 11 farmers and genotyped using the



Illumina 65K BeadChip. The animals used in the study included representatives from both commercial meat-type breeds (Boer, Kalahari Red and Savanna), as well as IVG ecotypes (Xhosa-lob, Northern Cape Skilder and Nguni/iMbuzi), with some samples obtained from previous work. Analyses of the datasets shows that the TG rams cluster with the Nguni/iMbuzi group, thereby suggesting that these animals are pure and have not been crossed with commercial breeds. The phenotypic descriptions fit the IVG Breeding Society standards for a breeding ram. The study highlighted that, with accurate pedigree records, merged with genomics and animal husbandry technologies, rural communities can be used for within breed/ecotype conservation and improvement. ARC BTP would like to thank the Thukela Genetics Mbuzi Club for their participation in the project.



*The Thukela Genetics Mbuzi Club participants with the ARC's team on a site visit and results reporting workshop.*

## OUTCOME 4:

### A SKILLED AND CAPABLE AGRICULTURE SECTOR

#### **BTP GOES BIG WITH CHEAPER SEQUENCING**

The Biotechnology Platform has always been a technological leader in genomics applications and has continued this tradition with the addition of a *MGI DNBSEQ-G400 genetic sequencer* to its "omics" portfolio in 2022. The *MGI DNBSEQ-G400* produces superior-quality sequencing data for ARC researchers as well as external clients at a lower cost point and replaced the obsolete HiSeq2500 unit. This short read sequencer is used by the BTP to produce sequencing data for high-throughput genomic, transcriptomic and metagenomic applications, with this versatility supporting a large diverse range of research projects. Data generation can take less than 4 days – depending on the sequence read lengths – resulting in improved turn-around times, and better alignment with global sequencing prices. This reduction in sequencing cost of up to 70% cheaper than our previous genetic sequencer, directly impacted client numbers and research projects' sizes that can be serviced by the BTP. Fourteen MGI sequencing runs have been completed, resulting in the sequencing of 5 900 000 000 bases, i.e. 5,9 terrabases, of sequence data from 1197 samples since its commissioning.



*The MGI DNBSEQ-G400 DNA sequencer that replaced the HiSeq2500.*

Projects that were made possible by the local accessibility of the technology were the sequencing of *Cannabis*, *Tilapia*, indigenous cattle, indigenous goats, and Mopani worm genomes. Eukaryotic whole genome sequencing projects, such as these, require large amounts of data that is only possible when sequencing costs are affordable. Disease surveillance in the face of emerging diseases and pandemics was also made possible by the *MGI DNBSEQ-G400*. Here sequencing of wastewater samples for the presence of the SARS-CoV-2 virus, as well as the sequencing of animals and birds for African Swine Fever and Avian Influenza viruses, were performed using this new sequencer. These are just a few of the projects where the *MGI DNBSEQ-G400* has contributed to both researchers in the ARC as well as clients of the ARC's Biotechnology Platform.



*Application Specialist is preparing the MGI DNBSEQ-G400 for a sequencing run.*



*The ARC's Team that received training on the new MGI DNBSEQ-G400 DNA sequencer.*

## BUILDING GENOMICS AND BIO-INFORMATIC CAPACITY IN DISEASE DIAGNOSTICS AND SURVEILLANCE – CASE OF BRUCELLA

ARC co-hosted a workshop, entitled *Bioinformatics for Bacterial Genomics and Metagenomics Training Workshop*, with Texas A&M (TAMU) and Northern Arizona University at the ARC's Biotechnology Platform Bioinformatics Training Laboratory, ARC's Onderstepoort campus. The workshop formed part of TAMU's US Department of Defense's "Defense Threat Reduction Agency Contract" under the project title: *A collaborative interdisciplinary approach to an endemic zoonotic disease in Cameroon: Enhancing capabilities to prevent, detect and respond to Brucellosis*. Responses to the online advert and registration required participant selection for the 12 available seats based on the feedback provided at registration. The Team also tried to distribute the participants amongst international vs local and government vs universities (students), with *Brucella*-related research projects getting priority overall. Participants were from three different countries (South Africa, Cameroon and USA) and included both governmental institutions, laboratory personnel and students from different universities.

The 5 day workshop (20-24 March 2023) provided participants with an introduction to genomic

epidemiology and aimed at beginners. Participants were taken from raw metagenome sequence data obtained from *Brucella* samples, through all the bioinformatics steps, ending at assembling a phylogenetic tree. The topics include sequencing approaches, sequence read processing (quality control, trimming), genome assembly and alignments, genome annotation, taxonomic assignment of metagenome sequence data, and building a phylogenetic tree to understand the relationships among samples. The entirety of the training used an online tool called KBase – a software and data science platform intended to make complex tasks in genomics accessible to scientists that lack either the tools and/or specialised skill sets.



All participants of the *Bioinformatics for Bacterial Genomics and Metagenomics Training Workshop*, at the ARC's Biotechnology Platform, with inserts depicting participants working or trainers during the workshop.

## KNOWLEDGE DISSEMINATIONS

Some of the knowledge dissemination interventions for 2022/23 included the following:

### JOURNAL ARTICLES

Chokoe, T.C., Hadebe, K., Muchadeyi, F.C., Nephawe, K.A., Dzomba, E.F., Mphahlele, T.D., Matelele, T.C. & Mtileni, B.J. 2022. Conservation status and historical relatedness of South African communal indigenous goat populations using a genome-wide single-nucleotide polymorphism marker. *Front. Genet.* doi: 10.3389/fgene.2022.909472.

Dewing, C., Van der Nest, M.A., Santana, Q.C., Proctor, R.H., Wingfield, B.D., Steenkamp, E.T., De Vos, L. 2022. Characterization of Host-Specific Genes from Pine- and Grass-Associated Species of the *Fusarium fujikuroi* Species Complex. *Pathogens* 2022. <https://doi.org/10.3390/pathogens11080858>.

Dlamini, N.M., Dzomba, E.F., Magawana, M., Ngcamu, S., Muchadeyi, F.C. 2022. Linkage Disequilibrium, Haplotype Block Structures, Effective Population Size and Genome-Wide Signatures of Selection of Two Conservation Herds of the South African Nguni Cattle. *Animals* <https://doi.org/10.3390/ani12162133>.

Dzomba, E.F., Van Der Nest, M.A., Mthembu, J.T., Soma, P., Snyman, M.A., Chimonyo, M., & Muchadeyi, F.C. 2023. Selection signature analysis and genome-wide divergence of South African Merino breeds from their founders. *Front. Genetics*. doi: 10.3389/fgene.2022.932272.

Hegy, Á.I., Otto, M., Geml, J., Hegyi-Kaló, J., Kun, J., Gyenesei, A., Pierneef, R., Váczy, K.Z. 2022. Metatranscriptomic Analyses Reveal the Functional Role of *Botrytis cinerea* in Biochemical and Textural Changes during Noble Rot of Grapevines. *Journal of Fungi*, <https://doi.org/10.3390/jof8040378> (Impact factor: 5.816).

Khan, A.S., Pierneef, R.E., Gonzalez-Escalona, N., Maguire, M., Georges, K., Abebe, W., Adesiyun, A.A. 2023. Phylogenetic analyses of *Salmonella* detected along the broiler production chain in Trinidad and Tobago. *Poultry Science*. <https://doi.org/10.1016/j.psj.2022.102322>.

Kunene, L.M., Muchadeyi, F.C., Hadebe, K., Mészáros, G., Sölkner, J., Dugmore, T. & Dzomba, E.F. 2022. Genetics of Base Coat Colour Variations and Coat Colour Patterns of the South African Nguni Cattle Investigated Using High-Density SNP Genotypes. *Frontiers in Genetics*, doi: 10.3389/fgene.2022.832702 (Impact factor: 4.772).



Lashmar, S.F., Visser, C., Okpeku, M., Muchadeyi, F.C., Mapholi, N.O. & van Marle-Köster, E. 2022. A within- and across-country assessment of the genomic diversity and autozygosity of South African and eSwatini Nguni cattle. *Tropical Animal Health and Production*, doi: 10.1007/s11250-022-03373-7. PMID: 36316504.

Mabuza, L.M., Mchunu, N.P., Crampton, B.G., Swanevelder, D.Z.H. 2023. Accelerated Breeding for *Helianthus annuus* (Sunflower) through Doubled Haploidy: An Insight on Past and Future Prospects in the Era of Genome Editing. *Plants*. <https://doi.org/10.3390/plants12030485>.

Magoro, A.M., Mtileni, B., Hadebe, K., Zwane, A. 2022. Assessment of Genetic Diversity and Conservation in South African Indigenous Goat Ecotypes: A Review. *Animals*. <https://doi.org/10.3390/ani12233353>.

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Modiba, M.C., Nephawe, K.A., Mdladla, K.H., Lu, W., Mtileni, B. 2022. Candidate Genes in Bull Semen Production Traits: An Information Approach Review. *Veterinary Science*, <https://doi.org/10.3390/vetsci9040155> (Impact Factor 2.44)

Moloto, O.T., Pietersen, G., Swanevelder, D.Z.H., Thompson, G.D., & Read, D.A. 2022. First report of grapevine polerovirus 1 in South Africa. *Australasian Plant Dis*. <https://doi.org/10.1007/s13314-022-00459-x> (Impact factor:1.599).

Ncube, K.T., Dzomba, E.F., Rosen, B.D., Schroeder, S.G., Van Tassell, C.P. & Muchadeyi, F.C. 2022. Differential gene expression and identification of growth-related genes in the pituitary gland of South African goats. *Front. Genet.* doi: 10.3389/fgene.2022.811193.

Otto, M., Geml, J., Hegyi, A.I., Hegyi-Kaló, J., Pierneef, R., Pogány, M., Kun, J., Gyenesi, A., Váczy, K.Z. 2022. Botrytis cinerea expression profile and metabolism differs between noble and grey rot of grapes. *Food and Microbiology*, <https://doi.org/10.1016/j.fm.2022.104037> (Impact factor: 3.451).

Ranketse, M., Hefer, C.A., Pierneef, R., Fourie, G., Myburg, A.A. 2022. Genetic diversity and population structure analysis reveals the unique genetic composition of Page 4 of 17. *South*

*African selected macadamia accessions*. *Tree Genetics and Genomes*. <http://doi.org/10.1007/s11295-022-01543-0> (Impact Factor: 2.297).

Shen, P., Niu, D., Liu, X., Tian, K., Permaul, K., Singh, S., Mchunu, N.P., Wang, Z. 2022. High-efficiency chromosomal integrative amplification strategy for overexpressing  $\alpha$ -amylase in *Bacillus licheniformis*. *Journal of Industrial Microbiology Biotechnology*, doi: 10.1093/jimb/kuac009. PMID: 35325171 (Impact Factor: 2.824).

Swalaski-Parry, B.S., Steenkamp, E.T., van Wyk, S., Santana, Q.C., van der Nest, M.A., Hammerbacher, A., Wingfield, B.D. & De Vos, L. 2022. Identification and Characterization of a QTL for Growth of *Fusarium circinatum* on Pine-Based Medium. *Journal of Fungi*. <https://doi.org/10.3390/jof8111214>.

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Alderson-Smith, S.G. 2022. Comparative performance of KiwiCross, Holstein and Jersey dairy cattle on pasture herds in KwaZulu-Natal. MSc (Agric Livestock Production), University of Pretoria.

Keena, J.M. 2022. The application of genomics and transcriptomics for the characterization of the genetic diversity of tick-resistance in Angus, Brahman, Nguni, and Santa Gertrudis cattle artificially infested with *Rhipicephalus microplus* and *Rhipicephalus decoloratus* ticks. PhD (Animal Science), University of Stellenbosch.

Mkhize, N.E. 2022. Genetic analysis of calving difficulty in South African Holstein cattle. MSc (Life Science), UNISA University of South Africa.

Molomo, K.P. 2022. Factors influencing the commercialization of Emerging dairy farmers in South Africa: A case study of the Free State Province. Ph.D. (Sustainable Agriculture) University of the Free State.

## CHAPTERS IN BOOKS

Mphaphathi, M., Ledwaba, M., & Thema, M. 2023. The Current Status of Semen and Oocytes Cryopreservation. In *Cryopreservation-Applications and Challenges*. IntechOpen. <https://www.intechopen.com/chapters/83798#:~:text=DOI%3A%2010.5772/intechopen.107404>.

## CONFERENCE PROCEEDINGS

None



## RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# NATURAL RESOURCES AND ENGINEERING

The ARC's Natural Resources and Engineering (ARC-NRE) is a newly created division comprising the Soil, Climate and Water (ARC-SCW) and Agricultural Engineering (ARC-AE) Campuses. It has the responsibility for areas of research and innovation that are crosscutting over the whole ARC, and can provide advanced research and technologies that are applicable across the full range of crops and animal systems. It creates opportunities for new interactions, approaches to training and development, and the application of a wide range of new technologies within the full value chain of different commodities. In addition, it provides a basis for the growth and development of a new generation of research staff suited to future needs of the ARC. It also provides a culture of continuous skills development based on a large postgraduate programme and a strong collaborative culture.

The ARC-NRE division follows a holistic approach towards natural resources utilisation and conservation. It promotes and collaborates in multi-institutional, cross-sectoral, bilateral and multilateral research teams. Its strength lies in the ability to provide innovative solutions to clients with respect to sustainable land use, conservation of the natural resources and environmental quality.

The division develops and applies agricultural engineering technologies that contribute to higher yields, increased income and lower input costs for agriculture and related industries in a sustainable way. It also develops and increases the efficient and sustainable utilisation of natural resources and human capital in the field of agricultural engineering technology.



## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

## OUTCOME 2:

## SUSTAINABLE ECOSYSTEMS AND NATURAL RESOURCES

**NATIONAL ASSESSMENT REPORT ON MIGRATION LINKAGES TO DESERTIFICATION, LAND DEGRADATION, DROUGHT, CLIMATE CHANGE, AND OTHER ENVIRONMENTAL FACTORS**

South Africa faces increasing threats to food production due to the impacts of climate change - linked to meteorological hazards such as floods and droughts, and loss of productive land due to land degradation processes including soil erosion and desertification. In addition, the country faces threats due to migration pressure linked to land degradation processes, which would have contributed to a decline in local economic activities. In Africa, land degradation is a key challenge and is intricately linked to food insecurity, poverty, human migration, urbanization, climate change, biodiversity and political processes. The UN General Assembly adopted Sustainable Development Goals (SDGs) comprising 17 goals and 169 targets in order to eradicate poverty and realize a sustainable world. SDG 15 aims to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss. With its reasonably stable democracy and robust economy, South Africa faces increasing migration pressure from the rest of Africa where political and economic challenges are on the increase.

In South Africa, land degradation is severe and increasing in most communal croplands, grazing lands and areas surrounding urban centres, including mining areas. Rural to urban migration as well as migration within the SADC region in search of better opportunities has compounded pressure on the country's limited natural resources and heightened drought impacts. The drought-migration linkages needed further scientific investigation and unpacking, particularly here in South Africa where migration from the rest of Africa confounds impacts of local migration on Desertification, Land Degradation and Drought (DLDD). An in-depth assessment of migration hotspots in tandem with DLDD hotspots as well as the drivers of the processes was required. The relationship between migration and environmental phenomena is complex due to the interactions among different phenomena of global environmental change that trigger environmentally induced migration.

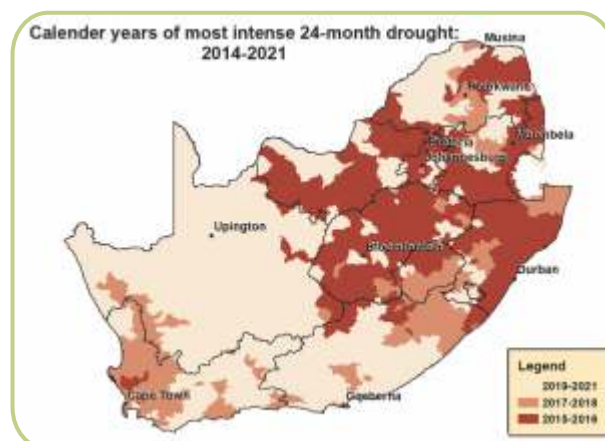
The Department of Forestry, Fisheries and the Environment (DFFE) commissioned the ARC to undertake a study on migration linkages to drought, land degradation, climate change and other environmental factors. The project was conducted in collaboration with the Human Sciences Research Council (HSRC) and had the following objectives:

- 1) To build an understanding and information base on the linkages between all migration patterns and DLDD, climate change and other related environmental factors (immigration, emigration and internal migration patterns);
- 2) To outline the impacts of migration in relation to DLDD and how such impacts contribute to social, economic and environmental challenges; and
- 3) To inform policy review and decision making in an integrated approach to ensure coordination at all levels.

The key question to be answered was: What is the information base on the linkages between all migration patterns and DLDD, climate change and other related environmental factors that could inform a policy review and decision making in an integrated approach to ensure coordination at all levels in South Africa?

A combination of approaches including mathematical modelling, social surveys and interviews were used to collect and process data on natural resources degradation as well as information from key stakeholders such as the Departments of Home Affairs and Mining, Statistics SA and local communities.

The map below shows the specific calendar years during which the most intense drought was registered according



Drought occurrence over time during the period 2014-2021.

to the Standard Precipitation Index (SPI). The most intense droughts occurred over the central to eastern parts, western to southern interior and the winter rainfall region of South Africa early in the period from 2014 to 2021.



*Evolution of drought intensity for northeastern areas.*

Several anomalously warm summers occurred during the period from 2010 to 2020. The spatial extent and intensity of these warm anomalies were closely associated with the occurrence of drought during this period.

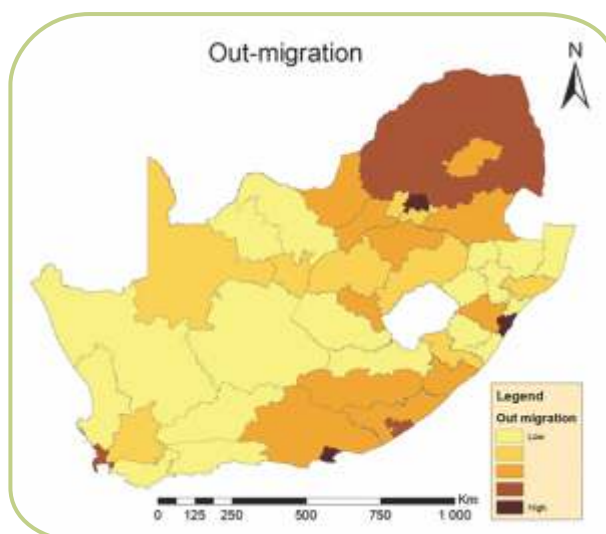
The provincial out-migration map shows the districts that are experiencing low to high number of people migrating out of them. Limpopo, Eastern Cape, Mpumalanga and North West were the provinces experiencing the highest levels of out-migration.

People whose livelihoods depend on rainfall are vulnerable to land degradation, climate change and drought. DLDD and climate change disproportionately contribute to increased poverty, unemployment and inequality, and lead to forced migration of the most marginalized and vulnerable. The research results showed that the poor and vulnerable members of a society undertake migration as an adaptation strategy, whereby the affected individuals move to nearby cities to seek alternative sources of livelihoods. Therefore, migration in the context of DLDD is defined as a way by which households that are heavily dependent on basic ecosystem goods and services diversify their livelihood strategies and sources of income, and adapt to variable environmental conditions and socio-economic uncertainty. The study further indicated that migrants contribute to land degradation where they settle. The assessment of changes in land productivity indicator and land cover of migration hotspots confirm this.

Case studies from different continents on migration linkages to DLDD and climate change showed that migration induced by environmental factors can be reduced by land restoration, enabling land tenure systems, and climate change adaptation measures. Results from a financial appraisal based on the recommendations of this project suggest that

investment in a rehabilitation and restoration strategy by improving productivity and soil organic carbon stocks in cropland, clearing of bush encroachment and alien invasive plant species, and climate change adaptation will yield positive benefits for the affected communities. Capacitating local communities with skills to deal with climate change, overgrazing and soil degradation is necessary to improve their adaptive capacity to deal with DLDD and associated impacts on migration.

As migration and DLDD are crosscutting, stakeholders targeted by this project include national and provincial government departments, non-governmental agencies and civil society.



*Provincial out-migration map.*

## KNOWLEDGE HUB FOR CONTAMINANTS OF EMERGING CONCERN



The Water Research Commission (WRC) funded an ARC-led project to create a Knowledge Hub for Contaminants of Emerging Concern (CECs) in agriculture and their impact on water resources in South Africa. CECs are pollutants that have previously been undetectable in water bodies but are now being detected at potentially harmful levels. These include nanomaterials, flame retardants, microplastics, agricultural waste, microbial contaminants, heavy metals, pharmaceuticals and personal care products. The continued unregulated use of these products could lead to both ecological and human health risks.



Agricultural CECs usually originate from inputs such as the use of inorganic fertilizers, pesticides, herbicides, fungicides and hormones. These inputs are increasingly used to feed a growing human population. For example, some livestock farmers have adopted the use of veterinary medicines such as hormones to increase animal and dairy output, whilst there is also an increase in the use of synthetic chemicals to fight pests, weeds and microorganisms that pose a threat to crop quality and yield.

Agricultural CECs make their way into water sources in different ways depending on the nature and application of the CEC. Some CECs are applied through spraying and are blown by wind into the atmosphere and may land in open water bodies such as rivers, dams and lakes that are utilized by surrounding communities. However, the most common route of agricultural CECs is runoff. During the rainy season, the CECs that settle on the crop and soil are easily washed off and deposited into nearby water bodies. In terms of commonly used hormones such as estrogen and androgen, they can enter the environment due to improper disposal after use or through excretion by animals that only utilize a portion of the medicine. The leftover residues tend to accumulate in the aquatic environment due to their inability to degrade, therefore posing a threat to aquatic life and the environment.

The aim of the Knowledge Hub is to collate all available data on CECs in South Africa and display it in a user-friendly online format. Its establishment is an important step towards identifying a potentially acute problem and taking relevant, informed steps to prevent it from escalating beyond control. The database will provide information on CECs and guide regulatory bodies, identify potential hotspots and assist researchers to avoid duplication of studies and costly analyses. The design of the Knowledge Hub is based on a web GIS (spatial data viewer) that consists of a geodatabase, map server and web viewer. Visitors to the website (<https://www.ceckh.agric.za/index.html>) can view printable information sheets regarding CECs, as well as information on how to avoid CEC contamination and locating a laboratory for specialized CEC analyses.

The most recent update from the Knowledge Hub for CECs in South Africa has highlighted some knowledge gaps, particularly in certain regions such as the Northern Cape where no CEC data has been published yet. The presence of organic pollutants has been detected in all provinces except the Free State. Microbiological CECs have only been documented in Limpopo, Mpumalanga and KwaZulu-Natal, while statistical data on microplastics is available for most provinces. Currently, the database includes 1190 inputs, with the majority being from pharmaceutical and personal care products (544), followed by microplastics (176), with nanomaterials having the fewest at only five.

As human exposure to these contaminants can also cause severe health issues such as endocrine disorders, cancer and other chronic diseases, it is expected that the Knowledge Hub for CECs in South Africa will benefit society as a whole and not just the agricultural sector.



## **DEVELOPMENT OF MANAGEMENT AND REHABILITATION PROTOCOLS FOR PEATLANDS IN SOUTH AFRICA: CASE STUDIES OF PEAT FIRES**

Peatlands are under pressure globally and are being lost at increasing rates. Land use changes within and around peatlands, as well as direct peat extraction, have been the greatest contributors to the degradation of peatlands. These land use changes result in the lowering of the water table of a peatland, causing desiccation and erosion, all of which expose peatlands to an increased risk of peat fires. These fires result in a loss of sequestered carbon to the atmosphere as organic carbon stores are combusted, thereby contributing to anthropogenic climate change. Furthermore, peat fires pose risks to respiratory health due to substantial fumes and are a safety hazard to people and animals. These risks are amplified by the prolonged subsurface nature of peat fires, instead the location of subsurface burning may be undetectable. Peat fire occurrence is increasing across South Africa, indicating a lack of control in fighting the fires. The South African Peatland Database housed at the ARC-NRE has recorded 635 peatland observations, with an estimated storage of about 29 million tons of carbon. The total loss of carbon due to peat fires is estimated at about 280 000 tons to date.

A project was funded by the WRC with the overarching aim to develop management and rehabilitation protocols for South African peatlands affected by peat fires from the determined peat loss in three selected case studies: 1) Molopo Peatland, North West Province; 2) Onrus Peatland, Western Cape; and 3) Muzi and Vasi Peatlands, KwaZulu-Natal.

New knowledge created in this study using a multi-disciplinary approach included:

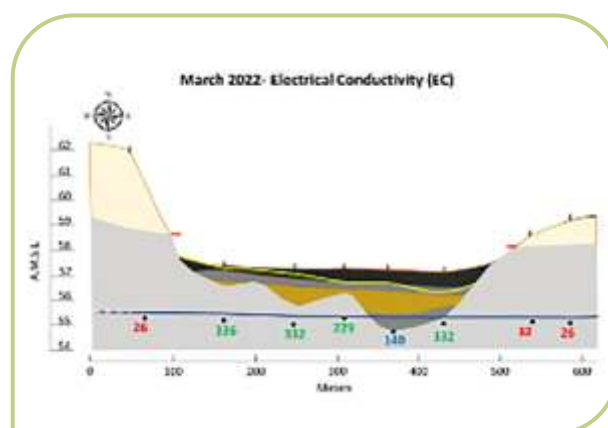
- Calculating the amount of peat that has been lost to fires in the studied peatlands using dumpy level surveys;
- Hydrological investigations on the peatlands to provide insight into how they function before and after a peat fire; and
- Socio-economic studies to determine the ecosystem services/functions lost to local communities due to peat fires in the studied peatlands.

This research project addressed the problem of degrading peatlands in South Africa and found that land use change, both externally and internally, has been the greatest contributor to the degradation of peatlands. The study also provided substantial evidence to give input to the envisaged wetland policy for management and rehabilitation.

The innovative products include a draft set of protocols/guidelines developed in the form of “decision tree” frameworks for controlling peat fires, as well as the prevention, management and rehabilitation of degraded peatlands that can be used by government officials, landowners or communities. The draft “decision trees” should be further workshopped with key stakeholders

that include regulators (i.e. mandated authorities) for refinement and finalization. Various government institutions ranging from local municipalities to conservation authorities were informed and trained during the project on aspects relating to peat fires, management and conservation.

The Global Peatland Assessment highlighted the need for action to conserve, restore and manage peatland systems in a sustainable manner. This project has shown that land use changes influence the hydrology of peatlands and can have a negative impact on them, causing degradation either by drying out, eroding or burning. The case studies confirmed that the lowered water tables, due to land use change, have negative implications for peatland functionality and the related provision of ecosystem services. A peatland's ecological reserve should therefore be determined and honoured for all historic and future developments.



*Electrical conductivity values of Vasi Peatland. The historic surface elevation of the peatland is indicated by the red marks.*



*A soil auger indicating the 1.2 m of peat loss using the bottom of the fence line as an indicator of the former level of the peatland surface at the Molopo Peatland, North West Province (left).*



*Reed cutters from five wards around KwaMsomi in KwaZulu-Natal whose livelihood were affected by a subsurface fire in the Muzi Peatland.*

*Vasi Peatland in KwaZulu-Natal burned in the 24-year interval between the two extreme decadal national droughts of 1991-1995 and 2015-2016, and even burned again in 2022 (right).*



## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

## OUTCOME 4:

## A SKILLED AND CAPABLE AGRICULTURE SECTOR

**4IR FARMING FOR EMERGING FARMERS AND THE SOUTH AFRICAN AGRICULTURAL COMMUNITY**

The ARC-NRE division is developing a drone platform for application in precision agriculture and natural resources monitoring. The platform consists of Unmanned Aerial Vehicle (UAV) systems with multispectral cameras. The aim is to provide and introduce UAV technology and services to smallholder and emerging crop farmers in South Africa. The data derived from the system has high spatial resolution at centimetre level, making it ideal for precision agriculture and natural resources research compared to medium coarse resolution satellite products such as Sentinel-2.

The drone platform has already been used in several ARC projects in different provinces of South Africa. For example, it was used to monitor wheat and maize crops during their various growth stages in the Free State, Gauteng and Limpopo. Assessment of crop conditions was made in the field and communicated to the farmers for possible solutions. The NDVI images illustrates how the use of UAV data provided improved resolution to identify areas of the farm that require urgent attention. Such information can assist farmers to improve crop yields.

The drone platform contributes towards the adoption of 4<sup>th</sup> Industrial Revolution (4IR) technology by emerging and smallholder farmers. Even though this is a relatively new technology for the South African agricultural community, most farmers have indicated that it is useful as it helps to save input costs and improve farm management. However, they also raised the following concerns:

- Adoption of drone technology is expensive and they are unable to afford it or its services;
- The regulations around the use of the technology are currently too stringent; and
- The technology is highly technical including operations and data management.

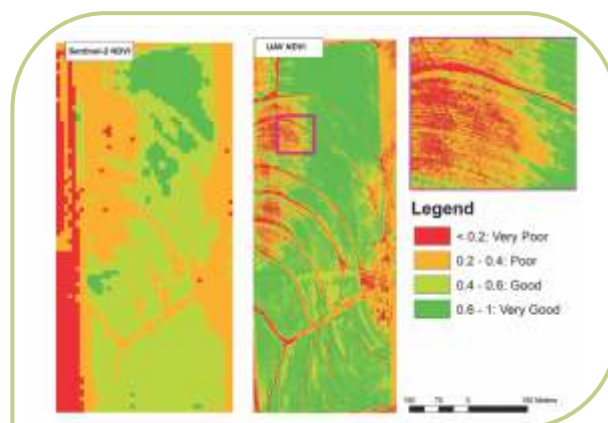
Therefore there is a need to train farmers and develop tools that can assist them to better understand and use the data generated by UAV systems.



*UAV system used to capture high resolution images.*



*Distribution of UAV surveys in different provinces of South Africa.*



*Normalized Difference Vegetation Index (NDVI) images from Sentinel-2 and UAV platforms depicting the condition of a wheat crop.*

## OUTCOME 5: ENHANCED RESILIENCE OF AGRICULTURE

### AGRICULTURAL DROUGHT EARLY WARNING SYSTEM

Drought is a major climatic factor playing a significant role in substantial decreases in agricultural output, food insecurity, reduced livelihoods and economic losses on a worldwide scale, including in South Africa. To address this issue, the ARC-NRE Agrometeorology team embarked on a 4-year project funded by the WRC to develop an agricultural drought preparedness framework for South African croplands and grasslands. Central to the framework was the development of an Agricultural Drought Early Warning System (ADEWS) to support the organization's strategic objectives of promoting sustainable ecosystems, natural resources, as well as utilization and development of water resources in agriculture.

The ADEWS is a web-based system (<https://www.drought.agric.za/>) that relies on multi-disciplinary datasets and indices related to specific agricultural commodities (shown in diagram). It provides free access to a wide range of products using monitored and forecasted data for any location and period across South Africa. The advantage hereof is that users are able to generate and visualize maps depicting historical and impending drought conditions by selecting the different indices for their desired location. Additionally, the system automatically sends registered users daily emails about drought conditions specific to their areas.

The study further analyzed the role of policy on the potential effectiveness of the ADEWS through policy documents review and expert interviews with senior management officials at both national and provincial levels of governance. The findings revealed that current policies and plans recognize the usage of early warning systems for effective drought preparedness and response. However, indicators regarding the implementation showed that officials must be capacitated in terms of available sources of drought early warning information. This should further be complemented by communication channels that promote timely and informative warnings. Subsequently, the ADEWS was tested through workshops with relevant stakeholders for scientific knowledge, functionality, relevance and ease. The primary goal of these workshops was to evaluate whether the system satisfies the anticipated standards for improving early warning efforts in the agricultural sector of South Africa.

In the 21<sup>st</sup> century, numerous drought early warning systems have been developed across the globe to address drought issues and provide solutions for agriculture. These systems have yielded positive outcomes as they provide essential drought-related information that minimize the potential impacts on vulnerable sectors. Thus, the importance of adopting the ADEWS is that it will enhance the capacity of all stakeholders in the agricultural sector to make informed decisions relating to drought. This will ensure the success of transitioning from an emergency response to risk management.

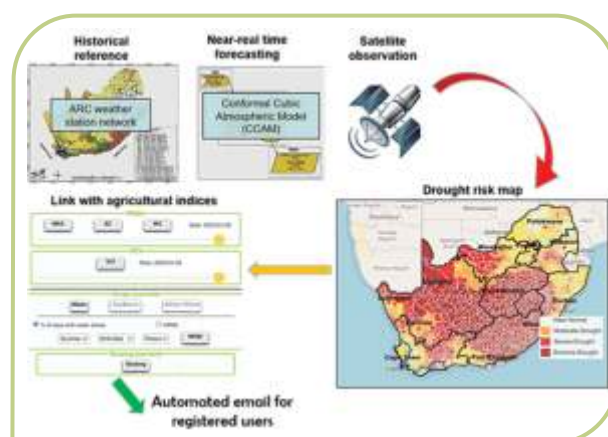


Diagram illustrating the ADEWS from data collection, processing to output.



Testing of the ADEWS with members of the National Agrometeorological Committee (NAC) on 13 December 2022 in Vanderbijlpark, Gauteng.

## KNOWLEDGE DISSEMINATION

Some of the knowledge dissemination interventions for 2022/23 included the following:

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## RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# GRAIN CROPS

The ARC-Grain Crops (ARC-GC) Campus was established in 1981 in Potchefstroom in the North-West province. Strategic and need driven research conducted by the campus involves cultivar evaluation, plant breeding, improvement of crop quality, weed control, conservation agriculture, plant nutrition, climate resilience, crop modelling, crop estimates, plant pathology, entomology and nematology.

The ARC-GC is mandated to serve the summer grain crops as well as oil and protein seeds sectors. The Campus conducts R&D to enhance national productivity and the competitiveness of relevant producers and related industries. The ARC-GC researchers conduct field trials at both on-station and on-farm sites in all the nine provinces. In addition, the Campus is involved in training

smallholder farmers, new commercial farmers and extension officers, and maintains genebanks of the mandated crops as national assets.

The mandated summer grain crops of ARC-GC are maize, sorghum and pearl millet. The oil and protein seed crops include bambara, cowpea, dry bean, groundnut, pigeon pea, soybean and sunflower. New crops currently under evaluation are pigeon pea, finger millet, lentil and rice.

In addition to other ARC Campuses, the ARC-GC collaborates with both local and international partners in International Agricultural Research Centres (CIMMYT, CIAT, ICRISAT, IITA, and IRRI), Universities, Private Seed Companies, NGOs, NARS, etc.



## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

# OUTCOME 2:

## SUSTAINABLE ECOSYSTEMS AND NATURAL RESOURCES

### ***CHARACTERISATION AND EFFECTS OF DIFFERENT LEVELS OF WATER STRESS AT DIFFERENT GROWTH STAGES IN MALT BARLEY UNDER WATER-LIMITED CONDITIONS.***

Irrigation is one of the few and most important areas of barley production over which the emerging farmer has complete control. Simple and practical irrigation guidelines are therefore essential to achieve optimal yield and quality. However, irrigation of barley has always been managed with guidelines based on wheat production and therefore irrigation water has not been used optimally. Little information on the basic and advanced knowledge of irrigated malt barley is available in literature. Therefore, the goal of this investigation was to understand the growth, yield, and water management of irrigated malt barley under South Africa conditions. To achieve this goal, there were specific objectives put in place and one of them was to examine the response of transpiration, stomatal conductance, and leaf water potential to different levels of water stress at different growth stages of malt barley. This is especially important considering the growing challenge of drought in South Africa, causing water stress and resulting in the reduction of crop yields.

Malt barley is typically grown in dryland conditions in South Africa. It is an important grain after wheat, but little is known about its water requirements and, most importantly, how it responds to water stress. Determining when water stress sets in and how malt barley responds to water deficit during its growing season is crucial for improved management of crop water requirements.

The objectives of this study were to evaluate the response of transpiration (T), stomatal conductance (SC), and leaf water potential (LWP) to water stress for different growth stages of malt barley and to characterise water stress to different levels (mild, moderate, and severe). This was achieved by monitoring the water stress indicators (soil- and plant based) under greenhouse conditions in well-watered and water-stressed lysimeters over two seasons. Water stress was characterised into different levels with the aid of soil water content 'breaking points' procedure. During the first season, at

the end of tillering, flag leaf, and milk/dough growth stages, which represent severe water stress, plant available water (PAW) was below 35%, 56%, 14%, and 36%, respectively. LWP responded in accordance with depletion of soil water during the growing season, with the lowest recorded value to  $-5.5$  MPa at the end of the milk/dough growth stage in the first season. Results also show that inducing water stress resulted in high variability of T and SC for both seasons. In the second season, plants severely stressed during the anthesis growth stage recorded the least total grains per pot (TGPP), with 29.86 g of grains. The study suggests that malt barley should be prevented from experiencing severe water stress during the anthesis and milk/dough stages for optimum malt barley production. Quantification of stress into different levels will enable the evaluation of the impact of different levels of stress on the development, growth, and yield of barley.



*Barley grown in small weighing lysimeters under glasshouse condition*

This is an opportunity to manage the irrigation scheduling to maximise the period and level of water applications in barley. Therefore, this study provided information on the development of an irrigation schedule specific for barley, its optimum production, reduction of irrigation water application and input cost reduction. The lower the cost of production, the lower the amount of money that SAB will pay for malt barley and invariably the lower the cost of production of beer. Water footprint is another important concept in crop production. The results from this study can assist or be part of means of developing a framework towards water footprints in barley production. This will help to develop policy towards irrigation, irrigation water and crop production by the policy makers.

## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

## OUTCOME 5:

## ENHANCED RESILIENCE OF AGRICULTURE

**AGRICULTURAL DEVELOPMENT SUPPORT FOR INTERNALLY DISPLACED PERSONS (IDPS) IN CABO DELGADO PROVINCE OF MOZAMBIQUE IN THE CONTEXT OF SUSTENTA FARMER SUPPORT PROJECT**

The current political conflict in Cabo Delgado province of Mozambique has displaced large numbers of people and families from their homes and caused major distress and loss of sources of incomes. Effects of this include jobs loss, insecurity, and disruption of social and economic development. Loss of sources of income could lead to anxiety, depression and broken family structures. This project seeks to enhance food and nutrition security through utilisation of new or improved technologies (e.g. improved seeds and adapted chicken genetics) and climate-resilient farming practices.

In response to the abovementioned challenge, DIRCO through the African Renaissance Fund (ARF) appointed the ARC, a state entity of the Department of Agriculture and Rural Development, to implement the “Agricultural development support for Internally Displaced Persons (IDPs) in Cabo Delgado province of Mozambique in the context of SUSTENTA farmer support project”.

The overall objective of the project is to enhance food and nutrition security, and family agricultural income through training of extension officers and internally displaced people, and technology transfer in the form of provision of improved seeds, chickens and production inputs. The key outcomes are (1) food and nutrition security, (2) and sustainable livelihood and economic opportunities from improved farming methods, and (3) skilled public extension services.

The ARC Grain Crops campus provided soil information of the field given to the IDPs through soil sampling and analysis. The ARC Grain Crops campus is also responsible for conducting training of extension officers from Cabo Delgado Province in order to equip them with sustainable and improved farming practices for three crops (e.g. maize, cowpea and sesame) adapted to five areas (Metuge, Ancuabe, Chirue, Montepuez and Namuno) of Mozambique.

The first consignment of production kits was sent to Pemba, Mozambique on 29 December and technical



*Distribution of consignment*



*Handing over ceremony of crop kits*

handing over was done on 30 December 2022. The technical handing over ceremony was held at the warehouse in Pemba by the ARC, DIRCO and SPAE (Mozambique). The distribution was managed locally in Pemba through the provincial government office (SPAE) and was led by Mr. Dalilo Ambasse and Mr. Nota Ovidio. The distribution of the crop kits started immediately after arrival of the first cargo in Pemba, Mozambique. The last kits were distributed at the last district of the five on 10 January 2023.

The internally displaced people will be equipped with farming skills to produce crops, specifically maize, cowpea and sesame. This will enhance the recovery process through acquisition of source of incomes, security, enhancement of social and economic development of the community. This project will also help to seal the continuity and cooperation between South African and Mozambique governments in the agricultural and international relations sections.



RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

**OUTCOME 4:**

A SKILLED AND CAPABLE AGRICULTURE SECTOR

**INCORPORATING MALE STERILITY INCREASES HYBRID MAIZE YIELD IN LOW INPUT FARMING SYSTEMS**

Maize is a staple food crop in sub-Saharan Africa (SSA), but yields remain sub-optimal due to a variety of biotic and abiotic stress factors. Improved breeding and seed systems are vital to increase productivity. The ARC is participating in an international public-private partnership known as Seed Production Technology for Africa (SPTA). The SPTA is a collaboration of partners bringing together complementary skills, technologies and germplasm. Corteva Agriscience is providing the proprietary Seed Production Technology (SPT) to the project on a royalty-free licensing basis for humanitarian purposes in Africa. The ARC and Kenya Agriculture and Livestock Research Organization (KALRO) are leading field research and stakeholder engagements. The International Maize and Wheat Improvement Center (CIMMYT) is coordinating the partnership, conducting research and providing germplasm.

The Project aims to address low maize yields associated with low levels of nitrogen fertiliser application for much of SSA due to lack of access and/or lack of affordability of fertiliser. Smallholder farmers in South Africa are equally affected due to lack of financial resources.

Hybrids are maize varieties in which the seed is produced by two different parent lines, increasing the yield through hybrid vigour. Detasseling (removal of tassels of maize female parent plants) in hybrid seed production is done manually by pulling the tassels by hand, leading to higher cost of seed and issues with seed quality associated with unwanted self-pollination. The detasseling process often

results in the removal of an average of three leaves per plant, thereby reducing seed yields. The innovative hybrid seed production technology made possible using a dominant male sterile gene (Ms44) in conjunction with the SPT system improves efficiency and integrity of seed production by removing the need for detasseling. The resulting hybrids segregate 1:1 for pollen production and non-pollen production and are known as fifty-percent non-pollen producing (FNP). The non-pollen producing plants conserve resources for grain production, produce bigger ears than pollen producing plants, and confer a 200 kg/ha benefit across a range of yield levels. This represents a 10% increase for farmers operating at 2 t/ha the common average yield level obtained by low-input smallholder farmers in sub-Saharan Africa.



Ears of pollen producing (left) and non-pollen producing (right) plant



Number of leaves removed during detasseling: results of 2000 tassels collected from a detasselled field



## KNOWLEDGE DISSEMINATION

Some of the knowledge dissemination interventions for 2022/23 included the following:

### JOURNAL ARTICLES

Akhtar, S., Mekonnen, T.W., Mashingaidze K., Osthoff, G., Labuschagne, M. (2023): Heterosis and combining ability of iron, zinc and their bioavailability in maize inbred lines under low nitrogen and optimal environments. *Heliyon*. Volume 9, Issue 3, March 2023, e14177, <https://doi.org/10.1016/j.heliyon.2023.e14177>. Received: 07 March 2023.

Akhtar, S.; Mekonnen, T.W.; Osthoff, G.; Mashingaidze K., and Labuschagne, M. (2023): Genotype by Environment Interaction in Grain Iron and Zinc Concentration and Yield of Maize Hybrids under Low Nitrogen and Optimal Conditions. *MDPI. Plants*. Volume 12(7), 1463; <https://doi.org/10.3390/plants12071463> Received: 26 February 2023 / Revised: 11 March 2023 / Accepted: 20 March 2023 / Published: 27 March 2023.

Amegbor I.K.; van Biljon A.; Shargie N.G.; Tarekegne A.; and Labuschagne MT (2023). Combining ability estimates for quality and non-quality protein maize inbred lines for grain yield, agronomic, and quality traits. *Front. Sustain. Food Syst*. Volume 7 - Received 13 December 2022. <https://doi.org/10.3389/fsufs.2023.1123224> Accepted 10 February 2023. Published 09 March 2023.

Amegbor, I.K.; van Biljon, A.; Shargie, N.G.; Tarekegne, A.; Labuschagne, M.T. Does the quality protein maize trait cause hybrid yield losses? A case study in Southern Africa. *Euphytica*, 218, 87 (2022). <https://doi.org/10.1007/s10681-022-03041-9>. June 2022. Received: 30 June 2022.

Amegbor, I.K.; van Biljon, A.; Shargie, N.G.; Tarekegne, A.; Labuschagne, M.T. Identifying Quality Protein Maize Inbred Lines for Improved Nutritional Value of Maize in Southern Africa. *Foods* 2022, 11, 898. <https://doi.org/10.3390/foods11070898>. 22 March 2022. Received: 30 June 2022.

Boddupalli M.P.; Burgueño, J.; Beyene, Y.; Makumbi, D.; Asea, G.; Woyengo, V.; Tarekegne, A.; Magorokosho, C.; Wegary, D.; Ndhlela, T.; Zaman-Allah, M.; Matova, P.M.; Mwansa, K.; Mashingaidze, K.; Fato, P.; Teklewold, A.; Vivek, B.S.; Zaidi, P.H.; Vinayan, M.T.; Patne, N.; Rakshit, S.; Kumar, R.; Jat, S.L.; Singh, S.B.; Kuchanur, P.H.; Lohithaswa, H.C.; Singh, N.K.; Koirala, K.B.; Ahmed, S.; San Vicente, F.; Dhliwayo, T.; Cairns, J.E. Genetic trends in CIMMYT's tropical maize breeding pipelines. *Scientific Reports* volume 12, Article number: 20110 (2022) Published: 22 November 2022. <https://www.nature.com/articles/s41598-022-24536-4>.

Collinson, S.; Hamdziripi, E.; De Groote, H.; Ndegwa M.; Cairns J.E.; Albertsen, M.; Ligeyo, D.; Mashingaidze, K.; Olsen, M.S. Incorporating male sterility increases hybrid maize yield in low input African farming systems. *Communications Biology* 2022, 5, 729. <https://doi.org/10.1038/s42003-022-03680-7>. 22 July 2022.

Mofokeng, M.A.; Bello, Z.A.; Mashingaidze, K.; Gerrano, S. Morphological Plasticity of Economical Traits in Pigeonpea Genotypes Grown in South Africa. *International Journal of Agriculture and Biology* 2022, 28 (02). [http://www.fspublishers.org/html\\_issue.php?i\\_id=41784](http://www.fspublishers.org/html_issue.php?i_id=41784). *International Journal of Agriculture and Biology (IJAB)*, DOI: 10.17957/IJAB/15.1954. 25 August 2022.

Sejake, T.; Shargie, N.; Figlan, S.; Mofokeng, A.; Tsilo, T.J. Phenotypic Variation of Sorghum Accessions for Grain Yield and Quality Traits. *Agronomy* 2022, 12(12), 3089; <https://doi.org/10.3390/agronomy12123089> Received: 1 November 2022. Accepted: 1 December 2022. Published: 6 December 2022.

Shandu, S., Gasura, E., Mashingaidze, K. & Derera, J. (2022): Contribution of temperate germplasm to the performance of maize hybrids under stress and non-stress environments in South Africa, *South African Journal of Plant and Soil*, DOI:10.1080/02571862.2021.1994047. Received: 30 June 2022.

### THESES AND DISSERTATIONS

Ntidi N. 2022. Supported Student: Melissa Buys (28385195). Title: Evaluation of integrated pest management practices on nematode assemblages in a potato field in South Africa Qualification: Master of Science in Environmental Science – NWU. Awarded on 21 June 2022. Received: 30 June 2022.

### CHAPTERS IN BOOKS

Mofokeng, M.A, Bello, Z.A, Mashingaidze, K. 2020. Phenotypic Analysis of Pigeon Pea Reveal Genotypic Variability under Different Environmental Interaction. In: Jimenez-Lopez, J.C, Clemente, A. eds. *Legumes Research - Volume 1*. IntechOpen, Chapter 9: 114-123. Submitted: March 9th, 2021 Reviewed: July 7th, 2021 Published: October 12th, 2022 P05000106.

### CONFERENCE PROCEEDINGS

None

## RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# SMALL GRAIN

The ARC-Small Grain Campus (ARC-SG) serves the South African small grain commodity grouping, encompassing wheat, barley, triticale and oats. As South Africa strives to become less dependent on wheat imports (avg. 1.5 mil tons per annum), ARC-SG continues to render research in support of mainly four production pillars:

1. Pre-breeding for enhanced yield/resistance/quality traits in locally-released cultivars;
2. Cultivar development for planting under dryland and irrigation conditions, nationally;
3. Cultivar evaluations under the NCEP; and
4. Crop protection through the development of bioinsecticides and pest surveillance for early warning.

The Campus employs new state-of-the-art breeding technologies, including techniques for improved background selection and molecular markers. A meta-data analysis on wheat breeding research conducted by ARC-SG, has revealed a return on investment (ROI) ratio of 5.1:1. Cultivar evaluations under the NCEP are performed in all major production areas, supporting

reliable, independent and annually-published Production Guidelines, used by small grain producers and policy makers. Several industry role players assisted with the task of gathering, combining and presenting these results to the small grain industry. Crop Protection research focuses on pest surveillance and early warning systems as pre-emptive approach against insects and diseases. Research on insect-killing microbes and their development as bio-insecticides is a key focus; commercialisation of these beneficial microbes is pursued in collaboration with private industry. A molecular screening service for weed resistance to herbicides is rendered to producers, facilitating correct herbicide choice.

In essence, research activities at ARC-SG enable producers to be economically competitive, ensuring food security through the availability of high quality, affordable cereals. Innovative technologies are implemented to maintain and extend the contribution that the small grain industry makes to the wealth and social welfare of all South Africans.



## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

**OUTCOME 1:****INCREASED AGRICULTURAL PRODUCTION AND PRODUCTIVITY*****PLANT BREEDERS RIGHTS AWARDED TO THREE WHEAT CULTIVARS***

During 2022-2023 three wheat cultivars developed by ARC breeders specifically for South African production circumstances, were awarded Plant Breeders Rights (PBR) by the National Registrar for Plant Breeders' Rights of the Department of Agriculture, Land Reform and Rural Development. PBR are essential to protect intellectual property of cultivars. Winter wheat cultivar "Kougas" and two spring irrigation cultivars "Usutu" and "Selons" are now registered.

Kougas is an intermediate grower with an intermediate type vernalization need. It is moderately to high yielding. The hectolitre mass is good in comparison to Elands (quality standard). The protein content is high in comparison to cultivars in the market. It is susceptible to stripe rust, resistant to moderately susceptible to leaf rust and resistant to stem rust.

Usutu has a medium to late growth period with excellent yields and has an average straw length of 105 cm. Usutu shows lodging tolerance despite its exceptional yields and large ears. In terms of disease resistance, Usutu is moderately resistant to leaf rust and moderately susceptible to stripe rust. Over the last four years Usutu has had an average yield of 12 t/ha and during 2021 produced an average yield of 12.5 t/ha. This yield is exceptional and far better than any of the commercial cultivars up to date.



*Seed of these three cultivars, when commercialised and properly marketed, will significantly boost South African wheat production, especially in the irrigation area.*

Selons has a medium growth period and slightly shorter straw. The average straw length is 95 cm and shows no lodging problems. Similar to Usutu, Selons is moderately resistant to leaf rust, but is resistant to moderately susceptible to stripe rust. Selons is also capable of higher yields, with a four-year yield average of 11.4 t/ha. During 2021, Selons produced an average yield of 12 t/ha.

***FINAL RELEASE OF MKUZE FOR THE FREE STATE DRYLAND CULTIVATION AREA***

An intermediate growth type breeding line (Mkuze) complied with all the baking and milling requirements of the industry for the three-year evaluation period and was finally released as a cultivar and named Mkuze, at a meeting with the industry held on 18 July 2022. Mkuze is a high yielding cultivar with good quality characteristics for the Free State Dryland Summer Rainfall cultivation area. The yield was the same and better over the three-year evaluation period in comparison with Matlabas (ARC-SG yield benchmark). The hectolitre mass (harvest quality grading) of Mkuze was higher than that of Elands (industry benchmark) over the three-year evaluation period. Mkuze is moderately resistant to moderately susceptible against stripe rust (major disease) biotypes occurring in the production area. Mkuze is a long grower, with a winter type vernalization need.



*Mkuze*

## KNOWLEDGE DISSEMINATION

Some of the knowledge dissemination interventions for 2022/23 included the following:

### JOURNAL ARTICLES

Bapela, T., Shimelis, H., Tsilo, T.J. & Mathew, I. 2022. Genetic Improvement of Wheat for Drought Tolerance: progress, Challenges and Opportunities. *Plants* 2022, 11. <https://doi.org/10.3390/plants11101331>.

Duma, S., Shimelis, H. & Tsilo, T.J. 2022. Response of Bread Wheat Genotypes for Drought and Low Nitrogen Stress Tolerance. *Agronomy* (2022) 12. <https://doi.org/10.3390/agronomy12061384>.

Khumalo, T.P., Hlongoane, T., Barnard, A. & Tsilo, T.J. 2022. Genomic Regions Influencing Preharvest Sprouting Tolerance in Two Doubled-Haploid Wheat Populations (*Triticum aestivum* L.). *Agronomy* 2022, 12. <https://doi.org/10.3390/agronomy12040832>.

Lephuthing, M.C., Khumalo, T.P., Tolmay, V.L., Dube, E. & Tsilo, T.J. 2022. Genetic mapping of quantitative trait loci associated with plant height and yield component traits in a wheat (*Triticum aestivum* L.) doubled haploid population derived from Tugela-DN x Elands. *Agronomy* 2022. <https://doi.org/10.3390/agronomy12102283>.

Sosibo, N.Z., Dube, E., Muchanyerwa, P. & Tsilo, T.J. 2022. Influence of cropping sequences on labile carbon and phosphorus fractions in a wheat-based conservation agriculture system. *South African Journal of Plant and Soil*. <https://doi.org/10.1080/02571862.2022.2092659>.

Sosibo, N.Z., Muchanyerwa, P., Dube, E. & Tsilo, T.J. 2022. Soil Carbon and Phosphorous after 40 years of contrasting tillage and straw management in dryland wheat production under semi-arid temperate climate. *Land* 2022 (11). <https://doi.org/10.3390/land11081305>.

Spekman, Z., Visser, B., Terefe, T., Pretorius, Z.A. & Boshoff, W.H.P. 2022. Pathogenicity and microsatellite characterisation of *Puccinia hordei* in South Africa. *Crop Protection* 158 (2022). <https://doi.org/10.1016/j.cropro.2022.106014>.

Terefe, T., Visser, B., Pretorius, Z.A. & Boshoff, W.H.P. 2022. Physiologic races of *Puccinia triticina* detected on wheat in South Africa from 2017 to 2020. *Eur Journal of Plant Pathology*. <https://doi.org/10.1007/s10658-022-02583-x>.

Visser, M.H., Barnard, A. & Du Preez, C.C. 2022. Impact of preceding crop sequence on wheat growth and development under conservation agriculture in the Eastern Free State, South Africa. *South African Journal of Plant and Soil*. <https://doi.org/10.1080/02571862.2021.1994046>.

### THESES AND DISSERTATIONS

Kgosiemang, J. 2022. Isolation and identification of entomopathogenic nematode bacterial metabolites for biological control of fusarium head blight of wheat and wheat aphids. MSc in Agriculture at UNISA, October 2022.

Kisten, L. 2022. Investigation into the genetic control of Russian wheat aphid *Diuraphis noxia* resistance. PhD Degree in Botany, University of Johannesburg. Graduation October 2022.

### CHAPTERS IN BOOKS

None

### CONFERENCE PROCEEDINGS

None



## RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# INFRUITEC-NIETVOORBIJ

The ARC Infruitec-Nietvoorbij Campus (ARC-NVB) does research and development, as well as technology transfer on breeding, cultivation, pest and disease control and postharvest technology of stone and pome fruit, grapevines, alternative crops (such as olives and pomegranates) and indigenous herbal teas. Its main campus is situated in Stellenbosch, Western Cape, but cultivar development and research is conducted in all regions of South Africa where the crops are grown.

Breeding cultivars that are adapted to different local conditions, comply with market requirements and able to cope with climate change, and knowledge generated by research on sustainable soil cultivation and management, water efficient irrigation, winery wastewater management, viticultural and horticultural practices to improve crop performance and integrated pest and disease management (pre- and postharvest) ensure the economic sustainability of commercial farms, thereby protecting and creating jobs on farms and in the industries supplying materials and equipment to these

farms. It also allows fruit production to be expanded to more rural households to help address malnutrition because fruit is an excellent source of the vitamins and minerals that are vital for the physical and mental development of children. Research on winemaking and postharvest processing of fruit and herbal teas add value to agricultural products, contribute to economic sustainability and to job creation.

ARC-NVB is the custodian of genetic resources for grapevine, pome and stone fruit, wine yeast, fynbos and indigenous teas (rooibos and honeybush). These genebanks are used by the ARC, private sector and government for breeding purposes, training and comparative descriptions of cultivars.

The Campus also provides a range of diagnostic and analytical services to growers, winemakers and technical advisors to assist with decision-making and to help ensure sustainable, economically viable farming.



## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

## OUTCOME 1:

## INCREASED AGRICULTURAL PRODUCTION AND PRODUCTIVITY

**NEW ARC PEACH AND PROTEA CULTIVARS**

The registration of a new cultivar with plant breeder's rights (PBR) is a tool breeders can use to protect a new cultivar, but also to secure future income in the form of royalty payments to be used for on-going breeding activities.

'Victory' is a new canning peach cultivar bred by the ARC. It is a yellow skinned, non-melting peach with orange yellow flesh suitable for processing. It ripens in week 8 after 'Kakamas'. It has a lower cold requirement and higher yield per hectare than 'Kakamas'. The tree has sturdier shoots than 'Kakamas', which makes it less susceptible to wind damage and suitable for higher density planting.

'Delight' is a Protea hybrid that was selected for release as a new cut flower cultivar. It has small, intense pink flowers and is only 11 cm long and 8.7 cm in diameter. These smaller Protea flowers address the need of the fynbos cut flower industry for smaller flowers, because more flowers can be packed per export carton and Northern Hemisphere countries demand smaller, but unique flowers. The flower mass is a complementary soft shade of pinkish red with a white tuft and does not have any dark tuft on the involucre bracts. The selection has a long flowering window from July to November in the Southern Hemisphere.



*'Delight' is a new cut flower Protea cultivar bred by the ARC.*

**PHYLLOXERA - FORGOTTEN BUT PRESENT EVERYWHERE**

Phylloxera, a type of aphid, feeds only on grapevines (*Vitis* spp.). Where it feeds on the fine grapevine roots characteristic hook-shaped galls develop. This weakens the root system and shortens the productive lifespan of vines, eventually killing them. It nearly destroyed the wine industry when it was introduced from North America via planting material around 1886. The industry was saved only by grafting grapevines onto resistant rootstocks. Since then, local grape growers often underestimate how serious a threat phylloxera is. Increased reports of phylloxera in vineyards in recent years led to a survey being conducted by researchers of ARC Infruitec-Nietvoorbij in the major table and dried grape growing areas of the Western and Northern Cape provinces.

The survey confirmed that phylloxera is present in all table and raisin grape production areas in the Western and Northern Cape. Resistant and moderately resistant rootstocks allow small numbers of phylloxera to persist on the roots, but do not allow numbers to reach levels where production is affected negatively. However, there is a risk of phylloxera numbers increasing to damaging levels should grapevines come under stress (like drought or other pests) because phylloxera resistance weakens when vine vigour is reduced. If soil becomes infested with phylloxera while planted with a resistant rootstock and is subsequently replanted with a susceptible rootstock, phylloxera can proliferate to the point where it affects growth and yield negatively. Phylloxera should be controlled in vineyards supplying rootstock material to nurseries and every effort should be made to ensure that planting material is free from phylloxera.



*Galls caused by phylloxera feeding on fine roots*

## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

**OUTCOME 2:****SUSTAINABLE ECOSYSTEMS AND NATURAL RESOURCES****POTENTIAL INTERCEPTION CROPS WHERE WINERY WASTEWATER IS RE-USED FOR VINEYARD IRRIGATION**

Wineries generate approximately 15 330 million litres of wastewater per annum. Irrigation of crops with winery wastewater reduces energy use and wastewater treatment cost, while also helping to mitigate reduced availability of water for irrigation due to climate change and population growth. However, winery wastewater often contains high levels of potassium and sodium salts that are detrimental to soil structural stability and increase soil salinity, which affect plant growth negatively. Excessive potassium uptake by grapevines can potentially have a negative effect on wine quality as well. ARC researchers conducted a field trial to identify fodder producing summer catch crops and winter cover crops that can intercept potassium and sodium applied through irrigation with diluted winery wastewater in open land cultivation and in a vineyard.

Vetiver grass, Dolichos beans and Chicory performed best as fodder producing summer catch crops in open land cultivation, but only absorbed a low percentage of elements, particularly sodium, applied via the diluted

winery wastewater. Although the nitrogen-fixing winter cover crops extracted substantial amounts of elements from the vineyard soil, they extracted only low amounts of sodium. The study showed that cover and catch crops, even for use as fodder, are not effective potassium and sodium salt interceptors under the prevailing conditions of the study when winery wastewater is used for irrigation. However, cover crop cultivation in vineyards is still strongly recommended because of all the other positive benefits.



*Nitrogen fixing (left) and oats (right) winter cover crops in the vineyard*

**OUTCOME 3:****IMPROVED NUTRITIONAL VALUE, QUALITY AND SAFETY OF AGRICULTURAL PRODUCTS****DELAYED WINEMAKING TO IMPROVE QUALITY AND AROMA OF SAUVIGNON BLANC AND CHENIN BLANC WINES**

To make South African wines more competitive, particularly in the export market, winemakers are continually looking for novel winemaking techniques to produce wines with unique aroma and taste. Researchers at ARC investigated how chilling and freezing of Sauvignon blanc and Chenin blanc grapes and must/juice for different lengths of time at various stages during the winemaking process affect wine quality and aroma. Grapes in the control treatment were harvested and fermented immediately, as is standard practice.

Treatments included chilling ( $-4^{\circ}\text{C}$ ) and freezing ( $-20^{\circ}\text{C}$ ) of whole berries, macerated grapes, turbid musts and clear juice for 0 months (immediate freezing/chilling and immediate thawing) and 4 months before further processing and winemaking.

This study showed that chilling or freezing of grapes or must at the appropriate stage during winemaking as a delayed winemaking strategy can produce new styles of Sauvignon blanc and Chenin blanc wines with more intense aromas. Winemakers can apply immediate freezing, defrosting and fermentation, but more defined flavour expression is observed after chilling or freezing for four months before winemaking is completed.



## NEW TECHNOLOGY FOR ETHYLENE REMOVAL DURING FRUIT STORAGE

The accumulation of ethylene gas during post-harvest storage and transportation of fruit results in reduced quality and has the potential to reduce the shelf life of fresh produce by 10-30%. To mitigate this, various ethylene inhibitors are used by the fruit industry in South Africa. However, strict international regulations regarding chemical residues permitted on fresh horticultural products drive the need for alternatives.

A study conducted by ARC researchers identified numerous ethylene hotspots within the packhouses included in the study, and showed that none of the packhouses have effective ethylene management strategies other than ventilation. A vacuum ultraviolet (VUV) photolysis reactor was designed and compared with the standard potassium permanganate adsorbent used by the fruit industry for the removal of ethylene. The VUV photolysis reactor removed 86.9% ethylene compared to the standard adsorbent, which removed only 25.4% ethylene.

This study showed that VUV photolysis is a more efficient tool for ethylene removal in a mixed fruit load and could replace the conventional industry practice of adsorption. The knowledge generated and the technology developed in this study are of interest to fruit packhouses and exporters to reduce losses in the fruit supply chain due to ethylene accumulation.



*Laboratory trials to compare ethylene removal with VUV photolysis (left) and potassium permanganate adsorbent (right)*

## OUTCOME 4: A SKILLED AND CAPABLE AGRICULTURE SECTOR

### WORKSHOP ON PRUNING AND DEVELOPMENT OF YOUNG GRAPEVINES

On 6 July 2022, a workshop on pruning and development of young grapevines was held at the Eksteenskuil Agricultural Cooperative in the Northern Cape. The event was attended by 58 emerging farmers. A presentation was first given by Dr. Andries Daniels, after which different vineyards were visited by the group where Dr. Andries Daniels and Mr. André Schmidt gave a practical demonstration of how to prune and develop young vines. The participants were also given the opportunity to prune vines themselves. Farm visits took place on 6 and 7 July 2022 to assist growers with problems that they were facing with pruning. This highly successful workshop highlighted to the participants the importance of proper grapevine development right from the start to make pruning easier in the long run and to ensure successful farming with a good quality harvest.



*Workshop attendees practising pruning of young vines*



## KNOWLEDGE DISSEMINATION

Some of the knowledge dissemination interventions for 2022/23 included the following:

### JOURNAL ARTICLES

Allsopp, E. & Stiller, M. 2022. Is *Haplothrips clarisetis* Priesner (Thysanoptera: Tubulifera) an Economic Threat to Table Grapes in the Lower Orange River Production Region of South Africa? South African Journal for Enology and Viticulture 43: 81-84. <https://doi.org/10.21548/43-1-5027>.

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Conradie, W.J., Raath, P.J., Mulidzi, A.R. & Howell, C.L. 2022. Dry matter accumulation, seasonal uptake and partitioning of mineral nutrients by *Vitis vinifera* L. cv. Sultanina grapevines in the Lower Orange River region of South Africa – A preliminary investigation. South African Journal for Enology and Viticulture 43, 26-37.

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Díaz, G.A., Valdez, A., Halleen, F., Ferrada, E., Lolas, M. & Latorre, B.A. 2022. Characterization and Pathogenicity of *Diplodia*, *Lasiodiplodia*, and *Neofusicoccum* Species Causing Botryosphaeria Canker and Dieback of Apple Trees in Central Chile. Plant Disease 106: 925-937. <https://doi.org/10.1094/PDIS-06-21-1291-RE>.

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## THESES AND DISSERTATIONS

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## CHAPTERS IN BOOKS

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## RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# PLANT HEALTH AND PROTECTION

The ARC-Plant Health and Protection (ARC-PHP) has a main campus at Roodeplaat, northeast of Pretoria, as well as satellite campuses at Cedara (KwaZulu-Natal) and Vredenburg (Western Cape). The business unit has the mandate to provide extensive and specialist knowledge of the organisms that threaten agricultural crops and plants in natural environments, to protect arable land, water resources, natural biodiversity and food security.

Research is focused on promoting economic and environmentally acceptable management strategies for pests, plant and soil diseases and invasive plants, as well as developing and implementing fast and accurate diagnostic services for all matters relating to plant health in the agricultural sector.

The following strategic assets are maintained on behalf of the State:

- The National Collections of Arachnids, Fungi, Insects and Nematodes
- The South African Rhizobium Culture Collection
- The Plant Pathogenic and Plant Protecting Bacteria Culture Collection
- Plant Virus and Antisera Collection
- Biological control quarantine facilities
- Live collection of alien invasive control agents
- National registered diagnostic plant health laboratories.

These assets also form the basis of the Campus' strategic plan and turnaround strategy with the objective to develop sustainable agricultural solutions and are critical to on-going research and the delivery of essential services to the agricultural sector as a whole.





## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

## OUTCOME 1:

## INCREASED AGRICULTURAL PRODUCTION AND PRODUCTIVITY

**DEVELOPMENT OF NOVEL BIO-PRODUCTS AGAINST LEPIDOPTERAN CROP PESTS**

The use of entomopathogenic fungi (EPF) as biocontrol agents is an effective and environmentally sound means of managing insect pests and their impact on crops through the use of natural fungal pathogens contained in the National Collections at the ARC. Increasing incidences of resistance to many conventional insecticides worldwide are especially prevalent for lepidoptera pests such as the South American tomato pinworm, *Phthorimaea absoluta* (= *Tuta absoluta*) and the diamondback moth (DBM), *Plutella xylostella*. Many of the older generation insecticides are being phased out, so there is an urgent need for cost-effective and sustainable bio-product alternatives for pest management. The South African National Collection of Fungi (NCF), housed and curated at the ARC-PHP, currently comprises 33 000 strains isolated from plants, insects, and soil samples. The ARC-PHP has screened a number of promising EPF isolates for their pathogenicity against *T. absoluta* and *P. xylostella* in laboratory bioassays. The impact of the best performing EPF strains was comparable to the insecticide standard Methomyl and performed better than the commercially available EPF products. The combination of the EPF isolates PPRI 20574 and PPRI 6752 was the most interesting, giving excellent control of the target pests. The ARC has now applied for an international patent for the unique combination of these isolates.

**RE-PACKAGING DIAGNOSTIC SERVICES TO MEET CLIENT NEEDS**

The diagnostic services units at ARC-PHP aim to streamline and adapt their offering by continuously revisiting and expanding to meet changing client needs. In this way, the ARC stays dynamic and relevant, but also satisfies the needs of a broader client base. Over the past year, three service packages were developed and launched and this strategy has already proven to be a success. The objective of these packages is to give the clients a more comprehensive service by creating an all-inclusive package for diagnostic services and advice pertaining to specific areas in the value chain of healthy crop production. The YourSoil™ package, a collaboration between PHP and NRE, provides a full analysis of soil

samples including both biotic and abiotic factors that clients require. Results are packaged in a manner that enables easy interpretation by clients to support their pest and disease management strategies, as well as providing expert advice on demand. The YourSeed™ package is especially important to clients needing to ensure their export hybrid seeds are of top quality and do not contain pests or diseases, especially of quarantine and regulatory importance. Lastly, the newly established Root Health Clinic™ conducts soilborne disease trials on a variety of crops with various objectives in mind. These include bioassays to evaluate soil status with regard to root health and pathogen risk, as well as evaluations of current and new products, such as seed treatments and cultivars. These newly established brands will increase awareness of ARC-PHP's services in the agricultural industry and thereby increase the ARC's contribution to improved root and soil health, crop yields and food safety and security in South Africa.

ARC develops tool for rapid identification of soybean sudden death syndrome. Sudden death syndrome (SDS) is one of the most important soilborne diseases of soybean and is responsible for economically devastating reductions in yields in North and South America. SDS was first reported in South Africa in 2013 in the Lydenburg/Badfontein area, Mpumalanga. Following the first report, it was also reported in the Free State, Limpopo, KwaZulu-Natal and North West. Several *Fusarium* species, recently included into the newly described species *Neocosmospora phaseoli*, cause the disease.

It is extremely difficult to isolate the SDS-causing fungi from samples using conventional methods because of the slow growth of the fungus and diagnosis of SDS in the field can be difficult because several other diseases produce similar symptoms. Researchers at the ARC developed a highly specific and sensitive qPCR detection assay that will be an invaluable tool for the rapid and sensitive detection of SDS in samples submitted by farmers.





*Discoloration of vascular tissue of plant with sudden death syndrome of soybean (A), SDS leaf symptoms*



*(B) and (C) discolouration of vascular tissue*

## OUTCOME 2: SUSTAINABLE ECOSYSTEMS AND NATURAL RESOURCES

### IMPLEMENTATION OF TWO ARC-SARIR INITIATIVES

The Natural Science Collections Facility (NSCF) and the Biodiversity Biobanks of South Africa (BBSA) are two projects implemented by the DSI as part of the South African Research Infrastructure Roadmap (SARIR). The NSCF and BBSA in the ARC report to SANBI (South African Biodiversity Institute) as the lead organisation of these projects. The NSCF is a network of South African institutions that together hold more than 30 million preserved natural science specimens collected over almost 200 years. It aims to use the natural science collections for national and globally relevant research, such as climate change; for identification of biological material, generating data for use in research and decision-making, and for education and citizen science to promote understanding of South Africa's biodiversity assets. During the reporting period, 35 838 specimens were added to the collections through new accessions and incorporating specimens from donated orphan collections from other institutions. Studies on specimens from the collections resulted in 15 papers published by external researchers. Thirty-five new orthopteran species were described, 37% of these by taxonomists at ARC.

The Biodiversity Biobanks of South Africa (BBSA) endeavour to increase the range and quality of live specimens and improve access to these holdings for the scientific community at large. Information is being co-ordinated through a centralised data portal, allowing

more strategic collection of specimens as gaps across biobanks are identified. These accessions can be used to support research, capacity development and the development of new or improved products and practices in various fields of research. This aligns with the DSI's Bioeconomy Strategy (2013) and the Science and Technology White Paper (2019) in terms of improved coherence and coordination, and the principle of open science "that allows people to re-use, redistribute and reproduce research and its underlying data and methods". Multiple ARC campuses in Crop Sciences and Animal Science participate in this project. The biobanks support the concept of open data access and agree to the implementation of the standards and procedures developed by the BBSA community. As part of the first phase of funding, the National Public Good Assets under custodianship of the ARC received R27 million in support towards the expansion and upgrading of infrastructure.



*ARC-PHP delegates attending the BBSA launch and forum*

## OUTCOME 2:

### SUSTAINABLE ECOSYSTEMS AND NATURAL RESOURCES

#### **SUCCESS OF THE TORTOISE BEETLE AGAINST INVASIVE MEXICAN SUNFLOWER IN SOUTH AFRICA**

Mexican sunflower, *Tithonia diversifolia*, remains a serious invasive weed in KwaZulu-Natal, Mpumalanga and Limpopo provinces where it creates dense stands that outcompete native biodiversity. The weed is especially abundant in disturbed areas along road and railway verges and around home dwellings.

To alleviate the impact of this weed, the ARC-PHP released *Physonota maculiventris*, a defoliating tortoise beetle imported from Mexico, as a biocontrol agent. Following extensive evaluation in quarantine, approximately 40 000 beetles were released between 2019 and 2023 at 39 sites throughout the range of *T. diversifolia* in South Africa, with 300 to 1000 beetles released per site.

The first establishment of the tortoise beetle was confirmed in 2020 and by autumn 2022 the beetle was considered fully established, with populations increasing rapidly, from less than 5 beetles per plant in 2020 to up to 150 beetles per plant by autumn 2023, with the highest population recorded in Limpopo. The beetle is now also dispersing widely by itself, with beetles recorded at distances up to 14km from initial release sites.

Field observations have shown noticeable signs of defoliation and overall reduction in the vegetative and reproductive output of the Mexican sunflower caused by the beetle agent, which is a great success story for ARC-PHP weed biocontrol.



*The tortoise beetle Physonota maculiventris*



*Roadside infestation of invasive Mexican sunflower and defoliation of plants by the tortoise beetle Physonota maculiventris*



## KNOWLEDGE DISSEMINATION

Some of the knowledge dissemination interventions for 2022/23 included the following:

### JOURNAL ARTICLES

Allsopp, E. & Stiller, M. 2022. Is *Haplothrips clarisetis* Priesner (Thysanoptera: Tubulifera) an economic threat to table grapes in the Lower Orange River production region of South Africa? South African Journal of Enology and Viticulture 43(1): 81–84. <https://doi.org/10.21548/43-1-5027>.

Bopape, F.L., Beukes, C.W., Katelgo, K., Hassen, A.I., Steenkamp, E.T. & Gwata, E.T. 2023. Symbiotic performance and characterization of pigeonpea (*Cajanus cajan* L. Millsp.) rhizobia occurring in South African soils. Agriculture, 13, 30. <http://doi.org/10.3390/agriculture13010030>.

Boshoff, W.H.P., Visser, B., Bender, C.M., Wood, A.R., Rothmann, L., Wilson, K., Hamilton-Attwell, V.L., Pretorius, Z.A. 2022. Fig rust caused by *Phakopsora nishidana* in South Africa. *Phytopathologia Mediterranea* 61: 283-298.

Boshoff, W.H.P., Wood, A.R., Visser, B., Bender, C.M., Joubert, L., Richter, J., Aime, M.C., Pretorius, Z.A. 2022. The life cycle of *Puccinia digitariae* on *Digitaria eriantha* and *Solanum* species in South Africa. *Mycologia*, 114:2, 319-336.

Bowers, M.A., Zachariades, C., Robinson, D.E., Cohen, J.E., Von Tschirnhaus, M., Uyi, O. 2023. Helical shoot-tip mines on three genera of Asteraceae in Jamaica are caused by different species of *Melanagromyza* – Implications for the biological control of *Chromolaena odorata* using *Melanagromyza eupatoriella*. *Biological Control* 179: 105151.

Crous, P.W., et al including Lamprecht, S.C. *Fusarium* and allied fusarioid taxa (FUSA). 2022. *Fungal Systematics and Evolution* 9: 161 - 200.

Goodall JM & Witkowski ETF. 2022. Herbicide trials on *Campuloclinium macrocephalum* (Asteraceae) during adverse conditions reveal incompatibility with biocontrol and a narrow window of opportunity for chemical control. *African Journal of Range and Forage Science*. DOI: 10.2989/10220119.2022.2103585.

Goodall, J.M., Witkowski, E.T.F., Morris, C. (2022). Patterns of persistence demonstrate the vulnerability of the root hemiparasite *Thesium utile* A.W.Hill (Santalaceae) to weed control measures. *South African Journal of Botany* 151: 481-484.

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Hristov, Y.V., Allsopp, M.H., Wossler, T.C. 2022. *Apis mellifera* capensis larvae show low resistance to a highly virulent *Paenibacillus* larvae field strain. *Journal of Apicultural Research*, <https://doi.org/10.1080/00218839.2022.2085403>.

Lind, B.M., Uys, V.M., Eggleton, P. & Hanan, N.P. 2022. Precipitation mediates termite functional diversity and dominance in southern Africa. *Bothalia, African Biodiversity & Conservation* 52(1), a3: 1–13. <https://doi.org/10.38201/btha.abc.v52.i1.3>.

Madire, L.G., Olckers, T. & Simelane, D.O. 2023. Effect of host-plant age on the performance of the root-feeding flea beetle *Heikertingerella* sp., a biological control agent for *Tecoma stans* in South Africa. *Biocontrol Science and Technology*, 33:3, 258-267, DOI: 10.1080/09583157.2023.2175786.

Mahlangu, L., Sibisi, P., Nofemela, R.S., Ngmenzuma, T., Ntushelo, K. 2022. The Differential Effects of *Tuta absoluta* Infestations on the Physiological Processes and Growth of Tomato, Potato, and Eggplant. *Insects* 2022, 13, 754. <https://oi.org/10.3390/insects13080754>.

Mahlanza, T., Pierneef, R.E., Makwarela, L., Roberts, R., Van der Merwe, M. 2022. Metagenomic analysis for detection and discovery of plant viruses in wild *Solanum* spp. in South Africa. *Plant Pathology* DOI: 10.1111/ppa.13585.

Mulaudzi, L., Mutamiswa, R., Zachariades, C., Chidawanyika, F. 2022. Life-stage-related desiccation and starvation resistance in the biological control agent *Neolema abbreviata*. *Entomologia Experimentalis et Applicata* DOI: 10.1111/eea.13238.

Murray, J.F., Allsopp, M.H., Vd Horst, G. & Venter, C.M. 2022. A new fluorescent method to determine honey bee sperm motility parameters with computer-aided sperm analysis. *Journal of Apicultural Research*. <https://doi.org/10.1080/00218839.2022.2090729>.

Nguyen, H.D.T., Dodge, A., Dadej, K., Rintoul, T.L., Ponomareva, E., Martin, F.N., de Cock, A.W.A.M., Lévesque, C.A., Redhead, S.A., Spies, C.F.J. 2022. Whole genome sequencing and phylogenomic analysis show support for the splitting of genus *Pythium*. *Mycologia*. DOI: 10.1080/00275514.2022.2045116.

Rauwane, E.M., Mchunu, P.N., Pierneef, R., Moloto, M.V., Goszczynska, T., Sibisi, P. & Khayaletu Ntusheloa, K. 2023. Draft Genome Sequence of *Pectobacterium brasiliense* Isolated from Potato in South Africa. *Microbiology Resource Announcements*, Volume 12, Issue 3 <doi/full/10.1128/mra.00763-22>.

Ríos-Tamayo, D., Lyle, R. & Sole, C.L. 2023. Ekapa, a new genus of mygalomorph spiders (Araneae, Entypesidae) from South Africa. *African Invertebrates* 64(1): 1–12. <https://doi.org/10.3897/AfrInvertebr.64.97018>.

Shokoohi, E., Swart, A., Marais, M., Moyo, N.A.G. & Abolafia, J. 2022. Characterization of *Acroboloides longiuterus* (Rahid & Heyns, 1990) Siddiqi, De Lay & Khan, 1992 (Rhabditida: Cephalobidae) from South Africa including the SEM study of the species. *Zoomorphology* 1-13. [Doi.org/10.1007/s00435-022-00583-3](https://doi.org/10.1007/s00435-022-00583-3).

Sonnekus, B., Slippers, B., Hurley, B.P., Joubert, E., Stiller, M., Fourie, G. 2022. Diversity and molecular barcoding of stink bugs (Hemiptera: Pentatomidae) associated with macadamia



in South Africa. *Insects* 13(7), 601: 1–13 + Suppl. Tables S1–S3. doi:10.3390/insects13070601.

Stiller, M., Webb, M.D. (2022). Leafhoppers of the Fynbos Biome of South Africa: *Colistra*, *Proekes*, *Proekoides* and a new genus (Insecta, Hemiptera, Cicadellidae, Deltocephalinae, Bonaspeiini). *Zootaxa* 5199: 1–79 + Suppl. Files 1–4. <https://doi.org/10.11646/zootaxa.5199.1>.

Stiller, M. 2023. Revision of the South African leafhopper genus *Hadroca* Theron (Hemiptera, Auchenorrhyncha, Cicadellidae, Bonaspeiini). *Deutsche Entomologische Zeitschrift* 70(1): 13–54 + Suppl. Mat. 1. <https://doi.org/10.3897/dez.70.90851>.

Van Coller, G.J., Kloppers, F.J., Coetzee, V.M., Van Rooyen, T., Rose, L.J., Lamprecht, S.C. & Viljoen, A. 2022. Foliar fungicides provide chemical control of *Fusarium* head blight of wheat in South Africa. *South African Journal of Plant and Soil* 39(2): 1 – 12.

Van Coller, G.J., Rose, L.J., Boutigny, A-L., Ward, T.J., Lamprecht, S.C., Viljoen, A. 2022) The distribution and type B trichothecene chemotype of *Fusarium* species associated with head blight of wheat in South Africa during 2008 and 2009. *PLoS ONE* 17(9): e0275084. <https://doi.org/10.1371/journal.pone.0275084>.

Van der Linde, E.J., Píchova, K., Pazoutova, S., Stodulkov, E., Flieger, M., Novak, P. & Kolarík, M. 2022. Pre-invasion assessment on African invasive grasses revealed five new species of ergot fungi, *Claviceps* section *Pusillae*. *Fungal Biology* 126: 752-763.

Vermeulen, M., Allsopp, M., Marini, F., Williams, P.J. & Manley, M. 2022. Geografiese klassifikasie van Suid-Afrikaanse heuning met naby-infrarooi spektroskopie. *SA Tydskrif vir Natuurwetenskap en Tegnologie* 41(1), 47-57.

Zachariades, C., Uyi, O., Hill, M.P., Mersie, W., Molo, R. 2022. The benefits to sub-Saharan Africa of the biological control of weeds: already considerable, but could be far greater. *Current Opinion in Insect Science* 52:100932. doi.org/10.1016/j.cois.2022.100932.

## THESES AND DISSERTATIONS

Moloto, M.V. 2022. Seedborne pathogens of onion: a study of pathogenicity and diversity, PhD theses. University of Pretoria.

Phasoana, T.J. 2022. Characterization of important seed- and soil borne fungal and oomycete species associated with soybean and their management through chemical seed treatments. MSc thesis, Stellenbosch University.

Retief, E. 2022. Verticillium wilt of tomatoes in South Africa: Biology, quantification and management. PhD dissertation, Stellenbosch University.

## CHAPTERS IN BOOKS

Swart, A. 2022. *Anguina agrosti* (bent grass nematode). Datasheet (ID is 5386-ISC-20220114-ITAP14pathogens-FY21 p.). Issue 386. Wallingford, UK: CAB International. <https://doi.org/10.1079/cabicompendium.5386>.

## CONFERENCE PROCEEDINGS

None

## RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# TROPICAL AND SUBTROPICAL CROPS

The main campus of ARC-Tropical and Subtropical Crops (ARC-TSC) is situated in Mbombela, Mpumalanga, in the heart of the Lowveld with its subtropical climate. The campus has several other research stations which are located in a wide range of Agri ecozones thus facilitating research on crop adaptation in different regions. The ARC-TSC campus develops and transfers a range of improved, sustainable and appropriate technologies right across the value chain for a variety of subtropical crops in order to enhance food and nutrition security, global competitiveness and wealth creation. This is achieved through harnessing national and international collaboration opportunities across multi-institutional, multi-disciplinary teams. The campus is also custodian of several genebanks comprising several thousand accessions. New accessions are regularly added thus contributing towards genetic resource conservation, increasing genetic diversity for breeding new, improved cultivars as well as for the identification of tolerance to biotic and abiotic stressors, many of which are associated with climate change. The campus is also a post entry quarantine facility for plant material which is critical for ensuring biosecurity of the horticultural industry.

Analytical and diagnostic services are one of the cornerstones of the campus offering and various services are provided to a wide range of clients across a broad spectrum of disciplines. These services ensure that

clients remain sustainable and competitive within their respective industries and enterprises. Critical to the sustainability of the tropical and subtropical crop industries, the ARC-TSC is actively involved in capacity development. Formal postgraduate development programmes allow young up-and-coming scientists to gain knowledge and experience while the more informal training programmes focus on smallholder and commercial sectors, the private sector as well as undergraduates and school learners.

The mandate crops of ARC-TSC include the following:

- (i) Macadamia, citrus, avocado, mango, litchi, banana, pineapple, papaya, granadilla, pecan, cashew, coffee and ginger;
- (ii) Medicinal plants, herbs and essential oil crops;
- (iii) Indigenous fruit; and
- (iv) Exotics such as carambola, surinam cherry, white sapote, annona and jaboticaba.

The ARC-TSC Campus research focus areas include:

- (i) Plant Breeding & Biotechnology;
- (ii) Pest and Disease Management;
- (iii) Horticultural Practices;
- (iv) Postharvest and Agro-Processing;
- (v) Smallholder Development; and
- (vi) Analytical and Diagnostic Services.



## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

## OUTCOME 1:

## INCREASED AGRICULTURAL PRODUCTION AND PRODUCTIVITY

**UNDERSTANDING THE IMPACT OF EMERGING VIRAL DISEASES IN TROPICAL AND SUBTROPICAL FRUIT COMMODITIES IS CRITICAL FOR INDUSTRY SUSTAINABILITY**

South Africa is a world-leader in the production of export quality fruit and nut crops. Two of the largest commodities are macadamia and avocado. However, disease pressure in the form of various viral diseases has a significant impact on yield, quality and ultimately sustainability of the industries.

Macadamia trees in Mpumalanga suffer from severe chlorosis, which coincides with a significant drop in production. In an attempt to determine whether the chlorosis may be associated with a virus, the genetic content of diseased and healthy trees were 'mined'. Unfortunately, analyses could not link a specific virus to the chlorotic trees, however, a novel virus belonging to the Orthospovirus genus was detected from samples. A detection method for the novel virus was optimised and subsequent surveys linked the virus to ringspot symptoms observed on different macadamia cultivars. The virus has to date been identified from orchards in Mpumalanga, Limpopo and KwaZulu-Natal, since initial detection in 2020. Related viruses are known to cause severe crop losses and it is therefore important that the virus, provisionally named macadamia ringspot-associated virus (MRSV), be further studied to determine whether this virus can lead to yield losses and whether it will be economical to implement control strategies against MRSV.



The virus, provisionally named macadamia ringspot associated virus, is characterised by ringspots on macadamia leaves.

Avocado is one of the world's fastest growing tropical fruit industries and South Africa is one of the largest export countries well-known for its excellent fruit quality. Avocado sunblotch viroid (ASBVd) is a major threat both to production and access to international export markets. ASBVd is seed transmissible, with infection possible via either the male (pollen) or female gametes.

ASBVd-infected symptomless carrier trees have a 100 % seed transmission rate and if these trees are present in an orchard, pollination from infected trees is highly likely. Like many fruit crops, insect pollination is important for high avocado yields and honey bee (*Apis mellifera*) hives are typically moved into orchards for pollination. In this study, the ARC demonstrated that ASBVd can be confidently detected in bees and pollen samples from hives within 100 m of infected trees. The potential for using this approach, screening of beehives for ASBVd, in ASBVd surveillance for improved orchard management and support of market access is important for monitoring especially in newly-established avocado production regions to manage disease-free status.



Screening beehives is an important tool for ASBVd surveillance and therefore improved orchard management.



## TARGETING PROFITABLE MARKET SECTORS WITH NEW HIGH QUALITY TROPICAL AND SUBTROPICAL FRUIT CULTIVARS

The ARC-TSC Plant Breeding Division focuses on the development of high quality selections of its mandate crops, which have the ability to attract high prices particularly on international markets. New selections are bred not only for internal and external quality but also for yield and pest and/or disease resistance. The latest range of exciting new selections emanating from the breeding programmes include three new granadilla selections and one new mandarin selection. These are all in the process of registration for Plant Breeders' Rights.

The three granadilla selections all have a bright red-purple skin and are all well-filled, an important characteristic for granadilla fruit. Each selection has its own internal quality characteristics, targeted to specific markets and can also be used to develop further high quality selections. Climatic adaptability and disease resistance across a range of agro-ecotypes is still to be determined so that recommendations can be made to growers throughout South Africa.

The mandarin selection was developed using irradiation breeding and is a 'Furr' mandarin. While this cultivar has excellent internal (sugar/acid ratio, soft flesh, close core, thin skin) and external (good colour, easy to peel, closed flower end) characteristics it normally has more than 10 seeds per fruit. Seediness is not desirable on the market and less acceptable than seedless varieties. The irradiated selection has 0–1 seeds per fruit and therefore makes this selection highly desirable together with its excellent internal and external quality characteristics. Seedlessness will be confirmed during the following seasons while the registration process is underway.



Fruit with excellent internal and external quality characteristics are developed through breeding programmes to ensure profitability and sustainability of tropical and subtropical fruit industries.

## SCOUTING IS A CRITICAL TOOL FOR THE MANAGEMENT OF PESTS AND DISEASES IN TROPICAL AND SUBTROPICAL FRUIT CROPS: MANGO AS A CASE STUDY

South Africa is a known exporter of subtropical fruit. The main production areas for subtropical fruit (avocado, litchi and mango) in South Africa are parts of Limpopo, Mpumalanga and KwaZulu-Natal. The planted area is approximately 21 501 ha and the estimated crop value is R2.645 billion. There is a range of pests including fruit flies (Diptera: Tephritidae); the mango seed weevil, *Sternonchetus mangiferae* (Fabricius) (Coleoptera: Curculionidae); the mango scale, *Aulacaspis tubercularis* (Newstead) (Hemiptera: Diaspididae); the South African citrus thrips, *Scirtothrips aurantii* Faure (Thysanoptera: Thripidae); the mango gall fly, *Procontarinia matteiana* Kieffer and Cecconi (Diptera: Cecidomyiidae); the African bollworm, *Helicoverpa armigera* (Hübner) (Lepidoptera: Noctuidae); and the coconut bug, *Pseudotheraptus wayi*. Brown (Hemiptera: Coreidae) and diseases (powdery mildew (caused by *Oidium mangiferae*) blossom blight (caused by *Fusicoccum* and *Colletotrichum*), malformation (caused by *Fusarium mangiferae*), anthracnose (caused by *Colletotrichum gloeosporioides*) and bacterial black spot (caused by *Xanthomonas axonopodis* pv. *Mangiferaeindicae*) which are important in mango production with many of them requiring corrective treatments to produce a high quality crop (pests) and an understanding of the type of diseases, requirements, growth stage of the mango as well as climatic conditions.



Mango scouting courses train scouts on IPM, how and when to scout for pests and diseases on mangos and reporting.



The FAO of the United Nations promotes Integrated Pest Management (IPM) as a pillar of sustainable agriculture. Integrated Pest Management requires competence in three areas: prevention, monitoring and intervention. Prevention is the use of strategies to prevent pest populations from building up to economically-damaging levels. Monitoring involves scouting for pests to determine if intervention should take place. In addition to giving supporting data for making a management decision, regular monitoring is also important for evaluating the success or failure of control strategies. Various methods of intervention can be used which include chemical, biological, cultural, sanitary and mechanical controls. The effect of intervention methods on both pests and their natural enemies needs to be considered.

A mango scouting course was developed to train scouts. The course provides information on:

- Integrated Pest Management,
- The economic important pest and diseases of mango,
- How and when to scout for the pests and diseases and
- How to report on the pests and diseases.



*Fruit flies (top) and mango seed weevils (bottom) are some of the most economically-important pests on mango.*

## **ACCESS TO HIGH QUALITY PLANTING MATERIAL IS CRITICAL FOR SMALL-HOLDER FARMER SUCCESS**

The DSI is funding a Renewable Energy-Water-Food project at the Masia Multi-Purpose Centre in Limpopo. The project is a collaboration between University of Stellenbosch Centre for Renewable and Sustainable Energy, University of Venda (UNIVEN) Physics Department and the ARC. The main activities for this project are the deployment of renewable energy and climate-smart agriculture technological innovations along the agricultural value-chain to increase agricultural production and productivity through sustainable intensification at farm level.

The intended outcomes are:

- Establishment of affordable and sustainable energy mix for the Masia Multi-Purpose Centre and adjacent activities including crop production, harvesting, storage and processing.
- Skills development in agro-processing, agricultural production and business management at Masia.
- Increased farm productivity, reduced post-harvest losses and food waste; improved shelf-life and diversity of food products; and improved incomes and livelihoods.
- Establish of an out-grower scheme that will work together to ensure marketing of produce; negotiated rates for inputs and most important, organize agriculture in Masia

The ARC has been instrumental in developing suitable infrastructure for the production of high quality planting materials for a range of fruit trees as well as several ARC sweet potato varieties developed by its sister campus, ARC-VIMP. Access to high quality planting materials and skills development in plant production will have a significant impact on smallholder farmers in this region.



*Successful harvest of sweet potatoes at Masia.*

## KNOWLEDGE DISSEMINATION

Some of the knowledge dissemination interventions for 2022/23 included the following:

### JOURNAL ARTICLES

Acosta, Y., Escobar-Gutiérrez, A., Ahmed, L.Q., Cejas, I., Martínez-Montero, M.E., Sánchez, J., Hajari, E., Höfer, M., Lorenzo, J.C. & Fontes D. 2023. Morpho-anatomical evaluation of *Teramnus labialis* seeds: strategies to overcome physical dormancy. *Biologia*.

Andújar, I., González, M., García-Ramos, J.C., Hajari, E., Bogdanchikova, N., Pestryakov, A., Concepción, O., Lorenzo, J.C. & Escalona, M. 2023. Are silver nanoparticles the “silver bullet” to promote diterpene production in *Stevia rebaudiana*? *Plant Cell, Tissue and Organ Culture*.

Bekker, S., Du Preez, G., Daneel, M. & Fourie, H. 2022. Nematode assemblages in conservation and conventional maize fields: a South African baseline study. *Journal of Plant Diseases and Protection*. <https://doi.org/10.1007/s41348-022-00619-2>.

Cronje, R.B., Hajari, E., Jonker, A., Ratlapane, I.M., Huang, X., Theron, K.I. & Hoffman, E.W. 2022. Foliar application of ethephon induces bud dormancy and affects gene expression of dormancy- and flowering-related genes in 'Mauritius' litchi (*Litchi chinensis* Sonn.). *Journal of Plant Physiology*, 276: 153768.

Dibakoane, S.R., Du Plessis, B., Da Silva, L.S., Anasi, T.A., Emmambux, M.N., Mlambo, V., & Wokadala, O.C. 2022. Nutraceutical properties of unripe banana flour resistant starch: A review. *Starch*, 2200041, 1-12.

Du Preez, G., Daneel, M., De Goede, R., Du Toit, M.J., Ferris, H., Fourie, H., Geisen, S., Kakouli-Duarte, T., Korthals, G., Sanchez-Moreno, S. & Schmidt, J.H. 2022. Nematode-based indices in soil ecology: Application, utility, and future directions. *Soil biology and biochemistry*. *Soil Biology and Biochemistry* 169: 108640.

Entensa, Y., González-Morales, A., Linares, C., Vázquez, J.G., Martínez-Montero, M.E., Zevallos-Bravo, B.E., Hajari, E., Höfer, M., Villalobos-Olivera & A., Lorenzo, J.C. 2022. Cryopreservation of seeds of the highly valued tropical timber species *Swietenia mahagoni*. *CryoLetters*. 43: 341-348.

Grove, T. 2022. Progress towards an eco-friendly insect pest management approach in subtropical agro-ecosystems (South Africa). *CABI Agriculture and Bioscience*, 3:44.

Khosa M.C., Dube Z., De Waele D. & Daneel M.S. 2022. Crudely-milled soil amendments of South African medicinal plants suppress population densities of *Meloidogyne incognita* race 2 and enhance vegetative growth and yield of tomato under microplot and field conditions. *International Journal for Plant Diseases and Protection*. <https://doi.org/10.1007/s41348-022-00641-4>.

Rashidifard, M., Fourie, H., Ashrafi, S., Engelbrecht, G., Elhady, A., Daneel, M. & Claassens S. 2022. Suppressive Effect of Soil Microbiomes Associated with Tropical Fruit Trees on *Meloidogyne enterolobii*. *Microorganisms* 10(5), 894. <https://doi.org/10.3390/microorganisms10050894>.

Roberts, J.M.K., Jooste, A.E.C., Pretorius, L-M & Geering, A.D.W. 2023. Surveillance for avocado sunblotch viroid utilising the European honeybee (*Aphis mellifera*). *Phytopathology*, 113(3):559-566.

Serrano, J.O., Mayea, A.L., Villares-Garachana, A., Correa-Herrera, N., González-Morales, A., Pérez-Bonachea, L., Hernández, L., Lorente, G., Hajari, E., Fonseca-Fuentes, N., Martínez-Melo, J. & Lorenzo, J.C.L. 2022. Effect of short-term radiation stress on physiological and haematological parameters in Pelibuey sheep in Cuba. *Small Ruminant Research* 210:106679.

Villalobos-Olivera, A., Entensa, Y., Martínez, J., Escalante, D., Quintana, N., Souza, F.V.D., Martínez-Montero, M.E., Hajari, E., & Lorenzo, J.C.L. 2022. Storage of pineapple shoot tips in liquid nitrogen for three years does not modify field performance and fruit quality of recovered plants. *Acta Physiologiae Plantarum* 44: 65. <https://doi.org/10.1007/s11738-022-03406-6>.

### THESES AND DISSERTATIONS

None

### CHAPTERS IN BOOKS

None

### CONFERENCE PROCEEDINGS

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Nhleko, Z.V., Mphahlele, R.R., Caleb, O.J. & Mafeo, P.T. 2022. Combined effects of harvest stages, postharvest treatments, and storage duration on the quality of minimally processed litchi – a preliminary study. *Acta Hort.* 1349. ISHS 2022. DOI:10.17660/ActaHortic.2022.1349.43.

## RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# VEGETABLES, INDUSTRIAL AND MEDICINAL PLANTS

For the ARC to achieve its constitutional mandate under a resource-constrained environment, it needed to undertake measures geared towards effective and rational resource utilisation. As part of the resource rationalisation initiative, the ARC took a decision to evaluate the feasibility of amalgamating campuses with similar R&D products and within a manageable geographic distance. As part of this initiative, the ARC-Industrial Crops (ARC-IC) Campus at Rustenburg was amalgamated with the ARC-Vegetable and Ornamental Plants (ARC-VOP) Campus at Roodeplaat. The name of the new business unit is the ARC-Vegetables, Industrial and Medicinal Plants (ARC-VIMP).

The ARC-VIMP Campus conducts innovative, needs-driven, applied and adaptive research, and environmentally-friendly research and technology development on commercial vegetables, African leafy vegetables, medicinal plants (including medicinal cannabis), and industrial crops, such as cotton, tobacco, hemp, flax, kenaf, cassava and sisal. Research involves a variety of disciplines, including crop science, agronomy, crop protection, breeding, genetics, biotechnology, agro-processing and product development. The aim is to conduct research and technology development and transfer for improving the productivity, competitiveness and sustainable production of vegetables, as well as industrial and medicinal plants for the agricultural industry.

The nutrient content of vegetables is a key factor in addressing malnutrition and the campus plays a significant role in the development of models for food and nutrition security. The ARC conducted an impact study of vegetable research and it was determined that for every R100 invested in vegetable research an improvement of R140 was realised in the industry as a whole, which clearly demonstrates the importance of vegetable research for South Africa. The breeding programmes focus on the development of cultivars with improved resilience against agricultural risks, including improved drought tolerance, pest and disease resistance, as well as increased quality, including nutritional, and yield. It also maintains the genetic resources of the mandated crops as national assets. Crop Sciences focuses on the development of propagation and sustainable production systems for vegetables, industrial and medicinal plants, identifying crops with good water use efficiency and development of water and nutrient efficient production systems.

Agro-processing and new product development from medicinal plants, indigenous/African vegetables, and industrial crops is a key programme of the campus. The crop protection research focuses on the development of integrated pest and disease management mechanisms for economically-important pests and diseases of vegetables, industrial and medicinal plants. The campus delivers several services to the industry, including diagnostic analyses and feasibility studies, training and enterprise development and rural development.





## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

## OUTCOME 1:

## INCREASED AGRICULTURAL PRODUCTION AND PRODUCTIVITY

**BOOSTING AGRICULTURAL PRODUCTIVITY OF SOUTH AFRICAN FARMERS THROUGH IMPLEMENTATION OF RESOURCE-EFFICIENT HYDROPONIC CROP PRODUCTION SYSTEMS**

The ARC in partnership with the WRC initiated a project focusing on technology exchange and training on recirculating hydroponic systems for vegetable production in the Gauteng Province of South Africa.

To date, innovative water-, space-, energy- and nutrient-efficient technologies were developed, which have great potential to contribute to water savings in agriculture, reduced nutrient leaching and environmental preservation that will ultimately lead to more sustainable crop production and profitability of farmers. These technologies were introduced, for the first time, to emerging commercial farmers in the Gauteng Province of South Africa.

Fruity vegetables, such as tomato, used a maximum of 1.0L of water per day per plant, while leafy crops such as lettuce, sweet basil and coriander, used a maximum of 0.2L of water per day per plant. This contributes to approximately 90% of irrigation water savings, while producing at least double the yield, particularly for leafy vegetable and herb crops, thus offering a promising approach for increased income generation of farmers.

Findings generated from on-farm and on-station research trials being implemented under this project, were disseminated through the publication of several popular articles and pamphlets, attendance of local and international conferences, farmer's days and presentations at a stakeholder workshop. The ARC hosted an international delegation organized and managed by the WRC. The delegation comprised more than 35 participants from across the globe, including post-graduate students from the Winter School.

The various hydroponic technologies being investigated were all demonstrated, in the context of the water-energy-food nexus. The event also served to train hydroponic farmers on the operation, management and

maintenance of recirculating hydroponic systems. The potential of hydroponics to improve food security, farmers' profitability and environmental protection and preservation was emphasized. This strengthened the collaboration between the ARC and the WRC, with a promising expansion of project implementation through the rollout across various provinces of South Africa. The development and transfer of such innovative, resource-efficient crop production systems will contribute to increased agricultural production and productivity, while making a more sustainable utilization of South African ecosystems and natural resources.

The generated knowledge, technology transfer and farmer support systems implemented will build a skilled, capable agricultural sector, thus empowering emerging commercial farmers with sufficient tools for enhanced resilience in agriculture.



*An innovative, resource-efficient vertical hydroponic system established at a farmer's site in the Gauteng Province and the implementing team, consisting of the farmer, ARC-VIMP researchers and a Simeka Harvest representative (top), and hydroponically grown fresh spring onions readily packed for market sales (bottom).*



## OUTCOME 3:

### IMPROVED NUTRITIONAL VALUE, QUALITY AND SAFETY OF AGRICULTURAL PRODUCTS

#### **PARTICIPATORY SELECTION OF SWEET POTATOES WITH FARMERS**

Sweet potato is a valuable crop for income generation, reducing food insecurity and malnutrition. One of the reasons for the key role played by sweet potato is that it is a hardy crop, with lower water requirements than most commercial vegetables. In addition, orange fleshed types with enhanced  $\beta$ -carotene content are key to address the malnutrition crisis. In South Africa, the gross value of sweet potato production was estimated at R370 million in 2020. The ARC-VIMP sweet potato program aims to improve the quality of sweet potato, endurance to disease infestation and provide a variety of flesh colours and textures as per demand of clients. The collaborative trials are conducted with farmers over the full spectrum from small-holder to commercial farmers in various provinces, predominantly in collaboration with the provincial Departments of Agriculture and Rural Development. Sweet potato cultivar demonstration trials were harvested on-station from Nooitgedacht, and on-farm at Thulamahase, Dipaleseng and Driefontein in collaboration with the Mpumalanga Department of Agriculture and Land Reform, and on-farm in KwaZulu-Natal at Zwelitsha, Obonjaneni. Sweet potato advanced yield trials evaluating the adaptability of 27 ARC elite clones and cultivars were harvested on-farm at Madidi (North West), Zinjokeni near Ladysmith (KZN), and on-station at Groblersdal (Limpopo), University of Venda

(Limpopo) and Tovoomba (Limpopo). Harvesting of the trials coincided with farmer demonstrations on harvesting and grading of sweet potatoes and cooking of roots for taste evaluations.

Semi-commercial evaluation of ARC elite lines was conducted together with commercial companies near Malmesbury (Western Cape), Groblersbrug (Limpopo) and Kakamas (Northern Cape), indicating ARC clones 2010-5-2 and FS10-25 as promising lines with high yields and excellent taste. Collaborative seedling evaluations were conducted with Langplaas Family Farms, Brits. In total, 75 new clones were selected for representing an array of colours and primarily will have improved storability.

The various evaluation trials introduced farmers to the different sweet potato cultivars and elite clones which are available, provided production information and involved their participation in selection of the best suitable clones. Plant Breeders' Rights will be filed for two new varieties.

#### **ON-FARM MULTI-ENVIRONMENT EVALUATION OF SELECTED CASSAVA (*MANIHOT ESCULENTA* CRANTZ) CULTIVARS IN SOUTH AFRICA**

Cassava is the second most important food security crop grown, after maize, and is consumed by more than 40% of the African population. The ability of cassava to withstand difficult growing conditions such as extreme drought, heat, and soil acidity makes it a suitable crop for climate-smart agriculture. Cassava is also listed as the fourth source of starch, after maize, wheat and potato worldwide. Cassava supplied more than 8 million tons of industrial starch to the global market and the global demand for cassava starch is projected to be over 10 million tons by 2024. The ARC and its partners have identified cassava as a food security crop and an alternative source of starch for the starch industry to replace imports. Cassava has also been endorsed as one of the climate risk mitigation strategies for managing food price inflation resulting from competing user interest in major staple food crops such as maize, wheat, and potato. Information on the performance, adaptability and stability of imported cassava cultivars are critical for cultivation and commercialization of cassava in South



*Harvesting of sweet potato demonstration trials in Mpumalanga Province with farmers and officials from the Mpumalanga Department of Agriculture and Land Reform.*

Africa. Eleven cassava cultivars were evaluated in on-farm evaluation trials for yield and yield related traits. In addition, the agronomic suitability, adaptability and stability of the cultivars were evaluated per location and across locations. MSAF2 and UKF4 showed the overall best performances for most of the root yield and yield component traits, whilst UKF9 (49.5%) and P1/19 (48.5%) had the highest dry matter yield, which is one of cassava processing quality parameters. UKF4 (102.7 t ha<sup>-1</sup>) had the highest yield and greatest root yield stability across environments. Yield and stability are the major focus of our breeding programs since the objective is to identify ideal cultivars with a stable performance and broad adaptation over a wide range of environments. MSAF2 did not perform consistently across environments because it was highly susceptible to cassava mosaic disease (CMD). MSAF2 could be used as a donor parent to generate novel clones with large numbers of marketable roots, and high fresh root yields, if the other parent can provide effective resistance to CMD. Mabuyeni (KwaZulu-Natal), Mandlakazi (Limpopo), and Shatale (Mpumalanga) were found to be suitable environments for cassava cultivation and testing. This study is a pioneer in cassava research using multiple environments in South Africa. It provides baseline information on the performance of currently available cassava clones, their adaptation to multiple sites, the identification of suitable test sites, and information on current genetic resources

for a future breeding program. There is a huge demand and farmers' readiness levels to adopt the crop is high. This confirmed that cassava could provide South Africa with an alternative source of starch.



*Cassava on farm evaluation trial in Mpumalanga, with MSAF2 cultivar harvested from one of the participant farmer's field*

## HEMP RESEARCH AT THE ARC-VIMP

Cannabis, and specifically hemp, is seen as a potential economic driver that can uplift small-scale growers from poverty-stricken areas in South Africa. The hemp growers in South Africa are faced with multiple challenges which include seed availability, availability of locally adapted cultivars, and the lack of cultivation information. Several biotic and abiotic factors, as well as cultivation practices can alter cannabinoid production (including tetrahydrocannabinol (THC) and cannabidiol (CBD)) in hemp plants, which is problematic for farmers investing in industrial hemp cultivation under open field production. Hemp inspectors and departmental officials are also faced with challenges to monitor compliance to the permit conditions since they have limited knowledge on the crop and cannot provide the required guidance to growers on cultivation of the crop.

The first cannabis research permit in South Africa was granted to the ARC, as a pioneer research organization on cannabis. The ARC has taken the opportunity to address the current challenges on cultivation and supply of good quality hemp by conducting research and development under controlled conditions, establishing cultivation sites and training hemp growers and inspectors. The research resulted in the breeding of two new cultivars, popularly



*Limpopo Department of Agriculture and Rural Development (LDARD) officials visiting the hemp cultivation site at the ARC-VIMP*

known as SA Hemp 1 and SA Hemp 2, which are in the process of cultivar registration. These cultivars are adapted to South African traditional hemp production areas in the Eastern Cape, Western Cape and KwaZulu-Natal Provinces. An inspection guideline was developed in collaboration with the DALRRD, and hemp inspectors were trained on the guideline. Provincial department representatives visited the hemp cultivation sites at the ARC-VIMP to learn about the crop. The project will increase the availability of locally adapted hemp seed for commercialisation.

## KNOWLEDGE DISSEMINATION

Some of the knowledge dissemination interventions for 2022/23 included the following:

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Gerrano, A.S., Thungo, Z.G. & Mavengahama, S. 2022. Phenotypic description of elite cowpea (*Vigna unguiculata* L. Walp) genotypes grown in drought-prone environments using agronomic traits. *Heliyon* 8: e08855. <https://doi.org/10.1016/j.heliyon.2022.e08855>.

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## THESES AND DISSERTATIONS

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Mpemba, O.S., Du Toit, A., de Wit, M., Venter, S.L. & Hugo, A. 2022. Relationship between quality characteristics of cactus pear nopalitos for use as an alternative vegetable source in South Africa. In: Acta Hort. 1343. ISHS 2022. DOI:10.17660/ActaHortic.2022.1343.67.

## RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# IMPACT AND PARTNERSHIPS

The Division aims to foster internal (ARC) collaborations and external (national and international) partnerships to scale up the ARC's R&D outputs, for visible, measurable impact in the agricultural sector. It focuses on translation of research outputs to generate knowledge and facilitate decision-making, contributing to the performance of the organisation. There are six business units as outlined below.

The Agricultural Economics unit conducts research that establishes the impact of ARC programmes and integrates gender and socio-economic analysis into ARC research and development projects. Specialisation areas include market intelligence; business plan development; policy analysis, baseline studies, gender analysis and project impact assessments.

The Agrimetrics unit, deals with deriving value from data, amalgamating agricultural and biological data analysis to generate information that shapes decision-making. The unit facilitates a farm assessment application online and conducts statistical analysis of biological research, serving as quality audit of the scientific information disseminated by the ARC.

Intellectual Property Management and Commercialisation's role is to ensure that research and development outputs are identified, assessed, protected, managed and commercialised for the benefit of the ARC and the sector.

International Relations aims to enhance the ARC's credibility by promoting our capabilities, through strategic partnerships and engagements.

The Smallholder Agricultural Development (SHAD) unit is responsible for the coordination and quality assurance of Training and Advisory Services. The unit is responsible for driving ARC training and farmer support, which enable ARC to impart knowledge and information to a wide spectrum of users of agricultural research and development (R&D) output. For Advisory Services, the unit guides packaging of ARC technologies for successful enterprise development and transition to commercial production. It entails farmer support, targeted development initiatives, farming systems research and management of ARC Advisory Services e-Platforms (ARC Apps, e.g., ARCHub and AgriCloud).

Marketing and Communications develops and implements strategies to raise the organisation's profile and visibility and improve internal communications to foster a strong and positive ARC brand.

The Division operates from ARC-Central Office in Pretoria, but works strategically across the organization with all Campuses spread across the country.



## RESEARCH HIGHLIGHTS FROM THE 2022/23 FINANCIAL YEAR

### IMPACT AND PARTNERSHIPS

#### AGRICULTURAL ECONOMICS

The Economics Unit was involved in a project titled “Development of the Precision Agriculture Information System in Support of Emerging Farmers and the South African Agricultural Sector”, towards modernizing the sector with 4IR technologies. The project assessed the adoption and utilization of drone technology among small-scale farmers in Africa and other developing countries. It targeted wheat, maize, and sunflower farmers in Limpopo and Gauteng. Main findings indicated that farmers were aware and positive towards drone technology and are willing to pay for it. However, financial constraints could cause non-adoption. Farmers need to be trained on how to process and interpret data from drones, whilst providers should consider the cost to charge farmers for this technology.

The Unit finalised a gendered-market study, willingness-to-pay, and Impact assessment of the genetically modified TELA® Bt. maize technology in Mpumalanga and Limpopo in collaboration with the ARC-GCI, funded by the African Agricultural Technology Foundation (AATF). The gender study revealed disparities about gender roles, activities, and access to resources along the value chain. Enhancing women's participation in these chains is required. Adoption of the GM TELA® Bt. maize technology is associated with a 61% and 69% increase in average yields and incomes respectively, as well as enhanced technical efficiency (27%) compared to non-adopters. Farmers are generally aware of the GM TELA® Bt. maize technology, and its benefits, and are willing to pay an additional R6.59/kg for the seed. These outcomes were presented during the 5<sup>th</sup> TELA Maize Project Annual Review & Planning Meeting held in April 2023 in Mpumalanga.



*Field surveys on the adoption of drone technology*

Contributing to a skilled and capable sector, Economics, in collaboration with the FAO implemented a project that focused on capacity development of veterinary paraprofessionals (VPPs). The study highlighted a need to utilize independent Animal Health technicians (AHTs) on primary health care and non-controlled diseases, while the state focus on controlled diseases. Capacity development is recommended including the institutionalization of community in-service training, overseen by the South African Veterinary Council (SAVC) and the state. Findings were presented to the FAO VPP National Advisory Committee and at the South African Association for Animal Health Technicians (SAAHT), as well as Eastern Cape and Northwest farmers, Vets, and animal health technicians.



*Maize Project Annual Review & Planning Meeting, 17th – 20th April 2023 in Mpumalanga*

#### AGRIMETRICS

The unit provides statistical services to ARC staff and scientists from industry, government, and universities. It generates external income from these and markets the ARC and its services. The unit had 1445 statistical consultations with ARC scientists and 1140 consultations with external clients, earning R477 232 in external income. Biometricians reviewed 71 scientific articles during the year and co-authored 13 scientific publications. Biometricians reviewed 26 proposals, presented papers and posters at 7 conferences, and facilitated 14 workshops and training courses.

In terms of farm assessment, collaboration with scientists across disciplines in refinement of a digitized farm assessment toolkit continued. The ARC assisted Mr. Tshabalala a land reform beneficiary with a farm assessment consequently equipping him to use the ARC



analysis to seek funding to develop his farm. The unit also engaged the Department of Correctional Services who identified Leeuwkop in Kyalami as case study. The team visited the facility and engaged with the different enterprises on the farm.

The unit leads a work package in the EU funded DIVAGRI (Revenue Diversification in Africa through bio-based and circular Agricultural Innovations) project. It addresses limitations of smallholder systems, through bio-based technologies adapted to an African context. The ARC is part of a consortium of 20 European and African R&D organizations in this incentive. Activities this year included submission of financial and technical reports, as well as a presentation to an EC review. The reviewers praised the team for connections achieved with farmers across the five participating countries. The unit also initiated a survey across the DIVAGRI consortium, initiating the next data collection phase that the ARC is responsible for.

The unit actively engages stakeholders from the private and public sector, aimed at establishing sustainable and mutually beneficial partnerships. These engagements also provide a platform for communication of ARC services. Both statistical and farm analysis services are marketed, delivering output in terms of assessments, external income, and publications. The unit has a sound record in terms of income generation and contributes to ARC outcomes in support of productivity, sustainability, resilience, products, and skills in the sector. A unit strength is its ability to garner support across the ARC in facilitating trans-disciplinary evaluations and providing quality control of scientific output.

## INTELLECTUAL PROPERTY MANAGEMENT AND COMMERCIALISATION

The Unit continues to give support for outcomes 1-6. The ARC continued to build and increase its intellectual property portfolio that addresses food security by applying for Plant Breeders' Rights for mango (one), forage (four) and plum (one) varieties. In addition, one provisional patent was filed to obtain protection from entomopathogenic fungus for biocontrol of pest of plants. The portfolio was also expanded to include trademarks registration for the deciduous fruit known as Cape Blush. Plant Breeders' Rights were granted for five different types of sweet potatoes SP-6, SP-7, SP-8, and SP-9 and two wheat varieties Selon and Usutu. The ARC, through its effort to commercialise its intellectual property through licensing was able to realise over R47 million including end-point royalties of over R1,5 million

generated from self-pollination grains. The ARC continues to participate in public events to share knowledge, including the World Science Forum 2022 themed "Science for Social Justice" and Licensing Executive Society of South Africa on "Licensing- Growing Business". At these events, the ARC gained interest from a number of parties interested in commercialising its technologies.

## INTERNATIONAL RELATIONS

The ARC signed a Memorandum of Understanding (MoU) for cooperation with the Bulgaria Agricultural Academy in May 2022 in a virtual signing event. The MoU allows for research collaboration in the following research areas: (a) Genetics and plant breeding studies. Development of new varieties with increased productivity and quality, adapted to market and climate changes; (b) Sustainable and effective management of resources (ecosystems, soils, waters, biomass) under climate changes, mitigating the impacts of climate changes; (c) Development of conventional and organic farming systems, new solutions for integrated plant protection management in agro-ecosystems; (d) Genetics and animal breeding studies, improvement of feeding, animal welfare and mitigation of harmful ecological effects; (d) Sustainable fisheries and aquaculture development; and (e) Development of technologies for safety, quality and healthy foods, drinks and other food products. The ARC engaged in efforts to develop the action plan for joint initiatives with the Agricultural Academy to enhance existing research programmes in both countries.



The ARC and the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) entered into a MoU to expand regional relations in September 2022 on the margins of Africa's Food Systems Forum (AGRF) 2022 Summit held in Kigali, Rwanda.

The MoU is a vehicle which will assist the partners to work together on issues of common interest including (a) the Exchange of research material, scientific information, knowledge, and technologies; (b) Training and capacity development programmes and projects; (c) Consultancy & advisory services; (d) Facilitation of technology transfer and business development initiatives from research outputs; (e) Conducting joint resource mobilization for agricultural research and development, capacity building, and outreach activities; and (f) Monitoring & evaluation, impact assessment and pilot projects.

The partnership intends to enrich ongoing cooperation within the Southern African Development Community (SADC).



The ARC partnered with French research institutions Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement (CIRAD) and French Institut National de Recherche Pour l'agriculture, l'alimentation et l'environnement (INRAE) co-host the first General Assembly of the "Transforming Food Systems and Agriculture through Research in Partnership with Africa (TSARA)" partnership on 5 December 2022.

TSARA aims to strengthen cooperation between the members from African and French organisations contributing to food security, the fight against global warming, the strengthening of biodiversity, human, animal and ecosystem health as well as youth employment and gender equity. The TSARA event was held in Cape Town as a side event of the World Science Forum and it attracted African and French organisations who participated in-person and virtually. The ARC secured support from the DSI, DALRRD and DIRCO to co-host the TSARA general assembly as an event of the partnership.

The General Assembly focused on: (i) the governance arrangements (co-presidency; operational secretariat; external advisory board; ad-hoc working groups) of the TSARA initiative, (ii) the shared scientific agenda for the 8 scientific working groups and (iii) an action plan for 2023–2025. Delegates included CEOs, Deans or Rectors, and Heads of International Affairs of all the TSARA research/universities partner institutions from Africa and France. ARC's international visibility was enhanced by co-hosting this event and more partnerships will be pursued with African organisations linked to the TSARA. The ARC CEO will co-chair the TSARA initiative until the next General Assembly.

The ARC contributed post the General Assembly to the activities to direct the TSARA partnership including the report of the General Assembly, development of governance documents, review of thematic working groups work, and communication to TSARA members.





University of Agriculture and Natural Resources (BUAN) on 22 November 2022 to expand collaboration from ongoing initiatives on animal production into other thematic areas in both partner institutions. Areas of collaboration covered by the MoU include student and staff exchange, student co-supervision, joint scientific events, exchange of scientific information, technologies, and other information, and capacity building.



As part of the drive to strengthen strategic partnerships on the African continent, ARC signed an MoU with the Food, Agriculture, Natural Resources Policy Analysis Network (FANRPAN) alongside the 2023 Regional Climate Smart Agriculture Policy Dialogue hosted by FANRPAN at Future Africa, University of Pretoria in March 2023. The MOU encourages research collaboration in the following areas: joint research programmes and technical events, information exchange and knowledge dissemination, joint translation of research outputs, and capacity building.



## MARKETING AND COMMUNICATION

Agriculture, as an essential service, outperformed most local industries during the Covid-19 pandemic. As the premier institution providing sustainable R&D solutions, the ARC celebrated World Food Day on 16 October 2022 with a "King of the Mountain" challenge. Colleagues from all ARC campuses collected non-perishable food for charity. ARC Small Grain emerged as the campus with the highest food mountain and was declared the King of the Mountain 2022/23. All items collected across the ARC were handed to ARC Small Grain for distribution to two organisations in Bethlehem and Clarens respectively.

As part of the 2022 Mandela Day celebration, ARC employees donated school shoes and jerseys for the less fortunate, handed over on 11 August 2022 at Kgantshe Primary School, Kwamhlanga in Mpumalanga. About 50 learners benefited from the initiative.

The CEO and President Dr. Litha Magingxa led a team of agricultural scientists and experts at the World Science Forum from 6 to 9 December 2022 in Cape Town. The theme for the 10th World Science Forum was "Science for Social Justice" and was held in Africa for the first time. South Africa is the fourth country in the world to host the WSF outside Hungary.

The ARC joined the 2023 Top Employers on the African continent for the first time. Being certified as a Top Employer showcases an organisation's dedication to a better world of work and exhibits this through excellent HR policies and people practices. The certification was celebrated by the entire ARC family through various events with the main programme held at CO attended by staff and members of the Council.

An ARC Inter-Campus Hybrid Research Conference was organised from the 1st to the 2nd of March 2023. The conference themed 'The heat is on: The weird and wonderful research at the ARC', saw ARC scientists and

researchers converge under one roof to share knowledge with peers in an effort to encourage collaboration and stimulate new ideas. The conference also served as a platform for sharing research findings and developments that address challenges in the sector. Distinguished researchers that are nearing or in retirement were invited to speak about their careers.

The ARC added a gin to its Nietvoorbij range, launched at the ARC's Nietvoorbij Campus on Friday, 18 November 2022. Subsequently, the CEO and President, Dr. Magingxa was interviewed live on eNCA on 21 November 2022 on the launch and the important work done by the ARC. Dr. Magingxa was also interviewed on eNCA on 27 January 2023 on the Top Employer Certification, how the energy crisis affects the sector and what the ARC is doing to mitigate the effects of the crisis on the nation's food basket.

ARC staff were interviewed live on Power FM on 28 February 2023 and 3 March, respectively. They covered a range of topics, which included the work of the ARC and the aim of the Inter-Campus Hybrid Research Conference. The interview highlighted important research undertaken, and development projects initiated by the institution.

In terms of Exhibitions of the ARC's work, impact, and employment opportunities, 34 events were held in the year.



*AAPs based at ARC Ncerha at Eastern Cape*

## TRAINING AND EXTENSION

Contributing to a skilled and capable agriculture sector, the ARC participated in policy development processes and aided in the implementation of policy directives. In the year under review, the unit assisted in the state drive to recruit unemployed graduates.

South Africa has more than three million smallholders but only 1989 public agricultural extension officers.

While the number has increased due to the extension recovery plan (ERP) of 2018, producers at smallholder level are not serviced adequately. The DALRRD program to appoint 10 000 unemployed agricultural graduates as Assistant Agricultural Practitioners (AAP's) to reach a target of 1 extension to 250 farmers (1:250) was supported. The ARC hosted 113 AAPs in Gauteng province, 5 in Mpumalanga, 6 in the Eastern Cape and 7 in the Free State, totalling 131 across its various campuses.

The unit conducted training on Climate Smart Agriculture to the Limpopo Department of Agriculture and Rural Development Extension officers during March 2023. 70 Extension officers were trained on 'Climate Smart Fruit and Vegetable Production' and 'Climate Smart Livestock Production'. A total of 56 EPs attended fruit & vegetables training. A total of 14 EPs attended livestock training. The training was in collaboration with five ARC campuses (ARC CO I&P, NRE, AP, VIMP and TSC, with the Impact & Partnership Division playing a coordination role. The goal was to capacitate agricultural extension officers on Climate Smart agriculture production and facilitate CSA technology transfer to farmers.



*Exposure of Extension Practitioners to ARC climate smart agriculture tools*





*Presentation and exhibition at Limpopo Agripreneurship Seminar and Awards*

expose farmers to ARC products and services for decision support, promoting Climate smart agriculture. A presentation on farmer support through digital platforms was also given.

The unit in collaboration with internal and external stakeholders hosted a series of Farmer Field Days to expose farmers to ARC's digital platforms for disseminating technologies and on ARC training services. The unit has been inundated with demand for ARC training where farmers days were held. Additionally, exhibitions also played an important role in shaping careers for students and farmers respectively, with ARC sharing information in Gauteng, Limpopo and KZN respectively.



*Extension practitioners trained from NW, MP Ehlanzeni and Emalahleni*

The division trained ninety-four extension practitioners from Mpumalanga and Northwest through soft skills training on Facilitation Skills and a five-modular Extension methodology course, roughly 30% above target.

The unit actively engaged stakeholders from both the private and public sector, with benefits to the ARC that include a platform for communication of ARC services and R&D offerings. As part of information dissemination and stakeholder engagements the unit was involved at the City of Polokwane AgriPreneurship Seminar and Competition on 15 November 2023. The unit also facilitated engagements with the Nozala trust on 17 January 2023 and presented capacity development and support initiatives for farmers. The unit exhibited and presented at a Conservation Agriculture farmer's day held on the 23 February 2023 in collaboration with Mahlathini Development Foundation at Bergville, KZN, to



*Presentation and exhibition at Limpopo Agripreneurship Seminar and Awards*

## KNOWLEDGE DISSEMINATION

Some of the knowledge dissemination interventions for 2022/23 included the following:

### JOURNAL ARTICLES

Evelyn Madoroba., Keneiole Portia Malokotsa., Cynthia Ngwane., Sogolo Lebelo & Kudakwashe Magwedere. 2022. Presence and virulence characteristics of Shinga Toxin *Escherichia coli* and non-shinga toxin producing *Escherichia coli* O157 in products from animal protein supply chain enterprises in South Africa. *Foodborne pathogens and disease*, Vol 19(6). <https://doi.org/10.1089/fpd.2021.0062>.

Gericke, R., Combrink, N. J. J. & van der Rijst, M. 2023. Low magnesium content in potato tubers associated with mass loss during storage. *South African Journal of Plant and Soil*; <https://doi.org/10.1080/02571862.2022.2144959>.

Mamabolo, M., Chaminuka, P., & Machethe, C. 2023. District analysis of poverty dynamics in rural South Africa. *African Journal of Science Technology Innovation and Development*; <https://doi.org/10.1080/20421338.2023.2178773>.

Saul Ngarava., Abbyssinia Mushunje., Petronella Chaminuka & Leocadia Zhou. 2022. Impact of the COVID-19 pandemic on the South African tobacco and alcohol industries: Experiences from British American Tobacco and Distell Group Limited. *Physics and Chemistry of the Earth*, Vol 127. <https://doi.org/10.1016/j.pce.2022.103186>.

Wekeza, S.V., Sibanda, M., & Nhundu K. 2022. Prospects for organic farming in coping with climate change and enhancing food security in Southern Africa: A systematic Literature Review. *Sustainability*, 14(20), 13489. <https://doi.org/10.3390/su142013489>.

Zhou, L., Kori, D.S., Sibanda, M., & Nhundu K. 2022. An Analysis of the Differences in Vulnerability to Climate Change: A Review of Rural and Urban Areas in South Africa. *Climate*, Vol 10 (8):118. <https://doi.org/10.3390/cli10080118>.

### THESES AND DISSERTATIONS

Loquitur, M. 2022. Entrepreneurship as a viable solution to unemployment: Agricultural postgraduate students' perceptions. Doctor of Philosophy (Sustainable Agriculture), University of Free State.

Mankaba Matshidiso Whitney Matli. 2022. Socio-economic analysis of Smallholder sweet potato production and acceptability of entomopathogenic nematodes as bio-control of sweet potato weevil in South Africa. Master of Agricultural Science, University of Limpopo.

Ntokozo Blessing Zitha. 2022. Factors influencing harvesting commercialisation and consumption of edible termites in the Vhembe District of the Limpopo Province in South Africa. Master of Agricultural Science, Tshwane University of Technology.

Phetoe Patrick. 2022. Modelling willingness to pay for genetically modified TELA BT Maize seed technology in Mpumalanga Province, South Africa. Master of Science Agricultural Economics, University of Limpopo.

### CHAPTERS IN BOOKS

None

### CONFERENCE PROCEEDINGS

None

## RESEARCH HIGHLIGHTS LINKED TO PERFORMANCE

# INFORMATION AND COMMUNICATION TECHNOLOGY AND INFRASTRUCTURE

With the advent of the 4IR, South Africa (SA) formed a Presidential Commission on the Fourth Industrial Revolution (PC4IR). The Commission was designed to help government make the most of the opportunities revealed in the current upheaval. The goal of the Commission is to develop relevant policies, systems and action plans to enable South Africa to respond appropriately to the opportunities and challenges presented by the 4IR.

In its report, the Commission argues that the combination of biotechnology with agri-informatics enabled by precision data has the power to improve seed and plant resilience, particularly given climate variability. This can enhance food security and, in the case of bio-diversity management and protection, aid in the preservation of existing biodiversity for future generations, such as the use of drones for mapping and data gathering and automated, energy-efficient water-monitoring sensors that support precise water-use for irrigation.

In 2020, the ARC completed a comprehensive process towards the development of a Five-Year Strategic Plan for a period 2020/21-2024/25. To align with the Corporate Strategic Plan, the Information and Communication Technology (ICT) division developed the ICT Strategic Plan for a period 2020/21-2024/25.

The ICT continues to deliver on its three main strategic objectives- namely; Stabilization, Optimization and Digitization. During the year, the ICT saw a number of projects linked to this strategic objectives being delivered. The ICT also took an initiative to review its strategy in order to stay relevant and align with ARC business needs.



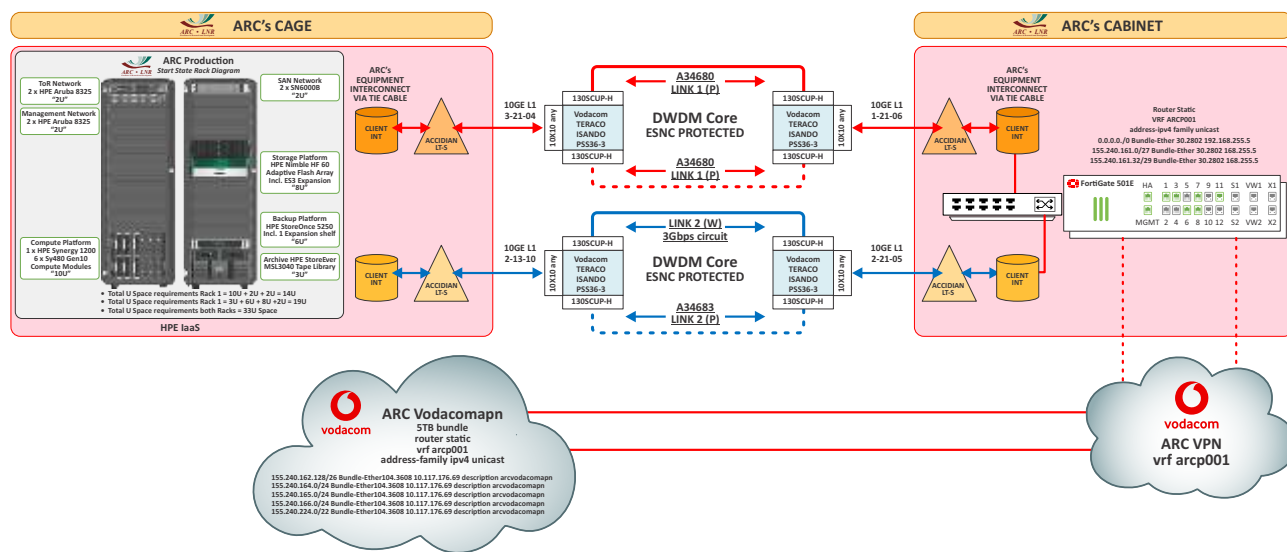


## INFRASTRUCTURE AS A SERVICE (IaaS)

The ARCs existing ICT Infrastructure reached end-of-life. The ageing infrastructure made it impossible for the ICT Division to meet modern and contemporary business requirements. ICT therefore procured Infrastructure-as-a-Service (IaaS) to improve the infrastructure performance and provide needed capacity for the Research Institutes' digital transformation and current

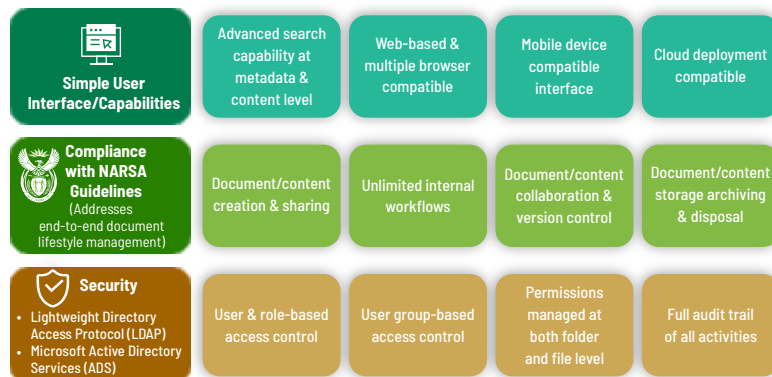
corporate applications (AX, Sage and LIMS) performance as part of the ARC Turnaround Strategy.

The implementation of this project has improved application performance and service availability. This has also improved stability on the overall application and server landscape and optimize performance.

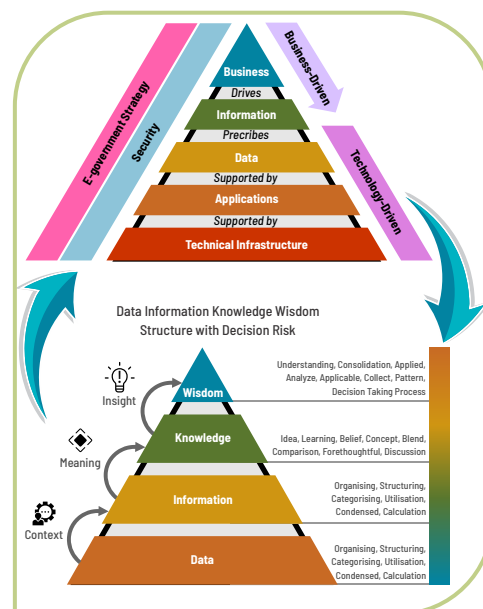


## ELECTRONIC DOCUMENT AND RECORDS MANAGEMENT SYSTEM (EDRMS)

The implementation of this project has improved performance of application performance and service availability. This has also improved stability on the overall application and server landscape and optimize performance.



EDRMS solution Overview



Link between Information and Knowledge Management



## RESEARCH APPLICATIONS

During the financial year, the ICT launched three (3) application that assist farmers with different production guides as well as maintaining and control of diseases. The following applications were deployed on Google Playstore.

The CBSA App assists farmers to make informed decisions when it comes to a specific breed, ensuring optimal production. The App supplies farmers with readily available, up-to-date information on available breeds adapted to different production systems & climatic conditions.

### CBSA APPLICATION

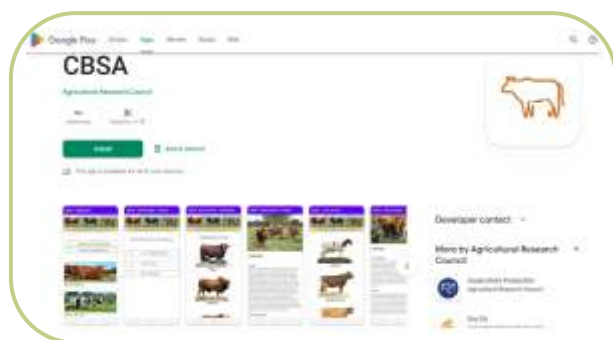
**The CBSA App provides users with the following information:**

- Comprehensive information on beef breeds in South Africa
- Comprehensive information on dairy breeds in South Africa
- Search functionalities according to: *Frame size (small, medium, and large frame), Alphabetical order, Cattle classifications (Bos-indicus, Bos-taurus, composite)*

Important information (Animal improvement, bull testing units in South-Africa)

Functional Efficiency

Information of all the Breeders Societies in South Africa

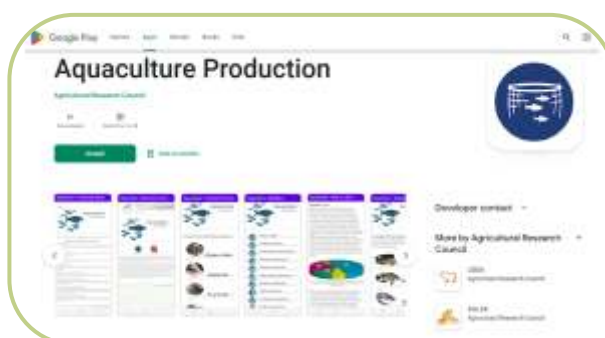


### AQUACULTURE PRODUCTION APPLICATION

The Aquaculture Production App eases the conveying of production concepts or practices for best management in aquaculture and improve the farmer's return of investment. The App will assist farmers in achieving best management practices of their aquaculture venture, enabling them to adjust appropriately for individual situations and conditions, factors such as production species, systems used, location, and even potential markets.

*The Aquaculture Production App provides users with the following information:*

- Comprehensive farmed species background information
- Comprehensive farmed species identification information
- Comprehensive common aquaculture diseases and management
- Comprehensive aquaculture biosecurity Information
- Downloadable aquaculture environmental requirements factsheets
- Downloadable farmed species feeding requirements
- Discussion Forum
- Useful Links
- Addition resources (Publications, Articles)

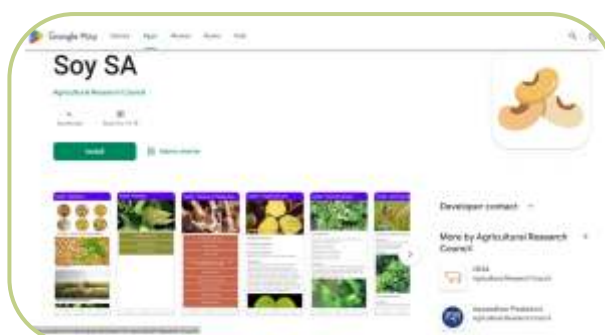


### SOY APPLICATION

The Soy SA App provides soybean producers with readily available, up-to-date information on soy production and even more on pests and diseases affecting soy production in South-Africa.

**The Soy SA App provides users with the following information:**

- Cultivar Information
- Pest & Disease Control Measures
- Soybean Production
- Guidelines Comprehensive Disease Information
- Comprehensive Pests Information
- Comprehensive Nematodes Information
- Comprehensive Nutritional Deficiencies Information
- Comprehensive Herbicides Damage Information
- Comprehensive Disease Information
- Comprehensive Pests Information
- Comprehensive Nematodes Information
- Comprehensive Nutritional Deficiencies Information
- Comprehensive Herbicides Damage Information



## SECURITY SERVICES

The Security Services Division aims to establish, implement and maintain a series of physical and technical security control measures to prevent and mitigate potential security risks' impact on ARC's core business operations.

As a result, the ARC must rely on advanced security systems and measures to ensure the safety of its employees, service providers and visitors and preserve critical assets.

Following the successful implementation of the **Electronic Visitor Management System (EVMS)** pilot project at the Central Office which aimed to improve access control in accordance with the Control of Access to Public Premises and Vehicles Act 53 of 1985.

A Visitor Management solution offers a streamlined and simplified visitor experience as it reduces the time required to process visitors, keeps everyone safe, securely maintains personal data, and makes operations more effective and efficient as it reduces the manual workload of security thereby improving the efficiency of the entire security access control process.

The Electronic Visitor Management System solution was deployed nationally to ARC sites across the country. The solution is a cloud-based visitor management system that replaces the traditional Visitor's Register with a secure cloud-based digital solution. The most crucial feature of the solution is that the visitor's driver's license or identity document can be scanned instantaneously at the entry and exit points. Data is validated promptly, and the system can detect expired, invalid, or fraudulent documents.

All data obtained is then saved on the cloud, making it easily accessible. The fact that the solution is POPI-compliant and securely manages all visitor information, as opposed to seeing the private data of every person who has visited you when utilizing traditional registers, is essential.

Finally, in the event of an emergency, such as a fire or natural disaster, having a visitor management system on-site can help guarantee that everyone on-site has been accounted for and safely evacuated.



## FACILITIES MANAGEMENT BUSINESS MODEL ASSESSMENT PROJECT

The Infrastructure Division implemented the new Facilities Management framework, which was approved early in 2022. This framework includes a new management model, a facilities management structure, and an effective physical assets management process. As per the new framework, the Infrastructure team has prioritized vital initiatives, such as the Facilities Management Centre of Excellence and Facilities Management Operations. To achieve this, the Facilities management and reporting model changed from reporting at Institute level to reporting directly to the Senior Manager of Infrastructure at Corporate Office. This change significantly impacted strategic operations and corporate budget management, allowing the ARC to focus its capital investment on Solar Technology, Farming Equipment, and Fleet operations. The Facilities Team has also produced an ARC Maintenance Management plan for 2022-2026 that includes the budgeting requirement to meet the ARC's maintenance needs over the next four years.

Two main focus areas for Facilities were asset management and verification and land & property management. Facilities, in conjunction with Finance, conducted an asset verification process to ensure the accuracy of the asset register and determine the state of the ARC's assets. This process enables Facilities to put systems and structures in place to manage the accuracy and lifecycle of all ARC assets. Facilities also produced a land & property management report to identify ARC land & property used and unused for business operational activities. This approach will allow Facilities to focus investments and maintenance on operational activities while using non-operational properties and land to increase external rental income to enable self-sustainability and self-maintenance.



# PART C:

## GOVERNANCE

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# PART C:

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# GOVERNANCE

## 1. INTRODUCTION

The Council of the ARC embraces the highest standards of corporate governance, transparency, accountability, responsibility and integrity in respect of its fiduciary oversight duties over the discharge of the legislative mandate by the ARC. Council is always cognisant, in exercising its oversight, of the policy ideals and imperatives envisioned in the National Development Plan Vision 2030 which recognises that South Africa needs to spend more time on Research and Development in general, but that the institutional setup also needs to improve the link between innovation and business requirements. Whilst ensuring that the ARC embeds the section 27 (1) (b) Bill of rights entrenched in the Constitution of our country, relating to the right by everyone to have sufficient food and water, Council ensures that the strategies, policies, and plans of the ARC institutionalises the commitment of its members, management and staff towards enhancement of research and development within the agricultural sector.

The PFMA and its National Treasury Regulations remain the staunch guide and reminder for Council of the authority vested in and duties imposed on it to ensure that the ARC's operations serves and are managed sufficiently to support the objects of the PFMA, which are to secure transparency, accountability, and sound management of revenue, expenditure, assets and liabilities. Council has ensured that the peremptory duties and obligations put on Council by the PFMA and its Treasury Regulations are codified in that Council developed a Shareholder Compact with the Minister which embodies such. The Charter of Council which is in line with the expectations of the PFMA and the Act was approved for the reporting year. Council established the following Committees and ensured that the Terms of Reference thereof were reviewed in compliance with the PFMA, the Act, where applicable, principles espoused in the King IV Code, the Companies Act and common law:

- a. The Finance, Investment, ICT Governance and Infrastructure Committee;
- b. The Human Resources and Remuneration Committee;
- c. The Research, Development and Evaluation Committee;
- d. The Audit and Risk Committee; and
- e. The Social, Ethics and Governance Committee.



## 2. PORTFOLIO COMMITTEE

Item	Description	Date	Attended
1	Performance & Expenditure Report for Q1 FY 2022/23 first quarter performance and expenditure	13 September 2022	Virtual
2	Annual Report 2021/22 FY	12 October 2022	Virtual

**13 September 2022** - The ARC reported an improvement in its fourth and first quarters, while informing the Committee of positive steps to fast-track the foot-and-mouth disease (FMD) vaccine. They also reported that they had challenges securing personnel with critical skills, which was also their biggest expenditure.

**12 October 2022** - The ARC discussions concerned its qualified audit opinion with material findings; non-compliance with legislation; training and support for emerging farmers; the retaining of skilled staff; its commercialisation strategy; new vaccines, and revenue generated from vaccines; its animal database and record keeping; and the student training and placement strategy. Members also sought more information on land reform beneficiaries; the ARC's mobile laboratories; programmes to improve emerging farmers' livestock; its working relationship with the OBP; the foot and mouth disease (FMD) facility; and the measurement of their support for farmers.

## 3. EXECUTIVE AUTHORITY

The Shareholder Compact and the APP for the reporting year was submitted to the Executive Authority in February 2022.

1. First Quarter Performance Report was submitted on 29 July 2022
2. Second Quarter Performance Report was submitted on 31 October 2022
3. Third Quarter Performance Report was submitted on 31 January 2023; and
4. Fourth Quarter Performance Report was submitted on 28 April 2023.

## 4. THE ACCOUNTING AUTHORITY/COUNCIL

### INTRODUCTION

#### ***The importance and purpose of the Council***

The main role of the Council is management oversight and planning of the affairs of the ARC, which shall, subject to the provisions of Agricultural Research Act 86 of 1990, determine the policy and objectives of the ARC and exercise control generally over the performance of its functions, the exercise of its powers and the execution of its duties.

#### ***Council's responsibilities and accountability for the public entity's performance and strategic direction***

The statutory functions of the ARC Council are determined in terms of the provisions of the Agricultural Research Act, 1990 (Act No 86 of 1990, and the PFMA, 1999 (Act No. 1 of 1999). These include to be the Accounting Authority; approval of the APP, Strategic Plan and the policies of the ARC; and setting of performance targets for the organisation. The Council is responsible *inter alia* for approval of the prepared Annual Financial Statements that accurately reflect the ARC financial position and results at the end of the financial year, which is set at 31 March each year.

Council as Accounting Authority is accountable for all matters relating to the ARC, including, but not limited to, the performance of functions by the management of the ARC taking into account, amongst others, that the delegation of functions by the CEO, does not absolve Council from its responsibilities as well as its financial and performance accountability. The Office of the AG is responsible for auditing the Annual Financial Statements of the ARC.

#### ***The role of the Council***

In the governance of the ARC, the Council is responsible for policymaking and control while the ARC President and CEO has been delegated the responsibility for the day-to-day execution of the policies and objectives as directed by Council.

The members of the Council are appointed by the Minister of Agriculture, Land Reform and Rural Development (the Minister) on the basis of their expertise in the fields of agriculture, business, financial management, law, research, technology development and technology transfer in the field of agriculture, as prescribed by the Agricultural Research Council Act, 1990 (Act No. 86 of 1990). Council members are appointed for a maximum period of three years and eligible for re-appointment. With the exception of the President and CEO of the ARC none of the members of Council hold an executive position in the ARC.

Council exercises full and effective control over the ARC and monitors its EMC. Council may obtain independent professional advice if deemed necessary.

#### ***Council Charter***

In compliance with best practice of corporate governance principles, and in accordance with the powers and authority delegated to them by the Minister, Council Members (Council) of the ARC have agreed to define their responsibilities and duties, and record them in a statement of powers reserved to the ARC Council within the constraints of their authority as defined in the Agriculture Research Act (Act No 86 of 1990), the PFMA (Act No 1 of 1999), the Treasury Regulations, the Charter and any other relevant legislation. Council Members recognise their accountability in achieving the objectives defined in the Act.

In accordance with its stated intent, Council seeks to identify and record its responsibilities and reserved powers and to clarify the authority delegated to the Management of the ARC, defining the organisation monitoring measures required to ensure the proper execution of the delegated authority and the integrity of risk management and internal controls. Furthermore, in recognition of the importance of the leadership role of the Chairperson, her functions and duties are stipulated in the Charter.

*Composition of the Council*

Composition of the Council								
NAME	DESIGNATION (in terms of the public entity board structure)	DATE APPOINTED	DATE RESIGNED	QUALIFICATIONS	AREA OF EXPERTISE	BOARD DIRECTOR- SHIPS (List the entities)	OTHER COMMITTEES OR TASK TEAMS (e.g: Audit committee / Ministerial task team) None	NO. OF MEETINGS ATTENDED
Ms. Joyene Isaacs	Chairperson	1 July 2020	Not applicable	Bachelor of Science in Pathology and Plant Protection Honours and Bachelor of Science	Research and management	ARC	None	12 (Twelve)
Dr. Monodowafa Mashaba	Deputy Chairperson	1 July 2020	Not applicable	PhD in Public Affairs, Master of Management (P&DM), Post Graduate Diploma and Bachelor of Art Degree	Research	ARC	Finance, Investment, ICT Governance & Infrastructure Committee Audit & Risk Committee	26 (Twenty Six)
Prof. Raymond Auerbach	Member	1 July 2020	Not applicable	Masters of Science, and Doctorate	Research	ARC	Finance, Investment, ICT Governance & Infrastructure Committee Research, Development & Evaluation Committee	17 (Seventeen)
Prof. Nic Olivier	Member	1 July 2020	Not applicable	BA Law, LLB, B.Phil., BA honours, MA Linguistics, Dr of Law (private and comparative law), Dr of Law (recognition of Legal pluralism)	Legal	ARC	Human, Resources & Remuneration Committee Audit & Risk Committee	20 (Twenty)
Dr. Konanani Liphadzi	Member	1 July 2021	Not applicable	MBL, MAD, PhD-Agronomy, M.Inst Agrar, B. Inst Agrar, B. Agriculture	Legal and Research	ARC	Research, Development & Evaluation Committee Human Resources and Remuneration Committee	18 (eighteen)
Ms. Nalini Maharaj	Member	1 July 2020	Not applicable	B. Proc, Bachelor of Laws, Financial Accounting for Public Entities, Corporate Governance	Legal	ARC	Finance, Investment, ICT Governance & Infrastructure Committee Human Resources & Remuneration Committee	19 (Nineteen)

Composition of the Council								
NAME	DESIGNATION (in terms of the public entity board structure)	DATE APPOINTED	DATE RESIGNED	QUALIFICATIONS	AREA OF EXPERTISE	BOARD DIRECTOR- SHIPS (List the entities)	OTHER COMMITTEES OR TASK TEAMS (e.g: Audit committee / Ministerial task team) None	NO. OF MEETINGS ATTENDED
Dr. Naude Malan	Member	1 July 2020	Not applicable	Doctor of Philosophy, Master of Arts, B.A Hons, Bachelor of Arts	Research	ARC	Research, Development & Evaluation Committee Human Resources and Remuneration Committee	19 (NineTeen)
Dr. Poncho Mokaila	Member	1 July 2020	Not applicable	MBA, BVMCH, Certificate in HACCP	Research	ARC	Finance, Investment, CT Governance & Infrastructure Committee Human Resources & Remuneration Committee	24 (Twenty Four)
Mr. Goodman Gcaba	Member	1 July 2020	Not applicable	Master of Science in Forest Management Bachelor Degree in Agriculture and Commercial Forestry	Research	ARC	Finance, Investment, ICT Governance & Infrastructure Committee Research, Development & Evaluation Committee	19 (Nineteen)
Dr. Steven Cornelius	Member	1 July 2020	Not applicable	BSc, BSc Honours, BVMCh, BVScH	Research	ARC	Human, Resources & Remuneration Committee Research, Development & Evaluation Committee	19 (Nineteen)
Prof. Phatu Mashela	Member	01/04/2017 Reappointed 1 July 2022	30 June 2020 Reappointed 1 July 2022	MSc (Nematology), PhD (Nematology and Horticulture), MBA	Research	ARC	Research, Development & Evaluation Committee	17 (Seventeen)
Dr. Saskia van Oosterhout	Member	01/04+/2017 Reappointed 1 July 2022	30 June 2020 Reappointed 1 July 2022	PhD (Agricultural Ecology)	Research	ARC	Finance, Investment, ICT Governance & Infrastructure Committee Research, Development & Evaluation Committee	25 (Twenty Five)



**Committees**

COMMITTEES			
Committee	No. of meetings held	No. of members	Name of members
FINANCE, INVESTMENT & ICT GOV & INFRASTRUCTURE COMMITTEE	5 (Five)	6	Dr. M Mashaba Prof. R Auerbach Mr. G Gcaba Ms. N Maharaj Dr. S van Oosterhout Dr. P Mokaila
RESEARCH, DEVELOPMENT, AND EVALUATION COMMITTEE	6 (Six)	5	Dr. S van Oosterhout Prof. R Auerbach Mr. G Gcaba Dr. S Cornelius Dr. K Liphadzi
HUMAN RESOURCES & REMUNERATION COMMITTEE	4 (Four)	5	Dr. S Cornelius Dr. N Malan Dr. P Mashela Dr. P Mokaila Dr. K Liphadzi
AUDIT & RISK COMMITTEE	7 (2 In-committee Meeting)	7	Mr. V Naicker Prof. N Olivier Dr. M Mashaba Dr. K Laubscher Ms. M Mbonambi Ms. T Mokgabudi Ms. B Schutte
SOCIAL, ETHICS & GOVERNANCE COMMITTEE	3 (1 In-committee Meeting)	4	Dr. N Malan Prof. N Olivier Prof. P Mashela Ms. N Maharaj

**Council Executive Committee**

The Executive Committee comprises of Chairperson of Council and the Chairpersons of Committees of Council with the exception the Chairperson of the Audit & Risk Committee. During this reporting year, three (3) Council Executive Committee Meetings were held.

COUNCIL EXECUTIVE COMMITTEE		
No.	Names & Surname	Designation
a.	Ms. J Isaacs	Chairperson of Council
b.	Dr. M Mashaba	Chairperson of the Finance, Investment & ICT Governance Committee
c.	Dr. S Cornelius	Chairperson of the Human Resources & Remuneration Committee
d.	Dr. S Van Oosterhout	Chairperson of the Research, Development & Evaluation Committee
e.	Ms. N Maharaj	Chairperson of the Social, Ethics & Governance Committee

**Foot and Mouth Disease Task Team**

The Foot-and-Mouth Disease (FMD) Task Team comprises of the Deputy Chairperson of Council and ordinary Council members. During this reporting year, 5 (Five) Foot-and-Mouth Disease (FMD) Task Team meetings were held.

FOOT AND MOUTH DISEASE TASK TEAM		
No.	Names & Surname	Designation
a.	Dr. M Mashaba	Deputy Chairperson of Council
b.	Dr. S van Oosterhout	Chairperson of the Research, Development & Evaluation Committee
c.	Dr. P Mokaila	Deputy Chairperson of the Human Resources & Remuneration Committee

**Compliance Regulatory Universe Task Team**

The Compliance Regulatory Universe Task Team comprises of the Audit & Risk Committee members. During this reporting year, two (2) Compliance Regulatory Universe Task Team meetings were held.

COMPLIANCE REGULATORY UNIVERSE TASK TEAM		
No.	Names & Surname	Designation
a.	Dr. N Olivier	Council Member
b.	Dr. K Laubscher	Independent Audit & Risk Committee Member
c.	Ms. B Schutte	Independent Audit & Risk Committee Member

**Technical Review Task Team**

The Technical Review Task Team comprises of Council Members. During this reporting year, two (2) Technical Review Task Team Meetings were held.

TECHNICAL REVIEW TASK TEAM		
No.	Names & Surname	Designation
a.	Dr. K Liphadzi	Council Member
b.	Dr. P Mokaila	Deputy Chairperson of the Human Resources & Remuneration Committee (Council Member)
c.	Mr. G Gcaba	Council Member
d.	Prof. N Malan	Council Member

**Remuneration of council members**

Members of Council are paid in line with the Adjusted Remuneration Levels: Service benefits packages for office bearers of certain statutory and other institutions as a Schedule 3A: Sub-category A1 entity for preparation for and attendance of meetings as detailed below:

REMUNERATION OF COUNCIL MEMBERS					
Category, sub-category and official designation	Comparative full time	PART-TIME			
		Meeting fee per day	Meeting fee per hour	Board fee per annum (5%)	Board fee per annum (8%)
Chairperson	R1 317 874	R5 230	R654	R65 984	R105 430
Vice-Chairperson	R1 120 078	R4 445	R556	R56 004	R89 606
Member	R979 781	R3 888	R486	R48 989	R78 382
Audit & Risk Chairperson	R1 087 879	R4 317	R539	R54 394	R87 030
Audit & Risk Member	R660 087	R2 619	R327	R33 004	R52 807

A retainer fee, which is the sum of two sitting fees, payable to members of Council and Committee members was approved by the Minister effective 1 April 2021.

There are no members serving on Council and its Committee who are excluded from being remunerated by law and other legal applicable legal prescript.

### **Other Expenses**

The ARC further reimburses members of Council and its Committees for other expenses as outlined in below as per such allowable rate or as per receipt:

a.	Incidental costs (sleep away from home)	:	R 152 per day
b.	Travel to meetings	:	R4.18/km
c.	Parking	:	As per provided receipts
d.	Toll gates	:	As per provided receipts
e.	Any other expenses	:	As per provided receipts
f.	Daily allowance for breakfast	:	R100
g.	Daily allowance for lunch	:	R150
h.	Daily allowance for dinner	:	R170
i.	Travelling outside the borders of RSA	:	Prescribed amount applicable to the Authority (SARS guidelines)

Refer to Note Number 1 - 5 (page 249 - 251) the Financial Statements in respect of detailed remuneration fees, allowances and reimbursements paid to Members of Council.

## **5. RISK MANAGEMENT**

The ARC has an established risk management process, which is captured and outlined within the organisation's formulated and approved Risk Management Strategy. Contained within this strategy, the ARC outlines its commitment to the undertaking of formal annual strategic risk assessments for purposes of identifying new and emerging risks, which may impede the achievement of the ARC strategic goals. From a governance perspective, the ARC has an established Corporate Enterprise Risk Management Committee (CERMC), comprising of both Senior and Executive Management and representatives from the respective divisions/operations of the organisation. The Committee's key role is to advise management on the overall system of risk management within the organisation, which is inclusive of the mitigations of strategic risk exposures.

The organisation's Audit and Risk (A&R) Committee also plays a key role in advising on risk management processes and practices, which is further supported through the Internal Audit function whom independently monitors and reports to the A&R Committee on the effectiveness of the entire risk management system. The ARC have, over the reporting period, realised varied levels of success, being ascribed to the minimisation of key strategic risk exposures, translating into an improvement in the ARC performance. The focus for the next financial year and beyond would be on devising and implementing risk minimisation strategies, aimed at reducing the resultant impacts posed by key strategic risk exposures for the benefit of enhancing the organisation's performance.

## **6. INTERNAL CONTROL UNIT**

Not applicable to the ARC

## 7. INTERNAL AUDIT AND AUDIT RISK COMMITTEES

During the reporting period, the Audit and Risk Committee considered the following:

### First Quarter: F2022/23

- a. Q1 - FY2022/23 Internal Audit Report
- b. External Quality Assurance Report
- c. FY2022/23 - Internal Audit Methodology –
- d. Revised ARC Three-Year and Annual Internal Plan 2022/25
- e. Q1 - Fruitless & Wasteful, Irregular Expenditure and Reported Allegations Cases Report
- f. Q1 - FY 2022/23 Combine Assurance
- g. Q1 – FY2022/23 ICT Performance Report
- h. Update on Citrusdal Matter
- i. Q1 - FY2022/23 Legal Services Performance Report
- j. Progress Report on Compliance Management System
- k. Compliance Management Universe and Public Finance Management Act Checklist
- l. Q1 - FY 2022/23 Performance Information Report
- m. FY 2021/22 Draft Annual Report
- n. Q1 – Enterprise Risk Management Performance Report – FY2022/23
- o. Q1 - FY2022/23 SCM Performance Report
- p. Q1 - FY 2022/23 Financial Results
- q. Draft FY2022/23 TOR of F&I

### Second Quarter: F2022/23

- a. Draft ARC Annual Work Plan
- b. Draft FY2023/24 Corporate Calendar
- c. Q2 Internal Audit Report
- d. 2nd Report Fruitless & Wasteful, Irregular Expenditure and Reported Allegations
- e. Progress Report: Quality Assurance Improvement Implementation Plan
- f. Revised Internal Audit Charter
- g. Revised Combined Assurance Plan / Framework
- h. Draft Quality Assurance Improvement Framework
- i. Q2 Combined Assurance Report
- j. Internal Audit Improvement Plan
- k. FY2022/23 – Internal Audit Methodology
- l. Q2 ICT Performance Report
- m. Draft Record Management Policy
- n. Q2 Legal Services Performance Report
- o. Q2 Compliance Management Universe and Public Finance Management Act Checklist
- p. Q2 Litigation Report
- q. Q2 Performance Information Report
- r. Q2 Enterprise Risk Management Performance Report
- s. Risk Appetite and Tolerance Report
- t. Q2 Finance Report
- u. Q2 Supply Chain Management Report
- v. Revised Delegation of Authority Matrix
- w. Accounting Policy

### Third Quarter: F2022/23

- a. Q3 Internal Audit Report
- b. Q3 External Quality Assurance Implementation Plan Report
- c. Q3 Combined Assurance Report
- d. Q3 Report Fruitless & Wasteful, Irregular Expenditure and Reported Allegations Cases
- e. Internal Audit Improvement Plan
- f. Audit Strategy
- g. Engagement Letter



- h. Q3 Performance Information Report
- i. Q3 Quarter Enterprise Risk Management Performance Report
- j. Draft APP FY2023/24
- k. Q3 ICT Performance Report
- l. ICT Policies
  - Firewall Policy
  - ARC Change Management Policy
  - User Acceptance Policy
- m. Q3 Legal Services Performance Report
- n. Q3 Compliance Management Report
- o. Irregular Expenditure Condonation
- p. Fruitless & Wasteful Expenditure Condonation
- q. SCM Turnaround Plan Implementation status
- r. Q3 SCM Report
- s. Corporate Compliance Calendar Submission

#### **Fourth Quarter: F2022/23**

- a. Q4 Internal Audit Report
- b. Q4 External Quality Assurance Implementation Plan Report
- c. Q4 Combined Assurance Report
- d. Q4 Report Fruitless & Wasteful, Irregular Expenditure and Reported Allegations Cases
- e. Internal Audit Improvement Plan
- f. Internal Audit Annual and Three-Year Rolling Plan (2023/24-2025/26)
- g. Q4 Performance Information Report
- h. Q4 Enterprise Risk Management Performance Report
- i. Total Scenario Blackout
- j. Q4 ICT Performance Report
- k. Q4 Legal Services Performance Report
- l. Q4 Compliance Management Report
- m. SCM Turnaround Plan Implementation status
- n. Q4 SCM Report
- o. Finance Report as of 31 March 2023
- p. Write off debtors
- q. ARC Briefing Report with AGSA

The table below discloses relevant information on the audit committee members

NAME	QUALIFICATIONS	INTERNAL OR EXTERNAL	IF INTERNAL, POSITION IN THE PUBLIC ENTITY	DATE APPOINTED	DATE RESIGNED	NO. OF MEETINGS ATTENDED
Ms. Glynnis Masaccha Mbonambi (Chairperson)	Bachelor of Accounting B. Com - Honours (Accounting - CTA)	External	Not applicable	1 July 2022	Not applicable	4 (Four)
Dr. Kobus Laubscher (Deputy Chairperson)	PhD Agricultural Economics - Master of Science - Bachelor of Commerce Honours - Bachelor of Commerce Bcom	External	Not applicable	1 July 2020	Not applicable	7 (Seven)
Mr. Vishnu Naicker	B.Com Degree; Higher Diploma in Taxation and Business Management Diploma	External	Not applicable	1 Dec 2013 (reappointed 1 July 2022)	Not applicable	6 (Six)
Prof. Nic Olivier	BA Law, LLB, B.Phil., BA honours, MA Linguistics, Dr of Law (private and comparative law), Dr of Law (recognition of Legal pluralism)	External	Not applicable	1 July 2020	Not applicable	7 (Seven)
Ms. Brigitte Schutte	BCom (Acc), BCom Honours (Acc), Diploma in Criminal Justice and Forensic Auditing	External	Not applicable	1 July 2022	Not applicable	5 (Five)
Dr. Monodowafa Mashaba	PhD in Public Affairs, Masters of Management (P& DM) Post-Graduate Diploma (P&DM) Bachelor of Art Degree)	External	Not applicable	1 July 2020	Not applicable	7 (Seven)
Ms. Tshidi Mokga`budi	Dip Tax Law, Honours Bachelor of Science, Bachelor of Accounting Science, Bachelor of Commerce, Economics and Industrial Psychology, Dip: Nutritional Supplementation	External	Not applicable	1 July 2022	Not applicable	5 (Five)

## 8. COMPLIANCE WITH LAWS AND REGULATIONS

The ARC is fully committed to comply with the provisions of the PFMA, 1999 (Act No. 1 of 1999). The internal and external auditors continue to provide the Council with assurance on the degree of compliance with the PFMA.

## 9. FRAUD AND CORRUPTION

The ARC stance on fraud and corruption remains that of zero tolerance. The ARC focuses on preventative procedures in its fight against fraud and corruption. To this end all ARC employees undergo a two-step process to ascertain their suitability for employment and reduce the risk of fraud. All new employees undergo an initial pre-employment suitability check,

which is followed by a comprehensive vetting process once the employee has been appointed. This process has already yielded results in identifying and dealing with employees who could have potentially defrauded the entity.

The Internal Audit function of the ARC runs a comprehensive annual anti-corruption awareness campaign in all ARC campuses which ensures that all employees of the entity are made aware of the internal and external impact of fraud and corruption. ARC has an anonymous tip-off service independently managed by Deloitte and this Tip-offs Anonymous service provides an anonymous reporting channel for unethical behaviour in the ARC workspace.

All allegations received are investigated either by an independent forensic firm and/or internal audit; depending on the complexity of the allegations. Depending on the outcome of the investigation, disciplinary measures, civil and/or criminal action will be taken against implicated employees and third parties if found guilty.

## 10. MINIMISING CONFLICT OF INTEREST

The Code of Ethics and Business Conduct (Code) of the ARC stipulates employees should avoid conflict of interest as this may occur when personal interest of an employee or the interest of the third party competes with that of the ARC. ARC supports the prohibition of employees doing business with any organs of state (including the ARC), or of being a director of a public or private company conducting business with an organ of state. The code stipulates that all new employees and students in the ARC are required to disclose their interests within 30 days after assumption of duty; and all employees and students will be required to disclose their interest on an annual basis, but not later than 30 April of each year.

These new measures assist the ARC in raising awareness of possible conflicts of interest for employees, and to avoid them. The ARC continues to raise awareness and to coach and guide employees on how to avoid conflicts of interest. Where such interests are identified, employees are engaged and, where appropriate, standard disciplinary steps are taken in terms of the code.

## 11. CODE OF CONDUCT

The Code of Ethics and Business Conduct (Code) of the ARC outlines expectations regarding employees' behaviour towards their colleagues, stakeholders, and when conducting any business of the ARC. ARC is committed to being exemplary at all times and in all respects, and for its work and conduct to be guided by the values outlined in the Code. The ARC expects employees to be ethical, responsible and professional, and to fulfil their duties with integrity. The ARC builds a culture that encourages employees to think and behave ethically by providing training and awareness through induction, security and fraud prevention and training sessions. These sessions are conducted continuously throughout all ARC campuses to remind and reinforce the ethical conduct of employees at all times. The ARC will take disciplinary action in terms of its disciplinary code and procedure against employees who repeatedly or intentionally fail to follow its Code.

## 12. HEALTH, SAFETY AND ENVIRONMENTAL ISSUES

The ARC is committed to providing a safe working environment for all its employees and ensuring the safety of visitors, clients, interested parties, and communities both inside and outside its premises that internal processes and activities might impact.

The ARC's Social and Ethics Committee assists Council to monitor the effectiveness of the OHSE programme and provides support in the prioritisation of aspects needing urgent attention.

Section 8 of the Occupational Health and Safety Act (OHSA), 1983 (Act No. 85 of 1993) stipulates that every employer shall provide and maintain as far as reasonably practicable a safe working environment without risk to the health of his employees. It further specifies that the employer shall establish all hazards attached to the workplace and take preventive measures to protect employees' health and safety.

A Safety, Health and Environment service provider was successfully appointed to assess the current OHSE Programme throughout the ARC. The assessment aimed to identify aspects where improvement is required, review if there are any structural improvements needed as well as confirm which existing approaches are worth maintaining for sustained compliance.

During the 2022/23 FY, the OHSE team facilitated the formal appointment of the section 16 (2)'s to provide continued support to the CEO on matters relating to the health and safety of employees. In addition to this, campus specific health and safety representatives were appointed to maintain the safety culture at the “operations” level, whilst providing the platform for employees to receive awareness and report occupational health and safety concerns.

Occupational injuries as well as occupational diseases have drastically reduced due to continued observation, training interventions and compliance monitoring by the OHSE team.

To maintain proper environmental management, the ARC's compliance section has been involved in continuous site visits across the country, to familiarise with site activities, report on observations and advise on actions required to meet best practice and compliance.

Continued site-specific support across the ARC campuses and research farms is being provided with the goal of communicating local, provincial, and national compliance obligations, as guided by the type of research activities conducted.

## 13. COMPANY SECRETARY

The Company Secretary provides guidance and advise to Council regarding its duties, responsibilities, powers and matters of procedure in terms of the Board Charter, terms of reference, principles of good ethics, good governance, and best practices. Furthermore, assists Council and its subcommittees with interpretation of applicable legislation relevant to or affecting the organisation and implications for non-compliance with such applicable statutory requirements. The Company Secretary monitors compliance to execution of duties in line with the delegation of authorities and plays a key role in preparing the reports for the Annual Report and ensuring that relevant deadlines and appropriate statutory disclosures are met.

## 14. SOCIAL RESPONSIBILITY

The ARC continues to play a pivotal role in the agricultural sector by providing scientific solutions to agricultural and related challenges in the food security, nutrition and safety realm. Agriculture is one of the key drivers in the National Development Plan; one of the largest employers in the country and has enormous potential for being a solutions provider and an alleviator of the social, economic and environmental challenges humanity is currently faced with. Agriculture was declared one of the essential services at the height of the Covid-19 pandemic and subsequently outperformed many industries. It is against this backdrop that the ARC endeavours to continuously assert itself as the ultimate strategic and premier institution that provides efficient and effective solutions for South Africa and the African continent.

As World Food Day was celebrated across the globe on 16 October 2022 to commemorate the date of the founding of the FAO in 1945 and in support of the plight of millions of people worldwide who cannot put a decent meal on the table, the ARC played its part by embarking on a "King of the Mountain" challenge in an effort to raise funds and increase awareness about food insecurity issues experienced by many around the world. Colleagues from all ARC campuses heeded the call to collect non-perishable food items which were to be donated to a charity of choice at the end of the challenge. ARC colleagues were encouraged to make their contributions daily for a month and the response was commendable. However, like all challenges there could only be one winner. ARC-SG emerged as the campus with the highest food mountain and was consequently declared the King of the Mountain 2022/23. In line with the rules of the challenge, the rest of the items collected by other ARC campuses were handed over to ARC-SG for distribution to their chosen non-profit organisation. Two charity organisations namely, Charlotte Theron in Bethlehem and Ithuseng Centre for the Disabled in Clarens, were chosen by ARC-SG as recipients of the “food mountains”. The handover ceremonies was attended and welcomed by the management of both charities, respectively.

To ensure that more CSI projects are undertaken, the ARC Council is considering the establishment of a Social & Ethics Committee.





## 15. AUDIT AND RISK COMMITTEE REPORT

We are pleased to present the report of the Audit and Risk Committee for the financial year ended 31 March 2023.

### Audit & Risk Committee Responsibility

The Audit & Risk Committee has complied with its responsibilities arising from Section 51(1)(a)(ii) of the Public Finance Management Act (PFMA) and the National Treasury Regulation 27.1. The Audit & Risk Committee also reports that it has adopted appropriate formal terms of reference as its Audit & Risk Committee Charter; has regulated its affairs in compliance with this charter and has discharged all its responsibilities as contained therein.

The charter is updated regularly and complies with the requirements of the PFMA, read together with the National Treasury Regulations and the principles of good governance. The Committee is accountable to the Council and performs an oversight function over:

- Financial management;
- Financial and performance reporting practices;
- Internal controls and risk management processes;
- Internal Audit function;
- External Audit process;
- Compliance with laws, regulations, and ethical conduct; and
- ICT governance.

The Audit Committee consists of the five (5) external members and two (2) members of Council listed hereunder and is required to meet at least four times per annum as per the provisions of the PFMA. In terms of the approved Audit and Risk Committee Charter, four (4) meetings were held during the current year to consider the Quarterly Performance Reporting (financial and non-financial), internal audit reports, risk management reports and other Compliance reports. Three (3) special meetings were held to consider the Annual Financial Statements and the Auditor-General of South Africa's (AGSA) audit reports.

The attendance of meetings by the members of the Audit and Risk Committee were as follows:

Name	Internal / external	No. of Meetings attended
Ms. Khulekelwe Masaccha Mbonambi (Chairperson) - #	External	4 (Four) meetings - 2 Special Meetings and 2 Quarterly Meetings
Dr. Kobus Laubscher (Deputy Chairperson)	External	7 (Seven) meetings - 3 Special Meetings and 4 Quarterly Meetings
Mr. Vishnu Naicker - #	External	6 (Six) meetings - 2 Special meetings and 4 Quarterly Meetings
Prof. Nic Olivier	Internal	7 (Seven) meetings - 3 Special Meetings and 4 Quarterly Meetings
Dr. Monodowafa Mashaba	Internal	7 (Seven) meetings - 3 Special Meetings and 4 Quarterly Meetings
Ms. Brigitte Schutte	External	5 (Five) meetings - 2 Special Meetings and 3 Quarterly Meetings
Ms. Tshidi Mokgabudi	External	5 (Five) meetings - 2 Special Meetings and 3 Quarterly Meetings

# Mr. Vishnu Naicker was the Chairperson of the Committee for the duration of the financial year under review.

Ms. Khulekelwe Mbonambi was appointed as the Chairperson of the Committee effective 01 April 2023.

The Chief Executive Officer, Chief Audit Manager, Chief Financial Officer and the relevant senior management, attended all meetings that were held during the course of the financial year.

### The Effectiveness of Internal Control

The system of internal controls within the ARC is designed to provide reasonable assurance that the assets are safeguarded and that liabilities and working capital are properly managed in line with the PFMA. This is achieved by means of a risk-based internal audit plan, where the internal audit function provides the Committee and management with assurance that the internal controls are appropriate and effective in mitigating the risks. The Committee monitors the implementation of corrective actions, whilst management retains the responsibility for implementing such recommendations as per the National Treasury Regulations.

From the Committee's review of the Internal Audit reports presented during the FY2022/23 and the outcome of the AGSA audit process, it can be concluded that the system of internal control as applied over financial and non-financial matters, enterprise risk management and in compliance with laws and regulations, is improving.

Notwithstanding the areas of improvement noted during the year under review, more improvements are required within the area of asset management, other areas of financial reporting and compliance with laws and regulations, especially compliance with the supply chain management prescripts. Improvements are also required in ICT security controls, both in terms of application and network.

The Committee reviewed and approved the internal audit charter for the year under review. The Committee reviewed and approved the three-year rolling plan, including the annual internal audit plan for the FY2022/23. The approved FY2022/23 internal audit plan consisted of Seventeen (17) planned audit reviews, and sixteen (16) of these audit reviews were completed by 31 March 2023.

The Committee is satisfied that the internal audit function has properly discharged its functions and responsibilities during the year under review.

### **In-Year Quarterly Reports**

The Committee is satisfied that the ARC has established appropriate financial reporting procedures for quarterly reporting. Some improvements were noted in the quality of the quarterly reports submitted to the Executive Authority and this continues to be an area of focus for the Committee.

### **Evaluation of Financial Statements**

The Committee has performed a high-level review of the FY2022/23 unaudited financial statements with due consideration of the independent assurance provided by Internal Audit as well as the assurance provided by Management. The Committee also reviewed the unaudited information on predetermined objectives with due consideration of the independent assurance provided by Internal Audit as well as the assurance provided by Management.

The Committee also reviewed the AGSA's audit and management reports post the audit process, with due consideration of the responses provided by Management. This included the review of the audited annual financial statements and reviewed annual performance report to be included in the annual report.

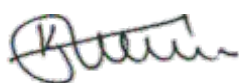
### **External Auditor's Report**

The Committee has reviewed the progress made by Management in the implementation plan of the external audit issues raised in the prior year, and the progress made is acknowledged. However, based on the interaction with the Management, reports of internal audit and the AGSA, some matters were not been adequately addressed. To effectively address and prevent repeat audit outcomes, the Committee has implored Management to treat this as a high priority area in FY2023/24, and the Committee will closely monitor the implementation of the action plan.

The Committee met with the AGSA to ensure that there are no unresolved issues that emanated from the regulatory audit. The Committee concurs and accepts the conclusions of the AGSA on the Annual Financial Statements, the Annual Performance Report, and the report on compliance with laws and regulations, and believes that the audited Annual Financial Statements and other reports must be accepted and read together with the report of the AGSA.

### **Appreciation**

The Committee wishes to acknowledge the work performed by the Chief Executive Officer, Management and Officials of the ARC. The Committee wishes to express its appreciation to Management, the AGSA and the Internal Audit Unit for the co-operation and information they have provided to enable the Committee to discharge its responsibilities.



Ms. Masaccha Khulekelwe Mbonambi  
Chairperson of the Audit and Risk Committee  
Agricultural Research Commission  
31 August 2023

## 16. B-BBEE COMPLIANCE PERFORMANCE INFORMATION

The following table has been completed in accordance with the compliance to the BBBEE requirements of the BBBEE Act of 2013 and as determined by the Department of Trade, Industry and Competition.

Has the Department / Public Entity applied any relevant Code of Good Practice (B-BBEE Certificate Levels 1 – 8) with regard to the following:		
Criteria	Reponse Yes / No	Discussion <i>(include a discussion on your response and indicate what measures have been taken to comply)</i>
Determining qualification criteria for the issuing of licences, concessions or other authorisations in respect of economic activity in terms of any law?	N/A	N/A
Developing and implementing a preferential procurement policy?	Yes	The ARC has issued a Circular implementing the new Preferential Procurement Regulations 2022 through the approval of specific objectives in line with the PPPFA.
Determining qualification criteria for the sale of state-owned enterprises?	No	ARC has not engaged in the sale of state-owned enterprises. Not applicable
Developing criteria for entering into partnerships with the private sector?	Yes	Partnering with the private sector through the procurement process. Evaluation criteria are set for the tendering process.
Determining criteria for the awarding of incentives, grants and investment schemes in support of Broad Based Black Economic Empowerment?	No	ARC has not engaged in the awarding of incentives, grants and investment schemes in support of BBBEE

# PART D:

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# PART D:

## HUMAN CAPITAL MANAGEMENT

### 1. OVERVIEW OF HUMAN CAPITAL MANAGEMENT

The ARC is pivotal in ensuring food security in the Republic. This is not only a thing we speak of but is something real brought to you by the competent talent bred in the ARC. The ARC acknowledges that human capital remains its key driving force for the successes and accolades it continues to receive in the industry and from the public. During the year under review, the ARC, through the initiatives driven by the HCM Division, was recognised as a #TopEmployer2023. The Top Employer certification is awarded to employers that nurture and develop talent across all organisational levels, striving to enhance employee experience, employment conditions, and practices. The ARC is very proud to have been amongst other global companies whose practices were assessed, audited, and found to be above board and worthy of recognition.

*Building on the success of the 2021/2022 financial year, the Human Capital continued to*

1. Improve its recruitment turnaround time
2. Improve well-being service offering
3. Increase investment in training and development
4. Partner with other stakeholders to train and build a talent pipeline through our Professional Development Programme
5. Improve the relationship with organised labour

### 2. THE HUMAN CAPITAL MANAGEMENT FUNCTIONS

The HCM Portfolio is organised into five main domains, viz.



**Employee Relations**



**Employee Wellness**



**Human Capital and Organisational Development**



**Talent and Performance Management**



**Human Capital Management Information Systems**

#### 2.1 EMPLOYMENT RELATIONS & EMPLOYEE WELLNESS

The Human Capital Management Division strives for a fruitful and conducive working environment within the ARC. This is done through collaborative employee relations between management and organised labour, building positive and strong relationships with employees.

In the year under review, the ARC renegotiated its partnership with its wellness provider to ensure that employees continue to receive high-level and personalised well-being services for themselves and their immediate family members. These services include various wellness interventions, e.g., emotional well-being, financial well-being, legal advice, job performance counselling, etc.

## 2.2 TALENT AND PERFORMANCE MANAGEMENT

Talent management is critical to ensure that people with the right skills are attracted and retained in the organisation. The ARC values accountability and has introduced performance management in its structures to ensure the ARC meets its goals, employees are accountable and rewarded for their performance. The HCM provided continuous training on compiling performance development agreements and performance development evaluations to ensure alignment with the organisation strategy. The ARC follows a three-fold performance cycle depicted below, which is done within set timelines that the employees must abide by.



## 2.3 POLICY DEVELOPMENT

Policies in ARC serve as a cornerstone in reinforcing and clarifying the expected conformance standards from employees. They further provide structure, control, and consistency in applying standards in the workplace. In the year under review, the following policies were extensively consulted on and negotiated between the ARC and Organised Labour:

- The grievance handling procedure
- Performance management policy
- Employee wellness policy
- Workplace harassment policy
- HIV/AIDS Policy
- Subsistence and Travel Policy
- Internal Transfer & Relocation Policy
- Recruitment and Selection Policy

## 2.4 HIGHLIGHTS OF ACHIEVEMENTS DURING THE FINANCIAL YEAR UNDER REVIEW

The ARC continues to be a trendsetter in the research and development space. Ensuring food security in the Republic is the ARC's main focal priority; therefore, it continues to hire specialist talent to fulfil its mandate.

*The following are the highlights for the year under review:*

1. Being recognised as #TopEmployer 2023.
2. Appointment of the new CEO in the beginning of the financial year.
3. Continued partnerships with other funding agencies for the Professional Development Programme (AgriSETA, DSI, NRF, WRC, DALRRD).
4. Intensified employee development
5. Improved relations with organised labour

## 2.5 CHALLENGES FACED BY THE PUBLIC ENTITY

- Increasing labour costs vs revenue
- Decreasing staff morale caused by current economic conditions;
- Managed and unmanaged exits (resignations and retirement of critical staff)
- Scientific skills demand versus availability
- Building productive workplace relations
- Managing the changing world of work

## 2.6 FUTURE HCM PLANS /GOALS

In keeping up with the #TopEmployer Brand, the Human Capital Management Division partnered with the Information, Communication and Technology Division to introduce world-class automated human capital solutions, which includes:

- Online recruitment process
  - Online Learning Management System
  - Online Performance Management

Other Human Capital Management initiatives include:

- Talent management and development – with a specific focus on succession planning
- Agile recruitment – improving the turnaround time to recruit new employees
- Next generation talent pipeline development – with a specific focus on the Professional Development Programme and Graduate Development Programme
- Next generation talent pipeline development – with a specific focus on the Professional Development Programme and Graduate Development Programme
- Building a high-performance culture with innovative workforce innovations.
- Creating an enabling workplace environment with right people, policies, systems and procedures.
- Deploying modernised human capital administrative process across the human capital function
- Ensuring a fit for purpose organisational structure

## 3. HUMAN CAPITAL MANAGEMENT OVERSIGHT STATISTICS

### 3.1 PERSONNEL COST BY BUSINESS DIVISION

(All payrolls including Students for the period 01 April 2022 to 31 March 2023)

BUSINESS DIVISION/FOCUS	PERSONNEL EXPENDITURE (R'000)	NO. OF EMPLOYEES	AVERAGE PERSONNEL COST PER EMPLOYEE (R'000)
<b>Crop Sciences</b>	280 011	1603	174
<b>Animal Sciences – including BTP</b>	183 514	541	339
<b>Natural Resources and Agricultural Engineering</b>	56 443	269	209
<b>Impact and Partnerships</b>	13 776	19	725
<b>Support (HR, Finance, ICT)</b>	194 302	461	421
<b>Professional Development Programme (PG Funded)</b>	20 991	295	71
<b>Independent Contractors</b>	4 211	35	120
<b>Council</b>	4 105	17	241
<b>TOTAL</b>	<b>757 358</b>	<b>3240</b>	<b>233</b>

**Explanatory note:**

The personnel numbers and expenditures reflected in section 3.1 and 3.2 include employees' total remuneration package (salaries and wages) (active and terminated) from 1 April 2022 to 31 March 2023. These are inclusive of pension/provident fund employer contributions, medical aid employer contributions, car allowance, deferred compensation as well as other additional salary employee-related costs (e.g., long service awards, overtime remuneration, performance bonuses, and ex-gratia payments) processed through the ARC payroll system. This amount excludes training, recruitment expenses, post-employment medical benefits, membership fees, etc. as outlined in the Annual Financial Statements on page 226).

**Core Business Divisions:** Include core staff namely Researchers, Specialist Researchers, Research Team Managers, Senior Managers Research, Research Technicians and Research Support staff being Research Support, Labourers, Artisans, Farm Personnel, Trucks & Tractors Drivers

**Support Staff:** Include all employees in Human Capital Management, Finance, Information, Communication, Technology and Infrastructure, Risk Divisions, Admin Support, Secretaries, Librarians, Public Relations, Messengers, Drivers, and the Office of the CEO.

## 3.2 PERSONNEL COST BY OCCUPATIONAL LEVEL

(All payrolls, including Students for the period 1 April 2022 to 31 March 2023)

OCCUPATIONAL LEVEL	PERSONNEL EXPENDITURE (R'000)	% OF PERSONNEL EXP. TO TOTAL PERSONNEL COST (R'000)	NO. OF EMPLOYEES	AVERAGE PERSONNEL COST PER EMPLOYEE (R'000)
Top Management (GG17 to GG19)	11 438	1,51%	5	2 287
Senior Management (GG14 to GG16)	32 964	4,35%	29	1 136
Professional qualified (GG11 to GG13)	298 040	39,35%	467	638
Skilled (GG8 to GG10)	209 019	27,60%	600	348
Semi-skilled (GG5 to GG7)	84 835	11,20%	396	214
Unskilled (GG3 to GG4)	71 751	12,11%	1396	65
Professional Development Programme (PG Funded)	20 991	2,77%	295	71
Independent Contractors	4 211	0,56%	35	120
Council	4 105	0,55%	17	241
<b>TOTAL</b>	<b>757 358</b>	<b>100%</b>	<b>3240</b>	<b>233</b>

**Core Business Divisions:** Include core staff namely Researchers, Specialist Researchers, Research Team Managers, Senior Managers Research, Research Technicians and Research Support staff being Research Support, Labourers, Artisans, Farm Personnel, Truck & Tractors Drivers

**Support Staff:** Include all corporate support being HR, Finance, ICT, Facilities, Risk, Admin Support, Secretaries, Librarians, Public Relations, Messengers, Drivers and Office of the CEO.



### 3.3 PERFORMANCE REWARDS

During the financial year under review, the ARC had set aside funding for performance bonuses to qualifying employees; payments were dispersed as per the table below:

OCCUPATIONAL LEVEL	PERFORMANCE REWARDS	PERSONNEL EXPENDITURE (R'000)	% OF PERFORMANCE REWARDS TO TOTAL PERSONNEL COST (R'000)
Top Management	3	243	1%
Senior Management	20	958	5%
Professional qualified	380	8 080	40%
Skilled	504	5 809	29%
Semi-skilled	370	2 678	13%
Unskilled	585	2 361	12%
<b>TOTAL</b>	<b>1 862</b>	<b>20 129</b>	<b>100%</b>

#### Reasons for variance from FS:

The Payment of the Performance Bonuses excludes the ex-gratia and service bonus which is reflected in the AFS.

TRAINING COSTS					
Type of Training	Training Expenditure (R'000)	Personnel Expenditure (R'000)	Training Expenditure as a % of Personnel Cost	No of the Employees Trained	Average Training cost per employee (R'000)
Formal and Informal Training	5 882	757 358	1%	222	26.50

Personnel Training: Formal - R3 329 518.27

Personnel Training: Informal - R 2 552 66100

#### Reasons for variance from FS:

The personnel numbers and expenditures reflected above include employees' total remuneration package (salaries and wages) (active and terminated) from 1 April 2022 to 31 March 2023. These are inclusive of pension/provident fund employer contributions, medical aid employer contributions, car allowance, deferred compensation as well as other additional salary employee-related costs (e.g., long service awards, overtime remuneration, performance bonuses, and ex-gratia payments. This amount excludes training, recruitment expenses, post-employment medical benefits, membership fees, etc. as outlined in the Annual Financial Statements on page 225).

The total Avg training cost per employee is the Training expenditure divided by the Number of employees trained.

### 3.4 EMPLOYMENT AND VACANCIES

The ARC currently has 271 vacancies, and the vacancy rate is 12.2%

BUSINESS DIVISION/ FOCUS	NO. OF PERMANENT EMPLOYEES AT THE BEGINNING OF THE PERIOD (01/04/2022)	2022/2023 APPROVED POSTS	2022/2023: NUMBER OF PERMANENT EMPLOYEES ON 31/03/2023	2022/2023 VACANCIES - 31 MARCH 2023	% OF VACANCIES
Crop Sciences	968	1086	939	147	13.5%
Animal Sciences – including BTP	488	540	479	61	11.3%
Natural Resources and Agricultural Engineering	106	114	107	7	6.1%
Impact and Partnerships	18	22	20	2	9.1%
Support (HR, Finance, ICT)	400	465	411	54	11.6%
<b>TOTAL</b>	<b>1980</b>	<b>2227</b>	<b>1956</b>	<b>271</b>	<b>12.2%</b>

**Core Business Divisions:** Include core staff namely Researchers, Specialist Researchers, Research Team Managers, Senior Managers Research, Research Technicians and Research Support staff being Research Support, Labourers, Artisans, Farm Personnel, Truck & Tractors Drivers

**Support Staff:** Include all corporate support being HR, Finance, ICT, Facilities, Risk, Admin Support, Secretaries, Librarians, Public Relations, Messengers, Drivers and Office of the CEO.

OCCUPATIONAL LEVEL	NO. OF PERMANENT EMPLOYEES AT THE BEGINNING OF THE PERIOD (01/04/2022)	2022/2023 APPROVED POSTS	2022/2023: NUMBER OF PERMANENT EMPLOYEES ON 31/03/2023	2022/2023 VACANCIES - 31 MARCH 2023	% OF VACANCIES
Top Management (GG17 to GG19)	4	7	5	2	28.6%
Senior Management (GG14 to GG16)	23	26	23	3	11.5%
Professional qualified (GG11 - GG13)	408	503	416	87	17.3%
Skilled (GG8 - GG10)	529	595	532	63	10.6%
Semi-skilled (GG5 - GG7)	353	389	352	37	9.5%
Unskilled (GG3 - GG4)	663	707	628	79	11.2%
<b>TOTAL</b>	<b>1980</b>	<b>2227</b>	<b>1956</b>	<b>271</b>	<b>12.2%</b>

### 3.5 EMPLOYMENT CHANGES

The following table shows the number of employees per Occupational Level . The number of employees decreased from 1 980 on 1 April 2022 to 1 956 on 31 March 2023.

OCCUPATIONAL LEVEL	PERMANENT EMPLOYMENT AT THE BEGINNING OF THE FINANCIAL YEAR (01 APRIL 2022)	PERMANENT EMPLOYMENT AT THE END OF THE FINANCIAL YEAR (31 MARCH 2023)
Top Management (GG17 to GG19)	4	5
Senior Management (GG14 to GG16)	23	23
Professionally qualified (GG11 to GG13)	408	416
Skilled (GG8 to GG10)	529	532
Semi-skilled (GG5 to GG7)	353	352
Unskilled (GG3 to GG4)	663	628
<b>TOTAL (Permanent staff)</b>	<b>1 980</b>	<b>1 956</b>

This was as a result of terminations of 155 employees during the financial year under review, on the same period, the ARC made a total of 131 new appointments. The Table below depicts the employee movements per ARC occupational groupings:

ARC OCCUPATIONAL GROUPING	PERMANENT EMPLOYMENT AT THE BEGINNING OF THE FINANCIAL YEAR (01 APRIL 2022)	APPOINTMENTS (PERMANENT STAFF)	TERMINATIONS (PERMANENT STAFF)	PERMANENT EMPLOYMENT AT THE END OF THE FINANCIAL YEAR (31 MARCH 2023)
Executive Management	4	1	0	5
Senior Management (Core)	13	0	1	12
Researchers / Specialist Researchers & RTM's	277	26	36	267
Research Technicians	297	26	18	305
Research Support including Artisans & Farm Personnel	363	9	26	346
Support Groupings	453	41	39	455
Labourers	573	28	35	566
<b>TOTAL (Permanent staff)</b>	<b>1 980</b>	<b>131</b>	<b>155</b>	<b>1 956</b>

### 3.6 REASONS FOR STAFF LEAVING (PERMANENT STAFF)

REASON	NUMBER	% OF TOTAL NO. OF STAFF LEAVING
Death	12	7.44%
Resignation	64	41.29%
Dismissal	15	9.68%
Retirement	54	34.84%
Ill health	6	3.87%
Expiry of contract	0	0%
Other	4	2.58%
<b>TOTAL</b>	<b>155</b>	<b>100%</b>

### 3.7 EMPLOYEE RELATIONS: MISCONDUCT AND DISCIPLINARY ACTION

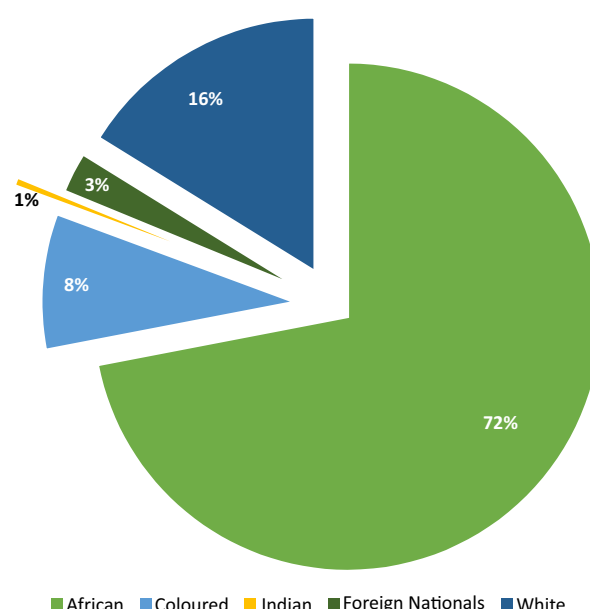
The table provides the number of warnings and dismissals as of 31 March 2023.

NATURE OF DISCIPLINARY ACTION	NUMBER
Warnings	41
Dismissal	12

### 3.8 EMPLOYMENT EQUITY STATUS

The Employment Equity Plan for the ARC was approved in 2021 and will be coming to an end in September 2023. The total headcount, as reported above, was 1 956. Foreign Nationals across all occupational levels account for 3% of the total workforce, while South Africans account for 97% of the total workforce. The total female representation in the ARC was at 46% of the total workforce by the end of the financial year under review. The chart below illustrates the ARC employment equity profile as of 31 March 2023, per race.

The nature of the work done in ARC limits the organisation to attracting employees living with disabilities; as of 31 March 2023, the ARC had on its books 0.41% (8 employees out of 1 956). Efforts are to be put in place in the next employment equity plan on how to attract employees with disabilities.





### 3.9 PROFESSIONAL DEVELOPMENT PROGRAMME (PDP)

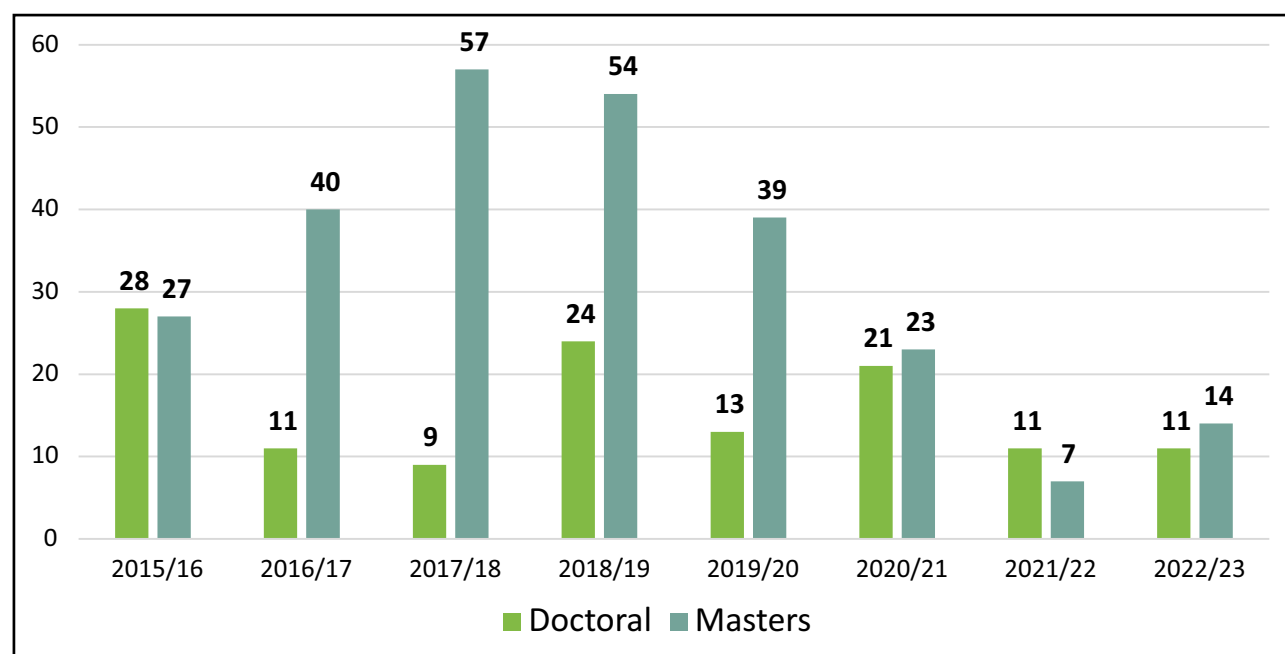
ARC launched the Professional Development Programme (PDP) in 1996 with the purpose of attracting young graduates from previously disadvantaged communities in South Africa into the agricultural sciences and research careers. The graduates are exposed to real-life learning and development opportunities where they are paired with an experienced academic and/or workplace supervisor.

Below is a summary of the eleven-year period of enrolment into the PDP.

PROGRAMME	2011 /12	2012 /13	2013 /14	2014 /15	2015 /16	2016 /17	2017 /18	2018 /19	2019 /20	2020 /21	2021 /22	2022 /23
<b>Post-Doc</b>	3	5	15	16	21	19	14	16	15	11	13	13
<b>Doctoral</b>	21	33	54	70	84	117	121	117	97	82	99	78
<b>Masters</b>	27	56	130	191	149	170	102	63	38	24	91	62
<b>TOTAL</b>	<b>51</b>	<b>94</b>	<b>199</b>	<b>277</b>	<b>254</b>	<b>306</b>	<b>237</b>	<b>196</b>	<b>150</b>	<b>117</b>	<b>203</b>	<b>153</b>

The table above outlines the number of students enrolled in the programme in the past eleven years in the three categories of the programme. The ARC Management took a decision to reduce the reliance of the PDP on Parliamentary Grant funding and approached various funding agencies to sponsor the programme, which came with different funding modalities than the one ARC applied. This led to students being transferred to other grants.

The chart below depicts students that graduated in the past eight financial years.





## PART E:

# *PFMA COMPLIANCE REPORT*

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# PART E:

## PFMA COMPLIANCE REPORT

### 1. INTRODUCTION

This section provides guidance on the information to be included in the annual report guide relating to PFMA compliance requirements.

### 2. FRUITLESS AND WASTEFUL EXPENDITURE INTRODUCTION

#### 2.1 Reconciliation of fruitless and wasteful expenditure

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Opening balance	87	90
Add: Fruitless and wasteful expenditure confirmed	36	375
Less: Fruitless and wasteful expenditure written off	(83)	(359)
Less: Fruitless and wasteful expenditure recoverable	(3)	(19)
Closing balance	37	87

#### Reconciling notes

DESCRIPTION	2022/2023	2021/2022 <sup>4</sup>
	R'000	R'000
Fruitless and wasteful expenditure for the current year	36	250
<b>TOTAL</b>	<b>36</b>	<b>250</b>

#### 2.1 Details of current and previous year fruitless and wasteful expenditure (under assessment, determination, and investigation)

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Fruitless and wasteful expenditure under assessment	–	–
Fruitless and wasteful expenditure under determination	–	–
Fruitless and wasteful expenditure under investigation	37	87
<b>TOTAL</b>	<b>37</b>	<b>87</b>

## 2.2 Details of current and previous year fruitless and wasteful expenditure recovered

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Fruitless and wasteful expenditure under recovered	3	19
<b>TOTAL</b>	<b>3</b>	<b>19</b>

## 2.3 Details of current and previous year fruitless and wasteful expenditure not recovered and written off

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Fruitless and wasteful expenditure written off	83	359
<b>TOTAL</b>	<b>83</b>	<b>359</b>

## 2.4 Details of current and previous year disciplinary or criminal steps taken as a result of fruitless and wasteful expenditure

DISCIPLINARY STEPS TAKEN
During the current year, the investigations were finalised on some of the fruitless and wasteful expenditures incurred during current and prior years resulting in a recovery of R2 569 and the condonation of R83 237.

# 3. IRREGULAR EXPENDITURE

## 3.1 Reconciliation of irregular expenditure

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Opening balance	746 949	532 132
Prior period errors	-	188 495
	35 268	720 627
Add: Irregular expenditure confirmed	0	26 898
Less: Irregular expenditure condoned	0	0
Less: Irregular expenditure not condoned and removed	688 486	0
Less: Irregular expenditure recovered	0	25
Less: Irregular expenditure not recovered and written off	0	551
Closing balance	<b>93 731</b>	<b>746 949</b>

## Reconciling notes

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Irregular expenditure that was under assessment in 2021/22	-	280
Irregular expenditure that relates to 2021/22 and identified in 2022/23	-	1 479
Irregular expenditure for the current year	-	25 139
<b>TOTAL</b>	<b>-</b>	<b>26 898</b>



### 3.2. Details of current and previous year irregular expenditure (under assessment, determination, and investigation)

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Irregular expenditure under assessment	0	532 132
Irregular expenditure under determination	0	-
Irregular expenditure under investigation	102 495	3 934
<b>TOTAL</b>	<b>102 495</b>	<b>536 066</b>

Irregular expenditure as defined in section 1 of the PFMA is expenditure other than unauthorised expenditure, incurred in contravention of or that is not in accordance with a requirement of any applicable legislation, including -

(a) this Act;

(b) the State Tender Board Act, 1968 (Act No. 86 of 1968), or any regulations made in terms of the Act; or

(c) any provincial legislation providing for procurement procedures in that provincial government.

Irregular expenditure that was incurred and identified during the current financial is due to payments made in contravention of the supply chain management requirements, which resulted in irregular expenditure of R 7 442 451.31

### 3.3 Details of current and previous year irregular expenditure condoned

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Irregular expenditure condoned	0	0
<b>Total</b>	<b>0</b>	<b>0</b>

*None*

### 3.4 Details of current and previous year irregular expenditure removed - (not condoned)

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Irregular expenditure NOT condoned and removed	688 486	-
<b>Total</b>	<b>688 486</b>	<b>-</b>

*Irregular expenditure written off by Council include use of services while a contract has expired, deviations and emergency procurement not in line with SCM policy, contract variation exceeding 15% and deviations not submitted to National Treasury prior to approval by delegated authority.*

### 3.5 Details of current and previous year irregular expenditure recovered

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Irregular expenditure recovered	0	25
<b>Total</b>	<b>-</b>	<b>25</b>

*Irregular expenditure was recovered from one official of the entity.*

3.6 Details of current and previous year irregular expenditure written off (irrecoverable)

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Irregular expenditure written off	0	551
Total	-	551

*Additional disclosure relating to Inter-Institutional Arrangements*

3.7 Details of non-compliance cases where an institution is involved in an inter-institutional arrangement

DESCRIPTION
None

3.8 Details of non-compliance cases where an institution is involved in an inter-institutional arrangement

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
N/A	-	-
Total	-	-

3.9 Details of current and previous year disciplinary or criminal steps taken as a result of irregular expenditure

Disciplinary steps taken
N/A

Details of current and previous year disciplinary or criminal steps taken as a result of irregular expenditure

## 4. ADDITIONAL DISCLOSURE RELATING TO MATERIAL LOSSES IN TERMS OF PFMA SECTION 55(2)(B)(I)&(III))

### 4.1 Details of current and previous year material losses through criminal conduct

Material losses through criminal conduct	2022/2023	2021/2022
	R'000	R'000
Theft	-	-
Other material losses	-	-
Less: Recovered	-	-
Less: Not recovered and written off	-	-
Total	-	-

### 4.2 Details of other material losses

Nature of other material losses	2022/2023	2021/2022
	R'000	R'000
N/A	-	-
Total	-	-

### 4.3 Other material losses recovered

Nature of losses	2022/2023	2021/2022
	R'000	R'000
N/A	-	-
Total	-	-

### 4.4 Other material losses written off

Nature of losses	2022/2023	2021/2022
	R'000	R'000
N/A	-	-
Total	-	-

## 5. INFORMATION ON LATE AND / OR NON-PAYMENT OF SUPPLIERS

DESCRIPTION	2022/2023	2021/2022
	R'000	R'000
Valid invoices received	-	-
Invoices paid within 30 days or agreed period	-	-
Invoices paid after 30 days or agreed period	-	-
Invoices older than 30 days or agreed period (unpaid and without dispute)	-	-
Invoices older than 30 days or agreed period (unpaid and in dispute)	-	-

## 6. INFORMATION ON SUPPLY CHAIN MANAGEMENT

### Procurement by other means

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Ex Pos Facto submission for repair of Agilent HPLC ALS Unit	Chemetrix Eport ( Pty) Ltd	Emergency	9 561.86
Urgent Medical Care-Injured Bull	Private Vet	Emergency	3 983.53
Request for an emergency repair on an irrigation pump, Addo farm.	UNISA	Single source	8 925.00
Annual software maintenance renewal of ArcGIS & ENVI specialised software products from ESRI	Chemetrix	Sole Supplier	75 984.89
To procure service and repair services for Snijders Labs and SP Scientific equipment from United Scientific as a sole supplier as per Section 33 of the SCM policy on sole supplier selection.	United Scientific (Pty) Ltd	Sole supplier	15 141.28
Annual software maintenance renewal of I-Plant Nutrition Limited specialised software products from ESRI	ESRI South Africa (Pty) Ltd	Sole Supplier	641 142.83
Annual Service of ICPE-9820	Shimadzu	Sole Supplier	17 674.62
Repairs to Laboratory Chillers	Ginger Brown (Pty) Ltd	Sole Supplier	11 706.00
Rabies DFA Reagent, CHM-LIGH 5100 (5m1) - Rabies DFA Reagent	Davies Davies Diagnostics (Pty) Ltd	Sole Supplier	292 015.00
Food Proficiency testing	National Laboratory Association of SA	Single Source	25 222.95
Deviation to procure GAS	AIR LIQUIDE	Single source	227 346.32
Request for an emergency repair on an irrigation pump, Addo farm.	Idexx Laboratories	Sole supplier	40 803.01
Research Consumables	Life Technologies	Sole Source	182 073.87
Reagents and research consumables	Separations Scientific	Single source	60 421.86
Service the Immunospot®	CTL	Sole Supplier	263 534.54
MACSQuant Service and training	BIOCOM Africa (Pty) Ltd	Sole Supplier	99 522.18
To deviate from the SCM policy by procuring a torch and orifice for ICP 9000/9800 model from Shimadzu South Africa (Pty) Ltd as authorised distributor.	Shimadzu South Africa (Pty) Ltd	Single source	16 926.71
TAD Switch Gear	Lermat Construction and Projects	Emergency repair	895 601.60
To procure Sanger sequencing services from Inqaba Biotechnical Industries as a sole supplier as per Section 33 of the SCM policy on sole supplier selection.	Inqaba Biotechnical Industries (Pty) Ltd	Single source	23 000.00 11 500.00 11 500.00
Request for an emergency repair on an irrigation pump, Addo farm.	Expert Tech Engineering and Maintenance	Emergency	7 822.30



PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Request for an emergency repair on an irrigation pump, Addo farm.	Mbele Electrical	Emergency	32 801.70
Deviation request to approve emergency procurment repairs at Small Grain by the Chief Executive Officer	Free State Transformers	Emergency	35 190.00
Request to deviate from the ARC SCM policy to pay article processing charge to Agronomy MDPI for an accepted scientific research paper	MDPI	Single Source	32 145.80
Electrical Work	Mzansi Steam on Call	Emergency	21 666.00
Annual software maintenance renewal of ArcGIS & ENVI speacalised software products from ESRI	Esri South Africa	Sole Supplier	52 374.45
Request for an emergency repair on an irrigation pump, Addo farm.	Cherry Irrigation	Emergency	67 746.26
Request for an emergency repair on an irrigation pump, Addo farm.	Denver Agricultural Tractors	Single Source	30 000.00
Deviation request to deviate from SCM policy to get approval by the Senior Manager for the payment of emeregency repairs of ultra freezer done at Grain Crops	United Scietific	Emergency	3 996.25
Elisa Consumables	BIOCOM Africa (Pty) Ltd	Single source	494 975.82
Service and repair of compressors	DUP Air	Single source	42 088.67
IFAT Test	BIOCOM Africa (Pty) Ltd	Single source	79 360.63
To use of Plantovita testing laboratory as the sole service provider for testing of sampled in-vitro potato plant and tubers: Microsep and Separations as single source suppliers for the service of Direct Pure Water System repair/service of ovens.	Plantovita, Microsep and Separations	Sole supplier and Single sources	1037.30 9 888.95 8 462.85
The ugrade of the Eltek Darca Temperature logger system	Monitoring & Control Laboratories	Sole Supplier	72 186.65
Test Kits and Reagents	Institute of Tropical Medicine	Sole supplier	128 417.62
Laboratory products	BIOMERIEUX	Sole Supplier	29 589.65
Request for an urgent repair to the water pump at the water reservoir, Addo farm.	Askyl Trading	Emergency	7 500.00
To request the approval of the SM: SCM to allow for the payment of Article Processing Charges for an accepted manuscript in MDPI Cosmetics-Foreign exchange CHF 400	MDPI Cosmetics	Single source	6 664.24
Request for an urgent repair/ replacement of stolen power cables at Addo farm.	Zet Electrical	Emergency	7 807.35
Repair Beckman Coulter centrifuge and microfuge	AMS Laboratory Technologies Pty Ltd	Single source	16 147.54

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Annual Service of Flash 2000	Anatech Instruments	Sole Supplier	3 600.00
Part of the ICP-MS 7700	Chemetrix	Sole supplier	14 514.58
Kinetex columns	Promolab/Separations	Sole supplier	143 734.82
Elisa kits	AE Solutions	Sole Supplier	113 367.00
Annual software maintenance renewal of I-Plant Nutrition Limited specialised software products from ESRI	I-Plant Nutrition Limited	Sole supplier	3 708.00
Repairs of Hamilton -ML 600 Diluter	Promolab (Pty) Ltd T/A separation	Sole Supplier	34 222.05
Magnapure LC Service	Roche	Sole Supplier	25 834.59
Kits	AEC Amersham	Sole Supplier	138 802.70
Diagnostic Kits	LTC Tech SA	Sole Supplier	309 973.30
Kits	Inqaba Biotechnical	Sole Supplier	71 282.81
Repairs to Elga Chorus ICPL	Labotec Pty Ltd	Sole Supplier	11 081.98
Diagnostis Kits	Kat Laboratory Medical	Sole Supplier	204 700.00
Diagnostis Kits	The Scientific Group	Sole Supplier	61 475.55
Diagnostis Kits	Whitehead Scientific	Sole Supplier	215 166.63
Services	JGK Lab Afrika	Single source	58 270.50
Liquid Nitrogen	AIR LIQUIDE	Single source	390 465.34
Deviation Request to approve Emergency procurement repair at Grain Crops	Fridental & Wentzel CC	Emergency	5 882.25
To pay for membership fee to the American Society of Agronomy Crop Science Society of America	American Society of Agronomy Inc	Single source	2 730.00
Appoint 3F Scientific Authorised for maintenance, services and calibration spectrophotometer	3F SCIENTIC	Single source	5 920.00
Deviation to procure in route Diagnostics	Biocom Africa (Pty) Ltd	Sole supplier	79 360.63
Diagnostic Kits	LTC Tech SA	Sole supplier	288 652.30
Air conditioning repair	AIR RE PAIR	Single Source	12 443.58
Procurement of chemicals	Rhine Rhur	Sole Source	101 226.45
The submission requests that approval be granted to deviate from SCM policies to repair & replace damaged Eddy Covariance equipment at a farmer's site using Campbell Scientific Africa (Pty) Ltd, who is the sole supplier of such equipment and service in South Africa	Campbell Scientific Africa (Pty) Ltd	Sole Supplier	10 890.50
To appoint Carl Zeiss authorised for maintenance and service of Nikon NI U Microscope	Carl Zeiss	Single source	5 395.80
Diagnostic Kits	Reliable Diagnostic	Single Source	72 680.00
Repair of humidity temperature control	Air repair conditioning	Single Source	12 443.58

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Repairing and maintenance of Bio-Rad laboratory equipment	Lasec	Sole Supplier	59 871.95
Procurement of spares for the Dionex IC 1600	Anatech Instruments	Sole supplier	49 802.17
The submission seeks approval to deviate from normal SCM policies to extend the service of Berekishanang (Pty) Ltd in order to complete the renovation of two greenhouse plastic tunnels, PG Capex Funding	Berekishanang (Pty) Ltd	Single source	12 850.00
To use the Mpumalanga Agricultural show single supplier	Mpumalanga Agricultural Show	Single source	8 000.00
Deviation request acquire laboratory media, reagents, good and services	JGK LAB AFRICA(Pty)Ltd	Single Source	59 270.50
Deviation request to use Hanna Instruments	Hanna Instruments	Sole Source	9 082.70
SANAS Annual Accreditation Fee	South African National Accreditation System	Sole Source	33 878.00
Deviation request to use Metrohm	Metrohm	Sole Source	47 000.00
Request to deviate from the ARC SCM policy to use Koppert as Sole Suppliers for leucania loreyi pheromone lures	Koppert	Sole supplier	14 110.50
Repair electrical fault at Lutzville irrigation pump house a	Zero Sparks Electrical CC	Strip and Quote	52 900.00
Strip to quote 6904 repair D1 irrigation pump Robertson-INF	Breerivier Besproeiing Edms Bpk	Strip and Quote	45 277.80
To approve payment of emergency replacing of VIMP stolen electricity supply cable	Exquisitt Services & Trading	Emergency	42 537.55
Request for urgent repair to the irrigation water pump	Zet Electrical	Emergency	4 915.10
Chemicals for tissue culture	Merck life sciences	Single Source	14 422.15
Renewal of statistica software package	South African Analytics (Pty) Ltd	Sole supplier	19 722.50
Deviation request to deviate to get approval by the CEO to purchase universal SYBR GREEN SUPERMIX FROM LASEC the sole supplier	LASEC	Sole supplier	37 192.38
Payment for service of fume extraction	Vivid Air Cc	Sole Supplier	53 245.00
Renewal of CAB Direct subscription	Ebsco	Sole supplier	\$44 241.65
Renewal of EBSCO Discovery Service subscription	Ebsco	Sole supplier	\$25 948.60
Renewal of Science Direct (journals) database subscription	Elsevier	Sole supplier	\$154 481.82
Renewal of Science Direct (eBooks) database subscription	Elsevier	Sole supplier	\$34 941.57
Renewal of SACat; SA Citations; ReQuest & SabiCat database subscriptions	Sabinet	Sole supplier	340 500.05

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
SANLiC membership (2023) and service fees (2022)	SANLiC	Sole supplier	TBD
Renewal of Microbiology Society Journals subscription	Skylight	Sole supplier	431 986.72
Renewal of American Phytopathological Society Journals subscription	Skylight	Sole supplier	374 265.81
Renewal of American Meteorological Society Journals subscription	Skylight	Sole supplier	267 766.79
Renewal of Clarivate Analytics subscriptions (Citation Connect; CPCI; JCR; WoS)	WWIS	Sole supplier	490 047.94
Renewal of Incites subscription	WWIS	Sole supplier	292 226.95
Renewal of Annual Reviews subscription	WWIS	Sole supplier	198 233.71
Renewal of Science Online subscription	WWIS	Sole supplier	75 667.49
Reprints Desk document delivery service (March)	WWIS	Sole supplier	4 123.98
Reprints Desk document delivery service (April)	WWIS	Sole supplier	R14 984.35
Reprints Desk document delivery service (May)	WWIS	Sole supplier	R2 383.98
Reprints Desk document delivery service (June)	WWIS	Sole supplier	R3 741.33
Reprints Desk document delivery service (July)	WWIS	Sole supplier	R1 735.76
Reprints Desk document delivery service (August)	WWIS	Sole supplier	R1030.55
Reprints Desk document delivery service (September)	WWIS	Sole supplier	R1 104.79
Emergency 0811 VSD circuit breaker at Drostersnes - INF	ZZ Electrical	Emergency	50 220.04
Agilent products from Sole supplier	Diagnostech (Pty) Ltd	Sole supplier	25 803.70
Reagents and Consumables that were used in test method validation	Separation Scientifica SA (Pty)Ltd	Single source	90 660.29
Deviation procedure and use Cepheid, Sole Supplier whose Laboratory consumables /reagents were used in test method validation	Cepheid (Pty) Ltd	Sole supplier	38 194.26
Repairs to Lab Equipment	Lomaen Medical Pty Ltd	Sole Source	53 302.36
Electrical Work	Ori Electrical	Emergency	82 360.00
Campbell Scientific Africa (Pty) Ltd	Campbell Scientific Africa (Pty) Ltd	Sole Supplier	2 945 995.04
Deviation request to approve emergency procurement repairs at Small Grain by Senior Research Manager	JLAS Trading	Emergency	12 980.68



PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Request urgent replacement of stolen cables to SNS irrigation pump	Mngabe Trading	Emergency	5 499.70
Laboratory consumable and reagents	Idexx	Single Source	156 131.25
To use Scientific Group for urgent repair of QIAGEN Qiaxcel Advanced instrument in the molecular biology	The Scientific group	Sole supplier	6 631.20
Deviation request to approve emergency procurement repair at Grain Crops by the SCM Snr Manager	Down Town Electrical and Construction	Emergency	102 930.00
Acquisition of Auto Analyser Consumables and services	Dermo Tech CC	Sole supplier	68 850.50
Deviation request to approve emergency procurement repair at Grain Crops by the SCM Snr Manager	Down Town Electrical and Construction	Emergency	42 145.00
Deviation request for an approval by the Snr Manager to approve the repair of file server at GCI that has damaged due to load shedding	Datacentrix	Emergency	53 864.16
Repair of centrifuge	Labotec	Sole supplier	12 800.65
Reagents and Consumables	Separation Scientifica SA (Pty)Ltd	Single Source	104 391.12
Repairs to Lab Equipment	United Scientific	Emergency	5 505.05
To approve payment of emergency replacing of VIMP damaged electricity supply cable	Leetech Engineering	Emergency	57 788.65
To purchase Greenhouse gas Trace analysers for measuring methane, nitrous oxide and carbon dioxide fluxes at parts per billion level	Campbell Scientific Africa (Pty) Ltd	Sole Supplier	701 380.63
Repair	Esco	Sole supplier	8 694.00
Calibration Lab Equipment	Perkinelmer South Africa	Sole Source	39 344.23
Deviation request to use Inqaba as a sole supplier for the procurement of Sanger sequencing services	Inqaba biotec	Sole supplier	25 000.00
Request for a deviation to pay Stellenbosch University as a single supplier for an EPN short course.	Stellenbosch University	Single supplier	25 000.00
Purchase a specialized instrument -ASD Spectrometer	Malvern Panalytical	Sole Supplier	1 500 459.05
A9528 50mg Amphotericin B solubilized sterile powder	Merck life sciences	Sole supplier	11 128.00
Elisa consumables	Idexx	Single Source	484 242.37
PT test material	Test Veritas	Sole supplier	54 396.74
Jesper service	Chemetrix Export	Sole supplier	51 632.93

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Nick service & pandora assesment	Chemetrix Export	Sole supplier	59 373.71
Ockie service	Chemetrix Export	Sole supplier	52 383.09
Service of chromameter	Narich Cc	Sole supplier	9 832.50
Shadrack service	Chemetrix Export	Sole supplier	9 832.50
Request to deviate from SCM policy to get approval by the Snr Research manager to use the South African Grain Laboratory for LCMSMS Mycotxib analysus of 42 samles as only SANAS accredited reference laboratory	South African Grain Laboratory	Sole Supplier	62 790.00
Subscriptions and other services (2022-24)	Lexis Nexis	Sole supplier	81 565.33
Subscriptions and other services (2022-24)	Sabinet	Sole supplier	234 082.26
Subscriptions and other services (2022-24)	Juta	Sole supplier	52 540.00
To appoint Air Filter maintenance services to undertaken the plant pathogen quarantine upgrade project	Air filter maintenance	single source	13 000 000.00
FMD VACCINE EXCIPIENTS FROM MERCK	Merck life sciences	Single Source	39 439.94
Chemetrix consumables	Chemetrix Export	Sole supplier	12 120.89
Chemetrix consumables	Chemetrix Export	Sole supplier	10 747.22
GoTaq G2 Green - Dr Y Petersen (INF)	Anatech Instruments	Sole supplier	2 895.36
Research Consumables - Dr Y Petersen (INF)	Anatech Instruments	Sole supplier	18 695.72
Research Consumables - Dr Y Petersen (INF)	Anatech Instruments	Sole supplier	24 940.91
Repair and service of purite water purifier	Lasec	Sole supplier	31 882.75
Request to use Idexx Laboratories as a sole supplier for the procurement of reagents and consumables for the Colilet-18 and HPC Quanti-Tray at Soil Science, Nelspruit.	Idexx Laboratories	Sole supplier	21 307.87
Unblocking of blocked sewerage lines and cleaning of manholes	Geo-Vuil	Emergency	25 587.50
Request to use North West University as a single supplier for a research contract signed between Potatoes South Africa and ARC where a joint proposal was submitted from the ARC and North West University for a period of 3 years.	North West University	Single supplier	282 000.00
Deviation request to upgrade the Microspe water HPLC System at GC	MICROSEP	Sole Supplier	1 108 176.80
Request to approve SA Grain Laboratory (SAGL) as single source supplier for analyses of sunflower and soybean seed oil protein and moisture.	SAGL	Single Source	163 686.00

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Repair powerline at Nietvoorbij drink water pump house+Labou	Bibtiq t/a Kays Electrical	Emergency	24 364.05
Repair generator that is leaking oil at Nietvoorbij	Kevin Grant Hannigan	Emergency	149 707.00
Calibration, certification Konica Minolta CR-400 & Cal plate	Narich Cc	Sole supplier	9 832.50
To pay publication fee	Frontiers Media SA	Single source	16 952.38
Request to deviate to make use of SMAC Enterprises as Sole supplier for the servicing of the munters air-drying machine of the drying room	SMAC Enterprise	Sole supplier	3 923.00
The procurement of Zymobiomics DNA miniprep Kit	Inqaba BIOTEC (Pty)Ltd	Sole supplier	22 918.79
Payment of Publication fees	Academic Journals Limited	Single source	10 797.42
Payment of Publication fees	Academic Journals Limited	Single source	10 797.42
Repair and service standby generator	Leeech Engineering	Emergency	60 720.00
Reagents	Davis Diagnostics	Single Source	79 736.40
Emergency repair work on generator at Vredenburg	DDD Electrical	Emergency	23 366.00
Request for Sansor to supply seed certification serices as Sole supplier	Sansor	Sole supplier	10 697.30
Mettler Tolendo titrator service J Strydom	Microsep (Pty) Ltd	Sole supplier	36 614.85
Millipore service - J Strydom	Merch life Science	Sole supplier	13 385.43
CelTaq DNA Polymerase required for PCR on project	Celtic Molecular Diagnostics	Sole supplier	3 191.25
CelTaq DNA Polymerase required for PCR on project	Calibration of pipettes (CH DdB)	Sole supplier	9 027.50
To procure of specified Invitrogen	LTC Tech South Africa (Pty) Ltd	Sole supplier	28 366.36
Deviation request to pay Taylor & Francis publication fees as a single supplier.	Taylor & Francis	Single source	3 863.41
Procurement of Promega molecular reagents.	Anatech Instruments	Sole supplier	14 918.09
Deviation request to pay Taylor & Francis publication fees as a single supplier.	Taylor & Francis	Single source	3 863.41
Request to deviate from ARC SCM policy to approve the University of Free State as a Sole supplier of spore collectors and inoculators to ARC-SG Rust laboratory	University of Free State	Sole supplier	20 000.00
Repair ammonia compressor at cold storage facility Post Harv	Calibration of pipettes (CH DdB)	Strip and Quote	37 914.76

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Request to use Anatech as a sole supplier for servicing of EZ Mate 601 instrument at Biotech Lab.	Anatech Instruments	Sole supplier	11 155.00
Consumables for Mp96	Roche	Sole supplier	343 900.59
Laboratory bottles and SPE tubes needed for experiments	Merch life Science	Sole supplier	25 950.90
Diagnostic Kits	Anatech Instrument	Sole supplier	44 754.26
Pandora service part 2	Chemetrix Export	Sole supplier	19 079.24
Pandora service part 1	Chemetrix Export	Sole supplier	24 577.11
To procure of MGI products	Nexrgen Molecular Supplies (Pty) Ltd	Sole supplier	475 416.90
To procure Perkinelmer products	Parkonelmer South Africa (Pty) Ltd	Sole supplier	38 076.50
Deviation request to use XSit (X Sterile Technique) as a sole supplier for sterile moth and trap supply at Addo farm, TSC	X Sterile Technique	Sole supplier	210 814.82
Avian Influenza	Deltamune	Sole supplier	71 368.31
Repair done on backup generator	Smart Intel Projects	Ermegency	6 500.00
Single source selection to undertake further genomic analysis	Inqaba biotec	Single source	13 343.70
Deviation request to use SAIOSH as a single supplier for annual membership registration for OHS Officer, TSC.	SAIOSH	Single source	1 546.75
Manuscript fee SAJEV Journal Vol 43 no. 2 C Howell	SAWWV	Single Source	3 375.00
Publication of manuscript	Dartmouth	Single source	8 840.47
Emergency job on testing and switching the OCB in our HT sub station	Smart Interl Projects	Ermegency	3 952.00
Pay publication fees	MDPI AG	Single Source	25 000.00
Deviation request to use Dermo Tech as a sole supplier for the acquisition of a sampler belt for the Auto analyser 3, Soil Science Lab.	Dermo Tech CC	Sole supplier	2 875.00
Servicing of Mantech PC Titrator	Test It	Sole Supplier	1 725.00
Request to deviate from ARC SCM policy to approve the University of Free State as a Sole supplier of spore collectors and inoculators to ARC-SG Rust laboratory	University of Free State	Sole supplier	30 000.00
Pay publication fees	National Inquiry Service Centre	Single Source	8 970.00
Milk meter samplers	Dairy Care	Single source	389 407.00
Repairs to Elga Chorus ICPL	Labotec Pty Ltd	Sole Supplier	4 341.25
Service of 2 CEM Microwave Systems	MAD Technology (Pty) Ltd	Sole Supplier	5 146.25



PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Sole Supplier Deviation Approval Request for the Procurement of Allflex Tissue Sample Unit from Dailstat Trading 91 (Pty) Ltd T/A Allflex.	Dailstat Trading 91	Sole Supplier	79 655.90
Request to deviate from the approved SCM policy to use Tunner Morris as a single source selection for servicing gensets at Bethlehem branch	Tunner Morris	Single Source	66 483.50
Sole Supplier Deviation Approval Request for the Procurement of IB-200-250 - Iso Bind Plant DNA kit from GENE VANTAGE	Gene Vantage	Sole Supplier	52 900.00
Paying for Publication fees	African Journal of Food, Agriculture, Nutrition and Development	Single Source	13 249.28
Critical reagents & Services	Roche	Single Source	492 274.15
Replacement of Matching Box Assembly and XYZ Converter for ICP-MS 7700 Series	Chemetrix Export	Sole Supplier	216 857.36
Repairs to XYZ Assembly	Chemetrix Export	Sole Supplier	233 444.01
Repair of Gailson Pipettes	Lasec	Sole supplier	3 211.05
Devaition Approval Request for the Repair of a PCRMAX PCR, instrument by Vacutec (Pty) Ltd	Vacutec Pty Ltd	Single Source	20 695.40
Guinea pig complement, Rabbit-anti-sheep cell hemolysin	Biocom	Single Source	387 189.48
Repair of gilson	Inqaba	Sole supplier	879.75
Services	Inqaba	Sole supplier	163 827.06
Supply and delivery of Cannabis Standards	Merck life sciences	Sole Supplier	54 711.25
Annual Service of Flash 2000 CHNS Analyser	Anatech Instruments	Sole Supplier	52 522.98
Validation of FEC & ICP Extraction	Vivid Air Cc	Sole Supplier	11 270.00
Emergency procurement repairs at grain crops by the acting senior manager	Down Town Electrical and Construction (Pty) Ltd	Emergency	63 450.00
The emergency procurement of a tractor part	Joe's Tractors T/A G L I Motors	Emergency	4 410.25
Deviation request to approve emergency procurement repairs at grain crops by the acting senior manager. Fault-finding and repairs	Down Town Electrical and Construction (Pty) Ltd	Emergency	6 505.00
Deviation request to approve emergency procurement repairs at grain crops by the acting senior manager repairs on diesel leaking 150kva Deutz standby generator set	Down Town Electrical and Construction (Pty) Ltd	Emergency	16 465.00
Payment for the analysis of samples by Nvirotek labs for Solvita and Potential Mineralizable Nitrogen	Nvirotek Labs	Single source	22 339.24

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
AB-5021170 Scitex - PCBA AC Distribution	Promolab	Sole supplier	14 062.42
Deviation request to use United Scientific as a sole supplier for the procurement of Bante Nitrate and Ammonium Ion selective electrodes.	United Scientific	Sole supplier	18 170.00
Request to purchase Illumina products from Promolab (Pty) Ltd T/A Separations	Promolab(Pty) Ltd T/A separation	Sole supplier	1 526 578.43
Request for approval to use CIPS Southern Africa as a single supplier for membership registration-N. Waleng.	CIPS Southern Africa	Single source	2 121.75
Request to Pay Smart Interl Projects	Smart Interl Projects	Emergency	8 500.00
Request to deviate to make use of SciCorp Laboratories (PTY) LTD as a Sole supplier for the buying of germination paper	Sci Corp Laboratories	Sole Supplier	8 763.00
Dairy Capec equipment	Dairy Care	Sole supplier	83 952.30
Maintain supply consumables for HP DesignJet printers	Miketra Trading	Single source	22 339.24
Maintenance, Services or repair of Scotsman Ice Machine	SCOTSMAN ICE SYSTEMS	Single source	8 035.15
Request to deviate to make use of SMAC Enterprises as Sole supplier for the servicing of the munters air-drying machine of the drying room	SMAC Enterprise	Sole supplier	3 923.00
Maintenance of franking machine	Hasler Business Systems	Sole supplier	10 183.00
Computer Program Licences	Model Maker Systems CC	Sole Supplier	8 135.00
Repair of Milkoscan	Rhine Rhur	Sole Supplier	17 643.00
To procure goods from Anatech Instruments (Pty) Ltd	Anatech Instruments (Pty)Ltd	Sole supplier	49 721.40
Procurement of parts needed on the Delaval Machine	Dairy Care CC 1739	Sole supplier	16 376.52
Single source deviation, to undertake the Plant Pathogen Quarantine Facility upgrade project	AirFilter Maintenance	Single source	1 092 718.50
Attend the 4th SADC: Precision Agriculture for Crop and Livestock Farming Summit	Leadership Institute of Administrators	Sole Supplier	6 799.00
Request to Pay Water Pleasure	Water Pleasure	Emergency	5 455.80
Request to use the International Society for Horticultural Science (ISHS) as a single source for ISHS membership.	ISHS	Single supplier	23 347.20
STQ6912 repair irrigator VDS NVB main pump house - INF	W M Spilhaus Boland (Pty) Ltd	Strip and Quote	87 104.40
Repair Ingersol Rand Compressor @ Nietvoorbij WS - INF	Winelands Compressors & Supplies CC	Single Source	10 994.00
Repair UPS (Kstar UB100 10kVA UPS system) Post Harvest INF	Cooper Power Cape Town	Strip and Quote	10 118.28

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Request for an urgent repair to the water pump at the water reservoir, Addo farm.	Askyl Trading	Emergency	13 500.00
Request to approve emergency repairs on faulty genset at Small Grain	Tunner Morris	Emergency	10 853.00
Deviation request to use Inqaba Biotec as the sole supplier for the procurement of Sanger sequencing services.	Inqaba Biotec	Sole Supplier	10 000.00
To approve to deviate from the SCM policy by procuring Sanger sequencing services from Inqaba Biotechnical Industries as a sole supplier as per Section 33 of the SCM policy on sole supplier selection.	Inqaba Biotechnical Industries	Sole Supplier	28 750.00
To request approval to deviate from SCM policy to use Whitehead Scientific as a sole source	Whitehead Scientific	Sole Supplier	15 800.80
Request of payment approval to Roncon CC for emergency replacing of VIMP two Minsub Fuses	Roncon	Emergency	20 180.20
STQ6916 repair chromameter at Post Harvest Anel Botes- INF	Narich Cc	Strip to Quote	2 070.00
Request to approve emergency procurement repairs at Grain Crops	Down Town Electrical and Construction (Pty) Ltd	Emergency	10 645.00
Single source supplier for supplying ink cartridge and maintenance & Sasfin as the provider of postage	Hasler Business Systems	Single source	5 954.02
Emergency to repair cooling system in the Dairy Production Unit	MBS	Emergency	143 769.55
To repair cold room infrared laboratory	AZUR Refrigeration	Emergency	8 303.00
Replacement of geysers	GST	Emergency	53 992.50
Faulty HV Overhead Line	Uphilo	Emergency	8 107.50
faulty HV Overhead Line @ Weather Services	Uphilo	Emergency	36 857.50
Tree felling	The Levites	Emergency	30 000.00
Faulty HV Overhead Line @ Bull Testing, Feedlot and Small Stock	Uphilo	Emergency	51 525.75
Faulty HV Overhead Line @ Bull Testing, Feedlot and Small Stock	Uphilo	Emergency	51 525.75
Installation of glass windows and doors	MUZP	Emergency	167 650.36
Request of payment approval by SM: SCM for Renka Group SA to Supply of Submersible water pumps on emergency case	Renka Group SA	Emergency	68 748.00
Deviation request for an approval by chief financial officer to generate a purchase order in order pay a foreign supplier (inter rent)	INTER RENT, LDA	Single Source	59 153.73
Annual software maintenance renewal of the MATLAB specialised software products	Opti-Num Solutions (Pty) Ltd	Sole Supplier	147 599.05

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Annual software maintenance renewal of the Photo Modeler specialised software products	Graham Griffiths Sessions	Sole Supplier	26 542.00
Approval request for a single source supplier Groter Cederberg BBV for the provision of fire protection services at Citrusdal farm	Greater Cederberg Fire Protection Association	Single source	1 116.94
To pay Alpha-Lab Technical services for the emergency repair of the milling units and ash furnace	Alpha-Lab Technical services	Emergency	13 182.30
Annual software maintenance renewal of the STATISTICA specialised software products	Southern African Analytics (Pty) Ltd	Sole Supplier	17 652.50
Deviation request to use Inqaba as the sole supplier for the procurement of Sanger sequencing services.	Inqaba Biotec	Sole Supplier	40 000.00
Deviation request to use Carl Zeiss as a sole supplier to purchase holding ring and high-powered LED ring illuminator for Zeiss microscope.	Carl Zeiss	Sole Supplier	21 299.73
Repair VSD irrigator on irrigation pump at Nietvoorbij	W M Spilhaus Boland (Pty) Ltd	Strip to Quote	62 233.01
Emergency repair of generator	DDD Electrical	Emergency	42 416.00
To approve payment of emergency cable repair	Vukani Technology	Emergency	58 894.18
Payment of annual fees	Agrilasa	Sole Supplier	36 900.12
To approve strip and quote for service and replace of washing	Diokaphuti	Emergency	3 500.00
Request for approval to use TD New Look Construction for emergency repairs of the 100AMPS 3 phase isolator at Levubu farm	TD New Look Construction	Emergency	2 864.25
Deviation request to use Agrilasa as a sole supplier for TSC Soil Science Lab membership	Agrilasa	Sole Supplier	31 000.00
Repairs at Grain Crops small Deutz generator and faulty backwater pump	Down Town Electrical and Construction (Pty) Ltd	Emergency	29 730.00
Strip and Repairs of Air Conditioner	Blomeyers Heating and Cooling CC	Emergency	4 138.90
GoTaQ Sole Supplier Submission - Dr Y Petersen (INF)	Anatech Instruments	Sole supplier	27 052.31
PRM7823 GoTaQ G2 Green Master Mix, 1000 reactions	Anatech Instruments	Sole supplier	9 017.44
PRM7823-GoTaQ G2 Green Master mix-QUO89947	Anatech Instruments	Sole supplier	27 052.31
Request to deviate from approved SCM policy to use Turner Morris as Single source Selection for servicing genset at Bethlehem branch	Tunner Morris	Single Source	60 804.80
Deviation request to use DG Capital	DG INCENTIVES	Sole Supplier	3 377.42
Deviation request to use DG Capital	Hasler Business Systems	Sole Supplier	5 287.36

PROJECT DESCRIPTION	NAME OF SUPPLIER	TYPE OF PROCUREMENT BY OTHER MEANS	VALUE OF THE CONTRACT (R)
Request to make us of Sci-Corp Laboratories PTY LTD as a Sole Supplier for buying of germination paper	Sci Corp Laboratories	Sole supplier	16 470.30
Grapes plants Vergelegen	IMDAWO-EKUHLE	Single Source	69 001.44
Repair ammonia compressors at Post Harvest cold storage at IN	Ammonia Refrigeration Engineering	Emergency	18 375.05
Request to make us of Sci-Corp Laboratories PTY LTD as a Sole Supplier for buying of germination paper	Sci Corp Laboratories	Sole supplier	42 793.80
Single source supplier for plant barcoding for the MSc student's study on MLND survey	University of Johannesburg	Single source	20 000.00
Emergency of repairing and servicing two air conditioners of PHP UPS room	Kopano Air Conditioning PTY LTD	Emergency	17 424.00
Maintenance and service of the Roodeplaat PHP minisub and Transformer	Roncon	Strip and quote	251 452.10
Emergency repair of glasshouse motors	Roncon	Emergency	42 770.80
Repair to minisub and transformer	Roncon	Emergency	78 287.40
Emergency repair to quarantine safety glass door	Glasfit	Emergency	2 377.05
Repairs to generator Cedara	Cato Ridge	Emergency	93 621.72
Repair of sporulation room air conditioner	DDD Electrical	Emergency	4 930.00
Repair fibre cable PHP Server Room and VIMP switch room	Vukani	Emergency	30 995.32
Emergency repair to generator	DDD Electrical	Emergency	10 800.00
			<b>41 117 155.51</b>



## 7. CONTRACT VARIATIONS AND EXPANSIONS

PROJECT DESCRIPTION	NAME OF SUPPLIER	CONTRACT MODIFICATION TYPE (EXPANSION)	CONTRACT NUMBER	ORIGINAL CONTRACT VALUE	VALUE OF PREVIOUS CONTRACT EXPANSION/S OR VARIATION/S	VALUE OF CURRENT CONTRACT EXPANSION OF VARIATION
Additional Security Services for 4 months - GCI Potchefstroom	Nceda Cleaning and Security Services	Expansion	ARC/10/09/19	R 11 405 709.38	N/A	R 175 340.40
Request for extension for 4 months until tender is finalised - appoint a panel of service providers to assist with the cooling system of the ARC	Araba Sechaba Trading Enterprise	Expansion	ARC/30/03/19	Artisan Assistant Labour: Normal hours R320 R240 Labour: After hours R320 R240 Labour: Weekends and Public Holidays R320 R240 Aerial Platform R550 R400 Total R1 510 R1 120	N/A	Rates
				Artisan Assistant Labour: Normal hours R280 R180 Labour: After hours R420 R350 Labour: Weekends and Public Holidays R420 R350 Aerial Platform R350 R280 Total R1 470 R1 160		
Request for extension for 4 months until tender is finalised - appoint a panel of service providers to assist with the cooling system of the ARC	MBS Air Conditioning & Refrigeration (MBS Elecmech Group)	Expansion	ARC/30/03/19		N/A	Rates
Security Services 2 months extension - Central Office	Eldna Security Services	Expansion	ARC/10/09/19	R 3 271 862.00	N/A	R 165 714.02
Security Services 2 months extension - AP	Eldna Security Services	Expansion	ARC/10/09/19	R 12 109 711.00	N/A	R 720 449.66
Security Services 2 months extension -AP Roodeplaat	Eldna Security Services	Expansion	ARC/10/09/19		N/A	R 88 008.32

PROJECT DESCRIPTION	NAME OF SUPPLIER	CONTRACT MODIFICATION TYPE (EXPANSION)	CONTRACT NUMBER	ORIGINAL CONTRACT VALUE	VALUE OF PREVIOUS CONTRACT EXPANSION/S OR VARIATION/S	VALUE OF CURRENT CONTRACT EXPANSION OF VARIATION
Security Services 2 months extension - VOP	Eldna Security Services	Expansion	ARC/10/09/19	R 4 089 900.00	N/A	R 230 475.52
Security Services 2 months extension - PHP	Eldna Security Services	Expansion	ARC/10/09/19	R 3 811 513.00	N/A	R 145 044.48
Security Services 2 months extension - OVR	Eldna Security Services	Expansion	ARC/10/09/19	R 10 347 428.00	N/A	R 498 622.40
Security Services 2 months extension - TAD	Eldna Security Services	Expansion	ARC/10/09/19		N/A	R 224 774.82
Security Services 2 months extension - Kaalplaas	Eldna Security Services	Expansion	ARC/10/09/19		N/A	R 79 022.32
Security Services 2 months extension - AE	Eldna Security Services	Expansion	ARC/10/09/19	R 13 487 908.00	N/A	R 201 157.66
Security Services 2 months extension - SCW	Eldna Security Services	Expansion	ARC/10/09/19	R 3 379 015.00	N/A	R 201 157.66
Security Services Extension will cost R 833 348.04 for the two month extension - BETHLEHEM	Rise Security Services	Expansion	ARC/10/09/19	R 3 112 519.75	N/A	R 91 548.30
Security Services Extension will cost R 833 348.04 for the two month extension - FRIEDENHAM	Rise Security Services	Expansion	ARC/10/09/19	R 11 053 838.72	N/A	R 186 234.38
Security Services Extension will cost R 833 348.04 for the two month extension- LEVUBU	Rise Security Services	Expansion	ARC/10/09/19		N/A	R 91 548.30
Security Services Extension will cost R 833 348.04 for the two month extension - NELSPRUIT	Rise Security Services	Expansion	ARC/10/09/19		N/A	R 216 750.48
Security Services Extension will cost R 833 348.04 for the two month extension - BURGERSHALL	Rise Security Services	Expansion	ARC/10/09/19		N/A	R 155 718.28

PROJECT DESCRIPTION	NAME OF SUPPLIER	CONTRACT MODIFICATION TYPE (EXPANSION)	CONTRACT NUMBER	ORIGINAL CONTRACT VALUE	VALUE OF PREVIOUS CONTRACT EXPANSION/S OR VARIATION/S	VALUE OF CURRENT CONTRACT EXPANSION OF VARIATION
Security Services Extension will cost R 833 348.04 for the two month extension - HLUHLUWE	Rise Security Services	Expansion	ARC/10/09/19	R 1 556 259.86	N/A	R 91 548.30
Security Services Extension will cost R 663 012.00 for the two month extension - GC	Nceda Security and Cleaning Services	Expansion	ARC/10/09/19	R 11 405 709.38	N/A	R 175 340.50
Security Services Extension will cost R 663 012.00 for the two month extension - IC	Nceda Security and Cleaning Services	Expansion	ARC/10/09/19	R 5 256 674.75	N/A	R 355 591.14
Security Services Extension will cost R 663 012.00 for the two month extension - Brits	Nceda Security and Cleaning Services	Expansion	ARC/10/09/19		N/A	R 132 080.36
ICT Asset Management including track and trace - Variance/ Addendum - 10% variation to the original contract value	KT Opportunities	Variation	ARC/23/03/20	R 2 238 843.00	N/A	R 224 957.25

# PART F:

## FINANCIAL INFORMATION

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# Report of the auditor-general to Parliament on the Agricultural Research Council

## Report on the audit of the financial statements

### Qualified Opinion

1. I have audited the financial statements of the Agricultural Research Council set out on pages 196 to 259, which comprise the statement of financial position as at 31 March 2023, statement of financial performance, statement of changes in net assets, cash flow statement of cash and statement of comparison of budget and actual amounts for the year then ended, as well as notes to the financial statements, including a summary of significant accounting policies.
2. In my opinion, except for the effects and possible effects of the matters described in the basis for qualified opinion section of this report, the financial statements present fairly, in all material respects, the financial position of the Agricultural Research Council as at 31 March 2023 and its financial performance and cash flows for the year then ended in accordance with the Standards of Generally Recognised Accounting Practice (GRAP) and the requirements of the Public Finance Management Act 1 of 1999 (PFMA).

### Basis for qualified opinion

#### Revenue from non-exchange transactions

3. I was unable to obtain sufficient appropriate audit evidence that revenue from non-exchange transactions were properly accounted for, due to the entity recognising a conditional grant as revenue without sufficient evidence. I was unable to confirm whether the conditions of the grant were met by alternative means. Consequently, I was unable to determine whether any adjustment was necessary to revenue from non-exchange transactions stated at R1 061 835 096 in the financial statements and unspent conditional grants.

#### Property, plant and equipment

4. I was unable to obtain sufficient appropriate audit evidence that management had properly accounted for property, plant and equipment, as the public entity did not have adequate systems to record and maintain proper accounting records for adjustments made to corresponding figures of property, plant and equipment. There were material differences between the financial statements, fixed assets register and underlying schedules relating to the adjustments to the corresponding figures. I was unable to confirm property, plant and equipment by alternative means. Consequently, I was unable to determine whether any adjustment was necessary to property, plant and equipment, stated at R1 931 601 461 (2022: R1 953 841 423) in note 20 to the financial statements.
5. There is a consequential impact on the following amounts in the financial statements:



- Prior year adjustments to property plant and equipment of R19 847 353, as disclosed in note 37 to the financial statements.
  - Prior year depreciation and amortisation amounting to R81 071 378, as disclosed on note 6 to the financial statements.
6. Some items of property, plant and equipment recorded in the public entity's fixed asset register could not be physically located, thus property, plant and equipment were overstated by these items. Consequently, property, plant and equipment were overstated by R12 347 061
  7. The public entity did not record some of the fixed assets in the fixed asset register, this has resulted in the understatement of the property, plant and equipment balance in the financial statements. I was unable to determine the full extent of the overstatement of property, plant and equipment, stated at R1 931 601 461 (2022: R1 953 841 423) in note 20 to the financial statements as it was impracticable to do so.

#### Depreciation and amortisation

8. The financial statements of the public entity were materially misstated, as the public entity did not depreciate property, plant and equipment as required by GRAP 17, Property, plant and equipment. The useful lives of property, plant and equipment were reassessed during the year but the entity could not provide sufficient and appropriate evidence on the assumptions and methodology followed for the reassessment of useful lives as required by GRAP 17 Property, plant and equipment. Some items of property, plant and equipment were also not included on the reassessment of useful lives and some were not included in the depreciation calculations. I was unable to quantify the full extent of the misstatements of the depreciation amount and of property, plant and equipment as it was impracticable to do so. I was unable to determine whether any adjustment was necessary to depreciation stated at R67 570 123 (2022: R81 071 378) in note 6 to the financial statements. Consequentially, Property, plant and equipment is also misstated.

#### Irregular expenditure and fruitless and wasteful expenditure

9. Not all irregular expenditure was included in the note 43 to the financial statements, as required by section 55(2) (b) (i) of the PFMA. This was due to payments made in contravention of the supply chain management requirements, which resulted in irregular expenditure of R7 442 451.31 and were not included in note 43. Consequently, I was unable to determine whether any further adjustments were necessary to the irregular expenditure stated at R0 in note 43 of the financial statements.

#### Context for opinion

10. I conducted my audit in accordance with the International Standards on Auditing (ISAs). My responsibilities under those standards are further described in the responsibilities of the auditor-general for the audit of the financial statements section of my report.
11. I am independent of the public entity in accordance with the International Ethics Standards Board for Accountants' *International code of ethics for professional accountants (including International Independence Standards)* (IESBA code) as well as other ethical requirements that are relevant to my audit in South Africa. I have fulfilled my other ethical responsibilities in accordance with these requirements and the IESBA code.

12. I believe that the audit evidence I have obtained is sufficient and appropriate to provide a basis for my qualified opinion.

### **Emphasis of Matters**

13. I draw attention to the matters below. My opinion is not modified in respect of these matters.

#### **Material impairments- Trade debtors**

14. As disclosed in note 15 to the financial statements, material losses of R18 604 511 (2022: R335 899) were incurred because of a write-off of irrecoverable trade debtors.

#### **Restatement of corresponding figures**

15. The corresponding figures were restated as disclosed in note 37 of the financial statements.

### **Other Matter**

16. I draw attention to the matter below. My opinion is not modified in respect of this matter.

#### **Unaudited irregular expenditure and fruitless and wasteful expenditure (UIFW)**

17. National Treasury Instruction Note No. 4 of 2022-23: PFMA Compliance and Reporting Framework On 23 December 2022 National Treasury issued Instruction Note No. 4: PFMA Compliance and Reporting Framework of 2022-23 in terms of section 76(1)(b), (e) and (f), 2(e) and (4)(a) and (c) of the PFMA which came into effect on 3 January 2023. The PFMA Compliance and Reporting Framework also addresses the disclosure of unauthorised expenditure, irregular expenditure and fruitless and wasteful expenditure (UIFW expenditure). Among the effects of this framework is that irregular and fruitless and wasteful expenditure incurred in previous financial years and not addressed is no longer disclosed in the disclosure notes of the annual financial statements, only the current year and prior year figures are disclosed in note 43 to the financial statements. Furthermore, the movements in respect of irregular expenditure and fruitless and wasteful expenditure are no longer disclosed in the notes to the annual financial statements of the public entity. The disclosure of these movements (e.g. condoned, recoverable, removed, written off, under assessment, under determination and under investigation) are now included as part of other information in the annual report of the public entity. I do not express an opinion on the disclosure of irregular expenditure and fruitless and wasteful expenditure in the annual report.

### **Responsibilities of the accounting authority for the financial statements**

18. The accounting authority, is responsible for the preparation and fair presentation of the financial statements in accordance with GRAP and the requirements of the PFMA, and for such internal control as the accounting authority determines is necessary to enable the preparation of financial statements that are free from material misstatement, whether due to fraud or error
19. In preparing the financial statements, the accounting authority is responsible for assessing the public entity's ability to continue as a going concern, disclosing, as applicable, matters relating to going concern and using the going concern basis of accounting unless the appropriate



governance structure either intends to liquidate the public entity or to cease operations, or has no realistic alternative but to do so.

## Responsibilities of the auditor-general for the audit of the financial statements

20. My objectives are to obtain reasonable assurance about whether the financial statements as a whole are free from material misstatement, whether due to fraud or error; and to issue an auditor's report that includes my opinion. Reasonable assurance is a high level of assurance but is not a guarantee that an audit conducted in accordance with the ISAs will always detect a material misstatement when it exists. Misstatements can arise from fraud or error and are considered material if, individually or in aggregate, they could reasonably be expected to influence the economic decisions of users taken on the basis of these financial statements.
21. A further description of my responsibilities for the audit of the financial statements is included in the annexure to this auditor's report.

## Report on the audit of the annual performance report

22. In accordance with the Public Audit Act 25 of 2004 (PAA) and the general notice issued in terms thereof, I must audit and report on the usefulness and reliability of the reported performance against predetermined objectives for selected outcomes as presented in the annual performance report. The accounting authority is responsible for the preparation of the annual performance report.
23. I selected the following outcomes presented in the annual performance report for the year ended 31 March 2023 for auditing. I selected outcomes that measure the public entity's performance on its primary mandated functions and that are of significant national, community or public interest.

Outcome	Page numbers	Focus
Outcome 1: Increased agricultural production and productivity	27 - 30	To generate knowledge and technologies (intellectual property and tools) that will diversify, improve the quality and increase the value of crop and animal based agricultural production and related processes and products; enhance productivity towards increased food security, commercial exports and income for the agricultural sector, and enabling farmers and producers to maximise their efficiency and productivity
Outcome 2: Sustainable ecosystems and natural resources	30 - 32	To generate knowledge and technologies (intellectual property and tools) that will conserve natural resources and sustain agriculture
Outcome 3: Improved nutritional value, quality, and safety of agricultural products	33 - 35	To generate knowledge, solutions and technologies for food safety, quality and improved efficiencies in the agriculture value chain, with particular focus on agro-processing, pre- and post-harvest processing biotechnology and

Outcome	Page numbers	Focus
		informatics, each cross-cutting across different areas of the agricultural value chain and intended to be applied to the full value chain of crops, animals and agricultural system research
<b>Outcome 4: Skilled and capable agricultural sector</b>	36 - 39	To provide strategies, analysis and information to develop and grow a competitive, productive, and diverse agricultural sector, and provide a support service to identify and develop the commercial potential of agricultural research and development to address smallholder and commercial farmer constraints
<b>Outcome 5: Enhanced resilience of Agriculture</b>	39 - 42	To enhance the resilience of the agriculture sector to factors such as Climate Change. The weather variability and climate change have a direct impact on food security, especially in semi-arid and arid countries.

24. I evaluated the reported performance information for the selected outcomes against the criteria developed from the performance management and reporting framework, as defined in the general notice. When an annual performance report is prepared using these criteria, it provides useful and reliable information and insights to users on the public entity's planning and delivery on its mandate and objectives.

25. I performed procedures to test whether:

- the indicators used for planning and reporting on performance can be linked directly to the public entity's mandate and the achievement of its planned objectives.
- the indicators are well defined and verifiable to ensure that they are easy to understand and apply consistently and that I can confirm the methods and processes to be used for measuring achievements.
- the targets can be linked directly to the achievement of the indicators and are specific, time bound and measurable to ensure that it is easy to understand what should be delivered and by when, the required level of performance as well as how performance will be evaluated.
- the indicators and targets reported on in the annual performance report are the same as what was committed to in the approved initial or revised planning documents.
- the reported performance information is presented in the annual performance report in the prescribed manner.
- there are adequate supporting evidence for the achievements reported and for the reasons provided for any over- or underachievement of targets.

26. I performed the procedures for the purpose of reporting material findings only; and not to express an assurance opinion.



27. I performed procedures to determine whether the reported performance information was properly presented and whether performance was consistent with the approved performance planning documents. I performed further procedures to determine whether the indicators and related targets were measurable and relevant, and assessed the reliability of the reported performance information to determine whether it was valid, accurate and complete.
28. I did not identify any material findings on the reported performance information of the selected outcomes.

### **Other matter**

29. I draw attention to the matter below.

### **Achievement of planned targets**

30. The annual performance report includes information on reported achievements against planned targets and provides explanations for over- and under achievements. Reasons for the underachievement of targets are included in the annual performance report on pages [27 to 42].

## **Report on compliance with legislation**

31. In accordance with the PAA and the general notice issued in terms thereof, I must audit and report on compliance with applicable legislation relating to financial matters, financial management and other related matters. The accounting authority is responsible for the public entity's compliance with legislation.
32. I performed procedures to test compliance with selected requirements in key legislation in accordance with the findings engagement methodology of the Auditor-General of South Africa (AGSA). This engagement is not an assurance engagement. Accordingly, I do not express an assurance opinion or conclusion.
33. Through an established AGSA process, I selected requirements in key legislation for compliance testing that are relevant to the financial and performance management of the public entity, clear to allow consistent measurement and evaluation, while also sufficiently detailed and readily available to report in an understandable manner. The selected legislative requirements are included in the annexure to this auditor's report.
34. The material findings on compliance with the selected legislative requirements, presented per compliance theme, are as follows:

### **Annual Financial Statements**

35. The financial statements submitted for auditing were not prepared in accordance with the prescribed financial reporting framework and were not supported by full and proper records, as required by section 55(1) (a) and (b) of the PFMA.
36. Material misstatements on property, plant and equipment, revenue from non-exchange transactions, depreciation and amortisation, cash generated from operations disclosure note, prior year adjustments disclosure note and segment information identified by the auditors in the



submitted financial statements were corrected and the supporting records were provided subsequently, but the uncorrected material misstatements resulted in the financial statements receiving a qualified opinion.

### Expenditure management

37. Effective and appropriate steps were not taken to prevent irregular expenditure, amounting to R7 442 451.31, which was identified during the audit of procurement and contract management as required by section 51(1) (b) (ii) of the PFMA. The value as disclosed in note 43 is not complete as management was still in the process of quantifying the full extent of the irregular expenditure. Most of the irregular expenditure identified was caused by non-compliance with treasury regulations.

### Consequence management

38. I was unable to obtain sufficient appropriate audit evidence that disciplinary steps were taken against some of the officials who had permitted irregular expenditure in prior years, as required by section 51(1)(e)(iii) of the PFMA. This was due to proper and complete records that were not maintained as evidence to support the investigations into irregular expenditure and steps taken by the public entity.

### Other information in the annual report

39. The accounting authority is responsible for the other information included in the annual report. The other information referred to does not include the financial statements, the auditor's report and those selected outcomes presented in the annual performance report that have been specifically reported on in this auditor's report.
40. My opinion on the financial statements, the report on the audit of the annual performance report and the report on compliance with legislation, do not cover the other information included in the annual report and I do not express an audit opinion or any form of assurance conclusion on it.
41. My responsibility is to read this other information and, in doing so, consider whether it is materially inconsistent with the financial statements and the selected outcomes presented in the annual performance report, or my knowledge obtained in the audit, or otherwise appears to be materially misstated.
42. I did not receive the other information prior to the date of this auditor's report. When I do receive and read this information, if I conclude that there is a material misstatement therein, I am required to communicate the matter to those charged with governance and request that the other information be corrected. If the other information is not corrected, I may have to retract this auditor's report and re-issue an amended report as appropriate. However, if it is corrected this will not be necessary.

## Internal control deficiencies

43. I considered internal control relevant to my audit of the financial statements, annual performance report and compliance with applicable legislation; however, my objective was not to express any form of assurance on it.
44. The matters reported below are limited to the significant internal control deficiencies that resulted in qualified opinion on financial statements and the material findings on compliance with legislation included in this report
45. Management did not prepare regular, accurate and complete financial and performance reports that are supported and evidenced by reliable information
46. Management did not implement proper record keeping in a timely manner to ensure that complete, relevant, and accurate information is accessible and available to support financial and performance reporting.
47. Management did not review and monitor compliance with applicable laws and regulations.
48. Leadership did not exercise oversight responsibility regarding financial and performance reporting and compliance and related internal controls.
49. Management did not adequately develop and monitor the implementation of action plans to address internal control deficiencies.

Auditor - General

Pretoria

31 July 2023





## Annexure to the auditor's report

The annexure includes the following:

- the auditor-general's responsibility for the audit
- the selected legislative requirements for compliance testing.

### Auditor-general's responsibility for the audit

#### Professional judgement and professional scepticism

As part of an audit in accordance with the ISAs, I exercise professional judgement and maintain professional scepticism throughout my audit of the financial statements and the procedures performed on reported performance information for selected outcomes and on the public entity's compliance with selected requirements in key legislation.

#### Financial statements

In addition to my responsibility for the audit of the financial statements as described in this auditor's report, I also:

- identify and assess the risks of material misstatement of the financial statements, whether due to fraud or error; design and perform audit procedures responsive to those risks; and obtain audit evidence that is sufficient and appropriate to provide a basis for my opinion. The risk of not detecting a material misstatement resulting from fraud is higher than for one resulting from error, as fraud may involve collusion, forgery, intentional omissions, misrepresentations or the override of internal control.
- obtain an understanding of internal control relevant to the audit in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the public entity's internal control.
- evaluate the appropriateness of accounting policies used and the reasonableness of accounting estimates and related disclosures made.
- conclude on the appropriateness of the use of the going concern basis of accounting in the preparation of the financial statements. I also conclude, based on the audit evidence obtained, whether a material uncertainty exists relating to events or conditions that may cast significant doubt on the ability of the public entity to continue as a going concern. If I conclude that a material uncertainty exists, I am required to draw attention in my auditor's report to the related disclosures in the financial statements about the material uncertainty or, if such disclosures are inadequate, to modify my opinion on the financial statements. My conclusions are based on the information available to me at the date of this auditor's report. However, future events or conditions may cause a public entity to cease operating as a going concern.
- evaluate the overall presentation, structure and content of the financial statements, including the disclosures, and determine whether the financial statements represent the underlying transactions and events in a manner that achieves fair presentation.

### Communication with those charged with governance

I communicate with the accounting authority regarding, among other matters, the planned scope and timing of the audit and significant audit findings, including any significant deficiencies in internal control that I identify during my audit.

I also provide the accounting authority with a statement that I have complied with relevant ethical requirements regarding independence and to communicate with them all relationships and other matters that may reasonably be thought to bear on my independence and, where applicable, actions taken to eliminate threats or safeguards applied.



## Compliance with legislation – selected legislative requirements

The selected legislative requirements are as follows:

Legislation	Sections or regulations
Public Finance Management Act	PFMA 51(1)(b)(i) PFMA 51(1)(b)(ii) PFMA 51(1)(e)(iii) PFMA 53(4) PFMA 54(2)(c) PFMA 54(2)(d) PFMA 55(1)(a) PFMA 55(1)(b) PFMA 55(1)(c)(i) PFMA 57(b)
National Treasury Regulations	TR 16A.7.1 TR 16A.7.6 TR 16A.7.7 TR 16A6.1 TR 16A8.4 TR 16A9.1(d) TR 16A3.2(a) TR 16A6.4 TR 16A6.5 TR 16A6.3(c ) TR 16A8.3 TR 16A8.4 TR 30.1.1 TR 30.1.3(a) TR 30.1.1 TR 30.1.3(b) TR 30.1.3(d) TR 30.2.1 TR 31.1.2(c) TR 31.2.1 TR 31.3.3 TR 33.1.3
	SCM Instruction Note 02 of 2021-22 PFMA instruction note no.3 of 2021/22

Legislation	Sections or regulations
	NT Instruction 4A of 2016/17 NT Instruction 07 of 2017/18 par 4.3 NT Instruction 4A of 2016/17 par 6 NT Instruction 01 of 2021-22 par. 4.1
Preferential Procurement reg 2017	PPPFA section 2(1)(a) and (b) Preferential Procurement reg 6(8), 7(8), 10(1)&(2) & 11(1) Preferential Procurement reg 5(1) & 5(3) Preferential Procurement reg 5(6) Preferential Procurement reg 5(7) Preferential Procurement reg 4(1) & 4(2) Preferential Procurement reg 8(2) Preferential Procurement reg 8(5) Preferential Procurement reg 9(1)
Preferential Procurement reg 2022	Preferential Procurement reg 4(4)
Construction Industry Development Board Act and regulations	CIDB Act 18(1) CIDB reg. 17 CIDB reg. 25(7A) CIDB reg. 17
State Information Technology Agency Act	SITA Act section 7(3)

## 2. ACCOUNTING AUTHORITY'S RESPONSIBILITIES AND APPROVAL

The accounting authority is required by the Public Finance Management Act (Act 1 of 1999), to maintain adequate accounting records and are responsible for the content and integrity of the annual financial statements and related financial information included in this report. It is the responsibility of the council to ensure that the annual financial statements fairly present the state of affairs of the entity as at the end of the financial year and the results of its operations and cash flows for the period then ended. The external auditors are engaged to express an independent opinion on the annual financial statements and was given unrestricted access to all financial records and related data.

The annual financial statements have been prepared in accordance with Standards of Generally Recognised Accounting Practice (GRAP) including any interpretations, guidelines and directives issued by the Accounting Standards Board.

The annual financial statements are based upon appropriate accounting policies consistently applied and supported by reasonable and prudent judgements and estimates.

The accounting authority acknowledge that they are ultimately responsible for the system of internal financial control established by the entity and place considerable importance on maintaining a strong control environment. To enable the council to meet these responsibilities, the accounting authority sets standards for internal control aimed at reducing the risk of error or deficit in a cost effective manner. The standards include the proper delegation of responsibilities within a clearly defined framework, effective accounting procedures and adequate segregation of duties to ensure an acceptable level of risk. These controls are monitored throughout the entity and all employees are required to maintain the highest ethical standards in ensuring the entity's business is conducted in a manner that in all reasonable circumstances is above reproach. The focus of risk management in the entity is on identifying, assessing, managing and monitoring all known forms of risk across the entity. While operating risk cannot be fully eliminated, the entity endeavours to minimise it by ensuring that appropriate infrastructure, controls, systems and ethical behaviour are applied and managed within predetermined procedures and constraints.

The accounting authority is of the opinion, based on the information and explanations given by management, that the system of internal control provides reasonable assurance that the financial records may be relied on for the preparation of the annual financial statements. However, any system of internal financial control can provide only reasonable, and not absolute, assurance against material misstatement or deficit.

The accounting authority have reviewed the entity's cash flow forecast for the year ended to 31 March 2024 and, in the light of this review and the current financial position, they are satisfied that the entity has or has access to adequate resources to continue in operational existence for the foreseeable future.

The entity is mainly dependent on the parliamentary grant for continued funding of operations. The annual financial statements are prepared on the basis that the entity is a going concern and that the entity has neither the intention nor the need to liquidate or curtail materially the scale of the entity.

Although the accounting authority is primarily responsible for the financial affairs of the entity, it is supported by the entity's external auditors.

The external auditors are responsible for independently reviewing and reporting on the entity's annual financial statements. The annual financial statements have been examined by the entity's external auditors and their report is presented on page 183-194.

The annual financial statements set out on page 196-259, which have been prepared on the going concern basis, were approved by the accounting authority on 31 August 2023 and were signed on its behalf by:



Ms J Isaacs  
Chairperson



Dr L Magingxa  
Chief Executive Officer

### 3. ANNUAL FINANCIAL STATEMENTS

#### STATEMENT OF FINANCIAL PERFORMANCE

Figures in Rand	Note(s)	2023	2022 Restated*
<b>Revenue</b>			
<b>Revenue from exchange transactions</b>			
Sale of goods		10 219 775	13 268 195
Rendering of services		296 305 149	241 283 545
Royalty income		47 489 609	35 163 711
Rental of facilities and equipment		31 196 748	27 430 655
Recoveries		1 350 043	7 871 680
Other income		16 387 910	9 048 177
Interest received	3	61 922 271	30 989 689
Dividends or similar distributions received	3	-	13 511
<b>Total revenue from exchange transactions</b>		<b>464 871 505</b>	<b>365 069 163</b>
<b>Revenue from non-exchange transactions</b>			
<b>Transfer revenue</b>			
Government grants	4	1 061 835 096	1 029 145 971
<b>Total revenue</b>		<b>1 526 706 601</b>	<b>1 394 215 134</b>
<b>Expenditure</b>			
Employee related costs	5	(787 733 398)	(761 882 394)
Depreciation and amortisation	6	(67 570 123)	(81 071 378)
Finance costs	7	(9 827)	(247 427)
Lease rentals on operating lease	8	(2 752 494)	(3 460 998)
Repairs and maintenance		(38 536 485)	(32 055 856)
Operating and administrative expenses	9	(396 574 861)	(328 478 373)
<b>Total expenditure</b>		<b>(1 293 177 188)</b>	<b>(1 207 196 426)</b>
<b>Operating surplus</b>		<b>233 529 413</b>	<b>187 018 708</b>
Loss on disposal of assets and liabilities		(13 416 155)	(9 171 920)
Loss on foreign exchange		(1 343 580)	(1 417 745)
Fair value adjustment on other financial assets at fair value	10	261 698	2 001 236
Actuarial gains/(losses)	11	1 055 579	(1 041 136)
Gain on biological assets and agricultural produce	12	3 528 020	2 621 043
Impairment loss		(7 851 847)	(19 251 769)
Inventories losses/(write-downs)		(439 599)	(2 836 986)
		<b>(18 205 884)</b>	<b>(29 097 277)</b>
<b>Surplus for the period</b>		<b>215 323 529</b>	<b>157 921 431</b>



# STATEMENT OF FINANCIAL POSITION AS AT 31 MARCH 2023

Figures in Rand	Note(s)	2023	2022 Restated*
<b>Assets</b>			
<b>Current Assets</b>			
Inventories	13	22 928 286	18 720 302
Operating lease asset	14	487 184	791 347
Receivables from exchange transactions	15	80 107 812	114 454 648
Prepayments	16	6 884 703	6 385 577
Cash and cash equivalents	17	1 205 011 572	796 969 462
		<b>1 315 419 557</b>	<b>937 321 336</b>
<b>Non-Current Assets</b>			
Biological assets that form part of an agricultural activity	18	809 576	1 038 169
Investment property	19	5 032 033	5 214 576
Property, plant and equipment	20	1 931 601 461	1 953 841 423
Intangible assets	21	14 650 599	11 870 463
Heritage assets	22	223 167	223 167
Living resources	23	1 674 778	1 360 002
Other financial assets	24	6 717 473	6 455 775
Operating lease asset	14	3 976 273	3 600 903
Prepayments	16	261 611	45 156
		<b>1 964 946 971</b>	<b>1 983 649 634</b>
<b>Total Assets</b>		<b>3 280 366 528</b>	<b>2 920 970 970</b>
<b>Liabilities</b>			
<b>Current Liabilities</b>			
Operating lease liability	14	–	20 356
Payables from exchange transactions	25	383 567 801	258 453 447
VAT payable		28 292 956	1 018 807
		<b>411 860 757</b>	<b>259 492 610</b>
<b>Non-Current Liabilities</b>			
Employee benefit obligation	26	10 228 452	11 533 555
Unspent conditional grants and receipts	27	478 371 220	484 805 506
		<b>488 599 672</b>	<b>496 339 061</b>
<b>Total Liabilities</b>		<b>900 460 429</b>	<b>755 831 671</b>
<b>Net Assets</b>		<b>2 379 906 099</b>	<b>2 165 139 299</b>
Share capital / contributed capital	28	111 986 013	111 986 013
Reserves			
Revaluation reserve	29	961 995 870	961 995 870
Self-insurance reserve		4 015 558	4 572 286
Accumulated surplus		1 301 908 658	1 086 585 130
<b>Total Net Assets</b>		<b>2 379 906 099</b>	<b>2 165 139 299</b>

## STATEMENT OF CHANGES IN NET ASSETS

Figures in Rand	Share capital / contributed capital	Revaluation reserve	Insurance reserve	Total reserves	Accumulated surplus / deficit	Total net assets
<b>Balance at 01 April 2021</b>						
Changes in net assets	111 986 013	961 995 870	5 732 604	967 728 474	928 663 699	2 008 378 186
Surplus for the year						
Movement in reserves	-	-	-	-	157 921 431	157 921 431
Total changes	-	-	(1 160 318)	(1 160 318)	-	(1 160 318)
	-	-	(1 160 318)	(1 160 318)	157 921 431	156 761 113
<b>Restated* Balance at 01 April 2022</b>	111 986 013	961 995 870	4 572 286	966 568 156	1 086 585 129	2 165 139 298
Changes in net assets						
Surplus for the year	-	-	-	-	215 323 529	215 323 529
Movement in reserves	-	-	(556 728)	(556 728)	-	(556 728)
Total changes	-	-	(556 728)	(556 728)	215 323 529	214 766 801
<b>Balance at 31 March 2023</b>	111 986 013	961 995 870	4 015 558	966 011 428	1 301 908 658	2 379 906 099
Note(s)	28	29				

## CASH FLOW STATEMENT

Figures in Rand	Note(s)	2023	2022 Restated*
<b>Cash flows from operating activities</b>			
<b>Receipts</b>			
Sale of goods and services		429 511 153	325 198 391
Grants		1 060 278 261	1 140 648 289
Interest income		61 922 271	30 989 689
Dividends or similar distributions received		-	13 511
		1 551 711 685	1 496 849 880
<b>Payments</b>			
Employee costs		(784 211 015)	(761 328 122)
Suppliers		(298 689 275)	(390 179 994)
Finance costs		(9 827)	(247 427)
		(1 082 910 117)	(1 151 755 543)
<b>Net cash flows from operating activities</b>	32	<b>468 801 568</b>	<b>345 094 337</b>
<b>Cash flows from investing activities</b>			
Purchase of property, plant and equipment	20	(57 260 837)	(46 503 605)
Purchase of other intangible assets	21	(3 498 621)	(3 784 200)
<b>Net cash flows from investing activities</b>		<b>(60 759 458)</b>	<b>(50 287 805)</b>
<b>Net increase/(decrease) in cash and cash equivalents</b>		408 042 110	294 806 532
Cash and cash equivalents at the beginning of the year		796 969 462	502 162 930
<b>Cash and cash equivalents at the end of the year</b>	17	<b>1 205 011 572</b>	<b>796 969 462</b>

The accounting policies on pages 197 - 224 and the notes on pages 225 - 256 form an integral part of the annual financial statements.

\*See Note 38 & 37

# STATEMENT OF COMPARISON OF BUDGET AND ACTUAL AMOUNTS

## Budget on Accrual Basis

Figures in Rand	Approved budget	Adjustments	Final Budget	Actual amounts on comparable basis	Difference between final budget and actual	Reference
<b>Statement of Financial Performance</b>						
<b>Revenue</b>						
Parliamentary Grant Operational	950 458 530	0	<b>950 458 530</b>	952 015 096	<b>1 556 566</b>	#1
Parliamentary Grant Capex	109 820 077	0	<b>109 820 077</b>	109 820 000	<b>(77)</b>	#2
External Income	425 703 808	0	<b>425 703 808</b>	353 570 390	<b>(72 133 418)</b>	#3
Other Income	80 888 842	0	<b>80 888 842</b>	120 807 690	<b>39 918 848</b>	#4
<b>Total revenue</b>	<b>1 566 871 257</b>	<b>0</b>	<b>1 566 871 257</b>	<b>1 536 213 176</b>	<b>(30 658 081)</b>	
<b>Expenditure</b>						
Personnel	(827 994 531)	0	<b>(827 994 531)</b>	(787 189 917)	<b>40 804 614</b>	#5
Depreciation and amortisation	(66 056 453)	0	<b>(66 056 453)</b>	(67 570 123)	<b>(1 513 670)</b>	#6
Finance costs	(10 000)	0	<b>(10 000)</b>	(9 827)	<b>173</b>	#7
Operating and administrative expenses	(556 304 131)	0	<b>(556 304 131)</b>	(466 119 781)	<b>90 184 350</b>	#8
<b>Total expenditure</b>	<b>(1 450 365 115)</b>	<b>0</b>	<b>(1 450 365 115)</b>	<b>(1 320 889 648)</b>	<b>129 475 467</b>	
<b>Surplus before taxation</b>	<b>116 506 142</b>	<b>0</b>	<b>116 506 142</b>	<b>215 323 528</b>	<b>98 817 386</b>	
<b>Surplus for the 12 months period</b>	<b>116 506 142</b>	<b>0</b>	<b>116 506 142</b>	<b>215 323 528</b>	<b>98 817 386</b>	
Capital expenditure	(109 820 077)	0	<b>(109 820 077)</b>	(60 759 458)	<b>49 060 619</b>	#9
<b>Net Operational Surplus/(Deficit)</b>	<b>6 686 065</b>	<b>0</b>	<b>6 686 065</b>	<b>154 564 070</b>	<b>147 878 005</b>	

The budget was approved by the ARC Council and submitted to the Executive Authority in terms of section 53(1) of the PFMA. (Both the annual budget and financial statement adopt an Accrual Basis.) The budget amounts reflected excluded VAT.

- #1 The difference is the FMD operational revenue coming from the deferred income.
- #2 Rounding difference.
- #3 Interest and uptake of the services and goods offered by the ARC were not taken up as anticipated.
- #4 Mainly driven by the interest received from the FMD and DALRRD funds received in advance.
- #5 Conservative stance on the filling of vacancies.
- #6 Capex acquisition depreciation underestimated during the budget process.
- #7 Slightly less interest expense incurred.
- #8 Lower expenditure as a direct consequence of lower external income generation. Expenditure is incurred in line with the project activities.
- #9 Less capital acquisitions, mainly due to process restrictions.

# ACCOUNTING POLICIES

## 1. PRESENTATION OF ANNUAL FINANCIAL STATEMENTS

The annual financial statements have been prepared in accordance with the Standards of Generally Recognised Accounting Practice (GRAP), issued by the Accounting Standards Board in accordance with Section 91(1) of the Public Finance Management Act (Act 1 of 1999).

These annual financial statements have been prepared on an accrual basis of accounting and are in accordance with historical cost convention as the basis of measurement, unless specified otherwise. They are presented in South African Rand and rounded to the nearest Rand.

In the absence of an issued and effective Standard of GRAP, accounting policies for material transactions, events or conditions were developed in accordance with paragraphs 8, 10 and 11 of GRAP 3 as read with Directive 5.

Assets, liabilities, revenues and expenses were not offset, except where offsetting is either required or permitted by a Standard of GRAP. Transactions are offset when such offsetting reflects the substance of the transaction or event. Where a legally enforceable right of offset exists for recognised financial assets and financial liabilities, and there is an intention to settle the liability and realise the asset simultaneously, or to settle on a net basis all related financial effects are offset and the accounting standard permits.

A summary of the significant accounting policies, which have been consistently applied in the preparation of these annual financial statements, are disclosed below.

These accounting policies are consistent with those adopted in the prior year's financial statements, except where a change in accounting policy has been recorded.

### 1.1 ENTITY INFORMATION

The ARC is a schedule 3(a) PFMA national public entity (enacted by the Agricultural Research Act, 1990 (Act 86 of 1990) domiciled in the Republic of South Africa.

### 1.2 PRESENTATION CURRENCY

These annual financial statements are presented in South African Rand, which is the functional currency of the entity.

### 1.3 GOING CONCERN ASSUMPTION

These annual financial statements have been prepared on a going concern basis, and that the entity will continue in operation and meet its obligations for at least the next 12 months.

### 1.4 SIGNIFICANT JUDGEMENTS AND SOURCES OF ESTIMATION UNCERTAINTY

In preparing the annual financial statements, management is required to make estimates and assumptions that affect the amounts represented in the annual financial statements and related disclosures. Use of available information and the application of judgement is inherent in the formation of estimates. Actual results in the future could differ from these estimates which may be material to the annual financial statements.

Other significant judgements, sources of estimation uncertainty and/or relating information, have been disclosed in the relating notes.



**Significant judgements include:****Impairment testing**

The entity reviews and tests the carrying value of assets when events or changes in circumstances suggest that the carrying amount may not be recoverable. Assets are grouped at the lowest level for which identifiable cash flows are largely independent of cash flows of other assets and liabilities. If there are indications that impairment may have occurred, estimates are prepared of expected future cash flows for each group of assets. Expected future cash flows used to determine the value in use of tangible assets are inherently uncertain and could materially change over time. They are significantly affected by a number of factors including supply and demand and other economic factors.

**Provisions**

Provisions were raised and management determined an estimate based on the information available.

**Property, plant and equipment and intangible assets**

Property, plant and equipment and intangible assets are depreciated over their useful lives, taking into account residual values, where appropriate. The entity's management determines useful lives, residual values and related depreciation charges for its property, plant and equipment (Including biological assets held for research) and intangible assets with reference to the estimated periods that the entity intends to derive future economic benefits from the use of these assets. The useful lives of the assets and residual values are assessed annually and may vary depending on a number of factors. In re-assessing asset useful lives, factors such as technological innovation and maintenance programmes are taken into account. Residual value assessments consider issues such as future market conditions, the remaining life of the asset and projected disposal values.

**Post-retirement benefits**

The entity's post retirement benefits relate to the post-retirement medical aid benefits. The present value of the post-retirement obligation depends on a number of factors (i.e. discount rates, healthcare cost inflation, average retirement age) that are determined on an actuarial basis using a number of assumptions. The assumptions used in determining the net cost (income) include the discount rate. Any changes in these assumptions will impact on the carrying amount of post-retirement obligations.

The entity determines the appropriate discount rate at the end of each year. This is the interest rate that should be used to determine the present value of estimated future cash outflows expected to be required to settle the pension obligations. In determining the appropriate discount rate, the entity considers the interest rates of high-quality corporate bonds that are denominated in the currency in which the benefits will be paid, and that have terms to maturity approximating the terms of the related pension liability.

Other key assumptions for post-retirement medical aid obligations are based on current market conditions. Additional information is disclosed in Note 26.

**Biological Assets**

In measuring fair value of biological assets, management estimates and judgements are required for determination of fair value. The determination of the fair value of a biological asset or agricultural produce may be facilitated by grouping biological assets or agricultural produce according to the significant attributes of the asset; e.g. sorted by age or quality. The Company selects the attributes corresponding to the attributes used in the market as a basis for pricing.

If an active market exists for a biological asset or agricultural produce, the quoted market price is appropriate for determining the fair value.

If there is no active market for a biological asset or agricultural produce one of the following valuations is applied:

- The most recent market transaction price, provided that the market has not significantly changed since that transaction;
- The market prices for similar assets with adjustments to reflect differences; and
- Sector benchmarks such as the value of an orchard expressed per export tray, bushel, or hectare and value of cattle expressed per kilogram of meat.

**Stage of completion**

In determining the stage of completion of a research project, management estimates the stage of completion based on work completed for as assessed by project leaders. This is then compared to costs incurred to date with appropriate revenue recognition processed in the statement of financial performance. Consideration is given to any arrangements with funders to offset any costs incurred in excess of budgeted amounts.

**Capitilisation of intellectual property**

The entity generates royalty revenue from Intellectual Property (IP) including Plant Breeders Rights, Patents and a Design arising from research conducted (either by entity's employees or funded by the entity or research collaboration or industry funding). These are internally generated intangible assets, however, they arise as a result of research activities and not development activities as envisioned by paragraph 52 of GRAP 31.

The entity protects the IP in terms of the Act by registering the results of the research (either an improved variant or cultivars or other products) with the relevant authorities. Entity protects the IP in terms of the Intellectual Property Rights from Publicly Financed Research and Development Act of 2008. It is a requirement to protect IP as a publicly funded institution.

The entity does not intend to sell the IP nor to use the IP for its own use but rather holds the IP for use by third parties and earns royalties from the IP. The object from the results of the research conducted by ARC (either through employees or funded research by entity) is generally to improve farming quality, either through more cost effective techniques, better yield and/or better quality of product for all levels of farming including Small and Medium Enterprises.

**1.5 BIOLOGICAL ASSETS THAT FORM PART OF AN AGRICULTURAL ACTIVITY**

The entity recognises biological assets that form part of an agricultural activity or agricultural produce when, and only when:

- the entity controls the asset as a result of past events;
- it is probable that future economic benefits or service potential associated with the asset will flow to the entity; and
- the fair value or cost of the asset can be measured reliably.

Biological assets that form part of an agricultural activity are measured at their fair value less costs to sell.

The fair value of livestock is determined based on market prices of livestock of similar age, breed, and genetic merit. The fair value of milk is determined based on market prices in the local area.

The fair value of the vine / pine plantations is based on the combined fair value of the land and the vines / pine trees. The fair value of the raw land and land improvements is then deducted from the combined fair value to determine the fair value of the vines / pine trees.

Agricultural produce is the harvested product of the company's biological assets and is measured at its fair value less estimated costs to sell at the point of harvest. Such measurement is the cost at that date when transferring the harvested produce to inventory. The presentation of biological assets as current or non-current assets depends on the nature of the biological assets. Biological assets that are expected to be consumed in the next 12 months are disclosed under current assets.

A gain or loss arising on initial recognition of biological assets that form part of an agricultural activity or agricultural produce at fair value less costs to sell and from a change in fair value less costs to sell of biological assets that form part of an agricultural activity is included in surplus or deficit for the period in which it arises. Costs to sell include all costs that would be necessary to sell the assets, including transportation costs and incremental selling costs, auctioneers fees and commission paid to dealers and brokers. All costs incurred in maintaining the biologicals assets are included in surplus or deficit for the period in which they arise.

Where biological assets are acquired at no cost or for a nominal cost, the cost is determined to be its fair value less costs to sell as at the date of acquisition. Where market determined prices or values are not available, the present value of the expected net cash inflows from the asset, discounted at a current market-determined pre-tax rate where applicable is used to determine fair value.

## 1.6 INVESTMENT PROPERTY

Investment property is property (land or a building - or part of a building - or both) held to earn rentals or for capital appreciation or both, rather than for:

- use in the production or supply of goods or services or for
- administrative purposes, or
- sale in the ordinary course of operations.

Owner-occupied property is property held for use in the production or supply of goods or services or for administrative purposes.

Investment property is recognised as an asset when, it is probable that the future economic benefits or service potential that are associated with the investment property will flow to the entity, and the cost or fair value of the investment property can be measured reliably.

Investment property is initially recognised at cost. Transaction costs are included in the initial measurement. Where investment property is acquired through a non-exchange transaction, its cost is its fair value as at the date of acquisition.

Costs include costs incurred initially and costs incurred subsequently to add to, or to replace a part of, or service a property. If a replacement part is recognised in the carrying amount of the investment property, the carrying amount of the replaced part is derecognised.

### Cost model

Investment property is carried at cost less accumulated depreciation and any accumulated impairment losses. Depreciation is provided to write down the cost, less estimated residual value by equal instalments over the useful life of the property, which is as follows:

<u>Item</u>	<u>Useful life</u>
Property - land	indefinite
Property - buildings	3 - 70 years

Investment property is derecognised on disposal or when the investment property is permanently withdrawn from use and no future economic benefits or service potential are expected from its disposal.

The entity separately disclose expenditure to repairs and maintenance investment property, in the notes to the annual financial statements (see note 19).

## 1.7 PROPERTY, PLANT AND EQUIPMENT

Property, plant and equipment are tangible non-current assets (including infrastructure assets) that are held for use in the production or supply of goods or services, rental to others, or for administrative purposes, and are expected to be used during more than one period.

The cost of an item of property, plant and equipment is recognised as an asset when:

- it is probable that future economic benefits or service potential associated with the item will flow to the entity; and
- the cost of the item can be measured reliably.

Property, plant and equipment is initially measured at cost.

The cost of an item of property, plant and equipment is the purchase price and other costs attributable to bring the asset to the location and condition necessary for it to be capable of operating in the manner intended by management. Trade discounts and rebates are deducted in arriving at the cost.

Where an asset is acquired through a non-exchange transaction, its cost is its fair value as at date of acquisition.

Where an item of property, plant and equipment is acquired in exchange for a non-monetary asset or monetary assets, or a combination of monetary and non-monetary assets, the asset acquired is initially measured at fair value (the cost). If the acquired item's fair value was not determinable, it's deemed cost is the carrying amount of the asset(s) given up.

When significant components of an item of property, plant and equipment have different useful lives, they are accounted for as separate items (major components) of property, plant and equipment.

Costs include costs incurred initially to acquire or construct an item of property, plant and equipment and costs incurred subsequently to add to, replace part of, or service it. If a replacement cost is recognised in the carrying amount of an item of property, plant and equipment, the carrying amount of the replaced part is derecognised.

The fruit trees are bearer plants under the definition in Standard of GRAP 27 Agriculture and therefore presented and accounted for as property, plant and equipment. Costs capitalised to bearer assets (Fruit trees: i.e banana palms, deciduous and macadamia trees) include all direct costs of land preparation and planting. Bearer plants are measured at cost less accumulated depreciation and impairment losses. Bearer plants are measured at accumulated costs until maturity, similar to the accounting for a self-constructed item of property, plant and equipment. However, the fruit growing on the plants are accounted for as biological assets until the point of harvest. All costs relating to the development of an orchard/vineyard are capitalised to the respective orchard/block of vineyard planted. The establishment costs are allocated per orchard/block of vineyard based on establishment costs allocated per hectare. Production costs and capital expenditure are capitalised to the bearer plant until the plant has reached the age of full bearing. Income that is received related to the orchard/vineyard prior to it becoming full bearing is credited to the capitalised costs. Depreciation in respect of orchards/vineyards is calculated from the date the orchard/vineyard reaches the state of full bearing and calculated by taking the cost per orchard/vineyard and dividing by the relevant remaining useful life.

Items such as spare parts, standby equipment and servicing equipment are recognised when they meet the definition of property, plant and equipment.

Property, plant and equipment is carried at cost less accumulated depreciation and any impairment losses.

Land and buildings are carried at revalued amount, being the fair value at the date of revaluation less any subsequent accumulated depreciation and subsequent accumulated impairment losses. Land and buildings are revalued independently every five (5) years.

When an item of property, plant and equipment is revalued, any accumulated depreciation at the date of the revaluation is eliminated against the gross carrying amount of the asset and the net amount restated to the revalued amount of the asset.

Any increase in an asset's carrying amount, as a result of a revaluation, is credited directly to a revaluation surplus. The increase is recognised in surplus or deficit to the extent that it reverses a revaluation decrease of the same asset previously recognised in surplus or deficit.

The revaluation surplus in equity related to a specific item of property, plant and equipment is transferred directly to retained earnings when the asset is derecognised.

Property, plant and equipment are depreciated on the straight-line basis over their expected useful lives to their estimated residual value.



The useful lives of items of property, plant and equipment have been assessed as follows:

Item	Depreciation method	Average useful life
Land		Not depreciated
Buildings	Straight-line	3 to 70 years
Machinery and farming equipment	Straight-line	3 to 60 years
Office furniture and equipment	Straight-line	5 to 30 years
Motor vehicles and aircraft	Straight-line	1 to 20 years
Computer equipment	Straight-line	3 to 55 years
Infrastructure	Straight-line	5 to 60 years
Laboratory equipment	Straight-line	5 to 60 years
Bearer plants	Straight-line	3 to 50 years
Buffalo	Straight-line	8 to 23 years
Horse	Straight-line	10 to 30 years

The depreciable amount of an asset is allocated on a systematic basis over its useful life.

Each part of an item of property, plant and equipment with a cost that is significant in relation to the total cost of the item is depreciated separately.

The entity assesses at each reporting date whether there is any indication that the entity expectations about the residual value and the useful life of an asset have changed since the preceding reporting date. If any such indication exists, the entity revises the expected useful life and/or residual value accordingly. The change is accounted for as a change in an accounting estimate.

The depreciation charge for each period is recognised in surplus or deficit unless it is included in the carrying amount of another asset.

Items of property, plant and equipment are derecognised when the asset is disposed of or when there are no further economic benefits or service potential expected from the use of the asset.

The gain or loss arising from the derecognition of an item of property, plant and equipment is included in surplus or deficit when the item is derecognised. The gain or loss arising from the derecognition of an item of property, plant and equipment is determined as the difference between the net disposal proceeds, if any, and the carrying amount of the item.

The entity separately discloses expenditure to repair and maintain property, plant and equipment in the notes to the financial statements (see note 20).

The entity discloses relevant information relating to assets under construction or development, in the notes to the financial statements (see note 20).

## 1.8 INTANGIBLE ASSETS

An intangible asset is an identifiable non-monetary asset without physical substance.

An intangible asset is recognised when:

- it is probable that the expected future economic benefits or service potential that are attributable to the asset will flow to the entity; and
- the cost or fair value of the asset can be measured reliably.

The entity assesses the probability of expected future economic benefits or service potential using reasonable and supportable assumptions that represent management's best estimate of the set of economic conditions that will exist over the useful life of the asset.

Intangible assets are measured initially at cost. Where an intangible asset is acquired through a non-exchange transaction, its initial cost at the date of acquisition is measured at its fair value as at that date.

The entity has registered a number of patents, plant breeders rights and designs emanating from the research conducted or funded by entity in terms of Agricultural Research Act as amended in order to protect the Intellectual Property derived from the research. The entity does not capitalize the research costs incurred, but expenses these costs in terms of GRAP 31: Intangible Assets, as the criteria to capitalize these assets as development costs has not been met.

Expenditure on research (or on the research phase of an internal project) is recognised as an expense when it is incurred.

An intangible asset arising from development (or from the development phase of an internal project) is recognised when:

- it is technically feasible to complete the asset so that it will be available for use or sale.
- there is an intention to complete and use or sell it.
- there is an ability to use or sell it.
- it will generate probable future economic benefits or service potential.
- there are available technical, financial and other resources to complete the development and to use or sell the asset.
- the expenditure attributable to the asset during its development can be measured reliably.

Intangible assets are carried at cost less any accumulated amortisation and any impairment losses.

An intangible asset is regarded as having an indefinite useful life when, based on all relevant factors, there is no foreseeable limit to the period over which the asset is expected to generate net cash inflows or service potential. Amortisation is not provided for these intangible assets, but they are tested for impairment annually and whenever there is an indication that the asset may be impaired. For all other intangible assets amortisation is provided on a straight-line basis over their useful life.

The amortisation period and the amortisation method for intangible assets are reviewed at each reporting date. Amortisation of intangible assets is included in the depreciation and amortisation line item in the statement of financial performance.

Reassessing the useful life of an intangible asset with a finite useful life after it was classified as indefinite is an indicator that the asset may be impaired. As a result the asset is tested for impairment and the remaining carrying amount is amortised over its useful life.

Amortisation is provided to write down the intangible assets, on a straight-line basis, to their residual values as follows:

Item	Depreciation method	Average useful life
Computer software	Straight-line	3-10 years

The entity discloses relevant information relating to assets under construction or development, in the notes to the financial statements (see note 21).

Intangible assets are derecognised:

- on disposal; or
- when no future economic benefits or service potential are expected from its use or disposal.

The gain or loss arising from the derecognition of intangible assets is included in surplus or deficit when the asset is derecognised (unless the Standard of GRAP on leases requires otherwise on a sale and leaseback).

## 1.9 HERITAGE ASSETS

Carrying amount is the amount at which an asset is recognised after deducting accumulated impairment losses.

Class of heritage assets means a grouping of heritage assets of a similar nature or function in an entity's operations that is shown as a single item for the purpose of disclosure in the annual financial statements.

Cost is the amount of cash or cash equivalents paid or the fair value of the other consideration given to acquire an asset at the time of its acquisition or construction or, where applicable, the amount attributed to that asset when initially recognised in accordance with the specific requirements of other Standards of GRAP.

Fair value is the amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties in an arm's length transaction.

Heritage assets are assets that have a cultural, environmental, historical, natural, scientific, technological or artistic significance and are held indefinitely for the benefit of present and future generations.

An impairment loss of a non-cash-generating asset is the amount by which the carrying amount of an asset exceeds its recoverable service amount.

### **Recognition**

The entity recognises a heritage asset as an asset if it is probable that future economic benefits or service potential associated with the asset will flow to the entity, and the cost or fair value of the asset can be measured reliably.

### **Initial measurement**

Heritage assets are measured at cost.

Where a heritage asset is acquired through a non-exchange transaction, its cost is measured at its fair value as at the date of acquisition.

### **Subsequent measurement**

After recognition as an asset, a class of heritage assets is carried at its cost less any accumulated impairment losses.

#### **Impairment**

The entity assesses at each reporting date whether there is an indication that it may be impaired. If any such indication exists, the entity estimates the recoverable amount or the recoverable service amount of the heritage asset.

### **Derecognition**

The entity derecognises heritage asset on disposal, or when no future economic benefits or service potential are expected from its use or disposal.

The gain or loss arising from the derecognition of a heritage asset is included in surplus or deficit when the item is derecognised (unless the Standard of GRAP on leases requires otherwise on a sale and leaseback).

## 1.10 FINANCIAL INSTRUMENTS

A financial instrument is any contract that gives rise to a financial asset of one entity and a financial liability or a residual interest of another entity.

The amortised cost of a financial asset or financial liability is the amount at which the financial asset or financial liability is

measured at initial recognition minus principal repayments, plus or minus the cumulative amortisation using the effective interest method of any difference between that initial amount and the maturity amount, and minus any reduction (directly or through the use of an allowance account) for impairment or uncollectibility.

Credit risk is the risk that one party to a financial instrument will cause a financial loss for the other party by failing to discharge an obligation.

Currency risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in foreign exchange rates.

Derecognition is the removal of a previously recognised financial asset or financial liability from an entity's statement of financial position.

The effective interest method is a method of calculating the amortised cost of a financial asset or a financial liability (or group of financial assets or financial liabilities) and of allocating the interest income or interest expense over the relevant period. The effective interest rate is the rate that exactly discounts estimated future cash payments or receipts through the expected life of the financial instrument or, when appropriate, a shorter period to the net carrying amount of the financial asset or financial liability. When calculating the effective interest rate, an entity shall estimate cash flows considering all contractual terms of the financial instrument (for example, prepayment, call and similar options) but shall not consider future credit losses. The calculation includes all fees and points paid or received between parties to the contract that are an integral part of the effective interest rate (see the Standard of GRAP on Revenue from Exchange Transactions), transaction costs, and all other premiums or discounts. There is a presumption that the cash flows and the expected life of a group of similar financial instruments can be estimated reliably. However, in those rare cases when it is not possible to reliably estimate the cash flows or the expected life of a financial instrument (or group of financial instruments), the entity shall use the contractual cash flows over the full contractual term of the financial instrument (or group of financial instruments).

Fair value is the amount for which an asset could be exchanged, or a liability settled, between knowledgeable willing parties in an arm's length transaction.

A financial asset is:

- cash;
- a residual interest of another entity; or
- a contractual right to:
  - receive cash or another financial asset from another entity; or
  - exchange financial assets or financial liabilities with another entity under conditions that are potentially favourable to the entity.

A financial liability is any liability that is a contractual obligation to:

- deliver cash or another financial asset to another entity; or
- exchange financial assets or financial liabilities under conditions that are potentially unfavourable to the entity.

Interest rate risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market interest rates.

Liquidity risk is the risk encountered by an entity in the event of difficulty in meeting obligations associated with financial liabilities that are settled by delivering cash or another financial asset.

Market risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market prices. Market risk comprises three types of risk: currency risk, interest rate risk and other price risk.

Other price risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market prices (other than those arising from interest rate risk or currency risk), whether those changes are caused by factors specific to the individual financial instrument or its issuer, or factors affecting all similar financial instruments traded in the market.

Transaction costs are incremental costs that are directly attributable to the acquisition, issue or disposal of a financial asset or financial liability. An incremental cost is one that would not have been incurred if the entity had not acquired, issued or disposed of the financial instrument.

Financial instruments at amortised cost are non-derivative financial assets or non-derivative financial liabilities that have fixed or determinable payments, excluding those instruments that:

- the entity designates at fair value at initial recognition; or
- are held for trading.

Financial instruments at cost are investments in residual interests that do not have a quoted market price in an active market, and whose fair value cannot be reliably measured.

### Classification

The entity has the following types of financial assets (classes and category) as reflected on the face of the statement of financial position or in the notes thereto:

Cash and cash equivalents	Financial asset measured at amortised cost
Trade and other receivables	Financial asset measured at amortised cost
Other financial asset - JSE Listed	Financial asset measured at fair value
Other financial asset - Unlisted shares	Financial asset measured at cost

The entity has the following types of financial liabilities (classes and category) as reflected on the face of the statement of financial position or in the notes thereto:

Trade and other payables	Financial liability measured at amortised cost
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### Recognition and measurement

Financial assets and liabilities are recognised when the entity becomes a party to the contractual provisions of the instruments. The entity recognises financial assets using trade date accounting.

Financial assets and liabilities are initially measured at fair value plus transaction costs that are directly attributable to the acquisition or issue of the financial asset or financial liability when the entity is a party to a contractual arrangement. Subsequent to initial recognition these instruments are measured as set out above.

#### *Receivables from exchange transactions*

Trade and other receivables, excluding, when applicable, VAT and prepayments, are measured at initial recognition at fair value, and are subsequently measured at amortised cost using effective interest rate method. Appropriate allowances for estimated irrecoverable amounts are recognised in surplus or deficit when there is objective evidence that not all amounts due will be collected according to original terms of the receivables.

Significant financial difficulties of the debtor, probability that the debtor will enter bankruptcy or financial derecognition, and default or delinquency in payments are considered indicators that the trade receivable is impaired. The allowance recognised is measured as the difference between the asset's carrying amount and the present value of estimated future cash flows, discounted at the effective interest rate computed at initial recognition.

The carrying amount of the asset is reduced through the use of an allowance account, and the amount of the credit loss is recognised in surplus or deficit. When a trade receivable is uncollectable, it is written off against the allowance account for trade receivables. Subsequent recoveries of amounts previously written off are credited in surplus or deficit.

#### *Payables from exchange transactions*

Trade and other payables, excluding VAT and amounts received in advance, are initially measured at fair value and subsequently measured at amortised cost, using effective interest rate method.

#### *Cash and cash equivalents*

Cash and cash equivalents are initially measured at fair value plus transaction costs that are directly attributable to the acquisition, which is deemed to be their fair value and subsequently recorded at amortised cost. Cash and cash equivalents comprise cash on hand, highly liquid investment and short-term deposits, all of which are available for use by the entity with insignificant risk of changes in value.

#### *Other financial assets*

Other financial assets are initially measured at fair value plus transaction costs that are directly attributable to the acquisition, which is deemed to be their fair value and subsequently recorded at amortised cost and fair value.

Other financial assets comprise shares in JSE listed companies and shares in co-operatives. The fair value of the other financial assets traded in active markets is based on quoted market prices (closing price) at the end of each reporting period.



*Impairment and uncollectivity of financial assets*

The entity assesses at the end of each reporting period whether there is any objective evidence that a financial asset or group of financial assets is impaired.

**Derecognition**

The entity derecognises a financial asset only when the contractual rights to the cash flows from the asset expire, are settled, waived, or when it transfers substantially all the risks and rewards of ownership of the asset to another party. If the entity neither transfers nor retains substantially all the risks and rewards of ownership and continues to control the transferred asset, the entity recognises its retained interest in the asset and an associated liability for amounts it may have to pay. If the entity retains substantially all the risks and rewards of ownership of a transferred financial asset, the entity continues to recognise the financial asset.

The entity derecognises financial liabilities when, and only when, the entity obligations are discharged, cancelled or they expire. The difference between the carrying amount of the financial liability derecognised and the consideration paid and payable, including any non-cash assets transferred or liabilities assumed is recognised in surplus or deficit.

**1.11 STATUTORY RECEIVABLES****Identification**

Statutory receivables are receivables that arise from legislation, supporting regulations, or similar means, and require settlement by another entity in cash or another financial asset.

Carrying amount is the amount at which an asset is recognised in the statement of financial position.

The cost method is the method used to account for statutory receivables that requires such receivables to be measured at their transaction amount, plus any accrued interest or other charges (where applicable) and, less any accumulated impairment losses and any amounts derecognised.

The transaction amount for a statutory receivable means the amount specified in, or calculated, levied or charged in accordance with, legislation, supporting regulations, or similar means.

**Recognition**

The entity recognises statutory receivables as follows:

- if the transaction is an exchange transaction, using the policy on Revenue from exchange transactions;
- if the transaction is a non-exchange transaction, using the policy on Revenue from non-exchange transactions (Taxes and transfers); or
- if the transaction is not within the scope of the policies listed in the above or another Standard of GRAP, the receivable is recognised when the definition of an asset is met and, when it is probable that the future economic benefits or service potential associated with the asset will flow to the entity and the transaction amount can be measured reliably.

**Initial measurement**

The entity initially measures statutory receivables at their transaction amount.

**Subsequent measurement**

The entity measures statutory receivables after initial recognition using the cost method. Under the cost method, the initial measurement of the receivable is changed subsequent to initial recognition to reflect any:

- interest or other charges that may have accrued on the receivable (where applicable);
- impairment losses; and
- amounts derecognised.

**Derecognition**

The entity derecognises a statutory receivable, or a part thereof, when:

- the rights to the cash flows from the receivable are settled, expire or are waived;
- the entity transfers to another party substantially all of the risks and rewards of ownership of the receivable; or

- the entity, despite having retained some significant risks and rewards of ownership of the receivable, has transferred control of the receivable to another party and the other party has the practical ability to sell the receivable in its entirety to an unrelated third party, and is able to exercise that ability unilaterally and without needing to impose additional restrictions on the transfer. In this case, the entity:
  - derecognise the receivable; and
  - recognise separately any rights and obligations created or retained in the transfer.

The carrying amounts of any statutory receivables transferred are allocated between the rights or obligations retained and those transferred on the basis of their relative fair values at the transfer date. The entity considers whether any newly created rights and obligations are within the scope of the Standard of GRAP on Financial Instruments or another Standard of GRAP. Any difference between the consideration received and the amounts derecognised and, those amounts recognised, are recognised in surplus or deficit in the period of the transfer.

## 1.12 TAX

### **Tax expenses**

The entity is exempt from income tax in terms of section 10(1) (a) of the Income Tax Act (Act no. 58 1962).

### **Value added tax**

The entity is subject to a value added tax ("AT" of 15% for the sale of goods and services. The amount of VAT liability is determined by applying the applicable tax rate to the invoiced amount of the sale of goods and services (output VAT) less VAT paid on purchases made with the relevant supporting invoices (input VAT). The entity reports revenue net value added tax for all the periods presented in the statement of financial performance.

## 1.13 LEASES

A lease is classified as a finance lease if it transfers substantially all the risks and rewards incidental to ownership. A lease is classified as an operating lease if it does not transfer substantially all the risks and rewards incidental to ownership.

The entity has entered into commercial property leases on land and buildings and it retains all the significant risks and rewards of ownership of the properties. The entity accounts for these contracts as operating lease, with the entity being a lessor. On the other hand, the entity leases premises occupied by staff in regional offices, where it does not retain all the significant risks and rewards of ownership of these properties and so accounts for these contracts as operating leases, with the entity being a lessee.

### **Operating leases - lessor**

Operating lease revenue is recognised as revenue on a straight-line basis over the lease term. Income for leases is disclosed under revenue in statement of financial performance.

### **Operating leases - lessee**

Operating lease payments are recognised as an expense on a straight-line basis over the lease term. The difference between the amounts recognised as an expense and the contractual payments are recognised as an operating lease asset or liability.

## 1.14 INVENTORIES

Inventories are initially measured at cost except where inventories are acquired through a non-exchange transaction, then their costs are their fair value as at the date of acquisition.

Subsequently inventories are measured at the lower of cost and net realisable value.

Inventories are measured at the lower of cost and current replacement cost where they are held for;

- distribution at no charge or for a nominal charge; or
- consumption in the production process of goods to be distributed at no charge or for a nominal charge.

Net realisable value is the estimated selling price in the ordinary course of operations less the estimated costs of

completion and the estimated costs necessary to make the sale, exchange or distribution.

Current replacement cost is the cost the entity incurs to acquire the asset on the reporting date.

The cost of inventories comprises of all costs of purchase, costs of conversion and other costs incurred in bringing the inventories to their present location and condition.

The cost of inventories is assigned using the weighted average cost formula. The same cost formula is used for all inventories having a similar nature and use to the entity.

Consumable stores are valued at the lower of cost and current replacement cost. Research Livestock is valued at the lower of cost or net realisable value. Cost of work in progress and finished goods includes direct costs and an appropriate allocation of overheads based on normal production levels.

Inventories comprising agricultural produce that an entity has harvested from its biological assets shall be measured on initial recognition at their fair value less costs to sell at the point of harvest. This is the cost of the inventories at that date for application of this Standard.

When inventories are sold, the carrying amounts of those inventories are recognised as an expense in the period in which the related revenue is recognised. If there is no related revenue, the expenses are recognised when the goods are distributed, or related services are rendered. The amount of any write-down of inventories to net realisable value or current replacement cost and all losses of inventories are recognised as an expense in the period the write-down or loss occurs. The amount of any reversal of any write-down of inventories, arising from an increase in net realisable value or current replacement cost, are recognised as a reduction in the amount of inventories recognised as an expense in the period in which the reversal occurs.

## 1.15 IMPAIRMENT OF CASH-GENERATING ASSETS

Cash-generating assets are assets used with the objective of generating a commercial return. Commercial return means that positive cash flows are expected to be significantly higher than the cost of the asset.

Impairment is a loss in the future economic benefits or service potential of an asset, over and above the systematic recognition of the loss of the asset's future economic benefits or service potential through depreciation (amortisation).

Carrying amount is the amount at which an asset is recognised in the statement of financial position after deducting any accumulated depreciation and accumulated impairment losses thereon.

A cash-generating unit is the smallest identifiable group of assets used with the objective of generating a commercial return that generates cash inflows from continuing use that are largely independent of the cash inflows from other assets or groups of assets.

Costs of disposal are incremental costs directly attributable to the disposal of an asset, excluding finance costs and income tax expense.

Fair value less costs to sell is the amount obtainable from the sale of an asset in an arm's length transaction between knowledgeable, willing parties, less the costs of disposal.

Recoverable amount of an asset or a cash-generating unit is the higher its fair value less costs to sell and its value in use.

### Identification

When the carrying amount of a cash-generating asset exceeds its recoverable amount, it is impaired.

The entity assesses at each reporting date whether there is any indication that a cash-generating asset may be impaired. If any such indication exists, the entity estimates the recoverable amount of the asset.

Irrespective of whether there is any indication of impairment, the entity also tests a cash-generating intangible asset with

an indefinite useful life or a cash-generating intangible asset not yet available for use for impairment annually by comparing its carrying amount with its recoverable amount. This impairment test is performed at the same time every year. If an intangible asset was initially recognised during the current reporting period, that intangible asset was tested for impairment before the end of the current reporting period.

#### **Value in use**

Value in use of a cash-generating asset is the present value of the estimated future cash flows expected to be derived from the continuing use of an asset and from its disposal at the end of its useful life.

When estimating the value in use of an asset, the entity estimates the future cash inflows and outflows to be derived from continuing use of the asset and from its ultimate disposal and the entity applies the appropriate discount rate to those future cash flows.

#### **Recognition and measurement (individual asset)**

If the recoverable amount of a cash-generating asset is less than its carrying amount, the carrying amount of the asset is reduced to its recoverable amount. This reduction is an impairment loss.

An impairment loss is recognised immediately in surplus or deficit.

Any impairment loss of a revalued cash-generating asset is treated as a revaluation decrease.

When the amount estimated for an impairment loss is greater than the carrying amount of the cash-generating asset to which it relates, the entity recognises a liability only to the extent that is a requirement in the Standard of GRAP.

After the recognition of an impairment loss, the depreciation (amortisation) charge for the cash-generating asset is adjusted in future periods to allocate the cash-generating asset's revised carrying amount, less its residual value (if any), on a systematic basis over its remaining useful life.

#### **Reversal of impairment loss**

The entity assesses at each reporting date whether there is any indication that an impairment loss recognised in prior periods for a cash-generating asset may no longer exist or may have decreased. If any such indication exists, the entity estimates the recoverable amount of that asset.

An impairment loss recognised in prior periods for a cash-generating asset is reversed if there has been a change in the estimates used to determine the asset's recoverable amount since the last impairment loss was recognised. The carrying amount of the asset is increased to its recoverable amount. The increase is a reversal of an impairment loss. The increased carrying amount of an asset attributable to a reversal of an impairment loss does not exceed the carrying amount that would have been determined (net of depreciation or amortisation) had no impairment loss been recognised for the asset in prior periods.

A reversal of an impairment loss for a cash-generating asset is recognised immediately in surplus or deficit. Any reversal of an impairment loss of a revalued cash-generating asset is treated as a revaluation increase.

After a reversal of an impairment loss is recognised, the depreciation (amortisation) charge for the cash-generating asset is adjusted in future periods to allocate the cash-generating asset's revised carrying amount, less its residual value (if any), on a systematic basis over its remaining useful life.

A reversal of an impairment loss for a cash-generating unit is allocated to the cash-generating assets of the unit pro rata with the carrying amounts of those assets. These increases in carrying amounts are treated as reversals of impairment losses for individual assets. No part of the amount of such a reversal is allocated to a non-cash-generating asset contributing service potential to a cash-generating unit.

In allocating a reversal of an impairment loss for a cash-generating unit, the carrying amount of an asset is not increased above the lower of:

- its recoverable amount (if determinable); and
- the carrying amount that would have been determined (net of amortisation or depreciation) had no impairment loss been recognised for the asset in prior periods.

The amount of the reversal of the impairment loss that would otherwise have been allocated to the asset is allocated pro rata to the other assets of the unit.

## 1.16 SHARE CAPITAL / CONTRIBUTED CAPITAL

The capital fund represents the amount of net assets at the date of transfer from the government to the entity.

## 1.17 EMPLOYEE BENEFITS

Employee benefits are all forms of consideration given by an entity in exchange for service rendered by employees.

Termination benefits are employee benefits payable as a result of either:

- an entity's decision to terminate an employee's employment before the normal retirement date; or
- an employee's decision to accept voluntary redundancy in exchange for those benefits.

Other long-term employee benefits are employee benefits (other than post-employment benefits and termination benefits) that are not due to be settled within twelve months after the end of the period in which the employees render the related service.

Vested employee benefits are employee benefits that are not conditional on future employment.

A constructive obligation is an obligation that derives from an entity's actions where by an established pattern of past practice, published policies or a sufficiently specific current statement, the entity has indicated to other parties that it will accept certain responsibilities and as a result, the entity has created a valid expectation on the part of those other parties that it will discharge those responsibilities.

### Short-term employee benefits

The cost of short-term employee benefits, (those payable within 12 months after the service is rendered, such as paid vacation leave and sick leave, bonuses, and non-monetary benefits such as medical care), are recognised in the period in which the service is rendered and are not discounted.

Short-term employee benefits include items such as:

- wages, salaries and social security contributions;
- short-term compensated absences (such as paid annual leave and paid sick leave) where the compensation for the absences is due to be settled within twelve months after the end of the reporting period in which the employees render the related employee service;
- bonus, incentive and performance related payments payable within twelve months after the end of the reporting period in which the employees render the related service; and
- non-monetary benefits (for example, medical care, and free or subsidised goods or services such as housing, cars and cellphones) for current employees.

When an employee has rendered service to the entity during a reporting period, the entity recognises the undiscounted amount of short-term employee benefits expected to be paid in exchange for that service:

- as a liability (accrued expense), after deducting any amount already paid. If the amount already paid exceeds the undiscounted amount of the benefits, the entity recognises that excess as an asset (prepaid expense) to the extent that the prepayment will lead to, for example, a reduction in future payments or a cash refund; and
- as an expense, unless another Standard requires or permits the inclusion of the benefits in the cost of an asset.

The expected cost of compensated absences is recognised as an expense as the employees render services that increase their entitlement or, in the case of non-accumulating absences, when the absence occurs. The entity measures the expected cost of accumulating compensated absences as the additional amount that the entity expects to pay as a result of the unused entitlement that has accumulated at the reporting date.

The entity recognises the expected cost of bonus, incentive and performance related payments when the entity has a present legal or constructive obligation to make such payments as a result of past events and a reliable estimate of the obligation can be made. A present obligation exists when the entity has no realistic alternative but to make the payments.

### Post-employment benefits

Post-employment benefits are employee benefits (other than termination benefits) which are payable after the completion of employment.



Post-employment benefit plans are formal or informal arrangements under which an entity provides post-employment benefits for one or more employees.

#### **Post-employment benefits: Defined contribution plans**

Payments to defined contribution retirement benefit plans are charged as an expense as they fall due.

Payments made to industry-managed (or state plans) retirement benefit schemes are dealt with as defined contribution plans where the entity's obligation under the schemes is equivalent to those arising in a defined contribution retirement benefit plan.

#### **Post-employment benefits: Defined benefit plans**

Defined benefit plans are post-employment benefit plans other than defined contribution plans.

Actuarial gains and losses comprise experience adjustments (the effects of differences between the previous actuarial assumptions and what has actually occurred) and the effects of changes in actuarial assumptions. In measuring its defined benefit liability the entity recognises actuarial gains and losses in surplus or deficit in the reporting period in which they occur.

Current service cost is the increase in the present value of the defined benefit obligation resulting from employee service in the current period.

Interest cost is the increase during a period in the present value of a defined benefit obligation which arises because the benefits are one period closer to settlement.

Past service cost is the change in the present value of the defined benefit obligation for employee service in prior periods, resulting in the current period from the introduction of, or changes to, post-employment benefits or other long-term employee benefits. Past service cost may be either positive (when benefits are introduced or changed so that the present value of the defined benefit obligation increases) or negative (when existing benefits are changed so that the present value of the defined benefit obligation decreases). In measuring its defined benefit liability the entity recognises past service cost as an expense in the reporting period in which the plan is amended.

The present value of a defined benefit obligation is the present value, without deducting any plan assets, of expected future payments required to settle the obligation resulting from employee service in the current and prior periods.

The amount recognised as a defined benefit liability is the net total of the following amounts:

- the present value of the defined benefit obligation at the reporting date;
- minus the fair value at the reporting date of plan assets (if any) out of which the obligations are to be settled directly;
- plus any liability that may arise as a result of a minimum funding requirement

Any adjustments arising from the limit above is recognised in surplus or deficit.

The entity recognises the net total of the following amounts in surplus or deficit, except to the extent that another Standard requires or permits their inclusion in the cost of an asset:

- current service cost;
- interest cost;
- actuarial gains and losses;
- past service cost;
- the effect of any curtailments or settlements; and
- the effect of applying the limit on a defined benefit asset (negative defined benefit liability).

The entity uses the Projected Unit Credit Method to determine the present value of its defined benefit obligations and the related current service cost and, where applicable, past service cost. The Projected Unit Credit Method (sometimes known as the accrued benefit method pro-rated on service or as the benefit/years of service method) sees each period of service as giving rise to an additional unit of benefit entitlement and measures each unit separately to build up the final obligation.

In determining the present value of its defined benefit obligations and the related current service cost and, where applicable, past service cost, an entity shall attribute benefit to periods of service under the plan's benefit formula. However, if an employee's service in later years will lead to a materially higher level of benefit than in earlier years, an entity shall attribute benefit on a straight-line basis from:

- the date when service by the employee first leads to benefits under the plan (whether or not the benefits are conditional on further service); until
- the date when further service by the employee will lead to no material amount of further benefits under the plan, other than from further salary increases.

Actuarial valuations are conducted on an annual basis by independent actuaries separately for each plan. The results of the valuation are updated for any material transactions and other material changes in circumstances (including changes in market prices and interest rates) up to the reporting date.

Before determining the effect of a curtailment or settlement, the entity re-measure the obligation (and the related plan assets, if any) using current actuarial assumptions (including current market interest rates and other current market prices).

#### **Other post retirement obligations**

The entity provides post-retirement health care benefits and gratuities upon retirement to some retirees.

The entity provides post-retirement medical benefits to qualifying employees. The expected costs of these benefits are determined using an accounting methodology similar to that of defined benefit pension plans, with actuarial valuations carried out every year. Contributions are made to the relevant funds over the expected service lives of the employees entitled to those funds. The estimated cost of providing such benefits is charged to the statement of financial performance on a systematic basis over the employees' working lives within the entity.

The entitlement to post-retirement health care benefits is based on the employee remaining in service up to retirement age and the completion of a minimum service period. The expected costs of these benefits are accrued over the period of employment. Independent qualified actuaries carry out valuations of these obligations.

The amount recognised as a liability for other long-term employee benefits is the net total of the following amounts:

- the present value of the defined benefit obligation at the reporting date;
- minus the fair value at the reporting date of plan assets (if any) out of which the obligations are to be settled directly.

The entity shall recognise the net total of the following amounts as expense or revenue, except to the extent that another Standard requires or permits their inclusion in the cost of an asset:

- current service cost;
- interest cost;
- the expected return on any plan assets and on any reimbursement right recognised as an asset;
- actuarial gains and losses, which shall all be recognised immediately;
- past service cost, which shall all be recognised immediately; and
- the effect of any curtailments or settlements.

Independent qualified actuaries carry out valuations of these obligations.

#### **Long-term employee benefits**

The liability for employees' entitlements to long service leave represents the present value of the estimated future cash outflows resulting from employees' services provided to the reporting date.

In determining the liability for employee benefits, consideration has been given to future increases in wage and salary rates, and entity's experience with staff turnover.

## **1.18 PROVISIONS AND CONTINGENCIES**

Provisions are recognised when:

- the entity has a present obligation as a result of a past event;
- it is probable that an outflow of resources embodying economic benefits or service potential will be required to settle the obligation; and
- a reliable estimate can be made of the obligation.

A provision is a liability of uncertain timing or amount.

The amount of a provision is the best estimate of the expenditure expected to be required to settle the present obligation at the reporting date.

Provisions are reviewed at each reporting date and adjusted to reflect the current best estimate. Provisions are reversed if it is no longer probable that an outflow of resources embodying economic benefits or service potential will be required, to settle the obligation.

Provisions are not recognised for future operating losses.

A restructuring provision includes only the direct expenditures arising from the restructuring, which are those that are both:

- necessarily entailed by the restructuring; and
- not associated with the ongoing activities of the entity

No obligation arises as a consequence of the sale or transfer of an operation until the entity is committed to the sale or transfer, that is, there is a binding arrangement.

After their initial recognition contingent liabilities recognised in entity combinations that are recognised separately are subsequently measured at the higher of:

- the amount that would be recognised as a provision; and
- the amount initially recognised less cumulative amortisation.

A contingent liability is a possible obligation that arises from past events, and whose existence will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of the entity, or a present obligation that arises from past events but is not recognised because it is not probable that an outflow of resources embodying economic benefits or service potential will be required to settle the obligation or the amount of the obligation cannot be measured with sufficient reliability.

A contingent asset is a possible asset that arises from past events, and whose existence will be confirmed only by the occurrence or non-occurrence of one or more uncertain future event not wholly within the control of the entity. Contingent assets and contingent liabilities are not recognised in financial statements. Contingencies are disclosed in note 35, unless the possibility of an outflow or inflow of resources embodying economic benefits or service potential is remote.

## 1.19 COMMITMENTS

Items are classified as commitments when an entity has committed itself to future transactions that will normally result in the outflow of cash.

Disclosures are required in respect of unrecognised contractual commitments.

Commitments for which disclosure is necessary to achieve a fair presentation should be disclosed in a note to the financial statements, if both the following criteria are met:

- Contracts should be non-cancellable or only cancellable at significant cost (for example, contracts for computer or building maintenance services); and
- Contracts should relate to something other than the routine, steady, state business of the entity –therefore salary commitments relating to employment contracts or social security benefit commitments are excluded.

## 1.20 REVENUE FROM EXCHANGE TRANSACTIONS

Revenue is the gross inflow of economic benefits or service potential during the reporting period when those inflows result in an increase in net assets, other than increases relating to contributions from owners.

An exchange transaction is one in which the entity receives assets or services, or has liabilities extinguished, and directly gives approximately equal value (primarily in the form of goods, services or use of assets) to the other party in exchange.

Fair value is the amount for which an asset could be exchanged, or a liability settled, between knowledgeable, willing parties in an arm's length transaction.

### **Measurement**

Revenue is measured at the fair value of the consideration received or receivable, net of trade discounts and volume rebates.

The amount of revenue arising on a transaction which is statutory (non-contractual) in nature is usually measured by reference to the relevant legislation, regulation or similar means. The fee structure, tariffs or calculation basis specified in legislation, regulation or similar means is used to determine the amount of revenue that should be recognised. This amount represents the fair value, on initial measurement, of the consideration received or receivable for revenue that arises from a statutory (non-contractual) arrangement (see the accounting policy on Statutory Receivables).

### **Rental of facilities and equipment**

Rental income of facilities and equipment from tenants is recognised in the statement of financial performance on a straight line basis over the term of lease agreement. Lease incentives granted are recognised as an integral part of the total rental income, over the term of the lease agreement.

### **Sale of goods**

Revenue from the sale of goods is recognised when all the following conditions have been satisfied:

- the entity has transferred to the purchaser the significant risks and rewards of ownership of the goods;
- the entity retains neither continuing managerial involvement to the degree usually associated with ownership nor effective control over the goods sold;
- the amount of revenue can be measured reliably;
- it is probable that the economic benefits or service potential associated with the transaction will flow to the entity; and
- the costs incurred or to be incurred in respect of the transaction can be measured reliably.

### **Rendering of services**

When the outcome of a transaction involving the rendering of services can be estimated reliably, revenue associated with the transaction is recognised by reference to the stage of completion of the transaction at the reporting date. The outcome of a transaction can be estimated reliably when all the following conditions are satisfied:

- the amount of revenue can be measured reliably;
- it is probable that the economic benefits or service potential associated with the transaction will flow to the entity;
- the stage of completion of the transaction at the reporting date can be measured reliably; and
- the costs incurred for the transaction and the costs to complete the transaction can be measured reliably.

When services are performed by an indeterminate number of acts over a specified time frame, revenue is recognised on a straight-line basis over the specified time frame unless there is evidence that some other method better represents the stage of completion. When a specific act is much more significant than any other acts, the recognition of revenue is postponed until the significant act is executed.

When the outcome of the transaction involving the rendering of services cannot be estimated reliably, revenue is recognised only to the extent of the expenses recognised that are recoverable.

Service revenue is recognised by reference to the stage of completion of the transaction at the reporting date. Stage of completion is determined by the proportion that costs incurred to date bear to the total estimated costs of the transaction.

Diagnostic service revenue is recognised by reference to the stage of completion of the tests at the reporting date. Stage of completion is determined by the proportion that costs incurred to date bear to the total estimated costs of the transaction.

### **Diagnostic services**

Due to the short lead time and the nature of the diagnostic tests, the diagnostic revenue is recognised at the completion of the diagnostic tests.

### **Research revenue**

When the outcome of a research can be estimated reliably, research revenue and research costs associated with the

research are recognised with reference to the stage of completion of the research at the reporting date. The stage of completion is determined using costs or scientific estimate and or milestone achieved as set in the project.

An expected loss on research is recognised in the statement of financial performance immediately.

When the outcome of research cannot be estimated reliably, revenue is recognised only to the extent of research costs incurred for which it is probable that the costs will be recovered. Research costs are recognised as expenses in the period they are incurred.

The entity has several funders that normally process payments for research related activities prior to the actual research commencing. Upon receipt, a liability is raised (income received in advance), and reduced as and when costs are incurred on the respective project.

#### **Advisory services**

Revenue from consulting and training services is recognised when services have been rendered however revenue from the PDP programme is recognised on a cost recovery basis.

#### **Bad debts recovered**

Revenue from bad debts recovered is recognised when payment is received for debts that were written off and considered uncollectible.

#### **Other income**

Revenue that is not in the ordinary course of business is recognised as other income. Revenue from the sale of blood vaccines is recognised when significant risks and rewards of ownership of the goods are transferred to the buyer. Revenue from lost cards, tender sales and other ad hoc sales are recognised when goods or services are received or rendered.

#### **Interest, royalties and dividends**

Revenue arising from the use by others of entity assets yielding interest, royalties and dividends or similar distributions is recognised when:

- It is probable that the economic benefits or service potential associated with the transaction will flow to the entity, and
- The amount of the revenue can be measured reliably.

Interest is predominantly earned from funds received in advance prior to the commencement or execution of projects and invested in fixed deposits and call accounts.

Royalties are recognised as they are earned in accordance with the substance of the relevant agreements.

Dividends or similar distributions are recognised, in surplus or deficit, when the entity's right to receive payment has been established.

## **1.21 REVENUE FROM NON-EXCHANGE TRANSACTIONS**

Revenue received from conditional grants, donations and fuunding are recognised as revenue at fair value of the consideration received to the extent that the entity has complied with any of the criteria, conditions or obligations embodied in the agreement.

To the extent that the criteria, conditions or obligations have not been met a liability is recognised.

Non-exchange transactions are transactions that are not exchange transactions. In a non-exchange transaction, an entity either receives value from another entity without directly giving approximately equal value in exchange, or gives value to another entity without directly receiving approximately equal value in exchange.

Government grants are recognised when it is probable that future economic benefits will flow to the public entity and these benefits can be measured reliably. The grants are recognised as income to the extent that there are no further obligations arising from the receipt of the grants.



**Recognition**

An inflow of resources from a non-exchange transaction recognised as an asset is recognised as revenue, except to the extent that a liability is also recognised in respect of the same inflow.

Government grants received for the purpose of giving immediate financial support with no future related cost are recognised as revenue in the period in which they become receivable. Government grants relating to specific expenditure are recognised in the year during the expenses are incurred.

**Measurement**

Revenue from a non-exchange transaction is measured at the amount of the increase in net assets recognised by the entity.

**1.22 REPAIRS AND MAINTENANCE**

The cost of normal, recurring or periodic repairs and maintenance activities should be expensed as incurred. In other words, cost during the in-service stage that extend the existing service potential of the long-lived asset or replace significant components of the long lived asset should be capitalized. All other costs, including normal repairs and maintenance activities, should be expensed as incurred.

**1.23 OPERATING AND ADMINISTRATIVE EXPENDITURE**

Operating and administrative expenditure is recognised on an accrual basis of accounting. Unless permitted by another standard of GRAP, operating and administrative expenditure has not been offset against revenue.

**1.24 ACCOUNTING BY PRINCIPALS AND AGENTS****Identification**

An agent is an entity that has been directed by another entity (a principal), through a binding arrangement, to undertake transactions with third parties on behalf of the principal and for the benefit of the principal.

A principal is an entity that directs another entity (an agent), through a binding arrangement, to undertake transactions with third parties on its behalf and for its own benefit.

A principal-agent arrangement results from a binding arrangement in which one entity (an agent), undertakes transactions with third parties on behalf, and for the benefit of, another entity (the principal).

**Identifying whether an entity is a principal or an agent**

When the entity is party to a principal-agent arrangement, it assesses whether it is the principal or the agent in accounting for revenue, expenses, assets and/or liabilities that result from transactions with third parties undertaken in terms of the arrangement.

The assessment of whether an entity is a principal or an agent requires the entity to assess whether the transactions it undertakes with third parties are for the benefit of another entity or for its own benefit.

**Binding arrangement**

The entity assesses whether it is an agent or a principal by assessing the rights and obligations of the various parties established in the binding arrangement.

Where the terms of a binding arrangement are modified, the parties to the arrangement re-assess whether they act as a principal or an agent.

**Assessing which entity benefits from the transactions with third parties**

When the entity in a principal-agent arrangement concludes that it undertakes transactions with third parties for the benefit of another entity, then it is the agent. If the entity concludes that it is not the agent, then it is the principal in the transactions.

The entity is an agent when, in relation to transactions with third parties, all three of the following criteria are present:

- It does not have the power to determine the significant terms and conditions of the transaction.
- It does not have the ability to use all, or substantially all, of the resources that result from the transaction for its own benefit.
- It is not exposed to variability in the results of the transaction.

Where the entity has been granted specific powers in terms of legislation to direct the terms and conditions of particular transactions, it is not required to consider the criteria of whether it does not have the power to determine the significant terms and conditions of the transaction, to conclude that is an agent. The entity applies judgement in determining whether such powers exist and whether they are relevant in assessing whether the entity is an agent.

### Recognition

The entity, as a principal, recognises revenue and expenses that arise from transactions with third parties in a principal-agent arrangement in accordance with the requirements of the relevant Standards of GRAP.

The entity recognises assets and liabilities arising from principal-agent arrangements in accordance with the requirements of the relevant Standards of GRAP.

## 1.25 TRANSLATION OF FOREIGN CURRENCIES FOREIGN CURRENCY TRANSACTIONS

A foreign currency transaction is recorded, on initial recognition in Rands, by applying to the foreign currency amount the spot exchange rate between the functional currency and the foreign currency at the date of the transaction.

At each reporting date:

- foreign currency monetary items are translated using the closing rate;
- non-monetary items that are measured in terms of historical cost in a foreign currency are translated using the exchange rate at the date of the transaction; and
- non-monetary items that are measured at fair value in a foreign currency are translated using the exchange rates at the date when the fair value was determined.

Trade receivables and payables denominated in foreign currencies at the reporting date are re-translated to the functional currency at the spot rate at that date. Any resulting foreign exchange gains or losses are recognised in surplus or deficit in the statement of financial performance. The foreign currency gain or loss on monetary items is the difference between amortised cost or fair value in the functional currency at the beginning of the period, adjusted for effective interest and payments during the period, and the amortised cost in foreign currency translated at the exchange rate at the end of the reporting period.

Non-monetary assets and liabilities denominated in foreign currencies that are measured at fair value are re-translated to the functional currency at the exchange rate at the date that the fair value was determined. Foreign currency differences arising on re-translation are recognised in surplus or deficit in the statement of financial performance.

Non-monetary items that are measured in terms of historical cost in foreign currency are translated using the exchange rate at the date of the transaction.

Cash flows arising from transactions in a foreign currency are recorded in Rands by applying to the foreign currency amount the exchange rate between the Rand and the foreign currency at the date of the cash flow.

## 1.26 INSURANCE FUND

In terms of the entity policy to cover a portion of vehicle, non-vehicle, stated benefits and fire and allied perils insurance claims, a risk assessment is made annually in conjunction with the insurance brokers in order to determine the extent of the self-insured amount to be credited to the reserve.

In determining the amount to be credited, the principle of maximum insurance cover at the lowest possible cost is applied.

The portion of claims borne by the entity is accounted for against the reserve. Any shortfalls on the reserve are written off against accumulated surplus in the year in which it originated and any surplus is carried over to the following year.

## 1.27 COMPARATIVE FIGURES

Where necessary, comparative figures have been reclassified to conform to changes in presentation in the current year.

## 1.28 FRUITLESS AND WASTEFUL EXPENDITURE

Fruitless expenditure means expenditure which was made in vain and would have been avoided had reasonable care been exercised.

All expenditure relating to fruitless and wasteful expenditure is recognised as an expense in the statement of financial performance in the period that the expenditure was incurred. The expenditure is classified in accordance with the nature of the expense, and where recovered, it is subsequently accounted for as revenue in the statement of financial performance.

Fruitless and wasteful expenditure is accounted for in line with all relating requirements, including, but not limited to, ruling Legislation, Regulations, Frameworks, Circulars, Instruction Notes, Practice Notes, Guidelines etc (as applicable).

## 1.29 IRREGULAR EXPENDITURE

Irregular expenditure as defined in section 1 of the PFMA is expenditure other than unauthorised expenditure, incurred in the contravention of or that is not in accordance with the requirement of any applicable legislation, including -

- (a) this Act; or
- (b) the State Tender Board Act, 1968 (Act No. 86 of 1968), or any regulations made in terms of the Act; or
- (c) any provincial legislation providing to procurement procedures in that provincial government.

Irregular expenditure as defined that was incurred and identified during the current financial year and which was condoned before year end and/or before finalisation of the financial statements must also be recorded appropriately in the irregular expenditure register. In such an instance, no further action is also required with the exception of updating the note to the financial statements.

Irregular expenditure that was incurred and identified during the current financial year and for which condonement is being awaited at year end must be recorded in the irregular expenditure register. No further action is required with the exception of updating the note to the financial statements.

Where irregular expenditure was incurred in the previous financial year and is only condoned in the following financial year, the register and the disclosure note to the financial statements must be updated with the amount condoned.

Irregular expenditure that was incurred and identified during the current financial year and which was not condoned by the National Treasury or the relevant authority must be recorded appropriately in the irregular expenditure register. If liability for the irregular expenditure can be attributed to a person, a debt account must be created if such a person is liable in law. Immediate steps must thereafter be taken to recover the amount from the person concerned. If recovery is not possible, the accounting officer or accounting authority may write off the amount as debt impairment and disclose such in the relevant note to the financial statements. The irregular expenditure register must also be updated accordingly. If the irregular expenditure has not been condoned and no person is liable in law, the expenditure related thereto must remain against the relevant programme/expenditure item, be disclosed as such in the note to the financial statements and updated accordingly in the irregular expenditure register.

The ARC will only record irregular expenditure when a transaction is recognised as expenditure in the Statement of Financial Performance in accordance with GRAP in the period that the expenditure was incurred.

## 1.30 SEGMENT INFORMATION

A segment is an activity of an entity:

- that generates economic benefits or service potential (including economic benefits or service potential relating to transactions between activities of the same entity);

- whose results are regularly reviewed by management to make decisions about resources to be allocated to that activity and in assessing its performance; and
- for which separate financial information is available.

Reportable segments are the actual segments which are reported on in the segment report. They are the segments identified above or alternatively an aggregation of two or more of those segments where the aggregation criteria are met.

### Measurement

The amount of each segment item reported is the measure reported to management for the purposes of making decisions about allocating resources to the segment and assessing its performance. Adjustments and eliminations made in preparing the entity's financial statements and allocations of revenues and expenses are included in determining reported segment surplus or deficit only if they are included in the measure of the segment's surplus or deficit that is used by management. Similarly, only those assets and liabilities that are included in the measures of the segment's assets and segment's liabilities that are used by management are reported for that segment. If amounts are allocated to reported segment surplus or deficit, assets or liabilities, those amounts are allocated on a reasonable basis.

If management uses only one measure of a segment's surplus or deficit, the segment's assets or the segment's liabilities in assessing segment performance and deciding how to allocate resources, segment surplus or deficit, assets and liabilities are reported in terms of that measure. If management uses more than one measure of a segment's surplus or deficit, the segment's assets or the segment's liabilities, the reported measures are those that management believes are determined in accordance with the measurement principles most consistent with those used in measuring the corresponding amounts in the entity's financial statements.

## 1.31 RESEARCH AND DEVELOPMENT EXPENDITURE

Expenditure on research is recognised as an expense when it is incurred.

An asset arising from development is recognised when:

- it is technically feasible to complete the asset so that it will be available for use or sale.
- there is an intention to complete and use or sell it.
- there is an ability to use or sell it.
- it will generate probable future economic benefits or service potential.
- there are available technical, financial and other resources to complete the development and to use or sell the asset.
- the expenditure attributable to the asset during its development can be measured reliably.

## 1.32 BUDGET INFORMATION

Entities are typically subject to budgetary limits in the form of appropriations or budget authorisations (or equivalent), which is given effect through authorising legislation, appropriation or similar.

General purpose financial reporting by entity shall provide information on whether resources were obtained and used in accordance with the legally adopted budget.

The approved budget is prepared on a accrual basis and presented by programmes linked to performance outcome objectives. The approved budget covers the fiscal period from 2022/04/01 to 2023/03/31.

The budget for the economic entity includes all the entities approved budgets under its control.

The annual financial statements and the budget are on the same basis of accounting therefore a comparison with the budgeted amounts for the reporting period have been included in the Statement of comparison of budget and actual amounts.

The Statement of comparative and actual information has been included in the annual financial statements as the recommended disclosure when the annual financial statements and the budget are on the same basis of accounting as determined by National Treasury.

Budget comparative information for prior year is not required.

### 1.33 RELATED PARTIES

A related party is a person or an entity with the ability to control or jointly control the other party, or exercise significant influence over the other party, or vice versa, or an entity that is subject to common control, or joint control.

Control is the power to govern the financial and operating policies of an entity so as to obtain benefits from its activities.

Joint control is the agreed sharing of control over an activity by a binding arrangement, and exists only when the strategic financial and operating decisions relating to the activity require the unanimous consent of the parties sharing control (the venturers).

Related party transaction is a transfer of resources, services or obligations between the reporting entity and a related party, regardless of whether a price is charged.

Significant influence is the power to participate in the financial and operating policy decisions of an entity, but is not control over those policies.

The entity operates in an economic sector currently dominated by entities directly or indirectly owned by the South African Government. As a consequence of the constitutional independence of the three spheres of government in South Africa, only entities within the national sphere of government are considered to be related parties.

Management are those persons responsible for planning, directing and controlling the activities of the entity, including those charged with the governance of the entity in accordance with legislation, in instances where they are required to perform such functions.

Close members of the family of a person are those family members who may be expected to influence, or be influenced by that person in their dealings with the entity.

The entity is exempt from disclosure requirements in relation to related party transactions if that transaction occurs within normal supplier and/or client/recipient relationships on terms and conditions no more or less favourable than those which it is reasonable to expect the entity to have adopted if dealing with that individual entity or person in the same circumstances and terms and conditions are within the normal operating parameters established by that reporting entity's legal mandate.

Where the entity is exempt from the disclosures in accordance with the above, the entity discloses narrative information about the nature of the transactions and the related outstanding balances, to enable users of the entity's financial statements to understand the effect of related party transactions on its annual financial statements.

### 1.34 EVENTS AFTER REPORTING DATE

Events after reporting date are those events, both favourable and unfavourable, that occur between the reporting date and the date when the financial statements are authorised for issue. Two types of events can be identified:

- those that provide evidence of conditions that existed at the reporting date (adjusting events after the reporting date); and
- those that are indicative of conditions that arose after the reporting date (non-adjusting events after the reporting date).

The entity will adjust the amount recognised in the financial statements to reflect adjusting events after the reporting date once the event occurred.

The entity will disclose the nature of the event and an estimate of its financial effect or a statement that such estimate cannot be made in respect of all material non-adjusting events, where non-disclosure could influence the economic decisions of users taken on the basis of the financial statements.



### 1.35 LIVING AND NON-LIVING RESOURCES

Living resources are those resources that undergo biological transformation.

Non-living resources are those resources, other than living resources, that occur naturally and have not been extracted.

Agricultural activity is the management by an entity of the biological transformation and harvest of biological assets for:

- (a) sale;
- (b) distribution at no charge or for a nominal charge; or
- (c) conversion into agriculture produce or into additional biological assets for sale or distribution at no charge or for a nominal charge.

A bearer plant is a living plant that:

- (a) is used in the production or supply of agricultural produce;
- (b) is expected to bear produce for more than one period; and
- (c) has a remote likelihood of being sold as agricultural produce, except for incidental scrap sales.

Biological transformation (for purposes of this Standard) comprises the processes of growth, degeneration, production, and procreation that cause qualitative or quantitative changes in a living resource.

Carrying amount is the amount at which an asset is recognised after deducting any accumulated depreciation and accumulated impairment losses.

Cost is the amount of cash or cash equivalents paid or the fair value of the other consideration given to acquire an asset at the time of its acquisition or development and, where applicable, the amount attributed to the asset when initially recognised in accordance with the specific requirements of other Standards of GRAP.

Depreciation is the systematic allocation of the depreciable amount of an asset over its useful life.

Depreciable amount is the cost of an asset, or other amount substituted for cost, less its residual value.

Group of resources means a grouping of living or non-living resources of a similar nature or function in an entity's operations that is shown as a single item for the purpose of disclosure in the annual financial statements.

The residual value of an asset is the estimated amount that an entity would currently obtain from disposal of the asset, after deducting the estimated costs of disposal, if the asset was already of the age and in the condition expected at the end of its useful life.

Useful life is the period over which an asset is expected to be available for use by an entity, or the number of production or similar units expected to be obtained from the asset by an entity.

#### Recognition

Non-living resources, other than land, are not recognised as assets. Required information are disclosed in the notes to the annual financial statements.

A living resource is recognised as an asset if it is probable that future economic benefits or service potential associated with the asset will flow to the entity, and the cost or fair value of the asset can be measured reliably.

Where the entity is required in terms of legislation or similar means to manage a living resource, but it does not meet the definition of an asset because control of the resource cannot be demonstrated, relevant information are disclosed in the notes to the annual financial statements.

Where the entity holds a living resource that meets the definition of an asset, but which does not meet the recognition criteria, relevant information are disclosed in the notes to the annual financial statements. When the information about the cost or fair value of the living resource becomes available, the entity recognise, from that date, the living resource and apply the measurement principles.

**Measurement at recognition**

A living resource that qualifies for recognition as an asset is measured at its cost.

Where a living resource is acquired through a non-exchange transaction, its cost is measured at its fair value as at the date of acquisition.

The cost of a living resource comprises its purchase price, including import duties and non-refundable purchase taxes, and any costs directly attributable to bringing the living resource to the location and condition necessary for it to be capable of operating in the manner intended by management.

**Measurement after recognition Cost model**

After recognition as an asset, a group of living resources are carried at its cost less any accumulated depreciation and any accumulated impairment losses.

**Depreciation**

Living resources are depreciated and the depreciation charge for each period is recognised in surplus or deficit unless it is included in the carrying amount of another asset, where appropriate.

The depreciable amount of a living resource is allocated on a systematic basis over its useful life.

The entity assesses at each reporting date whether there is any indication that the entity's expectations about the residual value and the useful life of a living resource have changed since the preceding reporting date. If any such indication exists, the entity revises the expected useful life and/or residual value accordingly. The change(s) are accounted for as a change in an accounting estimate.

In assessing whether there is any indication that the expected useful life of the living resource has changed, the entity considers the following indications:

- (a) The use of the living resource has changed, because of the following:
  - The entity has changed the manner in which the living resource is used.
  - The entity has made a decision to dispose of the living resource in a future reporting period(s) such that this decision changes the expected period over which the living resource will be used.
  - Legislation, government policy or similar means have been amended or implemented during the reporting period that have, or will, change the use of the living resource.
  - The living resource was idle or retired from use during the reporting period.
- (b) The living resource is approaching the end of its previously expected useful life.
- (c) There is evidence that the condition of the living resource improved or declined based on assessments undertaken during the reporting period.
- (d) The living resource is assessed as being impaired.

In assessing whether there is any indication that the expected residual value of the living resource has changed, the entity considers whether there has been any change in the expected timing of disposal of the living resource, as well as any relevant indicators as noted above.

The depreciation method used reflects the pattern in which the future economic benefits or service potential of the living resource is expected to be consumed by the entity.

The depreciation method applied to a living resource is reviewed at least at each reporting date and, if there has been a significant change in the expected pattern of consumption of the future economic benefits or service potential embodied in the living resource, the method is changed to reflect the changed pattern. Such a change is accounted for as a change in an accounting estimate.

The useful lives of items of property, plant and equipment have been assessed as follows:

Item	Depreciation method	Average useful life
Sheep	Straight-line	12 years
Cattle	Straight-line	22 years
Goats	Straight-line	18 years

### Impairment

The entity assesses at each reporting date whether there is an indication that the living resource may be impaired. If any such indication exists, the entity estimates the recoverable amount or the recoverable service amount of the living resource.

Compensation from third parties for living resources that have been impaired, lost or given up, is included in surplus or deficit when the compensation becomes receivable.

### Transfers

Transfers from living resources are made when the particular asset no longer meets the definition of a living resource and/or is no longer within the scope of this accounting policy.

Transfers to living resources are made when the asset meets the definition of a living resource.

### Derecognition

The carrying amount of a living resource is derecognised on disposal, or when no future economic benefits or service potential are expected from its use or disposal.

The gain or loss arising from the derecognition of a living resource is included in surplus or deficit when the item is derecognised.

## 1.36 BORROWING COSTS

Borrowing costs are interest and other expenses incurred by an entity in connection with the borrowing of funds. Borrowing costs are recognised as an expense in the period in which they are incurred.

## 1.37 CHANGES IN ACCOUNTING POLICIES, ESTIMATES AND ERRORS

Changes in Accounting Policies that are affected by management have been applied retrospectively in accordance with GRAP 3 requirements, except to the extent that it is impractical to determine the period-specific effects or the cumulative effect of the change in policy. In such cases, the entity restated the opening balances of assets, liabilities, and net assets for the earliest period for which retrospective restatement is practical. Details of Changes in Accounting Policies are disclosed in the Notes to the annual financial statements where applicable.

Changes in Accounting Estimates are applied prospectively in accordance with GRAP 3 requirements. Details of the changes in estimates are disclosed in the Notes to the Financial Statements where applicable.

Correction of Errors is applied retrospectively in the period in which the error has occurred in accordance with GRAP 3 requirements, except to the extent that it is impractical to determine the period-specific effects or the cumulative effect of the retrospective restatement is practical. Details of Correction of Errors are disclosed in the Notes to the Annual Financial Statements where applicable.

# NOTES TO THE ANNUAL FINANCIAL STATEMENTS

## 2. NEW STANDARDS AND INTERPRETATIONS

### 2.1 STANDARDS AND INTERPRETATIONS ISSUED, BUT NOT YET EFFECTIVE

The entity has not applied the following standards and interpretations, which have been published and are mandatory for the entity's accounting periods beginning on or after 01 April 2023 or later periods:

Standard/ Interpretation:Effective date:	Years beginning on or after	Expected impact:
Guideline: Guideline on Accounting for Landfill Sites GRAP 25	01 April 2023	Unlikely there will be a material impact
(as revised): Employee Benefits	01 April 2023	Unlikely there will be a material impact
GRAP 104 (as revised): Financial Instruments	01 April 2025	Unlikely there will be a material impact
iGRAP 21: The Effect of Past Decisions on Materiality	01 April 2023	Unlikely there will be a material impact
GRAP 2020: Improvements to the standards of GRAP 2020 GRAP 1	01 April 2023	Unlikely there will be a material impact
(amended): Presentation of Financial Statements	01 April 2023	Unlikely there will be a material impact

## 3. INVESTMENT REVENUE

	2023	2022
<b>Dividend revenue</b>		
Listed financial assets - Local	–	13 511
<b>Interest revenue</b>		
Bank	61 922 271	30 989 689
	<b>61 922 271</b>	<b>31 003 200</b>

## 4. GOVERNMENT GRANTS

	2023	2022
<b>Operating grants</b>		
Government grant (operating)	952 015 096	922 713 703
<b>Capital grants</b>		
Government grant (capital)	109 820 000	106 432 268
	<b>1 061 835 096</b>	<b>1 029 145 971</b>
<b>Conditional and Unconditional</b>		
Included in above are the following grants and subsidies received:		
Conditional grants recognised)	1 556 835	770 841
Unconditional grants received	1 060 278 261	1 028 375 130
	<b>1 061 835 096</b>	<b>1 029 145 971</b>

The entity receives parliamentary grants by virtue of being a schedule 3(a) PFMA national public entity and the amounts are determined by National Treasury on an annual basis.

Based on the motivation from the business plan, the entity receives a grant from the DSI to maintain the national public goods assets. The entity received all the grants that was budgeted for in the current year. The statutory receivable is cleared at year-end.

## 5. EMPLOYEE RELATED COSTS

	2023	2022
Salaries and wages	630 720 427	617 294 126
Medical aid - company contributions	16 555 998	17 066 437
UIF	3 862 817	3 875 163
WCA	1 186 778	1 268 756
SDL	6 487 396	6 371 338
Leave pay provision charge	3 771 907	1 289 854
Personal training	5 882 179	6 787 251
Membership fees	1 476 239	1 437 683
Defined contribution plans	58 167 522	56 547 777
Overtime payments	3 644 781	2 902 316
Long-service awards	3 314 421	3 348 933
Deferred compensation - fixed and variable pay	34 010 987	28 344 242
Allowance	9 446 058	8 718 088
Corporate - Royalty Benefit-sharing	9 205 888	6 630 430
	<b>787 733 398</b>	<b>761 882 394</b>

## 6. DEPRECIATION AND AMORTISATION

	2023	2022
Property, plant and equipment	66 478 470	73 359 764
Investment property	181 614	179 054
Intangible assets	718 485	7 380 062
Living resources	191 554	152 498
	<b>67 570 123</b>	<b>81 071 378</b>

## 7. FINANCE COSTS

	2023	2022
Trade and other payables	9 827	247427

## 8. LEASE RENTALS ON OPERATING LEASE

	2023	2022
<b>Premises</b>		
Contractual amounts	548 384	591 366
<b>Motor vehicles</b>		
Contingent amounts	2 270	32 056
<b>Equipment</b>		
Contractual amounts	2 201 840	2 837 576
	<b>2 752 494</b>	<b>3 460 998</b>



## 9. OPERATING AND ADMINISTRATIVE EXPENSES

	2023	2022
Advertising	74 798	1 230 903
Auditors remuneration	9 760 092	8 890 062
Bank charges	683 996	690 460
Cleaning	8 827 116	6 607 926
Commission paid	514 066	294 855
Computer expenses	42 813 277	28 159 275
Consulting and professional fees	31 532 356	38 015 788
Fines and penalties	4 400	6 808
Animal Costs	11 367 518	9 752 004
Insurance	6 329 920	6 822 397
Conferences and seminars	638 657	192 656
Fleet	34 655 852	18 284 038
Marketing	4 976 626	2 001 422
Horticulture	2 927 244	2 767 225
Magazines, books and periodicals	11 066 230	7 060 020
Pest control	2 429 245	2 588 379
Fuel and oil	13 005 008	7 258 956
Postage and courier	530 992	251 596
Printing and stationery	2 660 922	2 388 558
Protective clothing	2 258 537	3 377 795
Research and development costs	53 835 478	42 786 177
Security	27 811 438	25 701 283
Staff welfare	4 832 073	1 853 057
Telephone and fax	4 744 244	3 948 508
Travel - local	20 561 263	15 862 105
Travel - overseas	8 877 719	5 835 293
Utilities	80 740 504	76 999 584
General expenses*	8 115 290	8 851 243
	<b>396 574 861</b>	<b>328 478 373</b>

\*General expenses comprises of library database subscriptions, institute costs - lab, special investigations, tools and inter- institutes transactions.

## 10. FAIR VALUE ADJUSTMENTS

	2023	2022
<b>Other financial assets</b>		
Other financial assets (Designated as at FV through P&L) Refer to note 25	261 698	2 001 236

## 11. GAINS /(LOSSES) ON BIOLOGICAL ASSETS

	2023	2022
Gains or losses arising from a change in fair value less point of sale costs	464 522	(385 166)
Gain or loss on initial recognition of biological asset	3 063 498	3 006 209
	<b>3 528 020</b>	<b>2 621 043</b>

## 12. IMPAIRMENT OF ASSETS

	2023	2022
<b>Impairments</b>		
Trade and other receivables	7 851 847	19 251 769

## 13. INVENTORIES

	2023	2022
Biological Assets - Bearer	3 759 415	4 263 878
Biological Assets - Consumable (Fair Value)	2 785 146	3 802 912
Consumable stores	11 971 739	6 592 379
Finished goods	892 484	1 256 246
Forage	1 895 995	1 097 642
Livestock held for research	1 623 507	1 707 245
	22 928 286	18 720 302
Carrying value of inventories carried at fair value less costs to sell	6 544 561	8 066 790
Inventories recognised as an expense during the year	5 235 961	7 827 254
<b>Inventory pledged as security</b>		
There are no inventories pledged as security.		

## 14. OPERATING LEASE ASSET (ACCRUAL)

	2023	2022
Non-current assets	3 976 273	3 600 903
Current assets	487 184	791 347
Current liabilities	-	(20 356)
	4 463 457	4 371 894
<b>Operating lease receivable - lessor</b>		
Opening balance 1 April	4 371 895	3 633 063
Movement of the period	91 562	759 188
	4 463 457	4 392 251
<b>Operating lease accruals - lessee</b>		
Opening balance 1 April	-	(20 356)
<b>Total minimum lease receipts due - lessor</b>		
- within one year	10 526 105	11 182 264
- in second to fifth year inclusive	24 350 474	31 740 567
- later than five years	5 879 087	9 248 728
	40 755 666	52 171 559

## 15. RECEIVABLES FROM EXCHANGE TRANSACTIONS

	2023	2022
Trade debtors	49 427 388	70 870 465
Staff debtors	3 113 239	1 057 611
Deposits	2 940 662	2 867 065
Recoverable fruitless and wasteful expenditure	43 282	52 252
Other debtors*	24 583 241	39 607 255
	80 107 812	114 454 648

Trade receivables are shown net of impairment losses.

\*Included in other debtors is revenue accruals.

Of the receivables balance as at 31 March 2023, R8,7 million is due from the largest customer Onderstepoort Biological Products and R7.9 million is due from the second largest customer South African National Biodiversity Institute and R7.3 million is due from the third largest consumer UNDP Comros and the fourth and fifth largest customer owes 12% of the total balance respectively. There are no other debtors who represent more than 6% of total balance of the trade receivables.

Of the R30 million (before provision) in 150 days R19.7 million is due from 3 major customers. In line with our credit policy, amounts due will be assessed annually for impairment in line with credit policy. Provision in 150 days only made if customers made a single payment in the financial year, Provision for 90 to 150 days is provided if no payments were made by customer in the financial year.

Of the R30 million of provision for bad debts R8 million relates to government while R21 million relates to private clients.

	2023	2022
<b>Trade and other receivables past due but not impaired</b>		
The ageing of amounts past due but not impaired is as follows:		
60 days past due	2 823 714	9 892 332
61 - 90 days past due	234 760	306 410
120 days past due	1 058 744	1 141 453
More than 150 days past due	874 376	8 448 440
<b>Reconciliation of provision for impairment of trade receivables</b>		
Opening balance	42 855 305	31 102 868
Provision for impairment	7 053 928	19 251 769
Amounts written off as uncollectible	(18 604 511)	(335 899)
Other	(1 333 830)	(7 163 433)
	<b>29 970 892</b>	<b>42 855 305</b>

## 16. PREPAYMENTS

	2023	2022
<b>Prepayments are as a result of subscriptions and licences paid in advance.</b>		
Current assets	6 884 703	6 385 577
Non-current assets	261 615	45 156
	<b>7 146 318</b>	<b>6 430 733</b>

## 17. CASH AND CASH EQUIVALENTS

	2023	2022
<b>Cash and cash equivalents consist of:</b>		
Bank balances	144 958 880	21 597 249
Short-term deposits*	1 060 052 692	775 372 213
	<b>1 205 011 572</b>	<b>796 969 462</b>

\*Included in short-term deposits are funds received from ARC funders for various research projects. These funds had not been utilised as at 31 March 2023.

The total unsecured credit facilities granted to ARC relate to fleet management cards. At year end the facility amounted to R1.4 million (31 March 2022: R1.2 million).

## 18. BIOLOGICAL ASSETS THAT FORM PART OF AN AGRICULTURAL ACTIVITY

	2023			2022		
	Cost / Valuation	Accumulated depreciation and accumulated impairment	Carrying value	Cost / Valuation	Accumulated depreciation and accumulated impairment	Carrying value
Dairy cattle - Bearer	608 576	–	608 576	842 369	–	842 369
Chickens - Bearer	201 000	–	201 000	195 800	–	195 800
<b>TOTAL</b>	<b>809 576</b>	<b>–</b>	<b>809 576</b>	<b>1 038 169</b>	<b>–</b>	<b>1 038 169</b>

### Reconciliation of biological assets - 2023

	Opening balance	Decreases due to harvest / sales	Increase through non-exchange functions	Gains/Losses arising from changes in fair value	Decrease due to death	Total
Dairy cattle - Bearer	842 369	(163 602)	10 379	(80 009)	(561)	608 576
Chickens - Bearer	195 800	(180 760)	12 000	196 320	(22 360)	201 000
<b>TOTAL</b>	<b>1 038 169</b>	<b>(344 362)</b>	<b>22 379</b>	<b>116 311</b>	<b>(22 921)</b>	<b>809 576</b>

### Reconciliation of biological assets - 2022

	Opening balance	Decreases due to harvest / sales	Increase through non-exchange functions	Gains/Losses arising from changes in fair value	Decrease due to death	Total
Dairy cattle - Bearer	683 905	(73 505)	12 904	268 270	(49 205)	842 369
Chickens - Bearer	140 520	(129 550)	125 140	128 110	(68 420)	195 800
<b>TOTAL</b>	<b>824 425</b>	<b>(203 055)</b>	<b>138 044</b>	<b>396 380</b>	<b>(117 625)</b>	<b>1 038 169</b>

### Non-financial information

	2023	2022
<b>Quantities of each biological asset</b>		
Dairy cattle - Bearer	169	166
Chickens - Bearer	1 914	2 150
	<b>2 083</b>	<b>2 316</b>

	2023	2022
<b>Mature biological assets</b>		
Dairy cattle - Bearer	119	15
Chickens - Bearer	1 914	1 433
	<b>2 033</b>	<b>1 448</b>

	2023	2022
<b>Immature biological assets</b>		
Dairy cattle - Bearer	50	151
Chickens - Bearer	–	717
	<b>50</b>	<b>868</b>

**Pledged as security**

None of the biological assets were pledged as security.

**Restrictions imposed by regulations**

None of the biological assets are subjects to restrictions imposed by regulations.

**Nature**

ARC has biological assets, which varies in nature and use. There are various assets both within Animal sciences and Crop sciences business units respectively.

ARC's biological assets (bearer and consumable), agricultural products and the related products that are the result of processing after harvest.

Biological Assets	Agricultural Produce	Products as a result of processing
Dairy Cattle	Milk	Cheese, Yogurt
Beef Cattle	Carcass	Steak, Beef
Sheep	Carcass	Mutton chops
Pigs	Carcass	Sausages, bacon
Goat	Carcass	Meat
Wildlife (game)	Carcass	Venison, Biltong
Chicken	Eggs/meat	Sausages
Bushes	Leaf	Tea, cured tobacco
Vines	Grapes	Wine, fruit juices
Fruit trees	Picked fruit	Fruit juices, dried fruit

**19. INVESTMENT PROPERTY**

Figures in Rand	2023			2022		
	Cost / Valuation	Accumulated depreciation and accumulated impairment	Carrying value	Cost / Valuation	Accumulated depreciation and accumulated impairment	Carrying value
Investment property	9 397 335	(4 365 302)	5 032 033	9 428 335	(4 213 759)	5 214 576

	Opening balance	Disposals	Depreciation	Total
Investment property	5 214 576	(929)	(181 614)	5 032 033

**Reconciliation of investment property - 2022**

	Opening balance	Reclassification	Depreciation	Total
Investment property	4 694 697	698 931	(179 052)	5 214 576



**Pledged as security**

There are no properties that have been pledged as security.

A register containing the information required by the Public Finance Management Act is available for inspection at the registered office of the entity.

**Amounts recognised in surplus or (deficit)**

Rental revenue from Investment property	4 925 908	3 549 220
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There were no direct operating expenses, repairs, and maintenance incurred by the ARC on the investment property.

**20. PROPERTY, PLANT AND EQUIPMENT**

	2023			2022		
	Cost / Valuation	Accumulated depreciation and accumulated impairment	Carrying value	Cost / Valuation	Accumulated depreciation and accumulated impairment	Carrying value
Land	646 741 056	–	646 741 056	646 741 056	–	646 741 056
Buildings	551 390 473	(43 309 423)	508 081 050	551 513 443	(22 689 082)	528 824 361
Machinery and farming equipment	195 790 790	(73 142 867)	122 647 923	187 794 451	(70 430 245)	117 364 206
Office furniture and equipment	75 760 798	(66 363 960)	9 396 838	77 738 976	(67 589 263)	10 149 713
Motor vehicles and aircraft	84 293 559	(59 232 700)	25 060 859	86 333 579	(56 872 923)	29 460 656
Computer equipment	118 806 569	(70 804 057)	48 002 512	110 731 473	(65 315 144)	45 416 329
Infrastructure	248 939 136	(73 289 472)	175 649 664	239 933 117	(69 141 992)	170 791 125
Buffalo	250 000	(156 250)	93 750	250 000	(125 000)	125 000
Laboratory equipment	537 312 775	(209 886 828)	327 425 947	535 049 813	(200 140 599)	334 909 214
Bearer plants	45 531 725	(18 456 610)	27 075 115	45 531 725	(15 712 187)	29 819 538
Horse	15 000	(5 998)	9 002	17 000	(5 099)	11 901
Assets under construction	41 417 745	–	41 417 745	40 228 324	–	40 228 324
<b>TOTAL</b>	<b>2 546 249 626</b>	<b>(614 648 165)</b>	<b>1 931 601 461</b>	<b>2 521 862 957</b>	<b>(568 021 534)</b>	<b>1 953 841 423</b>

**Reconciliation of property, plant and equipment - 2023**

	Opening balance	Additions	Disposals	Transfers	Reclassification	Depreciation	Total
Land	646 741 056	–	–	–	–	–	646 741 056
Buildings	528 824 361	219 120	(331 729)	–	–	(20 630 702)	508 081 050
Machinery and farming equipment	117 364 206	14 696 211	(2 662 219)	–	(116 587)	(6 633 688)	122 647 923
Office furniture and equipment	10 149 713	985 371	(113 914)	–	–	(1 624 332)	9 396 838
Motor vehicles and aircraft	29 460 656	19 565	(451 929)	–	–	(3 967 433)	25 060 859
Computer equipment	45 416 329	11 063 145	(461 431)	320 851	(865 913)	(7 470 469)	48 002 512
Infrastructure	170 791 125	9 734 716	(1 267 573)	–	982 500	(4 591 104)	175 649 664
Buffalo	125 000	–	–	–	–	(31 250)	93 750
Laboratory equipment	334 909 214	19 353 288	(7 732 319)	(320 851)	–	(18 783 385)	327 425 947
Bearer plants	29 819 538	–	–	–	–	(2 744 423)	27 075 115
Horse	11 901	–	(1 215)	–	–	(1 684)	9 002
Assets under construction	40 228 324	1 189 421	–	–	–	–	41 417 745
<b>TOTAL</b>	<b>1 953 841 423</b>	<b>57 260 837</b>	<b>(13 022 329)</b>	<b>–</b>	<b>–</b>	<b>(66 478 470)</b>	<b>1 931 601 461</b>

**Reconciliation of property, plant and equipment - 2022**

	Opening balance	Additions	Disposals	Transfers from assets under construction	Reclassification	Depreciation	Total
Land	646 741 056	–	–	–	–	–	646 741 056
Buildings	551 384 927	215 096	(59 241)	–	(701 943)	(22 014 478)	528 824 361
Machinery and farming equipment	117 262 442	6 930 994	(361 145)	–	–	(6 468 085)	117 364 206
Office furniture and equipment	11 117 324	952 767	(256 491)	–	3 010	(1 666 897)	10 149 713
Motor vehicles and aircraft	34 940 618	–	(1 192 198)	–	–	(4 287 764)	29 460 656
Computer equipment	57 896 453	1 469 952	(1 506 704)	–	–	(12 443 372)	45 416 329
Infrastructure	165 796 277	8 393 541	(413 916)	1 736 472	–	(4 721 249)	170 791 125
Buffalo	312 500	–	(127 604)	–	–	(59 896)	125 000
Laboratory equipment	331 784 096	26 787 788	(4 884 098)	–	–	(18 778 572)	334 909 214
Bearer plants	32 736 790	–	–	–	–	(2 917 252)	29 819 538
Horse	23 201	–	(9 101)	–	–	(2 199)	11 901
Assets under construction	40 211 329	1 753 467	–	(1 736 472)	–	–	40 228 324
<b>TOTAL</b>	<b>1 990 207 013</b>	<b>46 503 605</b>	<b>(8 810 498)</b>	<b>–</b>	<b>(698 933)</b>	<b>(73 359 764)</b>	<b>1 953 841 423</b>

\*Included in the Land are some portions of the land that are in the name of the South African government under the custodianship of the Department of Public Works and Infrastructure (9 national and 1 provincial). These land portions have been under the ARC's care and control including direct access to the properties and the right to restrict or deny access of others through employment of its own securities to safeguard the properties. These land portions were under the care and control of the ARC and the title deeds were endorsed in favour of the ARC in 1994. DPWI will start the process of transfer in the name of ARC in 2023/24 financial year.

**Pledged as security**

There are no assets that are pledged as security.

**Compensation received for losses on property, plant and equipment – included in operating profit.**

Property, plant and equipment	597 115	897 511
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**Property, plant and equipment in the process of being constructed or developed****Cumulative expenditure recognised in the carrying value of property, plant and equipment**

Buildings	41 417 745	40 228 324
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Only the FMD building is under construction. The other work in progress relates to assets that are not ready for use.

The FMD building factory progress / status has been delayed due to the following:

- Modification of the original business plan and requirement for additional funding;
- Recruitment of independent consultants or contractors were only finalised in the current financial year;
- Delays in tender and contracting processes; and
- Vaccine plant and facility re-design.

**Reconciliation of Work-in-Progress - 2023**

	Included within Buildings	Total
Opening balance	40 228 324	40 228 324
Additions/capital expenditure	1 189 420	1 189 420
	41 417 744	41 417 744

**Reconciliation of Work-in-Progress - 2022**

	Included within infrastructure	Included within Buildings	Total
Opening balance	232 025	39 979 304	40 211 329
Additions/capital expenditure	1 504 447	249 020	1 753 467
Transferred to completed items	(1 736 472)	–	(1 736 472)
	–	40 228 324	40 228 324

**Expenditure incurred to repair and maintain property, plant and equipment****Expenditure incurred to repair and maintain property, plant and equipment included in Statement of Financial Performance**

	2023	2022
General expenses - repairs and maintenance	38 536 485	32 055 856

A register containing the information is available for inspection at the registered office of the entity.

## 21. INTANGIBLE ASSETS

	2023			2022		
	Cost / Valuation	Accumulated depreciation and accumulated impairment	Carrying value	Cost / Valuation	Accumulated depreciation and accumulated impairment	Carrying value
Computer software	52 569 543	(49 989 844)	2 579 699	53 666 177	(50 619 714)	3 046 463
Intangible assets under development	12 070 900	–	12 070 900	8 824 000	–	8 824 000
<b>TOTAL</b>	<b>64 640 443</b>	<b>(49 989 844)</b>	<b>14 650 599</b>	<b>62 490 177</b>	<b>(50 619 714)</b>	<b>11 870 463</b>

	Opening balance	Additions	Amortisation	Total
Computer software	3 046 463	251 721	(718 485)	2 579 699
Intangible assets under development	8 824 000	3 246 900	–	12 070 900
	<b>11 870 463</b>	<b>3 498 621</b>	<b>(718 485)</b>	<b>14 650 599</b>

	Opening balance	Additions	Amortisation	Total
Computer software	10 426 525	–	(7 380 062)	3 046 463
Intangible assets under development	5 039 800	3 784 200	–	8 824 000
	<b>15 466 325</b>	<b>3 784 200</b>	<b>(7 380 062)</b>	<b>11 870 463</b>

Intangible assets in the process of being constructed or developed

Cumulative expenditure recognised in the carrying value of Intangible assets

	2023	2022
Intangible assets under development	12 070 900	8 824 000

## 22. HERITAGE ASSETS

	2023			2022		
	Cost / Valuation losses	Accumulated impairment	Carrying value	Cost / Valuation	Accumulated impairment losses	Carrying value
Historical buildings	223 167	–	223 167	223 167	–	223 167

Reconciliation of heritage assets - 2023

	Opening balance	Total
Historical buildings	223 167	223 167

Reconciliation of heritage assets - 2022

	Opening balance	Total
Historical buildings	223 167	223 167

Heritage assets which fair values cannot be reliably measured

## Genebanks

Fair value cannot be determined reliably due to the size and magnitude of the ARC Genebanks. The ARC is not aware of any market to buy and sell Genebanks or any other valuation method or technique that is available to measure Genebanks. Due to the uniqueness of the Genebanks, mandate and nature of the ARC's Genebanks, neither the fair value, deemed cost or replacement cost could be determined for these Genebanks. For those reasons, the ARC's Genebanks could not be recognised in the financial statements.

## Insect collections

Fair value cannot be determined reliably due to the size and magnitude of the ARC Insect collections. The ARC is not aware of any market to buy and sell Insect collections or any other valuation method or technique that is available to measure Insect collections. Due to the uniqueness of the Insect collections, mandate and nature of the ARC's Insect collections, neither the fair value, deemed cost or replacement cost could be determined for these Insect collections. For those reasons, the ARC's Insect collections could not be recognised in the financial statements.

## Expenditure incurred to repair and maintain heritage assets

There was no repairs and maintenance expenditure incurred on heritage assets.

# 23. LIVING RESOURCES

	2023			2022		
	Cost / Valuation	Accumulated depreciation and accumulated impairment	Carrying value	Cost / Valuation	Accumulated depreciation and accumulated impairment	Carrying value
Cattle	2 010 000	(335 222)	1 674 778	1 632 000	(271 998)	1 360 002

## Reconciliation of living resources - 2023

	Opening balance	Increase through non-exchange functions	Disposals	Depreciation	Total
Cattle	1 360 002	906 000	(399 670)	(191 554)	1 674 778

## Reconciliation of living resources - 2022

	Opening balance	Increase through non-exchange functions	Depreciation	Total
Cattle	1 826 001	(313 501)	(152 498)	1 360 002



## 24. OTHER FINANCIAL ASSETS

	2023	2022
<b>Designated at fair value</b>		
Distell Group Holdings (Capevin unbundling 34 027 shares at R180.50 (2022: 34 027 shares at R175.25))	6 141 874	5 963 315
La Concorde Holdings Limited (formerly KWV Holdings LTD) 50 263 shares at R3.00 (2022: 50 263 shares at R3.00)	150 789	150 789
Hosken Passenger Logistics and Rail Limited 64 955 shares at R5.10 (2022: 64 955 shares at R3.82)	331 270	248 128
	<b>6 623 933</b>	<b>6 362 232</b>
<b>Residual interest at cost</b>		
De Doorns Winery 9 880 shares at R0.55 (2022: 9 880 shares at R0.55)	5 434	5 434
Hex Valley Coolrooms 16 092 shares at R0.50 (2022: 16 092 shares at R0.50)	8 046	8 049
Lutzville 2009 Co operative Limited 107 000 shares at R0.01 (2022: 107 000 shares at R0.01)	1 070	1 070
Lanko Co operative Limited 21 063 shares at R1.00 (2022: 21 063 shares at R1.00)	21 063	21 063
Lutzville Vineyard Co operative 44 867 shares at R1.00 (2022: 44 867 shares at R1.00)	44 867	44 867
Lutzville Vineyard Co operative 1 070 000 shares at R0.01 (2022: 1 070 000 shares at R0.01)	10 700	10 700
Roodezandt (Pty) Ltd 5 900 shares at R0.40	2 360	2 360
	<b>93 540</b>	<b>93 543</b>
	<b>6 717 473</b>	<b>6 455 775</b>
<b>Total other financial assets</b>		
Designated at fair value	6 623 933	6 362 232
Residual interest at cost*	93 540	93 543
	<b>6 717 473</b>	<b>6 455 775</b>
<b>Financial assets at fair value</b>		
<b>Fair values of financial assets measured or disclosed at fair value</b>		
Financial assets designated at fair value - JSE listed shares	6 623 933	6 362 232

### Fair value hierarchy of financial assets at fair value

For financial assets recognised at fair value, disclosure is required of a fair value hierarchy which reflects the significance of the inputs used to make the measurements. The fair value hierarchy have the following levels:

Level 1 represents those assets which are measured using unadjusted quoted prices in active markets for identical assets.

Level 2 applies inputs other than quoted prices that are observable for the assets either directly (i.e. as prices) or indirectly (i.e. derived from prices).

Level 3 applies inputs which are not based on observable market data.

<b>Level 1</b>	<b>2023</b>	<b>2022</b>
JSE listed shares	6 623 933	6 362 232
<b>Financial assets at cost</b>		
<b>Nominal value of financial assets at cost</b>	<b>2023</b>	<b>2022</b>
Financial asset: Shareholding in wine co operations	93 540	93 543

## 25. PAYABLES FROM EXCHANGE TRANSACTIONS

	2023	2022
Trade payables	16 064 950	12 839 983
Payments received in advanced - contract in process	204 079 913	110 839 081
*Other payables	107 154 225	77 050 439
Accrued leave pay	56 268 713	57 723 944
	<b>383 567 801</b>	<b>258 453 447</b>

\*Included in other payables is accruals, deposits from customers and salary control accounts.

### Fair value of trade payables

	2023	2022
Current	1 538 845	7 504 627
Up to 60 days	13 227 604	5 269 230
90 days	768 793	6 484
91 - 120 days	60 422	–
	469 283	59 642
	<b>16 064 947</b>	<b>12 839 983</b>

## 26. EMPLOYEE BENEFIT OBLIGATIONS

### Defined benefit plan

The Post-Retirement Medical Benefits (PRMB) is governed by the Pension Fund Act 24 of 1956.

The actuarial valuation determined that the post-employment medical benefit plan was in a sound financial position. The plan is a post employment medical benefit plan.

### Post-retirement medical aid plan

This includes current and past employees of the ARC who are currently members of the medical aid fund. Membership to the fund is voluntary.

The Council attempted to restructure the defined medical aid scheme, in terms of which the ARC had obligations to provide certain post-retirement medical aid benefits to ARC pensioners in terms of ARC service conditions, by renegotiating the benefit structuring from a medical subsidy to a guaranteed income (pension). ARC currently has no continuation members with effect from 1 April 2004.

The scheme is actuarially valued on an annual basis. The effective date of the most recent actuarial valuation was 31 March 2023. At that date, in the opinion of the actuary, the defined benefit plan was found to be in a sound financial position. The projected unit credit method has been used for the purposed of determining the acturial valuation. Change in currency or interest rate result in an insignificant change in the plan obligation.

The following table summarises the components of the net benefit expense recognised in the statement of financial performance and amounts recognised in the statements of financial position as at 31 March 2022. The obligation is fulfilled as employees exit this fund.

Carrying Value	2023	2022
Present value of the defined benefit obligation-wholly unfunded	(10 228 452)	(11 533 555)

**Changes in the present value of the defined benefit obligation are as follows:**

	2023	2022
Opening balance	11 533 555	11 228 000
Benefits paid	(1 789 582)	(2 374 493)
Net expense recognised in the statement of financial performance	484 479	2 680 048
	<b>10 228 452</b>	<b>11 533 555</b>

**Net expense recognised in the statement of financial performance**

	2023	2022
Current service cost	325 411	340 000
Interest cost	1 214 647	1 298 912
Actuarial (gains) losses	(1 055 579)	1 041 136
	<b>484 479</b>	<b>2 680 048</b>

**Calculation of actuarial gains and losses**

	2023	2022
Actuarial (gains) losses - Obligation	(1 055 579)	1 041 136

**Key assumptions used**

Assumptions used at the reporting date:

	2023	2022
Actual return on plan assets	12.00 %	11.22 %

The discount rate that reflects the time value of money is best approximated by reference to market yields at the reporting date on zero-coupon government bonds. We have used the average nominal yield curve for zero-coupon SA Government bonds with duration between 10 and 15 years as at 31 March 2023.

The source of the data is the Johannesburg Stock Exchange through IRESS data service.

No allowance has been made for future increases in the current subsidy amounts. Medical inflation was therefore set at 0%. The basis on which the discount rate has been determined is as follow:

The nominal and zero curves as at 31 March 2023 supplied by the JSE were used to determine the discount rates and CPI assumptions.

The PA90 ultimate mortality table (rated downwards by 3 years) was used in the valuation for the mortality of Continuation Members.

**Other assumptions**

Assumed healthcare cost trends rates have a significant effect on the amounts recognised in surplus or deficit. A one percentage point change in assumed healthcare cost trends rates would have the following effects:

	One percentage point increase	One percentage point decrease
Effect on the aggregate of the service cost and interest cost	1 448 350	1 549 603
Effect on defined benefit obligation	948 920	1 098 366

**Amounts for the current and previous four years are as follows:**

	2023	2022	2021	2020	2019
Defined benefit obligation	10 228 452	11 533 555	11 228 000	10 570 000	13 491 000

### Defined contribution plan

It is the policy of the entity to provide retirement benefits to all its employees. A number of defined contribution provident funds, all of which are subject to the Pensions Fund Act No. 24 of 1956 exist for this purpose.

The entity is under no obligation to cover any unfunded benefits.

The total economic entity contribution to such schemes	41 805 063	40 531 710
The amount recognised as an expense for defined contribution plans is	16 362 459	16 016 067

Included in defined contribution plan information above, is the following plan(s) which is the ARC Pension Fund (option D) and the ARC Provident Fund.

### ARC Pension Fund (option D)

Under the ARC Act, the Agricultural Research Council has established its own pension fund, the ARC Pension Fund on 1 April 1992, to provide retirement benefits for employees who were transferred from the Department of Agriculture to the then newly formed Agricultural Research Council. All employees who are appointed on an indefinite basis, is required to become a member of either the ARC-Pension Fund or the NEHAWU National Provident Fund.

The ARCPF is administered by Alexander Forbes. The Fund is defined contribution fund and members is receiving the benefits provided for the rules of the ARCPF on resignation, dismissal, retrenchments, retirement or death.

### ARC Provident Fund

The ARC become a participating employer of the NEHAWU National Provident Fund on 1 November 1997. All employees who are appointed on an indefinite basis will be required to become a member of either the ARC-Pension Fund or the NEHAWU National Provident Fund (NNPF).

The NNPF is administer by SANLAM. The Fund is a defined contribution fund and members is receiving the benefits provided for the rules of the ARCPF on resignation, dismissal, retrenchment, retirement or death.

## 27. UNSPENT CONDITIONAL GRANTS AND RECEIPTS

Unspent conditional grants and receipts comprises of:	2023	2022
<b>Unspent conditional grants and receipts</b>		
Foot and Mouth Disease ("FMD") vaccines facility	478 371 220	479 928 055
Exotic Disease and the Wild Suide facilities	–	4 877 451
	<b>478 371 220</b>	<b>484 805 506</b>
<b>Movement during the year</b>		
Balance at the beginning of the year	479 928 055	372 532 347
Additions during the year	–	113 044 000
Income recognition during the year	(1 556 835)	(770 841)
	<b>478 371 220</b>	<b>484 805 506</b>

Of the R535.55m allocated by National Treasury for the FMD project, R478.37m has yet to be spent. The ARC has started ring- fencing the funds during the FY2020 and will continue to ensure that the adequate cash reserves are reserved for funding of the future work on the FMD. At year end, the ARC had cash and cash equivalents of R1 205m which is adequate to fund the work on this project.

These amounts are invested in a ring-fenced investment until utilised.

## 28. SHARE CAPITAL / CONTRIBUTED CAPITAL ISSUED

	2023	2022
Capital Fund	111 986 013	111 986 013

The capital fund represents the cost of land when the ARC was transferred out of the Department of Agriculture, Land Reform and Rural Development (formerly Department of Agriculture, Forestry and Fisheries).

## 29. REVALUATION RESERVE

	2023	2022
Opening balance	961 995 870	961 995 870
<b>Revaluation surplus relating to property, plant and equipment</b>		
Revaluation surplus beginning of period	1 011 273 600	1 011 273 600

## 30. ACCOUNTING BY PRINCIPALS AND AGENTS

The entity is a party to a principal-agent arrangement(s).

**Details of the arrangement(s) is|are as follows:**

The entity is the principal. Refer to note for significant judgements applied in making this assessment.

ARC is the proprietor of certain plant varieties wherein SANSOR is appointed to collect royalties on behalf of the ARC. The entity is the principal. SANSOR is the designated authority to manage and execute all functions pertaining to seed certification on behalf of government.

### Entity as principal

#### Resources (including assets and liabilities) of the entity under the custodianship of the agent

The resources have not been recognised by the agent in its financial statements.

There are no cost implications for the entity if the principal-agent arrangement is terminated. The arrangement may be terminated by either party subject to three months notice.

Fee paid	2023	2022
Fee paid as compensation to the agent	514 066	111 986 013

## 31. TAXATION

### Reconciliation of the tax expense

The ARC is exempt from Income Tax in terms of section 10(1)(a) of the Income Tax Act no. 58 of 1962.



## 32. CASH GENERATED FROM OPERATIONS

	2023	2022
Surplus	215 323 529	157 921 431
<b>Adjustments for:</b>		
Depreciation and amortisation	67 570 123	81 071 378
Gain on sale of assets and liabilities	12 745 522	6 550 877
Loss on foreign exchange	1 343 580	1 417 745
Fair value adjustments	(261 698)	(2 001 236)
Impairment deficit	7 851 847	19 251 769
Movements in operating lease assets and accruals	(91 563)	(1 077 366)
Movements in retirement benefit assets and liabilities	(249 524)	(735 581)
Actuarial (gains)/ or losses	(1 055 579)	1 041 136
Inventory losses or write-downs	(439 599)	(2 836 986)
Stock write-off	439 599	2 836 986
Movement in reserves	(556 728)	(1 160 318)
<b>Changes in working capital:</b>		
Inventories	(4 207 984)	2 077 277
Receivables from exchange transactions	26 494 989	(12 800 292)
Prepayments	(715 581)	798 252
Payables from exchange transactions	123 770 772	(24 410 042)
VAT	27 274 149	(1 303)
Unspent conditional grants and receipts	(6 434 286)	117 150 610
	<b>468 801 568</b>	<b>345 094 337</b>

## 33. FINANCIAL INSTRUMENTS DISCLOSURE

### Categories of financial instruments

#### 2023

Financial assets	At fair value	At amortised cost	At cost	Total
Other financial assets	6 623 933	–	93 540	6 717 473
Trade and other receivables from exchange transactions	–	80 107 812	–	80 107 812
Cash and cash equivalents	–	1 205 011 572	–	1 205 011 572
	<b>6 623 933</b>	<b>1 285 119 384</b>	<b>93 540</b>	<b>1 291 836 857</b>
<b>Financial liabilities</b>				<b>At amortised cost</b>
Compound instruments				113 066 454

#### 2022

Financial assets	At fair value	At amortised cost	At cost	Total
Other financial assets	6 623 933	–	93 543	6 455 775
Trade and other receivables from exchange transactions	–	114 454 648	–	114 454 648
Cash and cash equivalents	–	796 969 462	–	796 969 462
	<b>6 362 232</b>	<b>911 424 110</b>	<b>93 543</b>	<b>917 879 885</b>
<b>Financial liabilities</b>				<b>At amortised cost</b>
Compound instruments				85 981 456

## 34. COMMITMENTS

### Authorised capital expenditure

Already contracted for but not provided for

	2023	2022
Buildings	14 821 215	219 120
Computer equipment	1 689 902	225 668
Computer software	–	143 294
Infrastructure	8 082 854	3 820 309
Laboratory equipment	13 845 335	7 301 093
Machinery and farming equipment	6 192 358	2 822 730
Motor Vehicle	9 329 472	340 934
Office furniture and equipment	179 453	510 328
Office Furniture & Fittings	155 180	–
WIP buildings	195 151	70 750
WIP computer software	–	688 500
WIP Machinery and Farming Equipment	3 923	–
	<b>54 494 843</b>	<b>16 142 726</b>
<b>Total capital commitments</b>		
Already contracted for but not provided for	54 494 843	16 142 726
<b>Total commitments</b>		
<b>Total commitments</b>		
Authorised capital expenditure	54 494 843	16 142 726
<b>Operating leases - as lessee (expense)</b>		
<b>Minimum lease payments due</b>		
- within one year	1 859 691	1 523 046
- in second to fifth year inclusive	1 371 686	1 099 919
	<b>3 231 377</b>	<b>2 622 965</b>

ARC leases certain of its equipment in terms of operating leases. The ARC does not have the option to acquire the assets at the termination of the lease. There are no escalation or renewal terms clauses or restrictions imposed by the leases. The ARC is not charged any contingent rentals.

## 35. CONTINGENCIES

The guarantees on municipal and electrical accounts relate to the City of Tshwane municipality to ensure a continued service to the ARC Onderstepoort Veterinary Institute.

Legal costs and litigations relate to the nature of the ARC's business, agreements with complex deliverables may be entered into. All necessary steps are taken to manage the risks inherent to these transactions. If and when it is evident that there is a reasonable probability that a dispute on a transaction could lead to costs against the ARC, such costs will be disclosed.

	2023	2022
Guarantees on municipal and electricity accounts	1 075 360	1 075 360
*Legal costs and litigations	31 897 580	31 817 580
Pending labour disputes	2 120 000	2 300 000
	<b>35 092 940</b>	<b>35 192 940</b>

\* Included in legal cost and litigations is a contingent liability of R30 982 484( 2022: R31 182 484) in favour of City of Tshwane Metropolitan Municipality for outstanding electricity charges. The ARC successfully launched an urgent court application against the Municipality; pending the finalisation of internal dispute resolution process around the incorrect meter reading.

### Retention of surplus funds

In terms of section 53(3) of the PFMA, constitutional institutions and public entities listed in schedule 3A and 3C to the Public Management Act (PFMA), 1999 may not accumulate surpluses that were realised in the previous financial year without obtaining prior written approval of the relevant Treasury.

In terms of paragraph 3.2 of the National Treasury instruction no. 12 of 2020/21, surplus is based on the net assets. A request for surplus retention will be submitted to the National Treasury based on the audited financial statement.

Figures in Rand	Controlling entity	
	2023	2022
Cash and Cash Equivalents at end of the year (#)	1 205 011 572	796 969 462
Add: Receivables	80 107 812	114 454 648
Less: Current Liabilities	(411 860 757)	(259 492 610)
Subtotal	873 258 627	651 931 500
Less: Deferred Income Grant (Ringfenced)	(478 371 220)	(484 805 506)
<b>Net Surplus/ (Deficit) after taking into account conditional grants</b>	<b>394 887 407</b>	<b>167 125 994</b>

(#) the Cash and Cash Equivalents includes the funds relating to the Conditional Grant for Foot and Mouth Disease (FMD) vaccine facility. The FMD and Exotic Disease and Wild Suide facility liability (disclosed under Non-Current Liabilities) had a balance of R478 371 220 as at 31 March 2023 (2022: R484 805 506).

The CAPEX commitments for the ARC of R54 494 843 are also to be funded from the cash surpluses retained.

### Contingent assets

Mr. Pretorius' lease agreement fell into arrears in respect of his rental obligation, civil proceedings have commenced against the tenant concerned to recover an amount of R502 708. According to entity's legal advisors, it is probable that the proceedings will result in the recovery of the full amount.

## 36. RELATED PARTIES

The ARC is a Schedule 3A national public entity in terms of the Public Finance Management Act (Act No. 1 of 1999 as amended) and therefore falls within the national sphere of government. As a consequence the ARC has a significant number of related parties being entities that fall within the national sphere of government.

Such transactions are for the research that the ARC performs from time to time. All such transactions are concluded on an arm's length basis.

The ARC reports to Department of Agriculture, Land Reform and Rural Development (DALRRD). Amounts disclosed below as related parties relates to the parent department, Department of Agriculture, Land Reform and Rural Development (DALRRD) and entities within DALRRD.

The ARC occupies land portions and associated immovable assets owned by the Department of Public Works and Infrastructure in Roodeplaat and Pretoria free of charge.

## Relationships

Ultimate controlling entity	Department of Agriculture, Land Reform and Rural Development
Controlling entity	Department of Agriculture, Land Reform and Rural Development
Public entity - (Under common control with the ARC)	Agricultural Land Holding Account
Public entity - (Under common control with the ARC)	KwaZulu-Natal Ingonyama Trust Board (ITB)
Public entity - (Under common control with the ARC)	National Agricultural Marketing Council
Public entity - (Under common control with the ARC)	Office of the Valuer-General
Public entity - (Under common control with the ARC)	Onderstepoort Biological Products
Public entity - (Under common control with the ARC)	Perishables Products Export Control Board
Public entity - (Under common control with the ARC)	Registration of Deeds Trading Account
Public entity - (Under common control with the ARC)	South African Veterinary Council

## Related party balances

	2023	2022
<b>Amounts included in Trade receivable (Trade Payable) regarding related parties</b>		
AgriSETA		
Department of Agriculture, Forestry and Fisheries (new DALRRD)	6 182 969	700 014
Department of Agriculture, Land Reform and Rural Development	6 013 955	25 930 306
Department of Education	-	3 890
Department Military Veterans	-	8 312
Department of Public Works and Infrastructure	-	1 439 916
Department of Rural Development and Land Reform (new DALRRD)	63 256	88 992
Department of Environment, Forestry and Fisheries	-	500 000
Department of Science and Innovation	1 201 825	542 243
Director of Veterinary Service	1 061 119	106 982
The National Commissioner of South Africa	-	347 033
Onderstepoort Biological Products - receivables	-	258 161
Onderstepoort Biological Products - payables	8 685 012	6 764 156
South African Veterinary Council	-	(848)
National Research Foundation	-	(4 404)
Water Research Commission	363 364	(675 723)
South African Bureau of Standards	1 682 000	-
South African Weather Services	10 500	-
	115 949	-
<b>Unconditional grants from related parties</b>		
Department of Agriculture, Forestry and Fisheries - Wild Suide	-	(4 877 451)
Department of Agriculture, Forestry and Fisheries - FMD	(478 371 220)	(479 928 053)

These are government grants received that will be recognised in future accounting periods. Recognition in future periods will be in line with reporting standards and determined by construction work on the facilities concerned.

	2023	2022
<b>Provision for doubtful debts related to outstanding balances with related parties</b>		
AgriSETA	5 376 494	904 608
Department of Agriculture, Forestry and Fisheries (new DALRRD)	66 698	8 127 945
Department of Agriculture, Land Reform and Rural Development	3 904 604	3 412
Department of Basic Education	-	19 639
Department of Military Veterans	-	1 263 084
Department of Public Works and Infrastructure	72 776	78 830
Department of Rural Development and Land Reform (New DALRRD)	-	438 596
Department of Science and Innovation	-	93 844
The National Commissioner of South Africa	-	221 451
Water Research Commission	2 174	-
South African Weather Services	45 576	-
Department of Military Veterans	1 263 084	-
South African Bureau of Standards	9 130	-
<b>Expenses recognised in respect of bad or doubtful debts</b>		
AgriSETA	(4 471 887)	546 905
Department of Agriculture, Forestry and Fisheries (new DALRRD)	8 127 945	3 049 581
Department of Public Works and Infrastructure	6 054	64 239
Department of Rural Development and Land Reform (new DALRRD)	438 596	1 730 151
Department of Science and Innovation	93 844	262 647
Director of Veterinary Service	62 256	62 256
The National Commissioner of South Africa	221 451	172 053
Water Research Commission	10 761	-
South African Weather Services	(34 693)	-
South African Bureau of Standards	31 438	-
Department of Education	19 639	-
Department of Agriculture, Land reform and Rural development	3 412	-
Department of Rural, Environmental and Agricultural development	(66 698)	-
South African National Accreditation System	1 402	-

### Council members, audit and risk committee members and executive management's remuneration

#### Council 2023

Name	Fees for services as a member of management	Total
Ms. JS Isaacs (Chairperson)	470 258	470 258
Dr. JM Mashaba	434 306	434 306
Dr. ST Cornelius	296 102	296 102
Prof. PW Mashela	230 850	230 850
Dr. SAM Van Oorsterhout	308 228	308 228
Mr. GS Gcaba	250 774	250 774
Miss. N Maharaj	247 888	247 888
Dr. KB Liphadzi	281 012	281 012
Prof. NJJ Oliver	360 344	360 344
Prof. RMB Auerbach	236 439	236 439
Dr. CPN Malan	254 905	254 905
Dr. PJ Mokaila	318 325	318 325
	<b>3 689 431</b>	<b>3 689 431</b>



**Council 2022**

Name	Fees for services as a member of management	Total
Ms. JS Isaacs (Chairperson)	410 941	410 941
Dr. JM Mashaba	389 674	389 674
Dr. ST Cornelius	256 925	256 925
Dr. KB Liphadzi	237 656	237 656
Dr. CPN Malan	234 013	234 013
Dr. PJ Mokaila	263 171	263 171
Dr. SAM van Oosterhout	264 145	264 145
Ms. N Maharaj	272 405	272 405
Mr. GS Gcaba	222 592	222 592
Prof. RMB Auerbach	216 270	216 270
Prof. PW Mashela	235 471	235 471
Prof. NJJ Olivier	532 549	532 549
	<b>3 535 812</b>	<b>3 535 812</b>

**Executive management 2023**

Name	Basic salary	Other short-term employee benefits	Other benefits received	Post-employment benefits	Total
Dr. N Motete	2 030 274	33 303	287 761	17 775	2 369 113
Dr. TG Sethibe	2 051 790	57 617	211 672	15 877	2 336 956
Mr. KE Mashala (Note 1)	792 708	-	-	-	792 708
Ms. B Muthuri (Note 4)	386 152	-	-	-	386 152
Mr. AK Carim (Note 2)	1 642 701	40 027	210 000	5 398	1 898 126
Dr. MA Magadlela	2 039 544	23 774	287 760	8 783	2 359 861
Dr. HW Vergotine (Note 5)	1 887 085	39 844	-	3 692	1 930 621
Dr. LL Magingxa	3 039 564	101 066	391 889	18 419	3 550 938
Dr. P Chaminuka (Note 3)	717 139	-	-	-	717 139
	<b>14 586 957</b>	<b>295 631</b>	<b>1 389 082</b>	<b>69 944</b>	<b>16 341 614</b>

**Executive management 2022**

Name	Basic salary	Other short-term employee benefits	Post-employment benefits	Termination benefits	Other benefits received	Total
Dr. SR Moephuli	919 043	30 697	137 267	428 899	777	1 516 683
Dr. HW Vergotine	365 144	-	-	-	-	365 144
Dr. N Motete	2 008 672	28 886	260 417	-	-	2 297 975
Ms. MM Manyama	2 219 588	35 677	298 337	-	-	2 553 602
Mr KE Mashala	38 132	-	-	-	-	38 132
Dr. MA Magadlela	1 772 143	20 620	260 417	-	-	2 053 180
Dr. T Sethibe	1 773 056	49 878	191 559	-	14 541	2 029 034
Dr. TS Mkhabela	1 537 927	-	-	126 610	-	1 664 537
Dr. P Chaminuka	352 596	-	-	-	-	352 596
Ms. B Muthuri	604 577	-	-	-	-	604 577
	<b>11 590 878</b>	<b>165 758</b>	<b>1 147 997</b>	<b>555 509</b>	<b>15 318</b>	<b>13 475 460</b>

\*Refer to note "Employee related costs"

Note 1: Mr. Mashala started acting as the CFO from 01/04/2022 to 31/07/2022. Note 2: Mr. AK Carim was appointed as CFO since 01/08/2022.

Note 3: Dr. Chaminuka is acting for the position of Dr. Mkhabela since 20/09/2021 (GE Impact and Partnerships).

Note 4: Ms. B Muthuri was appointed acting GE: Human Capital Management, Marketing and Legal Services from 01/04/2022 to 30/10/2022.

Note 5: Dr. HW Vergotine was appointed GE: Human Capital Management from 01/02/2023 and EMC member effective 14/03/2023.

#### Audit committee 2023

Name	Fees for services as a member of management	Total
Mr. VN Naicker (Chairperson)	162 138	162 138
Dr. JM Laubscher	89 935	89 935
Ms. KG Mbonambi	50 076	50 076
Ms. B Schutte	64 147	64 147
Ms. AM Mokgabudi	50 082	50 082
	<b>416 378</b>	<b>416 378</b>

#### Audit committee 2022

Name	Fees for services as a member of management	Total
Ms. P Stock (Chairperson)	127 939	127 939
Mr. VN Naicker	73 701	73 701
Dr. JM Laubscher	73 081	73 081
Ms. ND Maidi	71 854	71 854
	<b>346 575</b>	<b>346 575</b>

## 27. PRIOR-YEAR ADJUSTMENTS

Presented below are those items contained in the statement of financial position, statement of financial performance and cash flow statement that have been affected by prior-year adjustments:

#### Statement of financial position

2021	Note	As previously reported	Correction of error	Restated
Receivables from exchange transactions	15	128 820 615	(6 286 885)	122 533 730
Operating lease asset	14	3 633 063	(318 179)	3 314 884
Investment property	19	4 404 837	289 860	4 694 697
Property, plant and equipment	20	2 007 377 950	(17 170 938)	1 990 207 012
Intangible assets	21	15 508 653	(42 328)	15 466 325
Payables from exchange transactions	25	(262 678 736)	(16 422 568)	(279 101 304)
Revaluation reserve		(1 011 273 600)	49 277 730	(961 995 870)
Accumulated surplus		(919 337 011)	(9 326 691)	(928 663 702)
		<b>(33 544 229)</b>	<b>1</b>	<b>(33 544 228)</b>

**2022**

	Note	As previously reported	Correction of error	Restated
Inventories	13	18 665 835	54 467	18 720 302
Revaluation reserve		(1 011 273 600)	49 277 730	(961 995 870)
Receivables from exchange transactions	15	122 589 412	(8 134 764)	114 454 648
Operating lease asset - current		4 702 748	(3 911 401)	791 347
Investment property	19	4 990 943	223 633	5 214 576
Property, plant and equipment	20	1 973 688 776	(19 847 353)	1 953 841 423
Intangible assets	21	11 945 926	(75 463)	11 870 463
Operating lease asset - non-current	15	-	3 600 903	3 600 903
Payables from exchange transactions	26	(235 699 424)	(22 754 023)	(258 453 447)
VAT payable		(1 170 542)	151 735	(1 018 807)
Accumulated surplus		(1 087 999 666)	1 414 536	(1 086 585 130)
		(199 559 592)	-	(199 559 592)

**Statement of financial performance****2021**

	Note	As previously reported	Correction of error	Restated
Sale of goods		13 653 184	91 979	13 745 163
Recoveries		26 175 562	(54 896)	26 120 666
Other income		8 564 342	(410)	8 563 932
Interest received		21 666 258	(943 138)	20 723 120
Rendering of services	6	245 653 327	(1 429 177)	244 224 150
Royalty income	9	39 307 747	(1 646 407)	37 661 340
Depreciation and amortisation		(75 288 560)	(4 039 290)	(79 327 850)
Operating and administrative expenses	8	(322 033 796)	71 601	(321 962 195)
Repairs and maintenance		(28 343 605)	(14 365)	(28 357 970)
Lease rentals on operating lease		(4 388 295)	134 975	(4 253 320)
Employee cost		(785 839 917)	(6 097 433)	(791 937 350)
Loss on foreign exchange		(458 518)	(18 976)	(477 494)
Rental of facilities and equipment		39 673 982	(235 168)	39 438 814
<b>Surplus for the year</b>		<b>(821 658 289)</b>	<b>(14 180 705)</b>	<b>(835 838 994)</b>

**2022**

	Note	As previously reported	Correction of error	Restated
Rendering of services		241 240 056	43 489	241 283 545
Rental of facilities and equipment		27 716 079	(285 424)	27 430 655
Depreciation and amortisation		(78 308 848)	(2 762 530)	(81 071 378)
Lease rentals on operating lease		(3 404 937)	(56 061)	(3 460 998)
Repairs and maintenance		(31 989 942)	(65 914)	(32 055 856)
Operating and administrative expenses		(327 126 900)	(1 351 473)	(328 478 373)
Royalty Income		35 149 486	14 225	35 163 711
Sale of goods		13 073 695	194 500	13 268 195
Other Income		8 865 837	182 340	9 048 177
Employee related cost		(755 251 964)	(6 630 430)	(761 882 394)
Loss on foreign exchange		(1 406 627)	(11 118)	(1 417 745)
Finance cost		(247 844)	417	(247 427)
Loss on disposal of assets and liabilities		(9 158 677)	(13 243)	(9 171 920)
<b>Surplus for the year</b>		<b>(880 850 586)</b>	<b>(10 741 222)</b>	<b>(891 591 808)</b>

The following prior period errors adjustments occurred:

#### **Error 1**

During the current year, management discovered that projects, sale of goods revenue, recoveries, other income, royalty income and rendering of services were accounted for in the incorrect period. As consequence, trade receivables and other receivables, accumulated surplus and revenue were misstated. The error was corrected by restating the affected financial statements line items for prior periods.

#### **Error 2**

During the current financial year, management discovered that the employee costs as it relates to benefit sharing on intellectual property was not accrued for and as a consequence, payable from exchange transactions was understated. The error was corrected by restating the affected financial statements lines items from prior periods.

#### **Error 3**

During the current financial year, management discovered that operating and administrative expenses, loss on foreign exchange, lease rentals, repairs and maintenance were accounted for in the incorrect period. As consequence, trade payables and other payables, inventories, vat payable and accumulated surplus were misstated. The error was corrected by restating the affected financial statements line items for prior periods.

#### **Error 4**

During the current financial year, management discovered that depreciation on property, plant and equipment, intangible asset, and investment property were not posted correctly and reviewed the useful life of property, plant and equipment. As consequence, the prior year expenses, accumulated surplus were understated and property, plant and equipment was overstated. The error was corrected by restating the affected financial statements line items for prior periods.

## 38. CHANGES IN ACCOUNTING POLICY

The ARC adjusted its useful lives ranges for the asset groups below due to classification of assets from other asset classes. The assets were allocated useful lives outside the original useful lives ranges.

No financial impact, as the reclassified assets useful lives were maintained.

- Motor vehicles and aircraft: The useful lives range was adjusted from 4-20 years to 1-20 years
- Computer equipment: The useful lives range was adjusted from 3-15 years to 3-55 years.
- Infrastructure: The useful lives range was adjusted from 10-60 years to 5-60 years.
- Bearer plants: The useful lives range was adjusted from 4-50 years to 3-50 years
- Buffalo: The useful lives range was adjusted from 23 years to 8-23 years.
- Horse: The useful lives range was adjusted from 30 years to 10-30 years.

## 39. CHANGE IN ESTIMATE

### **Property, plant and equipment**

The useful life of Computer Equipment was estimated in the deemed acquisition date of every asset to be 3 years. At the beginning of the current period, management has revised their estimate based on the conditional grade percentage of RUL guide. The effect of this revision has decreased the depreciation charge from R1 981 820 to R918 185 for the current and future periods.

## 40. RISK MANAGEMENT

### **Financial risk management**

The entity's activities expose it to a variety of financial risks: market risk (including currency risk, fair value interest rate risk, cash flow interest rate risk and price risk), credit risk and liquidity risk.

The Council has overall responsibility for the establishment and oversight of the entity's risk management framework.. The entity's risk management policies are established to identify and analyse the risks faced by the entity, to set appropriate risk limits and controls, and to monitor risks and adherence to limits. Risk management policies and systems are reviewed regularly to reflect changes in market conditions and the entities activities.

The audit and risk committee oversees how management monitors compliance with the entity's risk management policies and procedures and reviews the adequacy of the risk management framework in relation to the risks faced by the entity. The entity Audit and Risk Committee is assisted in its oversight role by Internal Audit. Internal Audit undertakes both regular and ad hoc review of risk management controls and procedures, the results of which are reported to the Audit and Risk Committee.

### Liquidity risk

Liquidity risk is the risk that the entity will not meet its financial obligation as they become due.

The entity manages liquidity through effective management of working capital, capital expenditure and cash flow. Adequate cash reserves are maintained. The entity manages liquidity risk through forecasting as well as monitoring cash flows on a daily basis.

The following are maturities of financial liabilities. The amounts disclosed in the table are the undiscounted cash flows. Balances due within 12 months equal their carrying balances as the impact of discounting is not significant.

At 31 March 2023	Less than 1 year	Between 1 and 2 years	Between 2 and 5 years	Over 5 years
Trade and other payables	113 066 454	–	–	–
At 31 March 2022	Less than 1 year	Between 1 and 2 years	Between 2 and 5 years	Over 5 years
Trade and other payables	85 852 799	–	–	–

### Credit risk

Credit risk is the risk that a counterparty will not meet its obligations under a financial instrument or customer contract, leading to a financial loss. The entity is exposed to credit risk from its operating activities ( primarily trade receivables) and deposits with banks and financial institutions, and other financial instruments.

Trade receivables are presented net of an allowance for doubtful receivables. Currently only five of the entity's largest debtors exceeding 5% of the total trade receivables balance as disclosed in note 16. The ARC does not have any significant exposure to any other individual customer or counterparty.

The entity's bank balances and cash are placed with high credit, quality financial institutions with no significant exposure to any one counterparty.

The carrying amounts of financial assets included in the statement of financial position represent the ARC's maximum exposure to credit risk in relation to these assets. ARC does not hold collateral or any credit enhancements to cover its credit risk.

Financial assets exposed to credit risk at year end were as follows:

Credit risk consists mainly of cash deposits, cash equivalents, derivative financial instruments and trade debtors. The entity only deposits cash with major banks with high quality credit standing and limits exposure to any one counter-party.

Trade receivables comprise a widespread customer base. Management evaluated credit risk relating to customers on an ongoing basis. If customers are independently rated, these ratings are used. Otherwise, if there is no independent rating, risk control assesses the credit quality of the customer, taking into account its financial position, past experience and other factors. Individual risk limits are set based on internal or external ratings in accordance with limits set by the board. The utilisation of credit limits is regularly monitored. Sales to retail customers are settled in cash or using major credit cards. Credit guarantee insurance is purchased when deemed appropriate.



Financial assets exposed to credit risk at year end were as follows:

Financial Instrument	2023	2022
Cash and cash equivalents	1 205 011 572	796 969 462
Trade and other receivables	80 107 812	114 454 648

### Market risk

#### Interest rate risk

Interest rate risk is the risk that the fair value or future cash flows of a financial instrument will fluctuate because of changes in market interest rates. The entity's exposure to the risk of changes in market interest rates relates primarily to the entity's cash and cash equivalents. Exposure to interest rate risk is monitored on a continuous and proactive basis.

#### Cash flow interest rate risk

Financial Instrument	Current interest rate	Due in less than a year	Due in one to two years	Due in two to three years	Due in three to four years	Due after five years
Cash in current banking institutions	4.36 %	144 958 880	–	–	–	–
Short-term deposits	7.85 %	1 060 052 692	–	–	–	–

#### Interest rate sensitivity

Surplus or deficit is sensitive to higher/lower interest income from cash and cash equivalents as a result of changes in interest rates. This analysis assumes that all other variables remain constant. The analysis is performed on the same basis for 2022.

Figures in Rand	Impact on surplus or deficit	
	2023	2022
Interest rates - increase by 50 basis points	6 023 058	3 984 847
Interest rates - decrease by 50 basis points	(6 023 058)	(3 984 847)

#### Foreign exchange risk

The entity does not hedge foreign exchange fluctuations.

The exchange rates were obtained from OANDA.com.

The entity is exposed to currency risk on sales and purchases that are denominated in a currency other than the functional currency of the entity. The currencies in which the Council primarily deals are US Dollars, British Pounds and Euros. No forward exchange contracts are taken out for these transactions. The Council consider the foreign currency risk to be insignificant.

Exchange rates used for conversion of foreign items were:

USD	17.9698	14.4848
GBP	22.1944	19.0199
EURO	19.5455	16.1323

#### Price risk

The entity is exposed to equity securities price risk because of investments held by the entity and classified on the consolidated statement of financial position either as available-for-sale or at fair value through surplus or deficit. The entity is not exposed to commodity price risk. To manage its price risk arising from investments in equity securities, the entity diversifies its portfolio. Diversification of the portfolio is done in accordance with the limits set by the entity.

The entity's investments in equity of other entities that are publicly traded and are included in FTSE 100 UK equity index. The table below summarises the impact of increases/decreases of the indexes on the entity's post-tax surplus for the year

and on equity. The analysis is based on the assumption that the equity indexes has increased/decreased by 5% with all other variables held constant and all the entity's equity instruments moved according to the historical correlation with the index:

Financial instrument	Impact on post tax surplus in Rand		Impact on other components of equity in Rand	
	2023	2022	2023	2022
<b>FTSE 100 UK</b>	331 197	318 112	331 197	318 112

Post-tax surplus for the year would increase/decrease as a result of gains or losses on equity securities classified as at fair value through surplus or deficit. Other components of equity would increase/decrease as a result of gains or losses on equity securities classified as available-for-sale.

## 41. GOING CONCERN

The annual financial statements have been prepared on the basis of accounting policies applicable to a going concern. This basis presumes that funds will be available to finance future operations and that the realisation of assets and settlement of liabilities, contingent obligations and commitments will occur in the ordinary course of business.

## 42. EVENTS AFTER THE REPORTING DATE

The Council is not aware of any other significant matters or circumstances arising since the end of the financial year which needs to be reported as part of these financial statements.

## 43. IRREGULAR EXPENDITURE AND FRUITLESS AND WASTEFUL EXPENDITURE

	2023	2022
Irregular expenditure	–	26 897 476
Fruitless and wasteful expenditure	35 828	249 591
<b>Closing balance</b>	<b>35 828</b>	<b>27 147 067</b>

### Criminal or disciplinary steps taken as a result of losses, irregular and fruitless and wasteful expenditure

During the current year, the investigations were finalised on some of the fruitless and wasteful expenditures incurred during current and prior years resulting in a recovery of R2 569 and the condonation of R83 237. Refer to reconciling notes in the annual report.

There was no irregular expenditure confirmed relating to the current financial year. There were possible transgressions identified in the current year, which have been submitted to the internal audit for investigation and confirmation. At the time of reporting, line management were carrying out consequence management on all finalised investigations against officials who committed the offences. In all instances, no loss was suffered by the public entity.

### Additional narratives

#### Restatement of opening balances

Irregular expenditure was restated due to incorrect amounts of R5 891 075 reported in the prior year. The opening balance was also restated with the amount of R1 479 325 that relates to prior year and confirmed in the current year. Refer to reconciling notes in the annual report.

## 44. SEGMENT INFORMATION

### General information Identification of segments

The entity is organised and reports to management on the basis of three major functional areas: primary, secondary and tertiary educational services. The segments were organised around the type of service delivered and the target market. Management uses these same segments for determining strategic objectives. Segments were aggregated for reporting purposes.

Information reported about these segments is used by management as a basis for evaluating the segments' performances and for making decisions about the allocation of resources. The disclosure of information about these segments is also considered appropriate for external reporting purposes.

Operating segments are only required to be reportable if they exceed quantitative thresholds. Information on an operating segment should be separately reported if reported revenue is 10% or more of the combined revenue of all operating segments.

### Aggregated segments

The entity operates throughout the Gauteng Province in ten cities. Segments were aggregated on the basis of services delivered as management considered that the economic characteristics of the segments throughout Gauteng were sufficiently similar to warrant aggregation.

### Types of goods and/or services by segment

These reportable segments as well as the goods and/or services for each segment are set out below:

Reportable segment	Goods and/or services
Animal Science	Animal health and production
Crop Science	Improvement and cultivation of various crops
Natural Resources and Engineering	Carry out research and development on the natural agricultural resources, viz, soil, climate and water. Provides collaborative and support functions to a wide range of technologies in areas such as genomics, phenomics, remote sensing, agricultural modelling and engineering systems.

**Segment surplus or deficit, assets and liabilities 2023**

Segment surplus or deficit, assets and liabilities 2023	Animal Sciences	Crop Sciences	Natural Resources and Engineering	Total
<b>Revenue</b>				
Revenue from non-exchange transactions	257 010 237	364 177 757	82 506 196	703 694 190
Revenue from exchange transactions	140 397 734	220 471 452	30 321 837	391 191 023
Interest revenue	50 701	274 639	-	325 340
<b>Total segment revenue</b>	<b>397 458 672</b>	<b>584 923 848</b>	<b>112 828 033</b>	<b>1 095 210 553</b>
Other unallocated revenue				431 496 048
<b>Entity's revenue</b>				<b>1 526 706 601</b>
<b>Expenditure</b>				
Salaries and wages	230 342 971	340 935 213	71 920 246	643 198 430
Other expenses	132 418 593	180 810 461	41 549 840	354 778 894
Depreciation	18 133 884	38 970 709	5 383 283	62 487 876
<b>Total segment expenditure</b>	<b>380 895 448</b>	<b>560 716 383</b>	<b>118 853 369</b>	<b>1 060 465 200</b>
<b>Total segmental surplus/(deficit)</b>	<b>16 563 224</b>	<b>24 207 465</b>	<b>(6 025 336)</b>	<b>34 745 353</b>
Interest expense				9 827
Unallocated expenses				215 313 702
<b>Entity's surplus (deficit) for the period</b>				<b>215 323 529</b>
<b>Assets</b>				
Segment assets	625 702 640	1 270 624 223	94 772 977	1 991 099 840
Unallocated assets				1 289 266 688
<b>Total assets as per Statement of financial Position</b>				<b>3 280 366 528</b>
<b>Liabilities</b>				
Segment liabilities	650 806 428	127 344 852	17 604 419	795 755 699
Unallocated liabilities				104 704 730
<b>Total liabilities as per Statement of financial Position</b>				<b>900 460 429</b>

**Segment surplus or deficit, assets and liabilities 2022**

2022	Animal Sciences	Crop Sciences	Natural Resources and Engineering	Total
<b>Revenue</b>				
Revenue from non-exchange transactions	264 746 372	335 647 674	78 556 194	678 950 240
Revenue from exchange transactions	131 063 642	159 104 098	26 470 474	316 638 214
Interest revenue	20 053	295 209	-	315 262
<b>Total segment revenue</b>	<b>395 830 067</b>	<b>495 046 981</b>	<b>105 026 668</b>	<b>995 903 716</b>
Other unallocated revenue				398 311 418
Entity's revenue				<b>1 394 215 134</b>
<b>Expenditure</b>				
Salaries and wages	225 385 854	337 737 254	66 228 303	629 351 411
Other expenses	110 621 228	149 945 059	30 744 304	291 310 591
Depreciation	21 992 053	42 503 177	5 202 603	69 697 833
<b>Total segment expenditure</b>	<b>357 999 135</b>	<b>530 185 490</b>	<b>102 175 210</b>	<b>990 359 835</b>
<b>Total segmental surplus/(deficit)</b>	<b>37 830 932</b>	<b>(35 138 509)</b>	<b>2 851 458</b>	<b>5 543 881</b>
Total revenue reconciling items				398 311 418
Interest expense				244 362
Unallocated expenses				(240 634 349)
<b>Entity's surplus (deficit) for the period</b>				<b>157 921 431</b>
<b>Assets</b>				
Segment assets	638 094 157	1 289 917 627	100 378 651	2 028 390 435
Unallocated assets				892 580 535
<b>Total assets as per Statement of financial Position</b>				<b>2 920 970 970</b>
<b>Liabilities</b>				
Segment liabilities				659 899 795
Unallocated liabilities	578 088 134	59 559 001	22 252 660	95 931 876
<b>Total liabilities as per Statement of financial Position</b>				<b>755 831 671</b>

Following a change in the composition of its reportable segments, the corresponding items of segment information for earlier periods has been restated.

**Measurement of segment surplus or deficit, assets and liabilities****Basis of accounting for transactions between reportable segments**

The accounting policies of the segments are the same as those described in the summary of significant accounting policies. The unallocated revenue comprises of revenue from non-reportable segments in the form of grants allocated to cover head office expenses and interest earned on investments, including revenue from other non-reportable segment (AECD). The unallocated expenses comprises of employee costs and other operating expenditure incurred for the head office and other non-reportable segment (AECD).

**45. BBBEE PERFORMANCE**

Information on compliance with the B-BBEE Act is included in the annual report under the section titled B-BBEE Compliance Performance Information.





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