AGRICULTURAL RESEARCH COUNCIL

Annual Report 2021 - 2022

PRESENTATION TO THE PORTFOLIO COMMITTEE ON AGRICULTURE, LAND REFORM AND RURAL DEVELOPMENT

12 October 2022

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Excellence in Research and Development

LEGISLATIVE MANDATES

POLICY MANDATES

OUR MANDATE

To conduct agricultural research and development and drive tehnology development and dissemination in order to:

- Promote sustainability and equitable economic participation in the agricultural sector;
- Promote agriculture development and growth in related industries;
- Facilitate sector skills development and knowledge management;
- Facilitate and ensure natural resource conservation;
- Promote national food and nutrition security, and
- Contribute to improved health and better quality of life.

OUR VISION

Excellence in research and innovation for sustainable agricultural systems and socio-economic development

OUR MISSION

To conduct research, develop parternerships and human capital, and foster innovation for a sustainable agricultural sector

OUR IMPACT

Sustainable agricultural systems for agrarian transformation, food and nutrition security

OUR VALUES

I - Integrity
C - Commitment
A - Accountability
I - Innovation
R - Respect
E - Excellence

OUR OUTCOMES AND INTERVENTIONS

1. Increased agricultural production and productivity	2. Sustainable ecosystems and natural resources	3. Improved nutritional value, quality and safety of agricultural products	4. A skilled and capable agriculture sector	5. Enhanced resilience of agriculture	6. A high performing and sustainable organisation
- Crops with improved characteristics - Animal Improvement services - Diagnostic and analytical services	- Biodiversity management - Soil health assessment - Weed bioncontrol - Low carbon technologies	- Product development - Broadening the foodbase - Processing, preservation, and storage methods	- Skills development - Technology development and dissemination - Smallholder farmer supported - Farmer support - Knowledge generated	- Climate resilient solutions - Vaccine production - Diagnostic and analytical services	- Governance, financial management and internal controls - Revenue generation and financial sustainability - Asset utilisation - ICT Strategy Implementation - Effective human resources planning

MEDIUM TERM STRATEGIC FOCUS PRIORITIES FOR 2019 – 2024

MTSF PRIORITIES FOR ARC:

a) Priority 1: A Capable, Ethical and Developmental State

b) Priority 2: Economic Transformation and Job Creation

c) Priority 3: Education, Skills and Health

d) Priority 5: Spatial Integration, Human Settlements and Local Government

e) Priority 7: A better Africa and World

Cross Cutting Focus Areas:

- Women
- Youth
- People with Disabilities
- Climate Change

ARC ROLE/PURPOSE: ALIGNMENT TO MTSF PRIORITIES

1. Promote sustainability and equitable economic participation in the agricultural sector;
2. Promote agricultural development and growth related industries;
3. Facilitate sector skills development and knowledge management;
4. Facilitate and ensure natural resource conservation;
5. Promote national food and nutrition security; and
6. Contribute to improved health and better quality of life.

SCIENCE IN ARC FOR THE AGRICULTURE ECONOMY

SCIENCE COUNCIL

- Innovation in science
- Basic/fundamental research
- Applied research (technologies)
- Intellectual assets
- Skilled scientists & engineers
- Volume & quality publications
- Scientist ratings
- Number of PhDs
- Number of doctoral fellows
- Number of postdoc fellows
- Scientific awards

AGRICULTURE DEVELOPMENT

- Economic link to Innovation
- Applied research
- Technology Transfer/dissemination
- Intellectual Asset Use
- Agricultural Production & productivity
- Food Security – hunger
- Environmental Sustainability
- Import Substitution
- Export Promotion
- Agrarian Transformation
- New products (vaccines, cultivars etc.)

DESIRED IMPACT
SUSTAINABLE AGRICULTURAL SYSTEM FOR AGRARIAN TRANSFORMATION, FOOD AND NUTRITION SECURITY

DESIRED OUTCOMES AND INTERVENTIONS

Outcome 1	**Outcome 2**	**Outcome 3**	**Outcome 4**	**Outcome 5**
Increased agricultural production and productivity	Sustainable ecosystems and natural resources	Improved nutritional value, quality and safety of agricultural products	A skilled and capable agriculture sector	Enhanced resilience of agriculture
Crops with improved characteristics	Biodiversity management	Product development	Skills development	Climate resilient solutions
Animal improvement services	Soil health assessment	Broadening the food base	Technology development and dissemination	Vaccine production
Diagnostic and analytical services	Weed biocontrol	Processing, preservation, and storage methods	Smallholder farmer Support	Diagnostic and analytical services
	Low carbon technologies		Farmer support	
			Knowledge generated	

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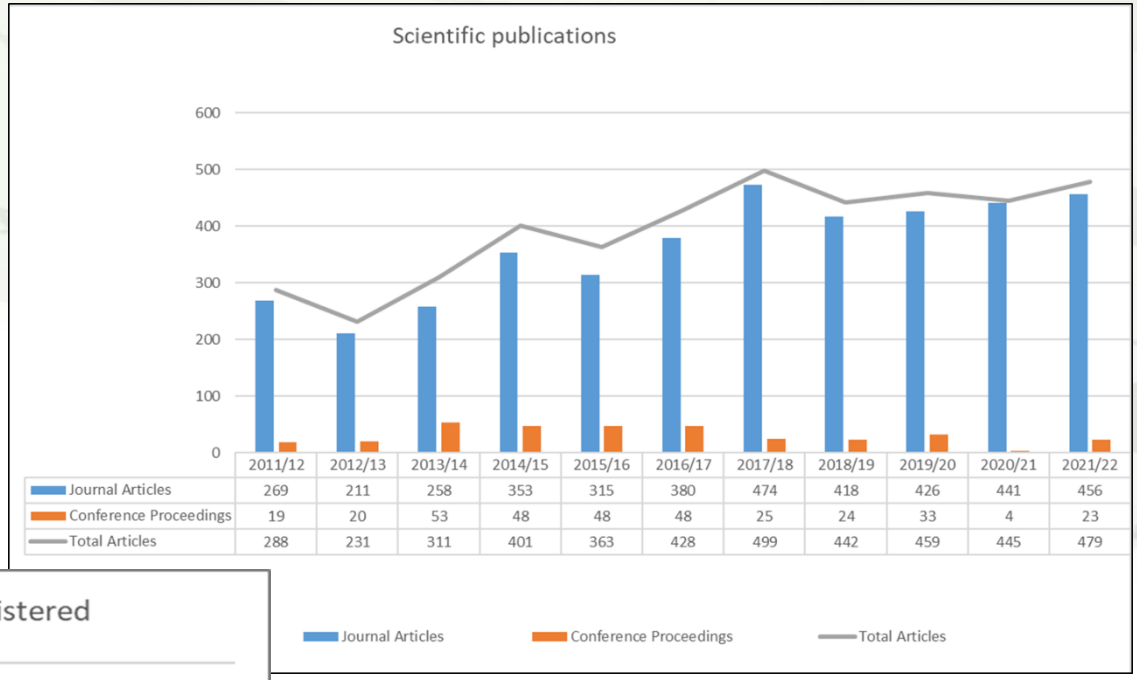
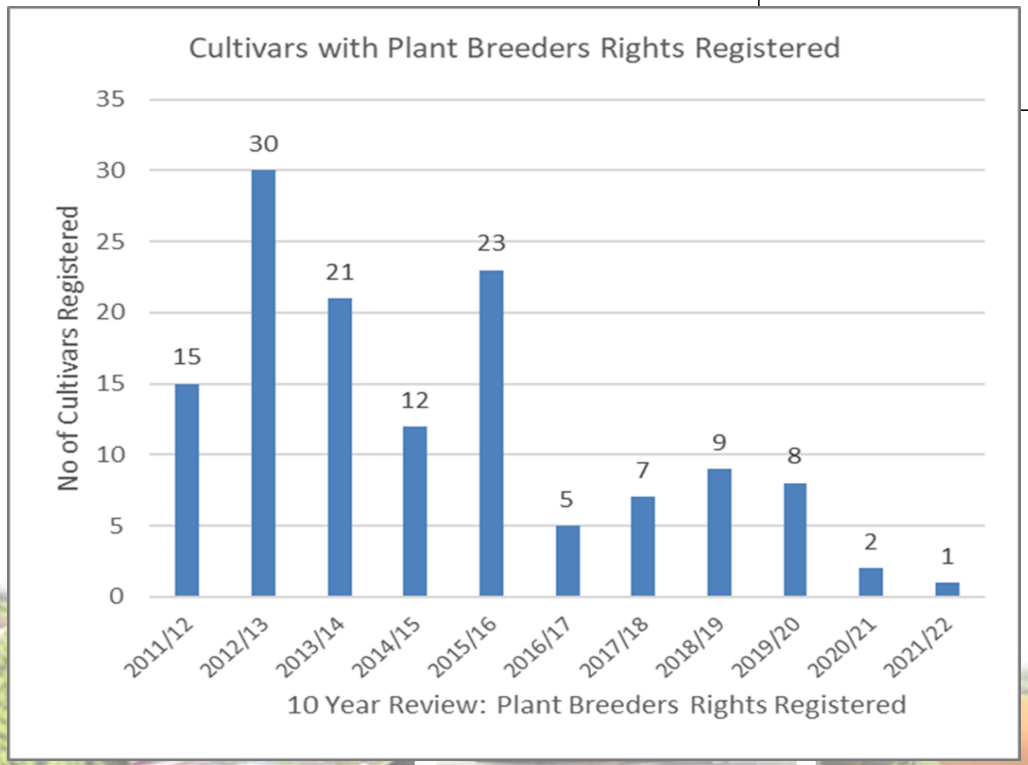
SUMMARY

- Overall for the 2021/22 FY the ARC had 83 Reportable Performance Information Output Indicators.
- 64% of overall Performance Targets were met and/or exceeded.
- 78% of the R&D Performance Targets were met and/or exceeded.
- 479 scientific publications achieved – the highest the organisation has ever achieved.
- Some stimulating discoveries and contributions were also made over the same period.
- The ARC expenditure for the year under review remained within budget.

10 YEAR ANALYSIS



	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Journal Articles	269	211	258	353	315	380	474	418	426	441	456
Conference Proceedings	19	20	53	48	48	48	25	24	33	4	23
Total Articles	288	231	311	401	363	428	499	442	459	445	479



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OUTCOME 1

INCREASED AGRICULTURAL PRODUCTION AND PRODUCTIVITY

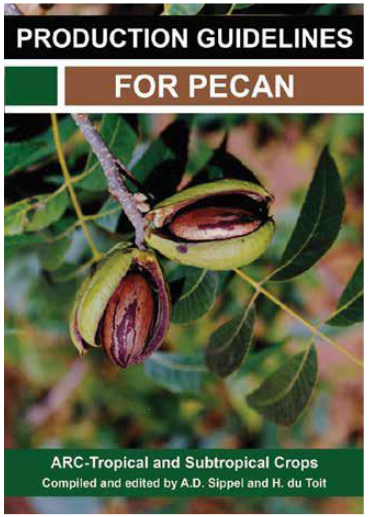
OUTCOME FOCUS	OUTPUT
• To generate knowledge and technologies (intellectual property and tools). • To improve the quality and increase the value of crop and animal based agricultural production and related processes and products. • Enhance productivity towards increased food security, commercial exports and income for the agricultural sector. • Enabling farmers and producers to maximise their efficiency and productivity.	Crop production technologies developed and information dissemination
	Animal improvement services

INCREASED AGRICULTURAL PRODUCTION AND PRODUCTIVITY

- The ARC in collaboration with partners developed a mini-A-frame vertical hydroponic system for household urban farming. The structure is 2 metres long, accommodating up to 115 plants per m2, making it ideal for urban farming set-up in households with small verandas or balconies. Vertical nutrient film technique (NFT) hydroponic systems are suitable for a range of leafy vegetable and herb crops, such as lettuce, basil, mint, coriander and rocket. In this system, nutrient solution recirculates continuously, thus saving water and fertiliser in crop production.

Mini A-frame hydroponic structures.

- The ARC has developed almost 30 production and identification guidelines for a variety of crops, with several more in the pipeline. The latest editions are the Production Guidelines for Pecan (developed in collaboration with the South African Pecan Producers' Association, university partners and industry specialists) and the Identification Guide for Avocado Pests and Diseases.



Production Guidelines for Pecan.

- In the period under review one (1) wheat cultivar was registered, 70 cultivar evaluations conducted on a number of crops, 289 field trials conducted, and 209 technical reports generated from scientific results for services rendered.

OUTCOME 2

SUSTAINABLE ECOSYSTEMS AND NATURAL RESOURCES

OUTCOME FOCUS	OUTPUT
• To generate knowledge and technologies (intellectual property and tools) that will conserve natural resources and sustain agriculture. • 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; • Mechanised farming and irrigation practices, techniques, equipment and machinery.	Natural Resource Management Soil and Water Science Weed Science Ecosystem Services

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SUSTAINABLE ECOSYSTEMS AND NATURAL RESOURCES

- A new service to determine soil health was launched. The YourSoil™ diagnostic services package offers a “double-aspect” analytical service to farmers and land users to determine the health of their soils. This service package is offered through the ARC-Plant Health and Protection and ARC-Natural Resources and Engineering-Soil, Climate and Water research campuses. It gives farmers the opportunity to test their soil health throughout the year, aligned to the various crop development stages. The customised set of tests can contribute towards a long-term soil monitoring system, which can result in improved soil health, reduced input costs, more income and can contribute to sustainable use and management of soil in agriculture.

- Knowing the impact of climate change on ecosystem processes, functions and structure (i.e. type of wetland, how it functions and the effect of catchment land use) might be one of the most cost-effective ways of helping southern Africa to cope with climate change.

- A project was undertaken to understand ecosystem resilience of headwater wetlands in two catchments: one situated in the Kgaswane Mountain Reserve, North West Province, South Africa and the other in the Malolotja Nature Reserve, near Mbabane, Kingdom of Eswatini. Both areas form part of Strategic Water Source Areas within the national priority focus areas of South Africa and Eswatini and are therefore important focal areas for measuring climate change effects on Transboundary Water Management.

- Research results support conservation management of Kgaswane Mountain Reserve (North West Province) and the Malolotja Nature Reserve (Eswatini), as well as the draft wetland policy document for Eswatini, because of the proposed future focus area of sustainability and wise use of wetlands.

OUTCOME 3

IMPROVED NUTRITIONAL VALUE, QUALITY AND SAFETY OF AGRICULTURAL PRODUCTS

OUTCOME FOCUS	OUTPUT
• 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. • Cross-cutting across different areas of the agricultural value chain. • Intended to be applied to the full value chain of crops, animals and agricultural system research.	Broadening the food base
	Post-harvest handling and agro-processing

ELECTROLYSED WATER (EW) FOR POST-HARVEST DECONTAMINATION OF STONE FRUIT

- Electrolysed water (EW) is an eco-friendly, effective technique for microbial decontamination of fruit surfaces, but the impact of EW on the physical and biochemical quality of nectarines during postharvest storage was not fully understood.

- The efficacy of EW (optimum concentration, 200 mg/L, pH, 6.7) to minimise decay and maintain physicochemical quality of nectarines, compared to chlorinated water, was investigated during storage for 31 days. Treatment with optimum EW effectively preserved the freshness of the nectarine fruit by reducing surface decay compared to the chlorinated water and control treatments.

- The EW treatment effectively maintained the firmness, reduced weight loss, and maintained high total soluble solid content with a slight decline in titratable acidity for nectarines. Furthermore, the EW suppressed the decease of colour qualities of the peel and reduced the incidence of browning compared to the chlorinated water and control treatments. The outcome of this study provides guidelines for stone fruit pack-houses and other industry role players on the potential of EW as an alternative to chlorine treatments.

Control after 21 days: nectarines not firm anymore and wrinkled..

After 21 days nectarines treated with electrolysed water were still firm and showed good colour.

OUTCOME 4

A SKILLED AND CAPABLE AGRICULTURE SECTOR

OUTCOME FOCUS	OUTPUT
• To provide strategies, analysis and information to develop and grow a competitive, productive, and diverse agricultural sector. • Provide a support service to identify and develop the commercial potential of agricultural research and development to address smallholder and commercial farmer constraints. • Implementation of initiatives to address smallholder farmer constraints in terms of access to resources (technology, information, etc.). • Packaging, exploitation and licensing of ARC research and development outcomes. • Enhance the capacity and skills of farmers, extension personnel, processors, and enterprise through facilitating the utilisation of ARC intellectual property.	Skills development
	Technology Transfer
	Smallholder farmer supported
	Farmer Support
	Knowledge generated and dissemination

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AGRICULTURE SECTOR SKILLS DEVELOPMENT

- The importance of training of farmers to attain sustainable agricultural development and food security cannot be over-emphasized. The ARC collaborates with Provincial Departments of Agriculture and other role players in the agriculture sector to achieve this deliverable. For example, on-farm demos in the form of farmer field days were conducted in the period under review; such as a farmer's day presentation held in collaboration with Mpumalanga Department Agriculture, Rural Development, Land and Environmental Affairs (DARDLEA) at Hluvukani, Bushbuckridge on "Maize on-farm trials/ TELA Stewardship and on-farm compliance".

- Celebrating 70 years of supporting sweet potato industry in South Africa was one of the key highlights of the period under review.

- Cultivar evaluation trials were established on-station and on-farm in collaboration with the Departments of Agriculture in Mpumalanga (Nooitgedacht, Thulamahase, Dipaleseng and Driefontein), KwaZulu-Natal (Zwelisha, Zithenjwa), Limpopo (Lebowakgomo, Tovoomba) and North West (Madidi), and the University of Venda.

A female farmer from Hluvukani, Bushbuckridge, posing at her field with her TELA maize produce.

Harvesting day at Nooitgedacht (station of the Mpumalanga Department of Agriculture and Rural Development).

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PROTECTIVE EFFECT OF PLANTS AGAINST MYCOTOXIN INDUCED MUTAGENICITY AND CARCINOGENICITY

Mining South Africa extraordinarily rich and diverse plant life for new therapeutics

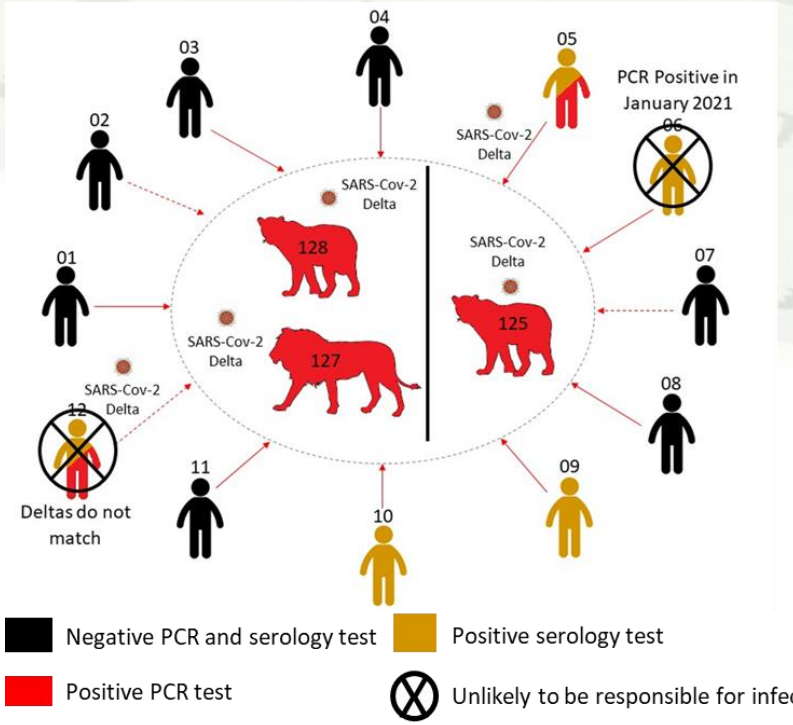
- Aflatoxins induce cancer of the liver (Hepatocellular carcinoma (HCC)).
- A known animal feed contaminant.
- The *Helichrysum odoratissimum (Imphepho)* confers protection against aflatoxin B_1 mutagenicity in vitro in a preliminary study.
- Potential as a feed or food additive and nutraceutical.

Sampling and processing of the plant material by postgraduate students.

SARS-COV-2 INFECTION IN ANIMALS

RESPONDING TO NATIONAL CHALLENGES

- SARS-CoV-2 impact on wildlife conversation and tourism
- Assisted with the testing of SARS-CoV-2 animal samples for identification of human-to-animal transmission
- Three natural infections of SARS-CoV-2 in felines investigated
- One puma and three lions from a private zoo tested positive



Potential infection route from animal handlers to the three lions in the private zoo. Direct (solid line) and indirect (dashed line) human contacts were traced and tested for SARS-CoV-2 RNA and IgG antibodies (Koeppel et al. 2022).

ALTERNATIVE FEEDING FOR SMALL-SCALE LIVESTOCK FARMERS USING HYDROPONIC BARLEY SPROUT

Barley sprout growing on trays.

Barley sprout offered to sheep during a demonstration at a Farmers' day in Irene.

- Barley fodder sprouts were produced under room temperature.
- Sprout weighed about 5 to 6 kg fresh biomass at harvest i.e. eight days after planting.
- This project was partially funded by the Gauteng Department of Agriculture and Rural Development (GDARD).

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WILDLIFE-FRIENDLY LIVESTOCK MANAGEMENT PROMOTES MAMMALIAN BIODIVERSITY

- In South Africa, livestock production practices have degraded landscapes through overgrazing, hunting and trapping to control predators and competing wildlife and erecting fences to control livestock movements.

- Herding could restore degraded landscapes and can have a positive impact on biodiversity whilst improving food production.

- We assessed how mammalian biodiversity, specifically richness and their relative abundances varied on five Karoo farms that had been amalgamated and subjected to a transition from **traditional livestock grazing techniques** to **wildlife-friendly non-lethal predator management**, using human shepherding of livestock under a high-density short-duration grazing regime.

- Our results show a clear indication of an increased species richness each year between 2016 and 2019.

High-density grazing

GENOMICS FOR UNRAVELING THE MOLECULAR BASIS OF VIRULENCE IN THE SOUTH AFRICAN TREE PATHOGEN CERATOCYSTIS ALBIFUNDUS

- *Ceratocystis albifundus* is a pathogen of non-native *Acacia mearnsii,* an important timber crop in South Africa.
- Although the fungus does not cause any disease symptoms on native host, certain cultivars of *Protea cynaroides* used in the cut-flower industry seem to be susceptible to it.

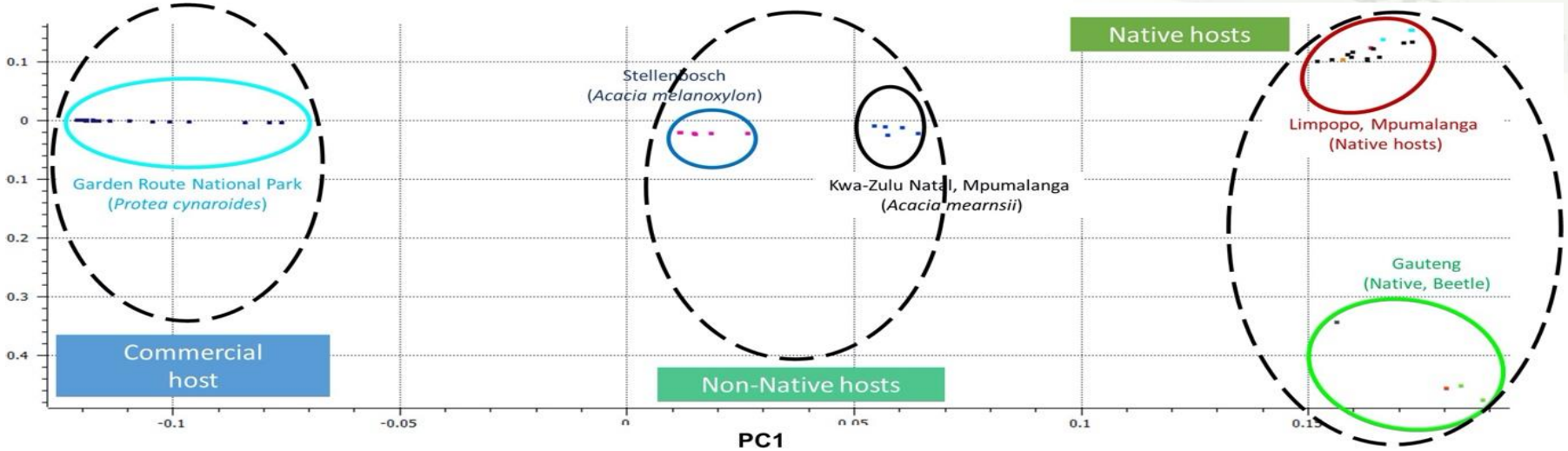
Major economic losses due to infection in cultivated Proteas and Acacia plantations.

Looking for disease symptoms of C . albifundus in natural stands of Protea caffra.

- An important step of disease management is early detection of the disease-causing agent.
- The ARC therefore undertook field work to look for the symptoms of *C. albifundus* in commercial Protea stands and natural occurring *Protea caffra* targeting stands that were hit by hailstorms during the current La Niña event.

GENOMICS FOR UNRAVELING THE MOLECULAR BASIS OF VIRULENCE IN THE SOUTH AFRICAN TREE PATHOGEN CERATOCYSTIS ALBIFUNDUS

- *Ceratocystis albifundus* as an aggressive pathogen of cultivated tree crops in South Africa is thought to represent a recent host jump and subsequent invasion.
- Host jumps to native species represent an important threat to South African biodiversity.
- The ARC is using population genomic approaches to determine how the plant host, and the pathogen's reproductive mode and geographic range are associated with virulence and pathogenicity.



Two-dimensional principal component analysis (PCA) revealed the presence of distinct clusters within our collection of strains

Genomics approaches were used to shed light on the molecular ecology of this fungus, which is essential if we want to design management strategies for limiting its socioeconomic impacts.

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CAPACITY BUILDING: BIOINFORMATICS AND STATISTICAL GENOMICS TRAINING

- Genomics and Bioinformatics are scarce and critical skills in South Africa and regionally.
- The ARC launched the Bioinformatics and Statistical Genomics Training Program (Bif) made up of six modules covering the concepts of bioinformatics tools used for analyses, and interpretation of data from Next Generation Sequencing (NGS) and Single Nucleotide Polymorphism (SNP) Genotyping.

Bioinformatics and Statistical Genomics Training Laboratory

This initiative is designed to transfer skills and contribute towards capacity building of postgraduate students, scientists and researchers from diverse academic backgrounds, including historically underrepresented institutions in scarce and critical skills as well as facilitate the uptake of genomics as a technology in the sector.

OUTCOME 5

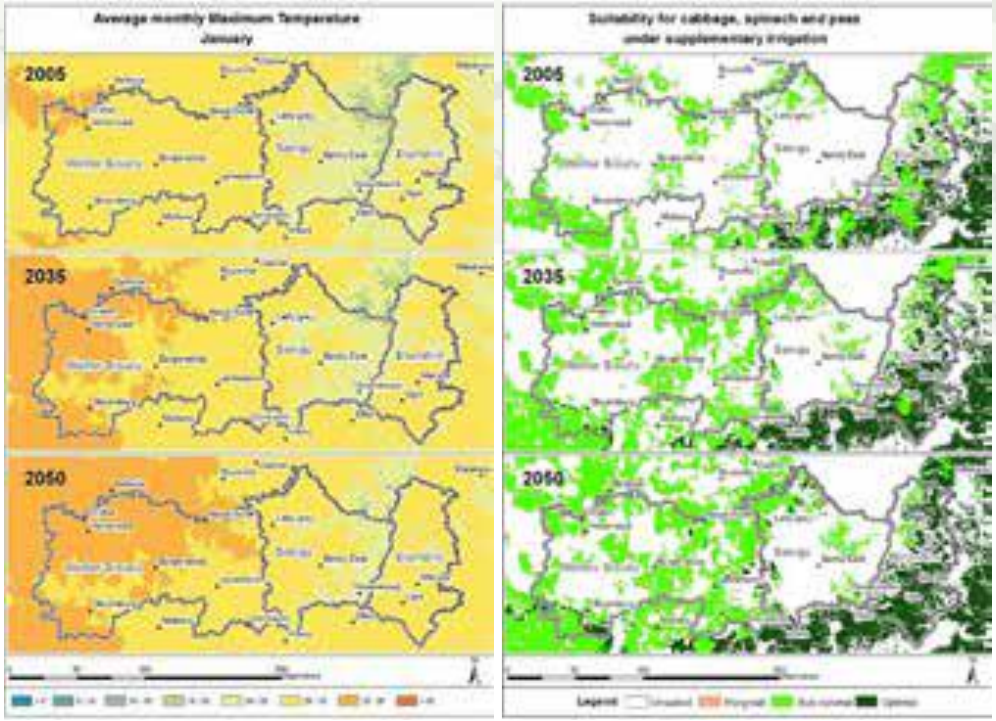
ENHANCED RESILIENCE OF AGRICULTURE

OUTCOME FOCUS	OUTPUT
• Enhance the resilience of the Agriculture sector to factors such as Climate Change. • Climate monitoring of agriculture and the effective maintenance of an operational national agro-climate weather station network for effective provision of weather and climate related services. • Effective and efficient diagnostic and analytical services. • A wide range of applied research and consultancy services on livestock diseases at local, provincial, national, and regional levels. • Development and improvement of diagnostic and analytical services and applying the latest biological techniques. • Development of vaccines to improve the health of the national herd.	Climate resilient solutions Vaccine production Laboratory services

INCREASING RESILIENCE AND REDUCING VULNERABILITIES OF LOCAL COMMUNITIES TO THE EFFECTS OF CLIMATE CHANGE

- The ARC was contracted by the United Nations Environment Programme (UNEP) to address the effects of climate change by promoting Ecosystem-based Adaptation (EbA) in the Joe Gqabi District Municipality mountainous area of the Eastern Cape Province in a three-pronged project. The first task was to characterise the natural resources and crop suitability under current climatic conditions as well as projected future conditions.

- The crop suitability maps show no optimal areas for maize production in Elundini Local Municipality, neither now nor in the future, but large areas are optimal for sorghum with a December planting date. Sorghum has a more stable and lower production risk than maize due to its drought tolerant properties and lower seasonal water requirements.



Maps of Joe Gqabi District Municipality showing projected changes in monthly maximum temperatures for January (left) and crop suitability for cabbage, spinach and peas cultivated with supplementary irrigation from a baseline of 2005 for the near future (centred on 2035) and mid-century (2050).

NATIONAL COLLECTION OF ANIMAL HELMINTHS (NCAH)

- NCAH is a National Public Goods Asset.
- Parasitic nematodes have a negative impact on farming of livestock.
- ARC research on parasite communities inform control strategies against parasite diseases in wildlife and livestock.
- Identified parasite species of wildlife in livestock – both wild host and livestock now maintenance host of these parasites.
- Evidence suggest that agricultural activities that impact the environment may influence the abundance of parasite species and transmission dynamics between host and parasite.

Spirurid nematode Gongylonema congolense anterior extremity.

KAONAFATSO YA DIKGOMO (KYD) – CHALLENGES & SOLUTIONS

- **Kaonafatso ya Dikgomo** is a special-purpose vehicle aimed at supporting smallholder farmers to ensure their active participation in formal livestock agri-business thereby promoting inclusivity in the sector.

- Implementation of the programme got off to a slow start as a result of a new contractual arrangement with DALRRD where funding was made available through CASP grant to provinces. The negotiation between ARC and provinces, and subsequent signing of the SLA took some time but was eventually concluded.

- Business plans for the nine provinces were finalised in Q1 of the year under review soon after the signing of the SLAs.

- Despite some delays at the beginning, KyD exceeded its annual target in terms of providing the much-needed support to smallholder livestock farmers.

SMALLHOLDER FARMERS SUPPORTED

ARC Senior Research Technician demonstrating bull selection at Winterveldt farmers' day.

ARC Research Technician presenting on bull fertility at Mandeni farmers' day.

- The **Kaonafatso ya Dikgomo (KyD)** Animal Improvement Scheme supported **7 096** smallholder livestock farmers to enable them to actively participate in formal livestock value chains.
- KyD enhanced market access to smallholder livestock farmers through hosting livestock auctions.
- Together with Livestock Associations in Kwa-Zulu Natal, KyD hosted **14 livestock auctions** in various districts. Nine hundred and ninety one (991) farmers comprising **« 22% »** women earned more than R21 million from sales of 2 207 head of cattle and 436 goats, 25 chickens and 6 ducks.

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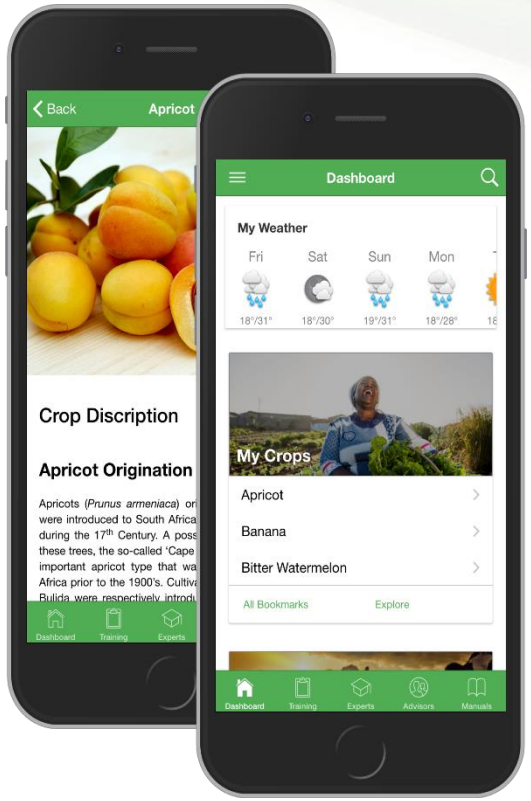
KEEPING THE SECTOR INFORMED ON INNOVATION AND DEVELOPMENTS IN RESEARCH AND DEVELOPMENT



A total of 3 969 users recorded.

80% positive feedback.

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SKILLS AUDIT FOR LAND REFORM BENEFICIARIES

- ARC's economists collaborated with the NAMC to conduct a skills audit for land reform beneficiaries.
- The findings will also inform implementation of the Agriculture and Agro-processing Master Plan (AAMP).

ARC PDP student conducting an interview for the Farmer Skills Audit Project.

AREAS SERVICED BY THE ARC

ACTIVITY	MUNICIPALITY / VILLAGE / PROVINCE	ACHIEVEMENT
KyD farmer's days for KZN, GP, NW and MP Provinces	Mandeni, KZN; KwaMaphumulo, KZN and Winterveldt, GP	352 farmers attended (274 males and 75 females)
KyD hosted 14 Livestock auctions	Various districts, KZN	991 comprising 22% women earned more than R21 million from sales of 2207 head of cattle, 436 goats, 25 chickens and 6 ducks.
Bioinformatics and Statistical Genomics Training Program (Bif)	Onderstepoort, GP	ARC researchers, PDP students and participants from the University of North West, University of Pretoria, University of KwaZulu-Natal, University of South Africa, Sefako Makgatho Health Sciences University, and Tshwane University of Technology attended the hands-on data analysis training.
Mobile Agricultural Laboratory: Taking soil testing to the Farmer's Backyard	Various provinces	This real-time soil testing service is in high demand from farmers across the country.
Agric-IT course - exposure to a range of applications on mobile smartphones for use in acquiring local weather and other relevant information.	Three villages in the Mount Fletcher area, Elundini Local Municipality, EC	18 youth trained
Upscaling of rainwater harvesting and conservation to croplands and rangelands for food	Krwakrwa village (between Alice and Hogsback) and the village of Upper Ncera, EC	Demonstration plots were established to show how rainwater harvesting, vegetable production and biogas production can be integrated. 14 bio-digesters (7 in each village) could be installed at households that had their own water storage tanks as well as access to cattle manure. Also helped the households to construct in-field rainwater harvesting (IRWH) basins in their gardens and provided them with seeds and seedlings.
Maize and dry bean production training - included various aspects of soil science, crop protection (diseases and insects and use of herbicides)	Harrismith, FS	25 farmers trained
Training on potential threats and integrated management of Sclerotinia on soybeans and sunflowers and the impact of nematodes	Lichtenburg, NW	26 people trained (22 males, 4 females and 8 youth)
Training on performing objective yield surveys	Potchefstroom, NW	18 people trained (11 males and 7 females)

AREAS SERVICED BY THE ARC

ACTIVITY	MUNICIPALITY / VILLAGE / PROVINCE	ACHIEVEMENT
Farmer's day on "Maize on-farm trials / TELA Stewardship and on-farm compliance"	Hluvukani, MP	53 farmers attended (20 males and 33 females)
Farmer's day on "Maize on-farm trials / TELA Stewardship and on-farm compliance"	Matibidi, MP	81 farmers attended (31 males, 50 females and 8 youth)
Farmer's day on "information on Bt technology and insect resistant management by planting refuge areas in the field"	Barberton, MP	39 farmers attended (16 males, 23 females and 2 youth)
Farmer's day on "grain production in the North West Province and a new strategy towards the integration of CA principles"	Mahikeng, NW	33 farmers attended (28 males and 5 females)
Information Day on "various experiments including maize planting date studies as well as the sunflower and soybean national cultivar evaluation trials"	Potchefstroom, NW	40 NWU final year students attended (37 male and 3 females)
Diseases and pests workshop	Eksteenskuil, NC	33 emerging farmers attended
Workshop and training in "Honeybush Propagation and Planting"	Thornham, EC	15 SMME beneficiaries attended
Workshop and training in "Honeybush Planting, Cultivation and Harvesting"	Thornham, EC	13 SMME beneficiaries attended
Sweet potato cultivation training	Kgora, Vryburg and Brits, NW	28 farmers trained
Training on orange-fleshed sweet potato production	Ingquza Hill, Port St Johns and Ntabankulu Municipalities, EC	Various women with children under 5 years were trained to improve child malnutrition and the quality of life.
Training on vegetable production skills	Cemetery View informal settlement, Woodlands	25 vulnerable young women with >5year-old children were trained

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OUTCOME 6

A HIGH PERFORMING & SUSTAINABLE ORGANISATION

OUTCOME FOCUS	OUTPUT
• Addressing the current working capital gap and financial position through the implementation of the targeted and robust Sustainability and Turnaround Plan. • Ensuring excellence in scientific research and development through enhanced capacity, capabilities and appropriate organisational technology and infrastructure. • Improving organisational effectiveness and efficiency towards a sustainable ARC. • Promoting public accountability, achieving high standards of corporate governance and efficient resource utilisation. • Strengthened revenue generation and productivity. • Good stakeholder engagement to ensure optimal organisational performance, visibility and service delivery.	Infrastructure Management ICT Strategy Implementation Human Resources Management Performance Management Human Resource Development Commercialisation of ARC solutions Exhibition and sponsorships International partnerships Governance Funding and revenue generation Cost efficiencies

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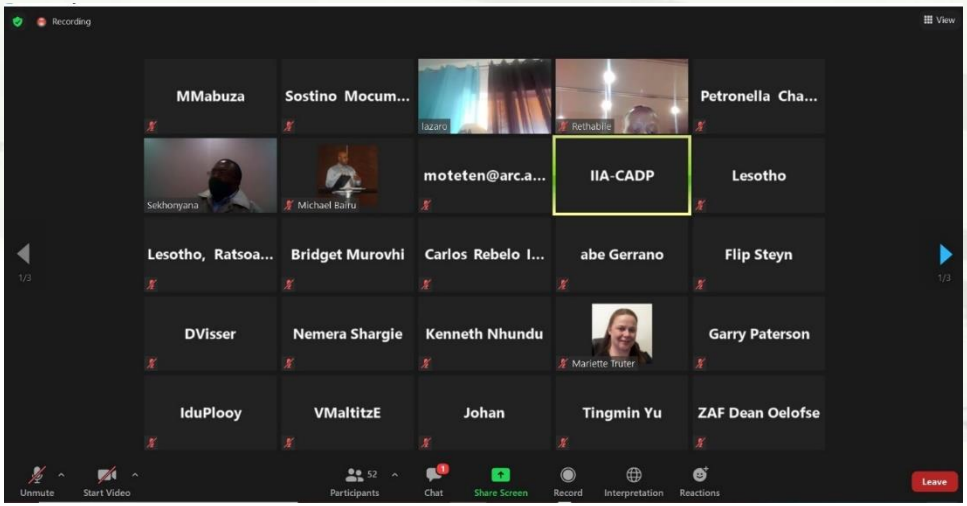
INTELLECTUAL PROPERTY MANAGEMENT AND COMMERCIALISATION

- 20 IP applications have been filed in different territories.
- Royalties amounted in excess of R35 million.
- License agreement signed with South African Mango Growers' Association (SAMGA), with an emphasis on BBBEE outcomes.
- ARC initiated discussions with the SA SME Development Fund as part of exploration of new pathways for commercialising IP.
- An event to seek potential investors for the exploitation of ARC IP was jointly organized in January 2022 - this was the first ever such event in ARC.
- ARC technologies were showcased at the event, engagements are ongoing for projects that garnered interest.

INTERNATIONAL PARTNERSHIPS AND INCREASED VISIBILITY

- ARC training scientists in Angola and Lesotho via Centre for Coordination of Agricultural Research in Southern Africa (CCARDESA).



Writeshop for scientists from Angola and Lesotho in collaboration with CCARDESA, June 2021.

ARC participating in an EU-Africa virtual workshop for the LEAP4FNSSA project, February 2022.

- ARC staff presenting in the EU-Africa Platform meetings for Food and Nutrition Security and Sustainable Agriculture

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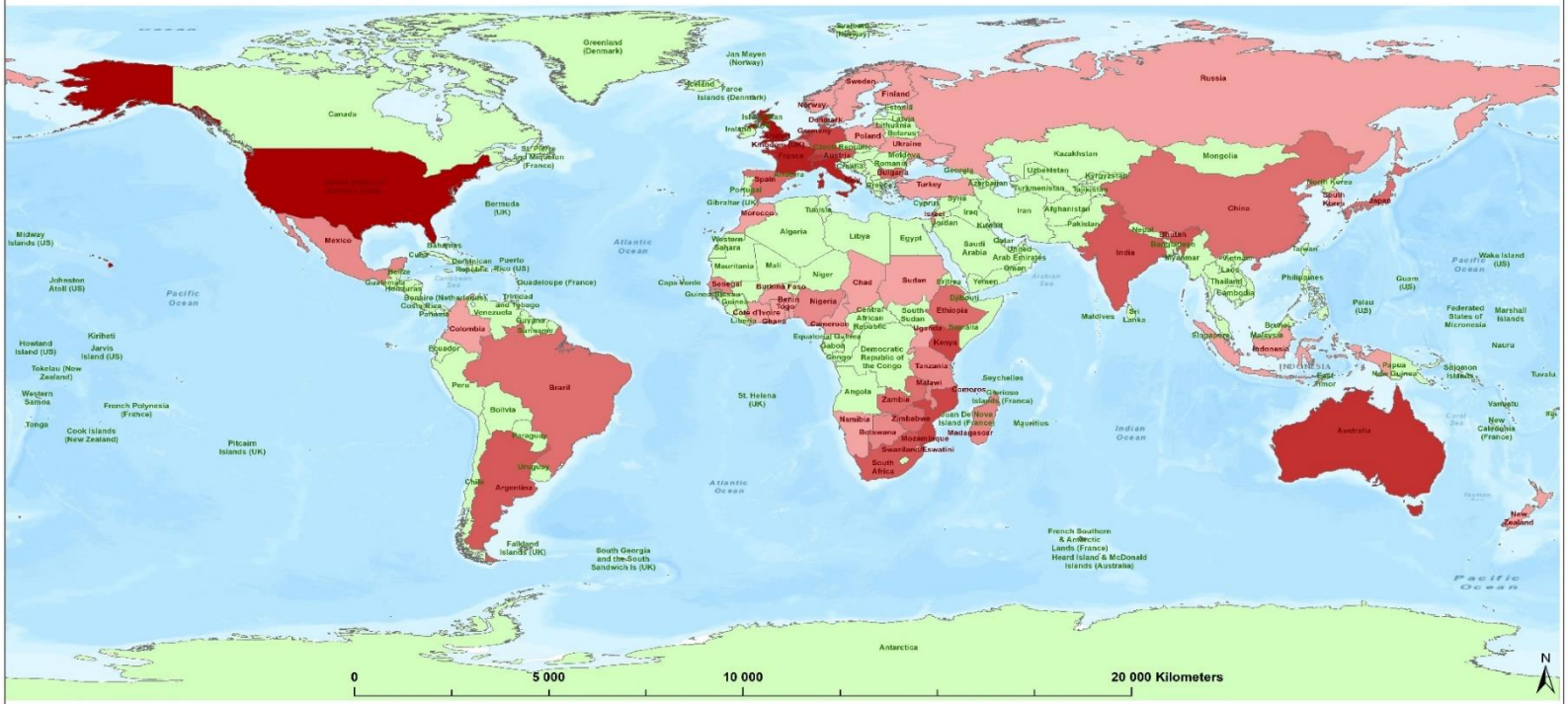
ARC INTERNATIONAL VISIBILITY

All countries - ARC's International Partnerships



Legend

Number of Partnerships

- 1
- 2
- 3
- 4
- 5
- 6
- 10
- 12
- 16
- No partnership

Country and number of Partnerships

Argentina	4	Bulgaria	3	Denmark	2	Israel	2	Mozambique	5	Rwanda	1	Switzerland	6	Zambia	3
Australia	6	Burkina Faso	1	Ethiopia	3	Italy	10	Namibia	1	Senegal	2	Tanzania	2	Zimbabwe	3
Austria	4	Cameroon	1	Finland	1	Japan	3	Netherlands	6	South Africa	4	Togo	1		
Belgium	2	Chad	1	France	10	Kenya	5	New Zealand	1	South Korea	1	Turkey	1		
Benin	1	China	3	Germany	5	Madagascar	2	Nigeria	2	Spain	3	Uganda	1		
Bhutan	1	Colombia	1	Ghana	1	Malawi	2	Norway	1	Sudan	1	Ukraine	1		
Botswana	2	Comoros	1	India	4	Mexico	2	Poland	1	Swaziland	1	United Kingdom	12		
Brazil	3	Cote d'Ivoire	1	Indonesia	1	Morocco	1	Russia	1	Sweden	1	United States of America	16		

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INFORMATION AND COMMUNICATION TECHNOLOGY & INFRASTRUCTURE

LABWARE – LABORATORY INFORMATION MANAGEMENT SYSTEM

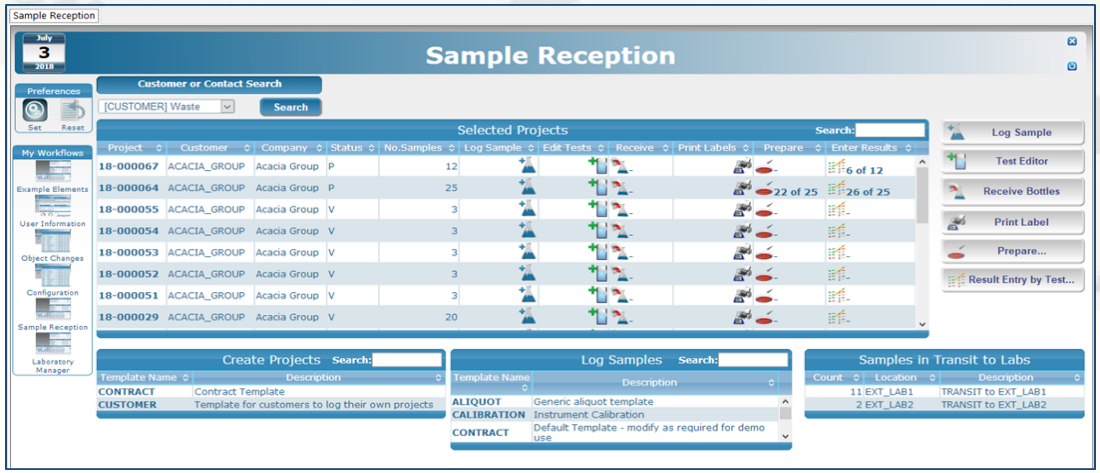
ARC-ICT team embarked on a process of replacing the ARC Laboratory information management system (ARCLAB) with a Labware solution that is aligned to the digital labs of the future. Labware is a flexible solution that many organizations worldwide use to automate laboratory workflows and improve efficiency. Its capability also includes:

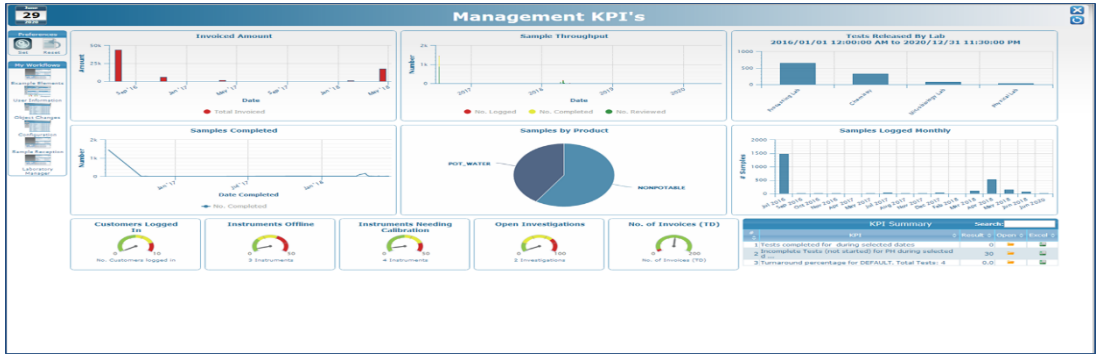
- Configurable workflow tools
- Open architecture and interoperability tools
- Powerful QC management capabilities
- Compliance with GLP, GALP, cGMP, and ISO
- Regulatory Data Integrity

Labware Solutions

CORE LABORATORY FUNCTIONS

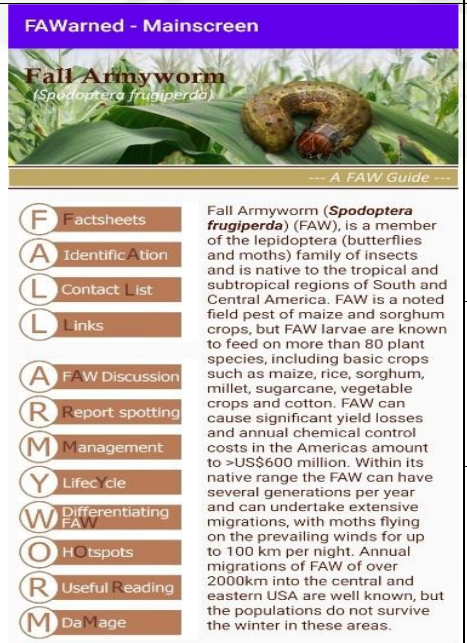
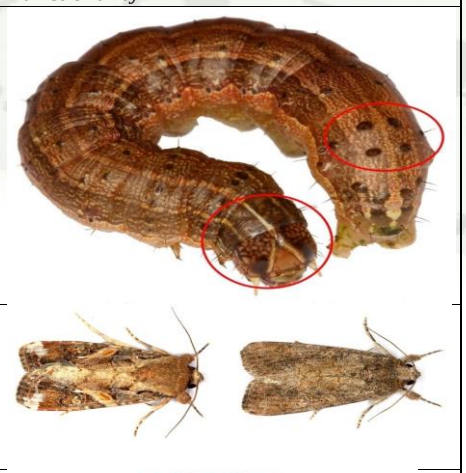
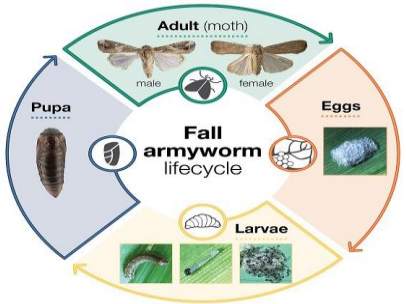
- Work Assignment
- Data Views
- Worksheets
- Batching of samples for analysis
- External testing
- Results Entry
- Calculations of results
- Instrument Integration
- Specification / Limits Checking
- Review and Approval
- Re-Testing / Re-Sampling
- Investigations
- Inventory Management





FALL ARMY WORM

- The application is essential to equip farmers with information that will enable them to run sustainable farming operations.
- The FAWarned aims to assist farmers in identifying FAW and the control thereof.
- **The FAWarned** enables farmers to participate in the online discussion groups and report spotting FAW that triggers a FAW warning system, supplies information on effective management strategies including biological and cultural control, and botanical and synthetic pesticides.
- The application can be downloaded from Google Playstore.

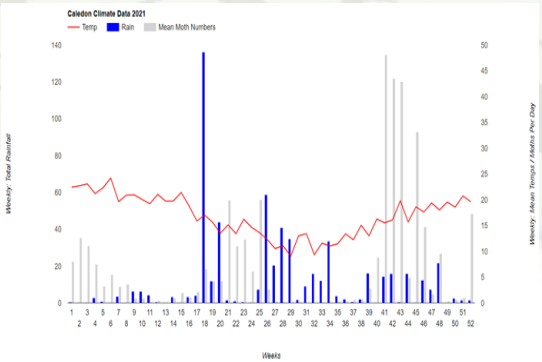
Modules	Functionality
	 

MOTH MODELLING WEB APPLICATION

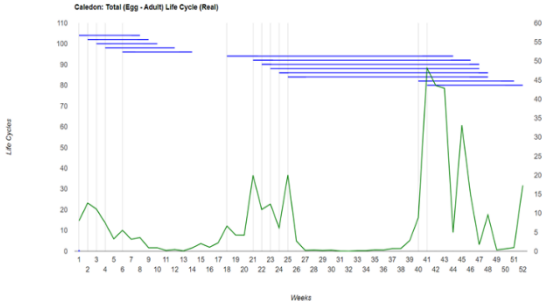
- The Moth Modelling web application was developed to assist the user in modelling the life cycles of the False Armyworm (Leucania loreyi).

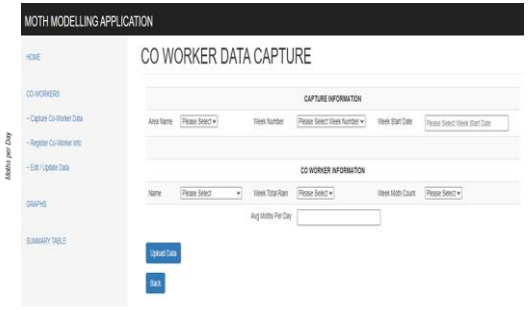
- The application assists users in capturing total moth numbers collected per week from certain areas. Using these total moth numbers, the application calculates the average moth numbers per week and plots it against the long-term average temperatures and the current temperature data for the said area.

- This web-based application is also available to external clients



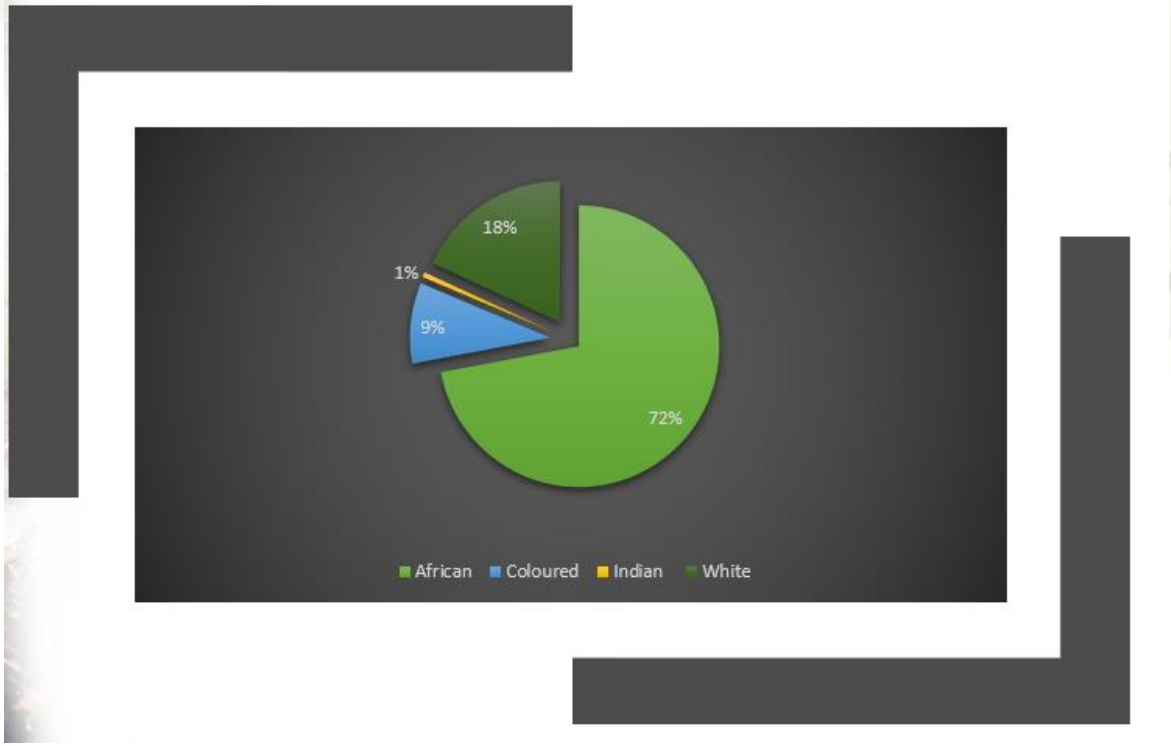
Moth Model Application & Plot of average moth numbers per week





HUMAN CAPITAL MANAGEMENT

EMPLOYMENT EQUITY PROFILE



Notes

- The total Staff complement of 1 969, with Foreign Nationals accounting for 1.9% and 98.1% being South Africans.
- Employees with Disabilities account for 0.5%, due to the nature of the jobs we have and the uniqueness of the ARC.

VACANCY RATE

Focus	2020/2021 No. of Employees (31/03/2021) Permanent employees	2021/2022 Approved Posts	2021/2022 No. of Employ-ees (31/03/2022) Permanent mployees	2021/2022 Vacancies 31 March 2022	% of vacancies
Crop Sciences	1 041	1 106	967	139	12.56%
Animal Sciences – including BTP	510	557	484	73	13.10%
Natural Resources and Agricultural Engineering	105	118	106	12	10.17%
Impact and Partnerships	22	26	18	8	30.77%
Corporate Support (HR, Finance, ICT)	430	453	394	59	13.02%
TOTAL	**2 108**	**2 260**	**1 969**	**291**	**12.87%**

Notes

- The main contributor to our vacancy rate is the high retirement rate (42% of employees that left during the year went on retirement).
- The second factor is normal resignation (34%) for better prospects.

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TRAINING COSTS FOR THE YEAR UNDER REVIEW

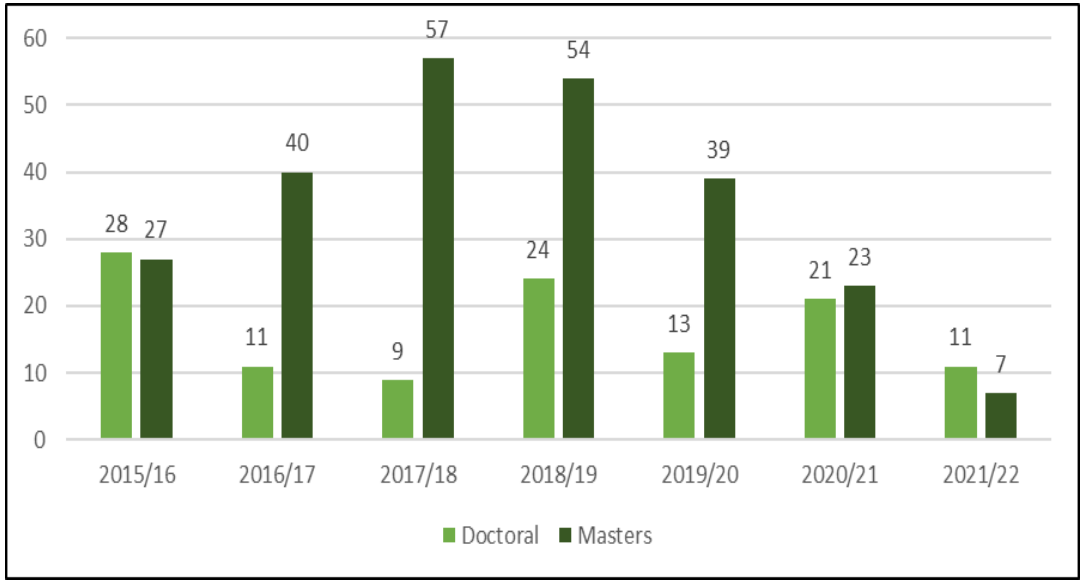
Level	*Training Expenditure (R'000)	Personnel Expenditure (R'000)	Training Expediture as a % of Personnel Cost	No. of employees trained	Avg training cost per employee (R'000)
Formal and Informal Training	6 787	729 688	0.93	515	13.17

Notes

- A total of 109 employees were afforded the opportunity to study further through formal education.
- A total of 406 employees attended informal training offered internally and externally.
- The total training expenditure covers tuition fees only and excludes incidental costs (travel to and from the training centre, accommodation, books, thesis reviews, etc.)

PROFESSIONAL DEVELOPMENT PROGRAMME (PDP)

Programme	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
Post-Doc	21	19	14	16	15	11	13
Doctoral	84	117	121	117	97	82	99
Masters	149	170	102	63	38	24	91
Total	**254**	**306**	**237**	**196**	**150**	**117**	**203**



Notes

- The table above projects the number of enrolments over a 7-year period.
- The graph illustrates the number of students that graduated in the seven-year period.
- COVID-19 pandemic during 2020 and 2021 had a negative impact on the performance of students.

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COVID-19 IMPACT

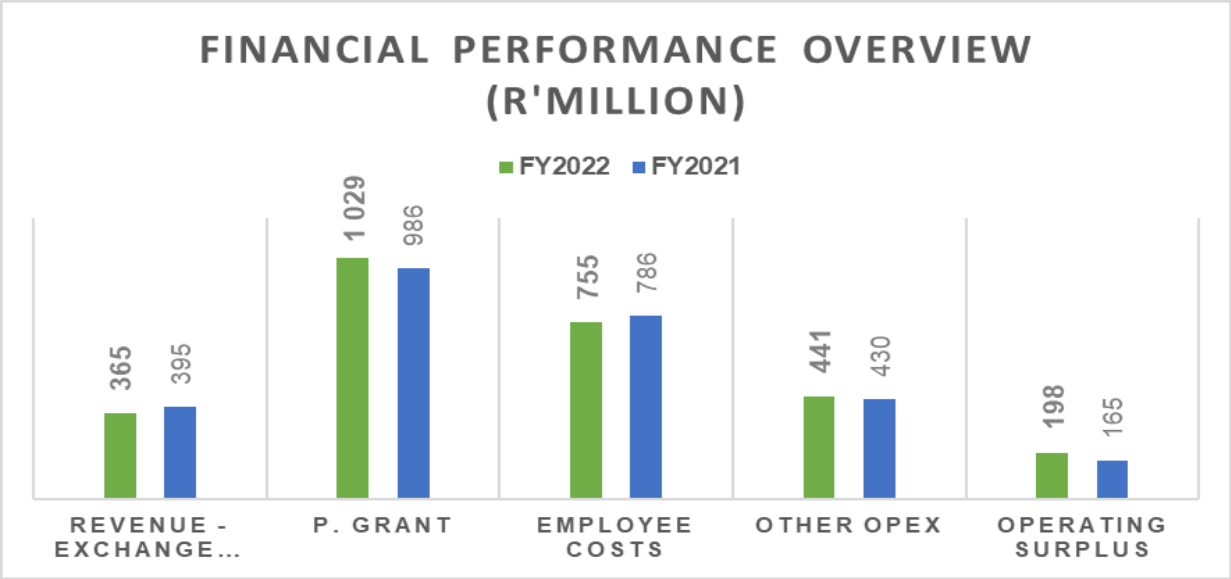
Status	# Affected Employees
Employees tested positive	210
Employees recovered	195
Employees Deceased as a result of COVID-19	0

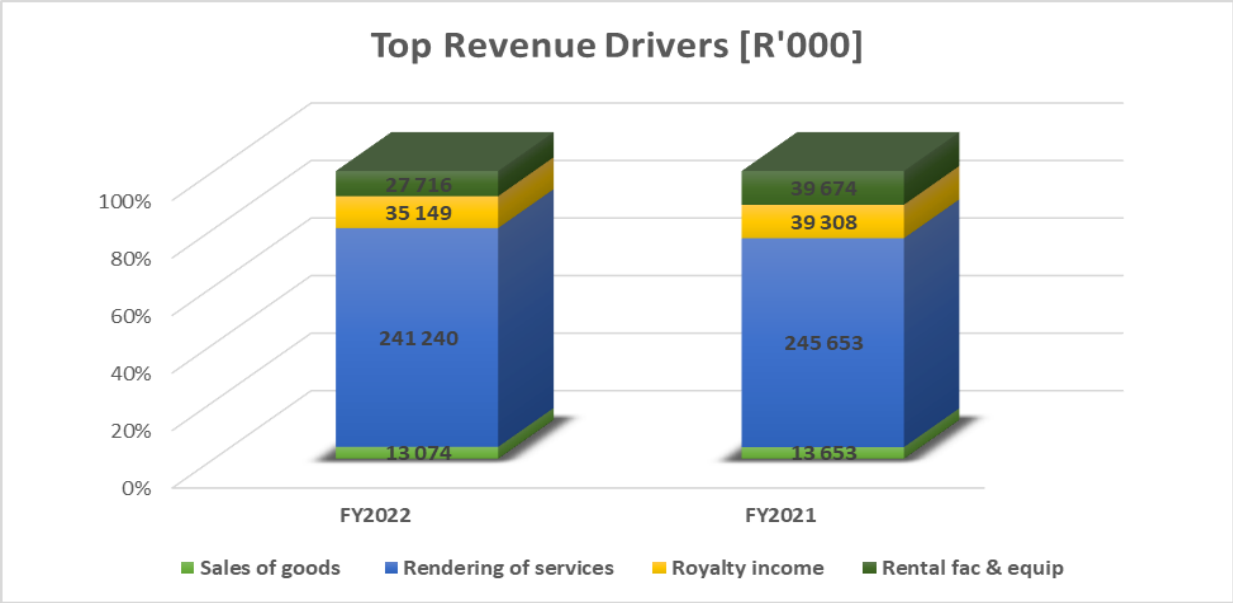
Notes

- A high increase of employees who tested positive (103%) was recorded in 2022 FY compared to the 2021 FY.
- Similarly, a high recovery rate was reported, 97% of employees infected recovered in 2022 FY when compared to 2021 FY.
- Fortunately, no COVID-19 related deaths were reported in 2022 FY, whereas 4 deaths were reported in 2021 FY.
- ARC continued with instituting work-from-home procedures, especially for vulnerable employees and those infected.

FINANCIAL PERFORMANCE OVERVIEW

FINANCIAL PERFORMANCE OVERVIEW





- Operating Surplus reported, > 20% YoY growth.
- Revenue from exchange transactions 8% YoY decline.
- Parliamentary grants represented a 4% YoY growth.
- Employee Costs remained with a 4% saving.
- Operating expenses reported a 3% growth.
- Repairs and Maintenance 14% YoY growth.

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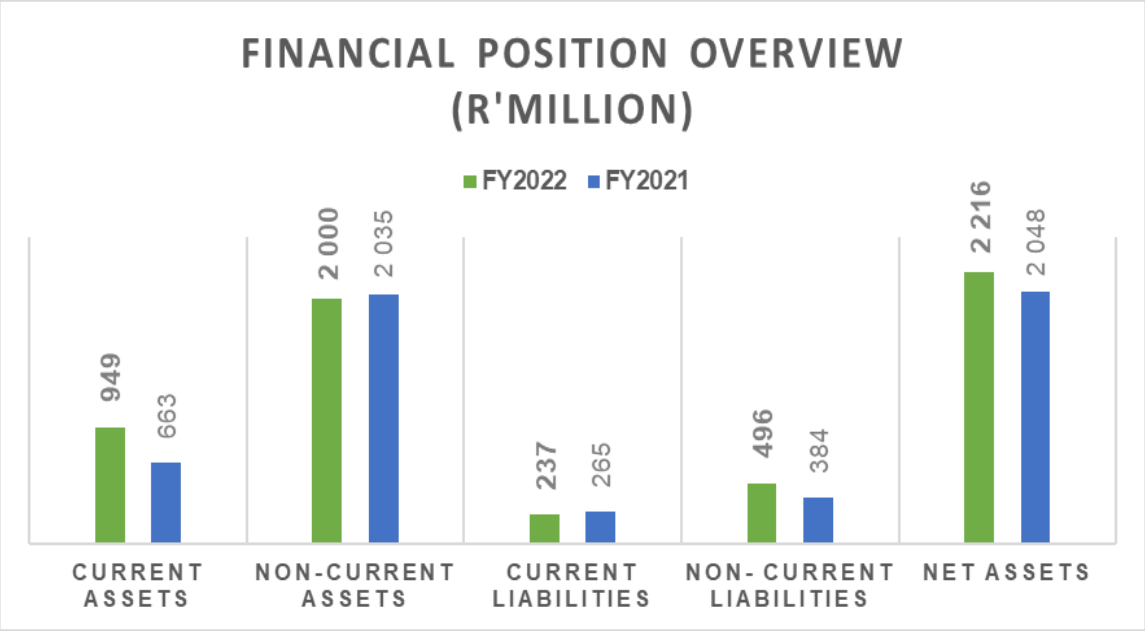
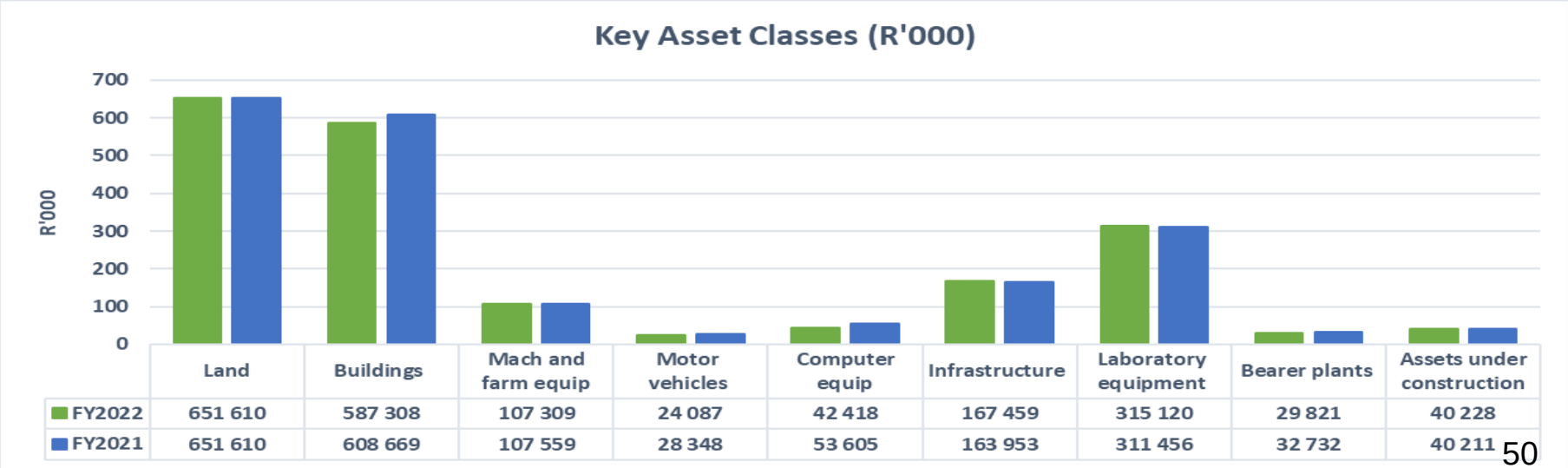
FINANCIAL POSITION OVERVIEW



- Strong Balance Sheet, with Net Asset of R2.2bn.
- CAPEX spend of R51m.
- FMD funds (R480m) continues to be invested at the Reserve Bank Corporation for Public Deposits.
- ARC is a going concern, liquidity and solvency assessment is satisfactory.



	Land	Buildings	Mach and farm equip	Motor vehicles	Computer equip	Infrastructure	Laboratory equipment	Bearer plants	Assets under construction
FY2022	651 610	587 308	107 309	24 087	42 418	167 459	315 120	29 821	40 228
FY2021	651 610	608 669	107 559	28 348	53 605	163 953	311 456	32 732	40 211

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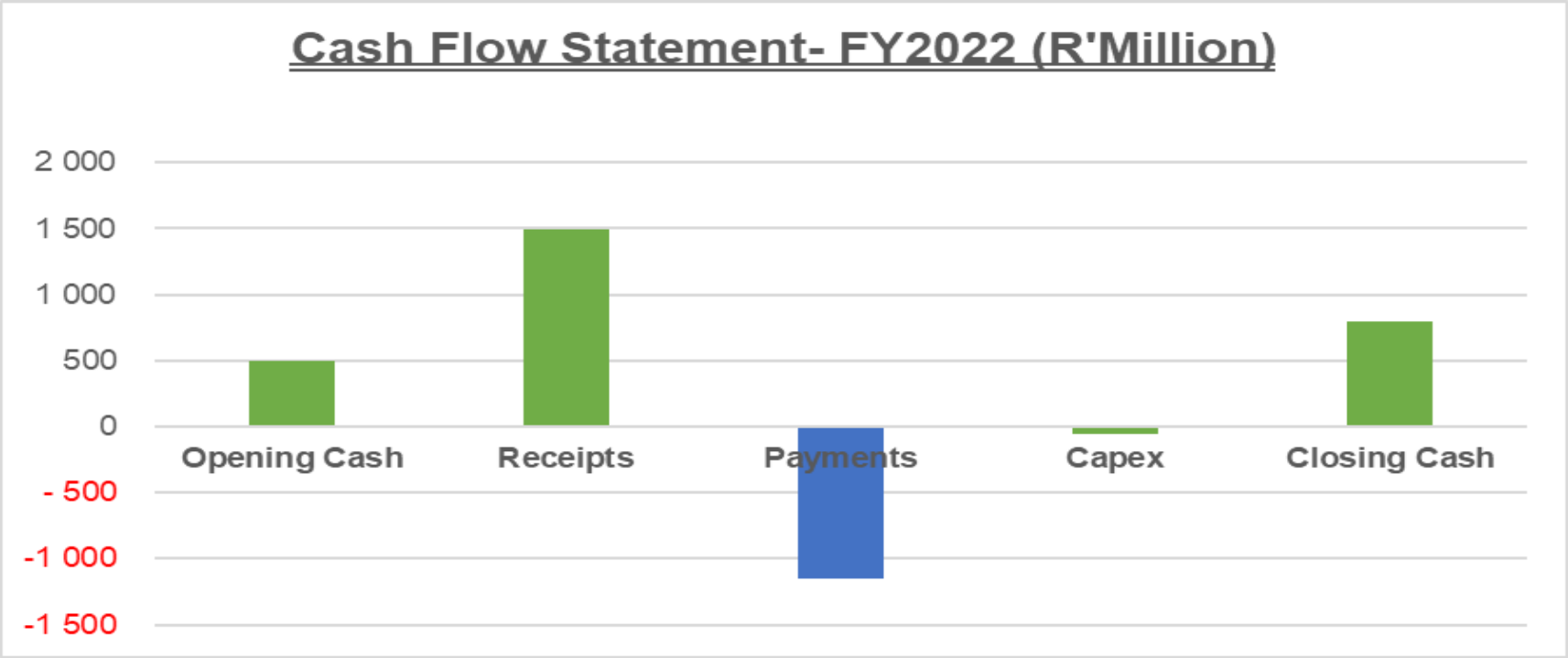
CASH FLOW STATEMENT OVERVIEW



- The significant cash received is from the PG (R1.1bn) followed by the Sale of goods / Services (R321m)
- The leading payments are to Employees (R755m) which is followed by Suppliers Payments of R392m
- Only R51m has been spent on Capital Expenditure
- The overall Cash increased by more than 50% to R797m

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AUDIT IMPROVEMENT PLAN (AIP) – FY2022/23

- The ARC received a qualified audit opinion from the AGSA for a sixth year.
- Management has developed an AIP to work towards a clean audit for FY2022/23.

Reference to the Audit Report FY2020/22	Basis for Qualification	Progress or Status
1	Property, Plant and Equipment (Repeat) Lack of proper records for adjustments made to corresponding figures. Some items could not be physically located. Land recognised for which ownership was not obtained. Assessment of useful lives of assets.	Approved AIP in place with action completion date of 30 November 2022.
2	Irregular expenditure (New) Irregular expenditure incorrectly recognised, and some irregular expenditure were omitted.	Approved AIP in place with action completion date of 31 October 2022.
3	Contingent liabilities (New) No sufficient appropriate evidence to substantiate the amounts disclosed in the financial statements.	Approved AIP in place with action completion date of 31 October 2022

Thank You