

THE AGRICULTURE BIOECONOMY INNOVATION PARTNERSHIP PROGRAMME



Making sure it's possible



science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA





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The Bioeconomy Strategy

The Bio-economy Strategy is a national initiative to promote bioinnovation and use it for economic growth and social development. It is underpinned by advanced science and indigenous knowledge and focuses on agriculture, health care and bio-based industry. It is powered by a range of partnerships, funded by public and private investment, and coordinated by the Department of Science and Innovation (DSI).

Our aim is to harness our country's wealth of knowledge and natural biological resources to develop new, globally competitive products that are responsive and relevant to the needs of South Africans. Spanning the entire value chain – from ideas, research and product development, to manufacturing and commercialisation – the bioeconomy has the potential to create much-needed job opportunities and contribute significantly to South Africa's gross domestic product (GDP). It is envisioned that the bioeconomy will add 5% to GDP by 2050.

The sectors that have been identified by the DSI and its stakeholders as being the most in need of – and likely to benefit from – the Bio-economy Strategy are agriculture, health, industry and the environment. Indigenous knowledge systems are also a focus, as they have much to offer the bioeconomy.

Projects implemented in each of these areas will help to help to address poverty, unemployment and inequality, by increasing food security, improving human health, making industries more efficient, reducing South Africa's carbon footprint and using indigenous knowledge for bioinnovation, among other things.

Agriculture and the bioeconomy

The science, art and occupation of producing crops, raising livestock and cultivating the soil is the foundation of civilization. Agriculture gives us the food we eat, the clothes on our backs and much more.

The world's population is growing and the climate is changing. We need to innovate across the agricultural value chain, enhancing productivity and reducing environmental harm, if we are to meet the challenges of a different kind of world.

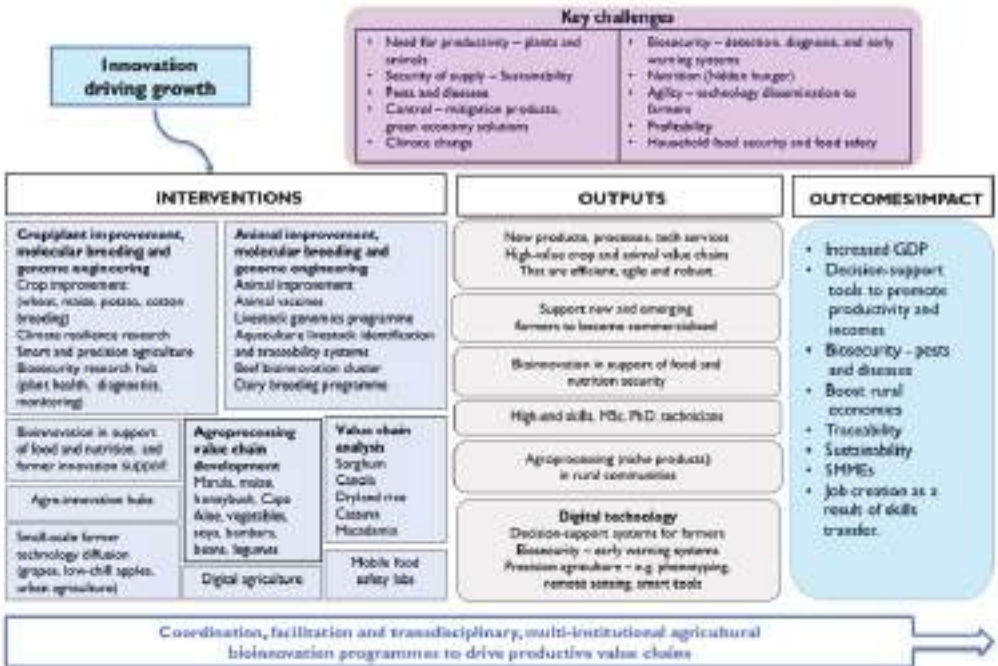
We have to use smart agricultural methods to make sure that all South Africans can have safe and nutritious food on their tables daily.

The Bio-economy Strategy's goal for agriculture is to boost innovation to ensure food security, enhance nutrition and improve health, and enable job creation through the expansion and intensification of sustainable agricultural production. We have several short to medium-term strategic interventions and projects to achieve this goal.

The Agriculture Bioeconomy Innovation Partnership Programme

The Agricultural Bioeconomy Innovation Partnership Programme (ABIPP) is an instrument managed by the Technology Innovation Agency using ring-fenced funding. The programme is used to implement the agriculture goals of the national Bio-economy Strategy. ABIPP funds, co-funds, coordinates, facilitates and actively manages multidisciplinary, multi-institutional research programmes focusing on agricultural bioinnovation, products, processes and services that contribute to increased productivity, food security and sustainable rural development. ABIPP is therefore also a key instrument for implementing the agricultural priorities of the Decadal Plan on Science, Technology and Innovation.

ABIPP's successes in revitalising agriculture include public-private partnerships that focus on some of the main challenges and opportunities in agriculture, in particular, climate change resilience, the development of new products and prototypes, agroprocessing, evidence-based mapping, value chain development, and support for farmer development through technology diffusion and digital decision-support systems. We want to make sure that research discoveries are used to benefit all South Africans.



Crop improvement consortium (Wheat Breeding Platform)

Since the turn of the millennium, the area of land dedicated to wheat farming in South Africa has declined from 1,4 million to approximately 500 000 hectares. While South Africa produces wheat of world-class quality, we need to produce it in larger quantities to reduce the country's reliance on imports.

The Wheat Breeding Platform is a response to this crisis. R35 million has been invested in the platform, which does research to improve resistance to abiotic stresses like drought and extreme temperatures. The Department of Science and Innovation is doing this work in partnership with Grain SA, the Department of Agriculture, Land Reform and Rural Development, the Agricultural Research Council, the Western Cape Department of Agriculture, the Winter Cereal Trust, Corteva and Syngenta.

The platform was officially launched on 31 October 2017 at Stellenbosch University's Welgevallen Experimental Farm.



Wintersteiger harvester and planter for the Wheat Breeding Platform

In the 2021/22 financial year over 200 advanced breeding lines were made available to SA breeding programs from the pre-breeding program; two cultivars were selected by industry for commercialisation, and one of these was submitted for registration under the Plant Breeders' Rights Act. Since 2015, several hundred breeding lines have been taken up into breeding programs by different breeding programmes in private companies with over 30 new cultivars released since 2015 by the individual breeding programs: ARC, Syngenta and Corteva.

Support for agroprocessing in rural communities and farmer development

ABIPP's Agroprocessing initiatives are aimed at developing and commercializing niche, underutilised and these indigenous crops that offer a greater nutritional content and new market opportunities that will result in job creation and local benefit.

ABIPP's technology/innovation support for agroprocessing in rural communities and farmer development programmes benefited a total of 2 608 black emerging farmers in 2021/22. This included 448 farmers in the Ukhanyo farmer development support programme.



Training smallholder farmers on maize storage

The Council for Scientific and Industrial Research (CSIR) has developed a range of six Aloe ferox-based cosmetic product prototypes (face wash, body lotion, hand cream, hand wash, hair food and hair spray) at 200 g lab scale.

Twenty-two farmers received training in processing Cape aloe; A minimum of five entrepreneurs will be supported with establishing their own businesses.

Niche aloe products



Niche aloe products

Sixteen farmers were supported through the honeybush programme.



Training SMMEs on honeybush cultivation and harvesting

A further 2 122 farmers benefited through the Strategic Innovation Partnership for Grains and Oilseeds (through agroprocessing support, plant health surveys, diagnostic surveys and seed business development).

Smallholder farmers have small harvests, and ABIPP helps them to increase their harvest and feed their families by providing threshing machines for household use and livestock, and cob cages so that they can store excess produce for longer by preventing contamination by bacteria. We give them training on agronomic practices for producing pulses, processing Cape aloe and honey bush, pest and disease management, nixtamalisation and financial literacy.



A smallholder farmer's maize harvest

Other initiatives include the marula value chain project in partnership with the Industrial Development Corporation and TIA, which seeks to establish the feasibility of developing a marula industry using the entire value chain of the marula crop. In addition, ABIPP is investing a number of evidence based value chain mapping projects with a view to developing productive value chains to that contributes increased nutritional benefit, support new sources of growth as well as promote import replacement. These include Sorghum (completed), Canola, Cassava, Sweet potatoes, Dryland rice, Amadumbe, Bambara Groundnut and leafy vegetables (Imfino).

Climate Resilience Consortium



Elevated carbon dioxide facility at Rhodes University

Given the significant challenge of climate, it is critical for research to focus not only on breeding new cultivars adapted to climate change but also to understand how drought,

elevated heat stress and CO₂ affects crop production. During 2021/22, the Climate Resilience Consortium implemented a total of seven projects.

One of these is the Sensako Breeding Programme, which is a partnership between Syngenta, the Agricultural Research Council and the CIMMYT (the International Maize and Wheat Improvement Center, a non-profit research and training organisation). The project is aimed at developing new maize germplasm varieties that have increased nutritional value, that can survive heat and drought better.

These maize lines are then evaluated under predicted future climate conditions (increased carbon dioxide and increased temperatures) at the elevated carbon dioxide facility at Rhodes University, which consists of 16 large, open-top chambers equipped with state-of-the-art analysers that continuously monitor atmospheric conditions.

An important objective of the consortium is to gather knowledge on the impact of climate change and variability on grain producers. The final report for the climate risks has been completed. The knowledge and outcomes of the study will be shared with producers (not only those who participated in the study). A second study, on the maize planting window, is progressing well, with trial sites harvested for the second season. Planting for the third season is under way.

The consortium is also looking to develop maize hybrids with increased resilience to drought and heat stress and to focus on smallholder farmers as a target market. The goal is to commercialise five hybrids by 2024. The test hybrids have so far shown good yielding capability under higher temperatures and drought conditions, but they are also able to compete with commercial varieties under normal conditions.

An Agronomy Research Hub to coordinate and conduct agronomy research is being established in collaboration with various stakeholders. The research conducted under this hub includes a long-term crop rotation trial at the University of the Free State. The summer crops have been harvested and the winter crop, wheat, is growing well. Furthermore, the first five-year cycle of a crop rotation trial in the eastern Free State, being done in collaboration with Potato SA, has been completed, and the results are being analysed.

Plant Health Consortium

The DSI contributes to a number of biosecurity initiatives, either directly through ABIPP, or through agencies like the Council for Scientific and Industrial Research (CSIR) and the Technology Innovation Agency (TIA). One of these initiatives is the Plant Health Consortium, which was established in 2016 to improve the management of economically important pests, diseases and weeds with a cosmopolitan distribution, as well as to respond to the threats presented by quarantine pests and pathogens.

Among other things, the Plant Health Consortium has provided diagnostic services and initiated pest and disease surveys on the farms of black smallholders and commercial producers in the Eastern Cape, North West, Free State, KwaZulu-Natal, Mpumalanga and Gauteng. A total of 22 farmers benefited from the surveys, and 77 grain and oilseed producers, as well as forestry members and partners, from the diagnostic services.

The information collected during these activities, with monitoring and surveillance and research on aetiology, provided insights into understanding pest and pathogen distribution and accurate risk analyses (for improved control), as well as helping with the identification of future research areas critical for strengthening South Africa's biosecurity and preventing crop yield losses. Through this work the vision for a broader biosecurity hub was born.

Researchers from the Agricultural Research Council, North West University and Grain SA are collaborating to learn more about soil health and investigate practical ways of dealing with the most prevalent and destructive soilborne diseases. This involves testing the soil to detect and monitor diseases, look at recurrent outbreaks and soil disease complexes, and see how conservation agriculture can be used to improve soil health and increase grain and oilseed crop yields.



Conservation agriculture practices include minimal tillage (left) and the use of cover crops (right)

Sclerotinia sclerotiorum, the fungus causing white rot, has caused major crop losses in soybean, canola and sunflower. Researchers from the University of the Free State and the University of Pretoria joined forces with Grain SA under the South African Sclerotinia Research Network to study the pathogen and find effective management strategies to minimise Sclerotinia yield losses.

The network is breeding sunflowers and soybeans with resistance to Sclerotinia, and is modelling the disease epidemiology.



*White rot caused by *Sclerotinia sclerotiorum* on sunflower*

Armyworm invasion alert



Fall armyworm

The fall armyworm, an invasive species, eats the reproductive parts of the plant as well as its leaves. Southern and false armyworms also threaten South African food security. An armyworm outbreak can ravage crops, leading to major food shortages.

Regular meetings are held between industry and government to discuss the national status of this pest, and how biosecurity surveillance, diagnostic capacity, damage assessment, pest management and regulations can reduce the threat.



Devastation after an armyworm invasion

Soybean Food and Nutrition Programme

The DSI, the Oil and Protein Seeds Development Trust and Grain SA are partnering to contribute to food and nutrition security by promoting household-level production and processing of soybean as a major source of quality protein.

Communities are being provided with machinery to process soybean to make desirable value-added products (soy yoghurt, nuts, chips and sauce) that could benefit the local community. Communities are being given information on the health benefits of soybeans, and training in how to plant and maintain soybean plants, as well as business skills.



Household and smallholder farmer training in Maswazini, Zwelisha and Okhomb

Value chain development

A study to establish market opportunities for sorghum in South Africa was completed in March 2021. Studies on rice and cassava are under way. ABIPP also commissioned a new study on canola cultivars in the Eastern Cape. The objectives of the study are to determine the grain yield performance of different cultivars in different localities of the Eastern Cape, to determine the number of days each cultivar take from planting to flowering, to observe the incidence of pest and diseases for each cultivar, and to determine the oil and protein content of each cultivar.

The nixtamalisation training gained a huge momentum in the Eastern Cape with a group of women trained under the Women in Agriculture and Rural Development structure in Qumbu. The Eastern Cape Department of Rural Development and Agrarian Reform provided women with baking equipment by to establish an enterprise and use nixtamalisation as a source of income.



Baked products from nixamilitation

The rice project focuses on the evaluation of foreign rice germplasm that will later lead into a pre-breeding programme to adapt upland rice genotypes for multiplication for further development under South African upland growth conditions.



Dryland rice trials at Cedara



The cassava feasibility study project aims to explore market opportunities for import substitution, availability of cassava value chain data as well as opportunities for commercialisation and technology deployment. The project will also conduct a cost-benefit analysis of cassava starch production. The intellectual property generated from this study will be made available to any small-scale/emerging farmer or other party interested in the commercialisation or industrialisation of cassava along the value chain.



Cassava feasibility study

Baler equipment for cotton farmers in Mpumalanga and Limpopo

The Smallholder Cotton Farmer Baler Equipment Project for Mpumalanga and Limpopo Provinces is a project implemented by Cotton SA to provide cotton baling machines to small holder farmers. Access to the equipment will assist smallholder cotton farming communities to save on harvesting and transport costs, and to maintain a high quality of produce. The cotton balers will enable the growers to conduct primary agroprocessing using a hub-and-spokes model, leveraging economies of scale by aggregating their produce in bales which the gins can readily accept without additional costs to the small-scale farmers.



Cotton bale in Matlerekeng

Launch of the cotton baler in Matlerekeng

Aquaculture Bioinnovation Programme

In South Africa, the aquaculture industry has not developed as fast as in the rest of the world. The government has therefore increased investment in research, development and innovation to unlock the potential of aquaculture to contribute to food security, job creation and economic development.

ABIPP-funded projects from the CSIR, a university and four SMMEs that are developing technologies to assist the aquaculture industry with efficient systems and increased productivity. A total of 10 prototype products were developed. These include two low-tech spirulina prototypes, and one field trial diagnostic kit for infectious spleen and kidney necrosis virus and tilapia lake virus, which cause high mortalities in the aquaculture industry. Seven value added (canned) products were demonstrated and launched by Karoo Catch – chakalaka fish, fish breyani, fish bobotie, fish cutlets in tomato, fish cutlets in chili, samp and fish, and fish mince with soya).

Aquaculture Bioinnovation Programme



Development of diagnostic kit for tilapia lake virus and infectious spleen and kidney necrosis virus at the CSIR



Low-tech spirulina demonstration by Nelson Mandela University



Canned products by Karoo Catch

Karoo Catch Products

Digital agriculture and Biosecurity

In terms of modernising agriculture and supporting interventions for diagnostics, surveillance, monitoring and early warning systems, ABIPP funded the development of a digital platform, the Information Hub, at Innovation Africa to support the piloting of tools and technologies using biosecurity data as a test case. This digital platform has evolved through some of the initial work in the Plant Health Consortium (mentioned earlier) coordinated by GrainSA, that now forms part and parcel of the National Biosecurity Hub launched on 11 October 2022. Part of the National Biosecurity Hub is the Information Hub.

The Information Hub initiative, coordinated by Innovation Africa, includes the development of a data warehouse. The structural and legal considerations of managing biosecurity data are being investigated. Historical and current data is collected from relevant data sources such as pest and pathogen diagnostic clinics, farmers, companies and agricultural extension services. CropWatch, the Institute for Commercial Forestry Research and the Forestry and Agricultural Biotechnology Institute are key partners in the collection of the data. The information from ongoing agricultural pest and pathogen surveillance will be integrated. There is also a project monitoring the main maize pests (*Busseola fusca*, *Chilo partellus* and *Spodoptera frugiperda*) across six provinces and spanning the whole season. This is the first such exercise to be performed at this scale in South Africa.

After the pilot study has been completed, the small-scale and developing producers will be given training in the use of the biosecurity tools offered by the Biosecurity Hub so that they are empowered through the early detection of biosecurity threats to the agricultural value chains.

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