SOUTH AFRICAN SUGARCANE RESEARCH INSTITUTE

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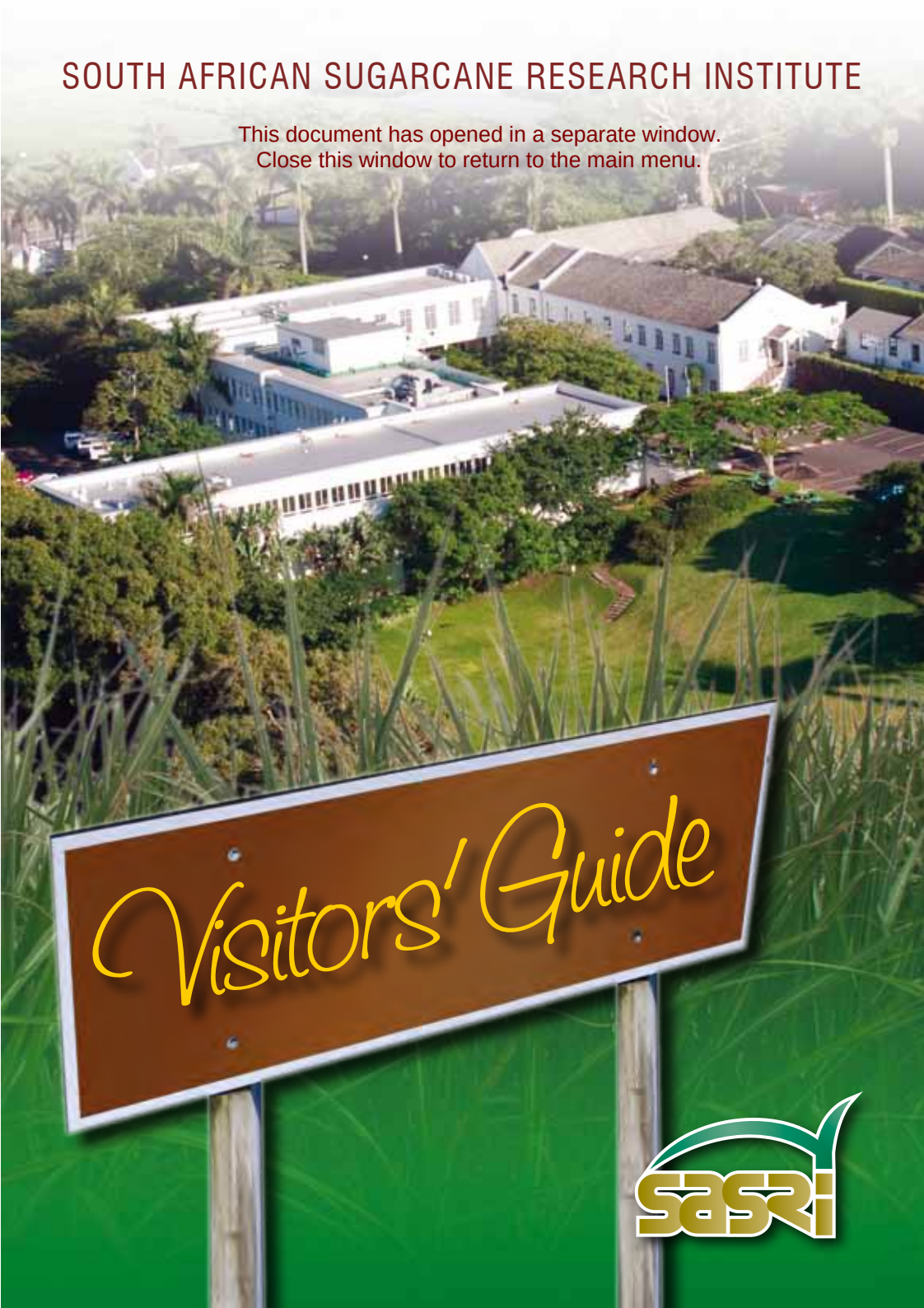
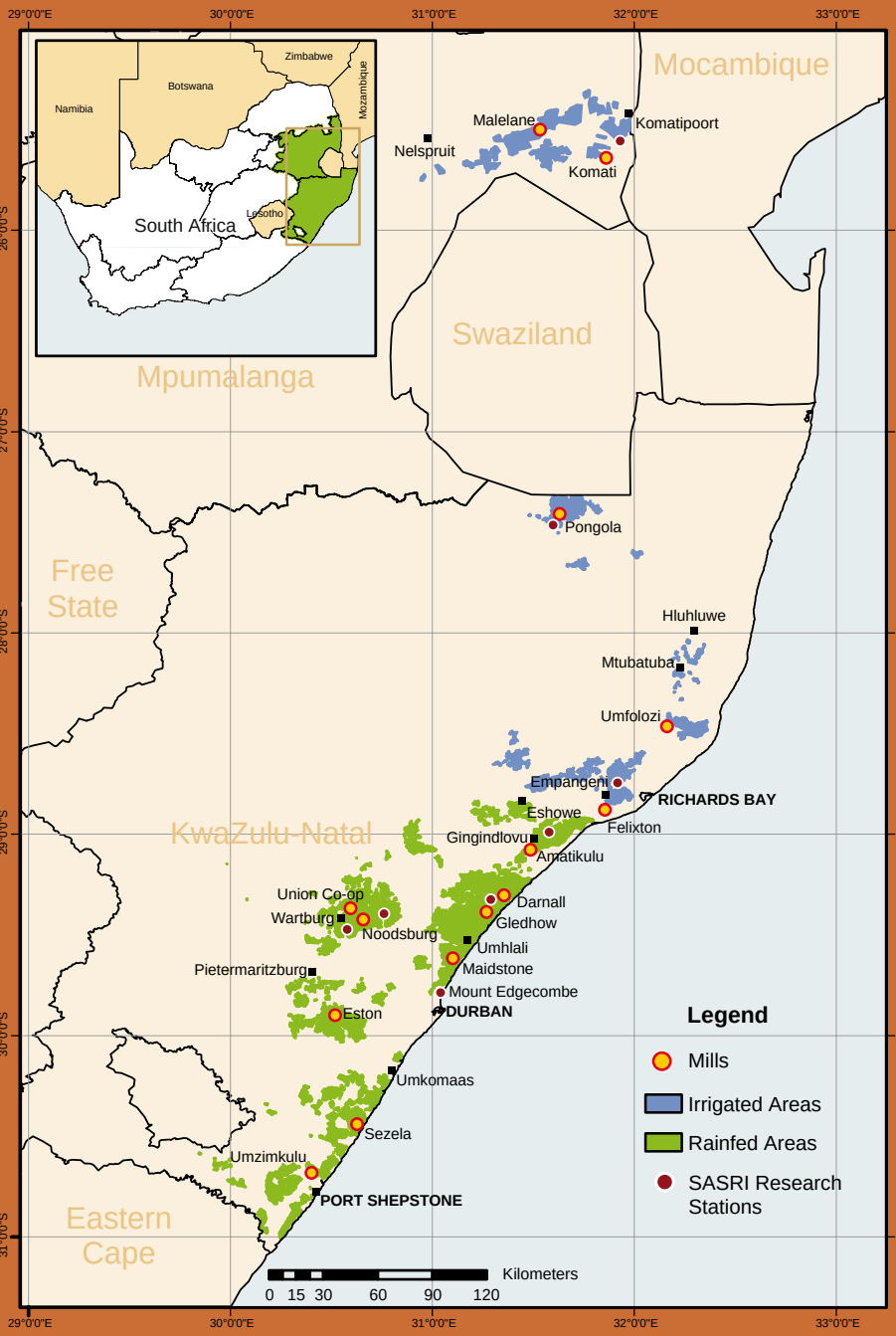


South African Sugar Industry



THE SOUTH AFRICAN SUGAR INDUSTRY

The South African sugar industry is one of the world's leading cost-competitive producers of high quality sugar. The sugar industry makes an important contribution to employment, particularly in rural areas, to sustainable development and to the national economy. It is a diverse industry combining the agricultural activities of sugarcane cultivation with the manufacture of raw and refined sugar, syrups, specialised sugars and a range of by-products. The industry generates an annual estimated average direct income of R8 billion.

The canegrowing sector comprises approximately 29 130 registered sugarcane growers farming predominantly in KwaZulu-Natal, with a substantial investment in Mpumalanga and some farming operations in the Eastern Cape. Sugar is manufactured by six milling companies with 14 sugar mills operating in these canegrowing regions.

The industry produces approximately 2,2 million tons of sugar per season. About 70% of this sugar is marketed in the Southern African Customs Union (SACU) and the remainder is exported to markets in Africa, Asia and the Middle East.

The South African Sugarcane Research Institute (SASRI)

SASRI was established at Mount Edgecombe, Durban in 1925 to produce new disease-resistant varieties of sugarcane to support a growing sugar industry. Today, the institute is world-renowned for its research into the development of new sugarcane varieties and improved crop management and farming systems that enhance profitability.

The delivery of relevant, innovative research is a core function of the institute. Research focal areas contribute to the development of new knowledge surrounding a multitude of agronomic and industry challenges. The expertise residing in the institute is extensive and represents the full range of agricultural and biological disciplines, with scientists in high demand to offer advice and guidance to both growers and millers. SASRI's research endeavours are enhanced and strengthened through collaboration with a number of local and international research organisations and tertiary institutions.

In addition to providing sound research outcomes, much emphasis is placed on transferring agricultural technology to the industry. This is achieved through a well-established network of Extension Specialists based in the various regions of the sugar industry. With the Extension Service being an integral part of the research institute, the advice given to the industry is relevant and aligned with current best practices.

SASRI also plays a vital role in providing a range of services to the industry on a user-pays basis. These include specialist advice on growers' problems, fertiliser advice, pest and disease diagnostic services and certificate courses in sugarcane agriculture.

Through its vast range of activities, research expertise, sound business acumen and strong knowledge base, SASRI's ultimate goal is to make a significant contribution to a sustainable and thriving South African sugarcane industry.

Research Farms

Apart from the research farm surrounding the facility at Mount Edgecombe, SASRI maintains seven other farms: two in the KwaZulu-Natal midlands, one near KwaDukuza, one in Gingindlovu, one further north at Empangeni, and another two farms in the irrigated north – one at Pongola in northern KZN, and the other at Komati in Mpumalanga.

The research farms serve as sites for selection of potential new varieties. Different locations are required to select varieties for different growing conditions. To accommodate the plant breeding programme, each research farm is approximately 100 ha in size. The farms are also used as trial sites for research projects.

VARIETY IMPROVEMENT

This research programme seeks to breed and select high yielding pest and disease-resistant sugarcane varieties using conventional breeding and modern molecular technology.

Plant Breeding

Plant Breeding consists of three complementary operations: breeding, selection, and bulking and release which ultimately deliver varieties adapted to the diverse agro-bioclimatic regions in the industry.

The primary objective of SASRI's Plant Breeding Project is the development and release of varieties with sucrose, yield, pest and disease, agronomic and milling characteristics that are desirable to both millers and growers.

At Mount Edgecombe, sugarcane does not produce fertile flowers under normal conditions, as daylength-decline going into winter is too rapid and night temperatures are too low during the flowering period (May to August). Photoperiod and glasshouse facilities are therefore required to produce fertile pollen by manipulating daylength and temperature.

The photoperiod house and the glasshouse can accommodate 336 and 320 parent varieties respectively. Each year these parent varieties are 'crossed' to

produce 250 000 seedlings which are then transferred to the various research farms. After 11-15 years of screening and evaluation, one or two new varieties from this initial 250 000 seedlings may be selected for release to the industry.

Variety Evaluation

In addition to breeding, SASRI conducts ongoing evaluation of all its varieties. These evaluations provide comprehensive information on the performance of new varieties, under different management practices and agro-climatic zones, after they are released into the industry.

Biotechnology

Modern biotechnological approaches are used in a number of ways to enhance the plant breeding process. For example, marker technology is used for early identification of suitable parent material. Research is also being conducted to establish and test protocols for introducing new, desirable traits into parent plants. Through the use of tissue culture technology, systems have been developed for the rapid bulking and distribution of high-quality seedcane to growers.

The Millroom is an essential support service to the Plant Breeding Project as well as to other research projects at SASRI. The Millroom conducts routine analyses of whole sugarcane stalk samples using Near Infra Red Spectroscopy (NIRS) and conventional chemical techniques. The Millroom analyses between 250–350 samples a day during the harvesting season (March to December).

CROP PROTECTION

SASRI is involved in minimising the effects of insect pests, diseases, nematodes and weeds through the development of Integrated Management Strategies.

Insect pests

Many insects attack cane, but fortunately few assume the status of a serious pest. Much attention has been given to one particular stalk borer, *Eldana saccharina*, which can cause serious crop loss.

Control measures have also been developed for pests that damage the leaves and roots of the sugarcane plant. Pests that damage the leaves include sugarcane thrips, sugarcane aphids, numicia, grasshoppers and trash caterpillars. Pests attacking the roots of the plant are white grub and nematodes. Nematodes are microscopic worm-like organisms found in the soil which can suppress sugarcane root growth resulting in a reduction in yield. Apart from developing control measures for this pest, SASRI offers a nematode testing service which will ascertain the nematode levels in a root system and offer appropriate control advice.

Diseases

A significant portion of SASRI's research effort is directed at investigating the many sugarcane diseases which occur in the South African industry. The focus is on diseases that cause major yield losses when cane is severely infected.

The most important diseases are sugarcane smut, mosaic, ratoon stunting disease and brown rust. If any of these diseases are severe they can cause yield reductions of up to 30%.

Ratoon stunting disease (RSD) is a bacterial disease that affects approximately 10% of fields throughout the industry. It does not have obvious external symptoms. SASRI provides a diagnostic service to determine the presence or absence of RSD. Growers submit samples from fairly mature cane taken from several points in their field or seedcane nurseries for analysis at SASRI's RSD laboratory.

Disease control strategies include releasing varieties that have adequate resistance to the diseases in our industry and encouraging growers to plant healthy seedcane. SASRI offers technical support and guidance to the Local Pest Disease and Variety Control Committees operating in each region. These committees monitor diseases and pests in the industry and pass this information to SASRI where it is collated into an industry database and used for research purposes.

Weed control

SASRI is constantly researching ways of reducing the impact of weeds on the sugarcane crop. Control measures are developed for the management of problem weeds and new herbicides are tested for their effectiveness in controlling weeds.

Approach to crop protection

SASRI has adopted a holistic approach to dealing with the industry's pest and disease challenges by embracing Integrated Pest Management (IPM) strategies, area-wide pest and disease control and biosecurity measures.

Integrated Pest Management involves a thorough understanding of the pest, finding solutions that include good soil health and nutrition and restoring wetland and riverine health. One arm of integrated pest management is biological control. This involves the use of plants and insects to control problem insects or weeds. The modern state-of-the-art insect rearing unit helps by propagating insects for use in SASRI's biological control programme.

Area-wide pest and disease control involves incorporating a number of farms into an ecological unit and practising pest and disease control and plant and animal ecological conservation over a whole unit.

Biosecurity is promoted by ensuring that insect pests, plant diseases and weeds that occur in other countries are not introduced into South Africa. Sugarcane varieties are imported from several foreign countries for use as parents in SASRI's local breeding programme. These foreign varieties have to pass through SASRI's quarantine facility before being used locally.

The **quarantine** glasshouse is a world-class laboratory where molecular techniques are used for the detection of the most important sugarcane diseases. The facility is also used for the export of varieties to other countries. This is the only sugarcane quarantine facility in South Africa.

CROP PERFORMANCE & MANAGEMENT

This research area looks at improving our understanding of how land, water and crop management affect sugarcane cultivation. Projects cover various crop management practices and models are developed to predict crop performance.

Soil health

SASRI approaches soil health from three perspectives: physical, chemical and biological soil health. Physical soil health revolves around compaction, water infiltration, and water retention. Specific aspects investigated are controlling in-field traffic to minimise compaction and stool damage, and increasing organic matter in soils to increase water and nutrient retention and water infiltration.

Chemical health looks at the increase in soil acidity which is a major problem in the dryland areas. More stringent liming practices across the industry are advocated, together with advice on the correct nutrient supply to optimise yields. In the irrigated areas, a particular problem is soil salinity (a build-up of salts in the soil). Recommendations for managing this problem include optimising water quality and ensuring good drainage.

The biological aspects of soil health revolve around green manuring, improving organic matter levels in soils and increasing the use of manures and compost.

Plant nutrition

Research in this area focuses on delivering balanced nutrition to the crop while being economically viable. Much of the work involves optimising the use of fertilisers for sugarcane production while ensuring that the use of these products does not harm the environment. The Fertiliser Advisory Service at SASRI gives advice to growers on the nutritional requirements of the crop, based on analyses of soils and sugarcane leaves. Recommendations are based on many decades of research work conducted in the industry.

Ripeners

Ripeners are chemicals that are sprayed on sugarcane leaves from about 12 weeks before harvesting. These chemicals help to improve the quality of cane thereby increasing the revenue for millers and growers. Additional income generated from ripener application can easily be around two tons of Recoverable Value (RV) per hectare. Research at SASRI focuses on quantifying yield responses to ripeners, developing recommendations on ripener treatments and evaluating chemicals used as ripeners.

Crop modelling and yield forecasting

One aspect of SASRI's research revolves around crop modelling, where computer programs or 'models' are used to benchmark the past and future performance of the crop. This information on cane yield and crop status can be used to assist in agronomic management. At an industry level, early crop estimates are vital for planning international sugar sales.

SYSTEMS DESIGN & OPTIMISATION

This programme looks at farming systems across the entire supply chain of sugarcane production. It adds value to the outcomes of the other research programmes at SASRI by designing and improving farming systems which impact on the profitability and sustainability of sugarcane production.

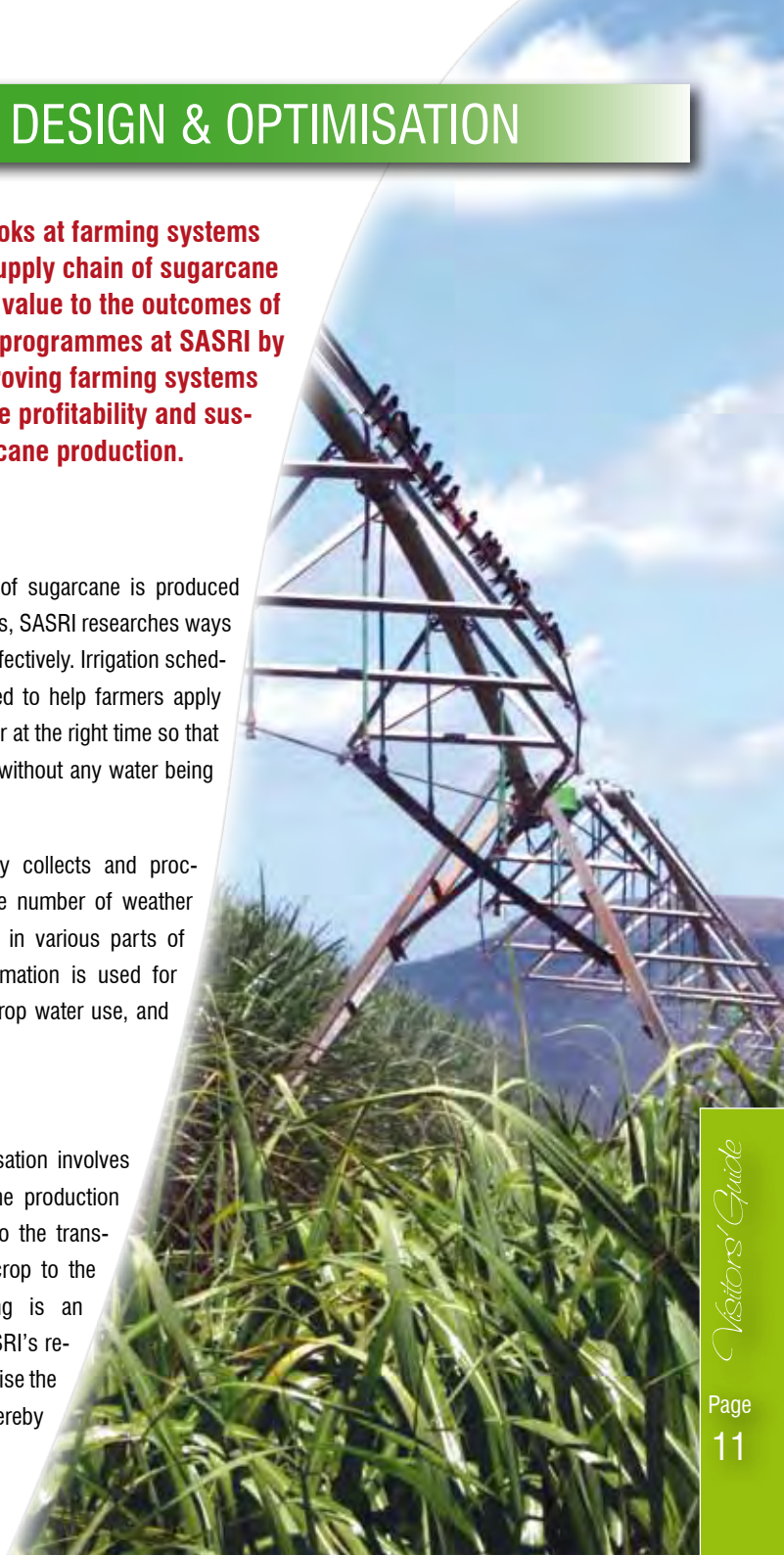
Water use

As approximately 20% of sugarcane is produced under irrigated conditions, SASRI researches ways to use irrigation water effectively. Irrigation scheduling tools are developed to help farmers apply the right amount of water at the right time so that the crop can grow well without any water being wasted.

A Meteorological facility collects and processes data from a large number of weather recording sites situated in various parts of the industry. This information is used for estimating cane yield, crop water use, and irrigation requirements.

Mechanisation

Research into mechanisation involves all aspects of sugarcane production from land preparation to the transport of the harvested crop to the mill. Vehicle scheduling is an important aspect of SASRI's research. It aims to maximise the use of vehicles and thereby



reduce the costs of transport. At the same time, scheduling also reduces harvest-to-crush delays and ensures a constant supply of cane at the mill. SASRI's Geographic Information System (GIS) comprehensive facility is responsible for providing mapping services and GIS analysis of geographically referenced data to support research.

Adoption of farming practices

Some research in this programme focuses on broader economic and social issues that impact on sugarcane farming, with the objective of understanding the factors that influence the adoption of better farming practices. Attention is also given to the development and promotion of computer-based Decision Support Systems.

Burning versus trashing trial (BT1)

One particular trial at Mount Edgecombe is reputed to be the longest running sugarcane trial in the world. It was established in 1939, and looks at the effects of burning versus trashing at harvest. Over time, it has contributed greatly to SASRI's understanding of soil organic matter losses under sugarcane monocropping.

TRAINING & GRADUATE ASSISTANCE

SASRI has been involved in training growers and industry stakeholders in the area of sugarcane agriculture since the 1960s.

Certificate courses

Certificate courses in sugarcane agriculture are held each year. These courses include subjects on soils, varieties, pests and diseases, husbandry, environmental management, land use planning, harvesting, weed control, mechanisation, irrigation and farm management. Since students come from all over southern Africa, the value derived from these courses extends across the region.

Research internship programme

SASRI runs a one to two-year internship programme for candidates with a Diploma or Degree. This programme aims to develop research and service skills and offers candidates an opportunity to apply their theoretical undergraduate education within a research context. One of the aims of the internship programme is to provide these individuals with work experience thus preparing them for full-time employment.

Post-graduate student programme

SASRI conducts a portion of its research in collaboration with other research institutes and universities. Post-graduate students play an important role in these collaborative efforts and Masters, Doctorate and Post-Doctorate students contribute to research projects that impact the sugar industry while continuing their education.

TECHNOLOGY TRANSFER

In order for SASRI's research to reach growers, effective communication and support mechanisms are required.

Agricultural extension

SASRI's Extension service consists of approximately 18 Extension Specialists who are located in the various sugarcane growing regions of the industry. They provide a specialised service to large, medium and small-scale growers with much attention currently being placed on offering specialised services to the large number of farmers entering the industry.

In responding to requests from growers, Extension facilitates the production of sugarcane by promoting better management practices. They also assist in the adoption of new varieties and advise local communities, groups and organisations (e.g. Local Environment Committees, Grower Councils and Local Pest, Disease and Variety Control Committees).

Apart from the services provided by Extension Specialists, SASRI endeavours to ensure that research outputs and advice are widely and frequently communicated. Through Extension, SASRI specialists regularly engage with growers, providing advice, conducting specialist investigations and delivering presentations on research outputs.

Grower days

Grower days are held throughout the year to provide advice and insights to growers on a range of issues, e.g. farming operations, how to reduce input costs or

better farming practices. Apart from these grower days, SASRI regularly hosts visitors at all its facilities. Some of the visitors include sugar industry representatives, government officials, student groups and scientists from South Africa and around the world.

Technical publications

The Link and the Ingede are technical newsletters in English and isiZulu, each published three times a year. These newsletters contain recommendations, updates and advice for efficient farming practices. In addition to these newsletters, regular articles containing SASRI advice are printed in the Coastal Farmers Newsletter and the South African Sugar Journal.

There are currently over 100 SASRI Information Sheets, each dealing with a different aspect of sugarcane agriculture. In addition, there are booklets and manuals on soils, weeds, herbicides, mechanisation and diseases. All these publications can be obtained from the H.H. Dodds Library at SASRI, which is the only sugarcane agriculture library in South Africa. The library also maintains access to a number of journals and on-line references and is a valuable resource for researchers.

Radio broadcasts

Radio broadcasts have proven to be an effective means of delivering SASRI's message, especially to the small-scale grower sector. Programmes on topical issues are broadcast regularly throughout the year on seven different radio stations.

Exhibitions and symposia

SASRI participates in science, career and agricultural exhibitions which are aimed at informing and educating students and learners about possible careers in the field of agriculture and science.

SASRI researchers present their research outcomes at national and international symposia. Their expertise, leadership and depth of knowledge are frequently rewarded through awards, honorary appointments and scientific ratings.

NOTES

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