THE SOUTH AFRICAN SUGAR ASSOCIATION EXPERIMENT STATION AT MOUNT EDGECOMBE - MILESTONES 1925 - 2000

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Abstract

The history of the Experiment Station and its principal contributions to the South African sugar industry through research, development, extension and training over the past 75 years are documented. In addition, the effect of new technology and methodology on many aspects of the Station's activities is recorded.

Keywords: sugarcane, research, R&D, history

Introduction

In 1925, after more than 10 years of prevarication, two events prompted leaders of the sugar industry to establish their own Experiment Station. The first was the forceful warning by the Natal government mycologist of the time (Storey, 1923) that mosaic disease posed a serious threat to the sugar industry. Uba, which was almost the only commercial variety of cane then grown, (Beater, 1989) was resistant to mosaic; but otherwise promising varieties under test were susceptible. Storey's hopes that mosaic might be eliminated if Uba alone was permitted for commercial planting were not realised, because that variety declined seriously as a result of streak disease, and other varieties were needed.

The second event was the advice of Dr WE Cross, Director of the Tucuman Research Station in Argentina, who had been invited, among other directors of agricultural research institutes, to advise the industry on its research needs. Essentially, his advice was not to rely on the inadequate number of government-employed agricultural scientists, working on a number of crops, for its research needs. Rather, he said, the industry should employ its own scientists in different disciplines (Anon, 1923) to concentrate exclusively on the sugarcane crop. The outstanding achievements of the Experiment Station during its first 75 years are undoubtedly due to the independence of the sugar industry in financing and controlling the research it requires.

The first 25 years

The Experiment Station's first 25 years, under the directorship of Dr HH Dodds, were years of budget restriction due to the economic depression of the 1920s and 1930s and staff shortages during the 1939-45 World War. Despite these difficulties, good progress was made with finding imported varieties to replace the streak-susceptible Uba, which occupied all but 0.2% of the area under cane. Many varieties were introduced from overseas and of these, Co 281 and Co 301 from India, proved particularly successful. Later, rather than cuttings, true seed was introduced from a number of countries with the object of selecting varieties adapted to local conditions. A consignment of seed requested from India was to prove the most valuable, because from resulting seedlings the variety NCo310 (Nuss and Brett, 1995; Donovan, 1996) was selected in trials at Mount Edgecombe. Later, more seed of the same cross was requested, and this gave rise to the variety NCo376 which was released in 1955 to become the dominant variety in only 25 years and retain that position for 40 years. Both these varieties have also been grown extensively in many other countries.

The major milestone of the era was the discovery in 1944 of a technique (Brett, 1948) whereby viable pollen could be produced locally using a special procedure involving controlled temperatures. This was of great scientific and, eventually, economic importance, not only in South Africa but also world-wide. Other notable advances made in the first 25 years were a system of soil classification (Beater, 1944), and the development of a method for interpreting sugarcane leaf analyses (du Toit, 1960). The former made it possible for the first time to map the soils of the industry, thus greatly facilitating subsequent agronomic and extension work, and the latter led to improvements in the fertiliser advisory service by elucidating previously inexplicable soil analyses results.

A measure of the Experiment Station's value to the industry during its first 25 years was quantified by the then Chairman of the Sugar Association (Heaton-Nicholls, 1948) when he said the Station had been responsible for reducing the amount of cane needed to make a ton of sugar from 14 to 8 tons.

The handing over of responsibility for research on factory processes and control by the Experiment Station to the Sugar Milling Research Institute in 1949 should also be regarded as a milestone; certainly it resulted in the establishment of a sister research institute, whose high repute locally and internationally is also largely due to its financial and policy independence.

The 1950s

Despite two severe droughts early in the decade, the 1950s was a period of expansion in the industry when sugar production increased by over 50%. Technologically, the 1950s can well be described as the Plant Breeding Era. The breakthrough in 1944 was followed by another plant breeding milestone (Brett, 1951), the ability to induce flowering in normally non-flowering varieties by combining exposure to natural sunsets with artificially controlled dawns. These two milestones led to an extremely productive programme of varietal improvement. Before the end of the decade the first variety bred wholly at the Experiment Station, N50/211, was released.

Three other advances during the 1950s were to have significant effects on cane production. These were the establishment of the Fertiliser Advisory Service in 1952 (Anon, 1954), the appointment of the first two Field Advisory Officers in 1954, which was the beginning of what was to become the Extension Service, and the soil survey (Beater and Maud, 1962) made possible by the systematic aerial survey of the whole industry.

The 1960s

Despite depressed prices during the 1960s, the industry continued its support of the Experiment Station by more than doubling its subvention per hectare of cane grown. During this decade the main technological activities were agronomic. A separate Agronomy Department was created and a plant physiologist was appointed to the Station staff which, incidentally, doubled overall in the 1960s. A major development was the establishment of the Pongola Research Station mainly to provide varieties for the newly opened northern irrigated areas. The milestones of the era were such pioneering innovations as the use of lysimeters (Thompson and Boyce, 1971), neutron probes (Thompson and de Robillard, 1968), radioactive isotopes (du Preez, 1966), growth analysis and establishing the relationship between meteorological factors and crop characteristics (Pearson *et al.,* 1961). These agronomic studies had a significant effect on industrial production and were also of high academic quality, resulting in two masters and three doctoral degrees for members of the Experiment Station staff.

The 1970s

These years were characterised by advances on a broad front, which included valuable biological and integrated control work on the stem borer eldana (Carnegie and Leslie, 1979) and the positive identification of RSD (Bailey 1976). In addition, the Pathology Department was created in response to the disease crisis in the industry and for the first time a rational integrated approach to disease control was adopted. The first varieties were released from Pongola, one of which was N14 which was destined to have a major effect on productivity in the irrigated areas. In addition, N12, which was released from the southern selection programme, later became the dominant variety in the rainfed areas.

There were other important advances in the 1970s: a Specialist Advisory Service was created as part of a policy of placing increased emphasis on the Extension Service and a Seed Certification Scheme was introduced to promote the use of disease-free seedcane. Important activities of a different kind were the considerable contributions made by the Experiment Station to the 15th ISSCT Congress, which was held in Durban in 1974, and the celebration of the Station's 50th anniversary in 1975.

The 1980s

This period can justifiably be regarded as the Training and Management Era. A Training Department had been established in 1976, and by 1980 employed 16 mobile training units and had trained more than 17 000 workers and operators in the industry. Independent research (Moore, personal communication[1]) had indicated that operator/worker training in the industry had a greater potential for increasing productivity and reducing costs than any other activity by the Experiment Station.

Evidence from the Cane Growers' Association that the net farm income of growers had declined steadily since the mid-1970s caused the Experiment Station to mount a number of two-day Modular Courses for growers. Of the five subjects presented, the course on Management and Productivity attracted more than twice as many growers as the best attended of the other four, all of which were on technological aspects of production. The emphasis placed on management by the Experiment Station during the 1980s had perhaps also been motivated by growers' response to a staff paper presented at SASTA in 1976 entitled, 'Programme Planning - a step towards improved sugarcane production' (Thompson and Moberly, 1976).

An empirical estimate of the cost effectiveness of the Experiment Station's operations in 1983 indicated the need for a more rigorous study of its value to the industry. This study indicated a satisfactorily positive benefit:cost situation for the investment by the sugar industry in the Experiment Station (Donovan, 1989).

The 1990s

Biotechnology

A most significant milestone of the 1990s was the introduction of biotechnology as a research tool, mainly to facilitate work on variety improvement in terms of both sucrose yield and resistance to pests and diseases. In addition, biotechnology has proved to be an invaluable aid in developing tools for disease diagnosis and identifying genetic markers which will be used in the conventional plant breeding programme.

An essential concomitant development has been closer association and co-operation with universities, technikons and other research institutions, including the International Consortium on Sugar Biotechnology, which promotes co-operative sugar research programmes in Australia, Brazil, Mauritius, South Africa and the United States.

By the end of the 1998/99 reporting year, there were nine researchers and seven students working on biotechnology related research at the Experiment Station, and six researchers and four students involved in contract research for the Experiment Station at the Institute of Plant Biotechnology, University of Stellenbosch. In recent years, a number of post-graduate students working at the Experiment Station in biotechnology have also obtained higher degrees at Natal University. A measure of the research activity in the discipline is the 34 papers and theses published or presented by Experiment Station staff in 1998/99.

Varieties, Pests and Diseases

Another important milestone of the 1990s was the release of a number of new varieties for both dryland and irrigated conditions. The recent commissioning of new farms (Nuss, 1998) representative of the major ecological areas in the industry, makes possible a doubling of the size of the conventional plant breeding programme, thus increasing the output of new varieties more specifically bred and selected for the different areas.

Despite research on a wide front, eldana borer remains a problem. The current approach is to use integrated pest management, which involves use of resistant varieties and agronomic practices which include manipulation of the harvesting cycle. The establishment and survival (Conlong personal communication[2]) at release sites in the industry of a parasitoid from West Africa, suggests that it may be successful in colonising large areas. In the past decade, the use of resistant varieties, certified seedcane, monitoring of the disease situation on an industry basis and an effective quarantine programme have all contributed to minimising disease losses.

Systems Agronomy

The 1990s saw a marked increase in the use of computers at the Experiment Station for both administrative and research purposes. Affordable computing power and new technology which can be used to measure crop growth characteristics heralded a new approach to agronomic, irrigation and crop nutrition research. This has resulted in the development of crop growth simulation models and a number of decision support programs to assist with irrigation management, fertiliser application rates, plough-out decisions and trash management. These programs, which are available to all extension officers, will eventually be placed on the SASA website and will be freely available to growers. A spin-off from this work has been the establishment of closer co-operative links with research workers in Australia, the USA, Zimbabwe and Swaziland.

Contract Research and 'User Pays'

Another milestone of the 1990s was the decision that activities at the Station which could best be done by contractors would be discontinued. In addition, activities which benefited one group would no longer be funded by the industry but would operate on a full recovery or User Pays basis. This resulted in the discontinuance of the mechanisation and machine design programmes as well as the farm planning and conservation service, followed by the amalgamation of the Agricultural Engineering and Farm Planning Departments into a single Agricultural Engineering Department with a reduced staff complement. Much of the research in these fields is now contracted out to consulting firms, specialist research organisations and universities. A further consequence of the User Pays policy was grower funding of commercial grower extension, which was nevertheless retained as a Station function. The vital link between research workers, the extension service and the clients was thus maintained. The past decade has also been characterised by other improvements in the communication links between the Station and its clients. These include the establishment of Regional Research Development and Extension Committees, whose members are drawn from growers, miller-cum-planters and the Extension Department. Roadshows, grower visits to the Station, the publication of The Link and the Information Sheet series have all made significant contributions to information dissemination and assessment of grower needs.

Of major importance has been the recent co-operation between the Station's Extension Department and the KwaZulu-Natal Department of Agriculture in providing a service to Small Cane Growers. This includes research into intercropping that is aimed at improving rural food security.

The current status of Experiment Station activities

The extension and service departments of SASEX are housed at Mount Edgecombe. The facilities have been recently refurbished and provide modern working conditions for staff. Field experiments which require regular attention are based at Mount Edgecombe but the bulk of the field work is conducted on research stations which are situated in the main ecological regions of the industry.

The SASEX mission is:

- To develop sugarcane varieties which provide maximum economic returns.
- To optimise the productivity of these varieties.
- To develop environmentally sound agricultural practices.
- To transfer technology to the growing community to promote prosperity and sustain the industry.

This is achieved through six major multi-disciplinary programmes, below. The percentage of the total budget allocated to each programme is given in brackets

1. Develop and release high productivity varieties, with pest and disease resistance, using conventional breeding and biotechnology based techniques (41%).
2. Reduce pest and disease losses through multi disciplinary approach. Monitor potential pests and diseases and provide regional security through effective quarantine (11%).
3. Improve productivity through improved agronomic and soil management practices, modelling and whole farm optimisation techniques, while sustaining the environment (22%).
4. Narrow the gap between actual and potential industrial yield through information transfer (19%).
5. Improve the cost-effectiveness of cane harvesting, transport systems and irrigation practises (1%).
6. Improve the production of small holders on a sound basis through provision of training and education to their extension services (6%).

Conclusion

The Experiment Station serves as the major source of varieties and expertise for most of the African cane growers south of the equator. Its importance as a regional asset will almost certainly increase, and it is perhaps not unrealistic to surmise that, at some time in the future, the Station could be a regionally funded Southern African Sugarcane Experiment Station.

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