VARIETY OF THE FUTURE

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1993 was a significant year in the history of the South African sugar industry. In October leaders agreed on deregulation and started to visualise how the industry would stay competitive in the market place.

Flowing from this decision, most players in the industry have had to take stock of their positions to see how they can best ensure that the industry meets its goal to remain competitive and to improve this competitiveness. Not least among these players is SASEX, with its key function of developing new varieties for the future.

Possible issues

What attributes are these varieties likely to have?

Drought resistance

In an exercise carried out by SASEX to determine research requirements for the industry, the request for drought resistant varieties was one of the most frequent. (Remember that the exercise was done during a four-year drought.) However, pragmatism must prevail, remembering the crop that we grow. Its origins are the rain forests of New Guinea, and in South Africa it is required to grow under rainfed conditions of less than 1 000 mm rainfall per annum compared with Australia where the crop is not recommended in areas with less than 1 500 mm. During the drought many of our areas received an annual rainfall of less than 600 mm.

Sacrifices have had to be made in achieving the drought tolerance that we already have in our varieties, particularly with regard to sugar content (and some millers are quick to tell us that we have the worst varieties in the world). But let us not forget that, in terms of yield of sucrose per hectare, imported varieties perform dismally in comparison with local varieties when grown under most SA conditions.

The establishment of the correct balance between sucrose content and hardiness or the degree to which cane production is extended into unfavourable areas through breeding, requires participation of all role players to answer, and cannot be tackled by the breeder or SASEX in isolation.

Perhaps drought avoidance is a more realistic direction to travel. This attribute is exhibited to a limited extent by N12, which is able to shut down growth when stressed and re-start when conditions are favourable. Among crop plants, this attribute is exploited best in the sorghums. Is this an area where genetic transformation through biotechnology might be the answer?

Sucrose content

In the past, varieties with the highest sucrose yield per unit area, coupled with satisfactory pest and disease resistance, have been the goals of the selection programme. These criteria have been used because they were seen to be the most advantageous for the industry as a whole. To cope with our harsh (drought prone) conditions, the plant breeders have had to breed relatively high levels of wild germplasm into varieties. As a result, South African canes (particularly those for rainfed conditions) have lower sucrose content than many of the modern varieties overseas.

Biotechnology may be one way that this apparent linkage between sucrose content and hardiness can be broken, perhaps through the manipulation of the enzyme systems. If this is the case, high sucrose and hardy varieties might result.

Mechanisation

In the past manual cane harvesting has always been cheaper than fully mechanised systems. However, mechanical costs already account for 30% of the costs of cane production in South Africa, and further improvements in this area promise rich rewards. One of the consequences of the need for breeders to maintain high levels of wild germplasm in South African varieties is that they tend to have high populations of thin canes with tightly adhering trash. In his address to SASTA in 1993, Dr James Cock suggested that this was the type of cane most suitable to mechanisation. Has South Africa unwittingly stolen a march on others by already growing such canes? Further research in agricultural engineering might be required to determine what the ideotype for mechanical harvesting might be.

Lodging is anathema for current mechanical harvesting systems, but high tonnage is often associated with lodging. Dr Cock suggested that high levels of cane production could be maintained by shortening the growth cycle between harvests. But is this an option for South Africa, where its ability to remain competitive has largely depended on harvesting relatively old mature crops? Cutting age is probably one of the most crucial factors affecting the long term survival of our industry.

Cutting Age

Since 1970 the age at which cane is cut has declined steadily, largely as a result of the severity of eldana in stand-over cane. In Colombia, where a similar decline in cutting age has taken place, the tonnage at which cane is harvested has been maintained in spite of a reduction in age at harvest, meaning that overall productivity has increased. However, in South Africa the decline in cutting age has also resulted in a lower tonnage at harvest and, at best, productivity is merely remaining constant.

The age at cutting has important implications on the cost of cane production, as the expensive operations in the crop cycle are at the beginning and end of the crop. Reducing the time between these operations will result in higher production costs unless other savings can be made. It has been said that cane cannot be profitably grown in South Africa below 50 tons per hectare. Certainly the likelihood of developing a variety capable of regularly producing more than 50 tons/ha under rainfed conditions on many of our soils is low. Competitive production in these areas is dependent on returning to older cutting ages. Eldana is the crucial factor here and illustrates the urgency to develop a cost effective control of this pest, preferably through the use of eldana resistant varieties.

Experiments to quantify effects of cutting age and time of harvest are notoriously difficult to conduct but we have seen that the development of crop modelling promises to provide a powerful new tool to investigate problems of this nature. The modelling concept can be extended further to consider not only the crop, but also the pest (or disease) that attacks the crop.

Burning versus trashing

The pros and cons of burning continue to be debated. Those against, maintain that the increased production due to moisture conservation (and soil conservation) outweighs the additional harvesting, transport and milling costs. It is likely that the outcome of the issue will finally be decided by public opinion, rather than strict economics. The decision will have important consequences on the breeding programme.

It is said that if burning were banned today then the Midlands would go out of business. This is because our current varieties ratoon poorly under trash when cut in winter. The industry and regions must give guidance to SASEX on their perception of this issue and the priority that the breeders should be giving to producing such a variety. Should not the millers be looking at uses for trash such as furfural that would enable growers to add to their income, and at the same time remove the unwanted trash?

Pest and disease resistance

The industry relies on the efforts of pathology and entomology to screen varieties for resistance and, as we have heard, past efforts in the disease screening programme have averted impending disease threats of smut, mosaic and leaf scald. Pathologists and entomologists must continue to ensure that new varieties meet the necessary resistance requirements, and we have heard how biotechnology is likely to improve the efficiency of doing this.

Unlike many of the previous issues that have been discussed, which rely on the participation of the stakeholders, the industry must accept the guidance of these specialists as to the pests and diseases that pose a potential threat.

We have been told that future strategies of the breeding programme are aimed at increasing the efficiency of the programme and allowing greater flexibility. The parent line project will enable the breeders to meet changes in the criteria demanded by the user with far less delay. A major thrust of the Biotechnology department is to provide tools that will speed up some of the procedures of the selection programme, again allowing the breeders to respond more quickly to the demands of the industry.

However, now more than ever, SASEX requires the participation of the industry, perhaps through the regions, in determining future goals for the plant breeding programme.