SUGARCANE VARIETY 2010

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Abstract

It takes about 15 years to develop a new variety of sugarcane to the stage where it is in significant commercial production. A minimum of 10 years is needed for the processes of breeding and selection, and a further five years for multiplication and planting. As a result, breeders must prognosticate how cane will be grown in 15 years' time if they are to ensure that their varieties will respond to the needs of the industry at the time the cane is commercially grown. This paper summarises the views of the Colombian sugar industry on future developments in cane growing, and how these changes will affect the variety of sugarcane that will be needed for the year 2010.

Mechanisation

In Colombia almost all cane is hand cut and then mechanically loaded. Manual cutting of cane is hard work and has limited appeal and, as the country develops, the availability of labour for hand harvesting is likely to decrease. With 150 000 hectares of cane and a production rate of 120 tons of cane per hectare, the industry requires about 10 000 cutters to harvest 15 million tons of cane. To sustain the historic rate of increase of sugar production (4% per year) and other things being equal, by the year 2010 the cane harvest would be about 30 million tons, grown on 225 000 hectares and cut by 20 000 cutters. However, if new varieties increase the sugar yield by one percentage point to about 12%, only 27 million tons of cane would be required.

At least one mill in the region has noted that with erect varieties, which permit greater efficiency by the cane cutters, the job of cutting cane becomes more attractive as they increase their incomes. On the other hand, commercial data indicate that as cane tonnage per hectare increases above 150 t/ha the efficiency of manual harvesting actually decreases, presumably due to lodging.

Because of uncertainties concerning the future development of the region, it is difficult to predict the extent of future labour scarcity for manual harvesting. It is nevertheless most unlikely that the industry will be able to attract a 100% increase in cane cutters in the next fifteen years. By the year 2010, it is probable that most of the cane crop will be mechanically harvested and the industry will therefore require varieties that can easily be cut by machine.

To facilitate mechanical harvesting, varieties with different characteristics are needed. For manual harvesting cutters prefer stalks to be thick, erect, long and heavy. However, the long, heavy cane may be more susceptible to lodging and thus may complicate mechanical harvesting. Furthermore, in the case of manual harvesting, uniformity of height is of little importance, whereas with mechanical harvesting it is essential for effective topping. For mechanical harvesting the varieties to be developed should be erect and resistant to lodging, and should have stalks that are shorter and thinner than those of the present varieties, with more tillering.

The importance of resistance to lodging is problematic as there is a close relationship between high tonnage and lodging. It is unlikely that erect cane varieties can be developed...
not only in terms of tonnage of cane but also in terms of sugar; the production of sugar per hectare per month increases with reduced age at harvest, reaching an optimum at close to one year and then declining as the harvest interval is further reduced (Figure 3). A reduction of the harvesting interval to one year opens up the possibility of synchronising harvesting with the climatic parameters in the different ecological niches, which would be a further advantage. It is therefore likely that future varieties with a cycle of one year will become the norm for the industry.

**Green Cane**

Burning the cane before harvest is a relatively new practice in the valley of the Cauca river. The mills began to burn cane in the middle 1970s. Initially the cutters and particularly the cane lifters or loaders were against the new system and resisted the change; however, with the introduction of mechanical loading, cane burning was rapidly accepted and adopted. Today the cane cutters are aware of the advantages of burning cane and, with the predominant present day varieties, it would be extremely difficult to return to the old green cane system, without making substantial bonus payments for cutting unburnt cane. From the point of view of the mills, which in Colombia are responsible for cutting, loading and transporting the cane, burnt cane has several advantages: cutting costs are reduced, less trash means that loading and transport costs are less, milling operations are facilitated and sugar yields are higher.

However, cane burning causes pollution, and may possibly cause health problems in the long term. This effect has yet to be demonstrated. The ash carried up by the burning that later falls on the local urban centres is a major annoyance to the public, and as a result political pressure is increasing to reduce or eliminate burning. Moreover the presence of colloidal smoke particles in the air could possibly reduce the total solar radiation reaching the cane crop, and hence the overall productivity of the region. Although this has not yet been quantified, it is another aspect that suggests that the permitted level of burning will diminish in the future.

Green cane harvesting presents serious problems with existing varieties due to the high levels of residue in the fields after harvest, increases in the costs of cutting, loading and transport, high levels of trash in the factory and reduced extraction of sugar. Commercial data from Ingenio Riopaila indicate that the efficiency of cane cutters was reduced by 24% in green cane with the most widely grown variety, MZC 74-275. However, these data also show that certain other varieties, such as V 71-52, can be cut green with much less problem, and indicate a potential for developing varieties for green harvesting.

What are the characteristics of varieties that are suitable for green harvesting and mechanical harvesting? The negative effects of increased levels of trash can be partly obviated by using varieties with high sugar content, and the amount of trash can be reduced by obtaining self trashing varieties which lose their leaves before harvest. Under Colombian conditions there is little evidence for or against the hypothesis that natural self trash will reduce photosynthetic area and hence cane production and sugar yield. However, in the Burdekin area of Australia similar levels of production of sugar per hectare per year are obtained to those of Colombia, with varieties that are self trash; hence the possibility of obtaining self trash varieties with good productivity would seem real.

**Seasonality of the harvest period**

The Colombian sugar industry traditionally mills cane throughout the year. However, historic data indicate that there is a certain seasonality in the harvest pattern, with about 30% more cane being milled per month from July to September than during April and May (Figure 4). In addition the sugar yield displays a seasonal pattern, being greater in the second semester (Figure 5) when most cane is milled. The high sugar yields correlate positively with rainfall in the two months before harvest, and with the average minimum temperature in the month before harvest (more than 60% of the variation in sugar yield over an eight year period was explained by these two factors and a dummy variable for technological improvement).

The sugar yield in the second semester is greater than in the first semester, although similar rainfall and temperature patterns before harvest indicate that there may be other effects, such as photoperiod, which have not yet been quantified.
conditions indicate that in the future producers will be confined to the dry months, and sugar yield tends to be greater and tonnage less, while in the wet period is difficult and damage to the ratoon crop can be severe. Various mills attempt to harvest on these soils in the dry period. However, it is impossible to do so effectively with varieties with growth seasons of more than a year and less than two years, without drastically reducing sugar content with very early harvests before the cane has ripened. Harvesting of one year cycle varieties on the heavy Udic soils will have to be confined to the dry months, and on the lighter Ustic soils to the rainy periods, thereby creating the demand for specialised varieties for these two conditions. The situation is complicated by the inverse relationship between sugar content and precipitation in the two months preceding the harvest.

Water

Water is a resource that becomes scarcer and more costly every day. In some areas of Colombia, where deep wells are the only source of water, irrigation accounts for about half the total variable costs of producing a ton of standing cane. The cane growers affirm that certain varieties are much more tolerant of a reduction in irrigation than others. Observations by Cenicafé and the mills indicate that several of the newer selections required less water to produce the same tonnage than has traditionally been used in the region. These observations indicate that in the future producers will demand varieties that use water efficiently.

Conclusions

Selection of the present generation of varieties has emphasised disease tolerance and high levels of sugar production per month. In addition to maintaining the desirable...
properties of existing varieties the following characteristics will be emphasised in varieties bred for the twenty-first century:

- High sugar contents, especially in varieties for the first semester
- Uniform height
- Resistance to lodging
- Limited flowering
- Self trashing stalks
- Short, thin stalks with high tillering
- Lower water requirement.

The tendency will be towards specific varieties for specific conditions in the sugar growing region rather than varieties of broad adaptability. In both wet and dry soils different varieties will be selected for the first and second semester.

The specific characteristics of the varieties for differing soil conditions will be as follows:

- **Wet (Udic) soils.** The varieties will be tolerant of wet soils and their associated high water tables. They will be harvested mainly in the drier months of June, July, August, December, January and February. As sugar yields in these soils tend to be high this will at least partially counteract the lower yields of the first semester without major emphasis on selection for this period.

- **Dry (Ustic) soils.** The selection of these varieties will emphasise sugar content as this tends to be low in these soils, especially in the first semester. Selection will be for harvest in March-April and September-November.

- **Saline soils.** Selection for these varieties will emphasise tolerance of saline conditions above all else. As these soils tend to be concentrated in areas of low rainfall where harvesting throughout the year is not a major problem, they will not be selected for specific harvest periods.

- **Piedmonte.** In these areas, where irrigation is often difficult and the water-holding capacity of the soil is low, the selection process will emphasise drought tolerance. Soil fertility is low and the ability to produce well under less fertile conditions will be emphasised also.