SUCROSE LOSSES IN PROCESSES PRIOR TO MILL OPERATIONS: EXPERIENCES IN THE COLOMBIAN SUGAR INDUSTRY

By

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Introduction

The sugarcane industry targets the production of sugar in the field and its extraction in the factory. However, it is common to lose part of this sugar in the harvesting and the factory processes.

To understand this situation, as a first step, it is necessary to be acquainted with reliable methodologies and indicators to measure the losses.

A second step is to concentrate efforts in avoiding or reducing the most significant losses. It has been found that the losses between burns (or harvesting) and milling can be of the order of 10–20% of the pol in the cane while, in the factory as a result of the extraneous matter, these losses can range between 1.5 and 8 of the pol in the cane, and by sucrose inversion with production of glucose and fructose and other aspects between 1.5 and 2.5 of the pol. It is probable that investments to reduce the harvesting losses would be more profitable than some of the investments in the factory.

In the field, it is necessary to consider processes related to the generation and concentration of sucrose in the plant. This aspect involves phases related to genetic development of varieties with specific characteristics; the generation of seedlings and seeds; the cultivation in characterised soils and in well defined climatic zones; weather cycles with summer and rain seasons (that in many countries involve the crushing seasons); the preparation of the soil (mechanically, chemically and with adequate fertiliser); the irrigation; the use of herbicides and ripeners; the age of the cane; harvesting burnt or green cane and harvesting mechanically or manually; the loading and the transportation; whole stalks or billets and dry or wet harvest conditions.

After the cut, the cane loses water (1% to 2% per day during the first week). When the cane is burnt before the cut, the loss of water is minimal, especially if the cane is processed within the same day of its harvest (the loss of water creates, in some cases, an apparent increase in the sugar content).

Whatever the quality at time of harvest, rapid deterioration begins from the moment the cane is cut, (Chen, 1993). Traditionally, deterioration proceeds by enzymic, chemical and microbial processes (Clarke et al., 1980; Foster et al., 1980). Thus, the enzyme invertase, which occurs naturally in cane, converts sucrose to invert sugars (glucose and fructose), thus lowering purity.

The rate of inversion, which is a genetic trait that can be minimised by variety selection, varies with temperature and moisture and is most rapid in hot, dry periods.

Chemical deterioration includes inversion caused both by acid conditions which increase as cane becomes staler, and as a side effect of some microbial growth. The products of inversion change further with time to form acids, coloured compounds and polysaccharides, grouped under the general name of non sugars in the factory processes. In this field significant advances have been achieved (Smythe, 1967; Montavani et al., 1986; Morel du Boil, 1991, 1992, 1995; Lionnet, 1986; Larrahondo et al., 1993; Ceruti et al., 1999).

Anything that diminishes the amount of sugar available in the field should be catalogued as a loss. At present, these losses are estimated in 1–3 pol % cane. These losses can be affected by varieties with high sucrose content, by resistance to pests and diseases; by better compatibility of soils and varieties; by better technical management of the soil. The present average of sucrose in Colombia is about 15 pol % cane (with maximum values of 16.9 and minimum of 14).

The costs resulting from activities associated with the harvesting and transportation of sugarcane can, at times, be considerable because of the amount of rocks, sand and other extraneous matter involved. This material, if not removed prior to processing, causes extensive damage to cane processing equipment and ancillary plant with associated high maintenance costs and loss of production time, as well as contributing greatly to numerous processing problems in the factory.

As a result of difficulties in crushing and in processing juices from harvested cane, in many localities it has become imperative to wash the sugarcane before it enters the tandem. In Louisiana and Hawaii, washing of sugarcane has been a standard practice for many years, and it has been introduced in some sugar factories in Puerto Rico, Florida, Brazil, Argentina and Colombia.

There are many variations in washing systems because of differences in the harvesting, delivering and unloading of sugarcane onto the tables or cane carriers. The method of removing unwanted material in delivered cane with water is an old procedure with a lot of drawbacks (environmental pollution, sucrose losses in the water, fresh water demanded per hour, investment in ponds for biological oxidation, severe corrosion problems at the wash table, etc.) Nevertheless, good washing of burned cane removes up to 80% of the field soil delivered with the cane. Poorly washed cane results in excessive wear on the knives,

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mills and juice pumps. Poor washing adversely affects boiler operation (low steam pressure and high extraneous fuel consumption), the filters and finally reduces sugar yield. Very good results can be accomplished by having a very thin cane mat on the table, and the use of adequate wash water flow. A good cane washing table should also provide drained cane to the main cane conveyer (Birkett, 1983).

**Sucrose losses in Colombia**

In Colombia, estimates have been made of the losses associated with harvest and transport conditions. The effects examined include storage time (between harvest and grinding), the amount of trash in the cane, manual versus mechanical harvesting, the use of cane ripeners and whole stalk versus billet cane. These investigations have shown that:

- sugar yield reduces by between 0.14 and 0.23 percentage units for each one percent increase in trash % cane,
- sugar yield reduces by between 0.0015 and 0.02 percentage units for each hour of storage time.

The presentation will provide more details on these losses.

**Conclusions**

In the field the target is to maintain the potential content of sucrose offered by each variety, soil type and climatic regions in Colombia. The associated losses associated with harvesting and transportation processes are between 0.5 and 1.5 pol % cane.

In the activities of harvesting, transportation, cleaning and storage (in the factory yard) of the cane, the losses in Colombia are between 1.2 and 2.0 pol % cane. It is, therefore, imperative to continue seeking processes, equipment and methodologies that help us to reduce these losses, before the cane is submitted to mill processes.

The content of sucrose detected in the washing water at Colombian mills averages between 0.2 to 0.3 pol % cane.

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**REFERENCES**


