Information Sheet

15. CANE QUALITY

15.2 Fertiliser management and cane quality

Introduction

The fertility status of the soil and the standard of fertiliser management can impact directly on the chemical quality of cane juice. This can be on sucrose content as well as on non-sucrose constituents such as gums, starch, phenols, dextrans and ash, which can affect sugar recovery during processing. Both nutrient deficiency and excess can result in below optimum sucrose content.

Nitrogen

- N has a dominant role in regulating crop production. Generally increasing applications of fertiliser N will stimulate vegetative growth, but rapid growth usually implies higher levels of N, moisture and non-sugars, and a lower sucrose content within the cane plant prior to harvest.
- The RV cane payment system accounts for the effect of non-sucrose and fibre content on the recovery of sucrose. Figure 1 shows that overall sucrose recovery for variety NCo376 was less under the RV system than for the direct payment system using only pol % cane.
- Reduction in cane quality with increasing amounts of N between 50 and 150 kg N/ha, averaged 0.45 units RV% cane for each additional 50 kg N/ha applied.
- Cane grown on an autumn/winter cycle is more likely to be affected by lower purity and a reduction in RV% cane with increasing N fertiliser levels.
- The variable capacity of industry soils to supply N through mineralisation is important, as over-supply of N is likely to have an adverse effect on purity, and therefore recoverable sugar, under the RV system of cane payment.
- Excessive use of N may cause lodging of cane, which can lead indirectly to a decline in recoverable sugar.

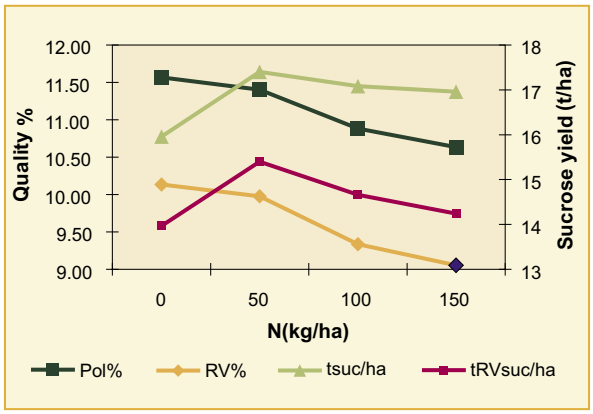

Figure 1. Effect of N on sucrose quality.

Recommendations from the Fertiliser Advisory Service at SASRI inform growers of the correct and optimum use of fertilisers.

- Figure 2 shows that another consequence of over-application of N fertiliser is the risk of increased eldana infestation and damage to cane, with an adverse effect on RV% cane.

Potassium (K)

- K is essential for plant growth and photosynthesis. It plays an important role in the moisture economy of the plant and translocation and storage of sucrose.
- Table 1 shows that an application of K fertiliser to a soil deficient in K may improve sucrose recovery through an increase in pol and RV%, and a reduction in fibre content.
- Potassium is the most effective element in reducing the starch content of cane, a large reduction in starch usually accompanying substantial increases in yield on K deficient soils.
- The use of potassic fertiliser in sugarcane has increased substantially over the last four decades, to the extent that in a number of areas leaf analysis shows luxury uptake of K. Very high applications of K can cause lodging of cane, which can indirectly reduce RV%.
- High K levels in cane juice also influence the exhaustibility of final molasses, as well as the colour and ash content of raw sugars. K forms a complex with sucrose and thereby holds the sucrose in solution, i.e. the solubility of sucrose is increased when K levels in juice, syrup or molasses increase. This means that when high K syrups are boiled the crystal yield will be smaller than usual and more sucrose will remain in solution and end up in the molasses.
- The effect of variety on average K content in juice is shown in Figure 3. Where varietal differences in leaf K content are significant, the threshold value for K is adjusted accordingly, as in the case of variety N14.

Phosphorus (P)

- This nutrient plays an important role in photosynthesis, root development and tillering.
- Table 2 shows that an application of P fertiliser to soil highly deficient in P can significantly increase cane yield and quality, and RV% will show a similar trend.
- Generally, application of P, while increasing yields and tons sucrose/ha, does not affect sucrose % cane significantly, although excessive amounts of P as superphosphate have been shown to reduce ERS % cane by an average of 0.2 units for every 45 kg P.

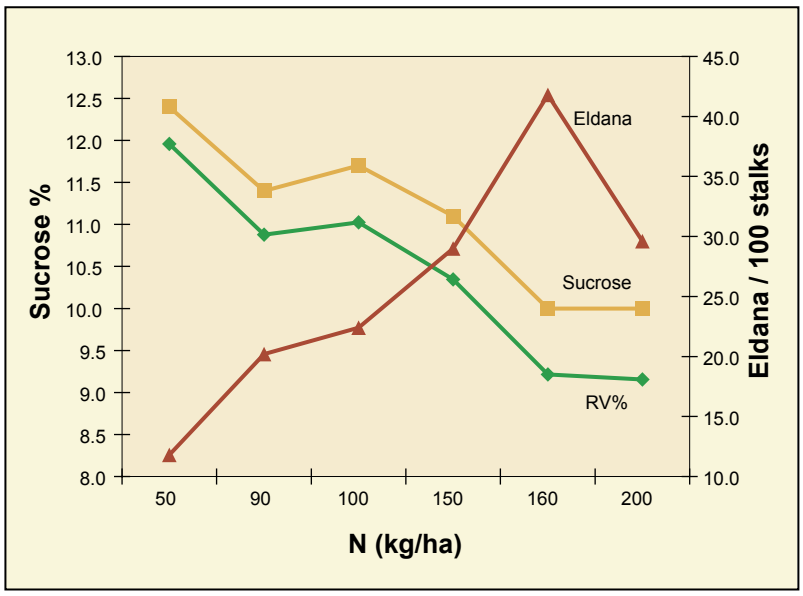

Figure 2. Effect of N on cane quality and eldana for variety NCo376.

Table 1. Cane, sucrose and RV% and sucrose yields (average 16 to 18 ratoons) at Pongola – Hutton form soil.

kg K/ha applied	Tons/ha cane	Fibre %	Sucrose % cane	Brix %	RV%	Tons/ha sucrose
0	145	10.7	11.7	15.3	9.9	17.0
75	154	10.2	12.0	15.0	10.3	18.7
150	147	10.2	12.0	15.5	10.3	17.8

Table 2. Response to superphosphate in plant cane on two different soils.

Treatments	Inanda			Melmoth		
	Tons/ha cane	Sucrose % cane	Tons/ha sucrose	Tons/ha cane	Sucrose % cane	Tons/ha sucrose
Control – No P	66.7	13.4	8.9	19.9	15.7	3.1
Supers – 1 100 kg/ha	166.4	14.9	24.8	95.6	17.5	16.8

Lime, filtercake and poultry manure

- Excess inorganic nitrogen from increased mineralisation of N which follows the liming of acid soils with high organic matter content can lead to a decline in sucrose content in cane grown in the KwaZulu-Natal Midlands.
- In many cases, cane quality has been significantly depressed due to the presence of excessive amounts of N supplied by filtercake used in various trials in the Midlands. This is one reason why N fertiliser recommendations in this region are adjusted for N.
- Poultry litter, which has an inherently high N and P content, can also affect cane quality adversely if used in excessive amounts.

Soil salinity and poor water quality

- An increase in soluble salts in the soil can cause an accumulation of salts in cane juice, which in turn lowers purity and sucrose percentage (see Table 3).
- Poor quality irrigation water may also indirectly contribute to increased uptake of Ca, Mg and Na from the soil profile, which will increase the potential for higher ash levels in raw sugars.

Conclusions

- Growers must use soil and leaf analysis in order to maximise RV production.
- Fertiliser use in excess of Fertiliser Advisory Service (FAS) recommendations is not only wasteful, but will be more 'expensive' under the RV system of payment.
- FAS not only informs the grower of the amount of fertiliser needed for each field, but also the correct type, optimum time, and method of fertilising to ensure maximum economic return of sugar per hectare.

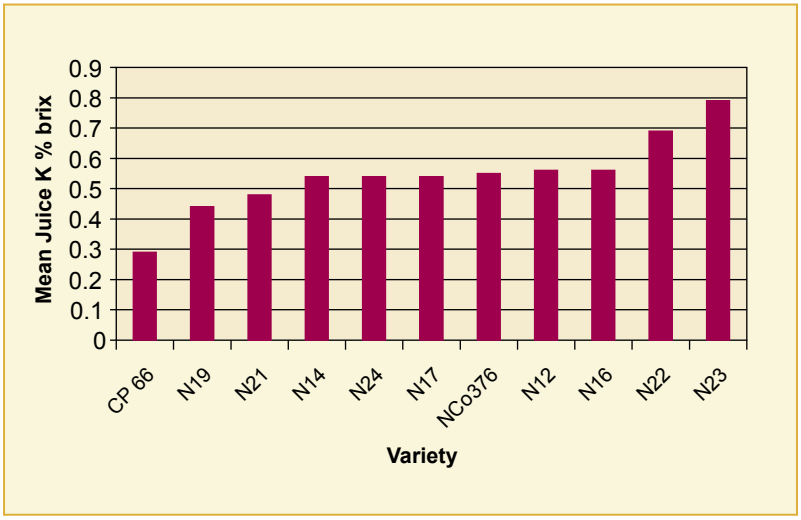

Figure 3. The effect of variety on the K content of juice.

Table 3. Effect of soil salts on the quality of sugarcane juice.

Soil salts %	Juice salts %	Juice chloride %	Brix %	Sucrose %	Purity %	Glucose %
0.062	0.060	0.019	21.2	20.1	95.0	0.39
0.145	0.099	0.047	21.0	19.2	91.2	0.56
0.147	0.068	0.068	19.0	16.1	84.6	0.63