POSTER SUMMARY

THE PERFORMANCE OF IRRIGATED SUGARCANE UNDER STILLAGE AND GRANULAR FERTILISER TREATMENTS

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Abstract

Stillage, a product of ethanol production from the fermentation of molasses, is used as a source of potassium on cane fields at Ubombo Sugar Ltd, Big Bend, Swaziland. The stillage is fortified with urea to provide nitrogen (N) and/or phosphoric acid to supply phosphorus (P) where necessary. Following perceptions by Section/Farm Managers that there were higher nitrogen losses where stillage had been applied late in the season compared to where fertilizer granules were used, a field experiment was carried out on a first ratoon field on a T-Set soil. The objective of the experiment was to assess the effect of splitting nitrogen in stillage compared with standard granular fertilizer blends on sugarcane yield and quality parameters. The treatments were (1) urea enriched stillage blend (180 kg N/ha + 180 kg K/ha), (2) granular fertilizer blend (180 kg N/ha + 180 kg K/ha), (3) urea enriched stillage blend (90 kg N/ha + 180 kg K/ha) + 90 kg N/ha applied eight weeks later, and (4) granular fertilizer blend (90 kg N/ha + 180 kg K/ha) + 90 kg N/ha applied eight weeks later. The rates were derived from soil analysis results. The treatments were replicated five times in a randomised complete block design (RCBD). The results indicated no statistically significant differences in cane and sucrose yields in all the treatments. It was therefore concluded that splitting the N in both stillage and granular fertilizer was not necessary at this time of the year.

Keywords: granules, stillage, fertilizer, nitrogen, losses, yield

Introduction

Molasses is often used in the distillation industry to produce ethanol. The residual fluid remaining after distillation is called stillage or vinasse. It is widely used in Australia and Brazil, and in many other sugarcane growing countries mainly as a source of potassium fertilizer. It contains organic matter to improve the soil structure, vitamins, enzymes and sugars for microbial growth and activity. When concentrated to a brix value of about 70% through evaporation, it is known as condensed molasses solids (CMS). CMS contains approximately 1% nitrogen (N), 0.2% phosphorus (P) and 3.5-5.5% K (Turner, 2002). Stillage also contains sulphur and some trace elements such as copper, manganese and zinc. To meet crop requirement, stillage is fortified with urea and with phosphoric acid to supplement nitrogen and phosphorus, respectively.

The experiment was carried out to compare stillage and granular fertilizer blends as nutrient sources on sugarcane yield and quality indices and to assess the effect of splitting N from each source.

Experiment site

The field trial was carried out at Ubombo Sugar, located at latitude 26º South and 31º East. The area experiences temperatures ranging from 9 to 34ºC and has an average rainfall of

674 mm per annum. The site was on a gently sloping lithormorphic vertisol intergrade fersialitic soil that is imperfectly drained and is without free lime (Murdoch, 1968). It is classified as the Tambankulu soil series (Anon, 1999). The cane started growing on 24 September 2002 and was harvested at 12 months of age on 28 September 2003.

Treatments

There were four treatments replicated five times in a randomised complete block design (RCBD). The treatments are shown in Table 1.

Table 1. Treatments and their application rates.

Treatment	Initial application (kg/ha)			Second split (kg/ha)		
	N	P	K	N	P	K
Stillage blend	180	0	180	0	0	0
Stillage blend	90	0	180	90	0	0
Granular blend	180	0	180	0	0	0
Granular blend	90	0	180	90	0	0

NB: The initial split was applied within a week after cutting the cane, and the second split was applied eight weeks later.

Results and Discussion

Table 2 shows the results of leaf analysis for the treatments at three and five months of age of the cane:

Table 2. Leaf tissue analysis at three and five months.

Treatment	N %		P %		K %		Mg %		Ca %	
	3m	5m	3m	5m	3m	5m	3m	5m	3m	5m
Stillage straight	1.87	1.93	0.29	0.25	1.58	1.50	0.20	0.22	0.22	0.22
Stillage split	1.95	1.95	0.31	0.25	1.66	1.34	0.18	0.19	0.20	0.19
Granular straight	1.82	1.96	0.27	0.25	1.50	1.39	0.17	0.19	0.18	0.20
Granular split	1.86	1.84	0.29	0.24	1.64	1.51	0.18	0.22	0.20	0.21
Significant level	**	**	ns	ns	ns	ns	ns	ns	**	ns
CV%	1.72	1.55	6.99	3.76	8.12	8.39	9.18	10.49	6.23	8.10
LSD (0.05)	0.04	0.04	0.03	0.01	0.18	0.17	0.02	0.03	0.02	0.02

Nitrogen levels in the leaf were above the threshold values at three and five months sampling age for all the treatments, confirming that the nutrient was not deficient. However, at three months, the stillage treatments showed statistically different higher leaf N levels than the granular fertilizer treatments, both at the straight split levels of N, suggesting that N use from the stillage treatments was more efficient than from the granular fertiliser treatments during the early stage of growth. However, at five months the early advantage of more efficient use of N from the stillage disappeared, and there was no difference in N content between the straight N treatments. At this stage split N stillage treatment was significantly better than the split granular fertilizer treatments suggesting higher N use efficiency of the former.

Table 3 shows cane yield and quality of the different treatments at harvest.

Table 3. Cane and sucrose yields.

Treatment	Cane (t/ha)	Sucrose (t/ha)	Sucrose %	Purity %	Moisture %
Stillage (180:0:180)	84.34	13.26	15.74	88.19	69.34
Stillage (90:0:180) + (90:0:0)	89.28	13.82	15.53	87.33	68.11
Granular (180:0:180)	91.08	13.85	15.27	86.79	69.31
Granular (90:0:180) + (90:0:0)	86.73	13.06	15.66	86.95	68.53
Significance level	ns	ns	ns	ns	ns
CV%	9.78	9.73	2.71	0.76	1.14
LSD (0.05)	17.016	2.625	0.839	1.321	1.566

There were no statistically significant differences in cane and sucrose yield between the treatments. Therefore there was no evident prejudice arising from the use of any of the nutrients sources, nor from splitting the N therein.

Conclusion

The results of the study showed that there was no significant difference in either cane or sucrose yield between the two sources of nutrients. Neither was there an advantage to splitting N from any of the sources of nutrients. It is therefore concluded that there are no grounds for assuming that N, P and K from the relatively cheaper stillage is less efficient than granular fertilizer in September harvested cane. On the contrary, the leaf evidence suggests that the stillage N treatment, applied straight or split, is more efficient during the initial stage of growth of cane, which implies that there may be scope for reducing the level of N when applied in a stillage carrier. Further work in the form of multiple N rates trials will be needed to substantiate this possibility and to quantify the savings in N that can be made. No evidence was found to justify the additional expense of splitting N on cane to be harvested late in the season.

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