SHORT COMMUNICATION

LONG TERM RATOONING OF SUGARCANE ON SANDY SOILS IN KWAZULU-NATAL

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Abstract

Variety x nematicide trials are planted throughout the South African sugar industry to study the response of varieties to nematode damage. Data from one such trial conducted over nine crops showed that the average ERC yield for the control plots ranged from 3.8 to 8.1 t/ha with NCo376 being the better performing variety. The nematicide treated plots produced ERC yields of 8.8 to 12.4 t/ha, with N16 the better performing variety. Treating each crop with a nematicide increased the yield of each of the varieties. The greater yields were due more to an increase in cane quantity (t sucrose/ha, t ERC/ha, t cane/ha, population, length) than cane quality (ERC, Pol, purity, Brix), although the effect was variety dependent. In the untreated control plots scattering the burnt cane tops or green cane harvesting, and changing the time of harvest from late season to earlier in the season, were associated with increased ERC yields.

Keywords: sugarcane, nematodes, ratoon, varieties, time of harvest, trashing

Introduction

Plant parasitic nematodes are a known constraint to sugarcane production on sandy soils (Cadet and Spaull, 1985; Spaull and Cadet, 1991; Cadet and Spaull, 2005). In addition to the nematode problem, sandy soils have low fertility status, low organic matter content, low water holding capacity and high erodibility (Anon, 1999), making management of these soils different to that of the better soils. Recent work has shown that by planting tolerant/resistant varieties and using a nematicide with each cane crop, it is possible to increase the immediate- (that particular crop) and future (increase the number of ratoons) profitability of the sugarcane farming enterprise (Cadet and Spaull, 2003).

The Nematology section of the Pathology department currently has several variety x nematicide trials. These provide useful data for growers regarding which varieties to plant in soils where nematodes are a problem. The trials, when grown for a sufficient number of ratoons, also enable predictions to be made on the sustainability of varieties after long term cropping. This paper presents and discusses data collected from a long-term (approx 10 years) variety x nematicide trial.

Material and Methods

Trial site

This trial, located 40 km north of Durban, on the KwaZulu Natal North Coast (29° 36’ S – 31° 6’ E) was planted in 1994 in a sandy soil (Fernwood series, FAO: Dystric and Eutric Rhegosols, USDA: Entisols). The trial is organised into a split-plot design consisting of 72 plots, with six varieties, N12, N16, N17, N23, N24 and NCo376. Half of the plots of each variety were treated with a nematicide (aldicarb) at 3 kg/ha at planting, and four to six weeks after each harvest. The remaining half were left untreated (control plots). Each plot of the trial comprised 6 rows by 10 m, with 1.17 m row spacing. The crops were harvested on a 12-month cycle. The plant crop and the following six ratoons were burnt prior to harvest. These crops were cut in September. The 7th ratoon was accidentally burnt at eight months and no harvest data were collected. The cane tops remaining in the field were scattered over the plots and not mostly moved to the breaks between the plots, as was the case for the previous harvests. The 8th and 9th ratoons were harvested at 12 months in June, and were not burnt at harvest. Fertiliser was applied each year as recommended by the Fertiliser Advisory Service of the South African Sugarcane Research Institute.

Soil samples were collected from each plot from each of the crops for nematode analysis, and from the 2nd, 3rd, 4th, 6th, 8th and 9th ratoons for analysis of pH, P, K, Ca, Mg, Na, Zn, Al and organic matter.

Harvest data

At harvest, the stalks in the four middle rows of each plot were harvested and weighed. Twelve harvested stalks were selected at random from each plot to determine the sucrose content and stalk characteristics (ERC, Pol, fibre, Brix).

Analysis of results

Average values of the harvest results were compared with student t-test and ANOVA. Predicted yields for the 8th and 9th ratoon were derived from the data from the first to sixth ratoon using log regression curves. These were compared with actual yields to assess the effect of the change from harvesting in September (late season) to harvesting in June (early season).

Results and Discussion

All six varieties responded to nematicide application, increasing the average yield by 54% relative to the controls. Variety N24 was particularly susceptible to nematode damage and economical yields were possible only with a nematicide. Where a nematicide was applied, variety N16 yielded significantly better than NCo376 ($P<0.01$). When no nematicide was used, NCo376 proved to be the best performing variety (Table 1). The yields of the untreated 8th and 9th ratoons were significantly greater than that predicted from the yields of the preceding ratoons (Table 2). The increase in yield in the nematicide treated plots was much smaller.

Three things changed at the seventh harvest: (1) the new, 8th ratoon crop began in June rather than September; (2) the crop began with the burnt tops scattered over the plots; (3) the application of lime was sufficient to bring the soil to a condition where no further liming was required in the following crop. Rainfall during the 8th and 9th ratoons was below the average for the 10-year period since the trial was planted, and so cannot explain the marked increase in yield. The pH, organic matter content and level of calcium increased in the soil during the 8th ratoon, while levels of aluminium decreased. These changes persisted or became greater in the 9th ratoon. Changing the season that the cane was harvested, from late season to early season, should have favoured the early to mid-season varieties and been to the detriment of the mid to late season varieties. This did not occur. N16 and N17 are mid to late season varieties, and their observed yields in the 8th ratoon were much greater than that predicted from their performance when cut on a late season cycle (Table 2). In contrast, the yield of N12, which is an early to mid-season variety, was not much greater than expected. The increased organic matter content of the soil, the decrease in aluminium and the increase in calcium, to levels where no further liming was required, suggests that improved nutrition could explain the increased yields in the 8th and 9th ratoons. Nematodes were still a significant constraint to production, judging by the large response to treatment with nematicide, although less so with N17. The small difference between the predicted and observed yields of the nematicide treated 8th and 9th ratoons may be a result of the varieties reaching their maximum for the environment.

Table 1. Summary of estimated recoverable crystal yield (t/ha) for nine crops.

Treatment	PC	1R	2R	3R	4R	5R	6R	8R	9R	Avg ERC[1]	Total ERC[2]	% gain[3]	% gain[4]
NCo376 (+T)	8.2[a]	11.7[b]	9.5[a]	10.2[a]	10.2[b]	9.6[a]	9.5[b]	10.1[a]	9.3[a]	9.8	88.3	21	
NCo376	6[b]	11[b]	7.8[b]	7.3[c]	8.1[c]	8.4[b]	8.2[b]	8.1[b]	8.3[b]	8.1	73.2		0
N12 (+T)	9.1[a]	12.3[b]	9.9[a]	9.8[b]	12.3[a]	8.7[b]	9.9[b]	10.6[a]	9.3[a]	10.2	91.9	30	
N12	6.5[b]	9.9[c]	7.5[b]	6.4[c]	8.4[c]	8.4[b]	7[c]	8.3[b]	8.1[b]	7.8	70.5		-4
N16 (+T)	9.8[a]	14.7[a]	11.6[a]	*12.4[a]	*14[a]	11[a]	*12.8[a]	12.7[a]	*12.5[a]	12.4	111.5	63	
N16	5.7[b]	11.3[b]	8[b]	6.8[c]	7[d]	7.5[b]	6.6[c]	8.8[b]	6.5[b]	7.6	68.2		-7
N17 (+T)	9[a]	12.3[b]	10.7[a]	10.5[a]	11.8[a]	10.6[a]	9.7[b]	10.2[a]	9.8[a]	10.5	94.6	32	
N17	5.4[b]	9.8[c]	7.3[b]	7.1[c]	7.1[d]	7.6[b]	7[c]	10.8[a]	9.3[a]	7.9	71.4		-2
N23 (+T)	8[a]	12.1[b]	11.3[a]	*12.3[a]	12.6[a]	9.5[a]	9.9[b]	11[a]	10[a]	10.8	96.7	42	
N23	4.8[b]	9.1[c]	6.7[c]	6.9[c]	8.9[b]	7.3[b]	7.1[c]	8.7[b]	8.5[b]	7.6	68		-7
N24 (+T)	8.4[a]	11.1[b]	9.8[a]	*9.2[b]	*10[b]	8.2[b]	*9.3[b]	8[b]	5.5[c]	8.8	79.5	134	
N24	5.1[b]	7.2[d]	2.9[d]	3[d]	3.1[e]	4.4[c]	3.5[d]	2.9[c]	1.9[d]	3.8	34		-54
Average	7.2	11	8.6	8.5	9.5	8.4	8.4	9.2	8.3	8.8	79.0	54	-12
LSD	2.79	2.17	2.44	2.34	3.03	2.07	2.60	3.68	3.47				

*Yield significantly greater than control treatment ($p<0.05$)
[1]Total ERC/number of crop cycles
[2]Sum of ERC for nine crops
[3]Percentage gain from using a nematicide for each crop
[4]Percentage gain from planting a variety other than NCo376

Table 2. Comparison of predicted and observed yields for untreated and nematicide treated varieties in the 8th and 9th ratoons.

Treatment	Predicted yield		Observed yield		Mean		Increase in ERC yield
	R8	R9	R8	R9	Predicted	Observed	
Control:							
NCo376	7.2	7.0	8.1	8.3	7.1	8.2	15%
N12	6.9	6.8	8.3	8.1	6.9	8.2	19%
N16	5.6	5.3	8.8	6.5	5.4	7.6	41%
N17	6.3	6.2	10.8	9.3	6.2	10.1	61%
N23	7.0	6.9	8.7	8.5	7.0	8.6	23%
N24	2.5	2.3	2.9	1.9	2.4	2.4	3%
Nematicide:							
NCo376	9.2	9.1	10.1	9.3	9.1	9.7	6%
N12	9.3	9.2	10.6	9.3	9.3	9.9	7%
N16	11.8	11.7	12.7	12.5	11.8	12.6	7%
N17	10.4	10.3	10.2	9.8	10.3	10.0	-3%
N23	10.2	10.1	11.0	10.0	10.2	10.5	4%
N24	8.5	8.3	8.0	5.5	8.4	6.8	-20%

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