A NOTE ON THE EFFECT OF *ALDICARB* ON THE YIELD OF FOUR SUGARCANE VARIETIES ON A SANDY SOIL IN THE NATAL MIDLANDS

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Abstract

The results are given of trials on a sandy soil in the Natal Midlands comparing the effect of treatment with aldicarb on the plant crop and first ratoon of varieties N12, N16, N17 and N21. All four varieties responded to treatment with the nematicide in both crops although there was no statistical difference between varieties. The mean response was about 24% in the plant crop and 50% in the ratoon. Significantly fewer *Meloidogyne javanica* were associated with N16 and N17 than with N21.

Introduction

Previous trials with nematicides in the Natal Midlands have shown that considerable benefit can be achieved from their use on sandy soils. Ringelmann (1980) reported increases in yield averaging 42% following treatment with aldicarb or carbofuran on the Table Mountain sandstone (TMS) derived soils on his farm 'Mount Elias' in the Mount Elias region near Fawn Leas. Similar marked responses to treatment with aldicarb were recorded in three trials on a TMS Cartref form soil at Noodsberg (Spaull & Donaldson, 1983). At that time the varieties grown in the Midlands area were predominantly NCo293 (a mean of 52% of cane crushed at the Noodsberg and Union Co-operative mills) and NCo376 (mean of 17%) (Lamusse, 1980). Over the years these have been replaced by the higher yielding and more mosaic-resistant varieties N12 and N16, which now represent about 68% and 14%, respectively, of the cane crushed in the Midlands (Lionnet, 1994).

N12 is recommended for drought prone soils and sandy soils where nematodes are likely to be a problem, while N16 is normally recommended for more favourable conditions. TMS-derived sands, loamy sands and sandy loams are widespread in the Midlands and there is a need for a greater choice of varieties for this region. Therefore the performance of N12 and N16 was compared with two other varieties, N17 and N21, in two nematicide trials. The trials were sited at Mr Ringelmann's old farm, now called Niederland and owned by Mr D Kriel. Variety N17 was included because of its relatively high sucrose content. It is not recommended for cooler environments, but the Mount Elias area is warmer than average for the Midlands region and does not experience frost. Although released only in 1989, N21 was included because it appeared to be tolerant of poor conditions.

Methods

The trials were conducted on the plant crop and first ratoon of varieties N12, N16, N17 and N21. The soil at the trial site was a TMS-derived loamy sand of the Glenrosa form with 6% clay, 5% silt, 30% fine sand, 42% medium sand and 17% coarse sand. The cane was planted at the end of October 1990 in a randomised block design with five replicates. There were two treatments: aldicarb applied at a rate of 3 kg/ha (20 kg Temik/ha) in the furrow at planting and an untreated control. The plant crop was harvested in June 1992 after 19 months. In early November, five months after the plant crop had been harvested and when the first ratoon was less than 300 mm in height, aldicarb was reapplied at 3 kg/ha over the row, to the plots that were treated in the plant crop. The ratoon was harvested towards the end of June 1994 after 25 months. The plots comprised five rows, 8 m long and with a row spacing of 1 m. At harvest the dead leaves on the cane were burnt and 1 m was discarded from the ends of the three centre rows. The number, length and mass of stalks in the three 6 m long net rows were then recorded. A representative 12 stalk subsample was taken from each plot for sucrose analysis.

Rainfall data were from the nearby Jaagbaan meteorological station.

The application of fertilisers and herbicides was made by the co-operator according to Experiment Station recommendations.

Soil samples for nematode assay were taken from the control plots of the plant crop two weeks after planting (Pi), from the control plots of the ratoon crop 20 weeks after the previous crop had been harvested (P20) and from all the plots just after the first ratoon crop was harvested (Pf). Root samples were also taken on this last occasion. Soil samples comprised 20 × 24 mm diameter cores per plot to a depth of 220 mm. Roots were taken from a 300 × 200 mm slice of soil to a depth of about 250 mm, adjacent to the cane in each of the two guard rows. The nematodes were extracted from the soil by a decanting-sieving-Baermann tray method (Brown and Boag, 1988) and from the roots in a mistifier (Seinhorst, 1950). The nematode counts were transformed to $\log(x+1)$ before conducting an analysis of variance.

Results

Rainfall on the plant crop (1 263 mm) was 89% of the long term mean (LTM) and on the ratoon (1 297 mm) 80% of the LTM. However, whereas the plant crop received 110% of the LTM (*i.e.* 600 mm) in the first five months, the ratoon received only 44% (88 mm) in the same period.

The plot yields were extremely variable. To reduce the variation, data from both crops were subjected to a covariance analysis which corrected for a group of 10 adjacent, low-yielding plots and allowed for trends over the site.

In the plant crop the yields of cane and estimated recoverable sucrose (ers) of the untreated control plots of all four varieties were similar (Table 1). The responses of N12, N16 and N21 to treatment with aldicarb were similar (29-33%) and notably larger than that of N17 (<10%). The yields of the untreated ratoon crop were less than that of the plant crop, especially for N21, while the response to treatment was somewhat greater (25-90%). N17 responded least to treatment in the ratoon (Table 1). For each variety the yield

Table 1

Yield from the untreated control plots (C) and additional yield from plots treated with 3 kg aldicarb/ha (T). (Percent response in parenthesis)

Variety	Plant crop				Ratoon crop			
	t/cane/ha		t ers/ha		t cane/ha		t ers/ha	
	C	T	C	T	C	T	C	T
N12	64,9	+19,4 (30%)	9,5	+3,1 (33%)	54,1	+31,1 (57%)	9,4	+5,3 (56%)
N16	67,5	+21,7 (32%)	9,4	+2,8 (30%)	57,7	+25,7 (45%)	9,9	+3,9 (39%)
N17	64,1	+3,1 (5%)	9,3	+0,8 (9%)	55,1	+16,9 (31%)	10,2	+2,6 (35%)
N21	62,3	+18,7 (30%)	9,0	+2,6 (29%)	44,1	+39,7 (90%)	7,7	+6,5 (84%)
Mean	64,7	+15,7 (24%)	9,3	+2,3 (25%)	52,7	+28,4 (54%)	9,3	+4,6 (49%)
CV%*	22,3		23,9		27,7		27,3	
SED** V × N	11,70		1,81		13,43		2,29	
SED mean	6,14		0,95		7,05		1,20	

* Coefficient of variation.
** Standard error of the difference between means of individual varieties with and without nematicide.

Table 2

Estimated recoverable sucrose % cane for the plant crop and first ratoon of the four varieties

Variety	Plant crop	Ratoon crop
N12	12,7	15,7
N16	12,3	15,3
N17	13,7	16,4
N21	12,4	15,3
SED	0,43	0,32

of treated cane in both crops was similar. The sucrose content of the ratoon crop was greater than that of the plant crop and was notably greater in N17 than in the other varieties in both crops (Table 2). Treatment with aldicarb had no effect on ers % cane. (The yield data were arrived at after performing a statistically determined adjustment. Since this was done independently for tons cane and tons ers, there is no direct relationship between these two yield parameters and ers % cane.)

Very few nematodes were present in the soil at the start of the trial. Greater numbers were present at the beginning and end of the ratoon crop (Tables 3 and 4). Fewer *Meloidogyne* (all *M. javanica)* were recovered from the soil from the plots of N16 and N17, than N12 and N21 plots (Table 3). Also fewer *M. javanica* were recovered from the roots of N16 and N17 than from the roots of N21. No differences were detected between varieties for other species of nematodes.

Table 3

Number of endoparasitic and semi-endoparasitic nematodes per 100 ml soil and per gram dry weight roots

Nematode genus	Variety	Plant Pi soil	Ratoon P20 soil	Ratoon Pf soil	Ratoon Pf roots
Meloidogyne	N12	2	97b*	67b	469bc
	N16	0	4a	1a	18a
	N17	0	4a	16a	61ab
	N21	1	187c	85b	393c
Pratylenchus	N12	6	32	16	29
	N16	5	10	16	49
	N17	5	17	14	22
	N21	2	22	13	37
Helicotylenchus	N12	3	157	140	52
	N16	2	82	103	110
	N17	3	107	103	38
	N21	1	31	51	22

* Numbers in columns followed by a different letter are significantly different ($P<0,05$).

Table 4

Number of ectoparasitic nematodes per 100 ml soil

Nematode genus	Variety	Plant Pi	Ratoon P20	Ratoon Pf
Scutellonema	N12	13	38	21
	N16	16	59	26
	N17	14	31	12
	N21	9	11	11
Xiphinema	N12	10	79	91
	N16	10	50	85
	N17	6	71	94
	N21	10	44	88
Longidorus	N12	2	14	11
	N16	3	10	7
	N17	2	24	15
	N21	3	34	18
Paratrichodorus	N12	9	85	129
	N16	7	59	167
	N17	8	79	155
	N21	14	46	170

Discussion

The results of the trials indicate that, with the exception of N17 in the plant crop, all four varieties are susceptible to damage from nematodes. They also indicate that, provided a nematicide is used, N12 followed by N16 and N21 would be the varieties of choice on sandy soils. Without a nematicide N17, with its higher sucrose content, might be considered, but only for the warmer, frost-free areas.

The longer crop cycle in the Natal Midlands compared with the coastal regions means that the responses to nematicides are probably greater (Donaldson, 1985). This should make their use more attractive to the growers in this region.

The marked response to treatment with a nematicide in the ratoon crop, which experienced very low rainfall (88 mm) during the first five months might have been predicted from data from nematicide trials on Recent sands (Donaldson, 1985). In these trials the response to treatment was notably greater where rainfall was less than 200 mm during the first five months. Also the response to a nematicide of rainfed cane on a Recent sand was greater than that of irrigated cane (Donaldson and Turner, 1988). However, these observations contrast with those from a series of trials on TMS-derived loamy sand and sandy loam soils, where notable and consistent responses to treatment were recorded only when good rainfall occurred during the early stages of growth (Spaull, 1995).

Conclusions

The data show that N12 and N21 are good hosts to *M. javanica.* Judging from the large response to treatment with aldicarb and the probability that *M. javanica* is the most pathogenic of the nematodes present at the trial site, these two varieties are susceptible to this nematode. On the other hand, N16 and N17 are poor hosts to *M. javanica* but, whereas the response of N17 to treatment was small, at least in the plant crop, there was a large response in both crops of N16. These observations indicate that N17 is resistant to *M. javanica* and possibly is tolerant of other nematodes, whereas N16 is intolerant of the damage caused by *M. javanica* and/or is susceptible to damage from other nematodes.

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REFERENCES

Brown, DJF and Boag, B (1988). An examination of methods used to extract virus-vector nematodes (Nematoda: Longidoridae and Trichodoridae) from soil samples. *Nematol medit* 16: 93-99.

Donaldson, RA (1985). The effects of soil pH, clay content, rainfall and age at harvest on the yield response of sugarcane to Temik. *Proc S Afr Sug Technol Ass* 59: 164-167.

Donaldson, RA and Turner PET (1988). A preliminary report of the effect of soil moisture level on responses to Temik and Curaterr. *Proc S Afr Sug Technol Ass* 62: 164-168.

Lamusse, JP (1980). Fifty-fifth annual review of the milling season in southern Africa (1979-1980). *Proc S Afr Sug Technol Ass* 54: 1-21.

Lionnet, GRE (1994). Sixty-ninth annual review of the milling season in southern Africa (1993-1994). *Proc S Afr Sug Technol Ass* 68: xix-xxxix.

Ringelmann, EH (1980). The evaluation of nematicides on Mount Elias farm at Fawn Leas. *Proc S Afr Sug Technol Ass* 54: 158-160.

Seinhorst, JW (1950). De betekenis van de toestand van de grond voor het optreden van aantasting door het stengelaaltje (*Ditylenchus dipsaci* (Kuhn) Filipjev). *Tijdschr PlZiekt* 56: 289-348.

Spaull, VW (1995). Revised estimate of crop loss in sugarcane caused by nematodes. *Proc S Afr Sug Technol Ass* 69: In press.

Spaull, VW and Donaldson, RA (1983). Relationship between time of nematicide application, numbers of nematodes and response to treatment in ratoon sugarcane. *Proc S Afr Sug Technol Ass* 57: 123-127.