SOME ASPECTS RELATED TO THE USE OF NEMATICIDES ON SUGARCANE IN SOUTH AFRICA

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Abstract

Early data indicated that there was little improvement in cane quality when nematicides were used. Small improvements in cane quality from the application of nematicides have not been emphasised in past data. Recent summaries have shown that cane quality may be significantly improved and this contributes to nematicide responses in terms of sucrose yields. The situations under which cane quality improvements can be expected are not clearly defined. Residual responses to nematicides are given and the detection of growth differences at an early stage after applying test strips of nematicide show how application over the whole field can be avoided in ratoons when good residual responses are expected. Responses to Temik and Curaterr are compared and the results show that they should always be assessed according to continual changes in the cost of chemicals, payment for sugar, and profitability of sugarcane production.

Introduction

The production of sugarcane on poor sands has been made more profitable by the use of nematicides. Recent changes in the cane payment system (A vs B pool sucrose price) and the escalating costs of production have made it necessary to review several aspects that affect the use of nematicides. The factors which influence the responses to nematicides needed to be identified and defined more precisely if the use of nematicides is to remain profitable. It was not evident from previous information that under certain conditions there may be an increase in cane quality in response to the use of nematicides. This paper also contains evidence that treatment with a nematicide in one crop may result in a residual response in the following crop. To benefit from these residual responses, early responses to a nematicide must be detected. Observation plots (described by Clowes and Moberly[1]) may be used to test the effects of nematicides in marginal situations. More data has been accumulated to compare responses from Temik and Curaterr.

Method

Experiments were conducted along the coast in Natal and Zululand on sandy soils where nematode damage to sugarcane is prevalent. The experiments were of a randomised block design with replicated treatments (5 or 6 replications). Eleven experiments were of a Latin square design with treatments replicated 4 to 8 times. At the time of harvesting, guard rows and 1 m at the end of 3 or 4 net rows, 8 to 10 m in length, were discarded while the remaining cane was weighed to determine cane yields. Twelve stalks were taken at random from each plot after harvesting to determine cane quality. Soil samples were taken to determine clay content, pH and nutrient requirements. Cane in the experiments was fertilized according to the advice given by the Fertilizer Advisory Service of the South African Sugar Association Experiment Station.

The data from 91 crops at 46 sites were assessed to ascertain how cane quality may be affected by nematicides. The most commonly used sugarcane variety in these experiments was N55/805 but N8, NCo 376 and N13 were also used. In eight experiments (six with variety N55/805, one with NCo 376 and one with N8) the residual effects of Temik were assessed by comparing yields from cane that had not been treated with a nematicide (Table 1, Treatment 1) with yields from cane that had been treated in one crop but not in the following crop (Treatment 2). These yields were also compared with the yields of cane that had been treated with a nematicide in two successive crops (Treatment 3).

In four other experiments carried out to measure early growth responses to nematicide (Table 2) the number of stalks were counted in one net row (8 to 10 m long) and this information was used as an estimate of stalk populations per hectare. The height of the top visible dewlap (TVD) above the ground of 10 stalks in two adjacent net rows were also measured to determine the average stalk length in each plot. These growth measurements were done within 9 weeks

Table 1

Residual responses to Temik applied in the previous crop

Exp no	Crop	Variety	Clay (%)	pH	Rainfall % LTM	Treatment 1 (control)		Treatment 2 (residual)				Treatment 3 (Temik)			
						tc ha^{-1}	ts ha^{-1}	tc ha^{-1}	Δ	ts ha^{-1}	Δ	tc ha^{-1}	Δ	ts ha^{-1}	Δ
1	R1	N55/805	7	8,9	99	99	15,0	94	− 5	14,5	−0,5	104	− 5	15,9	+0,9
2	R2	N55/805	3	6,8		45	6,2	56	+11	8,0	+1,8	64	+19	9,1	+2,9
3	R2	N55/805	4-7	8,4	97	76	11,2	78	+ 2	11,8	+0,6	87	+11	12,9	+1,7
4	R1	N55/805	6	5,3	212	70	10,1	78	+ 8*	11,0	+0,9	81	+11	11,2	+1,1
5	R1	N55/805	6	8,6	82	52	7,4	58	+ 6	8,3	+0,9	—	—	—	—
6	R1	NCo 376	4	7,5	97	66	5,6	67	+ 1	4,6	−1,0	79	+13	5,9	+0,3
7	R2	N8	5	6,2	94	61	7,5	69	+ 8	8,5	+1,0	92	+31	11,6 +3,1	
8	R1	N55/805	6	5,0	87	70	11,1	81	+11*	13,2	+2,1	82	+12	11,8	+0,7
Mean						67	9,3	73	+5,3	10,0	+0,7	84	+14,6	11,2	+1,5

* = (P = 0,05)

Note Treatment 1, 1st and 2nd crop = no nematicide
Treatment 2, 1st crop = Temik; 2nd crop = no nematicide
Treatment 3, 1st and 2nd crop = Temik

from the time of harvesting the previous crop and 2 to 6 weeks after the nematicide had been applied. The variety N8 was used in these four experiments.

Table 2

Details of experiments showing early growth responses in variety N8

Exp no	Date applied	Interval between harvesting and application	Date of measure-ments	Interval between nematicide appln and measurements	Age at harvest (mths)
1	13 Dec	1 week	12 Jan	4 weeks	12,0
2	21 Sep	5 weeks	5 Oct	2 weeks	10,0
3	24 Nov	2 weeks	22 Dec	4 weeks	9,1
4	19 Dec	2 weeks	31 Jan	6 weeks	12,2

The yields were compared when Temik or Curaterr were applied at 3 kg ai ha^{-1} in plant cane at eight sites and in ratoon cane at six sites. Details are shown in Tables 3 and 4 respectively.

Results

Cane quality

The effects of nematicides on cane quality are summarised in Table 5. Positive responses were measured in 61 of the 91 crops. These changes in cane quality reached levels of statistical significance in 18 instances which represented 20% of all the cases. Cane quality was significantly lower in the treated cane than in untreated cane in only two instances. Of the 18 cases in which cane quality was significantly higher in treated cane, 14 were conducted on soils with less than 6% clay (Fernwood series soil). These 14 crops represented 28% of the total (50 crops) grown on the Fernwood series soils. The remaining 4 experiments represent 10% of the 41 experiments conducted on Clansthal series soils which had a clay content of more than 6%.

Table 3

Details and yields of experiments with Temik and Curaterr on plant cane

Experiment no	Site	Variety	Age at harvest (mths)	Soil		Yields t ers ha^{-1}				
				Clay %	pH	Contol	Temik	Response	Curaterr	Response
NT16	Tongaat	N55/805	13,2	6	5,2	10,3	12,4	+2,1*	12,3	+2,0*
NT17	Umdloti	M55/805	11,8	6	8,6	6,8	8,6	+1,8	8,0	+1,2
NT18	Mposa	N8	16,5	3	6,2	5,4	6,7	+1,3	5,1	−0,3
NT29	Chakas Rock	N8	13,4	4–11	6,6	10,2	11,0	+0,8	10,1	−0,1
NT29	Chakas Rock	N13	13,4	4–11	6,6	9,2	12,2	+3,0	11,1	+1,9
NT30	Groutville	N8	11,5	6	4,8	5,8	8,4	+2,6**	9,5	+3,7**
NT31	Groutville	N8	13,1	5	6,3	7,0	10,3	+3,3**	9,1	+2,1**
NT33	Emoyeni	N8	12,0	3	6,5	1,4	4,4	+3,0**	3,9	+2,5**
A/NTxWater	La Mercy	NCo 376	12,0	5–7	4,6	7,3	14,2	+6,9**	12,3	+5,0**
A/NTxWater	La Mercy	N18	12,0	5-7	4,6	9,2	12,9	+3,7	12,7	+3,5
Mean						7,0	9,3	2,2	8,6	1,6

* (P = 0,05)
** (P = 0,01)

Table 4

Details and yields of experiments with Temik and Curaterr on ratoon cane

Exp no	Crop	Site	Variety	Age at harvest (mths)	Soil		Yields t ers ha^{-1}				
					Clay %	pH	Control	Temik	Response	Curaterr	Response
NT18	R1	Mposa	N8	19,8	2	6,3	2,8	4,9	+2,1**	4,6	+1,8**
NT18	R2	Mposa	N8	10,1	2	6,3	1,2	4,5	+3,3**	2,6	+1,4**
NT27	R4	Tongaat	N55/805	14,7	6	5,7	8,0	10,2	+2,2**	8,2	+0,2
NT27	R5	Tongaat	N55/805	16,0	6	5,7	10,3	13,4	+3,1**	10,9	+0,6
NT28	R2	New Guelderland	NCo 376	17,9	3	7,6	6,0	7,2	+1,2	7,5	+1,5
NT29	R1	Chakas Rock	N8	16,6	4–11	6,6	10,0	9,9	−0,1	9,5	+0,4
NT29	R1	Chakas Rock	N13	16,6	4–11	6,6	9,8	12,8	+3,0**	10,9	+1,1
NT30	R1	Groutville	N8	16,9	7	4,9	7,2	10,2	+3,0*	11,9	+4,7**
NT35	R1	Groutville	N8	9,1	5	6,6	8,9	12,5	+3,6**	12,3	+3,4**
NT36	R1	Emoyeni	N8	12,0	2	6,4	3,3	7,6	+4,3**	6,6	+3,3**
NT37	R2	Emoyeni	N8	12,2	3	6,8	2,3	4,5	+2,2**	3,5	+1,2**
Mean							6,4	8,5	2,1	7,8	1,4

* (P = 0,05)
** (P = 0,01)

Table 5

Nematicide experiments and changes in ers % cane

Item	no change	−ve change	+ve change	Total
No of crops	5	25	61	91
No of statistically significant changes (P = 0,05)		2	18	

Residual responses

The mean residual response to applying Temik to the previous crop was 5,3 tc ha^{-1} in this series of eight experiments (Table 1). In Experiments 4 and 8 responses reached levels of statistical significance (P = 0,05). The average response from re-applying Temik in these eight trials was 14,6 tc ha^{-1}, which was 9,3 tc ha^{-1} more than the average residual response. In Experiments 4 and 8 there was little to be gained from the re-application of Temik when compared with the residual effects of Temik applied to the previous crop.

Growth responses

Details of experiments in which growth responses were measured are shown in Table 2. The growth measurements from treated and untreated cane taken at various intervals after applying a nematicide in the four experiments are shown in Table 6. Cane yields and growth measurements at the time of harvesting are also shown for each experiment. The average growth response in terms of height, measured 4 or 6 weeks after treatment in Experiments 1, 3 and 4, was 6 cm. There was no difference in height between the treated and untreated cane measured 2 weeks after treatment in Experiment 2. In all the experiments there were substantial increases in stalk numbers in the treated plots. At the time of harvesting the average difference in height between stalks of treated cane and untreated cane was 36 cm and there were on average 29 000 more stalks per hectare in the treated plots. The average increase in cane yield was 23 t ha^{-1}.

Temik vs Curaterr

The results of a number of trials in which the responses to Temik and Curaterr were compared in plant cane are given in Table 3. The average sucrose yields obtained when Temik and Curaterr were applied were 9,3 and 8,6 t ha^{-1} respectively. The results of the responses to Temik and Curaterr on ratoon cane yields are shown in Table 4. The mean yield from cane treated with Temik was 8,5 ts ha^{-1} and from cane treated with Curaterr was 7,8 ts ha^{-1}. The yields of cane treated with Temik were on average 0,7 t ers ha^{-1} greater from both plant and ratoon crops than the yields of cane that had been treated with Curaterr. In general, the responses to Temik were greater than those from Curaterr, only 3 out of 16 crops showing poorer responses to Temik.

Table 6

Early growth measurements and responses to nematicides

Details	Stalk heights (cm)		Stalk populations (× 1000 ha^{-1})		Cane yields (t ha^{-1})
	Experiment 1				
	12 Jan	At harvest	12 Jan	At harvest	At harvest
Control	16	150	241	104	28
Temik	22	189	267	134	57
Response	+8	+39	+26	+30	+ 29
	Experiment 2				
	5 Oct	At harvest	5 Oct	At harvest	At harvest
Control	10	164	158	144	69
Temik	10	210	169	188	92
Response	0	+46	+11	+44	+ 23
	Experiment 3				
	22 Dec	At harvest	22 Dec	At harvest	At harvest
Control	26	195	201	166	76
Temik	28	224	209	191	101
Response	+2	+29	+8	+25	+ 25
	Experiment 4				
	31 Jan	At harvest	31 Jan	At harvest	At harvest
Control	28	127	228	88	20
Temik	37	157	268	106	35
Response	+9	+30	+40	+18	+ 15

Discussion and Conclusions

Dick and Harris[2] reported that there were no consistent effects on cane quality following the application of Temik. Moberly *et al.*[3] however showed that responses to Temik in terms of improved cane quality were remarkably consistant but that the responses only reached levels of statistical significance in 12% of the trials. The data presented in this paper show that more than 65% of the responses have been positive, the remainder being either negative or showing no change in cane quality. The conditions which favour positive responses in terms of cane quality are still undefined. Improvements in cane quality reached levels of statistical significance in more than 25% of the experiments conducted on Fernwood series soils while on the Clansthal series soils only 10% were statistically significant.

Moberly and Rau[4] reported that a mean residual response to Temik in eight first ratoon crops was 10,4 tc ha^{-1}. At two sites residual responses attained levels of statistical significance (P = 0,05). They also reported that residual responses were greatest on Fernwood series soils.

The results reported in this paper confirm that residual responses in excess of 10 tc ha^{-1} may be obtained on acid soils with a very low clay content. The smaller residual responses in this series of trials may have been due to the slightly higher clay content in the soils of the experimental sites than in the soils from the sites quoted by Moberly and Rau[4]. Because residual responses were high in Experiments 4 and 8 and the responses to the re-application of Temik in Experiment 1 were small the re-application of Temik appeared to be unwarranted.

The early growth measurements from Experiments 1, 3 and 4 show that responses may be detected within 6 weeks of applying a nematicide. If obvious responses to nematicides are not visible within 6 to 8 weeks of re-applying a nematicide in observation plots (Clowes and Moberly[1]), nematicide should not be applied to the whole field because it is probable that the residual effects from treating the previous crop are adequate.

The data confirm that responses to Temik are often superior to those obtained from Curaterr in both plant and ratoon crops. As indicated by Clowes and Moberly [1] the cost of these two chemicals should be considered when assessing the overall economics of using each product.

REFERENCES

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