NEMATICIDE APPLICATION TO RATOON CROPS OF SUGARCANE GROWN ON SOME SANDY SOILS OF THE NATAL SUGARBELT

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Abstract

Results are reported of fourteen field experiments in which the granular nematicide Temik was re-applied to first ratoon cane which had also been treated with Temik at planting. The mean increase in yield as a result of re-treating compared with the untreated plots was 29 tc/ha or 1,8 tc/ha/month, which represented a 71% increase. In eight of the experiments the residual effect of Temik applied to the plant crop was measured in the first ratoon. This effect was positive in six out of the eight experiments, but in only two cases did the response attain a level of statistical significance. Rates of Temik and timing of application are also discussed. The new nematicide Vydate was also tested as a foliar application in three of the experiments and found to be ineffective.

Introduction

Large yield responses to nematicides applied to plant cane in sandy soils have been reported in recent years (Dick,[1] Harris,[2] Moberly[3]). To make the growing of sugarcane on the coastal sandy soils economically sound, it is essential that good yields should also be maintained in the subsequent ratoon crops. There is very little information available regarding the treatment of ratoon cane with nematicides, primarily because the alkyl halide nematicides EDB and DD tend to be phytotoxic to cane, and because Temik is a comparatively new nematicide. Harris[2] found that there was an average response of 23 tc/ha ($P > 0,05$) to the application of Temik to a first ratoon crop in one experiment at Tongaat. He also reported that there was an indication of a residual response in the first ratoon crop where the plant crop had been treated with either Temik or EDB. The opportunity to measure nematicidal effects on first ratoon crops, over a wide range of sandy soils, arose after the harvesting of the plant crops in the seventeen experiments of the "weak sands" project. This project was a co-ordinated investigation conducted by staff of the SASA Experiment Station into the causes of poor cane growth on the recent wind-blown coastal sands. The findings from this investigation, reported by Moberly *et al*,[3] were that nematode damage was the main growth limiting factor on the weak sands. The mean response to treatment with Temik on the seventeen sites was 34,5 tc/ha, equivalent to an increase of 2,7 tc/ha per month. Fourteen of these experiments were used in the investigation reported in this paper.

Methods and materials

The plant crops were harvested in the summer of 1972 and in the spring of 1973. The first ratoon crops were therefore grown during different seasons and the age at harvest varied from 12,5 to 18,5 months, averaging 16 months. The variety N55/805 was used in all the experiments.

Design

A simple randomised block design with three treatments replicated four times was the same for each experiment. Each plot comprised six cane rows each 12 m long and spaced 1,4 m apart, from which a net plot of 4 rows 10 m long was harvested. All experiments included a control treatment which received no nematicide in either the plant or first ratoon crops. The remaining eight plots, all of which received Temik in the plant crop, were re-randomised for the ratoon treatments, taking cognisance of yields obtained in the plant crop.

Nematicides

Temik was used in all experiments, generally at a rate of 56 kg of the 10% formulation/ha. Vydate was used in four experiments and applied as a foliar spray in a 1% solution and at a volume rate of approximately 350ℓ/ha. Two spray applications were made approximately 6 and 12 weeks after harvest, the total quantity of Vydate applied being approximately 7ℓ/ha. Agral at 0,2% v/v was added to the spray. In one experiment only Vydate was applied on three separate occasions also in a 1% solution, but at approximately 4-weekly intervals.

Application method

Temik was applied in a furrow ± 5 cm deep on one side of the cane row only and as near to the row as possible. It was covered with soil soon after application. In some experiments the plant crop had been burnt out, where a trash blanket was present, this was first removed, the Temik applied and then the trash re-spread. With one exception, the applications of Temik were made on the same day as the plant crop was harvested.

Fertilizer

Adequate nitrogen, phosphorus and potash fertilizers were applied, according to the criteria used by the Fertilizer Advisory Service. Third leaf samples were taken at intervals to monitor the nutritional status of the crops.

Growth measurements

Shoot counts and stalk heights were monitored throughout the period of the experiments.

Treatment comparisons

(i) *Temik versus control*

In 14 experiments a comparison could be made between the control treatment and Temik re-applied at various rates and at different times of the year, but in three instances Vydate was used as well.

(ii) *Control versus the residual effect of Temik applied to the plant crop at 56 kg/ha*

This comparison was made in eight of the experiments.

(iii) *Temik at 30 kg/ha versus 56 kg/ha*

This comparison was made in two experiments.

(iv) *Temik versus Vydate*

This comparison was made in three experiments.

(v) *Temik applied at harvest in winter versus Temik applied three months later in spring*

This comparison was made in only one experiment.

TABLE 1

The responses to Temik applied to first ratoon crops, the plant crops of which had also received Temik, compared with the untreated controls

Site No.	Co-operator	Response in tc/ha	Response in ters/ha	Yield in tc/ha per 100 mm rainfall		% increase in tc/ha	Soil series
				Treated	Control		
1	Grant	+ 66†	+ 10,2†	6	2	173	Fernwood
10	Poynton	+ 49†	+ 5,7†	4	1	612	Fernwood
9	Starre	+ 42†	+ 6,3†	6	2	182	Fernwood
13	Illovo	+ 39†	+ 4,4†	6	3	165	Fernwood
21	Umzimkulu	+ 35*	+ 3,6*	9	6	40	Fernwood
20	Brand	+ 33*	+ 5,9†	7	4	67	Fernwood
17	Ellingham	+ 32†	+ 3,9†	7	4	66	Kroonstad
16	Ocean View	+ 28*	+ 4,4†	8	5	43	Shepstone
7	Chennels	+ 26*	+ 4,4*	5	3	83	Fernwood
8	Mayer	+ 22	+ 3,5	5	3	64	Fernwood
14	Crookes	+ 17	+ 3,3	9	7	21	Waaisand
3	Dell	+ 11	+ 2,0	5	5	14	Waaisand
2	Hammar	+ 1	− 0,2	6	6	—	Waaisand
18	Tyak	− 8	− 0,2	8	8	—	Clansthal
	Mean	28,7	4,0	6,5	4,2		

* Statistically significant (P > 0,05)
† Statistically significant (P > 0,01)

Results

(i) *Yield response to Temik*

The yield responses in the 14 experiments in which the re-application of Temik was compared with the untreated controls, are given in Table 1.

It is clear that in general, the largest responses were obtained on the deep Fernwood sands, and the smallest responses were recorded on those sands which overlie either a clay layer or parent rock. There are indications that, although Temik increased yields substantially in most instances, it was still not always sufficiently effective to cause the potential yield of 9 tc/ha/100 mm rainfall to be attained. It would be remarkable if a problem as complex as that of nematodes could always be completely rectified by a single application of a relatively short-term nematicide treatment.

(ii) *Residual yield response in the first ratoon crop to 56 kg Temik/ha applied to the plant crop*

The residual responses measured in eight experiments are given in Table 2.

TABLE 2

Yield responses in the first ratoon crop to the residual effect of Temik applied to the plant crop at 56 kg/ha

Site No.	Co-operator	Yield response in tc/ha	Soil series
1	Grant	+ 21*	Fernwood
7	Chennels	+ 19	Fernwood
21	Umzimkulu	+ 19	Fernwood
12	Illovo	+ 16*	Fernwood
8	Mayer	+ 10	Fernwood
3	Dell	+ 6	Waaisand
18	Tyak	− 2	Clansthal
2	Hammar	− 6	Waaisand
	Mean	+ 10,4	

* Statistically significant (P > 0,05)

Characteristically, yield variability in the recent sands is high, and although in most instances there were positive responses to the residual effects of Temik, only at sites 1 and 12 did these attain a level of statistical significance (P > 0,05). The responses were again greatest on Fernwood series soils.

(iii) *Temik re-applied at 30 kg/ha versus 56 kg/ha*

Sites 17 and 20 were used to compare the two rates of application. The yield levels and responses to treatment were very similar on the two sites. The mean responses to 30 kg/ha and 56 kg/ha were respectively 25 and 33 tc/ha, or 4,3 and 5,4 ters/ha. These differences did not attain a level of statistical significance.

(iv) *Temik versus Vydate*

At sites 9 and 14, Temik at 56 kg/ha was compared with Vydate applied twice in a 1% solution. At site 10, where growth was particularly poor in the plant crop, the Temik was applied at 56 kg/ha immediately after harvesting the plant crop and again at 56 kg/ha eight weeks later. A second treatment was Vydate applied as a 1% foliar spray on three occasions at four-weekly intervals. The responses to these treatments are given in Table 3.

TABLE 3

Yield responses in tc/ha to treatment in the first ratoon crops with Temik and Vydate

Site No.	Co-operator	Temik	Vydate	Temik-Vydate
10	Poynton	49*	17	32
9	Starre	42*	22	20
14	Crookes	15	9	6
	Mean	35,3	16,0	19,3

* Statistically significant (P > 0,01)

It is evident that Temik was considerably more effective than was Vydate. It is questionable in fact, whether Vydate had any effect at all as the yield response in this case is confounded with the residual effect of Temik applied at the time of planting, and the mean residual effect of Temik was 10 tc/ha, as shown in Table 2.

(v) *Temik applied immediately after harvest in winter versus a delayed application in spring*

The plant crop on site 16 was harvested on 5th July 1973 and Temik was applied at 56 kg/ha immediately afterwards to four plots. The remaining four plots were treated on 1st October, approximately 12 weeks later. The responses to the re-application of Temik in winter and to the delayed application

in spring, were respectively 21 tc/ha and 34 tc/ha* ($P > 0,05$). The implications are, albeit from only one experiment, that it is beneficial to delay application of Temik on fields harvested in winter until the start of active spring growth. It must be noted that of the other 11 experiments in which a positive response to a re-application of Temik was recorded, seven were ratooned and treated in spring or summer to give a mean response of 36 tc/ha, and four were ratooned and treated in winter to give a mean response of 29 tc/ha. Although the difference is small there is some indication of an advantage to be gained from a spring or summer harvest if Temik is to be re-applied.

Discussion and conclusions

The mean response to the re-application of Temik has generally been substantial, particularly on soils of the Fernwood series. It is evident, however, that the treatment was less effective in the ratoon crops than it was in the plant crops, and that the yields in the ratoon crops frequently fell well short of climatic potential. The plant crop yields in terms of tc/ha/100 mm rainfall for the treated and untreated plots were respectively 8,5 and 5,7, whilst in the first ratoon crops the average results were 6,5 and 4,2 tc/ha/100 mm.

The crop growth variability within treatments increased in the ratoon crops, resulting in comparatively high coefficients of variation in all experiments. It is clear that Temik is being effective, but not completely so, in protecting the crop from parasitic nematodes. Accepting for the present that the local yield potential is 9 tc/ha/100 mm water, then it is clear that the average ratoon crop fell far short of this potential despite the application of Temik. In some instances the percentage increase in yield due to treatment with Temik was very large, and yet the maximum yield obtained in the experiments was relatively low. The extreme example is the experiment on site 10 where the control plots yielded only 8 tc/ha compared with the 57 tc/ha obtained from the plots that were treated twice with Temik. There are apparently some areas where the economics of using Temik are dubious, perhaps because of the high nematode populations, or a predominance of a particularly harmful nematode genera, or because the soil texture is very sandy. It is quite possible that the method of nematicide application used in the majority of these trials, i.e. a single application on only one side of the cane row, was not particularly efficient and that a number of split applications applied on either side of the cane row could have been much more effective.

The comparison of Temik rates on ratoon crops indicates that the optimum economic level will be approximately the same as that currently registered for plant cane, i.e. 30 kg of the 10% granule per hectare. A higher level than 30 kg/ha did tend to increase yields, but to an extent that would not be economically warranted.

Until such time as a technique is found for applying Temik under a trash blanket it will be necessary to burn a crop in order to treat the succeeding ratoon with Temik. Despite the many well-known advantages of a trash blanket on the sugarbelt of Natal, the results obtained from this investigation indicate clearly that, where a severe nematode problem is known to exist, burning the crop and treating the next ratoon with Temik should be sound practice. The results of these experiments, however, refer exclusively to ratoons following plant crops which were themselves treated with Temik. Experiments are currently being conducted to measure the extent to which crops grown in nematode infested soils and not treated with Temik at planting can be rejuvenated in the ratoon stage. The indications are that the response, in terms of crop growth, to treatment with Temik are very substantial, but yield results are not yet available.

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