RATE, TIME AND METHOD OF TEMIK APPLICATION IN RATOON SUGARCANE

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Abstract

Treatments in eleven field experiments on ratoon sugarcane of variety N55/805 included: rates of Temik ranging from 1,5 to 6,0 kg ai/ha, placing Temik on one or both sides of the row, delaying the time of Temik treatment and applying half the Temik as a topdressing. The recovery of poor, nematode infected plots of sugarcane that received Temik only in the second ratoon crop, and the effect of omitting Temik treatment in one of three successive crops, were also investigated.

Temik increased cane and sugar yields appreciably in all experiments but there was little response to rates above 1,5 kg ai/ha. There was no statistically significant difference between applying Temik to one side or to both sides of the row. Delaying application for 6 to 9 weeks did not reduce the response to Temik in either one winter or six spring ratooned crops. In one experiment, Temik was more effective when applied at 6 or 9 weeks than when applied initially or at 3 weeks.

Previously untreated sugarcane made a remarkable recovery in 5 experiments when Temik was applied for the first time to the second ratoon crop, yielding only 5 tons of cane per hectare (tc/ha) and 0,8 tons estimated recoverable sugar per hectare (ters/ha) less than sugarcane that had always been treated with Temik.

Not treating with Temik in the first ratoon crop in one experiment caused the yield of the treated second ratoon crop to be 17 tc/ha and 2,3 ters/ha less than when all crops were treated.

Introduction

The application of Temik to poor sandy soils on the Natal Coastal Belt has given average yield increases, over a number of experiments, of 35 tons cane per hectare in sugarcane plant crops (Moberly, Harris and Millard[3]) and 29 tc/ha in ratoon crops (Rau and Moberly[4]). The optimum rate of Temik for plant crops is between 1,4 and 2,8 kg ai/ha (Harris[1]) but the best rate for ratoon crops has not yet been determined. In a number of ratoon crop experiments Rau and Moberly[4] found little difference in response between application rates of 3,0 and 5,6 kg ai Temik per hectare.

Temik applied to a plant crop has a beneficial residual effect in the first ratoon crop, of some 10 tc/ha (Rau and Moberly[4]), which suggests that it may be possible to reduce the amount of Temik applied below that required by plant crops. On the other hand the better growth of nematicide treated plants results in an increase in soil nematode populations by comparison with those in control plots (Harris[2]). This suggests that it may be necessary to use as much Temik in a ratoon crop as in a plant crop.

A number of experiments were therefore designed in an attempt to determine the optimum rate of Temik for ratoon crops. Because sugarcane is often harvested during dry winter conditions and because Temik requires adequate soil moisture to be effective, various delayed and split Temik treatments were included in these experiments, which were started between July and November, 1974. A comparison was also made between placing the Temik on one side, or on both sides of the cane row.

It is of considerable practical value to know whether it is necessary to plough out low yielding fields in order to re-establish them after treatment with Temik, or whether they can be resuscitated without replanting. Six of the 17 trials in the weak sand project reported by Moberly *et al*[3] and Rau and Moberly[4] were therefore continued into the second ratoon crop, in an attempt to answer this question.

In one experiment the effect of treating plant and second ratoon crops, but not the first ratoon, with Temik was compared with treatment of all crops. In five other experiments all plots were treated in the second ratoon, including control plots, which had not received Temik in either the plant or the first ratoon. In half of the plots the Temik was split and applied on two occasions.

Methods

Details of the experiments, which were on co-operating estates, are outlined in Table 1. They were of a randomised block design and the 5 row plots ranged in size from 70m^2 to 91m^2. Wherever treatments were superimposed on an existing experiment, previous treatments and yields were taken into account when randomising the new treatments and analysing the results.

Variety N55/805 was used in all experiments and fertilized according to the recommendations of the Fertilizer Advisory Service of the South African Sugar Association Experiment Station. The previous crop was burnt in all experiments to facilitate the application of Temik. This was placed by hand in a 5-10 cm deep furrow, as close to the cane row as possible, and covered with soil.

Stalk counts and height measurements were made during the growth of the crops. At harvest cane mass per plot was recorded and samples of 12 stalks per plot were taken for whole stalk analysis by standard methods. Stalk counts and heights were also recorded at harvest.

Treatments

Full details of the range of Temik treatments are given in Table 1. An untreated control was included in Experiments 1-5. The standard rate of Temik application (T20) was 20 kg/ha of a 15% granular formulation (15G), giving 3,0 kg ai/ha. In Experiment 1, a 10% formulation (10G) was used but the treatments have been converted to the equivalent of the 15% formulation for ease of comparison. Placing Temik on one side or on both sides of the row was investigated in Experiments 2 and 5.

Except in Experiments 6-11, initial Temik treatments were applied within 7-10 days of cutting the previous crop, and the second half of any split treatment (designated T10 + 10 etc) was applied six weeks later. In some instances Temik was not applied until several weeks after the crop had begun to grow and these treatments have been designated T20d3, etc (ie 20 kg Temik 15G per hectare applied after a delay of 3 weeks).

TABLE 1
Details of the experiments

Experiment	Site	Started	Crop	Harvest age (months)	Temik 15G treatments (kg/ha)
1	Padget 1	18 Jul. 1974	R2	16,2	20*, 20d6*, 10 + 10*, 40*, 40d6*, 20 + 20*
2	Padget 2	29 Aug. 1974	R2	14,9	10, 20, 20**, 30
3	Partridge	23 Sept. 1974	R1	13,0	10, 15, 20, 20d3, 20d6, 20d9, 10 + 10, 30, 15 + 15, 40, 20 + 20
4	Umdhloti	22 Oct. 1974	R2	11,8	10, 15, 20, 30, 40
5	Padget 3	14 Oct. 1974	R1	13,4	10, 10**, 20, 20**
6	Illovo	14 Jan. 1974	R2	16,5	37 + Nematicide foliar spray
7	Grant	13 Aug. 1974	R2	15,7	26*, 13 + 13*
8	Starr	12 Sept. 1974	R2	14,5	
9	Chennels	26 Sept. 1974	R2	14,0	
10	Ellingham	31 Oct. 1974	R2	13,2	
11	Ocean View	31 Oct. 1974	R2	13,2	

* Temik 10G applied but rate has been adjusted to 15G formulation.
** Applied to one side of row only, all other treatments to both sides.

In Experiment 6 Temik was applied after a delay of 4 weeks and two foliar applications of another nematicide were applied by spraying to all the Temik treated plots 3 and 6 weeks later. These spray applications did not affect the treatment comparisons referred to in this paper. In experiments 7-11, the initial Temik treatment (T26) was made 6-8 weeks after the crop had begun to grow and the second half of the split treatment (T13 + 13) was applied between 13 and 21 weeks after growth recommenced.

Results

Experiment 1: *Temik rates, delayed and split treatments on a July ratooned crop*

Soil conditions were dry when both initial and delayed Temik treatments were applied as there were only 15 mm of rain at the beginning of July and 9 mm between the initial application on 18 July and the delayed application 6 weeks later. Total rainfall was 50 mm during the first three months of growth. Despite these dry conditions and considerable variability in crop growth there was a statistically significant average response to Temik of 23 tc/ha and 3,2 tons estimated recoverable sugar (ters/ha) (Table 2). There was no difference in the response to Temik at the different rates, and splitting or delaying the application did not significantly affect the result.

TABLE 2
The effect of rates of Temik on the yield and quality of July ratooned sugarcane

Temik 15G (kg/ha)	Tc/ha	Ers % c	Ters/ha
0	38	13,6	5,1
20	58	13,2	7,7
40	64	14,0	8,9
Mean	53	13,6	7,2
L.S.D. (0,05)	17,6	0,7	2,5
C. of V. (%)	25,1	4,2	26,3

Experiment 2: *Temik rates and placement in an August ratooned crop*

Temik applied at 10 kg/ha gave large, statistically significant increases in yield of 21tc/ha and 3,1 ters/ha (Table 3). There was no significant difference in response at the higher rates of Temik and there was no difference between applying Temik on one side, or on both sides of the row.

Experiment 3: *Temik rates, delayed and split treatments, on a September ratooned crop*

When all the Temik was applied 4 days after harvesting the previous crop there was no statistically significant response to Temik at any of the rates of application, which ranged from 10 to 40 kg/ha (Fig. 1). For rates of Temik above 10 kg/ha however, there was a small but consistent increase in both tons cane/ha and ers % cane which resulted in an increase in ters/ha.

TABLE 3
Temik rate and placement in an August ratooned crop

Temik 15G (kg/ha)	Tc/ha	Ers % c	Ters/ha
0	46	13,8	6,3
10 both sides of row	67	13,6	9,4
20 one side of row	72	13,6	9,9
20 both sides of row	67	13,2	8,8
30 both sides of row	76	14,0	10,6
Mean	66	13,7	9,0
L.S.D. (0,05)	8,6	1,0	1,3
(0,01)	12,1	1,4	1,8
C. of V. (%)	9,4	5,2	10,3

When the application of 20 kg/ha Temik was delayed by 6 or 9 weeks there was a statistically significant improvement in both cane quality and sugar yield. Similar improvements in yield and quality also occurred where half the Temik was applied after a delay of 9 weeks, but there was again no difference between rates of Temik ranging from 10 + 10 kg/ha to 20 + 20 kg/ha.

These higher yields were due to increases in both stalk population and stalk length, which usually occur after Temik treatment. At harvest however, the stalk populations in Experiment 3 were uniformly low by comparison with those in other experiments (Table 4).

TABLE 4
The effect on stalk population at harvest (in thousands per ha) of rates of Temik applied initially

Temik 15G (kg/ha)	Experiment			
	1	2	3	4
0	89	101	80	103
10	—	105	82	116
20	104	106	77	120
30	—	114	77	103
40	110	—	80	117
Mean	101	106	79	112

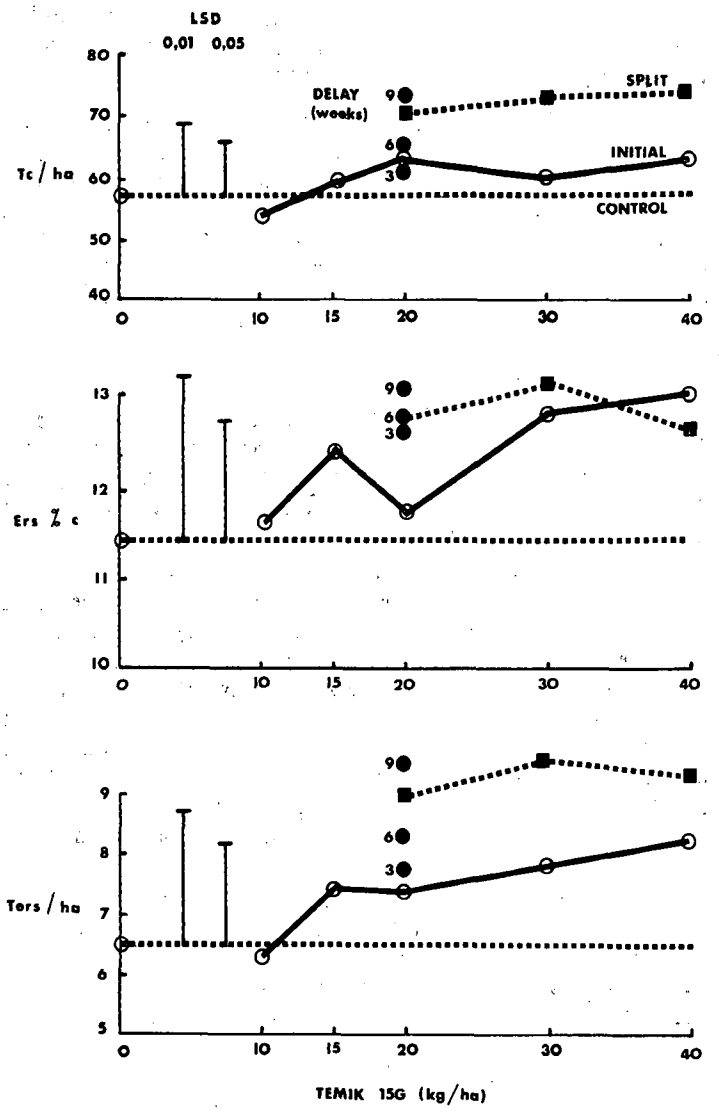

FIGURE 1 Rate, time and method of Temik application in a September ratooned crop.

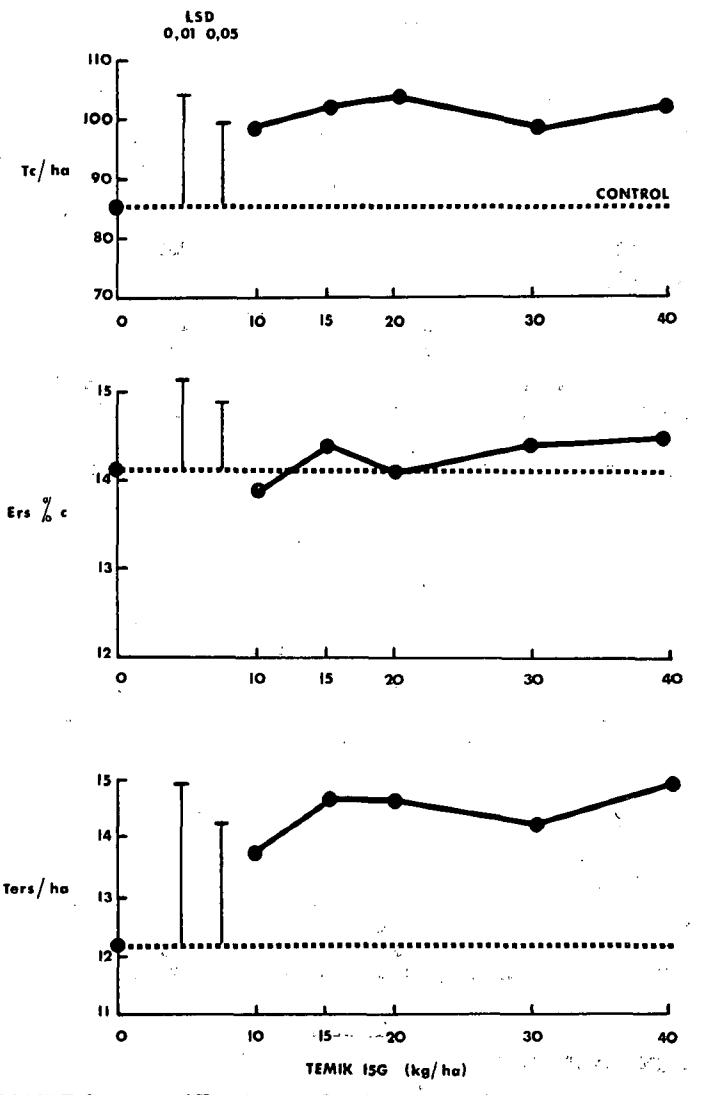

FIGURE 2 Rates of Temik in an October ratooned crop.

Experiment 4: *Rates of Temik applied to an October ratooned crop*

Temik gave a statistically significant increase in cane and sugar yields in this experiment (Figure 2). There was no statistically significant difference among rates of Temik but there was an indication of a slight increase in ters/ha when the amount of Temik was increased from 10 to 15 kg/ha.

Experiment 5: *Temik rate and placement in an October ratooned crop*

There was no statistically significant response to the treatments but at a rate of 10 kg/ha there was an indication that it was better to apply the Temik to both sides of the cane row rather than to one side only. (Table 5).

TABLE 5

Temik rate and placement in October ratooned sugarcane

Temik 15G (kg/ha)	Tc/ha	Ers % c	Ters/ha
0	73	14,3	10,5
10 one side of row	76	13,8	10,6
10 both sides of row	84	14,2	11,9
20 one side of row	83	13,8	11,5
20 both sides of row	87	13,5	11,7
Mean	81	13,9	11,2
L.S.D. (0,05)	13,2	0,7	2,0
C. of V. (%)	11,6	3,9	13,0

Experiment 6: *Omitting one Temik application in three crops*

There was a large increase in cane and sugar yield in the second ratoon crop following nematicide application, even where the previous first ratoon crop had not been treated (Table 6). There was, however, an additional yield increase of 17 tc/ha or 2,3 ters/ha when nematicide had been applied to both first and second ratoons.

TABLE 6

The effect of not treating a first ratoon with Temik on the yield and quality of treated second ratoon sugarcane

Temik 15G (kg/ha)			Tc/ha	Ers % c	Ters/ha
Plant	1st ratoon	2nd ratoon			
0	0	0	88	13,4	11,8
37	37	26	148	13,8	20,4
37	0	26	131	13,8	18,1
Mean			123	13,7	16,8
L.S.D. (0,05)			12,2	1,0	1,7
(0,01)			18,4	1,5	2,6
C. of V. (%)			5,7	4,1	5,8

Experiments 7-11: *Split applications of Temik on previously treated or untreated sugarcane*

Sugarcane in plots that had not received any Temik until the second ratoon showed a remarkable recovery in this crop, stalk population and stalk height improving in comparison with the preceding plant and first ratoon crops. As a result

of this improved growth the average yield of second ratoon crops that had received Temik as plant, first and second ratoons was only 5 tc/ha or 0,8 ters/ha higher than where Temik had been applied in the second ratoon only (Table 7). The extent of the recovery of these plots is well illustrated by comparison with yields in the first ratoon crop, which were so poor that treatment with Temik increased them from 41 tc/ha to 70 tc/ha, an increase of 71 %. There was no difference in response between applying all the Temik on one occasion, or splitting and applying it on two occasions.

The average second ratoon cane yield of 71 tc/ha from plots that had always received Temik was similar to that of the first ratoon crop but in terms of the average efficiency of rainfall utilisation at these sites there was a gradual decline from crop to crop (Table 8). This decline was most marked in Experiment 10 in which second ratoon yields were very low (Table 7).

TABLE 7

The response of a second ratoon crop to two Temik treatments

Exp. No.	Treatment A* Cane yield (Tc/ha)	Response (Treatment B − A)*		
		Tc/ha	Ers % c	Ters/ha
7	59	+ 6	0	+ 1,0
8	94	+ 3	0	+ 0,3
9	66	+ 8	+ 0,2	+ 1,6
10	39	+ 5	+ 0,5	+ 0,2
11	70	+ 2	0	+ 0,8
Mean	66	+ 5	+ 0,1	+ 0,8

* Treatment A: 26 kg/ha Temik 15G applied to the 2nd ratoon crop only. Treatment B: 37 kg/ha Temik 15G applied to both plant and first ratoon crops plus 26 kg/ha to the second ratoon crop.

TABLE 8

Sugarcane productivity per unit of total rainfall (tc/100mm) for Temik treated plant and ratoon crops

Site	Crop		
	Plant	1st ratoon	2nd ratoon
7	8	6	5
8	5	5	6
9	7	6	8
10	9	7	3
11	10	8	5
Mean	7,8	6,4	5,4

Discussion

Rate of Temik application

In none of the four experiments in which rates of Temik were compared was there a statistically significant response above a rate of 10 kg/ha of the 15% formulation. Nevertheless, in Experiments 3 and 4 there were small and fairly consistent improvements in cane yield and quality between rates of 10 and 15 kg/ha, which were maintained but not increased at the higher rates of application. Low rates of Temik had not previously been tested in ratoon crops, although Moberly *et al*[3] did not detect any differences between rates of 20 and 36 kg/ha when these were applied to one side of the row only.

The results reported here follow a pattern similar to that of the plant crop experiment reported by Harris,[1] in which there was a further yield increase of only 5 tc/ha when the rate of Temik 15G was doubled from the equivalent of 9,5 kg per hectare to 19 kg/ha. Presumably, the known residual effect in the following ratoon of Temik applied to the plant cane (Rau and Moberly[4]) is more than sufficient to compensate for the increased nematode population observed in good crops of sugarcane grown in sandy soils (Harris[2]).

On the basis of the results reported in this paper the rate of Temik for ratoon crops can be reduced from 20 to 15 kg/ha of the 15% granular formulation. It is not considered advisable to apply less than this amount because of the apparent, though small, response between rates of 10 and 15 kg/ha (Figs. 1 and 2), and the possible variation in rate and evenness of nematicide application under commercial conditions, caused by such factor as wheel slippage and normal wear of machine parts.

Time of Temik application

There was a remarkable degree of latitude in the time of Temik application under both winter and spring conditions. The response to Temik was similar for crops cut in July and August when it was dry and in October, shortly before the onset of the spring rains.

Only in Experiment 3 was there a positive response to delaying or splitting the Temik applied (Fig. 1). The stalk counts suggest (Table 4) that the results in this experiment may have been influenced by some other factor connected with weather or management. Rainfall was heavy at the time of the 9 week Temik application (Fig. 3) and the positive response obtained at this time indicates that the rain was, if anything, an advantage. Possibly the highly soluble Temik was carried to the lower soil horizons and so protected a larger portion of the root system than would have been the case with lower rainfall.

From the results of these experiments it may be concluded that there was no disadvantage, under either wet or dry soil conditions, in delaying the application of Temik by as long as nine weeks after harvesting the previous crop. Further experiments will be necessary to test this conclusion.

Method of Temik application

There was no advantage in applying Temik to both sides of the sugarcane row rather than to one side, except possibly

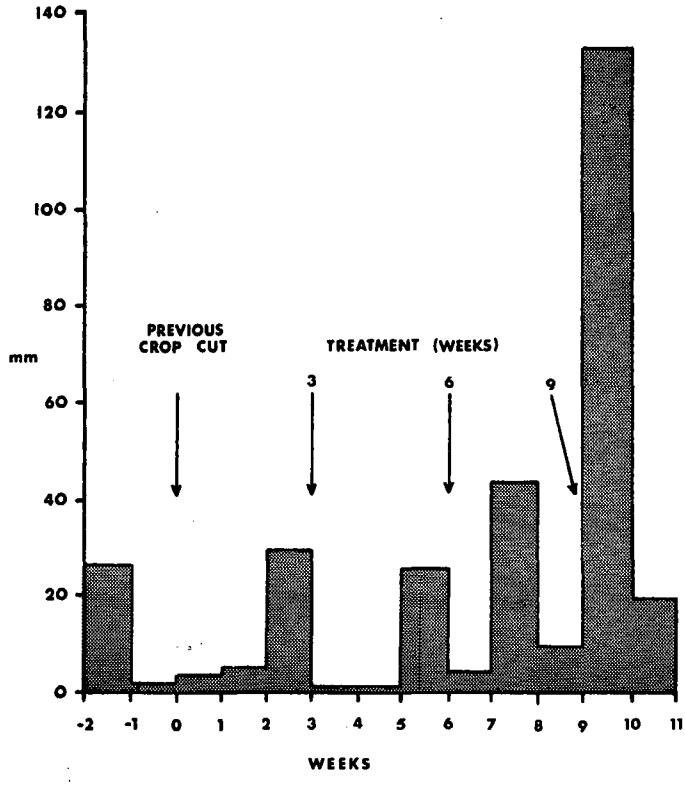

FIGURE 3 Weekly rainfall at the start of Experiment 3.

at the low rate of 10 kg/ha (Table 5). Nevertheless, if the recommended rate of Temik 15G was reduced from 20 to 15 kg/ha it would be preferable to apply the material to both sides of the row in order to provide protection for as much of the root system as possible.

Splitting the Temik application was effective only in Experiment 3 when timing in relation to weather conditions may have been important in determining the response (Fig. 1). It is possible that the lack of further response to splitting the Temik application in Experiments 7-11 was because the initial 13 kg/ha of the split application was adequate; there was little response at rates above 10 kg/ha in other experiments. It is also possible that applying the second part of the treatment between 8 and 13 weeks after the crop had begun to grow was too late for it to be effective. Further work will be necessary to determine whether split or delayed Temik applications would be effective at lower rates than those tested here.

Recovery of poor crops after Temik application

The improved growth and yield of crops of variety N55/805 that had not previously received Temik was spectacular and consistent in Experiments 7-11 in which Temik was applied for the first time to second ratoons. Despite a delay of between 6 and 8 weeks in applying Temik in these experiments, there was only a small yield difference in the second ratoon crop between sugarcane that had never been treated before and sugarcane that had been treated in every crop. The delay in application would presumably place the previous control plots at an even greater disadvantage, compared with previously treated plots in which there would be some residual effect of Temik.

The yield response was consistent in Experiments 7-11 and did not appear to be affected by rainfall or soil moisture conditions. The rainfall between cutting and the first Temik application was approximately 50 mm for Experiments 7-9 and 375 mm for Experiments 10 and 11. It is evident therefore that, in fields seriously infected with nematodes and where the stool population has not declined too seriously, Temik application will increase yields significantly, and replanting can be delayed.

Conclusions

The response to Temik 15G was not affected when the rate of application in ratoon sugarcane was reduced from 20 to 15 kg/ha.

There was no statistically significant difference between applying Temik to one side or to both sides of the sugarcane row, but it is preferable under commercial conditions to place Temik on both sides in order to improve the uniformity of distribution of the chemical in the soil.

The timing of Temik application to ratoon crops, up to at least 9 weeks after cutting the previous crop, did not appear to be critical under either wet or dry soil conditions. Under some, as yet undefined conditions, there may be some advantage in delaying the application of Temik by 6 to 9 weeks.

Nematode-infested ratoon crops of sugarcane which had never been treated with Temik, but which had a good, even population of stools, gave large yield increases following Temik application to the second ratoon crop.

Acknowledgements

It is a pleasure to acknowledge the willing assistance of the co-operators on whose farms and estates these experiments were carried out. Thanks are also due to all members of the Agronomy department of the South African Sugar Association Experiment Station who assisted with these experiments, to staff of the Chemistry department for cane analyses and to staff of the Biometry department for advice and for analysis of the data.

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