EPTAM SUPER AND SUTAN PLUS FOR CONTROL OF *CYPERUS ROTUNDUS* L. IN PLANT CROPS OF SUGARCANE

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Abstract

Although *C. rotundus* L. can be suppressed by herbicides or cultural practices, acceptable control of this weed in the rows of plant cane has not been achieved. Eptam Super (EPTC + a safener R25788) and later Sutan Plus (Butylate + R25788), were evaluated in trials for control of *C. rotundus* L. in plant cane. In other trials, the safety of these products on sugarcane variety NCo 376 was tested. Very good control of *C. esculentus* and grasses was achieved with the herbicides while the control of *C. rotundus* L. was superior to that obtained with other treatments. The effectiveness of weed control was not affected by the planting operation but it was essential for the chemicals to be efficiently incorporated in the soil for good weed control. No phytotoxic effects were recorded on plant cane of variety NCo 376 when the products were applied at twice the recommended rates.

Introduction

Cyperus rotundus L. has been cited as a serious weed of sugarcane in many countries including South Africa (Holm *et al*[1]) where a 100% ground cover can occur. The severe competitive effects of this weed on many crops have been shown (Holm *et al*[1], Meissner *et al*[3]) and recent work in Mauritius has quantified the effect on the growth and yield of sugarcane (MSIRI Annual Reports 1980, 1981).

Research in South Africa has shown that good control of emerged *Cyperus rotundus* plants can be achieved with 2,4-D and paraquat and that pre-emergence control could be achieved with EPTC in plant cane (Thompson and Gosnell[5]). There was however, no further development of EPTC probably because of its inhibiting effect on the growth of young cane (Gosnell and Thompson[2]), and because the chemical had to be incorporated into the soil. The subsequent discovery and use of the safener R25788 meant that the potential for the use of EPTC in sugarcane fields warranted re-examination.

It was necessary first to test whether the safener did protect the crop from damage and then to confirm that EPTC + R25788 (Eptam Super) could be used satisfactorily within the normal sugarcane planting system. The seven experiments which are reported cover both weed control efficacy and phytotoxicity and in later trials, the development of a similar product, Sutan Plus (Butylate + R25788).

Experiments 1 to 3 formed part of the Experiment Station's standard pre-emergence herbicide efficacy testing programme. Experiment 4 was conducted specifically to assess the product's efficacy against *Cyperus rotundus* under normal sugarcane planting conditions. Experiments 5 to 7 were designed to test the phytotoxicity of the products Eptam Super and Sutan Plus on the plant crop of sugarcane variety NCo 376. Experiment 5 was conducted in pots and Experiments 6 and 7 were conducted in the field.

Procedure

A randomised block design was used in each of the experiments except Experiments 2 and 3 where treatments requiring incorporation into the soil were applied alongside the standard screening experiments which were of a randomised block design. Plot sizes for the efficacy experiments varied between 8 m × 2,5 m and 40 m × 2,5 m while those of the phytotoxicity experiments ranged from 10 m × 3,2 m to 5 rows × 8 m × 1,4 m. Treatments were applied by means of gas or lever-operated knapsack sprayers fitted with two 8004-E Spraying Systems fanjets or a single TK5 Spraying Systems floodjet. Spray volume was between 200 and 300 ℓ/ha.

Incorporation of the chemicals into the soil was achieved by means of garden rakes (Experiments 1 and 6) or by a tractor-drawn disc-harrow. The time between application and incorporation was short, usually less than 2 minutes with tractor-drawn equipment but longer delays of up to 5 minutes occurred when rakes were used. The depth to which chemicals were incorporated was estimated to be between 100 and 150 mm.

In Experiments 3, 4 and 7, furrows were drawn a few days after herbicides had been applied and incorporated in order to simulate soil disturbances which occur during planting. These furrows were either covered immediately to simulate planting by machine or some days later as could occur with hand planting.

Weed control experiments were evaluated by means of visual ratings based on the European Weed Research Council (EWRC) system using a 1-9 scale where 1 = complete control, 4 = just acceptable, 5 = just unacceptable and 9 = no control. Since weeds also occurred in phytotoxicity experiments some evaluations of herbicide efficacy were carried out.

In Experiment 6, sugarcane variety NCo 376 was planted before herbicides were applied and incorporated in the soil, while in Experiments 5 and 7 it was planted after the herbicides were applied. Shoot populations, stalk lengths and the mass of either the above ground parts of the plants or the yield of sugarcane, were recorded and used to evaluate phytotoxic effects.

Soil characteristics at each site are presented in Table 1 while soil and climatic conditions prior to, during and after treatment in each experiment are presented in Table 2.

TABLE 1
Soil characteristics of experiment sites

Experiment No.	Site	Experiment type	Soil physical analysis				
			Clay %	Silt %	Sand %	*OM %	** CEC (me%)
1	La Mercy	Efficacy	7	-	-	-	-
2	La Mercy	Efficacy	2	4	94	1,39	3,2
3	La Mercy	Efficacy	10	4	87	0,79	4,18
4	Shakaskraal	Efficacy	17	14	69	2,06	6,56
5	Mt Edgecombe	Phytotoxicity	53	19	28	2,01	-
6	Shakaskraal	Phytotoxicity	7	-	-	-	-
7	Shakaskraal	Phytotoxicity	17	14	69	2,06	6,56

*OM % = organic matter %
**CEC(me%) = cation exchange capacity (milli-equivalent %)

TABLE 2

Soil and climatic conditions prior to, during and after treatment in each experiment

Experiment No.	Soil moisture % at spray (0–50 mm depth)	Rainfall (mm)				Days to first rain	Temperature °C	
		1 week before spray	Day of spray	Amount of first rain	2 weeks after spray		8 am	2 pm
1	12,5	9,0	2,8	2,8	31,2	0	15,6	18,8
2	3,7	2,9	0	2,2	40,0	1	17,8	28,2
3	7,7	30,4	7,2	7,2	135,1	0	21,0	23,8
4	2,3	0,4	0	36,0	46,6	3	22,0	20,8
5	Moist	Perfo-rainer irrigation					24,8	26,2
6	Dry	34,4	0	2,6	15,4	12	11,4	24,8
7	2,3	0,4	0	36,0	46,6	3	22,0	20,8

Results and Discussion

Results of four efficacy experiments are shown in Table 3. In three of the experiments (2, 3 and 4) superior control of *Cyperus rotundus* and of *Cyperus esculentus* was obtained by Eptam Super and Sutan Plus when compared with standard surface-applied herbicides such as Lasso + atrazine or Destun. The control of grass after treatment with the soil-incorporated products was usually either similar to or better than the control obtained with the standard treatments. However, very poor control of all weeds was achieved by incorporated herbicides in Experiment 1 and only fair control of *Cyperus esculentus* and poor control of grasses was achieved in Experiment 3.

TABLE 3

Visual ratings* of weed control in four experiments

Treatments	Expt. No.	4	1 2 3	2	1 2 3	1 3
	Days after treatment	58	67 66 51	66	67 66 51	67 51
	Rate in ℓ prod/ha	*C. rot*	*C. esc*	*P. max*	Grasses	Broadleaf
Lasso + atrazine	5 + 2		7 7 7	5	3 2 4	3 2
Destun	5 kg	9	– – –	–	– – –	– –
Eptam Super + atrazine	3 + 3	–	9 – –	–	8 – –	9 –
Eptam Super + atrazine	6 + 3	–	8 – –	–	8 – –	8 –
Eptam Super	3	4	– 3 6	4	– 2 8	– 5
Eptam Super	5	–	– 2 3	2	– 1 5	– 4
Eptam Super	6	4	– – –	–	– – –	– –
Sutan Plus	4	5	– 2 4	2	– 1 5	– 4

* Ratings are based on a 1–9 scale where 1 = complete control, 4 = just acceptable, 5 = just unacceptable and 9 = no effect

Incorporation of the herbicide into the soil in Experiment 1 was done with garden rakes and there was some delay in completing all the plots. The soil moisture content at the time of spraying was 12,5% compared with 3,7% and 2,3% in Experiments 2 and 4, in which better control was achieved. Thus inefficient incorporation into the soil and a high soil moisture content are the factors likely to have been responsible for the poor weed control. High soil moisture has been shown to increase the rate at which Eptam Super is lost from the soil surface (Schreiber and White[4]).

In Experiment 3, control of *Cyperus esculentus* was better after treatment with incorporated herbicides but this was evident only at rates higher than those recommended for this particular soil type (10% clay). Control of grass was inferior at all rates to that obtained with the standard Lasso + atrazine treatment. Although incorporation was effected immediately after application by a tractor-drawn offset disc-harrow, the subsequent drawing of furrows and consequent soil movement may have affected the amount of control that could be expected. Some soil movement was evident in the plots where soil incorporation of chemicals had taken place after 135 mm of rain which fell in the two weeks after application. This may have further affected the weed control.

In Experiment 5 which was conducted to test the effects of Eptam Super on plant cane, weeds emerged in most pots but were controlled to various degrees by the treatments (Table 4). As a result, cane in untreated control pots yielded less than cane in all treated pots and comparisons have been made preferably with Lasso + atrazine, the standard treatment. Results are expressed as a percentage of the yields of cane in unsprayed control pots. Yields of above ground parts of the plant appear to follow the trend in weed control, with Lasso + atrazine producing the highest yields and best weed control. The poor weed control achieved by Eptam Super treatments suggests that incorporation into the soil may not have been adequate and some volatilization may have taken place. Consequently the rates of Eptam Super applied were probably not retained in the pots and hence the safety of the product, as indicated by the results, would require confirmation.

TABLE 4

Mass of dried above ground parts of treated potted plant cane expressed as a percentage of the mass of unsprayed control plants. Weed control ratings are included.

Treatments	Rate in ℓ prod/ha	Crop measurements			Weed control ratings		
		Mass % of control	Shoot height	Shoot popn.	*R.* exaltata*	Other Grasses	Broadleaf
Lasso + atrazine	10 + 6	166	115	147	2	1	1
Eptam Super	6	116	90	97	8	3,7	-
Eptam Super	12	136	102	101	7	2,5	-
Eptam Super + atrazine	6 + 3	132	104	133	5,8	1	1
Eptam Super + atrazine	12 + 6	125	108	100	4,7	1,2	1

* *Rottboellia exaltata*

In Experiment 6, weed control ratings showed that weed control by Eptam Super treatments was generally poor (Table 5) and hence yield results (Table 6) were affected by weed competition. Yields tended to follow the pattern of the degree of weed control achieved. Cane treated with high rates of Eptam Super + atrazine yielded better (ns) than cane which received the low rates, where weed control was inferior. It thus appears that weed competition, even for a limited period is far more important than any phytotoxic effect of Eptam Super. Differences in yield and crop measurements were generally not statistically significant.

TABLE 5

Mean weed control ratings taken two and four months after spraying a plant crop of NCo 376

Treatments	2 months			4 months
	Cyperus esculentus	Grasses	Broadleaf	Weeds (General rating)
Control (unsprayed)	3,5	8	8,5	5
Lasso + atrazine	1,7	1,8	1,7	2
Eptam Super (6) + atrazine (3)	5,5	6,2	5,3	3,8
Eptam Super (12) + atrazine (6)	2	3,2	2,5	2,8

TABLE 6

Crop characteristics and yield at harvest in Experiment 6

Treatments	Rate in ℓ prod/ha	Yield			Crop measurements	
		Cane t/ha	* Ers % cane	Ers t/ha	Stalk height (m)	Stalk popn. (000/ha)
Control (unsprayed)	–	56	10,4	12,0	1,23	131
Lasso + atrazine	10 + 4,0	62	10,9	12,3	1,33	134
Eptam Super + atrazine	3 + 3	57	10,7	12,3	1,32	131
Eptam Super + atrazine	6 + 6	60	10,3	11,8	1,37	132
CV %		13,2	4,6	3,8	8,8	4,2
LSD (0,05)		9,33	0,57	0,54	0,1274	6,53

* ers = estimated recoverable sugar

Results from Experiment 7 (Table 7) indicate that stalk heights were not affected even by twice the recommended rates of Eptam Super and Sutan Plus. In this experiment excellent control of *Cyperus rotundus* was achieved by these treatments three weeks after application. Cane stalk populations were slightly higher in all treated plots than in untreated plots, but this did not follow the pattern of weed control ratings and therefore is not considered to be due to weed competition in unsprayed control plots.

TABLE 7

Crop measurements taken 5½, 9 and 12 weeks after planting and weed control ratings made 21 days after planting

Treatments	Rates in ℓ prod/ha	21 days after spray	Stalk heights (cm)			Stalk popn (000/ha)		
			5½	9	12	5½	9	12
Control	–	8,7	10	20	31	54	213	147
Eptam Super	7	3	10	21	31	82	228	167
Eptam Super	14	2	10	20	32	64	196	149
Sutan Plus	8	2,7	11	21	32	77	219	158
Lasso + atrazine	10 + 4	7	10	21	32	69	222	158

Conclusion

The results of seven experiments are reported, and they suggest that Eptam Super and Sutan Plus are superior to standard pre-emergence herbicides for the control of *Cyperus rotundus* L. in plant cane. Control of other weeds such as *Cyperus esculentus* and grasses by these products appears to be no better than obtained with the standard treatments when they are used under normal conditions of sugarcane planting. Variable weed control with the test products confirm the importance of efficient and immediate incorporation into the soil, particularly under moist soil conditions. No damage to plant cane NCo 376 is expected from the use of either product.

As the products Eptam Super and Sutan Plus do not control broadleaf weeds well, an additional herbicide treatment would be necessary. This would be best applied immediately after planting.

Thus the situations where these products are likely to be of value in the South African sugar industry would be in plant cane where *C. rotundus* L. is the predominant weed and where the dangers of soil erosion are small.

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