DEPARTMENT OF AGRICULTURE AND FISHERIES, SOUTH AUSTRALIA

Agronomy Branch Report

ALTERNATIVES TO DDT FOR THE CONTROL OF CLIMBING CUTWORM, *HELIOTHIS PUNCTIGERA* WALLENGR. IN FIELD PEAS

FIELD TRIALS:

ROSEDALE, 1972

NARRIDY, 1972

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SUMMARY

An aerian trial conducted in October, 1972, at Narridy showed that endosulfan at 0.37 kg ai/ha gave adequate control of *Heliothis punctigera* larvae although it was not as effective as DDT at 0.88 kg ai/ha.

A boomspray trial conducted in October, 1972, at Rosedale, showed that, in an increasing population of heliothis larvae in field peas, only DDT at 0.70 kg ai/ha gave effective control. Endosulfan at 0.35 kg ai/ha and lower rates gave inadequate control due to its low residual value. Endosulfan at 0.35, 0.28 and 0.21 kg ai/ha gave equal control and, where it is possible to time spraying to peak population level, it is likely that if 0.35 kg/ha is effective, a lower rate may also be effective.

INTRODUCTION

The larva of *Heliothis punctigera* Wallengr. feeds on a wide range of economic crops. In field peas its preference for buds, flowers and developing peas make it an important economic pest. Control has relied on the use of DDT but with concern over the use of this chemical alternative insecticides to control this pest must be found.

Trials in 1968 and 1971 screened a range of insecticides and indicated that endosulfan was the most promising alternative that can be used at economic rates. Endosulfan is also the best alternative to DDT for the control of pea weevil in peas and the use of the same insecticide for heliothis control would have distinct advantages. At 0.35 kg ai/ha it costs $2-94 per hecatre. A reduction in this rate would make it an economically attractive alternative to DDT. Its suitability for application by air should also be confirmed..

This paper reports two trials conducted in 1972:

(a) an aerial trial at Narridy where endosulfan and DDT were compared.

(b) a boomspray trial at Rosedale where endosulfan was tested at four rates and compared to DDT.

NARRIDY TRIAL, 1972

AIMS

(a) To assess the effectiveness of endosulfan, applied aerially at 0.37 kg ai/ha, against heliothis in peas.

(b) To compare the above treatment with DDT applied aerially at 0.88 kg ai/ha.

METHODS

(a) Treatments

No.	Insecticide	kg ai/ha	Product	Formulation	Pints/acre*
1.	DDT	0.88	DDT	25% E.C.	2.5
2.	Endosulfan	0.37	"Thiodan"	35% E.C.	0.75
3.	Nil	-	-	-	-

(b) Site

The trial was conducted on the property of Mr. R. Hosking of Narridy in crop of white peas.

(c) Application

By Beaver aircraft on 13 October, 1972. There was no wind. Insecticides applied with 2 Imperial gallons of water per acre.

(d) Sampling

Insecticide treatments were carried out on 7½ acre plots. The nil treatment was an acre plot located away from possible drift from the insecticide treatments. Pre-spray larval assessment was on 12 October, 1972, one day before spray. 40 sets of 5 swap samples were taken from each insecticide treatment plot. Only 20 sets of 5 sweep samples were taken from the nil treatment plot as it was a much smaller area. Two post-spray larval assessments were made on 16 October, 1972, 3 days after spray, and 30 October, 1972, 17 days after spray. No count was possible in the nil plot in the last assessment as the peas had dried off through lack of moisture.

To assess damage, 200 pods were taken from each treatment on 30 October, 1972. Damage was assessed in the following grades:

(a) Pod damage. (Includes superficial damage to pod only.)

(b) Peas completely eaten out. (Determined by careful opening of pods.)

(c) More than ½ damaged peas. (Does not include b. This approximates peas that will be lost in machine harvesting.)

(d) Pin hole to ½ damaged peas. (This category would probably be recovered in machine harvesting but would be undesirable for splitting.)

*Metric units are not given here as application by aircraft was actually calibrated as pints per acre. Metric rates are shown in amounts ai/ha.

(e) Pin hole damage. (Although damaged this category probably does not affect splitting. It would contribute to the inferior look of the sample when peas are offered for sale.)

RESULTS

Detailed results of the assessments are given in Appendix 1. Table 1 summarises the results of assessments.

DISCUSSION

There is no significant difference in pre-spray larval counts in the three treatments. Three days after spray compared to about 90% survival in the nil plot, the DDT treatment gave 8% survival representing 92% control and endosulfan treatment gave 14% survival representing 84% control.

The pre-spray means show that the infestation level was low. The percentage of pods damaged was twice as high in the endosulfan treatment compared to the DDT. However, the nil treatment did not have a high percentage of damaged pods either. The effect on peas was even smaller. There was no difference between the DDT and endosulfan treatments in percentage of sound peas. The recovery of sound peas from the nil treatment was almost as high.

CONCLUSION

Although not quite as effective as DDT, endosulfan at 0.37 ai/ha gives good control of heliothis when applied aerially with 20 litres/ha water.

RECOMMENDATION

As the trial was conducted in a rather dry year, pea growth was stunted and crops generally thin. Heliothis infestations were relatively light. In a good year when crops are denser and should heliothis infestations be heavier, endosulfan at 0.35 kg/ha may require more water per acre for penetration. This should be tested in further trials.

Table 1 Assessments of larval numbers before and after spray, percentage of pods damaged and percentage of peas undamaged and with varying degrees of damage

Treatment and Rate		Mean no. larvae/5 sweeps			Percent Pods Damaged	Percent of total peas in 200 pods				
Insecticide	kg ai/ha	Pre Spray	3 days after	17 days after		Completely eaten	More than ½ damaged	Pinhole to ½ damaged	Pinhole damage	Sound Peas
DDT	0.88	3.93	0.10	0.48	7.5	0.63	0.53	0.11	0	98.74
Endosulfan	0.37	2.60	0.52	0.65	18	0.59	0.50	0.89	0.10	97.82
Nil	-	3.95	3.15	No count	28	0.94	1.77	3.53	0.73	93.04

ROSEDALE TRIAL, 1972

AIMS

1. To determine the effectiveness of endosulfan at four rates: 0.35, 0.28, 0.21 and 0.14 kg ai/ha as control sprays against heliothis larvae in peas.

2. To compare the effecitveness of endosulfan used at the above rates against DDT at 0.70 kg ai/ha.

METHODS

(a) Treatments

No.	Insecticide	kg ai/ha	Product	Formulation	l/ha
1.	DDT	0.70	DDT	25% E.C.	2.80
2.	Endosulfan	0.35	"Thiodan"	35% E.C.	1.00
3.	Endosulfan	0.28	"Thiodan"	35% E.C.	0.80
4.	Endosulfan	0.21	"Thiodan"	35% E.C.	0.60
5.	Endosulfan	0.14	"Thiodan"	35% E.C.	0.40
6.	Nil	-	-	-	-

(b) Site and Design

The trial was conducted on the property of Mr. J. Mattiske of Rosedale in a crop of "Early dun" field peas. A randomised block design was used with 5 replicates of 6 plots. Each plot was divided into 5 sections for stratified random sampling of heliothis larvae. Plot sizes were 25 metres by 4 metres.

(c) Application

Insecticides treatments were applied on 19 October, 1972 with a 4 m boomspray delivering 100 l/ha. Insecticides were mixed in 25 l lots and the sprayer allowed to run for a short while before application to each treatment plot. Excess made up insecticide was drained and the sprayer completely flushed between treatments using different insecticides.

(d) Sampling

The pre-spray larval assessment was made on 19 October, 1972. Larvae were sampled using a sweepnet 38 cm in diameter mounted on a metre-long handle. An arc of about 160° was made across the tops of vines for each sweep. Larvae captured were counted and immediately released. Five random sweeps within each section of a treatment plot constituted one sample. Two post-spray larval assessments were made. The first on 23 October, 1972, four days after spray and the second on 26 October, 1972, seven days after spray.

There was no assessment of damage or yield as the crop had begun to fail due to lack of moisture when the trial was conducted.

(e) Statistical analysis

Regression analysis showed significant correlation between pre-spray and post-spray larval counts. The post-spray counts were then adjusted. Co-variance analysis on the first post-spray count was done without transformation and, in the second post-spray count, data were transformed to square root $x + 1$ where x is the number of larvae

per sample. Percentage survival and percentage control was calculated using the estimated grand mean for the pre-spray population, calculated using the estimated grand mean for the pre-spray population and adjusted means for the post-spray populations.

RESULTS

Detailed results of the three larval assessments are given in Appendix 2.

Analysis of variance on the pre-spray assessment showed no significant differences in the treatment plots. The estimated grand mean was 7.13 larvae per sample of five sweeps.

Table 2 shows the results of analysis and also includes estimates of percentage survival and percentage control.

Table 2 Means of larval numbers, percentage survival and percentage control in two post-spray assessments

Treatment and Rate			Larvae 4 days after spray			Larvae 7 days after spray		
No.	Insecticide	kg ai/ha	Mean No.	% survival	% control	Mean No.	% survival	% control
1.	DDT	0.70	0.53	7.5	94.6	0.2 (1.09)	2.8	97.1
2.	Endosulfan	0.35	5.06	71.0	48.8	2.4 (1.85)	33.7	65.7
3.	Endosulfan	0.28	4.76	66.8	51.9	3.1 (2.02)	43.5	55.7
4.	Endosulfan	0.21	4.71	66.1	52.4	4.2 (2.28)	58.9	40.0
5.	Endosulfan	0.14	7.64	107.1	22.8	3.4 (2.10)	47.7	51.4
6.	Nil	-	9.89	138.8	0	7.0 (2.82)	98.2	0
L.S.D.	p = 0.2	1.72				(0.32)		
	p = 0.1	2.73				(0.42)		
	p = 0.05	2.70				(0.50)		

DISCUSSION

There was an increase in population soon after spraying. This is shown as percentage survival in the nil treatment increasing to 138.8% 4 days after spray. Except for the DDT treatment, this resulted in high "survival" percentages in the endosulfan treatments. 7 days after spray the population had again dropped to 98% of the original level before spray. The DDT treatment was extremely effective not only in reducing the original population, but in preventing further infestations from new hatchings. From the results it appears that the low residual qualities of endosulfan would result in inadequate control where there is a fairly long egg laying and hatching period. It is interesting though that endosulfan at three rates, 0.35, 0.28 and 0.21 kg ai/ha, are not different in effect but at 0.14 kg ai/ha becomes less effective. Unfortunately due to the extremely dry conditions in 1972 the pea crop failed and it was not possible to obtain damage and yield assessments.

CONCLUSIONS

From the results of this trial, it appears that endosulfan at 0.35 kg ai/ha is not adequate to control heliothis and a crop where egg laying and egg hatching is still occurring. In such a situation a higher rate may be required. The effectiveness of endosulfan at 0.35, 0.28 and 0.21 kg/ha against heliothis larvae is very similar and, in a situation where 0.35 kg/ha can be used, it is likely that the lower rates of 0.28 and 0.21 kg/ha would also be effective.

RECOMMENDATIONS

The estimated grand mean of 7.13 larvae per sample of 5 sweeps show that infestation in this crop was fairly light at the start of the experiment. If the population was monitored by further sweeps before starting the trial, the confusion caused by the population increase during the trial could possibly have been avoided. It is recommended that in future trials, where populations are low to start with, the population should be monitored until a sudden increase is seen before the trial is started. All the three rates tested above as well as a higher rate of 0.42 kg/ha should also be tried.

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Appendix 1

Narridy Trial, 1972

(a) Pre-spray larval assessment, 12 October, 1972

Frequency of samples	Treatment	Number of larvae per sample												
		0	1	2	3	4	5	6	7	8	9	10	11	12
	DDT	1	5	7	7	4	6	4	4	1	0	0	1	0
	Endosulfan	9	6	9	4	6	3	0	0	1	1	0	0	1
	Nil*	0	1	3	4	5	5	1	0	0	1	0	0	0

(b) Post-spray larval assessment, 16 October, 1972

Frequency of samples	Treatment	Number of larvae per sample								
		0	1	2	3	4	5	6	7	8
	DDT	36	4	0	0	0	0	0	0	0
	Endosulfan	24	11	5	0	0	0	0	0	0
	Nil*	2	4	2	4	4	1	0	3	0

(c) Post-spray larval assessment, 30 October, 1972

Frequency of samples	Treatment	Number of larvae per sample								
		0	1	2	3	4	5	6	7	8
	DDT	33	4	1	0	0	1	0	0	1
	Endosulfan	18	18	4	0	0	0	0	0	0
	Nil	No samples taken - Peas dried off								

Appendix 1

(d) Assessment of Damaged Pods and Peas

Treatment	No. damaged Pods in 200	No. peas in 200 pods					
		Completely Eaten	½ damaged	Pinhole to ½ damaged	Pinhole Damage	Sound Peas	Total all peas
DDT	15	6	5	1	0	937	949
Endosulfan	36	6	5	9	1	989	1 010
Nil	56	9	17	34	7	895	962

Appendix 2

(a) Larval numbers in each treatment in pre-spray assessment, 19 October, 1972

Treatment and Rate			Larval numbers																							
No.	Insecticide	kg ai/ha	Replicate 1					Replicate 2					Replicate 3					Replicate 4					Replicate 5				
			Session					Session					Session					Session					Session				
			1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1.	DDT	0.07	12	8	4	10	13	7	16	6	1	1	5	9	3	11	16	4	7	7	11	10	5	9	3	2	1
2.	Endosulfan	0.35	4	13	12	9	11	11	11	11	16	10	6	5	2	5	15	2	6	7	5	3	1	6	10	15	13
3.	Endosulfan	0.28	5	8	11	11	11	4	3	6	13	8	10	2	9	16	8	4	4	6	13	6	5	6	1	2	6
4.	Endosulfan	0.21	6	6	10	6	4	6	2	4	10	10	5	3	2	5	5	7	7	7	3	6	11	11	5	10	7
5.	Endosulfan	0.14	9	7	11	12	12	3	7	3	10	11	3	7	9	3	3	4	2	4	11	13	4	13	10	11	5
6.	Nil	-	5	6	9	9	13	5	4	7	7	8	3	3	3	4	7	3	6	7	4	10	0	3	13	10	7

(b) Larval numbers in each treatment in post-spray assessment, 23 October, 1972

Treatment and Rate			Larval numbers																							
No.	Insecticide	kg ai/ha	Replicate 1					Replicate 2					Replicate 3					Replicate 4					Replicate 5				
			Section					Section					Section					Section					Section				
			1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
1.	DDT	0.70	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	2	0	1	1	0	0	2	5	0	0
2.	Endosulfan	0.35	5	2	2	5	2	7	3	0	5	3	3	0	2	5	4	2	8	7	3	3	3	14	22	10	14
3.	Endosulfan	0.28	7	3	3	4	4	3	3	7	5	11	4	4	6	9	5	4	2	4	4	0	6	9	7	3	2
4.	Endosulfan	0.21	4	3	5	5	4	4	8	6	7	7	5	6	4	6	0	3	7	1	1	1	7	6	4	4	5
5.	Endosulfan	0.14	0	11	7	5	13	7	10	8	15	11	1	7	3	6	5	9	5	10	8	11	1	8	9	12	11
6.	Nil	-	11	7	16	12	14	10	8	8	6	8	12	3	4	14	9	6	5	13	5	6	7	9	16	14	19