

PRE-TRASHING OF SUGARCANE AS A MEANS OF COMBATING THE BORER *ELDANA SACCHARINA* WALKER

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Abstract

In insectary experiments it was found that the moth *Eldana saccharina* Walker showed a preference for ovipositing cryptically on dry cane leaf material. Egg searches in the field have confirmed this. In a series of observations and replicated field trials in which infested maturing cane was manually pre-trashed it was shown that eldana populations were markedly reduced and that damage levels also were lowered, without losses in yield. A thorough pre-trashing with the fallen trash removed gave little advantage over a quick operation, and, although a second pre-trashing showed a further reduction, there was little advantage in pre-trashing a third time.

Introduction

The idea that pre-trashing might serve to reduce the fruitful oviposition by *Eldana saccharina* Walker arose as a result of an insectary experiment at Mount Edgecombe. It was found that when offered a choice of oviposition sites, which included growing cane plants and certain indigenous host plants, eldana moths laid a large proportion of their eggs out of sight among dry cane leaves. During a subsequent intensive search no eggs were found on green leaves. It seemed reasonable to assume therefore that if dry leaves were removed from the growing crop, several beneficial changes might result: (a) eggs already laid on such tissue would be removed from the vicinity of the host plant; (b) subsequent oviposition would be on the removed trash at a distance from the cane stalk too great to be traversed by the hatching larvae which would then die; (c) further eggs might be squandered on other dry media rather than laid on the green leaves which the moth normally avoids, and so fewer larvae would enter the growing cane plant. It was appreciated that detrimental agronomic effects might result from pre-trashing. Work had previously been done on pre-trashing because growers had reported that it increased sucrose % cane and offered better utilization of labour. Two trials were conducted, one at Mowbray and the other at Mtunzini and the following conclusions were reached: pre-trashing makes cane more susceptible to frost damage; pre-trashing reduces ers* % cane and this reduction is greater with a higher level of nitrogen fertilizer; and because ers % cane is reduced it would be expected that t ers/ha (yield of sugar) would be reduced (Moberly³). For those reasons pre-trashing could not be recommended. In recent years borer damage has become progressively more serious (Carnegie²), biological studies have been intensified, and it was felt that a substantial reduction in eldana infestation might well outweigh such agronomic disadvantages.

Materials and Methods

A series of field trials was conducted, ranging from small plot preliminary trials, through observation trials, to trials designed to test effects of both thoroughness and frequency of pre-trashing. Effects were assessed both on eldana populations and on crop damage. Where possible a reading for

% joints bored was obtained, but this is a time-consuming achievement, and in experiments such as these the statistic % stalks bored is considered to be nearly as good and is far quicker to record. All experiments were conducted in normally grown cane fields which supported natural eldana populations and yield figures were recorded. Various methods of removing trash were tried, including the use of sticks, metal hooks, cane knives and bare hands. It is largely a matter of personal preference; a firm stick, thinner at one end works well.

Survey methods were adjusted according to the type of trial but were essentially as follows: twenty stalks were collected over the central 10 m of each of the five middle rows in each plot to give a total of 100 stalks per plot. Stalks bored and eldana found were recorded. In some cases where time permitted, total numbers of joints and numbers of joints bored were recorded.

Adult numbers were assessed from a step ladder at night in the field when all moths visible in the beam of a hand-held torch were recorded.

Results

Preliminary small plot trials 1979/1980

Five replicated trials were laid down and the results are summarised in Table 1.

TABLE 1
Results of five small plot replicated trials 1979/80

Treatment	Eldana per 100 stalks	% stalks bored	Yield t ers/ha
Control	26	77	7,2
Pre-trashed.. .. .	18	68	7,4
Difference	-30%	-12%	+3%

Some trials in particular were so encouraging, especially regarding the drop in eldana numbers, that it was decided to implement a series of observation trials immediately and to initiate small-plot trials to study frequency and thoroughness of pre-trashing. In some cases yields appeared to have been lowered but never very seriously.

Observation trials

Results of 43 non-replicated trials four months after treatment are summarized in Table 2.

TABLE 2
Summarized results of 43 pre-trashing observation trials

Treatment	Eldana per 100 stalks	% stalks bored	ers g/stalk
Control	38	69	51
Pre-trashed.. .. .	25	65	54
Difference	-34%	-6%	+6%

A reduction in borer numbers and damage levels was again noted and there was an increase in sucrose yield. To

* estimated recoverable sugar

assess whether or not the reduction in eldana levels depended on the numbers originally present, the results were then grouped into three categories :

1. Trials with control plots having 40 or more eldana per 100 stalks.
2. Trials with control plots having 25-39 eldana per 100 stalks.
3. Trials with control plots having 0-24 eldana per 100 stalks.

The segregated data are summarized in Table 3, from which it may be noted that the greatest reduction in eldana numbers occurred when there were 40 or more per 100 stalks. At levels of 0 - 24 there was an average decrease of only three eldana per 100 stalks, possibly because at lower levels population build-up was slower. Pre-trashing resulted in an overall yield increase of 6%, but yield increases did not appear to correspond to eldana numbers present.

TABLE 3
Effects of pre-trashing at different eldana levels

1. 40 eldana or more/100 stalks (16 trials)				
Treatment	Eldana per 100 stalks	% stalks bored	ers g/stalks	ers % cane
Control	67	86	40	7,27
Pre-trashed	42	82	44	7,74
Difference	-37%	-5%	+8%	+6,5%
2. 25 to 39 eldana/100 stalks (12 trials)				
Control	31	73	45	8,83
Pre-trashed	21	64	44%	8,72%
Difference	-32%	-12%	-24%	-1,2%
3. 0 to 24 eldana/100 stalks (15 trials)				
Control	13	48	68	11,75
Pre-trashed	10	48	74	12,04
Difference	-23%	0%	+9%	+2,5%

Frequency of pre-trashing

In one trial cane was pre-trashed once, twice or three times, and in four other trials cane was pre-trashed once or twice. Results are summarized in Table 4.

A second pre-trashing treatment showed some additional benefit in reducing eldana levels but the order of reduction reflected in the five trials suggests little of practical value. In only one case did a second pre-trashing show an increase in sucrose yield and this occurred only after the first treatment had apparently reduced the sucrose level below that of the control. In trial 1, where as many as three treatments were carried out, results were erratic but there is a suggestion of yield increases with increasing numbers of treatments.

The ages of pre-trashed cane are shown in Table 5, which includes three different ages in one trial and two ages in the other four.

Results were inconclusive. For three trials there was an indication that when older cane was treated it supported slightly fewer eldana. Results for trial 1 were erratic, and in trial 2 younger cane was favoured. In four of the five trials sucrose yields were greater in cane pre-trashed at a younger age, but differences were small.

Thoroughness of pre-trashing

Four replicated trials were conducted, in which trash was removed from the plant in three different ways: quickly and superficially; very thoroughly; very thoroughly and then deliberately moved away from the base of the plants. The plots were surveyed approximately five months after treatment. Results are summarized in Table 6.

Little was gained from conducting more than a quick pre-trashing operation.

Moth numbers

In an observation trial, counts of moth numbers were made at night over a period of two months in alternating

TABLE 4
Results of pretrashing frequency trials

Trial	Treatment	Eldana per 100 stalks	% stalks bored	ers g/stalk	Treatment dates	Period between treatment and assessment
1	Control	63	82	52		8 months
	Pretrashed once	34	75	59	31/8/80	
	Pretrashed twice	20	67	55	18/12/80	
	Pretrashed thrice	17	61	63	24/2/81	
	Survey and sample				11/5/81	
2	Control	62	81	26		5 months
	Pretrashed once	53	80	34	28/11/80	
	Pretrashed twice	50	81	29	18/2/81	
	Survey and sample				6/5/81	
3	Control	88	93	58		6 months
	Pretrashed once	86	92	58	2/2/81	
	Pretrashed twice	77	94	52	9/4/81	
	Survey and sample				10/8/81	
4	Control	46	78	84		5½ months
	Pretrashed once	34	69	93	1/4/81	
	Pretrashed twice	36	74	93	1/7/81	
	Survey and sample				14/9/81	
5	Control	29	83	90		5 months
	Pretrashed once	19	77	88	2/4/81	
	Pretrashed twice	17	74	92	18/6/81	
	Survey and sample				7/9/81	

TABLE 5
Summary of pre-trashing effects at different ages

Trial	Treatments	Eldana per 100 stalks	% stalks bored	ers g/stalk	Treatment dates
1	Control	63	82	53	
	9 months.. .. .	34	72	61	31/8/80
	13 months.. .. .	32	72	59	24/2/81
	15 months.. .. .	36	82	58	24/2/81
	Survey and sample				11/5/81
2	Control	62	81	26	
	17 months.. .. .	51	76	34	28/11/80
	20 months.. .. .	56	85	33	18/2/81
	Survey and sample				6/5/81
3	Control	88	93	58	
	14 months.. .. .	89	92	59	2/2/81
	16 months.. .. .	83	93	56	9/4/81
	Survey and sample				10/8/81
4	Control	46	78	84	
	9 months.. .. .	35	69	90	1/4/81
	12 months.. .. .	32	68	96	1/7/81
	Survey and sample				14/9/81
5	Control	29	83	90	
	10 months.. .. .	20	76	90	2/4/81
	12½ months	17	78	86	18/6/81
	Survey and sample				7/9/81

pre-trashed and untreated sections of a field. Selected rows were surveyed every second week, and summarized results are shown in Tables 7 and 8.

Numbers of larvae decreased over the period and there were fewer in the treated plots, but there was no marked difference in adult numbers between the treated and untreated plots.

TABLE 6
Results of thoroughness of pre-trashing trial

Treatment	Eldana per 100 stalks	% stalks bored	ers g/stalk
Control	60	81	49
Quick pre-trash	40	74	50
Full pre-trash	35	75	47
Full pre-trash and removed from rows	36	73	50

TABLE 7
Statistics for first and last five surveys in moth observation experiment

Group of surveys	% stalks bored		% joints bored		Eldana/100 stalks	
	Control	Treated	Control	Treated	Control	Treated
First	92	88	19,5	15,0	181	132
Last	92	94	14,7	15,7	125	98

TABLE 8
Moths observed in treated and untreated sections of a field

Item	Control	Pre-trashed
Total moths observed	823	799
Mean moths per night	37	36
Mean moths per night per row	7	7

Discussion

The results show that a substantial reduction in eldana numbers can be achieved by pre-trashing. Although the insect is not eliminated from pre-trashed fields, the reduction in eldana populations must be beneficial, both for that field and for surrounding fields because the potential for population accumulation is reduced. Observations such as those recorded in Table 8 suggest that moths do not leave pre-trashed fields in search of preferred oviposition sites. This gives support to the suggestion that the reduction in borer numbers is a result of the squandering of eggs, from which the neonatal larvae cannot reach the growing plant. The reduction in damage levels following pre-trashing was less striking, which is understandable, because damaged cane tissue does not heal. Some individual experiments showed small yield reductions in sucrose after pre-trashing, especially where eldana numbers were low or absent. However, at higher levels of eldana (say 30 or more per 100 stalks) pre-trashing decreased eldana numbers and sucrose yields were not depressed. Figures may in some cases have been influenced by rainfall patterns, which became more normal as the year progressed.

There is little to be gained from conducting more than a quick pre-trashing operation, but a second pre-trashing does give a further reduction in eldana numbers. However, the erratic nature of the results for yield differences and the small additional reduction (if any) in eldana numbers were such that pre-trashing more than once cannot be recommended. It should be noted nevertheless that the second treatment is less demanding of labour than the first treatment.

Conclusive results were not obtained for the age at which cane should be pre-trashed. The longer it is left before pre-trashing the longer a high eldana population may be maintained or increased, and the greater the potential for damage. A delay therefore is probably not warranted.

Mention was made in the introduction of ways in which pre-trashing might reduce eldana numbers, but the actual

mechanism is not known and is very difficult to investigate. An intensive search in an infested field supported the finding of Atkinson¹ that most eggs are laid on dry leaf and sheath material on the lower parts of plants, and so it does seem that pre-trashing prevents young hatching larvae from regaining access to their host plant. In the observation trial in which, for two months, counts were made at night of moth numbers in pre-trashed and in untreated sections of a field, much the same numbers were found in both sections. However, when 100 stalks were examined from treated and untreated parts of an experimental field it was found that the upper parts of stalks in the pre-trashed section were slightly more heavily damaged than were the upper parts of those in the control section. This may have been a result of moths ovipositing higher up the stem than they would normally have done.

Conclusions

Pre-trashing maturing cane can reduce the numbers of eldana larvae which will develop in it with some consequent reduction in damage levels and with a saving in yield. There

was little advantage in anything more than a quick pre-trashing operation, and the practice was most effective where eldana populations were high. Early impressions that the operation was more successful when conducted at certain times of year have not been confirmed, and the delaying of pre-trashing until certain times of year cannot be recommended unless more conclusive information is obtained.

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