ELDANA BORER (*ELDANA SACCHARINA*) : THE RESULTS OF SURVEYS

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Abstract

The objectives and procedures of the eldana mill and field history surveys are discussed and the results from a number of seasons are presented. The purpose of field surveys is outlined and the initial work done by local Pest and Disease Control Committees is also mentioned.

Introduction

In January 1981 the responsibility for the administration, collection and analysis of data from mill and field surveys and the field history sheets was transferred from the Entomology Department to the Extension Division of the SASA Experiment Station at Mount Edgecombe. The purpose of this change was to enable the Entomology Department to concentrate on research aimed at controlling the eldana borer. The daily supervision of the mill survey teams became the responsibility of the Sugar Industry Central Board through their mill-based technologists who are able to maintain close contact with the inspectors in the mill yard.

A significant development during the 1981/82 season was the spread of eldana borer to sugarcane in the coastal areas south of Durban. At the beginning of April 1981 twelve farms, from Illovo to Izotsha, had low levels of infestation while in February 1982, eldana was identified on 48 farms and at levels of infestation up to 15,8 eldana/100 stalks.

Eldana has appeared in sugarcane areas at higher altitudes such as Eshowe and Entumeni where distribution is fairly wide but levels of infestation are low. Outbreaks are now fairly common in the Kearsney and Upper Tongaat areas.

Materials and Methods

Eldana mill yard surveys

These have been described by Smaill[1]. The standard mill survey team consists of three inspectors each working a shift of eight hours and each inspector examines an average of 24 consignments per shift. Such teams are located at most mills and at Amatikulu there is a six-man team because a large amount of cane is crushed at this mill. Where eldana has not yet been confirmed or where levels are very low, such as in the Entumeni, Noodsberg and Union Co-op mill areas, one-man teams carry out the inspections.

The mill surveys are the most satisfactory and economic method of warning growers early of possible outbreaks of eldana, and for the sugar industry to monitor the distribution and fluctuations in levels of the borer from one season to the next.

Eldana field surveys

Field survey teams consist of a supervisor and five inspectors. The teams are usually based at the mills but three teams operating in the Amatikulu area are based at the Experiment Station's farm at Mtunzini. The teams collect a sample of 100 stalks from fields of average size and record the numbers of eldana. The prime purpose of the surveys is to give the cane grower an indication of the level of eldana infestation in his fields, and so enable him to adjust his cutting programme to harvest fields with high levels of infestation first. In areas where outbreaks occur for the first time and after the first positive identification is made by the mill inspectors, the procedure is for a team to inspect fields adjoining the fields in which a positive identification of eldana was made and any additional fields in which eldana is found can be harvested.

On average a field survey team can cover 60 ha/day, which means that a visit to a farm is usually possible only after three to four months. Miller-cum-planters and large estates now have their own field survey teams, and growers should be encouraged to do likewise.

Eldana field history surveys

In an attempt to determine whether there was any correlation between field practices and the incidence of eldana, field histories were obtained from co-operating growers in the 16 surveys shown in Table 1. In 1979 those growers at Amatikulu and Pongola whose cane was inspected at the mills were requested to complete field history sheets for the fields from which consignments of cane were delivered. Data were obtained for 759 fields at Amatikulu and for 302 fields at Pongola. The numbers were limited by the inability to identify, from the delivery notes, the fields from which consignments were delivered.

TABLE 1

Eldana surveys associated with field histories, 1978–1981

Place	Type	Year	No. of fields
Amatikulu	Field	1978/79	1 558
	Field	1979	217
	Mill	1979	759
	Field	1980	1 713
	Field	1981	1 285
Darnall	Field	1980	903
	Field	1981	984
Gledhow	Field	1980	716
	Field	1981	1 019
Tongaat, MCP	Field	1979	1 013
	Field	1980	985
	Field	1981	1 170
Tongaat, growers	Field	1980	818
	Field	1981	787
Indian and Bantu growers ..	Field	1981	132
Pongola	Mill	1979	302
Total			14 361

When field surveys were begun at Amatikulu in 1978 and later at the north coast mills of Darnall, Gledhow and Tongaat, it was convenient to obtain field histories for as many of the fields being surveyed as possible. A total of 14 361 were obtained during the period 1978-1981. The histories provided information on the following :

Variety.
Age of crop at time of inspection.
Month of inspection.
Month when crop started.
N fertilizer, kg/ha.
P fertilizer, kg/ha.
K fertilizer, kg/ha.

TABLE 2
Average eldana populations over five seasons
Yearly means

Mill	Eldana per 100 stalks				
	1977/78	1978/79	1979/80	1980/81	1981/82
Malelane	0,3	0,2	0,2	0,3	0,8
Pongola	0,9	1,1	1,3	0,7	0,5
Umfolozi	0,3	0,3	0,6	0,5	0,8
Empangeni	0,9	0,8	0,9	0,8	1,6
Entumeni	No record	No record	No record	No record	0,1
Felixton	0,1	0,2	0,4	0,7	1,1
Amatikulu	3,7	3,5	5,1	10,8	11,8
Darnall	0,1	0,2	1,0	2,8	4,9
Glendale	No record	Nil	Nil	Nil	0,9
Gledhow	No record	0,1	0,3	1,3	1,2
Tongaat	No record	0,1	0,2	4,7	6,4
Mt. Edgecombe	No record	Nil	Nil	0,1	0,4
Illovo	No record	Nil	Nil	Nil	0,1
Sezela	No record	Nil	Nil	0,1	0,1
Umzimkulu	No record	Nil	Nil	0,1	0,1
Dalton	No record	No record	No record	No record	Nil
Noodsberg	No record	No record	No record	No record	Nil

Herbicides used.
Soil type.
Crop stage (P, 1R, etc.).
Previous crop burnt or trashed.
Nematicides used.
Irrigated or rainfed.

Computer programmes were used to calculate the average percentage of stalks damaged and the average number of eldana per 100 stalks for specified crop practices. It should be noted that, of the very large number of fields inspected over the period 1978 to 1981, only those for which histories were obtained could be considered in the computer exercise.

Local Pest and Disease Control Committees

Committees of representatives of growers and millers in most mill areas have been formed. The objective is to persuade growers to carry out the Experiment Station's recommendations on the control of the spread of pests and diseases, and so create an awareness of the present situation and potential threat to the industry. It is primarily through the efforts of these committees that in the 1981/82 season, an unprecedented 67%, compared with the normal 57% of the total area under cane, was cut in an effort to control eldana. This represents an increase of approximately 38 000 ha.

Results and Discussion

Millyard surveys

The results of millyard surveys during the past six years are shown in Table 2. Mean levels of eldana infestation have remained consistently low in the five northern-most mill areas though their distribution could be wide. This is probably due to the fact that most of the cane crushed at these mills is less than 15 months old. The annual increase in the mean populations at Tongaat and Darnall continues and this means that the pest is now well established in these areas. Levels at Amatikulu continue to rise while those south of Durban are low at present.

The millyard surveys continue to confirm a relationship between the seasons and eldana numbers. As an example the results for three seasons at Amatikulu are shown in Figure 1. In September and October levels are usually at their lowest and they reach a peak in May/June at the start of the milling season.

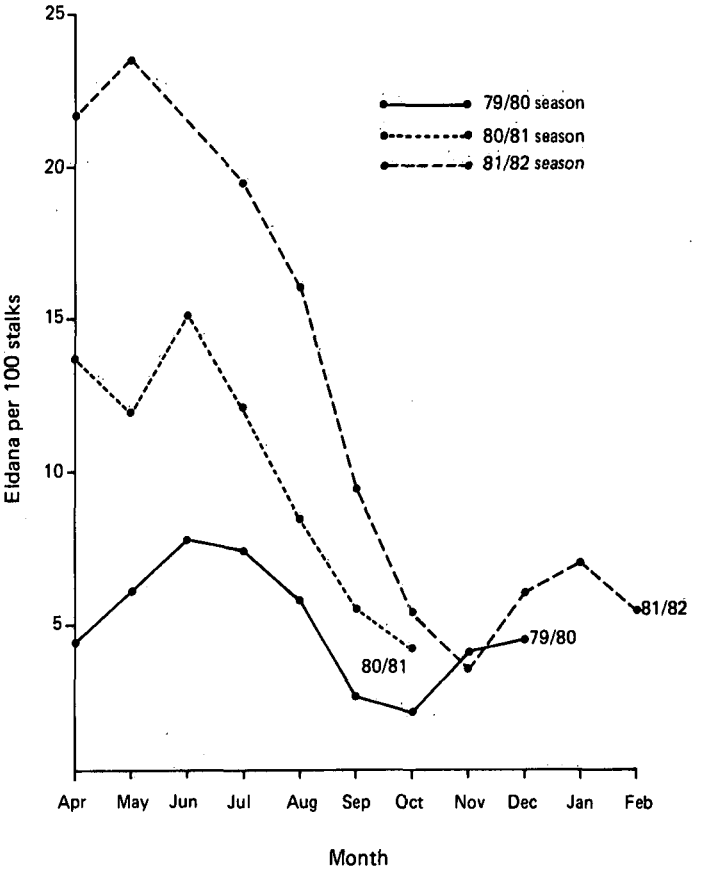

FIGURE 1 Relationship between season and eldana number — Amatikulu mill survey.

Table 3 shows : the percentage of farms on which eldana has been found for each mill area; the percentage of consignments inspected and in which eldana were found; and the average number of consignments examined each year at the mills. Surveys at the northern mills show that many growers have problems with eldana but it was identified in relatively few consignments. At Amatikulu, Darnall and

TABLE 3

Mill	% Eldana recorded according to growers and consignments over the last five seasons and average number of consignments examined										
	1977/78		1978/79		1979/80		1980/81		1981/82		1977/82
	Growers	Consign-ments	Growers	Consign-ments	Growers	Consign-ments	Growers	Consign-ments	Growers	Consign-ments	Av number of con-signments examined /annum
Malelane.. ..	19	3	19	2	22	2	43	4	46	7	14 691
Pongola	69	8	76	8	76	10	90	7	72	4	15 921
Umfolozi ..	55	3	65	3	65	7	63	6	74	8	14 074
Empangeni ..	30	8	30	6	37	7	53	9	74	19	10 545
Entumeni ..	No record	No record	No record	No record	No record	No record	No record	No record	60	1	10 892
Felixton	23	1	22	2	29	4	70	6	55	12	10 892
Amatikulu ..	28	20	26	20	23	25	40	43	50	52	26 158
Darnall	3	1	6	2	24	7	51	15	74	50	11 998
Glendale ..	—	Nil	Nil	Nil	Nil	Nil	Nil	Nil	60	8	2 973
Gledhow ..	No record	No record	9	1	13	2	32	9	56	8	2 973
Tongaat ..	No record	No record	1	0	5	1	25	15	61	37	10 093
Mt. Edgecombe	No record	No record	Nil	Nil	Nil	Nil	11	0,1	38	6	7 260
Illovo	No record	No record	Nil	Nil	Nil	Nil	Nil	Nil	14	1	4 804
Sezela	No record	No record	Nil	Nil	Nil	Nil	2	0,1	4	0	8 719
Umzimkulu ..	No record	No record	Nil	Nil	Nil	Nil	2	0,1	3	0	5 372
Dalton	No record	No record	No record	No record	No record	No record	No record	No record	—	—	879
Noodsberg ..	No record	No record	No record	No record	No record	No record	No record	No record	—	—	436

Tongaat, eldana is less widespread but its numbers are higher. Every day, 20 to 30% of the consignments entering the mill are checked.

Correlations with field practice information

Although 14 361 sets of data were accumulated, it was not always convenient or logical to pool all the results when assessing the relationship between the incidence of eldana and crop practices (Carnegie[2]).

Field survey results since 1978 confirm the observation made at the mills that the incidence of eldana has increased progressively, particularly along the North Coast and in the Amatikulu area. The increase at each mill is shown in Figure 2.

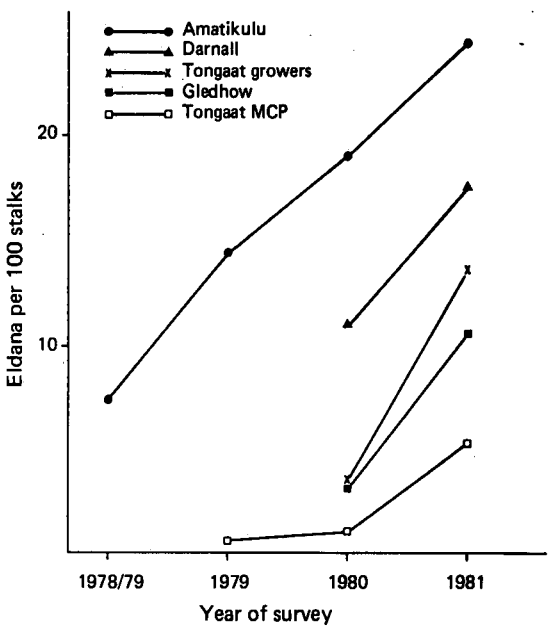

FIGURE 2 Average levels of eldana at various mills as indicated by field surveys since 1978/79.

Varieties

Table 4 shows that NCo 376, the predominant variety, occupies more than 70 percent of the surveyed fields and therefore results for other varieties are limited. The incidence of eldana in NCo 376 appeared to be slightly lower than in N55/805 and NCo 310 which were the only two other varieties which were significantly represented. In general, the varieties in the areas where eldana infestations are severe do not appear to differ much in their suitability for eldana. Experimental data (Carnegie[2]) and observations in the northern irrigated areas nevertheless indicate that some varieties such as N11, N52/219 and J59/3 may be more prone to damage by eldana that NCo 376.

TABLE 4

Eldana infestations in different varieties

Variety	No. of fields	Eldana/100 stalks
NCo 376	10 173	10,2
N55/805	2 435	14,9
NCo 310	352	14,2

Age of cane

The results of the surveys conducted at Amatikulu have shown consistently that the incidence of eldana increases with the age of the cane (Figure 3). Growers were advised to cut affected cane as young as possible. The results of surveys at mills along the north coast have been surprising in that the findings were different from those at Amatikulu. This difference is difficult to explain unless growers along the north coast followed Experiment Station advice and did not allow badly infested cane to remain unharvested for longer than a year. There is also some evidence to suggest that when eldana numbers are low the increase with the age of the cane is not so apparent.

Month of inspection

The results of field history surveys in 1981 given in Table 5 show that the incidence of eldana was highest during the

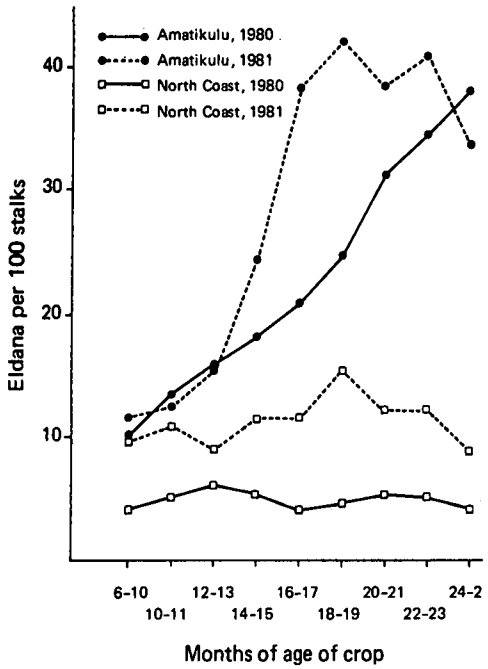

FIGURE 3 Relationships between average age fo cane and incidence of eldana at Amatikulu and on the north coast in 1980 and 1981.

early summer months and lowest towards the end of the year. Although these tendencies are similar to those observed in the mill survey results, it should be borne in mind that field surveys are carried out at various times on crops older than six months. Average ages of the crops inspected during each month are shown in Table 5.

TABLE 5

Average incidence of eldana in fields surveyed at Amatikulu on the North Coast in 1981

Month surveyed	No. of fields surveyed	Av age of crop months	Eldana/100 stalks
January	352	15,6	25,2
February	531	16,1	17,0
March	687	17,2	18,2
April	487	16,9	15,4
May	408	15,5	13,3
June	420	14,0	15,6
July	469	12,8	11,2
August	528	13,5	17,0
September	563	14,3	10,5
October	526	13,6	9,0
November	264	13,6	6,0
December	142	15,5	9,1

Month when crop is started

The results of all of the surveys show that the incidence of eldana is not related systematically to the month in which the crop is started.

Fertilizers

There is a possibility that the incidence of stalk borer is related to the protein or amino acid content of the stalk and therefore with the nitrogen status of the crop. The results of some experiments (Carnegie and Smaill[4]) indicated that this might be so, but the analysis of 11 126 sets of field data shown in Table 6 does not support this contention. In general, the incidence of eldana tends to decrease rather than increase with increasing amounts of nitrogen fertilizer. There was no apparent relationship between the incidence of eldana and the amounts of P and K fertilizer used.

TABLE 6

Average incidence of eldana in fields treated with different amounts of N fertilizer in 15 surveys conducted from 1979–1981

Kg N/ha	No. of fields	Av eldana/100 stalks
<60	227	12,7
60 – 90	434	13,1
90 – 120	2 094	13,3
120 – 150	5 419	9,8
150 – 180	1 917	11,4
180 – 250	739	9,6
>250	296	7,3
Total/Mean	11 126	10,8

Herbicides

Field histories were used to arrange the data into eleven categories for different herbicides and combinations of herbicides that had been used in the fields surveyed. Although the results of individual surveys sometimes indicated that one particular herbicide might have caused a significant increase in the incidence of eldana, the results were not confirmed in other surveys. The test to determine whether the use of herbicides led to an increase in eldana was of interest when the results for treated fields were compared with those where no herbicide was used. The results of 15 surveys are as follows :

	No. of fields	*Eldana/100 stalks*
No herbicide used	3 136	11,3
Herbicide used	8 625	10,1

There is a possibility that the use of herbicides may have contributed to an increase in eldana numbers but these results do not indicate that this was so. The wide distribution and the severity of eldana infestations at Amatikulu and on the north coast may have masked any effect that herbicides might have had.

Soil type

There has been a marked and consistent relationship between soil parent material and the incidence of eldana, as is shown in Table 7. Whilst it appears that eldana is less prevalent in crops growing on sandy soils, the distinction may be due mainly to the frequency with which crop moisture stress occurs on the ecca shale and the dwyka-derived soils. It is known that eldana flourishes in droughted cane.

TABLE 7

Average incidence of eldana in cane growing on soils derived from different parent materials, in 12 surveys conducted during the period 1978–1981

Soil parent material	No. of fields	Av eldana/100 stalks
Granite	17	4,1
TMS	2 234	6,7
Red sand	346	8,0
Grey sand	372	9,9
Alluvium	263	12,6
Dolerite	482	14,9
Lower ecca	841	19,4
Dwyka	1 356	20,0
Middle ecca	2 217	20,7

Crop stage

The incidence of eldana has not been significantly different in plant crops and the first eight ratoons according to the results of 15 surveys. This is shown in Table 8, a result which is consistent with observations that the residual population of eldana in a harvested field declines and almost disappears during the first five months of growth and that a new infestation is likely to be the cause of a problem thereafter (Atkinson[3]).

TABLE 8

Average incidence of eldana in plant cane and successive ratoons in 15 surveys from 1978–1981

Crop	No. of fields	Av eldana/100 stalks
P	2 356	9,2
1R	2 152	10,1
2R	2 325	10,6
3R	2 382	10,9
4R	1 096	11,1
5R	1 379	11,5
6R	743	12,5
7R	353	11,3
8R+	293	10,2
Total/Mean	13 889	10,6

Burning v trashing

The results of experiments conducted in Tanzania where eldana has been a pest of sugarcane longer that it has in southern Africa, showed that burning of cane before it was harvested, the removal of all crop residues after harvesting and covering the remaining stubble with a shallow layer of soil, all helped to reduce eldana numbers. When eldana became a problem in the South African sugar belt, it was presumed that these practices would also be effective here. The results of field experiments (Carnegie and Smaill[4]) and of surveys do not indicate that burning is superior to trashing. The average results of all field surveys to date are :

	No. of fields	*Eldana/100 stalks*
Previous crop burnt	4 568	12,3
Previous crop trashed	6 365	10,9

Nematicides

The field histories have not been useful in assessing whether or not nematicides affect the incidence of eldana. Only a small proportion of the fields surveyed were treated with a nematicide and the results were confounded since nematicides were used mostly on coastal sands. Eldana numbers tend to be low in cane grown on such soils anyway. (See section on soil type above).

Irrigation

It is generally thought that eldana thrives best in droughted or stressed cane and that irrigated cane should therefore be less affected. Unfortunately, insufficient irrigated fields were included in the surveys for conclusions to be drawn but the Tongaat MCP surveys did include a significant proportion of irrigated fields.

	No. of fields	*Eldana/100 stalks*	*No. of fields*	*Eldana/100 stalks*
Irrigated	147	1,7	202	7,0
Not irrigated	480	1,2	298	4,9

The results are unexpected but may be due to soil type confounding the effects of water supply.

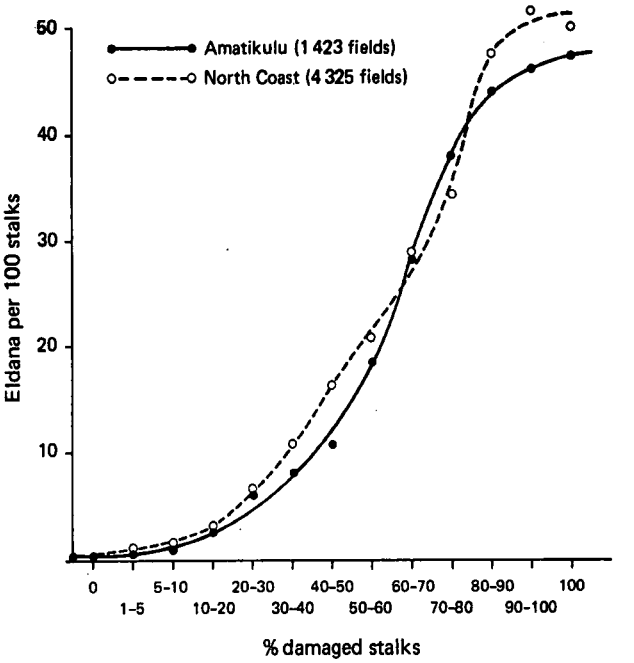

FIGURE 4 Relationship between % stalks damaged and eldana/100 stalks at Amatikulu and on the north coast in 1981.

Percentage damaged stalks

The percentage of damaged stalks was recorded whenever the eldana were counted so the relationship between these two parameters could also be assessed. Figure 4 illustrates that the relationship was very similar during 1981 at Amatikulu and along the north coast despite the fact that the relationship between the age of the crop and the incidence of eldana was very different in these two areas.

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