

OBSERVATIONS ON CROP DAMAGE AND LARVAL POPULATIONS OF THE PYRALID BORER *ELDANA SACCHARINA* IN THE SUGARCANE VARIETIES NCo376 AND N11

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Abstract

Two fields of sugarcane, of varieties N11 and NCo376 respectively, were sampled monthly over four seasons. At harvest, fields were either burnt or trashed, and pre-trashing was conducted at selected times.

Seasonal differences in eldana damage and populations were shown; low levels of damage seemed to be associated with seasons of high rainfall, and there was some association between larval populations and minimum temperatures. The monthly rates of accumulation of damage were estimated for each season and variety. These were influenced more by infestation level than season or treatment. From these rates, sucrose losses attributable to eldana were estimated. For a 12 month crop, losses of 2,6% and 24,5% were estimated for NCo376 and N11 respectively. No consistent effect of burning or trashing at harvest was shown. Similarly, no beneficial effects of pre-trashing on damage and eldana larval population levels were noted. This was attributed to the timing of this treatment.

Introduction

In sugarcane, the development of *Eldana saccharina* Walker (Lepidoptera, Pyralidae) infestations and consequent damage can be influenced by various factors, including variety (Nuss et al., 1986), agronomic practices such as pre-trashing (Carnegie and Smaill, 1982) and, less clearly, burning or trashing at harvest. The influence of burning or trashing at harvest was considered by Carnegie (1981) and Paxton (1982). They suggested that no clear effect of one or other practice on eldana infestations could be determined.

This study was undertaken to examine the influence of these factors on eldana infestations on the sugarcane varieties NCo376 and N11 in one region of the industry. These varieties were selected because N11 is susceptible to eldana

and NCo376 is moderately resistant. In addition NCo376 is frequently used as a standard variety in field trials and is still widely cultivated.

Materials and methods

Two fields were selected at the SASA Mtunzini propagation farm (central Zululand), one of variety N11 and the other of NCo376. Each field was divided into two divisions, one of which was burnt at harvest while the other was trashed. A further subdivision of each section was made in each field and one subdivision (block) was pre-trashed when the crop was nine months old. The blocks varied in size, but each was about 90 m by 50 m.

Crops were harvested during August each season from 1987 to 1991 (four seasons) and each block was surveyed once a month. A sample of 200 stalks was collected from each of the four blocks in each field. At each sampling, the following records were made:

- Number of stalks sampled and number bored
- Number of internodes per stalk and number bored
- Number of larvae per stalk.

Results

Varietal and seasonal influence on damage and larval populations

Only two seasons' data were obtained for the number of internodes bored, which are summarised in Table 1. Data on numbers of stalks bored and larval numbers were obtained for all four seasons, and these also are summarised in Table 1. All three sets of results show that larval populations and damage levels were much greater in the variety N11 than in NCo376. Typically, at 12 months, larval populations were 45 and 5 per 200 stalks in N11 and NCo376

Table 1
The mean number of internodes bored over two seasons, and stalks bored and larval populations over four seasons, in N11 and NCo376

Treatment	Internodes bored				Stalks bored				Larval numbers			
	N11		NCo376		N11		NCo376		N11		NCo376	
	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
Trashed (PT)	1.69	0.73	0.38	0.08	123,44	7,35	45,54	10,11	45,13	10,48	5,00	0,56
Trashed	1.11	0.39	0.15	0.05	101,11	15,35	30,30	10,21	31,11	9,91	3,67	0,67
Burnt	1.65	0.04	0.16	0.04	109,71	10,91	29,10	6,24	46,31	5,83	3,67	0,33
Burnt (PT)	1.66	0.09	0.14	0.04	100,91	5,31	26,62	7,21	45,81	7,70	3,67	0,67

SEM = Standard error of the mean
(PT) = Pre-trashed

Table 2
Seasonal means of the number of stalks bored and numbers of larvae recovered from N11 and NCo376

Measure	Variety	1987-1988 season		1988-1989 season		1989-1990 season		1990-1991 season	
		Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM
Stalks bored	N11	119,51	11,05	121,62	5,32	86,21	10,59	107,82	7,96
	NCo376	52,33	6,35	40,64	5,61	18,75	3,46	19,68	4,02
Larval numbers	N11	61,00	5,28	28,00	2,49	38,90	10,79	40,43	3,86
	NCo376	9,75	1,65	3,25	0,25	4,50	0,65	4,25	0,48

SEM = Standard error of the mean

Table 3
Regression equation parameters for number of internodes bored against age of crop for the two varieties surveyed

Variety	Treatment	Season					
		1989-1990			1990-1991		
		Coeff. of x	Constant C	r ²	Coeff. of x	Constant C	r ²
N11	Trashed (PT)	0,07	-0,01	0,97	0,04	0,14	0,93
	Trashed	0,03	0,02	0,88	0,05	0,02	0,94
	Burnt	0,06	-0,09	0,94	0,07	-0,04	0,91
	Burnt (PT)	0,08	-0,13	0,92	0,05	0,06	0,96
NCo376	Trashed (PT)	0,01	0,01	0,62	0,01	0,00	0,70
	Trashed	0,02	-0,04	0,76	0,02	0,00	0,75
	Burnt	0,01	-0,03	0,91	0,02	-0,03	0,75
	Burnt (PT)	0,02	-0,02	0,76	0,01	0,01	0,62

(PT) = Pre-trashed

Table 4
Monthly rates of increase in the number of internodes bored (log x+1) in varieties N11 and NCo376, and estimates of loss at two harvest dates

Variety	1989-1990 season		1990-1991 season		Estimated loss	
	Mean	SEM	Mean	SEM	12 months	15 months
N11	0,055	0,008	0,055	0,004	24,51	32,52
NCo376	0,014	0,003	0,012	0,002	2,61	3,11

SEM = Standard error of the mean

respectively. Damage expressed as numbers of stalks bored per 200 stalk sample, was 100 and 30 for N11 and NCo376 respectively.

The influence of season on numbers of stalks bored and larval populations is shown in Table 2. In both varieties damage was greater in the first two seasons. Larval numbers recorded showed a similar trend to that of damage; greater numbers being recovered from N11 than from NCo376. The greatest number of larvae were recovered in the 1987-88 season and the least in the 1988-89 season. This was most evident in N11 (Table 2).

Treatment effects on damage and larval populations

No clear influence of burning or trashing at harvest was shown over the four seasons. This can be seen in the sum-

marised results in Table 1. Similarly, no positive effect of pre-trashing was shown.

Accumulation of damage

The numbers of bored internodes attributable to eldana, were used to estimate the rate of accumulation of damage. Linear regressions were plotted of the number of internodes bored per month against the month of sampling. Only data on the number of internodes bored were used, since these relate more closely to loss than data on the number of stalks bored. Data were transformed by the log (internodes bored + 1) transformation, and in most cases high r² values were obtained (Table 3).

From the regression equations, the rates of accumulation of damage were calculated for each season and treatment.

No influence of season or treatments could be shown, but there was a varietal effect: higher rates being associated with N11. The estimated rates (from transformed values) were 0,055 and 0,013 internodes bored per month for N11 and NCo376 respectively (Table 4).

From these rates, the average number of internodes bored after twelve months was calculated to be 3,6 for N11 and 0,43 for NCo376. By converting these values to per cent internodes bored estimates were made of the losses attributed to eldana, based on the relationship of 1% loss for every 1% internodes bored (King, 1989). The losses calculated were estimated to be 24,5% for N11 but only 2,6% for NCo376.

The relationship between damage and age of crop

The relationship between the number of internodes present and the number bored for each of the two varieties surveyed, ignoring any seasonal and treatment effects, is shown in Figures 1 and 2. Until the time when about ten internodes had developed, damage remained low. Thereafter, damage in both varieties began to increase.

Discussion

Varietal influence on damage and larval populations can be seen when the results obtained for each variety are compared. Over all four seasons, consistently higher levels of damage and larger larval populations were recorded from N11. This is to be expected, since N11 is known to be more susceptible to eldana than NCo376. However the magnitude of the difference shows how severe damage can be, and how large eldana populations can become in susceptible varieties

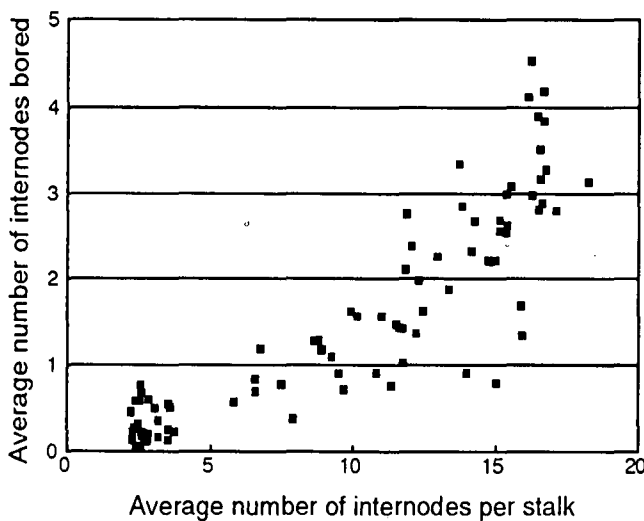


FIGURE 1 The relationship between internodes bored and number of internodes per stalk in N11.

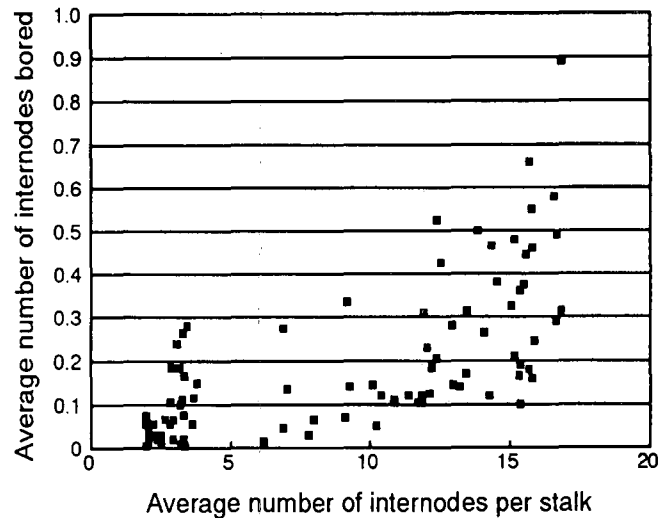


FIGURE 2 The relationship between internodes bored and number of internodes per stalk in NCo376.

such as N11. This emphasises the importance of varietal choice as a tool in eldana management.

There are various explanations for the seasonal differences in damage and eldana populations; for example, levels of nitrogen can influence populations (Atkinson and Nuss 1989). However, throughout this study the same quantities of fertiliser were applied from season to season, so differences are unlikely to be related to this.

Because stress can also influence pest populations (Mattson and Haack 1987), the rainfall and temperature patterns over the seasons were examined for any association with damage and larval populations (Table 5).

There was an association between damage and rainfall. Low rainfall seasons (1987-88 and 1988-89) were associated with higher levels of damage, whereas lower levels of damage were associated with higher rainfall seasons (1989-90 and 1990-91). No clear association between larval numbers and rainfall could be found, but there did seem to be an association with mean minimum temperatures, low numbers being associated with low minimum temperatures (Table 5 and Table 2). It is of interest that Way (in press) suggests that at about 15°C egg development is inhibited. This would influence the subsequent larval population, and the tentative conclusion is that eldana populations might have been influenced by the generally cooler conditions of the 1988-89 season.

There are several estimates of crop loss attributed to eldana and other sugarcane borers. King (1989) estimated a 1% yield loss of sucrose for every 1% internodes bored. From Bond (internal SASEX report), an estimate of 1,6% loss of

Table 5
Seasonal trends in rainfall and temperatures at Mtunzini, 1987-1991

Item	Season			
	1987-1988	1988-1989	1989-1990	1990-1991
Mean monthly rainfall (mm)	91,8	81,8	102,9	113,7
Total rainfall (mm)	1 194	899	1 235	1 365
Mean minimum temperature (°C)	16,4	15,8	16,9	16,3
Mean maximum temperature (°C)	26,7	27,1	26,5	25,9

sucrose for every 1% internodes bored was estimated. Metcalf (1969) recorded three estimates of losses attributed to borers in Louisiana. These were 0,73, 0,74 and 1,6 (per cent sucrose loss for every 1% internodes bored). Based on the results discussed in this paper, a general estimate of 1% sucrose loss for every 1% internodes bored seems reasonable. From this relationship, losses of 24,5% and 2,6% were calculated for the varieties N11 and NCo376 respectively. Such estimates clearly show the influence of varietal susceptibility on losses.

These estimated losses were based on a twelve month old crop (a typical harvest age in Mtunzini region). However, in the past, a harvest age of fifteen months was common and losses were also estimated for a crop of this age. These were 32,5% and 3,1% for N11 and NCo376 respectively. These projected losses represent a 33% increase over the losses calculated for a 12 month old crop of N11. The increase was 19% for NCo376. Although only a projection, such estimates emphasise the importance of early harvesting as an eldana control measure.

In addition to estimates of loss, the recording of the accumulation of damage in the crop over time can help in the correct timing of any control measures. In this study, at a stage when about ten internodes had developed, damage tended to increase in both varieties (Figures 1 and 2). This corresponded to a crop age of about six months and, had pre-trashing been conducted at about this time, some effect might have been noted, particularly in the variety N11.

The failure of pre-trashing to cause a measurable reduction in eldana damage, can probably be attributed to the timing of the operation in relation to crop age and peaks in eldana moth numbers. Carnegie and Smaill (1982) suggested that crop age can influence the effect of pre-trashing. The longer the delay in harvesting, the more eldana populations and damage levels increase, which reduces the effect of the operation. In this study, by the time pre-trashing was conducted high levels of damage had already occurred (particularly in N11) which probably reduced its effectiveness. In addition, for pre-trashing to have its greatest effect it should be conducted before the peaks in eldana moth numbers occur. At Mtunzini these usually occur during November and again in April (Carnegie and Leslie, 1990). In this study, the sugarcane was too young to be pre-trashed before the November peak; but treating during February or March would have had a greater effect than did the treatment conducted during May, when the sugarcane was nine months old.

No clear influence of burning or trashing at harvest on damage and larval populations was demonstrated. This confirms the findings of Carnegie (1981), who showed that no clear differences in larval populations could be shown between fields that were burnt or trashed at harvest. Similarly, in an industry survey, Paxton (1982) reported that no differences in eldana levels could be attributed to burning or trashing at harvest. All these studies suggest that burning or trashing at harvest does not measurably influence eldana damage or larval numbers in the subsequent crop.

Conclusions

Levels of damage and larval populations, which differed between the two varieties, were much greater in the variety N11, confirming its susceptibility to eldana.

Rates of damage accumulation as well as losses differed between varieties, and were related to the severity of the infestation.

After the development of about ten internodes, damage began to accumulate in both varieties.

No clear effect of burning or trashing was shown. Similarly no influence of pre-trashing could be shown. This was attributed to the timing of pre-trashing.

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