SHORT COMMUNICATION

IMPACT ON YIELD DUE TO EARLY AND LATE PHASE INFESTATION BY *ELDANA SACCHARINA* (LEPIDOPTERA: PYRALIDAE)

GOEBEL F R[1] and WAY M J[2]

[1]*CIRAD Unité de recherche Systemes Canniers, TA 70/09, Avenue Agropolis, 34398 Montpellier, cedex 5, France*
[2]*South African Sugarcane Research Institute, Private Bag X02, Mount Edgecombe, 4300, South Africa*
regis.goebel@cirad.fr   mike.way@sugar.org.za

Abstract

The effects of *Eldana saccharina* Walker (Lepidoptera: Pyralidae) damage on stalk yield components in field trials are reported. The experiment design involved reducing pest pressure with an insecticide to provide undamaged stalks or applying artificial inoculation techniques to elevate pest pressure to obtain damaged stalks for comparison. At harvest, trial results showed lower biomass, lower sucrose and higher fibre content in stalks that had been infested early in the season when compared with stalks that were infested during the maturation stage of the crop cycle.

Keywords: sugarcane, *Eldana saccharina*, Lepidoptera, Pyralidae, stalk borer, agricultural practices

Formal trials have been conducted in the past to study the negative impacts on various stalk parameters in sugarcane due to infestation by *E. saccharina* (Way, 2001; Goebel and Way, 2003). These studies showed that the timing during the crop cycle of attack by the borer might affect accumulation of plant biomass and, hence, have a negative influence on final yield in terms of stalk weight. The purpose of this trial was to investigate these findings in more detail.

Information on yield effects due to differential timing of attack by stalk borers in cane is important because it provides the option of applying controls, for example insecticides or biological control agents, in younger crops. Early controls might reduce borer population during the critical stage of the crop cycle that coincides with the main growth phase rather than when the plants are primarily in the physiologically maturing phase. In terms of the biology of this borer, targeting young cane would be appropriate because young cane is frequently attacked, particularly under stressed growing conditions.

Protocols described by Goebel and Way (2003), modified from Moyal (1998) and Goebel *et al* (1999), were employed with success in this field trial. The technique involves manipulating pest pressure by suppressing levels with insecticides in some plots, or in other plots elevating pressure by raising borer levels through artificial infestation techniques. This experiment started in September 2004, and ended in September 2005 in a third ratoon crop of sugarcane variety NCo376 on the South African Sugarcane Research Institute (SASRI) research station at Gingindlovu. The trial field was divided into five equal-sized blocks, each subdivided into four equal-sized plots. Plots were 130 m^2 in size, and consisted of 11 rows, 1.2 m apart and 10 m in length. Stalks from the centre row only were used for evaluation of each plot. Clearing the sugarcane around the plot perimeter created effective inter-plot breaks.

Treatments were randomised within the trial plots. One of the following four treatments were applied in each plot: T1 = left untreated for natural infestation by ferals, T2 = early season inoculation with laboratory bred eggs at five months into the crop cycle to elevate pest pressure at this early stage, T3 = late season inoculation at 10 months to elevate pest pressure at this later stage, and T4 = repeated applications of the insecticide deltamethrin at high concentration (12.5 g a.i./ha) to eliminate borer and thus obtain yield data from 'clean stalks' without damage for comparison purposes. The chemical was applied every 14 days with knapsack sprayers from four months of age until harvest.

Damage in the four treatments and five blocks was compared to validate the effectiveness of the protocol. Yield data were analysed with SAS software (SAS Institute, 1997) and subjected to analysis of variance (ANOVA) to compare the effect of treatments on yield components. In the trial, blocks 2 and 5 were affected extensively by waterlogged conditions, resulting in a response to factors other than pest damage. These data were therefore excluded from the analysis of loss attributed to borer activity.

The damage level measured at harvest as mean per cent joints bored in the four treatments and five blocks in this trial showed that the protocol adopted was successful. There was lower pest pressure, combined with concomitantly reduced damage levels in plots treated with the insecticide. Plots left unprotected and untreated were attacked by feral *E. saccharina*, but had the lowest levels of infestation, which illustrated the importance of applying the artificial inoculation treatment.

At harvest, differences in cane quality such as yield, ERC % cane and cane biomass, and cane g/stk between treatments were detected in three of the five blocks. Cane attacked earlier in the cane cycle, and hence predominantly during the growth phase, had significantly lower sucrose and biomass (Table 1). Fibre content was the highest in stalks damaged by *E. saccharina* (Table 2), which corroborates previous results (Way, 2001).

Table 1. Effect of treatments T1, T2, T3 and T4 on sugarcane stalk damage by *Eldana saccharina* Walker, and stalk characteristics and sucrose weight at Gingindlovu.

Plot	Internodes bored (%)	Stalk length (cm)	Stalk diameter (cm)	Stalk weight (g/stalk)	Sucrose (g/stalk)
T1	6,9 b	113,4 b	1,82 a	372,3 b	49,9 b
T2	9,0 b	105,1 c	1,83 a	338,6 c	40,6 c
T3	14,0 a	126,2 a	1,83 a	408,7 a	51,7 b
T4	1,9 c	124,8 a	1,87 a	419,5 a	57,8 a
CV%	122,6	8,3	7,0	17,4	24,4
F	14,61	68,00	2,14	22,52	19,31
P	<0,0001	<0,0001	0,0601	<0,0001	<0,0001

T1 = natural infestation T2 = artificial infestation at 5 months T3 = artificial infestation at 10 months T4 = insecticide applied. For each variable, the means followed by the same letter are not statistically different (P>0,05, Student-Newmans-Keuls).

Evidence is given that biomass was lower in stalks infested in younger cane. This finding was attributed to elevated pest pressure occurring during the growth phase as opposed to the maturation phase of the typical growth cycle. It was inferred that the early age at which the cane was attacked by *E. saccharina* negatively impacted on the rate of growth during this stage, and hence reduced the magnitude of stalk biomass yield at harvest.

Table 2. Effect of treatments T1, T2, T3 and T4 on non-sucrose and sucrose concentrations in sugarcane at Gingindlovu.

Plot	DM % cane	Fibre % cane	Brix % cane	Purity	Pol % cane	ERC % cane
T1	30,6 a	13,9 b	16,7 a	81,1 b	13,6 b	11,4 b
T2	30,5 a	14,4 a	16,0 b	76,9 c	12,4 c	9,9 c
T3	29,9 b	14,0 b	15,8 b	80,8 b	12,9 c	10,8 b
T4	30,4 a	13,3 c	17,0 a	84,0 a	14,3 a	12,3 a
CV%	4,5	10,3	8,9	8,2	14,5	20,4
F	4,60	7,48	13,8	18,38	13,18	14,58
P	0,0004	<0,0001	<0,0001	<0,0001	<0,0001	<0,0001

T1 = natural infestation T2 = artificial infestation at 5 months T3 = artificial infestation at 10 months T4 = insecticide applied DM = dry matter ERC = estimated recoverable sugar For each variable, the means followed by the same letter are not statistically different (P>0,05, Student-Newmans-Keuls).

The intensive study method adopted in this trial conducted under the same growing conditions allowed investigation of the effect on stalk weight in addition to other cane quality parameters. In contrast, many loss assessment studies in the past have compared single stalks collected from different fields under varying conditions, and with different degrees of damage, which is not as reliable because of natural stalk variability in cane crops (Samson and Kamur, 1983; Rajabalee *et al*, 1990).

These results constitute a first step towards investigating the effect of timing of borer attack on final cane yield in terms of cane quality and quantity. Based on these findings it appears that cane attacked at a younger age is likely to result in a higher biomass yield at harvest compared with cane of the same crop attacked at a later stage. This concurs with results obtained from crop loss trials conducted on the borer *Chilo sacchariphagus* Bojer (Lepidoptera: Crambidae), where cane height and stalk diameter were adversely affected by early infestations and resulted in reduced yields in terms of biomass (Goebel *et al*, 1999).

Further research should investigate the effect on yield when specific treatments are applied in young cane crops to target the early infestation phase of this pest. Treatments to consider include insecticides or release of candidate biological control agents.

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