

THE EFFECT OF *STRIGA HERMONTHICA* ON SUGARCANE

Part 1 : Reaction of sugarcane clones to *Striga hermonthica* infection in Kenya

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Abstract

Eighteen sugarcane clones were evaluated for their field reaction to *Striga hermonthica* Benth. All varieties screened were attacked by *S. hermonthica* weed. The effect of *Striga* on cane was first noted four months after planting. Severely attacked clones characteristically exhibited leaf burn, wilting, stunted growth and small pointed leaves, which contributed to poor canopy formation and tiller mortality. Clones KEN 83-1228, KEN 83-538 and Co617 were significantly more productive under *Striga* attack than the others and were rated as resistant.

Introduction

Striga species have been reported to cause damage in gramineous and some legume crops, amounting to substantial sums of money in many parts of Africa (Andrew, 1945, Ayensu *et al.*, 1984). Various species of *Striga* have been reported in Kenya (Kiriro and Mathenge, 1989). Of the reported species in Kenya, *Striga asiatica* (L) Kuntze and *S. hermonthica* (Del) Benth are of economic importance. During the pre-independence period (1963) in Kenya agricultural reports on *S. hermonthica* cited it as a serious pest in maize, sorghum and millets but causing only negligible damage to sugarcane (McDonald, 1929). However, observations suggest that *Striga* is becoming more serious in sugarcane, particularly on poorer soils. Various control measures have been recommended to minimize *Striga* related losses. The generally recommended control measures include mechanical uprooting of the weed, heavy application of nitrogenous fer-

tilizers, use of the herbicide 2,4-D and the planting of resistant or tolerant sugarcane cultivars (Ayensu *et al.*, 1984). However, information relating to *Striga* resistance or tolerance in sugarcane is very scanty. The objective of this study was to determine the reaction of some sugarcane clones to *Striga* infection, with a view to identifying resistant or tolerant clones.

Materials and methods

The experiment was conducted at the National Sugar Research Centre, Kibos. The soil was a sandy clay loam with a pH range of 5.9-6.2. The trial site which had been under maize for the previous three years, was heavily infected with *S. hermonthica*. Seventeen clones of the KEN 83 series were obtained from the Regional Research Centre, Mtwapa, after preliminary selection. Another batch of the same clones was planted in a *Striga*-free field. The commercial variety Co617, which had shown resistance in previous observations (Anon, 1989) was used as a control for resistance.

High quality seed setts were planted in a randomized complete block design replicated three times. The plot size was 10 m long and 3 m wide. The seed setts were protected against termites and other soil insects and fungal attack by using the recommended insecticide (dieldrin) and fungicide (benomyl) respectively at the time of planting. Phosphorus was applied at planting at a rate of 20 kg P/ha. Three months after planting, calcium ammonium nitrate was applied as a top-dressing at a rate of 100 kg N/ha. Three weed control treatments were carried out using herbicide TCA (sodium

Table 1
Reaction of eighteen sugarcane clones to *Striga hermonthica*

Clone	<i>Striga</i> No/pl.	<i>Striga</i> score	Millable stalk × 1 000/ha	Reaction	Yield tc/ha	% of <i>Striga</i> free
KEN 83-1228	76 b*	1,0	82 b	R	94 a	86
KEN 83-538	324 ab	1,7	74 bc	R	105 a	52
KEN 83-1161	211 ab	2,3	72 bc	R	80 ab	—**
KEN 83-368	163 ab	2,7	65 bcd	I	73 abc	60
KEN 83-868	233 ab	3,0	63 bcde	I	31 de	—
KEN 83-815	255 ab	1,3	62 bcde	I	82 ab	—
KEN 83-685	75 b	1,3	41 bdef	I	80 ab	93
KEN 83-655	171 ab	2,3	36 bcdef	I	64 a-d	—
KEN 83-625	22 b	1,3	30 cdef	S	45 b-e	—
KEN 83-639	622 a	2,0	27 cdef	S	63 a-d	70
KEN 83-1015	81 b	4,0	15 def	S	38 c-e	66
KEN 83-710	322 ab	4,3	13 ef	S	13 e	15
KEN 83-753	389 ab	3,3	5 f	S	12 e	—
KEN 83-787	223 ab	3,0	3 f	S	13 e	—
KEN 83-1159	365 ab	4,7	3 f	S	9 e	9
KEN 83-784	217 ab	4,3	2 f	S	16 e	—
KEN 83-999	210 ab	4,7	0,7 f	S	4 e	—
Co 617	79 b	0,7	109 a	R	124 a	113

* Means followed by the same letters do not differ significantly at the 5% level using Duncan's multiple range test.

** No data from *Striga*-free fields were obtained for these clones.

salt of tri-chloro-acetic acid) and diuron as a cocktail at a rate of 7,5 and 2,5 kg/ha respectively, and thereafter the trial was handweeded twice. Occasional eradication of weeds other than *Striga* was done by hand, for ease of *Striga* counting. Assessment of the effect of *Striga* included counting the number of millable stalks at harvest, yield, number of *Striga* plants around the host plant and blind weed assessment of cane suppression. A scale for scoring the infection of *Striga* was developed. The range of the score was: 0 = immune, 1-2 = resistant, 2-3 = intermediate, and above 3 susceptible.

Results and discussion

In the early stages of growth (4-5 months) little effect on the cane was noticed. However, numbers of *Striga*-infected plants started increasing from six to nine months after planting. Significantly suppressed clones formed compact shoots with short internodes and aerial roots. They also characteristically showed leaf burning, wilting and stunting, which resulted in poor canopy development.

Using the scale which was developed, clones KEN 83-1228, KEN 83-1161, KEN 83-538 and the standard clone Co617 were rated as resistant (Table 1). Clones KEN 83-368, KEN 83-868, KEN 83-815, KEN 83-685, KEN 83-625, KEN 83-655 were rated as intermediate and clones KEN 83-639, KEN 83-1015, KEN 83-710, KEN 83-753, KEN 83-787, KEN 83-1159, KEN 83-784 and KEN 83-999 were categorized as susceptible.

Resistant clones and the standard clone Co617 had a significantly greater number of millable stalks per hectare and a lower *Striga* score (0,7-2,3), with significantly less numbers of *Striga* when compared with the remaining clones. The results of this study showed that *Striga* numbers differed

between sugarcane clones. This is in agreement with the findings of Visser (1978), that the emergence of *Striga* on host varieties of sugarcane can differ. Some sugarcane clones are so severely damaged that no sugar can be recovered from them. Others can withstand the parasite and produce good cane yields.

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Part 2 : The effect of phosphorus application rates on *Striga* infection in two sugarcane varieties at Kibos – Kenya

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Abstract

A trial was conducted to determine the effect different rates of phosphorus would have on *Striga hermonthica* infestation in two sugarcane varieties (Co421 and Co617) and their subsequent growth and sugar quality. Results showed that phosphorus did not significantly affect *Striga* infestation. Variety Co617 was found to be *Striga* tolerant compared with Co421 irrespective of rate of phosphorus.

Introduction

Generally in fertile soils, *Striga* spp. infestation in maize, sorghum and even sugarcane has been low (Parker, 1990). Nitrogen rates and sources are documented as major determinants of levels of *Striga* infestation and resultant effects on crop yields (Mumera, 1988). Work by Cherif-Ari *et al.*, (1990) showed that root density could be a factor in resistance of sorghum variety P-967083 to *Striga* infestation. As phosphorus is an important nutrient in root development and cane growth there was therefore a need to determine whether different rates of phosphorus might affect *Striga* infestation and subsequent sugarcane growth.

Materials and Methods

The trial was conducted at the National Sugar Research Centre Kibos (NSRC-Kibos). The field used was infested with *Striga*, and other weeds.

Two commercial sugarcane varieties (Co421 and Co617) and six rates of phosphorus were applied (0, 13, 26, 39, 52 and 65 kg P/ha). The experiment was arranged in a randomised complete block design with three replications. The soil was analysed for available P status before planting. Three budded setts of each variety were dipped in dieldrin and Benlate. The setts were laid in 120-150 mm deep furrows 8 m long and spaced 1,5 m wide. Six rows of cane were planted per plot, resulting in 34 seed setts per plot. Calcium ammonium nitrate and triple superphosphate respectively were the sources of nitrogen and phosphorus. Nitrogen was applied at a rate of 100 kg N/ha to all treatments. Pre-emergence herbicides TCA (sodium salt of trichloro-acetic acid) and diuron were applied as a cocktail at rates of 7,5 and 2,0 kg/ha of the commercial product respectively. In addition four hand weedings were carried out.

Data collected included: germination counts after 42 days, tiller counts up to six months after planting, cane height and *Striga* counts when the cane was three, four and six months old.

Yield and stalk numbers were determined at harvest when the cane was 20 months old. The data were then subjected to statistical analysis using MSTAT. Significant means ($Pr < 0,05$) were separated using LSD.

Results and discussion

Soil pH values varied from 5,6 to 7,4 and phosphorus levels from 8 to 20 ppm, indicating that the soil was deficient in phosphorus. To provide adequate phosphorus for cane growth the soil P level should be at least 20 ppm (Nyandat and DaCosta, 1968).

After 42 days (Table 1) the germination counts for varieties Co421 and Co617 were comparable to NSRC-Kibos results obtained in a non-*Striga* infested trial field (Anon, 1988). This showed that at germination the effects of *Striga* infection had not yet occurred.

Table 1
The effect of P-level on germination and tiller counts

Treatment kg P/ha	Mean shoots counted at 42 days		Mean tiller counts at 180 days	
	Co421	Co617	Co421	Co617
P ₀ = 0	217	144	1 098	1 008
P ₁ = 13	233	213	816	1 182
P ₂ = 26	233	156	1 108	1 039
P ₃ = 39	228	184	928	1 210
P ₄ = 52	238	238	-	-
P ₅ = 65	259	203	1 177	1 225
Average	235	190	1 042	1 141

After 180 days tiller counts of variety Co617 were higher than those of Co421 (Table 1). An indication of the effect of *Striga* on variety Co421 was observed by Mbogo and Osoro working on infestation of *Striga hermonthica* Benth in sugarcane (Anon 1990). The herbicide mixture plus hand weedings had no effect on *Striga* infestation in cane, although *Striga* counts showed that variety Co421 was far more susceptible to this parasite than variety Co617 (see Figure 1).

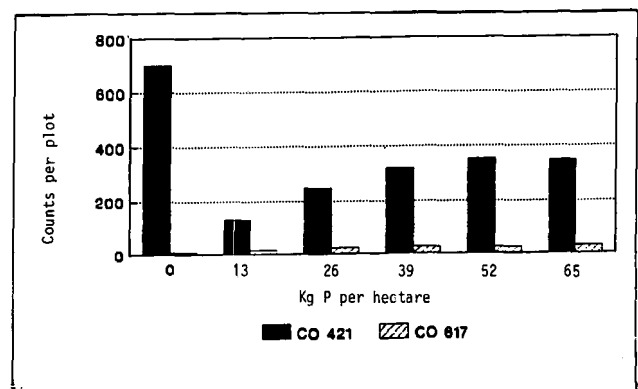


FIGURE 1 Effect of different rates of phosphorus on *Striga* counts of two cane varieties at NSRC-Kibos, 1991.

The results also showed that while different rates of phosphorus had no effect on *Striga* infestation in variety Co617, *Striga* counts in variety Co421 were markedly decreased in the presence of applied P (see Figure 1).

Figure 2 indicates that for variety Co421 there was a yield response of 30 tc/ha when phosphate was applied at 26 kg P/ha. This is in agreement with the NSRC recommended rate of 20 kg P/ha (Anon, 1986). However in all treatments, yields for variety Co421 were much lower than those obtained for variety Co617 where there was apparently no response to phosphate fertilizer. The large difference in yield between the two varieties was mainly due to *Striga* infestation.

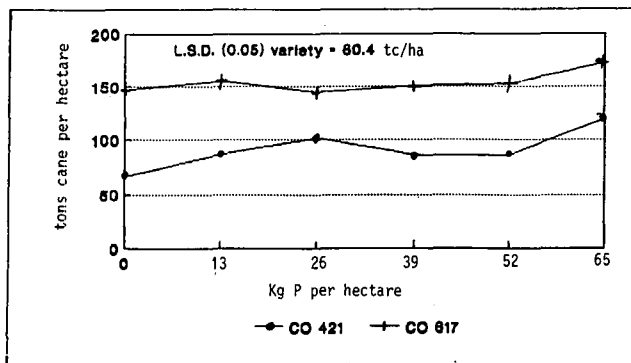


FIGURE 2 Effect of different rates of phosphorus on yield of two cane varieties at NSRC-Kibos, 1991.

Conclusion

Different rates of phosphorus while not significantly affecting *Striga* infestation in sugarcane appeared to alleviate its effects in variety Co421. Variety Co617 was found to be *Striga* tolerant, compared to Co421 irrespective of rate of applied P. Further research is in progress to confirm these results, and also to investigate the effect of other nutrients such as nitrogen and potassium in relation to witchweed.

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