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Short Communication

Effect of Intra- and inter-row mixing of sorghum with two varieties of cowpea on host crop yield in a *Striga hermonthica* infested field

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A trial was conducted in the International Institute of Tropical Agriculture (IITA) research farm in Kano, Nigeria during the 2002/2003 cropping season to evaluate the effect of intrarow and interrow mixing of sorghum with two varieties of cowpea on host crop yield in a *Striga hermonthica* infested field. Significantly (P≤0.05) highest number of *Striga* per sorghum plant were obtained with sorghum only, which also have the lowest yield (2370 kg/ha). A significantly (P≤0.05) higher yield (3709 kg/ha) was obtained with intra-row mixture of sorghum and densely planted cowpea variety, IT96D-452-1. This treatment also had the least number of *Striga* per net plot and per plant, which may be attributed to the effectiveness of the cowpea trap crop in stimulating the suicidal germination of the *Striga* seeds which would have otherwise attacked and reduced the productivity of the host plant. It may also be attributed to the effectiveness of the cropping method, with a ratio of sorghum : cowpea plants of 1:13, which improves the productivity of the system and at the same time suppresses the germination of *Striga* seeds.

Key words: Sorghum, yield, Intra-row, inter-row, cowpea, mixed-cropping.

INTRODUCTION

The plant parasite *Striga* is the most economically important parasite in Africa. It is estimated that crop loses can be upto about 40 percent; grain production is also compromised on 44 million ha in Africa (3.2% of the world's arable land). *Striga* seeds are the main source of inoculum. Each plant produces roughly 10,000 or more seeds (Pieterse and Pesch, 1983) each of which weighs about 10^{-5} g and measures about 200 microns wide by 300 microns long (Berner et al., 1997). The tiny brown *Striga* seeds can remain viable in the soil for 15 to 20 years in the absence of a suitable plant host (Ramaiah et al., 1983).

Intercropping of cereals with legumes is a predominant feature in the cropping systems of Nigeria as a means of maximizing the use of limited farmlands and also for food security to the subsistence farmers. Little is known by the farmers, however, that this age-old practice may have a positive impact on reducing the effect of *Striga* parasitism on host yield.

According to Berner and Williams (1998), little information is available on non-hosts of *Striga* that are capable of stimulating germination of the parasite's seeds. The objective of this research is to devise a crop management technique with different cowpea/sorghum intercropping systems, as a means of controlling or reducing the effect of *Striga hermonthica* (Del.) Benth. on host crop yield.

MATERIALS AND METHODS

At the onset of the 2002/2003 cropping season, an area of land was acquired at the IITA Kano Station research farm located at Wasai Village of Kano State, Nigeria. The aim of the field trial was to investigate the effect of intra-row and inter-row mixture of sorghum with two varieties of cowpea (IT-94K-440-3 and IT-93K-452-1) on the establishment of *S. hermonthica* and sorghum yield. The treatments consist of intra-row sole sorghum alternating with a cowpea (var. 452-1) row sown at 20 cm spacing (T_1), intra-row sole sorghum alternating with cowpea (var. 440-3) row sown at 20 cm spacing (T_2), intra-row mixture of sorghum and densely planted (10

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cm spacing) cowpea (var. 452-1) alternating with sole cowpea row (var. 452-1) sown at 20 cm spacing (T_3), intra-row mixture of sorghum and densely planted (10 cm spacing) cowpea (var. 440-3) alternating with sole cowpea row (var. 440-3) sown at 20 cm spacing (T_4), intra-row mixture of sorghum and densely planted (10 cm spacing) cowpea (var. 452-1) alternating with unplanted ridges (T_5), intra-row mixture of sorghum and densely planted (10 cm spacing) cowpea (var. 440-3) alternating with unplanted ridges (T_6), intra-row cereal mixture of sorghum and cowpea (var. 452-1) planted at 20 cm spacing alternating with sole cowpea (var. 452-1) row sown at 20 cm spacing (T_7), intra-row cereal mixture of sorghum and cowpea (var. 440-3) planted at 20 cm spacing alternating with sole cowpea (var. 440-3) row sown at 20 cm spacing (T_8) and finally sole sorghum (T_9). These treatments were laid out in a randomized complete block design with three replicates in plots measuring 5 x 6 m. The land was first harrowed and then 100 kg NPK (15:15:15) fertilizer per hectare was applied. Twenty four hours later the amount of *S. hermonthica* seeds that will be required to infest the field was calculated and weighed-out, a *Striga*–sieved sand mixture was made using a sieve of mesh size 180 micron. The area was inoculated with this mixture through hand-broadcasting. The planting area was shallow-ridged with a tractor ridger producing ridges at a spacing of 0.75 m from each other. A local sorghum variety (Minjibir local) was sown at a normal spacing of 1 metre between stands, while the cowpea varieties were planted as in the treatments mentioned above. Observations such as host seedling establishment (stand count), number of days to first *Striga* emergence, number of days to 50% flowering of *Striga,* plant height, *Striga* count at harvest and total host grain weight per net plot were made. The SAS® (Statistical Analysis System) software release version 9 for WINDOWS GLM (general linear model) procedure was adopted for the analysis from which the Student-Newman-Keuls test (SNK) at 5% level of significance was utilized in the interpretation of the results under the complete null hypothesis.

RESULTS AND DISCUSSION

The results (Table 1) indicate that treatment 9 (sole sorghum plant) had the significantly (P≤0.05) highest number of *Striga* per net plot of all the other sorghum treatments. The high infestation of this sole sorghum treatment with *Striga* might be responsible for this treatment being amongst those with significantly (P≤0.05) lowest yields (2370 kg/ha). Though Gurney et al. (1999) noted that the highest *Striga* infestation did not necessarily translate into the least yield, they indicated that the level of *Striga* biomass on a host influences host productivity, but the relationship is non linear, i.e. a point is reached where host grain production is independent of parasite biomass. A significantly (P≤0.05) higher grain yield (3709 kg/ha) was obtained in treatment 3 [intra-row mixture of sorghum and densely planted cowpea variety, IT96D-452-1, at 10 cm spacing alternating with sole cowpea row variety, IT96D-452-1, sown at 20 cm spacing]. This treatment was among those with the least number of *Striga* per sorghum net plot. The fact that *Striga* is few in number and the yield of the cultivar higher in treatment 3 may be attributed to the effectiveness of the cowpea trap crop in stimulating the suicidal germination of the *Striga* seeds which would have otherwise attacked and reduced the productivity of the host plant. It may also be attributed to the effectiveness of the cropping system, which not only reduced the *Striga* seed bank but also increased the nitrogen supply to the host crop, which manifested in a better yield. Gbéhounou and Adango (2002) pointed out that intercropping with cowpea leads to higher yield, and that this may be related to the benefits of nitrogen fixation under cowpea cropping, as well as a reduction in leaching of soil nutrients by cowpea cover. Symbiotic fixation, which depends on *Rhizobium* strain, may exceed 100 kg N ha^{-1} $year^{-1}$ and the nitrogen fixed is enough not only for the use of leguminous crops, but may also increase the soil reserve (Dupriez et al., 2001).

Table 1. Effect of Intra- and inter-row mixing of sorghum with two varieties of cowpea on the emergence of *Striga*, *Striga* per net plot and host crop yield in a *Striga hermonthica* infested field, 2002.

Treatment	No. of days to first *Striga* emergence	*Striga* per net plot	Sorghum yield (kg/ha)
T1	33.3^{a}	188.3^{cd}	3600^{a}
T2	33.7^{a}	243.3^{ab}	2414.8^{bcd}
T3	32^{a}	64.3^{de}	3708.8^{a}
T4	36^{a}	147.3^{cd}	2022.2^{cde}
T5	30^{a}	64^{de}	3133.3^{abc}
T6	34.7^{a}	201.7^{de}	2311.1^{bcd}
T7	33.3^{a}	53.7^{de}	3114.8^{abc}
T8	35^{a}	63^{de}	3300.9^{ab}
T9	33^{a}	281^{ab}	2370.4^{bcd}
Means	34.3	87.8	2283.3
CV	8	44.6	18.0
SE	1.9	22.6	237.8
ROOT MSE	2.8	39.2	411.8

Means followed by the same letter(s) in the same column are not statistically different from each other, using the Student-Newman-Keuls test (SNK).

It can be concluded that, as suggested by Kunjo and Jobe (2002), the results of this research underscores the benefits of intercropping in reducing *Striga* infestation and improving productivity of the system.

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