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INTERACTION EFFECT OF SELECTED TRAP CROPS ACCESSIONS ON GERMINATION AND ATTACHMENT OF *STRIGA HERMONTHICA* (DEL.) BENTH.ON SORGHUM (SORGHUM BICOLOR)

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Abstract
This study aimed at evaluating the ability of ten soyabeans genotype, cowpea genotype and groundnut genotype each for their ability to stimulate Striga suicidal germination in 2013 and 2014 cropping seasons. The experiment was conducted in 2013 and 2014 cropping seasons at Federal University of Technology Minna GidanKwano Research farm in polybags. It was 3 x 10 x 2 factorial laid out in a randomized complete block design. Factor A consists of Striga seed at three levels inoculation rate (0, 2.5 and 5g) mixed with 20g of sterilize soil respectively. Factor B was three trap crops, 10 varieties each. Factor C was sorghum variety consisting of resistance (ICSV1002) and susceptible (Local) varieties. All the treatments were replicated five times. Results of the interaction effects indicate that soyabeans varieties TGX 1448-2E and TGX 1019-2E performed best in fewer Striga count, higher plant height and grain yield compared to other treatments. Cowpea varieties IT07K-333-2, IT07K-25-3-3, IT04K-217-5, IT04K-339-1 performed best in fewer Striga count, higher plant height and grain yield compared to other treatments. Groundnut varieties RMP- 91 and RMP- 12 performed best in fewer Striga count, higher plant height and grain yield compared to other treatments. The three trap crops (soyabean, cowpea and groundnut) evaluated in the screen house were generally good in inducing germination of S. hermonthica seeds, they caused low Striga emergence and attachment and increased plant height and grain yield. This shows that integrating these legumes could help depressed the capacity of increasing the Striga seed bank.

Key words: *Striga hermonthica,* Trap crops, Suicidal germination,

INTRODUCTION

Striga hermonthica is one of the most economically important parasitic seed plant in the world (Parker and Riches, 1993). It is also given the common name of "witch weed" because it attaches itself to the roots of the host plant thus depriving it (the host) of water and nutrients. It is endemic in the African savannah and the Sahel where it devastates the yields of cereal crops. *Striga* is one of the most important biological constraints to cereal production in sub-Saharan Africa and it infest about 40% of the arable land causing between 30 and 100% loss of yield in cereals (Khan *et al.,* 2001; Gressel *et al*., 2004). Incidence and severity of *S. hermonthica* are exceptionally high on sorghum, pearl millet and maize, the main staple foods for over 300 million people in sub-Saharan Africa (Scholes and Press, 2008). *Striga* is a parasitic weed whose seedlings cannot sustain themselves on their own resources for long after germination. They need to find a host root shortly after germination and the germination needs to be perfectly timed with the presence of a host root. The use of trap crops which induce the germination of *Striga* seeds but without being parasitized is one of the most promising methods of control and culturally acceptable (Botanga *et al*., 2003). Indeed, the trap cropping induces suicidal germination and leads to depleted *Striga* seed bank. Many potentially successful approaches developed to control this weed include using resistant/tolerant varieties, sowing clean seeds that are not contaminated with *Striga* seeds, rotating cereal hosts with trap crops that induce abortive germination of *Striga* seeds. Most of these trap crops are being grown by farmers in *Striga hermonthica* infested areas. In order to solve *Striga* problems in small scale agriculture, a system that would improve soil fertility to increase yield as well as reduce *Striga* infestation will be of double advantage. Botanga *et al*. (2003) had indicated in their study that the major problem associated with the use of resistant cultivars is the lack of universal resistance. So, the small-scale farmers rely on *Striga*-tolerant varieties of host crops whose growing may lead to the increasing of *Striga* seed bank in the soil. Gbehounuou and Adango (2003) reported that root exudates of some soyabean,

cowpea and groundnut cultivars stimulate the germination of S. *hermonthica*. Bontanga *et al*., (2003) also reported 13.3 to 50.0% stimulation of *Striga* seed germination by cotton varieties. Therefore the objective of this study was to evaluate /screen the variability of ten soyabean genotypes, ten cowpea genotypes and ten groundnut genotypes with respect to their ability to induce suicidal germination of *S. hermonthica* seeds in Sorghum.

METHODOLOGY

Description of the experimental site

The screen house trial experiment was conducted at Federal University of Technology Research Farm Minna, (09^{o} 37'N and 06^{o} 28'E) in 2013 and 2014 cropping seasons, located in the southern Guinea Savanna Agroecology of Nigeria. Rainfall peaks in August and September, Usually begins in April and ends in October. Temperature average ranges from 270C to 320C while relative humidity fluctuates between 40 and 75%. The soil is described as sandy clay loam.

Treatment and experimental design

Treatments comprised of *Striga* seeds at three levels inoculation rate (0, 2.5 and 5 g). Ten varieties of soyabean, cowpea and groundnut each as trap crops was used with two sorghum varietie: ICSV 1002 (resistance) and Local (susceptible) Varieties. Treatments were arranged in a completely randomized block design in three

Experimental procedure

Striga-free soil was collected from the field and sterilized for two hours. Twenty gram of the sterilized soil was filled into poly bags and then inoculated with Striga seeds. The polybags were watered carefully the first day and later after 5 days in order to condition the *Striga* seeds.

The trap crops were sown one week after innoculation. After harvesting the trap crops, the two sorghum varieties (ICSV1002 (resistance) and Local (susceptible)) were sown the following day. Torn polybags at that time were carefully replaced with new one by transfering the old bags into the new ones so as not to lose part of the soil. The bags were monitored and watered regularly. Sorghum seedlings were thinned down to two per bag. The sorghum varieties were again sown the following year as done the previous year.

Data collection

Data collected on sorghum includes: Days to first *Striga* emergence, *Striga* count at 6 and 8 WAS per stand of sorghum, plant height at 10 and 14 WAS, and grain yield.

Data analysis

Data were subjected to analysis of variance using computer software Genstat (2010). Statistical differences between variable means were compared using the least significant difference ($P < 0.05$).

RESULTS AND DISCUSSION

There were significant ($P < 0.05$) differences in interaction effect of sorghum and soyabean varieties on *Striga* count throughout the sampling periods (6 sand 8 WAS) in 2013 and 2014 (Table 1). In 2013 at 6 WAS, the ICSV1002 sorghum variety in soyabean variety TGX 1448-2E supported fewer *Striga* count compared to other treatments, while in local sorghum variety, fewer *Striga* count was recorded in soyabean variety TGX 1019-2EB compared to other treatments (Table 1). At 8 WAS, in ICSV 1002 variety, soyabean variety TGX 1019-2EB recorded fewer *Striga* count compared to other treatments, while in local sorghum variety, fewer *Striga* count was recorded in soyabean variety TGX 1448-2E compared to other treatments (Table 1). In 2014, at 6 WAS ICSV 1002 variety, soyabean variety TGX 1987-96F supported fewer *Striga* count compared to other treatments. In Local sorghum variety fewer *Striga* count was observed in soyabean variety TGX 1990-45F compared to other treatments (Table 1). At 8 WAS, fewer *Striga* count was recorded in soyabean variety TGX 1019-2EB in ICSV 1002 variety (Table 1) compared to other treatments (Table 1). In local variety fewer *Striga* count was recorded in soyabean variety TGX 1448-2E compared to other treatments (Table 1).There were no significant difference in interaction effect of sorghum and soyabean varieties on plant height at 6 WAS in 2013, but at 8 WAS in the ICSV 1002 variety, soyabean variety TGX 1830-20E produced taller plant height, compared to other treatments (Table 1). In the Local variety, soyabean variety TGX 1019-2E produced taller plant height compared other treatments (Table 1). In 2014, there were significant ($P < 0.05$) difference in plant height at 6 WAS. In ICSV 1002 variety soyabean variety TGX 1830-20F recorded taller plant height compared to other treatments (Table 1). In Local variety, soyabean variety TGX 1448-2E produced taller plant height compared to other treatments (Table 1). There were no significant difference in interaction effect of sorghum and soyabean varieties on plant height at 8 WAS (Table1). Grain yield were not significantly difference in interaction effect of sorghum and soyabean varieties in grain yield in 2013 and 2014 (Table 1). Generally highest grain yield was recorded

in soyabean variety TGX 1448-2E (383.10g) in ICSV 1002 variety (Table 1) compared to other treatments
There were no significant differences observed in interaction effect of soyabean varieties and *Striga* level on days to first *Striga* emergence in 2013 and 2014 (Table 2). Generally variety TGX 1019-2EB at 2.5g *Striga* level in 2013 and varieties TGX 1448-2E and TGX 1019-2EB at both 2.5g and 5g *Striga* level in 2014 delayed *Striga* emergence compared to other treatments (Table 2). Significant difference was not also observed in the interaction effect of varieties and *Striga* level on *Striga* count at 6WAS and 8WAS in 2013 and 2014 (Table 2). There were no significant differences in interaction effect of varieties and *Striga* level on plant height in 2013 throughout the sampling period (Table 2). But in 2014, there were significant differences at 6 WAS. Variety TGX 1448-2E at 0g *Striga* level produced highest plant height compared to other treatments (Table 2). Grain yield was significantly ($P < 0.05$) affected by interaction of variety and *Striga* level in both 2013 and 2014 (Table 2). In 2013, variety TGX 1448-2E at 0g *Striga* level recorded highest grain yield (414.90g) compared to other treatments (Table 2) In 2014, same variety TGX 1448-2E at 0g *Striga* level produced the highest grain yield (432.11g) compared to other treatments (Table 2).

The fewer *Striga* count observed on soyabean varieties TGX 1019-2EB and TGX 1448-2E, 12 could be attributed to the germination and dead of some of the *Striga* seeds in the absence of the host which is more fatal in these trap crop varieties compared to other varieties used. This in agreement with the findings of Botanga *et al*., (2003) that trap crops varied in their *Striga* stimulation potential, some had high stimulation while others had medium or low stimulation.
The result of this study on sorghum plant height indicates that maximum plant height was observed in soyabean varieties TGX 1830-20E and TGX 1019-2EB. This might be due to inability of the fewer *Striga* shoot to have effects on the host cell elongation as it could not take photosynthetic away from the host crop which could have head to shorter host internodes and stunted growth. This confirm the work of press *et al*., (1989) that possible reduction in photosynthetic activity as well as competition for growth resources could lead to reduced plant height and yield.
The relatively high yield recorded by soyabean variety TGX 1448-2E, when compared to other varieties of each confirmed the ability of these varieties to reduce *Striga* attachment and it subsequent effect on the host plant resulting in good host development and growth. Ayongwa *et al*., (2010) earlier reported that parasitic weed competes for water and nutrients as a root parasite and in so doing crop growth is stunted and yield are generally reduced. The highest grain yield at 0 g *Striga* level compared to 2.5 g and 5 g *Striga* level might be due to establishment and growth of sorghum plant under *Striga*-free environment which translated into higher yield as also reported by Kuchinda *et al.,* (2003) that higher cob weight is a better indicator of reduce effect of *Striga* on maize yield.

There were significant differences in interaction effect of sorghum and cowpea varieties on days to first *Striga* shoot emergence in 2013 and 2014 (Table 3). The sorghum ICSV1002 variety in the presence of cowpea variety IT07K-333-2 delayed *Striga* emergence compared to other varieties. The Local sorghum variety with cowpea variety IT07K-227-4 delayed *Striga* emergence compared to other varieties (Table 3). In 2014, the sorghum variety ICSV1002 in the presence of cowpea varieties IT04K-217-5, IT07K-25-3-3, IT04K-333-2, and IT04K-339-1 delayed *Striga* emergence compared to other varieties (Table 3). The Local variety in cowpea variety IT04K-339-1 delayed *Striga* emergence compared to other varieties (Table 3). There was no effect of interaction of sorghum and cowpea varieties on *Striga* count at 6WAS in 2013, but at 8 WAS, sorghum variety ICSV1002 with cowpea variety IT07K-25-3-3 and IT04K-217-5 supported fewer *Striga* shoots (Table 3), while the local sorghum variety with cowpea variety IT04K-217-5 supported fewer *Striga* count compared to other varieties. In 2014, there were significant ($p < 0.05$) differences in the interaction effect on *Striga* shoot count throughout the sampling periods (6 and 8 WAS) (Table 3). At 6 WAS, ICSV1002 variety in variety IT04K-217-5 supported fewer *Striga* count compared to other varieties. While Local variety in variety IT04K-217-5 supported fewer *Striga* counts compared to other varieties. At 8 WAS, ICSV1002 variety in variety IT07K-25-3-3 and IT04K-217-5 supported fewer *Striga* count compared to other varieties. The Local sorghum variety in cowpea variety IT04K-217-5 supported fewer *Striga* counts compared toother varieties (Table 3). There was no significant interaction effect of cowpea varieties on sorghum plant height in 2013 and 2014 throughout the sampling period (6 and 8 WAS) (Table 3). Grain yield was significantly ($p < 0.05$) different in 2013 and 2014. Sorghum ICSV1002 variety in cowpea variety IT04K-339-1 recorded higher grain yield in both years compared to other varieties. Also Local sorghum variety in cowpea variety IT04K-339-1 recorded higher grain yield in both years (Table 3).

There were significant ($p < 0.05$) differences in days to first *Striga* emergence in 2013 (Table 4). The cowpea variety IT04K-333-2 delayed *Striga* emergence at 5g *Striga* level when compared to other treatments, while in 2014, there was no significant effect. The 0g level (control) had no *Striga* inoculation hence no *Striga* emergence (Table 4). There were significant ($p < 0.05$) difference in interaction effect of varieties and *Striga* levels on *Striga* count throughout the sampling period (6 and 8 WAS) in 2013 and 2014 (Table 4). In 2013, at 6 WAS cowpea variety IT07K-25-3-3 at 2.5g *Striga* level recorded fewer *Striga* count compared to other varieties, at 8 WAS fewer *Striga* count was recorded in variety IT04K-217-5 at 2.5g *Striga* level compared to other varieties. In 2014, fewer *Striga* count was observed in variety IT04K-217-5 at 2.5g *Striga* level at 6 and 8 WAS compared to other varieties (Table 4). There was no significant interaction effect of varieties and *Striga* levels on plant height in 2013 (Table 4). At 8 WAS in 2014, cowpea variety IT04K-217-5 at 0g *Striga* level produced significantly taller plant height compared to other varieties (Table 4). In grain yield variety IT04K-217-5 at 0g *Striga* level produced significantly higher grain yield in both years compared to other varieties (Table 4). The ability of Cowpea varieties IT04K-333-2 and IT07K-25-3-3 to hinder early *Striga* emergence compared to other varieties could be ability of some of this legumes to produces a radical growth inhibition chemical in addition to the germination-stimulating chemical which is found in them. This hinders the attachment of the parasite radicle onto the sorghum host plant. This finding is in consonant with that of Tsanuo *et al*., (2003) who observed that in addition to the germination-stimulating chemical, Desmodium also produces a radicle growth inhibition chemical, which hinders the attachment of the parasite radicle onto the associated maize host plant.

The relatively high yield recorded by cowpea Variety IT04K-339-1 when compared to other varieties confirmed the ability of this variety to reduce *Striga* attachment and it subsequent effect on the host plant resulting in good host development and growth. Ayongwa *et al*., (2010) earlier reported that parasitic weed competes for water and nutrients as a root parasite and in so doing crop growth is stunted and yield are generally reduced. The highest grain yield at 0 g *Striga* level compared to 2.5 g and 5 g *Striga* level might be due to establishment and growth of sorghum plant under *Striga*-free environment which translated into higher yield as also reported by Kuchinda *et al.,* (2003) that higher cob weight is a better indicator of reduce effect of *Striga* on maize yield.

There was no interaction effect of sorghum and groundnut varieties on day to first *Striga* emergence in 2013. In 2014, significant interaction effect was observed in sorghum variety ICSV1002 with groundnut varieties TE3, QH 243C, RMP-12 and RMP-91 which delayed *Striga* emergence compared to other groundnut varieties (Table 5). The Local sorghum variety in the presence of groundnut variety TES, delayed *Striga* emergence compared to other varieties (Table 5). There was significant ($P < 0.05$) interaction effect of sorghum and groundnut varieties on *Striga* count in 2013 and 2014 throughout the sampling period (Table 5). In 2013, sorghum ICSV 1002 variety in variety RMP-91 supported fewer *Striga* count at 6 WAS while at 8 WAS sorghum ICSV1002 variety in groundnut varieties RMP-91 and variety RMP-12 recorded fewer *Striga* count compared to other varieties. Sorghum Local variety in groundnut variety RMP-91 recorded fewer *Striga* count at 6 and 8 WAS compared to other varieties. In 2014, sorghum ICSV 1002 variety in groundnut variety RMP-91 at 6 and 8 WAS recorded fewer *Striga* count compared to other varieties. The Local sorghum variety in groundnut variety RMP-91 recorded fewer *Striga* count at 6 and 8 WAS compared to other varieties. (Table 5). There was no significant interaction effect of sorghum and groundnut varieties on sorghum plant height in 2013 and 2014 throughout the sampling period (6 and 8 WAS) (Table 5). Generally ICSV 1002 variety in variety RMP-91 recorded the taller plant height throughout the periods (6 and 8 WAS) compared to other varieties. Local variety in variety RMP-91 also produced taller plant height compared to other varieties. In 2014, same trend with 2013 was observed (Table 5). ICSV 1002 variety in Groundnut-11 Variety recorded higher grain yield compared to other varieties. Local variety in variety RMP-91 recorded the higher grain yield compared to other varieties (Table 5) .There was no significant difference in grain yield in 2014 (Table 5).

There was no significant interaction effect of groundnut varieties and *Striga* level on days to first *Striga* emergence in 2013 (Table 6). But in 2014, there was significant effect with groundnut varieties TE3 at 2.5g *Striga* level and QH 243C, RMP-12 and RMP-91 at 2.5g and 5g *Striga* levels delaying *Striga* emergence compared to other varieties (Table 6). There was significant ($P < 0.05$) interaction effect of groundnut varieties and *Striga* level on *Striga* count in 2013 and 2014 throughout the sampling periods (6 and 8 WAS) (Table 6). In both years, RMP-91 supported fewer *Striga* count at 6 and 8 WAS at 2.5g

Striga level (Table 6) compared to other varieties. There was no significant interaction effect of groundnut varieties and *Striga* level on groundnut plant height in 2013 (Table 6). But 2014 was, throughout the sampling periods (6 and 8 WAS) (Table 6) RMP-91 at 0g *Striga* level produced taller plant height in both periods compared to other varieties (Table 6). Grain yield in both years was significantly higher with variety RMP-91 at 0g *Striga* level compared to other varieties. (Table 6).

The ability of groundnut varieties RMP-91, RMP-12, TES and QH343C to hinder early *Striga* emergence compared to other varieties could be ability of some of this legumes to produces a radical growth inhibition chemical in addition to the germination-stimulating chemical which is found in them. This hinders the attachment of the parasite radicle onto the sorghum host plant. This finding is in consonant with that of Tsanuo *et al*., (2003) who observed that in addition to the germination-stimulating chemical, Desmodium also produces a radicle growth inhibition chemical, which hinders the attachment of the parasite radicle onto the associated maize host plant. The fewer *Striga* count observed on groundnut varieties RMP-91and RMP-12 could be attributed to the germination and dead of some of the *Striga* seeds in the absence of the host which is more fatal in these trap crop varieties compared to other varieties used. This in agreement with the findings of Botanga *et al*., (2003) that trap crops varied in their *Striga* stimulation potential, some had high stimulation while others had medium or low stimulation. The relatively high yield recorded by groundnut variety RMP-91 when compared to other varieties confirmed the ability of these varieties to reduce *Striga* attachment and it subsequent effect on the host plant resulting in good host development and growth. Ayongwa *et al*., (2010) earlier reported that parasitic weed competes for water and nutrients as a root parasite and in so doing crop growth is stunted and yield are generally reduced. The highest grain yield at 0 g *Striga* level compared to 2.5 g and 5 g *Striga* level might be due to establishment and growth of sorghum plant under *Striga*-free environment which translated into higher yield as also reported by Kuchinda *et al.,* (2003) that higher cob weight is a better indicator of reduce effect of *Striga* on maize yield.

CONCLUSION AND RECOMMENDATION

Based on the result obtained in the study, we conclude that soyabean TGX 1448-2E, cowpea IT04K-339-1 and groundnut RMP-91 were strongly recommended for sowing in *Striga* – infested field under crop rotation or intercropping system for enhanced crop yield.

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Table 1: Interaction effect of sorghum and soyabean varieties on soyabean trap crop

Treatments		2013						2014					
sorghum	**Soyabean**	**ISSE**	**6SSC**	**8SSC**	**6PH**	**8PH**	**GY**	**ISSE**	**6 SSC**	**8SSC**	**6PH**	**8PH**	**GY**
ICSV 1002	TGX1937-1F	56.30	5.30	9.59	24.13	39.27	280.50	55.99	7'7.40	9.59	23.93	37.60	274.15
	TGX1986-10F	57.40	4.60	6.99	25.00	43.20	337.20	57.70	8.60	6.99	25.27	45.33	336.64
	TGX1986-10F	56.10	5.60	10.28	23.93	42.00	260.70	55.99	8.60	10.28	23.53	37.00	245.85
	TGX1990-45F	56.00	5.30	8.89	24.87	41.47	328.60	55.99	7.70	8.89	24.60	41.67	322.07
	TGX187-62F	57.50	4.90	8.09	25.20	43.20	327.00	57.60	9.60	8.09	26.00	42.27	332.87
	TGX1987-96F	56.30	5.30	8.38	24.40	44.20	329.80	55.99	7.00	8.38	24.73	39.13	321.13
	TGX1448-2E	57.60	2.10	4.79	28.73	41.53	383.10	59.40	10.31	4.79	30.60	50.33	383.43
	TGX1835-10E	57.80	5.90	5.89	26.20	42.13	348.40	58.00	8.90	5.89	26.20	45.73	351.43
	TGX1830-20E	58.20	3.50	5.49	27.20	45.40	346.00	59.20	8.10	5.49	28.53	47.67	359.61
	TGX1019-2EB	58.90	3.00	4.59	27.53	43.00	359.70	59.20	8.41	4.59	28.40	50.27	372.49
Local variety	TGX1937-1F	56.20	9.50	14.52	23.40	44.80	251.00	55.99	4.80	14.52	22.67	35.53	252.17
	TGX1986-10F	57.70	7.70	10.81	23.87	42.53	309.00	57.80	5.90	10.81	23.47	42.13	308.99
	TGX1986-10F	56.30	10.80	16.42	23.67	38.20	235.40	55.99	5.50	16.42	22.07	34.87	232.47
	TGX1990-45F	56.30	8.80	14.02	24.33	39.13	302.20	55.99	4.60	14.02	23.47	38.73	299.46
	TGX187-62F	57.30	8.50	12.01	25.00	39.80	297.30	57.50	14.50	12.01	25.00	39.80	298.81
	TGX1987-96F	56.00	9.20	14.52	23.87	36.27	303.50	55.99	10.80	14.52	23.73	36.27	298.81
	TGX1448-2E	58.80	5.10	7.91	26.40	46.60	346.70	59.20	16.40	7.91	28.67	46.60	353.12
	TGX1835-10E	57.60	6.50	9.91	24.60	43.13	328.80	58.00	13.99	9.91	24.40	42.73	327.88
	TGX1830-20E	58.60	7.00	9.21	26.00	44.60	340.30	58.70	11.99	9.21	26.80	45.80	343.67
	TGX1019-2EB	58.50	4.70	8.51	26.67	46.87	353.90	59.10	14.50	8.51	27.33	47.80	351.55
Mean		57.27	6.17	9.54	25.25	42.37	318.46	57.47	9.48	9.54	25.47	42.36	318.33
LSD (P<0.05)		NS	0.88	0.67	NS	3.17	NS	NS	0.78	0.67	0.46	NS	NS

1SSE = first *Striga* shoot emergence, 6SSC= *Striga* shoot count at 6 WAS, 8 SSC= *Striga* shoot count at 8 WAS, 6PH=Sorghum plant heights at 6 WAS. 8PH= Sorghum plant height at 8 WAS, GY: Grain yield. NS= Not significant

Table 2: Interaction effect of soyabean varieties and *Striga* level on soyabean trap crop

Treatments		2013						2014					
Variety	*Striga* level (g)	ISSE	6SSC	8SSC	6PH	8PH	GY	ISSE	6 SSC	8SSC	6PH	8PH	GY
TGX1937-1F	0	0.00	0.00	0.00	25.20	42.40	317.40	0.00	0.00	0.00	24.90	39.40	309.17
	2.5	56.60	6.80	11.10	23.30	42.60	253.10	56.00	5.20	11.10	22.90	36.40	253.91
	5	55.90	8.00	13.00	22.80	41.10	226.80	56.00	7.00	13.00	22.10	33.90	226.40
TGX1986-10F	0	0.00	0.00	0.00	25.70	44.10	368.80	0.00	0.00	0.00	26.20	46.30	369.33
	2.5	57.70	5.30	7.70	24.40	42.00	319.10	57.70	6.80	7.70	23.80	43.20	317.58
	5	57.40	7.00	10.10	23.20	42.50	281.50	57.80	7.70	10.10	23.10	41.70	281.53
TGX1986-10F	0	0.00	0.00	0.00	24.00	40.40	256.80	0.00	0.00	0.00	24.20	39.60	260.75
	2.5	55.90	7.60	12.40	23.50	43.10	258.50	56.00	5.80	12.40	22.40	36.30	244.73
	5	56.50	8.80	14.30	23.90	36.80	228.60	56.00	8.30	14.30	21.80	31.90	212.01
TGX1990-45F	0	0.00	0.00	0.00	24.80	42.40	344.90	0.00	0.00	0.00	24.90	42.70	345.93
	2.5	56.50	6.90	10.50	24.40	39.50	320.50	56.00	5.30	10.50	24.00	40.20	307.26
	5	56.10	7.20	12.40	24.60	39.00	280.90	56.00	7.00	12.40	23.20	37.70	279.10
TGX187-62F	0	0.00	0.00	0.00	26.50	42.20	360.40	0.00	0.00	0.00	27.60	43.60	366.14
	2.5	57.50	6.10	9.00	25.00	41.50	300.50	57.50	11.10	9.00	25.30	41.30	305.37
	5	57.30	7.30	11.10	23.80	40.80	275.50	57.50	13.00	11.10	23.60	38.20	276.01
TGX1987-96F	0	0.00	0.00	0.00	25.30	41.20	345.10	0.00	0.00	0.00	26.10	40.10	330.11
	2.5	56.20	6.50	10.30	24.20	41.30	321.90	56.00	7.70	10.30	24.10	37.60	318.71
	5	56.10	8.00	12.60	22.90	38.20	283.10	56.00	10.10	12.60	22.50	35.40	281.09
TGX1448-2E	0	0.00	0.00	0.00	28.20	45.80	414.90	0.00	0.00	0.00	31.70	50.90	432.11
	2.5	58.30	3.20	5.40	27.10	44.10	350.60	59.30	12.40	5.40	29.00	49.20	348.58
	5	57.80	4.00	7.30	27.40	42.30	329.20	59.30	14.30	7.30	28.20	45.30	324.13
TGX1835-10E	0	0.00	0.00	0.00	26.60	43.30	402.80	0.00	0.00	0.00	27.00	47.40	401.61
	2.5	57.70	5.00	7.50	25.20	42.70	326.20	58.00	10.50	7.50	24.70	43.40	324.21
	5	57.70	7.40	8.30	24.40	41.90	286.80	58.00	12.40	8.30	24.20	41.90	293.15
TGX1830-20E	0	0.00	0.00	0.00	27.00	44.70	389.40	0.00	0.00	0.00	28.70	50.20	405.67
	2.5	58.60	4.60	6.10	26.20	45.90	327.90	59.00	9.00	6.10	27.10	46.60	339.14
	5	58.10	5.90	8.60	26.60	44.40	312.20	58.90	11.10	8.60	27.20	43.40	310.12
TGX1019-2EB	0	0.00	0.00	0.00	28.40	47.40	404.90	0.00	0.00	0.00	29.60	.00	0.56
	2.5	58.80	3.30	5.70	27.10	43.80	341.20	59.30	10.30	5.70	27.90	48.90	15.33	341.36
	5	58.60	4.40	7.40	25.80	43.60	22.59	324.30	59.30	12.60	7.40	26.10	46.20	13.23	324.20
			57.26	6.17	9.54	25.25	42.37	13.13	318.46	57.48	9.38	9.54	25.47	42.36	12.50
LSD(P<0.05)		NS	NS	NS	NS	NS	NS	23.72	NS	NS	NS	0.56	NS	0.77	13.74

1SSE = first *Striga* shoot emergence, 6SSC= *Striga* shoot count at 6 WAS, 8 SSC= Strigs shoot count at 8 WAS,
6PH. Sorghum plant height at 6 WAS. 8PH= Sorghum plant height at 8 WAS, GY: Grain yield. NS= Not significant

Table 3: Interaction effect Sorghum and cowpea varieties on cowpea trap crop

Treatments		2013						2014					
sorghum	Cowpea varieties	ISSE	6SSC	8SSC	6PH	8PH	GY	ISSE	6 SSC	8SSC	6PH	8PH	GY
ICSV 1002	IT04K-217-5	56.78	4.56	4.99	27.53	46.90	480.00	57.99	2.19	4.80	28.33	47.40	482.51
	IT04K-227-4	56.18	4.98	7.99	27.20	45.20	444.60	55.99	5.59	7.90	25.80	44.53	450.34
	IT07K-210-1	56.18	6.56	11.59	26.30	43.50	439.80	55.89	6.59	11.50	25.80	42.80	429.89
	IT07K-25-3-3	56.88	5.46	4.59	27.40	46.40	454.50	57.99	2.59	4.50	27.53	47.07	462.07
	IT07K-237.2-1	55.68	4.96	10.59	26.27	43.10	425.00	55.99	4.59	10.70	24.73	41.47	427.37
	IT04K-333-2	57.68	4.58	7.49	26.07	44.90	456.60	57.99	3.89	7.30	26.40	45.20	463.80
	IT04K-339-1	57.08	4.56	6.29	26.60	45.70	490.50	57.99	3.89	6.20	27.07	45.67	504.80
	IT04K-405-5	56.28	6.16	10.49	24.87	45.40	420.30	55.99	6.09	10.40	23.13	41.87	406.65
	IT07K-293-3	56.78	6.26	10.29	25.00	43.70	433.70	56.79	5.99	10.20	24.87	43.47	437.45
	IT07K-318-2	56.28	6.16	10.89	24.33	43.40	400.50	55.99	6.59	11.10	23.27	40.33	382.05
Local variety	IT04K-217-5	56.31	4.15	6.50	26.60	44.90	456.60	55.00	4.61	6.20	26.80	45.13	456.05
	IT04K-227-4	55.34	5.37	10.18	23.60	44.50	432.80	54.00	7.91	10.70	23.93	43.47	431.16
	IT07K-210-1	56.04	7.95	13.91	25.33	43.10	422.50	55.00	11.11	13.90	24.33	39.53	419.77
	IT07K-25-3-3	56.64	5.96	8.01	26.47	44.30	446.50	55.00	5.01	7.80	25.80	44.93	440.47
	IT07K-237.2-1	55.74	6.65	13.91	25.07	68.30	436.10	55.00	9.01	13.80	23.33	39.33	420.06
	IT04K-333-2	56.44	4.67	9.10	25.67	44.30	437.30	55.00	6.41	8.90	24.87	42.67	434.29
	IT04K-339-1	56.54	5.55	8.71	25.93	43.70	478.70	55.40	6.11	8.90	25.53	43.20	484.35
	IT04K-405-5	56.14	6.55	13.51	24.40	42.60	401.70	55.20	9.71	13.50	21.53	39.47	393.08
	IT07K-293-3	56.24	6.45	13.51	24.20	43.70	433.00	55.00	9.61	13.80	23.13	40.80	424.97
	IT07K-318-2	56.14	7.15	14.11	24.87	42.90	381.70	55.00	10.31	14.40	21.20	38.20	370.05
Mean		56.37	5.73	9.83	25.69	45.53	438.62	56.86	6.39	4.80	24.45	42.81	430.70
LSD (P<0.05)		0.67	NS	0.76	NS	NS	14.12	0.19	0.45	0.62	NS	NS	8.22

1SSE = first *Striga* shoot emergence, 6SSC= *Striga* shoot count at 6 WAS, 8 SSC= *Striga* shoot count at 8 WAS,
6 PH. Sorghum plant height at 6 WAS. 8PH= Sorghum plant height at 8 WAS, GY: Grain yield. NS= Not significant

Table 4: Interaction effect of cowpea varieties and *Striga* levels on cowpea trap crop

Treatments		2013						2014					
Cowpea variety	*Striga* level (g)	ISSE	6SSC	8SSC	6PH	8PH	GY	ISSE	6 SSC	8SSC	6PH	8PH	GY
IT04K-217-5	0	0.00	0.00	0.00	26.60	47.20	531.50	0.00	0.00	0.00	30.40	50.50	535.13
	2.5	56.60	5.70	5.20	27.70	46.10	442.90	56.50	2.80	4.90	27.30	46.70	442.88
	5	56.80	4.90	6.30	26.90	44.50	430.40	56.50	4.00	6.10	25.00	41.60	429.83
IT04K-227-4	0	0.00	0.00	0.00	27.90	45.80	449.70	0.00	0.00	0.00	28.00	47.10	458.36
	2.5	55.30	6.20	8.20	24.60	44.20	438.70	55.00	5.70	8.10	24.40	42.60	443.37
	5	56.00	8.20	10.60	23.70	44.50	427.70	55.00	7.80	10.50	22.20	40.30	420.53
IT07K-210-1	0	0.00	0.00	0.00	26.90	45.20	455.00	0.00	0.00	0.00	27.40	45.10	448.09
	2.5	56.00	7.60	11.80	25.50	43.60	423.30	55.50	8.20	11.80	24.50	40.30	419.23
	5	56.00	8.80	13.70	25.00	41.00	415.30	55.40	9.50	13.60	23.30	38.10	407.17
IT07K-25-3-3	0	0.00	0.00	0.00	28.30	47.20	506.30	0.00	0.00	0.00	29.30	50.10	515.20
	2.5	56.50	4.50	5.80	27.00	45.60	431.00	56.80	3.50	5.60	26.50	46.40	420.61
	5	56.80	5.60	6.80	25.50	43.20	414.20	56.70	4.10	6.70	24.20	41.50	408.00
IT07K-237.2-1	0	0.00	0.00	0.00	26.20	45.00	442.20	0.00	0.00	0.00	26.10	44.60	439.02
	2.5	55.60	6.40	10.80	25.20	42.70	424.00	55.50	6.20	10.70	23.80	40.30	422.54
	5	55.60	7.10	13.70	25.60	79.40	462.60	55.50	7.40	13.80	22.20	36.30	409.59
IT04K-333-2	0	0.00	0.00	0.00	26.50	45.60	462.60	0.00	0.00	0.00	28.70	47.10	472.93
	2.5	56.30	6.20	7.80	26.20	44.70	462.60	56.50	5.10	7.70	25.40	43.20	448.84
	5	57.00	6.10	8.80	24.90	43.60	430.50	56.50	5.20	8.50	22.80	41.50	425.38
IT04K-339-1	0	0.00	0.00	0.00	27.30	46.40	498.10	0.00	0.00	0.00	29.00	48.20	505.42
	2.5	56.70	5.30	7.30	25.80	44.10	487.30	56.70	4.30	7.30	26.10	43.70	499.77
	5	56.70	6.70	7.70	25.70	43.50	467.50	56.70	5.70	7.80	23.80	41.40	478.54
IT04K-405-5	0	0.00	0.00	0.00	25.70	44.80	439.80	0.00	0.00	0.00	25.10	43.40	425.05
	2.5	55.90	6.70	11.00	24.90	43.90	401.80	55.50	7.30	10.90	22.40	40.20	394.89
	5	56.30	7.90	13.00	23.30	43.30	391.30	55.50	8.50	13.00	19.50	38.40	379.66
IT07K-293-3	0	0.00	0.00	0.00	25.80	45.20	445.90	0.00	0.00	0.00	26.60	45.90	451.83
	2.5	56.80	7.20	10.50	24.80	43.50	435.00	56.00	8.10	10.80	23.70	41.50	428.92
	5	56.00	7.40	13.00	23.20	42.40	419.20	56.00	7.50	13.20	21.70	39.00	412.88
IT07K-318-2	0	0.00	0.00	0.00	26.30	44.10	409.20	0.00	0.00	0.00	24.80	42.30	403.41
	2.5	55.70	7.00	11.40	24.40	43.30	398.50	55.50	7.80	11.80	21.90	39.10	381.49
	5	56.50	8.20	13.60	23.10	42.00	365.50	55.50	9.10	13.70	20.00	36.40	343.26
Mean		56.37	5.74	9.85	25.68	45.52	440.32	55.94	6.39	9.83	24.87	42.76	435.73
LSD(P<0.05)		0.82	1.15	0.93	NS	NS	17.29	NS	0.55	0.76	NS	1.32	10.06

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Table 5: Interaction effect of Sorghum and Groundnut varieties on groundnut trap crop

Treatments		2013						2014					
sorghum	Variety	ISSE	6SSC	8SSC	6PH	8PH	GY	ISSE	6 SSC	8SSC	6PH	8PH	GY
ICSV 1002	TE3	38.53	4.00	6.13	24.33	46.07	497.75	38.67	3.47	6.00	25.27	45.47	496.77
	CHICO	41.27	5.27	8.27	24.33	45.47	467.60	37.33	5.00	8.47	24.73	44.07	467.52
	KH 241D	37.40	5.47	9.00	23.80	45.00	445.98	37.33	5.67	9.07	23.07	42.93	444.12
	QH 243C	38.33	4.60	7.20	25.13	45.00	480.19	38.67	4.33	7.07	25.87	44.87	479.51
	CN 94C	37.53	5.53	8.87	24.53	44.60	458.82	37.33	5.40	8.87	24.60	43.20	457.36
	RRB	37.47	5.80	9.00	23.60	43.93	434.39	37.33	6.13	9.53	23.53	41.80	433.82
	RMP-12	38.40	3.80	4.60	25.13	46.40	494.84	38.67	3.13	5.13	26.47	46.00	495.23
	RMp-91	38.53	2.93	4.80	26.00	47.47	504.46	38.67	2.40	4.53	26.73	47.47	502.39
	Groundnut-23	37.40	5.00	8.13	25.00	45.47	472.85	37.33	4.80	7.40	25.07	44.33	472.85
	Groundnut-11	37.40	6.00	8.87	22.47	42.73	431.57	37.33	6.73	8.67	22.47	41.20	431.57
Local variety	TE3	37.07	4.73	7.73	23.53	44.07	485.10	37.33	4.53	7.00	23.60	43.20	483.66
	CHICO	36.60	6.33	9.33	23.07	43.47	457.03	36.67	6.53	9.27	22.87	42.40	455.22
	KH 241D	36.73	6.53	9.13	22.07	42.47	437.07	36.67	6.53	9.40	21.33	41.07	436.72
	QH 243C	36.87	5.67	8.60	23.73	42.93	468.53	36.67	5.73	8.47	24.07	43.00	471.37
	CN 94C	36.80	6.00	9.53	23.13	41.40	446.78	36.67	6.27	9.53	22.80	41.20	445.40
	RRB	36.73	4.27	10.13	22.60	40.60	427.39	36.67	4.27	10.27	21.80	39.87	423.60
	RMP-12	36.87	4.40	7.60	23.87	44.53	480.50	36.67	4.67	7.40	24.80	43.60	480.71
	RMp-91	36.87	4.13	6.27	25.00	45.53	486.04	36.67	3.60	6.27	24.93	45.53	486.04
	Groundnut-23	36.40	5.73	8.33	23.80	43.80	467.33	36.00	6.27	8.40	23.33	42.27	466.50
	Groundnut-11	36.70	7.00	9.33	21.87	42.40	429.81	36.67	7.60	6.67	21.00	39.87	428.61
Mean		37.81	5.37	8.47	23.71	44.40	459.41	37.33	5.30	7.99	24.27	43.43	463.87
LSD (P<0.05)		NS	0.79	0.66	NS	NS	7.24	0.04	0.44	0.38	NS	NS	NS

1SSE= first *Striga* shoot emergence, 6SSC= *Striga* shoot count at 6 WAS, 8 SSC= Strigs shoot count at 8 WAS, 6 PH. Sorghum plant height at 6 WAS. 8PH= Sorghum plant height at 8 WAS, GY: Grain yield. NS= Not significant

Table 6: Interaction effect of Groundnut varieties and *Striga* levels on groundnut trap crop

Treatments		2013						2014					
Variety	*Striga* level (g)	ISSE	6SSC	8SSC	6PH	8PH	GY	ISSE	6SSC	8SSC	6PH	8PH	GY
TE3	0	0.00	0.00	0.00	26.20	45.70	501.70	0.00	0.00	0.00	28.00	46.80	501.07
	2.5	56.50	6.40	9.10	24.00	45.40	491.18	56.60	5.20	9.00	24.20	44.30	490.05
	5	59.90	6.70	11.70	21.60	44.10	481.40	56.00	6.80	11.40	21.10	41.90	479.53
CHICO	0	5.60	0.00	0.00	25.70	45.80	465.99	0.00	0.00	0.00	26.40	45.30	464.32
	2.5	55.60	8.20	12.20	23.70	44.30	462.45	55.40	7.50	12.56	23.70	43.30	461.88
	5	55.60	9.20	14.20	21.70	43.30	456.50	55.50	9.80	14.20	21.30	41.10	457.90
trapzKH 241D	0	0.00	0.00	0.00	24.30	45.80	458.50	0.00	0.00	0.00	24.50	43.80	445.12
	2.5	55.70	7.70	13.60	22.80	43.30	445.76	55.50	7.70	13.50	22.20	41.70	439.32
	5	55.50	10.30	13.60	22.80	43.30	440.91	55.50	10.60	14.20	19.90	40.50	436.80
QH 243C	0	0.00	0.00	0.00	26.40	45.00	481.97	0.00	0.00	0.00	27.90	46.30	487.79
	2.5	56.60	7.20	11.10	24.10	44.00	472.92	56.50	6.60	10.80	24.70	43.40	471.39
	5	56.20	8.20	12.60	22.80	42.90	468.20	56.50	8.50	12.50	22.50	42.10	467.13
CN 94C	0	0.00	0.00	0.00	25.00	43.90	461.26	0.00	0.00	0.00	25.90	43.90	457.97
	2.5	55.50	7.20	13.20	24.00	42.80	448.75	55.50	7.10	13.20	23.80	42.00	448.41
	5	56.00	10.10	14.40	22.50	42.30	448.40	55.50	10.40	14.40	21.40	40.70	447.95
RRB	0	0.00	0.00	0.00	23.90	43.80	437.05	0.00	0.00	0.00	24.60	43.00	437.05
	2.5	55.90	6.60	13.70	23.20	41.80	428.37	55.50	6.60	14.30	22.30	39.80	428.35
	5	55.40	8.50	15.00	22.20	41.20	427.25	55.50	9.00	15.40	21.10	39.70	420.72
RMP-12	0	0.00	0.00	0.00	25.40	48.00	509.15	0.00	0.00	0.00	28.00	48.20	508.80
	2.5	56.60	5.60	8.20	24.70	45.00	486.15	56.50	4.80	8.40	25.50	44.50	487.21
	5	56.30	6.70	10.10	23.40	43.40	467.72	56.50	6.90	10.40	23.30	41.70	467.90
RMp-91	0	0.00	0.00	0.00	26.60	48.20	513.72	0.00	0.00	0.00	28.10	49.00	514.83
	2.5	56.40	4.50	6.80	25.50	46.30	495.29	56.50	3.50	6.70	25.70	46.10	491.08
	5	56.70	6.10	9.80	24.40	45.00	476.74	56.50	5.50	9.50	23.70	44.40	476.74
Groundnut-23	0	0.00	0.00	0.00	26.00	45.90	478.60	0.00	0.00	0.00	26.40	45.80	478.60

	2.5	55.60	7.10	11.30	24.40	44.60	468.67	55.00	6.90	10.60	24.10	42.90	467.94
	5	55.10	9.00	13.40	22.80	43.40	463.00	55.00	9.70	13.10	22.10	41.20	462.47
Groundnut-11	0	0.00	0.00	0.00	24.10	43.50	446.36	0.00	0.00	0.00	23.90	41.90	445.35
	2.5	55.50	8.30	13.50	21.90	42.30	425.92	55.50	9.40	13.40	21.50	40.40	425.91
	5	55.70	11.20	13.80	20.50	41.90	419.80	55.00	12.10	14.10	19.80	39.30	419.00
		37.60	5.16	8.04	23.89	44.21	464.32	37.20	5.15	8.06	23.92	43.17	462.95
LSD(P<0.05)		NS	0.98	0.81	NS	NS	8.87	0.05	0.54	0.46	0.88	0.91	7.40

1SSE := first *Striga* shoot emergence, 6SSC= *Striga* shoot count at 6 WAS, 8 SSC= Strigs shoot count at 8 WAS, 6 PH. Sorghum plant height at 6 WAS. 8PH= Sorghum plant height at 8 WAS, GY: Grain yield. NS= Not significan