VARIABILITY OF TEN SOYABEAN, COWPEA AND GROUNDNUT VARIETIES ON STRIGA (*Striga hermonthica*) SUICIDAL GERMINATION IN NIGER STATE, NIGERIA

Mamudu, A.Y., Baiyeri, K.P. and Echezona, B.C.
Department of Crop Science, University of Nigeria, Nsukka, Nigeria.
Corresponding Author: mamuduay@gmail.com

Abstract

The exploitation of trap crops constitutes an effective and less costly method of Striga (Striga hermonthica) management. Trap crops may be used in cropping systems to deplete Striga seed bank in farmers' fields. Thus, this study was designed to screen 10 genotypes each of soybean, groundnut and cowpea as trap crops for Striga; the potential ability of their root exudates to stimulate germination of Striga seed was evaluated. The results indicate that soyabean varieties TGX 1019-2EB and TGX 1448-2E delayed Striga emergence in 2013 and 2014, respectively compared to other varieties. In the results of the Striga count, plant height and grain yield, Soyabean variety TGX 1448-2E generally performed better than other varieties. Cowpea varieties IT04K-339-1 and IT07K-25-3-3 delayed Striga emergence in 2013 and 2014 respectively, while in Striga count and plant height, cowpea variety IT04K-217-5 performed better than other varieties but higher grain yield was recorded in cowpea variety IT04K-339-1 compared to other varieties. Groundnut varieties TES, QH 243C, RMP-12 and RMP-91 delayed Striga emergence compared to other varieties in 2014. Groundnut variety RMP-91 performed better in Striga count, plant height and grain yield in both planting years 2013 and 2014 compared to other varieties.

Key words: *Trap crops, suicidal germination, Striga hermonthica control*

Introduction

The parasitic angiosperm, *Striga hermonthica* (Del.) Benth is an important weed mainly of C_4 cereals in the semi-arid tropics. This root parasitic weed inhibits host growth by competing for nutrients and impairing photosynthesis. *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).

Striga is pernicious because of the large number of seeds it produces, a single *Striga* plant can produce up to 200,000 small dust-like seeds that survive in the soil for up 20 years (Ma *et al.*, 2004) The incidence and severity of S. *hermonthica* are exceptionally high on sorghum, pearl millet and maize, the main staple food for over 300 million people in sub-Saharan Africa (Scholes and press, 2008). The annual losses of crop productions in sub-Sahara Africa due to *Striga* amount to 8 million tons (Gressel *et al.*, 2004). Several methods of *Striga* control including soil preparation, hand pulling, hoe-weeding use of herbicides, trap and catch crops, resistant chemical stimulants and the treatment of crop seeds have been developed (Radi, 2007).

Kureh *et al.*, (2000) found that sole hybrid maize supported significantly higher Striga incidence and infestation than when intercropped with selected soyabean varieties TGX 1019-2E and TGX 1440-1E in Northern Guinea of Nigeria. It has also been reported that intercropping *Striga* tolerant maize and selected soyabean varieties led to 46% reduction in *Striga* seed bank and ultimately 88% increase in maize production (Schulz *et al.*, 2003; Franke *et al.*, 2005). Studies have shown that there is variability among non-host crops and within crop cultivar in their ability to stimulate *Striga* seed germination and between *Striga hermonthica* population to respond to germination stimulant (Kureh *et al.*, 2000).

In view of some deficiencies and feasibility limits of *Striga* control methods, a single method might not solve effectively the serious agro-economic problems caused by *Striga* infestation (Marley *et al.*, 2005; De Groote *et al.*, 2008). However, for most African cereal growers, the most appropriate method would be one that uses a simple and expensive techniques adapted to their farming system. One such simple yet

promising control method is the use of non-hosts or trap crops. These crops have root exudates that stimulate *Striga* seed to germinate but the germinated *Striga* plants cannot parasitize them.

Hence when used as component of cropping systems, such trap crops have led to considerable reduction in *Striga* seed bank and infestation (Kroschel and Saurborn, 1988). The present study was therefore designed to screen 10 genotypes each of soybean, groundnut and cowpea as trap crops for *Striga*; the potential ability of their root exudates to stimulate germination of *Striga* seed was evaluated.

Materials and Methods

Two years (2013 and 2014) screen house trials were conducted at Federal University of Technology research farm (09° 3'N and 06° 28'E), Minna, Niger State, Nigeria. The soil was a sandy clay loan. *Striga*-free soil was collected and sterilized for two hours; polybags were filled with 20 g of the sterilized soil and then inoculated with *Striga* seeds at three inoculation rates (0, 2.5 and 5 g). Ten varieties of soyabean, cowpea and groundnut as trap crops were used with two sorghum varieties – resistant (ICSV 1002) and susceptible (Local) varieties. 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 later. After harvesting the trap crops, the two sorghum varieties were sown; torn polybags at that time were carefully replaced to prevent loss of soil. The bags were monitored and watered regularly. Sorghum seedlings were thinned down to two per bag. The sorghum varieties were repeatedly sown again the following year as done the previous year. Data were collected on trap crops as follow: Days to first *Striga* emergence, trap crop plant height and dry mass. Data collected on sorghum included days to first *Striga* emergence, trap crop plant height and dry mass. Data collected on sorghum were days to first striga emergence, *Striga* count at 6 and 8 weeks after sowing (WAS) per stand of sorghum, plant height at 10 and 14 WAS, 1000 grain weight and grain yield. Data were subjected to analysis of variance using computer software Genstat (2010). Statistically differences between variable means were compared using least significant difference ($P < 0.05$).

Results

The effect of Soyabean varieties in Soyabean response to screening on *Striga hermonthica* shoot emergence were significant ($P < 0.05$) in 2013 and 2014 planting years. Soyabean TGX 1019-2EB and TGX 1448-2E in 2013 and 2014 respectively delayed *Striga* emergence compared to other varieties (Table 1). Soyabean TGX 1448-2E performed better in striga count, plant height and grain yield in both years. Fewer *Striga* count was recorded at 2.5 g *Striga* level compared to 5 g *Striga* level in all sample periods and planting years. Taller plant height and higher grain yield was observed in 0 g (control) *Striga* level compared to other striga level (Table 1). The interaction effects of soyabean varieties and *Striga* level on soyabean response to screening were not significant on *Striga* emergence, *Striga* count and plant height in 2013 and 2014, in all sample periods except plant height at 6 WAS in 2014 where soyabean TGX 1448-2E at 0 g *Striga* level produced higher plant height compared to other varieties (Table 2). Grain yield were significant ($P < 0.05$) in both years; soyabean variety TGX 1448-2E at 0 g *Striga* level recorded highest grain yield compared to other varieties (Table 2).

The effects of cowpea varieties in cowpea response to screening were significant ($P < 0.05$) in 2013 and 2014 on days to first *Striga* emergence. Cowpea varieties IT04K-339-1 and IT07K-25-3-3 in 2013 and 2014, respectively delayed *Striga* emergence compared to other varieties (Table 3). Cowpea variety IT04K-217-5 recorded fewer *Striga* count and taller plant height compared to other varieties in both years. Higher grain yield was rather observed in cowpea variety IT04K-339-1 compared to other varieties (Table 3). *Striga* emergence was earlier at 2.5 g *Striga* level compared to 5 g *Striga* level in 2013. Fewer *Striga* count was seen in 2.5 g compared to 5 g *Striga* level in all the planting years. Taller height and higher grain yield were recorded at 0 g (control) *Striga* level compared to 2.5 and 5 g *Striga* level (Table 3). The interaction effect of cowpea varieties and *Striga* level on cowpea response to screening were significant ($P < 0.05$) in 2013, cowpea variety IT04K-333-2 delayed *Striga* emergence at 5 g *Striga* level compared to other varieties and *Striga* levels, but the effects in 2014 were not significant (Table 4). Cowpea variety IT04K-217-5 at 2.5 g *Striga* level performed better than other varieties. Plant height was not significant in 2013, but 2014 was, at 8 WAS, variety IT04K-217-5 at 0 g *Striga* level produced taller

plant height than other varieties (Table 4). The variety IT04K-217-5 also produced higher grain yield in both years compared to other varieties.

The effect of groundnut varieties in groundnut response to screening was significant ($P < 0.05$) in 2014, groundnut varieties TES, QH243C, RMP-12 and RMP-91 delayed *Striga* emergence compared to other varieties (Table 5). Fewer *Striga* count, taller plant height and higher grain yield were recorded in variety RMP-91 in both years compared to other varieties (Table 5). The interaction effect of groundnut varieties and *Striga* level on groundnut response to screening was significant ($P < 0.05$) in 2014; RMP-91 at *Striga* levels 2.5 g and 5 g delayed *Striga* emergence, a similar result was observed in varieties QH243C and TES. Fewer *Striga* count and taller plant height were recorded in variety RMP-91 at 2.5 g and 0 g, respectively. Variety RMP-12 also had taller height at 0 g *Striga* level compared to other varieties; higher grain yield was recorded in RMP-91 at 0 g *Striga* level in both years (Table 6).

Discussion

Striga Emergence

The ability of soyabean varieties TGX 1019-2EG and TGX1448-2E, Cowpea varieties IT04K-333-2 and IT07K-25-3-3 and groundnut varieties RMP-91, RMP-12, TES and QH343C to hinder early *Striga* emergence compared to other varieties could be ability of some of these legumes to produce radicle growth inhibition chemical in addition to the germination-stimulating chemicals. This hinders the attachment of the parasite radicle onto the sorghum host plant. This is in consonance with the findings of Tsanuo *et al.* (2003) which 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.

Striga Count

Fewer *Striga* count on soyabean varieties TGX 1990-4F and TGX 1448-2E, cowpea variety IT04K-217-5 and groundnut variety RMP-91 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.

Plant Height

The result of this study on sorghum plant height indicates that higher plant height observed in soyabean varieties TGX 1448-2E, TGX 1830-20E and TGX 1019-2EB; cowpea varieties IT07K-25-3-3 and IT04K-217-5 and groundnut variety RMP-91 might be due to inability of the fewer *Striga* shoot to have effects on the host cell elongation as it could not take photosynthate away from the host crop which could have led to shorter host internodes and stunted growth. This confirms 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.

Grain yield

The relatively high yield recorded by soyabean variety TGX 1448-2E; cowpea Variety IT04K-339-1 and groundnut variety RMP-91 when compared to other varieties confirmed the ability of these varieties to reduce *Striga* attachment and its 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 yields are generally reduced.

Conclusion

We conclude that soyabean variety TGX 1448-2E, cowpea IT04K-339-1 and groundnut variety RMP-91 were strongly recommended for sowing in *Striga* infested field under crop rotation or intercropping system for enhanced crop yield.

Refrences

De Groote, H., L. Wangare, F. Kanampiu, M. Odendo, A. Diallo, H. Karaya and D. Friesen, 2008. The potential of a herbicide resistant maize technology for *Striga* control in Africa. Agric. Syst., 97: 83-94.

Franke, A.C., Ellis-Jones, J., Tarawali, G., Schulz, S., Hussaini, M.A., Kureh, I., White, R., Chikoye, D., Douthweite, B., Oyewole, B.D. and Olanrewaju, A.S., 2005. Evaluating and Scaling-up integrated *Striga hermonthica* control technologies among farmers in Northern Nigeria. *Crop Protection* 1:8-18.

Gressel, J., Hanafi,A., Head, G., Marasa, W., Obilana, A.B., Ochanda, J., Souissi, T. and Tzotzos, G., 2004. Major heretofore-intractable biotic constraints to African food security that may be amenable to novel biotechnogical solutions. *Crop Protection 2:,661-689.1 (4): 375-380.*

Khan, Z.R., Picket, J.A., Wadhams, L., and Muyekho, F., 2001. Habitat management strategies for the control of cereal stem borers and *Striga* in maize in Kenya. *Insect Science and its Application*

Kureh, I., Chiezey, U.F. and Tarfa, B.D.,2000. On-station verification of the use of soybean trapcrop for the control of *Striga* in maize. *Afr. Crop Science Journal* 8 (3): 295-300.

Ma, Y.Q., Cheng, J.M., Inanaga, S., and Shui, J.F., 2004. Induction and inhibition of *Striga hermothica* (Del.) Benth. germination by extracts of traditional Chinese medicinal herbs. *Agronomy Journal 96:1349-1356.*

Marley, P.S., J. Kroschel and A. Elzein, 2005. Host specificity of *Fusarium oxysporum* schlect (isolate PSM 197), a potential mycoherbicide for controlling *Striga* sp. in West Africa. Weed Res., 45: 407-412.

Radi, A., 2007. Conventional and biotechnological approaches for control of parasitic weeds. *In vitro* Cell. Dev. Biol. Plant, 43: 304-317.

Scholes, D.J. and C.M. Press, 2008. *Striga* infestation of cereal crops-unsolved problem in resource limited agriculture. Curr. Opin. Plant Biol., 11: 180-186.

Schulz, S., Hussaini, M.A., Kling, J.G., Berner, D.K. and Ikie, F.O., 2003. Evaluation of integrated *Striga hermonthica* control technologies under farmer's management. *Exp. Agric. 39:99-108.*

Table 1: Effect of soyabean varieties and *Striga* levels no response to soyabean Screening

Treatments	2013							2014						
Soyabean varieties	ISSE	6SSC	8SSC	6PH	8PH	1000GW	GY	ISSE	6 SSC	8SSC	6PH	8PH	100GW	GY
TGX1937-1F	56.25	7.40	12.05	23.77	42.03	10.18	265.80	55.99	6.10	12.05	13.30	36.57	9.20	263.16
TGX1986-10F	57.55	6.15	8.90	24.43	42.90	12.90	323.10	57.75	7.25	8.90	24.37	43.73	12.93	322.81
TGX1986-10F	56.20	8.20	13.35	23.80	40.10	9.81	248.00	55.99	7.05	13.35	22.80	35.93	8.28	239.16
TGX1990-45F	56.15	7.05	11.45	24.60	40.30	11.70	315.40	55.99	6.15	11.45	24.03	40.20	11.36	310.76
TGX187-62F	57.40	6.70	10.05	25.10	41.50	11.89	312.20	57.50	12.05	10.05	25.50	41.03	12.01	315.84
TGX1987-96F	56.15	7.25	11.45	24.13	40.23	10.42	316.70	55.99	8.90	11.45	24.23	37.70	9.52	309.97
TGX1448-2E	58.05	3.60	6.35	27.57	44.07	17.18	364.90	59.30	13.35	6.35	29.63	48.47	17.76	368.27
TGX1835-10E	57.70	6.20	7.90	25.40	42.63	13.30	338.60	58.00	11.45	7.90	25.30	44.23	13.68	339.66
TGX1830-20E	58.35	5.25	7.35	26.60	45.00	14.46	343.20	58.95	10.05	7.35	27.67	46.73	14.99	351.64
TGX1019-2EB	58.70	3.85	6.55	27.10	44.93	19.81	356.80	58.30	11.45	6.55	27.87	49.03	15.23	362.02
Mean	57.25	6.17	9.54	25.25	42.37	13.17	318.47	56.78	9.85	9.83	26.30	43.22	12.86	318.33
LSD(P<0.05)	0.47	0.62	0.48	0.93	2.24	3.76	13.69	0.22	0.55	0.48	0.32	1.02	0.44	7.93
***Striga* level(g)**														
0	00.00	0.00	0.00	26.17	43.39	13.90	306.50	00.00	0.00	0.00	27.09	45.22	13.53	354.14
2.5	57.35	5.33	8.57	25.04	42.65	13.07	312.00	310.08	8.41	8.57	25.12	42.31	12.46	310.08
5	57.15	6.80	10.51	24.54	41.06	14.25	282.90	280.77	10.35	0.26	24.20	39.56	11.50	280.77
Mean	57.25	6.10	9.54	25.25	42.37	13.74	300.47	216.11	9.38	6.12	26.11	42.36	13.00	315.00
LSD)P<0.05)	NS	0.34	0.26	0.51	1.23	NS	7.50	4.34	0.30	0.26	0.18	0.56	0.24	4.34

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

Table 2: Interaction effect of soyabean varieties and Striga levels on response to screening

Treatments		2013							2014						
Varieties	*Striga* level (g)	ISSE	6SSC	8SSC	6PH	8PH	1000 GW	GY	ISSE	6 SSC	8SSC	6PH	8PH	1000 GW	GY
TGX1937-1F	0	0.00	0.00	0.00	25.20	42.40	10.87	317.40	0.00	0.00	0.00	24.90	39.40	9.47	309.17
	2.5	56.60	6.80	11.10	23.30	42.60	10.35	253.10	56.00	5.20	11.10	22.90	36.40	9.29	253.91
	5	55.90	8.00	13.00	22.80	41.10	9.33	226.80	56.00	7.00	13.00	22.10	33.90	8.84	226.40
TGX1986-10F	0	0.00	0.00	0.00	25.70	44.10	13.89	368.80	0.00	0.00	0.00	26.20	46.30	13.94	369.33
	2.5	57.70	5.30	7.70	24.40	42.00	13.13	319.10	57.70	6.80	7.70	23.80	43.20	12.90	317.58
	5	57.40	7.00	10.10	23.20	42.50	11.70	281.50	57.80	7.70	10.10	23.10	41.70	11.95	281.53
TGX1986-10F	0	0.00	0.00	0.00	24.00	40.40	10.26	256.80	0.00	0.00	0.00	24.20	39.60	8.72	260.75
	2.5	55.90	7.60	12.40	23.50	43.10	9.59	258.50	56.00	5.80	12.40	22.40	36.30	7.95	244.73
	5	56.50	8.80	14.30	23.90	36.80	9.59	228.60	56.00	8.30	14.30	21.80	31.90	8.17	212.01
TGX1990-45F	0	0.00	0.00	0.00	24.80	42.40	11.93	344.90	0.00	0.00	0.00	24.90	42.70	11.95	345.93
	2.5	56.50	6.90	10.50	24.40	39.50	11.77	320.50	56.00	5.30	10.50	24.00	40.20	11.07	307.26
	5	56.10	7.20	12.40	24.60	39.00	11.41	280.90	56.00	7.00	12.40	23.20	37.70	11.07	279.10
TGX187-62F	0	0.00	0.00	0.00	26.50	42.20	12.60	360.40	0.00	0.00	0.00	27.60	43.60	12.62	366.14
	2.5	57.50	6.10	9.00	25.00	41.50	11.51	300.50	57.50	11.10	9.00	25.30	41.30	11.77	305.37
	5	57.30	7.30	11.10	23.80	40.80	11.57	275.50	57.50	13.00	11.10	23.60	38.20	11.63	276.01
TGX1987-96F	0	0.00	0.00	0.00	25.30	41.20	10.39	345.10	0.00	0.00	0.00	26.10	40.10	10.37	330.11
	2.5	56.20	6.50	10.30	24.20	41.30	10.57	321.90	56.00	7.70	10.30	24.10	37.60	9.88	318.71
	5	56.10	8.00	12.60	22.90	38.20	10.31	283.10	56.00	10.10	12.60	22.50	35.40	8.31	281.09
TGX1448-2E	0	0.00	0.00	0.00	28.20	45.80	19.03	414.90	0.00	0.00	0.00	31.70	50.90	19.69	432.11
	2.5	58.30	3.20	5.40	27.10	44.10	17.08	350.60	59.30	12.40	5.40	29.00	49.20	17.86	348.58
	5	57.80	4.00	7.30	27.40	42.30	15.43	329.20	59.30	14.30	7.30	28.20	45.30	15.73	324.13
TGX1835-10E	0	0.00	0.00	0.00	26.60	43.30	14.56	402.80	0.00	0.00	0.00	27.00	47.40	14.92	401.61
	2.5	57.70	5.00	7.50	25.20	42.70	13.06	326.20	58.00	10.50	7.50	24.70	43.40	13.61	324.21
	5	57.70	7.40	8.30	24.40	41.90	12.28	286.80	58.00	12.40	8.30	24.20	41.90	12.50	293.15
TGX1830-20E	0	0.00	0.00	0.00	27.00	44.70	14.56	389.40	0.00	0.00	0.00	28.70	50.20	16.48	405.67

	2.5	58.60	4.60	6.10	26.20	45.90	13.81	327.90	59.00	9.00	6.10	27.10	46.60	14.95	339.14
	5	58.10	5.90	8.60	26.60	44.40	14.25	312.20	58.90	11.10	8.60	27.20	43.40	13.57	310.12
TGX1019-2EB	0	0.00	0.00	0.00	28.40	47.40	14.47	404.90	0.00	0.00	0.00	29.60	2.00	7.10	20.56
	2.5	58.80	3.30	5.70	27.10	43.80	22.11	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= *Striga* shoot count at 8 WAS,
6 PH. Sorghum plant height at 6 WAS. 8PH= Sorghum plant height at 8 WAS, GW= Grain weight, GY: Grain yield. NS= Not significant

Table 3: Effect of Cowpea varieties and Straga levels on response to cowpea screening

Treatments	2013							2014						
Cowpea varieties	ISSE	6SSC	8SSC	6PH	8PH	1000GW	GY	ISSE	6 SSC	8SSC	6PH	8PH	100GW	GY
IT04K-217-5	56.55	4.36	5.75	27.07	45.90	25.14	468.30	56.5	3.4	5.5	27.57	46.27	25.35	469.28
IT04K-227-4	55.76	5.18	9.40	25.40	44.80	21.04	438.70	55	6.75	9.3	24.87	43.33	20.54	440.75
IT07K-210-1	56.11	7.26	12.75	25.80	43.30	20.58	431.20	55.45	8.85	12.7	25.07	41.17	19.04	242.83
IT07K-25-3-3	56.76	5.71	6.30	26.93	45.30	23.82	450.50	56.75	3.8	6.15	26.67	46	23.79	451.27
IT07K-237.2-1	55.71	5.81	12.25	25.87	44.60	21.29	447.00	55.5	6.8	12.25	24.03	40.4	17.37	423.71
IT04K-333-2	57.06	4.63	8.30	25.87	44.60	21.29	447.00	56.5	5.15	8.1	25.63	43.93	21.24	449.05
IT04K-339-1	56.81	5.06	7.50	26.27	44.70	22.09	484.30	56.7	4.99	7.55	26.3	44.43	21.84	494.58
IT04K-405-5	56.21	6.36	12.00	24.63	44.00	18.33	411.00	55.5	7.9	11.95	22.33	40.67	17.37	399.86
IT07K-293-3	56.51	6.36	11.90	24.60	43.70	20.33	433.40	56	7.8	12	24	42.13	20.03	431.21
IT07K-318-2	56.21	6.66	12.50	24.60	43.10	17.75	391.10	55.5	8.45	12.75	22.23	39.27	16.79	376.05
Mean	56.37	5.74	9.87	25.70	44.40	21.17	440.25	55.94	6.39	9.83	24.87	42.76	20.34	417.86
LSD)P<0.05)	0.47	0.67	0.53	1.39	NS	0.79	9.98	0.40	0.32	0.44	0.50	0.76	0.31	5.81
***Striga* level (g)**														
0	0.00	0.00	0.00	26.75	45.70	21.60	464.00	0.00	0.00	0.00	27.54	46.43	21.24	465.44
2.5	56.14	6.28	8.98	25.61	44.20	20.78	433.10	56.0	5.9	8.96	24.6	42.4	20.21	431.25
5	56.37	7.09	10.75	24.69	46.70	20.28	418.60	55.5	6.88	10.69	22.47	39.45	19.57	411.48
Mean	56.37	5.73	9.87	25.68	45.53	20.89	438.57	37.17	4.26	6.55	24.87	42.76	20.34	436.06
LSD)P<0.05)	0.26	0.36	0.29	0.76	NS	0.43	5.47	NS	0.17	0.24	0.28	0.42	0.17	3.18

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, GW= Grain weight, GY: Grain yield. NS= Not significant.

Table 4: Interaction effect of cowpea varieties and *Striga* levels on response to cowpea screening

Treatments		2013							2014						
Cowpea varieties	*Striga* level (g)	ISSE	6SSC	8SSC	6PH	8PH	1000 GW	GY	ISSE	6 SSC	8SSC	6PH	8PH	1000 GW	GY
IT04K-217-5	0	0.00	0.00	0.00	26.60	47.20	25.85	531.50	0.00	0.00	0.00	30.40	50.50	26.20	535.13
	2.5	56.60	5.70	5.20	27.70	46.10	24.96	442.90	56.50	2.80	4.90	27.30	46.70	25.20	442.88
	5	56.80	4.90	6.30	26.90	44.50	24.61	430.40	56.50	4.00	6.10	25.00	41.60	24.67	429.83
IT04K-227-4	0	0.00	0.00	0.00	27.90	45.80	21.95	449.70	0.00	0.00	0.00	28.00	47.10	21.18	458.36
	2.5	55.30	6.20	8.20	24.60	44.20	21.14	438.70	55.00	5.70	8.10	24.40	42.60	20.63	443.37
	5	56.00	8.20	10.60	23.70	44.50	20.05	427.70	55.00	7.80	10.50	22.20	40.30	19.83	420.53
IT07K-210-1	0	0.00	0.00	0.00	26.90	45.20	20.79	455.00	0.00	0.00	0.00	27.40	45.10	19.84	448.09
	2.5	56.00	7.60	11.80	25.50	43.60	20.33	423.30	55.50	8.20	11.80	24.50	40.30	19.13	419.23
	5	56.00	8.80	13.70	25.00	41.00	20.62	415.30	55.40	9.50	13.60	23.30	38.10	18.16	407.17
IT07K-25-3-3	0	0.00	0.00	0.00	28.30	47.20	24.61	506.30	0.00	0.00	0.00	29.30	50.10	24.69	515.20
	2.5	56.50	4.50	5.80	27.00	45.60	24.61	431.00	56.80	3.50	5.60	26.50	46.40	23.87	420.61
	5	56.80	5.60	6.80	25.50	43.20	22.64	414.20	56.70	4.10	6.70	24.20	41.50	22.81	408.00
IT07K-237.2-1	0	0.00	0.00	0.00	26.20	45.00	19.27	442.20	0.00	0.00	0.00	26.10	44.60	18.26	439.02
	2.5	55.60	6.40	10.80	25.20	42.70	18.13	424.00	55.50	6.20	10.70	23.80	40.30	17.34	422.54
	5	55.60	7.10	13.70	25.60	79.40	18.12	462.60	55.50	7.40	13.80	22.20	36.30	16.51	409.59
IT04K-333-2	0	0.00	0.00	0.00	26.50	45.60	21.88	462.60	0.00	0.00	0.00	28.70	47.10	22.25	472.93
	2.5	56.30	6.20	7.80	26.20	44.70	21.88	462.60	56.50	5.10	7.70	25.40	43.20	20.93	448.84
	5	57.00	6.10	8.80	24.90	43.60	20.86	430.50	56.50	5.20	8.50	22.80	41.50	20.56	425.38
IT04K-339-1	0	0.00	0.00	0.00	27.30	46.40	22.38	498.10	0.00	0.00	0.00	29.00	48.20	22.63	505.42
	2.5	56.70	5.30	7.30	25.80	44.10	21.97	487.30	56.70	4.30	7.30	26.10	43.70	21.54	499.77
	5	56.70	6.70	7.70	25.70	43.50	21.92	467.50	56.70	5.70	7.80	23.80	41.40	21.36	478.54
IT04K-405-5	0	0.00	0.00	0.00	25.70	44.80	19.85	439.80	0.00	0.00	0.00	25.10	43.40	18.59	425.05
	2.5	55.90	6.70	11.00	24.90	43.90	17.90	401.80	55.50	7.30	10.90	22.40	40.20	17.23	394.89
	5	56.30	7.90	13.00	23.30	43.30	17.24	391.30	55.50	8.50	13.00	19.50	38.40	16.31	379.66
IT07K-293-3	0	0.00	0.00	0.00	25.80	45.20	20.94	445.90	0.00	0.00	0.00	26.60	45.90	21.03	451.83
	2.5	56.80	7.20	10.50	24.80	43.50	20.05	435.00	56.00	8.10	10.80	23.70	41.50	19.72	428.92
	5	56.00	7.40	13.00	23.20	42.40	20.01	419.20	56.00	7.50	13.20	21.70	39.00	19.33	412.88
IT07K-318-2	0	0.00	0.00	0.00	26.30	44.10	18.45	409.20	0.00	0.00	0.00	24.80	42.30	17.74	403.41
	2.5	55.70	7.00	11.40	24.40	43.30	18.02	398.50	55.50	7.80	11.80	21.90	39.10	16.47	381.49

	5	56.50	8.20	13.60	23.10	42.00	16.76	365.50	55.50	9.10	13.70	20.00	36.40	16.15	343.26
Mean		56.37	5.74	9.85	25.68	45.52	20.93	440.32	55.94	6.39	9.83	24.87	42.76	20.34	435.73
LSD(P<0.05)		0.82	1.15	0.93	NS	NS	NS	17.29	NS	0.55	0.76	NS	1.32	NS	10.06

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, GW= Grain weight, GY: Grain yield. NS= Not significant

Table 5: Effect of groundnut varieties and *Striga* levels on response to groundnut screening

Treatments	2013							2014						
Groundnut varieties	ISSE	6SSC	8SSC	6PH	8PH	1000 GW	GY	ISSE	6 SSC	8SSC	6PH	8PH	1000 GW	GY
TE3	37.80	4.37	6.93	23.93	45.07	31.70	491.43	37.67	4.00	6.80	24.43	44.33	31.40	490.22
CHICO	38.93	5.80	8.80	23.70	44.47	31.70	462.32	36.97	5.77	8.87	23.80	43.23	31.07	461.37
KH 241D	37.07	6.00	9.07	22.93	43.73	30.90	441.52	37.00	6.10	9.23	22.20	42.00	29.47	440.42
QH 243C	37.60	5.13	7.90	24.43	43.97	32.13	474.36	37.67	5.03	7.77	24.97	43.93	31.13	475.38
CN 94C	37.17	5.77	9.20	23.83	43.00	30.40	452.80	37.00	5.83	9.20	23.70	42.20	28.87	451.38
RRB	37.10	5.03	9.57	23.10	42.27	29.90	430.89	37.00	3.20	9.90	22.67	40.83	28.37	428.71
RMP-12	37.63	4.10	6.10	24.50	45.47	31.87	487.67	37.67	3.90	6.27	25.63	44.80	30.77	487.97
RMp-91	37.70	3.53	5.53	25.50	46.50	31.87	495.25	37.67	3.00	5.40	25.83	46.50	31.23	494.22
Groundnut-23	36.90	5.37	8.23	24.40	44.63	32.50	470.09	36.67	5.33	7.90	24.20	43.30	32.20	469.67
Groundnut-11	37.07	6.50	9.10	22.17	42.57	29.00	430.69	37.00	7.17	9.17	21.73	40.53	26.57	430.09
Mean	37.50	5.16	8.04	23.85	44.17	31.20	463.70	37.23	4.93	8.05	23.92	43.17	30.11	462.94
LSD(P<0.05)	NS	0.56	0.47	0.85	1.06	0.96	5.12	0.03	0.31	0.27	0.51	0.53	0.38	4.27
***Striga* level (g)**														
0	0.00	0.00	0.00	25.36	45.56	32.05	474.16	0.00	0.00	0.00	26.36	45.40	31.45	474.09
2.5	55.99	6.88	11.27	23.83	43.98	31.15	462.06	55.84	6.53	11.23	23.77	42.84	29.94	461.16
5	55.94	8.60	12.86	22.36	42.96	30.38	454.89	55.85	8.93	12.92	21.62	41.26	28.93	453.60
Mean	37.50	5.16	8.04	23.85	44.17	31.19	463.70	37.23	5.15	8.05	23.92	43.17	30.11	462.95
LSD)P<0.05)	0.19	0.31	0.26	0.47	0.58	0.53	2.81	0.02	0.17	0.15	0.28	0.29	0.21	2.34

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, GW= Grain weight, GY: Grain yield. NS= Not significant

Table 6: Interaction effect of groundnut varieties and *Striga* levels on response to groundnut screening

Treatments Groundnut Varieties	*Striga* level (g)	2013							2014						
		ISSE	6SSC	8SSC	6PH	8PH	1000 GW	GY	ISSE	6SSC	8SSC	6PH	8PH	1000 GW	GY
TE3	0	0.00	0.00	0.00	26.20	45.70	32.00	501.70	0.00	0.00	0.00	28.00	46.80	32.90	501.07
	2.5	56.50	6.40	9.10	24.00	45.40	32.00	491.18	56.60	5.20	9.00	24.20	44.30	31.20	490.05
	5	59.90	6.70	11.70	21.60	44.10	31.10	481.40	56.00	6.80	11.40	21.10	41.90	30.10	479.53
CHICO	0	5.60	0.00	0.00	25.70	45.80	32.30	465.99	0.00	0.00	0.00	26.40	45.30	32.40	464.32
	2.5	55.60	8.20	12.20	23.70	44.30	31.60	462.45	55.40	7.50	12.56	23.70	43.30	30.80	461.88
	5	55.60	9.20	14.20	21.70	43.30	31.20	456.50	55.50	9.80	14.20	21.30	41.10	30.00	457.90
KH 241D	0	0.00	0.00	0.00	24.30	45.80	31.20	458.50	0.00	0.00	0.00	24.50	43.80	29.80	445.12
	2.5	55.70	7.70	13.60	22.80	43.30	31.00	445.76	55.50	7.70	13.50	22.20	41.70	29.20	439.32
	5	55.50	10.30	13.60	22.80	43.30	31.00	440.91	55.50	10.60	14.20	19.90	40.50	29.40	436.80
QH 243C	0	0.00	0.00	0.00	26.40	45.00	32.60	481.97	0.00	0.00	0.00	27.90	46.30	32.30	487.79
	2.5	56.60	7.20	11.10	24.10	44.00	31.90	472.92	56.50	6.60	10.80	24.70	43.40	30.90	471.39
	5	56.20	8.20	12.60	22.80	42.90	31.90	468.20	56.50	8.50	12.50	22.50	42.10	30.20	467.13
CN 94C	0	0.00	0.00	0.00	25.00	43.90	31.00	461.26	0.00	0.00	0.00	25.90	43.90	29.70	457.97
	2.5	55.50	7.20	13.20	24.00	42.80	30.40	448.75	55.50	7.10	13.20	23.80	42.00	29.00	448.41
	5	56.00	10.10	14.40	22.50	42.30	29.80	448.40	55.50	10.40	14.40	21.40	40.70	27.90	447.95
RRB	0	0.00	0.00	0.00	23.90	43.80	31.00	437.05	0.00	0.00	0.00	24.60	43.00	29.80	437.05
	2.5	55.90	6.60	13.70	23.20	41.80	29.80	428.37	55.50	6.60	14.30	22.30	39.80	28.30	428.35
	5	55.40	8.50	15.00	22.20	41.20	28.90	427.25	55.50	9.00	15.40	21.10	39.70	27.00	420.72
RMP-12	0	0.00	0.00	0.00	25.40	48.00	33.30	509.15	0.00	0.00	0.00	28.00	48.20	32.70	508.80
	2.5	56.60	5.60	8.20	24.70	45.00	31.50	486.15	56.50	4.80	8.40	25.50	44.50	30.30	487.21
	5	56.30	6.70	10.10	23.40	43.40	30.80	467.72	56.50	6.90	10.40	23.30	41.70	29.30	467.90
RMp-91	0	0.00	0.00	0.00	26.60	48.20	33.30	513.72	0.00	0.00	0.00	28.10	49.00	33.20	514.83
	2.5	56.40	4.50	6.80	25.50	46.30	31.70	495.29	56.50	3.50	6.70	25.70	46.10	31.00	491.08
	5	56.70	6.10	9.80	24.40	45.00	30.50	476.74	56.50	5.50	9.50	23.70	44.40	29.50	476.74
Groundnut-23	0	0.00	0.00	0.00	26.00	45.90	33.10	478.60	0.00	0.00	0.00	26.40	45.80	33.20	478.60
	2.5	55.60	7.10	11.30	24.40	44.60	32.30	468.67	55.00	6.90	10.60	24.10	42.90	32.20	467.94
	5	55.10	9.00	13.40	22.80	43.40	32.10	463.00	55.00	9.70	13.10	22.10	41.20	31.20	462.47
Groundnut-11	0	0.00	0.00	0.00	24.10	43.50	30.90	446.36	0.00	0.00	0.00	23.90	41.90	28.50	445.35

2.5	55.50	8.30	13.50	21.90	42.30	29.30	425.92	55.50	9.40	13.40	21.50	40.40	26.50	425.91
5	55.70	11.20	13.80	20.50	41.90	26.80	419.80	55.00	12.10	14.10	19.80	39.30	24.70	419.00
	37.60	5.16	8.04	23.89	44.21	31.21	464.32	37.20	5.15	8.06	23.92	43.17	30.11	462.95
LSD (P<0.05)	NS	0.98	0.81	NS	NS	NS	8.87	0.05	0.54	0.46	0.88	0.91	0.66	7.40

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, GW= Grain weight, GY: Grain yield. NS= Not significant.