International Academy Journal of Agribusiness and Agricultural Science Annals
Volume 9, Issue 1, PP 1-9, ISSN: 2382-9025, August, 2024
DOI: 272142-56218731
Double Blind Peer Reviewed International Research Journal
arcnjournals@gmail.com
https://arcnjournals.org

Striga (Strigahermonthica Del. Benth) Managementin Sorghum (Sorghum bicolor L. moench) Using Crop Variety and Green Manureat Samaru, in the Northern Guinea Savanna of Nigeria

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Abstract: *A field experiment was conducted during the wet seasons of 2013 and 2014 at the experimental farm of institute of Agricultural Research Samaru "Lat 11^0 11^0 N, 7^0 38 E; 686 above sea level) in the northern Guinea Savanna of Nigeria to evaluate the effects of variety and organic manure for Striga control in Sorghum. The treatments consisted of two varieties of sorghum (SAMSORG – 40 and SAMSORG – 41, three levels of organic manure (Cassia obtusifolia green manure at 0, 7.5 and 15t ha^{-1} and Cowdung at 10t ha^{-1}). The experiment was laid in a split-plot design and replicated three times. The experimental site was inoculated to boost Striga level. SAMSORG – 40 had longer period to Striga emergence while SAMSORG – 41 supported less Striga count than SAMSORG – 40 in 2013. No significant influence was recorded by variety and manure rates on the Striga infestation and sorghum crop – reaction score.More number of days to Striga emergence was observed by green manure at 0 – 7.5t ha^{-1} in 2013 which was contrary to the result obtained by the same treatments in 2014. SAMSORG – 40 had greater values of yield compared to SAMSORG – 41. Significant interactions between variety and green manure was recorded. SAMSORG-40 out yielded SAMSORG-41 when treated with green manure from 0 – 15t ha^{-1}.[1]Application of 15t ha^{-1} green manure resulted in significant number of yield under Striga pressure and infestations compared to all other treatment combinations.*

Key Words: *Green manure, Sorghum, Striga, Samsorg 40, Samsorg 41*

INTRODUCTION

Sorghum (*Sorghum bicolor* (L.) Moench) is commonly referred to as guinea corn in West Africa, is the fifth most important cereal crop in the world after rice (*Oryza sativa* L.), wheat (*Triticum aestivum* L.), barley (*Hordeum vulgare* L.) and maize (*Zea mays* L.) (Abunyewa, 2008). Nigeria is the fourth largest producer of sorghum after USA, India and Mexico (CGIAR, 2013). It is unique to environmental conditions, including biotic and abiotic stresses and fits well in the diets of poor people of the semi-arid tropics where drought causes frequent crop failure (Godharle *et*

al., 2010). Sorghum is a principal source of nutrition for millions of people and provides a major source of energy to human diets in Africa and much of Asia (Anon., 2015). The grain and vegetative parts of the crops are used as animal feed. Sorghum serves as a major raw material in the brewing industry. Some varieties of sorghum can be malted to produce nutritious food stuff for infants and used in bakery.

Striga has adverse effect on sorghum, and infestation can result in crop failure. The extent of yield losses is related to the incidence and severity of attack, crop susceptibility to *Striga,* environmental factors (edaphic & climatic) and the management level under which the crop is produced (Esilaba, 2006). Its effect ranges from extraction of nutrients, water, assimilates and mineral salt from the host plant resulting in stunted growth, chlorosis, wilting and consequently death of the plant. It was reported that annual sorghum losses attributed to *Striga* in USA were 22-27% and 25% in Ethiopia and 235% in Nigeria (Anon, 2011). In terms of monetary value, the annual cereal losses due to *Striga* are estimated at US$ 7 billion in USA. In Ethiopia, Mali and Nigeria, the annual losses are estimated at US$ 75 million, US$ 87 million and US$ 12 billion respectively (Anon., 2011). Parasitic weed species of the genus *Striga* establishes preferentially on poor soils and fields which have been exhausted by continuous cropping (Vogt *et al.,*1991), and *Striga* infested areas are characterized by agricultural production systems that witness low crop productivity.

The work reported in this paper aimed at assessing the influence of Crop variety and green manure on the performance of sorghum in a *Striga* infested field at Samaru.

Material and Methods

Two field trials were conducted during each of the wet seasons of 2013 and 2014 to investigate the effects of organic manure, (using *Cassia obtusifolia* L. & Cowdung) on two varieties of sorghum grown on a *Striga*- infested field at the Experimental farm of the Institute for Agricultural Research, Samaru (Lat. 11^0 11 56 "N, 7^0 38" E; 686m above sea level) in Northern Guinea Savanna zone of Nigeria. The Experiment consisted of two sorghum varieties (SAMSORG-40 and SAMSORG-41), four levels of organic manure (*Cassia* green manure at 0, 7.5 and 15t ha^{-1} and cow dung at 10t ha^{-1}). Soils of the experimental Site and the green manure were analyzed for their physical and chemical properties and are presented in Table 1. And Cassia green manure was analyzed for its nitrogen, phosphorus and potassium contents, and is presented in Table 2. The experiment was laid out in a split plot design and the treatments were replicated thrice. The gross plot size consisted of six ridges,75cm apart, each 3m long giving an area of 13.5 m^2, while the net plot consisted of the two inner ridges, giving an area of 4.5 m^2.

In each trial and season, the land was harrowed to a fine tilth and ridged, 75cm apart. The site was marked into plots and replications. Alley path ways of one meter across and one ridge along the ridges were allowed as borders between the plots, while replications were separated by two ridges along and 1m across the ridges. *Cassia obtusifolia* plants were harvested at five weeks after emergence from nearby fields in both locations. The green manure and crushed cow dung were uniformly applied and incorporated into ridges two weeks before sorghum seed sowing according to treatments. The incorporation was done by opening the center

of each ridge to about 15cm depth, and applying cow dung or burying *cassia* plants according to treatments, after which, each was covered with soil.

Each experimental site was inoculated with *Striga* seeds, a day to sowing. This was done by using 25g of *Striga* seeds per 1kg of fine sand to inoculate each field. The inoculants were uniformly applied by broadcasting immediately after manure application. The inoculation was done to boost the *Striga* level of the infested fields. Dressed seeds of Sorghum was done on June 20th and 15th in 2013 and 2014, respectively at Samaru using 4 - 5 seeds per hill at a spacing of 30cm on 75cm ridges. Sorghum seedlings were thinned to two plants per stand at 3 weeks after sowing (WAS). Paraquat as a Gramazon 270 E.C. was applied on the experimental field prior to land preparation and repeated at two weeks after manure incorporation to control emerged weeds. Hoe weeding was done at 3 and 6 WAS. Subsequent weed control was done by hand pulling as the need arose, avoiding *Striga* plants destruction. Sorghum was harvested when the panicles had attained physiological maturity (Easteen *et al.,* 1973). Data collected included Number of days *to Striga emergence, Striga* shoot count, crop reaction score and sorghum grain yield. The data collected were subjected to analysis of variance to test the significance of differences between treatment means using the F-test as described by Snedecor and Cochran (1967). The treatment means were compared using the Duncan Multiple Range Test (Duncan, 1955).

Results & Discussions

The Soil in both years was loam, and was slightly acidic with low organic Carbon, total N and available P (Table 1). The exchangeable bases and C.E.C. were lower in 2014 than 2013. The nutrients (N, P& K) content of the green manure was lower in 2013 than 2014 (Table 2). Crop variety and organic manure application significantly influenced the number of days to *Striga* shoot emergence. SAMSORG – 40 had longer periods to *Striga s*hoot emergence in both years than SAMSORG -41(Table 3). Cassia green manure at 15t ha^{-1} and Cowdung at 10t ha^{-1} emerged earlier compared to untreated control and lower rate (7.5t ha^{-1}) of green manure in 2014.

SAMSORG – 41 supported less *Striga* shoots at harvest than SAMSORG – 40 in 2013. In 2014, green manure at 0t $ha^{-1}$and 7.5t ha^{-1} resulted in less *Striga* shoots than the 15t ha^{-1} level green manure. Cowdung treatment was at par with the other treatments. The lower shoot count of *Striga* with SAMSORG – 41 might be as a result of the reduction of *Striga* weeds shoot density induced by native soil treated with Cowdung which is rich in N.

Crop variety at 6WAS did not influence crop reaction to *Striga* in 2014 contrary to the result obtained by same treatment in 2013 where significant crop reaction score was observed by SAMSORG- 40. Crop reaction with green manure at 7.5t ha^{-1} was reduced compared to untreated control at 6 and 9 WAS. Green manure at 15t ha^{-1} and Cowdung at 10t ha^{-1} resulted in crop reaction values that were similar to both the control and the lowest by 7.5t ha^{-1} green manure at this period. In 2014, organic manure treatments show no any influence on sorghum reaction score. In both periods under study, SAMSORG – 40 out yielded SAMSORG – 41. The higher values of sorghum grain yield exhibited by SAMSORG-40 over SAMSORG-41 despite the fact that they are all tolerant to *Striga* may be the earlier variety responded favorably to fertilizer than the later. Also in each case, grain yield increased with green manure from 0 – 15t ha^{-1}. The use of 15t ha^{-1} green manure resulted in higher grain yield than Cowdung at 10t ha^{-1}. The greater values of yield by SAMSORG –

40 under higher dose of green manure shows that *Cassia obtusifolia* green manure releases more nitrogen to sorghum which in turn contributes significantly to yield. Yield of fresh vegetable maize on weed green manure was highest 12702 kg ha^{-1} by *Cassia obtusifolia.* Abdullahi, (2011) reported that SAMSORG – 40 had significant number of yield and yield attributes over the Kano fara-fara, a local variety.

There were significant interactions of crop varieties and organic manure in both 2013 & 2014. Grain yield increased with green manure from 0 - 15 t ha^{-1}under SAMSORG - 40 in both years under study. With each variety, green manure at 15 t ha^{-1}had higher yield over Cowdung at 10 t ha^{-1}. At each level of green manure, SAMSORG - 40 out yielded the other variety (SAMSORG - 41).

In conclusion, although SAMSORG - 40 delayed *Striga* seed emergence, and supported more *Striga* shoots, it was more tolerant to the parasitic weeds and gave higher yield than its counterpart, SAMSORG - 41. The use of 7.5 - 15.0 t ha^{-1} of green manure and 10t ha-1 of Cowdung ameliorated the effect of *Striga* on Sorghum growth, and gave a linear yield response to green manure rates from 0 - 15t $ha^{-1.}$ The use of green manure at 15 t ha^{-1} out yielded Cowdung at 10 t ha^{-1}.With variety, SAMSORG – 40 had an edge over SAMSORG – 41 with respect to *striga* shoot count even though both varieties were tolerant to *Striga*, yet *Striga* density was significantly higher in SAMSORG – 41. The study also revealed that, the highest grain yield of sorghum was by the application of 15t ha^{-1} green manure with SAMSORG – 40 grown on *Striga* infested field. Improving soil fertility, especially N will reduce the effect of *Striga* on sorghum.

Table 1: Physical and chemical characteristic of soil (0-30cm) taken from the experimental site during 2013 and 2014 wet seasons at Samaru

Soil properties	2013	2014
Physical properties		
Sand (%)	19.8	25.0
Silt (%)	13.2	16.6
Clay (%)	67.0	58.4
Textural class	Loam	Loam
Chemical properties		
pH in water (1:2.5).	6.30	6.05
pH in 0.01m $CaCl_2$ (1:2.5.).	5.61	5.08
Organic carbon (g/kg).	0.80	0.41
Total Nitrogen (g/kg).	0.58	0.50
Available P mg/kg	2.10	4.30
Exchangeable cation (Cmol/kg)		
K	1.40	1.20
Mg	1.80	1.50
Ca	4.30	3.03
Na	0.41	0.58
CEC (meq/100g)	2.40	5.27

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Table 2:Nutrients content of***Cassia*** **green manure used in the experiment at Samaru in 2013 and 2014 wet seasons.**

Nutrients (%)	Samaru	
	2013	2014
Total N	1.75	22.78
Available P	1.60	1.96
Available K	0.56	0.63

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Table 3: *Striga* management in Sorghum using Crop variety and organic manure on *Striga* parameters and Sorghum grain yield during 2013 wet season at Samaru.

Treatment	Number of days to Striga emergence	*Striga* shoot count @ harvest	Crop *striga* reaction score @ 6 WAS	Grain yield ($kgha^{-1}$).
Variety (V)				
SAMSORG – 40	107.0a	1.44a	6.9	2000a
SAMSORG – 41	96.0b	0.42b	6.8	1809b
SE±	0.17	0.36	0.14	9.70
Green manure (M) ($t\ ha^{-1}$)				
0	106.0a	0.67	6.9	1516d
7.5	103.0ab	1.33	7.0	1815c
15	91.7b	1.17	6.6	2166a
Cowdung 10t ha-1	92.2b	0.55	6.8	2120b
SE±	0.19	0.53	0.20	13.7
Interactions.				
V x M	NS	NS	NS	*

Means followed by the same letter (s) within a column of each treatment group are not significantly different at 5% level of probability using the DMRT.

Table 4: *Striga* management in Sorghum using Crop variety and Organic manure on *Striga* parameters and Sorghum grain yield during 2014 wet season at Samaru.

Treatment	Number of days to *Striga* emergence	*Striga* shoot count @ harvest	Crop *Striga* reaction score @ 6 WAS	Grain yield ($kgha^{-1}$).
Variety (V)				
SAMSORG – 40	105.0a	0.64b	3.91	2149a
SAMSORG – 41	95.2b	0.86a	3.85	1980b
SE±	0.15	0.16	0.12	18.7
Green manure ($t\ ha^{-1}$)				
0	93.7b	0.67b	3.93	1698d
7.5	109.0a	0.61b	3.90	2039c
15	92.2b	1.33a	3.90	2289a
10	102.2a	0.34bc	3.79	2233b
SE±	0.17	0.22	0.17	26.5
Interactions.				
V x M	NS	NS	NS	*

Means followed by the same letter (s) within a column of each treatment group are not significantly different at 5% level of probability using the DMRT.

WAS = Weeks After Sowing.

Table: 5 Interaction of variety and organic manure on Sorghum grain yield during 2013 & 2014 wet seasons at Samaru.

Manure rate (t ha^{-1}).	**Variety**		
	SAMSORG-40	**2013**	SAMSORG-41
0	1605f		1427g
7.5	1882d		1749e
15	2302a		2031c
10	2211b		2029c
SE±		5.0	
		2014	
0	1769c		1627f
7.5	2137c		1940d
15	2365a		2140c
10	2325b		1940d
SE±		5.2	

Means followed by same letter are not significantly different at 5% level of probability using DMRT.

REFERENCES

Abdullahi, R. (2011). Use of Cotton, Cowpea and Soyabean Varieties as Trap Crops for the Control of Striga in Sorghum in Northern Guinea Savannah. Unpublished M.Sc. Thesis Submitted to the Department of Agronomy Ahmadu Bello University, Zaria, Nigeria. 69pp

Anonymous, (2011). Feasibility study on Striga control in Sorghum. African Agriculture Technology Foundation, Nairobi: ISBN 9968-775-12-9.

Anonymous, (2015). IAR Released Variety Descriptors. Institute For Agricultural Research, Samaru, Federal Ministry of Agriculture and Rural Development, Ahmadu Bello University, P M B 1044, Zaria. 85pp.

Arunah, U. L., U. F., Chiezey and Aliyu L. (2006). Response of two Sorghum varieties to inorganic fertilizer and poultry manure on yield and yield components. Programme and Book of Abstract of the31stAnnual conf. Soil sci. society of Nigeria. 13th-17thNov., 2006 Ahmadu Bello University, Zaria, Nigeria. Pp: 42.

Duncan, D. B. (1955). Multiple Range and Multiple F - test. Biometrics II, (1955): 1 -42.

Esilaba, A.O.F. (2006). Options for *Striga* management in Kenya, Kenya Agricultural Research Institute, Nairobi, Kenya.

Godbharle, A. R, More, A.W. and Ambekar, S. S. (2010). Genetic variability and correlation studies in elite 'B' and 'R' lines in kharif sorghum. Electronic journal of plant breeding, 1(4): 14-23.

Gworgwor, N. A. (1993). Studies on the Biology and Control of Striga spp Unpublished Ph D Thesis, Phillips University, Margurg, FRG 184pp

Vogt, W., Sauborn, J. and Honissch, M. (1991). Striga hermonthica, distribution and Infestation in Ghana and Togo on Grain Crops. In Proceedings of the Fifth International Symposium on parasitic Weeds. Ransom, J.K., Musselman, L. J., Worsham, A. D. and Parker, C. (Eds.), Pp. 272 - 277. CIMMYT, Mexico. Pp34.