EVALUATION OF ORGANIC MANURE AND *PARKIA BIGLOBOSA* ON *STRIGA HERMONTHICA* CONTROL IN *SORGHUM BICOLOR*

MAMUDU, A.Y.
Department of Crop Production, Federal University of Technology,
P.M.B 65Minna, Niger State
E-mail: mamuduay@gmail.com **Phone No:** +234-805-705-5760

Abstract
The experiment was conducted in a screen house between June and November 2013 at the Research Farm of the Federal University of Technology Minna, which is found on latitude 09 39'N and longitude 06 28'E.Minna lies within the southern guinea savannah zone of Nigeria with a mean annual rainfall of 1300mm and an average monthly temperature of 32^{0}.^{C}The objective was to determine the effect of organic manure and Parkiabiglobosa pulp powder on Strigahermonthica control in sorghum .The research was a 4×4 factorial experiment in complete randomised design with sixteen treatments in three replications. Treatments consisted of combinations of four levels (0, 40, 80, and 120g/bag) of organic manure and four levels (0, 40, 80, and 120g/bag)of Parkiabiglobosa pulp powder used as seed treatment for Sorghum. The experiment was laid out in completely randomized design in three replications. The results showed that, Striga emergence varied significantly (p<0.05) throughout the sampling periods. However, the treatments used inhibited the growth of Striga in the presence of Striga resistant sorghum. There were very few Striga emergence in all the treatments, that is the treatments used inhibited their growth. This could be due to non-effective haustrorium attachment to host root. Organic manure at the rate of 120g/bag exhibited the highest plant height and sorghum dry weight. The effect of organic manure and Parkia pulp powder were significant(0<05) on Striga emergence and Striga plant height. The result showed that 120g organic manure and 120g parkia pulp powder and resistance sorghum variety is most effective in inhibiting the growth of Striga. Organic manure and Parkiabiglobosa can effectively be used to combat Strigahermonthica in sorghum as the combination of the treatments suppressed more than 75% of Strigahermonthica emergence.

Keyword: Sorghum, Organic manure, *Parkia* pulp powder and *Strigahermonthica* control

Introduction

Sorghum remains an important food security crop in Sub-Saharan African (SSA) especially in areas where other crops do not do well. Globally, sorghum (*Sorghum bicolor* (L) Moench) is the fifth most important staple food crop after wheat, rice, maize, and barley (FAO, 2012). The inherent tolerance of sorghum to marginal lands and environmental condition, its versatility as a food and feed grain and its ability to produce high yield ensure its important role in the lives of millions of people throughout the world. Weed is a major problem facing the resource poor farmers in Nigeria leading to a huge economic loss. Particularly in the northern region of which a root parasitic weed of the genus *Striga* in the family (Scrophulariaceae)constitute a major biotic constraint to cereal production such as maize, sorghum and millet in Sub-Sahara Africa (Yonli *etal., 2010*).

The *Strigahermonthica* (Del.) Benthis most devastating *Striga* species on cereals in West Africa and is estimated to cause losses ranging from 40-90 % (Gressel *et al.*, 2004). Dzomeku and Murdoch (2007) had reported that an average yield losses of 25-40% could occur and that total crop failure under drought is not uncommon. AATF (2006) also reported that there are many constraints that impede the realization of yield potentials of cereal crops one of the major causes of such low yields is *Striga* infestation. The effect of *Strigahermonthica* damage on crops was a reduction in yield. The extent of yield loss was related to the incidence and severity of attack, the host's susceptibility to *Striga*,

environmental factors edaphic and adaphic and the management level at which the crop was produced. Controlling *Striga* and other root parasite is difficult because the weed could cause huge damage to the host crop before emerging above the ground.

Research on identification of control measures for *Strigahermonthica* in Africa has been conducted for the last seven decades and still ongoing. Various control methods (e.g. land preparation, hand-pulling, hoe-weeding, trap cropping) have been tried out singly or in combination over the years with no conclusive and consistent results for the peasant farmers. This could partly be attributed to the huge amounts of seeds that accumulate over time in the seed bank (Oswald, 2004). Other methods are crop rotation, injection of ethylene gas (Radi,2007).The use of natural products could also inhibit or reduce the germination of *Striga* seeds in order to deplete the *Striga* seed bank in the soil (Yonli *et al.,* 2010).

Debrah *et al*., (1998) reported that *Striga* abundance is favoured by continuous cropping and low soil fertility, and hence does not do well on soils with high organic matter content. Organic manure is a complex mixture of living, dead and decomposed materials which include naturally occurring organic materials (e.g. cow dung, compost and guano).

Most of the organic manure is derived from plant tissue decomposing organic manure contain three primary macro nutrient: nitrogen(N),phosphorus(P), and potassium(K) and three secondary micro nutrients: calcium(Ca),sulphur(S) and magnesium (Mg). N-fertilizer has been reported to delay *Striga* emergence, promote high sorghum yield and reduces *Striga* damage in the guinea savannah ecological zones (Kureh *et al*., 2002; Sule *et al*., 2008).*Parkiabiglobosa* pulp powder from the treehas been discovered to have pesticidal effects on soil. Screen house evaluation of *Parkiabiglobosa* and *Azadirachta indica* (neem tree) has been reported to be effective in inhibiting *Strigahermonthica* seed germination and subsequently reduce *Striga* emergence (Marley*et al*., 2004; Syngeta, 2004).

In this trial, *Parkia* pulp powder was used as Sorghum seed treatment to determine the effectiveness of the plant material on *Strigahermonthica* control through reduction of *Striga* emergence. The concept of combining two or more farmer friendly control measures in integrated *Striga* control is currently being focus (Syngeta,2004).With good understanding of philosophies and legalities of organic farming, this research exploited the concept of integrated management. Hence, the objective of this study was to determine the effect of organic manure and *Parkia* pulp powder on *Striga* emergence and sorghum growth.

Material and Methods

Experimental site

The experiment was conducted in the screen house at Gidan Kwano campus of Federal University of Technology Minna from June to October, 2013. The Federal University of Technology Minna is located at latitude 9^0 37'N) and longitude ($6^0$32'E with an annual mean rainfall of 1300 mm and a mean monthly minimum and maximum temperature distribution value of 22.7^{0}C and 34.2^{0}C respectively.

Treatments and Experimental Design

The treatments comprised four levels (0,40,80 and 120g) of organic manure and four levels (0,40,80 and 120g) of *Parkia* pulp powder combined factorially to give sixteen treatments. The treatments were laid out in a Completely Randomised Design (CRD) with three replications. Description and treatment combinations are indicated in Table 1.

Table 1: **Description of treatment combination of organic manure and *Parkia* pulp powder**

Treatment	Description (g/bag)
T_1	0 organic manure 0 parkia pulp powder
T_2	0 organic manure 40 parkia pulp powder
T_3	0 organic manure 80 parkia pulp powder
T_4	0 organic manure 120parkia pulp powder
T_5	40 organic manure 0 parkia pulp powder
T_6	40 organic manure 40 parkia pulp powder
T_7	40 organic manure 80 parkia pulp powder
T_8	40 organic manure 120 parkiapulp powder
T_9	80 organic manure 0 parkia pulp powder
T_{10}	80 organic manure 40parkia pulp powder
T_{11}	80 organic manure 80parkia pulp powder
T_{12}	80 organic manure 120 parkia pulp powder
T_{13}	120 organic manure 0parkia pulp powder
T_{14}	120 organic manure 40 parkia pulp powder
T_{15}	120 organic manure 80 parkia pulp powder
T_{16}	120 organic manure 120 parkia pulp powder

Preparation of Soil Sample and Planting Materials

The polyethylene bags were filled with 5kg of topsoil and mixed with cowdung. The sorghum seeds treated with *Parkia* pulp powder were planted and later infested with 15g *Strigahermonthica* seeds in each bag. A *Parkia* fruit *was* collected from Bosso town in Minna. The pulp was separated from the seeds by pounding in mortar with pestle and sieved with a 2mm sieve. *Striga* seeds were obtained from National Cereal Research Institute (NCRI) Baddegi Bida, Niger State. The dry cow dung was collected from Federal University of Technology, Animal Production Department Research Farm Gidan Kwano Minna and the resistant sorghum seed was purchased from Agrochemical Seed Store Minna, and later thinned out to two plants per bag after germination.

Agronomic Practices

Polyethylene bags were irrigated every three days interval to provide adequate moisture for plant growth and *Striga* emergence. Excessive watering was avoided so as not to hinder *Striga* seeds emergence. Planting was done on 29thJune 2013 with four seeds per bag and thinning was done two weeks after sowing. Weeds other than *Striga* were removed by hand pulling to prevent competition with the crop.

Data Collection

Data collected on sorghum plants were plant height, number of leaves per plant and plant dry weight. Striga emergence and Striga height was taken at 4, 6, 8, 10 and 12 weeks after sowing.

The number of emerged *Striga* and *Striga* height in each bag was taken at different period (two weeks interval) as mentioned above,. The *Striga* height was measured from topsoil to the neck of a flag leaf.

Plant height of two plants in each bag was measured from topsoil to neck of the flag leaf using a meter rule. Sorghum leaf count for two plants in each bag was taken every two week from 4-8 WAS. Dry matter of sorghum plant was taken from two plants in each bag by

cutting the plant from the ground level, put in an envelope and oven dried at 105^C for 24 hours.

Data Analysis

Data collected were subjected to analysis of variance (ANOVA) using the computer software SPSS. Means were separated using Duncan's Multiple Range Test (Duncan, 1995).

Results and Discussion

Striga emergence

The *Striga* emergence results indicated a significant ($p<0.05$) variation in the sampling periods (4,6,8,10 and12 WAS) The lowest mean (1.5) Striga emergence was recorded with 120g organic manure plus 120g *Parkiabiglobosa*, followed by 120g organic manure combined with 0, 40 and 80*Parkia* pulp powder respectively which were all not statistically significantly different (Table 2) The lower *Striga* emergence seen in treatment with 120g organic manure with 120g *parkia* pulp powder could be attributed to increase in soil nitrogen (N) due to applied N which is known to reduce *Striga* attack by increasing crop tolerance. Kureh*et al.,* (2008) had reported that N-fertilizer delayed *Striga* emergence and promote high sorghum yield.

Table 2: Effect of organic manure and *parkia* pulp powder on *Striga* emergence

Treatment	*Striga* emergence					
	Weeks after sowing					
	4	6	8	10	12	MEAN
0 organic manure + 0 *Parkia* pulp powder	3.0^{f}	3.3^{f}	3.7^{e}	4.0^{c}	4.0^{d}	3.6^{f}
0 organic manure + 40 *Parkia* pulp powder	2.7^{ef}	3.0^{ef}	3.3^{de}	4.0^{c}	4.0^{d}	3.4^{ef}
0 organic manure + 80 *Parkia* pulp powder	2.3^{def}	2.3^{cde}	3.3^{de}	3.7^{bc}	4.0^{d}	3.1^{def}
0 organic manure + 120 *Parkia* pulp powder	$2.0c^{def}$	2.0^{bcd}	2.6^{bcd}	3.0^{ab}	4.0^{d}	2.7^{bcdef}
40 organic manure + 0 *Parkia* pulp powder	2.0^{cdef}	2.3^{cde}	2.3^{abc}	3.0^{ab}	3.7^{cd}	2.7^{bcdef}
40 organic manure + 40 *Parkia* pulp powder	2.0^{cdef}	2.3^{cde}	3.0^{cde}	3.3^{bc}	3.7^{cd}	2.9^{cdef}
40 organic manure + 80 *Parkia* pulp powder	2.0^{cdef}	2.7^{def}	3.3^{de}	3.7^{bc}	4.0^{d}	3.1^{def}
40 organic manure + 120 *Parkia* pulp powder	1.7^{bcde}	1.7^{abc}	2.0^{ab}	2.7^{ab}	3.3^{bcd}	2.3^{abcd}
80 organic manure + 0 *Parkia* pulp powder	1.7^{bcde}	2.0^{bcd}	2.3^{abc}	2.7^{ab}	3.0^{abc}	2.3^{abcd}
80 organic manure + 40 *Parkia* pulp powder	2.0^{cdef}	2.0^{bcd}	2.3^{abc}	2.7^{ab}	2.7^{ab}	2.3^{abcd}
80 organic manure + 80 *Parkia* pulp powder	2.0^{cdef}	2.0^{bcd}	2.7^{bcd}	3.0^{ab}	3.0^{abc}	2.5^{abcde}
80 organic manure + 120 *Parkia* pulp powder	1.3^{bcd}	1.3^{ab}	2.3^{abc}	2.0^{a}	2.7^{ab}	1.9^{abc}
120 organic manure + 0 *Parkia* pulp powder	1.0^{abc}	1.0^{a}	1.7^{a}	2.0^{a}	2.7^{ab}	1.7^{ab}
120 organic manure + 40 *Parkia* pulp powder	0.7^{ab}	1.3^{ab}	2.0^{ab}	2.0^{a}	2.7^{ab}	1.7^{ab}
120 organic manure + 80 *Parkia* pulp powder	0.7^{ab}	0.7^{ab}	2.0^{ab}	2.7^{ab}	2.7^{ab}	1.8^{ab}
120 organic manure + 120 *Parkia* pulp powder	0.3^{a}	1.0^{a}	2.0^{ab}	2.0^{ab}	2.3^{a}	1.5^{a}
S.E (±)	0.1	0.1	0.1	0.1	0.1	

Means not followed by the same letter within the column differ significantly ($p<0.05$) according to the DMRT

Striga shoot height

The 120g organic manure and 120g *Parkia* powder treatment significantly produced shorter *Striga* height throughout the sampling period (4, 6, 8, 10 and 12 weeks after sowing (WAS)) (2.7cm, 5.3cm, 5.7cm, 8.7cm and 7.7cm respectively) (Table 3) compared to other treatments (Table 3).The shorter *Striga* height could be as a result of the treatments (120g organic manure with 120g *Parkia* pulp) weakening the *Striga* shoot and slowing down of their development and growth due to increase on soil nitrogen which has been reported by Kureh*et al.,*(2002)to delayed *Striga* emergence.

Table 3: Effect of organic manure and *parkia* pulp powder on *Striga* plant height

Treatment	*Striga* plant height (cm)					
	Weeks after sowing					
	4	6	8	10	12	Mean
0 organic manure + 0 *Parkia* pulp powder	7.3^{a}	8.7^{d}	11.7^{a}	12.0^{e}	13.0^{f}	10.5^{c}
0 organic manure + 40 *Parkia* pulp powder	7.3^{a}	9.0^{d}	11.7^{a}	11.3^{de}	14.3^{g}	10.7^{c}
0 organic manure + 80 *Parkia* pulp powder	5.7^{f}	8.7^{d}	10.7^{fg}	12.0^{e}	11.7^{e}	9.7^{bc}
0 organic manure + 120 *Parkia* pulp powder	5.7^{f}	8.0^{cd}	10.3^{fg}	11.3^{de}	11.3^{de}	9.3^{abc}
40 organic manure + 0 *Parkia* pulp powder	5.7^{f}	8.7^{d}	10.0^{ef}	10.3^{cd}	10.7^{de}	9.0^{abc}
40 organic manure + 40 *Parkia* pulp powder	4.7^{de}	7.3^{c}	10.3^{fg}	10.3^{cd}	11.0^{de}	8.7^{abc}
40 organic manure + 80 *Parkia* pulp powder	5.0^{ef}	8.0^{cd}	9.7^{ef}	10.3^{cd}	10.3^{cd}	8.7^{abc}
40 organic manure + 120 *Parkia* pulp powder	5.0^{ef}	8.0^{cd}	9.7^{ef}	10.3^{cd}	11.0^{de}	8.8^{abc}
80 organic manure + 0 *Parkia* pulp powder	4.7^{de}	8.0^{cd}	9.7^{cde}	9.3^{abc}	11.0^{de}	8.5^{abc}
80 organic manure + 40 *Parkia* pulp powder	4.0^{cd}	8.0^{cd}	9.3e^{def}	9.3^{abc}	9.0^{b}	7.9^{abc}
80 organic manure + 80 *Parkia* pulp powder	4.0^{cd}	4.0^{cd}	9.e^{def}	9.0^{ab}	9.3^{bc}	7.1^{abc}
80 organic manure + 120 *Parkia* pulp powder	3.7^{bc}	7.3^{c}	8.7^{cde}	9.3^{abc}	9.3^{bc}	7.6^{abc}
120 organic manure + 0 *Parkia* pulp powder	3.0^{ab}	7.0^{bc}	8.0^{cd}	8.7^{a}	9.0^{ab}	7.1^{abc}
120 organic manure + 40 *Parkia* pulp powder	3.0^{ab}	5.3^{a}	7.7^{bc}	9.0^{ab}	8.3^{ab}	6.6^{ab}
120 organic manure + 80 *Parkia* pulp powder	2.3^{a}	6.0^{ab}	6.7^{ab}	9.0^{ab}	8.3^{ab}	6.5^{ab}
120 organic manure + 120 *Parkia* pulp powder	2.7^{a}	5.3^{a}	5.7^{a}	8.7^{a}	7.7^{a}	6.0^{a}
SE (±)	0.2	0.2	0.2	0.2	0.2	

Means not followed by the same letter within the column differ significantly (p<0.05) according to DMRT

Plant height

The results of sorghum plant height and plant leaf count were not significant, the interaction effect of variety and treatment was not also different in both (Table 4).

Table 4: Effect of organic manure and *Parkia*pulp powder onsorghum plant height

Treatment	Sorghum plant height			
	Weeks after sowing			
	4	6	8	Mean
0 organic manure + 0 *Parkia* pulp powder	20.0^{a}	40.3^{a}	89.3^{a}	49.9^{a}
0 organic manure + 40 *Parkia* pulp powder	20.7^{a}	41.0^{a}	90.3^{a}	49.9^{a}
0 organic manure + 80 *Parkia* pulp powder	20.3^{a}	41.0^{a}	89.0^{a}	50.1^{a}
0 organic manure + 120 *Parkia* pulp powder	20.3^{a}	40.3^{a}	89.0^{a}	50.7^{a}
40 organic manure + 0 *Parkia* pulp powder	22.7^{a}	45.3^{a}	91.7^{a}	53.1^{a}
40 organic manure + 40 *Parkia* pulp powder	23.3^{a}	44.7^{a}	91.3^{a}	53.1^{a}
40 organic manure + 80 *Parkia* pulp powder	23.3^{a}	44.7^{a}	91.3^{a}	53.2^{a}
40 organic manure + 120 *Parkia* pulp powder	23.7^{a}	45.3^{a}	94.3^{a}	54.4^{a}
80 organic manure + 0 *Parkia* pulp powder	24.7^{a}	45.7^{a}	98.1^{a}	58.5^{a}
80 organic manure + 40 *Parkia* pulp powder	27.0^{a}	46.0^{a}	96.3^{a}	58.7^{a}
80 organic manure + 80 *Parkia* pulp powder	26.0^{a}	47.3^{a}	97.3^{a}	58.8^{a}
80 organic manure + 120 *Parkia* pulp powder	27.7^{a}	46.7^{a}	98.7^{a}	58.8^{a}
120 organic manure + 0 *Parkia* pulp powder	29.3^{a}	48.0^{a}	98.3^{a}	60.8^{a}
120 organic manure + 40 *Parkia* pulp powder	29.7^{a}	52.7^{a}	98.0^{a}	61.2^{a}
120 organic manure + 80 *Parkia* pulp powder	29.3^{a}	53.3^{a}	98.0^{a}	61.5^{a}
120 organic manure + 120 *Parkia* pulp powder	29.7^{a}	52.7^{a}	97.0^{a}	61.9^{a}
S.E (±)	0.5	0.7	0.8	

Means not followed by the same letter within the column differ significantly (p<0.05) according to DMRT

Sorghum dry matter

Theresult showed that there was significant differencesin dry matter of sorghum. Thehighest (5.0g) sorghum dry matterwas recorded when 120g organic manure was

combined with 120g *Parkia* pulp powder which was at par with 120g organic manure combined with 40g *Parkia* pulp powder, whencompared to other treatments (Table 5). The highest sorghum dry matter observed could be attributed to the level of nitrogen which helped in delaying *Striga* emergence and reducing attack on the plant hence promoting sorghum yield and reduction in*Striga* damage. This finding is in agreement with Kurch*et al.,*(2002) who reported that nitrogen fertilizer delayed*Striga* emergence, promote high sorghum and maize yield as well as reduced*Striga* damage in the guinea savannah ecological zones.

Table 5: Effect of organic manure and *parkia*pulp powder onsorghum dry weight

Treatment	Sorghum Dry weight
0 organic manure + 0 *Parkia* pulp powder	2.1[a]
0 organic manure + 40 *Parkia* pulp powder	2.1[a]
0 organic manure + 80 *Parkia* pulp powder	2.0[a]
0 organic manure + 120 *Parkia* pulp powder	2.2[a]
40 organic manure + 0 *Parkia* pulp powder	2.9[b]
40 organic manure + 40 *Parkia* pulp powder	2.8[b]
40 organic manure + 80 *Parkia* pulp powder	3.0[b]
40 organic manure + 120 *Parkia* pulp powder	3.0[b]
80 organic manure + 0 *Parkia* pulp powder	4.0[c]
80 organic manure + 40 *Parkia* pulp powder	4.0[c]
80 organic manure + 80 *Parkia* pulp powder	3.9[c]
80 organic manure + 120 *Parkia* pulp powder	4.0[c]
120 organic manure + 0*Parkia* pulp powder	4.6[d]
120 organic manure + 40 *Parkia* pulp powder	5.0[de]
120 organic manure + 80 *Parkia* pulp powder	4.8[e]
120 organic manure + 120 *Parkia* pulp powder	5.0[e]

Means not followed by the same letter within the column differ significantly (p<0.05) according to the DMRT

Conclusion

Based on the results obtained from the experiment, the best control measure of *S. hermonthica* is the use of combination of 120g organic manure and 120g *Parkia* pulp powder and resistant sorghum variety. Therefore farmers in *Striga* affected areas are urged to use organic manure and *Parkia* pulp powder in addition to *Striga* resistant sorghum variety. It will however, be necessary for future research work to focus on the exact rates or organic manure and *Parkia* pulp powder that should be applied to obtain maximum output under field condition.

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