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Effectiveness of parkia (*Parkia biglobosa*) products for the control of *Striga genesrioides* in the southern guinea savanah

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Abstract

Field trials were conducted in 2011 and 2012 at the Teaching and Research Farm of the Department of Agricultural Technology, Plateau State College of Agriculture, Garkawa (08°52'N; 69°24'E) to evaluate the effectiveness of two Parkia(*Parkia biglobosa)* based products for the control of *Striga gesnerioides* in the Southern Guinea Savannah. The treatments consisted of two Parkia product : *Parkia* fruit powder (PP) and *Parkia* husk powder (PH) Plus No Parkia (Control) and ten cowpea genotypes (Banjar, IT84S-2246-4, IT97K-499-35, IT98K-573-1-1, IT89KD-391, IT03K-338-1, IT98K-205-8, Borno brown, TVX3236, UAM11D-24-55-3) and Gazum local check. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. Generally, *Parkia* based products significantly delayed the emergence of *Striga gesnerioides*. *Parkia* based products also recorded significantly the lowest *Striga* shoot counts when compared with the no *Parkia* check. Five cowpea genotypes (IT97K-499-35, IT98K-573-1-1, IT03K-338-1, IT98K-205-8 and UAM11D-24-55-3) did not support the emergence of *Striga gesnerioides* . Among the susceptible genotypes, TVX3236 and Gazum local recorded significantly higher *Striga* shoot counts. *Parkia* based products recorded significantly higher pod weights and heavier seeds compared with the no *Parkia* check. Grain yield, although not significant, the trend indicated higher grain yield with the use of *Parkia* products when compared with the no *Parkia* check. *Striga* free genotypes had significantly more pods, heavier pods, heavier seeds and subsequently higher grain yield compared with the susceptible genotypes. This study concludes that: *Parkia* based products posses great potentialities for suppressing the noxious weed, *Striga gesnerioides*.

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Introduction

Therefore this study was undertaken to evaluate the effect of varying levels of *Parkia* fruit husk in controlling *Striga gesnerioides* infesting cowpea. Cowpea, *Vigna unginculata* (L) Walp is one of the most important and widely grown legume crops in the savannah and Sahel regions of Africa (Steele, 1976). The relatively high protein content (23%) makes cowpea an important supplement to the diet of many African People (Bressani, 1985) who consume cereals, roots and tubers which are high in carbohydrates and low in protein. The cowpea haulm provides valuable animal feed during the dry season. An important feature of cowpea is that it fixes atmospheric nitrogen through symbiosis with nodule bacteria (*Bradyrhizobium* sp), thereby increasing N levels in the soil for the benefit of the following crop in a rotation. However, despite the economic importance of cowpea in Sub-Saharan Africa and its widespread high potential, its growth and yield are constrained by several biotic and abiotic factors. These include insect pests and diseases, parasitic flowering plants and nematodes. Among these biotic constraints, *Striga gesnerioides* (Wild*)* Vatke, an obligate, root-parasitic flowering plant of the family Orobanchaceae is a formidable constraint to cowpea production, especially in the dry savanna. Cowpea yield losses associated with *Striga gesnerioides* have been reported to range between 83 and 100% (Cardwell and Lane, 1995). On susceptible local varieties, Emechebe *et al.* (1991) reported 100% yield losses on farmers' fields in the Northern Guinea Savanna of Nigeria. In a survey of the level of *Striga gesnerioides* infestation on farmers fields, Dugje *et al.* (2006) reported that more than 81% of the fields grown to cowpea in north eastern Nigeria were infested with *Striga gesnerioides* and subject to serious crop losses. Various control measures, including cultural practices, chemical and biological control measures and host plant resistance have been suggested (Boukar *et al.*, 2004) but no single field method seems to be fully adequate. There is therefore the need to explore other means of controlling this noxious parasitic weed that can be afforded by the resource poor cowpea producers in the sub-Saharan region.

Several workers have reported on the use of plant materials to control *Striga* spp. Kambou *et al* .(1997) reported the use of *Parkia* products *(Parkia biglobosa)* powder to control *Striga hermonthica.* They reported that *Parkia* products improved the soil agrochemicals of the soil. According to Field and Latinga (1989), tannins are the main secondary exudates in *Parkia* and are toxic to animals especially in aquatic areas. Lane *et al* (1991) reported the presence of triterpenes carotenoids, tannins and polyphenolic compounds in *Parkia* fruits. Kambou *et al.* (1997) reported germination inhibition of 97-100% and 92% when untreated powder extract and decorticated powder of *Parkia* were used respectively. Marley *et al.* (2004) reported 29.1 and 38.8% reduction of *Striga* emergence under a field and screen house conditions when fruit and fruit powder of *Parkia* were used respectively. Yonli *et al* (2010) conducted a study to evaluate the allelopathic properties of endogenous plant species against *Striga hermonthica* (Del) Benth and reported that *Parkia biglobosa* peels completely inhibited *Striga* seed germination. Magani *et al* (2010) reported great advantage in using *Parkia* based products as pre-sowed treatments and thereafter followed by post emergence application of 2-4-D or Triclopyr (herbicides) at the rate of 0.36kg ai/ha to control *Striga hermonthica.* Therefore this study was undertaken to evaluate the effect of varying levels of *Parkia* fruit husk in controlling *Striga gesnerioides* infesting cowpea.

Materials and methods

The experiment was conducted at the Teaching and Research Farm of the Department of Agricultural Technology, Plateau State College of Agriculture, Garkawa (08°52'N; 69°24'E) in the Southern Guinea Savannah ecological Zone of Nigeria. The experiment was conducted under natural infestation on a field previously observed to be heavily infested with *Striga ghesnerioides*.

Plant Material

Ten cowpea genotypes were obtained from UAM cowpea breeding programme funded by Alliance for Green Revolution in Africa, and Kirk house Trust. One local variety (Land race) known to be susceptible to *Striga _gesnerioides* (Gazum local) was included as a check. The characteristics of the cowpea genotypes used for the study is presented in Table 1.

Table 1. Characteristics of cowpea genotypes used in the evaluation for resistance to *Striga* .

Cowpea line	Pedigree	Reaction to *Striga*	Remarks
Banjar	N/A	S	Land race from Borno State
IT84S-2246-4	IT86D-716 x IT819D-1020	S	Bred at IITA, Kano
IT97K-499-35	IT93K-596-12xIT93K-2046-2	R	Bred at IITA, Kano
IT98K-573-1-1	IT93K-596-9-12xIT93K-2046-2	R	Bred at IITA, Kano
IT89KD-391	N/A	S	Bred at IITA, Kano
IT03K-338-2	IT87D-941-1xIT95K-1088-4	R	Bred at IITA, Kano
IT98K-205-8	IT93K-596-9-12xIT93K-2046-1	R	Bred at IITA, Kano
Borno Brown	Commercial cultivar in Borno	S	Local cultivar in Borno
TVX 3236	TVu 1509 x Ife Brown	S	Bred at IITA, Kano
UAM11D-24-55-3	IT03K-338-1 X Borno Brown	R	UAM improved line.
Gazum Local	N/A	S	Local cultivar from Plateau

Source: Omoigui *et al* (2012). R = resistant; S = susceptible; N/A = not available.

Preparation of Parkia based products

Matured and well dried *Parkia* fruits were purchased from producers in Garkawa town. The fruits powder and the husks were spread under the sun for about one week to ensure they were properly dried. The Parkia fruits were peeled and pounded in a mortar to separate the powder from the seed. Each product was then ground into fine powder (<1mm) and stored in a dry place until when needed.

Experimental Design and Cultural Practices

The treatments consisted of eleven genotypes of cowpea and three levels of *Parkia* based products. These were combined factorially and laid out in a Randomized Complete Block Design (RCBD). The land was ploughed, harrowed and ridged at 0.75m apart. During planting, 2g of *Parkia* products was applied in the planting hole, according to the treatment, before the cowpea seeds were planted in the hole. Three seeds were planted per hole at intra- and inter-row spacings of 0.20m and 0.75m respectively. Thinning was done at two weeks after planting to maintain two plants per stand. Weed control was done manually at 3 and 4 weeks after planting (WAP). Thereafter, hand pulling was employed to avoid damage to the *Striga* plants. Fertilizer was applied by band method at 2WAP at the rate of 100g ha^{-1} of NPK (15:15:15) compound fertilizer, to give the equivalent of 15kg a.i. ha^{-1}N, P205 and K20, respectively. Insects were controlled by spraying at 50% flower initiation and at 2 weeks intervals thereafter with BEST Action (*Cypermethrin* plus *Dimenthoate*) at the rate of 1.5 litres /ha.

Data Collection and Analysis

Data were taken on days to emergence, number of crops infested with *Striga* , *Striga* shoot count and crop damage score at 9 and 12WAS, number of pods and pod weight per net plot, 1000 seed weight and grain yield of cowpea. All data were subjected to an Analysis of Variance using user's manual, version 9.1 SAS Institute (2002) and means were compared using Dunkan Multiple Range Test.

Results and discussion

The number of days to first *Striga* emergence was significantly affected by the *Parkia* products in the two years and among the cowpea genotypes tested (Table 2). Generally, the application of Parkia products delayed the emergence of *Striga* when compared to the control. Application of *Parkia* products generally delayed the emergence of *Striga* by one and three days respectively for *Parkia* husk powder and *Parkia* powder in 2011 and 2012.

Table 2. Effect of Parkia based products and cowpea genotypes on days to first emergence of *Striga* at Garkawa, 2011 and 2012 Cropping seasons.

Parkia Product (P)	2011	2012	Combined
No Parkia product (PO)	19.19c	19.64c	19.77c
Parkia Powder (PP)	23.42a	22.97a	23.21a
Parkia husk powder (PH)	21.06b	20.85b	20.95b
SE ±	0.383	0.183	0.260
GENOTYPE (G)			
Banjar	42.11a	40.22ab	41.17a
IT845-246-4	39.67bc	41.33a	40.50a
IT97K-499-35	0.00e	0.00d	0.00d
IT98K-573-1-1	0.00e	0.00d	0.00d
IT89KD-391	4067abc	39.67b	40.17ab
IT03K-338-2	0.00e	0.00d	0.00d
IT98K-205-8	0.00e	0.00d	0.00d
Borno Brown	41.33ab	40.33ab	40.83a
TVX 3236	39.22c	39.44b	39.33b
UAM IID-24-55-3	0.00e	0.00d	0.00d
Gazum local	33.11d	31.67c	32.39c
SE ±	0.637	0.456	0.355
PXG	*	*	*

Means in a column followed by the same letter(s) are not significantly different at 5% level of probability. (DMRT).

In the genotypes, *Striga* emergence was earliest in the Gazum local check in 2011, 2012 and the average of the two years. This was closely followed by TVX3236 (Table 2). *Striga* took significantly more days to emerge in Banjar and IT845-2246-4 in 2011 and 2012 respectively.The earlyemergence of Striga in TVX3236 further confirm suceptibilty of this variety to both *Striga* and *Alectra* (Magani, 1994) The average of the two years however showed that Banjar, IT84S-2246-4, IT89KD-391and Borno brown were at par in terms of delayed emergence of *Striga*. The genotypes IT97K-499-35, IT98K-573-1-1, IT03K-228-1, IT98K-205-8 and UAMIID-24-55-3 did not support the emergence of *Striga* throughout the period of the study. These genotypes had earlier been classified as resistant to *Striga* by Omoigui *et al*, 2012.

There was significant interaction between *Parkia* based products and genotypes in 2011 and 2012 (Table 3). In both years *Striga* emergence was earliest in the no *Parkia* X Gazum local interaction while it was significantly most delayed in *Parkia* powder X Borno brown interaction. The general trend showed that all the susceptible genotypes interacted with no *Parkia* treatment to promote early emergence of *Striga* compared with the interactions with *Parkia* based products. Magani *et al* (2010) had earlier reported delayance of *Striga* emergence when seeds of maize were treated with *Parkia* products before planting. Similarly, Marley *et al* (2004) reported 29.1 and 38.8% reduction in *Striga* emergence under field and green house conditions when fruit and fruit powder of *Parkia* were used respectively. Delayance of *Striga* emergence may be attributed to allelopathic properties of Parkia products. Tran *et al* (2008) had inferred that terpenes phenols, phenolic acids, long chain fatty acid and lactose, allelochemicals identified in dodder (*Cuscuta spp*) plants, are similar to the ones in *Parkia* based products. Nishida *et al* (2005) had suggested that the fatty acids are responsible for the strong inhibitory activities of *Parkia* based products against the emergence and subsequent growth of *Striga*. Kambou *et al* (1997) reported germination inhibition of 97 – 100% and 92% *Striga* seeds when untreated powder extract and decorticated powder of *Parkia* were used respectively.

Table 3. Interaction effect of Parkia and genotype on days to first *Striga* emergence at Garkawa, 2011 and 2012 Cropping seasons.

Genotype	2011			2012			Combined		
	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk
Banjar	38.67cd	46.67a	41.00c	38.33def	43.33b	39.00cde	38.50efg	45.00a	40.00de
IT845-246-4	40.67c	39.33cd	39.0cd	41.33bc	4000cd	42.67b	41.00cd	39.67def	40.83cd
IT97K-499-35	0.00g	0.00g	0.00g	0.00h	0.00h	0.00h	0.00k	0.00k	0.00k
IT98K-573-1-1	0.00g	0.00g	0.00g	0.00h	0.00h	0.00h	0.00k	0.00k	0.00k
IT89KD-391	36.67d	45.67a	36.7cd	36.00f	43.33b	39.67cd	36.33h	44.50ab	39.67def
IT03K-338-2	0.00g	0.00g	0.00g	0.00h	0.00h	0.00h	0.00k	0.00k	0.00k
IT98K-205-8	0.00g	0.00g	0.00g	0.00h	0.00h	0.00h	0.00k	0.00k	0.00k
Borno Brown	39.00cd	45.67ab	40.0cd	36.00f	46.00a	39.00cde	37.50gh	45.50a	39.50defg
TVX 3236	36.33d	42.00bc	39.3cd	36.00f	43.33b	39.00cde	36.17h	42.67bc	39.17defg
UAM IID-24-55-3	0.00g	0.00g	0.00g	0.00h	0.00h	0.00h	0.00k	0.00k	0.00k
Gazum local	27.67f	39.00cd	32.67e	28.33g	36.67ef	30.00g	28.00i	37.83fgh	31.33i
SE ±	1.20			0.775			0.642		

Means in a column followed by the same letter(s) are not significantly different at 5% level of probability. (DMRT)

There were significant variations in number of crop plants infested with *Striga* throughout the period of the observation in 2011 and 2012 (Table 4). At both 9 and 12WAS the no *Parkia* treatment (check) recorded the highest number of crops that were infested with *Striga* in 2011 and 2012. The result revealed that *Parkia* powder (PP) recorded significantly, the lowest number of crops infested with *Striga* throughout the period of observation in 2011 and 2012.

Table 4. Effects of Parkia based products and cowpea genotypes on number of cowpea plants infested with *Striga gesnerioides* at Garkawa, 2011 and 2012 Cropping seasons.

Treatment	9 WAS			12WAS		
	2011	2012	Combined	2011	2012	Combined
Parkia Product (P)						
No *Parkia* (PO)	3.72a	3.76a	3.74a	9.88a	6.39a	8.13a
Parkia Powder (PP)	1.82c	2.18c	2.00c	5.72c	4.21c	4.97e
Parkia husk powder (PH)	2.97b	3.03b	3.00b	8.67b	5.39b	7.03b
SE ±	0.161	0.093	0.074	0.239	0.206	0.204
GENOTYPE (G)						
Banjar	3.89c	6.89b	5.39bc	14.11b	9.89c	12.00b
IT845-246-4	5.44ab	6.11b	5.78b	15.78a	7.67d	11.72b
IT97K-499-35	0.00d	0.00d	0.00e	0.00c	0.00f	0.00d
IT98K-573-1-1	0.00d	0.00d	0.00e	0.00c	0.00f	0.00d
IT89KD-391	5.67ab	4.67c	5.17c	15.11ab	5.56e	10.33c
IT03K-338-2	0.00d	0.00d	0.00e	0.00c	0.00f	0.00d
IT98K-205-8	0.00d	0.00d	0.00e	0.00c	0.00f	0.00d
Borno Brown	5.89a	6.89b	6.39a	14.78ab	11.11b	12.94a
TVX 3236	5.00b	0.00d	2.50d	14.33b	12.78a	13.56a
UAM IID-24-55-3	0.00d	0.00d	0.00e	0.00c	0.00f	0.00d
Gazum local	5.33ab	8.33a	6.83a	14.89ab	11.67b	13.28
SE ±	0.275	0.325	0.219	0.402	0.392	0.328
PXG interaction	*	*	*	*	*	*

Means in a column followed by the same letter(s) are not significantly different at 5% level of probability

WAS = (Weeks After Sowing)

In the cowpea genotypes, the Gazum local check had significantly the highest number of crops infested with *Striga* throughout the period of observation in both years of the study except at 12WAS in 2012. At

9WAS, in 2011, Borno brown had significantly the highest number of crops infested with *Striga*. At 12WAS in 2012,TVX3236 had significantly the highest number of crops infested with *Striga*. The average of the two years in 2012 showed that the number of crops infested with *Striga* in TVX3236, Borno brown and the Gazum local check were at par and significantly higher compared with other cow pea genotypes. IT97K-499-35, IT98K-573-1-1, IT03K-338-1, IT98K-205-8 and UAM11D-24-55-3 were completely free of *Striga* throughout the period of the observation. This further confirms the unsuitability of these genotypes to infestation of *Striga*.

There were significant interactions between *Parkia* based products and genotypes on number of crops infested with *Striga* at 9 & 12WAS in 2011 and 2012. (Tables 5 & 6).

Table 5. Interaction effect of *Parkia* and genotype on number of crops infested with *Striga* 9WAS at Garkawa, 2011 and 2012 Cropping seasons.

Genotype	2011			2012			Combined		
	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk
Banjar	5.33cd	2.67f	3.67ef	9.00ab	4.33ef	7.33bcd	7.17ab	3.50fg	5.50d
IT845-246-4	7.00ab	3.33ef	6.00bcd	8.00bc	4.67ef	5.67de	7.50ab	4.00ef	5.83cd
IT97K-499-35	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g
IT98K-573-1-1	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g
IT89KD-391	7.67a	3.33ef	6.00bcd	6.99de	3.67f	4.33ef	6.83bc	3.50fg	5.17de
IT03K-338-2	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g
IT98K-205-8	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g
Borno Brown	7.67a	3.67ef	6.33abc	8.33abc	4.33ef	8.00bc	8.00ab	4.00ef	7.17ab
TVX 3236	6.67abc	3.67ef	4.67de	0.00g	0.00g	0.00g	3.33fg	1.83h	2.33gh
UAM IID-24-55-3	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g	0.00g
Gazum local	6.67abc	3.33ef	6.00bcd	10.00a	7.00cd	8.00bc	8.33a	5.17de	7.00b
SE ±		0.482			0.544			0.370	

Means in a column followed by the same letter(s) are not significantly different at 5% level of probability (DMRT). WAS = Weeks After Sowing).

Table 6. Interaction effect of *Parkia* and Genotype on Number of Crops infested with *Striga* at 12WAS at Garkawa, 2011 and 2012 Cropping seasons.

Genotype	2011			2012			Combined		
	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk
Banjar	18.00abc	10.33ghi	14.00ef	13.33abc	6.00ghi	10.33de	15.67ab	8.17ij	12.17efg
IT845-246-4	19.00a	12.33fg	16.00cde	9.33ef	5.67hi	8.00fg	14.17bcd	9.00i	12.00fg
IT97K-499-35	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j
IT98K-573-1-1	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j
IT89KD-391	18.33ab	10.33ghi	16.67bcd	6.67gh	4.00i	6.00ghi	12.50defg	7.17j	11.33gh
IT03K-338-1	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j
IT98K-205-8	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j
Borno Brown	18.67ab	9.67hi	16.00cde	13.00abc	9.00ef	11.33bcde	15.83ab	9.33i	13.67cdef
TVX 3236	16.00cde	11.33gh	15.67de	14.33a	11.33bcde	12.67abcd	15.17abc	11.33gh	14.17bcd
UAM IID-24-55-3	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j	0.00j
Gazum local	18.67ab	9.00i	17.00abcd	13.67ab	10.33de	11.00cde	16.17a	9.67hi	14.000bcde
SE ±		0.706			0.680			0.580	

Means in a column followed by the same letter(s) are not significantly different at 5% level of probability (DMRT). WAS = (Weeks After Sowing).

The variety IT98KD-391X No *Parkia* and TVX3236 X No *Parkia* interactions gave significantly the highest number of crops infested with *Striga* in 2011 . Generally, the susceptible genotypes interacted with no *Parkia* check to give significantly higher number of crop plants infested with *Striga,* against lower numbers in their interactions with the *Parkia* based products. This same trend was observed in 2012 and the average of the two years (Table 5). This result shows that *Parkia* based products have a depressive effect on the attachment of *Striga* to cowpea plants. This confirms the report of Kambou *et al* (1997) and Magani *et al* (2010) who reported significant reductions in the number of crops infested with *Striga harmonthica* when *Parkia* products were used in Burkina Faso and Nigeria respectively.

Similar results were obtained at 12 WAS during both years of study and the average of two years (Table 6).

The effects of *Parkia* based products and cowpea genotypes on *Striga* shoot count is presented in Table 7. Generally, *Parkia* based products recorded significantly lower *Striga* shoot counts compared with the no *Parkia* product check which gave significantly the highest shoot count throughout the period of the observation. This is an indication that *Parkia* based products possess some allelopathic potentials hence inhibiting *Striga* emergence. Tran *et al* (2008) through an invitro culture method analysis reported the presence of Steroids, triterpenes, carotenoids, tannis and polyphenolic compounds in *Parkia* fruits. Kambou *et al* (1997) reported germination inhibition of 97 – 100% when *Parkia* based products were used. The *Parkia* fruit powder recorded significantly the lowest *Striga* shoot count throughout the period of the observation in 2011 and 2012 compared with the other *Parkia* treatments. This result confirms the report of Magani *et al* (2010) that maize seeds soaked in *Parkia* powder recorded significantly lower *Striga* shoots than those soaked in *Parkia* seed powder. This is an indication that the *Parkia* fruit powder may contain more of the allelochemicals than the *Parkia* husk powder.

Table 7. Effects of *Parkia* based products and cowpea genotypes on *Striga* shoot count at Garkawa, 2011 and 2012 Cropping seasons.

	9 WAS			12WAS		
Treatment	**2011**	**2012**	**Combined**	**2011**	**2012**	**Combined**
Parkia Product (P)						
No Parkia (PO)	16.93a	21.88a	19.41a	29.69a	27.15a	28.42a
Parkia Powder (PP)	8.48c	13.76c	11.12c	12.69c	17.81c	15.26c
Parkia husk powder (PH)	12.88b	18.48b	15.68b	22.42b	23.15b	22.79b
SE ±	0.285	0.158	0.194	0.382	0.429	0.298
GENOTYPE (G)						
Banjar	22.00cd	32.00c	27.00c	36.78b	40.89b	38.83b
IT845-246-4	25.11ab	29.89d	27.50c	42.11a	37.89c	40.00b
IT97K-499-35	0.00e	0.00e	0.00e	0.00c	0.00d	0.00d
IT98K-573-1-1	0.00e	0.00e	0.00e	0.00c	0.00d	0.00d
IT89KD-391	19.78d	31.00cd	25.39d	36.78b	35.67c	36.22c
IT03K-338-1	0.00e	0.00e	0.00e	0.00c	0.00d	0.00d
IT98K-205-8	0.00e	0.00e	0.00e	0.00c	0.00d	0.00d
Borno Brown	23.22bc	33.78b	28.50bc	37.11b	41.89b	39.50b
TVX 3236	24.00bc	35.56a	29.78ab	41.78a	46.89a	44.17a
UAM IID-24-55-3	0.00e	0.00e	0.00e	0.00c	0.00d	0.00d
Gazum local	26.33a	36.22a	31.28a	43.11a	43.11a	45.00a
SE ±	0.782	0.796	0.598	1.271	0.845	0.815
PXG	*	*	*	*	*	*

Means in a column followed by the same letter(s) are not significantly different at 5% level of probability

WAS = (Weeks After Sowing).

Striga shoot count was significantly affected by cowpea genotypes. IT97K-499-35, IT98K-573-1-1, IT03K-338-1, IT98-205-8 and UAMIID-24-55-3 as reported earlier, did not support the emergence of *Striga* (Table7). The Gazum local check and TVX3236 had significantly the highest *Striga* shoot count throughout the period of observation in 2011 and 2012, compared with the other genotypes. This is an indication of high susceptibility of these genotypes to plant parasites. This result confirms the report of Magani *et al* 2008 who reported the highest total number of *Alectra* on TVX3236 compared with other varieties. Generally, there were more *Striga* shoots at 12WAS compared with those recorded at 9WAS. This shows that emergence of *Striga* on the host is continued up till maturity time of the crop.

There were significant interaction between genotype and *Parkia* based product on *Striga* shoot count at 9 and 12WAS (Tables 8 and 9).

Table 8. Interaction effect of *Parkia* and Genotype on *Striga* shoot count at 9WAS at Garkawa, 2011 and 2012 Cropping seasons**.**

Genotype	2011			2012			Combined		
	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk
Banjar	29.67bcd	15.00ij	21.33gh	40.33ab	22.33g	33.33cd	35.00bc	18.67i	27.33fg
IT845-246-4	33.00ab	16.00ij	26.33def	35.33c	24.67fg	29.67de	34.17bcd	20.33hi	28.00fg
IT97K-499-35	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h
IT98K-573-1-1	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h
IT89KD-391	26.67def	14.33ij	18.33hi	37.00bc	22.67g	33.33cd	31.83de	18.50i	25.38g
IT03K-338-1	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h
IT98K-205-8	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h
Borno Brown	31.00abc	13.67j	25.00efg	41.33a	26.00efg	34.00c	36.17ab	19.83hi	29.50ef
TVX 3236	31.67abc	17.67hij	22.67fg	42.67a	27.67ef	36.33bc	37.17ab	22.67h	29.50ef
UAM IID-24-55-3	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h
Gazum local	34.33a	16.67ij	28.00cde	44.00a	28.00ef	36.67bc	36.17a	22.33h	32.33cde
SE ±		1.322			.323			1.007	

Means followed by the same letter(s) are not significantly different at 5% level of probability (DMRT).

WAS = Weeks After Sowing).

Table 9. Interaction effect of *Parkia* and Genotype on *Striga* shoot count at 12WAS at Garkawa, 2011 and 2012 Cropping seasons.

Genotype	2011			2012			Combined		
	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk
Banjar	54.00abc	23.33g	33.00f	49.67bc	29.67i	43.33de	51.83b	26.50h	38.17f
IT845-246-4	55.67ab	22.67g	48.00cd	41.67ef	31.33i	40.67efg	48.67bc	27.00h	44.33cde
IT97K-499-35	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h
IT98K-573-1-1	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h
IT89KD-391	50.00bcd	21.67g	38.67ef	42.33def	29.00i	36.67gh	46.17cd	24.83h	37.67f
IT03K-338-1	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h
IT98K-205-8	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h
Borno Brown	50.33bcd	21.00g	40.00e	52.33ab	32.33hi	41.00efg	51.33b	26.67h	40.50ef
TVX 3236	58.67a	26.33g	40.33e	56.67a	36.33gh	46.67cd	57.67a	31.33g	43.50de
UAM IID-24-55-3	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h	0.00h
Gazum local	58.00a	24.67g	46.67d	56.00a	38.33fg	46.33cd	57.00a	31.50g	46.50cd
SE ±		2.134			1.460			1.378	

Means followed by the same letter(s) are not significantly different at 5% level of probability (DMRT).

WAS = Weeks After Sowing).

At 9WAS during both years of study, the Gazum local X no *Parkia*; TVX 3236 X no *Parkia* and Borno brown X no *Parkia* interactions gave significantly higher *Striga* shoot counts.

The same trend was shown at 12WAS during both years of the study (Table 9). The interaction of these genotypes with *Parkia* based product throughout the period of the observation led to significant reductions in *Striga* shoot count. The decrease in *Striga* shoot count with application of *Parkia* products confirms the report of Marley *et al* (2004) who reported 29.1 and 38.8% reduction of *Striga* emergence under a field and green house conditions when fruit and fruit powder of *Parkia* were used respectively.

Effects of *Parkia* based products and genotypes on vigour of cowpea as presented in Tables 10 showed that crop vigour differed significantly at 9 and 12WAS in 2011 and 2012. The result revealed that *Parkia* products gave significantly more vigorous plants compared with the no *Parkia* check throughout the period of the observation. This may be attributed to delays in the development of *Striga* in the *Parkia* treatment thereby reducing the effect of the *Striga* on the crop. This is in agreement with the report of Magani *et al* 2010, that maize seeds soaked in *Parkia* based products resulted in significantly more vigorous maize plants compared with the control (without *Parkia* treatment). Among the genotypes, IT97K-499-35, IT98K-573-1-1, IT03K-338-1, IT98K-205-8 and UAMIID-24-55-3 were healthy and more vigorous.

Table 10. Effects of *Parkia* based products and cowpea genotypes on crop vigour at Garkawa, 2011 and 2012 Cropping seasons.

	9 WAS			12WAS		
Treatment	**2011**	**2012**	**Combined**	**2011**	**2012**	**Combined**
Parkia Product (P)						
No Parkia (PO)	1.52a	1.39a	1.35a	1.71a	1.89a	1.76a
Parkia Powder (PP)	0.97b	1.03c	1.00c	1.27b	1.21b	1.24c
Parkia husk powder (PH)	1.00b	1.21b	1.11b	1.24b	1.52b	1.38b
SE ±	0.035	0.060	0.035	0.109	0.043	0.631
GENOTYPE (G)						
Banjar	2.00b	2.33a	2.17b	2.67a	2.67bc	2.67bc
IT845-246-4	2.00b	1.89c	1.94c	2.56a	2.33e	2.44cd
IT97K-499-35	1.00c	1.00d	1.00d	1.00c	1.00f	1.00e
IT98K-573-1-1	1.00c	1.00d	1.00d	1.00c	1.00f	1.00e
IT89KD-391	2.33a	2.00bc	2.17b	2.78a	2.56de	2.67bc
IT03K-338-1	1.00c	1.00d	1.00d	1.00c	1.00f	1.00e
IT98K-205-8	1.00c	1.00d	1.00d	1.00c	1.00f	1.00e
Borno Brown	2.56a	2.22ab	2.89a	1.78b	2.89bc	2.33d
TVX 3236	2.00b	2.44a	2.22ab	2.89a	3.22a	3.06a
UAM IID-24-55-3	1.00c	1.00d	1.00d	1.00c	1.00f	1.00e
Gazum local	1.89b	2.44a	2.17b	2.78a	3.00ab	2.89ab
SE ±	0.105	0.111	0.035	0.129	0.116	0.088
PXG	*	*	*	*	*	*

Means in a column followed by the same letter(s) are not significantly different at 5% level of probability (DMRT).

There were significant interaction between genotype and *Parkia* based product on crop vigour 9 and 12WAS (Tables 11 and 12).

Table 11. Interaction effect of *Parkia* and Genotype on Crop Damage Score at 9WAS at Garkawa, 2011 and 2012 Cropping seasons.

Genotype	2011			2012			Combined		
	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk
Banjar	2.67abc	1.33e	2.00cde	2.67ab	2.00bc	2.33abc	2.67bc	1.67g	2.17def
IT845-246-4	2.33bcd	1.67de	2.00cde	2.00bc	1.67c	2.00bc	2.17def	1.67g	2.00efg
IT97K-499-35	1.00f	1.00f	1.00f	1.00d	1.00d	1.00d	1.00h	1.00h	1.00
IT98K-573-1-1	1.00f	1.00f	1.00f	1.00d	1.00d	1.00d	1.00h	1.00h	1.00
IT89KD-391	2.67abc	1.67	2.67abc	2.33abc	1.67c	2.00bc	2.50bcd	1.67g	2.33cde
IT03K-338-1	1.00f	1.00f	1.00f	1.00d	1.00d	1.00d	1.00h	1.00h	1.00
IT98K-205-8	1.00f	1.00f	1.00f	1.00d	1.00d	1.00d	1.00h	1.00h	1.00
Borno Brown	3.00ab	2.00cde	2.67abc	2.67ab	1.67c	2.33abc	2.83ab	1.83fg	2.50bcd
TVX 3236	3.33a	2.67abc	3.00a	3.00a	2.00bc	2.33abc	3.17a	2.33cde	1.17h
UAM IID-24-55-3	1.00f	1.00f	1.00f	1.00d	1.00d	1.00d	1.00h	1.00h	1.00
Gazum local	2.67abc	1.33e	1.67de	2.67ab	2.33bc	2.33abc	2.67bc	1.83fg	2.00efg
SE ±		0.178			0.203			0.138	

Means followed by the same letter(s) are not significantly different at 5% level of probability (DMRT).

Crop damage symptoms score scale (1-5) where 1 = normal crop plant growth;

2 = no chlorosis; 3 = no blotching; 4 = no leaf scorching and

5= total scorching or and obvious stunted or dead plants.

WAS = Weeks After Sowing).

Table 12. Interaction effect of *Parkia* and Genotype on Crop Damage Score at Garkawa, 2011 and 2012 Cropping seasons.

Genotype	2011			2012			Combined		
	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk
Banjar	3.33ab	2.00d	2.67bcd	3.33bc	2.00e	2.67cde	3.33a	2.00g	2.67cde
IT845-246-4	2.67bcd	2.33cd	2.67bcd	2.67cde	2.00e	2.33de	2.67cde	2.17g	2.50deg
IT97K-499-35	1.00e	1.00e	1.00e	1.00f	1.00f	1.00f	1.00h	1.00h	1.00h
IT98K-573-1-1	1.00e	1.00e	1.00e	1.00f	1.00f	1.00f	1.00h	1.00h	1.00h
IT89KD-391	3.00abc	2.33cd	3.00abc	3.00bcd	2.00e	2.67cde	3.00cd	2.17g	2.83cde
IT03K-338-1	1.00e	1.00e	1.00e	1.00f	1.00f	1.00f	1.00h	1.00h	1.00h
IT98K-205-8	1.00e	1.00e	1.00e	1.00f	1.00f	1.00f	1.00h	1.00h	1.00h
Borno Brown	3.00abc	2.33cd	1.00	3.33bc	2.33de	3.00bcd	3.17c	2.33eg	1.50h
TVX 3236	3.67a	2.67bcd	2.33cd	4.00a	2.67cde	3.00bcd	3.83a	2.67cde	2.67cde
UAM IID-24-55-3	1.00e	1.00e	1.00e	1.00f	1.00f	1.00f	1.00h	1.00h	1.00h
Gazum local	3.00abc	2.33cd	3.00abc	3.67ab	2.33de	3.00bcd	3.33a	2.33eg	3.00cd
SE ±		0.240			0.196			0.160s	

Means followed by the same letter(s) are not significantly different at 5% level of probability (DMRT).

Crop damage symptoms score scale (1-5) where 1 = normal crop plant growth;

2 = no chlorosis; 3 = no blotching; 4 = no leaf scorching and

5= total scorching or and obvious stunted or dead plants.

WAS = Weeks After Sowing).

In the two years at both 9 and 12 WAS, TVX 3236 X no *Parkia* interaction significantly and consistently had the most damaged crop plants throughout the period of the observation. This may be attributed to the high level of infestation of *Striga* recorded on this genotype. Earlier reports had shown TVX3236 to be highly susceptible to attack by plant parasites (Magani *et al* 2009). Generally, more vigorous plants were obtained at the genotypes X *Parkia* powder interactions. This could be as a result of the reduced number of *Striga* shoots recorded on plants treated with *Parkia* powder, thereby enhancing the healthy growth and development of the crop.

The effect of *Parkia* based products and genotypes on number of pods and weight of pods is presented in Table 13. There was significant effect of *Parkia* based products only in 2012, where lower numbers of cowpea pods were recorded at the no *Parkia* check compared with higher number of pods in the *Parkia* based products. The average of the two years however did not show any significant effect. In the genotypes, significantly higher pod numbers were obtained in the resistant genotypes during both years of study. The average of the two years showed IT98K-205-8 having significantly the highest number of pods per plot. This could be that this genotype possess higher yield potential compared with the other resistant genotypes. The lower number of pods recorded by the susceptible genotypes could be as a result of the depressive effect of the parasite on these genotypes.

Table 13. Effects of *Parkia* based products and cowpea genotypes on Number of pods and weight of pods at Garkawa, 2011 and 2012 Cropping seasons.

	Number of pods per net plot			Weight of pods (Kg/ha)		
Treatment	**2011**	**2012**	**Combined**	**2011**	**2012**	**Combined**
Parkia Product (P)						
No Parkia (PO)	215.27	303.27b	259.27	430.41b	712.29	571.35b
Parkia Powder (PP)	221.46	319.42a	270.44	445.73a	730.08	587.90ab
Parkia husk powder (PH)	220.12	319.52a	269.82	442.54a	760.59	601.56a
SE ±	5.540	2.290	3.460	3.720	21.300	10.930
GENOTYPE (G)						
Banjar	180.67d	296.67cd	238.67d	154.72h	258.22e	206.47g
IT845-246-4	181.22d	266.33f	223.78de	396.89d	470.83d	420.36de
IT97K-499-35	258.67bc	409.33a	334.00b	529.69c	990.83b	760.26c
IT98K-573-1-1	279.22b	419.67a	349.44b	548.86c	1259.94a	904.40b
IT89KD-391	140,11e	278.67def	209.39c	318.78e	442.74d	380.78e
IT03K-338-1	226.89c	309.11c	268.00c	538.34c	1038.22b	788.28c
IT98K-205-8	326.89a	418.11a	372.50a	778.22b	1201.67a	989.95a
Borno Brown	181.78d	276.11ef	228.94de	315.73e	613.44c	464.59d
TVX 3236	166.11de	287.22de	226.67de	213.74g	395.78d	304.76f
UAM IID-24-55-3	337.56a	363.67b	350.61b	814.09a	1212.44a	1013.27a
Gazum local	129.33e	129.89g	129.61f	253.07f	193.33e	223.20g
SE ±	12.030	15.270	9.860	7.850	52.800	27.580
PXG	*	*	*	*	*	*

Means in a column followed by the same letter(s) are not significantly different at 5% level of probability (DMRT)
WAS = Weeks after sowing.

There were significant effects of *Parkia* based products on pod weight in 2011 and the average of two years (Table 13). In 2011, no *Parkia* check had significantly the lowest pod weight compared with *Parkia* powder and *Parkia* husk powder which were at par. The average of the two years showed *Parkia* husk powder having significantly the highest pod weight.

There were significant interaction between genotypes and *Parkia* product on number of pods per net plot of cowpea (Table 14).

Table 14. Interaction effect of *Parkia* and Genotype on number of pods at Garkawa, 2011 and 2012 Cropping seasons.

Genotype	2011			2012			Combined		
	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk
Banjar	176.00ef	188.33ef	177.67ef	253.33g	327.67b-f	309.00d-f	214.67bcd	258.00bc	243.33bcd
IT845-246-4	182.33ef	185.67ef	175.67ef	254.33g	282.00efg	262.67fg	218.33bcd	233.83bcd	219.17bcd
IT97K-499-35	274.67a-d	279.67a-d	221.67de	397.67abc	409.67ab	420.67a	336.17a	344.67a	321.17a
IT98K-573-1-1	259.33cd	270.33bcd	308.00abc	432.67a	411.67ab	414.67ab	346.00a	341.00a	361.33a
IT89KD-391	120.67f	124.33f	175.33ef	260.67g	282.00efg	293.33d-f	190.67d	203.17cd	234.33bcd
IT03K-338-1	221.67de	229.67de	229.33de	307.00d-f	312.67d-f	307.67d-f	264.33	271.17b	268.50b
IT98K-205-8	332.33ab	326.00ab	322.33abc	427.00a	414.67ab	412.67ab	379.67a	370.67a	367.50a
Borno Brown	182.33ef	182.33ef	180.67ef	242.67g	293.00d-f	292.67d-f	212.50bcd	237.67bcd	236.67bcd
TVX 3236	161.33ef	171.67ef	165.33ef	282.00efg	291.67d-f	288.00d-f	221.67bcd	231.67bcd	226.67bcd
UAM IID-24-55-3	336.33ab	337.33ab	339.00a	355.00a-f	358.33a-e	377.67a-d	345.67a	347.83a	358.33a
Gazum local	121.00f	140.67f	126.33f	123.67h	130.33h	135.67h	122.3e	135.50e	131.00e
SE ±		20.620			25.320			16.640	

Means followed by the same letter(s) are not significantly different at 5% level of probability (DMRT).

The Gazum local check X no *Parkia* interaction recorded significantly the lowest number of pods per plot though not significant when compared with the its interaction with *Parkia* based products (Table 14). In 2011, UAMIID24-55-3 recorded significantly the highest number of pods per net plot with *Parkia* husk powder. IT98K-205-8 reacted with no *Parkia* to give significantly higher number of pods per net plot. The average of the two years showed IT97K-499-35, IT98K-573-1-1, IT98K-205-8 and UAMIID-24-55-3interacting with all the *Parkia* treatments recorded significantly higher number of pods which were at par. This could be attributed to high yield potential of these genotypes and the fact that they are resistant to *Striga* infestation.

There was significant interaction between genotypes and *Parkia* products on pod weight during the two years of the trial (Table 15). Banjar X no *Parkia* interaction had significantly the lowest pod weight per net plot, though not significantly different when compared with its interaction with *Parkia* powder and *Parkia* husk powder. This was followed by TVX3236 interactions with the *Parkia* products. In 2012, Gazum local check X no *Parkia* interaction gave significantly the lowest pod weight.

Table 15. Interaction effect of *Parkia* and Genotype on weight of pods of cowpea at Garkawa, 2011 and 2012 Cropping seasons.

Genotype	2011			2012			Combined		
	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk	No. Parkia	Parkia Powder	Parkia Husk
Banjar	152.09l	158.89l	153.17l	203.50ij	298.2g-j	273.00hij	177.80k	228.53ijk	213.09jk
IT845-246-4	365.93fg	381.25fgh	362.4a	425.7f-j	503.30f-i	483.50f-j	395.80gh	442.29gh	423.00gh
IT97K-499-35	515.34de	527.09de	546.66cde	964.8cd	905.5de	1102.2a-d	740.09ef	716.3ef	824.41b-e
IT98K-573-1-1	509.92e	556.16cd	580.50c	1329.80a	1229.2abc	1220.80a-d	919.88abc	892.66a-e	900.67a-d
IT89KD-391	310.07i	333.06ghi	313.21i	388.3f-j	497.30f-j	442.7f-j	349.20g-j	415.20gh	377.94ghi
IT03K-338-1	532.12de	544.82cde	538.08de	984.30bcd	1073.30a-d	1057.00a-d	758.23def	809.08c-e	797.54c-f
IT98K-205-8	766.47b	786.44ab	781.76ab	1242.30abc	1081.30a-d	1281.30abc	1004.40a	933.89abc	1031.55a
Borno Brown	310.87i	322.90hi	313.42i	591.0fgh	638.30ef	611.00fg	450.93gh	480.62g	464.21gh
TVX 3236	210.77k	218.22k	212.23k	395.00f-j	400.7f-j	391.7f-j	302.89h-k	309.44h-k	301.95h-k
UAM IID-24-55-3	814.70a	810.03a	817.53a	1137.70a-d	1207.00a-d	1292.7ab	976.18a	1008.52a	1055.10a
Gazum local	246.20jk	264.15j	248.87jk	172.70j	196.7ij	210.70ij	209.43jk	230.41ijk	229.77ijk
SE ±		13.490			89.700			46.830	

Means followed by the same letter(s) are not significantly different at 5% level of probability (DMRT).

Table 16 shows the effect of *Parkia* product and genotype on 1000 seed weight and grain yield of Cowpea. There was significant variation in weight of 1000 seeds of cowpea among the *Parkia* based products (Table 16). *Parkia* powder recorded significantly heavier seeds compared with the no *Parkia* check and *Parkia* husk powder. This could be as a result of the low *Striga* shoot count recorded when *Parkia* powder was applied on the crops. The suppressive ability of the *Striga* plants by allelochemicals contained in the *Parkia* products might have been responsible for the heavier seeds of cowpea plants to which these products were applied. Among the genotypes, TVX3236 and the Gazum local check recorded significantly lower 1000 seed weight compared with heavier seeds in the resistant genotypes. This may be attributed to high levels of infestations on these genotypes.

Table 16. Effects of *Parkia* based products and cowpea genotypes on 1000 seed weight and Grain yield at Garkawa, 2011 and 2012 Cropping seasons.

	1000 seed weight (g)			Grain yield (Kg/ha)		
Treatment	**2011**	**2012**	**Combined**	**2011**	**2012**	**Combined**
Parkia Product (P)						
No Parkia (PO)	154.52b	161.36b	159.94b	317.86a	595.53a	456.70a
Parkia Powder (PP)	160.67a	168.79a	164.73a	327.97a	598.73a	463.35a
Parkia husk powder (PH)	156.46b	161.61b	159.03b	321.38a	618.65a	470.02a
SE ±	0.693	3.240	1.633	4.420	20.800	10.880
GENOTYPE (G)						
Banjar	119.67h	123.89de	121.78f	165.72i	172.89fg	169.31g
IT845-246-4	131.00g	132.56cd	131.78e	281.61f	337.11de	309.36f
IT97K-499-35	173.00d	180.56b	176.78c	339.67e	826.67b	583.17d
IT98K-573-1-1	171.33d	218.89a	195.11b	376.00d	1097.94a	736.97b
IT89KD-391	147.56e	138.89c	143.22d	239.22g	358.11d	298.67f
IT03K-338-1	189.11c	188.89b	189.00b	413.67c	902.33b	658.00c
IT98K-205-8	209.56b	217.78a	213.67a	576.89a	1065.39a	821.14a
Borno Brown	137.67f	142.78c	140.22d	254.78g	484.94c	369.86e
TVX 3236	107.33i	113.33e	110.33g	158.78i	250.89ef	204.83g
UAM IID-24-55-3	227.22a	212.22a	219.72a	534.11b	1017.50a	775.81ab
Gazum local	115.89h	133.33cd	124.61f	206,00h	133.56g	169.78g
SE ±	1.949	4.760	2.581	8.490	52.800	27.300
PXG	NS	NS	NS	NS	NS	NS

Means in a column followed by the same letter(s) are not significantly different at 5% level of probability (DMRT)
WAS = Weeks after sowing.

Among the genotypes, IT98K-205-8 and UAMIID-24-55-3 gave significantly heavier seeds throughout the period of the observation (Table 16). In contrast, Banjar, TVX3236 and Gazum local check interacted with the *Parkia* treatments to give significant lower seed weight. This is expected since the farmer has been identified to be resistant to *Striga* with high yield potentials while the letter has been identified to be suitable hosts of the parasite.

The grain yield although not significant, the trend indicted higher grain yield were recorded in the *Parkia* based products compared with lower yields in the no *Parkia* check (Table 16). In the genotypes the combined year effect showed that IT98K-205-8 recorded significantly the highest yield , though at par with UAMIID24-55-3.However, Banjar, TVX3236 and the Gazum local check recorded significantly lower grain yield throughout the period of the observation; while IT845-2246, and Borno brown had relatively higher grain yield compared with the other susceptible genotypes inspite of higher *Striga* shoot counts. This could possibly be as a result of tolerance of the genotypes to the parasite. Omoigui *et al* 2007, had reported higher yields in some varieties against higher *Striga* infestations. Genotypes that support higher *Striga* shoot counts also recorded lower grain yield than the resistant genotypes Press (1995) had shown that *Striga* infested plants recorded lower biomass accumulation as a result of

competition between the host and parasites for solutes, and lower rote of photosynthesis in the leaves of infested plants.

Conclusion

This study results revealed that *Parkia* products have high potentials for suppressing the parasitic weed (*Striga gesnerioides*) on cowpea. Since the locust bean trees are abundant in the Savannahs and the *Parkia* powder and husk are by-products of locust bean seed processing, they can easily be acquired by farmers for use on the farm. Farmers can therefore adopt the use of these products and integrate them with other control measures such as such cultural and use of resistant / tolerant varieties such as those identified in this study for effective control of *Striga hermonthica*.

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