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Full Length Research Paper

Effects of varying levels of *Parkia* husk powder for the control of *Striga gesnerioides* in Cowpea (*Vigna unguiculata*)

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Field trials were conducted in 2012 and 2013 at the Teaching and Research Farm of the Department of Agricultural Technology, Plateau State College of Agriculture Garkawa (Latitude 08°52'N; Longitude 69°24'E) to evaluate the effect of different *Parkia* husk levels in the control of *Striga gesnerioides* in the Southern Guinea Savannah of Nigeria. The treatments consisted of different *Parkia* husk rates thus: 1.0, 2.0, 3.0 and 4.0 g/hill, seed coated with *Parkia* husk and no *Parkia* husk check. These treatments were laid out in a *Randomized* Complete Block Design and replicated three times. The results indicated general delayance in the emergence of *Striga* with increased *Parkia* husk rates. In addition, application of *Parkia* husk before planting significantly reduced the number of crop plants infested with *Striga*, reduced *Striga* shoot, increased crop vigour, delayed flowering of *Striga*, reduced number of capsules/*Striga* plant and increased number of pods per net plot with subsequent increment in grain yield of cowpea. The application of *Parkia* husk reduced significantly the number of capsules per plant of *Striga*. The implication of this is that there will be depletion of seed bank build up for future infestation, thereby ensuring control of *Striga* over time

Key words: *Parkia biglobosa* husk, control, *Striga gesnerioides,* cowpea.

INTRODUCTION

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

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varieties, Emechebe (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 (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, 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 (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 (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*.

This study was undertaken to evaluate the effect of varying levels of *Parkia* husk in controlling *Striga gesnerioides* infestation in cowpea.

MATERIALS AND METHODS

Field trials were conducted in 2012 and 2013 at the Teaching and Research Farm of the Department of Agricultural Technology, Plateau State College of Agriculture, Garkawa (Latitude 08°52'N; Longitude 09°24'E) in the Southern Guinea Savannah where sandy loam is the dominant soil type.

The trials were established in a field that has previously been observed to be heavily infested with *S. gesnerioides*.

Preparation of the *Parkia* husk

Matured and well dried *Parkia* fruits were purchased from producers in Garkawa town. The fruits were peeled to separate the pulp and seeds from the husk. The husk was then spread under the sun for forty eight hours and ground into fine powder (<1 mm) which was stored in a dry place until when needed.

Cowpea material

A local genotype (land race) Gazum known to be susceptible to *S. gesnerioides* was used as a test material.

Experimental design and cultural practices

The treatments consisted of six levels of *Parkia* husk (1.0, 2.0, 3.0, 4.0 g seed coated and no *Parkia* control). The treatments were laid out in a Randomized Complete Block Design with three replications. Each plot consisted of four rows, 4 m long at spacing of 0.2 m intra row and 0.75 m inter row. The land was ploughed, harrowed and ridged at 0.75m apart. Three cowpea seeds were planted per hill on 26th August and 25th August 2012 and 2013 respectively. Thinning was done at two weeks after planting (WAP) to give two plants per stand. *Parkia* husk Powder was applied in each hill before planting the seed at the rate of 0, 1, 2, 3, and 4 g per hill, according to the treatments plus a seed coated treatment. Seed coating was done by adding cowpea seeds to slurry of *Parkia* husk powder and mixed properly to ensure that the *Parkia* product was properly coated on the seeds. The seeds were then removed from the slurry and spread on wire mesh for two hours under the sun to dry before planting. Weed control was done manually at 3 and 4 WAP. Thereafter hand pulling was employed to avoid damage to *Striga* plants. Fertilizer was applied by band method at 2 WAP at the rate of 100 kg ha^{-1} of NPK (15:15:15) compound fertilizer to give an equivalent of 15 kg a.i. ha^{-1}N, P_2O_5 and K_2O respectively. Insects were controlled with chemical insecticides by spraying at 5% flower initiation and at 2 weeks intervals thereafter with BEST Action Cypermethrin plus Dimethoate at rate of 1.5 L/ha, using a knapsack sprayer.

Data collected

Data were taken on number of days to *Striga* emergence, number of crops infested with *Striga* at 9 and 12 WAS, crop damage score at 9 and 12 WAS, number of days to first flowering of *Striga*, number of capsules/*Striga* plant, pod number, pod weight and grain yield (kg/ha) of cowpea.

Data analysis

All data were subjected to an Analysis of Variance using PROC user's manual, version 9.1 SAS Institute (2002) and means were compared using Least Significance Difference (LSD).

RESULTS AND DISCUSSION

The result of varying levels of *Parkia* husk powder on days to first emergence of *Striga* is presented in Table 1. The result shows that the emergence of *Striga* was significantly earliest in the no *Parkia* husk control in 2012, 2013 and the average of the two years. Emergence of *Striga* in the seed coated treatment was however similar to that of the control treatment during both years and the average of the two years. Emergence of *Striga* was most delayed at the 4.0 g treatment though at par when compared with those obtained at 3, 2 and 1.0 g *Parkia* husk powder per hill. This agrees with the report of Kolo et al. (2008) that the most concentrated dressed maize seeds with *Parkia* pulp significantly delayed *Striga hernonthica* shoot emergence. Similarly, Ibrahim et al. (2011) in field and screen house assessment of *Parkia biglobosa* based products in Nigeria reported that the number of days to *Striga* emergence was delayed in the pot experiment than for field trial. Inhibition of germination of *Striga* in plots treated with *Parkia* husk may be as a result of high concentration of tannin and phenolic compounds which have been reported earlier to be the likely cause of delayance or germination inhibition of *Striga* seeds (Sabiiti and Cobbina, 1992; Magani et al., 2009). Result also confirms the report of Yonli et al. (2010) that *Parkia biglobosa* peels completely inhibited *Striga* seed germination.

The number of cowpea plants infested with *Striga* was significantly affected by application of *Parkia* husk powder (Table 2). Application of different levels of *Parkia* husk powder and the seed coated resulted in significantly lower number of cowpea plants infested with *Striga* as compared to the no *Parkia* control. At 9WAS in 2012, the number of crops infested with *Striga* was statistically similar when *Parkia* husk powder was applied at 1.0, 2.0, 3.0, 4.0 grams and the seed coated while the no *Parkia* control gave significantly higher number of crops infested with *Striga*. In 2013 however, the control treatment gave significantly the highest number of crops infested but was statistically similar when compared with 1.0 and 2.0 g of *Parkia* husk per hill and the seed coated treatments. In contrast, 4.0 g *Parkia* husk per hill gave significantly lowest number of crops infested with *Striga*.

The effects of *Parkia* husk rates on *Striga* shoot count as presented in Table 3 depicts significant variations in shoot counts throughout the period of the observation in the two years. Significantly higher number crop plants infested with *Striga* were observed in the no *Parkia* check throughout the period of the observation when compared with the varied *Parkia* husk levels. There was significant variation in the *Parkia* husk levels only in the combined effect at 9WAS where 4.0 g of *Parkia* husk per planting hill had the lowest number of plants infested though not significant when compared with 2.0, 3.0 g/hill and seed coated of *Parkia* husk. There was no advantage raising the *Parkia* level to 4.0 g /hill. It was observed that number of plants infested with *Striga* was significantly and consistently highest in the no *Parkia* check throughout the period of the observation when compared with the other *Parkia* husk levels. This result confirmed the work of Kambou et al. (1997) and Magani et al. (2010) who reported inhibition of the germination of *S. hermonthica* seeds in Burkina Faso and Nigeria respectively, when different concentrations of *Parkia* pod extracts were used. The result is also similar to the findings of Kolo and Nkonchoson (2003) and Kolo *et al* (2005) who found that *P. biglobosa* parts (husk and seed extracts) reduced *S hernonthica* shoots in maize. Lower *Striga* shoot count in the *Parkia* husk treatments may be attributed to the presence of allelochemicals in the *Parkia* product which could have been responsible for germination inhibition of *S. gesnerioides* in these treatments. This result supports farmer's practice in Nigeria for *Striga* control among other practices such as the use of brine (NaCl) solution (Gworgwor et al., 2002) and *Parkia* extract to have inhibited germination of *S. hermonthica* (Kambou et al., 1997). Lane et al. (1991) reported the presence of triterpenes, carotenoids, tannins and polyphenolic compounds notably the, tannins as reported to be active biological substance. Ibrahim et al. (2011) in a pot experiment reported generally, maize seed soaking with *Parkia* fruit powder recorded significantly the lowest number of emerged *Striga* when compared to the highest obtained with use of distilled water (check) throughout the period of observation.

There was significant variation in crop damage score throughout the period of the observation in the two years (Table 4). Damage score was significantly highest in the no *Parkia* control throughout the period of observation. At 9WAS in 2012, the lowest damage score was obtained at 2.0 g *Parkia* husk//hill though at par with that obtained at 1.0 3.0, 4.0 g/hill and the seed coated treatments. There was however no significant difference between damage scores of the seed coated treatment and the highest at the no *Parkia* check. In 2013 and the average of the two years, the lowest damage score was at 4.0 g/hill, though similar with the damage score at 1.0, 2.0, 3.0 g *Parkia* husk/hill and the seed coated treatment. At 12WAS in 2012, 2013 and the average of the two years, damage score of plants at the seed coating treatment were similar compared with the highest at the no *Parkia* check. In

Table 1. Effect of *Parkia* husk levels on number of days to first *Striga* emergence at Garkawa in 2012 and 2013 Cropping Seasons.

Parkia level g/hill	Days to first *Striga* emergence		
	2012	2013	Combine
1.0 g	38.67a	34.00bc	36.33a
2.0 g	38.33ab	35.67ab	37.00a
3.0 g	39.00a	35.67ab	37.33a
4.0 g	40.00a	36.33a	38.17a
Seed coated	32.33bc	32.00c	32.17b
Control	31.67c	32.67c	32.17b
LSD 0:05	6.258	2.011	3.402

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

Table 2. Effect of *Parkia* husk powder levels on number of crops infested with *Striga* at Garkawa in 2012 and 2013 Cropping Seasons.

Parkia level (g/hill)	Crops infested with *Striga* at 9WAS			Crops infested with *Striga* at 12WAS		
	2012	2013	Combined	2012	2013	Combined
1.0 g	10.67b	16.67ab	13.67b	12.67b	13.67b	13.17b
2.0 g	8.67b	12.00b	10.33bc	11.00bc	11.00bc	11.00bc
3.0 g	10.33b	10.00b	10.17bc	14.33b	10.67bc	12.50b
4.0 g	7.33b	9.67b	8.50c	7.67c	8.67c	8.17c
Seed coated	6.67b	14.33ab	10.50bc	13.33b	13.67b	13.50b
Control	17.67a	19.00a	18.33a	22.00a	20.00a	21.00a
LSD 0:05	5.864	7.702	4.432	4.859	3.925	3.690

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

Table 3. Effect of *Parkia* husk powder levels on number of crops infested with *Striga* at Garkawa in 2012 and 2013Croppin Seasons.

Parkia level (g/hill)	Crops infested with *Striga* at 9WAS			Crops infested with *Striga* at 12WAS		
	2012	2013	Combined	2012	2013	Combined
1.0 g	10.67b	16.67ab	13.67b	12.67b	13.67b	13.17b
2.0 g	8.67b	12.00b	10.33bc	11.00bc	11.00bc	11.00bc
3.0 g	10.33b	10.00b	10.17bc	14.33b	10.67bc	12.50b
4.0 g	7.33b	9.67b	8.50c	7.67c	8.67c	8.17c
Seed coated	6.67b	14.33ab	10.50bc	13.33b	13.67b	13.50b
Control	17.67a	19.00a	18.33a	22.00a	20.00a	21.00a
LSD 0:05	5.864	7.702	4.432	4.859	3.925	3.690

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

2013 and the average of the two years, crops plants at 4.0 g/hill were significantly more vigorous compared with the crop plants of the seed coated treatment and those of the no *Parkia* check. Generally, damage score was least flowering which was similar to those of 1.0, 2.0 g *Parkia* at 4.0 g *Parkia* husk/hill because *Striga* shoots emerged late (Table 1) and fewer crops were infested with *Striga* (Table 2). It is possible that *Striga* seed germination and or attachment to the host root in this treatment were inhibited more than those of other treatments.

The effects of *Parkia* husk levels on number of days to first and 50% flowering of cowpea (Table 5) showed that there were significant variations in number of days to first and 50% flowering of cowpea. In 2012, cowpea flowering

Table 4. Effect of *Parkia* husk levels on crop Vigour at Garkawa in 2012 and 2013 Cropping Seasons.

***Parkia* level (g/hill)**	**Crop damage score at 9WAS crop**			**Damage score at 12WAS**		
	2012	**2013**	**Combined**	**2012**	**2013**	**Combined**
1.0 g	2.33b	2.67ab	2.50bc	2.67b	3.00ab	2.83bc
2.0 g	2.00b	2.67ab	2.33bc	2.33b	3.00ab	2.67bc
3.0 g	2.33b	2.33b	2.33bc	3.00ab	2.33b	2.67bc
4.0 g	2.33b	2.00b	2.17c	2.67b	2.33b	2.50c
Seed coated	2.67ab	3.00ab	2.83b	3.00ab	3.67a	3.33ab
Control	3.33a	3.67a	3.50a	4.00a	3.67a	3.83a
LSD 0:05	0.879	1.182	0.567	1.033	1.198	0.737

Means in a column followed by the same letter(s) are not significantly different at 5% level of probability using LSD. Crop damage symptom 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 5. Effect of *Parkia* husk levels on number of days to first and 50% flowering *of* Cowpea at Garkawa in 2012 and 2013.

***Parkia* level (g/hill)**	**Days to first flowering of cowpea**			**Days to 50% flowering of cowpea**		
	2012	**2013**	**Combined**	**2012**	**2013**	**Combined**
1.0 g	45.67ab	43.67bc	44.67b	48.67abc	46.67bc	47.67b
2.0 g	46.00ab	45.00ab	45.50ab	48.67abc	47.33ab	48.00ab
3.0 g	47.00a	45.00ab	46.00a	49.33a	47.67ab	48.50ab
4.0 g	47.00a	45.33a	46.17a	49.00ab	48.33a	48.67a
Seed Coated	45.67ab	43.33c	44.50b	47.67bc	45.33d	46.50c
Control	45.00b	44.00abc	44.50b	47.33c	46.00cd	46.67c
LSD 0:05	1.396	1.546	1.261	1.616	1.272	0.983

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

was earliest in the no. *Parkia* husk control though not significant when compared with seed coated, 1.0 and 2.0 g *Parkia* husk per hill. Application of 3.0 and 4.0 g *Parkia* husk per hill gave the highest number of days to cowpea husk per hill and the seed coated but significantly different from the lowest at the no *Parkia* husk check. Similarly in 2013, the highest number of days to flowering of cowpea was at 4.0 g *Parkia* husk per hill which was only significantly different from the lowest in the seed coated treatment. The combined effect showed that cowpea plants planted at 3.0 and 4.0 g *Parkia* husk per hill took longer days to flower compared with the lowest in the control treatment.

There was also significant variation in the number of days to 50% flowering of cowpea. In 2012, 50% flowering was earliest at no *Parkia* husk check though similar to that obtained at seed coated, 1.0 and 2.0 g *Parkia* husk per hill. In 2013 and the average of the two years, 50% flowering of cowpea was earliest at the seed coated with *Parkia* husk though at par with that of the no *Parkia* husk check. There was general delayance in 50% flowering of cowpea as *Parkia* husk level was raised from 1.0 to 4.0 g per hill though the difference was not significant.

Effect of *Parkia* husk levels on number of days to first and 50% podding as presented in Table 6 showed significant variation in the two parameters in 2012, 2013 and the average of the two (2) years. First podding and 50% podding were significantly earlier in the seed coated treatment and the no *Parkia* husk check. In both cases there was delayance as the *Parkia* husk levels were raised from 1.0 to 4.0 g/hill although the difference was not significant. The results indicated that there were no obvious advantages in raising the *Parkia* husk level from 1.0 to 4.0 g/hill.

The effect of *Parkia* husk levels on the number of days to first flowering of *Striga* and number of capsules per *Striga* plant is presented in Table 7. The table shows that the number of days to first flowering of *Striga* was inconsistent in 2012. In 2013 however, flowering of *Striga* plants was significantly earliest in the no *Parkia* husk compared with the other *Parkia* husk levels except 1.0g *Parkia* husk/hill and the seed coated treatments. The combined effect showed that flowering of *Striga* was significantly delayed at higher rates (3.0 and 4.0 g) *Parkia* husk per hill compared to the other *Parkia* husk levels which were significantly lower and at par.

Table 6. Effect of *Parkia* powder levels on number of days to first and 50% Podding of Cowpea at Garkawa in 2012 and 2013.

***Parkia* level (g/hill)**	**Days to first podding of cowpea**			**Days to 50% podding of cowpea**		
	2012	**2013**	**Combined**	**2012**	**2013**	**Combined**
1.0 g	49.00ab	47.00b	48.00bc	52.67a	50.33b	51.50b
2.0 g	49.00ab	49.00a	49.00ab	52.67a	52.00a	52.33ab
3.0 g	49.00ab	49.33a	49.17a	53.67a	52.33a	53.00a
4.0 g	50.33a	49.00a	49.67a	53.67a	53.00a	53.33a
Seed Coated	47.67bc	46.67b	47.17cd	50.67b	49.33b	50.00c
Control	47.00c	46.33b	46.67d	50.00b	49.67b	49.83c
LSD 0:05	1.726	1.650	1.147	1.616	1.616	1.174

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

Table 7. Effect of *Parkia* husk levels on number of days to first flowering of *Striga* and number of capsules per *Striga* plant at Garkawa in 2012 and 2013.

***Parkia* level (g/hill)**	**Days to first flowering of *Striga***			**Number of capsules per *Striga* Plant**		
	2012	**2013**	**Combined**	**2012**	**2013**	**Combined**
1.0 g	42.67a	42.67bc	42.67b	397.00a	442.00bc	419.50abc
2.0 g	42.33a	43.33b	42.83b	367.00a	416.00bcd	391.50bc
3.0 g	43.00a	45.00a	44.00a	358.00ab	403.67cd	380.83c
4.0 g	42.67a	45.67a	44.17a	306.00b	365.67d	335.83d
Seed coated	42.33a	42.33bc	42.33b	395.33a	455.67ab	425.50ab
Control	43.00a	42.00c	42.50b	415.33a	498.00a	456.67a
LSD 0:05	1.789	1.329	0.830	60.948	51.784	43.658

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

There was significant variation in the number of capsules per *Striga* plant (Table 7). In 2012, the number of capsules per plant was significantly highest at the no *Parkia* check, though similar with that obtained at 1.0, 2.0, 3.0 g/hill and the seed coated *Parkia* husk levels. In 2013, number of capsules per plant was significantly lowest at 4.0 g *Parkia* husk per hill compared with the other *Parkia* treatments except 2.0 and 3.0 g per hill of *Parkia* husk. The combined effect showed that number of capsules per plant was significantly lowest at the 4.0g *Parkia* husk per hill compared with the highest in the no *Parkia* check. This result is similar to that of Magani et al. (2010) who reported lower *Striga* capsules/plant in plots treated with *Parkia* based products. The consistently and significantly low number of capsules recorded at the 4.0 g *Parkia* husk per hill throughout the period of the observation may be due to higher concentration of allelochemicals in *Parkia* husk at this level which could have inhibited the growth of the *Striga* plants. Kolo et al. (2008) reported inhibition of germination and growth of *Striga* with high concentration of *Parkia* products.

Table 8 shows the effect of *Parkia* husk levels on days to crop maturity and number of pods per net plot in 2012 and 2013. 1.0 g *Parkia* husk/hill, seed coated and the no *Parkia* check had similar maturity days but significantly lower than the highest obtained at 3.0 and 4.0 g *Parkia* husk/hill throughout the period of observation. There was a general delayance of maturity when *Parkia* product was applied against earliest maturity in the no *Parkia* check.

There was significant variation in the number of pods per net plot only in 2013 and the average of the two years. In 2013 pods/net plot obtained at 2.0 and 3.0 g *Parkia* husk/hill were similar and significantly higher compared with the lowest in the no *Parkia* husk control. In both 2013 and the average of the two years, there was significant reduction in number of pods/net plot as *Parkia* husk level was raised to 4.0 g/hill.

The effects of *Parkia* husk levels on pod weight (kg/ha) and grain yield (kg/ha) in 2012 and 2013 showed there was no significant variation in the pod weight of cowpea (Table 9). Similarly, *Parkia* husk levels did not have any significant effect o grain yield in 2012. In 2013 however, 2.0 and 3.0 g *Parkia* husk/hill had similar yields that were significantly higher than the lowest obtained at 4.0 g *Parkia* husk/hill. The average of the two years showed that 2.0, 3.0 g *Parkia* husk/hill and seed coated gave similar grain yields that were significantly higher than the lowest obtained at 4.0 g *Parkia* husk/hill. The result revealed that there was no advantage in raising *Parkia* husk level beyond 2.0 g/hill. Increased yield as a result of the applications of *Parkia* product is in agreement with Magani et al. (2010), Kolo and Mamudu (2008) and

Table 8. Effect of *Parkia* husk levels on number of days to crop maturity and number of pods per net plot at Garkawa in 2012 and 2013.

***Parkia* level (g/hill)**	**Days to maturity**			**Number of pods per net plot**		
	2012	**2013**	**Combined**	**2012**	**2013**	**Combined**
1.0 g	64.67abc	64.33bc	64.50abc	235.00a	209.33bc	222.17ab
2.0 g	65.33ab	65.33ab	65.33ab	194.33a	267.00a	230.67a
3.0 g	65.67a	66.00a	65.83a	140.00a	256.67ab	198.33ab
4.0 g	65.67a	66.00a	65.83a	126.00a	195.00c	160.50b
Seed coated	63.67c	64.67abc	64.17bc	217.67a	209bc	213.67ab
Control	64.00bc	63.67c	63.83c	205.33a	162.33c	183.83ab
LSD 0:05	1.661	1.370	1.391	113.47	49.222	66.49

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

Table 9. Effect of *Parkia* husk levels on pod weight and grain yield (kg/ha) at Garkawa in 2012 and 2013 Cropping Seasons.

***Parkia* level (g/hill)**	**Pod weight (kg/ha)**			**Grain yield (kg/ha)**		
	2012	**2013**	**Combined**	**2012**	**2013**	**Combined**
1.0 g	311.00a	252.13a	281.57a	184.33a	177ab	180.80ab
2.0 g	331.05a	268.29a	299.67a	231.25a	191.23a	211.24a
3.0 g	248.54a	260.24a	254.39a	193.75a	202.58a	198.17a
4.0 g	219.79a	270.09a	244.94a	154.17a	120.24b	137.21b
Seed coated	311.46a	263.32a	287.39a	223.00a	188.61ab	205.81a
Control	246.95a	249.69a	248.32a	150.50a	158.17ab	154.33ab
LSD 0:05	158.450	21.539	84.002	88.481	70.18	57.658

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

Kanampiu et al. (2003). Earlier report had shown that the application of *Parkia* husk significantly delayed *Striga* emergence (Table 1), reduced number of crops infested by *Striga* (Table 2), reduced *Striga* shoot count (Table 3) and number of capsules/*Striga* plant (Table 7). The long time suppression of the parasite by allelochemicals contained in the *Parkia* husk might have been responsible for the better performance of the cowpea plants treated with this *Parkia* product with subsequent increment in grain yield. However, raising *Parkia* husk level to 4.0 g/hill significantly delayed *Striga* emergence, reduced number of crops infested, reduced *Striga* shoot count and capsules/*Striga* plant but without a corresponding increment in yield as shown above. This may be attributed to the fact that at this level, the concentration of the allelochemicals in the *Parkia* husk is beyond what can be tolerated by the crop, hence the reduction in the performance of the crop in terms of yield.

Conclusion

The Study result revealed that application of *Parkia* husk significantly delayed *Striga* emergence, reduced number of crops infested by *Striga*, reduced *Striga* shoot count, delayed flowering of *Striga*, reduced number of capsules per *Striga* plant, while it increased crop vigour, number of pods per plant and subsequently increased grain yield of cowpea. The application of *Parkia* husk reduced significantly the number of capsules per plant of *Striga*. The implication of this is that there will be depletion of seed bank build up for future infestation, thereby ensuring control of *Striga* over time. It could therefore be concluded that *Parkia* husk has great potentials for controlling *Striga* gesnerioides. *Parkia* husk is a waste product of *Parkia* fruit processing and therefore can easily be acquired by resource poor farmers. It is therefore recommended for inclusion by farmers in integrated *Striga* management strategy.

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