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EFFECT OF ORGANIC MANURE AND NEEM SEED POWDER ON *STRIGA HERMONTHICA* CONTROL IN MAIZE IN THE GUINEA SAVANNAH ZONES OF GHANA

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ABSTRACT
A pot experiment carried out in the greenhouse at Nyankpala Campus of University for Development Studies in Tolon-Kumbugu District of Northern region, between August and December 2010 to determine the effect of organic manure and neem seed powder on *Striga hermonthica* control in maize. The research was a 2×4 factorial experiment in Randomised Complete Block Design with sixteen treatments in three replications. Treatments consisted of combinations of four levels of organic manure and neem seed powder each at 0, 35.5, 71 and 106.5 g/pot. Parameters measured for maize were: plant stand, height of maize, number of leaves, leaf area index and number of internodes at two every weeks and total dry matter at harvest; and for *Striga,* emergence count and *Striga* heights. Hand watering was done based on the moisture content of the soil to ensure adequate soil moisture in the root zone of the plants but avoided excess moisture which could inhibit *Striga* emergence. The result showed that, the treatments used suppressed the emergence of *Striga* in the presence of *Striga* tolerant maize. There was no Striga emergence in replications one and three but few emergences in replication two especially T5 in which the *Striga* reduced height, number of leaves, straw weigh and dry matter of maize. However, the treatments used inhibited the growth of *Striga* as the parasite wilted within two weeks after emergence, probably due to non-effect haustorium attachment to host root. Organic manure at the rate of 106.5g/pot recorded highest number of leaves at 4WAP. Main effect of neem seed powder also showed optimum significant effect on number of leaves at 8WAP, straw biomass and dry matter of maize at harvest. The findings in this research showed positive response in using organic manure and neem seed powder for *S. hermonthica* control in maize in *Striga* affected areas in Northern Ghana as the combination of the treatments suppressed more than 80% of *S. hermonthica* emergence.

KEYWORDS: organic matter, neem seed powder and *Striga* hermonthica control.

INTRODUCTION

Maize (*Zea mays* L.) is one of the world's three most important cereal crops. Maize is cultivated in a wider range of environments than wheat and rice because of its greater adaptability (Kogbe and Adediran, 2003). It has the highest grain yield than all the other cereals and is a wonder of efficiency in transforming the energy of the sun into food energy. In Ghana, maize is mainly grown by small scale farmers, generally for subsistence as part of mixed farming. Maize is the most important grain crop in sub-Sahara Africa including Ghana being consumed directly and serves as a staple diet for many people in the region (IITA, 2006). It is an important source of protein, carbohydrate, iron vitamins, minerals and fat. It has industrial uses for example, starch from the grain could be made into fabrics and adhesives and production of alcoholic beverages (Yonli *et al.,* 2010). Maize is also an important livestock feed, ethanol production, commodity and for export (Yonli *et al.,* 2010). There are several constraints that lead to the loss of maize production such as nutrient deficiencies in the soil, prolong drought during the season of cultivation, pathological problems and pest infestations. Weed is another major problem facing the resource poor farmers in the country leading to a huge economic loss. Particularly, in the Northern region of which a root parasitic weed of the genus *Striga* in thefamily (*Scrophulariaceae*) constitute a major biotic constraint to cereal production in sub-Sahara Africa (Yonli *et al.,* 2010) such as maize, sorghum and millet. The most devastating species on cereals in West Africa is the *Striga hermonthica* (Del.) Benth which causes huge losses from 40-90% (Gressel *et al*., 2004). Parker and Riches (1993) reported that up to75% of its overall damage to the hosts occurred during its subterranean stage of development. Dzomeku and Murdoch (2007) also reported that average yield losses of 25-40% could occur but total crop failure under drought is not uncommon.

Research on identification of control measures for *S. hermonthica* in Africa has been conducted for the last seven decades. The use of *Striga* tolerant or resistant varieties of maize could be an effective way of reducing *Striga* damage on the maize plants (Sanerborn, 1991; Ejeta *et al*., 1993; Parker and Riches, 1993; Carskey *et al.,* 1996; Kling *et al.,* 2000). Other methods of *S. hermonthica* control are crop rotation, trap and catch cropping, injection of ethylene gas, uses of herbicides and fertilizers (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). *Striga* abundance is favoured by continuous cropping and low soil fertility (Debrah *et al*., 1998) and hence does not do well on soils with high organic matter content. The effect of *S. hermonthica* 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 climatic) and the management level at which the crop was produced. Maize yield losses of up to 81% were recorded in western Kenya (Ransom *et al*., 1990). About 1000 *Striga* parasites per hectare can cause a grain yield loss of 2-3 kg/ ha of sorghum and probably more on maize (Kiriro, 1991). Arable lands were reported abandoned because of the prohibitive parasite populations (Doggett, 1984). The land area of maize affected by *S. hermonthica* was over 5 million hectares in six West African Countries and over 10 million hectares in Africa as whole (Sauerborn, 1991). *Striga* weakens the host by wounding its outer roots tissues and absorbing its supply of moisture, photosynthesis and minerals. Parker and Riches (1993) reported that, the effect of infection by *S. hermonthica* resembled those of drought stress. There are always chlorotic symptoms in the form of small yellowish blotches and a generalized wilting even when the soil is still wet. Another effect of *Striga hermonthica* on maize is a significant change in amino acid content of the grain, this reduces the nutritional quality. Controlling *Striga* and other root parasites is difficult because the weed could cause huge damage to the host crop before emerging above the ground. Cultural, mechanical, chemical and biological control measures are available to regulate the parasite population. Dzomeku and Murdoch (2007) noted that, the nitrogenous compound fertilizer which contains urea considerably suppressed germination of *S. hermonthica* when applied during conditioning. However, few of these techniques could not provide complete *Striga* eradication and it is usually necessary to use a combination of these methods (integrated control) most relevant to the farming systems (Parker and Riches, 1993).

The use of host-plant resistance and tolerant varieties could stimulate the suicidal germination of *Striga* seeds and therefore used to reduce the seed bank in the soil. Kling *et al*. (2000) reported that in researcher-managed trials with artificial infestation, resistant hybrid maize (cv. 9022-13) yielded 2.5 t/ha of grain whereas the susceptible check variety (cv. 8338-1) produced only 0.7 t/ha. In this trial, the term 'resistant maize' refers to the cultivar that show less attack in terms of the numbers of emerged *S. hermonthica,* as defined by Parker and Riches (1993). The effectiveness of leguminous trap crops in reducing the *S. hermonthica* seed bank was demonstrated by Sauerborn *et al*. (1999) in field experiments in Ghana where annual double cropping of trap crops (soyabean, sunflower, cotton) reduced the seedbank by around 30% each year. Carsky *et al*. (2000) reported that *Striga* incidence in maize after soyabean, compared with maize after sorghum, was significantly reduced from 3.2 to 1.3 emerged *Striga* plants per maize plant, resulting in greatly improved maize yields.

Organic manure is a complex mixture of living, dead, and decomposed materials and inorganic compounds which include naturally occurring organic materials (e.g. Cow dung, compost and guano). Most of the organic manure is derived from plant tissue decomposition. Organic manure contains three primary macro nutrients: nitrogen (N), phosphorus (P), and potassium (K) and three secondary micro nutrients: calcium (Ca), sulphur (S), and magnesium (Mg) ("Wikipedia". http://fertilizer). Since declining in soil fertility contribute to increased *Striga* infestation, and the presence of this weed has been used by farmers as an indicator of reducing soil fertility (Mbwaga, 2002). And the *Striga* flourishes in conditions that have poorest farming activities e.g. Mono-cropping, lack of oxen and natural manure and in areas with poor soil fertility especially soils that are low in nitrogen and organic matter (Robert Shank, 1996). The essential element for reversing *Striga* infestation of cereal crops such maize is the use of nitrogen (N), which increases crop yield and reduces *Striga* attack by increasing crop tolerance. The mechanisms by which high levels of N suppress *Striga* include the reduction in stimulant exudation from host root (Sherif and Parker, 1988). N-fertilizer has been reported to delay *Striga* emergence, promote high maize growth, shoot biomass and dry matter production and reduces *Striga* damage in the Guinea Savanna ecological zones (Kurch *et al.,* 2002; Sule *et al*., 2008). Therefore since organic matter contains nitrogen which could equally reduce the emergence of *Striga* seeds, increase soil fertility that leads to high crop yield and above all, cost effective as compared to inorganic nitrogen fertilizers could be used by our resource poor farmers to address the problems of *Striga* affected areas in Northern Ghana.

Neem seed from the tree (*Azadirachta indica*) is currently one of the botanicals noted for its pesticidal effects on soil and aerial organisms. The active ingredient in the Neem *Azadirachtin* according to Tanzubil (1990), raw extract from neem leaves and seeds are effective for pest control. Screen house evaluation of *Azadirachta indica* and *Parkia biglobosa* to control *S. hermonthica* seeds germination were effective to reduce *Striga* emergence (Marley *et al*., 2004; Syngeta, 2004). According to this trial, Neem seed powder was used to determine the efficacy of the active ingredient on *Striga hermonthica* control through reduction in *Striga* emergence. Despite the numerous ways of *Striga* control, no single way had been found efficient in reducing the *Striga* emergence and increasing crop production. The concept of combining two or more farmer friendly control measures in integrated *Striga* control is the current focus (Syngeta, 2004). This project exploited the use organic manure and neem seed powder in an integrated management to reduce *Striga* emergence.

The study main objectives were to determine the effect of organic manure on *Striga* emergence and growth, Neem seed powder effects on *Striga* emergence and growth and toevaluate the interaction of organic manure and Neem seed powder effects on *Striga* emergence and growth in maize.

MATERIALS AND METHODS

Experimental site

This experiment was conducted in the greenhouse at Nyankpala campus of University for Development Studies in Tolon Kumbungu District in the Northern Region of Ghana from August to December, 2010. The green house is located at geographical positioning system of latitude

09°24′ 44.4′′ N and longitude 00° 58′ 49.7′′W. The area experiences unimodal rainfall with an annual mean rainfall of 1000-1022mm. The temperature distribution is fairly uniform with mean monthly minimum value of 21.9°C and maximum value of 34.1°C. It has a minimum relative humidity of 46% and maximum of 76.8% (SARI Annual Report, 2007).

Preparation of soil sample and planting materials

Six holes were created under the plastic buckets and were first filled with garden soil to a height of 20cm from the base of the container followed by 5cm of fine sand in which neem seed powder (NSP) and organic manure (OM) were mixed and later infested with a ladle full of *S. hermonthica* seeds (estimated 3000 germinable seeds) to make up the final layer of the pots. Each pot used had a surface area of 0.071m².

The *Striga* seeds/capsules were slightly crushed in-between the palms to expose the *Striga* seeds. Seeds of *Striga* tolerant yellow maize were obtained from the International Institute of Agriculture (IITA) and were planted on16th September, 2010 at stake with four seeds per pot and later thinned-out to two plants per pot after germination. The pots were laid such that all the pots touched each other within the block and 35cm between blocks.

Experimental Design and Treatments

The experiment consisted of combinations of organic manure and neem seed powder each at four (4) levels of 0, 35,5g, 71g and 106g per pot giving rise to 16 treatment. This was a 2×4 factorial experiment laid out design in Randomised Complete Block Design (RCBD). The experiment was replicated three times and the trial was laid on a platform.

Striga seeds were collected from farmers' fields at Zebila in Bawku-West of Upper East Region of Ghana. Cow dung was used as a source of organic manure. Neem seeds were collected from different trees on Nyankpala campus of the University for Development Studies. The seeds were dried and pounded into powder.

TABLE 1: Description of treatment combinations of organic manure and neem seed powder

Treatments	Description (g/pot)
T1	0 Organic manure + 0 Neem seed powder
T2	0 Organic manure + 35.5 Neem seed powder
T3	0 Organic manure + 71 Neem seed powder
T4	0 Organic manure + 1O6.5 Neem seed powder
T5	35.5 Organic manure + 0 Neem seed powder
T6	35.5 Organic manure + 35.5 Neem seed powder
T7	35.5 Organic manure + 71 Neem seed powder
T8	35.5 Organic manure + 1O6.5 Neem seed powder
T9	71 Organic manure + 0 Neem seed powder
T10	71 Organic manure + 35.5 Neem seed powder
T11	71 Organic manure + 71 Neem seed powder
T12	71 Organic manure + 1O6.5 Neem seed powder
T13	106.5 Organic manure + 0 Neem seed powder
T14	106.5 Organic manure + 35.5 Neem seed powder
T15	106.5 Organic manure + 71 Neem seed powder
T16	106.5 Organic manure + 1O6.5 Neem seed powder

NB: OM = organic manure and NSP = neem seed powder

Agronomic practices

Pots were hand irrigated when every three days to provide adequate moisture to permit plant growth and *Striga* emergence. Excessive watering was avoided for this could reduce the emergence of *Striga* seeds. Thinning-out was also done two weeks after planting and staking was done to the lodging plants. All weeds that appeared were removed to prevent competition with the crop.

Data collection

Records of the following parameters were taken every two weeks after planting: plant height, number of leaves per plant and leaf area. Data were also collected on *Striga* emergence and height of the parasite at 8-13WAP. At harvest, straw biomass and dry matter of maize were measured.

Plant height of maize

Plant heights of the two plants in each pot were measured at 2, 4, 6, and 8 WAP. Tape measure was used to measure the plant height and the averages were noted.

Leaf count of maize

The number of leaves for two plants in each pot was counted. This was done every two weeks after planting from 2-8 WAP.

Leaf area index (LAI) of Maize

The length and width of the bottom, middle and upper leaves were measured and their averages were used for the calculation of LAI. The data was collected at 4 and 6 WAP. The relationship $LAI = L \times W \times N \times 0.72 \div A$, where L = length of leaf, W = width of leaf, N = number of leaves per plant, A = area covered by plants and 0.72 a constant for the determination of LAI of maize (Watson, 1952).

***Striga* emergence**

The number of emerged root parasitic weed in each pot was noted at 6, 8, 10, 12 and 13 WAP.

Height of *Striga*

The heights of *Striga* were taken two weeks after emergence from 6-13 WAP.

Straw biomass
Two plants from each pot were cut from the ground level and weighed to determine straw biomass at harvest.

Dry matter of maize
Two plants from each pot were cut from the ground level for the dry matter determination, plants were put into envelops and oven dried at 105°C for 24 hours.

Data analysis
Count data collected were transformed using square root transformation ($\sqrt{n} + 0.5$) to homogenize the variance before subjecting them to analysis of variance (ANOVA) using GenStat statistical package edition nine (9) where n is number to be transformed and 0.5 is a constant. Treatment means were separated using SED at 5% significant level. Means were compared using the transformed values.

RESULTS

General observations
The plants were generally tall except T5 in Replication two (2) in which the plants showed sign of stunted growth as a result of *Striga* infestation at 6WAP. Most of the plants formed cobs but grains were not produced and the plant began wilting at the end of 12WAP.

Plant height
The interaction between the rates of OM and NSP did not show any significant effect ($p>0.05$) on plant height at 2, 4, 6 and 8 WAP. Plant height were not significantly ($p>0.05$) affected by the main effect of OM from 2-8 WAP. The mean values of the main effect for OM were 11.9cm, 30.1cm, 50.6cm and 111.2cm at 2WAP, 4WAP, 6WAP and 8WAP respectively. Also, the main effect of NSP from 2-8WAP showed no significant effect ($p>0.05$) on plant height and recorded mean values of 11.9cm, 29.6cm, 50.7cm and 111.12cm (Table 2) but there were no statistical difference between the treatments.

TABLE 2: Effect of rates organic manure of and neem seed powder on plant height of maize in greenhouse pot experiment

Main effects (g/pot)	Plant height (cm)			
	2 WAP	4 WAP	6 WAP	8 WAP
Organic manure				
0	11.36	29.03	47.74	109.5
35.5	11.76	30.12	49.81	107.3
71	12.17	30.31	51.77	111.5
106.5	12.26	30.95	52.92	116.4
Mean	**11.9**	**30.1**	**50.6**	**111.2**
Neem seed powder				
0	11.77	30.17	49.29	105.7
35.5	11.92	30.43	48.98	108.5
71	12.09	30.02	51.77	113.7
106.5	11.77	27.79	52.92	116.8
Mean	**11.9**	**29.6**	**50.7**	**111.2**
SED (0.05)	0.662	1.33	2.465	7.55
CV%	13.6	10.8	11.9	16.6

Number of leaves
The interaction between the rates OM × NSP did not show significant effect ($p>0.05$) on number of leaves at 2, 4, 6 and 8 WAP.

Number of leaves
At 4 and 8 WAP, number of leaves were significantly ($p<0.05$) affected by OM and NSP respectively. Organic manure at 106.5g/pot produced the highest number of leaves at 4WAP (Fig.1). Also, the main effect of NSP also had significant ($p<0.019$) effect on number of leaves. The highest number of leaves was observed for 106.5g/pot whiles the control recorded the least (Fig. 2).

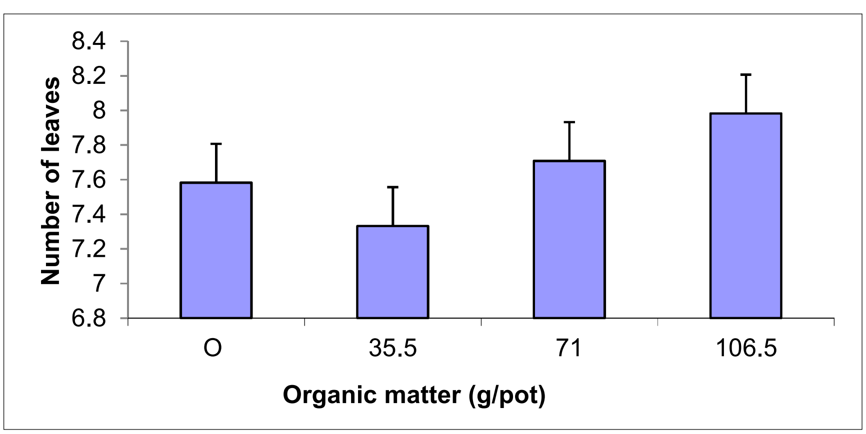

FIGURE 1: Effect of rate organic manure on number of leaves at 4WAP. Bars represent SED ($p<0.05$)

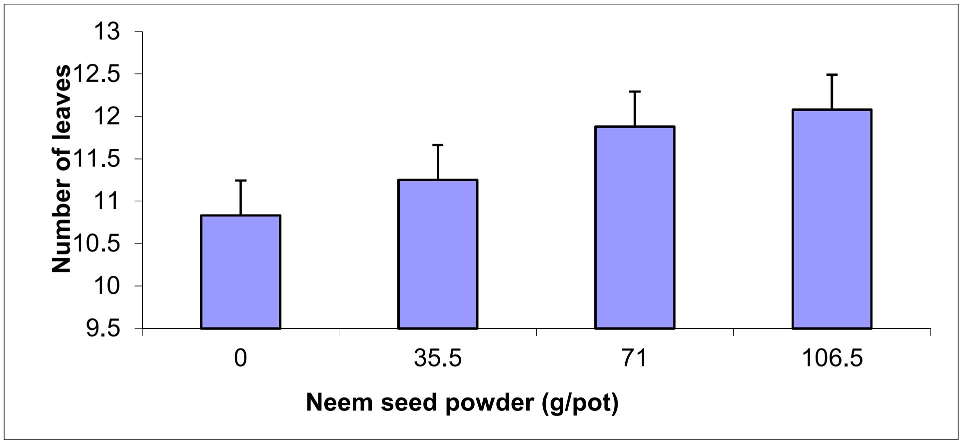

FIGURE 2: Effect of rate neem seed powder on number of leaves at 8WAP. Bars represent SED (p<0.05).

Number of leaves

Number of leaves at 2, 6 and 8 WAP was not significantly (p>0.05) affected by the main effects of OM. Mean values as influenced by OM were, 5.0, 8.0, 10.0 and 12.0 leaves per plant. Also, number of leaves as affected by the main effect of NSP at 2, 4, and 6 WAP showed no significance effect. The means values recorded were similar to the main effect of organic manure. (Table 3).

Table 3: Effects of rates of organic manure and neem seed powder on number of leaves of maize

Main effects (g/pot)	Leaf count (number/pot)			
	2 WAP	4 WAP	6 WAP	8 WAP
Organic manure				
0	4.958	7.583	10.03	11.62
35.5	5.125	7.333	9.75	11.33
71	5	7.708	10.21	11.12
106.5	5.083	7.567	9.46	11.96
Mean	**5.0**	**8.0**	**10.0**	**12.0**
Neem seed powder				
0	5	7.667	9.58	10.83
35.5	5.083	7.708	10.12	11.25
71	5.167	7.667	10.44	11.88
106.5	4.917	7.567	10.29	12.08
Mean	**5.0**	**8.0**	**10.0**	**12.0**
SED (0.05)	0.2062	0.0.2240	0.404	0.412
CV%	10	7.2	9.8	8.8

Leaf area index

The interaction between the rates of OM × NSP did not show significant difference (p>0.05) on leaf area index at 4WAP. However at 6WAP, the interactions between OM × NSP showed a significant effect (p<0.049) on LAI of maize. It was observed that, the combinations 35.5 OM ×106.5 NSP, 71 OM × 71 NSP and 106.5 OM ×71 NSP gave the highest LAI and 35.5 OM× 35.5 NSP recorded the least LAI (Fig. 3).

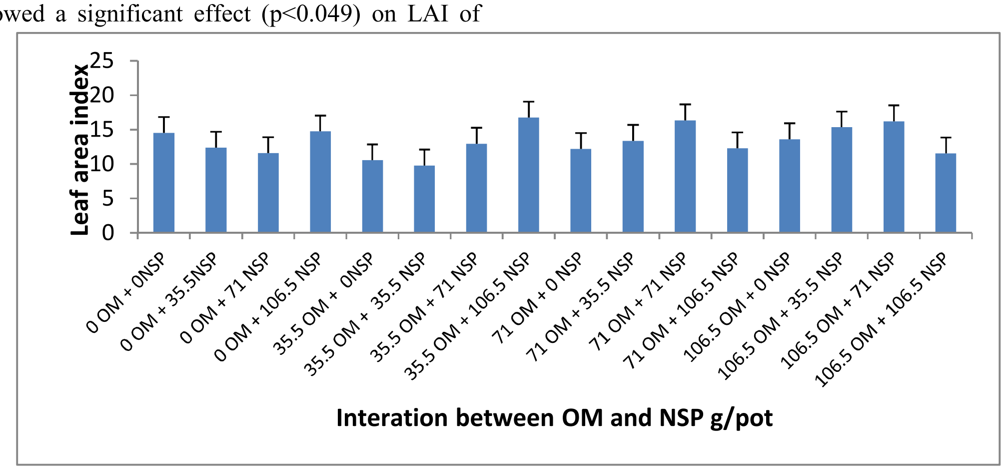

FIGURE 3: Interaction effect between organic manure and neem seed powder on leaf area index of maize at 4WAP. Bars represent SED (p<0.05).

Leaf area index

At 4WAP and 6WAP, leaf area index were not significantly (p>0.05) influenced by the main effects OM and NSP. The mean value of OM was 6.5cm and 13.4cm for 4 and 6WAP respectively. Also, mean values of the main effect of NSP on LAI were 6.5cm for 4WAP and 13.4cm for 6WAP (Table 4).

TABLE 4. Effect of rates of organic manure and neem seed powder on leaf area index

Main effects (g/pot)	LAI (cm)	
	4 WAP	6 WAP
Organic manure		
0	6.25	13.31
35.5	6.25	12.50
71	6.71	13.55
106.5	6.68	14.17
Mean	**6.5**	**13.4**
Neem seed powder		
0	6.48	12.70
35.5	6.35	12.72
71	6.56	14.28
106.5	6.50	13.83
Mean	**6.5**	**13.4**
SED (0.05)	0.664	1.155
CV%	25.1	21.1

***Striga* emergence**

The interaction between the rates of OM and NSP did not any show significant effect (p>0.05) on *Striga* emergence from 6-13 WAP.

***Striga* emergence**

Striga emergence at 6, 8, 10, 12 and 13 WAP, were not significantly affected (p>0.05) by the main effect of OM. Its mean values from 6-13WAP were, 0.7, 0.7, 0.8, 0.8 and 0.9 seedlings per pot. Also, the ANOVA showed that there was no significant effect (p>0.05) on *Striga* emergence as influenced by the main effect of NSP. The mean values of NSP were the same as the main effects of OM of which there were no statistical differences (Table 5).

TABLE 5. Effect of organic manure and neem seed powder on *Striga* emergence

Main effects (g/pot)	Transformed *Striga* emergence (number/pot)				
	6 WAP	8 WAP	10 WAP	12 WAP	13 WAP
Organic manure					
0	0.7	0.7	0.7	0.7	0.7
35.5	0.742	0.8	0.742	0.883	0.933
71	0.7	0.7	0.858	0.867	0.892
106.5	0.742	0.775	0.742	0.775	0.9
Mean	**0.72**	**0.74**	**0.76**	**0.81**	**0.86**
Neem seed powder					
0	0.742	0.8	0.783	0.775	0.9
35.5	0.742	0.775	0.742	0.7	0.7
71	0.7	0.7	0.742	0.867	0.892
106.5	0.7	0.7	0.775	0.883	0.933
Mean	**0.72**	**0.74**	**0.76**	**0.81**	**0.86**
SED (0.05)	0.0403	0.0855	0.0690	0.1724	0.2386
CV%	13.7	18.2	22.2	19.7	17.3

***Striga* height**

The interaction between the rates OM and NSP did not show significant difference (p>0.05) on *Striga* height at 6, 8, 10, 12 and 13 WAP. However, the main effects of OM and NSP also did not show any significant effect (p>0.05) on *Striga* height (Table 6).

TABLE 6. Effect of organic manure and neem seed powder on *Striga* height

Main effects (g/pot)	*Striga* height (cm)				
	6 WAP	8 WAP	10 WAP	12 WAP	13 WAP
Organic matter					
0	0.7	0.7	0.7	0.7	0.7
35.5	0.725	0.783	0.742	0.817	0.933
71	0.7	0.7	0.825	0.867	0.892
106.5	0.725	0.7	0.717	0.842	0.9
Mean	**0.71**	**0.72**	**0.75**	**0.81**	**0.86**
Neem seed powder					
0	0.725	0.783	0.742	0.842	0.9
35.5	0.725	0.767	0.733	0.7	0.7
71	0.7	0.7	0.767	0.867	0.892
106.5	0.7	0.7	0.742	0.817	0.933
Mean	**0.71**	**0.74**	**0.75**	**0.81**	**0.86**
SED (0.05)	0.02415	0.0730	0.0570	0.1636	0.2386
CV%	8.3	14.2	18.7	19.7	18.3

Straw biomass of maize

The interaction between the rates of OM and NSP and the main effect of OM did not show significant difference ($p>0.05$) on straw weight of maize. However, the application rate of the main effect of NSP determined ($p=0.002$) on the straw biomass of maize. NSP at 106.5g produced the highest straw biomass followed by 71g and that of 35.5g was similar to the control (Fig. 4).

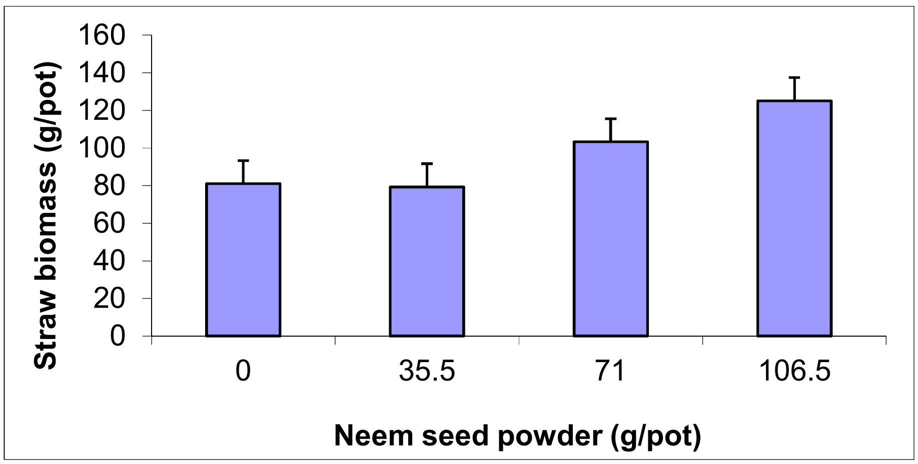

FIGURE 4: Effect application of neem seed powder on straw biomass of maize. Bars represent SED ($p<0.05$).

Dry matter of maize

The interaction between the rates of OM and NSP and the main effect of OM did not show significant difference ($p>0.05$) on dry matter of maize. However, the dry matter of maize showed a significant difference ($p = 0.041$) as influenced by the application of the main effect NSP. 106.5g/pot produced the highest dry matter which was similar to 71g/pot. The least dry matter was observed for 35.5g/pot (Fig 5).

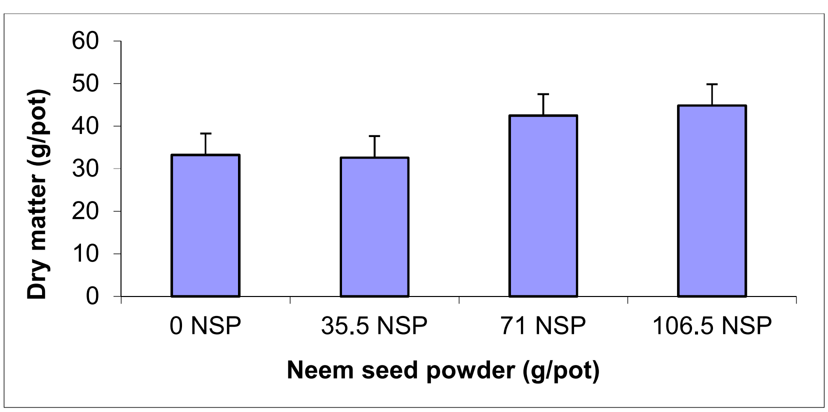

FIGURE 5: The effect of application of neem seed powder on dry matter of maize. Bars represent SED p(<0.05).

DISCUSSION

Plant height of maize

The height of the maize was not affected by the treatments. This could be due to the inability of the *S. hermonthica* seeds to germinate as a result of the treatments used. But however, T5 in replication two which was made of 35.5gOM and 0gNSP in which the plants showed stunted growth as a result of *Striga* infestation recorded the least plant height (Table 2). This was in line with the findings of Esilaba and Ransom, 1997 which stated that, the use of resistant and tolerant varieties and manures can reduce the incidence of *Striga* damage on maize.

Number of leaves of maize

The number of leaves showed significant effect among the treatments. It was observed at 4WAP that, organic manure at the rate of 106.5g/pot supported the highest number of number of leaves as compared to 35.5g/pot and the control. Also at 8WAP, 106.5g/pot of neem seed powder recorded number of leaves which was similar to 71g/pot (Fig. 2). In the pots in which there was Striga emergence, the leaves of the maize showed a sign of chlorosis as a result of *Striga* infestation. This correspond with the findings of Parker and Riches (1993) which stated that infestation by *S. hermonthica* resembled those of drought stress, chlorotic symptoms or yellow blotches and wilting of the maize plant even when the soil is still wet.

Leaf area index

The interaction between OM×NSP at 4WAP with the combinations of 35.5g/pot of OM×106.5g/pot of NSP, 71g OM×71g NSP and 106.5g OM×71g NSP showed the highest LAI which are similar to each other. However, combination 35.5g OM×35.5g NSP gave the least (Fig. 4). This could be due to the inability of the *Striga* to germinate which was in line with work done by Parker and Riches (1993) which reported that there is a correlation *S. hermonthica* infestation and canopy spread maize.

Striga emergence

Striga emergence count was not significantly influenced by the treatments. This could be due to the presence of the resistance maize (Esilaba and Ransom, 1997). However, the inability of the *Striga* to germinate in most of the pots has agreed with the work done by (Sherif and Parker, 1988; Raju *et al.,* 1990) which stated that, organic manure which contain high amount nitrogen was an essential element that could be used to reduce *Striga* infestation on cereal crops by the mechanisms of reduction in stimulant exudation from host roots. NSP also positively affected the emergence of *Striga* (Table 5). This could be the effect of the active ingredient in the neem seed which is the **Azadirachtin** on the *Striga* emergence. This result agrees with the research conducted by (Marley *et al*., 2004; Syngeta, 2004) in which *Azadirachta indica* and *Parkia biglobosa* were used to control *S. hermonthica* germination.

Striga height

The study proved that, the treatments used did not support the growth and the height of the *Striga* seedlings. This was because, even in the pots in which there were emergences of *Striga* seedlings, they wilted within few days after their emergences. It could therefore be concluded that the rates of OM and NSP looses their suppressive effects on *Striga* emergence and height in the presence of a susceptible host.

Straw biomass of maize

Straw biomass of was significantly affected by the main effect of NSP. The application rate of 106.5g/pot NSP supported the highest straw biomass and 35.5g NSP gave the lowest straw biomass (Fig. 4). The experimental units in which there were *Striga* emergences at 6WAP, the straw and dry matter were generally low especially treatment five (T5) in replication two. This agrees with the findings of Gurney *et al* (1996) which postulated that, *Striga* infestation results in a large reduction in host straw biomass and eventually grain yield loss.

Dry matter of maize

The main effect of NSP showed a significance difference on dry matter of maize. The application rate of 106.5g/pot produced the highest value and 35.5g/pot recorded the least (Fig. 5). The high dry observed could be the presence of the resistant maize variety of which Kling *et al*. (2000) reported that resistant hybrid maize could yield 2.5 t/ha of grain.

CONCLUSION AND RECOMMENDATIONS

The objectives of this study were to determine the effect of organic manure and neem seed powder and their interactions on *Striga* emergence and growth in maize. It was observed from the result obtained that, *Striga* did not germinate in most of the pots. In addition, it was also observed that, the main effect of NSP at 106.5g/pot produced the optimum number of leaves at 8WAP, straw biomass of maize and dry matter of maize at harvest. The study also revealed that, OM at 106.5g/pot recorded the highest number of leaves at 4WAP. The trial also revealed that, combinations of OM×NSP at 35.5g×106.5g, 106.5g×71g and 35.5g×106.5g gave the highest leaf area index. However, it was observed that, pots affected by *Striga* recorded the least number of leaves, straw biomass and dry matter. In conclusion, the study has proved that using organic manure, neem seed powder and *Striga* resistance maize could be used to reduce the effect of *Striga hermonthica* infestation on maize production. Therefore farmers in *Striga* affected areas are urged to use organic manure and neem seed powder in addition to resistance maize variety. Based on the results obtained from the experiment, the best control measure of *S. hermonthica* is the use of combinations of 71 OM and 106.5 NSP g/pot and resistance maize variety to reduce ability of the *Striga* seed to germinate. When this is done, there would be an increase yield per unit area, reduces the cost of production and sustainability of the agro ecological zones. I recommend that, further studies should be carried out to determine the exact rates of organic manure and neem seed powder that should be applied to obtain maximum output. The trial should also be carried under field condition.

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