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Effect of Sheep Manure on Growth and Yield of Cowpea Varieties Infected with *Alectra Vogelii*

[1]Salihu M. U.,[2]Alonge S. O., [3]Muhammad I. U., [4]Magaji D. D., [5]Onobo Y. I., [6]Oludare T. T.
[1&2]*Department of Botany, Ahmadu Bello University, Zaria, Nigeria.*
[3]*Department of Applied Biology/Microbiology, Federal Polytechnic Nasarawa, Nasarawa State, Nigeria*
[4]*Department of Plant Science and Biotechnology, Federal University Dutsin-Ma, Nigeria*
[5&6]*Department of Biology, Confluence University of Science and Technology, Osara, Kogi State, Nigeria*

ABSTRACT

This research was carried out on the effect of some animal wastes (manure) on growth and yield of cowpea varieties and Alectra infestation on Alectra inoculated soil. Two trials of pots experiments were conducted in the screen house, Department of Soil Science, Ahmadu Bello University, Zaria. Sheep manures were applied at the rate of 15, 30 and 45kgN/ha with control (soil without Alectra inoculation). Cowpea varieties SAMPEA 7, SAMPEA 9 and SAMPEA 14 were planted in nylon bags of (20 x 18.9 cm) which served as pots for the experiment. All the pot soils (except the control) were inoculated with Alectra seeds. The treatments were laid out in completely randomize design. The cowpea plants were sampled for growth parameters at 5, 7 and 9 WAP. The parameters evaluated for vegetative growth include Plant height, Number of leaves, Number of branches, Number of root nodules, Root length, Shoot fresh weight and Root fresh weight, and yield parameters were Pods number, Pods weight, Seeds number, Seeds weight and 100 seeds weight. The result showed that, application of manures generally enhanced the vegetative growth parameters of cowpea varieties on most sampling dates, with the highest values recorded at 45kgN/ha followed by 30kgN/ha on most of the parameters evaluated while in most cases 15kgN/ha and control produced the lowest values in growth parameters in both Trials. In Trial I, the plant height, number of leaves and branches was observed to be higher in variety SAMPEA 9 than the lowest recorded in variety SAMPEA 7. In Trial I, sheep manure treatment resulted in significantly higher values in each yield parameters (except seed weight). Variety SAMPEA 14 resulted in higher pods number, pods weight, seeds number and 100 seeds weight which were significantly higher than the lowest due to SAMPEA 7 and SAMPEA 9 in both Trials. At Trial I, the highest number of Alectra shoot was due to 45 and 30kgN/ha manure treatment and significantly higher than the lowest due to control and 15kgN/ha in both Trials. Variety SAMPEA 7 produced the highest number of Alectra shoots followed by variety SAMPEA 9 which was significantly higher than the lowest produced by variety SAMPEA 14. In conclusion, application of manures treatments at 15-45kgN/ha generally enhanced vegetative growth and yield parameters of cowpea varieties on Alectra inoculated soil. The 45kgN/ha sheep manure treatment had the highest incidence of Alectra vogelii but was also observed to have produced the highest

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Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

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grain weight. In view of these findings, it was recommended that the manures should be considered as an efficient control measure for Alectra infestation on susceptible cowpea varieties Also, for better vegetative growth and of cowpea, tolerant variety such as SAMPEA 14 should be cultivated most especially for commercial purposes.

INTRODUCTION

Cowpea is among the major legume food in sub-Saharan Africa, where the grain and leaves are major sources of food and family income, particularly for the resource-poor households (Boukar *et al*., 2015). The crop has a high protein content of around 25 % in the grain (dry weight basis) (Bressani, 1985; Singh *et al*., 2003), and also serves as an inexpensive source of vitamins and minerals. In addition, the crop improves the cropping systems and soil fertility by reducing soil erosion, suppressing the weeds and fixing atmospheric nitrogen which contributes to increased yields of non-nitrogen fixing crops grown with or after it (Tarawali *et al*., 2002)

Despite its widespread cultivation, the average yields on farmers' fields are low, averaging less than 300 Kg ha-1 (Takim and Uddin, 2010). The low yields have been attributed to a number of biotic stresses such as insect pests, nematodes, diseases and parasitic weeds and abiotic stresses such as drought and high temperature occasioned by environmental pollution such as heavy metals and other particulate ions (Upahi *et al.,* 2021; Upahi *et al.,* 2026).

Alectra vogelii Benth is the most important species parasitizing mainly grain legumes in sub-Saharan Africa, which include cowpea, Bambara groundnut (*Vigna subterranea* (L.) Verdc.), soybean (*Glycine max* (L.) Merr.), mung bean (*Vigna radiata* (L.) Wilczek), groundnut (*Arachis hypogaea L.*) and common bean (*Phaseolus vulgaris L.*), (Parker and Riches, 1993). *Alectra* appears to be more destructive in the Northern Guinea and Sudan agro-ecologies, because of the marginal nutrient status of the soils and unreliable rainfall in these zones.

The control of *Alectra vogelii* is difficult mainly because of the unique adaptation of the parasite to its environment and the complexity of the host-parasite relationship (Botanga and Timko, 2005). General control measures for *Alectra* species include trap crops, hand pulling, cultivation of resistant cultivars and application of herbicides (Ogborn, 1987; Parkinson *et al,* 1997, Sand *et al*, 1990; Magani and Lagoke, 2009). Among these control measures, no one method has been found to be effective for the control of parasitic weeds. However, the use of resistant cultivars seemed to be a more viable option.

Although organic manure contains plant nutrients in small quantities as compared to the fertilizers, the presence of growth promoting principles like enzymes and hormones, besides plant nutrients make them essential for improvement of soil fertility and productivity (Bhuma, 2001) Application of organic manures sustains cropping systems through better nutrientre cycling (Agbede *et al*., 2008; Ndung'u *et al*., 2003). Nutrients contained in organic manures are released more slowly and are stored for a longer time in the soil, thereby ensuring a long residual effect supporting better root development, leading to higher crop yields (Ibewiro *et al.,* 2000; Suge *et al.,* 2011).

Several researches focus on the effect of inorganic fertilizers on growth and yield of cowpea varieties and their effect on *Alectra* infestation in cowpea. It is essential to carry out research on the effect of manure on the growth and yield of different cowpea varieties and their effect to *Alectra* infestation. Therefore, this research is aimed determining the effect of sheep manure on the growth and yield of different cowpea varieties and *Alectra* infestation.

MATERIALS AND METHODS

STUDY AREA

Pot experiments were conducted in the Screen house at Department of Soil Science, Ahmadu Bello University, Samaru (11° 11′ N, 07°38′ E and 686m above sea level), Zaria, in the

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

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Northern Guinea Savanna ecological zone of Nigeria. The region is characterized with average annual temperature of 24.4^{0}C, relative humidity of 49 %, wind speed of 8 km/h and with annual rainfall of 1050 mm.

SOURCE OF MATERIALS

The seeds of the three varieties of cowpea that is SAMPEA 7, SAMPEA 9, and SAMPEA 14 were purchased from Seed Production Unit, Institute for Agricultural Research, Samaru- Zaria, for the study. Seeds of *Alectra* were obtained from International Institute of Tropical Agriculture, Kano. Sheep manure was collected from farmers from Kano state for the study.

PREPARATION OF *ALECTRA* SEEDS INOCULUM

About 10 g of *Alectra* seeds were weighed and put into polythene bag and 250 g sieved dried river sand were weighed and also put into the polythene bag. The *Alectra* seeds and 250 g sand were poured into a large polythene. These were mixed thoroughly by shaking in different direction for about 5 minutes. The same process was followed to obtain enough *Alectra* seeds inoculum for the experiment.

POT PREPARATION AND SEED PLANTING

Top Soil obtained from the Botanical Garden, Ahmadu Bello University, Samaru-Zaria, were sieved and mixed with sharp sand from nearby river in ratio 1:1. Sample of mixed sand-soil was then taken to Department of Soil Science, Institute for Agricultural Research, Samaru- Zaria, for physico-chemical analysis. The mixture was used to fill the nylon bags (20 x 18.9 cm) to be used as pots for the experiment.

The animal waste that is sheep manure was sun dried before being used for the experiment. The manure was mixed with soil in the upper part of the pot. The manure was applied at the rates of 0, 15, 30, and 45 kgN/ha and covered with soil. This procedure was repeated for the control without manure application and *Alectra* inoculation.

A hole was made in the centre of the soil in each pot, and a soft drink bottle top full of *Alectra* inoculums was introduced into the hole. The pot soil was watered for one week to precondition the *Alectra* seeds before sowing cowpea seeds. Cowpea seeds were dressed with Apron star prior to planting, each treatment was assigned 8 pots, and each treatment was replicated thrice. Then four seeds of cowpea were dropped in the hole and the hole was covered with soil. Cowpea seeds were planted at 2-3 cm depth in the pot. The treatments were laid out in completely randomized design. The pot soil was watered daily except when the sand was observed to have enough moisture. After germination, the seedlings were thinned to two plants per pot at three weeks after planting (WAP).

Cowpea seedlings were sprayed with benomyl and mancozeb (maneb/zinc complex) at the rate of 0.6 and 2.5 kg/ha respectively, to control fungal diseases and dimethoate at 0.75 kg/ha was applied at 3 weeks after planting (W AP), to prevent viral diseases. Cypermethrin and dimethoate (sherpa plus) was applied fortnightly at the rate of 1.0 kg/ha beginning from 7 WAP until harvest, to control insect pests during flowering and pod development. These chemicals were applied using a knapsack sprayer.

SAMPLING AND DATA COLLECTION

Sampling of the cowpea plants were conducted at 5, 7 and 9 WAP. On each of the sampling date, one pot was sampled per replicate from each treatment. The plants roots were gently separated from the soil and the plant was washed with water. The washed plant was spread on clean table for the water to drain off, then three plants from the replicates of each treatment were selected for determination of the vegetative growth parameters of the plants. Razor blade was used to separate the plants into root and shoot and each part was weighed on Metler balance and recorded.

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
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VEGETATIVE GROWTH PARAMETERS

Plant Height

Metre rule was used to measure the plant height of each sampled plants from the soil level to the stem tip at 5, 7, and 9 WAP from each treatment.

Number of leaves

The number of leaves from sampled plants from each treatment were counted and recorded.

Number of branches

Number of branches from sampled plant from each treatment were also counted and recorded.

Root Nodules

The root nodules were counted from each plant and recorded.

YIELD PARAMETERS

Dried pods were harvested at intervals into labeled envelopes and at the end of the harvest the following parameters were determined:

Pod Number

Number of pods harvested were counted and recorded for each treatment replicate. This was used to calculate the number of pods per plant from each treatment.

Pod Weight

The pods harvested from each treatment replicate were weighed on Metler balance. This was used to calculate pods weight per plant from each treatment. After this, the pods were threshed and winnowed to determine the following:

Seed Number

Number of seeds from each treatment replicate were counted and used to calculate seeds number per plant.

Total Seed Weight

The cowpea total seeds obtained per treatment were weighed on Metter balance and recorded and used to calculate seeds weight per plant.

100 Seed Weight

From the threshed and winnowed seeds, 100 seeds were counted from each treatment and
weighed on the weighing balance.

ALECTRA INFESTATION MEASUREMENT

Reactions of the cowpea varieties to *Alectra* infestation were determined by the following parameters viz; number of plants infected, *Alectra* shoot counts and crop damage score from each treatment on each sampling date.

DATA ANALYSES

The data collected from the experiment was subjected to Analysis of variance (ANOVA). Significant differences in treatment means were compared using Duncan Multiple Range Test (DMRT).

RESULTS

Physicochemical Properties of the Soil used for the Experiment

The physicochemical properties of the soil showed that, among the particle size distribution the sand recorded the highest value and this was followed by silt and the lowest value recorded was in clay (Table 1). The textural class analysis revealed that, the soil was predominantly sandy loamy. The pH of the soil showed that, the soil was slightly alkaline on both media (Table 1). The Available phosphorus (AP) and other mineral elements analyzed are as shown in Table 1.

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m.s.gaadankaya@gmail.com
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Table 1: Physicochemical Properties of the Soil used for the Experiment

Soil Parameters	Value
Particle Size	
Clay(%)	6
Silt(%)	16
Sand(%)	78
Textural Class	**Loamy Sand**
pH-H_20	7.6
pH-$CaCl_2$	7.46
OC(%)	1.537
TN(%)	0.21
P (ppm)	64.87
Ca (cmol/kg)	5.05
Mg (cmol/kg)	0.936
K (cmol/kg)	0.395
Na (cmol/kg)	0.254
H+Al	0.1
CEC	7.8

NB: OC= Organic Carbon, TN= Total Nitrogen, AP= Available Phosphorus, CEC= Cation Exchange Capacity, H+Al=Aluminium hydroxide

Effect of sheep manure treatments on the plant height of cowpea varieties on *Alectra* inoculated soil

Generally, the data showed that, there was no significant difference in plant height based on sheep manure treatments on all the sampling dates in the two trials. significant difference in the plant height among varieties was not observed on most of the sampling dates with the exception of that at 5 and 9 WAP in Trial I (Table 2).

Treatments

The result based on treatments showed that, there was no significant difference in the plant height of cowpea varieties among treatments on all the sampling dates of the two trials (Table 2).

Varieties

The result based on varieties showed that, there was no significant difference in the plant height among all the varieties on all the sampling dates of the two trials with the exception of that at 5 and 9 WAP in Trial I where the lowest plant height due to SAMPEA 14 at 5 WAP and SAMPEA 7 at 9 WAP were only significantly lower than the highest due to SAMPEA 9 on the two sampling dates (Table 2).

Table 2: Effect of sheep manure treatments on the Plant height of cowpea varieties on *Alectra* inoculated soil

	Sheep manure	Plant age (WAP) Plant height (cm)		
Trial	**Treatments (KgN/ha)**	**5**	**7**	**9**
I	0	26.84a	26.13a	35.16a
	15	25.79a	30.41a	41.34a

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m.s.gaadankaya@gmail.com
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Trial	Sheep manure Treatments (KgN/ha)	Plant age (WAP) Plant height (cm) 5	7	9
	30	29.02a	31.41a	34.46a
	45	28.68a	34.94a	42.37a
	Mean	27.58	30.66	38.33
	SE ±	1.82	3.00	4.31
	Varieties			
	SAMPEA 7	25.77ab	29.39a	29.48b
	SAMPEA 9	29.54a	33.63a	54.03a
	SAMPEA 14	25.12b	26.99a	37.07b
	Mean	26.81	30.00	40.19
	SE ±	1.41	2.33	3.34
II	0 *Alectra*	14.43a	13.46a	14.83a
	15kgN/ha	13.78a	14.71a	29.88a
	30kgN/ha	15.48a	31.20a	16.59a
	45kgN/ha	14.73a	16.83a	16.89a
	Mean	14.61	19.05	19.55
	SE ±	1.23	1.88	2.45
	Varieties			
	SAMPEA 7	14.39a	16.70a	15.51a
	SAMPEA 9	14.17a	13.57a	14.18a
	SAMPEA 14	13.69a	23.89a	26.20a
	Mean	14.08	18.05	18.64
	SE ±	1.19	1.33	2.01

NB: Means with the same letter(s) within each column, under each factor are not significantly different (P=0.05), using DMRT. 0 = Control without *Alectra* inoculation, WAP= Weeks after planting

Effect of sheep manure treatments on the number of leaves of cowpea varieties on *Alectra* inoculated soil

Generally, the data showed that, there was marked significant difference among number of leaves based on treatments in most of the sampling dates on both trials with the exception of that at 5 WAP of Trial I and 7 and 9 WAP of Trial II. Also, control resulted in lower number of leaves than the sheep manure treatments on most sampling dates (Table 3).

Treatments

At 7 WAP in Trial I, the lowest number of leaves due to control was only significantly lower than the highest due to 45 kgN/ha sheep manure treatments. At 9 WAP, the highest number of leaves due to 30 kgN/ha sheep manure treatment was comparable with that due to all the other treatments but significantly higher than the lowest due to control (Table 3). There was no significant difference in number of leaves in cowpea varieties among treatments at 7 and 9

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

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WAP in Trial II. At 5 WAP in Trial II, the lowest number of leaves due to control was significantly lower than that due to 30 and 45kgN/ha sheep manure treatments (Table 3).

Varieties

The data based on varieties showed that, there was no significant difference in the number of leaves among all the varieties at 7 WAP in Trial I and 7 and 9 WAP in Trial II. At 5 and 9 WAP in Trial I, the lowest number of leaves due to SAMPEA 7 at 5 WAP and SAMPEA 14 at 9 WAP were only significantly lower than the highest due to SAMPEA 14 (at 5 WAP) and SAMPEA 9 (at 9 WAP) (Table 3). At 5 WAP in Trial II, the highest due to SAMPEA 9 was only significantly higher than the lowest due to SAMPEA 14 (Table 3).

Table 3: Effect of sheep manure treatments on the Number of leaves of cowpea varieties on *Alectra* inoculated soil

	Sheep manure	**Plant age (WAP)**		
		Number of leaves		
Trial	**Treatments (KgN/ha)**	**5**	**7**	**9**
I	0	20.78a	19.56b	21.44b
	15	16.78a	24.67ab	28.56ab
	30	21.33a	24.33ab	35.56a
	45	24.22a	28.22a	31.78a
	Mean	20.78	24.20	29.34
	SE ±	2.55	2.31	3.13
	Varieties			
	SAMPEA 7	19.40b	22.60a	22.47b
	SAMPEA 9	25.13ab	25.93a	46.53a
	SAMPEA 14	25.60a	21.87a	20.93b
	Mean	23.38	23.47	30.00
	SE ±	1.98	1.79	2.43
II	0	7.00c	9.33a	13.56a
	15	7.67bc	11.56a	14.00a
	30	9.67a	12.00a	12.56a
	45	9.00ab	11.67a	16.11a
	Mean	8.34	11.14	14.06
	SE ±	1.12	1.25	1.34
	Varieties			
	SAMPEA 7	8.00a	11.27a	14.20a
	SAMPEA 9	9.00a	13.27a	15.27a
	SAMPEA 14	7.47b	11.13a	13.00a
	Mean	8.12	11.89	14.16
	SE ±	1.10	1.22	1.29

NB: Means with the same letter(s) within each column, under each factor are not significantly different (P=0.05), using DMRT. 0 = Control with *Alectra* inoculation, WAP= Weeks after planting

Effect of sheep manure treatments on the number of branches of cowpea varieties on *Alectra* inoculated soil

Generally, the data showed that, there was marked significant difference among number of branches based on sheep manure treatments in most of the sampling dates on both trials with

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

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the exception of those at 5 WAP in Trial I and 7 WAP in Trial II. However, the number of branches due to control was generally lower than that due to sheep manure treatments on most sampling dates. Significant difference among varieties was not observed on most sampling dates across the two trials (Table 4).

Treatments

The data showed similar trend at 7 and 9 WAP in Trial I where the lowest number of branches due to control at both sampling dates was only significantly lower than the highest due to 45 kgN/ha sheep manure treatments on the two sampling dates. There was no significant difference in number of branches among treatments at 5 WAP in Trial I (Table 4). At 5 WAP in Trial II, the highest number of branches due to 45 kgN/ha and 30 kgN/ha were only significantly higher than the lowest due to control which was comparable to that at 15 kgN/ha sheep manure treatment (Table 4). Also, at 9 WAP in Trial II, the lowest number of branches due to 15 kgN/ha was only significantly lower than the highest due to 45 kgN/ha sheep manure treatment (Table 4).

Varieties

The data based on varieties showed that, there was no significant difference in the number of branches among all the varieties at 5 and 7 WAP in Trial I and at 5 and 9 WAP in Trial II. At 9 WAP in Trial I, the lowest number of branches due to SAMPEA 14 was only significantly lower than the highest due to SAMPEA 9. Similarly, at 7 WAP in Trial II, the highest number of branches due to SAMPEA 9 was only significantly higher than the lowest due to SAMPEA 14 (Table 4).

Table 4- Effect of sheep manure treatments on the Number of branches of cowpea varieties on *Alectra* inoculated soil

	Sheep manure	**Plant age (WAP)**		
		Number of branches		
Trial	**Treatments (KgN/ha)**	**5**	**7**	**9**
I	0	7.89a	7.56b	15.11b
	15	6.44a	9.22ab	16.11b
	30	7.00a	9.89ab	15.78b
	45	7.22a	11.56a	20.56a
	Mean	7.14	9.56	16.89
	SE ±	0.55	1.15	1.49
	Varieties			
	SAMPEA 7	6.87a	9.67a	14.93b
	SAMPEA 9	7.80a	9.27a	20.93a
	SAMPEA 14	7.13a	9.80a	13.27b
	Mean	7.27	9.58	16.38
	SE ±	0.43	0.88	1.15
II	0	2.56b	5.33a	8.22b
	15	2.89b	6.33a	8.10b
	30	3.56a	6.22a	8.11b
	45	3.56a	6.56a	10.33a
	Mean	3.14	6.11	8.69

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Trial	Sheep manure Treatments (KgN/ha)	Plant age (WAP) Number of branches 5	7	9
	SE ±	0.52	1.02	1.13
	Varieties			
	SAMPEA 7	3.27a	6.53ab	8.60a
	SAMPEA 9	3.47a	7.13a	9.27a
	SAMPEA 14	3.13a	6.10b	8.07a
	Mean	3.29	6.58	8.65
	SE ±	0.32	0.82	1.02

NB: Means with the same letter(s) within each column, under each factor are not significantly different (P=0.05), using DMRT. 0 = Control without *Alectra* inoculation, WAP= Weeks after planting

Effect of sheep manure treatments on the number of root nodules of cowpea varieties on *Alectra* inoculated soil

Generally, the data showed that, there was no marked significant difference in number of root nodules on sheep manure treatments on most of the sampling dates in both trials with the exception of that at 9 WAP in Trial II. Also, most sheep manure treatments resulted in non-significant increase in number of root nodules compared with the control (Table 5).

Treatments

There was no significant difference in number of root nodules among treatments at all the sampling dates in Trial I and at 5 and 7 WAP in Trial II (Table 5). However, at 9 WAP in Trial II, the lowest number of root nodules due to control was only significantly lower than the highest due to 15 kgN/ha sheep manure treatment (Table 5).

Varieties

The data based on varieties showed similar trend in Trial I, in the sense that, the highest number of root nodules due to SAMPEA 9 at 5 and 9 WAP and SAMPEA 7 at 7 WAP were only significantly higher than the lowest due to SAMPEA 14 in all the sampling dates (Table 5). There was no significant difference in the number of root nodules among all the varieties at 7 WAP in Trial II but at 5 and 9 WAP in Trial II the lowest number of root nodules due to SAMPEA 9 at 5 WAP and SAMPEA 7 at 9 WAP were only significantly lower than the highest due to SAMPEA 14 in the two sampling dates (Table 5).

Table 5: Effect of sheep manure treatments on the Number of root nodules of cowpea varieties on *Alectra* inoculated soil

Trial	Sheep manure Treatments(KgN/ha)	Plant age (WAP) Number of root nodules 5	7	9
I	0	37.44a	50.00a	38.67a
	15	48.44a	58.22a	38.00a
	30	41.33a	50.67a	51.67a
	45	47.33a	60.67a	45.22a
	Mean	43.63	54.89	43.39
	SE ±	5.37	6.27	6.73
	Varieties			
	SAMPEA 7	48.40a	65.20a	52.71a
	SAMPEA 9	55.67a	57.93a	60.73a

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	SAMPEA 14	33.13b	33.53b	31.00b
	Mean	45.73	52.22	48.51
	SE ±	4.16	4.85	5.21
II	0	21.23a	20.97a	19.18b
	15	19.18a	21.57a	29.18a
	30	20.40a	20.69a	22.81ab
	45	22.37a	24.30a	24.29ab
	Mean	20.80	21.88	23.87
	SE ±	2.85	1.89	2.95
	Varieties			
	SAMPEA 7	18.51b	21.34a	21.03b
	SAMPEA 9	18.10b	21.53a	22.61ab
	SAMPEA 14	23.25a	23.01a	27.32a
	Mean	19.95	21.96	23.65
	SE ±	1.76	2.32	2.73

NB: Means with the same letter(s) within each column, under each factor are not significantly different (P=0.05), using DMRT. 0 = Control without *Alectra* inoculation, WAP= Weeks after planting

Effect of sheep manure treatments on the root length of cowpea varieties (combined data) on *Alectra* inoculated soil

Generally, the data showed that, there was no marked significant difference in the root length based on sheep manure treatments on most of the sampling dates in both trials with the exception of that at 7 WAP in Trial II. Also, root length due to most treatment in most sampling dates were comparable. Also, the root length due to SAMPEA 7 was significantly higher than that of other varieties on all the sampling dates in Trial II among cowpea varieties was observed on most sampling dates across the two trials (Table 6).

Treatments

There was no significant difference in root length among the treatments in all the sampling dates in Trial I and at 5 and 9 WAP in Trial II (Table 6). However, at 7 WAP in Trial II, the lowest root length due to 30 kgN/ha was only significantly lower than the highest due to 45 kgN/ha sheep manure treatment (Table 6).

Varieties

The result based on varieties showed that, there was no significant difference in root length among varieties at 7 and 9 WAP in Trial I. However, at 5 WAP in Trial I, the highest root length due to SAMPEA 14 was only significantly higher than the lowest due to SAMPEA 7 (Table 6). In Trial II, similar trend was observed in all the sampling dates in the sense that, the lowest root length due to SAMPEA 14 was only significantly lower than the highest due to SAMPEA 7 on all the sampling dates in Trial II (Table 6).

Table 6: Effect of sheep manure treatments on the Root length of cowpea varieties on *Alectra* inoculated soil

	Sheep manure	**Plant age (WAP)**		
		Root length (cm)		
Trial	**Treatments(KgN/ha)**	**5**	**7**	**9**
I	0	38.71a	43.54a	50.46a
	15	29.00a	49.10a	37.42a
	30	30.56a	44.89a	40.82a
	45	33.52a	39.77a	40.90a
	Mean	32.94	44.33	42.40

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

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Trial	Sheep manure Treatments(KgN/ha)	Plant age (WAP) Root length (cm) 5	7	9
	SE ±	3.49	4.92	4.82
	Varieties			
	SAMPEA 7	31.51b	41.27a	43.73a
	SAMPEA 9	33.87ab	40.61a	45.29a
	SAMPEA 14	39.83a	43.38a	36.60a
	Mean	35.07	41.75	41.87
	SE ±	2.70	3.81	3.74
II	0	18.67a	18.67b	22.33a
	15	19.33a	20.56ab	17.89a
	30	19.33a	17.22b	27.22a
	45	20.67a	29.89a	29.67a
	Mean	19.50	21.59	24.28
	SE ±	2.24	2.72	2.95
	Varieties			
	SAMPEA 7	12.07a	32.73a	38.95a
	SAMPEA 9	8.80b	36.80a	28.13b
	SAMPEA 14	7.53b	25.67b	28.13b
	Mean	9.47	31.73	31.74
	SE ±	1.26	1.99	2.65

NB: Means with the same letter(s) within each column, under each factor are not significantly different (P=0.05), using DMRT. 0 = Control without *Alectra* inoculation, WAP= Weeks after planting

Effect of sheep manure treatments on the shoot fresh weight of cowpea varieties on *Alectra* inoculated soil

Generally, the data showed that, there was marked significant difference in shoot fresh weight based on sheep manure treatments on all the sampling dates in Trial II but there was no significant difference in shoot fresh weight based on treatments on the sampling dates in Trial I. The 30 and 45kgN/ha sheep manure treatments produced non-significant increase compared with the control in the two Trials (Table 7). However, non-significant difference in shoot fresh weight among varieties was observed on most sampling dates across the two trials (Table 7).

Treatments

There was no significant difference in shoot fresh weight among treatments at all the sampling dates in Trial I (Table 7). At 5 WAP in Trial II, the highest shoot fresh weight due to 45 kgN/ha was similar to that due to 15 and 30 kgN/ha sheep manure treatments but significantly higher than that due to control (lowest). Also, at 7 and 9 WAP in Trial II, the lowest shoot fresh weight due to control was only significantly lower than the highest due to 45 kgN/ha sheep manure treatments in the two sampling dates (Table 7).

Varieties

The result based on varieties showed that, there was no significant difference in the shoot fresh weight among varieties in all the sampling dates of the two trials with the exception of that at 7 WAP in Trial II where the lowest shoot fresh weight due to SAMPEA 14 was only significantly lower than the highest due to SAMPEA 7 (Table 7).

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

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Table 7: Effect of sheep manure treatments on the Shoot fresh weight of cowpea varieties on *Alectra* inoculated soil

	Sheep manure	Plant age (WAP) Shoot fresh weight (g)		
Trial	Treatments(KgN/ha)	5	7	9
I	0	11.83a	17.51a	20.14a
	15	11.42a	16.11a	26.83a
	30	13.36a	19.27a	20.64a
	45	13.99a	21.38a	24.70a
	Mean	12.65	18.57	23.08
	SE ±	0.94	1.93	4.12
	Varieties			
	SAMPEA 7	12.86a	16.89a	23.45a
	SAMPEA 9	13.23a	19.35a	31.71a
	SAMPEA 14	13.95a	18.56a	26.01a
	Mean	13.35	18.27	27.06
	SE ±	0.73	1.49	3.19
II	0	2.10b	2.59b	3.60b
	15	2.13ab	3.28ab	3.44b
	30	2.58a	3.18ab	4.02b
	45	2.59a	4.17a	5.68a
	Mean	2.35	3.31	4.19
	SE ±	0.42	0.88	1.12
	Varieties			
	SAMPEA 7	2.20a	4.12a	4.69a
	SAMPEA 9	2.08a	2.99b	3.58a
	SAMPEA 14	2.28a	2.89b	3.99a
	Mean	2.19	3.33	4.09
	SE ±	0.32	0.58	0.89

NB: Means with the same letter(s) within each column, under each factor are not significantly different (P=0.05), using DMRT. 0 = Control without *Alectra* inoculation, WAP= Weeks after planting

Effect of sheep manure treatments on the root fresh weight of cowpea varieties on *Alectra* inoculated soil

Generally, the data showed that, there was marked significant difference in shoot fresh weight based on treatments on all the sampling dates in Trial II but there was no significant difference in shoot fresh weight based on treatments on all the sampling dates in Trial I. Most treatments resulted in comparable root fresh weight in the two trials. Significant difference in root fresh weight among varieties was observed on most sampling dates across the two trials (Table 8).

Treatments

There was no significant difference in root fresh weight among treatments at all the sampling dates in Trial I. (Table 8). At 5 WAP of Trial II, the lowest root fresh weight due to 15 kgN/ha was only significantly lower than the highest due to 45 kgN/ha sheep manure treatment. Also, similar trend was observed at 7 and 9 WAP in Trial II in the sense that, the lowest root fresh weight due to control were only significantly lower than the highest due to 45 kgN/ha sheep manure treatments on the two sampling dates in this trial (Table 8).

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

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Varieties

The data based on varieties showed that, there was no significant difference in the root fresh weight among varieties on most sampling dates in Trial I except that at 9 WAP where the highest root fresh weight due to SAMPEA 7 was only significantly higher than the lowest due to SAMPEA 14. In Trial II, similar trend was observed in the sense that, the lowest root fresh weight due to SAMPEA 9 at 5 and 9 WAP and due to SAMPEA 14 at 7 WAP were only significantly lower than the highest due to SAMPEA 14 at 5 WAP and due to SAMPEA 7 at 7 and 9 WAP in Trial II (Table 8).

Table 8: Effect of sheep manure treatments on the Root fresh weight of cowpea varieties on *Alectra* inoculated soil

	Sheep manure	**Plant age (WAP)**		
		Root fresh weight (g)		
Trial	**Treatments(KgN/ha)**	**5**	**7**	**9**
I	0	1.49a	3.47a	4.43a
	15	2.00a	3.73a	3.73a
	30	2.30a	4.76a	4.67a
	45	2.36a	4.23a	4.92a
	Mean	2.04	4.04	4.44
	SE ±	0.28	0.75	0.64
	Varieties			
	SAMPEA 7	2.37a	4.73a	6.55a
	SAMPEA 9	2.56a	4.12a	5.87a
	SAMPEA 14	2.37a	3.57a	4.42b
	Mean	2.43	4.14	5.61
	SE ±	0.22	0.58	0.49
II	0	0.20b	0.32b	0.56b
	15	0.15b	0.40b	0.66b
	30	0.21b	0.37b	0.72ab
	45	0.33a	0.81a	0.99a
	Mean	0.22	0.48	0.73
	SE ±	0.15	0.17	0.18
	Varieties			
	SAMPEA 7	0.21ab	0.68a	0.93a
	SAMPEA 9	0.17b	0.39b	0.53b
	SAMPEA 14	0.27a	0.37b	0.61b
	Mean	0.22	0.48	0.69
	SE ±	0.05	0.07	0.10

NB: Means with the same letter(s) within each column, under each factor are not significantly different (P=0.05), using DMRT. 0 = Control without *Alectra* inoculation, WAP= Weeks after planting

Effect of sheep manure treatments on the yield parameter of cowpea varieties on *Alectra* inoculated soil

Treatments

The data on yield parameters in Trial I showed that, sheep manure treatment resulted in a non-significant increase in most of the yield

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

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parameters. This observation was in contrast to that in Trial II where there was significant increase in most of the yield parameters compared with the control (Table 9). In Trial II, all the yield parameters followed similar pattern in the sense that, the lowest value of the yield parameters due to control was only significantly lower than the highest due to 30 and 45 kgN/ha sheep manure treatment for pods number and 45 kgN/ha sheep manure treatment for all the other yield parameters (Table 9).

Varieties

In Trial I, the data on the effect of sheep manure treatments on cowpea varieties yield parameters followed similar pattern in the sense that, the lowest value of all the yield parameters due to variety SAMPEA 7 was only significantly lower than the highest due to SAMPEA 14. (Table 9). In Trial II, SAMPEA 14 resulted in higher pods weight, seeds number, seeds weight and 100 seed weight which was only significantly higher than the lowest produced by variety SAMPEA 9 in most of the yield parameters (Table 9).

Table 9: Effect of sheep manure treatments on the Yield parameters of cowpea varieties on *Alectra* inoculated soil

	Yield parameters					
Trial	**Treatments (kgN/ha)**	**Pods number**	**Pods weight (g)**	**Seeds number**	**Seeds weight (g)**	**100 seeds weight(g)**
I	0	17.11a	13.48a	83.00a	11.20a	14.44a
	15	18.22a	16.56a	86.44a	13.50a	16.36a
	30	15.33a	14.97a	83.11a	12.14a	14.74a
	45	14.89a	15.74a	86.22a	11.91a	14.71a
	Mean	16.39	15.19	84.69	12.19	15.06
	SE ±	1.21	1.19	7.89	1.10	1.18
	Varieties					
	SAMPEA 7	11.43b	9.59b	59.64b	7.84b	14.04b
	SAMPEA 9	13.64b	11.21b	72.71b	10.98b	14.60b
	SAMPEA 14	23.36a	24.74a	128.36a	19.13a	16.99a
	Mean	16.14	15.18	86.90	12.65	15.21
	SE ±	1.21	1.19	7.89	1.10	1.18
II	0	6.11b	2.68c	24.33b	2.04b	9.13b
	15	8.11b	4.57b	26.44ab	3.31b	10.28b
	30	12.89a	3.79bc	34.78ab	2.04b	11.59ab
	45	13.44a	7.89a	43.25a	6.36a	13.22a
	Mean	10.14	4.73	32.20	3.44	11.06
	SE ±	0.89	0.54	2.41	0.57	1.10
	Varieties					
	SAMPEA 7	8.64b	5.39a	33.57a	4.22a	12.99a
	SAMPEA 9	6.71b	2.62b	20.43b	2.15b	10.14b

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

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SAMPEA 14	14.07a	5.56a	40.15a	4.28a	10.76b
Mean	9.81	4.52	31.38	3.55	11.30
SE ±	0.89	0.54	2.41	0.57	1.10

NB: Means with the same letter(s) within each column, under each factor are not significantly different (P=0.05), using DMRT. 0 = Control without *Alectra* inoculation, WAP= Weeks after planting

Effect of Sheep manure treatments on *Alectra* infestation of different cowpea varieties

Generally, the result showed that, the highest number of *Alectra* shoots produced due to variety SAMPEA 7 was only significantly higher than the lowest *Alectra* shoots produced due to SAMPEA 14 in Trial I and II (Table 10).

Also, the highest number of *Alectra* shoots produced due to sheep manure was at 45 kgN/ha treatment in Trial I and it was only significantly higher than the lowest due to control and 15 kgN/ha sheep manure treatment. In trial II, the highest number of *Alectra* shoots produced due to 45 kgN/ha was similar to that at 30 kgN/ha treatment but significantly lower than all the other treatments. However, the lowest number of *Alectra* shoots produced due to control was significantly lower than all the other sheep manure treatments in Trial II (Table 10).

Table 10: Effect of sheep manure treatments on *Alectra* infestation (combined data) of cowpea varieties

Trial	Treatments (KgN/ha)	Alectra Shoots Number
I	0	0.00b
	15	2.56b
	30	11.56ab
	45	15.67a
	Mean	9.93
	SE±	2.76
	Varieties	
	SAMPEA 7	12.33a
	SAMPEA 9	5.53ab
	SAMPEA 14	0.00c
	Mean	5.95
	SE±	1.06
II	0	0.00c
	15	3.44b
	30	7.00a
	45	7.00a
	Mean	4.36
	SE±	1.02
	Varieties	
	SAMPEA 7	5.79a
	SAMPEA 9	6.50a
	SAMPEA 14	0.00b
	Mean	4.1
	SE±	0.95

NB: Means with the same letter(s) within each column, are not significantly different (P=0.05) using DMRT
0 = Control without *Alectra* inoculation

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

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DISCUSSION OF FINDINGS

The result showed that, the application of sheep manure waste influenced the growth parameters of all the cowpea varieties. The improvement in the growth parameters is associated with the increase in plant nutrients as affirmed by Abayomi *et al*. (2008) that, application of the manure enhanced the growth parameters of cowpea varieties. The availability of sufficient growth nutrients from inorganic fertilizers lead to improved cell activities, enhanced cell multiplication and enlargement and luxuriant growth (Fashina *et al*., 2002). Nitrogen fertilizer reduced the severity of *Striga* attack while simultaneously increased the host performance (Lagoke and Isah, 2010). The increase in growth parameters of cowpea varieties in *Alectra* inoculated soil with increased manure rates is not unexpected and might be more possible due to the direct effect of nutrient on vegetative growth and its indirect effect by reducing *Alectra* infestation which was reported to have negative effect on growth of plant (Olupot *et al*., 2003).

The increase in growth parameters at 9 WAP could be attributed to low nutrient demand or low *Alectra* infestation at the age. In Trial I, cowpea variety SAMPEA 9 produced the highest values in most growth parameters, excluding Root Fresh Weight. On the other hand, in Trial II SAMPEA 7 produced the highest Number of Leaves, Root Length, Shoot Fresh Weight and Root Fresh Weight, but SAMPEA 9 produced the lowest Plant Height, Number of Root Noodles, Root Length, Shoot Fresh Weight and Root Fresh Weight in Trial II. These differences could be the character resulting from the crop genetic makeup and their differences in response to the effect of manure and this agrees with the findings of Abayomi *et al* (2008) that, application of fertilizer leads to more leaves and branches of cowpea. Also, Omotosho (2014) reported that, the number of leaves and number of branches per plant were also significantly increased with the increased rate of fertilizer application. Control resulted with the lowest values of parameters recoded especially at the Trial II when compared with the *Alectra* inoculated soil.

Sheep Manure application significantly increased all the yield parameters in Trial I. This is due to the activities of the manure on root/vegetative growth and root nodulation. These growth parameters were significantly improved by the application of manure and hence significant increase in grain yield and yield parameters. This is in line with the report of Abayomi *et al*. (2008) that, yield parameters and consequently grain yield were significantly increased by fertilizer application at 30-15-15-kgN-P-K/ha. *Alectra vogelii* inoculation did not significantly reduced the yield parameters of cowpea varieties on *Alectra* inoculated soil in Trials I and II. This is not in accordance with the report that, *A. vogelii* infestation causes a reduction in number of pods per plant, weight of pod, number of seeds per pod, weight of seeds and chlorophyll contents of the leaves among susceptible genotypes (Kutama *et al*., 2013).

However, despite the *Alectra* inoculation, the application of manure resulted in an increase in pod number, pod weight, seed number, seed weight, and 100 seed weight. This increase was due to the presence of adequate nutrient in the soil resulting from the manure application. This observation is in line with the findings of Kwaga *et al*. (2010) that, *Alectra* incidence was suppressed with fertilizer application at 50 kgN/ ha and thus increased pod yield above that of unfertilized plant.

The SAMPEA 14 generally produced the highest yield parameters when compared with the other cowpea varieties, this might be as a result of difference in genetic make-up and the variety resistance to the *Alectra*. Generally, variety SAMPEA 9 despite the high number of *Alectra* shoots present, produced the highest growth parameters due to sheep manure in Trial I. This variety is either moderately resistant or tolerant to *A. vogelii*. This might be due to the death of the *Alectra* shoots shortly after emergence which is one of the resistance mechanisms advocated by Kwaga *et al*. (2010). Kureh and Alabi (2003) considered tolerance as a horizontal resistance which is polygenic in contrast to vertical resistance which breaks down faster with time. Since the tolerant genotype can produce high yield in spite

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

of high parasitism, it implies that it is very efficient in the production of assimilates to support the parasites and still have enough to give high yields (Musell, 1980).

Control produced the lowest *Alectra* shoot when compared with the other treatments in the two Trials. This might be a result of absence of *Alectra* infestation in the treatment. The highest growth of *Alectra* shoot due to 45kgN/ha followed by 30kgN/ha in the two trials could be due to the presence of high level of Nitrogen in the soil. This is in contrast to the efficacy of nitrogen in reducing *Alectra* shoots in Soybean as reported by Tarfa *et al*. (1996). Similar effect of the nutrient was observed on cowpea by Magani (1994). Similarly, Kwaga *et al*. (2010), reported significant reduction in of *Alectra vogelii* shoots when 25 kgN/ha was applied to groundnut. The suppressing effect of nitrogen on parasitic weeds has to do with the lethal effect of the nutrient on the weeds. However, it was shown that, variety SAMPEA 14 exhibited the highest resistance to *Alectra* having shown the lowest *Alectra* incidence in Trials I and II. This could be attributed to the possibility of its producing the least germination stimulant (Kwaga *et al*., 2010). However, SAMPEA 7 was found to support the highest number of *Alectra* shoots throughout the growth period.

CONCLUSION AND RECOMMENDATIONS

In conclusion, application of manure at 15 – 45 kgN/ha generally influenced the vegetative growth parameters of the cowpea varieties on *Alectra* inoculated soil. Also, application of manure at 15 – 45 kgN/ha increased the yield parameters of the three cowpea varieties on *Alectra* inoculated soil. Application of sheep manures at 45 kgN/ha had the highest incidence of *Alectra vogelii*.

In view of this findings, it was recommended that. Sheep manure should be considered as an efficient control measure for *Alectra* infestation on susceptible cowpea varieties due to its ability to supply adequate nutrient to the soil to enhance its fertility, which in turn reduced the adverse effects of *Alectra vogelii* infestation. Also, Resistant varieties such as SAMPEA 14 should be cultivated most especially for commercial purpose.

REFERENCES

Abayomi, Y. A., Ajibade, T. V., Sammuel, O. F. and Sa'adudeen, B. F. (2008). Growth and Yield Responses of Cowpea (*Vigna unguiculata* (L.) Walp) Genotypes to Nitrogen Fertilizer (NPK) Application in the Southern Guinea Savanna Zone of Nigeria. *Asian Journal of Plant Sciences*, *7*(2): 170-176.

Agbede, T. M., S. O. Ojeniyi and Adeyemo (2008). Effect of poultry manure on soil physical and chemical properties, growth and grain yield of *Sorghum* in Southwest, Nigeria. *American-Eurasian Journal Sustainable Agriculture*. 2:72-77.

Bhuma, M. (2001). Studies on the impact of humic acid on sustenance of soil fertility and productivity of greengram. *MSc (Ag) Thesis. TNAU. Coimbatore*, India.

Boukar O, Fatokun C A, Robert P A *et al*. (2015), "Cowpea". In: De Ron, A. M. (Ed.), *Grain Legumes, Serie Handbook of Plant Breeding*, Springer, New York, pp. 219-250.

Bressani, R (1985). Nutritive value of Cowpea. In: Singh, S. R. and Rachie, K. O. (Eds)*,Cowpea Research, Production and Utilization*. John Wiley & Sons Ltd. London, pp 335-340

Fashina, A. S.. Olatunji, K. A. and Alasiri, K. O. (2002). Effects of Different Plant Population and Poultry Manure on Yield of Ugu (*Telfairia occidentalis*) in Lagos State, Nigeria. In: *Proceedings of the Annual Conference of Horticultural Society of Nigeria* (HORTON), pp.123-127.

Hall, A. E. (2004) Breeding for adaptation to drought and heat in cowpea. *European Journal of Agronomy*., 21: 447-454.

Ibewiro, B. N., Sanginga, N. B., Vanlauwe, and Merckx, R. (2000). Nitrogen contribution from decomposing cover crop residues to maize in a tropical derived savanna. *Nutrient. Cycling in Agroecosystems.* 57: 131-140.

Kureh, 1. and Alabi, S. O. (2003). The parasitic angiosperm *Alectra vogelii* (Benth) can influence the growth and nodulation of host soybean (*Glycine max*. L.) Merill. *Crop Protection* 22: 361-367.

Kutama, A. S., Auyo, M. I., Umar, S. and Umar, M. L. (2013). Reduction in growth and yield

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.

parameters of *Sorghum* genotypes screened for loose smuts in Nigerian Sudan Savanna. *World Journal of Agricultural Sciences*, *1*(5): 185-192.

Kwaga, Y. M., Olufajo, B., Tanimu, J. A., Shebayan, Y. and Lagoke. S. T. O. (2010). The reaction of groundnut {*Arachis hypogaea* L.} to *Alectra* parasitism as influenced by nitrogen and phosphorus fertilization at Samaru, Nigeria. *American-Eurasian Journal of Agriculture and Environmental Science,* 7(6):623-627.

Lagoke, S. T. O. and Isah, K. M. (2010). Reaction of maize varieties to *Striga hermonthica* as influenced by food legume intercrop, spacing and split application of compound fertilizer. *Nigerian Journal of Weed Science*, *23*: 45-58.

Magani, E. I. (1994). Effects of fertilizers and herbicides on the reaction of cowpea varieties (*Vigna unguiculata (L*.) Walp) to *Alectra vogelii* (Benth). Ph.D. Dissertation, Ahmadu Bello University, Zaria, Nigeria, 185pp.

Magani, I. E and Lagoke, S. T. O. (2009). Mechanism of reaction of cowpea varieties to, *Alectra vogelii* (Benth) and its control. *Journal of Applied Biosciences,* 14:775-781

Musell, H. (1980). Tolerance to Disease. In: Horsfall, J. and Cowling, E. B. (Ed.). *How Plant Defend themselves. An Advanced Treatise*. Academic Press, New York. 5:39-46.

Ndung'u, K. W., Kifuko, M. N. and Okalebo, J. R. (2003). Producing fortified compost from crop residues. In: Savala *et al.* (Ed) *Organic Resource Management in Kenya*. FORMAT, Nairobi. pp. 71-74.

Ogborn, J. E. A. (1987). *Striga* control under peasant farming conditions. In: L. J. Musselman, (Ed). Parasitic weeds in Agriculture. Vol. I, *Striga*. CRC Press, Boca Raton, 145-158.

Olupot, J. R., Osiru, D. S. O., Oryokot, J. and Gebrekidan, B. (2003). The Effectiveness of *Celosia argentia* (*Striga* Chaser) to Control *Striga* in *Sorghum* in Uganda. *Crop Protection,* 22: 463-468.

Omotoso, S. O. (2014). Influence of NPK 15-15-15 Fertilizer and Pig Manure on Nutrient Dynamics and Production of Cowpea (*Vigna unguiculata* L. Walp). *American Journal of Agriculture and Forestry* 2(6): 267-273.

Parker, C. and Riches, C. R. (1993). *Parasitic weeds of the world: biology and control*. CAB International. Wallingford, Oxon, UK. ISBN 0851988733 (hard bound)

Parkinson, J. A., Thompson, K. E. N., Band, S. R., and Spencer, R. E. (1997). A comparative study of leaf nutrient concentrations in a regional herbaceous flora. *New Phytologist*, *136*(4): 679-689.

Sand, P. F., Epele, and Wesbrooks, R.G. (1990). *Witch Weed Research and Control in the United States*. Print Book Publisher : Weed Science Society of America, Champaign,IL.

Singh, B. B, Ajeigbé, H. A, Tarawali, S. A, Fernandez-Rivera, S, Musa, A. (2003). Improving the production and utilization of cowpea as food and fodder. *Field Crops Research.,* 84(1-2): 169-177.

Suge, J. K., Omunyin, M. E., and Omami, E. O. (2011). Effect of Organic and Inorganic fertilizers on growth, yield and fruit quality of egg plant. *Archive of Applied Research.* 6:470-479.

Takim, F. O. and Uddin, R. O. (2010). Effect of Weed Removal on Insect Populations and Yield of Cowpea (*Vigna uguiculata* (L) Walp). *Australian Journal of Agricultural Engineering*, 1(5): 194-199.

Tarawali, S. A, Singh, B. B, Gupta, S. C, Tabo, R, and Harris, F (2002) Cowpea as a key factor for a new approach to integrated crop livestock systems research in the dry savannas of West Africa. International Institute of Tropical Agriculture, Ibadan, Nigeria pp.233-251.

Tarfa, B. D., Kureh, I. and Lagoke, S. T. O. (1998). Effects of Nitrogen and Phosphorus Levels on the Reaction of Soybean Cultivars to *Alectra vogelli* (Benth). *American-Eurasian Journal of Agriculture and Environmental Science*, 7(6):628-633.

Upahi, L., Aina, O. A., Muhammad, I. U., Salihu, M. U. and Animkou, M. E. (2026). Assessment of Vehicular Emissions Effect on some Heavy Metals content in *Hyptis suaveolens* Found along Zaria-Giwa Road, Kaduna state, Nigeria. *Nigerian Journal of Biotechnology and Life Sciences,* 3(1): 30-50.

Upahi, L., Alonge, S. O. and Balarabe, M. L. (2021). Assessment of some Heavy Metals Accumulation in *Borreria verticillata* Found along Zaria-Giwa road, Kaduna state, Nigeria. *Science World Journal*, 16(1): 48-56.

Corresponding author: Salihu M. U.
m.s.gaadankaya@gmail.com
Department of Botany, Ahmadu Bello University, Zaria, Nigeria.