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EFFECT OF *GLOMUS DESERTICOLA* ON PLANT HEIGHT AND LEAF NUMBER OF COWPEA VARIETIES (*VIGNA UNGUICULATA* (L.) WALP) ON *ALECTRA VOGELII* INOCULATED SOIL.

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ABSTRACT

This research was conducted to evaluate the effect of *Glomus deserticola* on plant height and leaf number of four cowpea varieties on *Alectra vogelii* inoculated soil. Four cowpea varieties used were: SAMPEA 7, IFE 82-12, IT97K-499-35 and TVX 3236. The sterilized sandy-loamy soil used for this experiment consisted of mixture of top soil and sand in

Introduction

Cowpea is grown across the world on an estimated 14.5 million hectares of land, planted each year and the total annual production is 6.2 million metric tons (Boukar *et al.*, 2016). Cowpea is of major importance to the livelihoods of millions of relatively poor people in less developed countries of the tropics (FAO, 2002). Islam *et al.* (2006) emphasized that all parts of the plant used as food are nutritious providing protein and vitamins, immature pods and peas are used as vegetables while several snacks and main dishes are prepared from the grains. Cowpea is of

ratio 1:1 (v/v). *Glomus deserticola* was applied in five rates: the control without *Alectra*, control with *Alectra*, 10, 20 and 30 g/pot. A constant quantity of *Alectra* was maintained. The treatments were arranged in complete randomized design. Four cowpea seeds were planted per pot but later thinned to two seedlings per pot at 2 weeks after planting (WAP). These cowpea plants were sampled for plant height and leaf number at 5, 7 and 9 WAP. The ANOVA of the three years data showed that *Glomus deserticola* treatment at 30 g/pot along the control minus *Alectra* treatment resulted in the highest plant height of the cowpea varieties. In addition, *Glomus deserticola* treatments significantly increased plant height and leaf number compared with control plus *Alectra* treatment. Cowpea variety SAMPEA 7 and/or TVX 3236 mostly resulted in higher plant height compared with other cowpea varieties at 9 WAP. Similarly, Cowpea variety TVX 3236 mostly produced higher leaf number compared with other cowpea varieties at 7 WAP. From this study, *Glomus deserticola* at different concentrations resulted in significant increase in the plant height and leaf number of the four cowpea varieties compared with the control plus *Alectra* treatment.. Therefore, in relation to plant height and leaf number of the four cowpea varieties, *Glomus deserticola* is recommended as a biological control agent on an *Alectra vogelii* infested soil.

Keywords: *Glomus deserticola*, *Alectra vogelii*, Cowpea Varieties, Plant Height, Leaf Number.

considerable nutritional and health value to man and livestock (Agbogidi, 2010).

In Nigeria, cowpea is mainly produced in the North in the Savannah belt. Between 10 and 100 % loss in crop yield is said to be caused by parasitic weeds (Aggarwal and Ouedraogo, 1989). *Alectra vogelii* which affects cowpea adversely is in the Orobanchaceae family (Broomrape family) or sub-family Orobanchoideae of Scrophulariaceae. It is also a serious weed of late planted groundnut and soybean in the same ecological zone (Nikcrent and Musselman,

2004). A few other species have also been reported as pests of sunflower and tobacco (Nikcrent and Musselman, 2004).

Considering the limitations of the current control methods, there is still need to search for an effective control measure that can be suitable for the host plant, safe for the environment, control the parasite and can be easily adopted by poor resource farmers. A Mycorrhiza is a symbiotic (generally mutualistic, but occasionally weakly pathogenic) association between a fungus and the roots of a vascular plants (Kirk *et al*., 2001). The benefit of the fungus is the receipt of carbohydrates from the plant while the host plant obtains a larger surface area to support the uptake of nutrients from the soil as a result of the symbiotic association (John *et al*., 1983). Mohammed *et al.* (2001) carried out a study to test the effect of mycorrhiza fungi and plant growth promoting bacteria on *Striga* control in Sorghum. The research indicated that AM fungi negatively impacted on *Striga* germination. Information concerning the effect of AM on *A. vogelii* infestation of Cowpea varieties could be valuable to Cowpea breeders in planning future Cowpea selection and development programmes aimed at increasing cowpea yield. This study was conducted to evaluate the tripartite interactions between Cowpea varieties, Arbuscular Mycorrhizal Fungi and *Alectra vogelii* with emphasis on the role of the fungi on plant height and leaf number of Cowpea varieties.

MATERIALS AND METHODS

This pot experiment was conducted on a fenced farmland at Agwa New Extension, Trikania, Kaduna in 2016, 2017 and 2019 wet seasons. The four cowpea varieties comprising of two susceptible varieties (SAMPEA 7 and TVX 3236) and two moderately resistant varieties to *Alectra* (IFE 82-12 and IT97K-499-35) were obtained from the Institute for Agricultural Research (IAR), Ahmadu Bello University, Zaria. Also, the *Alectra* seeds and AM inoculum were gotten from IAR farms, Zaria and University of Ibadan, Ibadan respectively. The method of Heckman and Angle (1987) was used to prepare *Glomus deserticola* inoculum. Soil composed of a mixture of topsoil and sharp sand in ratio 1:1 was sieved, sterilized and placed in polythene bags (used as pots) and used for

planting. Four seeds each of the different cowpea varieties were planted in each polythene bag. They were arranged at an intra-row spacing of 0.30 m. The cowpea plants were inoculated with propagules of *Glomus deserticola* depending on the treatments (control without *Alectra*, control with *Alectra*, 10, 20 and 30 g per pot) with a constant quantity of *Alectra*. The AM fungal inoculum was mixed with the top 3 cm of the pot soil for the relevant treatments. Each of the treatment above had three replicates and each replicate was represented by 8 pots. The treatments were arranged in Complete Randomized Design (CRD).

The plants were thinned to two plants per pot at two weeks after planting. The cowpea seedlings were sprayed with Benlate (Benomyl) and Dithane M45 (Carbendazim) at the product rate of 0.6 kg/ha and 2.5 kg/ha respectively (to control fungal diseases) and Rogor (dimethoate) at 0.75 L/ha at 4 WAP, to prevent viral diseases. Sherpa plus (cypermethrin + perfekthion) was applied fortnightly at the rate of 1.0 L/ha, beginning from 7 WAP until harvest, to control insect pests during flowering and pod development. Weeds with the exception of *Alectra* were controlled by hand pulling as at when necessary from 2 WAP. The sampled plants were brought to the laboratory in labeled polythene bags, washed carefully with tap water and the surface water was allowed to drain. The plant height was measured using measuring tape from soil level to terminal bud at two weeks interval beginning from 5 to 9 WAP. The number of leaves was determined by counting the number of leaves for each seedling at two weeks interval beginning from 5 to 9 WAP.

ANALYSIS OF DATA

The data obtained on the growth parameters were subjected to analysis of variance (ANOVA) as described by Lawes Agricultural Trust (1980), to compare the varietal reaction of cowpea varieties to parasitism by *Alectra vogelii* in the presence of Arbuscular mycorrhizal fungi. Significant differences between treatments means were compared using Duncan Multiple range test (DMRT).

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RESULTS

Most *Glomus deserticola* treatments at 5 and 7 weeks after planting (WAP) for both 2016 and 2017 showed no significant effect on plant height. *Glomus deserticola* only showed significant effect on the plant height of variety IFE 82–12 at 5 and 7 WAP in 2016, TVX 3236 at 5 WAP in 2016 and SAMPEA 7 at 7 WAP in 2016 (Table 1). At 9 WAP, *Glomus deserticola* at 30 g/pot treatment mostly resulted in significantly higher plant height in cowpea varieties in both 2016 and 2017 with the exception of TVX 3236 in 2017 where the control plus *Alectra* significantly produced higher plant height than 20 g/pot treatment (Table 2). The control without *Alectra* treatment mostly resulted in the highest plant height in SAMPEA 7 and TVX 3236 at 5 – 9 WAP in 2019 (Table 3). The ANOVA of the three years data based on *Glomus deserticola* treatments showed that, the control minus *Alectra* treatment resulted in the highest plant height in cowpea varieties which was only comparable with that due to 30 g/pot *Glomus deserticola* treatment. This was followed by that due to 10 g/pot *Glomus deserticola* treatment. The lowest plant height due to the control plus *Alectra* was comparable with that due to 10 and 20 g/pot *Glomus deserticola* treatments (Table 7). The three years data based on cowpea varieties showed that, *Glomus deserticola* treatments resulted in the highest plant height in TVX 3236 which was only comparable with that observed in SAMPEA 7. The lowest plant height observed in IFE 82 – 12 was only comparable with that in IT97K – 499 – 35 (Table 7). The three years data based on plant's age showed that, the highest plant height in cowpea varieties at 9 WAP was significantly higher than that at 5 and 7 WAP. The lowest plant height at 5 WAP was significantly lower than that at 7 and 9 WAP (Table 7).

The control treatments mostly resulted in comparable leaf number with that due to the *Glomus deserticola* treatments of the cowpea varieties in 2016 (Table 4). A similar observation was made in 2017 and 2019 (Table 5 and 6). The ANOVA of the three years data based on *Glomus deserticola* treatments showed that, the highest leaf number was observed in *Glomus deserticola* treatments compared with the two control treatments. The control plus *Alectra* resulted in the lowest leaf number which was only significantly lower than highest leaf

number recorded in 10 g/pot *Glomus deserticola* treatment (Table 7). *Glomus deserticola* treatments resulted in the lowest leaf number in SAMPEA 7 which was only significantly lower than the highest observed in TVX 3236 (Table 7). The leaf number recorded at various cowpea plant ages varied significantly from each other with the highest leaf number recorded at 7 WAP significantly higher than that at 5 and 9 WAP. The lowest leaf number at 9 WAP was significantly lower than that at 5 and 7 WAP (Table 7).

Table 1: Effect in *G. deserticola* on Plant Height of Cowpea Varieties in 2016

Cowpea variety	VAM CONC (g)	PLANT'S AGE (WAP)		
		Plant Height (cm)		
		5	7	9
SAMPEA 7	0 – parasite	5.90a	6.67c	8.30b
	0+ parasite	5.47a	6.93c	6.67b
	10	5.63a	7.97bc	7.97b
	20	6.47a	10.00a	8.83ab
	30	6.07a	8.57b	10.80a
	Mean	5.91	8.03	8.51
	SE ±	0.31	0.42	0.65
IFE 82 -12	0-Parasite	5.87ab	4.33c	6.13a
	0+ parasite	4.70b	5.60bc	5.17a
	10	5.90ab	6.90ab	5.20a
	20	5.20ab	7.00ab	5.37a
	30	6.47a	7.60a	7.50a
	Mean	5.63	6.29	5.87
	SE ±	0.44	0.54	0.67
IT97K -499-35	0- parasite	6.43a	7.47a	10.20ab
	0+ parasite	5.17a	6.37a	7.53bc
	10	5.60a	7.07a	6.37c
	20	6.50a	6.33a	5.37c

		30	6.07a	6.97a	11.40a
		Mean	5.95	6.84	8.17
		SE ±	0.44	0.64	0.89
	TVX – 3236	0-parasite	7.00a	8.40a	7.23a
		0+ parasite	4.80b	7.67a	6.93a
		10	6.90a	9.07a	7.57a
		20	7.13a	8.60a	6.47a
		30	7.27a	8.77a	7.97a
		Mean	6.62	8.50	7.23
		SE ±	0.34	0.63	0.46

NB: Means followed by the same letter(s) in each column, under each variety, in each year are not significantly different (P ≤ 0.05), using DMRT.
WAP- Weeks after Planting. (Source: Field Work, 2016)

Table 2: Effect in *G. deserticola* on Plant Height of Cowpea Varieties in 2017

Cowpea variety	VAM CONC (g)	PLANT'S AGE (WAP)		
		Plant Height (cm)		
		5	**7**	**9**
SAMPEA 7	0 – parasite	5.73a	5.30a	6.87b
	0+ parasite	5.10a	6.70a	7.50ab
	10	5.73a	5.83a	8.00ab
	20	5.77a	6.70a	8.47a
	30	4.97a	6.23a	8.43a
	Mean	5.46	6.15	7.85
	SE ±	0.37	0.45	0.40
IFE 82 -12	0-Parasite	5.50a	7.57a	7.27a
	0+ parasite	5.67a	7.00a	6.40a
	10	5.97a	5.23a	7.50a
	20	6.13a	6.23a	7.37a
	30	6.23a	6.17a	5.63a
	Mean	5.90	6.44	6.83

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		SE ±	0.48	0.73	0.54
	IT97K-499-35	0- parasite	5.73a	6.27a	6.73a
		0+ parasite	5.77a	7.20a	6.43a
		10	6.37a	6.00a	6.17a
		20	5.83a	6.40a	6.50a
		30	5.33a	7.20a	6.93a
		Mean	5.81	6.61	6.55
		SE ±	0.30	0.57	0.67
	TVX – 3236	0-parasite	6.97a	7.20a	7.00ab
		0+ parasite	6.07a	7.90a	7.83a
		10	6.50a	6.67a	7.40a
		20	5.20a	6.73a	5.27b
		30	5.80a	7.03a	6.47ab
		Mean	6.11	7.11	6.79
		SE ±	0.53	0.62	0.53

NB: Means followed by the same letter(s) in each column, under each variety, in each year are not significantly different (P ≤ 0.05), using DMRT.
WAP- Weeks after Planting. (Source: Field Work, 2017)

Table 3: Effect in *Glomus deserticola* on plant height of cowpea varieties in 2019

Cowpea variety	VAM Conc.(g)	Plant's age (WAP) Plant height (cm)		
		5	7	9
SAMPEA 7	0-	7.30a	7.30a	7.97a
	0+	7.27a	5.73b	6.23b
	10	5.40bc	5.63b	6.50b
	20	6.47ab	4.63b	6.10b
	30	4.80c	4.93b	5.30c
	Mean	6.25	5.65	6.42
	SE ±	0.37	0.38	0.18
IFE 82-12	0-	5.33b	7.13a	5.30b
	0+	7.23a	6.20a	6.50a
	10	5.50b	4.67b	6.73a
	20	4.40b	4.57b	6.20ab
	30	7.53a	4.27b	6.53a
	Mean	6.00	5.37	6.25

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		SE ±	0.43	0.32	0.30
	IT97K-499-35	0- 0+ 10 20 30 Mean SE ±	6.97a 4.00c 4.40c 5.27b 5.53b 5.23 0.22	5.27a 5.30a 4.00b 4.53ab 5.50a 4.92 0.29	4.67b 7.50a 6.80a 4.60b 4.93b 5.70 0.23
	TVX 3236	0- 0+ 10 20 30 Mean SE ±	7.33a 5.00bc 6.40ab 7.20a 4.47c 6.08 0.49	4.67a 6.13a 5.93a 6.30a 5.23a 5.65 0.52	7.13a 6.27b 6.43ab 6.73ab 5.17c 6.35 0.23

NB: Means followed by the same letter(s) in each column, under each variety, are not significantly different (P≤0.05), using DMRT. WAP- Weeks after Planting. (Source: Field Work, 2019)

Table 4: Effect in *Glomus deserticola* on Leaf Number of Cowpea Varieties in 2016

Cowpea variety	VAM CONC (g)	PLANT'S AGE (WAP)		
		Leaf Number		
		5	**7**	**9**
SAMPEA 7	0 – parasite	6.67a	8.00a	5.33b
	0+ parasite	6.67a	7.33a	7.00b
	10	7.67a	11.67a	7.67b
	20	6.67a	9.33a	6.00b
	30	6.67a	10.00a	12.33a
	Mean	6.87	9.27	7.67
	SE ±	0.80	1.38	1.02
IFE 82 -12	0-Parasite	7.33a	5.33b	4.67a
	0+ parasite	6.67a	7.67ab	5.00a
	10	7.67a	9.67ab	7.00a
	20	7.33a	9.33ab	6.00a
	30	8.00a	13.00a	4.00a
	Mean	7.40	9.00	5.33
	SE ±	0.76	1.76	0.97

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	IT97K -499-35	0- parasite	7.33a	8.33a	10.00a
		0+ parasite	6.33a	5.67a	6.00ab
		10	8.00a	11.00a	9.00ab
		20	7.00a	6.00a	5.33b
		30	7.00a	6.67a	9.00ab
		Mean	7.13	7.53	7.87
		SE ±	0.84	2.14	1.21
	TVX – 3236	0-parasite	9.67a	7.33a	6.33b
		0+ parasite	6.33b	9.33a	10.00a
		10	9.67a	10.67a	6.00b
		20	8.67a	11.33a	6.67b
		30	8.33a	11.00a	6.67b
		Mean	8.53	9.93	7.13
		SE ±	0.53	1.19	0.86

NB: Means followed by the same letter(s) in each column, under each variety, in each year are not significantly different (P≤0.05), using DMRT.
WAP- Weeks after Planting. (Source: Field Work, 2016)

Table 5: Effect in *G. deserticola* on Leaf Number of Cowpea Varieties in 2017

Cowpea variety		VAM CONC (g)	PLANT'S AGE (WAP)		
			Leaf Number		
			5	7	9
	SAMPEA 7	0 – parasite	8.33a	7.00a	6.67ab
		0+ parasite	5.67b	7.67a	7.00ab
		10	7.00ab	7.00a	5.67b
		20	6.67ab	8.33a	8.00a
		30	7.00ab	6.33a	5.33b
		Mean	6.93	7.27	6.53
		SE ±	0.56	0.59	0.57
	IFE 82 -12	0-Parasite	7.00a	7.00a	5.67ab
		0+ parasite	8.67a	7.67a	6.00ab
		10	8.33a	7.00a	5.00b
		20	7.00a	6.67a	7.00a
		30	7.00a	7.00a	5.00b
		Mean	7.60	7.07	5.73
		SE ±	0.86	0.39	0.52

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	IT97K – 499-35	0- parasite	7.33a	7.33bc	6.00a
		0+ parasite	7.33a	9.00ab	5.33a
		10	7.33a	9.33a	5.33a
		20	7.00a	8.67ab	5.33a
		30	7.67a	6.67c	5.00a
		Mean	7.33	8.20	5.40
		SE ±	0.52	0.54	0.79
	TVX – 3236	0-parasite	9.33a	8.00a	5.00b
		0+ parasite	8.33a	9.00a	5.00b
		10	9.00a	8.33a	6.00ab
		20	7.67a	10.00a	5.00b
		30	8.67a	7.67a	7.33a
		Mean	8.60	8.60	5.67
		SE ±	0.65	0.95	0.60

NB: Means followed by the same letter(s) in each column, under each variety, in each year are not significantly different (P ≤ 0.05), using DMRT.
WAP- Weeks after Planting. (Source: Field Work, 2017)

Table 6: Effect in *Glomus deserticola* on Leaf Number of cowpea varieties in 2019

Year	Cowpea variety	VAM Conc.(g)	Plant's age(WAP) Leaf Number		
			5	7	9
2019	**SAMPEA 7**	0-	6.00a	7.33a	6.33a
		0+	5.00ab	5.00b	4.67bc
		10	5.00ab	6.33a	5.00bc
		20	4.67b	4.33b	5.33ab
		30	4.67b	5.00b	4.00c
		Mean	5.07	5.60	5.07
		SE ±	0.34	0.39	0.36
	IFE 82-12	0-	5.67ab	6.67a	8.00ab
		0+	5.67ab	6.00a	6.00b
		10	6.00ab	7.33a	5.67b
		20	6.67a	5.67a	9.00a
		30	5.00b	5.67a	5.67b
		Mean	5.80	6.27	6.87

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		SE ±	0.39	0.57	0.72
	IT97K-499-35	0- 0+ 10 20 30 Mean SE ±	6.33ab 5.00c 5.33bc 4.67c 7.00a 5.67 0.38	5.33a 6.33a 6.00a 6.00a 6.00a 5.93 0.34	7.00b 9.00a 8.00ab 9.33a 7.00b 8.07 0.41
	TVX 3236	0- 0+ 10 20 30 Mean SE ±	7.67ab 8.67a 6.00bc 6.00bc 4.67c 6.60 0.66	6.33b 7.00ab 8.33a 7.00ab 7.67ab 7.27 0.49	5.00ab 6.67a 5.67ab 6.00ab 4.67b 5.60 0.48

NB: Means followed by the same letter(s) in each column, under each variety, are not significantly different (P≤ 0.05), using DMRT. WAP- Weeks after Planting.
(Source: Field Work, 2019)

Table 7: Effect of *Glomus deserticola* on plant height and leaf number of cowpea varieties in 2016, 2017 and 2019 (combined)

Treatment	Plant height (cm)	Leaf number
VAM (Conc) g/pot		
0-	6.62a	6.91b
0+	6.28b	6.82b
10	6.33b	7.38a
20	6.30b	6.99ab
30	6.56a	6.95b
Mean	6.42	7.01
SE±	0.07	0.14
Variety		
SAMPEA 7	6.69a	6.70b
IFE 82-12	6.06b	6.79b

IT97K-499-35	6.20b	7.01b
TVX 3236	6.72a	7.55a
Mean	6.42	7.01
SE±	0.07	0.13
Age		
Week 5	5.91c	6.96b
Week 7	6.46b	7.66a
Week 9	6.88a	6.41c
Mean	6.42	7.01
SE±	0.06	0.11
Year		
2016	6.96a	7.81a
2017	6.47b	7.08b
2019	5.82c	6.15c
Mean	6.42	7.01
SE±	0.01	0.01
Interactions		
Var*Treat	*	NS
Var*Age	*	*
Var*Year	*	*
Treat*Age	*	*
Treat*Year	*	*
Age*Year	*	*
Var*Treat*Age*Year	*	*

NB: Means followed by the same letter(s) in each column, under each parameter are not significantly different (P≤0.05), using DMRT. NS = Not Significant, *= Significant
(Source: Field Work, 2016, 2017 and 2019)

DISCUSSION

The significantly higher plant height observed in the control minus *Alectra* and 30 g/pot *Glomus deserticola* treatments which was higher than all the other

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Glomus deserticola treatments suggests the possibility of a reduced performance of the *Alectra* (parasite) on the host plant in the presence of high concentrations of AMF. The higher plant height due to most *Glomus deserticola* treatments compared with the lowest observed in the control plus *Alectra* treatment is probably due to the strength of the *Alectra* infestation in reduction of the plant height of the cowpea varieties. This shows that, the positive impact of *Glomus deserticola* treatments on the plant height was lower at lower concentration in contrast with the highest concentration. This is in agreement with the findings of Mohammed *et al*. (2001) that the plant height and dry matter of Sorghum were significantly higher in the combinations between AM and bacteria strain. Rajapakse and Miller (1987) observed that, inoculation with VAM fungi significantly increased the percentage of colonized roots, plant height and percentage nitrogen (N) of two cowpea (*Vigna unguiculata* (L.) Walp.) cultivars.

The highest leaf number observed in *Glomus deserticola* treatments compared with the two control treatments might be due to a less nutrient supply in non-mycorrhized roots compared with mycorrhized roots with enhanced nutrient and water uptake. With adequate supply of water and nutrients to the host plant, there is a high probability of an increased number of leaves. Many scientists have reported the role of AMF in uptake of soil nutrients, especially Nitrogen and Phosphorus, which can effectively promote the growth of host plants (Smith *et al*., 2011). Formation of hyphal network by the AMF with plant roots significantly enhances the access of roots to a large soil surface area, causing improvement in plant growth (Bowles *et al*., 2016).

The plant height and leaf number highest values observed in Cowpea variety SAMPEA 7 and/or TVX 3236 might be due to the extent of the AM fungi colonization in the cowpea varieties which enhanced nutrient uptake and in turn supports plant growth. This agrees with observation of Fidelibus *et al*. (2002) that AMF has been shown to differentially colonize plant roots, enhancing plant growth, biomass allocation and photosynthesis.

Plant height in *Glomus deserticola* treatments having their highest values at 9 WAP may probably be due to the crop level of maturity. This is in agreement

with Das *et al*. (2008) that dry matter production in plant gradually increases with crop age and attain maximum at maturity. Also, this may be due to AMF mycorrhization which brings about an increase in nutrient uptake through exploitation of a larger soil volume by the AMF fungal hyphae (as the roots elongate) which in turn enhances plant growth and nitrogen fixation (Abbolt and Robson, 1984). The leaf number having its highest values at 7 WAP might be due to an indication of peak period of rapid vegetative growth involving the synthesis of growth stimulating hormones and an increased rate of photosynthesis (Alonge, 2000).

CONCLUSION AND RECOMMENDATIONS

The result of this work shows that Arbuscular mycorrhizal fungi infection resulted in significant increase on plant height and leaf number of the Cowpea varieties under *Alectra* infestation. AMF treatments at different rates resulted in higher values than the control plus *Alectra* treatment.

As evident from this research work, the interaction between AM fungi and cowpea varieties enhanced plant height in cowpea varieties. Therefore, the following are being recommended:

1. The use of *Glomus deserticola* treatments in soils infested with *Alectra* is recommended for farmers to obtain higher values for plant height and leaf number in cowpea varieties.
2. Further research work is needed to determine the interaction between plant height and leaf number of the cowpea varieties, AMF with *Alectra* under unsterilized conditions.
3. Farmers can cultivate cowpea varieties SAMPEA 7 and/or TVX 3236 on soils infested with *Alectra*, if Glomus *deserticola* is applied in order to obtain higher values for plant height and leaf number.

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