Phosphorus Reduces the Virulence of *Alectra vogelii* (Benth) on Groundnut (*Arachis hypogaea* L.)

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Abstract: A screen house work was undertaken in 2000 and 2001 at Samaru ($11^0$11` N, 07°38` E) in northern Guinea Savanna of Nigeria; to evaluate the effectiveness of nitrogen and phosphorus in reducing the virulence of *Alectra* parasitism on groundnut *(Arachis hypogaea* L.). Treatments consisted of three groundnut genotypes (SAMNUT-11, SAMNUT-16, SAMNUT-18), three N levels (0, 25. 50 kg N/ha) and three P levels (0, 22, 44 kg P/ha). Application of 22 and 44kgP/ha significantly reduced mean crop damage syndrome at 12WAS while increasing the mean pod yield. However, only 44kg P/ha reduced the mean *Alectra* density considerably at 15WAS and at harvest, with concomitant increase in mean number of pods per plant. [New York Science Journal 2010;3(12):1-7]. (ISSN: 1554-0200).

***Key words**: Alectra,* Virulence, Parasite.

1,Introduction.

Parasitic weeds pose serious threat to crop production. Among the parasitic weeds *Alectra vogelii* (Benth) and *Striga gesnerioides* cause significant damage to legumes such as groundnut, cowpea and soybean in the northern and southern Guinea Savanna of Nigeria (Kureh *et al.*, 1996,Kureh and Alabi, 2003) .In the ecology, the scourge of *Alectra vogelii* is more devastating on groundnut than that of *Striga gesnerioides.* The parasites cause damage to the host plant by inducing the flux of nutrients and water from the host to itself.

Groundnut *(Arachis hypogaea* L.) is an important leguminous crop in the Savanna ecological region of Nigeria. Although it was one of the major export commodities in the pre-independence era of Nigeria, it is now mainly used in the provision of raw materials for the local industries. Since the Problem of *Alectra* parasitism on the crop is on the increase, there is need to combat the menace of the parasite to ensure good crop yield. Various methods have been advocated for the control of parasitic weeds. These include use of trap and catch crops (Lagoke *et al.*, 1991) chemicals (Botanga., 2003). Also, the use of nitrogenous fertilizer has been shown to reduce the virulence of *Alectra* on cowpea (Magani *et al.*, 1992), soybean (Tarfa Iet al.,1996) and groundnut (Kwaga *et al.*,2010). Although phosphorus application was reported to have shown no significant effect on *Alectra* shoot emergence in soybean crop (Tarfa *et al.*,1996); nevertheless it has been observed to increase grain yield in cowpea(Magani *et al.*,1992, Olufajo, 1996).In view of the prevailing problem of *Alectra* invasion on groundnut in the ecology and the ineffective control method of hoe weeding used by farmers in the area, there is need to evolve other methods to curb the menace of the parasite on groundnut. Therefore this study was conducted with the purpose of assessing the efficacy of nitrogen and phosphorus fertilizers in ameliorating *Alectra* parasitism on groundnut.

2. Materials and Methods.

The screen house study was undertaken in 2000 and2001 at the Institute of Agricultural Research Farm (IAR) Samaru (11^0 11`N, 07° 38` E), in the northern Guinea Savanna ecological zone of Nigeria. The treatments comprised three groundnut genotypes (SAMNUTS-1 1, 16, 18); three N levels (0, 25, 50kgN/ha) and three P rates (0, 22, 44kgP/ha). As a result of differences in sizes of pots, the experiment was arranged in three replications according to pot size. The pots were of the following dimensions in depth and diameter: 26.6cm by 24.2cm in two replications and 21.6cm by 23.55cm in one replication. The pots were filled with a mixture of loamy soil and fine sand prepared in a proportion of 1:1. *Alectra* stock mixture was prepared by thoroughly mixing I00g of *Alectra* seeds with 1.7kg of sand in a polythene bag. The soil in each pot was inoculated with *Alectra* seeds by mixing 0.77kg soil taken from the pot with l0g of the *Alectra* stock mixture. After thorough mixing in a polythene bag, the mixture was transferred into the pot. The pots were then watered for two weeks to pre-condition the *Alectra* seeds before sowing. The seeds were sown in the first week of October, 2000 and Mid-March , 2001; using four seeds per pot. At 2WAS (weeks after sowing), the seedlings were thinned to two plants per pot. The plants were watered daily except when the soil was observed to have enough moisture. Fertilizer application was effected according to treatment based on the weight of soil divided by the estimated value of 2.5 metric tons of soil per hectare. Phosphorus was applied as single dose along with half the rate of nitrogen at 2WAS. The remaining half dose of N was applied at 5WAS. All application was done by side placement. Emerged *Alectra* shoots were counted weekly from the time the first emerged *Alectra* shoot was observed in the experiment. Host injury was scored using a scale of 1-9; 1 = normal plant growth with no visible symptom; 9 = all leaves defoliated prematurely. Data were collected, analyzed and ranked using Duncan Multiple Range Test (Duncan, 1955).

3. Results.

In the two seasons of the screen house work, genotype and nitrogen had nosignificant effect on *Alectra* shoots density, neither at 15WAS nor at harvest (Table 1). Although phosphorus fertilization did not show marked influence on the density of *Alectra* shoots at any stage in the two seasons, yet application of 44kgP/ha significantly reduced the *Alectra* shoots density at 15WAS and at harvest compared to the zero phosphorus treatment. Crop injury sustained by SAMNUT-11 and SAMNUT-18 were similar in the two seasons at 9 and 12 WAS , except that at 12WAS of the March sowing SAMNUT-11 suffered higher crop injury than SAMNUT-18(Table). However, SAMNUT-16 sustained higher crop injury than either of these two genotypes at both growth stages in the October sowing but was the healthiest genotype at 9WAS in the March sowing. Nitrogen application did not influence crop damage syndrome at any stage in both seasons. However, application of 22 and 44 kg P/ha reduced the severity of the crop injury in the combined data at 12WAS.

In both seasons and the combined data, SAMNUT-l8 gave higher pod number than SAMNUT-1I and SAMNUT-16 which were both at par (Table 3). Neither N nor P application affected pod number in any of the seasons, but in the combined data, phosphorus at the rate of 44kgPha’ increased pod number appreciably compared to the zero phosphorus treatment. Genotypes did not vary significantly in their pod yield in the October sowing (Table 3). However, in the March seeding and combined analysis, SAMNUT-18 out-yielded both SAMNUT-11 and SAMNUT-16 which were at par. Nitrogen application did not influence pod yield in any of the seasons or the combined data. Although phosphorus fertilization did not affect pod yield in the October sowing, yet in the March sowing and the combined data, application of 22 and44kgP/ha gave significantly higher yield than the zero phosphorus treatment.

Table 1. Effect of genotype, nitrogen and phosphorus on the number of *Alectra* shoots per pot at 15WAS and at harvest when groundnut; grown under artificial *Alectra* infestation in the Screen house at Samaru in October 2000 and March 2001.

	***Alectra* shoot count**					
	15 WAS			**Harvest**		
	October	**March**	**Combined**	**October**	**March**	**Combined**
Treatment	**2000**	**2001**		**2000**	**2001**	
Genotype						
SAMNUT-1l	29.7	2.5	16.1	20.5	4.3	12.4
SAMNUT-16	22.7	1.7	12.2	17.2	2.9	10.1
SAMNUT-18	29.3	1.4	15.3	28.0	1.6	14.8
SE±	4.59	0.45	2.32	4.91	0.55	2.40
	ns	ns	ns	ns	ns	ns
Nitrogen Rate (kgNha^{-1})						
0	31.5	1.8	16.7	23.2	3.5	13.4
25	25.1	1.9	13.5	22.0	3.0	12.5
50	25.0	1.7	13.4	20.5	2.3	11.4
SE±	4.59	0.45	2.32	4.91	0.55	2.40
	ns	ns	ns	ns	ns	ns
phosphorus Rate						
(kgPha^{-1})	38.3	2.1	20.2a	33.0	3.2	17.8a
22	27.2	1.5	14.4ab	19.6	3.0	l1.3ab
44	16.1	1.9	9.0b	13.1	2.6	8.lb
SE±	4.59	0.45	2.32	4.91	0.55	2.40
	ns	ns		ns	ns	

Means followed by common letter(s) in each treatment group are not significantly different at 5% level of probability using Duncan Multiple Range Test,

Ns =Not significant at 5% level of probability.

WAS=Weeks after sowing.

x

Table 2. Influence of genotype, nitrogen and phosphorus on the crop injury score of groundnut grown under artificial Alectra infestation in the screen house at Samaru in October 2000 March 2001.

	Crop injury score					
	9 WAS			12 WAS		
Treatment	**October 2000**	**March 2001**	**Combined**	**October 2000**	**March 2001**	**Combined**
Genotype						
SAMNUT-1l	1.0b	1.3a	1.1	1.2b	2.7a	2.0
SAMNUT-16	1.2a	1.0b	1.1	1.9a	2.4ab	2.1
SAMNUT-18	1.0b	1.4a	1.2	1.5b	2.1b	1.8
SE±	0.04	0.08	0.05	0.11	0.18	0.04
			ns			ns
Nitrogen Rate						
(kgNha^{-1})	1.0	1.1	1.1	1.5	2.4	1.9
0	1.1	1.1	1.1	1.6	2.2	1.9
50	1.1	1.3	1.2	1.5	2.7	2.1
SE±	0.04	0.08	0.05	0.11	0.18	0.04
	ns	ns	ns	ns	ns	ns
phosphorus Rate						
(kgPha^{-1})						
0	1.1ab	1.3	1.2	1.7	2.7	2.2a
22	1.2a	1.1	1.2	1.5	2.3	1.9b
44	1.0b	1.1	1.1	1.4	2.3	1.9b
SE±	0.04	0.08	0.05	0.11	0.18	0.04
		ns	ns	ns	ns	

Means followed by common letter(s) in each treatment group are not significantly different at *5%* level of probability using

ns = Not significant at 5% level of probability

WAS = Weeks after sowing.

Crop injury score (1-9)

1= Normal crop growth with no visible symptom

9 =All leaves defoliated prematurely.

Table 3. Effect of genotype, nitrogen and phosphorus on pod number and pod yield per plant of groundnut; grown under artificial *Alecira* infestation in the screen house at Samaru in October 2000 and March 2001**.**

	Number of pods / plant (no.)			**pod yield/ plant (g)**		
Treatment	**October 2000**	**March 2001**	**Combined**	**October 2000**	**March 2001**	**combined**
Genotype						
SAMNUT-11	3.6b	9.5b	6.6b	*2.5*	8.7b	5.6b
SAMNUT-16	3.6b	10.0b	6.8b	2.8	9.2b	6.0b
SAMNUT-18	*5.8a*	16.8a	11.3a	2.7	13.4a	8.la
SE±	0.58	0.64	0.43	0.44	0.41	0.31
				ns		
Nitrogen Rate ($kgNha^{-1}$)						
0	4.7	12.3	*8.5*	2.8	10.6	6.7
25	4.4	11.6	8.0	*2.5*	10.3	6.4
50	4.0	12.4	8.2	2.7	10.4	6.5
SE±	0.58	0.64	0.43	0.44	0.41	0.31
	ns	ns	ns	ns	ns	ns
Phosphorus Rate (kgP/ha^{-1})						
0	3.6	11.1	7.3b	2.2	9.2b	5.7b
22	4.6	12.4	8.5ab	3.1	10.9a	7.0a
44	4.9	12.9	8.9a	2.8	11.3a	7.0a
SE±	0.58	0.64	0.43	0.44	0.41	0.31
	ns	ns		ns		

Means followed by common letter(s) in each treatment group are not significantly different at 5% level of probability using
Duncan Multiple Range Test.
ns = Not significant at 5% level of probability.

4, Discussions.

The genotype SAMNUT-18 gave the highest pod yield and pod number per plant however the genotypes did not vary in the *Alectra* density hosted(Table 1). Furthermore, effect of genotype was not consistent with respect to crop injury. The higher pod yield and pod number of SAMNUT-18 can be attributed to the concentration of its pods near the base of tits stems which fit more into the experimental pots than the scattered pods of the other two genotypes; which produced more pegs outside the pots. Therefore genotype did not play significant role on the reaction of groundnut to *Alectra.* Similarly, the effect of nitrogen fertilization was not significant in this study. This is in consonance with the findings of Anonymous (1996) who reported that nitrogen application had no marked effect on *Alectra* incidence in cowpea.. However Tarfa *et* al (1996) observed that nitrogen fertilization reduced *Alectra* shoot population in soybean. Bebawe (1981) pointed that there is no consistent report that nitrogen application fertilization suppress *Alectra*.

However, application of 44kgP/ha markedly reduced mean *Alectra* shoot population at 15WAS as well as at harvest, crop injury at I2WAS (Table 2) but increased mean pod number (Table 3) and yield compared to zero phosphorus treatment. The effect of the 44kgP/ha rate in suppressing *Alectra* infestation could be due to the depressive effect of increased level of P on the parasite. Egley(1971) posited that when certain threshold is exceeded mineral nutrients exert toxic effect on parasites. Therefore the application of 44kgP/ha might have raised the mineral content of the host plant to the toxicity level; hence the reduction in the injury caused by the parasite on the crop. Furthermore phosphorus application has positive effect on groundnut performance. Sankar *et al.* (1984) reported that P plays significant role in nodulation in groundnut, resulting in enhanced groundnut yield. Also Jana *et al.,* (1991) observed that phosphorus application enhanced yield in groundnut. Similarly Magani (1994) and Olufajo (1996) reported increase in cowpea grain yield with the application of phosphorus under *Alectra* infestation. However, anonymous (1996) noted that phosphorus application had no effect on cowpea grain yield. Therefore, this screen house work has shown that the application of 44kgP/ha ameliorated *Alectra* parasitism on groundnut.

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