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Poultry Droppings Ameliorate infection of Alectra *vogelii* (Benth) in Groundnut (*Arachis hypogaea* L.) in Mubi, in Semi – Arid Ecology of Nigeria

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ABSTRACT

A field trial was undertaken in 2007 and 2008 cropping seasons in Mubi in semi-arid ecology of Nigeria. The investigation was to evaluate the effect of nitrogen fertilization and poultry droppings in ameliorating the effect of vogelii on the performance of groundnut (Arachis hypogaea L.). Four groundnut varieties (SAMNUT -10, SAMNUT -11, SAMNUT -22, and a local variety kampala) were assessed using three nitrogen levels (0, 25, 50 kgNha^{-1}). The varieties were assigned to the main plots, while nitrogen levels and poultry droppings were combined in a factorial lay in the sub-plots in three replications. Applications of 25 and 50 kg Nha $^{-1}$ reduced incidence significantly, while application of 5.0 tonnes of poultry droppings ameliorated parasitism in groundnut by increasing groundnut kernel yield significantly in Sspite of high infection.

KEY WORDS: *vogelii, parasitism amelioration.*

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I. INTRODUCTION

Weed infestation is one of the problems that farmers have to contend with in achieving meaningful crop yield. Weed infestation can cause a significant yield loss in crops. The damage is more devastating in fields that are highly infested with parasitic weeds. While *striga hermonthica* poses serious threat to crops of the poaceae family such as maize, sorghum and rice in the Nigerian Savanna, the scourge of *vogelii* causes significant yield reduction in leguminous crops such as groundnut and cowpea in the region. A yield loss of 100% due to parasitism was observed on groundnut in the northern Guinea Savanna of Nigeria (Kwaga, *et al.*, (2012). Apart from yield loss, the parasite has been observed to cause pre-mature defoliation in groundnut, thereby reducing its photosynthetic capacity (Kwaga, 2004). The parasitic weed has also been reported to be widespread in East and Southern Africa (Singh, 2002).

Groundnut has been one of the important oil seed crop produced in the Savanna ecology of Nigeria. The kernels provide oil both for industrial and domestic uses. It also provides cheap source of protein to various individuals who take it as local snacks. Despite the importance of groundnut, the problem of parasitic weeds has been militating against its production. The methods used by local farmers to combat the menace of the parasitic weed has been mainly hand weeding. This is not quite effective, since much damage has been done before the weed emerges. The use of nitrogenous fertilizer has been found to be advantageous in reducing the virulence of parasitic weeds in crops (Lagoke, 1992, Adagba *et al*., 2003, Kwaga, 2004). Poultry droppings contain nutrients such as nitrogen, phosphorus and potassium (Kwaga, 2012). These major elements can improve growth and vigour and impart tolerance to parasitism and improve crop yield. Therefore this study was conducted with the objective of investigating the effectiveness of nitrogen fertilization and poultry droppings in combating parasitism in groundnut.

Materials and Methods

An investigation was undertaken at the Teaching and Research Farm of Adamawa State University, Mubi in the semi-arid ecology of Nigeria in 2007 and 2008 rainy seasons. The study was carried out with the objective of assessing the effect of nitrogen fertilization and poultry droppings in ameliorating parasitism in groundnut. The soil of the experimental area is broadly classified as alfisols with sandy loam texture and pH value of 5.9, total nitrogen 2.24gkg^{-1}, available P 211 mgkg^{-1}, and CEC 2.084 C mol kg^{-1}. The composition of the poultry dung used in the trial was 0.883% N, 0.632% P. and 0.925% K.

The trial was laid in a split – plot design with four groundnut varieties (SAMNUT -10, SAMNUT -11, SAMNUT -22, and a local variety "kampala") assigned to the main plots. Three levels of nitrogen (0, 25, 50 kg Nha^{-1}) and three rates of poultry droppings (0, 2.5, 5.0 tonnes ha^{-1}) were combined in a factorial lay and allocated to the sub – plots. The investigation was conducted in a field that was naturally infested with . Sowing was done on July 4 each year at the spacing of 25cm by 75cm. Gross plot consisted of four rows 3m long and 75cm apart ($9m^2$), while the two inner rows comprised the net plot ($4.5m^2$). Nitrogen and poultry droppings were applied at the rate for each treatment. Poultry droppings was broadcasted and incorporated into the soil before sowing. Nitrogen was applied by side placement in two equal split doses, half at 2 weeks after sowing (WAS) and the remaining half at 6 WAS. Phosphorus was applied by side placement at 2 WAS to all plots at the rate of 22kg Pha^{-1}. The experiment was hoe weeded at 3, 7 WAS and hand pulled at 11 WAS to avoid tampering with the un-emerged and emerged *Alectra* shoots. *Alectra* shoots were counted weekly from the time that the first emerged shoot was observed in the experimental area. Data were collected and analyzed and the means separated using Duncan multiple range test (Duncan, 1955).

Results

In two years and combined data variety had no significant influence on number of infected stands at 12 and 15 WAS (Table 1). However, application of 25kg and 50 kg Nha^{-1} in 2007 and the combined data exhibited similar effect and reduced number of infected stands appreciably when compared with zero nitrogen treatment. Nevertheless, in 2008, all N rates had comparable effects. In 2007 application of 2.5 and 5.0 tonnes of poultry droppings had comparable effects and increased number of infected stands significantly compared to the zero rate of poultry droppings. Although application of 2.5 and 5.0 tonnes poultry droppings exhibited similar effects in 2008, only application of 5.0 tonnes of poultry droppings t enhanced the number of infected stands when compared to the zero doses of poultry droppings. However, the combined data showed that number of infected stands increased markedly with increasing rate of poultry droppings. At 15 WAS in the two years and the combined data application of 2.5 and 5.0 tonnes of poultry droppings had similar effect on number of infected stands and significantly enhanced number of infected stands except that in 2008 only the 5.0 tonnes rate increased number of infected stands considerably.

The data on plant height at 9 and 12 WAS are presented in Table 2. In both years and the combined date plant height at 9 and 12 WAS followed similar trend. The local variety produced plants that were significantly taller thatn plants of SAMNUT – 10, SAMNUT – 11 and SAMNUT – 22. However, SAMNUT -11 and SAMNUT 22 exhibited plants of comparable heights that were taller than that of SAMNUT – 10, Nitrogen fertilization had no significant effect on plant height at 9 WAS in the two years and the combined data. At 12 WAS nitrogen application only influenced plant height in 2008. In that year at this growth stage, only application of 50kgN rate markedly increased plant height compared to the zero nitrogen doses. At 9 WAS in 2007, application of 5.0 tonnes of poultry dung exhibited appreciably taller plants than the zero and 2.5 tonnes poultry droppings which were at par. However, in 2008 the 2.5 and 5.0 poultry droppings dose produced plants of comparable heights that were considerably taller than plants that had no poultry droppings. Nonetheless, in the combined data plant height increased with increasing poultry droppings at this growth stage. At 12 WAS in 2007 and 2008 the 2.5 and 5.0 poultry droppings rate produced plants of similar heights that were markedly taller than plants that had no poultry droppings, except that in 2007 the 2.5 tonnes poultry droppings does was at par with the zero poultry dropping rate. In the combined data plant height increased with increasing poultry droppings dose.

The data on 100 kernel weight is shown in Table 3. Varieties did not differ significantly in kernel weight in the two years and the combined data. Similarly, nitrogen application had no marked effect on kernel weight in the study. Application of 2.5 and 5.00 tonnes poultry droppings produced kernels of comparable weight that were significantly heavier, the kernels of the zero poultry dropping rate in 2007 and the compared data. In 2008, application of poultry droppings had no effect on kernel weight. Varieties differed in kernel yield in 2008 and combined data. SAMNUT – 11 and SAMNUT – 22 had comparable kernel yields while only SAMNUT – 22 out yielded SAMNUT – 10 and the local variety which were at par in the combined data. Furthermore, nitrogen fertilization had no significant effect on kernel yield in both years and the combined data .In 2007 and the combined data kernel yield increased with increasing poultry dropping dose, but in 2008 the 2.5 and 5.0 tonnes doses produced similar kernel yields that were superior to the zero poultry droppings dose.

Discussion

In the study, all the varieties used exhibited comparable level of infection. This similar reaction to infection implies that they don't differ in their susceptibility to *s* invasion. This means the varieties have comparable level of resistance to parasitism. Various resistance mechanisms to *Alectra* parasitism has been observed in plants. *These* are low production of germination stimulants by host plants, (Ramaiah, 1978). These are compounds that flow from roots of host plants to the seeds of parasites, which gives the seeds signals to germinate. Other mechanisms are cell thickening of roots of host plant to resist invasion and production of antibiosis to prevent the parasitism on the host plant (El- Hiweris, 1987). Therefore it is possible that these varieties are similar in the exhibition of these characters and hence showed comparable level of infection. The local variety produced the tallest plants at the two growth stages, while SAM NUT – 10 produced the shortest plants. This can be attributed to their genetic variation. The superior kernel yield exhibited by SAMNUT-10 over the local cultivar has shown it to be a promising groundnut variety for production in the study area.

The application of 25 and 50 kg Nha^{-1} has shown significant effect in reducing number of infected stands sat 12 and 15 WAS; while only the 50 kg N dose increased plant height at 12 WAS in 2008. Similar effect of nitrogen fertilization in reducing invasion in soyabean was reported by Tarfa (1996). Also Magani (1994) noted the efficacy of N application in reducing infestation in cowpea. Application of high N dose of 120 kg Nha^{-1} to cowpea crop was observed to reduce *striga gesnerrioides* in cowpea without significant reduction in cowpea grain yield. (Emechebe *et al.*1991). Similarly Kwaga (2010) and Kwaga (2012) reported significant reduction in shoot population and increased crop vigour without marked reduction in groundnut pod yield when 25kg N was applied to groundnut. Also Parker (1978) observed that nitrogen application suppressed *striga* development, while Psech *et al.,* inhibited striga germination and development. Nevertheless in another investigation in the semi-arid ecology of Nigeria application of nitrogen had no significant effect in reducing infection in cowpea (Anonymous, 1996). The suppressing effect of nitrogen on parasitic weeds has to do with the lethal effect of the nutrient on the weeds. Just as contact between young crop seedlings and nitrogenous fertilizer can be lethal to the crop, contact between nitrogenous fertilizer and roots of parasitic weeds which are tender herbs, can be debilitating on the herbaceous weed. In which regard the second application of nitrogenous fertilizer which usually applied later can exhibit suppressive effect on parasitic weeds. Ogborn (1987) pointed that nitrogen exerts regulatory effect on development of *Striga* radicle

Although application of 2.5 and 5.0 tonnes poultry droppings enhanced incidence; the rates increased plant height kernel weight and yield. Similarly, Kwaga (2012) observed that while application of poultry 5.0 tonnes droppings increased *shoot* population, it enhanced crop vigour haulm yield, number of mature pods and pod yield in groundnut. In this respect, it appears that application of poultry droppings has ameliorating effect on *parasitism* in groundnut and not necessarily reducing invasion. Therefore application of the poultry droppings tend to confer tolerance on the crop to parasitism; by increasing crop yield, in spite of its hosting high application of poultry droppings to groundnut crop can be advantageous in increasing groundnut yield not withstanding invasion.

Conclusion

The study has shown that SAMNUT – 22 is a promising cultivar of groundnut to be used in Mubi area. While application of 5.0 kg ha^{-1} can reduce incidence, application of 5.0 tonnes of poultry droppings can assist in ameliorating parasitism.

Table 1: Influence of variety, nitrogen and poultry droppings on the number of infected stands/4.5m^2 of groundnut grown under infestation at Mubi 2007 and 2008 rainy season.

	Number of infected stands/5.5m^2					
	12 WAS			15 WAS		
Treatment	2007	2008	Combined	2007	2008	Combined
Variety						
SAMNUT – 10	1.14	1.32	1.23	1.38	1.59	1.48
SAMNUT – 11	1.13	1.19	1.16	1.28	1.51	1.39
SAMNUT – 22	1.11	1.37	1.24	1.39	1.65	1.52
Local variety	1.18	1.23	1.20	1.29	1.38	1.34
SES ±	0.222	0.344	0.194	0.319	0.409	0.20
Level of significance	ns	ns	ns	Ns	ns	Ns
Nitrogen Rate (Kg Nha^{-1})						
0	1.42a	1.39	1.40a	1.68a	1.61	1.85a
2.5	1.01b	1.22	1.11b	1.13b	1.54	1.34b
50	1.00b	1.22	1.11b	1.20b	1.45	1.32b
Se ±	0.101	0.107	0.074	0.115	0.129	0.087
Level of significance	*	ns	*	*	ns	*
Poultry droppings Rate (tonnes ha^{-1})						
0	0.89b	1.07b	0.98c	1.07b	1.27b	1.17b
2.5	1.24a	1.23ab	1.23b	1.46a	1.59ab	1.52a
50	1.30a	1.52a	1.41a	1.48a	1.74a	1.61a
Se ±	0.101	0.107	0.074	0.115	0.129	0.087
Level of significance	*	*	*	*	*	*

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

Table 2: Effect of variety, nitrogen and poultry droppings on plant height at 9 and 12 WAS of groundnut grown under infestation at Mubi 2007 and 2008 rainy seasons.

	Plant height (cm)					
	9 WAS			12 WAS		
Treatment	2007	2008	Combined	2007	2008	Combined
Variety						
SAMNUT – 10	21.5C	25.1c	23.3c	26.8c	28.3c	27.8c
SAMNUT – 11	29.6b	30.6b	30.0b	34.9b	35.2b	35.1b
SAMNUT – 22	28.9b	32.2b	30.5b	34.4b	35.8b	35.1b
Local variety	34.4a	36.0a	35.2b	41.5a	42.2a	41.8b
SE ±	0.85	0.59	0.52	1.58	0.72	0.72
Level of significance	*	*	*	*	*	*
Nitrogen Rate (Kg Nha^{-1})						
0	28.1	29.9	29.0	34.3	34.3b	34.3
2.5	29.4	31.2	30.3	34.8	35.4ab	35.1
50	28.3	31.8	30.0	34.2	36.4a	35.3
SE ±	0.65	0.66	0.23	0.81	0.58	0.52
Level of significance	ns	Ns	ns	ns	*	Ns
Poultry droppings Rate (tonnes ha^{-1})						
0	26.6b	28.3b	27.5C	32.2b	32.8b	32.5c
2.5	28.4b	31.5a	30.0b	34.3ab	36.1a	35.2b
50	30.8a	33.1a	31.1a	36.7a	37.3a	37.0a
SE ±	0.65	0.66	0.23	0.81	0.58	0.52
Level of significance	*	*	*	*	*	*

Means followed by common letters in each treatment group are not significantly different at 5% level of significance using Duncan Multiple Range Test.
*= Significant at 5% level of probability
ns = Not significant at 5% level of probability.

Table 2: Effect of variety, nitrogen and poultry droppings on 100 kernel weight and kernel yield of groundnut grown under *Alectra* infestation at Mubi 2007 and 2008 rainy seasons.

	100 kernel		weight(g)	Kernel yield (kgha^{-1})		
Treatment	2007	2008	Combined	2007	2008	Combined
Variety						
SAMNUT – 10	43.2	46.2	44.7	539	406b	473c
SAMNUT – 11	42.8	45.2	44.0	576	563a	570ab
SAMNUT – 22	43.4	44.7	44.0	664	670a	667a
Local variety	44.9	43.1	44.0	585	417b	501bc
SE ±	0.69	0.47	0.57	48.52	34.00	29.62
Level of significance	ns	ns	ns	ns	*	*
Nitrogen Rate (Kg Nha^{-1})						
0	43.3	44.2	43.8	614	503	558
2.5	43.6	46.5	44.9	547	516	531
50	43.7	43.7	43.7	613	523	568
SE ±	0.47	0.96	0.53	34.83	18.44	20.86
Level of significance	ns	ns	ns	ns	*	ns
Poultry droppings Rate (tonnes ha^{-1})						
0	41.6b	43.0	42.3b	454c	374b	414c
2.5	44.1a	45.7	44.9a	580b	557a	569b
50	44.9a	45.6	45.3a	739a	611a	675a
SE ±	0.47	0.96	0.53	34.83	18.44	20.86
Level of significance	*	*	*	*	*	*

Means followed by common letters in each treatment group are not significantly different at 5% level of significance using Duncan Multiple Range Test.
*= Significant at 5% level of probability
ns = Not significant at 5% level of probability.

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