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Influence of Some Soil Amendments on Insect Pest Infestation and Damage to Okra (*Abelmoschus esculentus* (L.) Moench) in Umudike, Abia State

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Abstract: Field experiment to determine the effect of three soil amendments (Poultry manure, goat manure and NPK 15:15:15 fertilizer) on insect pest infestation and damage to Okra (Oboro dwarf variety) was conducted in 2006 at Umudike, Nigeria. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three treatments and control replicated five times. During the experiment, application of poultry manure and goat manure at 50g/plant and 20g/plant of NPK 15:15:15 were applied two weeks after planting in a ring form. Results obtained showed that the application of goat manure and poultry manure generally, significantly reduced the prevalence of *Podagrica spps* with regards to plant height and leaf area of Okra. The application of NPK 15:15:15 may have promoted vegetative growth of Okra, making it more succulent and thereby enhancing high pest attack, survival and damage of the Okra. Hence, increasing the application rates of the different soil amendments may have significant increase on the yield as well as reduce pest invasion.

Key words: Soil amendments, okra, *Podagrica sjostedti*, *Podagrica uniforma*, poultry manur, goat manure

INTRODUCTION

Okra *Abelmoschus esculentus* (L.) Moench is a member of the Malvaceae family related to Cotton, Hibiscus etc. It is an important vegetable cultivated in the tropics and sub tropics (George, 1999) for its immature edible green seed/pod. The seed pods are 3-10 inches long tapering, usually with ribs down to leaves. These tender, unripe seed pods are used as a vegetable and have a unique texture and sweet flavour. When the pods are cut, they exude a mucilaginous (thick and sticky) juice that is an excellent thickener for stews and soups. The flavour blends well with acid foods such as tomatoes (Dupriez and Deleener, 1989).

Mature okra is used to make rope and paper. The young, tender pods can be sliced, dipped in egg, breaded with corn meal and fried. Okra can also be steamed, baked, pickled, boiled or stewed. Because of its similar flavour, it can be used in place of egg plant in many recipes. They contain about 27% protein, vitamin A (0.2 mg 100 g^{-1}), vitamin C (75 mg 100 g^{-1}) and high calcium content (92 mg 100 g^{-1}). Mature seeds contain about 20% of edible oil (Tindall, 1983). One of the limiting factors to the profitable production of Okra is damage by insects (Praveen and Dhandapani, 2002). The interactions between fertilizer application and insect pest infestation and damage in Okra production have not been adequately addressed. Due to high cost of chemical insecticides, resource poor farmers grow Okra without insecticides The objective of this study is to determine the influence of some soil amendments (Poultry manure, goat manure, NPK 15:15:15 fertilizer and control) on insect pest infestation and damage to Okra (*A. esculentus*).

MATERIALS AND METHODS

Experimental site: The experiment was conducted in 2006 at Michael Okpara University of Agriculture umudike in Abia State (Latitude 5° 50219N, Longitude 7° 70331E and 122 m above sea level).

Land preparation: The land area used was 150 m^2 (15×10 m) in which a composite soil sample of the experimental area was taken at land preparation. The land was ploughed using spade and the soil was pulverized. The experimental plots were laid out and each plot measuring 3×1.2 m with 0.5 m furrows spacing.

Planting of Okra, application of treatments and data collection: The Okra variety used was the "Oboro Dwarf", which was planted with two seeds per hole and thinned subsequently to one per stand, two weeks later. They Oboro Dwarf Okra germinated in four days time and supply was done on the fifth day after sowing.

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The design of the experiment was the Randomized Complete Block Design (RCBD) consisting of four treatments replicated five times.

The treatments consist of the following soil amendments.

- Poultry manure
- Goat manure
- NPK 15:15:15
- Control

The treatments were then applied two weeks after planting by applying 50g per plant of goat and poultry manures and 20g per plant of NPK 15:15:15 fertilizer in a ring form (Ogujobi *et al* ., 2005). The treatments were then effected thrice and done forth nightly starting at two weeks after seedling emergence. Weeding was manually done at two days interval due to the persistence of *Cyperus esculentus* (sedge plant) but reduced to two weeks intervals after the persistence of the weed was drastically reduced due to regular weeding.

Assessment of the population of *Podagrica spp* and *Bemisia tabaci* (white fly) started at 30 days after planting and the population of their adults was estimated by visual counting on 10 randomly selected plants in the middle row of each plot. This was done by gently examining the selected plants and by carefully turning the leaves for the correct assessment of all *Podagrica* sp. and *Bemisia tabaci* present on each of the Okra plants.

Sampling was done at 10 days intervals between 7.00 am and 9.00 am in the morning when the insects were relatively less active and easier to spot.

There was high incidence of attack by the two species of *Podagrica (P. sjostedti and P. uniforma)* This hampered the flowering, podding and maximum growth stages of the Okra plant. Therefore, measurement of days to 50% flowering, number of fruit per plant and length of fruits were not recorded. However, the following data were collected from the study; plant height, numbers of infested plants, percentage defoliation, leaf area and pest population.

The height of plants was taken from two plants out of the 10 randomly selected from the middle row. The tallest and the shortest plants were measured and the average height recorded, using a meter rule and measuring from the soil level to the apex of the plant.

The holes on the Okra leaves were carefully counted and recorded from the 10 randomly selected plants of the middle row of each plot.

The number of infested plants was recorded from the ten randomly selected plants.

Percentage defoliation on leaves was calculated thus:

$$\text{Percentage defoliation} = \frac{\text{Total number of leaves defoliated}}{\text{Total number of leaves in sample}} \times \frac{100}{1}$$

Pest population was taken on the sample plants; counting was done at 10 days interval after planting in the morning hours for 70 days.

Leaf area was measured using three plants carefully selected from the ten randomly selected from the middle row of each plot. The leaf area was measured and calculated using the graphical method.

Statistical analysis: Only the plants from the two middle rows were used for analysis. Data on insect counts were transformed using square root transformation while those in percentages were arcsine transformed prior to data analysis. Data obtained were subjected to Analysis of Variance (ANOVA) procedure for a RCBD and means were separated by using Fisher's protected least significant difference (p = 0.05), using SAS (SAS institute Inc., 2000).

RESULTS AND DISCUSSION

The influence of soil amendments on Okra height (cm) at 20 days after treatment is presented in Table 1. The results of the number of infected leaves, percentage defoliation and leaf area (cm^2) obtained from the study with okra treated with four soil amendments against *Podagrica* sp. infestation are presented in Table 2 while Table 3 shows the effect of some soil amendments on the population of *P. sjostedti* at 10 to 70 Days After

Table 1: Influence of some amendments on Okra height (cm) at 10 and 20 days

	No. of days	
Treatments	10 days	20 days
NPK fertilizer	8.7	21.3
Poultry manure	9.8	33.1
Goat manure	13.9	26.6
Control	10.2	16.8
LSD (0.05)	3.7	7.8

Table 2: Number of infested Leaves, percentage defoliation and leaf area obtained from studies with Okra treated with some soil amendments against *Podagrica* sp. infestation

Treatments	No. of infected leaves	Percentage defoliation(%)	Leaf area (cm^2)
NPK fertilizer	23.4	64.9%	1869.5
Poultry manure	20.2	56.1%	2230.1
Goat manure	12.0	33.3%	2467.2
Control	21.6	59.9%	1791.2
LSD (0.05)	2.60	7.19	315.9

Table 3: Effect of some soil amendments on *Podagrica sjostedti* populations in Okra at 10 to 70 Days After Treatment (DAT)

	No. of days						
Treatment	10	20	30	40	50	60	70
NPK fertilizer	22.0	27.2	74.4	27.4	28.4	24.6	17.6
Poultry	20.2	27.2	30.0	30.8	26.4	20.8	13.0
Goat manure	20.4	26.6	24.0	22.2	25.4	16.4	12.0
Control	19.0	20.4	22.4	17.6	20.6	20.2	14.4
LSD (0.05)	3.7	5.6	62.7	7.1	7.3	11.1	4.9

Table 4: Effect of some soil amendments on *Podagrica uniforma* populations in Okra at 10 to 70 Days after Treatment (DAT)

	No. of days						
Treatment	10	20	30	40	50	60	70
NPK fertilizer	23.6	28.4	31.8	27.0	29.0	25.8	17.2
Poultry	21.4	27.4	25.6	24.4	26.6	19.6	15.8
Goat manure	21.4	27.4	35.6	33.3	29.0	23.0	16.6
Control	20.6	21.0	22.0	16.8	17.0	17.2	12.6
LSD (0.05)	3.1	5.9	7.6	6.2	8.9	8.8	5.6

Treatment (DAT). The effect of some soil amendments on the population of *P. uniforma* 10 to 70 Days After Treatment (DAT) is presented in Table 4. The soil amendments used in the control of insect pest of Okra were comparatively effective in the control of the insect pest of Okra especially *Podagrica* sp.

The application of goat manure and poultry manure significantly reduced the prevalence of *Podagrica* sp. NPK fertilizer contains nitrogen which promotes the vegetative growth of plants. However, the pest found it succulent and fresh, which made plots applied with NPK fertilizer prone to high pest infestation. This result agrees with the work by (Majanbu *et al*., 1986) that nitrogen application has more significant effect on both vegetative and reproductive growth of Okra than phosphorous application. The leaf area was significantly higher in the plots treated with poultry and goat manures than the NPK fertilizer and control.

The pest population of *Podagrica sjostedti* was significantly lower at 20, 40, 50 and 70 days of pest population count. However, it was significantly higher at 30 and 60 days and this can be attributed to the succulent appearance of the leaves to the pests. The pest population of *P. uniforma* was significantly different at 20 to 60 days count except for 30 and 70 days, which were not significant. Generally, *P. uniforma* was predominant in the field, which was suspected to have done much of the defoliation. The height measurement of the Okra at 10 days with the plots treated with Goat manure had the highest height but at 20 days there was significant difference in the poultry and goat manure treatments. However, at 20 days poultry had the highest height, showing that it had less pest attack. The number of infested leaves and percentage defoliation determined the rate of pest incidence from the study. However, these parameters revealed that there was significant difference among the treatments showing that the rate of defoliation was high on the plot applied with NPK fertilizer. This reveals the fact that that NPK fertilizer contains nitrogen which helps in the vegetative growth of plants. However, the pest found it succulent and fresh, which made plots applied with NPK fertilizer more prone to high pest infestation. A similar result was obtained in the research of Ogunjobi *et al*. (2005). The goat manure reduced the incidence of attack by *Podagrica* sp. This can be seen as a prospect of achieving substantial control of *Podagrica* sp. by the use of goat manure. This has disproved the superiority of synthetic pesticides over this particular soil as shown by this study. However, the fact remains obvious that pesticide applications are not an option for smallholder farmers because of the exorbitant cost and the danger posed to humans, livestock and wildlife.

CONCLUSION

The effects of synthetic pesticides is hazardous to humans, birds and wildlife; soil amendments are less costly than synthetic pesticides; soil amendments such as Poultry, Goat and other manures do not pollute the environment. To reduce the pollution in the environment and other beneficial organisms, soil amendment should be used effectively and efficiently in the control of insect pests, not only on Okra but other crop species of economic importance.

However, in this study, the application of goat and poultry manures significantly reduced the prevalence of *Podagrica* sp. The NPK 15:15:15: fertilizer may contain nutrients that aided the vegetative growth of the plants making it more luxuriant and thereby enhancing pest incidence, survival and

damage. Though there was no record of yield in the experiment due to high incidence of *Podagrica* sp. infestation. Further studies are however recommended on the composition of the soil amendments used in the experiment.

Pest management practices or principles are aimed at optimizing control and ensuring safe and healthy environment. Thus, there is need for supplementary control measures in addition to the soil amendments, such as use of botanical insecticides. Also, it would be interesting to look at higher application (dosage) rates of the different soil amendments used.

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