Effects of forest plant extract preparation and nutrient sources on performance of okra plant

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ABSTRACT

The possibility of solving the fertility and problems associated with disease control was explored by applying Neem extract (N_e), Swine manure (S_m) and Urea (U_f) amendment as botanical insecticide and nutrient source. The leaves used for the trial were collected from the locality, washed, pounded and soaked for 12 hours. The experiment was laid out in a randomized complete block design (RBCD) with five treatments and four replicates. Treatments include, 0, 5 and 10 litres concentration of both N_e and Detergent (D_e), two sources of nutrients (S_m and U_f) at three levels 5: 2.5: 1.25 and 120: 60: 30 kg/ha respectively. The efficacy of the treatments was based on the reduction in whitefly number, leaves defoliation, nutrient use efficiency and the performance of the Okra. Results showed that the N_e, D_e and the nutrient sources (S_m and U_f) significantly ($P<0.05$) influenced the performance of Okra. Though there were no significant difference in the number of seed per pod and pod number between the treatments but were better than the control that gave the least values. The experiment confirmed that the combine use of N_e and S_m application was found to be more effective to increase Okra growth, yield and soil fertility. It also indicated that N_e with S_m fortified urea could be used to substitute for synthetic insecticide and heavy use of chemical fertilizer.

Keywords: Neem extract, Swine manure, Urea fertilizer, Detergent, Okra.

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INTRODUCTION

Okra *Abelmoschus esculentus* (L.) is a special valued vegetable in different parts of Nigeria as for its delicious fruits and can be consumed alone or in combination with other foods. Nutritionally the dried seed has been considered has the richest part of the crop (Adelakun *et al,* 2009).The crop occupies about 1.5 million hectares of the arable land in Nigeria (IFA, 1992). Its World production as fresh fruit vegetable has been estimated at 1.7 million t/year (Schippers, 2000). However, the yield of Okra has been reported to be very low in Nigeria, hardly up to 7t/ha (Schippers, 2000). Recently, Onunkun (2012) opined that the problems of Okra production in Nigeria are insect pest infestations, disease incidence and poor soil nutrient level.

Frequent use of synthetic insecticides leads to a destabilization of ecosystem and to enhanced resistance to insecticides as pest control (Dittrich *et al*, 1990). Consequently, improper application of pesticides has resulted in environmental, human health problems and insect resistance (Perkins, 1982). Also, frequent uses of nitrogenous fertilizer have been found to increase the acidity of soil which adversely affect crops and microbiological properties of the soil (Kapkiyai *et al*, 1999). The high cost of importing pesticides, chemicals, which were further aggravated by local currency devaluation, not only creates a serious drain on the economy of countries with low Gross Domestic Products (GDP) like Nigeria, hence makes such chemicals unaffordable to resource poor farmers (Alphonsus, et al. 2005).

In response to the above mentioned fact, locally available and economically sustainable products and crop production strategies are now being explored to control crop pests and fertility restoration in this present condition for sustainability of man and its environment. The neem tree *Azadirachta indica* and its products have the potential to help in this situation (Besedow *et al*, 2002), especially in the regions where neem trees are abundant, such as in the Western part of Nigeria. Also, Swine industries are booming in developing countries with discharge of huge amount of manures that pollute the environment. The estimated fractions of organic N mineralizable in its manure indicated a range from 0.08 - 0.52 % for Swine (Cabrera and Gordillo, 1995). Aside from supply of nutrients, the manure suppress disease by generating ammonia and or nitrous acid in the soil (Larzarovite, 2001), it is also very cheap and effective as a good source of N for sustainable crop production.

This project therefore aimed at evaluating the effects of Neem extract, Neem extract with detergent, Swine manure and urea fertilizer in reducing pest effect and enhancing nutrient use efficiency for optimum Okra performance. It attempts to: (1) ascertain the efficiency of Neem leaf extract as organic treatment in Okra plant performance compared to the use of Neem extract with detergent and to (2) monitor the efficacy of organic and inorganic treatment in Okra production.

MATERIALS AND METHODS

Field trials were conducted during the cropping seasons of 2011 and 2012 at the Teaching and Research Farm, Oyo State College of Agriculture Igboora (Latitude 07º 40'N, Longitude 30º 30'E, 27.5 m) in the derived Savannah zone of Oyo state Nigeria. The site for the experiment was cleared, ploughed, harrowed and marked out into plot sizes of 3 x 5 m and separated by a 1m pathway. The experiment was laid out in a Randomized Complete Block Design (RCBD) with five treatments and four replicates. The planting material, an early maturing cultivar of okra (NHAE 47-4), was procured from the Oyo State Agricultural Development Program, Oyo state, Nigeria. The okra seeds were planted at a spacing of 60 cm between rows and 30 cm between plants. The manure was applied two weeks before planting while the urea fertilizer application took place a week after planting.The insecticides were applied once in a week and began 2 weeks after planting.

The treatments includes three levels of Neem concentration extracts and detergent at 0 litre (control), 5 litres (half) and 10 litres (full) dosages respectively. The urea (120: 60: 30 kg/ha) and swine manure at 5, 2.5 and 1.25 tons/ha rates were applied respectively. Hence, the treatments are: Control (N_o $D_o$$U_o$), 10 litres of neem extract concentration and swine manure at 5 tons/ha (N_fD0$S_f$$U_o$), 10 litres of neem extract with detergent (a match box full of omo) and swine manure 1.25tons/ha and urea 30 kg/ha ($N_f$$D_f$$S_q$$U_q$), 5 litres of neem extract and swine manure at 2.5 tons/ha and urea 60 kg/ha ($N_h$$D_o$ $S_h$$U_h$) and 5 litres of neem extract with Detergent (a match box full of omo) and urea 120 kg/ha ($N_h$$D_f$$S_o$$U_f$).

Neem leaf extracts solution preparation

Soil sample was collected before planting for physico-chemical analysis. Sampling of white fly was by visual count and commenced three weeks after planting. The method for the solution preparation includes: Collection of fresh neem leaves for azadirathin extraction, weighing of 5 kg leaves and placed in mortar. Pound very well and soak the pounded leaf overnight in water (soak 5 kg grounded leaves in 10 liters and 5 liters of water separately). After sieving, add a match box full of omo into 10 litres and 5 litres of Neem extract respectively, and then stir very well. Retain the filtrate as neem solution for spraying.

Data collection and Statistical Analysis

Sampling of whitefly was by visual count and it commenced 3 weeks after planting (WAP) in the morning between 6 - 8a.m. There were three sampled plants per plot. Growth parameters, (Leaf area, plant height, girth and leaf number) were taken 3-5WAP weekly. The yield parameter were taken fresh and on dry basis. Data collected were subjected to analysis of variance (ANOVA) using JMP 5 soft ware's while different in treatment means were separated using Duncan's Multiple Range Test (DMRT).

RESULTS AND DISCUSSION

The result of pre-Soil Analysis of the experimental site presented in the table 1, the soil had organic matter content of 1.56%, total N 0.14%, available P 16.6mg/kg, exchangeable K 0.31cmol/kg; Ca 0.19cmol/kg; Mg 0.40 cmol/kg, sand 74.4%, silt 13.6% and clay 12.0%. The soil is low in OM, N, and exchangeable ca. The low level of these nutrients justified the use of swine manure, urea and their fortification.

The efficacy of the treatments was based on the reduction in whitefly *Podagrica spp* and leaf defoliation effect, compatibility with the nutrients source and the performance of the okra plant. The results showed that the Neem detergent extracts and the nutrient sources (swine and urea fertilizer) significantly ($P< 0.05$) influenced the growth and yield of the okra plant respectively. Table 2 and 3 show that the treatments increased plant height, girth, leaf number and leaf area at 3,4 and 5 weeks after planting.

Fruit yield increased significantly in all treated plots over the control plots (Table 4). The treatments varies in their action, however more yield was recorded at full doses of Neem (9.38 g& 9 g) followed by half dose (7.8 g) respectively. Whereas, plots treated with half doses of Neem and with full doses of aqueous detergent and full urea rate ($N_hD_fS_oU_f$) produced relatively poor (5.6g) of fresh okra fruits at 7WAP. Though there were not significant effect in the number of seed per pod and pod number between the combine use of Neem with detergent at full doses and quarter doses of swine and urea fertilizer ($N_fD_fS_qU_q$) compared with the use of full doses of Neem and swine manure alone ($N_fD0S_fU_o$), but both were better than other treatments with the control the least.

Treated plant showed significantly lower (Table 5) population than untreated plots regardless of dose concentration. As concentration rate of Neem extract raised (N_f), there is suppression in the white fly population as compared to the reduced value (N_h) while the untreated plant had the highest number of white fly (4/leaf). Also, as the treatment in organic content increased the number of white fly is enhanced but the more organically inclined the less the pest encountered. There was a positive response between the white fly population and incidence of defoliation. Similar trend was also observed by the treatments on the leaf defoliation % with the control given the highest. Continuous feeding of whitefly on okra leave resulted in a significant higher defoliation of the foliar surface on untreated plots. The assertion is similar to the work of Obeng-Ofori and Sackey (2003) who noticed similar leaf damage with a rise in whitefly population.

Several studies have also mentioned that insecticides spraying enhanced yield increase in okra (Thul *et al*, 2009 and Ahmed *et al*, 2007). Thus, Neem extract gave good result in controlling white fly population and reducing leaf defoliation and disease incidence as compared with treatments with reduced value or deficient in it. The observed result is similar with the findings of Safdar *et al* (2005) who viewed that the easiest and cheapest means of reducing disease of okra is the use of resistant varieties but the use of Neem extract at 15days interval commencing from two weeks after

germination should be considered. The promising effect of Neem extract against whitefly and other okra pest enhanced the yield in the present study confirmed with the work of Mudathir and Basedow (2004). Similarly, the findings also fell in-line with the work of Pun *et al* (2005) who reported that treatment containing azadirachtin significantly reduced the attack of okra pests and increased yield. Hence, proved effective in reducing the population of whitefly population on okra thus improved the yield.

The use of Neem leaf extract with swine manure or its fortification with small quantity of urea application was found to be more effective, hence its use by resource poor farmers is recommended for maximum production of okra with reduced effect of pest and efficient nutrient utilization.

Table 1:Pre-Soil Analysis of the experimental site

Elements	Values
PH(H20)	6.67
Organic C%	1.56
Kjel N%	0.14
C/N ratio	9.75
P(mgKg-1)	16.6
Ca (cmolKg-1)	0.19
Mg(cmolKg-1)	0.40
K (cmolkg-1)	0.31
Na (cmolkg-1)	0.37
Acidity	0.42
Mn	0.2
ECEC	5.0
Particle	Size – Analysis
Sand (%)	74.4
Silt (%)	13.6
Clay (%)	12

Table 2: Effect of Neem extract, detergent, swine manure and urea fertilizer on girth and leaf number of leaves of okra in weeks after planting (WAP)

Treatment	Plant girth (cm)			Leaf number		
	3WAP	4WAP	5WAP	3WAP	4WAP	5WAP
$N_oD_oS_oU_o$	0.636e	0.720e	1.380e	7.100c	8.200e	8.400de
$N_fD_oS_fU_o$	3.063a	3.425a	3.620a	13.250a	15.625a	16.500a
$N_hD_oS_hU_h$	1.710c	2.24cb	2.60b	10.000ab	12.600b	11.000c
$N_fD_fS_qU_q$	2.650b	2.85b	2.40bc	10.000ab	11.000c	13.500b
$N_hD_fS_oU_f$	1.328d	1.600cd	1.750d	8.60b	10.60cd	9.60d

Means followed by the same letter (s) along the same column are not statistically different according to Duncan's Multiple Range Test.

Table 3: Effect of Neem extract, detergent, swine manure and urea fertilizer on plant height and leaf area of okra in weeks after planting (WAP)

Treatment	Plant height (cm)			Leaf area (cm^2)		
	3WAP	4WAP	5WAP	3WAP	4WAP	5WAP
$N_oD_oS_oU_o$	Ns	0.720e	1.380e	7.100c	8.200e	8.400de
$N_fD_oS_fU_o$	Ns	3.425a	3.620a	13.250a	15.625a	16.500a
$N_hD_oS_hU_h$	Ns	2.24cb	2.60b	10.000ab	12.600b	11.000c
$N_fD_fS_qU_q$	Ns	2.85b	2.40bc	10.000ab	11.000c	13.500b
$N_hD_fS_oU_f$	Ns	1.600cd	1.750d	8.60b	10.60cd	9.60d

Means followed by the same letter (s) along the same column are not statistically different according to Duncan's Multiple Range Test.

Table 4: Effect of Neem extract, detergent, swine manure and urea fertilizer on yield of okra

Treatment	Fresh fruit (g) 7WAP	Fresh fruit (g) 8WAP	Dry seed no	Pod number
$N_oD_oS_oU_o$	2.60d	3.60d	56.00d	37d
$N_fD_oS_fU_o$	9.38a	9.00a	138.13a	100a
$N_hD_oS_hU_h$	7.80ab	6.80ab	96.00b	69b
$N_fD_fS_qU_q$	9.00b	8.00b	155.00a	91a
$N_hD_fS_oU_f$	5.60c	4.60c	82.00c	48cd

Means followed by the same letter (s) along the same column are not statistically different according to Duncan's Multiple Range Test.

Table 5: Effect of treatments on plant leaf defoliation and whitefly population on okra plant

Treatments	No of white fly/leaf/plant	% leaf defoliation
$N_oD_oS_oU_o$	3.50a	30.00a
$N_fD_oS_fU_o$	1.50c	12.20e
$N_hD_oS_hU_h$	2.50b	20.70c
$N_fD_fS_qU_q$	1.90bc	17.50cd
$N_hD_fS_oU_f$	3.10ab	25.00b
Mean	5.50	21.08

Means followed by the same letter (s) along the same column are not statistically different according to Duncan's Multiple Range Test.

CONCLUSION

The study revealed the potentials of Neem leaf extracts in controlling a variety of insect pests in the field especially in controlling the whitefly. The use of plant wastes, animal manure and or with reduced amount of urea is a way to organic farming and an attempt to sustainable agriculture with less threat on the environment. The acceptability of neem leaf extract will also promote/protect on-farm planting of neem tree which can help in term of tree sustainability and carbon sequestration among farmers. Therefore, the use of Neem extract and organic wastes should be considered as way of sustaining the environment, cost reduction for poor farmers, soil maintenance of farming area. However, further research work on the use of Neem seeds, leaf lotion and leaf tea solution compared

with the leaf extract should be studied. The rate of application compare with the neem tree density and other neem tree utilization purposes for sustainability and economic purpose should also be examined.

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