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Pod Yield and Nutrient Uptake Of Okra *(Abelmoschus Esculentus)* as Affected by Rice Husk Mulch and NPK, 20; 10; 10 Rates in Abakaliki Agro Ecological Zone

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ABSTRACT: An experiment was set up in the Teaching and Research Farm of the Faculty of Agriculture and Natural Resources Management, Ebonyi State University, Abakaliki, to investigate the effect of 7.5 t/ha of rice husk dust used as mulch and four levels (250,200,150 kg/ha) of NPK 20:10:10 on pod yield and nutrient uptake of okra. The control received no mulch and no fertilizer treatment. Four seeds of okra was planted at a spacing of 50 X 50 cm on a plot size of 2 X 3 m and replicated five times. After germination the stands were thinned down to two and ungeminated seeds were supplied. This planting distance gave a plant population of 80,000 plants/ha. The experiment was laid out in randomized complete block design and raw data generated was analyzed according to Gomez and Gomez, 1986. When the treatments were compared with the control there was positive significant difference (p=0.05) .T2 was significantly different from T3 and T4 and T1. T3 was also significantly different from T2, T4 and T1. The trend of the increase in yield was T2>T3>T4>T1.When the amended plots were compared with the control there was positive significant effect. Available P, Total Nitrogen, Sodium and Calcium contents of the crop were significantly different when the treatments were compared with the control. There was also significant difference when the treatments were compared among themselves. Potassium and magnesium did not differ when the treatments were compared with the control and when the treatments were compared among themselves.

KEY WORDS: ***Abelmoschus esculentus***, Pod Yield, Nutrient uptake, Treatments, Rice husk, Fertilizer rates, Abakaliki.

INTRODUCTION

Tropical soils are beset with problems of acidity, low nutrient contents, nutrient imbalance and soil erosion. The use of fertilizers (organic and inorganic) has been found to solve these problems (Babatola and Olaniyi, 1997).The importance of the use of organic manure and mineral fertilizer in tropical agriculture for increased world food production has been thoroughly discussed (Aliyu and Olanrewaju, 1996; Abad *et al.*, 1997). In most cases, single applications of these organic or in organic fertilizers are carried out (Akanbi and Togun, 2002; Babatola and Olaniyi, 1997). Inorganic fertilizers are applied to the soil mainly to increase the supply of one or more of the essential nutrient e.g. nitrogen, phosphorus and potassium while organic manure are added to improve the physical and chemical properties of the soil; to maintain humus status of the soil and also maintain the optimum condition for the activities of soil micro and macro organisms.

Researchers have evaluated the agronomic potentials of inorganic fertilizers and organic manure available to farmers in improving soil fertility status, chemical; and physical properties and improving crop yield. Regular and substantial addition of mulch materials like rice husk dust left on the surface rather than incorporated into the soil have proven to be a beneficial practice for a wide range of soil and agro- ecological environments. The main benefits include maintenance of moisture and temperature regimes in the root zone, favorable biological activities, particularly earth worm activity and addition of plant nutrients (Maurya and Lal, 1980).

The extent to which combined use of rice husk as mulch and different levels of N.P.K. 20: 10:10 has not been researched to a satisfactory level. The rate of growth and final economic yield depends on the quantity of plant nutrients absorbed by the plants (Brady and Weils,1999). The aim of this paper is to evaluate and access the benefits of the simultaneous use of abundant rice husk as mulch and fertilizer rates on the pod yield and nutrient contents of okra.

MATERIALS AND METHOD

The Description

The experiment was conducted at the Teaching and Research Farm of the Faculty of Agriculture and Natural Resources Management, Ebonyi State University Abakaliki. The study area is located between Latitude 06^0 4^1N and longitude $08^{\ 0}$ 5^1E and rainfall pattern is bimodal (April-July), September-November with a short spell sometimes in August. The annual rainfall is between 1000mm-1500mm.The vegetation of the area is predominantly derived Savannah. The mean annual temperature is about 24^oC and the relative humidity is between 60-80% (Ofomata, 1975). Common crops found in the study area include cassava, yam, okra, maize, soya bean, cowpea, groundnut etc; The dominant grasses are P***ennisetum purpureum***, Panicum *maximum*, T*ridax procumbens;*. The soil type is sandy clay loam which in some places are poorly drained (Anikwe, 2000)

Site Selection / Field Layout

The site was cleared of the existing Vegetation. The field was marked into 20 plots of 2 X 3 m ($6m^2$). The 20 plots were divided into 5 bocks, each block was separated from the other by 1m and the distance between plots was 0.5m. The site was tilled manually using conversional hoe.

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Materials

The rice husk dust was collected from the Abakaliki rice mill, NPK 20:10:10 fertilizer was purchased at the Ebonyi State Chemical Fertilizer Blending Plant. Okra variety "Clemson spineless" used as a test crop was purchased at the Enugu State Agricultural Development Programme (ENADEP).

Tilling/Treatment Allocation/Planting

The plot was pulverized before planting and application of treatments. NPK fertilizer 20:10:10 was applied at the rates of 250 kg/ha, 200 kg/ha and 150 kg/ha and a blanket application of rice husk at the rate of 7.5 t/ha was uniformly spread as a surface mulch two weeks before seeds were planted. The Okra seed was planted four per hole and later thinned down to two, one week after germination (WAG). Again there was a plot without treatment which was used as the control. The study consisted of four treatments namely: T1= control, T2= rice husk dust mulch + 250kg/ha NPK 20:10:10, T3=rice husk dust mulch + 200kg/ha NPK 20:10:10 and T4= rice husk dust mulch + 150kg/ha NPK 20:10:10

Weeding

Weeding was done manually as the need arose.

Plant Measurement

Fruit yield was measured when pods were immature but mature enough for soup making. Plant materials for total nutrient content was harvested at 40 DAP by uprooting the whole plant. This was done by randomly uprooting three plants per plot. The materials were dried in the oven at 105 ± 1°C for 72 hours. After this the materials were ground with Moulinex blender to form a fine powder. About 80 g representative samples was collected from each replication for analysis of plant nutrients (total N, Available P, K, Na, Mg, Ca.) according to standard analytical method.

Experimental Design/ Statistical Analysis

The experiment was laid out in a Randomized complete block design and replicated five times with 4 treatments in three blocks. Analysis of variance, means, percentages were according to Okporie,(2006)

RESULTS AND DISCUSSIONS

The effect of different levels of treatments on pod yield of okra is given in Table 1. the mean pod yield in the control was 955.5kg/ha while yield among the treatments were 4007.70,3402.30 and 3494.00kg/ha for T2, T3 and T4.There was significant difference (P=0.05) when the yield in the treated plots were compared with the control plot .The control plots produced pods 76.1 , 71.9 and 72.6 %lower than T2, T3 and T4. respectively .There was positive significant difference when T2 was compared with T1 , T3 and T4.Similarly,T3 showed positive significant effect when compared with T1 and T4 but showed negative effect when compared with T2 . The result also revealed a negative significant effect when T4 was compared with T2 and T3, but showed positive effect when compared with T1. These results corroborated the report of Akanbi and Togun, (2002), who showed that soil recycling of agricultural wastes such as rice husk produced comparably high yield and mineral fertilizers produced higher yield when combined with agricultural waste. The rice husk used as mulch improved the physical properties of the soil. This in turn helped the roots to make better use of the applied inorganic fertilizer. Again increase in pod yield followed the increasing quantities of the inorganic fertilizer showing that the optimal fertilizer rate for okra production in the zone has not been reached even at 250 kg/ha. The lowest yield among the treatments was recorded in the plots with 150kg /ha NPK 20:10:10. Here the fertilizer was not sufficient for the crop to make good use of the improved soil environment provided by rice husk used as mulch. The yield recorded in this work agrees with the results of Babatola, and Olanaiyi, (1997).

Table 1: Effect of treatment on, pod yield

Treatment	Pod Yield (kg/ha)
T1	956.50 ^{a}
T2	4007.70 ^{b}
T3	3402.30 ^{c}
T4	3494.00 ^{d}
FLSD $_{(P=0.05)}$	0.094

Figures with the same subscript are not statistically significant

Plant Total Nutrient Content

The plant nutrient content absorbed by the crops as affected by the treatments is presented in table 2. The result showed that there was significant effect of treatment on percentage phosphorus (P) absorbed by the plants planted on the treated soils over the control. However, T1 contained 19.4% and 30.9% less Available P than T2 and T4 respectively. Comparatively, T1 showed positive significant effect when compared with Available P content of crops harvested from T2, T3 and T4 plots. Treatment T2 showed positive significant change when compared with T4 and T3. Again treatment 3 when compared with T2 and T4 showed negative significant effect, but when compared with T1 showed positive significant effect. Phosphorus is among the elements that are found highest in rice husk. This might be the reason the content of P in the untreated plot is low. There was significantly positive effect when T4 was compared with T1, T2 and T3.The higher level of Available P recorded in the treated plots proved that sufficient nitrogen in the soil increased absorption of available P from the soil. Within the treatments also available P increased according to the increase in the applied fertilizer. The soil bound P may have also contributed to the overall high level of P that was recorded in the plants among the treated plots.

Total Nitrogen (N)

The mean value for the effect of treatment on percentage Nitrogen absorbed by the plant showed that T1 plots produced crops with 2.8% nitrogen, which was 39.1, 39.1 and 26.3% lower than N contents of T2, T3 and T4 treated plots respectively. Statistical analysis of the data showed that amended plots produced negative significant

Effect (P=0.05) when crops from T1 plots were compared with the amended plots. However, T2 when compared with T1 and T4 showed positive significant effect, similarly, N content of crops from T3 plots when compared with those of T1 and T4 plots showed positive significant difference. Again the table showed that there was no significant effect when N in crops T2 plots was compared with N from T3 plots. There was statistical difference when a treatment 4 was compared with T1, T2 and T3. Nitrogen was highest in the plants with 250 kg/ha fertilizer treatment than the control plot and 150 kg/ha treatment. But the value was the same for 250 kg/ha and 200 kg/ha. The high rate of nitrogen in the NPK 20:10:10 and the N quantity released from the rice husk may have impacted on the soil N, with the improved environment provided by the rice husk; the okra crop would likely absorb more N from the T2 and T3 treated plots. Again in T4 treated plots, the low level of N recorded in the crops may have been caused induced deficiency which results when there is an imbalance in soil nutrients. The levels of N in a crop determines the nutritional value of the crop and invariable the price of the produce. This is in agreement with the findings of Babatola, and Olanaiyi, (1997).

Potassium (k)

The effect of treatment on percentage potassium absorbed by the plants did not show any significant difference when the treatments were compared with the control. Similarly, there was no significant effect when the treatments were compared among themselves. However T2 plots produced crops with higher content of K than the other treatments, followed by T3 and T4. But treatment T1 produced crops with levels of K about 16.6; 25.0, 18.9% lower than treatment 2, 3 and 4 respectively. The treatment did not affect statistically the quantity of K absorbed by the plants

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Sodium (Na)

The effect of treatments on total sodium absorbed by the plants as presented in the table 2. Showed that there was statistical difference when the Na content of the okra in the treated plots was compared to the control. Again there was also statistical difference when the okra Na contents in the treatments were compared among themselves. Accordingly the table showed that treatment 1 plots produced okra crops with percent sodium 34.2, 50.0, and 37.3% lower than treatments T2, T3 and T4 respectively. Multiple comparison of T1 with the amended plots showed negative significant differences. Similarly, there was negative significant difference when T2 was compared with T3 and T4, but when compared with T1 there was significantly positive effect. However, T3 and T4 showed positive significant effect when compared with T1 and T2 respectively. But when Treatment 3 was compared with T4 there was no significant effect. Treatment 3 and 4 did not affect the quantity of Na absorbed by the plants.

Calcium (Ca)

The data on the mean effect of treatment on percentage calcium absorbed by the plants showed that there was statistically significant difference when the treatments were compared with the treatments. There was also statistically significant difference when the treatments were compared among themselves. Treatment 1 plots contained 37.3, 34.8 and 22.7% lower calcium than treatment T2, T3 and T4 respectively. Comparatively, T1 showed negative significant difference when compared with the amended plots. Furthermore, T2 when compared with T1, T2 and T4 showed positive significant effect. Similarly, T3 when compared with T1 and T4 showed positive significant difference but, when compared with T2 showed negative significant change. Treatment (T4) when compared with treatment T2 and T3 showed negative significant difference but, produced significantly positive effect when compared with T1.

Magnesium (Mg)

Table 1 showed statistically no significant effect when the control was compared with the treatments. And there was no significant difference when the treatments were compared among themselves. Nevertheless, the result showed that magnesium content of the okra crops from treatment 1 was 34.5, 36.0 and 30.0% lower than the Mg contents in the amended plots (table 2). The treatments did not have detectible effect on the quantity of Mg absorbed by the plants.

SUMMARY

The results indicated that NPK 20:10:10 and rice husk dust used as mulch in the amended plots improved the pod yield of the crop. Also, nutrient elements absorbed by the plants were significantly improved. Similarly, percentage plant nutrients elements absorbed by the plant like Ca, K, N, and P were significantly improved relative to the control while Mg and Na contents did not show any significant difference. These could be attributed to the amendment, which directly added organic matter to the soil, as sources of energy for soil microbes and added plant nutrient elements through the inorganic fertility

CONCLUSION

In conclusion, it was observed that a combination of organic waste and inorganic fertilizer is very useful as soil amendment, as it increased pod yield of okra and the nutrients absorbed by the plants. This research has provided an ecologically sound means of getting ride of the hitherto pollution effects of rice husks in the State

RECOMMENDATION

The researcher recommends the use of organic waste and inorganic fertilizer as soil amendments. Farmers should be encouraged to use organic waste to compliment inorganic fertilizers as it is readily available and affordable. The effective use of this seemingly waste by product will immensely contribute in checking environmental pollution caused by the rice husk.

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