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RESPONSE OF EGG PLANT (*Solanum melongena (L.)*) TO NPK FERTILIZER ON DEGRADED ALFISOL IN SOUTH WESTERN NIGERIA

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ABSTRACT: Field trials were conducted at NIHORT, Ibadan in 1998 and 1999 to assess the effect of varying levels of NPK (20:10:10) on the performance of egg plant on degraded Alfisol in southwestern Nigeria. In each year, four levels (0,45,90 and 135 Kg N/ha) of NPK (20:10:10) fertilizer were applied to eggplant (Variety: long purple) in RCBD with four replications. Data were collected on growth and yield parameters to assess treatment effects.
Results of this study showed that application of NPK (20-10-10) fertilizer significantly (P=0.05) increased plant height, number of leaves, number of fruits/plant, fruit weight/plant, fruit quality, and total yield, compared to control (no fertilizer). However, optimum performance was obtained when NPK 20-10-10 was applied at the rate of 90kg N/ha in both years of study. The increase in fertilizer level from 45kg N/ha to 90kg N/ha was accompanied by a concomitant increase in yield from 7.38t/ha to 31.7 t/ha in 1998 and from 13.02 t/ha to 50.6 t/ha in 1999. Increasing the fertilizer level to 135 kg N/ha resulted in yield reduction (4.62t/ha and 25.5 t/ha in 1998 and 1999, respectively) Maximum economic returns were obtained at 90kg N/ha by calculating the cash advantage due to fertilizer application. Generally, application of NPK 20-10-10 enhanced crop growth and yield, and also ensured high economic returns of egg plant even at moderate fertilizer level.

Key words: Egg plant, NPK fertilizer, yield components

INTRODUCTION

Egg plant *(Solalum melongena (L.)* belongs to the family Solanaceae. The crop is cultivated for its fruits, both in distant farms and home-gardens especially in peri-urban areas of southwestern Nigeria and it can be grown almost throughout the year.
The unripe fruits (green, purple or white) are mostly found at the farm gate and in urban markets especially in grocery stores. The unripe fruit can be fried or cooked with stew to eat rice and yam or sliced for making salad. Egg plant is reported to be rich in calcium (Ca), potassium (K), phosphorus (P), Thiamin, riboflavin, vitamin C and to a lesser extent, protein (Tindall, 1978).
In Nigeria, little information is available on agronomic practices to improve the performance and yield of egg plant. Ogbadu and Easmon (1989) while working on influence of organic and inorganic fertilizer on chemical composition of egg plant in Zaria, Nigeria, reported that fertilizer application caused a decrease in the nitrate and moisture content while crude – fiber, verifiable total acidity and total protein content of the fruit were increased. Asiegbu and Uzo (1984) also noted that in Nsukka, Southeastern Nigeria, yield increase per hectare in egg plant largely depends on number of plant contributing to yield and number of fruit set per plant. In India, Rastogi *et al* (1979) reported that at different levels of nitrogen 45, 60, 75, 90 kg ha^{-1} and no fertilizer, nitrogen had no significant affect on fruit yield indicating that the lowest rate was probably sufficient for egg plant grown in soils of average fertility. However, Umrani and Khot (1973), also in India, observed that N increased the number of fruits per plant and fruit size of egg plant, while there was no response to P application.
Against this background of conflicting response of egg plant to fertilizer application, this study was therefore carried out to evaluate the effect of NPK (20-10-10) fertilizer on the growth and yield of eggplant in south western Nigeria.

MATERIALS AND METHODS

Two field experiments were carried out in 1998 and 1999 at the National Horticultural Research Institute (NIHORT), Ibadan, Nigeria (7°30'N and 3°50'E). Ibadan lies in the

Table I: Monthly distribution of rainfall (mm)during the study period

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1998	0.0	0.0	22.6	138.6	143.8	131.1	61.8	60.2	239.3	151.3	50.2	24.3
1999	0.0	78.5	97.2	155.3	164.5	320.4	269.5	146.3	216.2	355.1	56.8	0.5

forest–savanna transition zone of Nigeria. The rainfall in the area has bimodal distribution pattern (Table I). The soil used for the study was sandy loam soil derived from basement complex rocks (Smyth and Montgomery, 1962).

Ten representative composite soil samples collected at 0-15 cm depth were bulked, air- dried and passed through a 2 mm sieve before being subjected to routine soil analysis using standard laboratory procedures (IITA, 1981). The experimental plot of land was ploughed and harrowed. Each plot size was 3m x 4m with 1m within and between plots. The treatments were four levels of NPK (20:10:10) fertilizer , applied 2 weeks after transplanting (WAT), as single dose at the rates 0, 45, 90 and 135 kg N/ha. The seeds of egg plant (variety long purple) were planted in July 1998 and 1999. The seedlings were transplanted when they were six weeks old. Plants were spaced 90 cm x 60 cm apart (Kogbe, 1983) and the experiment was carried out using a randomized complete block design with four replications.

Plots were hand weeded at 3 and 6 WAT before canopy cover. Other routine cultural practices were also carried out. Eight plants were randomly tagged for measurement of the following parameters: height of plants, number of leaves at flowering and at physiological maturity (before fruits turn yellow), number of fruits/plant, weight of fruits/plant and total fruit yield.

Table 2. Physico-Chemical Properties of the Soil (0-15cm)

Properties	1998	1999
PH (1.1) water: soil ratio	6.5	6.8
Available P (mg 1kg)	6.7	7.2
Total N (%)	0.06	0.06
Organic C (%)	3	3.9
Exchange cation	-	-
K (cmol /kg)	0.19	0.2
Ca (cmol /kg)	0.83	0.8
Mg (cmol /kg)	0.29	0.21
Na (cmol /kg)	0.38	0.38
Texture	-	-
Sand%	80.6	82
Silt%	15.4	13
Clay%	4	4

Data collected were analysed using General Linear Model Procedures of the Statistical Analysis System (SAS Inst. 1998). Means were separated using Duncan's Multiple Range Test (DMRT) at 5% level of significance. Cash advantage due to applied fertilizer was estimated by the difference between no fertilizer application and each kg of fertilizer added at the rate of ₦2,500/50kg bag of fertilizer. Egg plant fruits were sold at the rate of ₦40/kg in both years.

RESULTS AND DISCUSSION

There was a general enhancement of performance of egg plant in 1999 apparently because of higher level of rainfall (1549.9 mm) recorded that year compared to (562.8 mm) recorded in 1998 which led to reduced crop performance in 1998 (Table 1). This was clearly shown by the lower values of vegetative parameters (Table 3) and in particular, the yield of egg plant (Table 4) in 1998 compared to 1999. Kogbe 1983 also reported larger fruit size when adequate moisture was available than in previous planting when supplementary irrigation was disrupted.

The total soil available N for each year (Table 2) was generally low and this may be the reason why there was significant increase in yield of egg plant even at the lowest rate (45kgN/ha) of fertilizer applied.

Plant heights of egg plant were significantly (P= 0.05) increased by fertilizer application in the two years of study and the optimum growth was obtained at the fertilizer rate of 90kg N/ha, after which additional fertilizer application was no longer beneficial to the crop. Note that additional fertilizer, apart from not being beneficial, depressed the growth and yield of the crop (Table 4). Similar trend of variation was observed on the number of leaves. Leaf development was enhanced by NPK fertilizer and highest number of leaves (94) was obtained at 90kg N/ha, which was significantly higher than the number of leaves obtained at other levels of fertilizer applied to egg plant. This findings agrees with those results of Maidu *et al.* (1999) who reported that fertilizer application significantly increased plant height, number of leaves, number of nodes and internode length of egg plant.

The number of fruits per plant, weight of fruits per plant, fruit quality (number of marketable fruits expressed as a percentage of total fruits harvested) and total fruit yield (tons/ha) were generally enhanced by fertilizer application. Highest response was observed at 90kg N/ha. This agrees with the finding of Umrani and knot (1973), who noted that applied nitrogen increased the number of fruits per plant and fruit size. However, Subbiah *et al.* (1983) reported that 50kg N, 25kg P_2O5 and 15kg K_2 0 per ha gave best yield of

Table 3. Effect of NPK fertilizer on Morphological Characteristics of eggplant at Flowering.

NPK fertilizer (kg/ha)	Plant Height (cm)		Number of leaves per plant	
	1998	1999	1998	1999
0	67.0b	68.0b	69.25c	76.0c
45	71.7b	81.0a	81.20b	81.5b
90	81.5a	85.7a	94.00a	94.0a
135	67.0b	69.7b	85.00b	86.0b

Table 4: Yield and Yield Components of Eggplant under different levels of NPK fertilizer.

NPK Fertilizer (kg /ha)	No of fruit per plant		Fruit weight (g per plant)	
	1998	**1999**	**1998**	**1999**
0	5b	9.0b	40.0c	66.2b
45	7ab	10.2ab	59.0b	141.0b
90	8a	11.25a	94.2a	236.8a
135	5b	11.0ab	59.7b	147.3b
	Total fruit yield (t/ha)		Fruit quality (% marketable fruit)	
0	3.7c	11.3c	50c	50c
45	7.38b	31.7b	72.5b	80.5b
90	13.62a	50.6a	95.6a	99.8a
135	4.62c	25.5b	75.6b	97.2a

egg plant. Sawan and Rizk (1998) in Egypt also reported that application of 90 kg N through NPK fertilizer led to improved shoot growth in egg plant. This suggested that application of NPK is essential for growth and yield of egg plant particularly when N and P were applied at ratio 2:1.

The total fruit yield (Table 4) especially the marketable fruit yield (fruits harvested without blemish) in 1998 was lower than in 1999. In addition, fruit size (g/plant) had similar trend. This may be attributed to moisture availability, which was greater in 1999, considering total amount of rainfall recorded during the growth period, and the fact that adequate moisture is needed to transport applied nutrient for efficient utilization by plant for its growth and development. However, Asiegbu and Uzo (1984) noted that yield increases per hectare in eggplant plant largely depend on the number of plants contributing to yield and also on number of fruit set per plant. Kogbe (1983) also noted that differences in fruit number per square meter and partly fruit size (weight) had great influence on total fruit yield and all these processes are directly affected by optimum supply of light, water and nutrients.

Table 5. Cash Advantage due to Fertilizer application (CAF)

NPK fertilizer Level	CAF (₦ 000)	
	1998	1999
0	-	-
45	144	816
90	369	1572
135	36.8	568

The fruit quality of egg plant as shown by the % marketable fruit was significantly enhanced by fertilizer application in both years and highest % marketable fruit was obtained at 90kg N/ha (Table 4). Also, there was greater returns for each kg of fertilizer added up to 90kg N/ha after which additional fertilizer did not bring higher economic returns, considering the Cash Advantage due to Fertilizer application (CAF) (Table 5).

In conclusion, this study showed that an optimum rate of 90kg/ha of NPK 20: 10: 10 is adequate for eggplant cultivation and that optimum yield is possible even at the above rate of fertilizer application, when there is adequate moisture in the soil during cultivation of egg plant.

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