

IMPROVING THE PRODUCTIVITY OF EGG PLANT (*Solanum melongena*) USING FERTILIZERS

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Abstract: Despite the benefits of Eggplant, the optimum yield cultivation has not been attained in Nigeria. Therefore, the objectives of this study are to (1) investigate the effect of NPK and manure fertilizers on vegetative and reproductive stages of eggplant and (2) determine the impact of the combination of manure and NPK on the yield and yield components of eggplant. The experiment was laid out at randomized complete block design with three replications. Morphological and yields parameters were measured. There was significant difference ($P < 0.05$) amongst the treatments, V3 showed the highest branches (23.66) with manure while in control 9.83 were recorded. The leaf length was statistically different ($P < 0.05$), the longest leaf was recorded in V2 (41.88 cm) and V3 (41.50 cm) with NPK and manure and the shortest with no fertilizer in all the varieties (21.22 cm for V1). V1 demonstrated the highest yield (1166.66g) with NPK and was statistically different from other varieties and the lowest yield was obtained in the control. V1 with only N-P-K fertilizer treatment recorded the best result in terms of fruit production or yield. Thus, the best option for the eggplant farmer is to work with V1 and N-P-K fertilizer.

Keywords: Eggplant, production, yield, amendment, field

INTRODUCTION

Eggplant (*Solanum melongena* L.) is one of the most important vegetable in the world after potato, tomato and cucumber and it is usually grown for its nutritious fruits which are utilized as vegetables to contribute to the essential nutrients in human diet (Maghfoer *et al.*, 2013).

Eggplant fruits could be consumed raw as snacks by both adult and children. The fruits are cooked and used in the preparation of sauces for cocoyam and yam (Onwuka, 2005). In Southeastern Nigeria, the fruits are served alongside with Kolanuts (*Cola accumilata*) in both big and small ceremonies such as marriages, festivals, traditional title taking, meeting and others (Okafor, 1993). Schippers (2000) also reported that the fruits are said to represent blessings and fruitfulness and are offered as tokens of goodwill during visits, marriages and other social events in Ghana and Nigeria.

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There is high demand for eggplants and this is due to the increasing awareness toward the nutritional and health benefit of eggplant in fulfilling the nutritional requirement of the family (Jumini and Marliah, 2009).

In spite of the considerable economic, social and health importance of eggplants, the optimum yield cultivation has not been attained in Nigeria due to continuous cropping resulting in declining soil fertility, organic matters in the soil and other land degradation factors (Ullah *et al.*, 2008). Eggplant is highly responsive to NPK and deficient will inhibit the growth and result low production. Efforts aimed at increasing the yield of eggplants using inorganic fertilizer are limited by high cost, scarcity at the farmers' level and degradation of soil properties due to continuous use (Moyin-Jesu, 2007). Moreover, low use efficiencies of inorganic fertilizers coupled with their rising costs and the need for organically produced foods has directed the attention of farmers towards organic sources. Organic manures may increase soil fertility and thus the crop production potential possibly by changes in soils physical and chemical properties including nutrient bioavailability, soil structure, water holding capacity, cation exchange capacity, soil pH, microbial community & activity etc (Marschner, 1986). Hence animal wastes that result to animal manures are better alternative and a necessary option. The organic matter of the soil which can be replenished and maintained by the application of animal manures has been considered by Reddy and Reddi (1992) as the life of soil as well as store house of plant nutrients especially nitrogen, phosphorous, potassium and micronutrients and as well prevents leaching of nutrients.

Nutrients contained in organic manures are released more slowly and are stored for a longer period in the soil ensuring longer residual effects, improved root development and higher crop yields (Sharma and Mitra, 1991)

In Nigeria, huge amount of animal manures are generated and heaped on dumpsite, posing potential environmental hazard. Incorporating this waste material into the soil for crop production is expected to be beneficial since most Nigerian soils are low in organic matter, which is crucial for maintaining soil fertility as well as supplying primary, secondary and micronutrients for crop production. Several studies carried out indicate positive effect of organic manure on soil productivity, crop growth and yield (Eifediyi and Remison, 2010, Adesina and Sanni, 2013, Nweke *et al.*, 2013, Sanni and Adenubi, 2015, Fagwalawa and Yahaya, 2016). Therefore, the rising consumption of eggplants offers a positive scenario for the study of the crop.

The specific objectives were to:

1. study growth, and fruit yield in eggplant with NPK fertilizer
2. investigate the effect of manure on vegetative and reproductive stages of eggplant
3. determine the impact of the combination of manure and NPK on the yield and yield components of eggplant

MATERIALS AND METHODS

Experimental site

This experiment was carried out on eggplants at Bowen University Teaching and Research Farm Iwo, Osun State.

Experimental Set-up

The experiment was laid out at randomized complete block design with three replications. Seeds of three varieties (V1, V2 and V3) of garden egg obtained from a farmer from Iwo city were raised in the nursery for 7 weeks before transplanting to the field. The seedlings were adequately watered and protected from harsh weather by providing light shade which was removed some days prior to transplanting to hardening up the seedlings. The field used were cleared for eggplant transplantation. The field was demarcated into 3 blocks. Each block (10m x 2m in dimension) consisted of 12 experimental units. At the time of transplanting, the seedlings were watered heavily to prevent excessive damage to the roots when lifted. The treatments applied were three fertilizers and a control.

The treatment 1 served as control and no fertilizer was applied.

Treatment 2 was the use of 10 grams of NPK fertilizer on the variety planted.

Treatment 3 was the use of two handfuls of dry manure on the variety planted.

Treatment 4 was the use of 5 grams of NPK fertilizer and one handful of dry manure on the variety planted.

VIP Insect spray(pesticide)was used twice to manage the negative effect of pests.

The dry weight of the harvested fruit was obtained by firstly cutting them into smaller pieces then putting them in an oven. The temperature of the oven was set at 100°C with a control temperature of 90°C

Measurements

Measurements taken include plant height, leaf length, and leaf width, and leaf area, number of leaves, flowering date, and number of branches, yield and yield component.

Data analysis

Analysis of variance (ANOVA) was done to determine the treatment differences in, growth and yield. The Duncan Multiple Range Test (DMRT) was used to compare treatment means at $P < 0.05$.

RESULTS

Table 1 shows the effect of organic and inorganic fertilizer on eggplant branch. Significantly differences were observed among treatments. The result show that Variety 2 gave the longest branches (10.44 cm) while V1 the shortest branches (5.88 cm) under control condition. With N-P-K treatment, longest branches (17.11 cm) were observed in V3 while the shortest branches (6.1 cm) were recorded in Variety 1. With manure treatment only, V3 showed the longest branches (23.66 cm) while V2 gave the shortest branches (10.1 cm) though not statistically different. The combination of manure and N-P-K treatment V2 produced the longest branches and V1 the shortest branches. Manure produced the longest branches compared to other fertilizers used either solely or in combination.

Table 1: Effect of organic and inorganic fertilizer on eggplant branch

Variety	Control	NPK	Manure	NPK + Manure
V1	5.88b	6.1b	21.16a	12.00b
V2	10.44b	10.0b	19.1a	13.00ab
V3	9.83b	17.11ab	23.66a	12.50b

Different letters in the same row show significant difference at 0.05 probability level

Table 2 shows the effect of organic and inorganic fertilizer on eggplant leaf length. There was significant difference between the four treatments, the longest leaf (31.77 cm) was obtained with NPK treatment followed by the combination of manure and NPK (25.16 cm), and the shortest leaves were recorded in the control. V3 produced plants with the longest leaves and V1 produces plants with the shortest leaf length under no treatment. V2 with only N-P-K treatment produced crops with the longest leaf length (41.88 cm) and V3 the shortest leaf length (31.77 cm). With manure treatment only, V3 produced crops with the longest leaves (41.50 cm) while V1 produced leaves with the shortest leaf length (24.66 cm). With a combination of N-P-K and manure treatment, V2 gave crops with the longest leaves (36.00 cm) and V1 with the shortest leaves (25.16 cm).

Table 2: Effect of organic and inorganic fertilizer on leaf length

Variety	Control	NPK	Manure	NPK + Manure
V1	21.22b	31.77 a	24.66b	25.16b
V2	23.33b	41.88a	35.77a	36.00a
V3	28.83b	31.33b	41.50 a	35.66ab

Different letters in the same row show significant difference at 0.05 probability level

Table 3 shows the effect of organic and inorganic fertilizer on eggplant yield (fresh weight). With the control treatment, both V1 and V3 gave the lowest results. With only N-P-K treatment, V1 gave the highest yield (1166.66 g) and V3 the lowest yield (244.28 g). With only manure treatment, V2 gave the highest yield (437.26 g) and V1 gave the lowest yield (218.75 g). With a combination of N-P-K and manure treatment, V2 produced the highest yield (541.50 g) and V3 gave the lowest yield (270.16 g). Overall, the highest yield (1166.66 g) was observed with the application of NPK while the lowest yield (200.00 g) was obtained from the control. Significant difference was observed amongst the treatment used.

Table 3: Effect of organic and inorganic fertilizer on yield (fruit fresh weight)

Variety	Control	NPK	Manure	NPK + Manure
V1	200.00 c	1166.66a	218.75c	380.77b
V2	211.23 c	594.85a	437.26b	541.50a
V3	200.00c	244.28a	307.41a	270.16a

Different letters in the same row show significant difference at 0.05 probability level

Table 4 shows the effect of organic and inorganic fertilizer on eggplant yield (dry weight). Significant differences were observed among treatments. With the control treatment only, V2 produced the highest dry weight (15.83 g) and V3 produced the lowest dry weight (7.80 g). With N-P-K fertilizer treatment, the highest dry weight content (88.07 g) was recorded in V1 and the lowest dry weight content in V3 (18.50 g). With manure treatment only, V1 gave the highest dry weight matter (37.83 g) and V3 gave the lowest dry weight matter (23.30 g). With a combination of N-P-K and manure treatment, V2 produced the highest dry weight matter (79.43 g) and V1 produced the lowest dry weight matter (18.19 g). Amongst the

varieties, V1 demonstrated the highest dry matter (88.06 g) under NPK treatment followed by V2 under the combination of NPK and manure (79.43 g)

Table 4: Effect of organic and inorganic fertilizer on Fruit (dry weight)

Variety	Control	NPK	Manure	NPK + Manure
V1	15.55c	88.066a	37.93 b	18.19c
V2	15.83 d	48.85b	30.66b	79.43a
V3	7.80 c	18.50b	23.30b	39.50a

Different letters in the same row show significant difference at 0.05 probability level

Table 5 shows the effect of organic and inorganic fertilizer on number of fruit. There was significant differences in number of fruits with fertilizers used. The highest number of fruit (20.55) was observed in V2 under NPK. With control treatment only, V2 produced the highest number of fruits (7.11) and V3 produces the lowest number of fruits (3). With N-P-K treatment only, V2 produced the highest number of fruits (20.55) while V3 produced the lowest number of fruit (3.55). With only manure treatment only, V2 produced the highest number of fruit (15) while V3 produced the lowest number of fruit (4.50). With the combination of both manure and N-P-K treatment, V2 produced the highest number of fruit (10.66) and V3 produced the lowest number of fruits (2.33). The overview of the plant with fruits is presented in figure 3

Table 5: Effect of organic and inorganic fertilizer on Fruit number

Variety	Control	NPK	Manure	NPK + Manure
V1	3.50 a	5.66b	4.72b	4.33ab
V2	7.11a	20.55 a	15.00a	10.66a
V3	3.00a	3.55b	4.50b	2.33b

Different letters in the same column show significant difference at 0.05 probability level

The effect of organic and inorganic fertilizer on leaf width is presented in table 6. The statistical analysis showed significant differences at $P < 0.05$ between treatments and varieties. The manure treatment (25.00 cm) and the combination of NPK and manure (25.77 cm) revealed the longest leaf width. With control treatment only, V3 produced the longest

leaf width (22 cm) while V2 gives the shortest leaf width (10.66 cm). With N-P-K treatment only, V3 gave the longest leaf width (22.66 cm) while V1 gave the shortest leaf width (15.88 cm). With manure treatment only, V3 produced the longest leaf width (25 cm) while V2 gave the shortest leaf width (23.22 cm). With the combination of both manure and N-P-K treatment, V2 produced the longest leaf width (25.77 cm) and V1 produces the shortest leaf width (19.16 cm).

Table 6: Effect of organic and inorganic fertilizer on leaf width

Variety	Control	NPK	Manure	NPK + Manure
V1	20.11a	15.88b	23.66a	19.16ab
V2	10.66c	16.55ab	23.22a	25.77a
V3	22.00a	22.66a	25.00a	22.33a

Different letters in the same row show significant difference at 0.05 probability level

Table 7 shows the effect of organic and inorganic fertilizer on plant height. Significantly differences were observed among treatments. With control treatment only, V2 gave the tallest plants (49.22 cm) while V1 gave the shortest plants (39.88 cm). For N-P-K treatment only, V2 produced the tallest plants (80.77 cm) and V1 produced the shortest plants (65.16 cm). For manure treatment only, V3 produced the tallest plants (70.33 cm) and V1 produced the shortest plants (44.66 cm). Lastly, with the combination of both manure and N-P-K treatment, V3 produced the tallest plants (82.33 cm) and V1 produced the shortest plants (39.88 cm). Amongst the treatments, the combination of manure and NPK produced the tallest plants (82.33 cm) when compared to other treatments

Table 7: Effect of organic and inorganic fertilizer on plant height

Variety	Control	NPK	Manure	NPK + Manure
V1	39.88b	65.16 a	44.66b	39.88b
V2	49.22c	80.77 a	68.55b	67.33b
V3	43.83 b	70.00a	70.33a	82.33a

Different letters in the same row show significant difference at 0.05 probability level

Figure 1 shows the effect of organic and inorganic fertilizer on number of leaves. With control treatment only, V3 produced the highest number of leaves (38.50) and V2 gave the lowest number of leaves (33.66). For N-P-K treatment only, V3 produced the highest number of leaves (30.22) and V2 gave the lowest number of leaves (20.55). For manure treatment only, V3 produced the highest number of leaves (34.16) and V1 produced the lowest number of leaves (21.22). Lastly, with the combination of both manure and N-P-K treatment, V3 produced the highest number of leaves (28.50) and V1 produced the lowest number of leaves (24.50). The highest number of leaves (38.5) was obtained from the control, but amongst inorganic and organic fertilizers, manure treatment produced the highest with 34.16. No significant difference was observed at 0.05 probability level at all treatments.

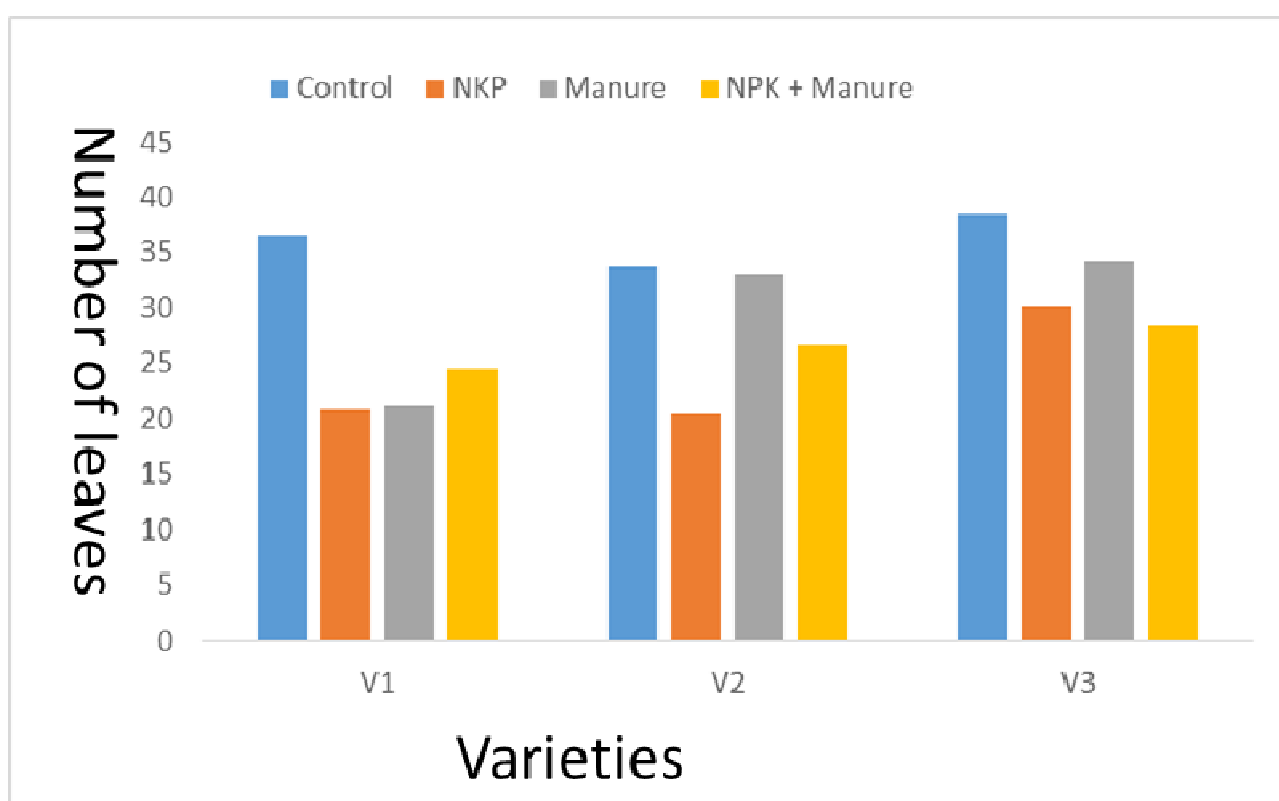


Figure 1: Effect of organic and inorganic fertilizer on number of leaves eggplant

DISCUSSION

The vegetative and reproductive parameters measured were positively impacted by the NPK and manure fertilizers used. The highest number of branches was obtained with manure. This indicates that manure treatments contained nutrients that increased the number of branches. Leaf branch is important because the longer the branches, the more exposure the leaves has to

sunlight for adequate photosynthesis. The results are consistent with the studies of Cardoso *et al.*, (2009) who reported that manure increase the aboveground parameters of eggplants.

The highest leaf lengths (41.88 cm and 41.50 cm) were obtained from varieties 2 and 3 under NPK and manure treatment, respectively. This indicates that the two varieties responded to the NPK and manure positively by increasing their leaf lengths. For number of leaves, variety 2 recorded the highest with the application of manure plus NPK. This showed that the combination of organic and inorganic fertilizers was more effective than either the use of only NPK or manure. The work of Lawal *et al.*, (2015) is similar to our study.

The highest yield was obtained from variety 1 with NPK application when compared to other varieties. Though the yield of other varieties were higher than the control (no fertilizer application). This illustrates that both organic and inorganic fertilizers increased the yield of eggplants. This results are similar with those of Ulger *et al.*,(1997) and Akanbi *et al.*, (2001) and Lawal *et al.*, (2015). The study shows that the number of fruit did not correlate with the yield(size) but the fruit size because the highest yield was recorded in V1 with 5.66 as number of fruits while V2 with the highest number of fruit produced 594.85 g of yield both under the application of NPK. The highest dry weight was recorded with V1 under NPK. This indicates that V1 adequately photosynthesized and therefore accumulate more dry matter than other varieties.

The combination of manure and NPK recorded the tallest plant compared to other treatment. This shows that the mixture was more effective in increasing the plant height. This result is consistence with that of Lawalet *et al.*, (2015).

CONCLUSION AND RECOMMENDATIONS

Eggplant (*Solanum melongena* L.) is a very important vegetable grown for its edible fruit which can be eaten raw or cooked. It is also economically important as it contributes to the farmer's income. The results obtained from this experiment indicates that the use of control treatment for each variety gave the highest number of leaves in V1 and V3 although the use of N-P-K treatment has lesser effect on the number of leaves for V1 and V2.

For eggplant yield, V1 with N-P-K treatment gave the highest yield followed by V2 with N-P-K treatment and V2 with the combination of N-P-K and manure treatment. So, V2 gave the highest yield when N-P-K treatment is introduced to it. Therefore, V1 with N-P-K treatment is recommended as it gave the highest yield.

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