NIGERIAN AGRICULTURAL JOURNAL
ISSN: 0300-368X
Volume 51 Number 2, August 2020 Pg. 530-537
Available online at: http://www.ajol.info/index.php/naj

EFFECT OF NPK FERTILIZER RATES ON GROWTH AND YIELD COMPONENTS OF EGGPLANT (*Solanum melongena*) CULTIVARS

[1]Nwokwu, G. N., [1]Ogbonna, L. C. and [2]Egwu, P. N.

[1]Department of Crop Production and Landscape Management,
[2]Department of Agricultural Economics,
Management and Extension, Ebonyi State University, Abakaliki, Ebonyi State, Nigeria
Corresponding Authors' email: g.nwokwu@yahoo.com

Abstract

A field experiment was conducted to determine the effect of NPK fertilizer rates on growth and yield of eggplant (*Solanum melongena*) cultivars. The experiment was laid out in a 3x4 factorial in a randomized complete block design (RCBD). The treatments used were four rates of NPK fertilizer (0, 50, 100, and 150 kg NPK ha^{-1}) and three cultivars of eggplant (dark green, white-green striped and light green), and replicated were four times. The parameters studied were plant height, number of leaves, number of branches, days to 50% flowering, number of fruits, weight of fruits, and total yield. Results showed that plant height, number of leaves, number of branches, number of fruits, weight of fruits and total yield increased as the NPK fertilizer rate increased from 0 kg NPK ha^{-1} to 150kg NPK ha^{-1}. Dark green cultivars proved superior over white green striped and light green cultivar on growth characteristics, while white-green striped cultivars produced the highest weight of fruit and total yield. The lowest weight of fruit and total yield were recorded by dark green cultivars. The interaction between the treatments indicates that 150kg NPK ha^{-1} and dark green cultivar gave the highest vegetative growth while vegetative parameters such as plant height, number of leaves, number of branches and days to 50% flowering recorded were lowest at 0kg NPK ha^{-1} and Light green cultivar. White-green produced the highest fruit weight, and total yield per hectare at fertilizer rate of 150kg NPK ha^{-1}. Therefore, based on the result, the use of 150kg NPK ha^{-1} and white-green cultivar for profitable eggplant production in the study area are recommended.

Keywords: Cultivars, eggplant, fertilizer rates, growth, and yield

Introduction

Eggplant (*Solanum melongena*) belongs to the family *Solanaceae*. It is a perennial herb which is woody at the base. It has large purple egg-shaped fruits and the crop requires a temperature of 25-35°C for optimum growth and development. Eggplants were domesticated in South-East Asia, particularly in North-East India and South-East China more than 2000 years ago (Sekara *et al.,* 2007). World's production is about 54.08 million tons (FAOSTAT, 2018). China and India are the major growing countries with 63.13% and 23.71% of the total volume respectively, followed by Egypt (2.61%), Turkey (1.55%), Iran (1.23%), Indonesia (1.02%), and Japan (0.56%) (FAOSTAT, 2018). Eggplant fruit is an excellent source of carbohydrates, proteins, fats, fiber, water, minerals, salts and other vital mineral sources. Fruits of eggplant are eaten with groundnut, rice or yam. In the absence of kola-nut, eggplant fruits are served as substitute at wedding occasions, burials and ceremonial functions in most communities in Nigeria today (Oniah *et al.,* 2010). Gandhi and Sundari (2012) noted that eggplant can also be utilized as medicine to reduce cholesterol in blood, and suitable as diet to regulate hypertension. Owing to high nutrient content of the eggplant, it is presumed that the demand for eggplant will increase, which in turn expected to increase production (Sowinska and Krygier, 2013)

Constraints of soil nutrients availability have caused low yield potential (Savvas and Lenz, 2000). One of the methods to maintain soil fertility and continuous cropping is to put back into the soil what plants has taken out and this can be achieved by the use of inorganic fertilizer. The consequences of differences in the availability of nutrients for production of quality crops and other vegetables are well documented. Adequate supply of nutrients stimulates the production of a large leaf area index, through branching and leaf size expansion, with a high chlorophyll content, which absorbs radiation efficiently (Odeleye *et al*., 2001). Adequate supply of required nutrients is therefore needed in order to obtain eggplant fruits that will meet worlds' quantity and quality requirements. According to Enya and Agba (2006), one of the problems confronting farmers in Nigeria is determining the economic optimum level of fertilizer application, and additional cost of applying the fertilizer. Adinya *et al.* (2006) reported that fertilizer gave economic benefits to farmers, and it helps them to cover all overhead costs/expenditure in their farms. With a good soil fertility management program, proper timing and good fertilization are necessary to maintain high yield of crop. Increasing the amount of NPK-fertilizer led to an increase in the vegetative growth of eggplant, fruit yield and fruit quality (Meniutiu, 2006; Balliu *et al.,* 2007). Fertilizer application and increased dosage is only at advantage when eggplants are matured, and there are enough roots to absorb the available nutrient supplied to the plants (Buttour, 1987). Application of phosphorus and nitrogen fertilizer enhances root development, which improves the supply of other nutrients, and water to the growing parts of the plants, resulting in an increased photosynthetic area, and more dry matter accumulation (Ali *et al.,* 2010).

Nafiu *et al*. (2011) described that eggplant has longer potential harvesting time, and reside in the soil for longer time as long as sufficient N fertilizer is applied during growth. Non- addition of phosphorus to eggplant leads to decrease in yield and quantity of crop. Phosphorus fertilization is very essential for exploiting maximum yield potential of different crop plants. Adequate amount of phosphorus in soils enhance rapid plant growth, early fruiting or maturity, and improves the quality of produce. Nitrogen is required for plant growth and reproduction, while Potassium (K) is required for plant metabolism, carbohydrate formation, and translocation of starch to all part of the plants, and also necessary for the neutralization of organic acid in plants. The yield of eggplant in Nigeria is generally low due to the use of varieties that of narrow genetic base, which are grown on soils of inherent low fertility (Dauda *et al.,* 2005). The efficiency of cultivars, as regards nutrients (NPK) uptake in the form of inorganic fertilizers, varies with respect to location. Hence, before the recommendation of a variety for commercial cultivation, and for inorganic farming, determination of nutrient (NPK) requirements of the varieties for particular agro-ecological zone is important. Since most Nigerian eggplant farmers apply mineral fertilizers without considering the optimum level that will minimize production cost, reduce wastage and reduce soil toxicity, this research was undertaken to find out an optimum level of NPK 15:15:15 fertilizer that can maximize growth, and fruit yield of eggplant in soil of South-East Nigeria.

Materials and Methods

The field experiments were conducted at the experimental field of the Faculty of Agriculture and Natural Resources Management, Ebonyi State University Abakaliki Nigeria. Abakaliki is located approximately on latitudes 6^0 04' N, and longitudes 8^0 05' E, at an elevation of 94 m above sea level. It is in the derived savannah zone of southern Nigeria. The climate is characterized by daily temperature ranging from 22 to 32°C. It experiences bimodal pattern of rainfall (April to July and September to November) with short spell in August called "August break". Total annual rainfall ranges between 1500 – 2000 mm, with a mean of 1,800 mm and in form of intensive violent showers of short duration. The relative humidity is 80% during rainy season and declines to 65% in dry season. The experiment was laid out in a randomized complete block design (RCBD) in a 3x4 factorial arrangements with three cultivars of eggplant (Dark green, White green striped and Light green) as factor A and four NPK fertilizer rates (0, 50, 100 and 150kg NPK ha^{-1}) as factor B. The treatments used which gave a total of 12 treatment combinations were replicated four times and each replication consisting of twelve treatments. Each plot was measured 2m x 2m ($4m^2$) with 0.5m between adjacent plot and 1.0m between replicates. The area size was 12 m × 30m for the width and length respectively, which gave a total area of 360 m^2. The area was tilled and leveled manually with hoe to obtain fine tilled area and the area was divided into four blocks and then into 2m x 2m plots as per the treatments The three eggplant cultivars (Dark green, White - green striped and Light green) were sourced from farmers' fields in Enugu and Kaduna States of Nigeria. The seeds were sown into the seed boxes in the nursery and watered for four weeks before transplanting to the field. Weed was controlled manually by hand pulling at least two to three times before maturity. The fruits were picked from the plants periodically as it matures. Data were collected from four randomly tagged plants in each plot on growth and yield parameters and were analyzed with General Linear Model in Minitab version 15.0 and where there were significant differences, Turkey's test were used to separate the means at the probability of 5%.

Results and Discussion

The soil physio-chemical properties of the experimental site during the experimental periods are summarized in Table 1. The result showed that the soil was clay loam textural class with 220g/kg sand, 434g/kg silt, and 301g/kg clay. The pH value of the soil is 4.6, indicating acidic. Organic matter content and total nitrogen are low. The exchangeable cations and cation exchangeable capacity, and total nitrogen were relatively low, indicating that the soil is marginally fertile.

Table 1: Physical and Chemical Properties of Soil (0-30 cm) collected from the Experimental site

Physical Properties	Value	Rating
Sandy (g/kg)	220.00	-
Silt (g/kg)	434.00	-
Clay (g/kg)	301.00	-
Textural Class	Clay loam	-
Chemical Properties		
pH in 0.01M $CaCL_2$	4.6	moderately acidic
Organic Matter g/kg	28.30	low
Total Nitrogen (g/kg)	0.09	low
K (Cmol (+) kgl	0.11	low
Mg (Cmol (+) kgl	0.51	low
Ca (Cmol (+) kgl	0.50	low
Na (Cmol (+) kgl	0.18	low
CEC (Cmol (+) kgl	7.50	low

NPK fertilizer rates recorded significant difference (P=0.05) on plant height (Fig.1). Fertilizer rate of 100kg ha^{-1} produced the tallest plants, while the shortest plants were obtained at 0kgNPK ha^{-1} and differed significantly. The tallest plants recorded by 150kgNPK ha^{-1} fertilizer rate was due to application of major nutrients, which increased the photosynthesis, chlorophyll formation, nitrogen metabolism and auxin contents in the plants, which ultimately improved the plant height. This result is in agreement with Ekwu *et al.* (2012), who reported that the plant height increased as the fertilizer rates increased from 0kg to 150kgNPK ha^{-1}. Aminifard *et al,* (2010) reported similar results that nitrogen application increased plant height at vegetative stage, and level of 150kgN ha^{-1} produced the tallest plants, and shortest plants in the control. Cultivars also recorded significant difference ($P < 0.05$) on plant height (Fig. 1). Dark green cultivar produced the tallest plant, followed by White green striped cultivar, while the shortest plant was produced by Light green cultivar. The interaction effect of NPK fertilizer rates and cultivar had no significant ($P > 0.05$) effect on plant height (Fig. 1). The tallest plants were produced at 100kgNPK ha^{-1} with Dark green cultivar, while the shortest plants were obtained at 0kgNPK ha^{-1} with Light green cultivar. The tallest plants produced by Dark green cultivars might be attributed to genetic constitution with respect to higher growth of the plant. The tallest plants produced at 100kgNPK ha^{-1} with Dark green cultivar was in agreement with the findings of Jayasinghe *et al.* (2016).

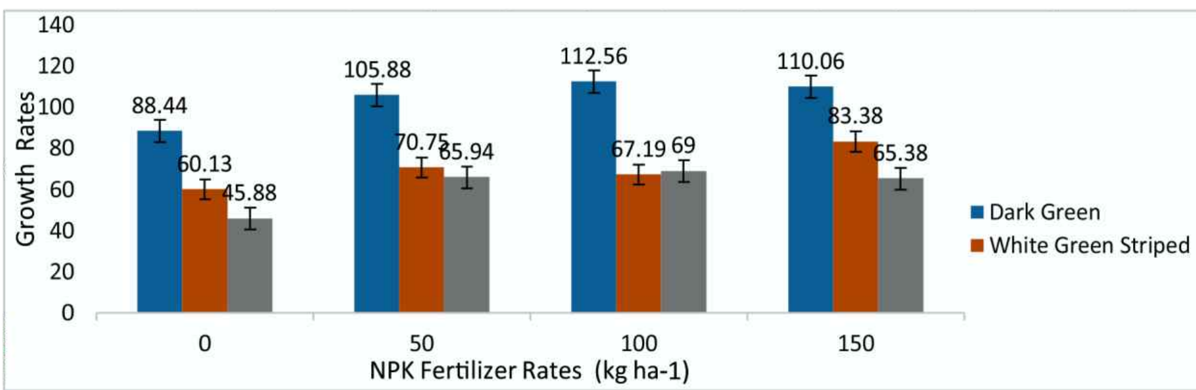

Fig 1: Effects of NPK fertilizer rates on the height of three cultivars of egg plants

Number of leaves

NPK fertilizer rates recorded significant difference ($P < 0.05$) on number of leaves (Table 2). Highest number of leaves was recorded at 150kg NPK ha^{-1}, followed by 100kg NPK ha^{-1}, while the lowest was recorded at 0kg NPK ha^{-1} and differed significantly. The highest number of leaves recorded by 150kg NPK ha^{-1} might be attributed to adequate supply of nitrogen which is essential for vigorous vegetative growth. This result is in agreement with the findings of El-Nemr *et al.* (2012), who reported that the number of leaves was improved by fertilization of eggplant with 100% Super Veit (SV), followed by using 100% Lant Fort (LF). However, using 50% Lant Fort (LF) gave the lowest value. Also, similar result was reported by Wange and Kale (2004) that increase in inorganic fertilizer addition tends to increase number of leaves per plant, compared with the un-fertilized control. However, cultivar also had significant effect ($P < 0.05$) on number of leaves (Table 2). The highest number of leaves was obtained with Dark green cultivar, while the lowest was obtained with Light green cultivar, and differed significantly. The interaction effect between NPK fertilizer rates and cultivar had no significant ($P > 0.05$) effect on number of leaves (Table 2). Although, the highest number of leaves was recorded at 150kg NPK ha^{-1} with Dark green cultivar, while the lowest was obtained at 0 kg NPK ha^{-1} with Light green cultivar. The highest number of leaves obtained with Dark green cultivar might be due to composition or environmental factors. This confirms with the findings of Akpan *et al.* (2016) who reported that the genotypes in all the traits studied were highly significant on number of leaves per plant. Principal component analysis showed that number of leaves per plant contributed more to the total variations observed in the eggplant in both seasons. The interaction effect between NPK fertilizer rates and cultivar had no significant effect on number of leaves. Although, the highest number of leaves was recorded at 150kg NPK ha^{-1} with Dark green cultivar. Reasons for more number of leaves at 150kg NPK ha^{-1} with Dark green cultivar may be due to primitive effects of macro nutrients on vegetative growth, which ultimately lead to more photosynthetic activities. This is in conformity with the result of Umar and Momoh (2015), who reported that the interaction of fertilizer and variety on some of the growth and yield characters such as number of branches, number of leaves and number of flowers shows that the two varieties behaved differently under different fertilizer levels.

Number of branches

NPK fertilizer rates recorded significant difference ($p < 0.05$) on number of branches (Table 2). Number of branches increased as fertilizer rates increased from 0 to 150kg NPK ha^{-1}. Fertilizer rate of 150kg NPK ha^{-1} produced the highest number of branches, while the lowest number of branches was obtained at 0kg ha^{-1} and differed significantly. The 150kg NPK that produced highest number of branches may be due to increased supply of major plant nutrients, which are required in large quantities for growth and development of plants. For example, nitrogen accelerates the development of growth, reproductive phases and protein synthesis, thereby, promoting yield attributing characters. This is in line with the study of Sawan and Rizik (1998) who found that applying NPK as compound fertilizer to eggplant at an intermediate or higher rate improved growth characteristics, yield and quality, compared with applying low rate of 60:0:45. Cultivar also recorded significant difference ($P < 0.05$) on number of branches (Table 2). Dark green cultivar produced the highest number of branches, while the lowest number of branches was produced by Light green cultivar. The interaction effect of NPK fertilizer rates, and cultivar was significant ($P < 0.05$) on number of branches (Table 2). The highest number of branches was produced at 150kg NPK ha^{-1} with Dark green cultivar, while the lowest was obtained at 0kg NPK ha^{-1} with Light green cultivar. Dark green cultivar produced the highest number of branches compared to White green striped and Light green cultivars. This might be because the cultivar combined its genetic make-up to exploit the newly favorable agro-ecological conditions of the study area for rapid growth and branching. The highest number of branches was produced at 150kg NPK ha^{-1} with Dark green cultivar. The increased number of branches at 150 kg NPK ha^{-1} (Dark green cultivar) might be due to application of 150kg NPK ha^{-1} fertilizer rate that improved the available nutrient status of soil, which resulted in vigorous plants, and increased branch production. This is in agreement with Niaz *et al.* (2016) who reported that the highest number of branches was noted with *Ghotki* cultivar at N level of 250kg ha^{-1}, and the lowest observed with *Kunri*-1 at N level of 0kg ha^{-1}.

Days to 50% flowering

NPK fertilizer rates had no significant ($P > 0.05$) effect on days to 50% flowering (Fig. 2). However, more number of days to 50% flowering was recorded at 150kg NPK ha^{-1}, while less was recorded at 100kg NPK ha^{-1}. The more number of days to 50% flowering recorded at 150kgNPK ha^{-1} was in agreement with Sat and Saimbhi (2003), who observed that increasing the nitrogen level, significantly delayed flowering of eggplants, and increased the number of days taken for fruit setting. This result is also in agreement with Ekwu *et al*. (2018), who observed that application of NPK fertilizer significantly increased vegetative and yield parameters over control. Cultivars recorded significant differences ($P < 0.05$) on days to 50% flowering (Fig. 2). Among the cultivars, Dark green cultivar produced the greater number of days to 50% flowering, while Light green cultivar produced less number of days to 50% flowering, and differed significantly. However, NPK fertilizer rates and cultivars had no significant ($P > 0.05$) effect on days to 50% flowering (Fig. 2). More number of days to 50% flowering was recorded at 50kg NPK ha^{-1} with Dark green cultivar, while smaller number of days was obtained at 0kg NPK ha^{-1} with Light green cultivar. The induction of early flowering in Light green cultivar may be due to genetic variations, which play important role in flowering. Baswana *et al.* (2002) gave similar results, indicating that H-17 had lowest number of days before 50% flowering compared to other cultivars. However, wide range of days to 50% flowering was recorded among the genotypes with greater number of days at 150kg NPK ha^{-1}(Dark green cultivar).

This may be because nitrogen in plants increased cell division and cell differentiation. Thus, plants remained in vegetative phase and resulted in imbalance between C:N ratio, thus delayed flowering at higher nitrogen level. This is in agreement with Niaz *et al.* (2016), who observed that the maximum days to flower initiation were observed in *Kunri*-1 at highest N level of 250 kg ha^{-1}, and minimum in *Nagina* as control (0kg N ha^{-1}).

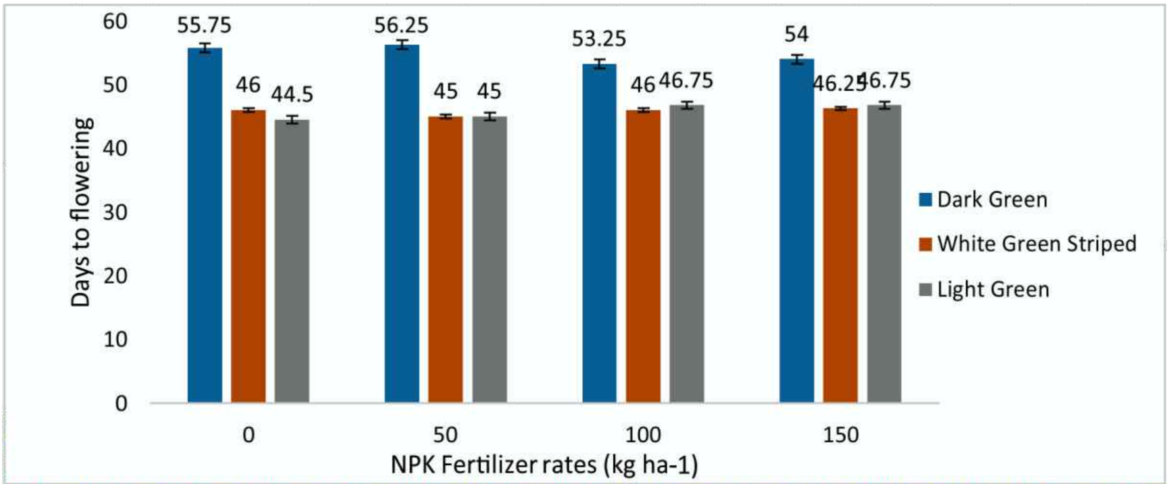

Fig. 2: Effect of NPK (15:15:15) Fertilizer rates on days to 50% flowering of three egg plant cultivars

Number of fruits per plant

NPK fertilizer rates recorded significant difference (p= 0.05) on number of fruits per plant (Table 2). Number of fruits increased as fertilizer rates increased from 0 to 150kg NPK ha^{-1}. Fertilizer rate of 150kg NPK ha^{-1} produced the highest number of fruits per plant, while the lowest number of fruits per plant was obtained at 0kg NPK ha^{-1}, and differed significantly. The highest number of fruits obtained at 150kg NPK ha^{-1} may be due to nutrient availability observed. Similar results have been reported by Idio and Adinya (2017), that the highest number of fruits of 140.25kg was recorded when 149kg ha^{-1} of NPK (15:15:15) fertilizer was applied in 2014 and 2015 cropping seasons. Akanbi *et al.* (2007) also reported increments in the nitrogen rate of the fertilizers on number of fruits. Number of fruits per plant was not significantly (P > 0.05) influenced by cultivar (Table 2). Dark green cultivar recorded the highest number of fruits per plant, while the lowest was produced by Light green cultivar. The interaction effect of NPK fertilizer rates and cultivar was significant (P < 0.05) on number of fruits per plant (Table 2). The highest number of fruits was recorded at 150kg NPK ha^{-1} (Dark green cultivar), while the lowest was obtained at 0kg NPK ha^{-1} (Light green cultivar). Dark green cultivar recorded the highest number of fruits per plant over other cultivars. This result is in agreement with Pandit *et al.* (2010) who reported higher ratio of long/ medium to short/pseudo-short style flowers, and fruit number per plant were found to be the premium traits for better yield. BCB-23, 38 and 57 yielded better in autumn-winter season, while BCB-43 gave best yield in summer-rainy season. This result is also in tandem with Baswana *et al.* (2002), who observed the significant genotypic differences among the genotypes of *brinjal*, with highest number of fruits plant-1 in Arka Sirish compared to other genotypes. The highest number of fruits was recorded at 150kg NPK ha^{-1} (Dark green cultivar). This result is in accordance with Kanneh *et al.* (2017) who reported that the highest number of fruit per plant was recorded in *gbengeh* variety with fertilizer rate of 90kg ha^{-1}, while highest fruit number was obtained at fertilizer rate of 120kg ha^{-1}.

Weight of fruits per plant

NPK fertilizer rates recorded significant (P < 0.05) differences on weight of fruits per plant (Table 2). The heaviest fruits per plant were recorded with 150kg NPK ha^{-1}, followed by 100kgNPK ha^{-1}, while the lowest was 0kg NPK ha^{-1} and differed significantly (P < 0.05). The weight of fruit increased with increase in NPK fertilizer rates. This might be attributed to increased number of leaves and leaf size, which resulted to increased number of fruits. Ekwu *et al.* (2012), reported similar results, that weight of fruits increased as the NPK rate increased from 0kg NPK ha^{-1} to 150kg NPK ha^{-1}. The result is also in agreement with Devi *et al*. (2002) and Aujla *et al.* (2007) who reported that increasing the rate of nitrogen fertilizers increased the average fruit weight and fruit volume. However, cultivar had no significant (P > 0.05) effect on the weight of fruits per plant (Table 2). The heaviest fruits per plant were recorded with white green striped cultivar, followed by Light green cultivar and Dark green cultivar. Also, NPK fertilizer rates and cultivar interaction had no significant (P > 0.05) effect on weight of fruits per plant (Table 2). Although, the highest weight of fruits per plant was recorded at 150kg NPK ha^{-1} (Light green cultivar), while the lowest was at 0kg. However, the highest weight of fruits per plant was recorded with White green striped cultivar compared to Light green and Dark green cultivars. This result is in agreement with the Diouf *et al.* (2017), who reported that varieties L10 followed by Locale Mali had the highest marketable yield, and average fruit weight. The result is also in tandem with the report of Ranajan and Chakrbarti (2003) who reported that the fruit weight gradually increased as the fruits matured. At 30 days after fruit set (DAS), fruit weight was highest in *Pusa Uttam* and lowest in *Pusa Purple* Clusters. Also, the highest weight of fruits per plant was recorded at 150kg NPK ha^{-1} (Light green cultivar). This result is in agreement with the findings of Fondio *et al.* (2016) who reported that the highest fruit weight per plant were recorded in Aub33K/06Gn variety, with application of T + 1/4T dose of fertilizer, while the least fruit weight was obtained with control.

Total yield

NPK fertilizer rates recorded significant difference (P = 0.05) on total yield per hectare (Table 2). Total yield per hectare increased as fertilizer rates increased from 0 to 150kg NPK ha.$^{-}$ Fertilizer rate of 150kg NPK ha^{-1} produced the highest total yield per hectare, while the lowest was obtained at 0kg NPK ha^{-1} and differed significantly. This result is in conformity with Feleafel, (2005), who reported that increasing N rate was accompanied with significant increases in vegetative growth characters. Moreover, total fruits yield significantly increased with increasing N rate up to 120kg N fed-1. Also, Hochmuth *et al.* (1991) gave similar results that the yield of eggplant increased as the fertilizer rates increased from 0kg NPK ha^{-1} to 336.24 kg ha^{-1}. Cultivar had no significant effect on total yield per hectare (Table 2). White green cultivar produced the highest total yield per hectare, while the lowest was produced by Dark green cultivar. The interaction effect of NPK fertilizer rates and cultivar recorded significant (P < 0.05) effect on total yield produced per hectare (Table 2). The highest total yield per hectare was produced at 150kg NPK ha^{-1} (White green striped cultivar), while, lowest was obtained at 0kg NPK ha^{-1} (Dark green cultivar). White green cultivar produced the highest total yield per hectare than other cultivars. This result is in agreement with Reshmika *et al.* (2016) who reported that Jawahar Brinjal-347 (2.65kg) had the highest total fruit yield per plant followed by genotypes IC-90123 (2.30kg), IC-90933 and ABSR- 2 (2.00kg each). Yield per plot was superior in Jawahar Brinjal-347, and the lowest by IC-545920 (2.83kg). The highest total yield per hectare was produced at 150kg NPK ha^{-1} (White green striped cultivar). This result is in agreement with Umar and Momoh, (2015) who reported that NC-2 (green variety) recorded the highest fruit yield with fertilizer application of 200kgN compared to NC-1 (off-white variety).

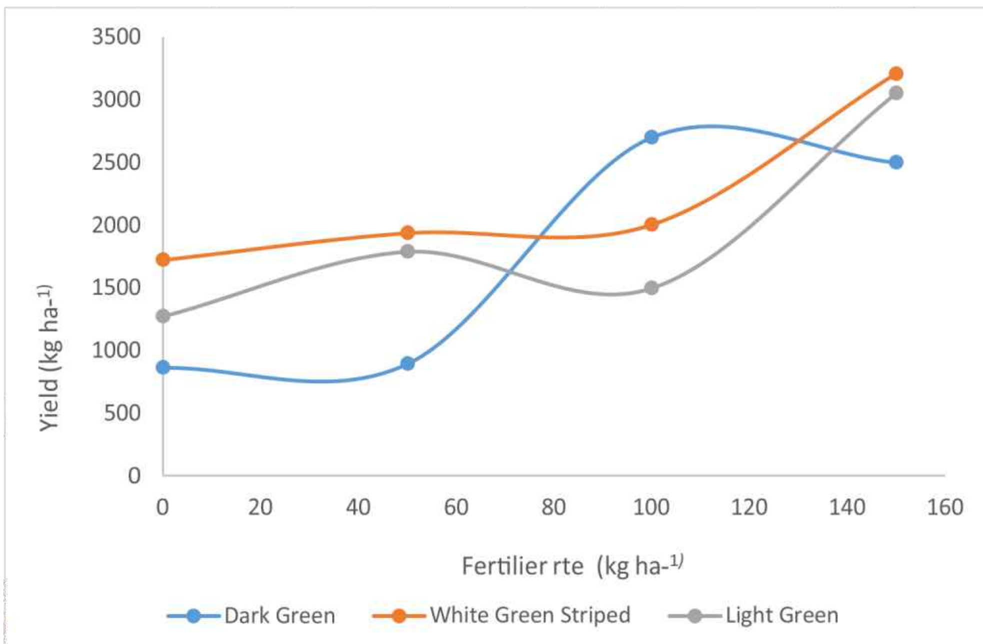

Fig. 3: Effect of NPK Fertilizer rate on the yield of three cultivars of Egg Plant

Table 2: Effect of NPK fertilizer rates on growth and yield components of *Solanum* cultivars

NPK rate (kgha^{-1})	Plant height (cm)	No of leaves	No of branches	Days to 50% flowering	Fruit No/plant	Fruit wt./plant (g)	Total yield (tha^{-1})
			Dark Green (C1)				
0	88.44	127.75	11.25	55.75	6.63	172.00	860.00
50	105.88	110.94	11.56	56.25	7.75	178.50	892.50
100	112.56	126.30	15.19	53.25	18.13	419.00	2696.25
150	110.06	131.81	16.13	54.00	26.81	575.25	2495.00
Mean	104.24	124.22	13.53	54.81	14.83	336.19	1735.94
LSD	8.639	6.804	1.052	NS	3.755	11.245	45.230
			White Green Strip (C 2)				
0	60.13	78.00	6.81	46.00	11.63	347.25	1720.00
50	70.75	106.94	8.75	45.00	9.88	387.75	1935.00
100	67.19	114.94	8.25	46.00	12.38	450.25	2001.25
150	83.38	116.63	9.50	46.25	18.63	641.00	3205.00
Mean	70.36	104.13	8.33	45.81	13.13	456.56	2215.31
LSD	9.977	9.804	0.911	NS	NS	25.123	27 .342
			Light Green (C 3)				
0	45.88	59.00	5.94	44.50	7.81	244.00	1267.50
50	65.94	76.19	7.81	45.00	11.50	447.00	1785.00
100	69.00	93.38	7.19	46.75	11.75	359.75	1495.00
150	65.38	130.75	9.50	46.75	17.00	659.50	3047.50
Mean	61.55	89.83	7.61	45.75	12.02	427.56	1898.75
LSD	7.403	4.212	0.525	NS	NS	22.431	23.243

Conclusion

It was evident that increased rates of NPK fertilizer enhanced growth and yield in all the three cultivars studied. At 150kg NPK ha^{-1} fertilizer application, yield increased compared to other application rates used in the trial. Dark green cultivar gave the highest and superior response to growth parameters except weight of fruits and total yield, where White green striped cultivar recorded the highest value with fertilizer rate of 150kg NPK ha^{-1}. Therefore, fertilizer rate beyond 150kg NPK ha^{-1}should be used in further studies, and White green striped cultivar should be used by farmers who embark on large scale production of eggplant in the study area to ensure maximum yield.

References

Adinya, I. B., Kuye, O. O., Idio, A. D., Agba, O. A., Essien, A. and Idiege, D. A. (2006). Profit margin analysis of the response of cowpea (*Vigna unguiculata*) to phosphorus fertilizer and poultry manure in Ovonum, Obubra. *Journal of Agriculture, Forestry and the Social Sciences,* 4(2):40 -49.

Akanbi, W. B., Togun, A. O., Olaniran, O. A., Akinfasoye, J.O. and Tairu F.M. (2007). Physico-chemical properties of eggplant (*solanum meloongena* L.) fruit in response to nitrogen fertilizer and fruit size. *Agr. Journal*. 2(1):140-148.

Akpan, N. M, Ogbonna, P.E., Onyia, V.N., Okechukwu, E.C. and Atugwu, I. A. (2016). Variability studies on ten genotypes of eggplant for growth and yield performance. *The Journal of Animal & Plant Sciences*, 26(4):1034-1041.

Ali, M. A, Abbas, G., Mohy-ud-Din, Q., Ullah, K., Abbas, G. and Aslam, M. (2010). Response of mungbean (*Vigna radiata*) to phosphatic fertilizer under arid climate. *J Anim Plant Sci*., 20(2): 83-86.

Aminifard, M. H., Aroiee, H., Fatemi, H., Ameri, A. and Karimpour, S. (2010). Responses of eggplant (*Solanum melongema* L.) to different rates of nitrogen under field conditions. *J. Central Eur. Agric*., 11(4):453-458.

Aujla, M.S., Thind, H. S. and Buttar, G. S. (2007). Fruit yield and water use efficiency of eggplant (*Solanum melongena* L.) as influenced by different quantities of nitrogen and water applied through drip and furrow irrigation. *J. Sci & Horti.*, 112: 142-148.

Balliu, G. V., Kaciu, S., Nasto, T. and Haxhinasto, L. (2007). Grafting effect on Tomato Rates, yield and fruit quality under saline irrigated water. *Acta Hortic*., 801:1161–1166.

Baswana, K. S., Bhahia, M.K. and Dharamveer, D. (2002). Genetic variability and heritability studies in rainy season brinjal (*Solanum melongena* L.). *Haryana J. Hort. Sci.*, 31(1-2): 1431-145.

Buttour, F. I., (1987). Agricultural Science. West African Books Publisher Limited, Accra.183pp.

Dauda, S.N., Aliyu. L. and Chiezey, U. F. (2005). Effect of variety, seedling age and poultry manure on growth and yield of garden egg (*solanum gilo* L). *Nigeria* Chattopadhyay, Arup; Dutta, Subrata and Hazra, Pranab, (2011). Characterization of genetic resources and identification of selection indices of brinjal (*Solanum melongena* L.) grown in Eastern India. Vegetable Crops Research Bulletin, 74: 39-49.

Devi, H. H., Maity, T. K., Paria, N. C., Thapa, U. (2002). Response of brinjal to different sources of nitrogen. *J. Veg. Sci*., 29(1):45-47.

Ekwu, L.G., Utobo, E.B. and Nwokwu, G. N. (2012). Effect of NPK fertilizer and weeding regime on the growth and yield of eggplant (*solanum melongena* L.). *Int'l Journal of Agric. and Rural Dev*., 15 (2):1033 – 1040.

Ekwu, L.G., Nwokwu, G.N. and Utobo, E.B. (2018).Growth and yield response of eggplant to NPK fertilizer and plastic mulch. *Nigeria Crop Science*, 5 (2): 18 - 23.

El-Nemr, M.A., EL-Desuki, M., Fawzy, Z.F. and El-Bassiony, A.M. (2012). Yield and fruit quality of eggplant as affected by NPK-Sources and micronutrient application. *Journal of Applied Sciences Research*, 8(3): 1351-1357.

Enya, V.E. and Agba, O.A. (2006). Economic optimum of nitrogen fertilizer application in cucumber production: The case of Cross River University of Technology (CRUTECH) Farm, Obubra Campus. *Glob J Agric. Sci*., 5(1): 39-42.

FAOSTAT (2018). Country in the world, by commodity; eggplants (aubergines).http://faostat.fao.org/site/339/default.aspx.Accessed Sept. 2020.

Feleafel, M.N. (2005). Response of growth, yield and quality of eggplant to varying nitrogen rates and their application systems. *J.Agric. and Env. Sci. Alex.Univ., Egypt*, 4 (1):122- 136.

Gandhi, A. and Sundari, U.S. (2012). Effect of vermi compost prepared from aquatic weeds on growth and yield of eggplant (*Solanum melongena* L.). *J. Bio fertilizer and Bio pesticide*, 3 (5): 1-4.

Hochmuth, G., Hochmuth, B., Hanlon, E. and Donley, M. (1991). Nitrogen requirements of mulched eggplant in northern Florida. *Hort.,* 97(1): 1-25.

Idio, A. D. and Adinya, I. B. (2017). Analysis of different rates of N.P.K. (15:15:15) fertilizer on yield of eggplant (*Solanum melongena*) in Cross River University of Technology Teaching and Research Farm, Obubra Campus, Cross River State, Nigeria. *Net J Agric Sci,* 5(4): 121- 125.

Jayasinghe, H. A. S. L., Alwis, L. M. H. R. and Gunadasa, H. K. S. G. (2016). Effect of different NPK levels on the growth and yield of three Tomato (*Solanum lycopersicum*) Varieties. *Asian Research Journal of Agriculture,* 2(1): 1-6.

Fondio, L., N'Gbesso, M. F. and Coulibaly, N. D. (2016). Effect of Mineral Fertilization on African Eggplant (*Solanum* spp.) Productivity. *Journal of Agricultural Science and Technology* B, 6: 188-195.

Diouf, M., Gueye, M. and Samb, P. I. (2017). Participatory varietal selection and agronomic evaluation of African Eggplant and Roselle Varieties. *European Scientific Journal*. Vol.13 (30):327 - 337.

Meniutiu, D. (2006). Research concerning plant directing method and fertilization method on eggplant cultivated in plastic tunnels. *Notulae Botanical Horticulture Agrobotanici Cluj Napoca*, 34: 69-74.

Nafiu, A. K., Togun, A. O., Abiodun, M. O. and Chude, V. O. (2011). Effect of NPK fertilizer on growth, dry matter production and yield of eggplant in Southwestern Nigeria. *Agriculture and Biology Journal of North America,* 2 (7):117-1125.

Niaz, A. W., Zeshan, A., Sheikh, 1., Qamaruddin, J., Khalid, H. T. and Shah, J. L. (2016). Growth and productivity of chili (*Capsicum annuum* l.) under various nitrogen levels. *Sci. Int. (Lahore),* 28(2):1321-1326.

Odeleye, F. O., Togun, A.O. and Tayo, T.O. (2001). The effect of light intensity on the growth, development and yield of soybean in southwest Nigeria. *African Crop Science Journal,* 9 (3): 577 – 590.

Oniah, M. O., Adinya, I.B., Kekong, M.A., Ogar, E.A. and Afu, S.M. (2010). Profitability analysis in eggplant fruits production in Cross River State. Nig. *J Agric Econ Extens*., 9(1&2): 46-50.

Pandit, M. K., Thapa, H., Akhtar, S. and Hazra,P. (2010). Evaluation of brinjal genotypes for growth and reproductive characters with seasonal variation. *Journal of Crop and Weed*, 6(2): 31-34.

Ranajan, J. K. and Chakrbarti, A. K. (2003). Changes in the physical characters of brinjal (00.*Solanum melongena* L.) fruit during development. Capsicum & Eggplant Newsletter. (22): 139-142.

Reshmika, P. K., Gasti, V. D., Shashikanth, E., Jayappa, J., Ravindra, M. and Basavaraj, L. B. (2016). The Performance of brinjal (*Solanum melongena* L.) genotypes under GLBC *Condition. Environment & Ecology*, 34 (2): 519—525.

Kanneh, S. M., Musa, P. D., Osei, M. K., Quee, D. D., Akromah, R. and Lahai, M. (2017). Response of different NPK fertilizer rates on the growth and yield of local varieties of pepper (*Capsicum annuum* L.). *Journal of Agricultural and Biological Science*, 2(4): 123 - 127.

Sat, P. and Saimbhi, M.S. (2003). Effect of varying levels of nitrogen and phosphorus on earliness and yield of brinjal hybrids. *J. Res. Crops*. 4(2):217-222.

Savvas D. and Lenz, F. (2000). Response of eggplants grown in recirculating nutrient solution to salinity imposed prior to the start of harvesting. *Journal of Horticultural Science & Biotechnology*, 75 (3): 262 – 267.

Sawan, O.M. and Rizk, F. A. (1998) .The productivity of eggplant (solanum melongena l.) as affected by sulphur element and NPK mixture. *Egypt. J. Hort*., 25:1 -16.

Sekara, A., Cebula, S. and Kunicki, E. (2007). Cultivated eggplants-origin, breeding objectives and genetic resources, a review. *Folia Horticulture Ann.*, 19:1 97-114.

Sowinska, K.A. and Krygier.\, M. (2013). Yield and quality of field cultivated and the degree of fruit maturity. *Acta Sci. Pol. Holturum Cultus*., 12 (2): 13-23.

Umar, M. T. and Momoh, J. Y. (2015). Influence of – fertilizer on the yield and yield components of eggplant (Solanum melongena L.). *Journal of Biology, Agriculture and Healthcare*, 5 (17): 201 - 208.

Wange, S. S., and Kale, R. H. (2004). Effect of bio fertilizers and nitrogen levels on brinjal crop. *J. Soils. Crops*. 14 (1):9-11.