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RESPONSE OF GARDEN EGG (*Solanum Melongena L.*) TO DIFFERENT PRUNING METHODS AND NUTRIENT SOURCES IN ADO-EKITI ENVIRONMENT

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ABSTRACT

A field experiment was carried out to study the response of garden egg to different pruning methods and nutrient sources in Ado-Ekiti environment during the early rainy season in 2018. The treatments consisted of two factors, namely pruning methods (shoot, branch and unpruned) and three nutrient sources namely, Poultry droppings at 3t/ha, goat manure at 3t/ha while NPK fertilizer was applied at two weeks after transplanting at 200kg/ha. The experiment was a 3 x 4 factorial combination arranged in a randomized complete block design (RCBD) with three replications. Each plot size was 4m x 3m (12m^2), separated by 1m spacing and 2m between replications. Seedlings were raised in the nursery and transplanted at two weeks after sowing at a spacing of 60x45cm, resulting to 16 plants per plot. The shoots and lateral branches were pruned once at 2weeks after transplanting (WAT), while the unpruned were not removed. Growth parameters such as number of leaves, leaf area, plant height, number of primary and secondary branches were observed from four tagged plants within each plot fortnightly, while yield attributes such as number of fruits, fruit circumference and fruits weight were taken per plot. Branch Pruning combined with application of 3t/ha poultry manure had an impact on total productivity. The yield and yield characters of garden egg performed better under branched method of pruning under 3t/ha poultry manure. It is therefore recommended that in order to enhance the productivity of garden egg, branched method of pruning at 3t/ha poultry manure as source of nutrient be adopted as the optimum agronomic practice to harness the highest foliage production and thereby boost garden egg productivity.

KEYWORDS: Garden egg; Nutrient sources; Productivity; Pruning method

INTRODUCTION

Soil fertility depletion is becoming a serious problem affecting agricultural productivity in Sub- Saharan Africa (SSA) (Bantiono, 2007). In Sub Saharan Africa however, high costs of inputs like fertilizers are a limitation to improving production of vegetables by small holder farmers (Ajayi, 2009). Studies in the Northern part of Nigeria showed that approximately 80% of farmer households rely on the use of organic inputs (Mugwe et al., 2007). In Uganda vegetable production for *Solanacea* vegetables especially Nakati (*Solanum aethiopicum*) is one of the most profitable enterprises in the region (FAO, 2010; Ssekabembe et al., 2018) and it is also highly constrained by soil fertility depletion. This is mainly as a result of increased soil erosion, leaching and continuous use of the land. One of the ways to increase soil nutrient status is either by the use of organic material such as poultry manure, cow dung or with the use of inorganic fertilizer (Dauda et al., 2005, 2008). Organic

fertilizer increases the yield and quality of agricultural crops in ways similar to inorganic fertilizer (Fabiyi et al., 2015). However, awareness of the importance of organically produced food, coupled with high cost and scarcity of chemical fertilizer has reduced its use by vegetables farmers as major, readily available plant nutrient. Hence, attention has been shifted to organic sources of plant nutrients. Poultry droppings, cow dung and goat manure are typical source of nutrients for plant growth used commonly in the tropics due to their high nutrient content, cheapness and availability (Adeniyan & Ojeniyi, 2003; Ekinya, 2003). Pruning can give a stronger plant that produces more fruits than one that is left alone (Amboszczyk et al., 2007). Generally, the reason for pruning is to observe and control plant growth, manipulate branching, flowering and fruit production in different stages by creating or increasing the availability of metabolic sink (Muhammad & Singh, 2007). Pinched plants produce multiple terminal growths that bear flowers and hence increase the plant yield. Amboszczyk (2008) reported that pruning in okra plants significantly increased number of pods per plant and pod yield more than the control plants, which had neither apical bud removal nor pruning. He further stated that there was an increase in the leaf area of apically debudded okra plants with three-quarter pruning and the increase was proportional to the severity of pruning. This work aims to determine the most suitable pruning methods and nutrient sources that will enhance growth and productivity of garden egg in the study area.

MATERIALS AND METHOD

Study Area

The experiment was conducted at the Teaching and Research Farm of the Department of Soil, Pest and Soil Management of the Federal University of Technology, Akure, between April and June 2018. The ambient temperature fluctuated between 25^{o}C to 31^{o}C during the period of the experiment. Temperature ranges in the plant house were from 24.5 °C to 30.1°C and from 24.7 °C to 32.4 °C for the minimum and maximum temperatures respectively.

Source of planting materials

Mature fruits of Garden egg (*Solanum melongena L.*) were sourced from local farmers within Ekiti. Seeds were manually extracted from the fruits and bulked together for uniformity.

Planting procedures

The treatments consisted of two factors, namely pruning methods (shoot, branch and unpruned) and three nutrient sources namely, Poultry droppings at 3t/ha, goat manure at 3t/ha while NPK fertilizer was applied at two weeks after transplanting at 200kg/ha. There was a control treatment. The experiment was a 3 x 4 factorial combination arranged in a randomized complete block design (RCBD) with three replications. Each plot size was 4m x 3m (12m^2), separated by 1m spacing and 2m between replications. Bulked soil samples were randomly taken from top soil (0-15cm and 15cm-30cm depth) prior to the start of the experiment and taken for laboratory analysis to determine their physical and chemical properties. Seedlings were raised in the nursery and transplanted at two weeks after sowing at a spacing of 60x45cm, resulting to 16 plants per plot. The shoots and lateral branches were pruned once at 2weeks after transplanting (WAT), while the unpruned were not removed. The organic manures used for this experiment were obtained from the School farm and were incorporated into the soil two weeks before transplanting at 3t/ha, to ensure adequate curing while soil sample at 0-20cm depth for soil physical and chemical properties were analyzed while NPK 15:15:15

fertilizer was applied at 200kg/ha two weeks after transplanting. Manual weeding was carried out every two weeds till the termination of the experiment. Cypermethrine insecticide at 20ml/ 20litres of water was sprayed every fortnight to control locust and variegated grasshopper found defoliating the leaves. Growth parameters such as number of leaves, leaf area, plant height, number of primary and secondary branches were observed from four tagged plants within each plot fortnightly, while yield attributes such as number of fruits, fruit circumference and fruits weight were taken per plot.

Data Collection and Analysis

Data collected were subjected to analysis of variance (ANOVA), Standard Deviation and Standard Error while the treatment means were separated using Duncan Multiple Range Test (DMRT) at 5% level of probability with the aid of Gestate Discovery Software (L.A.T., 2007).

RESULTS AND DISCUSSION

Table 1 showed the result of soil chemical properties before the experiment. The pH of the soil was 6.95. Organic matter contents analyzed was 4.01%. Nitrogen content was 0.38 g/kg. The available P content in the soil was 16.1 mg/kg, K (0.38 cmol/kg), Na (1.80 cmol/kg), Ca (5.40cmol/kg) and Mg (2.50 cmol/kg). The result showed that the soil was sandy loam in texture with high proportion of sand (82.3%). This implies that basic cations such as Ca, K, Na and Mg would be leached more easily as texture determines the degree of retention or ease of leaching of basic cations. The soil was slightly acidic with pH (6.95) with low organic carbon; total nitrogen and available P were also low in the soil. Low organic carbon and organic matter in the soil of the experimental site was probably as a result of high proportion of sand content of the soil. The low level of nutrients in the soil shows that the soil is low in fertility and could respond well to any form of organic manure as a source of nutrients for fertilizing the soil which will in turn enhance the production of garden egg in the study area. The poultry manure used at experimental site had N, P and K ranges of 6.73, 13.50 and 8.80 respectively and a pH of 7.9 (that is, slightly alkaline). The exchangeable cations particularly Ca^{2+} and K^{+} were high while Mg^{2+} and Na^{2+} are of moderate levels. The nutrient contents of the manure were moderate to high; therefore, the quantities applied and mixed with top soil must have supplied the important nutrients such as N, and especially P and K, which are critical for the production of garden egg in the study area.

Effect of different pruning methods and nutrient sources on growth characters of garden egg.

The result in Table 4 shows that garden egg significantly responded to the various pruning methods and nutrient sources imposed. The study revealed that garden egg under branched pruning method had consistently higher plant height at harvest length throughout the crop growth stages with the highest plant height recorded for branched pruning method (25.90cm) when compared to the other pruning methods. The lowest plant height at harvest was recorded for garden egg under unpruned (21.3cm). Similarly, number of primary and secondary branches at harvest was highest under branched pruning methods at (33.10) and (3.40) respectively. The branched pruning method also had the highest mean of (20.80) .Under nutrient sources as indicated in Table 4, garden egg applied with 3t/ha of poultry manure had the highest plant height (26.12cm), number of primary branches (28.91) while garden egg applied with 200kg/ha of NPK 15:15:15 had highest secondary branches at 8WAT with the lowest value recorded for

control. This might be due to the ability of poultry manure to supply more readily available nutrients required for plant growth. These results are in line with those of Ilodibia and Chukwuma (2015) and Ahmad et al., (2017), who stated that poultry manure causes increase in plant height of Okra at maturity over the control. The better crop performance in relation to plant height that was obtained from the 3t/ha poultry manure over other treatments could be due to the presence of growth promoting factors such as enzymes and hormones that cause development of more buds and a subsequent increase in the number of primary branches.. It is therefore possible that as the height increased due the uptake of N in its nitrate form, there was an increase in vegetative growth as indicated by the increase in number of primary branches (Bvenura, 2013).

Effect of different pruning methods and nutrient sources on number of leaves of garden egg

The result in Table 5 shows that garden egg significantly responded to the various pruning methods and nutrient sources imposed. The study revealed that garden egg under branched pruning method had consistently higher plant height throughout the crop growth stages with the highest plant height recorded for branched pruning method (43.59cm) at 8WAT when compared to the other pruning methods. The lowest plant height at harvest was recorded for garden egg under unpruned (28.34cm). Similarly, under different nutrient sources as indicated in Table 5, garden egg applied with 200kg/ha of NPK fertilizer consistently had the highest number of leaves throughout the growth stages of garden egg with the highest recorded at 8WAT (29.02), (28.91) while garden egg applied with 200kg/ha of NPK 15:15:15 had highest secondary branches at 8WAT with the lowest value recorded for control.

Effect of different pruning methods and nutrient sources on leaf area of garden egg

Leaf area development is a basis for photosynthetic ability of plants. In this study, the leaf area was significantly influenced by different methods of pruning and nutrient sources. A Similar trend to plant height and number of leaves was recorded for leaf area of garden egg as observed in Table 6. The behavioural pattern of response in growth parameters exhibited by garden egg in this study agrees with the work of Akanni and Ojeniyi (2008) who opined that animal manures releases nutrients slowly and stabilizes soil physical conditions thus, enhancing nutrient uptake and resulting in improved vegetative growth of garden egg. Pruning method had a consistently higher value for leaf area throughout the duration of plant growth. At 8WAT, leaf area under branched method of pruning recorded the highest value of ($43.29cm^{2)}$ which was followed by the shoot pruning method ($39.04cm^{22}$) with the unpruned as the lowest ($33.0cm^2$). Similarly, highest value was recorded under poultry manure at 8WAT ($44.89cm^2$), this was closely followed by 200kg/ha of NPK 15:15:15 fertilizer ($41.45\ cm^2$)

Effect of different pruning methods and nutrient sources on yield and yield characters of garden egg

Table 7 shows that that all yield and yield components of garden egg were significantly affected by the various methods of pruning and nutrient sources and this promoted fruit yield in the study area. Branched pruning method had the highest number of fruits at harvest (38.5) and fruit yield (6.33kg) over the shoot and the unpruned method with the highest mean value of (19.26). This was closely followed by the shoot method of pruning while the lowest value was recorded for the unpruned. Results of the study revealed that branched pruning method at 3t/ha of poultry

manure application improved the performance of garden egg. Poultry manure at 3t/ha was observed to significantly improve the growth and yield performance of garden egg, hence, it promoted a better growth and yield characters and this translated to increased yield.

CONCLUSIONS AND RECOMMENDATIONS

Branch Pruning combined with application of 3t/ha poultry manure had an impact on total productivity. Organic fertilizer application is very essential for plant growth and yield, as it contained essential plant nutrients. The yield and yield components of garden egg performed better under branched method of pruning and with 3t/ha poultry manure as observed in this study. It is therefore suggested that, in order to enhance the productivity of garden egg, branched method of pruning with poultry manure as source of nutrient at 3t/ha be adopted as the optimum agronomic practice to harness the highest foliage production and thereby boost garden egg productivity.

The study was limited to Ado-Ekiti environment in the early rainy season. In addition, the poultry and goat manure were examined at 3t/ha. Further study is therefore necessary to examine their effect at different rates in the late rainy season and at different locations.

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Table 1: Physical and chemical properties of the soil used at experimental site

Properties	**Values**
Ph	6.95
Total N (%)	0.38
Available P (mg/kg)	16.10
Exchangeable cations (Cmol.kg^{-1})	
Ca^{2+}	5.40
Mg^{2+}	2.50
K^{+}	1.07
Na^{2+}	0.38
Organic Carbon (%)	1.80
Organic matter (%)	0.59
H+	0.20
CEC	2.96
Particle size distribution	
Sand	82.30
Silt	10.50
Clay	7.20
Texture	Sandy loam
Bulk density (g/cm^3)	1.32

Table 2: Characteristics of poultry manure used for the experiment

Properties	**Values**
Ph	7.90
Total N (%)	6.73
Available P (mg/kg)	13.50
Exchangeable cations (Cmol.kg^{-1})	
Ca^{2+}	19.20
Mg^{2+}	5.45
K^{+}	8.80
Na^{2+}	1.77
Organic Carbon (%)	14.70
Organic matter (%)	25.40

Table 3: Characteristics of goat manure used for the experiment

Properties	**Values**
Ph	8.00
Total N (%)	2.54
Available P (mg/kg)	0.85
Exchangeable cations (Cmol.kg^{-1})	
Ca^{2+}	21.70
Mg^{2+}	0.44
K^{+}	1.71
C/N	8.50
Organic Carbon (%)	14.70
Organic matter (%)	21.70

Table 4. Effect of different prunning methods and nutrient sources on growth characters of garden egg

Treatment	Plant height At harvest	Number of primary branches 8WAT	Number of secondary branches 8WAT	Mean	SD	SE±
Pruning methods						
Shoot	23.09^{d}	28.90^{c}	3.05^{b}	**18.35**	**3.03**	**1.75**
Branch	25.90^{b}	33.10^{a}	3.40^{b}	**20.80**	**3.22**	**1.85**
Unpruned	21.34^{f}	32.90^{b}	2.87^{c}	**19.04**	**3.09**	**1.78**
Nutrient sources						
PM (3t/ha)	26.12^{a}	28.91^{c}	3.81^{b}	**19.61**	**3.13**	**1.81**
GD (3t/ha)	24.06^{c}	24.12^{e}	3.08^{b}	**17.09**	**2/92**	**1.69**
NPK Fertilizer (200kg/ha)	25.56^{b}	26.32^{d}	4.15^{a}	**18.67**	**3.06**	**1.76**
Control (0t/ha)	22.67^{e}	21.01^{f}	2.94^{c}	**15.54**	**2.79**	**1.61**

Mean in the same column of treatment followed by different superscripts differ significantly

WAT – Weeks after transplanting.PM-Poultry manure.GD-Goat manure. SD-Standard deviation

Table 5. Effect of different prunning methods and nutrient sources on number of leaves of garden egg

Treatment	2 WAT	4 WAT	6 WAT	8 WAT	Mean	SD	SE±
Pruning methods							
Shoot	12.10^{d}	18.15^{c}	27.22^{c}	36.90^{c}	**23.59**	**3.43**	**1.72**
Branch	16.79^{a}	21.82^{b}	31.10^{a}	43.59^{b}	**28.33**	**3.76**	**1.88**
Unpruned	9.90^{e}	11.09^{e}	19.89^{d}	28.3^{4}	**17.31**	**2.94**	**1.47**
Nutrient sources							
PM(3t/ha)	14.90^{b}	19.34^{c}	29.09^{b}	47.71^{a}	**27.76**	**3.04**	**1.52**
GM (3t/ha)	13.17^{c}	17.92^{d}	22.66^{c}	39.56^{b}	**23.32**	**2.79**	**1.39**
NPK Fertilizer (200kg/ha)	15.21^{a}	24.00^{a}	29.67^{a}	47.23^{a}	**29.02**	**3.11**	**1.56**
Control (0t/ha)	12.02^{d}	13.49^{e}	15.00^{d}	25.95^{d}	**16.62**	**2.35**	**1.18**

Mean in the same column of treatment followed by different superscripts differ significantly

WAT – Weeks after transplanting. PM-Poultry manure. GM-Goat manure. SD-Standard deviation

Table 6. Effect of different prunning methods and nutrient sources on leaf area of garden egg

Treatment	2 WAT	4 WAT	6 WAT	8 WAT	Mean	SD	SE±
Pruning methods							
Shoot	-	12.71^{b}	19.92^{c}	39.04^{b}	**23.89**	**3.46**	**1.99**
Branch	-	14.92^{a}	25.31^{a}	43.29^{a}	**27.84**	**3.73**	**2.14**
Unpruned	-	6.50^{c}	12.90^{d}	33.0^{c}	**17.47**	**3.00**	**1.71**
Nutrient sources							
PM (3t/ha)	-	13.90^{a}	18.51^{b}	44.89^{a}	**25.78**	**3.60**	**2.07**
GM (3t/ha)	-	14.94^{a}	17.00^{b}	39.02^{b}	**25.32**	**3.56**	**2.05**
NPK Fertilizer (200kg/ha)	-	15.03^{a}	21.65^{a}	41.45^{b}	**26.04**	**3.61**	**2.08**
Control (0t/ha)	-	8.90^{b}	11.9^{b}	22.17^{d}	**14.32**	**2.68**	**1.55**

Mean in the same column of treatment followed by different superscripts differ significantly

WAT – Weeks after transplanting.PM-Poultry manure, GM-Goat manure. SD-Standard deviation

Table 7. Effect of different prunning methods and nutrient sources on yield and yield characters of garden egg

Treatment	Number of fruits	Fruit girth (cm)	Fruit weight (kg)	Mean	SD	SE±
Pruning methods						
Shoot	33.30[b]	13.30[b]	5.50[b]	**17.37**	**2.95**	**1.70**
Branch	38.50[a]	12.95[b]	6.33[a]	**19.26**	**3.10**	**1.80**
Unpruned	27.00[c]	14.23[a]	4.82[c]	**15.35**	**2.78**	**1.60**
Nutrient sources						
PM (3t/ha)	34.90[a]	14.34[a]	7.12[a]	**18.9**	**3.07**	**1.77**
GM (3t/ha)	33.12[b]	11.90[c]	5.91[b]	**16.98**	**2.91**	**1.68**
NPK Fertilizer (200kg/ha)	33.13[b]	12.19[b]	5.94[b]	**17.08**	**2.92**	**1.69**
Control (0t/ha)	27.61[c]	6.71[d]	3.93[d]	**12.75**	**2.52**	**1.46**

Mean in the same column of treatment followed by different superscripts differ significantly

PM-Poultry manure.GM- Goat manure.