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Effects of Different Rates of NPK 15:15:15 and Pruning Methods on the Growth and Yield of Cucumber (*Cucumis Sativus* L.) in Unwana-Afikpo

P. N. Umekwe[1], F. M. Okpani[2], I. O. Okocha[3]

[1, 2]Department of Agricultural Technology[1], Akanu Ibiam Federal Polytechnic, Unwana–Afikpo, P.M.B 1007, Afikpo, Ebonyi State, Nigeria

[3]Department of Horticulture and Landscape Management, Akanu Ibiam Federal Polytechnic, Unwana–Afikpo, P.M.B 1007, Afikpo, Ebonyi State, Nigeria

Abstract: ***An experiment was conducted at the experimental field of the Department of Agricultural Technology, Akanu Ibiam Federal Polytechnic Unwana-Afikpo, Ebonyi State during 2013 rainy season to evaluate the effect of different rates of NPK 15:15:15 and pruning methods on the growth and yield of cucumber (Cucumis sativus L.). The experiment was conducted as 6 x 2 factorial laid out in Randomized Complete Block Design (RCBD) with three replications. Vine length, number of vines, number of days to 50% anthesis, number of flowers, number of fruits per plant, and number of marketable fruits were observed. The result of the experiment on NPK 15:15:15 fertilizer showed a significant difference (P = 0.05) on vine length, number of flowers, number of fruits and number of marketable fruits as compared to the control. Similarly, the result on pruning showed significant difference (P = 0.05) on vine length, number of days to 50% anthesis and number of fruits. The interactions between the treatments indicated that 60kg/ha NPK and pruning gave the highest number of fruits and marketable fruits.***

Keywords: Cucumber, NPK15:15:15, pruning and yield

1. Introduction

Cucumber (*Cucumis sativus* L.) belongs to the family cucurbitaceae. It originated from India where it has been cultivated for 3000 years. Cucumber gives satisfactory yield as an early season crop and does well during the summer [1]. The leaves produce bristle hairs on their surface. Optimum growth occurs between 20^0C – 25^0C with growth reduction occurring below 16^0C and above 30^0C. Cucumber is adapted to a wide variety of soil types which have good drainage and slight acidity. Cucumber is a climbing plant whose stem may reach 2.5m long [2, 3]. The role of fertilizer cannot be over emphasized in the development of crops in Nigeria. Cucumber requires a lot of nutrient for proper growth and yield. Thus, the need for fertilizer application is widely recognized as it is readily observed that plants grown in soil with freshly applied fertilizer shows better response to growth and yield [4]. In the course of this study, different rates of NPK 15:15:15 was used in growing cucumber. [5] observed that NPK at 140, 60, 150 kg/ha exhibited better results for highest germination percentage, more fruits per vine, maximum fruit diameter and weight, vine length and total yield. However, days to flowering, fruit setting and maturity were delayed. [6] observed that response of cucumber plants to NPK at the rate of 200:85:150kg/ha was substantially higher than the control. [7] reported that different dozes of NPK were significantly different for days to flowering, days to fruiting, number of branches per plant, plant height (cm), number of fruits per plant, length of fruit (cm) and total yield (kg/ha). [8] reported that increasing the level of NPK resulted in a positive response in the vegetative growth and increased pod yield of cucumber. [9] reported that an increase in nitrogen application resulted in maximum fruit length, fruit weight, vine length and yield of cucumber. [10] reported that NPK level of 120-90-60 kg/ha significantly performed better with regard to head weight, head diameter, head length, marketable yields and head yield of cabbage. Pruning is an act of cutting off plant branches so as to encourage flowering or fruiting. Shoots, flowers and fruits are pruned to maintain a proper balance between the vegetative growth and fruit load. Pruning had a significant effect on vine length of cucumber [11]. Similar results were obtained in a pruning study on cucumber variety "Poung" [12]. [13] reported that the removal of the lateral shoot had a positive effect on the lateral runners near the base of the plant, resulting in higher yield. [14, 15] also found that suitable plant spacing with pruning gave higher yield of cucumber. [16] also found that the removal of the lateral shoots had a positive effect on the total yield of bitter gourd. [17] reported that unpruned cucumber flowered three days earliest than the pruned ones. In a field trial carried out to determine the effect of pruning and spacing on a commercial variety "Amata 765", [20] reported that the highest yield was obtained from unpruned treatment. Pruning all the branches on the main stem or pruning the branches up to node ten decreased the number of non marketable yield. The present research work was undertaken to study the effect of different rates of NPK 15:15:15 and pruning methods on the growth and yield of cucumber in Unwana-Afikpo.

2. Materials and Methods

2.1 Site Description

The experiment was conducted during the 2013 rainy season at the experimental field of Department of Agricultural Technology, Akanu Ibiam Federal Polytechnic, Unwana-Afikpo, Ebonyi State in South eastern zone of Nigeria.

2.2 Land Preparation

The experimental field measured 29.5m long by 8m wide, giving a total of 236m^2 was cleared using cutlass. Tillage was carried out using hoe while plots measuring 2m x 2m

($4m^2$) were marked out. The distance between two experimental units was 0.5m, while the distance from one replication to the other was 1m

2.3 Pre-planting soil Analysis

Soil samples were randomly collected from the site between 0 – 20cm deep with soil auger, bulked and analyzed for physico-chemical properties.

2.4 Experimental Design

The experiment was conducted as a 6 x 2 factorial laid out in Randomized Complete Block Design (RCBD). Each treatment was replicated three times and the treatment comprised six rates of NPK 15:15:15 (0, 30, 60, 90, 120 and 150kg/ha) and two pruning methods (pruning and non-pruning).

2.5 Seed collection, planting, NPK 15:15:15 application, weeding and pruning

Seeds of cucumber were obtained from National Institute of Horticulture (NIHORT), Ibadan. Cucumber seeds were sown in four rows per plot at spacing of 50cm x 50cm, given a total of 16 stands per plot. Fertilizer application was done at 3rd week after planting. Weeding was done at 3weeks after planting and subsequently as the need arose and the four tagged plants were pruned at fourth week with the aid of a secateur.

2.6 Data collection and Analysis

Data were collected on the vine length, number of vines, number of flowers and number of days to 50% anthesis from fifth week to eighth week on the four tagged plants. Yield components such as number of fruits and number of marketable fruits were taken from the four tagged plants per plot. The four tagged plants were selected from the center of each plot. Fruits of the four tagged plants per plot were separated by visual observation into marketable and non marketable fruits. Statistical analysis of data was based on the procedure outlined by [19] for factorial experiment in Randomized Complete Block Design (RCBD). Separation of treatment means for significant effect was by the use of least Significant Difference (LSD) as described by [20].

3. Results

3.1 Physico-chemical properties of the experimental site

The result showed that the soil is sandy loam with 48.00% sand, 11.80% clay and 40.20% silt. The soil is generally acidic with a pH of 5.80. The organic matter and organic carbon content are 3.45% and 2.03% respectively. The total N and P in the soil are 0.70% and 2.15ppm respectively (Table 1). The exchangeable cations were low in status with values of 1.80cmolkg^{-1} for Ca and 1.30cmolkg^{-1} for Mg. The values obtained for K (0.10cmolkg^{-1}) and Na (0.21cmolkg^{-1}) were low.

Table 1: Soil physico-chemical properties of the experimental site

Soil parameters	Values
pH (H_2O)	5.80
Organic matter (%)	3.45
Organic carbon (%)	2.03
Total N (%)	0.70
Available phosphorus (ppm)	2.15
Basic cations (cmolkg^{-1})	
Ca	1.80
Mg	1.30
K	0.10
Na	0.21
ECEC	3.86
Particle size Analysis (%)	
Sand	48.00
Silt	40.20
Clay	11.80
Textural class	sandy loam

3.2 Vine length

The result showed that NPK 15:15:15 had significant effect on the vine length (Table 2). The longest vine (74.66cm) was recorded at 120kg/ha NPK while the shortest (64.23cm) was at 0kg/ha NPK (control) and they differed significantly. Vine length recorded at 60kg/ha NPK (73.00cm), 90kg/ha NPK (72.10cm), 120kg/ha NPK (74.66cm) and 150kg/ha NPK (68.47cm) were statistically similar. Non pruned plants produced longer vines than the pruned plants (Table 2). NPK15:15:15 and pruning interaction was significant at P= 0.05. The vine length obtained at 120kg/ha NPK on the pruned treatment was significantly higher than all other combinations but at 60kg/ha NPK and 90kg/ha NPK on the unpruned treatment did not differ among themselves.

3.3 Number of vines

The effect of NPK 15:15:15 rates, pruning and their interaction was non-significant on the number of vines produced (Table 2). Fertilizer rate at 60kg/ha produced the most profusely vined plants (2.96) while the least number of vines (2.35) was recorded at control. Unpruned treatment produced a higher number of vines (2.69) than the pruned treatment (2.65). The highest number of vines was obtained at 60kg/ha NPK on the pruned plants while the least was at control on the unpruned plants.

3.4 Number of days to 50% anthesis

The effect of NPK 15:15:15 rates and interaction with pruning on the number of days to 50% anthesis was non-significant (Table 2). Although, 150kg/ha NPK had the longest number of days to 50% anthesis (41.24 days) while the shortest (40.44 days) was recorded at 60kg/ha NPK. The number of days to 50% anthesis was significantly higher on the pruned treatment (41.67 days) than the unpruned treatment (40.22 days) (Table 2).

3.5 Number of flowers

The application of NPK 15:15:15 fertilizer significantly increased the number of flowers over the control (Table 2).

The highest number of flowers (19.68) was obtained at 60kg/ha NPK while the lowest (10.79) was at 0kg/ha NPK and they differed significantly. Number of flowers recorded at 60kg/ha NPK was significantly higher than all other fertilizer rates except at 180kg/ha NPK were they did not differ significantly among themselves. There was non significant difference on the number of flowers between the pruned and unpruned treatment (Table 2). NPK 15:15:15 fertilizer and pruning interaction was significant at LSD = 0.05.

3.6 Number of fruits

NPK 15:15:15 fertilizer and pruning had significant effect on the number of fruits at P = 0.05. The highest number of fruits (3.80) was recorded at 60kg/ha NPK while the lowest (1.78) was at 0kg/ha NPK and they differed significantly. The number of fruits increased as the fertilizer rates increased from 0kg/ha NPK to 60kg/ha NPK beyond which there was a decrease in the number of fruits. The number of fruits obtained at 60kg/ha NPK (3.80), 90kg/ha NPK (3.78), 120kg/ha NPK (3.70) and 150kg/ha NPK (3.55) did not differ significantly among themselves. The pruned treatment (3.50) produced a higher number of fruits than the unpruned treatment (2.91).

3.7 Number of marketable fruits

NPK 15:15:15 fertilizer rates had significant effect on the number of marketable fruits at P =0.05 (Table 2). The highest number of marketable fruits (2.83) was obtained at 60kg/ha NPK while the lowest (1.15) was at 0kg/ha NPK and they differed significantly. The number of marketable fruits at 60kg/ha NPK (2.83), 90kg/ha NPK (2.78), 120kg/ha NPK (2.73) and 150kg/ha NPK (2.58) were statistically similar. The number of marketable fruits increased as the fertilizer rates increased from 0kg/ha NPK to 60kg/ha NPK beyond which there was a decrease in the number of marketable fruits. The effect of pruning, NPK 15:15:15 and pruning interaction on the number of marketable fruits was non-significant (Table 2). Number of marketable fruits (2.56) was higher on the pruned plants than (2.08) on the unpruned plants.

Table 2: Effects of different rates of NPK 15:15:15 fertilizer and pruning methods on the growth and yield parameters of cucumber.

Treatments	*VL*	*NV*	*NDA*	*NFL*	*NFR*	*NMFR*
NPK 15:15:15 (kg/ha)						
0	64.23^{c}	2.35^{a}	41.17^{a}	10.79^{e}	1.78^{c}	1.15^{c}
30	65.01^{b}	2.37^{a}	41.10^{a}	15.62^{d}	2.61^{b}	1.23^{b}
60	73.00^{a}	2.96^{a}	40.44^{a}	19.68^{a}	3.80^{a}	2.83^{a}
90	72.10^{a}	2.90^{a}	40.46^{a}	17.16^{c}	3.78^{a}	2.78^{a}
120	74.66^{a}	2.75^{a}	40.94^{a}	17.28^{b}	3.70^{a}	2.73^{a}
150	68.47^{a}	2.60^{a}	41.24^{a}	18.48^{a}	3.55^{a}	2.58^{a}
LSD (0.05)	**6.45**	**NS**	**NS**	**2.17**	**0.72**	**0.75**
Pruning methods						
Pruning	68.42^{b}	2.65^{a}	41.67^{a}	16.97^{a}	3.50^{a}	2.56^{a}
Non-pruning	71.45^{a}	2.69^{a}	40.22^{a}	16.15^{a}	2.91^{b}	2.08^{a}
LSD (0.05)	**NS**	**NS**	**1.16**	**NS**	**0.51**	**NS**
Interaction	**3.23**	**NS**	**NS**	**1.09**	**NS**	**NS**

Means in the same column having the same letter (s) are not significantly difference at (p<0.05); LSD = Least Significant Difference and NS = Not Significant. VL: vine length, NV: number of vines, NDA: number of days to 50% anthesis, NFL: number of flowers, NFR: number of fruits and NMFR: number of marketable fruits

4. Discussion

4.1 Vegetative growth

The application of 60kg/ha NPK produced the highest number of vines and highest number of flowers. The longest vine was obtained at 120kg/ha NPK while the shortest was recorded at 0kg/ha NPK. This observation is in agreement with the report by [6] who noted that the response of cucumber to NPK fertilizer at the rate of 0, 85, 150 and 200kg was substantially higher than the control. [8] also noted that an increase in the level of NPK resulted to a positive response in the vegetative growth and increased the pod yield of snap bean. The number of days to 50% anthesis was longest at 150kg/ha NPK and shortest at 60kg/ha NPK. This is not in conformity with the report by [5] who observed that NPK application rates at 60, 140, 150kg/ha delayed number of days to flowering, fruit setting and maturity. The least vegetative parameter was consistently recorded at 0kg/ha NPK except on the number of days to 50% anthesis were 60kg/ha NPK gave the earliest bud break.

The pruned treatment produced the highest number of flowers and longest number of days to 50% anthesis while number of vines and vine length was highest on the unpruned treatments. The unpruned plants had an earlier bud break than the pruned treatment. This agrees with the observation made by [17] who reported that unpruned cucumber flowered three days earliest than the pruned ones. [18] also noted that removal of apical bud and leaf of okra enhanced vegetative growth and development of okra. [19] observed that pruning of okra significantly delayed fruiting by 8 to 10 days, increase harvest duration by 12 to 15 days, increase number of pods per plant by 10 to 40% and pod yield by 1 to 36% more than the control.

4.2 Yield

The highest number of fruits and number of marketable fruits was obtained at 60kg/ha NPK. This suggests that NPK 15:15:15 fertilizer application induced luxuriant vegetative growth which provided a wider surface for photosynthesis and subsequent accumulation of photosynthate which enhanced the production of more fruits. The number of fruits increased as the NPK 15:15:15 rates increased from 0kgNPK/ha to 60kgNPK/ha beyond which there was a decrease. This is in agreement with work done by [23] who found a positive effect of all nitrogen treatment over the control on the number of fruits and marketable yield of cucumber. This experiment on cucumber is in contrary to the report by [24] who observed that the yield of cucumber was recorded at 120kg/ha N. [15, 25] however, suggested that NPK at the rate of 50kg/ha and 100kg/ha should be used for good growth and yield of cucumber.

Pruned plants consistently gave higher values in all the yield parameters measured. This is in conformity with the observation made by [16, 13] who reported that the removal of the lateral shoot had a positive effect on the total yield of cucumber. They also noted that pruning lateral runners near the base of the plant will result in higher yield

5. Conclusion

The study was carried out to evaluate the effects of different rates of NPK 15:15:15 fertilizer and pruning methods on the growth and yield of cucumber (*Cucumis sativus* L.) in Unwana-Afikpo. Based on the results of the study the following major findings and conclusion were made: NPK 15:15:15 fertilizer at the rate of 60kg/ha proved to be the most economical dose for cucumber plant since it produced the highest number of fruits and marketable fruits. Pruned cucumber plants also gave the highest number of fruits and marketable fruits. Cucumber grew better and yielded higher when pruned and treated with 60kg/ha of NPK 15:15:15 fertilizer.

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