



Effect of NPK, Urea and Foliar Fertilizers on Cucumber (*Cucumis Sativus*) Performance and Weed Density

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Abstract

Pot experiment was conducted at the back of the Faculty of Agricultural Sciences, Ladoke Akintola University of Technology, Ogbomoso, Oyo State to determine the effect of NPK, urea and foliar fertilizers on Cucumber (*Cucumis sativus*) performance and weed density. The treatments were laid out in a Randomized Complete Block Design (RCBD) with three replicates. NPK was applied at 150 kg/ha, urea at 85 kg/ha, foliar fertilizer (Maxi Force) containing NPK 20-20-20 + trace elements at 30 L/ha, while the control was untreated with fertilizer. Data collected were plant height, vine diameter, number of leaves, leaf area, number of days to flowering, 50% flowering, fruit yield, number of seeds per cucumber, fruit weight and weed density from two weeks after planting to 8 weeks after planting. The data collected were analysed using Analysis of Variance, and significant means were separated using Duncan's Multiple Range Test DMRT at 5% probability level. The application of urea fertilizer produced significant effect on ($P \leq 0.05$) leaf area (97.90 cm^2) of cucumber plant at 6 WAP. Cucumber fruit yield in response to the fertilizers was in the order: Urea > NPK > Control > Foliar, with foliar fertilizer producing the lowest significant fruit yield (63.33 kg/ha). Cucumber responded positively to fertilizer application with NPK 15:15:15 and Urea being superior to foliar applied fertilizer. High nitrogen content in urea may be responsible for luxuriant weed growth observed on urea treated plants at 3 WAP. Also, foliar fertilizer produced highest significant ($P \leq 0.05$) weed density (29.67%) at 6 WAP, while the lowest significant weed density (9.33%) was produced by NPK at 9 WAP.

Key words: Fertilizers, cucumber, weed density, growth and yield

Introduction

Cucumber (*Cucumis sativus* L.) is an ancient vegetable and one of the most important members of the Cucurbitaceae family (Thoa, 1998). It is cultivated for its fruit which is rich in minerals and vitamins. The fruit is eaten fresh in salads in accompaniment with other vegetables.

The soil where cucumber is cultivated requires moderate to high nutrient levels so as to achieve high yields. Infertile soil results in bitter and misshapen fruits which are often rejected by consumer thereby reducing farmers' income.

Cucumber is a plant that requires high level of humidity due to the large surface area of leaves. The optimum relative humidity during the day is between 60% - 70% and in the night is between 70% - 90% respectively. Cucumber may be grown in all types of loose soils which may be well drained and with sufficient organic matter. It is a plant which tolerates certain amount of salinity up to some extent. The optimum pH range is 5.5-7.0. Cucumber plant requires very large amount of water especially at the fruit formation stage throughout the growth stage.

The crop requires a large quantity of macro and micro nutrients especially manganese and iron. 100 kg N ha^{-1} had significantly maximized cucumber fruit length, which are indirectly related to the yield (80 kg N ha^{-1}) was the most economical dose for minimizing the days to flowering, fruit setting, and maturity and getting higher number of fruits and ultimately higher yield (Waseem *et al.*, 2008). An increase in nitrogen application resulted in maximum fruit length and fruit weight of cucumber (Ahmed *et al.*, 2007).

Most soil as a result of cultivation over time, suffered nutrient depletion such that high yields can only be attained through the judicious application of inorganic fertilizers. The invention of chemical fertilizers has allowed man to raise soil productivity higher than could be attained by relying on natural recycling process. Farmers for a long time had relied on natural soil recycling process for fertility restoration but as a result of high population, the fallow period in many communities have been shortened and also the cultivation has been extended for more than two years, hence there is a decline in crop



yield. Many studies of various crop have shown significant advantage of applying inorganic fertilizer (Akinrinde, 2006).

Fertilizer is any organic materials of natural or synthetic origin which is added to the soil into increase the supply of one or more plant nutrients essential to plant growth (Owoade *et al.*, 2010).

Weeds are unwanted plant growing on cultivated lands thereby depriving the crop of the necessary space, moisture and nutrient resulting in poor growth, reduce yield and quantity (Olabode *et al.*, 1999). Therefore, the effect of weed on cucumber plant is very devastating because they compete with the crop for nutrient, moisture and space, harbor pest and disease, make the farm activities laborious and reduce the aesthetic value of the farmland. Thus, it is very important to evaluate the response of cucumber to fertilizer types and the influence of the fertilizer types on weed density.

The objectives of this work therefore, are to determine the effects of NPK, Urea and foliar fertilizers on cucumber performance and to determine the effects of NPK, Urea and Foliar fertilizer application on weed density.

Materials and methods

Experimental Site

The experiment was carried out at the back of the Faculty of Agricultural Sciences building, Ladoke Akintola University of Technology, Ogbomosho, Oyo State. The climate is mostly influenced by the North-East trade wind which is characterized with cold wind with a drying effect starting from November till March and characterized by bimodal rainfall distribution with two peaks (1150mm and 1250mm) in late July/early August and October/November, the soil is a moderately well drained, ferruginous tropical soil (Browfield, 1969), with a sandy loam texture. The soil is over lined with metamorphic rocks.

Propagation of Cucumber

Cucumber seeds were obtained from Farmers Centre, Ogbomosho and sown at three seeds per pots, after treatment with fungicides (A pron plus) to prevent fungi attack.

Treatments and Experimental Design

The experimental pot had three treatments and one control, with three replicates. Each

treatment was represented by three pots to give a total of thirty-six (36) pots. The pots were arranged at 0.3m distance from one another within replicate. There was 1m spacing between replicate. The trials were laid down in a Randomized Complete Block Design (RCBD).

The treatments were: T₀- Cucumber without fertilizer, T₁- Cucumber + NPK 15:15:15, T₂- Cucumber + Urea and T₃- Cucumber + Foliar fertilizer application. NPK was applied at the rate of 150 kg/ha, Urea was applied at the rate of 85 kg/ha, while foliar fertilizer (Maxi force) was applied at the rate of 78.8 L/ha.

Cultural Practices

All pots on the site were subjected to similar activities such as supplying missing stand, thinning, spraying of insecticides, weeding and regular watering. Thinning was carried out after ten (10) days of planting. Each pot was sprayed with insecticides at 5days intervals from 10 days after planting to prevent insect pests attack. Weeding was done at three weeks' intervals to reduce competition. Appropriate fertilizers according to the treatments were applied two weeks after sowing by ring method, while foliar fertilizer was sprinkled manually.

Data Collection

Data collection commenced eight days after sowing. The data collected were as follows: Vine diameter was recorded using vernier caliper. Number of the leaves from the base of the plant to the top was counted by visual observation and only fully opened leaves were counted. Plants height was taken by full measurement of the length of the plant from the ground level to the apex at 2, 4, 6, 8 weeks after sowing. Weight of fruits was estimated by weighing on a digital sensitive scale, all measurements were taken in grams. Leaf area of cucumber at flowering was estimated following the formula $LA = 4.27 \cdot (L \times B) \cdot 0.88$ (Blanco *et al.*, 2000).

Where: LA= Leaf Area, L= Leaf Length and B= Leaf Breadth

Other parameters taken includes: number of days to flowering was counted and recorded, number of days to 50% flowering, number of fruit (s) per plant and number of seeds per fruit.

Statistical Analysis

The data collected were subjected to analysis of variance (ANOVA) and significant means were separated using Duncan's Multiple Range



Test (DMRT) at 5% probability level, according to SAS (2009).

Results

The effect of fertilizer types on cucumber plant was not significantly different from the control with respect to plant height (Table 1), vine diameter (Table 2) and number of leaves of cucumber (Table 3). However, after 8 weeks of planting, application of urea gave the highest plant height of 91.33 cm while the lowest plant height was observed in pots that received foliar fertilizer. Similar trend was noticed on number of leaves with the urea fertilizer having 10.67 while foliar application gave 5.00.

Leaf area of cucumber was similarly not significantly affected by fertilizer types up to 4 WAP (Table 4). At 6 WAP however, the largest leaf area (110.73 cm²) were produced from plants treated with Urea. The leaf area was not significantly different from the control (76.56cm²) and N.P.K 15:15:15 (44.89 cm²). Foliar fertilizer was also comparable to the control and N.P.K 15:15:15 but not with the Urea treated plants.

The highest fruit weight of cucumber was produced by Urea with 270.0 kg ha⁻¹ (Table 6). This was however similar to those of control (146.67 kg ha⁻¹) and NPK (220.0 kg ha⁻¹) as Foliar applied fertilizer produced significantly lowest yield (63.3 kg ha⁻¹). Similarly, the total number of fruits and seeds per fruit followed the same trend. The weed density of cucumber was not significantly different to 3 WAP (Table 7). At 6 WAP, the weed density of the foliar applied fertilizer was significantly higher (29.67). Weed density under control (14.33), NPK (11.67) and Urea (15.67) were not significantly different at WAP.

Table 1: Effects of NPK, urea and foliar fertilizers on the plant height (cm) of cucumber in weeks after planting (WAP)

Fertilizer	2 WAP	4 WAP	6 WAP	8 WAP
No fertilizer	14.63a	28.50a	54.50a	65.37a
NPK	11.15b	20.71a	42.70a	86.03a
Urea	12.25b	26.20a	64.87a	91.33a
Foliar fertilizer	12.59b	18.00a	34.30a	51.00a

Means followed by the same letter on the same column are not significantly different at $P \leq 0.05$ by DMRT

Table 2: Effects of NPK, urea and foliar fertilizers on the vines diameter (mm) of cucumber in weeks after planting (WAP)

Fertilizer	2 WAP	4 WAP	6 WAP	8 WAP
No fertilizer	2.83a	2.83a	3.10a	2.97a
NPK	2.40a	2.00a	2.97a	2.03a
Urea	2.87a	2.00a	2.87a	2.90a
Foliar fertilizer	0.92a	0.90a	1.00b	1.97a

Means followed by the same letter on the same column are not significantly different at $P \leq 0.05$ by DMRT

Table 3: Effects of NPK, urea and foliar fertilizers on the number of leaves of cucumber in weeks after planting (WAP)

Fertilizer	2 WAP	4 WAP	6 WAP	8 WAP
No fertilizer	6.00b	9.00b	8.67a	8.33a
NPK	5.33b	8.33b	6.67a	7.33a
Urea	8.67b	11.67b	9.67a	10.67a
Foliar fertilizer	7.33a	5.00a	5.00a	5.00a

Means followed by the same letter on the same column are not significantly different at $P \leq 0.05$ by DMRT

Table 4: Effects of NPK, urea and foliar fertilizers on the leaf area (cm²) of cucumber in weeks after planting (WAP)

Fertilizer	2 WAP	4 WAP	6 WAP	8 WAP
No fertilizer	57.07a	69.58a	76.56b	57.01a
NPK	57.14a	72.59a	44.89ab	43.68b
Urea	84.79a	57.01a	97.90a	110.73a
Foliar fertilizer	57.07a	60.00a	29.64b	19.67b

Means followed by the same letter on the same column are not significantly different at $P \leq 0.05$ by DMRT

Table 5: Effects of NPK, urea and foliar fertilizers on the number of days to flowering and 50% flowering of cucumber

Fertilizer	Number of days to flowering	50% flowering of cucumber
No fertilizer	32.67a	28.67a
NPK	35.67a	31.67a
Urea	30.33a	26.33a
Foliar fertilizer	11.67b	10.00b

Means followed by the same letter on the same column are not significantly different at $P \leq 0.05$ by DMRT

Table 6: Effects of NPK, urea and foliar fertilizers, on the number of fruit, number of seeds per cucumber and fruit weight

Fertilizer	Number of fruits	Number of seeds per cucumber	Weight of fruit (kg/ha)
No fertilizer	1.44a	28.00a	146.67a
NPK	2.02a	46.33a	220.00a
Urea	3.00a	54.67a	270.00a



Foliar 1.00b 14.33b 63.33b
fertilizer

Means followed by the same letter on the same column are not significantly different at $P \leq 0.05$ by DMRT

Table 7: Effects of NPK, urea and foliar fertilizers on the weed density (%) of cucumber

Fertilizer	3 WAP	6 WAP	9 WAP
No fertilizer	39.00a	14.33b	12.00a
NPK	21.00	11.67b	9.33b
Urea	41.33a	15.67b	14.33a
Foliar fertilizer	24.00a	29.67a	16.00a

Means followed by the same letter on the same column are not significantly different at $P \leq 0.05$ by DMRT

Discussion

The result of the experiment showed that cucumber benefited from applied fertilizer except the foliar applied fertilizer. Philip, 2004 and Fageria, 2009 posited that fertilizer boosts the nutrient diversity of the treated crops, supplement absorbed nutrients and increase crop yield and quality. However, the negative effects of foliar applied fertilizer is observed in the present study may be due to leaf burns which could have resulted from nitrogen burns. The foliar fertilizers contained NPK 20-20-20 Mg. Application during mid-day, when sun is up and hot may have to be arrested in future studies.

Also, the yield of cucumber was significantly affected by the fertilizer application implying that cucumber benefitted from the additional nutrients supplied. Highest yield from Urea indicated the significance of nitrogen in cucumber production. The observed result corroborated with the findings of Iren *et al.*, 2016 who stated that adequate nitrogen application has been reported to favour plant growth and leaf production.

Higher weed density under foliar fertilizer may also be due to spraying at untargeted plants (weeds). Similarly, high nitrogen content in urea may be responsible for luxuriant weed growth observed on urea treated plants.

Conclusion

This study showed that cucumber responded positively to fertilizer application with NPK 15:15:15 and Urea being superior to foliar applied fertilizer. It is therefore recommended that farmers can plant cucumber using either NPK 15:15:15 at 150 kg/ha or Urea (46%N) fertilizer at 85 kg/ha for cucumber production in this area.

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