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EFFECT OF PRILLED AND GRANULAR UREA ON THE GROWTH AND YIELD ON CUCUMBER (*Cucumis sativus*. L) CULTIVARS IN SOUTHERN GUINEA SAVANNAH, NIGERIA

A.I. Afe, A.I. Ayodeji, T.O. Ajiboye and U.Y. Ibrahim

Department of Crop Production, Faculty of Agriculture, Kwara State University, Malete, Nigeria

ABSTRACT

A pot experiment was conducted between March and July 2021 at the screen house of the Department of Crop Production, Kwara State University, Malete in the Southern Guinea Savannah agro-ecology, Nigeria to evaluate the response of cucumber cultivars to prilled and granular urea. The study consists of three cucumber cultivars (Basma, Pico and Pointset) and two forms of urea (prilled and granular urea) and the control laid out in a 3×3 factorial combinations in a completely randomized design replicated three times. Data were collected on the following variables: number of leaves, vine length, leaf area, days to 50% flowering and fruiting, fruit length and fruit circumference, and fruit yield/ha. Data were subjected to Analysis of variance (ANOVA) and treatment means where significant difference exist, were separated using Duncan Multiple Range Test at 5% level of probability. The control treatment significantly had shorter vine length at 4 and 6 weeks after sowing (WAS) compared to the granular and prilled urea application. Application of prilled urea was superior to granular urea on the vine length at 4 and 6 WAS. All the cultivars had similar leaf area at 8 WAS. There were no significant differences on days to 50% fruiting and fruit circumference among the three cultivars. The control treatment, however, took longer days to attain 50% flowering in Poinsett cultivar compared to other treatments. In addition, the control treatment also significantly had shorter fruit length, poor fruit yield compared to application of granular and prilled urea fertilizers. Application of prilled urea significantly produced higher fruit yield/hectare than granular urea in Basma and Pico cultivars. The least fruit yield/plant 5.00, 4.62, and 3.92 t ha^{1} respectively for Basma, Pico and Poinsett were obtained at the control treatment. Basma cultivar recorded the highest fruit yield (17.36 t ha^{-1}) with application of prilled urea fertilizer and hence, recommended.

Keywords: Basma; fruit yield; Pico; Poinsett

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is a widely cultivated plant belonging to the family Cucurbitaceae. It is usually grown throughout the tropical and subtropical countries. When harvested at immature stage, the fruits have extremely high metabolic activity (Singh *et al*.,

2018). The seed is a good source of minerals and used in diet and disease treatment programs (Murad and Nyc, 2016). Hence, it is considered as one of the creeping vegetables with large consumer demand worldwide (Petre *et al*., 2015). According to FAOSTAT (2020), the estimated world production of cucumber was 91,258,272 metric tons with China being the largest producer.

Market gardening involving cucumber is profitable as it provides a living for many families, especially those living below the poverty line (Drabo, 2016). Despite numerous socio-economic and nutritional benefits of cucumber, the annual production in Nigeria is estimated about 40,000 tons which have not been able to meet the nutritional needs (Opara *et al.*, 2012; Abdul and Khan, 2015). This can be due to difficult access to land, high pest pressure, climate change (especially the increasing scarcity of rainfall) and, above all, declining soil fertility. Purbajanti *et al.* (2019) reported that, the decline in production of cucumbers is partly caused by reduced field area and insufficient supply of essential nutrient elements. Increase in cucumber production can be achieved either by putting more land area under its cultivation or by using improved varieties with appropriate cultural practices. Okoli and Nweke (2015) noted that increased in cucumber production in Nigeria in the recent time could be attributed to the awareness created by market demand, economic returns, short maturity dates, nutritional and medicinal values. Application of either organic or mineral fertilizer has been found to be one of the quickest and easiest strategies for increasing the yield of cucumber per unit area (Abdel-Mawgoude *et al*., 2005; Jilani *et al*., 2008; Agu *et al.*, 2015). Eifediya and Remison (2010) observed a positive response of cucumber to organic, inorganic as well as combination of organic and inorganic fertilizers for optimum growth and fruit yield.

Prilled and granular urea are nitrogenous fertilizer with 46 % Nitrogen. The prilled urea is smaller in size with high dimensional consistency and dissolves rapidly compared to granular urea. These forms of nitrogen have been extensively used in crop growth and yield. Since yield potentials of crops differs across the ecological zone and among the cultivars, Iken and Amusa (2004) suggested that testing new crop varieties across the ecological zone should be an established practice in plant breeding for selecting cultivar that is adapted for each zone. At present, numerous cucumber cultivar are cultivated in Nigeria, however, very little or no information existed in Nigeria on the response of cucumber cultivars to the two forms of urea. Hence, this study was conducted to evaluate the effect of prilled and granular urea on the growth and yield of cucumber cultivars.

MATERIALS AND METHODS

Study Area

The experiment was carried out between May and July, 2021 at the Kwara State University, Faculty of Agriculture screen house. The study area is located about 316.37 m above sea level on a latitude of 08°43'N and longitude 4°28'E. Malete, is in the Southern Guinea Savannah agro-ecological zone, Nigeria.

Experimental Design and Cultural Practices

Pico, Pointset and Basma cucumber cultivars used for the study were obtained from a reliable agro-outlet at Amilegbe, Ilorin,Kwara State, Nigeria. The two forms of urea inorganic fertilizer used for the trials were prilled and granular urea.

The study comprises two forms of urea and a control in combination with three cultivars of cucumber in a 3 x 3 factorial concept fitted into a completely randomized design (CRD) and replicated three times. At the screen house, planting was done on 15th of March, 2021. Three seeds were sown per hole which was later thinned down to two per stand at 2 WAS. The plants were watered every morning and evening throughout the growing period to ensure adequate water supply to the plants.

The prilled and granular ureas fertilizers were applied at the rate of 130 kgN/ha (Adeoye and Balogun, 2016) in two splits at 3 and 6 WAS. The crops were staked at 3WAS to expose the leaves and to also prevent the fruits from touching the ground to avoid disease infection.

Data Collection and Analysis

Data were collected for the following variables: vine length, number of leaves, leaf area, number of days to attain 50% flowering and fruiting, weight of fruit/plant, fruit length and fruit circumference and fruit yield/ha. The collected data were subjected to Analysis of variance (ANOVA) and treatment means where significant difference exist, were separated using Duncan's Multiple Range Test at 5% level of significance.

RESULTS

The response of cucumber cultivars to granular and prilled urea fertilizers on number of leaves and vine length is presented in Table 1. Similar vine length values were recorded among the cucumber cultivars at 2 WAS. At 4 and 6 WAS, Basma cultivar had the longest vine but at par with Pico at 6 WAS. The Pointset cultivar significantly had shortest vine compared to other cultivars at 4 and 6 WAS. There was no significant difference among cucumber cultivars in the number of leaves at 2, 4, 6 and 8 WAS.

Table 1: Response of cucumber cultivars to granular and prilled urea on number of leaves and vine length at 2, 4, 6 and 8 weeks after planting

Treatments	Number of leaves at 2-8 WAS				Vine length (cm) at 2-6 WAS		
	2	4	6	8	2	4	6
			Cultivars				
Basma	4.33	8.33	11.33	15.66	3.88	12.58a	60.77a
Pico	4.00	7.33	12.00	16.33	4.78	10.69b	62.24a
Poinsett	4.66	7.33	10.66	15.33	4.14	9.05c	49.33b
			Form of urea fertilizer				
Control	4.33	7.33	10.66	15.00	4.00	9.41c	47.91c
Granular	4.00	7.66	11.66	15.33	4.36	10.70b	60.35b
Prilled urea	6.66	8.00	11.66	17.00	4.43	11.97a	64.08a
LSD (0.05)	0.49	1.05	1.05	1.12	1.70	0.77	3.04

Values with the same letter(s) in the same column are not significantly different at 5% level of significance by Duncan's Multiple Range Test.

The control treatment had significantly ($p<0.05$) shortest vine length at 4 and 6 WAS compared to granular and prilled urea application. Application of prilled urea was superior to granular urea on vine length at 4 and 6 WAS. There was no significant ($p>0.05$) difference on the number of leaves produced at 2, 4, 6 and 8 WAS between applications of granular and prilled urea as well as the control.

The interactive effects of cucumber cultivars, granular and prilled urea on vine length at 4, 6, and 8 WAS is shown in Figure 1. Application of prilled urea fertilizer significantly produced a longer vine length than other treatments in all the cucumber cultivars. Except pointset cultivars, application of granular urea had similar vine length with the control at 8 WAS.

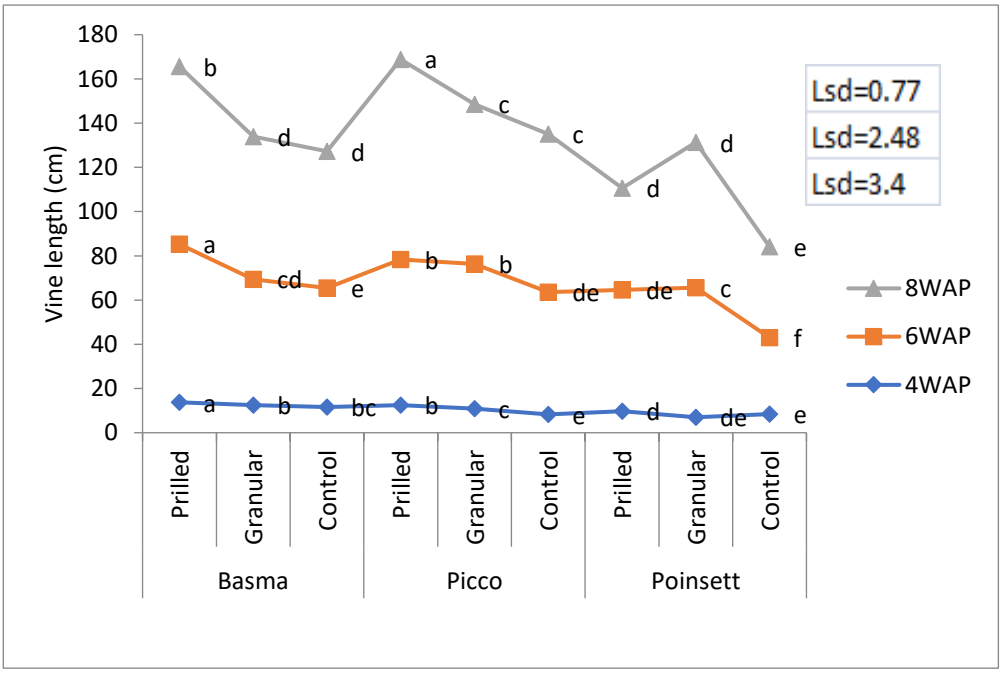

Figure 1: Interactive effect of prilled and granular urea on vine length at 4, 6 and 8 weeks after planting

The interactive effect of cucumber cultivars as influenced by application of prilled and granular urea had no significant effect on number of leaves until 6 WAS (Figure 2). The highest number of leaves for all the cultivars were produced with the application of prilled urea. This, however, were not significantly different from the application of granular urea. The number of leaves produced at the control treatments was at par with the application of granular urea.

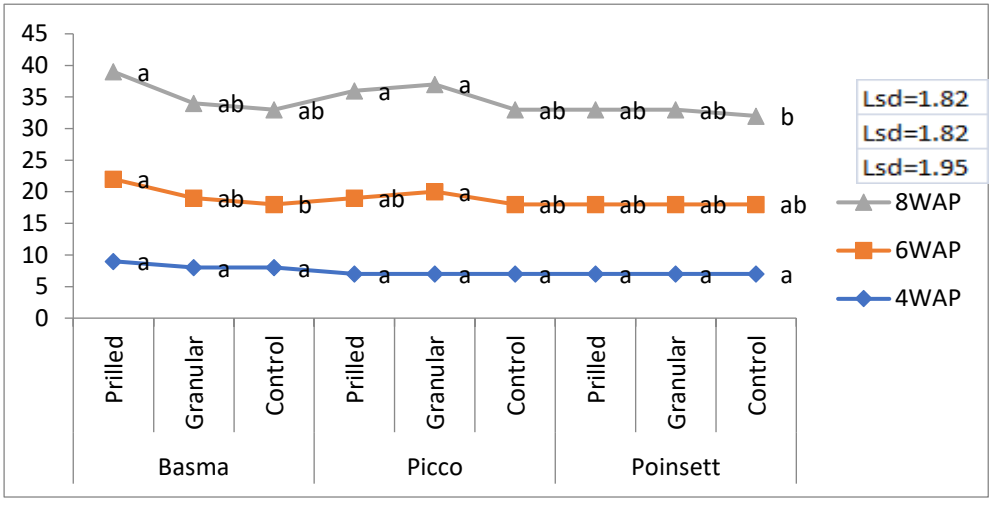

Figure 2: Interactive effect of prilled and granular urea on the number of leaves of cucumber cultivars at 4, 6, and 8 weeks after planting

The interactive effects of cucumber cultivars, granular and prilled urea on leaf area at 4, 6 and 8 WAS is shown in Figure 3. The highest leaf area at 4, 6 and 8 WAS of basma and pico cultivars were produced with the application of prilled urea fertilizer but application of granular urea produced the highest leaf area in pointset cultivars. At 8 WAS, application of granular urea had similar leaf area with the control treatment with Pico cultivar.

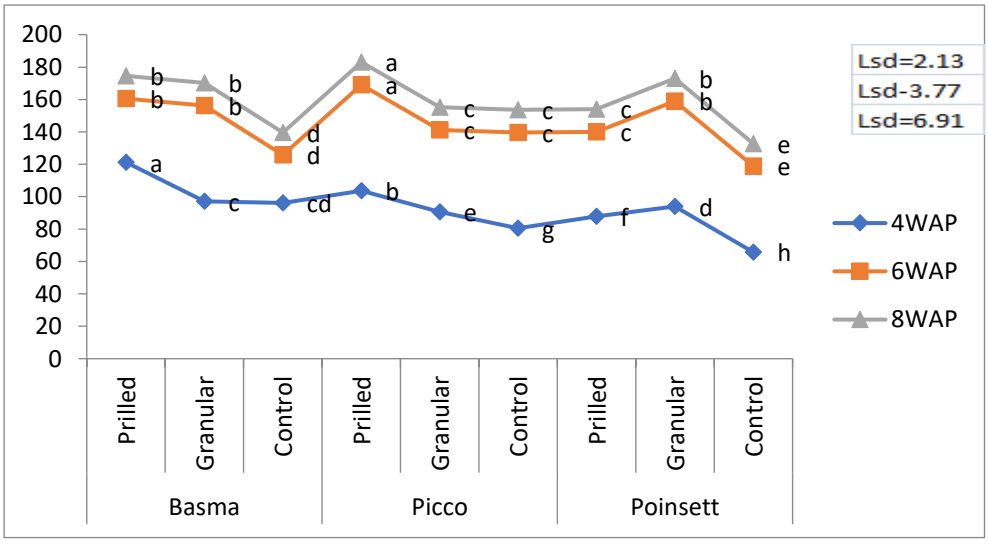

Figure 3: Interactive effect of prilled and granular urea on leaf area of cuccumber cultivars at 4, 6 and 8 weeks after planting

The interactive effects of cucumber cultivars to granular and prilled urea on days to 50% flowering, fruiting, fruit length, fruit circumference and fruit yield is presented in Figures 4 and 5.

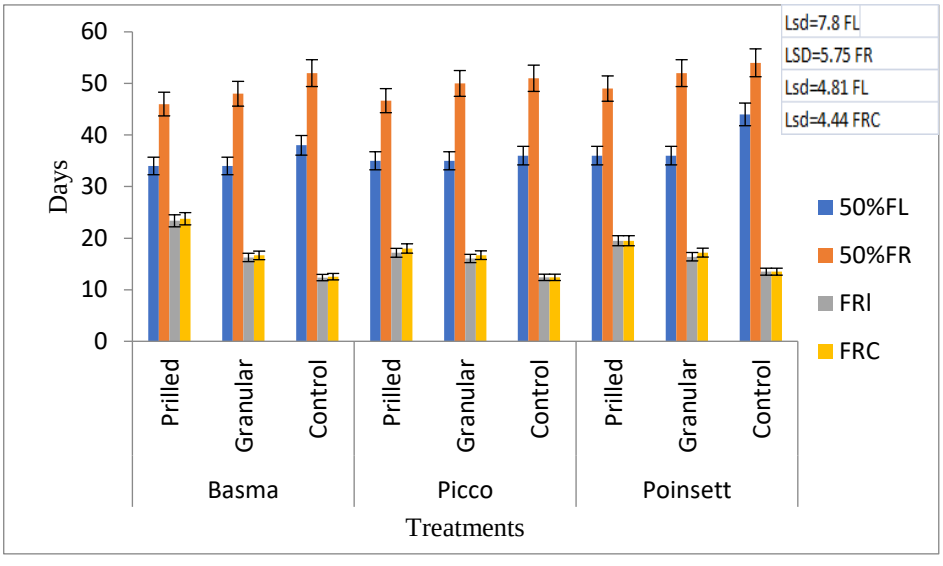

Figure 4: Interactive effect of prilled and granular ureas on days to 50% flowering, fruiting, fruit length and fruit circumference of cucumber cultivars

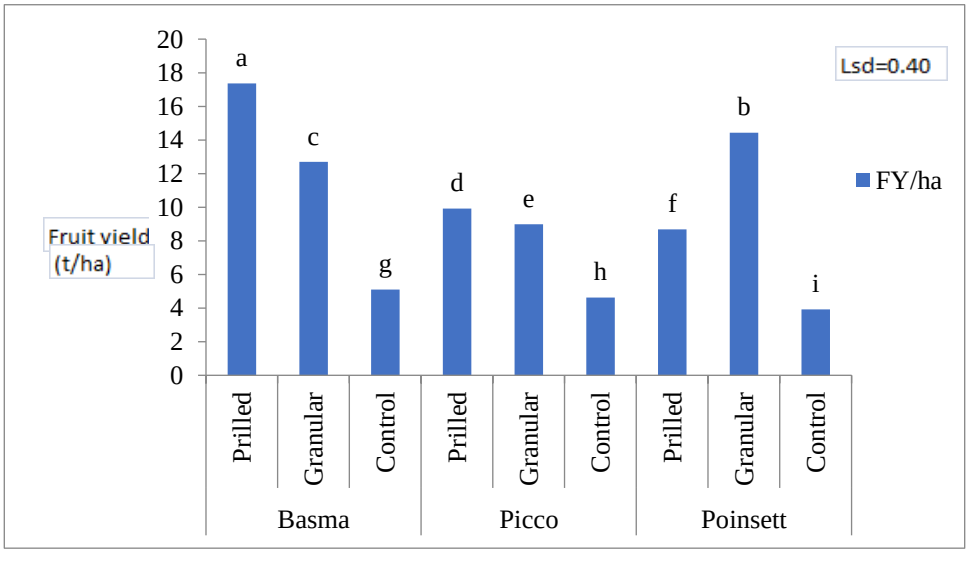

Figure 5: interactive effect prilled and granular urea on fruit yield of cuccumber cultivars

The control treatment took longer days to flower, and fruit compared to other treatments in all the cucumber cultivars. Application of prilled form of urea fertilizer significantly produced longer fruit, thicker fruit, and fruit yield than granular urea and control treatment in Basma cultivar. There was no significant difference in the fruit length and circumference between application of granular urea and the control in the cucumber cultivars. The lowest fruit yield, 5.00, 4.62, and 3.92 t ha^{-1} respectively for Balsam, Pico and Pointset were obtained at the control treatment.

DISCUSSION

This study showed that application of urea fertilizers enhanced the growth and yield components of cucumber irrespective of cultivars used. This suggests that the soil in the zone is relatively low in both the micro and macro elements that cannot support cucumber growth and yield without external application of soil amendments. This inherent low nutrient status of Savannah soils has been reported by Labaran and Idris (2016) due to continuous farming and indiscriminate application of synthetic fertilizers that is common among the farmers in the zone. Tivet *et al*. (2013) had earlier observed that changes in the soil properties due to continuous cultivation was a major factor that is responsible for soil degradation and decline in crop yield.

Although, all the cucumber cultivars responded positively to the application of urea fertilizer, their response to the form of the fertilizer differs. For instance, the Basma cultivar significantly out-yielded other cultivars with the application of prilled urea fertilizer while Poinset cultivar significantly had higher yield with the other cultivars with the application of granular urea. This significant difference in the yield and yield components showed that there could be genetic variation among cucumber cultivars. Genetic variations among cucumber cultivars have been reported by (Ojeifo *et al*. (2008) and Adinde *et a*l. (2016). Ibrahim *et al*. (2000) had earlier reported that the differences in growth indices of crops were normally attributed to their genetic constitution. Similarly, Sajjian *et al*. (2002) mentioned that growth characters of crops such as plant height, vine length, leaf area, number of leaves or branches, and fruit yield were influenced by genetic factors.

The better performance of prilled over granular could be due to easy of dissolution in the soil of the latter over granular. The increased in growth and yield components character of plants treated with the inorganic fertilizer agreed with report of Jilani *et al*. (2008), Agu *et al*. (2015) and Adinde *et al*. (2016) who reported the enhancement of cucumber productivity with the application of either organic or synthetic fertilizers. Similarly, Shehata *et al*. (2012) reported enhanced growth and quality fruits of cucumber with the application of combined organic and inorganic fertilizers.

CONCLUSION

The results of this study had demonstrated that application of prilled and granular urea enhanced the growth and yield of cucumber irrespective of cultivars. The highest fruit yield was obtained in Basma cultivar with application of prilled urea.

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