# Effect of Nitrogen and Spacing on Yield and Yield Attributes of Watermelon (*Citrullus lanatus*) (Thumb Mest.) and their Interactions in Bauchi

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## ABSTRACT

*This study is undertaken to investigate the effect of nitrogen and spacing on yield and yield attributes of watermelon (Citrullus lanatus) (Thumb Menst). Field experiments were conducted during 2011 wet season at Abubakar Tafawa Balewa University, Bauchi and Bauchi State Agricultural Development project, Teaching and Research farms, Bauchi. The treatments used consisted of four levels of nitrogen (0, 25, 50 and 75kg N $ha^{-1}$) and three plant spacings (1.0x1.0m, 1.5.m x 1.5m and 2.0m x 2.0m). The treatments were factorially combined and arranged in a randomized complete block design. Results indicate that nitrogen significantly increased number of flowers per plant, number of fruits per plant, total fruit yield per hectare and marketable fruit yield per hectare. Days to 50% flowering were also attained earlier with application of nitrogen. Spacing however had no significant effect on yield and other yield characters observed. Result indicate among many others that existence of significant interaction effect between nitrogen and spacing on fruit number per plant at Bauchi State Agricultural Development Project (BSADP) experimental site. A combination of 50kg N $ha^{-1}$ and 1.5m x1.5m spacing provided best yield in the study area.*

***Keywords**: Watermelon, Nitrogen, Spacing, Yield and Yield Attributes*

## INTRODUCTION

Watermelon (*Citrullus lanatus)* (Thumb Menst) belongs to the family *cucubitacea*. The production of watermelon covers all major regions of the world (tropics and subtropics). It is considered an important crop in China, Egypt, India, America and Southern Europe. It leads the production figures of all cucubits in terms of tonnage (69,318,000) and hectarage (3.1 million hectares) (FAO, 2005). Research dealing with watermelon production in Nigeria is uncertain, what is obvious however, is that the crop is mainly grown in derived savannah and savannah areas (Norman, 1992) with little cultivation in forest zone. It is however presently gaining popularity and is abundantly grown in the northern parts of the country (Bauchi, Borno, Kaduna, Kano, and Jos) where it is available in most times of the year. Different fertilizer levels are adopted among the local farmers with the hope of increasing the yield potential of the crop. This result not only to acute variation in yields but also variation in crop quality and storability. In addition, the high costs of nitrogenous fertilizer in the country are enough clear indications for research needs. There is therefore an urgent need to identify the most economic dose of nitrogen fertilizer to be applied to watermelon in the study area. Similarly, varying spacings are being adopted by different growers which

are practiced mostly based on farmers' instinct (personal judgment/views) and land availability. These lead to acute variation in yield. The right spacing therefore needs to be identified in order to increase the yield potential of the crop. In line with the above, this work therefore aims at investigating the effect of nitrogen and plant spacings on yield and yield attributes of watermelon in Bauchi State.

## MATERIALS AND METHOD

A field experiment was conducted at two locations (multi location) during the raining season of the year 2011 at Abubakar Tafawa Balewa University Bauchi (ATBU) and Bauchi State Agricultural Development Project (BSADP) Training and Research Farms, Bauchi. The sites are both approximately located at $10^0$ $19^1$N $9^0$ $47^1$E and 609m above sea level in the Northern Guinea Savannah zone of Nigeria (Anonymous, 1983). Prior to the set up of the experiment, soil samples were taken randomly from both sites of the experimental plots after ploughing at the depth of 0-15 and 15-50cm using a tubular auger. The samples were analyzed for composite and physico-chemical properties as described by Black (1965). Sugar baby which is resistant to anthracnose and sunburn was used as a test crop variety. It is the most popular variety among the watermelon producers of the Nigerian Savannah (Ibrahim, Mahmud, Tanimu and Babaji, 1997).

The treatments tested were in factorial combination of four levels of nitrogen (0, 25, 50 and 75kg $Nha^{-1}$) and three plant spacings (1.0m x 1.0m, 1.5m x 1.5m and 2.0m x 2.0m) (4x3). The treatments were arranged in a randomized complete block design (RCBD) and replicated three times. Plot size was 6.0m x 6.0m ($36m^2$) in dimension and separated by 2.0m spaces between them. Raised beds were used to facilitate drainage. Other cultural practices were adequately performed as at when necessary. The number of flowers per plant was determined by counting the full opened and closed flowers that had colour and were conspicuous. The mean number of flowers from the tagged plants represents the plot means. Days to 50 percent flowering was determined by counting the days starting from the day of sowing to the days when half of the plants in each plot had flowered.

Harvested fruits from the tagged plants were weighted and the mean weight of the sampled plants was used as yield per plant. The number of fruits produced by the tagged plants was counted and the mean number of the sampled plants was used as number of fruits per plant. Fruit yield per hectare was determined by converting the total weights obtained from the net plots in kilogram (kg) to tones per hectare. Data collected were subjected to analysis of variance to determine the significant effect of the treatment as described by Sneedecor and Cochran (1967). The differences among the treatment means were then compared using least significant difference (LSD).

## RESULTS AND DISCUSSION

***Effect of Nitrogen Application:*** The effect of nitrogen application on number of flowers was found to be highly significant (table 1). The mean number of flowers produced by 50kg N $ha^{-1}$ treatment did not significantly differ with that of 75kg N ha. Similarly, there

was no statistically significant difference between the mean number of flowers obtained from the control plots and those treated with 25kg $Nha^{-1}$. Nitrogen also had significant effect on days to 50% flowering. The control and 75kg $Nha^{-1}$ treatments had the highest and least number of days to attain 50% flowering respectively (table 1). Similarly, Nitrogen had significant effect on number of fruits per plant (table 2). The highest and the least mean number of fruits were obtained with 50kg $Nha^{-1}$ and 0kg $Nha^{-1}$ applications respectively. In addition interaction effect between nitrogen and spacing on fruit number per plant was statistically significant (table 2). The effect of nitrogen on total fruit yield per hectare was statistically significant (table 2). However, at ATBU site there was no significant difference between the mean fruit yield of 50kg $Nha^{-1}$ treatment and 75kg $Nha^{-1}$. The effect of Nitrogen on marketable yield was also significant (table 2). The highest and the lowest marketable yields were obtained from 75kg N $ha^{-1}$ and the control treatments respectively.

***Effect of Spacing:*** Spacing had no significant effect on number of flowers produced (table 1). Similarly, it had no significant effect on days to 50% flowering (table 1). The effects of spacing on number of fruits per stand, total fruit yield per hectare were also not significant (table 2).

***Interaction Effect:*** Significant interaction effect was observed between nitrogen and spacing on number of fruits per plant (table 2). Spacing alone had no significant effect on number of fruits per plant. However, the combine effect of spacing and nitrogen treatment significantly affected the number of fruits produced per plant (table 3). The highest number of fruits per plant was recorded by the combination of 50kg N $ha^{-1}$ and 1.5m x 1.5m spacing while the least was obtained by the combination of 0kg N $ha^{-1}$ and 1.0m x 1.0m spacing which were however statistically at par with other spacings. Significant increase in number of flowers produced was observed with nitrogen treatments when compared with the control. This agreed with Andrade *et al* (2006) who report increase in number of flowers when nitrogen level was increased from 0 – 120kg N $ha^{-1}$.

Similarly, nitrogen had significant effect on days to 50% flowering. Plots treated with nitrogen, flowered earlier than the control. This is in accordance with Dosantos *et al* (2009) who observe longer days to reach 50% flowering on control plots when compared with plots treated with nitrogen. The rapid flower formation in nitrogen treated plots could probably be attributed to the ability of nitrogen to stimulate growth through meristimatic process. Number of fruits per plant and total fruit yield per hectare were significantly influenced by nitrogen application. The positive response could be expected in view of the role of nitrogen with its inherent capability of promoting the physiology of plants thereby producing good canopy to trap sunlight for photosynthetic activity. This finding concurred with Andrade *et al* (2006) and Dosantos *et al* (2009) who observe significant yield increase on plots treated with nitrogen when compared to the controls. Spacing had no significant influence on both number of flowers produced and days to 50% flowering. It was however observed that, the closer the spacing, the lower the mean number of flowers produced and the earlier the attainment of 50% flowering which were not statistically significant. This might be due to better water use by the crop which had closer canopy that was capable of reducing water loss through evaporation from the soil surface. In line with this finding,

Kasarawi (1998) reports that timing of the production of flowers and number of flowers produced was not affected by densities and row spacings. Spacing equally had no statistically significant effect on number of fruits produced per plant, fruit yield per hectare and marketable fruit yield per hectare. This observation could probably be because the spacings used were not beyond optimal range which influenced the intensity of interplant competition and hence failed to affect fruit formation process. In disagreement with this result Dean *et al* (2011) observe decrease in fruit number produced per plant and total yield when spacing was increased from 1.0m to 2.5m.

## CONCLUSION

This study explored the effect of Nitrogen and spacing on yield and yield attributes of water melon and their interactions in Bauchi State. The findings of this study indicate that nitrogen significantly influences yield and yield attributes in watermelon and a combination of 50%kg N $ha^{-1}$ and 1.5m x 1.5m spacing are quite suitable for achieving average economic yield of watermelon in the study area. Based on the above, it can be concluded that nitrogen plays a pivotal role on the yield attributes as well as a 1.5m X 1.5m spacing pattern of citrullus lanatus. Hence, these variables are recommended for improved cultivation of the fruit plant in Bauchi State.

**Table 1:** Effect of nitrogen and spacings on number of flowers produced and days to 50% flowering of watermelon at Bauchi in 2011 wet season

| Treatment | ATBU | | BSADP | |
|---|---|---|---|---|
| | Number of Flowers | 50% flowering | Number of flowers | 50% Flowering |
| Nitrogen (kg N $ha^{-1}$) | | | | |
| 0 | 1.7 | 61.1 | 0.5 | 62.6 |
| 25 | 2.1 | 51.4 | 1.8 | 57.9 |
| 50 | 5.2 | 50.7 | 5.2 | 50.4 |
| 75 | 5.6 | 47.1 | 4.0 | 48.2 |
| LS | ** | ** | ** | ** |
| LSD (0.01) | 0.68 | 1.22 | 1.14 | 1.14 |
| Spacing (m) | | | | |
| 1.0 x 1.0 | 3.4 | 52.5 | 2.6 | 53.2 |
| 1.5 x 1.5 | 3.5 | 52.6 | 3.1 | 53.6 |
| 2.0 x 2.0 | 4.1 | 52.7 | 3.0 | 53.1 |
| LS | NS | NS | NS | NS |
| Interaction N x spacing | NS | NS | NS | NS |

** = significant at 1% level of probability

NS = Not significant LS = Level of significant

***Source:*** Experimentation, 2011

**Table 2:** Effect of nitrogen and spacings on number of fruits per plant, fruit yield per hectare and marketable yield per hectare at Bauchi in 2011 wet season.

| **Treatment** | **ATBU** | | | **BSADP** | | |
|---|---|---|---|---|---|---|
| | Number of fruit ($plant^{-1}$) | Total yield (t/ha) | Marketable yield ($t/ha^{-1}$) | Number of fruit ($plant^{-1}$) | Total yield (t/ha) | Marketable yield (t/ha) |
| **Nitrogen (kg n $ha^{-1}$)** | | | | | | |
| 0 | 2.0 | 8.3 | 5.8 | 0.9. | 5.6 | 4.1 |
| 25 | 4.2 | 15.7 | 14.5 | 2.1 | 12.3 | 11.5 |
| 50 | 8.3 | 18.8 | 18.5 | 5.0 | 16.9 | 16.7 |
| 75 | 56.7 | 20.3 | 20.1 | 34.8 | 18.9 | 18.2 |
| LS | ** | ** | ** | ** | ** | ** |
| LSD/0. | 0.63 | 1.52 | 1.53 | 1.02 | 1.15 | 1.12 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Spacing (m)** | | | | | | |
| 1.0 x 1.0 | 5.0 | 14.2 | 14.3 | 2.8 | 13.4 | 12.6 |
| 1.5 x 1.5 | 5.1 | 13.9 | 14.5 | 3.3 | 12.9 | 12.6 |
| 2.0 x 2.0 | 5.1 | 13.7 | 15.3 | 2.9 | 12.9 | 12.7 |
| LS | NS | NS | NS | NS | NS | NS |
| **Interaction** | | | | | | |
| N x spacing | NS | NS | NS | * | NS | NS |

***Source:*** Experimentation, 2011

**Table 3:** Interaction effect between nitrogen and spacing on number of fruits per plant of water melon at Bauchi in 2011 wet season

| **Spacing (m)** | **Nitrogen (kg N ha $^{-1}$)** | | | |
|---|---|---|---|---|
| | 0 | 25 | 50 | 75 |
| 1.0 x 1.0 | 1.0e | 2.3d | 4.0c | 3.7c |
| 1.5 x 1.5 | 0.9e | 2.3d | 6.0a | 3.8c |
| 2.0 x 2.0 | 0.9e | 1.6de | 5.0b | 4.0c |
| Level of significance | | * | | |
| LSD (0.05) | | 0.92 | | |

* = significant at 5% level of probability.

Means with different superscript letter(s) are significantly different.

***Source:*** Experimentation, 2011

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