



EFFECTS OF ROW AND PLANT SPACING ON THE GROWTH AND YIELD OF CARROT AT KADAWA, NIGERIA.

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ABSTRACT

Field trials were conducted at Kadawa (11° 39'N, 08° 02'E; 500m altitude) in Sudan Savannah agro ecological zone of Nigeria during the dry seasons of 2006/07, 2007/08 and 2008/09 to determine the effects of row spacing (20, 30 and 40cm) and plant spacing (5, 10 and 15 cm) on carrot. The nine treatment combinations were laid out in a randomized complete block design with three replications. The results obtained showed that number of leaves per plant and plant height were not affected by the treatments. Root length was significantly increased by the use of 40cm row spacing compared with 20cm while, a reverse response was recorded for marketable yield. Root length and diameter were significantly increased by 15cm plant spacing compared with lower spacings, total and marketable yield were increased with 5cm compared with 10 and 15cm spacings.

Key words: Row spacing, plant spacing, plant height, Root length, Root diameter, Marketable yield.

Introduction

Carrot (*Daucus carota* L.) is a popular vegetable that is eaten mostly as a desert in salads and various other food and feed preparations. Carrot yields are generally low in Nigeria compared with other European countries (Sarkindiya and Yakubu, 2006; Anon, 2013). Various researchers have attempted to improve the yield of carrot mostly through increase fertilization (Masud *et al.*, 2009; Dawuda *et al.*, 2011; Ahmed *et al.*, 2014).

The global concern for the environment and the demand for organic produce have increased the need to produce crops using environmentally friendly technologies devoid of agro-chemicals. In view of the foregoing, attempts were focused on increasing crop productivity using other cultural or agronomic practices (Aliyu *et al.*, 2012, Sambo *et al.*, 2013). This study was therefore carried out to determine the response of carrot to various row and plant spacings.

Materials and Methods

Experiments were conducted at Kadawa, (11°39'N, 08° 02'E and 500 m altitude) in the Sudan Savanna agro ecological zone of Nigeria during the dry seasons of 2006/07, 2007/08 and 2008/09. The treatments consisted of factorial combinations of three row spacings (20, 30 and 40 cm) and three plant spacings (5, 10 and 15 cm). The nine treatment combinations were laid out in a randomized complete block design with three replications. The gross plot size was of 10.8 m² while, the net plot size was 6 m². Carrot seeds were sown in December each year during the experimental period. The seeds were drilled at the rate of 3 seeds per hole as per the row and plant spacing treatments. The plots were irrigated weekly. Fertilizers were applied at the rate of 100kg N, 50 kg P₂O₅ and 50 kg K₂O ha⁻¹ in two split doses. First dose at planting while, the second half at 6 WAS. Weeds were manually controlled at 3, 6 and 9 weeks after sowing (WAS).

Data were collected on plant height, numbers of leaves per plant, root length and

diameter on plant basis while, the yield characters were estimated from the net plot. Data collected were analyzed using Statistical Analysis System (SAS Institute, 2013) and the means compared using Least Significant Difference (Steel *et al.*, 1984).

Results and Discussion

Table 1 show the response of plant height and number of leaves to row and plant spacings during the period of the trials. The two parameters were not significantly affected by the treatments tested. Although it was reported that wider spacing generally improves growth in crops due to less competition and more available space and nutrients (Belum, 2010); in the present study growth parameters were not affected by spacing possibly due to the nature of the crop which is a root crop and does not require much above ground space.

The effect of row and plant spacing on root length and diameter is presented in Table 2. Root length was significantly increased with the use of 40cm row spacing compared with 20cm row spacing. Both root length and diameter were significantly increased when 15 cm plant spacing was used, compared with closer plant spacings of 10 and 5 cm which were at par. This could be explained on the basis of more available soil space which permits greater root expansion at the 15 cm plant spacing.

Data on yield characters in response to row and plant spacings are presented on Table 3. Marketable yield was affected by row spacing, with 20 cm out yielding 40 cm. However both total and marketable yield were significantly affected by plant spacing, with 5 cm producing significantly higher yield compared with 10 and 15 cm which were statistically comparable. The high plant population at 5cm resulted in greater yield due to more plants per unit area. Sarkindiya and Yakubu (2006) also made similar observations.

Conclusion

Carrot production could be improved through the use of row spacing of 20 cm and plant spacing of 5 cm.

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References

- Ahmed, A., B. E. Sambo, E. C. Odion & U. L. Arunah. (2014). Response of carrot to farmyard manure and inorganic fertilizer for sustainable yield in Northern Nigeria. *IOSR Journal of Agricultural and Veterinary Science*. 7: 26 – 33.
- Aliyu, L., D. I. Adekpe, H. Mani, & M. O. Ogunlana, (2012). Response of carrot to mulching and irrigation interval at Kadawa, Nigeria. *Research on crops* 13(1): 268 – 270.
- Anonymous (2013). World Carrot Museum (WCM), carrot production statistics. <http://www.carrot-museum.co.uk/statistics.htm>
- Belum, A. (2010). Effect of plant density and growth duration of grain Sorghum yield under limited water supply. *Agronomy Journal* 62 (3): 333-336.
- Dawuda, M.M., E. K. Asiedu, O. B. Henry, Y. Agbeko & E. K. Amponsah. (2011). Effect of Poultry and Sheep manure on growth and yield of carrot. *Ghana Journal of Horticulture* (6): 66 – 69
- Duncan, D.B. (1959). Multiple Range and

- Multiple F' Tests. Biometrics 11 – 42.
- Masud, M.M., M. Moniruzzaman, M. M. Maman, S. Noor, (2009). Effect of time of poultry manure application in combination with chemical fertilizers on the yield and nutrient uptake by carrot in the hilly region. Journal of Soil Nature 3(2): 24 – 27.
- Sambo, B.E., E. C. Odion L. Aliyu & D. A Labe. (2013). Cowpea clipping Management Technology: A potential for fodder production sustained growth and food security in Savannah region of Nigeria. Journal of Agricultural and Crop Research. 1(3): 36-45.
- Statistical Analysis Systems (SAS) for windows (2013). Released 9.3.1 SAS Institute, Cary NC.
- Sarkindiya, S. & A. I. Yakubu. (2006). Effect of Intra row spacing fertilizer level and Period of weeding of the performance of carrot in Sokoto Rima Valley. Savannah Journal of Agriculture 1(1): 1 – 5.
- Steel, R. G., G. H. Torrie and D. A. Dickey (1984). *Principles and Procedures of Statistics: A Biometrical Approach* McGraw Hill Co. New York. 633 pp.
- Snedecor, G. W. & W. G. Cochran (1989). *Statistical Methods*. 8th ed., Iowa state University Press USA. p. 242–245

Table 1: Effect of Row and Plant Spacing on growth Parameters of Carrot at Kadawa, Nigeria (2006–2009 Combined Data)

Treatments	Plant Height (cm)	Number of Leaves/Plant
<u>Row Spacing (cm)</u>		
20	51.68	12.20
30	50.98	12.65
40	47.90	14.32
SE \pm	1.533	1.193
<u>Plant Spacing (cm)</u>		
5	50.53	12.36
10	48.86	12.15
15	51.45	14.42
SE \pm	1.533	1.193

Means in a column of any set of treatment followed by unlike letter(s) are significantly different at 5% level using LSD.

Table2: Effect of Row and Plant Spacing on Yield components of Carrot at Kadawa, Nigeria (2006 – 2009 Combined Data)

Treatments	Root length (cm)	Root diameter (cm)
<u>Row Spacing (cm)</u>		
20	13.89b	9.50
30	14.45ab	9.72
40	15.00a	9.75
SE \pm	0.481	0.634
<u>Plant Spacing (cm)</u>		
5	13.80b	8.66b
10	14.44b	9.50b
15	15.52a	10.77a
SE \pm	0.481	0.634

Means in a column of any set of treatment followed by unlike letter(s) are significantly different at 5% level using LSD.

Table 3: Effect of Row and Plant Spacing on Yield of Carrot at Kadawa, Nigeria (2006 – 2009 Combined Data)

Treatments	Total Yield (t/ha)	Marketable Yield (t/ha)
<u>Row Spacing (cm)</u>		
20	10.40	5.02a
30	9.46	4.56ab
40	6.54	3.04b
SE \pm	1.785	0.934
<u>Plant Spacing (cm)</u>		
5	12.64a	6.33a
10	6.89b	3.15b
15	6.77b	3.13b
SE \pm	1.785	0.934

Means in a column of any set of treatment followed by unlike letter(s) are significantly different at 5% level of significance.