EFFECT OF IRRIGATION INTERVALS AND NPK APPLICATION ON THE GROWTH AND YIELD OF CARROT \textit{(Daucus carota L.)} IN SAMARU, KADUNA STATE, NIGERIA

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\textbf{ABSTRACT}

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Two field experiments were conducted in 2010 and 2011 cropping seasons at the Teaching and Research Farm of the Institute for Agricultural Research, Ahmadu Bello University Zaria located on latitude 11 °N longitude 7 °38′E and 686 m above sea level in the Northern Guinea savannah ecological zone of Nigeria. The trial is a two factors experiment (irrigation and NPK fertilizer application). It consisted of five irrigation intervals \(I_0 = \text{No irrigation after germination}, I_1 = 5 \text{ days}, I_2 = 7 \text{ days}, I_3 = 9 \text{ days and } I_4 = 12 \text{ days} \) and NPK 20-10-10 fertilizer at 0, 100, 150, 200 and 250 kg ha\(^{-1}\). The treatments were replicated three times and laid out in a randomised complete block design (RCBD). Seeds of carrot were sown on the 11th November, 2010 and 9th November, 2011 at a spacing of 15 x 15 cm, unit plot size was 2.4 m x 1.2 m. It was observed that irrigation scheduling at 5 days interval \(I_1\) and NPK fertilizer at 250 kg ha\(^{-1}\) significantly enhanced the production of highest values of characters measured compared to the other treatments and control \(I_0\) and 0 kg ha\(^{-1}\) of NPK fertilizer. Farmers are therefore advised to grow carrot during the dry seasons at 5 days of irrigation interval and 250 kg ha\(^{-1}\) of NPK fertilizer in order to promote growth and yield of carrot in Samaru.

Keyword: Carrot, Irrigation, Fertilizer application, NPK, Yield

\textbf{INTRODUCTION}

Carrot \textit{(Daucus carota L.)} is a cool season crop and is grown all over the world (Alam \textit{et al.}, 2010). It is highly rich in beta-carotene and an excellent source of iron, calcium, phosphorus, vitamin B, sugar and folic acid. It also has some medicinal values in the production of vitamin A (Sadhu, 1993). It is used as salad and cooked vegetable in soups, stews, curries, preparation of jams, pickles, and sweet dishes (Kabir \textit{et al.}, 2000). Carrot cultivation is now gaining popularity from farmers but yields are too low due to lack of high yielding varieties as well as the use of low standard agro-technologies (Kabir \textit{et al.}, 2000). Proper irrigation scheduling has been observed as one of the major factors of agro-technologies for increasing the yield of carrot (Barta and Kallo, 1991). Water is the single most important factor which directly influences the yield of vegetables (Siddiqui, 1995). Water requirement studies of carrot for proper irrigation scheduling have been conducted in Zaria but to a limited extent (Islam, 1995 and Islam \textit{et al.}, 2006). However, information regarding the efficient use of irrigation water for improved growth and higher yield of carrot is still lacking in Nigeria. Scarcity of irrigation water is an acute problem for successful crop production anywhere in the world (Chowdhury \textit{et al.}, 1999). Hence the need for more efficient utilization and management of scarce irrigation water for high quality crop production. Therefore the objective of this experiment was to determine the appropriate irrigation interval and NPK fertilizer rate for carrot production in Samaru, Zaria.

\textbf{MATERIALS AND METHODS}

The experiments were conducted in 2010 and repeated in 2011 cropping seasons at the Teaching and Research Farm of the Institute for Agricultural Research, Ahmadu Bello University Zaria located on latitude 11 °N longitude 7 °38′E and 686 m above sea level in the Northern Guinea Savannah ecological zone of Nigeria. The 5 by 5 factorial experiments comprised five intervals of irrigation and five rates of fertilizer application. The irrigation intervals included zero irrigation \(I_0\), irrigation at 5 days interval, irrigation at 7 days interval, irrigation at 9 days interval and irrigation at 12 days interval \(I_1, I_2, I_3, \text{ and } I_4 \) respectively, while fertilizer application included 0, 100, 150, 200 and 250 kg ha\(^{-1}\) of NPK \((15:15:15?)\). The experiments were replicated three times and laid out in a randomised complete block design (RCBD).

Seeds of carrot were sown on the 11th November, 2010 and 9th November, 2011 respectively, at a spacing of 15 x 15 cm, unit plot size was 2.4 m x 1.2 m. Excessive seedlings of the crop were thinned in each row to maintain proper plant population of 13 seedlings per plot after three weeks of planting. The crop was harvested at 12 WAS which corresponds to 13th February, 2010 and 8th February, 2011 respectively. Five plants were randomly selected from each plot to record the data on growth and yield characters. The yield per ha of the plots were
computed. Data were analysed statistically using GENSTAT and significantly different means were compared using Duncan Multiple Range Test (DMRT) at 5% level of probability.

RESULTS

The results of the experiments in the two cropping seasons (Table 1) show that there were significant differences on plant height, number of leaves per plant, weight of individual roots and yield per hectare of carrot due to irrigation intervals and NPK 20-10-10 fertilizer application. Equally there were significant interaction between the effects of irrigation intervals and fertilizer application. Irrigation interval (I1) and 250 kg ha⁻¹ of NPK fertilizer significantly produced higher plant height, larger number of leaves per plant, weight of individual roots and yield per hectare of carrot compared to the rest of the treatments. However, the control (I0) and 0 kg ha⁻¹ of NPK fertilizer significantly produced the lowest means in the entire characters studied. A decrease in the number of days for irrigation significantly increased the mean values of characters studied from treatment (I0) to (I1). Equally, an increase in the rate of NPK fertilizer from 0 - 250 kg ha⁻¹ significantly increased the treatment means. Irrigation intervals and rates of fertilizer application did not significant influence the following performance characteristics including length of individual roots, diameter of individual roots and percent dry matter in the study (Table 1).

DISCUSSION

In the control (I0) and 0 kg ha⁻¹ of NPK fertilizer, carrot roots neither received irrigation water nor fertilizer and that might have decreased the water content in every cell thus contributing a higher proportion of dry matter. On the other hand, treatments (I1) and 250 kg ha⁻¹ received adequate supply of water and fertilizer which probably increased water content of every cell, and ultimately contributed to higher fresh root yield. This observation corresponded with previous research reports by Chowdhury et al. (1999); Fawole et al. (2010); Senjobi et al. (2010) and Alam et al. (2010). An increase in the duration of irrigation intervals as well as nutrition significantly increased dry matter production and partitioning. Irrigation interval (I1) and NPK fertilizer 250 kg ha⁻¹ significantly produced higher treatment means because of adequate supply of water and nutrition which enhanced the process of photosynthesis consequently more partitioning of assimilates were recorded. The control treatments of (I0) and 0 kg ha⁻¹ NPK fertilizer were not provided with any additional water or fertilizer apart from the residual amount in the soil which was not adequate for enhanced photosynthesis and consequently resulting in lower partitioning of assimilates. These results were in closely conformity with the earlier reports of Chowdhury et al. (1999); Fawole et al. (2010); Senjobi et al. (2010); Kabir et al. (2000) and Alam et al. (2010).

CONCLUSION

Five days irrigation interval (treatment I1) and 250 kg ha⁻¹ of NPK fertilizer may be recommended for better growth and yield of carrot in Samaru, Zaria due to their superior performances.

REFERENCES


### Table 1: Growth and Yield of Carrot as Influenced by Irrigation Intervals and NPK 20-10-10 at Zaria in 2010 and 2011 cropping seasons

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Plant height (cm)</th>
<th>Number of leaves per plant</th>
<th>Weight of individual roots (g)</th>
<th>Length of individual roots (cm)</th>
<th>Diameter of individual roots (cm)</th>
<th>Dry matter in %</th>
<th>yield per ha⁻¹ (t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation Intervals</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>I₀</td>
<td>20.23b</td>
<td>6.56b 6.87b</td>
<td>99.84c 102.11c</td>
<td>2.34a 2.35a</td>
<td>1.35a 1.36a</td>
<td>15.33a 14.88a</td>
<td>2.48b 2.51b</td>
</tr>
<tr>
<td>I₁</td>
<td>21.45b</td>
<td>10.82a 11.22a</td>
<td>122.11a 134.21a</td>
<td>2.42a 2.44a</td>
<td>1.45a 1.46a</td>
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<td>3.45a 3.51a</td>
</tr>
<tr>
<td>I₂</td>
<td>23.67a 24.34a</td>
<td>09.73a 10.14a</td>
<td>116.34ab 116.44ab</td>
<td>2.26a 2.27a</td>
<td>1.35a 1.30a</td>
<td>13.76a 12.89a</td>
<td>2.90b 2.93b</td>
</tr>
<tr>
<td>I₃</td>
<td>21.11b</td>
<td>08.90a 08.68a</td>
<td>109.11bc 107.33bc</td>
<td>2.15a 2.19a</td>
<td>1.23a 1.21a</td>
<td>14.45a 13.46a</td>
<td>2.67b 2.68b</td>
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<tr>
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<td>1.18a 1.17a</td>
<td>15.26a 14.28a</td>
<td>2.52b 2.54b</td>
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<td>NPK (kg ha⁻¹)</td>
<td></td>
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<td></td>
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<tr>
<td>0</td>
<td>22.14c</td>
<td>20.18c</td>
<td>4.87c 5.43c</td>
<td>87.34d 94.65d</td>
<td>2.00a 2.02a</td>
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<td>102.11b 124.13b</td>
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<td>4.02a 4.05a</td>
</tr>
</tbody>
</table>

**Interactions**

I × NPK

Means with the same letter (s) within a column are not significantly different at P = 0.05 using Duncan’s Multiple Range Test (DMRT). (I₀) = No irrigation after germination, (I₁) = Irrigation at 5 days interval, (I₂) = Irrigation at 7 days interval, (I₃) = Irrigation at 9 days interval and (I₄) = Irrigation at 12 days interval and 0, 100, 150, 200 and 250 kg ha⁻¹ of NPK fertilizer).

NS = Not significant at 5% level of significance

* = Significant at 5% level of significance