

GROWTH AND SEED YIELD OF CARROT AS INFLUENCED BY DIFFERENT REGIMES OF NITROGEN AND POTASSIUM

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Abstract: The research was conducted to observe the effect of different N and K levels on carrot growth and seed yield during 2002-2003. Different combinations of N and K levels had no significant effect on sprouting percentage, number of tertiary umbels and total number of umbels per plant, seed weight of primary, secondary and tertiary umbels. Plant height, number of secondary umbels per plant, seed yield of primary, secondary and tertiary umbels per hectare and total seed yield were affected by various combinations of N and K levels. A combination of 75 kg N and 90 kg K ha⁻¹ was most effective for obtaining maximum seed yield ha⁻¹.

Keywords: Carrot, growth, nitrogen, potassium, seed yield, umbel order.

INTRODUCTION

Carrot (*Daucus carota* L.) is an important vegetable and is being consumed all over the world. The fleshy roots are eaten as raw in salads, boiled or steamed in vegetable dishes and also used with other vegetables in the preparation of soup. It is cultivated in Pakistan on an area of 11 thousand hectares with an annual production of 195,000 metric tones of carrot roots, with an average yield of 17815 kg ha⁻¹ [Anonymous 2004].

The yield of carrot variety T-29 in Pakistan is much lower than its potential [22000 kg ha⁻¹]. Among many factors affecting yield, use of low quality seed is the major factor. There are different seed production methods in carrot crop, i.e. seed to seed and root to seed. Root to seed method is more common in carrot and other root crops compared with seed to seed method. In Pakistan, the farmers are not only facing a problem of low quality seed but also a shortage of high quality seed according to their requirements.

There are several factors which influence the yield and quality of seed. Out of these optimum plant spacing, floral set, planting material, nutrition, health of mother plant, root size and root age etc., are very important. Information on growth, umbel order and seed yield of carrot as influenced by various levels of N and K under Faisalabad conditions is not very much available. The objective of present investigation was to study the effect of N and K on growth, umbel order and seed yield to benefit the farming community in future.

MATERIALS AND METHODS

The research was carried out at the Experimental Vegetable Farm, Institute of Horticultural Sciences, University of Agriculture, Faisalabad

during 2002-2003. Seeds of carrot variety T-29 were taken from vegetable section, Ayub Agriculture Research institute, Faisalabad. Seeds were sown on 15th September 2002 to prepare carrot stecklings. Irrigation and hoeing was done when required. Nitrogen fertilizer was applied as a basal dose after germination for vegetative growth [Sheikh *et al.* 1990].

The carrot stecklings were replanted on 13th February 2003. Soil was well prepared before planting stecklings. The experiment consisted of different combinations of N and K levels (Table 1). Half dose of N along with full dose of K was applied at the time of planting, whereas, the rest of half the dose of N was applied at flowering stage.

In carrot crop, seeds are produced on different positions of umbels. There are various types of umbels called primary, secondary and tertiary. Primary umbel matures earlier therefore, harvesting is also early. Whereas, secondary umbels normally mature next to primary, similarly tertiary follow the same pattern.

Following observations were recorded during the course of study:

1. Sprouting percentage (%)
2. Plant height (cm)
3. Number of secondary umbels per plant
4. Number of tertiary umbels per plant
5. Total number of umbels per plant
6. Seed weight of primary umbel per plant (g)
7. Total seed yield of primary umbel per hectare (kg)
8. Seed weight of secondary umbels per plant (g)
9. Total seed yield of secondary umbels per hectare (kg)
10. Seed weight of tertiary umbels per plant (g)
11. Total seed yield of tertiary umbels per plant (kg)
12. Total seed yield per plant (g)
13. Total seed yield per hectare (kg)

The experiment was laid out in a Randomized Complete Block Design (RCBD) under field conditions. There were twelve treatments and four replications. Data collected were analyzed statistically by using the Analysis of Variance Techniques and treatment means were subjected to Duncan's New Multiple Range Test for comparison at 5% probability level [Peterson 1994].

RESULTS AND DISCUSSION

SPROUTING PERCENTAGE

The results presented in Table 1 show non-significant differences for sprouting percentage among different combinations of N and K levels. Maximum sprouting percentage (85.1%) was observed in plots treated with 75 kg N and 50 kg K ha⁻¹ and minimum sprouting (81.7%) in plots treated with 75 kg N and 110 kg K ha⁻¹. N and K doses had no significant effect on sprouting percentage because food stored in the roots is used

immediately unless stecklings will produce feeder roots and plant does not receive any food or supplement from the soil at once. Such results were also reported by Kondo and Shinsu [1967], and Anjum and Amjad [2002].

PLANT HEIGHT (cm)

It is clear from Table 1 that plant height at maturity is significantly affected by different N and K levels. Plant treated with 75 kg N and 90 kg K ha⁻¹ gave the maximum plant height (81.7cm). Minimum height (68.2cm) was observed in treatment 225 kg N and 90 kg K ha⁻¹, which may be due to over dose of fertilizers during growth. These results agree with the finding of Singh and Singh [1996], Rao and Maurya [1998] and Heryati and Thalib [2003].

NUMBER OF SECONDARY UMBELS PER PLANT

Number of secondary umbels directly affect the seed yield. More the number of secondary umbels, more will be the number of seeds and consequently higher will be the seed yield. The results in Table 1 indicated that various N and K levels significantly affected the number of secondary umbels. Maximum number of secondary umbels (6.8) were recorded in plots receiving 75kg N and 90kg K ha⁻¹. These results agree with the findings of Rao and Maurya [1998] and Satyaveer *et al.* [1994].

NUMBER OF TERTIARY UMBELS PER PLANT

Different combinations of N and K did not affect number of tertiary umbels significantly (Table 1). Plants treated with 75kg N and 90kg K ha⁻¹ produced 13.67 tertiary umbels per plant whereas, minimum number of tertiary umbels (11.0) was found in plants treated with 225kg N and 110kg K ha⁻¹. It may be due to the reason that nitrogen might be used more for vegetative growth of primary and secondary umbels, while potash for seed development. Another reason for less number of umbels may be dense planting, i.e. 30 cm x 30 cm apart.

TOTAL NUMBER OF UMBELS PER PLANT

The data showed that various combinations of N and K levels are non-significantly different for total number of umbels per plant (Table 1). Maximum number of umbels (20.92) were found in plants treated with 75kg N and 90 kg K ha⁻¹ whereas, the combination 225 kg N and 110 kg K ha⁻¹ gave minimum number of umbels per plant (17.1).

SEED WEIGHT OF PRIMARY UMBELS PER PLANT

It is clear from Table 1 that there is no significant effect of treatment on seed weight of primary umbel per plant. 75kg N and 90kg K ha⁻¹ gave maximum seed weight of primary umbel (4.2g per plant). Similar results were reported by Satyaveer *et al.* [1994] and Anjum and Amjad [2002].

Table 1: Effect of N and K combinations on different growth and yield parameters of carrot at Faisalabad during 2002-2003.

	225+110	225+90	225+70	225+50	150+110	150+90	150+70	150+50	75+110	75+90	75+70	75+50	(N+K) kg ha ⁻¹
81.7a	83.7a	83.7a	83.7a	81.6a	81.7a	82.4a	83.1a	83.1a	80.3a	83.7a	84.4a	85.1a	Sprouting Percentage (%)
78.5ab	68.2c	74.5abc	70.1bc	76.6abc	76.6abc	75.0ab	73.8ab	78.4ab	77.9ab	81.7a	80.35a	79.4a	Plant height (cm)
5.1c	5.2bc	5.8bc	5.2bc	5.9b	5.9b	5.3bc	5.6bc	5.3bc	5.4bc	6.9a	6.7a	5.6bc	No. of secondary umbels/plant
11.0a	11.1a	12.7a	11.8a	11.8a	11.8a	12.7a	11.2	12.4a	13.0a	13.6a	13.1a	12.6a	No. of tertiary umbels per plant
17.1a	17.3a	19.6a	18.0a	18.8a	18.8a	19.0a	17.8a	18.7a	19.4a	20.9a	20.8a	19.25a	Total no of umbels/plant included one primary umbel in each treatment
3.2a	3.2a	3.3a	3.1a	3.5a	3.5a	3.2a	3.1a	3.0a	3.4a	4.2a	4.0a	3.4a	Seed wt. of primary umbel (g)
237.5bcd	241.1bcd	248.1bcd	235.2cd	262.0bc	239.6bcd	236.6bcd	236.6bcd	223.4d	246.4abc	317.6a	309.9a	267.4b	Total seed yield of primary umbel/ha (Kg)
1.9a	1.9a	2.1a	1.9a	2.1a	2.1a	1.5a	1.8a	1.9a	1.8a	2.4a	2.1a	1.8a	Seed wt. of secondary umbel (g)
726.4c	733.7c	846.0bc	723.6c	819.7bc	729.0c	729.0c	777.7c	743.3c	827.0bc	1200.0a	1049.0ab	779.7c	Total seed yield of secondary umbels/ha (kg)
1.0a	0.9a	0.9a	0.9a	1.0a	1.0a	1.0a	0.9a	0.9a	0.9a	1.2a	1.0a	1.0a	Seed w t. of tertiary umbel (g)
751.1de	707.0e	738.6de	726.4de	889.3bcd	924.7bc	924.7bc	779.0c	820.6bcd	846.4bcd	1239.0a	965.1b	928.3bc	Total seed yield of tertiary umbels/ha (kg)
23.2bc	22.2c	24.2bc	22.8bc	26.7bc	25.4bc	25.4bc	23.8bc	23.8bc	27.6bc	36.4a	30.55a	25.7bc	Total seed yield per plant (g)
1714.0c	1681.0c	1832.0b	1684.0c	1971.0bc	1891.0bc	1891.0bc	1793.0bc	1787.0bc	1990.0bc	2757.0a	2323.0ab	1975.0bc	Total seed yield ha ⁻¹ (kg) per ha

Means followed by the same letters in columns are non-significantly different (DMRT = 0.05).

TOTAL SEED YIELD OF PRIMARY UMBELS PER HECTARE

It is clear from Table 1 that various N and K levels had a significant effect on seed yield of primary umbel per hectare. Maximum seed yield (317.5 kg ha⁻¹) was found in 75 kg N and 90 kg K ha⁻¹ treatment followed by 309.9 kg ha⁻¹ seed yield in treatment 75 kg N and 70kg K ha⁻¹. Combination of 150 kg N and 50 kg K ha⁻¹ yielded minimum seed yield per hectare (223.4 kg). These results are similar to those of Satyaveer *et al.* [1994] and Anjum and Amjad [2002].

SEED WEIGHT OF SECONDARY UMBELS PER PLANT

Results in Table 1 show non-significant differences in seed weight (g) of secondary umbels in various N and K levels. However average values for secondary umbels revealed that maximum seed weight (2.4g) was obtained for N and K combination (75kg N + 90kg K ha⁻¹).

SEED YIELD OF SECONDARY UMBELS PER HECTARE

Table 1 shows significant results for total seed yield of secondary umbels per hectare. Maximum seed yield per hectare (1200.0 kg) was recorded in plots treated with 75 kg N and 90 kg K ha⁻¹, while minimum (723.6 kg) in plots with 225 kg N and 50kg K ha⁻¹. These results are supported by the findings of Satyaveer *et al.* [1994].

SEED WEIGHT OF TERTIARY UMBELS PER PLANT

It is clear from Table 1 that different combinations of N and K levels had no significant effect on seed weight of tertiary umbel. Maximum seed weight (1.17 g) was found in plots treated with 75 kg N and 90 kg K ha⁻¹, while plots treated with 225 kg N and 50 kg K ha⁻¹ produced minimum seed weight (0.85 g). These results agree with the findings of Satyaveer *et al.* [1994].

TOTAL SEED YIELD OF TERTIARY UMBELS PER HECTARE

Different N and K levels had significant effect on seed yield per hectare for tertiary umbels. Maximum seed yield (1239.0 kg) for tertiary umbel per hectare was found with 75kg N and 90 kg K ha⁻¹, while minimum (707.0 kg) was recorded in 225 kg N and 50 kg K ha⁻¹ treatment. These results agree with the findings of Satyaveer *et al.* [1994].

TOTAL SEED YIELD PER PLANT

Steckling size, spacing and nutrition have been reported to exert greater influence on seed yield. Seed yield per plant was significantly affected by different combinations of N and K levels (Table 1). Maximum seed yield per plant (36.4g) was recorded in plots with 75 kg N and 90 kg K ha⁻¹, while minimum (22.2g) was observed in combination of 225 kg N and 50 kg K ha⁻¹. These results agree with the findings of Satyaveer *et al.* [1994], Satyaveer *et al.* [1996] and Rao and Maurya [1998].

TOTAL SEED YIELD PER HECTARE

Seed yield per hectare as influenced by various N and K levels is highly significant. Maximum seed yield (2757.0 kg) was obtained from combination of 75 kg N and 90 kg K ha⁻¹, while minimum yield was recorded in 225 kg N and 50 kg K ha⁻¹. It may be due to over-dose of fertilizer received by stecklings. These results are similar to that of Rao and Maurya [1998], Singh and Singh [1996] and Satyaveer *et al.* [1994].

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