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Evaluating the Response of Carrot (*Daucus carota* L.) to Different Macronutrients and Harvesting Time

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The growth and production of carrot influenced by macronutrients and harvesting time, thus a field experiment was conducted at Horticultural Research Field of Sher-e-Bangla Agricultural University, Dhaka, between December 2020 and March 2021 during the Rabi season to evaluate the response of carrot to different macro nutrients and harvesting time. The experiment consisted of two factors

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i.e., macro nutrients and harvesting time, and laid out using Randomized Complete Block Design (RCBD) with three replications. Factor A: Different levels of macronutrients (4) *i.e.,* F_0= Control, F_1= $N_{160}P_{50}K_{120}S_{30}$ kg $ha^{-1,}$ F_2 = $N_{185}P_{70}K_{140}S_{40}$ kg $ha^{-1,}$ F_3 = $N_{210}P_{90}K_{160}S_{50}$ kg ha^{-1} and Factor B: A Harvesting time (3) *i.e.,* H_1 = 90 days after sowing, H_2 = 100 days after sowing and H_3 = 110 days after sowing. Experimental results revealed that different levels of macronutrients and harvesting time significantly influenced the growth and yield of carrot. In case of combination treatment (macro nutrients and harvesting time) the highest brix percentage of carrot root (8.20 %), marketable root yield per plot of carrot (6.40 kg) and marketable root yield of carrots per hectare (26.67 t) were observed in the F_2H_2 treatment combination comparable to others treatment combinations. Therefore, it was suggested that cultivation of carrot through application of fertilizer @ $N_{185}P_{70}K_{140}S_{40}$ kg ha^{-1} (F_2) and harvesting at 100 days after sowing (H_2), appeared to be best for achieving higher growth, yield and quality root of carrot.

Keywords: Brix percentage; carrot; harvesting time; macronutrients; marketable root yield.

1. INTRODUCTION

The root vegetable known as the carrot (*Daucus carota* L.), a member of the Apiaceae family, is said to have originated in the Mediterranean region, where it was also first cultivated as a crop. It is a significant vegetable crop worldwide [1]. It is usually orange in color, though purple, black, red, white, and yellow cultivars exist. Carrot is a popular root crop from the nutritional point of view. It contains appreciable amount of carotene (10 mg/100 g), thiamine (0.04 mg/100 g), riboflavin (0.02 mg/100 g), carbohydrates (10.6%), protein (0.9 g/100 g), fat (0.2 g/100 g) and vitamin C (3mg/100 g) [2]. Carrot roots have endogenous sugar levels that are 10 times higher in sucrose than in glucose and fructose. It has some significant medical benefits [3]. Eating carrots is thought to enhance night vision. It can be prepared as a salad, a cooked vegetable for recipes including soups, stews, and curries, as well as pickles, preserves, and desserts. [4]. In spite of the crop's many virtues, growing consumer demand, and the fact that it is a profitable crop, carrot production in Bangladesh is currently limited in scale and efficiency.

Carrot (*Daucus carota* L.) cultivation encounters several challenges, especially concerning the response to different macronutrients and harvesting time. Firstly, inadequate understanding of optimal macronutrient requirements often leads to suboptimal growth and yield outcomes [5]. Secondly, variations in soil nutrient levels and deficiencies can hinder nutrient uptake by carrot plants, affecting their overall health and productivity [6]. Thirdly, improper timing of harvesting can result in reduced quality and market value due to issues such as lignification, excessive root branching, or loss of moisture content [7]. Fourthly, nutrient imbalances or deficiencies can predispose carrots to diseases and pests, further compromising yield and quality. Finally, fluctuations in environmental conditions, such as temperature and moisture, can exacerbate nutrient stress and affect carrot growth, making it crucial to develop robust management strategies tailored to specific growing conditions [8].

In order to sustain a greater yield and soil fertility, nutrient management is one of the most important factors affecting carrot production [9]. Nutrients play a vital role in functioning of normal physiological processes during the period of growth and development of plants. However, for obtaining higher economic yield, balanced supply of nutrients is one of the key factors [10]. Too low or high fertilizers levels can reduce the growth and development process of plants which may affect the crop yield.

Nitrogen is a crucial macronutrient for plant growth and development, but a lack of it results in interveinal yellowing, the production of the anthocyanin color, leaf rolling, chlorosis, and necrosis [11]. Nitrogen (N) has the great effect on plant physiology and is probably the most important limiting nutrient for crop growth. Nitrogen strongly stimulates growth expansion of the plant canopy, yield and yield contributing characters and gross yield [12]. Phosphorus is a crucial component of phospholipids, enzymes, and nucleic acids. It participates in a number of the plant's metabolic processes and is necessary for the transfer of energy within the system of the plant [13]. Potassium facilitates protein and starch synthesis and improves plant immunity to weather changes, diseases and nematodes in plants. Application of inorganic S is very essential for better growth and biosynthesis of protein and chlorophyll in plants [14].

When produced as a winter crop, carrots need three to five months from seeding to harvest. When it reaches the proper size for the grade and market demand, it should be harvested. The harvesting period has a significant impact on carrot yield. The most crucial elements influencing carrot storage are temperature and root yield, which are determined by harvesting time [15]. Fritz and Habben [16] suggested that carrot should be harvested at proper stage of maturity; otherwise, it will become fluffy and unfit for consumption. This study will help farmers become more knowledgeable about managing fertilizer and carrot harvesting times, resulting in increased productivity and benefits to farmers' revenue. The purpose of this study is to find out the appropriate levels of macronutrient and suitable harvesting time for maximum growth and yield of carrot in the study area. It also helps to identify the best combination of macronutrient levels and harvesting time for maximum growth and yield of carrot.

2. MATERIALS AND METHODS

2.1 Description of the Site

Between December 2020 and March 2021, the research was carried out at the Horticulture Farm of the Sher-e-Bangla Agricultural University in Sher-e-Bangla Nagar, Dhaka. The site was at a latitude and longitude of 23°77′ N and 90°35′ E, and it was 8.6 meters above sea level. The experimental site was located in a subtropical region with three distinct seasons: winter (November to February), the hot pre-monsoon season (March to April), and monsoon season (May to October). The research site experiences a cold winter and a scorching summer. The monsoon season accounts for the majority of the year's average precipitation, which is 490 mm over a 30-year period. The mean maximum and lowest temperatures were 28 and 19°C, respectively, for the entire year.

2.2 Planting Materials

The seeds of carrot cv. New Kuroda (a Japanese Varity) were used as planting material for this experiment. The seeds of this variety were collected from Nadim Seed Store, Siddique Bazar, Dhaka.

2.3 Treatments, Experimental Design and Experimental Procedures

The plot selected for the experiment was opened with a power tiller in the 14th December, 2020 and left exposed to the sun for 10 days. To achieve good tilth, the land was harrowed, ploughed, and cross-ploughed several times, followed by laddering. The experiment was laid out in a Randomized Complete Block Design (RCBD) having double factor with three replications. The experiment comprised as two factors. Factor A: Different levels of macronutrients (4) *i.e.,* F_0= Control, F_1= $N_{160}P_{50}K_{120}S_{30}$ kg ha$^{-1,}$ F_2 = $N_{185}P_{70}K_{140}S_{40}$ kg ha$^{-1,}$ F_3 = $N_{210}P_{90}K_{160}S_{50}$ kg ha^{-1} and Factor B: A Harvesting time (3) *i.e.,* H_1 = 90 days after sowing, H_2 = 100 days after sowing and H_3 = 110 days after sowing. Each block was divided into 12 plots where 12 treatments combination were distributed randomly and 36-unit plots altogether in the experiment. The size of each plot was 2.5 m × 1.5 m. The distance maintained between two blocks were 1.00 m and two plots were 0.50 m. The plots were raised up to 10 cm.

2.4 Manuring and Fertilization

In the experimental plots total amount of cowdung (10 ton /ha) and Urea, TSP, MoP, gypsum as a source of nitrogen, phosphorus, potassium and sulphur were applied as par treatment requirement. Urea was applied in two splits, the first dose as basal application and another dose at 30 days after sowing. The recommended doses of fertilizer of carrot were given below Table 1.

Table 1. The following doses of organic and inorganic fertilizers were applied in the experimental plots

Organic and Inorganic Fertilizer	Dose /ha	Dose for F_1 Treatment	Dose for F_2 Treatment	Dose for F_3 Treatment
Urea	200 kg	130.13 g	150.75 g	171 g
Triple super phosphate (TSP)	150 kg	40.5 g	57 g	73.13 g
Muriate of Potash (MP)	200 kg	75 g	87.38 g	99.75 g
Gypsum	220 kg	62.25 g	83.25 g	103.88 g

2.5 Data Collection

Data collection involved the systematic selection of 10 plants from each experimental plot. Subsequently, pertinent data were meticulously recorded for various parameters, and the resultant values were subjected to averaging. This rigorous procedure was consistently applied across all measured variables.

2.6 Statistical Analysis

Statistic 10 software was used to statistically examine the acquired data for the various parameters. At a 5% level of probability, the least significant difference test (LSD) was used to determine the significance of the differences between the treatment means.

3. RESULTS AND DISCUSSION

3.1 Effect of Different Levels of Macronutrients

Significant differences were observed in the different parameters of plant due to different levels of macronutrients. The maximum plant height (55.40 cm) was measured at harvest from F_3 followed by F_2 treatment (Fig.1). The highest number of leaves (15.97) per plant of carrot at harvest was recorded from F_3 treatment (Fig.2). The treatment F_3 recorded the maximum fresh weight of leaves per plant of carrot (86.53 g), dry matter (%) of leaves (8.73 %), root length (19.71 cm), fresh weight of root per plant of carrot (174.74 g), root diameter (4.70 cm), core diameter of root (1.69 cm), dry matter (%) of roots (12.43 %), cracked root (9.53 %), rotten root (8.20 %), root yield per plot (6.83 kg) of carrot and highest root yield per hectare (28.47 t) of carrot were observed in F_3 treatment (Table 2). However, the highest brix percentage of carrot root (7.77 %), marketable root yield per plot (6.13 kg) and marketable root yield per hectare (25.56 t) of carrot were observed in F_2 treatment (Table 2).

The plant height increased with increasing fertilizer dose, possibly as a result of its beneficial influence on plant height in conjunction with other crucial components [17]. Verma et al. [18] who said that the number of leaves was recorded maximum with increasing levels of fertilizer doses, nitrogen is a crucial element influencing overall plant development, including increased plant height and biomass. The positive correlation between nitrogen application and plant height in the current study is consistent with this understanding. Muhmood et al. [19] who reported that the root length of radish increased with increased application of inorganic fertilizer. Patwary et al. [20] claimed that greater macronutrient levels result in a higher percentage of carrot roots that crack, phosphorus is essential for root development, and increased phosphorus levels have been associated with enhanced root length and diameter, as observed in the F_3 treatment, Potassium, another vital macronutrient, is known to contribute to improved water and nutrient uptake, leading to increased fresh weight of leaves and roots. The cracking percentage is reduced by application of optimum dose of fertilizer in the soil. Hossain [21] reported that the application of NPK fertilizers at 140 kg, 40 kg, and 80 kg ha^{-1}, respectively, produced the highest marketable yield. The variations in carrot root quality parameters, such as cracked and rotten roots, can be attributed to the intricate interplay of macronutrients in modulating root structure and health. The increased root yield in the F_3 treatment could be attributed to the synergistic effects of optimal levels of nitrogen, phosphorus, potassium, and sulfur, promoting overall plant growth and productivity [18].

3.2 Effect of Harvesting Time

Experimental data revealed that growth and yield of carrot significantly influenced due to harvesting time. Experimental result showed that the highest plant height (55.03 cm) was observed from H_3 treatment (Fig. 3). The highest number of leaves per plant (16.20) was observed from H_3 treatment (Fig. 4).The treatment H_3 recorded the highest fresh weight of leaves per plant of carrot (86.53 g), dry matter (%) of leaves (8.73 %), root length of carrot (19.71 cm), fresh weight of root (174.74 g), root diameter (4.70 cm), core diameter of carrot roots (1.69 cm), dry matter (%) of roots (12.43 %), cracked root (9.53 %), rotten root (8.20 %), root yield per plot (6.83 kg) and root yield per hectare (28.47 t) of carrot (Table 3). However, the highest brix percentage of carrot root (7.77 %), marketable root yield per plot (6.13 kg) and marketable root yield per hectare (25.56 t) of carrot were observed in H_2 (100 days after sowing) treatment (Table 3).

It was discovered that throughout the early stages of growth, the plant's height increased quickly. The plant height was found to be decreased at the very end of harvest. This might be due to the senescence of the longer leaves at

the later stages of plant growth. But [22] reported that plant height increased until harvested at 135 days after sowing. Kabir et al. [23] observed that the highest number of leaves per plant was found in last harvest (at 135th day) comparable to 1st harvest (75th day), this might be due to the plants harvesting at 135th day got more time for attaining physiological growth. Shalaby et al. [24] reported that the fresh weight of sugar beet leaves rose considerably by postponing harvesting dates from 180 to 210 days after sowing. Terouzi et al. [25] reported that the time of harvesting, which was inversely proportionate to the delay in planting date, had a substantial impact on total soluble solids, sucrose content, and sugar yields in sugar beet.

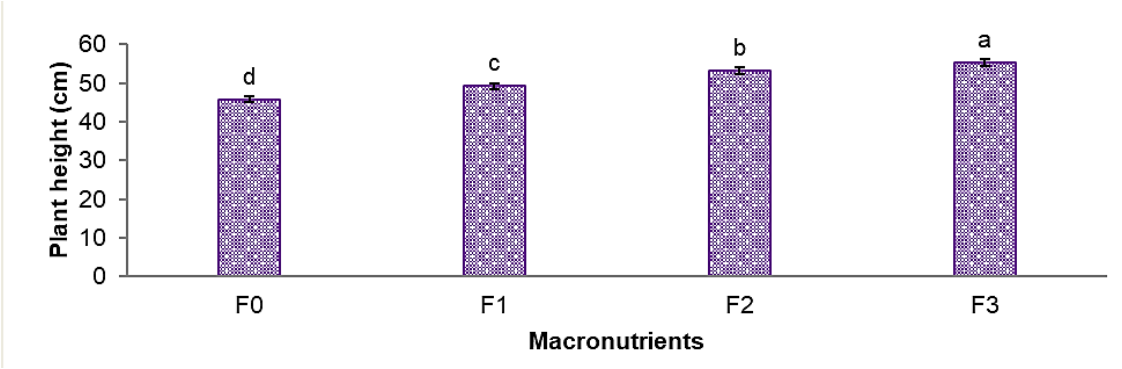

Fig. 1. Effect of macronutrients on plant height of carrot

Here, F_0: Control, F_1 : $N_{160}P_{50}K_{120}S_{30}$ kg ha^{-1}, F_2 : $N_{185}P_{70}K_{140}S_{40}$ kg ha^{-1} and F_3 : $N_{210}P_{90}K_{160}S_{50}$ kg ha^{-1}.

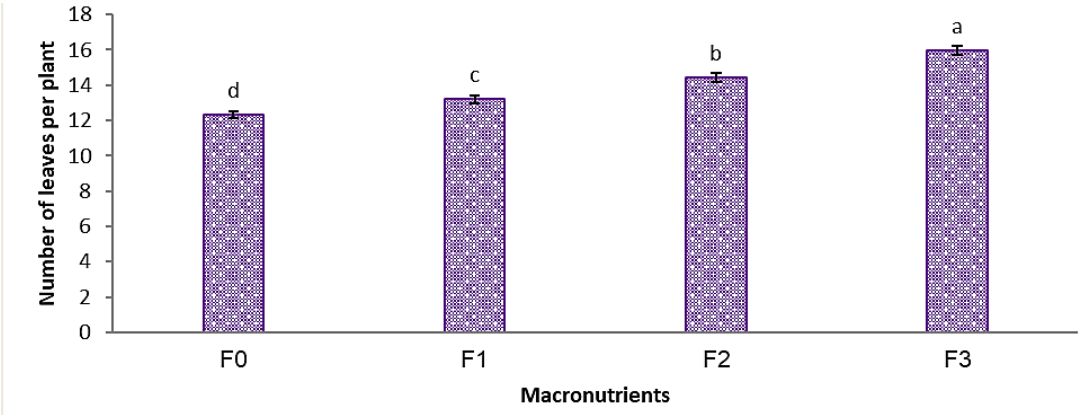

Fig. 2. Effect of macronutrients on number of leaves per plant of carrot

Here, F_0: Control, F_1 : $N_{160}P_{50}K_{120}S_{30}$ kg ha^{-1}, F_2 : $N_{185}P_{70}K_{140}S_{40}$ kg ha^{-1} and F_3 : $N_{210}P_{90}K_{160}S_{50}$ kg ha^{-1}.

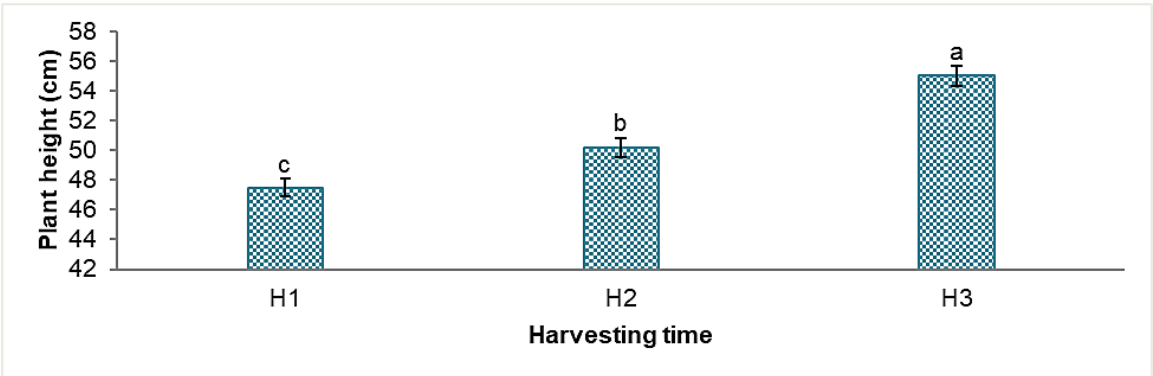

Fig. 3. Effect of different harvesting time on plant height of carrot

Here, H_1 : Harvest at 90 days after sowing, H_2 : Harvest at 100 days after sowing and H_3 : Harvest at 110 days after sowing.

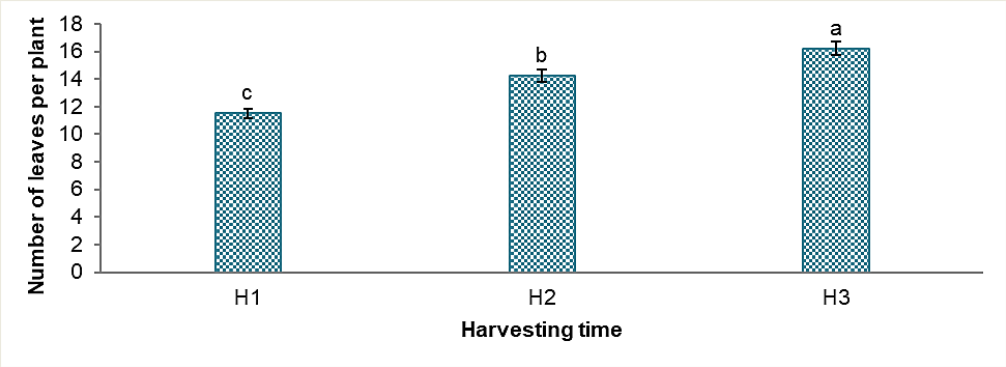

Fig. 4. Effect of different harvesting time on number of leaves per plant of carrot

Here, H_1: Harvest at 90 days after sowing, H_2: Harvest at 100 days after sowing and H_3: Harvest at 110 days after sowing.

Table 2. Effect of macronutrients on fresh weight of leaves plant^{-1}, dry weight of leaves plant^{-1}, root length, fresh weight of root per plant, diameter of root, core diameter of root, dry matter (%) of roots, Brix^0 percentage, cracked root percentage, Rotten root percentage, yield per plot, marketable yield per plot, yield per hectare and Marketable yield per hectare of carrot

Treatments	Fresh weight of leaves plant^{-1} (g)	Dry weight of leaves plant^{-1} (g)	Root length (cm)	Fresh weight of root per plant (g)	Diameter of root (cm)	Core diameter of root (cm)	Dry matter (%) of roots	Brix^0 (%)	Cracked root (%)	Rotten root (%)	Yield per plot (kg)	Marketable yield per plot (kg)	Yield per hectare (t)	Marketable yield per hectare (t)
F_0	75.50 c	7.07 c	14.67 d	145.10 d	3.73 c	1.43 d	10.17 c	5.87 d	4.97 d	2.97 d	6.07 d	5.43 c	25.28 d	22.64 d
F_1	81.32 b	8.17 b	15.73 c	152.20 c	4.15 b	1.50 c	10.50 bc	6.40 c	6.10 c	5.53 b	6.43 c	5.77 b	26.81 c	24.03 c
F_2	83.63 b	8.17 b	17.73 b	163.67 b	4.23 b	1.60 b	10.77 b	7.77 a	6.50 b	4.87 c	6.63 b	6.13 a	27.64 b	25.56 a
F_3	86.53 a	8.73 a	19.71 a	174.74 a	4.70 a	1.69 a	12.43 a	7.27 b	9.53 a	8.20 a	6.83 a	5.90 b	28.47 a	24.58 b
$LSD_{(0.05)}$	2.46	0.31	0.67	6.21	0.14	0.05	0.40	0.31	0.27	0.28	0.16	0.15	0.56	0.38
CV(%)	3.08	4.05	4.05	4.00	3.57	3.71	3.80	4.77	4.27	5.36	2.67	2.13	2.78	1.65

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability. Here, F_0: Control, F_1: $N_{160}P_{50}K_{120}S_{30}$ kg ha^{-1}, F_2: $N_{185}P_{70}K_{140}S_{40}$ kg ha^{-1}, F_3: $N_{210}P_{90}K_{160}S_{50}$ kg ha^{-1}.

Table 3. Effect of harvesting time on fresh weight of leaves plant^{-1}, dry weight of leaves plant^{-1}, root length, fresh weight of root per plant, diameter of root, core diameter of root, dry matter (%) of roots, Brix^{0} percentage, cracked root percentage, Rotten root percentage, yield per plot, marketable yield per plot, yield per hectare and Marketable yield per hectare of carrot

Treatments	Fresh weight of leaves plant^{-1} (g)	Dry weight of leaves plant^{-1} (g)	Root length (cm)	Fresh weight of root per plant (g)	Diameter of root (cm)	Core diameter of root (cm)	Dry matter (%) of roots	Brix^{0} (%)	Cracked root (%)	Rotten root (%)	Yield per plot (kg)	Marketable yield per plot (kg)	Yield per hectare (t)	Marketable yield per hectare (t)
H_0	75.50 c	7.07 c	14.67 d	145.10 d	3.73 c	1.43 d	10.17 c	5.87 d	4.97 d	2.97 d	6.07 d	5.43 c	25.28 d	22.64 d
H_1	81.32 b	8.17 b	15.73 c	152.20 c	4.15 b	1.50 c	10.50 bc	6.40 c	6.10 c	5.53 b	6.43 c	5.77 b	26.81 c	24.03 c
H_2	83.63 b	8.17 b	17.73 b	163.67 b	4.23 b	1.60 b	10.77 b	7.77 a	6.50 b	4.87 c	6.63 b	6.13 a	27.64 b	25.56 a
H_3	86.53 a	8.73 a	19.71 a	174.74 a	4.70 a	1.69 a	12.43 a	7.27 b	9.53 a	8.20 a	6.83 a	5.90 b	28.47 a	24.58 b
$LSD_{(0.05)}$	2.46	0.31	0.67	6.21	0.14	0.05	0.40	0.31	0.27	0.28	0.16	0.15	0.56	0.38
CV(%)	3.08	4.05	4.05	4.00	3.57	3.71	3.80	4.77	4.27	5.36	2.67	2.13	2.78	1.65

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability. Here, H_1: Harvest at 90 days after sowing, H_2: Harvest at 100 days after sowing and H_3: Harvest at 110 days after sowing.

Table 4. Combined effect of macronutrients harvesting time on plant height, number of leaves per plant, fresh weight of leaves plant^{-1}, dry weight of leaves plant^{-1}, root length, fresh weight of root per plant, diameter of root, core diameter of root, dry matter (%) of roots of carrot.

Treatments	Plant height (cm)	Number of leaves per plant	Fresh weight of leaves plant^{-1} (g)	Dry weight of leaves plant^{-1} (g)	Root length (cm)	Fresh weight of root per plant (g)	Diameter of root (cm)	Core diameter of root (cm)	Dry matter (%) of roots
F_0H_1	43.90 g	10.06 g	70.30 g	6.50 e	12.60 g	101.30 j	3.30 e	1.00 h	8.60 f
F_0H_2	45.30 g	12.30 de	75.60 f	7.00 e	13.60 g	142.00 fg	3.90 cd	1.40 e	10.60 cd
F_0H_3	48.10 ef	14.60 c	80.60 de	7.70 d	17.80 de	192.00 c	4.00 cd	1.90 b	11.30 bc
F_1H_1	46.10 fg	11.00 fg	74.67 f	7.60 d	13.10 g	113.30 i	3.80 d	1.20 g	9.60 e
F_1H_2	48.70 ef	13.30 d	82.30 d	8.30 bc	15.00 f	145.30 f	4.06 c	1.40 e	10.30 de
F_1H_3	52.90 c	15.30 bc	87.00 bc	8.60 b	19.10 c	198.00 bc	4.60 b	1.90 b	11.60 b
F_2H_1	49.80 de	12.00 ef	77.00 ef	7.60 d	15.20 f	125.00 h	3.90 cd	1.30 f	10.00 de
F_2H_2	52.30 cd	15.00 c	84.30 cd	8.30 bc	16.90 e	162.00 e	4.10 c	1.60 d	10.30 de
F_2H_3	57.50 b	16.30 b	89.60 ab	8.60 b	21.10 b	204.00 b	4.70 b	1.90 b	12.00 b
F_3H_1	50.10 de	13.00 de	82.30 d	8.00 cd	17.70 de	131.60 gh	4.10 c	1.30 f	11.30 bc
F_3H_2	54.50 c	16.30 b	84.00 cd	8.60 b	18.70 cd	177.30 d	4.60 b	1.70 c	12.00 b
F_3H_3	61.60 a	18.60 a	93.30 a	9.60 a	22.73 a	215.33 a	5.40 a	2.06 a	14.00 a
$LSD_{(0.05)}$	2.72	1.13	4.26	0.55	1.16	10.76	9.25	0.09	0.70
CV(%)	3.16	4.79	3.08	4.05	4.05	4.00	3.57	3.71	3.80

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability. Here, F_0: Control, F_1: $N_{160}P_{50}K_{120}S_{30}$ kg ha^{-1}, F_2: $N_{185}P_{70}K_{140}S_{40}$ kg ha^{-1}, F_3: $N_{210}P_{90}K_{160}S_{50}$ kg ha^{-1}, H_1: Harvest at 90 days after sowing, H_2: Harvest at 100 days after sowing and H_3: Harvest at 110 days after sowing.

Table 5. Combined effect of macronutrients harvesting time on Brix^0 percentage, cracked root percentage, Rotten root percentage, yield per plot, marketable yield per plot, yield per hectare and Marketable yield per hectare of carrot

Treatments	Brix^0 (%)	Cracked root (%)	Rotten root (%)	Yield per plot (kg)	Marketable yield per plot (kg)	Yield per hectare (t)	Marketable yield per hectare (t)
F_0H_1	5.30 f	3.00 g	1.30 f	5.60 g	4.90 e	23.33 g	20.42 g
F_0H_2	6.20 e	4.30 ef	3.60 e	6.20 ef	5.90 bc	25.83 ef	24.58 cd
F_0H_3	6.10 e	7.60 c	4.00 e	6.40 de	5.50 d	26.67 de	22.92 e
F_1H_1	6.20 e	4.00 f	4.00 e	6.10 f	5.30 d	25.42 f	22.08 f
F_1H_2	6.80 d	6.30 d	5.60 d	6.30 d-f	6.10 b	26.25 d-f	25.42 b
F_1H_3	6.20 e	8.00 c	7.00 c	6.90 ab	5.90 bc	28.75 ab	24.58 cd
F_2H_1	7.10 cd	4.30 ef	3.60 e	6.20 ef	5.90 bc	25.83 ef	24.58 cd
F_2H_2	8.20 a	4.60 e	4.00 e	6.70 bc	6.40 a	27.92 bc	26.67 a
F_2H_3	8.00 ab	10.60 a	7.00 c	7.00 a	6.10 b	29.17 a	25.42 b
F_3H_1	7.00 d	8.00 c	7.60 b	6.50 cd	5.80 c	27.08 cd	24.17 d
F_3H_2	7.60 bc	9.60 b	8.00 b	6.90 ab	6.00 bc	28.75 ab	25.00 bc
F_3H_3	7.20 cd	11.00 a	9.00 a	7.10 a	5.90 bc	29.58 a	24.58 cd
$LSD_{(0.05)}$	0.55	0.48	0.49	0.29	0.27	0.97	0.67
CV(%)	4.77	4.27	5.36	2.67	2.78	2.13	1.65

In a column means having similar letter(s) are statistically similar and those having dissimilar letter(s) differ significantly at 0.05 level of probability. Here, F_0: Control, F_1: $N_{160}P_{50}K_{120}S_{30}$ kg ha^{-1}, F_2: $N_{185}P_{70}K_{140}S_{40}$ kg ha^{-1}, F_3: $N_{210}P_{90}K_{160}S_{50}$ kg ha^{-1}, H_1: Harvest at 90 days after sowing, H_2: Harvest at 100 days after sowing and H_3: Harvest at 110 days after sowing.

3.3 Combined Effect of Different Levels of Macronutrients and Harvesting Time

In case of combination, F_3H_3 treatment combination recorded the highest plant height (61.60 cm), number of leaves per plant (18.60), fresh weight of leaves per plant of carrot (93.30 g), dry matter (%) of leaves (9.60 %), root length (22.73 cm), fresh weight of root per plant of carrot (215.33 g), diameter of root (5.40 cm), core diameter of carrot roots (2.06 cm), dry matter content (14.00 %) of carrot roots (Table 4). However, F_3H_3 treatment combination recorded the highest cracked root percentage of carrot root (11.00 %), rotten root percentage of carrot root (9.00 %), root yield per plot of carrot (7.10 kg) and root yield per hectare (29.58 t) of carrot (Table 5). However, the highest brix percentage of carrot root (8.20 %), marketable root yield per plot of carrot (6.40 kg) and marketable root yield of carrots per hectare (26.67 t) were observed in the F_2H_2 treatment combination. While corresponding lowest value were found in F_0H_1 combination treatment (Table 5).

4. CONCLUSION

On the basis of present study, it is concluded that, among different levels of macronutrients application the highest brix percentage of carrot root (7.77 %), marketable root yield per plot (6.13 kg) and marketable root yield per hectare (25.56 t) of carrot were observed in F_2 treatment ($N_{185}P_{70}K_{140}S_{40}$ kg ha^{-1}). However, in case of different time of harvesting, the highest brix percentage of carrot root (7.20 %), marketable root yield per plot (6.10 kg) and marketable root yield per hectare (25.42 t) of carrot were observed in H_2 (harvesting at 100 days after sowing) treatment. Therefore, it was suggested that cultivation of carrot through application of fertilizer @ $N_{185}P_{70}K_{140}S_{40}$ kg ha^{-1} (F_2) and harvesting at 100 days after sowing (H_2) and their combination (F_2H_2) seems promising for getting highest marketable yield and quality root of carrot.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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