Response of NPK and Organic Manures on Quality and Commercial Yield of Carrot (*Daucus carota* l.) cv. Nantes

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Abstract— A field study was conducted on the Experimental Unit, Department of Horticulture, Tilak Dhari Post Graduate College, Jaunpur during rabi season year 2017-18 in to study the response of NPK and organic manures on quality and commercial yield of carrot (*Daucus carota* L.) cv. Nantes. The seed of carrot were sown in the mid November with a spacing of 30×10 cm. The experiment was laid out in Randomized Block Design with twelve treatments replicated thrice. Among the minimum root forking (5.25%) was recorded in the treatment T_5 (75%NPK+PM), while maximum root forking (8.47%) was noted under the treatment T_7 (50%NPK+VC). The root cracking percentage lied between 0.67 to 3.46%. The minimum root cracking (0.67%) was recorded under the treatment T_9 (25%NPK+FYM). However, the maximum root cracking (3.46%) was observed in the treatment T_1 (control). Highest total soluble solid (9.72^{0}Brix) was determined with treatment T_4 (75%NPK+VC) while lowest total soluble solid (7.34^{0}Brix) was found in treatment T_1 (control). Statistical analysis revealed that treatment T_4 (75%NPK+VC) has increases the maximum ascorbic acid (6.02 mg/100g) while the minimum ascorbic acid (5.02 mg/100g) were found in treatment T_1 (control). Maximum yield/plot (2.32 kg) and maximum yield/ha (232.20 qt) was recorded in treatment T_4 (75%NPK+VC) while minimum yield/plot (0.80 kg) and minimum yield/ha (0.80) was found in T_1 (control). Benefit cost ratio maximum (15.20:1) is found in treatment T_4 (75%NPK+VC) and maximum net income (871070) was found in T_4 (75%NPK+VC).

Keywords: Vermicompost, Farm Yard Manure, Poultry Manure, B:C Ratio, NPK, Total Soluble Solid, Net Income and Carrot

I. INTRODUCTION

The carrot is originated in Asia and belonging to the family Umbelliferae, genus Daucus and species carota with chromosome no 2n=18 (X=9). The carrot is an annual (root production) and biennial (seed production). Initially the roots were long and thin and either purple or yellow in colour. The stem are small plate like structure, leaves are rosette of leaves arise from the stem. The inflorescence of carrot is 'Compound Umbel' and the edible part of carrot is modified root (Conical form) which develops in soil. The root type is tap, root length varying from 15-35 cm. botanically "modified root" (Conical form) which developed in the soil carrot has vertical root system. The fruit type of carrot is schizocarp and seed are spiny and one gram seed have 500-1000 seed (Singh and Bahadur, 2015).

Carrot roots contain sucrose 10 times higher than that of glucose or fructose. It also contains abundant amounts of nutrients such as protein, carbohydrates, fibre and sodium (Ahmad *et al.*, 2014). The foliage of carrot is used as forage particularly feeding horses & cattles. Carrot fleshy roots are used as vegetables for salads, soups and are also steamed or boiled in other vegetable dishes. Besides food value different parts of carrot can be used for different medicinal purposes due to its wide range of pharmacological effects. Roots are also used for preparation of delicious dishes such as gajar halwa and carrot jam. The roots in the form of disc and slices can be dehydrated. Carrot juice is a rich source of carotene and is sometimes used for coluoring butter and other food items (Vanangamudi *et al.*, 2006).

Excessive or under dose of N, P and K can affect the growth and yield of good quality carrot. Excess of nitrogen increases root splitting, which reduces marketable yield. It is considered that doses of nitrogen, phosphorus and potassium are important fertilizer variables for quality production of carrot. There are sufficient scope for increasing the yield of this crop by judicious application of manures & fertilizers. Optimum requirement of nutrients especially NPK is obviously needed. Nitrogen is one of the most important yield-limiting nutrients for plants. In recent years use of organic manures like FYM, vermicompost and poultry manure for improving the productivity of crop and maintaining soil fertility and productivity of soil is gaining prominence (Mahokar *et al.*, 2007). Vermicompost is a rich source of micro and macro nutrients, vitamins, growth hormones and enzymes. FYM is not a good source of nutrients, which increase organic carbon content in the soil and improves soil physical properties. Poultry manure one of the components in integrated nutrient management highly used in production of vegetable crops. Carrot is a most important crop for healthy diet so it's needed to be available in high quality (Radices *et al.*, 2002).

II. MATERIALS AND METHODS

The present investigation was carried out at the Experimental Unit, Department of Horticulture, Tilak Dhari Post Graduate College, Jaunpur, Uttar Pradesh, during rabi season year 2017-18. Seed of carrot cv. Nantes were procured from Indian Institute of Vegetable Research (IIVR), Varanasi (U.P.). The climatic condition of Jaunpur is subtropical with three distinct seasons i.e., winter, summer and rainy. The mean temperature is minimum 15-20 ^{0}C and maximum18-32 ^{0}C, maximum relative humidity 95% and minimum 55% with annual rainfall of 850-1100 mm. The carrot seed of uniform size were transplanted 1-3 cm depth at a spacing of 30×10 cm. in mid November. Farm yard manure, vermicompost, poultry manure were applied in the concerned plots as per the treatment. The treatments viz., T_1(Control), T_2(100%NPK), T_3(75%NPK+FYM), T_4(75%NPK+VC), T_5(75%NPK+PM), T_6(50%NPK+FYM), T_7(50%NPK+VC), T_8(50%NPK+PM), T_9(25%NPK+FYM),T_{10}(25%NPK+VC),T_{11}(25%NPK+PM, T_{12}(FYM+VC+PM) were evaluated in Randomized Block Design with three replications. The required quantity of organic manures as per treatments was applied at the time of

land preparation. The seed of carrot sowing on the ridges were done. Other cultural practices like weeding, hoeing, irrigation, insect pest and disease management were done as and when required. The observations were recorded on five randomly selected plants from each treatment to assess the response of NPK and organic manures on quality and commercial yield character in carrot cv. Nantes. Quality characters Root cracking (%), root forking (%), ascorbic acid (mg), total soluble solid (^{0}Brix) and yield/plot (kg) and yield/ha (qt) in carrot. The data recorded during the course of investigation were analyzed by analysis of variance (ANOVA) using the statistical program and the significance differences between the mean were tested against the critical difference at 5% probability level.

III. RESULTS AND DISCUSSION

Mean data presented in table-1 clearly show that the root forking are not a desirable traits. Amongst the application of organic manure in carrot production the minimum (5.49%). root forking was recorded in the treatment T_4 while maximum (7.75%) root forking was observed with the application of only inorganic fertilizers 60:80:75 kg NPK/ha as T_{12}. These findings are supported by the findings of (Netra Pal, 2001), who reported that the splitting or forking of carrot root is a major problem in many carrots growing area. Although the tendency of splitting seems to be controlled by genetic factors, a number of other factors may be involved. The splitting is reduced by low nitrogen and increases as the amount of nitrogen in the soil increases. High soil concentration of ammonium compounds causes more serious splitting than by other forms of nitrogen. carrot splitting is not affected due to time of sowing or variety. wider the spacing, the greater is the amount of splitting and large roots are more likely to split than small ones.

The application of NPK and organic manure did not exert any significant influence upon root cracking percentage. The minimum root cracking (0.67%) was recorded under the treatment T_9 while the maximum (2.63%) root cracking percentage was observed with the application of 60:80:75 kg NPK/ha under the treatment T_2. These findings are supported by the findings of (Netra Pal, 2001), who also reported that the cracking of carrot root is a major problem in carrot growing area. Among the nutrient level T_4 recorded the maximum T.S.S. (9.72^{0}Brix) followed by (9.54^{0}Brix) in T_3 While the minimum T.S.S. (7.34^{0}Brix) was determine in case of T_1 (control) Similar findings are in line with (Kumar *et al.*, 2014). The ascorbic acid was recorded highest (6.02 mg/100g) in T_4, while it was lowest (5.02 mg/100g) with T_1.The maximum, yield/plot (2.32 kg) and yield/ha (232.20 qt) was recorded in the T_4. Whereas, the minimum yield/plot (0.80 kg) and yield/ha (80.00 qt) was recorded in T_1. These findings are in line with the Kumar *et al.*, (2014) in carrot. Data presented the Table-3 it is clear that during the investigation. The maximum benefit: cost ratio (15.20:1) was recorded from treatment T_4, which was followed by (15:1) in T_2. Maximum net income (871070 Rs.) was also obtained from treatment T_2 followed by (738070) in T_3. The minimum benefit: cost ratio (5.53:1) and net income (630680 Rs.) was observed from control. The result are agreement with (Vithwal and Kanaujia, 2013) in carrot, (Sunandarani and Mallareddy, 2007) in carrot and (Narayan *et al.*, 2014) in potato, they reported highest B: C ratio with application of organic manures.

Treatments	Root cracking (%)	Root cracking (%)	Total soluble solid (^{0}Brix)	Ascorbic acid (mg/100g)	Yield/plot (kg.)	Yield/ha (qt.)
T_1	6.09	3.46	7.34	5.02	0.80	80.00
T_2	7.75	2.63	7.53	5.13	1.13	113.16
T_3	9.34	2.63	9.54	5.95	1.96	196.20
T_4	5.49	2.65	9.72	6.02	2.32	232.20
T_5	5.25	2.13	7.96	5.32	1.46	146.10
T_6	5.63	1.57	8.52	5.62	1.78	178.10
T_7	8.47	3.75	9.11	5.85	1.96	196.10
T_8	3.69	2.74	7.84	5.263	1.36	136.11
T_9	7.85	0.67	8.03	5.38	1.52	152.33
T_{10}	6.85	2.25	8.12	5.47	1.66	165.00
T_{11}	7.52	2.063	7.73	5.19	1.23	123.66
T_{12}	6.58	2.60	8.89	5.73	1.86	186.17
CD at 5%	0.411	0.039	0.048	0.025	0.017	0.796
SEM-+	0.139	0.013	0.016	0.008	0.006	0.270

Table 1: Response of NPK and organic manures on quality character and yield attributes of carrot (*Daucus carota* L.) cv. Nantes

Treatments	Common Cost (Rs.)	Treatment Cost (Rs.)	Total cost (Rs.)	Yield/ha (qt.)	Gross income (Rs.)	Net income (Rs.)	B:C ratio
T_1	38000	0000	38000	80.00	320000	282000	7.00:1
T_2	38000	7640	45650	113.16	452640	407000	8.91:1
T_3	38000	8730	46730	196.20	784800	738070	15.00:1
T_4	38000	19730	57730	232.20	928800	871070	15.20:1
T_5	38000	7730	45730	146.10	584400	538670	11.77:1
T_6	38000	9820	47820	178.10	712400	664580	13.89:1
T_7	38000	31820	69820	196.10	784400	714580	10.00:1

T_8	38000	78820	45820	136.11	544440	498620	10.88:1
T_9	38000	108860	48860	152.33	609320	560460	11.47:1
T_{10}	38000	43860	81860	165.00	660000	578140	7.00:1
T_{11}	38000	78860	45860	123.66	494640	448780	9.78:1
T_{12}	38000	76000	114000	186.17	744680	630680	5.53:1

Table 2: Economics of the different treatments per hectare in carrot cv. Nantes

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