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RESEARCH ARTICLE

Effect of Integrated Nutrient Management on Yield Attributes of Black Carrot and Physico-chemical Properties of Soil

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Abstract

A field experiment was conducted during Rabi season of 2017-2018 to assess the effect of integrated nutrient management on yield attributes of black carrot and physico- chemical properties of soil at Experimental Farm of Division of Vegetable Science SKUAST-K Shalimar. The experiment was laid out in randomized complete block design with nine treatments replicated thrice. The nine treatments wereT_1-RFD(control), T_2 (50%RFD+50%FYM), T_3(50% RFD +50%VC), T_4 (50%N&K+25%P+PSB+50%FYM), T_5(50%N&K+ 25%P+PSB+50%VC),T_6 (50%N&P+25%K+KSB+50% FYM), T_7 (50%N&P+25%K+KSB+50%VC) ,T_8 (50% N+ 25% P&K+PSB+KSB+50% FYM) and T_9 (50%N+ 25%P&K+PSB+KSB+ 50%VC). Results revealed that among the different treatment combinations, treatment T_9 recorded the higher values for average root weight (148.85 g), root yield per plot (23.81 kg), root yield per hectare (285.79 q). It was further revealed that treatment T_9 recorded lowest soil pH (7.04) which was statistically at par with treatment T_8 and treatment T_5. Bulk density (1.10 g cc^{-1}) was found to be lowest in treatment T_9 which wasstatistically at par with treatment T_8.

The treatment T_9 resulted in improvement of soil electrical conductivity with a value of 0.287 dSm^{-1} which was statistically at par with treatment T_8 and significantly higher than rest of the treatments. The treatment T_1 showed least increase in electrical conductivity of soil.

Keywords: Black carrot, integrated nutrient management, yield , physico- chemical properties

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Introduction

Carrot is one of the major vegetable crops grown throughout the world (Vilela, 2004) and it is considered as an important economical vegetable due to its high yield per unit area (Hassan *et al*.,2005) .

Although orange carrot varieties are more common but consumption of black carrots is increasing as well. The black carrot is rich in phenolic content, flavinols, calcium, iron zinc, vitamin A, B, C, E and selenium. It also contains calcium pectate which is a very good source of fibre. The continuous use of chemical fertilizers has resulted in the depletion of soil heath and the increasing cost of chemical fertilizers makes it impossible for marginal farmers to purchase it at such higher rate .The ill effects of chemical fertilizers on physicochemical properties of soil has resulted in depletion of soil structure, decrease in the microbial population in the soil which adversely affected the yield and quality of vegetables (Agarwal, 2003). On the other hand, organic manures are cheap source of nutrients and key factor in restoring the productivity of degraded soils as they supply the multiple nutrients and improve the organic matter content in the soil which in turn improves the physical properties, enhances the biological diversity and soil microflora, leading to sustainable vegetable production, devoid of harmful residues (Acharya and Mandal, 2002) however, it has been observed that the crop response to organic manures is not as spectacular as with the chemical fertilizers owing to the slow release of nutrients during the initial years. Biofertilizers also play an important role in maintaining the sustainability of soil as biofertilizers are ready to use live formulations of such beneficial microrganisims which on

application to seed, root or soil mobilizes the availability of nutrients by their biological activity in particular and help to build up the soil micro-flora and thereby the soil health. Therefore, to maintain the soil fertility and to supply the plant nutrients in balanced proportion without compromising the yield and quality of the crop an integrated approach is to be practiced under specific agro-ecological situation through the combined use of inorganic and organic sources along with the application of biofertilizers.

Materials and Methods

The experiment was carried out at Experimental Farm, Division of Vegetable Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar. The experimental field is situated at 34.1° North latitude and 74.89° East longitude with an altitude of 1587 meters above mean sea – level. The experiment was laid out in randomized block design with nine treatments and three replications. The treatment combinations were T_1 RFD(control),T_2(50%RFD+50%FYM),T_3(50%RFD+50%VC),T_4(50%N&K+25%P+PSB+50%FYM),T_5(50%N&K+25%P+PSB+50%VC),T_6(50%N&P+25%K+KSB+50%FYM),T_7(50%N&P+25%K+KSB+ 50%VC), T_8 (50%N+25%P&K+ PSB+KSB+ 50% FYM), T_9 (50%N+ 25%P&K+ PSB+ KSB+ 50%VC).

Twenty seven plots of 3.0 m × 2.5 m size each were prepared as per layout specifications. The seeds of Black carrot variety Local Black were sown at spacing of 30 cm × 15 cm. Recommended dose of Nitrogen, Phosphorus and Potassium (90:60:60 kg ha^{-1}) was provided through urea, diammonium phosphate and muriate of potash according to the treatment. Organic manures viz., well decomposed farmyard manure (FYM), vermicompost were incorporated as per treatment to respective plots 15 daysprior to sowing on the basis of nitrogen percentage. Biofertilizers (PSB&KSB) @ 5 l ha^{-1} were applied into the respective treatments before sowing of seed. Observations were recorded on various aspects like yield attributes of crop and physico chemical properties of soil. The experimental data was then subjected to statistical analysis as per the standard statistical procedure given by.

Results and Discussions

Perusal of data presented in (Table 1) revealed significant effect of different treatments on yield attributes of black carrot. Among all treatments, treatment T_9 (50% N+25%P&K + PSB+KSB+50% VC) recorded a maximum average root weight of 148.85 g followed by treatment T_8 (50% N+25%P & K +PSB+KSB+50%FYM) which recorded average root weight of 144.18 g while the minimum average root weight of 104.19g was observed in treatment T_1 (RFD). Among different treatments the maximum root yield per plot of 23.81 kg was recorded in treatment T_9 (50% N+25% P&K + PSB+KSB+50% VC) which was significantly superior to all other treatments .However the minimum root yield per plot (16.67 kg) was observed in treatment T_1 (RFD).The maximum root yield per hectare (285.79q) was observed in treatment T_9 (50% N+25% P & K + PSB+KSB+50% VC) which was significantly superior to all other treatments while the minimum root yield per hectare (200.05q) was observed in treatment T_1 (RFD) which received nutrients only in inorganic form. Chemical fertilizers contain higher amounts of nutrients and are sources of readily available form of nutrients, but the fertilizer use efficiency is often low due to the inherent soil characteristics, losses and low uptake. On the other hand, the integration improves nutrient availability and uptake influences the soil physical and biological properties favourably, which reflects positively on the growth and yield of crops as reported by Isaac and Verghese, (2016) and Singh and Verma, (2011). The yield promoting effect may be ascribed to improved plant nutrition due to continuous supply of nutrients by organic manures as explained by Summer (1990) and Somani *et al*., (1990). The increase in weight may also be attributed to accelerated mobility of photosynthates from source to sink as influenced by growth hormones, released or synthesized due to organic sources as well as biofertilizers which contributed to increased root yield. These findings are in conformity to the observations made by Devlin (1973), Rabindra Kumar and Srivastava, (2006).

The experimental findings presented in (Table 2) provided a detailed account on effect of integrated nutrient management on physico-chemical parameters of soil .The data presented in table 2 revealed significant effect for soil pH due to various treatments after the harvest of crop and the lowest soil pH (7.04) was recorded in treatment T_9 (50%N+25%P&K+PSB+KSB+50%VC)which was statistically at par with treatment T_8 (50%N+25%P&K+PSB+KSB+50%FYM) and T_5 (50% N&K +25%P+PSB+50%VC).The biofertilizers and organic manures have ability to reduce the pH of surrounding environment by the production of organic acids especially gluconic acid, acetic acid, citric acid, propionic acid , glycolic acid, fumaric acid , tartaric acid, humic acid etc which might have resulted in lowering of pH. These results are in close conformity with Thornsbury *et al*., (2000), Deubel *et al*., (2000), Chatoo (2006), Chen *et al* ., (2006), Song *et al*., (2008), Meena *et al* . (2014).The data presented in (Table 2) reveal that among all treatments, highest EC (0.287dSm^{-1}) was recorded in treatment T_9 (50%N+25%P&K+PSB+KSB+50%VC) after the harvest of crop which was statistically at par with treatment T_8 (50%N+25%P&K+PSB+KSB+50%FYM)and the lowest was recorded in treatment T_1(RFD).Decrease in pH due to application of organic manures and biofertilizers (PSB &KSB) induces an acidic condition in soil which results in more solubility of salts. Since the salts present in soil becomes more mobile and conducts more electric current which results in increase in electrical conductivity. These results collaborate with Thornsbury *et al*., (2000), Sharma *et al*., (2003) and Chatoo, (2006) .The data presented in the table 2 further reveal that bulk density of soil after crop harvest significantly decreased from 1.38 g cc^{-1} in treatment T_1(RFD) to 1.10 g cc^{-1} in treatment T_9 (50%N+25%P&K+PSB+KSB+50%VC).The decrease in bulk density might be due to improvement in the structural status of soil by judicious application of bulky organic manures (VC) , biofertilizers (PSB&KSB) as well as chemical fertilizers. The results are in conformity with Martens and Frankenberger (1992), Islam *et al*., (2012).

Table 1: Effect of Integrated Nutrient Management on Average Root Weight(g), Root Yield per plot (kg) Root yield per hectare (q) of Black carrot

Treatment	**Treatment Combinations**	**Average Root Weight (g)**	**Root Yield per plot (kg)**	**Root Yield per hectare (q)**
T_1	RFD	104.19 [i]	16.67 [h]	200.05 [i]
T_2	50% RFD+50%FYM	111.64 [h]	17.86 [h]	214.32 [h]
T_3	50% RFD+50% VC	115.67 [g]	18.50 [g]	222.08 [g]
T_4	50%N&K+25%P+PSB+50%FYM	132.29 [d]	21.16 [d]	253.99 [d]
T_5	50% N&K +25%P+PSB+50%VC	137.37 [c]	21.97 [c]	263.75 [c]
T_6	50%N&P+25%K+KSB+50%FYM	121.24 [f]	19.39 [f]	232.77 [f]
T_7	50% N&P +25%K+KSB+50%VC	126.24 [e]	20.19 [e]	242.38 [e]
T_8	50%N+25%P&K+PSB+KSB+50%FYM	144.18 [b]	23.06 [b]	276.83 [b]
T_9	50%N+25%P&K+PSB+KSB+50%VC	148.85 [a]	23.81 [a]	285.79 [a]
	C.D ($p \leq 0.05$)	3.65	0.60	6.64
	S.E (d)	1.711	0.285	3.109

Mean values with same letters don"t differ significantly

Table2 : Effect of Integrated Nutrient Management on soil physico-chemical properties

Treatments	Treatment combinations	Soil pH	Soil EC (dsm-1)	Bulk density (gcc-1)
T1.	RFD	7.18a	0.144g	1.38a
T2.	50%RFD+50%FYM	7.17ab	0.158f	1.33b
T3.	50%RFD+50%VC	7.15b	0.173e	1.29c
T4.	50%N&K+25%P+PSB+50%FYM	7.08de	0.233c	1.18e
T5.	50%N&K+25%P+PSB+50%VC	7.06ef	0.25lb	1.16e
T6.	50%N&P+25%K+KSB+50%FYM	7.1lc	0.197d	1.25d
T7.	50%N&.P+25%K+KSB+50%VC	7.10cd	0.206d	1.22d
T8.	50%N+25%P&K+PSB+KSB+50% FYM	7.05f	0.278a	1.11f
T9.	50%N+25%P&K+PSB+KSB+ 50%VC	7.04f	0.287a	1.10f
	CD ($p \leq 0.05$)	0.020	0.010	0.030
	S.E (d)	0.09	0.005	0.014

Mean values with same letters don"t differ significantly

Conclusion

The integrated nutrient management exhibited a significant influence on all treatments under study over sole application of chemical fertilizers (treatment T_1). The treatments (T_4, T_5, T_6, T_7, T_8 and T_9) which received biofertilizers in addition to chemical fertilizers and organic manures are more responsive in terms of improving the yield, soil properties (physical and chemical) in comparison to the treatments that receive only chemical fertilizers and organic manures (treatment T_2 and T_3).

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