Research Article

Performance of Organic Manures, Inorganic Fertilizer and Plant Density on Quality of Radish

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Abstract
A field experiment was conducted during Rabi season of 2014-15 on sandy loam soil to "Effect of organic, inorganic fertilizers and plant densities on performance of radish (*Raphanus sativas L.*)". The experiment consisted three treatment of organic manures (control, VC @ 5 t/ha and FYM @ 15 t/ha), three treatment of inorganic manures (control, 50% RDF of NPK and 100% RDF of NPK) and two treatment of plant densities (20 x 10 cm and 30 x 10 cm), thereby making eighteen treatment combinations tested in RBD with three replications. Results indicated that application of VC @ 5 t/ha and 100% RDF of NPK significantly higher quality attributes of radish over control, FYM @ 15 t/ha and control, 50% RDF of NPK, respectively. The result also indicated the plant spacing 30x10 cm significantly higher the quality attributes of radish over plant spacing 20x10 cm. However, TSS unchanged under different organic manures and plant densities.

Keywords: FYM, NPK, Plant Density, Radish, RDF , Quality and Vermicompost

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Introduction

Radish (*Raphanus sativas L.*) is one of the most popular root crops of Rabi season and is widely acclaimed for its excellent nutritive and medicinal values. It belongs to family Cruciferae and it has (2n=18) chromosomes. It is popular in both tropical and temperate countries. The radish leaves are rich in minerals and vitamin A (5 IU) and vitamin C (15 mg) and are roots rich in potassium (138 mg) and calcium (50 mg). The edible part of radish is modified root which develops form both primary root and hypocotyls. The pungency in radish is due to the presence of volatile isothiocynates.

FYM being rich in organic matter is required for supplementing the nutrients provided through other manure. Organic manure increases CEC, water holding capacity and phosphate availability and improves soil texture, besides improving the fertilizer use efficiency and microbial population of soil; it reduces nitrogen loss due to slow release of nutrients [1]. Vermicompost is a slow releasing & organic manure which have most of the macro as well as micro nutrients in chelated form and fulfil the nutrients requirement of plant for longer period. Vermicompost helps in reducing C:N ratio, increasing humic acid content, cation exchange capacity and water-soluble carbohydrates. It also contains biologically active substances such as PGR. Availability of nitrogen is important for growing plant as it is major essential constituent of protein and nucleic acid. An adequate supply of nitrogen is associated with vigorous vegetative growth and more efficient use of available inputs, finally leading to higher productivity. Phosphorus is transfer of energy within the plant system and is involved in its various metabolic activities; Phosphorus has its beneficial effect on early root development, plant growth, yield and quality [2]. Phosphorus plays a key role in the formation of energy bound phosphate (ADP and ATP).

Potassium imparts vigour and disease resistance to the plant and plays an important role in crop productivity. It functions as an activator of numerous enzymes like pyruvic kinase activity, thus plays important role in. It is always involved in the movement of carbohydrate, therefore, accumulation of carbohydrates and soluble nitrogen compound points towards diminishing protein synthesis in case of potassium deficiency. There are evidences of direct involvement of potassium in photosynthesis and its involvement in leaf tissues metabolic activities of chloroplast. It regulates transpiration through opening and closing of the stomata by affecting activities of guard cells [3].

Optimum plant population is also another important aspect of crop production; wider plant spacing not only leads to excessive vegetative growth but also accelerates the evaporative losses of water from the bare ground. On the other hand, the struggle for existence increases with increasing plant population because of severe competition for light, water and nutrients [4].

Materials and Methods

A field experiment was conducted during Rabi season of 2014-15 at Department of Horticulture, College of Agriculture, Jobner, in a RBD with three replications. The soil was loamy sand in texture, alkaline in reaction (pH 8.1), low in organic carbon (0.16 %), low available nitrogen (130 kg/ha), medium available phosphorus (15.1 kg P2O5/ ha) and medium in potassium (140 kg K2O/ha) content. The experiment consisted three treatment of organic manures (control, VC @ 5 t/ha and FYM @ 15 t/ha), three treatment of inorganic manures (control, 50% RDF of NPK and 100% RDF of NPK) and two treatment of plant densities (20 x 10 cm and 30 x 10 cm), thereby, making eighteen treatment combinations. Fertilizers were applied as per treatment through Urea, SSP and MOP at the time of sowing as basal dose and split application of urea at top dressing. The radish cv. 'Pusa Rashmi' was sown on 8th September 2014 using seed rate of 10 kg/ha with a row spacing of 20x10 cm and 30x10 cm. The 6-10 days interval irrigations were applied during growing season. Intercultural operations viz., thinning, hoeing and weeding were followed after 20 days of sowing to maintain recommended spacing and weed control. Two hand weeding during growing period and harvest maturing in 50 to 55 days after sowing and observations on tagged plants were recorded.

Results and Discussion

Effect on quality parameters
Organic manures

The application of VC @ 5 t/ha significantly maximum in case of ascorbic acid (12.52 mg/100g), nitrogen content in root (2.15%) and leaves (3.39%) over control and FYM @ 15 t/ha treatments (Table 1). Different organic manures non- significantly affected the total soluble solids at harvest. The increased concentration of nutrients in plant under vermicompost application might be due to adequate supply of nutrients resulting in increased N content, TSS and ascorbic acid in root. The increased photosynthetic efficiency and nutrient concentration in plants seems to be major factor responsible for higher NPK content of root under the influence of vermicompost application [3,5]. However, total soluble solid (TSS) unchanged under different organic manures. The protein content in root intact is a manifestation of root nitrogen content. Application of FYM might have improved chemical and biological properties of soil and enabled plant roots in better utilization of nutrients by crop. The protein content in root infect is a manifestation of root nitrogen content [6,7].

Inorganic manures

The results indicated that the application of 100% RDF of NPK significantly higher the ascorbic acid (12.31 mg/100g), total soluble solid (7.41%), nitrogen content in root (2.18%) and leaves (3.48%) over control and 50% RDF of NPK (Table 1). The quality attributes were found superior under higher level of N and P (100% RDF of NPK) then control and lower level (50% RDF of NPK) [8]. The Progressive improvement in quality parameters of radish root with the use of adoption of safe production practices along with 100%RDF of NPK might be due to increase in growth parameters, which might have resulted in improved uptake of nutrients and photosynthetic activities and finally the quality parameters of radish through the process of enzymatic activities stimulated by plant growth component. The beneficial influence of phosphorus in early stage of growth might be explained by early stimulation of scanty root system through efficient translocation of certain growth stimulating compounds to the roots on account of protoplasmic activity in phosphorus fed plants, which enhanced absorption of nitrogen and other nutrients and their utilization. The increase in yield and quality attributes due to potassium application might be due to its functional role in higher net photosynthetic activity. Potassium improves color, glossiness and dry matter accumulation besides improving, it also keeping bulb quality of onion [4, 9].

Plant density

The results further indicated that plant spacing 30x10 cm (S2) significantly higher ascorbic acid (11.48 mg/100g), nitrogen content in root (2.05%) and leaves (3.12%) with compare to plant spacing 20x10 cm, which might have improved chemical and biological properties of soil and enabled plant roots in better utilization of nutrients by crop. (Table 1). This enhancement might be due to better moisture holding capacity, supply of micronutrients and availability of major nutrients in soil due to fevourable conditions created by spacing. The wider spacing of radish at 30 x 10 cm showed significant superiority over other spacing for all these characters [6, 8, 10]. The TSS (%) was not significantly changed due to spacing's.

Table 1 Effect of organic manures, inorganic manures and plant density on quality of radish.

Treatments	Ascorbic acid (mg/100g)	TSS (%)	Nitrogen content (%)	
			Root	Leaves
Organic manures				
M0: Control	8.88	5.79	1.08	2.21
M1: Vermicompost @ 5 t/ha	12.52	6.55	2.15	3.39
M2:FYM @ 15 t/ha	10.59	6.08	1.57	2.61
SEm +	0.56	0.38	0.18	0.25
CD (P= 0.05)	1.59	NS	0.51	0.72
Inorganic manures				
F0: Control	9.03	4.76	0.96	1.97
F1: 50% RDF of NPK	10.66	6.25	1.66	2.75
F2: 100% RDF of NPK	12.31	7.41	2.18	3.48
SEm +	0.56	0.38	0.18	0.25
CD (P= 0.05)	1.59	1.08	0.51	0.72
Plant density				
S1: (20 x 10 cm)	9.85	6.00	1.15	2.35
S2: (30 x 10 cm)	11.48	6.28	2.05	3.12
SEm +	0.45	0.31	0.15	0.21
CD (P= 0.05)	1.30	NS	0.42	0.59

Conclusion

On the basis of the results obtained in the present investigation, it may be concluded that application of vermicompost 5 t/ha and 100 % RDF of NPK and plant spacing 30x10 cm may be considered as best treatment in terms of quality of radish. Radish was significantly superior to other treatments in including sole or combination in different proportions under Jaipur condition.

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