

Response of Organic Manures, Inorganic Fertilizers and their Combinations on Growth and Yield of Radish

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ABSTRACT

The present investigation entitled “Response of Organic manures, Inorganic fertilizers and their combinations on Growth and yield of Radish (*Raphanus sativus* L.)” was conducted during the *rabi* season, 2020-21 at the research farm of Department of Horticulture, Udai Pratap Autonomous College Varanasi. The field experiment was laid out in RBD comprising of nine treatments that replicates thrice.

The initial experiment soil was sandy loam in texture, slightly alkaline and fine. It was observed that the application of recommended dose of fertilizers through combination of fertilizer and organic manures like FYM and *Azotobacter* significantly increased the plant growth, yield attributes and economic evaluation of treatments. Among these treatments application of 50% NPK +50% FYM+ *Azotobacter* resulted in significantly higher value of plant height (35.06 cm), No. of leaves per plant (13.49 cm) and length of leaves per plant (30.40 cm) and yield attributes i.e., root length (20.18 cm), root diameter

(3.80 cm), days to harvest (51.43 days), average root weight (117.91g) and root yield (393.79 q/ha). The cost benefit ratio (1:3.48) was also recorded maximum in this treatment. Where as the minimum result in respect to all parameters was noticed under T₀ (control) in radish. The study suggested that application of *Azotobacter* with FYM found more beneficial and significantly improved growth and yield of radish.

In overall investigation, the obtained results specified that the combination of organic manure with inorganic fertilizer showed promising results in the cultivation of radish to all the parameters and proved better for obtaining the higher growth and yield in radish.

Keywords Organic manure, NPK, Radish, Growth and yield, B:C ratio.

INTRODUCTION

Radish (*Raphanus sativus* L.) is an edible root vegetable of the family Cruciferae and it has 2n=18 chromosome. Radish originated from Mediterranean region. It is grown in both tropical and temperate regions of India. India has area about 200 (000 ha) and production is 3,252 (000 MT) of radish by 2018-19 (NHB). Radish is predominantly a cool season vegetable crop. But Asiatic types can tolerate higher temperature than European varieties. Being a cool season crop, it is sown during winter from September to January in northern plains. In the mild climate of peninsular India, radish can be grown almost all the year round except for few months of summer. It is an

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Table 1. Effect of organic manures, inorganic fertilizers and their combinations on growth attributes of radish.

Treatments	Plant height (cm)			No. of leaves/plant			Length of leaves (cm)		
	30 days	45 days	At harvest	30 Days	45 days	At harvest	30 days	45 days	At harvest
T ₀	8.05	20.78	26.31	4.43	7.47	10.60	7.03	18.65	21.77
T ₁	9.93	28.59	31.73	5.40	8.53	11.65	9.17	21.21	27.70
T ₂	8.17	24.36	27.81	4.86	7.79	11.00	8.17	19.64	25.36
T ₃	9.68	27.74	30.53	5.27	8.47	11.36	8.82	20.67	27.24
T ₄	8.23	25.46	30.07	5.14	8.25	11.19	8.57	20.16	26.67
T ₅	13.30	31.22	34.45	6.61	10.43	13.19	11.16	25.47	29.95
T ₆	12.36	30.64	33.40	5.98	9.50	12.54	10.42	24.18	29.20
T ₇	11.11	29.15	32.98	5.52	8.86	11.96	9.73	21.97	28.74
T ₈	14.61	32.22	35.06	6.84	11.40	13.49	11.46	27.69	30.40
SEm±	0.45	0.59	0.42	0.24	0.22	0.32	0.36	0.51	0.52
CD	1.36	1.79	1.28	0.71	0.67	0.96	1.09	1.52	1.55

annual or biennial depending upon the type for the purpose it is grown. Radish response well to both the application of organic manures and fertilizers. Adequate and balanced fertilizer management in association with manure is very much essential to exploit the full yield potential of radish. It has been proved that indiscriminate use of inorganic fertilizer results in decrease in soil fertility and increase in soil acidity with depletion of organic humus content in addition to poor crop quality. Hence fertilizers, manures and other amendments either alone or in combination could be used to enhance nutrient supplying capacity of the soil.

Chemical fertilizers deteriorate the quality of produce and are expensive too, leading to reduction in net profit and returns to the farmers. The integrated nutrient management system approach utilize a judicious combination of organic fertilizer and organic manure in building soil fertility and to the increase the production potential of crop (Kumar *et al.* 2013). The balanced use of chemical fertilizer in radish crop to boost yield attributes. The application of nitrogen with different doses increase plant growth and yield of radish (Patel *et al.* 1992, Sharma 1992). Phosphorus has its beneficial effect on early root development, plant growth, yield and quality. Potassium regulates transpiration through opening and closing of stomata by affecting activities of guard cells. The organic manure not only provides nutrients to plants but also improve the soil texture, fertility and moisture. It also increases CEC, water holding capacity and phosphate availability of the soil. Organic manure

is the plant and animal waste that release nutrients after its decomposition. Use of judicious combination of inorganic and organic materials (NPK, FYM, Vermicompost and *Azotobacter*) is essential not only maintain soil health but also sustain the productivity. Keeping the above facts in view, a field experiment was conducted to find out effect of organic manures, inorganic fertilizers and their combinations on growth and yield of radish and to work out the economics of different treatment in radish.

MATERIALS AND METHODS

The experiment was conducted on experimental field at Department of Horticulture, Udai Pratap Autonomous College, Varanasi during *rabi* season 2020-21. The land topography of the experimental site was almost uniform with an adequate surface drainage. The internal drainage of the experimental site was good. Varanasi city is situated in eastern part of Uttar Pradesh, which lies between 25°19'59" North latitude and 83°00'00" East longitudes at an elevation of 252 feet above from mean sea level. The climatic condition of Varanasi is sub-tropical with three distinct seasons i.e., winter, summer and rainy and the soil of the experimental field was sandy loam in texture. It was medium in organic matter and had good water holding capacity. Radish (*Raphanus sativus* L.) var Japanese white was taken as a test crop during *rabi* season of the year 2020-2021 with a spacing 30×10 cm and optimum time for sowing is from November to December in plains. It is an upright variety producing green wavy leaves, roots are cylindrical pure white

Table 2. Effect of organic manures, inorganic fertilizers and their combinations on yield and yield attributes of radish.

Treatments	Length of root (cm)	Diameter of root (cm)	Days to harvest	Weight of root (g)	Root yield (q/ha)	Gross income (Rs/ha)	Net income (Rs/ha)	B:C ratio
T ₀	15.50	2.59	60.29	81.88	140.76	140760	38310	1: 1.37
T ₁	17.29	3.00	56.72	98.12	330.04	330040	223390	1:3.09
T ₂	16.35	2.70	58.82	84.09	300.73	300730	183380	1:2.56
T ₃	16.97	2.83	57.46	91.25	310.97	310970	195920	1:2.70
T ₄	16.76	2.77	58.19	90.73	303.30	303300	198800	1:2.90
T ₅	19.14	3.62	52.67	101.86	338.76	338760	227910	1:3.05
T ₆	18.15	3.40	54.08	100.41	336.82	336820	224820	1:3.00
T ₇	17.79	3.31	55.13	99.73	331.98	331980	222205	1:3.02
T ₈	20.18	3.80	51.43	117.91	393.79	393790	280765	1:3.48
SEm±	0.37	0.14	0.46	1.31	5.31			
CD	1.12	0.42	1.37	3.94	15.94			

20 to 25 cm long mildly pungent and with blunt end. It matures in 60 to 65 days after sowing. The field experiment was laid out in a Randomized Block Design comprising of nine treatments were T₀ Control, T₁ Recommended dose of fertilizer (100 kg N, 80 kg P₂O₅ and 50 kg K₂O ha⁻¹), T₂ 100% FYM, T₃ 100% Vermicompost, T₄ 100% Azotobactor, T₅ 50% NPK + 50% Vermicompost, T₆ 50% NPK + 50% FYM, T₇ 50% FYM + 50% *Azotobactor*, T₈ 50% NPK + 50% FYM + *Azotobactor* with three replications. Radish is a fast-growing, short period crop. Different doses of manures and fertilizers have been recommended for various regions of the country. Farmyard manure should be applied at the time of land preparation. RDF (100:80:50 kg NPK ha⁻¹) and organic manures FYM (25 ton/ha), Vermicompost (4 ton/ha) and *Azotobactor* (5 kg/ha) should be done. The complete doses of P, K and half dose of N should be added to the soil before sowing. The remaining half dose of N is top dressed in 2 split doses during early plant growth and root formation. Radish variety Japanese white was used for sowing. It was sown by hand dibbling method to maintain a row to row distance of 30 cm and plant to plant distance of 10 cm. Seeds were sown on 14th November, 2020 in shallow furrows 5-6 cm apart by dropping the seeds at 1-2 cm depth. The first irrigation applied after seed germination and subsequent two irrigation were applied at 10 days interval. After complete germination gap filling was done to maintain and two weeding were done by manual i.e., first after 15 days and second 30 days after germination. To prevent the pest and disease attack on plants that

plant protection measures were followed regularly. It should harvested when its roots are still tender. They are pulled out vertically with least breakage. Observations were recorded at successive growth stages. Five plants will be selected from each plot as observational plant and were labeled and two parameters added-growth parameters, yield and its attributes. The data obtained of various observations for each treatments were statistically analyzed.

RESULTS AND DISCUSSION

Growth parameters

Significant effect of organic manures, inorganic fertilizers and their combinations on growth of plant. Among all the treatments, T₈ (50% NPK+50% FYM + *Azotobactor*) recorded maximum value of plant height (14.61 cm, 32.22 cm, 35.06 cm), No. of leaves per plant (6.84,11.40,13.49) and length of leaves (11.6 cm, 27.69 cm, 30.40 cm) (Table 1)) during the different stages (i.e., 30 DAS, 45 DAS and at harvest) respectively of growth.

Among all the treatments, T₈ 50% NPK+50% FYM + *Azotobactor* recorded maximum value of plant height while minimum value of plant height observed with T₀ (Control). Similar results were reported by Chumyani *et al.* (2012) and Vimera *et al.* (2012) in tomato and chilli respectively. Samsangheile and Kanaujia (2014) also reported that 50% NPK + 50% FYM + bio-fertilizer recorded maximum plant height.

Highest number of leaves were observed with treatment T_8 , While the minimum value of no. of leaves was observed with T_0 (control) at all the stages of crop growth. Present studies clearly indicated that FYM and *Azotobactor* in combination with 50% recommended dose of fertilizers played significant role in increasing the growth and ultimately number of leaves in radish. Highest number of leaves in T_8 due to fact that application of inorganic fertilizer and organic manure along with bio-fertilizer had the great influence rather than alone. This result confirmed by Ghoname and Shaffek (2005) who reported that in sweet pepper application of organic manure combined with bio-fertilizer and inorganic fertilizer resulted in vigorous plant expressed as number of leaves. These results are also in conformity with the findings of Singh *et al.* (2014) and Sentiyangla *et al.* (2010) in radish. The maximum length of leaves per plant was recorded with the treatment T_8 , While the minimum value of length of leaves was observed with T_0 (control) at all the stages of crop growth. Similar findings have been reported by Khalid *et al.* (2015) in radish that integrated use of organic, inorganic and bio-fertilizer had given good results.

Yield parameter

Among all the treatments, maximum of root with (20.18 cm), diameter of root (3.8 cm), weight of root (117.91 cm) and maximum root yield (393.9 q/ha) recorded under the treatment T_8 (50% NPK+50% FYM + *Azotobactor*) (Table 2).

The maximum and significantly length of root observed with treatment T_8 , While minimum length of root was observed under the treatment T_0 (control). Similar findings have been reported by Vithwel and Kanaujia (2013) their same combination had a beneficial impact on carotene content in roots. Maximum diameter of root was found under the treatment T_8 , While the minimum diameter of root was observed with 2.59 cm T_0 (control). These findings are in agreement with those reported by Sentiyangla *et al.* (2010) in radish. Khalid *et al.* (2015) and Mohmmad *et al.* (2015) in radish. The maximum days to harvest were found under the treatment T_0 (Control) with 60.29 had taken maximum days to attain marketable size root. While the minimum days to harvest was observed

with T_8 (50% NPK+ 50% FYM + *Azotobactor*) with 51.43 days (Table 2). These findings are in agreement with those reported by Vithwel and Kanaujia (2013) in carrot. The maximum and significantly average weight of root was recorded in T_8 . Whereas, the minimum average weight of root was recorded in T_0 (Control). This was attributed due to solubilizing effect of plant nutrients. Organic manure plays a direct role in plant growth as a source of all necessary macro and micro-nutrients in available forms during mineralization, improving physical and physiological properties of soil. Similar findings have been reported by Mohmmad *et al.* (2015) in radish and Setiyangla *et al.* (2010). Among the treatments, the maximum and significantly root yield was recorded in T_8 , while the minimum yield of root was recorded in T_0 (control) with 140.76 (q/ha) due to no any manures or fertilizers used. Similar findings have been reported by Khalid *et al.* (2015) in radish Vithwel and Kanaujia (2013) in carrot.

Economic evaluation of treatment

The data pertaining to benefit : Cost ratio revealed that maximum benefit : Cost ratio was obtained in that treatments, which fetched highest gross returns. Treatments indicated significant effect on gross income, net income and B : C ratio. Highest gross income (393790 Rs/ha), net income (280765 Rs/ha) and B : C ratio (1:3.48) was found with T_8 (50 % NPK + 50 % FYM + *Azotobactor*) (Table 2) which was significantly superior over all other treatments. Whereas minimum benefit : Cost ratio was obtained in the treatment T_0 (Control) due to lesser yield. Therefore, balance nutrition is integration in essential to enhance the benefit : Cost ratio in radish. The result obtained with respect to benefit : Cost ratio is in line with the findings of Sunandarani and Mallareddy (2007), Vithwel and Kanaujia (2013) and Sharma *et al.* (2015) in carrot.

Thus, It may be concluded from the finding of the present study that among the different treatments, T_8 (50% NPK + 50% FYM + *Azotobactor*) showed in the highest growth and yield parameters of radish and it is followed by treatment T_5 (50% NPK + 50% Vermicompost). Further treatments, T_8 (50% NPK + 50 % FYM + *Azotobactor*) also gave highest benefit :

Cost ratio (1: 3.48) and closely followed by treatment T₁.

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