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Evaluation of different organic manures on growth and yield traits of radish (*Raphanus sativus* L.)

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Abstract

Evaluation of different organic manures on growth and yield traits of radish (*Raphanus sativus* L.)” was conducted during cool season 2023-24 in the Research cum instructional farm at K.D. College of Horticulture and Research Station, Jagdalpur (C.G.) during the cool season of the year 2023-24. The experiment was designed using a randomized block design with three replications and ten treatments. *i.e.*, FYM (50%) + Vermicompost (50%) (T₁), Poultry manure (50%) + FYM (50%) (T₂), Vermicompost (50%) + Poultry manure (50%) (T₃), Farm Yard Manure (FYM) (100%) (T₄), Poultry manure (100%) (T₅), Vermicompost (100%) (T₆), Vermicompost (30%) + FYM (70%) (T₇), Poultry manure (30%) + FYM (70%) (T₈), Vermicompost (70%) + Poultry manure (30%) (T₉), Control (T₁₀). The results showed that the different organic manure Vermicompost (50%) + Poultry manure (50%) gave significantly better performance at vegetative growth like plant height (51.68 cm), number of leaves plant⁻¹ (11.38), length of leaves (37.29 cm) and leaf area index (3.47). In case of yield parameter like fresh weight of plant (305.44 g), fresh weight of root (195.45 g), fresh weight of leaf (109.81 g), root length (27.06 cm), diameter of root (5.01 cm), dry weight of root (31.95 g), dry weight of leaf (23.84 g), yield per plot (73.31 kg) and yield per ha (58.65 t) also found better Vermicompost (50%) + Poultry manure (50%) (T₃) treated plant. Increased benefit cost ratio (3.30) found under this treatment Poultry manure (50%) + FYM (50%).

Keywords: Radish, organic manure and growth and leaf yield

Introduction

The radish (*Raphanus sativus* L.) is diploidy (2n=18) in nature, belongs to the genus *Raphanus* included in the Rapa/Oleaceae lineage according to phylogenetic studies of the Brassicaceae family and can be considered as an annual as well as a biennial crop. The genus *Raphanus* originated from coastal regions along the Mediterranean and Black Seas. Radish is considered a root since its specialized structure (hypocotyls) has a full or partial subterranean habitat, its shape is close to the true roots, and it can store starch and other compounds. It is cool season vegetable. It is preferred for its young fleshy enlarged edible roots consumed mainly as a salad. Green leaves and immature pods are also cooked as a vegetable. It is a cross-pollinated (entomophilous) vegetable due to saprophytic system of self-incompatibility (Alam *et al.*, 2010) [1].

Radish is a good source of vitamin-C (14.8 mg/100 gm of edible portion) and supplies types of minerals. The characteristic pungent flavour of radish is due to isothiocyanate. It contains glucose as the major sugar and smaller quantities of fructose and sucrose. It is useful in liver and gall bladder troubles. In homoeopathy, radish is used for neuralgic headache, sleeplessness and chronic diarrhoea and the roots are said to be useful in urinary complaints, piles and gastrodynia (Kushwah *et.al* 2019) [7].

Radish growth and yield are highly reliant on soil and climate factors. For its best effectiveness, different varieties require various climatic conditions. One of the major agro-techniques that affects the growth and yield of radish is nutrition. The crop's nutritional needs are influenced by soil type, soil fertility, agroclimatic conditions and variety. The root growth should be quick and uninterrupted because this crop has a short lifespan and grows quickly. Hence, optimum fertilisation using organic, inorganic and biofertilizers is necessary for the production of high-

quality radish (Dhananjay, 2007) ^[4].

Radish is mainly grown in West Bengal, Madhya Pradesh, Bihar, Uttar Pradesh, Karnataka, Punjab, Maharashtra and Assam. In India, radish is cultivated an area of 202 mha with an annual production of 3304 MT. (Anon., 2022). In Chhattisgarh, Kondagaon, Korba, Surguja, Kanker, Durg, Rajnandgaon, Raipur and Korea are particularly important radish producing districts. The area and production of white radish in Chhattisgarh was 11727 ha and 171.990 MT. (Directorate of Horticulture and Farm Forestry C.G., 2024) ^[2].

In recent years use of organic manures like FYM, vermicompost and neem cake for improving the productivity of crop and maintaining soil fertility and productivity of soil is gaining prominence (Shukla *et al.*, 2013) ^[10]. FYM being rich in organic matter is required for supplementing the nutrients provided through other manure. The organic manure not only provides nutrients to plants but also improves the soil texture by binding effect to soil aggregates. Organic manure increases CEC, water holding capacity and phosphate availability of this soil, besides improving the fertilizer use efficiency and microbial population of soil. It reduces nitrogen loss due to slow release of nutrients (Talashilkar *et al.*, 1999) ^[14]. Vermicompost provides essential macronutrients (N, P, K, Ca and Mg) and micronutrients (Fe, Mn, Zn and Cu). It is a slow releasing organic manure which has most of the macro as well as micro nutrients in chelated form and fulfils the nutrients requirement of plant for longer period. Vermicompost helps in reducing C: N (carbon nitrogen ratio), increasing humic acid content, cation exchange capacity and water-soluble carbohydrates. It helps to reduce soil erosion and also helps to decrease soil pollutants. It also contains biologically active substances such as plant growth regulators. It reduces soil erosion and deodorification of soil pollutants due to rapid mineralization of poultry manure, it was recognized as a valuable source of plant nutrient for all crops. Soil physical properties such as bulk density, water holding capacity and percent water stable aggregation were noted to be influenced by poultry waste addition to soil (Weil and Kroontje, 1979) ^[15]. Soil application of organic manure such as FYM, vermicompost, neem cake and biodynamic manure has a positive effect on crop production. Vermicompost has all characteristics to use it as the most valuable organic manure. (Sharma *et al.*, 2013) ^[9].

Materials and Methods

The experiment was carried out in season 2023-24 at K.D. College of Horticulture and Research Station, Jagdalpur (C.G.). The experiment was designed using a randomized block design with three replications and ten treatments. The experiment was conducted in randomized block design with three replications and ten treatments *i.e.*, FYM (50%) + Vermicompost (50%) (T₁), Poultry manure (50%) + FYM (50%) (T₂), Vermicompost (50%) + Poultry manure (50%) (T₃), Farm Yard Manure (FYM) (100%) (T₄), Poultry manure (100%) (T₅), Vermicompost (100%) (T₆), Vermicompost (30%) + FYM (70%) (T₇), Poultry manure (30%) + FYM (70%) (T₈), Vermicompost (70%) + Poultry manure (30%) (T₉), Control (T₁₀). The soil was made to fine tilth by continuous harrowing after the area had been carefully ploughed and weeds, stubbles, stones etc., were completely removed. The nutrients were applied to the crop with different organic manures such as farmyard manure, vermicompost and poultry manure was incorporated in the field 15 days before sowing. December was the month that the sowing was completed. The soil was dipped by hand with seeds at a depth of roughly 2 cm. The 30 × 15 cm seeds were sown on one side of the ridge in accordance with the procedures.

Protective irrigations were done every five to seven days during the cropping period. Five plants at random were selected from each plot and tagged in order to record the observations on the plant height (cm), number. of leaves plant⁻¹, length of leaves (cm), leaf area index, fresh weigh of plant (g) and fresh weigh of leaf (g).

Results and Discussion

Growth parameter

The results revealed that different organic manure for increasing the growth parameter of radish. Among the entire treatments Vermicompost (50%) + Poultry manure (50%) increasing plant height (cm), number. of leaves plant⁻¹, length of leaves (cm), leaf area index, fresh weigh of plant (g) fresh weigh of leaf (g) and dry weigh of leaf (g). The interpretations were recorded on various parameter are presented in Table 1,2 and 3.

Plant height (cm)

At 15 DAS, the maximum plant height (3.10 cm) was observed under treatment T₃ (Vermicompost (50%) + Poultry manure (50%)), followed by T₁ (FYM (50%) + Vermicompost (50%)) with 3.07 cm, whereas the minimum height (2.44 cm) was recorded in the control plot. Similar trends were noticed at 30 DAS and at harvest, where treatment T₃ continued to exhibit superior performance, recording 25.55 cm and 51.68 cm, respectively. This treatment was statistically at par with T₁, which recorded 24.85 cm at 30 DAS and 49.15 cm at harvest. The lowest plant height at both stages was recorded in the control treatment (15.95 cm at 30 DAS and 41.16 cm at harvest). The synergistic effect of these organic sources likely contributed to the superior plant height observed in T₃. These findings are in close agreement with those reported by Khatri *et al.* (2019) ^[5] in radish observed that combined use of vermicompost and poultry manure significantly improved the growth attributes of various crops.

Number of leaves per plant⁻¹

At 15 DAS, the maximum number of leaves (6.25) was recorded under treatment T₃ (Vermicompost (50%) + Poultry manure (50%)), which was closely followed by T₁ (FYM (50%) + Vermicompost (50%)) (5.66), while the minimum number of leaves per plant (3.96) was observed in the control. A similar trend continued at 30 DAS and at harvest, where T₃ again recorded the highest number of leaves (8.80 and 11.38, respectively), which was statistically at par with T₁ (8.20 and 10.86). The lowest number of leaves (5.70 and 7.89) was found in the control treatment.

These findings are in agreement with Khatri *et al.* (2019) ^[5] and Srivastava *et al.* (2024) ^[11] in radish reported that integrated organic nutrient management significantly enhances the growth parameters of root vegetables by improving nutrient availability and soil biological properties.

Length of leaves (cm)

At 15 DAS, the maximum leaf length (9.83 cm) was recorded in treatment T₃ (Vermicompost (50%) + Poultry manure (50%)), which was closely followed by T₁ (FYM (50%) + Vermicompost (50%)) (9.57 cm), while the minimum length of leaves (6.00 cm) was observed in the control. Similar trends were noticed at 30 DAS and at harvest, where T₃ consistently produced the longest leaves (18.30 cm and 37.29 cm, respectively), which were statistically at par with T₁ (18.00 cm and 36.09 cm). The lowest leaf length (14.11 cm and 27.00 cm) was recorded in the control treatment.

These results are in accordance with the findings of Srivastava *et al.* (2024) ^[11] reported that integrated application of organic manures improves leaf growth and overall plant vigor in radish and other vegetable crops.

Leaf area index (LAI)

At 15 DAS, the highest leaf area index (1.65) was observed in treatment T₃ (Vermicompost (50%) + Poultry manure (50%)), which was closely followed by T₁ (FYM (50%) + Vermicompost (50%)) (1.52), while the minimum LAI (0.74) was recorded in the control. Similar results were recorded at 30 DAS and at harvest, where T₃ maintained superiority with leaf area index values of 2.18 and 3.47, respectively. This treatment was statistically at par with T₁ (2.01 and 3.28), whereas the lowest leaf area index values (1.29 and 1.92) were observed in the control. Similar observations were made by Kiran *et al.* (2019) ^[6] and Supriya *et al.* (2024) ^[13] in radish.

Fresh weight of plant (g)

At harvest, T₃ (Vermicompost (50%) + Poultry manure (50%)) recorded the maximum fresh weight of plant (305.44 g) which was statistically at par with treatment T₁ (FYM (50%) +

Vermicompost (50%)) (286.84 g). While, the lowest fresh weight of plant (160.00 g) was observed in Control. These findings are in close agreement with those of Pandey *et al.* (2024) ^[8] and Supriya *et al.* (2024) ^[13] in radish.

Fresh weight of leaves (g)

At harvest, T₃ (Vermicompost (50%) + Poultry manure (50%)) recorded the maximum fresh weight of leaves (109.81 g) which was statistically at par with treatment T₁ (FYM (50%) + Vermicompost (50%)) (99.95 g). While, the lowest fresh weight of leaves per plant (56.00 g) was observed in Control. Similar findings were reported by Sujatha *et al.* (2020) ^[12] and Supriya *et al.* (2024) ^[13] in radish.

Dry weight of leaf (g)

At harvest, T₃ (Vermicompost (50%) + Poultry manure (50%)) recorded the maximum dry weight of leaf (23.84 g) which was statistically at par with T₁ (FYM (50%) + Vermicompost (50%)) (21.96 g). While, the lowest dry weight of leaf (11.42 g) was observed in Control. Similar findings were reported by Sujatha *et al.* (2020) ^[12] and Supriya *et al.* (2024) ^[13] in radish.

Table 1: Effect of different organic manures on plant height (cm) and number of leaves per plant⁻¹ of radish

Notation	Treatment	Plant height (cm)			Number of leaves per plant ⁻¹		
		15 DAS	30 DAS	At Harvest	15 DAS	30 DAS	At Harvest
T ₁	FYM (50%) + Vermicompost (50%)	3.07	24.85	49.15	5.66	8.20	10.86
T ₂	Poultry manure (50%) + FYM (50%)	3.04	24.15	45.73	5.15	7.86	10.37
T ₃	Vermicompost (50%) + Poultry manure (50%)	3.10	25.55	51.68	6.25	8.80	11.38
T ₄	Farm Yard Manure (FYM) 100%	2.57	21.10	41.51	4.22	6.69	8.44
T ₅	Poultry manure 100%	2.71	21.95	42.64	4.56	7.08	8.93
T ₆	Vermicompost 100%	2.68	21.80	42.47	4.28	6.81	8.64
T ₇	Vermicompost (30%) + FYM (70%)	3.03	23.55	45.60	4.83	7.45	10.33
T ₈	Poultry manure (30%) + FYM (70%)	2.93	22.94	45.58	4.66	7.38	9.86
T ₉	Vermicompost (70%) + Poultry manure (30%)	2.83	22.35	43.78	4.59	7.26	8.95
T ₁₀	Control	2.44	15.95	41.16	3.96	5.70	7.89
Sem±		0.10	0.56	1.72	0.26	0.29	0.38
CD (P=0.05)		0.29	3.12	5.11	0.77	0.87	1.11
CV (%)		6.05	8.12	6.63	9.35	7.01	6.81

Table 2: Effect of different organic manures on length of leaves (cm) and leaf area index (LAI) of radish

Notation	Treatment	Length of leaves (cm)			Leaf area index (LAI)		
		15 DAS	30 DAS	At Harvest	15 DAS	30 DAS	At Harvest
T ₁	FYM (50%) + Vermicompost (50%)	9.57	18.00	36.09	1.52	2.01	3.28
T ₂	Poultry manure (50%) + FYM (50%)	8.05	17.00	35.90	1.45	1.86	3.02
T ₃	Vermicompost (50%) + Poultry manure (50%)	9.83	18.30	37.29	1.65	2.18	3.47
T ₄	Farm Yard Manure (FYM) 100%	6.17	14.21	32.55	0.86	1.41	2.11
T ₅	Poultry manure 100%	6.26	14.64	34.68	1.70	1.58	2.55
T ₆	Vermicompost 100%	6.20	14.38	33.38	0.97	1.49	2.31
T ₇	Vermicompost (30%) + FYM (70%)	7.27	16.23	35.58	1.36	1.77	2.84
T ₈	Poultry manure (30%) + FYM (70%)	7.10	15.59	35.22	1.23	1.68	2.72
T ₉	Vermicompost (70%) + Poultry manure (30%)	6.43	14.83	35.02	1.15	1.62	2.64
T ₁₀	Control	6.00	14.11	27.00	0.74	1.29	1.92
Sem±		0.36	0.68	1.19	0.05	0.08	0.14
CD (P=0.05)		1.10	2.01	3.54	0.14	0.25	0.43
CV (%)		8.71	7.39	6.02	6.65	8.47	9.31

Table 3: Effect of different organic manures on fresh weight of plant (g), fresh weight of leaves (g) and dry weight of leaves (g) of radish

Notation	Treatment	Fresh weight of plant (g)	Fresh weight of leaves (g)	Dry weight of leaves (g)
T ₁	FYM (50%) + Vermicompost (50%)	286.84	99.95	21.96
T ₂	Poultry manure (50%) + FYM (50%)	268.31	97.58	20.81
T ₃	Vermicompost (50%) + Poultry manure (50%)	305.44	109.81	23.84
T ₄	Farm Yard Manure (FYM) 100%	202.00	63.56	12.93
T ₅	Poultry manure 100%	239.93	69.60	14.52
T ₆	Vermicompost 100%	235.51	64.28	13.10
T ₇	Vermicompost (30%) + FYM (70%)	257.18	94.22	19.92
T ₈	Poultry manure (30%) + FYM (70%)	250.00	85.62	18.67
T ₉	Vermicompost (70%) + Poultry manure (30%)	245.25	73.82	14.68
T ₁₀	Control	160.00	56.00	11.42
	Sem±	8.56	3.02	0.72
	CD (P=0.05)	25.43	8.98	2.13
	CV (%)	6.04	6.42	7.21

Conclusion

The study conclusively demonstrated that the integrated application of vermicompost and poultry manure in equal proportions (50:50) resulted in the best growth, yield and economic performance of radish under the given agro-climatic conditions. This treatment (T₃) effectively enhanced vegetative and leaf yield, improved soil health and maximized profitability. The synergistic effects of vermicompost and poultry manure ensured a continuous supply of macro- and micronutrients, improved soil aeration and microbial activity and fostered sustainable nutrient recycling. Hence, it is concluded that for achieving higher productivity, profitability and soil fertility improvement, the combined use of vermicompost (50%) + poultry manure (50%) is the most effective and sustainable practice for radish cultivation.

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