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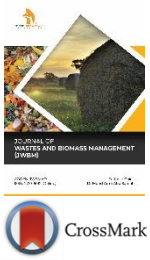

REVIEW ARTICLE

EFFECT OF DIFFERENT ORGANIC MANURES ON THE GROWTH AND YIELD OF RADISH (*RAPHANUS SATIVUS* L.) IN PARBAT DISTRICT

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ABSTRACT

In Nepal, radish (Raphanus sativus) is a popular root vegetable. Because of the careless and ongoing use of chemical fertilizers, which deteriorate the quality of the soil, its productivity is decreased. Therefore, from October to November of 2021, an experiment was conducted in Kushma, Parbat to determine the proper ratio of organic manure to preserve and improve the quality of the soil. Design used was randomized complete block design with seven treatments that is farmyard manure 30 t ha $^{-1}$, farmyard manure 20 t ha^{-1}+ mustard oil cake 2 t ha^{-1}, poultry manure 20 t ha^{-1}, poultry manure 15 t ha^{-1} + mustard oil cake 2 t ha^{-1}, farmyard manure 15 t ha^{-1} + poultry manure 10 t ha^{-1}, farmyard manure 15 t ha^{-1} + poultry manure 10 t ha^{-1} + mustard oil cake 2 t ha^{-1} and control with three replications each. Line sowing of forty days variety was done with the spacing of 20cm × 20 cm. There were 30 plants per plot among them 5 sample plants were taken randomly. These treatments had varying effects on the various growth and yield-related indicators. Plant height (44.87 cm), number of leaves (24.40), root length (28.58 cm), root diameter (3.2 cm), root yield (21.84 t ha^{-1}), shoot yield (29.86 t ha^{-1}), total biological yield (51.70 t ha^{-1}), dry root weight (31.70 g), dry shoot weight (35.45 g), and total dry matter (66.15 g) were all significantly increased by the combined application of mustard oil cake, farmyard manure, and poultry manures. The control treatment yielded the lowest results. These findings suggested that the addition of organic manures had a favorable impact on the majority of growth and yield-related factors, including radish yield.

KEYWORDS

Organic manure, Parameters, Radish, Treatment, Yield

1. INTRODUCTION

One of Nepal's most well-liked root vegetables, radish (Raphanus sativus L.) is highly regarded for both its exceptional nutritional and therapeutic qualities. Its chromosomal count is (2n=18), and it is a member of the family Cruciferae. Modified root, which grows from both the primary root and the hypocotyls, is the portion of radish that is edible. It may be cultivated all year round in Nepal's highlands and throughout the winter in the Terai. Radish is widely grown by farmers because to its quick growth habit, short growing season, ease of cultivation, and increased climate adaptability Radish is farmed as a mixed crop or as a single crop everywhere in Nepal (Shrestha and Shakya, 2004).

In total, 257,335 metric tons of radish are produced in Nepal on 16,808 hectares of land, yielding 15.31 mt ha^{-1}. In Parbat, radish's area coverage, yield, and output were 75 hectares, 1,250 metric tons, and 16.67 mt ha^{-1}, respectively (MOALD, 2019). Radish is a short-duration and fast-growing crop so; its root growth and development should be uninterrupted.

Vitamin C and minerals like calcium, potassium, and phosphorus are present in it, and it may be eaten raw as a salad or cooked as a vegetable. Light and fertilizer levels have a big impact on how much vitamin C radish roots contain. Certain cultivars allow for the use of its leaves and pods as a vegetable when cooked. In addition to being cooling, it is diuretic. Neurological headache, insomnia, and persistent diarrhea are among conditions for which it is utilized. Additionally, the roots can help with piles, liver, gall bladder, and urinary issues (Hadley, 1993). Radish gets peppery when isothiocyanates are present, and roots turn red when anthocyanin is present. Radish growth and development are highly dependent on the soil's nutritional content and climate (Tripathi, 2017). Chemical fertilizers are costly and environmentally dangerous when applied to crops. Other organic nutrition sources should be employed to counteract the negative effects of chemicals. (Kumar et al., 2014).

It has been shown that applying organic manures improves soil quality, particularly the amount of organic matter in the soil, and increases crop output. After broccoli and tomato, radishes are ranked fifth among vegetable crops in terms of both area and productivity (MOALD, 2019). Radish cultivar forty days being popular in mid – hills because of its short production period (Shrestha and Thapa, 2018). Under these circumstances, the current experiment was conducted to determine how various organic manures affected the radish's development and output in the Parbat district.

2. MATERIALS AND METHODS

2.1 Site selection

The field trial took place in the Kushma Municipality 5 Parbat district of western Nepal during September and November of 2021. The experimental location is situated 1294 meters above sea level at 28°13'06 N 83°40'45 E.

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2.2 Land preparation

In order to level the field, it was ploughed once, harrowed twice and then planked. Weeds and other undesired plant stubbles were removed following levelling. To encourage healthy root development, twenty-one plots that were elevated by 15 cm were developed.

2.3 Manure application

In accordance with treatments, various organic manures, including farmyard manure, chicken manure and mustard cake, were added to the field plots seven days prior to seeding.

2.4 Experimental design

Three replications of each of the seven treatments were included in the Randomized Complete Block Design (RCBD) setup for the experiment.

2.4.1 Treatments details

T_1	FYM 30 t ha^{-1}
T_2	FYM 20 t ha^{-1}+ MOC 2 t ha^{-1}
T_3	PM 20 t ha^{-1}
T_4	PM 15 t ha^{-1}+ MOC 2 t ha^{-1}
T_5	FYM 15 t ha^{-1} + PM 10 t ha^{-1}
T_6	FYM 15 t ha^{-1}+ PM 10 t ha^{-1}+ MOC 2 t ha^{-1}
T_7	Control

2.5 Seed sowing and intercultural operation

Throughout the whole experimental field, the seeds were evenly drilled into the raised beds that had been well-prepared, with three seeds per hill and a depth of two centimeters. On September 25, 2021, radish seeds of the forty-day variety were sowed. Following seed sowing, a light irrigation was provided right away. Later, irrigation was adjusted based on field observations. During the plant's early growth stage, two weeding and one earthing up helped the roots develop properly. Every plot of plants was tagged in order to identify the treatments used throughout the research period and gather data. Upon reaching a marketable size, the roots were physically harvested by removing them.

2.6 Observation recorded

The observation was taken randomly from 5 plants from 3 standards rows of each plot and their mean was calculated. The data were collected on different parameters viz. vegetative parameters: plant height (cm), number of leaves, yield parameters: root yield (t ha^{-1}), root length (cm), root diameter (cm), shoot yield (t ha^{-1}), total biological yield (t ha^{-1}) and dry mass (g) at 30 DAS, 40 DAS and 50 DAS. Using a measuring tape, the plant height (in centimetres) was determined from the base of the plant, just above the soil's surface, to the top of the plant, at maturity. Up to maturity, the number of leaves on each plant was counted. Additionally, a manual scale was used to measure the root's length (in centimetres) from the crown to the distal end, and a vernier caliper was used to measure the root's diameter (in centimetres). Furthermore, the yield per ha t ha^{-1} of every treatment was computed based on the yield of every treatment.

2.7 Statistical analysis

Analysis of variance (ANOVA) and DMRT separation of means at a 5% level of significance were performed on the experiment data, which had been imported into Microsoft Excel and subjected to R studio data analysis program.

3. Results And Discussion

3.1 Effect of different organic manures on growth parameters

Table 1 shows the impact of several organic manures on plant height and leaf count at 50 DAS. Plant height (47.48 cm) and leaf count (24.40) were at their highest at 50 DAS (harvesting) in T_6 (FYM 15 + PM 10 + MOC 2 t ha^{-1}) and were statistically comparable to those of T_4 (PM 15 + MOC 2 t ha-1) and T3 (PM 20 t ha^{-1}). Plant height (30.20 cm) and leaf count (12.38) were found to be lowest in T_7 (Control).

The increased growth parameters attributed to beneficial effect of PM has been reported in radish (Uddain, 2010; Subedi, 2018).

Table 1: Effect of different organic manures on plant height and no. of leaves at 50 DAS

Treatment	Plant Height	No. of leaves
T_1 (FYM 30 t ha^{-1})	33.77^{d}	14.61^{de}
T_2(FYM 20 + MOC 2 t ha^{-1})	35.15^{c}	16.57^{cd}
T_3(PM 20 t ha^{-1})	40.48^{b}	21.39^{b}
T_4(PM 15 + MOC 2 t ha^{-1})	41.23^{b}	22.32^{ab}
T_5 (FYM 15 + PM 10 t ha^{-1})	35.72^{c}	18.53^{c}
T_6 (FYM 15 + PM 10 + MOC 2 t ha^{-1})	44.87^{a}	24.40^{a}
T_7 (Control)	30.20^{d}	12.38^{e}
LSD	1.24	2.45
F – test	***	***
SE_m (±)	1.01	0.94
CV%	1.87	7.42
Grand Mean	37.36	18.60

3.2 Yield Parameter

The control plot yielded the least amount of biological yield among the treatments, whereas T6 (FYM 15 + PM 10 + MOC 2 t ha^{-1}) demonstrated the largest root length (28.58 cm), root diameter (3.2 cm), root yield (21.84 t ha^{-1}), shoot yield (29.84 t ha^{-1}) and overall biological yield (51.70 t ha^{-1}).

As a fast-growing vegetable, radish requires a higher amount of nutrients (Baloch et al., 2014). The thirteen necessary nutrients found in PM are N, P, K, Ca, Mg, S, Mn, B, Zn, Cu, Fe, Cl, and Mo (Chastain et al., 2014). PM contained 30% readily available nitrogen form (Sunassee, 2002). A significant concentration of secondary and micronutrients may be found in mustard oil cake, in addition to N, P, and K (5.1–5.2%, 1.8–1.9%, and 1.1–1.3%), respectively (BARC, 1997).

Higher levels of nitrogen are essential for increasing the fresh weight of leaves, the weight of roots, and the weight of the entire plant since nitrogen is also converted into amino acids, which form complex proteins and support the opulent growth of crops (Muthuswamy, 1971).

Table 2: Effect of different organic manure in different yield characters

Treatment	Root Length	Root Diameter	Root Yield (t ha^{-1})	Shoot Yield (t ha^{-1})	Total biological Yield (t ha^{-1})
T_1 (FYM 30 t ha^{-1})	13.18^{e}	2.41^{c}	11.69^{f}	12.23^{f}	23.92^{f}
T_2(FYM 20 t ha^{-1} + MOC 2 t ha^{-1})	16.21^{d}	2.77^{b}	13.75^{e}	14.18^{e}	27.93^{e}
T_3(PM 20 t ha^{-1})	19.73^{c}	2.86^{b}	17.09^{d}	23.28^{d}	40.37^{d}
T_4(PM 15 t ha^{-1}+ MOC 2 t ha^{-1})	23.18^{b}	2.90^{b}	19.12^{b}	27.74^{b}	46.87^{b}
T_5 (FYM 15 t ha^{-1}+ PM 10 t ha^{-1})	24.62^{b}	2.93^{b}	18.40^{c}	26.34^{c}	44.75^{c}
T_6 (FYM 15 t ha^{-1}+ PM 10 t ha^{-1}+ MOC 2 t ha^{-1})	28.58^{a}	3.2^{a}	21.84^{a}	29.86^{a}	51.70^{a}
T_7 (Control)	9.55^{f}	2.13^{d}	8.43^{g}	10.19^{g}	18.62^{g}
LSD	2.49	0.20	0.68	0.82	0.23
F – test	***	***	***	***	***
SE_m(±)	1.42	0.07	0.97	1.68	2.63
CV%	7.27	4.17	2.45	2.27	1.32
Grand Mean	19.29	2.74	15.76	20.55	36.31

3.3 Dry matter

Dry matter with respect to different organic manure was found significant. The highest dry matter was found in T_6 (FYM 15 + PM 10 + MOC 2 t ha^{-1}) 67.15 followed by T_4(PM 15 + MOC 2 t ha^{-1}) 55.57, while the minimum was found in T_7 (Control) 25.20.

Treatment	Dry Root Weight (gm)	Dry Shoot weight(gm)	Total dry mass (gm)
T_1 (FYM 30 t ha^{-1})	16.73^{c}	16.08^{d}	32.81^{e}
T_2(FYM 20 + MOC 2 t ha^{-1})	22.25^{b}	21.46^{c}	43.71^{d}
T_3(PM 20 t ha^{-1})	23.57^{b}	29.23^{b}	52.79^{bc}
T_4(PM 15 + MOC 2 t ha^{-1})	24.78^{b}	30.79^{b}	55.57^{b}
T_5 (FYM 15 + PM 10 t ha^{-1})	22.28^{b}	28.4^{b}	50.68^{c}
T_6 (FYM 15 + PM 10 + MOC 2 t ha^{-1})	31.70^{a}	35.45^{a}	67.15^{a}
T_7 (Control)	11.97^{d}	13.23^{e}	25.20^{f}
LSD	3.25	2.66	3.92
F- test	***	***	***
SE_m (±)	1.33	1.72	2.96
CV%	8.36	6.0	4.70
Grand Mean	21.89	24.94	46.84

3.4 Economic analysis

Lower cultivation costs can yield higher profits. The table displays the data that was used to calculate the treatments' economics. According to the results, the plot with the combination of T_6 (FYM 15 t ha^{-1}+ PM 10 t ha^{-1}+ MOC 2 t ha^{-1}) and T_4 (PM 15 t ha^{-1}+ MOC 2 t ha^{-1}) applied had the greatest benefit cost ratio (1.93:1). T_1 produced a low benefit-cost ratio (FYM 30 t ha^{-1}).

Table 4: Economic analysis of different treatments

Treatments	Total cost (Rs)	Root Yield (t ha^{-1})	Gross Income (Rs ha^{-1})	Net Income (Rs ha^{-1})	B:C ratio
T_1 (FYM 30 t ha^{-1})	19200	11.69	19873	673	1.03:1
T_2(FYM 20 + MOC 2 t ha^{-1})	17400	13.75	23375	5975	1.34:1
T_3(PM 20 t ha^{-1})	17700	17.09	29053	11353	1.64:1
T_4(PM 15 t ha^{-1} + MOC 2 t ha^{-1})	16900	19.12	32504	15604	1.90:1
T_5 (FYM 15 t ha^{-1} + PM 10 t ha^{-1})	18450	18.40	31280	12830	1.69:1
T_6 (FYM 15 t ha^{-1} + PM 10 t ha^{-1} + MOC 2 t ha^{-1})	19150	21.84	37128	17978	1.93:1
T_7 (Control)	11700	8.43	14331	2631	1.2:1

4. Conclusion

Based on the current study, it is determined that, among the several treatments, FYM 15 t ha^{-1}+ PM In the Parbat district's mid-hills, the 40-day radish cultivar grew and yielded best when treated in a mixture of 10 t ha^{-1} with MOC 2 t ha^{-1}. The physical and chemical qualities of soil can be improved by combining various organic manures. The use of organic manures improves radish quality and output.

The application of T_6, or the blend of FYM 15 t ha^{-1} organic manures with PM In terms of maximum growth (plant height, number of leaves), yield parameters (i.e., root length, root diameter, root weight, shoot weight, total biological yield, and dry matter), and comparative analysis revealed that 10 t ha^{-1} + MOC 2 t ha^{-1} was considerably superior to other organic manures.

It is revealed from the data obtained that maximum marketable root yield 21.84ton ha^{-1} was recorded from plot i.e., T_6 (FYM 15 t ha^{-1}+ PM 10 t ha^{-1} + MOC 2 t ha^{-1}) and highest benefit cost ratio (1.93:1) followed by plot where T_4(PM 15 t ha^{-1}+ MOC 2 t ha^{-1}) was applied. The T_1 (FYM 30 t ha^{-1}) plot yielded a minimal benefit cost ratio of 1.03:1, but the yield was similarly poor. Therefore, producers may save money by combining three distinct types of organic manure, and the combined yield was found to be greater.

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