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RESEARCH ARTICLE

EFFECT OF DIFFERENT ORGANIC MANURES ON GROWTH AND YIELD OF RADISH AT KAILALI DISTRICT

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ABSTRACT

Excessive chemical fertilizers could lead to chemical toxicity in major root crops and inhibit their growth and development. Radish is one of the well-known root crops and its popularity could be due to its wider climatic adaptation, easy cultivation methods, and a wider range of its uses. A field experiment was conducted in Taranagar-5, Kailali from Sept-Nov, 2021 to evaluate the influences of different organic manures on the growth and yield of radish. Mino's early variety of radish was used as a test crop. The experiment was set up in RCBD Design with seven treatments (FYM 30t/ha, Poultry manure 20t/ha, Mustard cake 4t/ha, FYM 15t/ha + Poultry Manure 10t/ha, FYM 15t/ha + Poultry Manure 10t/ha + Mustard Cake 4t/ha, FYM 15t/ha+ Poultry Manure 10t/ha + Mustard Cake 2t/ha and control) and were replicated 3 times. The results revealed that all the growth attributes and yield were significantly enhanced by the application of organic manures. At the time of harvest, significantly higher plant height (46.21cm) was obtained in mustard cake followed by FYM 15t/ha + Poultry manure 10t/ha, a maximum number of leaves per plant (25.53) in mustard application followed by FYM 15ton/ha+ PM10ton/ha + MOC 4ton/ha, root diameter (4.08cm), root length (31.40cm), total dry weight per plant (38.99gm) and biological yield (97.24t/ha) was observed in treatment consisting mustard cake followed by FYM 15ton/ha+ PM10ton/ha + MOC 2ton/ha. The study suggested that the application of mustard cake was found more beneficial and significantly improved the growth and yield of radish.

KEYWORDS

Biological yield, Mino Early, Mustard cake, Root diameter, Root length

1. INTRODUCTION

Radish (Raphanus sativus L.) is an important winter season vegetable, grown throughout the country. It is both an annual and biennial crop that belongs to the family Cruciferae. The origin of radish is believed to be in Asia, China, and Europe, and is cultivated in tropical and temperate climates around the world (Etesami and Tajpour, 2016). In Nepal, radish was grown in an area of 16,808 hectares with a total production of 257,335 metric tons and productivity of 15.31 tons/ha (MOALD, 2020).

Radish is a fast-growing root vegetable that grows well in cool and moist climates. It thrives best in well-draining sandy loams with a pH of 5.8 to 6.8 and a temperature range of 10 to 18°C (50–65°F) (Reddy, 2020). It is a short-duration vegetable and takes only 50 to 65 days to come to harvest. Generally, Radish is grown for the consumption of its fresh tender tuberous root which can be used as cooked or raw food as a salad. The tender tuberous roots are fusiform botanically and are developed from both the primary roots and hypocotyls. It has a short hairy stem and oblong-shaped rosette leaves (horizontal and circular leaves at ground level). Its green leaves are a good source of vitamin A and are also used as green leafy vegetables (Reddy, 2020). The pungent flavor in radish is due to the presence of volatile isothiocyanates (Kanhaiya Prasad Singh, 2015). In a hot climate, roots become pungent and tough before attaining marketable maturity. Long photoperiod and warm temperature favor early bolting even before proper root development. Normally plants bolt when days are 8-10 h long. At lower temperatures, pungency is reduced. Radish is tolerant to frost (Dhaliwal, 2017).

Organic manure, such as farmyard manure (FYM), poultry manure, and mustard cake, should also be used since they fertilize the soil and provide nutrients to the plants. By delivering nutrients and increasing the physical, chemical, and biological qualities of soil, FYM aids in crop growth. Similarly, poultry manure contains a higher concentration of nitrogen, phosphate, and potassium than manure from other animals. Poultry manure also aids in the improvement of soil water holding capacity, aeration, and fertility (Khatri et al., 2019). Organic manures and fertilizers improve soil texture, allowing it to store water for long periods while also increasing bacterial and fungal activity and reducing environmental issues. As a result, they benefit not only your plants but also the soil.

2. METHODOLOGY

2.1 Experimental Site

This field experiment on radish was conducted in Taranagar-5, Dhangadhi, Kailali during the period between September 2021 to November 2021 to determine the effect of different organic manure on the grown crop. The experimental site is located at 28° 68'52|| north latitude and 80°62'16|| east longitude. Kailali district lies in Sudurpaschim province and covers an area of 3,235 square kilometers with an altitude from 109 m to 1950 m.

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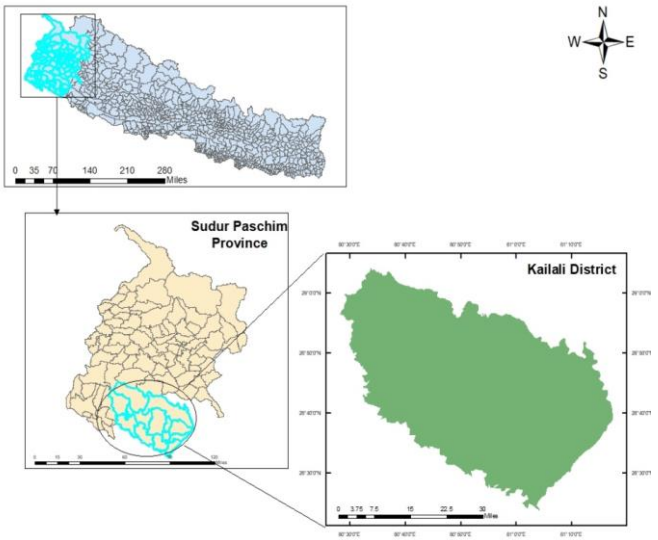

Study area

2.2 Experimental Details

The experimental design was Randomized Complete Block Design (RCBD) with 7 treatments that are FYM 30 t/ha (T1), Poultry manure 20 t/ha (T2), Mustard cake 4 t/ha (T3) , 15 t/ha FYM + 10 t/ha Poultry Manure (T4) , 15 t/ha FYM + 10 t/ha Poultry Manure + 2 t/ha Mustard Cake (T5) ,15 t/ha FYM+ 10 t/ha Poultry Manure + 4 t/ha Mustard Cake (T6) and control (T7)with 3 replications. The variety used in the experiment was Mino Early. The size of the plot is 1m * 1m and the spacing is 20 cm* 20 cm and plant population is 36 plants per plot and 5 plants are taken as sample plants.

2.3 Cultivation Practices

Organic manures were added as a basal dose 7 days before sowing after the field preparation was completed. On September 21, 2021, good quality seeds of the Mino early variety were sowed at a depth of 2 cm. The seed was planted on ridges using the hand dibbling method, with a row to row distance of 20cm and a plant to plant distance of 20cm. Intercultural activities such as re-sowing and thinning out to maintain desired plant populations, weeding and earthing up in the early stages of plant growth, and plant protection measures were carried out as needed.

2.4 Sampling and Data Recording

Five plants were randomly selected from each plot as sample plants for data collection. Growth parameters such as plant height, number of leaves, fresh shoot weight, and dry shoot weight were recorded, as well as yield parameters such as root length, root diameter, fresh root weight, and dry root weight. Plant height and the number of leaves were measured at 30 days after sowing (DAS), 45 days after sowing (DAS), and 65 days after sowing (DAS), while all other parameters were measured at 65 days after sowing (DAS).

2.5 Root and Shoot Weight (gm)

Three plants were selected randomly from each plot at 65 DAS and weighed. After taking fresh root and shoot weight, they were dried in sun for two days followed by a hot air oven at 70°C till constant weight, and dry weight was measured.

2.6 Statistical Data Analysis

Each treatment was replicated 3 times, with data collected from five plants selected at random. The data was statistically analyzed using R studio 4.1.2 and analysis of variance (ANOVA). The least significant difference (LSD) was used to compare the significant differences between treatment means at a 5% level of probability.

3. Result and Discussion

3.1 Effect of Organic Manures on Growth Parameters

Plant height was recorded at 30, 45, and 65 DAS respectively. The data on plant height was found to be significant. In general, there was an increase in plant height and no. of leaves up to the harvesting stage. Among different treatments, treatment T3 (Mustard cake 4) recorded a maximum plant height of 46.21 cm at 65 DAS. It was followed by T4 (FYM 15t/ha+ PM10t/ha) with a plant height of 44.77 cm at 65 DAS respectively. While minimum plant height of 19.05 cm, 29.57 cm, and 35.54 cm was found under T1 (control) at 30, 45, and 65 DAS respectively. However, in 65 DAS, the maximum number of leaves per plant was recorded at 25.53 in treatment T3 (Mustard cake 4t/ha) followed by treatment T6 (FYM 15t/ha+ PM10t/ha + MOC 4t/ha) with several leaves per plant of 25 at 65 DAS respectively. While the minimum number of leaves i.e. 9.46, 11.40, and 18.86 per plant were observed under the treatment T7 (Control) at 30, 45, and 65 DAS respectively. The number of leaves and plant height of radish increases with an increase in nitrogen level, which was mostly found in mustard oil cake and poultry manure.

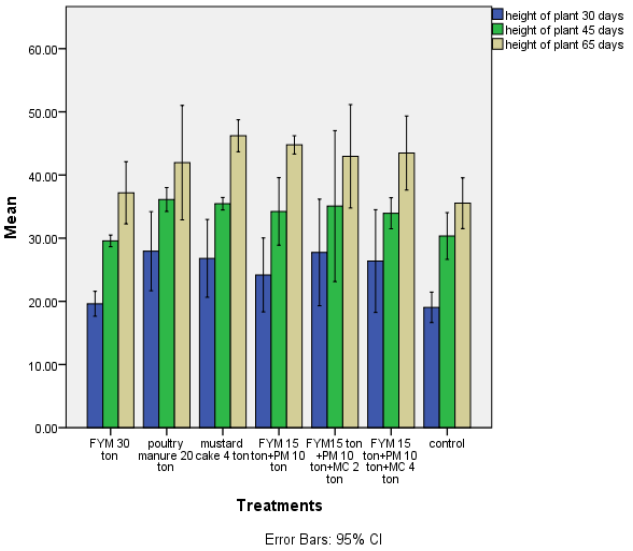

Figure 1: Effect of different sources of organic manure on plant height of Radish at Kailali district, Nepal

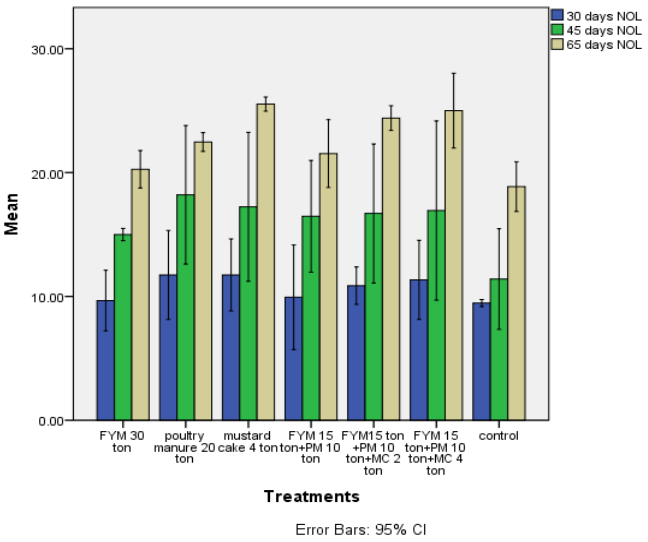

Figure 2: Effect of different sources of organic manure on the number of leaves per plant of Radish in Kailali district, Nepal

3.2 Effect of Organic Manures on Yield Parameters

Root length was taken after harvest. Statistical analysis revealed significant differences among the treatments. Among various treatments, T3 (Mustard cake 4t/ha) has the highest root length of 31.40 cm, which was followed by T5>T4>T6>T2>T1 in descending order. Minimum root length (4.08 cm) was recorded under the treatment T7 (Control).

Treatment showed a significant effect on root diameter in radish. The data on the effect of different manures and fertilizers on root diameter are furnished in Table 1. Among the different treatments, the significantly highest root diameter of (4.08 cm) was recorded in treatment T3 (Mustard oil cake 4t/ha) which was followed by T5>T4>T6>T2>T7 in descending order. A minimum root diameter of (2.68 cm) was recorded under the treatment T1 (Control). According to M.R. mustard oil cakes are the most effective because they not only reduce nematode development but also promote stable root enlargement (Ali et al., 2014).

Table 1: Effect of different organic manures on root length (cm) and root diameter (cm)of radish		
Treatments	Root Length	Root Diameter (cm)
FYM 30t/ha (T1)	23.75[b]	2.91[bc]
PM 20t/ha (T2)	28.75[a]	3.42[ab]
MOC 4 t/ha (T3)	31.40[a]	4.08[a]
FYM 15t/ha+ PM10t/ha (T4)	31.20[a]	3.59[ab]
FYM 15t/ha+ PM10t/ha + MOC 2t/ha (T5)	31.27[a]	3.65[a]
FYM 15t/ha+ PM10t/ha + MOC 4t/ha (T6)	31.03[a]	3.51[ab]
Control (T7)	23.62[b]	2.68[c]
Grand Mean	28.72	3.41
F test	**	**
LSD	3.84	0.65
SEM (±)	0.82	0.12
CV (%)	7.53	10.76

***highly significant at p<0.01 **: highly significant at p<0.05, *: significant, SEM: Standard error of means, LSD: Least significant difference, CV: Coefficient of variation, Means in a column followed by the same letter(s) are not significantly different.

Treatment showed a significant effect on dry shoot weight, dry root weight, and total dry weight per plant in radish. The data on the effect of different manures and fertilizer on dry shoot weight, dry root weight, and total dry weight per plant are furnished in figure (3) Among the different treatments, the significantly highest dry shoot weight per plant was found in T3 followed by T6 where minimum dry shoot weight per plant was found in control. Similarly, dry root weight per plant was found in Mustard at 4t/ha which was statistically at par with T2, T4, T5, and T6. However, the minimum dry root weight per plant was found in controlled. The maximum total dry weight was found in T3 followed by T5 where the minimum total dry weight per plant was found in control. Sufficient plant nutrients found on mustard oil cake also contributed to the production of large roots having maximum dry weight (Kabir et al., 2011).

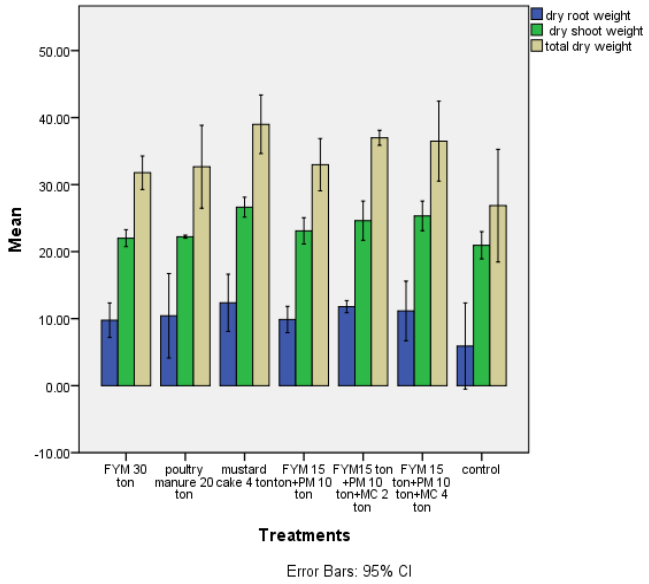

Figure 3: Effect of different sources of organic manure on dry shoot weight, dry root weight, and total dry weight per plant of Radish at Kailali district, Nepal

Treatment showed a significant effect on Fresh shoot weight, fresh root weight, and biological yield in radish. The data on the effect of different manures and fertilizers on shoot weight, fresh root weight, and biological yield are furnished in figure (4). Among the different treatments, significantly highest fresh shoot weight was found in T3 which was statistically at par with T2, T4, T5, and T6 where minimum dry shoot weight per plant was found in control. Similarly, fresh root weight was found in Mustard at 4t/ha which was statistically at par with T4, T5, and T6. However, the minimum dry root weight per plant was found in controlled. The maximum biological yield was found in T3 followed by T5 where the minimum was found in control. The biological yield was increased due to an increase in food assimilation resulting from an increase in photosynthetic areas, and vegetative growth (Sunil Ghimire et al., 2020). The fresh weight of leaves was maximum with the application of mustard oil cake which was also found in (Kabir et al., 2011).

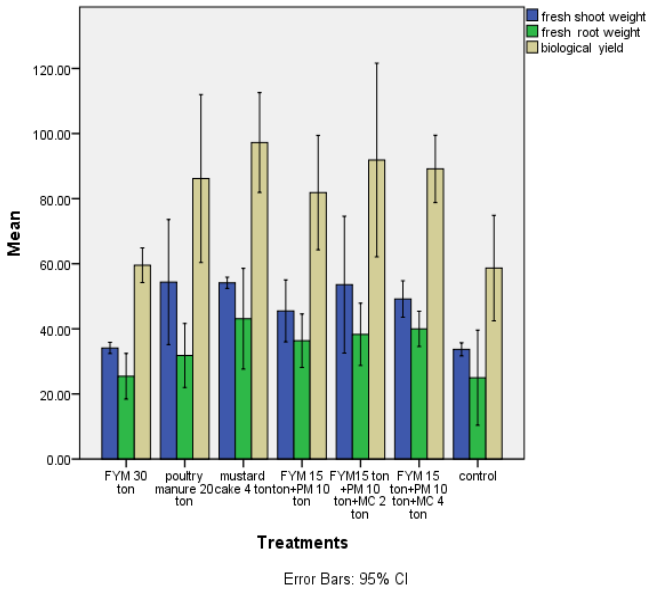

Figure 4: Effect of different sources of organic manure on fresh shoot weight, fresh root weight, and biological yield per hectare of Radish at Kailali district, Nepal

4. Economic Analysis

The data on the cost of cultivation for different treatments have been presented in Table 2. The highest total cost of cultivation per hectare (Rs. 25780) was found in treatment T2 followed in treatment by Rs. 23000 in treatment T6. The lowest cost of cultivation of Rs 21000 was obtained in treatment T7 (control). Net returns per hectare were however highest (Rs 37590) in treatment T3 followed By Rs. 32958 in treatment T6 Whereas the lowest net return (Rs. 13958) was calculated in treatment T7 Maximum B: C ratio (2.65:1) was observed in treatment T3 followed by treatment T6. Whereas minimum B: C ratio of 1.6:1 were observed in treatment T7 (control).

Table 2: Effect of different organic manure on economic analysis of different treatments					
Treatment	Total cost (Rs)	Yield t/ha	Gross income	Net income	B: C ratio
T1	21250	25.43	35602	14352	1.67:1
T2	27980	31.79	44506	16526	1.5:1
T3	22750	43.1	60340	37590	2.65:1
T4	21448	36.33	50862	29414	2.3:1
T5	22548	38.29	53606	31058	2.37:1
T6	23000	39.97	55958	32958	2.43:1
T7	21000	24.97	34958	13958	1.6:1

5. Conclusion

Based on the findings of this research, it can be stated that the radish variety Mino Early responded effectively to the application of various organic manures in terms of growth and yield characteristics.

Based on the overall performance of the treatments, radish performed better in mustard oil cake. Poultry manure 10t/ha + FYM 15t/ha + Mustard oil cake 4t/ha and has been found best combination in early season variety of Mino early. In conclusion, mustard oil cake 4t/ha and organic manure having a combination of poultry manure, FYM, and Mustard oil cake were found suitable organic manure for increasing the yield of Mino Early variety of Radish in the Terai region of Kailali district.

Significantly maximum marketable root yield of radish 43.10 t/ha was recorded in T4 (Mustard Cake) and cost-benefit ratio 1:2.65 followed by T6 (FYM 15t/ha + Poultry Manure 10t/ha + Mustard Cake 4t/ha) (39.97 t/ha, 1: 2.43 root yield and cost-benefit ratio, respectively) While, minimum cost-benefit ratio 1: 1.5 was obtained in the T2 (Poultry Manure) due to higher expenditure on the treatment which calculated root yield 31.79 t/ha as compared to other treatments.

6. Limitations of the Research

The research was carried out in only one season and at only one location. Therefore, this experiment should be further verified by conducting similar research at different locations. The increase in the number of replications could also be done in this research but wasn't carried out due to time constraints.

7. Suggestions for Further Research

The present investigations should be repeated to confirm the findings. Similar research can be done with more replications and more treatment dosages. The performance in combination of treatment levels than the one used in this experiment could be carried out in the future. The same research could be done at different locations and we can delineate the differences.

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