***Original Research Article***

# Effect of integrated nutrient management on growth and yield of radish.


## ABSTRACT

Integrated Nutrient Management (INM) is necessary to enhance sustainable yield in an eco-friendly way. A field experiment was conducted during November 2021 in winter season at School of Agriculture, Abhilashi University Mandi (Chail Chowk), Himachal Pradesh to study the effect of integrated nutrients management on growth and yield of the radish cv. Pusa Desi. The experiment consisted 7 treatments with control, laid out in Randomized Block Design with three replications. The treatment combination consisted of organic manure (FYM and Vermicompost) and inorganic fertilizers (NPK). The quantitative growth and yield parameters were recorded at 30 DAS and at harvest. Numbers of leaves (6.51) at 30 DAS and (14.28) at harvest, root length (8.51 cm) at 30 DAS and (26.44cm) at harvest, root diameter (1.56 cm) at 30DAS and (3.85cm) at harvest, was recorded in T5 (NPK 50% + FYM 25% + Vermicompost 25%) Whereas the fresh weight (195.18 g) and dry weight of roots (39.04g), root yield per plot (30.49 kg), root yield per hectare (508.24 q) and harvest index was also maximum recorded in $T_5$ (NPK 50% + FYM 25% + Vermicompost 25%).

The study suggested that the combined application of inorganic and organic manure and fertilizers (NPK 50% + FYM 25% +Vermicompost 25%) were highly beneficial for all the growth and yield parameters of radish.



Keywords: Radish, Integrated nutrients managements, Growth and Yield.




## INTRODUCTION

Radish (*Raphanus sativus* L.) is one of the most important root crops grown in the world and India. Radish is a quick growing herbaceous annual plant belonging to the family Brassicaceae having chromosome number 2n=2x=18. Radish is probably said to be originated in Europe and the Western Asian region.

The fleshy roots that grow from both the primary root and the hypocotyl are the major part of a radish that are consumed. It is eaten raw as salad, cooked as a vegetable and also used to prepare pickles. The roots are reportedly helpful for stomach issues, piles, gastrodynia, enlarged spleen, jaundice, and urinary symptoms. The strong flavour of radish is due to volatile isothiocyanates (trans-4-methyl-thibutenyl-isothiocyanate) The total area under radish cultivation in India is 208.55 thousand hectares with a production of 3061.29 Mt. Radish is grown throughout the country, mainly in Punjab, Uttar Pradesh, Maharashtra and Kashmir. West Bengal ranks number one in area and production of radish. In Himachal Pradesh, it is cultivated under an area of 206 thousand hectares with a production of 3304 Mt. (Anonymous 2022).

Organic manure like farm yard manure (FYM) not only provides nutrients to plants but also improves the soil texture by binding effect to soil aggregates. Organic manure increases water holding capacity and phosphate availability of the soil, besides improving the fertilizer use efficiency and microbial population in the soil; it reduces nitrogen loss due to the slow release of nutrients (Khatri et al. 2019). Vermicompost provides essential macronutrients (N, $P_2O5$, K2O, Ca and Mg) and micronutrients Fe, Mn, Zn and Cu). Vermicompost helps in reducing C:N ratio (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 (Kumar et al. 2018).

The growing of radish plants has been affected most severely due to lack of N and subsequently by P as well as K. The application of nitrogen with different doses increases plant growth and yield of radish. Deficiency of nitrogen first appears on older leaves due to the high mobility of the element. Its deficiency causes interveinal yellowing, development of anthocyanin pigment, rolling of leaves, chlorosis and necrosis (Uddin et al. 2010). According to the phosphorus deficiency, the radish plants were shorter in height, leaves were distorted in shape and a pink tinge appeared along the margins and veins. Phosphorus is an indispensable constituent of nucleic acids, phospholipids and several enzymes. It is also needed for the transfer of energy within the system of plants and is involved in its various metabolic activities (Cetner et al.2020). In potassium-deficient plants, the colour of leaves changed from green to pale yellow and brown scorches appeared on the leaves at later stages. So, potassium has a very important role in the proper growth and development of plants. It regulates transpiration through the opening and closing of the stomata by affecting the activities of guard cells. In these organelles, Potassium activates & the fat-producing enzymes and enhances the oil content. (Mandal 2007).

Thus, it is essential to find out adequate nutrient requirements of nitrogen, phosphorus and potash along with organic manure in radish crops. This study aimed to analyse the influence of various sources of organic nutrients on the yield and quality parameters of radishes.

## MATERIAL AND METHODS

The present investigation was conducted during 2021-2022 (*rabi*) at the agriculture research farm school of agriculture, Abhilashi University, Mandi (HP). The soil of the experimental field was sandy lome with a pH of 5.95.

The experiment consists of 7 treatments laid out in a Randomized Block Design with three replications. Treatments included $T_1$ (Absolute Control), $T_2$ (100% recommended NPK through chemical fertilizers), $T_3$ (100% FYM), $T_4$ (100% recommended dose through Vermicompost), $T_5$ (NPK 50% + FYM 25% + Vermicompost 25%), $T_6$ (NPK 25% + FYM 50% + Vermicompost 25%), $T_7$ (NPK25%+ FYM 25% + Vermicompost 50%). All the treatments except absolute control received uniform doses of NPK, FYM and Vermicompost.

The seeds of radish cv. Pusa Desi were dibbled at spacing of 30 x 10cm in ridge and furrow method. Thinning was done 10 – 15 days after sowing. Irrigation immediately after seed sowing and then once in 7-9 days. The proper irrigation helps to maintain the optimum soil moisture in the field. Two weedings were done manually first after 15 days, second 25 days after germination, and one-time hand hoeing before root development. With the help of proper weeding practices, the farmers can improve the quality of their product, because the

nutrient uptake capacity of the weeds are much higher than the crop plants. The organic manures under study were FYM, vermicompost and inorganic manures were Urea, SSP and MOP. Both organic and inorganic manures were applied alone and in combinations. Organic manures were incorporated as basal dose during field preparation 15 days before sowing. The observations were recorded growth, yield attributes and economics.

The obtained data was subjected to analysis using MS-Excel and OPSTAT online statistical program (sheoran et al. 1998). To interpret the treatment differences the results were compared at 5 per cent level of significance. The treatment effects were compared using the transformed means. The significance of the treatment difference was judged by using critical difference (C.D).

## RESULTS AND DISCUSSION

### Growth Parameters:

All the growth parameters i,e. Days to 50 % crop emergence (5.66), Numbers of leaves per plant at 30 DAS (7.72) and at harvesting (14.28), Root Length at 30 DAS (12.10 cm) and at harvesting (26.43 cm) and Shoulder Diameter of root 30 DAS (3.13 cm) and at harvesting (5.70) maximum values was recorded in T5 (NPK 50% + FYM 25% + Vermicompost 25%). Maximum parameters were followed by T2 (100% NPK). Whereas the minimum values were recorded in T1 (Absolute Control). Increasing the values of all growth parameters directly depend upon the proper nutrient supply to the crop plant. The nutrients need of crop was fulfil by the proper combination of organic and inorganic fertilizers supply to the soil. So in treatment T5 there was the combination of integrated nutrient management, and in proper ways the nutrients was supplied to the soil. As a result, it was clear that the best result in T5 was reported with the use of proper amount of organic and inorganic fertilizers to the soil. The data presented in Table 1.

### Yield and its attributes parameters:

All the yield parameters i,e. Effective plant population at harvest (per ha) (156), fresh weight of root (195.18 gm), Dry weight of root (39.04 gm), Root Yield per plot (28.23 kg) and harvest index (45.45%) maximum value was recorded in $T_5$ (NPK 50% + FYM 25% + Vermicompost 25%). Maximum parameters were followed by $T_2$ (100% NPK). Whereas the minimum values were recorded in $T_1$ (Absolute Control). Increasing the yield is directly proportional to the sufficient amount of manure and fertilizers to the soil according to the nutrients demand of crop and soil. As a result, with proper nutrients supply plays very important role in the growth of any plant or any crop. If growth of the plants are good already the yield parameters should be increased. So, in treatment $T_5$ there was the combination of integrated nutrient management, and in proper ways the nutrients were supplied to the soil. As a result, it was clear that the best result in T5 was reported with the use of proper amount of organic and inorganic fertilizers to the soil. The data presented in Table 2.

### Economics:

Higher money value and less cultivation cost are the desirable traits for getting higher returns. The following treatments, the maximum cost of cultivation (Rs/ha 123814.2) was recorded in $T_4$ (100% recommended doze through vermicompost) and maximum Gross return (Rs/ha$^{-1}$ 470530) and maximum net return (Rs/ha$^{-1}$ 376997.53) was recorded in $T_5$ (NPK 50%

+ FYM 25% + Vermicompost 25%). Whereas the minimum gross return and net return was recorded in $T_1$ (Absolute Control). Economically the study suggested that the combined application of inorganic and organic manure and fertilizers (NPK 50% + FYM 25% + Vermicompost 25%) were highly beneficial for all the growth and yield parameters of radish. The data presented in Table 3.

| S. No. | Treatments | Days to 50% emergence | Numbers of leaves | | Root Length | | Shoulder Diameter | |
|---|---|---|---|---|---|---|---|---|
| | | | 30 DAS | At harvest | 30 DAS | At harvest | 30 DAS | At harvest |
| $T_1$ | Absolute Control | 15.33 | 5.83 | 9.81 | 7.06 | 17.66 | 1.66 | 3.80 |
| $T_2$ | 100% recommended NPK through chemical fertilizers | 8.33 | 6.66 | 13.70 | 9.26 | 23.16 | 3.06 | 5.10 |
| $T_3$ | 100% FYM | 14.00 | 6.04 | 12.58 | 8.20 | 20.50 | 1.80 | 4.40 |
| $T_4$ | 100% recommended dose through Vermicompost | 12.33 | 6.17 | 12.73 | 8.36 | 20.90 | 2.00 | 4.78 |
| $T_5$ | NPK50%+FYM25%+Vermicompost25% | 5.66 | 7.72 | 14.28 | 12.10 | 26.43 | 3.13 | 5.70 |
| $T_6$ | NPK25%+FYM50%+Vermicompost 25% | 11.33 | 6.33 | 13.31 | 8.70 | 21.70 | 2.40 | 4.93 |
| $T_7$ | NPK25%+FYM25%+Vermicompost+50% | 9.66 | 6.48 | 13.49 | 8.80 | 21.96 | 2.80 | 5.03 |
| SE (m) ± | | 0.563 | 0.337 | 0.581 | 0.55 | 1.24 | 0.22 | 0.17 |
| CD at 5% | | 1.755 | 1.050 | 1.809 | 1.73 | 3.88 | 0.68 | 0.55 |

**Table 1.** Growth Parameters

| S. No. | Treatments | Effective plant population | Weight of Roots | Weight of Roots | Root Yield | Harvest Index |
|---|---|---|---|---|---|---|

| | | at harvest | Fresh | Dry | 30 DAS | At harvest | Yield (kg) | Yield (q) | |
|---|---|---|---|---|---|---|---|---|---|
| $T_1$ | Absolute Control | 104.67 | 130.89 | 26.17 | 7.06 | 17.66 | 13.73 | 228.76 | 31.01 |
| $T_2$ | 100% recommended NPK through chemical fertilizers | 141.67 | 191.78 | 38.35 | 9.26 | 23.16 | 27.10 | 451.81 | 41.56 |
| $T_3$ | 100% FYM | 127.00 | 166.22 | 33.24 | 8.20 | 20.50 | 21.08 | 351.43 | 33.42 |
| $T_4$ | 100% recommended dose through Vermicompost | 128.33 | 172.83 | 34.56 | 8.36 | 20.90 | 22.12 | 368.75 | 36.94 |
| $T_5$ | NPK50%+FYM25%+Vermicompost25% | 156.00 | 195.18 | 39.04 | 12.10 | 26.43 | 28.23 | 470.53 | 45.45 |
| $T_6$ | NPK25%+FYM50%+Vermicompost 25% | 134.00 | 183.80 | 36.76 | 8.70 | 21.70 | 24.69 | 411.62 | 36.37 |
| $T_7$ | NPK25%+FYM25%+Vermicompost+50% | 143.33 | 185.30 | 37.06 | 8.80 | 21.96 | 26.62 | 443.72 | 40.65 |
| SE (m) ± | | 3.303 | 7.662 | 1.532 | 0.55 | 1.24 | 1.168 | 19.48 | 1.12 |
| CD at 5% | | 10.289 | 23.869 | 4.773 | 1.73 | 3.88 | 3.640 | 60.68 | 3.5 |

**Table 2.** Yield Attributes

**Table 3**. Economics

| S. No. | Treatments | Cost of cultivation (Rs/h) | Gross Return (Rs/ha) | Net Returns (Rs/ha) |
|---|---|---|---|---|
| $T_1$ | Absolute Control (no manure or fertilizers) | 70314.2 | 228770 | 158455.8 |
| $T_2$ | 100% recommended NPK through chemical fertilizers | 78250.29 | 451810 | 373559.71 |
| $T_3$ | 100% FYM | 93814.2 | 351430 | 257615.8 |
| $T_4$ | 100% recommended dose through Vermicompost | 123814.2 | 368750 | 244935.8 |
| $T_5$ | NPK50%+FYM25%+Vermicompost25% | 93532.47 | 470530 | 376997.53 |
| $T_6$ | NPK25%+FYM50%+Vermicompost 25% | 97423.42 | 411620 | 314196.58 |
| $T_7$ | NPK25%+FYM25%+ Vermicompost 50% | 104923.42 | 443120 | 338196.58 |

**Conclusion:**

On the basis of the result obtained in the present investigation, it may be concluded that $T_5$ (NPK50%+ FYM 25% + Vermicompost 25%) showed maximum values in the growth, yield Parameters and also observed maximum gross return, net return values in radish. This treatment is closely followed by $T_2$ (100% NPK). And whereas the minimum values were obtained in $T_1$ (Absolute Control).

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