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RESPONSE OF INTEGRATED NUTRIENT MANAGEMENT ON VEGETATIVE GROWTH, YIELD, QUALITY AND ECONOMICS OF RADISH (*RAPHANUS SATIVUS*) CV. JAPANESE WHITE

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ABSTRACT

A field experiment was conducted in Rabi season during the year 2019-20 at Agricultural Research Farm of RBS College, Bichpuri, Agra, U.P. India to study the effect bio-fertilizers along with organic and inorganic fertilizers on growth and yield of radish (*Raphanus sativus* L.) cv. Japanese white. The experiment was laid out in Randomized Block Design with three replications and eight treatments. The treatment combination consisted of T_0- control, T_1-100% RDF, T_2-80% RDF +Vermicompost, T_3-80% RDF +PSB, T_4-80% RDF +Vermicompost +PSB, T_5-50% RDF +Vermicompost,T_6-50% RDF + PSB, and T_7-50% RDF +Vermicompost +PSB. Among the treatments application of 80% RDF applied with 5 t ha^{-1} Vermicompost and 4 kg ha^{-1} PSB resulted in maximum values of growth, yield attributes and 100% yield of radish.

***Keywords* :** Radish, Root yield, Bio-fertilizer, Plant height, Quality and Economics.

Introduction

Radish (*Raphanus sativus* L.) is one of the most important root crops belonging to the family Cruciferae. It is grown both in tropical and temperate regions of the world and is probably a native of Europe and Asia. Radish is grown for its edible young, tender and fusiform roots which are eaten raw as a salad or cooked as a vegetable. It is a good source of minerals, vitamins A and C and has good medicinal properties.

In India, during 2017-18 radish was cultivated on 209 thousand hectares with an annual production of 3061 thousand metric tonnes. It is cultivated throughout country, mostly in West Bengal, Bihar, U.P., M.P., Punjab, Assam, Haryana, Gujarat and Himachal Pradesh. The area and production of radish in Uttar Pradesh during 2017-18 was 5.84 thousand hectares and 150.27 thousand MT, respectively (Horticulture statistics at a glance, 2018).

Organic agriculture is gaining movement in India due to the individual as well as group efforts to conserve environments. Vermicompost provides vital macronutrients (N, P_2O_5, K_2O, Ca and Mg) and micronutrients Fe, Mn, Zn and Cu). The chemical analysis of vermicompost reveals that the N, P_2O_5, K_2O content was 0.8, 1.1, 0.5, respectively (Namalata, 2011). Biofertilizer or microbial inoculants are eco-friendly, non-bulky, cheap and renewable sources of nutrients for plants. The application of bio-fertilizers also helps in improving biological activities of soil. The integrated nutrient management system approach utilizes a judicious combination of inorganic fertilizers and organic manures in building soil fertility and to increase the production potential of any crop (Khalid *et al.,* 2015). Moreover, this approach is economically cheap, technically sound and practically feasible and can maintain the sustainability in production. Therefore, integrated nutrient management practice is the only answer to produce good quality yield. Keeping in view the above facts in mind, the present experiment was planned to use organic, inorganic and biofertilizers on growth and yield contributing characters of radish.

Materials and Methods

The study was conducted in Rabi season during the year 2019-20 at Agricultural Research Farm of RBS College, Bichpuri, Agra, U.P. India (27.2^0 N latitude and 77.9^0E longitude and 168 m above mean sea level). The soil was sandy loam in texture, slightly alkaline in reaction (pH 8.10) low in available organic carbon (0.32%) and nitrogen (183.0 kg ha^{-1}), medium in available phosphorus (28.30 kg P_2O_5 ha^{-1}) and sufficiently higher in available potassium (290kg K_2O ha^{-1}). The treatment combinations consisted of an organic manure (Vermicompost), Bio-fertilizer (PSB) and recommended dose of NPK (100:80: 50 kg^{-1})along with control. Thus, eight treatments viz. T_0- control, T_1-100% RDF, T_2-80% RDF +Vermicompost, T_3-80% RDF +PSB, T_4-80% RDF + Vermicompost +PSB, T_5-50% RDF + Vermicompost, T_6-50% RDF + PSB, T_7-50% RDF + Vermicompost +PSB were laid out in Randomized Block

Design with three replications. The Radish (cv. Japanese white) seeds @ 10 kg ha^{-1} were treated with 0.02% Thiram and sown on 5th December 2019 in plot of 1.8m x 2.2 m size. The distance between row to row and plant to plant was kept as 30 × 10 cm. Nitrogen was applied in the form of urea, phosphorus in the form of single super phosphate and potash in the form of muriate of potash as per treatment. Entire quantity of phosphorus and potash and half dose of nitrogen were applied as basal dressing at the time of sowing, remaining half dose of nitrogen was applied after 25 days of sowing. Vermicompost @ 5 tonnes ha^{-1} and PSB @ 4 kg ha^{-1} were applied in rows before sowing the seeds. Standard package of practices was adopted, and sufficient irrigation was applied to maintain a continuous supply of moisture throughout the root zone. Observations were recorded from randomly selected three plants per plot at 15 days interval from germination. The data was analyzed by adopting the standard procedure of *Panse and Sukhatme* (1985). Wherever, the results were found significant, critical differences (CD) were computed at 5 % level of probability to draw statistical conclusions.

Results and Discussion

Growth characters

The results of the present investigation revealed that there was a significant difference on the vegetative growth parameters, viz., plant height, number of fully open leaves, length of longest leaf and width of longest leaf (Table 1). The plant height (38.04 cm) was recorded to be significantly higher due to the combined application of 80% RDF + VC +PSB and the magnitude of increase was to the tune of 6.23 to 27.22 per cent over rest of the treatments and control. The number of fully open leaves per plant, length and width of longest leaf showed significant variations due to different treatments. All these growth characters appreciably increased with the combined application of 80% RDF + VC +PSB over all other treatments. The significant effect on these parameters, as consequence of organic manures and bio-fertilizer are attributed to the increased nutritional status of soil resulting into increased growth of the crop. This may be attributed to favorable effect of organic sources on microbial activity and root proliferation in soil which caused solubilizing effect on native nitrogen, phosphorus, potassium and other nutrients and organic manures also decreases exploitation of micronutrients.

Application of Organic manure also enhanced the vegetative growth of radish and also acted as stimulate for supply of plant nutrient during the course of microbial decomposition and enabled the crop to utilize nutrient and water more efficiently. It also releases macro and micronutrients during microbial decomposition which ultimately improved the vegetative growth. These results are in close agreement with the findings of Verma, *et al.* (2016) and Khede, *et al.* (2019).

Yield attributes and yield

The application of vermicompost and PSB in combination with different levels of inorganic fertilizers significantly increased the yield parameters. At harvest the significantly maximum values of yield attributes *i.e.* fresh wight of leaves plant^{-1} (119.41 g), fresh weight of roots plant^{-1} (178.25 g), root diameter (3.92 cm) root length (26.15 cm) as well as yield (586.11 q ha^{-1}), were achieved by application of 80% RDF + VC +PSB (T_4) followed by T_2 (80% RDF +VC) and T_3 (80% RDF +PSB) Whose as minimum values were recorded in control (T_0)

The increase in all these yield attributes may be due to higher level of nitrogen from vermicompost and bio-fertilizers along with reduced quantity of RDF. The nitrogen will also be synthesized into amino acids which are built into complex proteins and help in promoting the luxurious growth of crop. This might be due the facts that combined application of RDF, vermicompost and PSB helped in increasing number of leaves, expansion of leaf area and chlorophyll content which together might have accelerated the photosynthetic rate and in turn increased the supply of carbohydrates to the plants. The application of 80% RDF + VC +PSB favored the metabolic and auxin activities in plant and ultimately resulted in increased root weight, root diameter, root length and finally the total yield. Similarly, vermicompost and PSB improved physical, chemical and biological properties of soil which consequently increased the value of growth parameters, yields attributes and finally yield. Phospho bacteria would have caused more mobilization and solubilization of insoluble P in the soil and improved the availability of phosphorus which would have caused an increased uptake of phosphorus in plants (Mali, *et al.* 2018). It supplied nitrogen, phosphorus, potassium of which phosphorus involved in cell division, photosynthesis and metabolism of carbohydrates where potash regulated proper translocation of photosynthates and stimulated enzyme activity which in turn might have increased the rate of growth and positive development in yield characters which was resulted in high root yield of radish. These findings of the study are in proximity of the findings of Khalid *et al.* (2015), Verma, *et al.* (2016) Mali, *et al.* (2018).

Economics of various treatments

The regional adaptability of any agronomic practice in the cultivation of any crop is completely based on maximum economic value of treatments. Based on the cost analysis, highest net profit of Rs. 125129 ha^{-1} was recorded when 80% RDF applied with 5 t ha^{-1} Vermicompost and 4 kg ha^{-1} PSB but maximum B:C ratio (3.66) was noted with application of 80% RDF +PSB4 kg ha^{-1}. Additional benefit with each rupee invested in this case is due to less investment as compared to the same treatment with vermicompost which costs higher.

In the present investigation, supplementation of radish with organic fertilizers along with bio-fertilizer resulted in higher growth and yield parameters. Therefore, to produce a sustainable higher yield of radish it is recommended to make use of Vermicompost @ 5 tonnes ha^{-1}and PSB @ 4 kg ha^{-1}along with 80% RDF to enhance growth and yield in addition to improve soil fertility in radish cultivation. The present findings are supported by Kirad *et al.* (2010) Verma *et al.* (2016) and Khede *et al.* (2019).

Table 1 : Effect of various treatments on growth Characters of radish cv. Japanese white

Treatments	Plant height (cm)	No. of fully open green leaves	Length of longest leaf (cm)	Width of longest leaf (cm)
(T_0) Control	29.90	9.33	26.14	6.81
(T_1) 100% RDF	35.81	10.84	32.76	8.91
(T_2) 80% RDF +VC	34.44	10.77	33.79	8.94
(T_3) 80% RDF +PSB	34.85	10.55	33.02	8.84
(T_4) 80% RDF + VC +PSB	38.04	11.46	37.27	9.69
(T_5) 50% RDF + VC	34.32	10.11	31.87	8.47
(T_6) 50% RDF + PSB	34.03	9.99	31.51	7.94
(T_7) 50% RDF + VC +PSB	34.66	10.22	32.06	8.58
SEm±	0.92	0.31	0.57	0.51
CD at 5%	2.79	0.94	1.73	1.55

Table 2 : Effect of various treatments on yield attributes of radish cv. Japanese white

Treatments	Fresh weight of leaves (g) plant^{-1}	Fresh weight of roots (g) plant^{-1}	Diameter of root (g)	Length of root (cm)	Yield of root (qha^{-1})
(T_0) Control	94.27	135.55	2.56	20.5	280.00
(T_1) 100% RDF	103.85	152.53	3.28	22.05	443.33
(T_2) 80% RDF +VC	111.08	164.40	3.40	23.18	494.44
(T_3) 80% RDF +PSB	105.29	152.74	3.33	22.10	476.67
(T_4) 80% RDF + VC +PSB	119.41	178.25	3.92	26.15	586.11
(T_5) 50% RDF + VC	100.25	144.58	3.24	22.45	415.56
(T_6) 50% RDF + PSB	99.98	140.87	3.22	21.65	408.33
(T_7) 50% RDF + VC +PSB	103.53	148.74	3.28	22.85	436.67
SEm±	1.87	1.74	0.16	0.52	17.42
CD at 5%	5.67	5.28	0.49	1.58	52.78

Table 3 : Effect of various treatments on yield and economics of radish cv. Japanese white

Treatments	Root Yield (q ha^{-1})	Gross income (q ha^{-1})	Cost of cultivation (q ha^{-1})	Net income (q ha^{-1})	B:C ratio
(T_0) Control	280.00	84000	23600	60400	2.56
(T_1) 100% RDF	443.33	132999	30479	102520	3.36
(T_2) 80% RDF +VC	494.44	148332	49104	99228	2.02
(T_3) 80% RDF +PSB	476.67	143001	30704	112297	3.66
(T_4) 80% RDF + VC +PSB	586.11	175833	50704	125129	2.47
(T_5) 50% RDF + VC	415.56	124668	47042	77626	1.65
(T_6) 50% RDF + PSB	408.33	122499	28642	93857	3.28
(T_7) 50% RDF + VC +PSB	436.67	131001	48642	82359	1.69

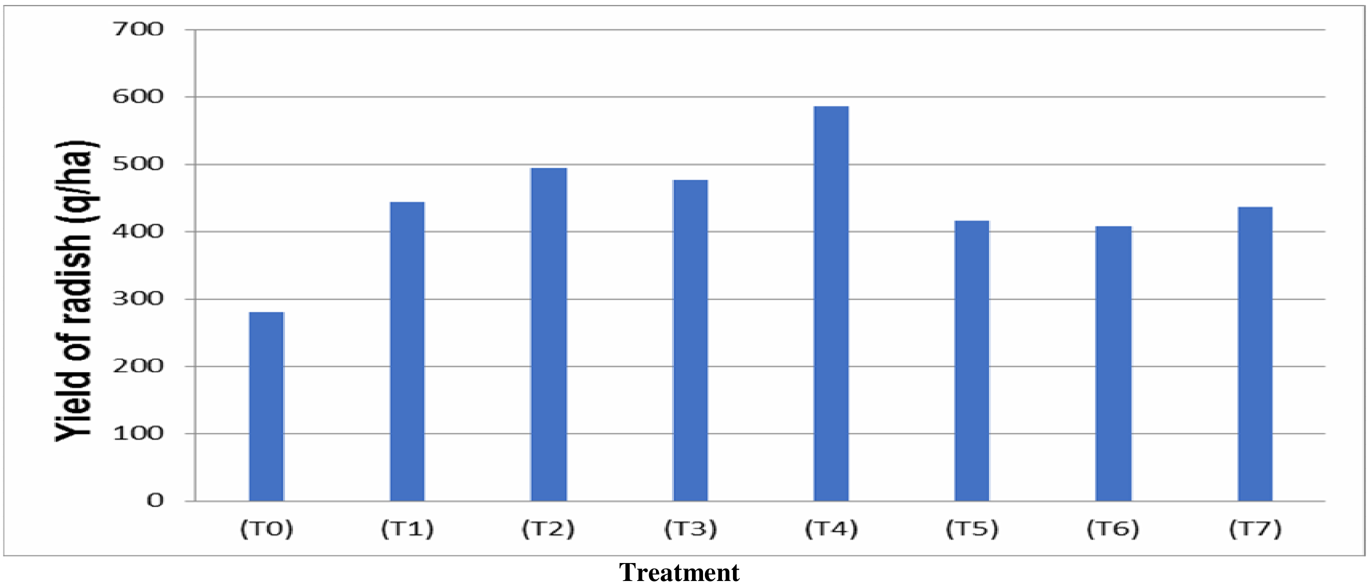

Fig. 1 : Yield of radish (q ha^{-1}) as influence by different treatments

References

Khalid, M.; Yadav, B.K. and Yadav, M.P. (2015). Studies on the effect of integrated nutrient management on growth and yield attributes of radish (*Raphanus sativus* L.). *Annual of Horticulture*, 8(1): 81-83.

Khalid, M.; Yadav, B.K. and Yadav, M.P. (2015). Studies on the effect of integrated nutrient management on growth and yield attributes of radish (*Raphanus sativus* L.). *Annual of Horticulture*, 8(1): 81-83.

Khede, K.; Kumawat, A. and Tembare, D. (2019). Effect of Organic Manures, Fertilizers and their Combinations on Growth, Yield and Quality of Radish (*Raphanus sativus* L.) cv. Japanese White, *International Journal of Current Microbiology and Applied Sciences, 8*(3): 400-405.

Khede, Kaluram; Kumawat, A. and TembareD. (2019) Effect of Organic Manures, Fertilizers and their Combinations on Growth, Yield and Quality of Radish (*Raphanus sativus* L.) cv. Japanese White, *International Journal of Current Microbiology and Applied Sciences, 8*(3): 400-405.

Mali, D.L.; Singh, V.; Sarolia, D.K.; Teli, S.K.; Chittora, A. and Dhakar, R. (2018). Effect of organic manures and bio-fertilizers on growth and yield of radish (R*aphanus sativus* L.) *cv*. Japanese white*, International Journal of Chemical Studies,* 6(2): 1095-1098

Namalata, H. (2011). Varietal Trial of Different Radish (Raphanus sativus) Varieties under Claveria condition, 6-11.23.

Panse, V.G. and Sukhatme, P.V. (1967). Statistical methods for Agricultural workers. I.C.A.R., New Delhi.

Verma, U.K.; Kumar, R.; Kumar, S. and Kumar, A. (2016). Integrated effect of organic manures and inorganic fertilizers on growth, yield and yield attributes of Radish cv. Kalyanpur Safed, *International Journal of Agricultural Invention*, 1(2): 158–161.