Original Research Article

Effect of organic manures with inorganic fertilizer on growth and yield performance of radish (*Raphanus sativus* L.) C.V. Japanese White

Abstract

A Field experiment was conducted during Kharif season of 2018 at research farm of Udai Pratap (Autonomous) College, Varanasi (U.P.) adjoining the Department of Horticulture. The experiment consisted of Six treatments comprising of combinations of recommended dose of organic and inorganic manures (FYM, Vermicompost and poultry manures). The experiment was laid out in randomized block design with three replications. The applications of 50% RDN through Vermicompost @ 7.5 ton/ha + 50% RDN through poultry manures @ 5 ton/ha (T_4) resulted in maximum value of growth and yield attributes *viz.* maximum growth (*i.e*. leaf length), yield parameters (*i.e*. root length, root weight, root diameter, root yield/ plot) and root yield q/ha. It is revealed from the data obtained that the significantly maximum root yield/ha of radish was recorded with the application of 50% RDN through Vermicompost + 50% RDN through poultry manures (PP with organic methods) (T_4) along with maximum net return of and maximum benefit cost ratio.

Keywords: Radish, organic manure, growth, yield, FYM, inorganic RDN.

Introduction

Radish (*Raphanus sativus* L.) belongs to the family Brassicaceae. It is a popular root vegetable crop. Radish belongs to the genus *Raphanus* and species *sativus*. It is originated in Europe and Asia. It is mainly cool season crop and popular in both tropical and temperate regions. In India, during 2018-19 radish was cultivated on an area of 209 thousand hectares with annual production of 3061 thousand metric tonnes (NHB, 2018-19). It is cultivated throughout India, mostly in West Bengal, Bihar, U.P., M.P., Punjab, Assam, Haryana, Gujarat and H.P. Radish is grown for its young tender tuberous root which is consumed either cooked or raw. It is a good source of vitamin-c and minerals like calcium, potassium and

phosphorus. It has refreshing and diuretic properties. It is also used for neurological headache, sleeplessness and chronic diarrohea. The roots are also useful in urinary complaints and piles. The leaves of radish are good source for extraction of protein on a commercial scale and radish seeds are potential source of non-drying fatty oil suitable for soap making illuminating and edible purposes. (Kumar *et al*.2014). Due to increasing demands for food supply by the ever-growing population, production systems using chemicals and fertilizers were adopted. This has dramatic effect on the enhancement of production and productivity, but not without a cost. Continuous use of chemical fertilizers has resulted in nutritional imbalance, depletion of soil organic matter, contamination of food and water, adverse effect on biodiversity as well as on human health. Supply of nutrients through organic sources can be opted for avoiding the hazardous effects of fertilizers and maintaining sustainability. Organic agriculture is derived as a production system, which largely excludes or completely avoids the use of synthetically compounded pesticides, fertilizers, growth regulators, preservatives and livestock feed additives. Organic manures are extremely advantageous in enriching soil fertility and do not contain any chemicals which are harmful. Organic manures feed the soil and maintain sustainability in the agro-ecosystem. Organic components like FYM, vermicompost and poultry manures may play a major role in supplementing the crop nutrients through their direct addition, improvement in soil condition, nitrogen fixation and solubilisation of fixed forms of phosphorus and zinc in soil.

Materials and methods

The field experiment was conducted during *Kharif* season of 2018 on research farm of Udai Pratap (Autonomous) College, Varanasi (U.P.) adjoining the Department of Horticulture. The soils of Varanasi formed on alluvial, deposited by river Ganga. The experiment was conducted under randomized block design (RBD) with six treatment combinations (T_0– Control,T_1 -Conventional practices- recommended FYM + fertilizer + PP with chemicals, T_2 - 100% RDN through Vermicompost T_3 (100% RDN through FYM)Treatments were replicated thrice making the total number of 18 plots. Seeds of radish were sown on 24th Oct. 2018 treatment wise by hand dibbling method. Field was prepared by ploughing with disc and cross harrowing followed by planking in all the plots. Nitrogen, Phosphorus and potassium at 60:50:50 kg NPK per ha in the form of urea, diamonium phosphate and muriate of potash, FYM, vVermicompost, poultry manures respectively were applied as a basal dose as per treatments. The seeds were sown at a spacing of 45 x 10 cm on ridges. The seed sowing

was done 1.25 cm deep to facilitate good root production. After sowing, the seeds were covered properly with soil by using of rake. The seeds were sown at the rate of 12 kg/ha. The first light irrigation was given on 27st Oct., 2018 and subsequent irrigations were given as and when required at an interval of 5 to 8 days depending upon soil moisture. Two weeding *i.e.* first at 15 days after and second at 30 days after germination were done manually. The observations on different growth and yield parameters were recorded on ten randomly selected competitive plants of each plot in each replication. The data recorded on various parameters were subdivided into two categories during the period of experimentation. Growth parameters (Leaf length (cm) and Number of leaves per plant), Yield parameters (Root length (cm), Root diameter (cm), Root weight (g), Total yield per plot (kg), Total yield per hectare (q)) and maximum gross return, net return , maximum benefit cost ratio of treatments. The details of treatment combinations presented in **Table-1.**

Results and discussion

***Growth and yield attributing traits*:** The leaf length increased significantly with the increased crop growth period. At 45 days after sowing, the significantly maximum leaf length of 17.84 cm (**Table no.-2**) was recorded in T_4 (50% RDN through Vermicompost + 50% RDN through poultry manure) (PP with organic methods). The minimum leaf length of 12.23 cm was observed in T_0 (Control- zero application). The findings are in agreement with the result of Zhou-Dongmei *et al*. (2005)[1], Rani *et al*. (2006)[2], Sunandarani and Mallareddy (2007)[3], Uddain *et al*. (2010)[4], Yanthan *et al*. (2012)[5], Kumar *et al*. (2014)[6]. The number of leaves/plant recorded at 45 days after sowing, the maximum number of 13.18 leaves per plant (table no.-1) was recorded in T_1 (Conventional practices- recommended FYM + fertilizer + PP with chemicals). The minimum number of 8.46 leaves/plant was recorded in T_0 (Control - zero application). The increase in number of leaves may be due to the vital macro and micronutrient availability with vermicompost (Giraddi, 1993)[7], Abbey L. (2000)[8] reported that application of vermicompost appears to be very effective amendment in onion. The increased number of leaves and leaf area in Bhunmyalaki (*Phyllanthus amarus schum*) with the application of poultry manures along with FYM were recorded by Chezhiyan *et al.* (2003)[9]. The maximum root length of 23.26 cm was recorded in T_4 (50% RDN through vermicompost + 50% RDN through poultry manure) (PP with organic methods). The minimum root length of 13.34 cm was recorded in T_0 (Control- zero application).The maximum root diameter of 4.02 cm was recorded in T_4 (50% RDN through vermicompost +

50% RDN through poultry manure (PP with organic methods). The minimum root diameter of 2.62 cm was recorded in T_0 (Control- zero application).

Yield parameters and Economics Returns: The data presented in **Table- 3** shows that the significantly maximum root weight of 197.52g was recorded in T_4 (50% RDN through vermicompost + 50% RDN through poultry manure) (PP with organic methods) followed by T_2 (100% RDN through vermicompost) (PP with organic methods) with 164.68 g, T_1 (Conventional practices- recommended FYM + fertilizer + PP with chemicals) with 163.72 g, T_5 (50% RDN through FYM + 50% RDN through poultry manure) (PP with organic methods) with 148.36g and T_3 (100% RDN through FYM) (PP with organic methods) with 140.12g. The minimum root weight of 124.26 g was recorded in T_0 (Control- zero application). The maximum root yield of 6.55 kg/plot was recorded in T_4 (50% RDN through vermicompost + 50% RDN through poultry manure) (PP with organic methods).The minimum root yield of 3.51 kg was recorded in T_0 (Control- zero application). The maximum root yield of 390.12 quintals per hectare was recorded in T_4 (50% RDN through vermicompost + 50% RDN through poultry manure) (PP with organic methods). The minimum root yield of 245.37 quintals / hectare was recorded in T_0 (Control- zero application). The higher yield is a resultant of higher growth and yield attributes. This might be due to the higher availability of the nutrients in readily available form and the C: N ratio of the soil. These findings are in agreement with the findings of Sharma *et al.* (2003)[10], Anjaiah *et al.* (2006)[11], Ahmad *et al*. (2005)[12], Kumar *et al.* (2017)[13],Kanaujia *et al.* (2010)[14] , Reddy *et al.* (2011)[15],Yanthan *et al.* (2012)[16], Mali *et al. (2018)*[17], Khade *et al.* (2019)[18] and Khatri *et al.*(2019)[19]. The data presented in Table-3 revealed that the maximum net return of Rs. 187817/ ha with benefit: cost ratio of 2.20 was recorded in T_4 (50% RDN through Vermicompost + 50% RDN poultry manure) (PP with organic methods). It was followed by T_0 (Control) with net income of Rs 107992/ha along with benefit cost ratio 1.69, T_2 (100% RDN through Vermicompost) (PP with organic methods) with net income of Rs. 141328/ ha along with benefit: cost ratio of 1.62, T_5 (50% RDN through FYM + 50% RDN through poultry manure) (PP with organic methods) with net income of Rs.121031/ha along with benefit: cost ratio of 1.40, T_1 (Conventional practices- recommended FYM + fertilizer + PP with chemicals) with net income of Rs.140998/ha along with benefit: cost ratio of 1.64. The minimum net income of T_3 (100% RDN through FYM) (PP with organic methods) with net income of Rs. 105784/ ha along with benefit: cost ratio of 1.19.

Conclusions:

On the basis of present investigation, it is concluded that The application of 50% RDN through vermicompost+ 50% RDN through poultry manure (PP with organic methods) (T_4) was found significantly superior as compared to other organic manures and recorded maximum growth (i.e. leaf length), yield parameters (i.e. root length, root weight, root diameter, root yield/ plot) and root yield q/ha. It is revealed from the data obtained that the significantly maximum root yield of 390.12q/ha of radish was recorded with the application of 50% RDN through vermicompost + 50% RDN through poultry manure (PP with organic methods) (T_4) along with maximum net return of Rs.187817and benefit cost ratio of 2.20.

References

1. Zhou-Dongmei, Hao-Xiuzhen, Wang-Yuhun, Dong-Yuan Hua and CangLong, (2005). Copper and Zn uptake by radish and pakchoi as affected by application of livestock and poultry manures. *Chamosphere,* 59(2) : 167-175.
2. Rani, N. S., Syed Ismail and Reddy, Y. N. (2006). Effect of cropping Situations and integrated nutrient management practices on growth, yield, quality and economics of growing carrot in ber-based cropping system. *Indian Journal of Dryland Agricultural Research and Development.* 21 (2):136-140.
3. Sunandarani, N. and Mallareddy, K. (2007). Effect of different organic Manures and inorganic fertilizers on growth, yield and quality of carrot (Daucus carotaL.). *Karnataka Journal of Agricultural Sciences*. 20 (3): 686-688.
4. Uddin, A.S.M.M., Hoque, A.K.M.S., Shahiduzzaman, M., Sarker, P.C.,Patwary, M.M.A. and Shiblee, S.M.A. (2004). Effect of nutrients on theyield of carrot. *Pakistan Journal of Biological Sciences.* 7 (8): 1407-1409.
5. Yanthan, T.S., Singh, V.B., Kanaujia, S.P. and Singh, A.K. (2012). Effect of integrated nutrient management on growth, yield and nutrient uptake by turnip (*Brassica rapa* L.*) cv.* Pusa sweti and their economics. *Journal of Soils and Crops.* 22 (1): 1-9.
6. Kumar, S.,Maji, S., Kumar, S. and Singh, H. D., (2014). Efficacy of organic manures on growth and yield of radish (*Raphanus sativus L*.) cv. *Japanese White*. *International J. of Plant Sciences.* 9 (1)*:* 57-60.

7. Giraddi,R. A., (1993).Vermiculture and role in agriculture.In : Proc.Course on the Officers of the State Department of Agriculture, Karnataka, *Department of Agricultural Microbiology, Univ. Agric. Sci.Dharwad*, 5:50-54.

8. Abbey, L., (2000). Effect of poultry manure and post-production application of fungicide on the shelf life of onion cv. Bawku Red. *Crop Re.*, 20 (1): 87-92.

9. Chezhiyan, N., Saraswathy, S. and Vasumathi,(2003). Studies on organic manure and biofertilizers on plant density on growth, yield and alkaloid content of bhumyamalaki (*Phyllarthus amarus* schum and thonn). *South Indian Hort.*, 51:96 101.

10. Sharma, A., Sharma, R. P., Sood, S. and Sharma, J.J., (2003). Influence of Integrated use of nitrogen, phosphorus, potassium and Farm yard manure on the yield attributing traits and marketable yield of carrot (*Doucus carota* L.) under the high hills dry temperate conditions of north western Himalayas. Indian *Journal of Agricultural Sciences.* 73 (9): 500-503.

11. Anjaiah, T. and Padmaja, G. (2006). Effect of potassium and farm yard manure on yield and quality of carrot. *Journal of Research, ANGRAU.*34 *(2):* 91-93.

12. Ahmad, T., Mazhar, M. S., Ali, H., Batool, A. and Ahmad, W., (2015). efficacy of fertilizer management on carrot productivity and quality. sci.int ,27(5),4321-4325

13. Kumar, S., Garhwal, O. P. and Sharma, A., (2017). Effect of Integrated Nutrient Management (INM) on Growth and Yield Attributes of Kharif Onion (*Allium cepa L.*). Int. J. Pure App. Bioscience, 5 (3): 854-857.

14. Kanaujia, Sentiyangla S. P. Singh, V. B. and Singh, A. K. (2010). INM for quality production of radish (*Raphanus sativus* L.) in acid alfisol. *Journal of Soils and Crops*. 20: 1, 1-9.

15. Reddy,T.P., Padmaja, G. and Rao, P.C.(2011). Integrated effect of vermicompost and nitrogen fertilisers on yield and economics of onion-radish cropping system. *Journal of Research ANGRAU.* 39 (3): 62-65.

16. Yanthan, T.S., Singh, V.B., Kanaujia, S.P. and Singh, A.K. (2012). Effect of integrated nutrient management on growth, yield and nutrient uptake by turnip (*Brassica rapa* L.*) cv*. Pusa sweti and their economics. *Journal of Soils and Crops.* 22 (1): 1-9.

17. 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 (*Raphanus sativus L.) cv*. Japanese white. *International Journal of Chemical Studies* 6(2): 1095-1098.

18. Khade, 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. Int.J.Curr.Microbiol. App.Science ,* 8(3): 400-405.

19. Khatri, K. B., Ojha, R. B., Pande, K. R. and Khanal, B. R., (2019). Effects of Different Sources of Organic Manures in Growth and Yield of radish 7(1*):* 39-42.

Table No-2: Effect of different treatments on growth and yield attributing traits of Radish.

Treatments	Leaf length at 45 DAS (cm)	Number of leaves per plant	Root length (cm)	Root diameter (cm)
T_0	12.23	8.46	13.34	2.62
T_1	15.56	13.18	19.55	3.32
T_2	15.92	12.44	19.66	3.34
T_3	14.22	11.92	16.76	2.84
T_4	17.84	12.76	23.26	4.02
T_5	14.88	12.18	17.92	3.00
SEm ±	0.46	0.39	0.68	0.20
CD (P=0.05)	1.44	1.24	2.14	0.63

Table No-3 Effect of different treatments on yield parameters and Economics of Radish.

Treatments	Root weight (g)	Root yield per plot (kg)	Root yield (q/ha)	Gross return(Rs.)*	Net return (Rs.)	B:C ratio
T_0	124.26	3.51	245.37	171759	107992	1.69
T_1	163.70	5.23	323.84	226688	140998	1.64
T_2	164.68	5.93	325.85	228095	141328	1.62
T_3	140.12	4.26	277.93	194551	105784	1.19
T_4	197.52	6.55	390.12	273084	187817	2.20
T_5	148.36	5.40	296.14	207298	121031	1.40
SEm ±	0.43	0.44	0.96			
CD (P=0.05)	1.34	1.38	3.01			