

Effects of Organic Manures and Inorganic Fertilizer on Growth and Yield Performance of Radish (*Raphanus sativus* L.) c.v. Japanese White

Abstract

A Field experiment was carried out during *Kharif* season of 2018 at the research farm in Udai Pratap (Autonomous) College; Varanasi (U.P.), India. The site was adjoining to the Department of Horticulture of the college. The experiment consisted of Six treatments comprising of combinations of recommended doses of organic and inorganic manures (FYM, Vermicompost and poultry manures). The experiment was laid out in a Randomized Complete Block Design (RBD) with six treatment combinations (T₀– Control, T₁ - Conventional practices- recommended FYM + fertilizer + PPI with chemicals, T₂ -100% RDF through Vermicompost T₃ (100% RDF through FYM), T₄ -50% RDF through Vermicompost +50% RDF through poultry manure and T₅ -50% RDF through FYM + 50% RDF through poultry manure. The applications of 50% RDF through Vermicompost at 7.5 ton/ha + 50% RDF through poultry manures at 5 ton/ha (T₄) resulted in maximum value of growth and yield attributes viz. maximum growth (leaf length), yield parameters (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% RDF(Recommended dose of Fertilizer) through Vermicompost + 50% RDF through poultry manures (PPI-Pre plant Incorporation with organic methods) (T₄) along with maximum net return of and maximum benefit cost ratio.

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

Introduction

“Radish (*Raphanus sativus* L.) belongs to the family Brassicaceae. It is a popular root vegetable crop originated from Europe and Asia. It is mainly a cool season crop and it is popular in both tropical and temperate regions. In India, during 2018-19 radish was cultivated on an area of 209,000 ha with annual production of 3061,000 MT (NHB, 2018-19). It is

cultivated throughout India, mostly in West Bengal, Bihar, U.P., M.P., Punjab, Assam, Haryana, Gujarat and H.P” (Kumar et al.2014). “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 and It is also used for treatment of neurological headache, sleeplessness and chronic diarrhoea as well as urinary complaints and piles. The leaves of radish are good sources for the extraction of protein on a commercial scale while the seeds are potential sources of non-drying fatty oil that is 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 to avoid the hazardous effects of fertilizers and maintaining sustainability. Organic agriculture is as a production system, which largely excludes or completely avoids the use of synthetically compounded pesticides, fertilizers, growth regulators, preservatives and livestock feed additives”[1-3]. Organic manures are extremely advantageous in enriching soil fertility and do not contain any chemicals which are harmful-Organic manures it feed the soil and maintain its sustainability in the agro-ecosystem [3,6]. “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” [15]

Materials and methods

The field experiment was conducted during *Kharif* season of 2018 on the research farm of Udai Pratap (Autonomous) College, Varanasi (U.P.) that is adjoining to the Department of Horticulture. The soils of Varanasi formed on alluvial, deposited by river Ganga was used for the study. The experiment was conducted under Randomized Complete Block Design (RBD) with six treatment combinations (T₀- Control, T₁ -Conventional practices- recommended FYM + fertilizer + PPI(pre plant incorporation) with chemicals, T₂ -100% RDF(Recommended doses of fertilizer) through Vermicompost T₃ (100% RDF through FYM). The treatments were replicated thrice for a total of 18 plots. The seeds of radish were

sown on 24th Oct., 2018, by hand dibbling method. The 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 per ha as NPK Through the combine use of urea in di-ammonium phosphate and muriate of potash, while FYM, vermicompost and poultry manures were respectively applied as a basal treatments. The seeds of radish were sown at a spacing of 45 x 10 cm on ridges and the seed sowing was done at 1.25 cm deep to facilitate good root production. After sowing, the seeds were covered properly with soil by the use of rake. The seeds were sown at the rate of 12 kg/ha. The first irrigation was carried out on 27st Oct., 2018 while subsequent irrigations were carried out at interval of 5 to 8 days depending on the soil moisture condition. Manual weeding was carried out twice, with the first and second weeding 15 days and second at 30 days after germination were on different growth and yield parameters were recorded on ten randomly selected plants of each plot in each replication. The data collected includes growth parameters such as (Leaf length (cm) and number of leaves per plant), and yield parameters such as (root length (cm), root diameter (cm), root weight (g), total yield per plot (kg), which was extrapolated to yield per hectare (q)) while and maximum gross return, net return, maximum benefit cost ratio of treatments were calculated. The details of treatment combinations presented in **Table-1**.

Table-1 Treatment details and their combination.

S. No.	Treatment Combination
1.	T ₀ – Control,
2.	T ₁ -Conventional practices- recommended FYM + fertilizer + PPI with chemicals,
3.	T ₂ -100% RDF through Vermicompost
4.	T ₃ (100% RDF through FYM),
5.	T ₄ -50% RDF through Vermicompost +50% RDF through poultry manure
6.	T ₅ -50% RDF through FYM + 50% RDF through poultry manure.

Results and discussion

Growth and yield performance: The leaf length at 45 days after sowing was, 17.84 cm (**Table-2**) which was obtained under T₄ while the minimum leaf length of 12.23 cm was obtained in T₀. The trends were in agreement with the results by 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, showed a highest value of 13.18 leaves per plant (**Table-1**) in T₁. “The least number of leaf was 8.46 leaves/plant which was obtained in T₀. The increase in number of leaves obtained when under fertilizer treatment 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 production”. “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 root length of 23.26 cm was obtained in T₄ was longest compared to the minimum root length of 13.34 cm was obtained in T₀. While the maximum root diameter of 4.02 cm was obtained in T₄. The minimum root diameter of 2.62 cm was obtained in T₀.

Yield parameters and Economics Returns: The data presented in **Table- 3** shows that there was significantly maximum high root weight of 197.52g with was recorded in T₄ application of (50% RDN through vermicompost + 50% RDN through poultry manure) (PP with organic methods) which was followed respectively by T₂ with 164.68 g, T₁ with 163.72 g, T₅ with 148.36g and T₃ with 140.12g. The least root weight of 124.26 g was obtained in T₀. The maximum root yield of 6.55 kg/plot was obtained in T₄. The minimum root yield of 3.51 kg was recorded in T₀. The maximum root yield of 390.12 quintals per hectare was obtained in T₄, while the minimum root yield of 245.37 quintals / hectare was obtained in T₀. The higher yield is a resultant of higher growth and yield attributing performance. This might be due to the higher availability of the nutrients in readily available form and the C: N ratio of the soil. These results are agreements 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 highest net return of Rs. 187817/ ha with benefit: cost ratio of 2.20 was recorded in T₄. It was followed by T₀ with net income of Rs 107992/ha along with benefit cost ratio 1.69, T₂ with net income of Rs. 141328/ ha along with benefit: cost ratio of 1.62, T₅ (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, T₁ (Conventional practices- recommended FYM + fertilizer with net income of Rs.140998/ha along with benefit: cost ratio of 1.64. While the minimum net income of T₃ with net income of Rs. 105784/ ha along with benefit: cost ratio of 1.19.

Conclusions:

On the basis of the results, it was concluded that the application of 50% RDN through Vermicompost+ 50% RDN through poultry manure (PP with organic methods) (T₄) was found significantly superior compared to other organic manures and it resulted to optimal growth in the plant (leaf length), the yield parameters in the term of (root length, root weight, root diameter and root yield/ plot finally, the root yield per/ha. A significant optimal radish root yield of 390.12q/ha was recorded with the application of 50% RDN through Vermicompost + 50% RDN through poultry manure (PP with organic methods) (T₄) along with net return of Rs.187817 and benefit cost ratio of 2.20, compared to the lower values obtained using the other treatments.

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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			

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