Original Research Article

Effects of oOrganic mManures andwith iInorganic fFertilizer on gGrowth and yYield pPerformance of rRadish (*Raphanus sativus* L.) cvC.V. Japanese White

Abstract

A Field experiment was conducted during Kharif season of 2018 at the research farm inof Udai Pratap (Autonomous) College, Varanasi (U.P.). 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 with three replications. The applications of 50% RDN through Vermicompost at@ 7.5 ton/ha + 50% RDN through poultry manures at@ 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 iwas 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 that. Radish belongs to the genus *Raphanus* and species *sativus*. It is originated fromin 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 thousand hectares with annual production of 3061,000 MTthousand metric tonnes (NHB, 2018-19). It is cultivated throughout India, mostly in West Bengal, Bihar, U.P., M.P.,

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Comment [DI1]: You have not defined or told us the various 6 treatments. You did not said anything about the field size and size of the blocks. You did not said anything about the planting methodology for the test crop and the planting rate per ha

Comment [DI2]: Was there no data collection and at what time what types of data that were collected?

Comment [DI3]: What is RDN?

Comment [DI4]: Maximum or optimum value?

Comment [DI5]: Is leaf length the only grotyj parameters?

Comment [DI6]: What is PP?

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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~~c~~ and minerals like calcium, potassium and phosphorus. It has refreshing and diuretic properties and ~~.~~ ~~I~~it is also used for treatment of neurological headache, sleeplessness and chronic ~~diarrhea~~diarrhoea, as well as~~. The roots are also useful in~~ urinary complaints and piles. The leaves of radish are good sources for the extraction of protein on a commercial scale, while the ~~and radish~~ 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 (provide Authority)~~.~~ Supply of nutrients through organic sources can be opted for, to avoid~~ing~~ 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 (provide Authority). Organic manures are extremely advantageous in enriching soil fertility and do not contain any chemicals which are harmfu~~l. Organic manures~~ it feed the soil and maintain its sustainability in the agro-ecosystem (provide Authority). 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,~~condition; nitrogen fixation and solubilisation of fixed forms of phosphorus and zinc in soil (provide Authority).

Comment [DI8]: Do you mean defined?

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 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). The ~~T~~treatments were replicated thrice for a ~~making the~~ total ~~number~~ of 18 plots. The ~~s~~seeds of radish were sown on 24th Oct., 2018 ~~treatment wise~~ by hand dibbling

Comment [DI9]: What is PP?

Comment [DI10]: What is RDN?

method. The ~~F~~field was prepared by ploughing with disc and cross harrowing followed by planking in all the plots. Nitrogen, ~~P~~phosphorus and potassium at 60:50:50 kg ~~NPK~~ per ha as NPK through the combined use~~in the form~~ of urea, di-ammonium phosphate and muriate of potash, while FYM, ~~v~~Vermi-compost~~,~~ and poultry manures were respectively ~~were~~ applied as a basal ~~dose as per~~ treatments. The seeds of radish were sown at a spacing of 45 x 10 cm on ridges and~~.~~ ~~T~~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~~ing~~ of rake. The seeds were sown at the rate of 12 kg/ha. The first ~~light~~ irrigation was carried out~~given~~ on 27st Oct., 2018, while ~~and~~ subsequent irrigations were carried out~~given as and when required~~ at ~~an~~ interval of 5 to 8 days depending ~~up~~on the soil moisture condition. ~~Two w~~Manual weeding was carried out twice, with the~~i.e.~~ first and second weeding at 15 and 30 days ~~after and second at 30 days~~ after seedling germination ~~were done manually~~. Data ~~The observations~~ on ~~different~~ growth and yield parameters were recorded on ten randomly selected ~~competitive~~ plants from~~of~~ each treatment replication per plot ~~in each replication~~. The data collected includes ~~recorded on various parameters were subdivided into two categories during the period of experimentation. G~~growth parameters such as (Leaf length (cm) and ~~N~~number of leaves per plant~~),~~ and ~~Y~~yield parameters such as ~~(R~~root length (cm), ~~R~~root diameter (cm), ~~R~~root weight (g), ~~T~~total yield per plot (kg)~~,~~ which was extrapolated to ~~Total~~ 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.**~~

NOTE 1:

NOTE 2

Comment [DI11]: Spell out the dara collected and how theu were collected

Comment [DI12]: Tell us how you calculated them

Comment [DI13]: There was no information on the nutrient composition of the organic materials or manures used. Were they not analyzed for in the laboratory?

Comment [DI14]: No statistical analysis used?

Results and discussion

Growth and yield* performance*~~attributing traits:~~

The leaf length ~~increased significantly with the increased crop growth period. A~~at 45 days after sowing was~~, the significantly maximum leaf length of~~ 17.84 cm (**Table ~~no.~~ 2**), which was obtained under ~~was recorded in~~ T_4 ~~(50% RDN through Vermicompost + 50% RDN through poultry manure) (PP with organic methods), whike . T~~the minimum leaf length of 12.23 cm was obtained~~served~~ in T_0 ~~(Control- zero application)~~. The trends~~findings~~ ~~a~~were in agreement with the results by~~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, showed~~the~~ a

highest~~maximum~~ value~~number~~ of 13.18 leaves per plant (~~t~~Table ~~no.~~ 1)~~ was recorded~~ in T_1 ~~(Conventional practices recommended FYM + fertilizer + PP with chemicals)~~. The least~~minimum~~ number of leaf was 8.46 leaves/plant which was obtained~~recorded~~ in T_0 ~~(Control zero application)~~. The increase in number of leaves obtained when under fertilizer treatments may be due to the vital macro and micronutrients 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 ~~maximum~~ root length of 23.26 cm obtained~~was recorded~~ in T_4 was longest compared to ~~(50% RDN through vermicompost + 50% RDN through poultry manure) (PP with organic methods). T~~the least~~minimum~~ root length of 13.34 cm for~~was recorded in~~ T_0, while, the ~~(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~~ but was 2.62 cm for~~was recorded in~~ T_0 ~~(Control zero application)~~.

NOTE:

Yield parameters and Economics Returns: The data presented in **Table- 3** shows that there was significant~~ly~~ ~~maximum~~ high root weight of 197.52g with ~~was recorded in~~ T_4 application~~(50% RDN through vermicompost + 50% RDN through poultry manure) (PP with organic methods)~~ which was followed respectivley 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 least ~~minimum~~ root weight of 124.26 g was recorded under~~in~~ T_0 ~~(Control zero application).~~ While ~~T~~the maximum root yield of 6.55 kg/plot was recorded under~~in~~ T_4 ~~(50% RDN through vermicompost + 50% RDN through poultry manure) (PP with organic methods)~~.The lowest~~minimum~~ root yield of 3.51 kg was recorded in T_0 ~~(Control zero application)~~ and. ~~T~~the highest~~maximum~~ root yield of 390.12 kg ~~quintals~~ per hectare was recorded in T_4 ~~(50% RDN through vermicompost + 50% RDN through poultry manure) (PP with organic methods)~~. The lowest~~minimum~~ root yield of 245.37 quintals / hectare was recorded in T_0 ~~(Control zero application)~~. The highest~~r~~ yield obtained in T4 might be as~~is~~ a resultant of the

Comment [DI15]: What were the nutrients and in what amount?

Comment [DI16]: What was the trend for other treatments compared to T_4 and T_0?

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Comment [DI17]: You have given the meaning of To-T5 in your methodology. No need repeating then all over

Comment [DI18]: Why change in unit?

higher growth~~ and yield~~ attributes of the radish plants resulting from the treatment applications and probably~~. This might be~~ due to the higher~~ availability of the~~ nutrients that were~~in~~ readily available form fertilizers and the low C: N ratio of the soils. 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 showed~~revealed~~ that the higher~~maximum~~ net return of Rs. 187817/ ha with benefit: cost ratio of 2.20 was recorded using~~in~~ T_4 ~~(50% RDN through Vermicompost + 50% RDN poultry manure) (PP with organic methods)~~. It was followed respectively by T_0 (Control) with net income of Rs 107992/ha and~~long with~~ benefit cost ratio of1.69, T_2 ~~(100% RDN through Vermicompost) (PP with organic methods)~~ with net income of Rs. 141328/ ha and~~long 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 and~~long with~~ benefit~~:~~ cost ratio of 1.40, T_1 ~~(Conventional practices recommended FYM + fertilizer + PP with chemicals)~~ with net income of Rs.140998/ha and~~long with~~ benefit~~:~~ cost ratio of 1.64~~.~~ and~~The minimum net income of~~ T_3 ~~(100% RDN through FYM) (PP with organic methods)~~ with net income of Rs. 105784/ ha and~~long with~~ benefit: cost ratio of 1.19.

Comment [DI19]: State how you got the net return and how you calculate the cost ratio in the methodology section

Conclusions:

On the basis of the results~~present investigation~~, it ~~i~~was concluded that ~~T~~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 it resulted to optimal ~~recorded maximum~~ growth in the plant~~(i.e.~~ leaf length~~)~~, the yield parameters in terms of ~~(i.e.~~ root length, root weight, root diameter and~~,~~ root yield/ plot~~)~~ and finally, the root yield per ~~q~~/ha. A~~It is revealed from the data obtained that the~~ significant~~ly~~ optimal~~maximum~~ radish 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, compared to the lower values obtained using the other treatments.

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No Table 1?

Table ~~No~~ 2: Effect of fertilizer~~different~~ treatments on growth and yield attribut~~esing 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 fertilizer ~~different~~ treatments on yield parameters and e~~E~~conomic~~s~~ returns o~~f~~ Radish production.

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			