Research Journal of Agriculture and Forestry Sciences ISSN 2320 – 6063
Vol. **5(11),** 1-4, November **(2017)** *Res. J. Agriculture and Forestry Sci.*

Marketable tuber yield of radish (*Raphanus sativus L.*) as influenced by compost and NPK fertilizers

Imthiyas M.S.M. and Seran T.H.*
Department of Crop Science, Faculty of Agriculture, Eastern University, Chenkalady, Sri Lanka
thayaseran@yahoo.com

Available online at: www.isca.in
Received 27th August 2017, revised 28th October 2017, accepted 6th November 2017

Abstract

An experiment was done to assess the integrated use of compost and NPK fertilizers on marketable yield of radish (Raphanus sativus L.) variety Beeralurabu. It was carried out in a randomized complete block design with eight treatments which included recommended full doses of NPK fertilizers alone, compost alone and integrated use of compost plus half doses of recommended NPK fertilizers were applied as basal application and with or without full doses of NK fertilizers as top dressing. At harvest, tuber length, tuber diameter, total root length, fresh weight of tuber, dry weight of tuber, marketable yield and biological yield were recorded. All the collected data were subjected to statistical analysis. The result revealed that full doses of NPK fertilizers alone (standard control-T2), 20 t/ha compost alone (T4) and 10 t/ha compost plus half doses of NPK fertilizers (T6) as basal application and full doses of NK fertilizers as topdressing showed statically comparable performance for maximum of the parameters such as tuber diameter, fresh and dry weights of tuber, biological yield and marketable tuber yield. Treatment T4 and T6 showed higher mean value in most of the parameters especially in fresh weight of tuber (81.14g, 81.24g respectively) than T2 (68.90g). The application of 20 t/ha compost plus half doses of NPK fertilizers as basal and full doses of NPK fertilizers as topdressing (T8) exhibited significant variations ($P<0.05$) in marketable yield as well as biological yield than standard control treatment (T2). When concerning profitable way of cultivation, T8 causes to comparatively high cost of production and it may have over plant nutrition in radish cultivation. Therefore 20 t/ha compost alone (27.04t/ha) or 10 t/ha compost plus half doses of NPK fertilizers (27.07t/ha) as basal application with topdressing was the best choices than standard control (22.96 t/ha) for the increasing marketable tuber yield of radish. Thus saving certain amount of NPK fertilizers and improving soil conditions would be the benefits in radish cultivation.

Keywords: Biological yield, Compost, NPK fertilizers, Radish, Tuber yield.

Introduction

Radish (*Raphanus sativus* L.) belongs to the family Brassicaceae and it is a popular root vegetable in both tropical and temperate regions in the world. It has some benefits on human diet and contains antioxidants and other compounds which help in the prevention of cancer[1]. In addition, it is a good source of vitamin C and minerals and also high in fiber. Seeds of radish are possible source of non-drying fatty oil which is suitable for soap making illuminating and edible purposes[2]. In radish cultivation, good cultivation practices are necessary to obtain high tuber yield of radish. In conventional fertilizer practice, NPK macronutrients are applied but other macro and micro nutrients are required for tuber formation and its growth[3].

Adequate amount of fertilizers should be applied to fulfill the tuberous requirement because excess and continuous use of fertilizer possesses drain off into adjacent waterways[4] and leads to soil and health problems. Combined use of organic and chemical fertilizers is better for improving crop yield in sandy loam soil[5]. For formation of tuberous root, good organic amendments are needed to retain water holding capacity and nutrients of soil[6].

According to literature survey, incorporation of organic materials into soil enhances soil microbial activity[7] reported that application of organic fertilizer with lower level of chemical fertilizers had significant effect on the yield attributes of vegetable crops. Therefore, the study was done to evaluate the effect of compost combined with NPK fertilizers on tuber yield of radish.

Materials and methods

This experiment was done during March to May 2014 at the Agronomy Farm, Eastern University, Sri Lanka to study the effect of compost and NPK fertilizers on tuber yield of radish (*Raphanus sativus* L.). Type of soil is sandy regosol which contains 22 N kg/ha, 235 kg/ha P_2O_5 and 224 kg/ha K_2O. The some properties of soil sample used in this experiment were given in Table-1.

The rainfall and temperature ranged from 22.2 mm to 174.2 mm and 32.6ºC to 30.5ºC respectively during the experiment. It was carried out in Randomized Complete Block Design with eight treatments (Table-2) and each replicated three times.

Table-1: Properties of soil sample used in this experiment.

Properties of soil	Values
Soil texture	Sand – 93%, silt – 3.8% and clay – 3.2%
Porosity	44.04%
True density	2.52 gcm^{-3}
Bulk density	1.41gcm^{-3}
Organic carbon	1.2 g/100g of soil
Organic matter	2.069 g/100 g of soil
Soil pH	7.33
Electrical conductivity (EC)	0.37ms/cm

Plot size was 1.2m x 0.8m. Compost was applied two weeks before seeding and recommended NPK fertilizers (90 kg/ha urea, 110kg/ha Triple super phosphate and 65 kg/ha Muriate of potash) were applied two days before seeding as basal application (Table-2). Radish seeds of "Beeralurabu" variety were planted. The spacing of plot was maintained as 30 cm between rows and 10 cm between plants. As top dressing, recommended NK fertilizers (90kg/ha urea and 65kg/ha Muriate of potash) were applied and other cultural practices were done according to the Department of Agriculture, Sri Lanka.

Table-2: Treatments used in this experiment.

Treatment code	Treatments	
	Basal dressing	Top dressing
T1 (control 1)	No fertilizers	No fertilizers
T2 (control 2)	NPK fertilizers	NK fertilizers
T3	20 t/ha compost	None
T4	20 t/ha compost	NK fertilizers
T5	10 t/ha compost + half doses of NPK fertilizers	None
T6	10 t/ha compost + half doses of NPK fertilizers	NK fertilizers
T7	20 t/ha compost	None
T8	20 t/ha compost + half doses of NPK fertilizers	NK fertilizers

At harvest, tuber length, tuber diameter, total root length, fresh and dry weights of tuber, marketable yield and biological yield were recorded. All the data were subjected to analysis of variance (ANOVA) procedures using Statistical analysis software version 6.3. The Turkey's Test was used to compare the mean differences. Furthermore, correlations between parameters were also analyzed.

Results and discussion

Tuber length: In the present study, there was no remarkable variation in tuber length of radish among the treatments (Table-3). Highest value of tuber length was obtained in T8 (17.22cm) followed by T4 (16.34cm). This is in accordance with Suthamathy and Seran[8] who stated that no significant difference was noted in tuber length of radish among the different level of manure EM bokashi.

Tuber diameter: Tuber diameter was significantly varied (P<0.01) among the treatments (Table-3). Treatment T1 remarkably differed with all treatments except T2 and T5 in tuber diameter. When 20 t/ha compost applied in T3 and T4 as basal dressing it was not statistically indicated any difference in diameter 4.07 cm and 4.21 cm respectively. In this case, T4 only received additional NK fertilizers as topdressing when compared to T3. Further, it was noted that treatments T6 (4.16 cm) and T8 (4.36cm) had statistically similar tuber diameter although T8 showed increase in fertilizer level. Yadav *et al.*[9] stated that application of vermicompost with other organic manure root volume in chili. It may be due to increase in water holding capacity nutrient of the soil by the organic manures applications.

Table-3: Tuber length, tuber diameter and total root length of radish in each treatment.

Treatments	Tuber length (cm)	Tuber diameter (cm)	Total root length (cm)
T1	13.14±1.06	3.16±0.14[b]	17.01±6.77[b]
T2	15.42±0.84	3.88±0.14[ab]	20.89±0.41[ab]
T3	15.13±1.39	4.07±0.17[a]	20.05±1.50[ab]
T4	16.34±1.71	4.21±0.21[a]	22.47±2.02[ab]
T5	15.07±1.34	3.89±0.11[b]	20.21±1.28[ab]
T6	15.92±2.18	4.19±0.13[a]	23.18±1.63[ab]
T7	15.77±0.60	4.07±0.12[a]	21.60±0.54[ab]
T8	17.22±1.62	4.36±0.13 [a]	24.82±1.41[a]
F test	ns	**	**
CV %	15.45	6.78	10.41

F test: ns-not significant, **: P<0.01. Means followed by the same letter in each column are not significantly different according to Tukey test at 5% significant level.

Total root length: Highest mean value of total root length (24.82cm) was recorded in T8 among the treatments (Table-3) and it was not significantly differed (P<0.05) from all other treatments except T1 (control 1). It may be due to the higher nutrient level in T8 than all other treatments. Similar result was recorded in Thanunathan *et al.*[10] stated that higher root length of onion was obtained in the application of vermicompost and coir pith.

Fresh weight of tuber: Highest mean value of fresh weight of tuber was rescored in T8 (88.48 g) then followed by T6 (81.24 g) and T4 (81.14g). T1 (control 1) showed higher variation with all other treatments (Table-4). But T2, T4 and T6 were shown similar mean values but in case of T8 only remarkably differed with T2 (control 2). Therefore, it could be concluded that T4 is best option for obtaining higher tuber weight while concerning the use of compost with NPK fertilizers. It suggested that when applied the various levels of plant nutrients to soil, fresh weight of tuber was increased but beyond certain level it did not show significant difference with fertilizer application. Biofertilizers give high growth and dry matter accumulation[11]. Satyanarayana *et al.*[12] stated that soil health and fertility as well as crop productivity can be enhanced by the integrated use of organic and inorganic fertilizers.

Dry weight of tuber: All treatments except T1 did not show significant effect on dry weight of tuber (Table-4) and highest dry weight of tuber was obtained in T8 (8.21 g) followed by T6 (7.56g) and T4 (7.52g) and lowest value (3.57g) was in T1 (control 1). The dry weights of tuber were not significantly differed between T1 and T5. When comparing T8 (8.21g) and T2 (6.51g), it did not differ significantly. The dry matter accumulation into tuber per plant was almost statistically equal in all treated plots except T1.

Correlation analysis: Leaf area is a prominent parameter when considering photosynthesis. While leaf area increases, photosynthetic rate will increases. It produces more starch portion to be translocated into tuberous roots in later part of growth stage. Consumer normally prefers large sized tuber with high nutrient content. There was a possible chance to increase the fresh weight of tuber by increasing the tuber diameter. It was determined according to the Pearson correlation between leaf area and tuber fresh weight as well as tuber diameter and fresh weight of tuber as given in Table-5. Positive correlations were observed between selected parameters.

Table-4: Tuber weights, marketable tuber yield and biological yield of radish in each treatment.

Treatments	Fresh weight of tuber (g)	Dry weight of tuber (g)	Marketable tuber yield (t/ha)	Biological yield (t/ha)
T1	42.44±1.91^{d}	3.57±0.13^{b}	14.14±0.63^{e}	20.66±1.12^{c}
T2	68.90±3.40^{bc}	6.51±0.23^{a}	22.96±1.13^{cd}	33.43±0.96^{b}
T3	73.39±8.51^{abc}	6.71±1.11^{a}	24.46±2.84^{bc}	35.21±2.79^{b}
T4	81.14±2.52^{ab}	7.52±0.25^{a}	27.04±0.83^{ab}	40.65±1.04^{ab}
T5	64.23±6.06^{c}	5.65±0.29^{ab}	21.41±2.02^{d}	32.96±1.84^{b}
T6	81.24±2.56^{ab}	7.56±0.17^{a}	27.07±0.83^{ab}	40.82±1.19^{ab}
T7	76.31±6.51^{abc}	7.15±0.54^{a}	25.43±2.17^{bc}	37.28±2.08^{ab}
T8	88.48±6.09^{a}	8.21±0.67^{a}	29.49±2.03^{a}	44.45±1.68^{a}
F test	**	*	*	*
CV %	12.40	14.11	4.34	8.45

F test: *P<0.05; **: P<0.01. Means followed by the same letter in each column are not significantly different according to Tukey's test at 5% significant level.

Table-5: Correlation between some selected parameters of radish in the some selected treatments.

	Correlation between leaf area and fresh weight of tuber				Correlation between tuber diameter and fresh weight of tuber			
Treatments	T2	T4	T6	T8	T2	T4	T6	T8
Correlation coefficient	0.977**	0.955**	0.954**	0.917**	0.947**	0.897**	0.914**	0.899**
P-value	0.000	0.000	0.000	0.001	0.000	0.003	0.001	0.002

** Correlation is significant at P=0.01 level (2-tailed).

Marketable tuber yield: Statistical data on marketable tuber yield is presented in Table-4. Marketable tuber weight was significantly varied (P<0.05) in T1 (control 1) with all other treatments. Among the treatments, maximum marketable tuber yield was obtained in T8 (29.49 t/ha) followed by T6 (27.07 t/ha) and T4 (27.04 t/ha) those are statistically significant to T8. But T2 (control 2) showed remarkable variation with T4, T6 and T8. Therefore, it can be concluded for getting higher marketable yield that T4 and T6 could be a possible option while concerning use of reduced levels of NPK fertilizers and optimum level of nutrient supply throughout the whole cropping season. This is close conformity with Ashgar *et al.*[13] that yield increased by integrated fertilizer usage in radish cultivation by using compost as a combination with chemical fertilizers.

Biological yield: In case of biological yield, T8 showed highest mean value (44.45 t/ha) in Table-4 and significantly differed (P<0.05) from T2 (33.43 t/ha). And there were no significant difference with T4 (40.65 t/ha) and T6 (40.82 t/ha). These two treatments were comparable with T8 when considering all other parameters. This finding is in conformity through compost application that increases tomato total yield up to 20% than chemical fertilizer alone[14].

Conclusion

Tuber length did not show significant difference among the treatments. Marketable tuber yield was varied significantly between NPK fertilizers alone (T2) and 20 t/ha compost alone (T4) or compost (10-20 t/ha) with half doses of NPK fertilizers as basal and full dose of NK fertilizers as top dressing (T6, T8). Treatment T8 gave higher mean value of tuber yield than the other treatments. But when considering cost of production, application of 20 t/ha compost alone or 10 t/ha compost plus half doses of NPK fertilizers as basal with full doses of NK fertilizers as top dressing was the best alternative than NPK fertilizers alone for obtaining higher marketable tuber yield of radish.

References

1. Coogan R.C., Wills R.B.H. and Nguyen V.Q. (2001). Pungency levels of white radish (*Raphanus sativus* L.) growth in different seasons in Australia. *Food Chemist.,* 72(1), 1-3.
2. Dhananjaya (2007). Organic studies in radish (*Raphanus sativus*l.) varieties. M.Sc. (Hort). Thesis, Department of Horticulture, College of Agriculture, Dharwad University of Agricultural Sciences, Dharwad – 580 005. 63.
3. Shehata S.A., Ahmed Y.M., Emad A., Shalaby and Oma ima Darwish S. (2011). Influence of compost rates and application time on growth, yield and chemicalcomposition of snap bean (*Phaseolus vulgaris* L). *Aust.J.Basic Appl. Sci.,* 5(9), 530-536.
4. Aisha A.H., Rizk F.K., Shaheen A.M. and Abdel-Mouty M.M. (2007). Onion plant growth, bulbs yield and its physical and chemical properties as affected by organic and natural fertilization. *Res. j. agric. biol. sci*., 3(5), 380-388.
5. Rautaray S.K., Ghosh B.C. and Mittra B.N. (2003). Effect of fly ash, organic wastes and chemical fertilizers on yield, nutrient uptake, heavy metal content and residual fertility in a rice–mustard cropping sequence under acid lateritic soils. *Bioresour. Technol.,* 90(3), 275-283.
6. Walker D.J., Clemente R. and Bernal M.P. (2004). Contrasting effects of manure and compost on soil pH, heavy metal availability and growth of *Chenopodium album* L. in a soil contaminated by pyritic mine waste. *Chemosphere.*, 57(3), 215-224.
7. Islam M.M., Karim A.J.M.S., Jahiruddin M., Majid N.M., Miah M.G., Ahmed M.M. and Hakim M. A. (2011). Effects of organic manure and chemical fertilizers on crops in the radish-stem amaranth-Indian spinach cropping pattern in homestead area. *Australian Journal of Crop Science*, 5(11), 1370.
8. Suthamathy N. and Seran T.H. (2013). Residual effect of Organic manure EM Bokashi applied to Proceeding Crop of Vegetable Cowpea (Vigna unguiculata) on succeeding Crop of Radish (Raphanus sativus). *Research Journal of Agriculture and Forestry Sciences*, 1(1), 2-5.
9. Yadav H. and Vijayakumari B. (2003). Influence of vermicompost with organic and inorganic manures on biometric and yield parameters of chilli [Capsicum annuum (L.) var. Plri]. *CROP RESEARCH-HISAR*, 25(2), 236-243.
10. Thanunathan K., Natarajan S., Senthilkumar R. and Arutmurugan K. (1997). Effect of different sources of organic amendments on growth and yield of onion in mine spoil. *Madras Agricultural Journal*, 84, 382-383.
11. Rao S.S. and Shaktawat M.S. (2001). Effect of organic manure, phosphorus and gypsum on growth, yield and quality of groundnut (*Arachis hypogaea* L.). *Indian journal of plant physiology*, 6(3), 306-311.
12. Satyanarayana V., Vara Prasad P.V., Murthy V.R.K. and Boote K.J. (2002). Influence of integrated use of farmyard manure and inorganic fertilizers on yield and yield components of irrigated lowland rice. *Journal of plant nutrition*, 25(10), 2081-2090.
13. Asghar H.N., Ishaq M., Zahir Z.A., Khalid M. and Arshad M. (2006). Response of radish to integrated use of nitrogen fertilizer and recycled organic waste. *Pakistan Journal of Botany*, 38(3), 691.
14. Cheuk W., Lo K.V., Branion R.M. and Fraser B. (2003). Benefits of sustainable waste management in the vegetable greenhouse industry. *Journal of Environmental Science and Health*, Part B, 38(6), 855-863.