EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH CHARACTERS OF RADISH (*Raphanus sativus* L.) cv. Pusa Chetki

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ABSTRACT

A field experiment was conducted in 2014 at farmer's field in Varagoorpettai village, Cuddalore, Tamilnadu to study the effect of integrated nutrient management on growth characters of radish (*raphanus sativus* l.) cv. pusa chetki. The experiment was laid out in Randomized Block Design with three replications and ten treatments. The treatment combination consisted of a organic manures (FYM and Vermicompost) Bio-fertilizer (Azospirillum) and Plant bio regulator (Humic acid). The treatment details *viz.*, T_1 - FYM @ 17.5 t ha^{-1}+ Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.1 % ha^{-1}, T_2 - FYM @ 17.5 t ha^{-1}+ Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1}, T_3 - FYM @ 25 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.1 % ha^{-1}, T_4 - FYM @ 25 t ha^{-1}+ Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1}, T_5 - Vermicompost 10 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.1 % ha^{-1}, T_6 - Vermicompost 10 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1}, T_7 -Vermicompost 12.5 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.1 % ha^{-1}, T_8 -Vermicompost 12.5 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 %, T_9 – Recommended dose of NPK @ 80:40: 80 kg ha^{-1} and T_{10} - Absolute Control. Among the treatment significantly influenced on application of Vermicompost 12.5 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1} (T_8) resulted in maximum values of growth attributes *viz.*, days taken for germination (3.12), shoot length (43.56 cm), number of leaves per plant (14.68 DAS), leaf area (185.86), shoot weight (56.23 g), crop dry matter production (26.13 g). Application of Vermicompost 12.5 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1} is recommended to get higher growth in radish.

Keywords: Organic manure, Bio-fertilizer, Radish.

I. 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 medicinal properties. Organic agriculture is gaining movement in India due to the individual as well as group efforts to conserve

environments and avoid contamination of the farm produce from the use of chemical fertilizers and pesticides. The important tenet of the organic food movement is the promotes ecological soundness and sustainable use of natural resource, also maintenance of crop diversity.

Farmyard manure being a bulky organic material releases the soil compaction and improves the aeration in addition to the supply of essential plant nutrients and organic matter, thereby increasing the soil microbial establishment along with the accumulation of excess humus content. Vermicompost provides vital macronutrients (N, P_2O_5, K_2O, Ca and Mg) and micronutrient 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 (Giraddi et al., 1993). Humic acid influence the plant growth by modifying the physiology of plants and improving the physical, chemical and biological properties of soil. Humic acid is reported to increase the permeability of plant membranes, resulting in higher metabolic activity.

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. Nitrogen-fixing bacteria belonging to genus Azospirillum is known to increase the yield by 5 to 20 percent with a saving of nitrogen up to 40 percent of the recommended dose (Dart, 1986). Azospirillum not only fixes biological nitrogen but also produces a growth regulator like substance (Sundaravelu and muthukrishnan,1993). 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, practically feasible and is capable of maintaining the sustainability in production. Therefore, integrated nutrient management practice is the only answer for the production of good quality. Keeping in view the above facts in mind, the present studies have been planned to use organic, inorganic and biofertilizers on growth contributing characters of radish.

II. MATERIALS AND METHODS

The study was conducted during 2015 at farmer field in Varagoorpettai village, Cuddalore, Tamilnadu (11^0 24' N latitude, 75°11' E longitude and $\pm$ 5.70 m MSL above mean sea level). The soil was sandy loam in texture, alkaline in reaction (pH 5.74) low in available nitrogen (192.7 kg ha^{-1}), medium in available phosphorus (18.5 kg P_2O_5 ha^{-1}) and higher in available potassium (299.0 kg K_2O ha^{-1}). Thus ten treatments were laid out in Randomized Block Design with three replications. The treatment combination consisted of an organic manures (FYM and Vermicompost) Bio-fertilizer (Azospirillum) and Plant bio regulator (Humic acid), Recommended dose of NPK (80:40: 80) and along with control. Treatment details viz., T_1 - FYM @ 17.5 t ha^{-1}+ Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.1 % ha^{-1}, T_2 - FYM @ 17.5 t ha^{-1}+ Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1}, T_3 - FYM @ 25 t ha^{-1} + Azospirillum @ 5 kg

ha^{-1} + Humic acid @ 0.1 % ha^{-1}, T_4 - FYM @ 25 t ha^{-1}+ Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1}, T_5 - Vermicompost 10 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.1 % ha^{-1}, T_6 - Vermicompost 10 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1}, T_7 -Vermicompost 12.5 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.1 % ha^{-1}, T_8 -Vermicompost 12.5 t ha^{-1} + Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 %, T_9 – Recommended dose of NPK @ 80:40: 80 kg ha^{-1} and T_{10} - Absolute Control. The Radish (cv. Pusa Chetki) seeds were sown during mid-December in 1m x 2 m plot size. The experiment field was supplied with well rotten farmyard manure (20 t ha^{-1}). The observations were recorded on five randomly selected plants from each plot on different growth characters like days taken for germination, number of leaves per plant (DAS), leaf area, crop dry matter production (g). (Table 1). The data was analyzed by adopting the standard procedure of Panse and Sukhatme (1985) and using AGRISTAT software. Wherever, the results were found significant, critical differences (CD) were computed at 5 percent level of probability to draw statistical conclusions.

III. RESULT AND DISCUSSION

3.1 Growth Characters

The results of the present investigation showed that there was a significant difference on the growth parameters, viz., days taken for germination, shoot length, number of leaves, leaf area, shoot weight and crop dry matter production (Table 1).

The days taken for germination (3.12 DAS) was found to be early in the treatment which received Vermicompost 12.5 tonnes ha^{-1} + *Azospirillum* @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1} (T_7) + whereas the days taken for germination was delayed in control. Vermicompost resulting from degradation of organic waste which is rich in nutrient content and growth promoting substances may fit well in integrated nutrient management for crop germination. This was in line with the result of Kamalakar Reddy and Venkata Rao (2004). The shoot length (43.56 cm and 45 DAS) was found to be increased significantly due to the application of Vermicompost 12.5 tonnes ha^{-1} + *Azospirillum* @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1} (T_8) was recorded to be the highest when compared to other treatments. Application of 50 percent RDF of NPK plus vermicompost at the rate of 2 t ha^{-1} plus *Azospirillum* and phosphobacteira increased the vine length, earliness in flowering and yield in cucumber (Prabu *et al*., 2010). The number of leaves per plant and leaf area showed significant variations in the crop. The results of the investigation revealed that application of Vermicompost 12.5 tonnes ha^{-1} + *Azospirillum* @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1} (T_8) increased the number of leaves (14.68 and 45 DAS) and leaf area (185.86 cm^2) when compared to (T_{10}). The increase in a number of leaves may be due to the vital macro and micronutrient availability with vermicompost. This was on the line with the result (Giraddi, 1993). Increasing trend in the shoot weight and dry matter production were recorded in the present investigation. The application of Vermicompost 12.5 tonnes ha^{-1} +

Azospirillum @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1} envisaged maximum shoot weight (56.23 g $plant^{-1}$) and dry matter production (26.13 g $plant^{-1}$) in T_8 whereas it was recorded to be minimum in T_{10} (Control). Enhancement in the growth attributes due to Vermicompost in the present research is in line with the reports of Rajamanickam *et al.* (2008) who revealed enhanced growth parameter in plants grown in the potting mixture, treated with vermicompost.

IV. CONCLUSIONS

In the present investigation, supplementation of radish with organic fertilizers along with bio-fertilizer and plant bio regulator resulted in higher growth parameters. Therefore, to produce a sustainable higher growth of radish it is recommended to make use of Vermicompost 12.5 tonnes ha^{-1} + *Azospirillum* @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1} (T_8) to enhance growth in addition to improve soil fertility in radish cultivation.

Table 1. Effect of integrated nutrient management and growth characters of radish cv. Pusa Chetki

S.No.	Treatment description	Number of days taken for germination	Shoot length (cm)	Number of leaves	Leaf area (cm^2)	Shoot weight (g $plant^{-1}$)	Crop dry matter production (g $plant^{-1}$)
T_1	FYM@17.5 tonnes ha^{-1} + *Azospirillum*@5 kg ha^{-1} + Humic acid @ 0.1% ha^{-1}	4.87	35.71	11.27	136.21	47.36	23.64
T_2	FYM@17.5 tonnes ha^{-1} + *Azospirillum*@5 kg ha^{-1} + Humic acid @ 0.2% ha^{-2}	4.4	38.47	12.24	14.03	52.65	24.73
T_3	FYM@25 tonnes ha^{-1} + *Azospirillum*@5 kg ha^{-1} + Humic acid @ 0.1% ha^{-3}	3.88	40.44	12.68	165.12	53.27	24.93
T_4	FYM@25 tonnes ha^{-1} + *Azospirillum*@5 kg ha^{-1} + Humic acid @ 0.2% ha^{-4}	4.86	35.73	11.52	136.18	47.3	23.64
T_5	Vermicompost 10 tonnes ha^{-1} + *Azospililllum* @ 5 kg ha^{-1} + Humic acid @ 0.1 % ha^{-1}	4.84	35.45	11.72	138.28	47.27	23.63
T_6	Vermicompost 10 tonnes ha^{-1} + *Azospililllum* @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1}	5.56	34.78	10.26	131.16	42.6	22.62
T_7	Vermicompost 12.5 tonnes ha^{-1} + *Azospililllum* @ 5 kg ha^{-1} + Humic acid	3.48	41.74	13.51	175.35	54.58	25.58

	@ 0.1 % ha^{-1}						
T_8	Vermicompost 12.5 tonnes ha^{-1} + *Azospilillum* @ 5 kg ha^{-1} + Humic acid @ 0.2 % ha^{-1}	3.12	43.56	14.68	185.86	56.23	26.13
T_9	Recommended dose of NPK @ 80:40:80 kg ha^{-1}	3.94	40.53	12.65	165.92	53.21	24.92
T_{10}	Absolute Control	6.2	28.44	9.52	125.04	39.6	21.85
	S.Ed	0.1	0.19	0.18	2.18	0.14	0.09
	C.D (p=0.05	0.21	0.38	0.38	4.59	0.29	0.21

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