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Effect of source of nutrient on growth, yield and quality of Radish (*Raphanus sativus* L.) in radish - coriander cropping sequence

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Abstract
A field experiment was conducted in AICRP on vegetable crops, Orissa University of Agriculture and Technology, Bhubaneswar, Orissa, India, during Rabi *Season* of 2016-17 to study the effect of source of nutrient on growth, yield and quality of radish (*Raphanus sativus* L.) in radish – coriander cropping sequence. The experiment was laid out with 8 treatments by adopting Randomized Block Design replicated thrice. The treatment combinations were T_1: Conventional practices (Recommended FYM @ 20 tha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} +PP chemicals), T_2 : Vermicompost @ 12.5t ha^{-1} (PP with organic methods), T_3 : FYM @ 20t ha^{-1} (PP with organic methods), T_4 : T_1 + IIHR microbial consortium @ 12.5 kg ha^{-1}), T_5 : T_2 + IIHR microbial consortium @ 12.5 kg ha^{-1} (PP with organic methods), T_6 : T_3 + IIHR microbial consortium @ 12.5 kg ha^{-1} (PP with organic methods), T_7: Safe production (Recommended FYM @ 20t ha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} + PP with organic methods) + IIHR microbial consortium @ 12.5 kg ha^{-1} and T_8 : *Azospirillium* + PSB @ 4 kg ha^{-1}(Control). The results revealed that significant variations for growth, yield and quality parameters in radish. Invariably Safe production (Recommended FYM @ 20t ha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} + PP with organic methods) + IIHR microbial consortium @ 12.5 kg ha^{-1} record significantly highest days to seed germination(4days), plant height(33.50cm), number of leaves $plant^{-1}$(10.47), leaf area (293.46cm^2), length of leaves (26.69cm), length of root(15.24cm), root circumference (10.23cm), Average root weight (160.26g), Days taken to harvest of roots(54days),fresh weight of radish root(72.33g), dry weight of radish root (3.60g), root yield (296.28qha^{-1}), vitamin C (15.44mg/ 100g), reducing sugar(2.97%), non reducing sugar(16.78%), total sugar(18.95%) and T.S.S.(5.45°Brix). However, Conventional practices (Recommended FYM @ 20 tha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} +PP chemicals) + IIHR microbial consortium @ 12.5 kg ha^{-1}) record the similar result recorded at *par*. Thus, it may be concluded that the adoption of either safe production (Recommended FYM @ 20t ha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} + PP with organic methods) + IIHR microbial consortium @ 12.5 kg ha^{-1} or conventional practices (Recommended FYM @ 20 tha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} +PP chemicals) + IIHR microbial consortium @ 12.5 kg ha^{-1}) may be recommended for better growth, yield and nutritional quality of radish in radish-coriander cropping sequence under Bhubaneswar condition.

Keywords: Radish-Coriander cropping sequence, Radish, vegetative growth, reproductive growth, inorganic fertilizers, Bio-fertilizers

Introduction
Among the root vegetable, Radish (*Raphanus Sativus* L.) is an important vegetable crop. It is consumed as raw or as a salad. It is rich in calcium, potash, phosphorus and Vitamin C. It is rich source of ascorbic acid and a variety of minerals. The productivity of radish is influenced by several factors such as soil, varieties, fertilizer management and various agro techniques used for growing crop. Nutrients play a vital role in functioning of normal physiological processes during the period of growth and development of plants. However, for obtaining higher economic yield, balanced supply of nutrients is one of the key factors (Singh, 1976) [8]. The organic sources are directly or indirectly helpful in increasing the availability and uptake of nutrients from the soil and ultimately to boost up the yield and quality of radish without rendering the detrimental effects on physicochemical properties of the soil.

Farm Yard Manures (FYM) is available in plenty in locality and can be effectively utilized for vegetable production. It is bulky in nature and containing small quantity of nutrients which are required in large quantities; however it also contains trace or micronutrients (Yawalkar *et al*. 2002) [10] in sufficient amount, the deficiency of which cannot be supplemented by others. Since vermicomposting supply all the nutrients in readily available form,

it enhances uptake of nutrients by plants (Rai and Pandey, 2007) [7]. Vermicomposting influences the physio-chemical and biological properties of the soil, which, in turn improves the fertility. It is cost effective and renewable source of plant nutrients to supplement the chemical fertilizers. Biofertilizers in combination with organic manures found as effective component in organic farming for reliable and cheap supply of nutrients. These combinations were ecologically safe and improve soil fertility by improving the soil physical, chemical and biological condition. Microbial consortium is a carrier based microbial product that contains N fixing, P & Zn solubilizing and plant growth promoting microbes in single carrier. *Azospirillum* is a micro – Europhilic nitrogen fixer. It fixes nitrogen in an environment of low oxygen tension. The bacteria induce the plant roots and secrete mucilage, which creates low oxygen environment that helps to fix atmospheric nitrogen. It fixes N_2 10-40 kg $ha^{-1}season^{-1}$ in many vegetable crops. Fertilizers cost is increasing day by day, therefore, the farmers are looking for alternate sources, which may lower down the cost of cultivation along with maintaining the fertility status of soil. The response of organic sources and bio fertilizer with or without chemical fertilizer on a large number of crops have been reported by several workers. Keeping in view the contents noted above, the present investigation entitled 'Effect of source of nutrient on growth, yield and quality of radish (*Raphanus Sativus* L.)' was carried out.

Materials and methods

The present investigation was carried out at the field site of AICRP on Vegetable Crops of O.U.A.T., Bhubaneswar, Odisha, India during *Rabi* season of 2016-17. The layout was under Randomized Block Design with eight treatments and randomized in three replication. There were altogether twenty four plots each of 3m X 2.7m size. Sowing was done on 24 October, 2016 with spacing of 30 X 10 cm. During the life cycle of the plants, hoeing, weeding and irrigation were provided at proper time so as to facilitate better growth and development of crop. The observations were recorded *i.e* Days to seed germination, plant height (cm), number of leaves, length of leaves (cm), length of shoot (cm), length of root (cm), root circumference (cm), fresh weight of root (g), dry weight of root(g), Days taken to harvest of root, root yield (q ha^{-1}),vitamin C(mg $100gm^{-1}$), reducing sugar(%), non-reducing sugar(%), total sugar(%) and T.S.S(°Brix).The treatment combination were T_1: Conventional practices (Recommended FYM @ 20 tha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} +PP chemicals), T_2: Vermicompost @ 12.5t ha^{-1} (PP with organic methods), T_3: FYM @ 20t ha^{-1} (PP with organic methods), T_4 : T_1 + IIHR microbial consortium @ 12.5 kg ha^{-1}), T_5: T_2 + IIHR microbial consortium @ 12.5 kg ha^{-1} (PP with organic methods), T_6: T_3 + IIHR microbial consortium @ 12.5 kg ha^{-1} (PP with organic methods), T_7: Safe production (Recommended FYM @ 20t ha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} + PP with organic methods) + IIHR microbial consortium @ 12.5 kg ha^{-1} and T_8: *Azospirillium* + PSB @ 4 kg ha^{-1}(Control). Pusa Chetki variety was collected from local market, Bhubaneswar. The data on the growth, yield and quality were statistically analyzed according to the method suggested by Fischer and Und (1963) [1]. The obtained data was analyzed by statistical significant at P<0.05 level, S.E. and C.D.at 5 percent level of significance by the procedure given by (Gomez and Gomez, 1984) [2].

Results and discussion

Effect of source of nutrient on growth and growth parameters

The radish was respond well to organics and their combination. In general, nutrient management such as T_1(Conventional practices Recommended FYM @ 20tha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} +PP chemicals), T_4 (Conventional practices Recommended FYM @ 20tha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} +PP chemicals + IIHR microbial consortium @ 12.5 kg ha^{-1}) and T_7(Safe production Recommended FYM @ 20tha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} +PP chemicals + IIHR microbial consortium @ 12.5 kg ha^{-1}) recorded significantly minimum days taken to seed germination (4.00 to 4.33 days) and maximum days(7 days) taken to germinate in control plot(T_8), the maximum height of plant (34.52cm) was observed with the application of Conventional practices (Recommended FYM @ 20 tha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} +PP chemicals), followed by Safe production (Recommended FYM @ 20t ha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} + PP with organic methods) + IIHR microbial consortium @ 12.5 kg ha^{-1} and minimum (26.59cm) recorded from *Azospirillium* + PSB @ 4 kg ha^{-1}(Control). The maximum number of leaves per plant (10.47) was also recorded under the treatment T_7 and minimum number of leaves per plant (8.40) T_8 namely control. The maximum leaf area was observed (293.46cm^2) in T_7 and minimum leaf area (204.92cm^2) namely control. The maximum days taken (54.00days) was observed with the application of T_7 and minimum (41.67days) T_8 namely control. The maximum length (28.23cm) of leaves was also recorded under the treatment (T_1) and minimum (12.83cm) recorded in control. The maximum Fresh weight of leaves (87.91gm) was observed with the application of T_7 and minimum (35.82) from T_8 namely control. This might be due to favorable environment created by integrated application of RDF + FYM @ 20 tha^{-1} with or without IIHR consortium @ 12.5 kg ha^{-1} (Arka microbial consortium). Increased vegetative growth of radish in the present study due to integrated application of RDF + FYM @ 20 t ha^{-1} with (T_7) or without (T_1) Arka microbial consortium might be due to availability of more nutrients during crop growth period in radish. Organic matter might have created favorable environment for better root growth and development (Islam *et al*, 2010) [3].

Effect of source of nutrient on yield and yield parameters

The maximum Fresh weight of radish root (73.27g) was observed with the application of (T_4) and minimum (41.13g) from T_8 namely control. The maximum dry weight of radish root (3.60g) was observed with the application Safe production (Recommended FYM @ 20t ha^{-1} + fertilizer @ 80:60:80 NPK kg ha^{-1} + PP with organic methods) + IIHR microbial consortium @ 12.5 kg ha^{-1}(T_7) and minimum (2.13g) from T_8 *Azospirillium* + PSB @ 4 kg ha^{-1}(Control).Similarly, the maximum dry weight of radish shoot (5.60g) was observed with the application of T_7 and minimum (3.27) from T_8 namely control (*Azospirillium* + PSB @ 4 kg ha^{-1}).The maximum root circumference (10.23cm) was observed with the application of T_7 followed by T_1(9.30cm) and T_4(9.69) and minimum from T_8(7.73cm) namely control. The maximum average root weight (160.26g) was observed with the application of T_7 followed by T_4 (152.63g) and T_1 (143.10) while minimum average root weight (90.49g) from T_8 namely control. The maximum days taken to harvest of

roots (54.00 days) was also recorded under treatment (T_7) and minimum under control (41.67days). The highest radish root yield (296.28 q ha^{-1}) was observed with the application of T_7 followed by T_4 (290.72 q ha^{-1}) and T_1(258.62 q ha^{-1}) and minimum from T_8(84.16 qha $^{-1}$) namely control. Integrated application of inorganic fertilizer + FYM had positive increased in growth of the plants, in turn the yield attributing parameters. This might be due to faster in cell division, multiplication and cell elongation in meristematic region of the plant due to production of plant growth substances by FYM. Sendur *et al*. (1998) [9] also stated that organic fertilizer application increases the fresh and dry weight of leaves than chemical fertilizer also. Better efficacy of these treatments might be attributed to the availability of more nutrients and slow release coincides with the stage of root development in radish mixed with increased root growth and aeration of root growth.

Effect of inorganic and bio fertilizer on quality

The maximum TSS (5.45°Brix) was recorded under T_7 and minimum to control (3.73°Brix).The maximum reducing sugar (2.97%) was observed under treatment T_7 and minimum to control (2.10%). The maximum non - reducing sugar (16.85%) observed under treatment T_4 followed by T_7 (16.78) and minimum to control (12.19).The maximum total sugar was observed with the application of T_7 (18.95) followed by T_4 (18.67) and minimum to control (14.30).The maximum ascorbic acid (15.44 mg 100 gm^{-1}) revealed that there was remarkable increase in under the treatment T_7 and minimum percent of ascorbic acid (11.22mg 100gm^{-1}) was recorded under control. The maximum Protein content (26.10%) was recorded under treatment (T_7) and minimum (25.06%) under control. The Progressive improvement in quality parameters of radish root with the use of adoption of safe production practices along with Arka microbial consortium @ 12 kg ha^{-1} might be due to increase in growth parameters, which might have resulted in improved uptake of nutrients and phothosynthetic activities and finally the quality parameters of radish through the process of enzymatic activities stimulated by plant growth component. Similar results have also been made by Shani *et al*. (2016).

Table 1: Effect of different combination of nutrient sources on days to seed germination, plant height, number of leaves per plant, leaf area, days taken to harvest of roots, root fresh and dry weight

Treatments		Days to seed germination	Plant height (cm)	Number of leaves per plant	Leaf area (cm^2)	Shoot length (cm)	Days taken to harvest of roots	Root Fresh weight (g)	Root Dry weight (g)
T_1	Conventional practices (Recommended FYM@20tha^{-1} + fertilizer@80:60:80 NPK kg ha^{-1} +PP chemicals)	4.00	34.52	9.67	246.61	28.23	53.00	70.87	2.40
T_2	Vermicompost @ 12.5tha^{-1}(PP with organic methods)	5.33	21.26	8.83	223.75	18.70	48.00	59.07	3.33
T_3	FYM@20tha^{-1} (PP with organic methods)	5.67	23.83	8.90	212.96	17.70	47.33	48.87	2.87
T_4	Conventional practices (Recommended FYM@20tha^{-1} + fertilizer@80:60:80 NPK kg ha^{-1} +PP chemicals)+IIHR microbial consortium @ 12.5 kg ha^{-1}	4.33	31.74	10.27	286.96	25.27	53.33	73.27	3.33
T_5	Vermicompost @ 12.5tha^{-1} + IIHR microbial consortium @ 12.5 kg ha^{-1} (PP with organic methods)	6.00	22.07	9.20	254.81	16.20	50.00	59.27	2.80
T_6	FYM@20tha^{-1} +IIHR microbial consortium @ 12.5 kg ha^{-1} (PP with organic methods)	5.00	24.24	8.67	231.92	17.73	44.67	64.47	2.47
T_7	Safe production (Recommended FYM@20tha^{-1} + fertilizer@80:60:80 NPK kg ha^{-1} +PP chemicals) + IIHR microbial consortium@ 12.5 kg ha^{-1}	4.00	33.50	10.47	293.46	26.69	54.00	72.33	3.60
T_8	*Azospirillium* + PSB (Control)	7.00	21.59	8.40	204.92	12.83	41.67	41.13	2.13
	$CD_{.05}$	0.87	2.60	1.31	51.53	3.78	1.85	19.26	0.65

Table 2: Effect of different combination of nutrient sources on root length, root diameter, average root weight, toot yield, tss, ascorbic acid content, protein content, sugar content (reducing, non-reducing and total sugar)

Treatment	Root length (cm)	Root diameter (cm)	Average root weight(g)	Root yield (qha^{-1})	TSS (°Brix)	Ascorbic acid (mg/100g)	Protein content (%)	Reducing Sugar (%)	Non-Reducing sugar (%)	Total sugar (%)
T_1	15.19	9.30	143.10	258.62	5.14	15.33	25.63	2.77	14.58	18.00
T_2	12.99	8.81	96.38	182.45	4.67	12.27	26.02	2.39	14.73	16.17
T_3	15.01	8.96	96.48	211.96	4.56	11.33	25.79	2.33	14.61	15.90
T_4	15.67	9.69	152.63	290.72	5.21	15.22	26.10	2.87	16.85	18.67
T_5	14.06	9.07	113.23	169.74	4.33	13.67	25.92	2.66	15.03	16.86
T_6	15.79	9.09	99.47	134.56	4.72	13.89	25.88	2.81	15.25	17.42
T_7	15.24	10.23	160.26	296.28	5.45	15.44	26.06	2.97	16.78	18.95

T_8	12.02	7.73	90.49	84.16	3.73	11.22	25.06	2.10	12.19	14.30
$CD_{.05}$	2.36	1.30	26.68	41.25	0.62	2.97	0.19	0.47	1.07	1.13

Conclusion

On the basis of present investigation, it may be concluded that the adoption of either safe production (T_7) or conventional practices (T_4) increased the growth, yield and nutritional quality of radish in radish coriander cropping sequence.

References

1. Fischer RA, Und FY. Statistical tables for biological, agricultural and medical research. 6. Aufl. Oliver & Boyd, London. 146 S. Preis 30, 1963.
2. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John Wiley and sons. Inc, 1984.
3. Islam MM, Karim AJMS, Jahiruddin M, Majid MK, Miah GM, Ahmed MM *et al*. Effect of organic manure and chemical fertilizer on crops in the radish-stem amaranthus – Indian spinach cropping pattern in homestead area. Australian Journal Crop Science, 2010; 5(11):1370-1378.
4. Kumar S, Kumar S, Maji S, Pandey VK. Effect of inorganic fertilizers and biofertilizers on growth, yield and quality of radish (*Raphanus sativus* L.). International Journal of Plant Sciences. 2016; 11(1):71-74.
5. Kumar S, Maji S, Kumar S, Singh HD. Efficacy of organic manures on growth and yield of radish (*Raphanus Sativus* L.)cv. Japanese white. International Journal Plant Science, 2014; 9(1):57-60.
6. Moslemi M, Aboutalebi A, Hasanzadeh H, Farahi MH. Evaluation of the effects of different levels of vermicompost on yield and yield components of Coriander (*Coriandrum sativum* L.). Annuals of Biological Research. 2012; 3:4852-4853.
7. Rai M, Pandey AK. Towards a revolution in Ram. Hindu survey of India Agricultural, 2007, 112-117
8. Singh K. Manorial Requirement of vegetable Crops. ICAR. New Delhi, 1976.
9. Sendur KS, Natarajan S, Thamburaj S. Effect of Organic and inorganic Fertilizers on growth, yield and quality of tomato. South Indian Horticulture. 1998; 46(3-4):203-205.
10. Yawalkar KS, Agrawal JP, Bokde S. Manure and Fertilizers (9th edition), Agril-Horticultural Publishing House Nagpur, India, 2002, 326-329.