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Effect of biofertilizers and different sources of organic manures on growth parameters and yield attributes of amaranth (*Amaranthus Spp*.) Cv. Arka Suguna

BM Chaudhary, LR Varma, SG More, MD Acharya and SS Rabari

Abstract
An experiment was conducted to examine the response of three levels of biofertilizers *viz*. (*Azotobactor*, *PSB*, *Azotobactor + PSB*) and five different sources of organic manures *viz*. FYM, Vermicompost, Caster Cake, Poultry Manure, Neem Cake a in factorial randomized block design with four replications during late *Kharif* season 2016. The results revealed that among different biofertilizers, minimum days taken for first cutting at 20 cm height, days taken for subsequent cutting at 20 cm height (second cutting), days taken for subsequent cutting at 20 cm height (third cutting), days taken for subsequent cutting at 20 cm height (fourth cutting), maximum yield of first cutting at 20 cm height (g), yield of subsequent cutting at 20 cm height (g) (Second cutting), yield of subsequent cutting at 20 cm height (g) (third cutting), yield of subsequent cutting at 20 cm height (g) (fourth cutting), yield per plot (kg) and yield per ha (q/ha) were recorded with treatment b_3 (*Azotobactor + PSB*). In case of different sources of organic manures, minimum days taken for first cutting at 20 cm height, days taken for subsequent cutting at 20 cm height (second cutting), days taken for subsequent cutting at 20 cm height (third cutting), days taken for subsequent cutting at 20 cm height (fourth cutting), maximum yield of first cutting at 20 cm height (g), yield of subsequent cutting at 20 cm height (g) (Second cutting), yield of subsequent cutting at 20 cm height (g) (third cutting), yield of subsequent cutting at 20 cm height (g) (fourth cutting), yield per plot (kg) and yield per ha (q/ha) were observed with treatment f_2 (Vermicompost).

Keywords: Arka Suguna, amaranth, growth, yield, Biofertilizer, organic manure

Introduction
Amaranth (*Amaranthus spp*.) originated in America and it is one of the oldest food crops in the world, with evidence of its cultivation reaching back as far as 6700 BC. The genus Amaranth consists of nearly 60 species; most of them are cultivated as leafy vegetables, grains or ornamental plants, while others are weeds. It is the most common leafy vegetable grown during summer and rainy season in India. The present production and consumption of vegetables in the country are very inadequate being only about one-fourth to one-third of requirement. The population being increased without check is the main handicap in our progress with the result of that food shortage, malnutrition and poverty occurs. Therefore, there is an urgent need to increase the vegetable production by bringing more area under vegetable cultivation and adoption of improved technologies. However, due to heavy pressure of industrialization and urbanization, there is literally no scope to increase the area under vegetables therefore the only way is to increase the production of vegetables per unit area by scientific cultivation.

Van Soest *et al*. (1991) [26] have reported leafy vegetables to contribute significant amount of vitamins and minerals to the human diet and are also excellent sources of protein, carotene (vitamin A), iron and ascorbic acid (vitamin C) and this group of vegetables are also referred to as "mines of minerals". It is in this back drop that a field experiment was attempted to assess the performance of leafy vegetables. For maintaining proper physique, recommendation have been made by the ICMR is 300 g of total vegetables per day per head, out of which 125 g of leafy, 100 g of roots and 75 g of other vegetables. Therefore, amaranth plays an important role for continuous supply of leafy vegetables in summer. The leaves and tender stem of amaranth are rich in protein, minerals, carbohydrates, vitamin 'A' and 'C'. It is also a rich source of magnesium, phosphorus, sodium, riboflavin, potassium, sulphur and nicotinic acid.

There are two varieties based on leafy colour *i.e.* green and red leaf. The most common amaranth popular in India are *A. tricolor*, *A. dubius* and *A. blitum*. Amaranth leaves as well as the softest portions of the shoots are usually boiled in water and then cooked with onions, tomatoes, oil and other additives of modern culinary delights. Its leaves are combined with condiments to prepare soup. The flavour of raw and cooked vegetable amaranth was reported as equal to or better than spinach or other similar greens.

The soil condition is one of the most important factor to improve the productivity and quality of produce. Soil must have favorable physical, chemical nutritional and biological conditions. It is worth to mention that good effect of organic nitrogen treatment as well as bio-fertilizer inoculation in increasing root growth parameters may be mainly due to improving root rhizosphere condition, *i.e.* soil structure and moisture content. In addition, adding of organic manures and bio-fertilizer had beneficial return to increase the population of microorganisms especially in the surface layer-root rhizosphere that produce substances, which stimulate plant growth. Many investigators studied the role of organic manures, which incorporated with bio-fertilizer as stimulating the plant growth, yield and quality of plant part.

Organic fertilizers also had a positive effect on soil microbial population resulting in enhanced soil biomass, carbon, nitrogen content and dehydrogenase activity. To compensate the short supply and to mitigate recent price hike in inorganic fertilizers, use of indigenous sources like farmyard manure, vermicompost, poultry manure, neem cake and castor cake, etc. should be necessary. Use of organic manures not only helps to sustain crop yields but also plays a key role in improving the physical, chemical and biological properties and also increases the efficiency of applied fertilizers (Singh and Biswas, 2000) [20].

FYM is principle source of organic matter in our country. Use of well decomposed FYM alone or in combination with Bio-fertilizer helps in proper supply of nutrition and maintaining soil health. It supplies all the essential plant nutrients, which improve the physic-chemical properties, increases water holding capacity and encourages the soil microbial activities. FYM is also advantageous for its residual value, it contains about 0.50% N, 0.20% P_2O_5 and 0.50% K_2O.

Castor cake is produce by crushing castor seeds in expeller to extract oil from it in a control temperature with help of steam; it contains about 5.8% N, 1.8% P_2O_5 and 1.0% K_2O.

Vermicompost is adopted as organic manure produced by use of earth worms. Earth worms play an important role in organic farming by vermin technology is a cost effective method for converting all types of bio-wastes in to nutrient rich organic manure. It modified physical, chemical and bio-chemical properties of soil. It contains about 1.60% N, 2.20% P_2O_5 and 0.67% K_2O.

Poultry manure is nutrient rich organic manure, since in birds, liquid and solid excreta are excreted together resulting in a no urine loss. Poultry manure ferments very quickly. Poultry manure contains 2.87% N, 2.93% P_2O_5 and 2.35% K_2O.

Neem cake is the by product obtained in the process of cold pressing of neem tree fruits and kernels and the solvent extraction process for neem oil cake. It is a potential source of organic manure, which contains 5.2% N, 1.0%P_2O_5 and 1.4% K_2O.Neem cake as organic manure protects plant roots from nematodes, soil grubs and white ants probably due to its residual limonoid content. It also acts as natural fertilizer with pesticidal properties and also reduces alkalinity in soil, as it produces organic acids during decomposition. Being totally Nautral, it is compatible with soil microbes improves and rhizospher microflora and hence ensures fertility of soil. Neem cake improves the organic matter content of the soil, helping improve soil texture, water holding capacity, and soil aeration for better root development.

Biofertilizers are carrier-based inoculants containing cells of efficient strains of specific microorganisms (namely bacteria) used by farmers for enhancing the productivity of the soil by fixing atmospheric nitrogen or by solubilizing soil phosphate or by stimulating plant growth for synthesis of growth promoting substances. In recent years, free living bacteria (*Azotobacter*), associatitve (*Azospirillum*) and symbiotic (*Rhizobium*) bacteria and phosphate solubilizing one (*Bacillus megaterium*, *B. polymyxa* and *Ps. striata*) are gaining much popularity. Such practices are being encouraged to save the chemical fertilizers, natural economy and the environment. Application of NPK supplemented with organic manures and biofertilizers in adequate amounts with proper proportion is one of the factor which controls the growth and development of Amaranth.

Therefore, looking to all these factors, combinations of biofertilizer and organic manures in amaranth is the need of the time. Keeping into consideration the above facts in mind an experiment entitled "Effect of biofertilizers and different sources of organic manures on growth parameters and yield attributes of amaranth (*Amaranthus spp*.) cv. Arka Suguna" was planned and performed.

Materials and methods

The investigation was conducted at College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan (Gujarat). Jagudan is about 70 km away from Ahmadabad and it is located on 72^0 43' East longitude and 23^0 50' North latitude at an elevation of 87 meters above the Mean Sea Level. It represents the North Gujarat Agro-climatic region. Amaranthus cultivar Arka Suguna was obtained from Indian Institute of Horticulture Research, Bangalore for experiment. Total fifteen treatment combinations comprising three level of biofertilizers *viz*. (b_1) (*Azotobactor*), (b_2) (PSB) and (b_3) (*Azotobactor + PSB*) application as a seed treatments and five levels of organic manures *viz*. (f_1) (FYM 25 t/ha), (f_2) (Vermicompost 6.25 t/ha), (f_3) (Castor Cake 2.32 t/ha), (f_4) (Poultry Manure 3.48 t/ha) and (f_5) (Neem Cake 1.92 t/ha) were tried in the experiment was laid out in Factorial Randomized Block Design as described by Panse and Sukhatme (1985) [14] with three replication and plot size of 1.5 m^2 (Spacing 30 cm X 15 cm) on amaranth cv. Arka Suguna. The test of significance among the treatment means was worked

out by "F" test given by Cochran and Cox (1967). The appropriate Standard Error of mean (S.Em.)

was calculated in each case and the Critical Difference (C.D.) at five per cent level of probability was worked out to compare two treatments means where the treatment effects were significant. Various observations were taken on growth parameters like days taken for first cutting, and subsequent second cutting, third cutting and fourth cutting and other yield attributes like yield of greens at first, second, third and fourth cutting at 20 cm height (g), yield per plot (kg), yield of green leaves per hectare (q) Observations were recorded periodically in relation to growth parameters and yield attributes using standard techniques.

Results and Discussion

1 Growth and Yield Attibutes

1. Effect of biofertilizers and different sources of organic manure on days taken for first cutting, and subsequent second cutting, third cutting and fourth cutting.

Influences of biofertilizer and different sources of organic manure and their combinations on days taken for first cutting and subsequent second, third, and fourth cutting are presented in table 1 and graphically illustrated in fig 1.

Effect of different biofertilizers on days taken for first cutting and subsequent second, third and fourth cutting were found significant. The significantly minimum days taken for first cutting (22.73) and subsequent second cutting (34.33), third cutting (43.33) and fourth cutting (56.33) was recorded with treatment b_3 (*Azotobactor + PSB*). Treatment b_3 was found statistically at par with treatment b_2 (*PSB*) at subsequent third cutting (44.73). The maximum days taken for first cutting (25.93) and subsequent second cutting (38.53), third cutting (47.53) and fourth cutting (62.93) was observed with treatment b_1 (*Azotobactor*). These result might be due to the biofertilizer help to microorganism in the faster decomposition of organic matter available in the soil, thereby increasing the availability of nutrents and ultimately in higher plant growth. These finding are in accordance with the findings of Mehta *et al.* (2010) [10] in fenugreek, Thenmozhi (2010) [25] in amaranth, in spinach, Meena *et al.* (2013) [9] in fenugreek and Kavitha *et al.* (2013) [6] in amaranth.

Influences of different sources of organic manure on days taken for first cutting and subsequent second, third and fourth cutting at 20 cm height were found significant. The significantly minimum days taken for first cutting (23.55), second cutting (35.55), third cutting (43.77) and fourth cutting (57.22) at 20 cm height was obtained with treatment f_2 (vermicompost). The treatment f_2 was found statistically at par with treatment f_3 and f_4 at first cutting, f_4, $f_5$and f_1 at second cutting, f_4 and f_5 at third cutting and f_4 at fourth.The maximum days taken for first cutting (25.44) and subsequent second cutting (37.77), third cutting (46.66) and fourth cutting (61.11) was recorded with treatment f_3 (poultry manure).The minimum days taken for first cutting and subsequent cutting might be due to easy realease of different nutrients and also presence of different micronutrients and plant growth substance in vermicompost. These findings are in accordance with the findings of Suthar *et al.* (2009) [23] in garlic, Tayade *et al.* (2012) [24] in amaranth, Dubey *et al.* (2013) [5] in fenugreek.

The interactions effect between biofertilizeres and different sources of organic manures at first, second, third and fourth cutting at 20 cm height of greens were found not significant.

2. Effect of biofertilizers and different sources of organic manure on yield of greens at first, second, third and fourth cutting at 20 cm height (g).

Data recorded on yield of first, second, third and fourth cutting influenced by different biofertilizers were found significant. Significantally maximum yield of greens was found with treatment b_3 at first cutting (217.46 g), second cutting (214.90 g), third cutting (214.38 g) and in fourth cutting (203.97 g). The treatment b_3 was found statistically at par with treatment b_2 in second cutting (198.46 g). The lowest yield of greens was found with treatment b_1 in first cutting (177.64 g), second cutting (186.10 g), third cutting (180.10 g) and in fourth cutting (173.53 g). These results are in accordance with the findings of Narayanamma *et al.* (2005) [12] in cauliflower, in spinach beet, Dadresan *et al.* (2012) [4] and Kumar *et al* (2013) [7] in fenugreek, Sahu *et al.* (2014) [18] in coriander.

Data in table showed that the influence of different organic manures on yield of greens at first, second, third and fourth cutting were found significant variation. Significantly highest yield of greens was recorded with treatment f_2 at first cutting (217.17 g), second cutting (222.15 g), third cutting (213.90 g) and fourth cutting (207.84 g). The treatment f_2 was found statistically at par with treatment f_4 in first cutting (196.73 g), second cutting (201.26 g), third cutting (202.21 g) and in fourth cutting (188.54 g). The minimum yield of greens at first cutting (183.10 g), second cutting (189.41 g), third cutting (178.77 g) and fourth cutting (186.18 g) was found with treatment f_3.These results are in accordance with the findings of Patil *et al.* (2007) [16] in garlic, Suthar (2009) [23], in garlic, Akaparobi (2009) [3] in amaranthus, Naimuddin *et al*. (2013) [11] in fenugreek, Okoli (2015) [13] in Amaranthus.

The interactions effect between biofertilizeres and different sources of organic manures at first, second, third and fourth cutting on yield of green were found not significant.

3. Effect of biofertilizers and different sources of organic manures on yield per plot (kg)

Influences of different biofertilizers and organic manures on yield of greens per plot are presented in table 1 and graphically illustrated in fig 2.

Data presented in table revealed that the effect of biofertilizers on yield per plot (kg) was showed significant variation. The significantly maximum yield of greens per plot (0.849 kg) was recorded with treatment b_3 (*Azotobactor + PSB*) and minimum yield was recorded with treatment b_1 (*Azotobactor*). The similar results were obtained by Malhotra *et al.* (2006) [8] in coriander, Mehta *et al.* (2010) [10] in fenugreek, Patel *et al.* (2010) [10, 15] in fenugreek, Singh *et al.* (2012) [21] in kasurimethi, Sonali *et al.* (2012) [22] in fenugreek and Sahu *et al.* (2014) [18] in coriander.

The effect of different organic manures on yield per plot (kg) was showed significant variation. The maximum yield per plot (0.861 kg) was recorded with treatment f_2 (Vermicompost). These results are in accordance with the findings of Adekayode (2004) [1] in amaranthus, Shashidhar *et al.* (2005) in garlic, Patil *et al.* (2007) [16] in garlic, Akaparobi (2009) [3] in amaranthus, Adewole and Dedeke (2012) [2] in amaranthus and Tayade *et al.* (2012) [24] in amaranthus.

In case of interaction effect between biofertilizeres and different sources of organic manures on yield per plot (kg) was found not significant.

4. Effect of biofertilizers and different sources of organic manures on yield of green leaves per hactare (q)

The data pertaining to yield per hactare (q) as affected by different biofertilizers, organic manures and their combinations are presented in Table 1 and graphically illustrated in Fig. 3.

The effect of biofertilizers on yield of greens per hactare (q) was found significant. The significantly maximum yield of greens per hactare (118.15 q) was recorded with treatment b_3 (*Azotobactor + PSB*) and the minimum yield of greens (99.62 q) per hectare was recorded with treatment b_1 (FYM). The similar result were reported by Malhotra *et al.* (2006) [8], Mehta *et al.* (2010) [10] and Patel *et al.* (2010) [10, 15] in fenugreek, Singh *et al.* (2012) [21] in kasurimethi, Sonali *et al.* (2012) [22] in fenugreek and Sahu *et al.* (2014) [18] in coriander.

The effect of different organic manures on yield of greens per hactare (q) was showed significant variation. The maximum yield of greens per hectare (119.59 q) was recorded with treatment f_2 (Vermicompost). The minimum yield (100.72 q) of greens was recorded with treatment f_3 (caster cake). These results are in accordance with the findings of Adekayode (2004) [1] in amaranthus, Shashidhar *et al*. (2005) [19] in garlic, Patil *et al*. (2007) [16] in garlic, Akaparobi (2009) [3], Adevole and Dedeke (2012) [2] and Tayade *et al*. (2012) [24] in amaranthus.

In case of interaction effect of between biofertilizeres and different sources of organic manures on yield per hectare (q) was found not significant.

Table 1: Effect of biofertilizers and different sources of organic manures on days taken for first, second, third and fourth cutting at 20 cm height, yield of green leaves at first, second, third & fourth cutting at 20 cm height (g), yield per plot (kg) and yield per ha (q)

Treatments	Days taken for first, second, third and fourth cutting at 20 cm height				Yield of green leaves at first, second, third and fourth cutting at 20 cm height (g).				Yield per plot (kg)	Yield per ha (q)
	First	Second	Third	Fourth	First	Second	Third	Fourth		
Biofertilizers (B)										
b_1 (*Azotobactor*)	25.93	38.53	47.73	62.93	177.54	186.10	180.10	173.53	0.718	99.62
b_2 (*PSB*)	24.33	36.40	44.73	59.13	192.10	198.46	191.70	184.64	0.769	106.51
b_3 (*Azotobactor +PSB*)	22.73	34.33	43.33	56.73	217.46	214.90	214.38	203.97	0.849	118.15
S Em±	0.28	0.42	0.50	0.68	6.18	6.17	6.28	5.97	0.01	1.58
CD at 5%	0.82	1.23	1.46	1.98	17.90	17.89	18.19	17.31	0.03	4.59
Organic Manures (F)										
f_1 (FYM)	24.66	36.77	45.77	60.55	186.98	191.56	187.55	180.44	0.747	103.68
f_2 (Vermicompost)	23.55	35.55	43.77	57.22	217.17	222.15	213.90	207.84	0.861	119.59
f_3 (Caster Cake)	25.44	37.77	46.66	61.11	183.10	189.41	178.77	173.90	0.725	100.72
f_4 (Poultry Manure)	24.00	35.55	44.55	59.00	196.73	201.26	202.21	188.54	0.790	109.54
f_5 (Neem Cake)	24.00	36.44	45.55	60.11	194.53	194.72	194.55	186.18	0.771	106.94
S Em±	0.37	0.55	0.65	0.88	7.98	7.97	8.10	7.71	0.01	2.04
CD at 5%	1.07	1.59	1.88	2.55	23.11	23.09	23.48	22.35	0.04	5.92
Interaction (B x F)										
S Em±	0.63	0.95	1.13	1.53	13.82	13.81	14.04	13.37	0.025	3.55
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
CV %	4.55	4.53	4.32	4.44	12.23	11.97	12.45	12.36	5.59	5.68

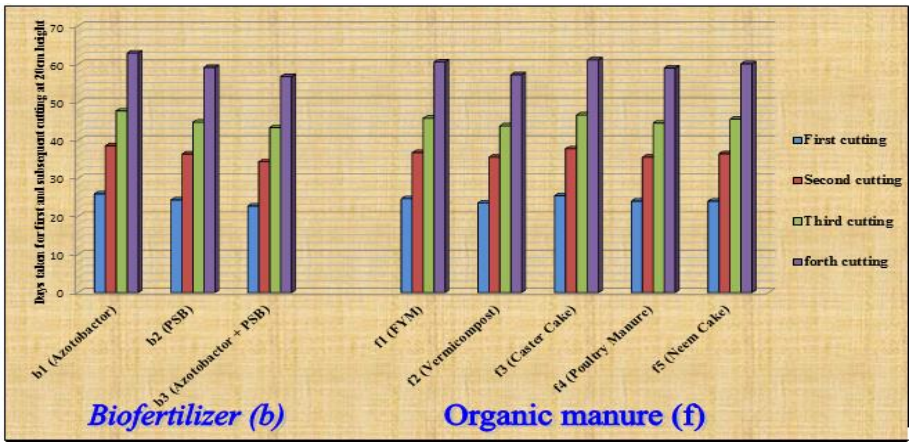

Fig 1: Effect of biofertilizers and different sources of organic manures on days taken for first and subsequent cutting at 20 cm height

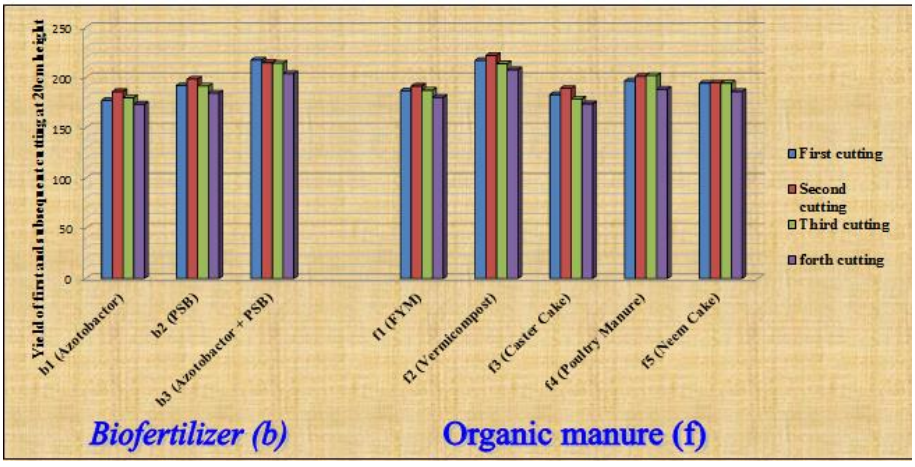

Fig 2: Effect of biofertilizers and different sources of organic manures on yield of first and subsequent cutting at 20 cm height

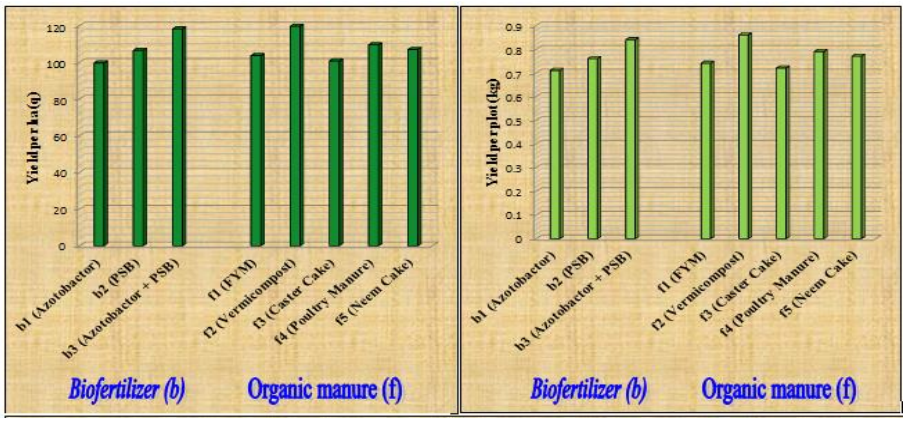

Fig 2: Effect of biofertilizers and different sources of organic manures on yield per plot (kg) and yield per ha (q)

Conclusion

It is, therefore, concluded from the present investigation that the application of *Azotobactor* + PSB @1.5 lit./kg and Vermicompost 6.25 t/ha should be applied to achieve higher growth parameters and yield attributes of amaranth cv. Arka Suguna under North Gujarat conditions.

References

1. Adekayode FO. The use of manure to increase the yield and quality of amaranthus to feed rabbit in a humid tropical region. Journal of Animal and Veterinary Adavances. 2004; 3(11):758-762.
2. Adewole MB, Dedeke OA. Growth performance, yield and nutritional quality of *Amaranthus cruentus* L. under repeated applications of poultry manures. Journal of Life Science. 2012; 14(2):345-355.
3. Akaparobi SO. Effect of farmyard manures on the growth and yield of *Amaranthus cruentus*. Agricultura Tropica Et Subtropica. 2009; 42(1):1-4.
4. Dadresan, Mandana, Mohammad, Reza Chaichi, Mohammad, Bagher Hosseini *et al*. Effect of biofertilizers on the growth, productivity and nutrient absorption of fenugreek (*Trigonella foenum-graceum* L.). International Journal of Agriculture Innovations and Research. 2012; 3(5):2319-1473.
5. Dubey P, Pandey CS, Bhardwaj SB, Khanday, Shakoor AB. Effect of integrated nutrient management on some soil health indices and seed yield of fenugreek (*Trigonella foenum-graecum* L.). Pantnagar Journal of Research. 2013; 11(1):145-149.
6. Kavitha, Srinivasan, Sivagami, Ranjini. Individual and combined effect of biofertilizer, chemical fertilizer and vermicompost on *Amaranthus tristis*. Int. J Pharm. Sci. Rev. Res. 2013; 20(2):190-195.
7. Kumar, Jitendra, Kumar, Sanjay, Maji, Sutanu *et al*. Studies on effect of biofertilizers with chemical fertilizers on growth, yield and quality of fenugreek (*Trigonella foenum-graecum* L.). International Journal of Agricultural Sciences. 2013; 11(1):198-200.
8. Malhotra SK, Vashishtha BB, Apparao VV. Influence of nitrogen, *Azospirilium* sp. And farmyard manure on growth, yield and incidence of stem gall disease in Coriander (*Coriandrum sativum* L.). Journal of Spices and Aromatic Crops. 2006; 15(2):115-117.
9. Meena SS, Mehta RS, Bairwa M, Meena RD. Productivity and profitability of fenugreek (*Trigonella foenum-graecum* L.) as influenced by biofertilizers and plant growth regulators. Legume Res. 2013; 37(6):646-650.
10. Mehta RS, Patel BS, Meena SS, Meena RS. Influence of nitrogen, phosphorus and bio-fertilizers on growth characters and yield of fenugreek (*Trigonella foenum-graecum* L.). Journal of spices and Aromatic Crops. 2010; 19(1, 2):23-28.
11. Naimuddin, Aishwath OP, Lal G, Kant K, Sharma YK, Ali SF. Response of *Trigonella foenum-graecum* to organic manures and *Rhizobium* inoculation in a Typic Haplustepts. Journal of Spices and Aromatic crops. 2014; 23(1):110-114.
12. Narayanamma M, Chiranjeevi CH, Reddy IP, Riazuddin Ahmed S. Integrated nutrient management in Cauliflower (*Brassica oleracea var. botrytis* L.). Veg. Sci. 2005; 32(1):62-64.
13. Okoli PSO, Nweke IA. Effect of different rates of poultry manure on growth and yield of Amaranthus (*Amaranthus cruentus*). Journal of agriculture and veterinary science, 2015, 73-76.
14. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers (4th edition) ICAR. Publishers. New Delhi, 1985.
15. Patel BS, Patel SG, Patel SP, Amin AU. Integrated nutrient management in fenugreek (*Trigonella foenum-graecum* L.). Journal of Spices and Aromatic Crops. 2010; 19(1, 2):68-70.
16. Patil MB, Shitole DS, Shinde SB, Purandare ND. response of garlic to organic and inorganic fertilizers. Journal of Horticulture Science. 2007; 2(2):130-133.
17. Revathi K, Reddy, Subhash, Sumathi R, Manorama k. Influence of biofertilizers on yield and nutrient content of spinach beet (*Beta vulgaris*). J Res. ANGRAU. 2012; 40(1):46-48.
18. Sahu, Roshanlal, Sahu Hansa, Kumar, sachin. Effect of application of inorganic fertilizers and biofertilizers on growth components and yield traits of coriander (*Coriandrum sativum* L.*)*. International Journal of Agricultural Sciences. 2014; 10(1):433-436.
19. Shashidhar TR, Dharmatti PR, Chavan ML, Mannikeri IM. Nutrient uptake and yield of garlic with different organic manures. Karnataka Journal of Horticulture. 2005; 1(4):98-101.
20. Singh GB, Biswas PP. Blanced and integrated nutrient management for sustainable crop production. Indian Journal of fertilizers. 2000; 45(5):55-60.
21. Singh S, Choudhary MR, Garhwal OP, Jakhar ML, Yadav BL. Effect of biofertilizers and inorganic sources of nitrogen and phosphorus on quality production of kasurimethi (*Trigonella corniculata*). International Journal of Seed Spices. 2012; 2(2):38-40.

22. Sonali Ra, Soyam, Wagh AP, Dod VN, Nagre PK, gade RM. Effect of different biofertilizers on growth, yield and quality of fenugreek. The Asian Journal of Horticulture. 2012; 7(1):28-30.
23. Suthar, Surendra. Impact of Vermicompost and composted farmyard manure on growth and yield of garlic (*Allium sativum* L.) field crop. International Journal of Plant Production. 2009; 3(1):27-38.
24. Tayade MS, Bawkar SO, Kale VS, Deshmukh UB. Integrated nutrient management in amaranthus (*Amaranthus tricolor* L.). The Asian Journal of Horticulture. 2012; 7(2):291-293.
25. Thenmozhi R, Rejina K, Madhusudhanan K, Nagasathya K. Study on effectiveness of various biofertilizers on the growth and biomass production of selected vegetables. Research Journal of Agriculture and Biological Sciences, 2010; 6(3):296-301.
26. Van Soest PJ, Robertson JB, Lewis BA. Symposium: carbohydrate methodology, metabolism and nutritional implications in dairy cattle. J Dairy Sci. 1991; 74:3583-3597