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Effect of integrated nutrient management on quality parameters of broccoli (*Brassica oleracea* L. var. *italica*) in light textured soil of Western Uttar Pradesh

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ABSTRACT
A field experiment was carried out to study the effect of integrated nutrient management on quality parameters of broccoli (Brassica oleracea L. var. italica) in light textured soil of Western Uttar Pradesh at Horticultural Research Centre of Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut during winter season of 2016-17 and 2017-18. The experiment was laid out in a randomized block design with three replications. The treatments consisted of T_1: 150 Kg N + 100 Kg P_2O_5 + 100 Kg K_2O/ ha (RDF), T_2: 150 Kg N + 100 Kg P_2O_5 + 100 Kg K_2O/ ha (RDF), T_3: 75 % RDF + 25% FYM, T_4: 75 % RDF + 25% Vermicompost, T_5: 75 % RDF + 25% FYM + PSB, T_6: 75 % RDF + 25% Vermicompost + PSB, T_7: 75 % RDF + 25% FYM + PSB + Azosporillum, T_8: 75% RDF + 25% Vermicompost + PSB + Azospirillum, T_9: RDF + FYM, T_{10}: RDF + Vermicompost, T_{11}: RDF + FYM + PSB, T_{12}: RDF + Vermicompost + PSB, T_{13}: RDF + FYM + PSB + Azospirillum, T_{14}: RDF + Vermicompost + PSB + Azospirillium. Result indicated that application of 75% RDF + 25% Vermicompost + PSB + Azospirillum (T_8) found to be statistically significant and most beneficial & promotive in relation to maximum vitamin A (2402.83 IU), Vitamin C (102.95 mg/ 100g) and protein content (3.46 %). While minimum vitamin A (2342.78), vitamin C (55.95 mg/ 100g) and protein content (2.63%) was recorded under control treatment during 2016-17 and 2017-18.

Key Words: *Broccoli, Biofertilizers, vermicompost, FYM and recommended dose of NPK, and quality, Vitamin A, Vitamin C and Protein.*

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INTRODUCTION

Broccoli (*Brassica oleracea* L. var. *italica)* is one of the most nutritious vegetables amongst the cole crops grown for its tender heads. It belongs to the family Brassicaceae and originated from the Mediterranean region [18]. The word *broccoli* comes from the Latin word *brachium* and Italian word *brocco* meaning "arm", or "branch". Morphologically the plant of broccoli resembles to cauliflower and in the local parlance is known as '*Hari gobi*', meaning green cauliflower. Worldwide production of broccoli and cauliflower is 24.2 million tonnes. China and India together accounted for 74% of the total production in the year 2014. Broccoli is commercially cultivated in Himachal Pradesh, Jammu and Kashmir, Uttrakhand, Uttar Pradesh, Maharastra and Nilgiris hills in Tamil Nadu.

In India, the cultivation of broccoli is gaining popularity among the growers for the last couple of years obviously due to increasing demand in cosmopolitan cities and awareness of

its high nutritive values. The consumable parts of broccoli are tender green bud, thick floral stalk and the secondary heads (spears). It is more nutritious as compared to other vegetables of the *Cruciferae* genus. This has about 130 times more vitamin A contents than cauliflower and 22 times more than cabbage. It is low in sodium, fat-free and good source of vitamin A, vitamin B, vitamin B_2 and calcium [5]. Broccoli contains indole-3-carbinol, which helps to fight breast and lung cancer. It is also a rich source of sulphoraphane compound which is associated with reducing the risk of cancer [8]. Its sprouts are rich source of glucosinolate. Particularly glucoraphanin, the substance associated with reducing cancer [10]. Broccoli is known as the "Crown of Jewel Nutrition" due to the good source of vitamin and minerals.

The modern Indian agriculture depends heavily on chemical fertilizers, pesticides and fungicides and is responsible for the deterioration of soil health. But the plant nutrient deficiency of Indian soils is increasing. Hence involving organic manure and chemical fertilizers will go a long easy in building soil fertility and productivity. As the nutrient management system will supply all the nutrients judiciously to increase the production of crops. Thus, attention is now being shifted towards the alternate sources of nutrients from inorganic to organic. To increase the yield and quality, plenty of chemical fertilizers along with a small quantity of organic manure are being used by the growers, which ultimately determinate the soil texture and health. The use of organic manure, farmyard manure, and compost, oil cake and crop residues etc. as nutrient sources is being advocated so as to minimize the use of chemical fertilizers [4]. Application of organic along with inorganic sources of nutrients in combination can minimize use of costly fertilizer and improve the fertilizers use efficiency [15].

MATERIAL AND METHODS

The present investigation was conducted at the Horticultural Research Center of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, 250110 (UP) during the two consecutive years i.e.; 2016-17 and 2017-18. Pusa KTS-1 cultivar of broccoli was used for the experiment. The experiment was laid out in randomized block design (RBD) caring three replications. The treatments involved in the study were fourteen in numbers i.e. T_1: Control T_2: 150 Kg N + 100 Kg P_2O_5 + 100 Kg K_2O/ha (RDF), T_3: 75 % RDF + 25% FYM, T_4: 75 % RDF + 25% Vermicompost, T_5: 75 % RDF + 25% FYM + PSB, T_6: 75 % RDF + 25% Vermicompost + PSB, T_7: 75 % RDF + 25% FYM + PSB + Azosporillum, T_8: 75% RDF + 25% Vermicompost + PSB + Azospirillum, T_9: RDF + FYM, T_{10}: RDF + Vermicompost, T_{11}: RDF + FYM + PSB, T_{12}: RDF + Vermicompost + PSB, T_{13}: RDF + FYM + PSB + Azospirillum, T_{14}: RDF + Vermicompost + PSB + Azospirillium. The organic manures (FYM and vermicompost) ware incorporated in the soil tan days before transplanting of seedlings and biofertilizers (PSB and azospirillium) were mixed with soil prior to three days of transplanting. The full dose of phosphorus and potassium and half dose of nitrogen were applied at the time of transplanting of seedling and remaining half dose of nitrogen applied in two split doses at 30 and 45 days after transplanting of broccoli seedling as per the treatments. The sources of N, P and K were urea, single super phosphate and muriate of potash, respectively. All the replicated plots were maintained under uniform cultural practices during the course of experimental study. All the biochemical analysis for quality parameters were conducted in the laboratory of the Department of Horticulture, SVP University of Agriculture and Technology, Meerut. The broccoli heads were subjected to analysis of all quality parameters. Different quality parameters of broccoli viz. vitamin A, vitamin B and protein content were analyzed by following standard methods of analysis. As β-carotene is the precursor of vitamin A so, β- carotene was estimated as per the method suggested by Ranganna [13]. Similarly, Vitamin C also analyzed as per the method suggested by Ranganna, [13] The protein estimation for each treatment sample was done by Lowery's method.

RESULTS AND DISCUSSION

It is evident from the data (table-1) that different combinations of organic, inorganic and/or biofertilizers exhibit significant and promotive influence on the quality parameters of broccoli during both years of investigation. Vitamin A plays an essential role in maintaining vision, body growth, immune function and reproductive health of human. The broccoli plants come under the treatment T_8 (75% RDF + 25% Vermicompost + PSB + Azospirillum)

ware contained maximum Vitamin A (2402.83 IU). On the basis of analyzed data, during the year 2016-17 the statistically higher value of Vitamin A (2401.35 IU) content in head recorded under the treatment 75% RDF + 25% Vermicompost + PSB + Azospirillum which was at par with the treatment T_7 (75 % RDF + 25% FYM + PSB + Azosporillum), similar pattern of results were also obtained in the successive year of investigation. While minimum vitamin A (2342.78), was recorded under control treatment during 2016-17 and 2017-18. These results are quite comparable with the findings of Bashyal, [3] and Kachari and Korla, [7]. Bahadur *at al.* [1] also reported that application of organic manures and biofertilizers significantly increased vitamin A content. It was reported by many researchers that inorganic nitrogen and monosodium phosphate helps to increase carotenoids content in plants. It is notable that organic manures (vermicompost and farmyard manure) helps in better colonization of beneficial microorganisms besides providing slow releasing macro and micro-nutrients in the soil. It seems to be that phosphate solubilizing bacteria was accumulating phosphate solubilizing isolates in the rhizosphere, which were readily available to the plants for quality head production. Azospirillum is important bacteria responsible for accumulate and fixes the atmospheric nitrogen in the soil in the available form to the plants. The better colonies of phosphorus solubilizing bacteria and Azospirillum due to the high organic matter in the soil attributes of better mobilization, accumulation and supply of available plant nutrients, as these are associated with several vital functions, such as the utilization of sugar and starch, photosynthesis and root growth. The increased availability of various micro-nutrients could be another reason for increasing vitamin A content in broccoli head.

Vitamin C is a water-soluble vitamin and it is found in sufficient amount in broccoli. Vitamin C plays a very important role in the human body as its being a potent antioxidant, as well as having beneficial effects on skin health and immune function. During present investigation, maximum value of Vitamin C (102.95 mg/100g) was recorded with treatment T_8 (75% RDF + 25% Vermicompost + PSB + Azospirillum). During the first year of investigation, the maximum content of vitamin C (103.65 mg/100g) was estimated with treatment T_8 (75% RDF + 25% Vermicompost + PSB + Azospirillum). Similarly in the second year of investigation the maximum vitamin C content was also recorded with treatment T_8 (75% RDF + 25% Vermicompost + PSB + Azospirillum), it was statistically at par with treatment T_7 (75 % RDF + 25% FYM + PSB + Azosporillum), with this treatment the vitamin C content was recorded 101.65mg/100g in the first year of investigation and 101.15 mg/100g during the second year of investigation. The minimum value of vitamin C content (55.95 mg/100g) was observed with control treatment, which was statistically at par with T_2 (58.99 mg/100g), T_3 (61.94 mg/100g) and T_4 (65.09 mg/100g). These findings are in close agreement with those who reported Mohanta *et.al.* [11] in broccoli, Bambal *et al.* [2] in cauliflower. Generally, it has been reported that higher vitamin C content is found with an increased dose of organic manures and biofertilizers than the conventional fertilizer dose because when a plant is treated with more nitrogen, it increases protein production and reduce carbohydrate synthesis due to the dilution effect [1]. Since vitamin C is made from carbohydrates, its levels are also reduced at the recommended dose of fertilizers. Staugaitis *et al.* [17] found that balance nutrition including with biofertilizers and organic manures result accumulates more amount of vitamin C, while the concentration of nitrates considerably decreases. Moreover, the higher content of vitamin C in the combination of the treatments might be due to the biosynthesis of auxin and gibberellins by phoshphobacteria. Similarly, the gibberellins could either augment the biosynthesis of ascorbic acid by ascorbic acid oxidase, which ultimately resulted in an increase in ascorbic acid content [7].

Proteins are the building blocks of the human body, it's necessary for both growth and maintain muscle mass. Higher protein content (3.46 %) was estimated when reduced dose of inorganic fertilizers was applied in combination with vermicompost, PSB and Azospirillum (T_8, 75% RDF + 25% Vermicompost + PSB + Azospirillum), which were statistically at par with T_7, 75 % RDF + 25% FYM + PSB + Azosporillum; (3.41%). During 2016-17 maximum protein content (3.46 %) was estimated with treatment T_8 (75% RDF + 25% Vermicompost + PSB + Azospirillum). Similarly during 2017-18 maximum protein content (3.45%) was also recorded with treatment T_8 (75% RDF + 25% Vermicompost + PSB + Azospirillum). Minimum protein content (2.63%) was observed with control treatment,

which was at par with T_2 (2.73%). Protein content in broccoli was significantly increased with the integration of reduced chemical fertilizers, biofertilizers and organic manure were due to the improved nutritional environment in the rhizosphere as well as faster utilization by the broccoli plant [9]. Moreover, the increment in protein content is due to increased activity of nitrate reductase, which is the cause of the synthesis of certain amino acids and proteins [14]. A similar result in protein content increment in the head of Chinese cabbage was noted by Bahadur *et al.* [1], Everaarts and de Willigen [6] and Padamwar & Dakore [12] in cauliflower. Further, it has been reported that protein content increase with the application of biofertilizers which might be due to increase in the activity of enzymes involved in protein synthesis [16].

The present investigation revealed that the quality attributing characters significantly increase with a reduced dose of inorganic fertilizers in the combination with organic manure and biofertilizers. On the basis of the present investigation, it may be concluded that the treatment T_8 (75% RDF + 25% Vermicompost + PSB + Azospirillum) found the best treatment with respect to quality parameters of broccoli like vitamin A (2402.83 IU), Vitamin C (102.95 mg/100g) and protein (3.46 %).

Table-1: Effect of integrated nutrient management on vitamin A, Vitamin C and protein content of broccoli (*Brassica oleracea* L. var. *italica*) in light textured soil of Western Uttar Pradesh.

Treatments	**Notation**	**Vitamin A (IU)**			**Vitamin C (mg/100g)**			**Protein (%)**		
		2016-17	**2017-18**	**Mean**	**2016-17**	**2017-18**	**Mean**	**2016-17**	**2017-18**	**Mean**
Control	T_1	2,340.20	2,345.35	2342.78	55.25	56.65	55.95	2.650	2.610	2.63
150 Kg N + 100 Kg P_2O_5 + 100 Kg K_2O/ha (RDF)	T_2	2,350.32	2,349.25	2349.79	59.32	58.65	58.99	2.750	2.720	2.73
75 % RDF + 25% FYM	T_3	2,365.40	2,366.32	2365.86	62.45	61.42	61.94	2.900	2.870	2.88
75 % RDF + 25% Vermicompost	T_4	2,370.25	2,370.85	2370.55	65.32	64.85	65.09	3.010	2.980	3.00
75 % RDF + 25% FYM + PSB	T_5	2,384.65	2,384.95	2384.80	85.65	85.21	85.43	3.280	3.270	3.28
75 % RDF + 25% Vermicompost + PSB	T_6	2,386.45	2,387.12	2386.79	92.55	90.45	91.50	3.300	3.310	3.31
75 % RDF + 25% FYM + PSB + Azosporillum	T_7	2,401.35	2,401.95	2401.65	101.65	101.15	101.40	3.410	3.400	3.41
75% RDF + 25% Vermicompost + PSB + Azospirillum	T_8	2,402.14	2,403.52	2402.83	103.65	102.25	102.95	3.450	3.460	3.46
RDF + FYM	T_9	2,372.32	2,373.65	2372.99	70.25	68.32	69.29	3.100	3.090	3.10
RDF + Vermicompost	T_{10}	2,375.21	2,375.85	2375.53	75.98	74.35	75.17	3.150	3.120	3.14
RDF + FYM + PSB	T_{11}	2,378.12	2,378.65	2378.39	80.25	80.10	80.18	3.220	3.210	3.22
RDF + Vermi Compost + PSB	T_{12}	2,380.45	2,381.21	2380.83	82.12	80.35	81.24	3.250	3.240	3.25
RDF + FYM + PSB + Azospirillum	T_{13}	2,390.45	2,391.65	2391.05	96.32	95.45	95.89	3.350	3.340	3.35
RDF + Vermicompost + PSB + Azospirillium	T_{14}	2,397.45	2,398.25	2397.85	98.32	96.15	97.24	3.390	3.370	3.38
C.D. at 5%		1.361	2.486		2.841	2.839		0.068	0.060	
SE(m)		0.465	0.850		0.972	0.971		0.023	0.020	

REFERENCES

1. Bahadur, A., J. Singh, K.P. Singh, A. K. Upadhyay, and M. Rai. (2007). Effect of organic amendments and bio-fertilizers on growth, yield and quality attributes of Chinese cabbage (*Brassica pokiness***)**. *Research Journal of Agriculture and Biological Sciences***, 3** (6): 858- 885.
2. Bambal, A.S., Verma, R.M., Panchbhai, D.M., Moharkar, V.K. and Khankhane. (1998). Effect of bifertilizers and nitrogen levels on growth and yield of cauliflower (*Brassica oleracea* var. *botrytis*). *Orrisa Journal of Horticulture*. **26**(22): 14-17.
3. Bashyal, L.N. (2011). Response of cauliflower to nitrogen fixing biofertilizer and graded levels of nitrogen. *Journal of Agriculture and Environment*. **12**: 41-50
4. Bhardwaj , M.L., Harender, Raj and Koul B.L. (2000). Yield response and economic of organic source of nutrients as substitute to inorganic sources in tomato (*Lycopersicon esculantum*), okra (*Abelmoschus esculentus*), cabbage (*Brassica oleracea var. capitata*) and (*Brassica oleracea* var. botrytis). *Indian Journal of Agricultural Science*. **70**(10): 653-656.
5. Decoteau, D.R. (2000). *Vegetable Crops*. Prentice Hall, Upper Saddle River, New Jersey, ISBN-**10**(3): 464.
6. Everaarts, A.P. and de Willigen, P. (1999). Effect of nitrogen and the method of application on yield and quality of broccoli. *Netherland Journal of Agricultural Science*. **47**: 123-133.
7. Kachari, M. and Korla, B.N. (2012). Studies on influence of influence biofertilizers on quality and economics of cauliflower cv. PSB K-1 production. *Indian Journal of Horticulture*. **66**(2): 215-220.
8. Kalia, P. (1995). Biochemical assays and yield performances of sprouting broccoli genotypes of Himachal Himalayas. *Cruciferae Newsl*. 17: 90-91.
9. Khudair . G.A., Mirza, T.K. and Saadwan, S.A. (1989). Effect of different levels of urea fertilizer and plant spacing on growth and production of cabbage. *Dirast*. **16**: 88-105
10. Maurya, A.K., Singh, M.P., Srivastava, B.K., Singh, Y.V., Singh, D.K., Singh, S. and Singh, P.K. (2008). Effect of organic manures and inorganic fertilizers on growth characters, yield and economics of sprouting broccoli cv. Fiesta. *Indian Journal of Horticulture*. **65**(1): 116-118.
11. Mohanta, R., Nandi, A.K., Mishra, S.P., Pattnaik, A., Hossain, M.M. and Padhiary. A.K. (2018). Effects of integrated nutrient management on growth, yield, quality and economics of sprouting broccoli (*Brassica oleracea var. italica*) cv. Shayali. *Journal of Pharmacognosy and Phytochemistry*. **7**(1): 2229-2232.
12. Padamwar, S.B. and Dakore, H.G. (2009). Influence of organic fertilizers on morphological and nutritional parameters of cauliflower. *Bioinfolet*. **6**(2): 158-160.
13. Ranganna, S. (1995). *Hand book of analysis and quality control for fruit and vegetable products*. 2nd edition. Tata McGraw Hills Education Private Limited. New Delhi. 1112P.
14. Rutkauskiene, G. and Poderys, M. (1999). Influence of NPK fertilizers on the yield and quality of white cabbage heads. *Sodininkyste of Darzininkyste*. **18**: 155-162
15. Sharma, A., Parmar, D.K., Kumar, P., Singh, Y. and Sharma, R.P. (2008). Azotobacter soil amendment integrated with cow manure reduces need for NPK fertilizers in sprouting broccoli. *International Journal of Vegetable Science*. **14**(13): 273-285
16. Singh, J.P., Singh O.V. and Solanki, V.P.S. (2009.). Effect of potassium and boron on yield and uptake of nutrients by cauliflower. *Annals of Horticulture*. **2**(1): 80-82.
17. Staugaitis, G. Viskalis, P. and Venskutonis, P.R. (2008). Optimizing of application of nitrogen fertilizers to increase the yield and improve the quality of Chinese cabbage heads. Acta Agriculturae Scandinavica. **58**(2): 176-181.
18. Thamburaj, S., and Singh N. (2001). Text book Vegetables, Tubercrops and Spices. ICAR. New Delhi. 469 p.