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Comparative study of growing condition and integrated nutrient management on growth and yield of broccoli cv. Pusa KTS-1

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Abstract
An experiment on "Comparative study of growing condition and Integrated Nutrient management on growth and yield of broccoli cv. Pusa KTS-1"was conducted in *rabi* season during the year 2019-20 and 2020-21 at Horticultural Research Farm, B.A. College of Agriculture, Anand Agricultural University, Anand. The experiment was laid out in Split Plot Design with three replications and twelve treatment combinations comprising of three main plot treatments of Growing conditions (G_1: Poly house, G_2: Green shade net (50% Shade net) and G_3:Open condition) and four sub plot treatments of integrated nutrient management N_1: 50% RDF through chemical fertilizer+ 50% RDF through FYM, N_2: 50% RDF through chemical fertilizer +50% RDF through Vermicompost, N_3: 50% RDF through chemical fertilizer + 50% RDF through Poultry manure and N_4: Control (RDF: 100-50-50 NPK kg/ha). Growing of broccoli in green shade net recorded maximum plant height whereas, growing of broccoli in polyhouse recorded maximum number of leaves per plant, plant spread (N-S) & (E-W), leaf area, curd height, curd weight, yield (t/ha) with minimum days to 50% curd formation and days to first harvest, The maximum number of leaves, curd height, curd weight and yield (t/h) with minimum days to 50% curd formation and days to first harvest were observed with application of 50% RDF through chemical fertilizer +50% RDF through vermicompost. Growing of broccoli in green shade net (50% Shade net) with application of 50% RDF through chemical fertilizer +50% RDF through vermicompost recorded maximum plant height whereas, growing of broccoli in polyhouse and application of 50% RDF through chemical fertilizer +50% RDF through vermicompost recorded maximum curd height, curd weight and yield (t/ha).

Keywords: Growing condition, integrated nutrient management, growth, yield, broccoli cv. Pusa KTS-1

Introduction
Broccoli (*Brassica oleracea var. italica* L.) is a cole crop belongs to family Brassicaceae having chromosome no. 2n = 18 and it is considers as a one of the important member of the cole group of vegetables. It contain both antioxidant and anti-carcinogenic properties and dietary intake of such food provides effective support for the building of strong defensive system of body. Broccoli is a highly nutritious, rich in vitamins and minerals.

Broccoli still grown in very limited and scattered areas in India, mostly it is cultivated in open field which is often affected with sudden adverse changes in weather conditions and pest. Whereas, polyhouse /net house provides protection from such conditions. Protected cultivation is gaining importance in the recent past, owing to its perpetual demand throughout the year. Net house and poly house technology has been recommended for the cultivation of different vegetables. Polyhouse production has already been proven as profitable and production under protection has attracted much attention in recent years. The cultivation of vegetables in net house can play a better role in improving quality, advancing maturity as well as increasing fruiting span, productivity and also reduce the incidence of insect pest as compared to open field when cultivation of different vegetables grow in net house.

Excessive use of chemical fertilizers to meet the crop demand has badly affected the soil health and productivity with adding high economic load but reliance on organic fertilizers alone is also not feasible because they are comparatively low in nutrient and can better serve as a supplement rather than substitute. Integrated nutrient management (INM) improve and maintain soil fertility for sustainable crop productivity through optimization of all available organic, inorganic and biotic resources in an integrated manner with its ecological, social and economic ramifications.

Organic manures viz. FYM, Vermicompost and Poultry manure improve the soil structure, aeration, slow-release nutrient which support root development leading to higher yield with

better quality. To ascertain the above facts "Comparative study of growing condition and integrated nutrient management on growth and yield of broccoli cv. Pusa KTS-1" was taken.

Materials and Methods

The present investigation on "Comparative study of growing condition and integrated nutrient management on growth and yield of broccoli cv Pusa KTS-1" was conducted in *rabi* season during the year 2019-20 and 2020-21 at Horticultural Research Farm, B.A. College of Agriculture, Anand Agricultural University, Anand. The experiment was laid out in Split Plot Design with three replications and twelve treatment combinations comprising of three main plot treatments of growing conditions and four sub plot treatments of integrated nutrient management

Treatment details are as under

A. Growing conditions (G)

G_1: Poly house
G_2: Green shade net (50% Shade net)
G_3: Open condition

B. Integrated nutrient management (INM)

N_1:50% RDF through chemical fertilizer+ 50% RDF through FYM
N_2:50% RDF through chemical fertilizer +50% RDF through Vermicompost
N_3:50% RDF through chemical fertilizer + 50% RDF through Poultry manure
N_4: Control (RDF: 100-50-50 NPK kg/ha)

Growth and yield parameters observations

Observations of growth and yield parameters were recorded from the five tagged plants of net plot. The height of plant was measured in centimetre (cm) from the ground level to top of curd and average height was worked out. Numbers of fully developed leaves were recorded from all the five tagged plants and mean number of leaves per plant was worked out. The spread of the selected five plants was measured both along and across the row with the help of meter scale and the average was calculated. Five randomly selected large, medium and small leaves of treated plants were used to calculate the leaf area per plant with the help of leaf area meter and their average was worked out. For days to 50% curd formation the numbers of days were counted right from the date of transplanting of seedlings to the date when at least 50% plant show curd formation. Days to first harvest was counted from date of transplanting to date of first five plants harvested and average was work out for each plot. For curd height middle portion of marketable curd height of the five selected plants from each plot was measured by scale and average was worked out. Curd which are use for measuring curd height were use for weight and average value was expressed in gram. Yield per hectare was computed on the basis of yield per net plot for each treatment.

Results and Discussion

Effect of growing conditions and INM on growth parameters of broccoli

The data presented in Table 1 revealed that growing conditions showed significant responses with regards to growth parameters. The maximum plant height (77.46 cm) was observed in treatment G_2 (Green shade net 50%) which was statistically at par with G_1 (75.82 cm) This might be due to controlled environment condition could enhanced higher CO_2 assimilation efficiency andphotosynthesis which leads cell elongation, cell enlargement and cell division in protected environment. These results are accordance with Chatterjee *et al.* (2018) [2] in bell pepper in chinese cabbage. Maximum number of leaves (21.78) was observed with treatment G_1 (polyhouse condition). This might be due to the availability of congenial growing conditions due to higher CO_2 assimilation efficiency and favorable micro-climate in polyhouse. These results are in conformity with the findings of Bambhaniya (2020) [1] in kale, Sam and Regeena (2015) [11] in cabbage as well as cauliflower. Maximum plant spread (N-S) (81.70 cm) and plant spread (E-W) (83.03 cm) was recorded in treatment G_1 (polyhouse condition). This might be due to polyhouse condition has favourable environmental conditions could enhance photosynthesis which increases length and width of leaves resulted in the maximum plant spread. These results have parity with findings obtained by Thakur (2016) [14], Thapa *et al*. (2013) [15] as well as Goutam and Biradar (2017) [4] in broccoli. Maximum Leaf area (696.52 cm^2) was observed with treatment G_1 (polyhouse condition).This might be due to availability of optimum climatic condition promoting cell division and cell elongation which eventually increase leaf length and width ultimately lead to more leaf area. These results agree with Bambhaniya (2020) [1] in kale. Minimum days to 50% curd formation (52.61) was observed with treatment G_1 (polyhouse condition). This might be due to the accumulation of maximum photosynthates which triggered early initiation of curd and optimum temperature and humidity inside polyhouse hasten early curd formation. These results have parity with findings obtained by Thapa *et al*. (2013) [15] in broccoli. The maximum number of leaves (21.50) was observed with treatment N_2 (50% RDF through chemical fertilizer +50% RDF through vermicompost).This might be due to vermicompost could enhance the growth of nitrogen fixing microorganisms in the rhizosphere, which enhances availability of nitrogen, moisture, better soil condition and facts that nitrogen might have contributed towards an increase in leaf buds and finally increased leaf number Similar findings have been reported by Chattoo *et al.* (1997) [3] in knol-khol, Mohanta *et al*. (2018) [8] and Singh *et al.* (2018) [12] in broccoli. Minimum days to 50% curd formation (53.20) were observed with treatment N_2(50% RDF through chemical fertilizer +50% RDF through vermicompost).Earliness of flowering might be due to hormone-like activity associated with the high levels of humic acids and humates as well as easy availability of major and micronutrient nutrients in soil due to application of vermicompost and inorganic fertilizer resulted better translocation of nutrients to the aerial parts of the plant which enhance reproductive phase These results are in conformity with the findings of Pretty *et al*. (2015) [10] in knol-khol. The data regarding growth parameters like plant height, plant spread (N-S) & (E-W), leaf area influenced by INM was found non-significant.

Effect of growing conditions and INM on yield parameters of broccoli

The data presented in Table 2 revealed that growing conditions showed significant responses with regards to days to first harvest, curd height, curd weight and yield. The

minimum days to first harvest (66.90) was observed with treatment G_1 (polyhouse condition). This might be due to the higher temperature prevailed inside poly house, which acted as a stress and allowed plant to complete life cycle at faster rate. These results have parity with findings obtained by Pooja and Hakkim (2017) [9] in tomato. Maximum curd height (17.72 cm), curd weight (405.19 g) and yield (15.18t/ha) were observed with treatment G_1 (polyhouse condition). Increase in curd weight might be due to favourable microclimate governed by appropriate level of temperature, relative humidity, light, CO_2 and protection from heavy wind, pest and diseases which helped to increase length and width of the leaves, more number of leaves and plant spread ultimately contributed to more carbohydrates, photosynthesis from a larger area of the leaves and the translocation of photosynthates to the sink which is ultimately the curd and consequently more weight of curd. These results have parity with findings obtained by Goutam and Biradar (2017) [4], Thapa *et al*. (2013) [15] and Karistsapol *et al.* (2014 b) [5] in broccoli and Sam and Regeena (2015) [11] in cabbage and cauliflower.

INM showed significant responses with regards to days to first harvest, curd height, curd weight and yield. The minimum days to first harvest (66.91) was observed with treatment N_2 (50% RDF through chemical fertilizer +50% RDF through vermicompost). It might be due to balanced nutrition as well as better uptake of nutrients by the plants which helped in early harvesting. These results are in conformity with findings of Meena *et al.* (2017b) [7] in broccoli. Maximum curd height (17.47 cm) was observed with treatment N_2(50% RDF through chemical fertilizer +50% RDF through vermicompost) which was statistically at par with treatment N_3(50% RDF through chemical fertilizer +50% RDF through poultry manure).It might be due to vermicompost and chemical fertilizers increased the availability of major and micro nutrients as well as humic acids and hormons might have accelerated the synthesis of chlorophyll and amino acids resulted more translocation of photosynthesis from leaves to curd ultimately increased curd height. These results are accordance with Mohanta *et al.* (2018) [8] in broccoli. Maximum curd weight (391.66 g) and yield (14.57 t/ha) were observed with treatment N_2 (50% RDF through chemical fertilizer +50% RDF through vermicompost). It might be due to availability of major and micronutrient nutrients in soil due to vermicompost and inorganic fertilizer which favour balanced nutrition, ultimately better uptake of nutrients by the plants which helped for better curd weight. This results are accordance with Karistsapol *et al.* (2014 b) [5], Goutam and Biradar (2017) [4], Meena *et al.* (2017 b) [7], Mohanta *et al.* (2018) [8] and Singh *et al.* (2020) [13] in broccoli.

Interaction effect of growing condition and integrated nutrient management on growth and yield parameters of broccoli

The data depicted in Table 3 revealed that interaction effect of growing condition and INM with respect to plant height, curd height, curd weight and yield(t/ha) found significant. Maximum plant height (80.07) was observed with G2N2 (Net house condition+50% RDF through chemical fertilizer +50% RDF through Vermicompost).This might be due to in protected condition there was a favourable micro-climatic condition and application of vermicompost with inorganic fertilizers increased the availability of major and micro nutrients which lead cell elongation and cell division ultimately height of plant. Maximum curd height (17.93 cm), curd weight (434.63 g) and yield (16.41 t/ha) were observed with G1N2 (Polyhouse condition + 50% RDF through chemical fertilizer + 50% RDF through vermicompost).It might be due to favourable micro-climatic condition in polyhouse enhanced photosynthesis and combined application of vermicompost and inorganic fertilizers increased the absorption of nutrients especially nitrogen which enhanced the cell division, cell elongation and increased the curd height. Maximum curd weight might be due to in polyhouse favourable microclimate governed by appropriate level of temperature, relative humidity, light, CO_2 and protection from heavy wind, pest and diseases which helped to increase length and width of the leaves, more number of leaves and plant spread ultimately contributed to more carbohydrates, photosynthesis from a larger area of the leaves and the translocation of photosynthates to the sink and application of vermicompost and inorganic fertilizer provide balance nutrients and better uptake of nutrients consequently more weight of curd under polyhouse.

Table 1: Effect of growing condition and integrated nutrient management on growth parameters of broccoli (Pooled of two years)

Treatments	Plant height (cm)	Number of leaves per plant	Plant spread (cm) (N-S)	Plant spread (cm) (E-W)	Leaf area (cm^2)	Days to 50% curd formation
A. Growing conditions						
G_1- Poly house	75.82	21.78	81.70	83.03	696.52	52.61
G_2-Green shade net (50% Shade net)	77.46	19.31	69.98	70.05	508.72	56.23
G_3- Open condition	64.97	20.23	77.42	74.25	635.09	53.47
S. Em. ±	1.11	0.25	1.58	1.53	10.32	0.28
C.D.at 5%	3.63	0.812	5.16	4.99	33.65	0.90
C.V.%	7.50	5.97	10.15	9.90	8.24	2.51
B. Integrated nutrient management						
N_1-50% RDF through chemical fertilizer+ 50% RDF through FYM	72.04	19.97	75.27	73.37	598.75	54.64
N_2-50% RDF through chemical fertilizer +50% RDF through Vermicompost	73.63	21.50	78.04	77.04	619.60	53.20
N_3-50% RDF through chemical fertilizer + 50% RDF through Poultry manure	73.07	20.44	76.68	76.63	618.53	54.18
N_4- Control (RDF: 100-50-50 NPK kg/ha)	72.24	19.84	75.48	76.07	616.90	54.39
S. Em. ±	0.49	0.27	0.96	1.22	10.96	0.17
C.D.at 5%	NS	0.78	NS	NS	NS	0.49
Year effect	NS	NS	NS	NS	NS	NS
Sig. interaction	G X N	-	-	-	-	-
C.V.%	2.84	5.55	5.34	6.85	7.58	1.34

Table 2: Effect of growing condition and integrated nutrient management on yield parameters of broccoli (Pooled of two years)

Treatments	Days to first harvest	Curd height (cm)	Curd weight (g)	Yield (t/ha)
A. Growing conditions				
G_1- Poly house	66.90	17.72	405.19	15.18
G_2-Green shade net (50% Shade net)	70.55	17.20	327.65	12.08
G_3- Open condition	68.78	16.35	374.38	13.83
S. Em. ±	0.43	0.15	4.68	0.22
C.D.at 5%	1.40	0.48	15.25	0.71
C.V.%	3.06	4.18	6.21	7.76
B. Integrated nutrient management				
N_1-50% RDF through chemical fertilizer+ 50% RDF through FYM	69.06	16.69	350.02	13.01
N_2-50% RDF through chemical fertilizer +50% RDF through Vermicompost	66.91	17.47	391.66	14.57
N_3-50% RDF through chemical fertilizer + 50% RDF through Poultry manure	69.00	17.37	373.54	13.84
N_4- Control (RDF: 100-50-50 NPK kg/ha)	70.01	16.82	361.07	13.36
S. Em. ±	0.21	0.21	4.01	014
C.D.at 5%	0.61	0.60	11.51	0.40
Year effect	NS	NS	NS	NS
Sig. interaction	-	G X N	G X N	G X N
C.V.%	1.32	5.17	4.61	4.36

Table 3: Interaction effect of growing condition and integrated nutrient management on growth and yield parameters of broccoli

Growing conditions Integrated nutrient management	Plant height(cm)			Curd height(cm)			Curd weight(g)			Yield(t/ha)		
	G_1	G_2	G_3	G_1	G_2	G_3	G_1	G_2	G_3	G_1	G_2	G_3
N_1	76.20	77.07	62.87	17.62	17.40	15.07	393.37	327.27	329.43	14.66	12.10	12.28
N_2	75.00	80.07	65.83	17.93	17.82	16.67	434.63	340.70	399.63	16.41	12.54	14.75
N_3	77.10	77.30	64.80	17.63	17.22	17.27	403.60	332.27	384.77	15.02	12.23	14.26
N_4	74.97	75.40	66.37	17.70	16.35	16.40	389.17	310.37	383.67	14.61	11.45	14.03
S. Em. ±	0.84			0.36			6.95			0.24		
C.D.at 5%	2.42			1.04			19.93			0.70		

Conclusion

From the two years of field study, it can be concluded that growing of broccoli in polyhouse condition and application of require nutrients by 50% RDF through chemical fertilizer and 50% RDF through vermicompost recorded maximum plant height, curd height, curd weight and yield(t/ha).

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

1. Bambhaniya KK. Effect of plant spacing and nutrient spray on growth, yield and quality of kale (Brassica oleraceavar. acephala dc) under different growing environments. (M.Sc. Thesis, Navsari Agricultural University, Navsari); c2020.
2. Chatterjee R, Sen A, Mahanta S, Thirumdasu R, Mal D. Performance of off-season bell pepper (Capsicum annuum L.) under different growing condition, transplanting dates and pruning level. Journal of Applied and Natural Science. 2018;10(3):826-830.
3. Chattoo MA, Gandroo MY, Zargar M Y. Effect of Azospirillum and Azotobacter on growth, yield and quality of knol- khol (Brassica oleracea var. gongylodes L.). Vegetable science. 1997;24(1):16-19.
4. Goutam K, Biradar MS. Integrated nutrient management studies for protected cultivation of broccoli (Brassica oleracea var. italica L.). Int. J. Chem. Stu. 2017;5(4):225-227.
5. Karistsapol N, Santipracha Q, Sompong T. Growth and yield of broccoli under different rain protectors during the rainy season in Songkhla province, Southern Thailand. Kasetsart J. (Nat. Sci.). 2014b;48:1-8.
6. Karistsapol N, Santipracha Q. Sompong T. Effect of shading and variety on the growth and yield of broccoli during the dry season in Southern Thailand. Int. J. Plant, Ani. Envi. Sci. 2014a;3(2):111-115.
7. Meena K, Ram RB, Meena ML, Meena JK, Meena DC. Effect of organic manures and bio-fertilizers on growth, yield and quality of broccoli (Brassica oleracea var. italica Plenck.) cv. KTS-1. Chem Sci Rev Lett. 2017b;6(24):2153-2158.
8. Mohanta R, Nandi AK, Mishra SP, Pattnaik A, Hossain MM, Padhiary AK. Effects of integrated nutrient management on growth, yield, quality and economics of sprouting broccoli (Brassica oleracea var. italica) cv. Shayali. J. of Pharmaco. and Phytochem. 2018;7(1):2229-2232.
9. Pooja BG, Hakkim VM. Comparative study of tomato under polyhouse and rain shelter conditions. International Journal of Engineering Science and Computing. 2017;7(10):15317-15319.
10. Pretty G, Singh SP. Effect of organic manure and inorganic fertilizers on growth and yield of knol-khol (Brassica oleracea var. caulorapa L.). Progressive Horticulture. 2015;47(2):304-306.
11. Sam B, Regeena S. Comparative performance evaluation of cool season vegetables under poly house structure and in open field. Int. J. Eng. Res. Devl. 2015;11(12):13-18.
12. Singh G, Sarvanan S, Kerketta A, Rajesh J. Effect of

organic manures and inorganic fertilizers on plant growth, yield and flower bud quality of broccoli (Brassica oleracea var. italica) cv. Green Magic. Int. J. Pure App. Biosci. 2018;6(5):1338-1342.
13. Singh S, Chamroy T, Malik S. Kundu S. The integrated nutrient management on growth and yield of broccoli (Brassica oleracea var. italica). Plant Archives. 2020;20(2):9651-9654.
14. Thakur R, Kushwah SS, Sharma RK, Haldar A. Effect of environmental conditions and varieties on quality parameters of sprouting broccoli (Brassica olreacea var. italica). Int. J. Agri. Sci. 2016;8(52):2574-2576.
15. Thapa U, Rai R, Lyngdoh YA, Chattopadhyay SB, Param PH. Assessment of producing quality sprouting broccoli (Brassica oleracea var. italica) under cover and open condition. African Journal of Agricultural. Research. 2013;8(15):1315-1318