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Research Article

Effect of Organic Manures and inorganic Fertilizers on Growth, Yield, Quality and Economics of Broccoli (*Brassica oleracea var. italica*) cv. Paraiso

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ABSTRACT

The experiment entitled "Effect of Organic Manures and inorganic Fertilizers on Growth, Yield, Quality and Economics of Broccoli (Brassica oleracea var. italica) cv. Paraiso" was conducted during Rabi season of the year 2020-2021 on experimental farm of Department of Horticulture, AKS University, Satna (M.P.). The experiment was laid out in a randomized block design with three replicated 12 treatments viz., T_1: Control, T_2: 100% NPK, T_3: 100% NPK +100% FYM, T_4: 100% NPK + 100% VC, T_5: 100% NPK + 50% FYM, T_6: 100% NPK + 50% VC, T_7: 100% NPK + Bioinoculant, T_8: 100% NPK + 50% FYM + 50% VC, T_9: 100% NPK + 50% FYM + Bioinoculant, T_{10}: 100% NPK + 50% FYM + 50% VC + Bioinoculant, T_{11}: 75% NPK + Bioinoculant + 100% FYM, T_{12}: 75% NPK + Bioinoculant +100% VC. The results reveal that increase in nitrogen and Bioinoculant level had significant response on vegetative growth yield and quality of Broccoli. The treatment (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant was found to be the best treatment among the different treatments with growth, yield and quality as well as maximum gross return for broccoli under satna condition.

Keywords: *Broccoli, nitrogen, Bioinoculant, FYM, Vermicompost.*

INTRODUCTION

Broccoli has lots of medicinal importance. The national research council committee on diet, nutrition and cancer has recommended increased consumption of broccoli to decrease the incidence of cancer. *Brassica* vegetables contain high concentrations of carotenoids, which are believed to be chemo preventive and associated with a decreased risk for various human cancers in epidemiological studies. It has about 130 times more vitamin A content than cauliflower and 22 times more than cabbage. The excessive use of chemical fertilizers has caused tremendous harm to environment Although the use of chemical fertilizers have become essential part of production and a balanced form of fertilizer use is always a pre-requisite to higher yield.

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However, these chemical fertilizers are costlier and also pollute the environment through the process of denitrification and volatilization and soil water through leaching. only 50% of available nitrogen being used and rest 50% goes as waste, which is an environmental hazard. Vermicompost, bulky organic manure is the compost prepared with help of earthworms, Vermicompost is a rich mixture of major and minor plant nutrients. It increases total microbial population of nitrogen fixing bacteria, actinomycetes and symbiotic association of mycorrhiza on plant root system. Bioinoculant is a free-living nitrogen-fixing bacterium, fixing nitrogen equivalent to 25-30kgN/ha. It also produces hormones like Indole Acetic Acid (IAA) and gibberellins, vitamins like biotin & folic acid and different B- groups are also produced Azospirillum helps improving fertility of soil and help plant growth by increasing the number and biological activity of derived microorganism in the root environment. Organic manure has the capability of supplying a range of nutrients and improving the physical and biological properties of the soil. However, at high level of crop production, these nutrients are not adequate. Moreover they are very slow action, so they are useful at a long run only. Although the inorganic manure are required in very small quantities and are very quick in action. The interaction of chemical fertilizers with the soil is considered less favorable to the soil environment in comparison to organic sources of crop nutrient.

MATERIALS AND METHODS

The experiment entitled **"**Effect of Organic Manures and inorganic Fertilizers on Growth, Yield, Quality and Economics of Broccoli (*Brassica oleracea var. italica*) cv. Paraiso**"** was conducted during Rabi season of the year 2020-2021 on experimental farm of Department of Horticulture, AKS University, Satna (M.P.). The experiment was laid out in a randomized block design with three replicated 12 treatments *viz*., T_1: Control, T_2: 100% NPK, T_3: 100% NPK +100% FYM, T_4: 100% NPK + 100% VC, T_5: 100% NPK + 50% FYM, T_6: 100% NPK + 50% VC, T_7: 100% NPK + Bioinoculant, T_8: 100% NPK + 50% FYM + 50% VC, T_9: 100% NPK + 50% FYM + Bioinoculant, T_{10}: 100% NPK + 50% FYM + 50% VC + Bioinoculant, T_{11}: 75% NPK + Bioinoculant + 100% FYM, T_{12}: 75% NPK + Bioinoculant +100% VC. The seeds were sown on 27th October 2020, germination started and transplanted on 20 November 2020 the recording of observations was done 20 days after transplanting and subsequent readings were recorded after every 20 days interval. The crop was harvested on 8th February - 2021. Raised nursery beds of 3.0 x 1.0 m were prepared thoroughly. Then the seeds were sown on 20 November 2020 during Rabi season. The nursery beds were maintained systematically upto 30 days till the seedlings were ready for transplanting. All the facilities necessary for cultivation, including labour were made available in the department. Well rotten FYM @ 250 q ha^{-1} was applied at the time of field preparation. The field was fertilized to supply nitrogen at the rate of 120 kg ha^{-1} along with 60 kg ha^{-1} phosphorus and 50 kg ha^{-1} potash. The urea was applied in three equal doses. The first dose of urea was applied before transplanting in prepared beds with full amount of single super phosphate and murate of potash. Thirty days old healthy and uniform seedlings of Broccoli cv. Paraiso were transplanted in the evening hours in each bed at prescribed with spacing 60 to 50cm on 20 November 2020. Light irrigation was given after transplanting. The observations were taken at 30, 60 and 90 days after transplanting. treatments and three replications. The data recorded during the course of investigation were subjected to statistical analysis as per method of analysis of variance (Panse & Sukhatme, 1967). The significance and non-significance of the treatment effect were judged with the help of 'F' variance ratio test. Calculated 'F' value (variance ratio) was compared with the table value of 'F' at 5% level of significance. If calculated value exceeded the table value, the effect was considered to be significant. The significant difference between the means was tested

against the critical difference at 5% level of significance.

RESULTS AND DISCUSSION

Data mentioned in table 1 clearly revealed that the optimum levels of nutrients were found to significantly improve plant height at all the growth stages. The significantly higher plant height of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the respective values of 24.47, 49.91 and 59.83 cm at growth stage of 30, 60 and at harvest, respectively. The optimum levels of nutrients were found to significantly improve number of leaves per plant at all the growth stages. The significantly higher number of leaves per plant of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the respective values of 12.04, 17.80 and 28.43 at growth stage of 30, 60 and at harvest, respectively. The optimum levels of nutrients were found to significantly improve diameter of stem (cm). The significantly higher diameter of stem (cm) of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the value of 4.87 cm proved significantly superior to rest of the treatments. The optimum levels of nutrients were found to significantly improve leaf area per plant (cm^2). The significantly higher leaf area per plant (cm^2) of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the value of 1835.78 cm^2 proved significantly superior to rest of the treatments. These results closely match with the findings of Chaterjee et al. (2005), Agrawal et al. (2010), Tripathi et al. (2012) and Ola et al. (2019). The optimum levels of nutrients were found to significantly improve days required for 50 percent curd initiation. The significantly minimum days required for 50 percent curd initiation of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the value of 52.85 days proved significantly superior to rest of the treatments. The optimum levels of nutrients were found to significantly maximum days required for 100 percent curd initiation. The significantly days required for 100 percent curd initiation of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the value of 68.33 days proved significantly superior to rest of the treatments. The results of present study are almost match with the findings of Yoldas et al. (2008), Freitas et al. (2011), Srichandan et al. (2015) and Singh et al. (2020). The optimum levels of nutrients were found to significantly improve on days required for curd maturity. The significantly minimum days required for curd maturity of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the value of 79.12 days proved significantly superior to rest of the treatments. The optimum levels of nutrients were found to significantly improve on diameter of curd (cm). The significantly higher on diameter of curd (cm) of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the value of 13.81cm proved significantly superior to rest of the treatments. The optimum levels of nutrients were found to significantly improve fresh weight per curd (g). The significantly higher on fresh weight per curd (g) of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the value of 498.93g proved significantly superior to rest of the treatments. Results related to fresh weight per curd (g) of Broccoli found to be close agreement with that of Jeyab and Kuppuswamy (2001), Sharma et al. (2004), Zaki et al. (2009) and Lal et al. (2021). The optimum levels of nutrients were found to significantly improve on dry weight per curd (g). The significantly higher on dry weight per curd (g) of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the value of 57.16g proved significantly superior to rest of the treatments. The significant improvement in yield and yield attributing parameters on account of integrated form using in organic and vermicompost might have attributed to the optimum levels of nutrients were found to significantly improve on yield per plot (kg/plot). The significantly

higher on yield per plot (kg/plot) of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the value of 7.983 kg/plot proved significantly superior to rest of the treatments. The optimum levels of nutrients were found to significantly improve on yield (tonne/ha). The significantly higher on yield (tonne/ha) of Broccoli was recorded under (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant with the value of 16.63 tonne/ha proved significantly superior to rest of the treatments. Maximum Benefit: Cost ratio (2.81) was obtained with treatment (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant followed by (2.50) with with (T_9) with 100% NPK + 50% FYM + Bioinoculant and the minimum (0.66) was obtained with treatment (T_1) control. From the present investigation it is concluded that treatment (T_{10}) with 100% NPK + 50% FYM + 50% VC + Bioinoculant was found to be the best treatment among the different treatments with growth, yield and quality as well as maximum gross return for Broccoli under satna condition.

Table 1: Effect of Organic Manures and inorganic Fertilizers on Growth and Yield of Broccoli

Treatments	Plant height (cm)	Number of leaves per plant	Diameter of stem (cm)	Days required for 50 % curd initiation	Days required for 100 % curd initiation	Days required for curd maturity	Diameter of curd (cm)	Fresh Weight per curd (g)	Yield per plot (kg/plot)	Yield (tonne/ha)
T_1	36.60	16.27	2.79	57.80	78.45	89.69	7.42	113.84	1.821	3.79
T_2	39.53	18.51	3.09	57.33	77.53	88.35	8.30	224.60	3.593	7.48
T_3	51.43	25.58	4.01	55.53	73.12	83.26	11.27	361.20	5.779	12.04
T_4	53.47	25.94	4.12	55.14	72.08	82.05	12.07	384.22	6.147	12.81
T_5	44.80	22.06	3.58	56.72	75.44	85.44	9.53	298.07	4.769	9.93
T_6	48.27	23.13	3.71	56.20	75.09	85.51	10.04	317.58	5.081	10.59
T_7	50.93	23.67	3.96	55.61	74.81	83.52	10.58	323.80	5.180	10.79
T_8	56.78	26.33	4.35	54.76	71.53	81.77	12.79	403.62	6.458	13.45
T_9	58.01	26.87	4.50	53.17	70.48	80.33	13.13	442.95	7.087	14.76
T_{10}	59.83	28.43	4.87	52.85	68.33	79.12	13.81	498.93	7.983	16.63
T_{11}	41.87	20.80	3.20	56.96	77.27	87.37	8.45	255.21	4.083	8.51
T_{12}	43.47	20.02	3.36	56.82	76.36	86.54	9.10	278.23	4.452	9.27
S.Ed(±)	0.52	0.05	0.03	68.99	0.03	8.17	0.03	0.04	0.408	1.26
CD at 5%	1.07	0.11	0.05	143.09	0.06	16.94	0.06	0.08	0.846	2.62

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