Original Research Article

EFFECT OF ORGANIC AND INORGANIC FERTILIZERS ON GROWTH, YIELD AND QUALITY OF BITTER GOURD (*Momordica charantia* L.) UNDER PRAYAGRAJ AGRO-CLIMATIC CONDITIONS

ABSTRACT

An experiment was conducted to study the **Effect of organic and inorganic fertilizers on growth, yield and quality of bitter gourd (*Momordica charantia* L.) under Prayagraj agroclimatic conditions** at Horticultural Research Field, Department of Horticulture, Naini agricultural institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (UP) during 2021 kharif season. The experiment was conducted in Randomized Block Design (RBD) with ten treatments replicated thrice with organic manures (FYM, vermicompost, poultry manure) and Inorganic fertilizers (NPK). The results of the experiment revealed that the treatment T_8 (50% RDN through chemical fertilizers + 50% through vermicompost) was found to be best treatment combination in terms of vine length (312.44 cm), days to first female flower appearance (40), node to which first female flower appearance (19), days taken to first harvest (56), average fruit weight (107.35 g), average fruit length (15.72 cm), number of fruits per plant (20), average fruit yield per plant (2.16 kg), average fruit yield per hectare (17.96 t/ha), TSS (4.33ºBrix). Significantly the highest gross return (Rs. 305320/ha), net returns (Rs. 207903/ha) and B: C ratio (3.1) were also recorded under the treatment T_8(50% RDN through chemical fertilizers + 50% through vermicompost) while average fruit diameter (7.84 cm) was observed in the treatment T_2 (100:50:50 NPK +10 tonnes vermicompost).

Key words: *Bitter gourd, FYM, Vermicompost, Poultry manure, growth, quality, yield.*

1. INTRODUCTION

Bitter gourd (***Momordica charantia* L**.) is a popular vegetable crop that is grown all over the world. It is cultivated for food as well as a medicinal constitute in many tropical nations. It includes more than 60 phytomedicines with therapeutic characteristics and effective against approximately 30 human diseases, such as cancer, diabetes, and AIDS **(Basch *et al.*, 2003).** Fruits are rich in vitamin C (88mg/g). It has antioxidant, antibacterial, antiviral, antihepatotoxic, and antiulcerogenic qualities, as well as the capacity to reduce blood sugar levels **(Behera, 2011)**. It is in high demand in both the domestic and foreign markets for fresh vegetables because of its hypoglycemic properties. Andhra Pradesh, followed by Odisha, Bihar, Chattisgarh, and Madhya Pradesh are the leading states growing the crop. Bitter gourd is an important vegetable crop grown in South Indian states especially in Kerala and it is cultivated for its juvenile tuberculate organic products (**Priyadarshini *et al.*, 2022**) It is grown during the rainy season as well as the spring and summer seasons. Fruits come in a variety of forms, sizes, colours, and bitterness. Manure and fertiliser applications work well for bitter gourd. Constant over dosage of fertilizers affects natural soil ecology and has a

negative impact on nutrient availability and soil microflora, which are crucial for crop productivity **(Prasad *et al.*, 2009).** Usage of organic manures not only supplies nutrients but also adds organic matter to the soil. Hence combined use of organic and mineral fertilizers in adequate quantity increases crop yield more than used individually. Organic inputs such as Farmyard manure, Vermicompost, Poultry manure has a great potential in improving soil productivity and crop yield through enhancement in soil physical, chemical and microbial properties and inorganic fertilizers increases the availability and intake of essential nutrients like N, P, K immediately by plants. Keeping all the above points in view an experiment was conducted to evaluate the suitable combination of organic manure and inorganic fertilizers on growth, yield, quality of bitter gourd and economics of treatments under the conditions of Prayagraj.

2. MATERIALS AND METHODS

The experiment was conducted at Horticultural Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (U.P) during 2021 Kharif season in India. Prayagraj is situated at an elevation of 78 meters above sea level at 25.870 North latitude and 81.150 E longitudes. This region has a sub-tropical climate prevailing in the South-East part of U.P. with both the extremes in temperature, i.e., the winter and the summer. In cold winters, the temperature sometimes is as low as 320F in December – January and very hot summer with temperature reaching up to 1150F in the months of May and June. During winter, frosts and during summer, hot scorching winds are also not uncommon. The average rainfall is around 1013.4 mm with maximum concentration during July to September months with occasional showers in winters. The texture of soil is sandy loam in nature and pH of soil is slightly towards alkalinity. The size of plot was 2.4m × 1.8m with a spacing of 1.2m × 0.9 m. The experiment was laid out in Randomized Block Design (RBD) having 3 replications with 10 treatments. Details of treatments are T_0 -100:50:50 NPK+20 tonnes FYM (Control), T_1-100% RDN through chemical fertilizers, T_2-100:50:50 NPK +10 tonnes Vermicompost, T_3-100:50:50 NPK+3.3 tonnes Poultry Manure, T_4-75% RDN through Chemical fertilizers +25% RDN through FYM, T_5-75% RDN through Chemical fertilizers +25% through Vermicompost, T_6-75% RDN through Chemical fertilizers + 25% through Poultry manure, T_7-50% RDN through Chemical fertilizers + 50% through FYM, T_8-50% RDN through Chemical fertilizers + 50% through Vermicompost, T_9-50% RDN through Chemical fertilizers +50% through Poultry manure. Required amount of fertilizers and organic manures are applied in soil according to treatment wise just one day before sowing. Half of the nitrogen as urea and full dose of phosphorus (P_2O_5) as SSP, potash (K_2O) as muriate of potash, Vermicompost, FYM and Poultry manure applied in each pit before the sowing of seeds. Remaining dose of nitrogen as urea was applied as two split doses, at an interval of 25 and 50 days after two true leaf stage.

3. RESULTS AND DISCUSSIONS

3.1 Germination Parameter

The early germination was recorded for the treatment T_2 (100:50:50 NPK +10 t vermicompost) 8 to 9 days. The days taken for germination can be affected by various environmental factors such as the difference between day and night temperature, soil moisture, light, pH of the soil in bitter gourd.

3.2 Growth Parameters

The statistical data on growth parameters are recorded in table 1. The maximum vine length (312.44 cm), days taken to first female flower appearance (40 days), the number of nodes (19) to first female flower appearance were recorded for treatment T_8 (50% RDN through Chemical fertilizers + 50% through Vermicompost). Increase in vine length may be due to the use of large concentration of inorganic fertilizers through inorganic sources. A sufficient supply of nitrogen to vines resulted in the release of amino acids, which are protein polymers, which boosted the rate of cell division in apical shoots and accelerated meristematic activity, resulting in enhanced vegetative characteristics in the vines (**Kharga *et al.*, 2019).** The earliness in days taken to first female flower appearance (40 days), the node (19) to which first female flower appearance might be due to the fact that plants in the presence of organic and inorganic nutrients along with vermicompost regulates the plant physiological and morphological functions that results in plants to complete vegetative growth faster and plants enters into the reproductive phase which causes female flower production to be earlier and appear at lesser node number **(Sangeeta *et al.*, 2018).**

3.2 Yield Parameters

The statistical data on yield parameters are recorded in table 2. The days taken to first fruit harvest (56 days), number of fruits per plant (20), fruit length (15.72 cm) was recorded for treatment T_8 (50% RDN through Chemical fertilizers + 50% through Vermicompost). Treated plants are physiologically active translocate food to developing fruits which results in early maturity and early harvest. Increase in number of female flowers per vine increases the number of fruits per plant which could be attributed to photosynthetic activity and accumulation of carbohydrate which enabled the growth and development of female flowers. The increase in fruit length might be due to the availability of nutrients especially N has been better sink and transported by axillary branches to the fruits that leads to healthier fruits with better length. **(Ahmed *et al.*, 2007)**. Average fruit weight (107.35 gm), fruit yield per plant (2.16 kg), fruit yield per hectare (17.96 t) was recorded for treatment T_8 (50% RDN through Chemical fertilizers + 50% through Vermicompost). This might be due to the optimal dose of NPK, which enhanced photosynthetic mobility from the source to the sink as regulated by growth hormone, and NPK uptake. These findings are agreement with findings of **(Jilani *et al.*, 2009)** in cucumber and **(Sangeeta *et al.*, 2018)** in bitter gourd**.** While the fruit diameter (7.84 cm) of bitter gourd was recorded for treatment T_2. The fruit diameter might increase due to increase in N through nitrogenous fertilizers. Significantly maximum TSS (4.33^0Brix) of bitter gourd was recorded in treatment T_8 (50% RDN through Chemical fertilizers + 50%

through Vermicompost. This might be because vermicompost released nutrients into the soil and created a favorable environment in the plant root zone, resulting in increased nutrient absorption or uptake of major and minor nutrients, which could have been linked to TSS levels in fruits. These findings are similar to findings of **(Sreenivas *et al.*, 2000), (Prashanthi *et al.*, 2021)** in bitter gourd**.** The maximum B:C ratio (3.1), net returns (Rs.207903) was also recorded maximum under the treatment T_8 which is shown in table 3.

4. CONCLUSION

Based on the results of the present investigation entitled **Effect of organic and inorganic fertilizers on growth, yield and quality of bitter gourd (*Momordica charantia* L.) in Prayagraj agroclimatic condition,** it was concluded that treatment T_8(50% RDN through Chemical fertilizers + 50% through vermicompost) was superior in terms of vine length , days to first female flower appearance , nodes to which first female flower appearance , days taken to first harvest , fruit weight, fruit length , number of fruits per plant , fruit yield per plant, yield per hectare , TSS and B:C ratio while treatment T_2 (100:50:50 NPK +10 tonnes Vermicompost) was found superior in terms of fruit diameter.

Table 1: Effect of organic and inorganic fertilizers on growth of bitter gourd (*Momordica charantia* L.)

Treatments	Treatment Combination	Days to germination	Vine length (cm)				Number of days to first female flower appearance	Node to which first female flower appears
			20 days	40 days	60 days	Last harvest		
T_0	100:50:50 NPK+20 tonnes FYM (Control)	8.1	51.63	81.56	152.81	212.56	50.67	24.11
T_1	100% RDN through chemical fertilizers	8.6	53.13	82.64	151.78	230.00	47.33	22.00
T_2	100:50:50 NPK +10 tonnes Vermicompost	8.0	56.17	87.64	156.78	277.78	45.44	23.11
T_3	100:50:50 NPK+3.3 tonnes Poultry Manure	8.9	53.64	82.84	153.82	248.67	53.00	22.67
T_4	75% RDN through Chemical fertilizers +25% RDN through FYM	8.6	55.31	83.87	154.41	243.67	49.44	25.00
T_5	75% RDN through Chemical fertilizers +25% through Vermicompost	9.2	54.12	83.32	153.09	267.67	50.11	25.11
T_6	75% RDN through Chemical fertilizers + 25% through Poultry manure	8.3	55.67	85.57	153.93	254.78	50.67	26.11
T_7	50% RDN through Chemical fertilizers + 50% through FYM	9.3	51.63	79.30	149.91	225.67	50.78	21.11
T_8	50% RDN through Chemical fertilizers + 50% through	8.8	59.79	92.43	162.27	312.44	40.67	19.44

	Vermicompost							
T_9	50% RDN through Chemical fertilizers +50% through Poultry manure	8.3	58.00	90.20	159.81	297.33	43.00	20.78
F-TEST		**S**	**S**	**S**	**S**	**S**	**S**	**S**
SE (d) ±		**0.29**	**0.67**	**0.90**	**1.06**	**2.29**	**0.07**	**0.88**
CD $_{0.05}$		**0.61**	**1.42**	**1.89**	**2.22**	**4.81**	**0.14**	**1.84**
CV		**4.11**	**1.50**	**1.30**	**0.83**	**1.09**	**0.17**	**4.68**

Table 2: Effect of organic and inorganic fertilizers on yield and quality of bitter gourd (*Momordica charantia* L.)

Treatments	Treatment Combination	Days to first harvest	No of fruits per plant	Average fruit length (cm)	Average fruit diameter (cm)	Average fruit weight (gm)	Fruit yield per plant (kg)	Fruit yield per hectare (t/ha)	TSS (^{0}Brix)
T_0	100:50:50 NPK+20 tonnes FYM (Control)	64.9	11.33	14.06	6.49	88.35	1.00	8.30	4.02
T_1	100% RDN through chemical fertilizers	66.3	12.33	10.61	5.86	93.51	1.15	9.58	2.97
T_2	100:50:50 NPK +10 tonnes Vermicompost	67.7	17.11	11.54	7.84	101.75	1.74	14.52	4.08
T_3	100:50:50 NPK+3.3 tonnes Poultry Manure	63.1	14.89	11.26	7.46	97.73	1.46	12.10	3.30
T_4	75% RDN through Chemical fertilizers +25% RDN through FYM	70.3	13.22	12.29	6.63	94.95	1.26	10.47	3.50
T_5	75% RDN through Chemical fertilizers +25% through Vermicompost	67.0	15.78	13.14	7.12	100.19	1.58	13.16	3.93
T_6	75% RDN through Chemical fertilizers + 25% through Poultry manure	63.9	15.00	12.54	6.96	99.21	1.49	12.41	3.86

T_7	50% RDN through Chemical fertilizers + 50% through FYM	63.0	11.56	10.97	6.29	89.69	1.04	8.63	3.10
T_8	50% RDN through Chemical fertilizers + 50% through Vermicompost	56.8	20.11	15.72	6.49	107.35	2.16	17.96	4.33
T_9	50% RDN through Chemical fertilizers +50% through Poultry manure	58.2	19.11	14.59	6.83	105.40	2.01	16.77	3.73
F-TEST		**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
SEd (±)		**1.96**	**0.61**	**0.19**	**0.18**	**1.02**	**0.06**	**0.47**	**0.07**
CD $_{0.05}$		**3.74**	**1.27**	**0.40**	**0.37**	**2.15**	**0.12**	**0.99**	**0.14**
CV		**4.12**	**4.93**	**1.85**	**3.16**	**1.28**	**4.62**	**4.65**	**2.27**

Table 3 : Effect of organic and inorganic fertilizers on economics of treatment

Treatments	Treatment Combination	Total cost of cultivation Rs/ha	Gross Returns Rs/ha	Net Returns/ha	B:C Ratio
T_0	100:50:50 NPK+20 tonnes FYM (Control)	113295	141100	27805	1.2
T_1	100% RDN through chemical fertilizers	73295	162860	89565	2.2
T_2	100:50:50 NPK +10 tonnes Vermicompost	113295	246840	133545	2.1
T_3	100:50:50 NPK+3.3 tonnes Poultry Manure	116195	205700	89505	1.7
T_4	75% RDN through Chemical fertilizers +25% RDN through FYM	82856	177990	95134	2.1
T_5	75% RDN through Chemical fertilizers +25% through Vermicompost	82856	223720	140864	2.7
T_6	75% RDN through Chemical fertilizers + 25% through Poultry manure	83581	210970	127389	2.5
T_7	50% RDN through Chemical fertilizers + 50% through FYM	92417	146710	54293	1.5
T_8	50% RDN through Chemical fertilizers + 50% through Vermicompost	97417	305320	207903	3.1
T_9	50% RDN through Chemical fertilizers +50% through Poultry manure	93867	285090	191223	3.0

REFERENCES

Ahmed N, Baloch, Haleem M H, Ejaz A, Ahmed N. Effect of different levels of nitrogen on growth and production of cucumber. Lifesciences *International Journal*. 2007;99-102

Ashra I, Zain M, Sarwar M, Abbasi Y K, Amin M. Role of different levels of Nitrogen, Phosphorous and Pottassium on growth, yield and quality attributes of bitter gourd (*Momordica charantia* L). *Food Science and Technology*. 2019; 7(2): 16-21. DOI: 10.13189/fst.2019.070202

Basch E, Gabardi S, Ulbricht C. Bitter melon (*Momordica Charantia* L.) a review of the efficacy and safety. *American Journal of Health Systemic Pharmacology*. 2003;**60**: 356–359.

Behera T.K., Sureja A K, Sabina, Islam, Munshi, A. D., and Sidhu, A. S. Minor cucurbits. *Genetics, genomics and breeding of cucurbits*. 2011;17- 60.

Chinanshuk G, Priyanka B, Subrata M. Effect of integrated nutrient management on growth and yield of okra on red lateritic soil of Purulia West Bengal. SATSA Mukhapatra. 2018; 22: ISSN 0971-975X

Jilani M. S., Abu B, Waseem, and Mehwish K. Effect of different levels of NPK on growth and yield of Cucumber (*Cucumis sativus*). *Journal of Agriculture and Social Sciences*. 2009;**5**: 99-101.

Prashanthi, Deepanshu and Reshma. Effect of organic and inorganic fertilizers on growth, yield and quality of bitter gourd (Momordica charantia L). *International Journal of Microbiology and Applied Sciences*. 2021;10(02): 1690-1696

Prasad P H, Mandal A R, Sarkar A, Thapa U. and Maity T K. Effect of Bio-Fertilizers and Nitrogen on Growth and Yield Attributes of Bitter gourd (*Momordica charantia* L.). *International Conference on Horticulture*. 2009;738-739.

Priyadarshini V. Response of organic and inorganic fertilizer on growth and yield of bitter gourd: A review; 2022

Sangeeta S, Champa Lal Regar, Fiza Ahmad, Vijay Kumar Singh, Ritu Kumari and Amrita Kumari. (2018). Effect of Organic and Inorganic Fertilizers on Growth, Yield and Quality Attributes of Hybrid bitter gourd (*Momordica charantia* L.). *International Journal of Current Microbiology and Applied Sciences*. 2018; **7**(04): 2256-2266.

Sreenivas C, S Muralidhar and Rao. Yield and quality of ridge gourd fruits as influenced by different levels of inorganic fertilizers and vermicompost. *Annals of Agricultural Research*. 2000; **21** (2): 262-266.

Kharga S, Pranabjyoti Sarma, Warade S D, Debnath P, Wangchu L. Effect of Integrated Nutrient Management on Growth and Yield Attributing Parameters of Cucumber (*Cucumis sativus* L.*). International Journal of Current Microbiology and Applied Sciences*. 2019;**8**(8): 1862-1871.