



Effect of Organic Manure and Inorganic Fertilizer on Growth, Fruit Yield and Quality of Bitter Gourd (*Momordica charantia* L.)

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

The experiment was conducted on bitter gourds at the department of horticulture in Shuats, Uttar Pradesh. To find out the effect of organic and inorganic fertilizers on the growth, fruit yield, and quality of bitter gourd with three different varieties: TMBI 1309, TMBI 3346, and VNR 22. Experimental factors included N:P:K(RDF) alone and with the combination of six various treatments, including V1, V2, and V3, i.e., V1+fym (18 t/ha), V1+vermicompost (1.23 t/ha), V1+poultry manure (12.5 t/ha), V1+NPK(100%)+FYM, V1+NPK+VC, and V1+NPK+PM. same as applied for the other two varieties. It revealed that variety V2 (TMBI 3346) was recorded as significantly taller plants

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(201.71) and also recorded in T7 NPK + PM (210.30 cm), with the earliest 50% male flower initiation (57.52), and hybrid v2 with days to germination (65.09) in T7 (69.87 cm). IT also revealed that V2 was recorded with fruit length (cm), fruit diameter (cm), and fruit weight (kg) of 17.64, 14.40, and 72.78, respectively. Data also revealed that more fruits per plant, yield per acre, and yield per hectare were recorded in TMBI 3346. The hybrid V2 (VNR 22) (1.85) and treatment T7 (NPK (100%) + PM (12.5/ha) recorded (1.65) showed the greatest impact of varieties and treatments on TSS.

Keywords: N:P:K; Vermicompost (VC); Poultry manure (PM); FYM.

1. INTRODUCTION

The juvenile tuberculate fruits of the bitter melon (*Momordica charantia* L.), which have a distinct bitter flavor, are the reason this vegetable crop is so important. *Momordica charantia* has a somatic chromosomal number of $2n=2x=22$. It is a member of the "Cucurbitaceae" family. Fruits are thought to be a great source of vitamins, minerals, and vitamin C, with 88 mg per 100g. The vegetable known as a bitter melon has green skin, white to translucent flesh, and a flavor that matches its name. If bitter melon was not a staple in your childhood diet, it may take some time for you to get used to its bitter taste. *Momordica charantia* most likely came from southern China or eastern India. It prefers hot, muggy weather with lots of sunshine and regular availability to water. Though it has gained popularity in the Caribbean and South America, bitter melon is still grown in farms throughout Asia today.

Agricultural yard Essentially, cow feces, urine, waste straw, and other dairy wastes are used to prepare manure. FYM has a lot of nutrients. While the plants may immediately use a tiny amount of N, a bigger amount becomes available as the FYM breaks down. Plants are provided with a balanced nutrition when urine and cow manure are combined. Potassium and phosphorus availability from FYM is comparable to that from inorganic sources. Soil fertility is increased with FYM application.

It has been demonstrated that vermicompost, as opposed to compost made using other ways of composting, is more nutrient-rich. It has also performed better than a commercial plant medium with added nutrients; nevertheless, pH and magnesium levels needed to be adjusted. increases in the soil's accessible nitrogen and phosphorus levels, as well as a rise in the vermicompost's overall nitrogen content. increases agricultural production, plant development, and germination enhances the structure and growth of roots, microorganisms that enrich the soil.

One of the most crucial elements in raising plant productivity is plant nutrition. One of the elements that has the biggest effects on a plant's growth, development, yield, and fruit quality is nitrogen (N). In contemporary agriculture, reducing reliance on chemical fertilizers and promoting sustainable output are essential goals that can be met with the use of an integrated plant nutrient supply system (IPNS). However, organic manures such as FYM, poultry, and pig manure are readily available in the area, are inexpensive, and can be effectively used for tomato cultivation. Integrated nutrition sources improve soil fertility and nutrient use, which in turn increases tomato yield. In addition to balancing the nutrition supply, organic manures enhance the chemical and physical characteristics of the soil. Vermicomposting recognized to boost plant protein synthesis, have a discernible impact on plant yield and growth. The use of biofertilizers, which are more affordable and environmentally friendlier than chemical fertilizers, can help lessen reliance on fertilizers.

2. MATERIALS AND METHODS

The research was conducted from July to October of 2023 at the Horticulture Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj (U.P.). With three replications and 21 treatments, the experiment was carried out using a Factorial Randomized Block Design. viz.T0: V1T0 TMBI-1309+Control (Water Spray),T1: V1T1 TMBI-1309 + FYM (18 t/ha) , T2: V1T2 TMBI-1309+Vermicompost (1.25 t/ha), T3: V1T3 TMBI-1309 + Poultry manure (12.5 t/ha), T4: V1T4 TMBI-1309 + NPK (100%) + FYM (18t/ha), T5: V1T5 TMBI-1309+ NPK (100%) +Vermicompost (1.25t/ha), T6: V1T6 TMBI-1309 + NPK (100%) +Poultry manure (12.5t/ha), T7: V2T0 TMBI-3346+Control (Water Spray),T8: V2T1 TMBI-3346 + FYM (18 t/ha) , T9: V2T2 TMBI-3346+Vermicompost (1.25 t/ha), T10:

V2T3 TMBI-3346 + Poultry manure (12.5 t/ha), T11: V2T4 TMBI-3346 + NPK (100%) + FYM (18t/ha), T12: V2T5 TMBI-3346+ NPK (100%) +Vermicompost (1.25t/ha), T13: V2T6 TMBI-3346 + NPK (100%) +Poultry manure (12.5t/ha), T14: V3T0 VNR-22 +Control (Water Spray),T15: V3T1 VNR-22 + FYM (18 t/ha) , T16: V3T2 VNR-22 +Vermicompost (1.25 t/ha), T17: V3T3 VNR-22 + Poultry manure (12.5 t/ha), T18: V3T4 VNR-22 + NPK (100%) + FYM (18t/ha), T19: V3T5 VNR-22 + NPK (100%) +Vermicompost (1.25t/ha), T20: V3T6 VNR-22 + NPK (100%) +Poultry manure (12.5t/ha), with three Bitter gourd hybrids TMBI-1309 ,TMBI-3346 and VNR-22. Plants were spaced 150 x 75 cm apart, and a basal dose of FYM@ 18 tonnes + NPK 100:25:50 was applied. Insecticide was sprayed at 20, 40, and 60 days following the appearance of the first two genuine leaf stages. The plot measured 3 by 1.5 meters. The following parameters are where the data was recorded: fruit yield/acre (q/acre), fruit yield/hectare (q/ha), fruit length (cm), fruit weight (g), fruit diameter (cm), days to first harvest, number of fruits per plant, fruit length (cm), fruit weight (g), and TSS.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

3.1.1 Vine length(cm)

The length of the vine differs greatly throughout hybrids. Variety TMBI-3346 (201.71 cm) in Table 1 had a longer vine 60 days after sowing. Table 2 shows that the longer vine length was observed in NPK (100%) + Poultry manure (12.5t/ha) (210.30 cm) due to the varying quantities of organic and inorganic fertilizer. Table 3 showed that T6: TMBI-1309 + NPK (100%) + Poultry manure (12.5t/ha) had a longer vine length (214.08 cm) based on interaction data. Similar findings of Mujahid et al. [1] in lettuce and Bano and Kale [2] in brinjal and radish were also observed.

3.1.2 Days to 1st male flower

The first male flower's days vary greatly amongst hybrids. Table 1 shows that variety TMBI-3346 (57.52) has early male flower initiation. Table 2 shows that the earliest male flower was observed in NPK (100%) + Poultry manure (12.5t/ha) (61.83 cm) because of the varying quantities of organic and inorganic fertilizer. Table 3's interaction results showed that the earliest male flower initiation (65..57) was recorded for T13:

V2T6 TMBI-3346 + NPK (100%) + Poultry manure (12.5t/ha). . The presence of GA3 and N,P,K may be the cause of early female flower initiation. Patle et al. obtained similar results [3].

3.1.3 Days to 1st female flowers

Days of January 1st The female flower in several hybrids differs greatly from one another. Variety TMBI-3346 (46.45) was observed to have early female flower initiation in Table 1. Table 2 shows that the earliest female flower was observed in NPK (100%) + Poultry manure (12.5t/ha) (52.45) due to the varying quantities of organic and inorganic fertilizer. Interaction findings revealed that T13: V2T6 TMBI-3346 + NPK (100%) +Poultry manure (12.5t/ha) was observed with earliest female flower initiation (54.50) in Table 3. The presence of GA3 and N,P,K may be the cause of early female flower initiation. Patle et al. obtained similar results [3].

3.1.4 Days to the first harvest

The number of days till the first harvest varies greatly amongst hybrids. In Table 1, the variety TMBI- 3346 (65.09) had the earliest days to harvest. In Table 2, the treatment with the highest number of fruits (69.87) was NPK (100%) + poultry manure (12.5t/ha). Interaction results showed that T13: V2T6 TMBI-3346 + NPK (100%) + Poultry manure (12.5t/ha) (72.03) in Table 3 had the earliest number of days to first harvest. Early fruit maturity may be the consequence of enhanced metabolic activity in the days preceding up to the initial harvest, which in turn causes active nutrient translocation to produce fruits. Anjanappa et al. [4] reported similar findings.

3.2 Yield Parameters

3.2.1 No. of fruits per plant

The number of fruits produced by each hybrid plant varies greatly. Table 1 displays the maximum quantity of bitter gourd fruits per plant for variety VNR-22 (40.63). Table 2 indicates that the treatment of NPK (100%) + poultry manure (12.5t/ha) (47.63) produced the highest amount of bitter gourd fruits per plant. The largest quantity of bitter gourd fruits per plant was found in T20: V3T6 VNR-22 + NPK (100%) + Poultry manure (12.5t/ha) (51.17) in Table 3 according to interaction data. The Similar result were reported by the Sekhar and Rajashree, [5] in tomato hybrid and Jose [6] in Brinjal.

Table 1. Three hybrids' effects on bitter gourd growth, yield, and quality

Hybrids	Vine Length(cm) 60 Days	Days to 1 st Male Flower	Days to 1 st Female Flower	Days to First Harvest	No. of Fruits Per Plant	fruits Length (cm)	Fruit Weight (kg)	Fruit Diameter (cm)	Yield/Acre (q/acre)	Yield/Hectare (q/ha)	TSS (oBrix)
V ₁ (TMBI-1309)	191.65	54.72	43.02	62.62	39.23	16.61	72.85	14.04	4.83	12.07	1.00
V ₂ (TMBI -3346)	201.71	57.52	46.45	65.09	38.31	17.64	70.78	14.00	6.18	15.46	1.53
V ₃ (VNR 22)	189.91	55.15	45.35	64.44	40.63	17.44	71.95	14.40	7.57	18.92	1.85
SEm±	1.10	1.46	0.20	0.34	0.21	0.11	0.43	0.09	0.04	0.09	0.01
CD or LSD	3.14	4.18	0.59	0.97	0.60	0.31	1.22	0.25	0.11	0.27	0.02

Table 2. Impact of different concentrations of Organic manure and inorganic fertilizer on growth, yield and quality of bitter gourd

Treatments	Vine Length(cm) 60 days	Days to 1 st Male Flower	Days to 1 st Female Flower	Days to First Harvest	No. of Fruits Per Plant	fruits Length (cm)	Fruits Weight (kg)	Fruit Diameter (cm)	Yield/Acre (q/acre)	Yield/Hectare (q/ha)	TSS (oBrix)
T ₀	166.76	50.40	39.92	59.16	31.61	12.75	54.13	12.79	5.60	14.00	1.32
T ₁	188.18	52.56	41.95	60.19	34.00	14.19	62.57	13.92	5.83	14.56	1.37
T ₂	192.97	53.39	42.89	61.41	36.41	16.28	69.56	14.10	6.04	15.10	1.41
T ₃	197.88	56.03	43.88	63.34	38.35	18.07	71.39	14.15	6.16	15.39	1.46
T ₄	200.16	57.39	44.46	66.55	40.78	19.16	76.35	14.37	6.42	16.04	1.50
T ₅	204.72	58.98	49.05	67.85	46.94	19.98	82.98	14.61	6.51	16.26	1.55
T ₆	210.30	61.83	52.45	69.87	47.65	20.15	86.03	15.06	6.80	17.00	1.62
SEm±	1.68	2.23	0.31	0.52	0.32	0.16	0.65	0.13	0.06	0.14	0.01
CD or LSD	4.80	6.38	0.89	1.48	0.92	0.47	1.87	0.38	0.17	0.41	0.04

Table 3. Interaction effect of organic manure and inorganic fertilizer on growth yield and quality of two different hybrids of bitter gourd

Notation	Treatment Combination	Vine Length(cm) 60 days	Days to 1 st Male Flower	Days to 1 st Female Flower	Days to First Harvest	No. of Fruits Per Plant	Fruits Length (cm)	fruits Weight (kg)	Fruit Diameter (cm)	Yield/Acre (q/acre)	Yield/Hectare (q/ha)	TSS (oBrix)
T ₀	V1T0	177.17	51.16	37.33	57.57	30.34	12.38	52.09	11.03	4.27	10.67	0.85
T ₁	V1T1	185.81	51.64	39.49	58.50	33.48	14.01	60.74	14.05	4.37	10.93	0.89
T ₂	V1T2	185.99	52.71	41.21	61.93	37.11	15.11	71.37	14.22	4.70	11.74	0.93
T ₃	V1T3	186.33	53.88	43.36	61.93	38.98	16.41	72.29	14.04	4.72	11.80	0.97
T ₄	V1T4	191.83	56.40	44.02	64.48	41.41	19.30	76.76	14.43	5.09	12.72	1.02
T ₅	V1T5	200.36	57.50	46.65	65.81	46.05	19.49	87.81	15.04	5.15	12.86	1.11
T ₆	V1T6	214.08	59.78	49.09	68.14	47.27	19.55	88.89	15.46	5.50	13.76	1.24
T ₇	V2T0	158.14	46.87	39.75	58.43	33.44	12.02	60.46	13.27	5.64	14.09	1.38
T ₈	V2T1	202.64	52.18	42.99	60.58	34.24	13.84	64.97	13.59	5.89	14.73	1.42
T ₉	V2T2	208.50	53.77	43.14	60.89	34.98	16.40	67.36	13.95	5.96	14.91	1.48
T ₁₀	V2T3	209.03	60.16	43.56	64.51	37.01	19.87	69.99	14.06	6.22	15.54	1.54
T ₁₁	V2T4	209.53	61.23	43.62	68.54	40.05	20.24	76.67	14.32	6.38	15.96	1.59
T ₁₂	V2T5	211.30	62.86	50.62	70.67	43.92	20.39	74.13	14.34	6.36	15.89	1.63
T ₁₃	V2T6	212.87	65.57	54.50	72.03	44.51	20.69	81.87	14.47	6.83	17.06	1.67
T ₁₄	V3T0	158.14	53.17	42.68	61.46	31.06	13.87	49.83	14.08	6.90	17.25	1.74
T ₁₅	V3T1	202.64	53.86	43.36	61.50	34.27	14.70	62.01	14.11	7.21	18.03	1.79
T ₁₆	V3T2	208.50	53.71	44.32	61.42	37.13	17.32	69.96	14.14	7.46	18.64	1.82
T ₁₇	V3T3	209.03	54.03	44.72	63.59	39.06	17.94	71.91	14.36	7.53	18.83	1.86
T ₁₈	V3T4	209.53	54.54	45.73	66.63	40.87	17.94	75.63	14.36	7.78	19.46	1.89
T ₁₉	V3T5	211.30	56.60	49.87	67.08	50.84	20.08	87.00	14.47	8.01	20.04	1.91
T ₂₀	V3T6	212.87	60.13	53.75	69.43	51.17	20.20	87.32	15.25	8.08	20.19	1.94
	S.Ed(±)	2.91	3.87	0.54	0.90	0.56	0.29	1.13	0.23	0.10	0.25	0.02
	CD or LSD	8.32	11.06	1.55	2.57	1.59	0.82	3.24	0.66	0.29	0.72	0.06

3.2.2 Fruit length (cm)

The length of the fruit varies greatly amongst hybrids. Table 1 shows the maximum fruit length (17.64 cm) for variety TMBI-3346. with Table 2, the maximum fruit length was recorded with NPK (100%) + Poultry manure (12.5t/ha) (20.15cm). T13 interaction data: V2T6 TMBI-3346 + 100% NPK + poultry manure (12.5 t/ha) is noted in Table 3 with a maximum fruit length of (20.69 cm). The maximum length of the fruit may have resulted from increased photosynthesis that caused cell elongation and division, as well as growth hormones and macronutrients that affected the treated plants. Similar results in okra were also previously reported by Abusaleh [7].

3.2.3 Fruit diameter (cm)

Fruit diameters of several hybrids fluctuate considerably from one another. Table 1 shows that variety VNR-22 had the largest fruit girth, measuring (14.40 cm).Fruit girth average was significantly affected by treatments. In Table 2, the maximum fruit diameter of (15.06 cm) was recorded with NPK (100%) + Poultry manure (12.5t/ha). It was discovered that there was a considerable interaction between the treatments and hybrids on the average fruit diameter. Table 3 displays the interaction data that were discovered in T6: V1T6 TMBI-1309 + NPK (100%) + Poultry manure (12.5t/ha) is documented with the largest fruit diameter (15.46 cm). The integrated use of NPK along with organic manures significantly influenced the length diameter ratio of fruit result are conformity with finding of Mausi [1] also reported that application of muskmelon resulted in bigger fruit.

3.2.4 Fruit weight (kg)

Fruit weight in hybrids differs greatly from one another. In Table 1, the variety TMBI-1309 (72.85 kg) had the highest fruit weight. Table 2 shows that greater fruit weight was recorded at NPK (100%) + Poultry manure (12.5t/ha) (86.03.66 kg) due to differing concentrations. It was discovered that there was a considerable interaction between the treatments and hybrids on the average fruit weight. The interaction results showed that the maximum fruit weight (88.89 kg) for T6: V1T6 TMBI-1309 + NPK (100%) + Poultry manure (12.5 t/ha) is recorded in Table 3. Similar outcomes have been reported for tomatoes by Sekhar and Rajashree [8] and cardamom by Vadiraj et al. [9].

3.2.5 Yield per acre (q/acre)

The quintal yield of fruit per acre varies statistically amongst hybrids. Variety VNR-22 (7.57) yielded the highest fruit output quintal per acre, according to Table 1. Table 2 shows that the treatment with 100% NPK + 12.5% poultry manure (12.5 t/ha) (6.80) had the highest fruit output tons per hectare due to the varying percentages of organic and inorganic fertilizer. The interaction impact between hybrids and treatments on the average quintal fruit yield per acre was found to be greatest in treatment T20: V3T6 VNR-22 + 100% NPK + Poultry manure (12.5 t/ha) (8.08) in Table 3 [10,11].

3.2.6 Yield per hectare (t/ha)

The amount of fruit produced per hectare varies statistically amongst hybrids. Variety VNR-22(18.92) yielded the highest fruit production tons per hectare, according to Table 1. Table 2 indicates that the treatment with 100% NPK + 12.5 t/ha of poultry manure (17.00) yielded the highest fruit yield tons per hectare, owing to the varying percentages of organic and inorganic fertilizer. The interaction impact between hybrids and treatments on average fruit production tons per hectare was found to be greatest in treatment T20: V3T6 VNR-22 + 100% NPK + Poultry manure (12.5 t/ha) (20.19) in Table 3.

3.3 Quality Parameters

3.3.1 TSS (°Brix)

TSS differs statistically amongst several hybrids. Table 1 shows that variety VNR-22(1.85) had the highest TSS. Owing to the varying amounts of organic and inorganic fertilizer, treatment NPK (100%) + poultry manure (12.5t/ha) (1.62) in Table 2 had the highest TSS. Table 3 shows the largest interaction impact on TSS caused by hybrids and treatments in treatment T20: V3T6 VNR-22 + 100% NPK + Poultry manure (12.5 t/ha) (1.94). Increased in Total soluble solids content of fruits in treatments of organic manures, previously also reported by Sekhar and Rajashree [8,12].

4. CONCLUSION

From the present investigation, it was concluded that the influence of organic manures with different treatment combinations played their significant impact on bitter gourd growth, yield, and quality. Hybrid TMBI-3346 and treatment NPK (100%) + Poultry manure (12.5 t/ha)

recorded best in vine length , days to 1st male flower , days to 1st first female flowers , days to first harvest, fruit weight , fruit length , fruit diameter , number of fruits per plant, yield (t/ha), TSS (°Brix), Fruit shape, Fruit colour , with net return (327850) and Benefit Cost ratio (4.75).

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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