



Performance of Different Hybrids of Bitter Gourd (*Momordica charantia* L.) in Terms of Growth, Yield and Quality in Prayagraj Agro-climatic Condition

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Bitter gourd botanically known as *Momordica charantia* (L.) is an important commercial cucurbitaceous vegetable belonging to the family Cucurbitaceae, with a diploid chromosome number, $2n=22$. It is variously known as balsam pear, bitter melon, bitter gourd, and African bitter gourd. Therefore, the present investigation was carried out at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences,

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Prayagraj, Uttar Pradesh during the *Zaid* season 2023 with a view to check performance of different genotypes of bitter gourd under Prayagraj agro climatic conditions. The experiment was laid in Randomized block design with 12 hybrids with 3 replications. The results concluded that growth parameters viz. Vine length at last harvest (3.45 m), and yield attributes viz. individual fruit weight (53.13 g) was highest in H6 fruit diameter (40.67 mm) was highest in H5 and fruit length (13.57 cm) was highest in H3 and weight of fruit per plant(kg) (1.38) in H6 and yield of fruits per hectare(q/h) (122.48) was recorded highest in H6. Growth Parameters viz. TSS brix (4.30) was recorded highest in H9 and Ascorbic acid (%) (1.67) in H1. Highest gross returns (4,89,920 Rs/ha), net return (3,44,706 Rs/ha) and Benefit cost ratio (3.37) was also recorded in highest in H6.

Keywords: *Momordica charantia*; hybrids; growth; fruit yield and quality.

1. INTRODUCTION

“Bitter gourd botanically known as *Momordica charantia* L. is an important commercial cucurbitaceous vegetable belonging to the family Cucurbitaceae, with a diploid chromosome number, $2n=22$. It is variously known as balsam pear, bitter melon, bitter gourd, and African bitter gourd” [1]. “Bitter gourd is grown in different varieties in different countries. In India the main varieties are India long green, India long white and Hybrid India baby whereas Japan is famous for Japan Green Spindle, China is for green lover and Hong Kong for its Hong Kong Green” [2]. “In Bangladesh mainly two varieties are grown i.e., Uchee (small) and Korolla (long)” [3]. “The bitter gourd plant is perennial with climbing and flowering vine grows up to 5 m and fruits are elongated with ridges on surface” [4]. “The young fruit is emerald green and later changes to orange-yellow when it is ripened” [5]. “The shape and size of bitter gourds vary due to varieties, climatic factors, regions but in general bitter gourds are 1.0 to 9.8 inch long and 1.0 to 5.9 inch wide with round, oval, oblong and club in shape and colour varies from dark green to white. In India the length of bitter gourd ranges from 2.4 to 3.9 inch and dark green in colour with ridges on its surface” [6]. “The bitter gourd fruit gets mature after 45-80 days and harvesting is carried out after 60 days and continues up to 150 days from the planting” [7]. “The shelf life of fresh bitter gourd is only 4 days at natural conditions, and it can be stored up to 3-4 weeks in cold storage (0 to 7°C)” [8]. The bitter gourd is highly nutritious due to presence higher amount of protein, ascorbic acid, calcium, iron, and phosphorus [9], also important source of glucosides, carbohydrate, charantin, steroidal, saponin, momordium, vitamins, protein and minerals [10-12]. “The protein content in bitter gourd is fractioned into albumin (49.3 per cent), globulin (29.3 per cent) and glutelin (3.1 per cent)” [13]. “The seeds of the bitter gourd contain

35 to 40 per cent of oil and fatty acid i.e., 3.33 per cent MUFA (monosaturated fatty acid) and 36.71 per cent SFA (saturated fatty acids)” [14]. “Bitter gourd contains high amount of Vitamin A, Vitamin C and vitamins B1, B2, B3 and B12” [15]. According to NHB [16] area under bitter gourd production in India accounts to 96.85 million ha with production of 1332.55 million tonnes in year 2021-22. Madhya Pradesh ranks first in area and production of bitter gourd in year 2021-22 followed by Chhattisgarh and Tamil Nadu. The production of bitter gourd in Uttar Pradesh is 89.73 million tonnes for year 2021-22. It has many uses in ayurvedic medicines. Study was undertaken to estimate the performance of different hybrid varieties of Bitter gourd (*Momordica charantia*) under Prayagraj Agro-climatic condition [17-19]. The varieties were evaluated based on growth, yield and quality of varieties, shelf life and economics of different Bitter gourd hybrid varieties. Yield is a complex character and their interactions. For any effective selection programme, it would be desirable to consider the relative magnitude of association of various characters yield.

2. MATERIALS AND METHODS

The present investigation was done to understand the plant growth, fruit yield and quality of fruit of different F_1 hybrids of bitter gourd. The investigation was carried out at Horticultural Research Farm (HRF), Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Prayagraj during the winter season of 2022-23. The experiment was laid in Randomized block design with 12 Hybrids and 3 replications. Hybrids comprised of H₁ (2020/BIGHYB-1), H₂ (2020/BIGHYB-2), H₃ (2020/BIGHYB-3), H₄ (2020/BIGHYB-4), H₅ (2020/BIGHYB-5), H₆ (2020/BIGHYB-6), H₇ (2020/BIGHYB-7), H₈ (2020/BIGHYB-8) H₉ (2020/BIGHYB-9),

H₁₀(Shriram Samridhi), H₁₁ (Alpine F₁ Hybrid) and H₁₂ (F₁ Hybrid Aman). Observations were recorded at different stages of growth for parameters like vine length, days to flower emergence, fruit length, fruit diameter and yield per vine and quality parameters like TSS and vitamin C content. The data were statistically analysed by the method suggested by Fisher and Yates [20]. The experimental site is levelled land with sandy loam soil of uniform fertility status with low clay and high sand percentage. Soil samples were collected randomly from depth of 0-30 cm and the soil was analysed for pH found to be slight neutral (6.9), organic carbon was 0.36%, available nitrogen was 212.56 kg ha⁻¹, available phosphorus was 14.59 kg ha⁻¹, and available potassium was 225.10 kg ha⁻¹. The preparation of the experimental field involved several steps to ensure optimal conditions for cultivation. Initially, a Tractor drawn disc plough was used to plough the field. Following this primary ploughing, two cross harrowing sessions were conducted, and the field was then planked. To achieve a uniform surface, a leveller was employed to thoroughly level the field before proceeding with the experimental layout. This sequence of activities was undertaken to create an environment conducive to the study's objectives and to promote consistent and reliable results. To maintain a weed-free field, regular and shallow cultivation was performed frequently. This process aimed to eliminate weeds, enhance soil aeration, and support healthy root development. Furthermore, two to three hoeing sessions and earthing up were conducted to meticulously control weed growth and maintain the crop's weed-free status. Around FYM 40 t/ha as basal was applied to field and 35 kg of N/ha at 30 days after sowing. NPK are required for hybrid bitter gourd is 150:75:75 kg NPK/ha, accordingly urea, DAP, MOP was applied in field. Light irrigation was provided at critical stages of crop growth, such as just after transplanting, pre flowering, fruit formation.

3. RESULTS AND DISCUSSION

3.1 Growth Parameters

The data pertaining to Vine length significantly varied among different Hybrids. The hybrid AVT-II 2020/BIGHYB-6 has the longest vines, measuring 3.45m, while AVT-II 2020/BIGHYB-9 had the second longest, measuring 3.36 m. In AVT-II 2020/BIGHYB-8, shortest vine length of 2.51 m was noted. Hybrid AVT-II 2020/BIGHYB-6

of bitter gourd likely exhibits a longer vine length compared to other hybrids due to its specific genetic makeup and environmental interactions. Research on bitter gourd [21,22] reported similar results.

3.2 Earliness Parameters

With 46.20 days, the hybrid AVT-II 2020/BIGHYB-1 was earlier most for male flowering; AVT-II 2020/BIGHYB-5 and Shriram Samridhi came second most early in number of days to first male flowering, with 51.80 days. The maximum days to first male flowering (53.67 days) was observed in AVT-II 2020/BIGHYB-8. With 50.80 days, the hybrid AVT-II 2020/BIGHYB-5 was earlier most for female flower appearance; AVT-II 2020/BIGHYB-7 came second most early in number of days to first female flower appearance, with 51.60 days. The maximum days to first female flower appearance (53.83 days) was observed in AVT-II 2020/BIGHYB-8. With 54.67 days, the hybrid AVT-II 2020/BIGHYB-5 was earlier most for fruit harvest; AVT-II 2020/BIGHYB-7 came second most early in number of days to first fruit harvest, with 57.00 days. The maximum days to first fruit harvest (61.67 days) was observed in AVT-II 2020/BIGHYB-3.

This trait could confer advantages in bitter gourd cultivation, such as extended fruiting periods and improved yield potential. Similar findings were reported in studies on bitter gourd by Kumar and Topno [22] Triveni et al., 2022.

3.3 Yield Parameters

The hybrid AVT-II 2020/BIGHYB-2 had maximum number of fruits per plant (28.07 fruits), followed by F₁ hybrid Aman (26.07 fruits). In AVT-II 2020/BIGHYB-8, the minimum number of fruits per plant (22.73 fruits) was noted. The hybrid Shriram Samridhi exhibited the longest fruit (13.57 cm), at par with AVT-II 2020/BIGHYB-6 (12.90 cm). The minimum fruit length (7.33 cm) was observed in AVT-II 2020/BIGHYB-1. The hybrid AVT-II 2020/BIGHYB-5 exhibited the maximum fruit diameter (40.67 mm), at par with AVT-II 2020/BIGHYB-3 (40.00 mm). The minimum fruit diameter (34.00 mm) was observed in Alpine F₁ hybrid.

The findings were earlier reported in studies on bitter gourd by Ramya et al. [23] Kumar and Topno [22] Triveni et al., 2022.

Table 1. Performance of different Hybrids of bitter gourd for various vine length, flowering and yield parameters studied

Hybrid Notation	Hybrid details	Vine length (cm)	Days to first male flower appearance	Days to first female flower appearance	Days to first fruit harvest	No of fruits per plant	Fruit length (cm)
H ₁	AVT-II 2020/BIGHYB-1	2.82	46.20	53.67	59.67	24.07	7.33
H ₂	AVT-II 2020/BIGHYB-2	3.17	53.20	53.67	60.33	28.07	10.80
H ₃	AVT-II 2020/BIGHYB-3	2.65	53.27	55.30	61.67	23.07	11.73
H ₄	AVT-II 2020/BIGHYB-4	-	-	-	-	-	-
H ₅	AVT-II 2020/BIGHYB-5	3.01	51.80	50.80	56.67	25.87	11.87
H ₆	AVT-II 2020/BIGHYB-6	3.45	52.90	54.60	60.33	25.93	12.90
H ₇	AVT-II 2020/BIGHYB-7	2.94	52.37	51.60	57.00	23.07	11.57
H ₈	AVT-II 2020/BIGHYB-8	2.51	53.67	53.83	61.33	22.73	12.87
H ₉	AVT-II 2020/BIGHYB-9	3.36	52.90	52.90	57.67	25.47	11.70
H ₁₀	Shriram Samridhi	3.14	51.80	52.97	57.33	25.30	13.57
H ₁₁	Alpine F ₁ Hybrid	3.02	52.90	53.80	58.00	25.23	12.80
H ₁₂	F ₁ hybrid Aman	3.19	52.57	52.77	58.33	26.07	10.93
'F' Test		S	S	S	S	S	S
SE d (±)		0.22	1.19	1.15	1.27	0.80	0.83
CD. at 5%		0.45	2.49	2.40	2.65	1.66	1.73
CV (%)		8.76	2.00	2.64	2.64	3.91	8.74

Table 2. Performance of different Hybrids of bitter gourd for various yield and quality parameters studied

Hybrid Notation	Hybrid details	Fruit diameter (mm)	Fruit weight (grams)	Fruit yield per plant (kg/plant)	TSS [°Brix]	Ascorbic acid content (mg)
H ₁	AVT-II 2020/BIGHYB-1	37.67	37.57	0.90	3.37	1.67
H ₂	AVT-II 2020/BIGHYB-2	39.33	47.60	1.34	3.07	1.37
H ₃	AVT-II 2020/BIGHYB-3	40.00	35.60	0.82	3.27	0.93
H ₄	AVT-II 2020/BIGHYB-4	-	-	-	-	-
H ₅	AVT-II 2020/BIGHYB-5	40.67	47.13	1.22	3.50	1.27
H ₆	AVT-II 2020/BIGHYB-6	39.33	53.13	1.38	3.90	1.53
H ₇	AVT-II 2020/BIGHYB-7	39.67	38.03	0.88	4.17	1.50
H ₈	AVT-II 2020/BIGHYB-8	35.83	36.83	0.84	2.93	1.27
H ₉	AVT-II 2020/BIGHYB-9	39.33	46.13	1.17	4.30	1.07
H ₁₀	Shriram Samridhi	36.00	43.93	1.11	4.27	1.37
H ₁₁	Alpine F ₁ Hybrid	34.00	41.13	1.04	3.03	1.10
H ₁₂	F ₁ hybrid Aman	35.33	37.47	0.98	4.13	1.53
'F' Test		S	S	S	S	S
SE d (±)		2.04	1.92	0.07	0.15	0.14
CD. at 5%		4.26	4.01	0.15	0.32	0.29
CV (%)		6.60	5.57	8.32	5.13	12.87

The hybrid AVT-II 2020/BIGHYB-6 exhibited the maximum fruit weight (53.13 grams) at par with AVT-II 2020/BIGHYB-2 having 47.60 grams. The minimum fruit weight (35.60 grams) was observed in AVT-II 2020/BIGHYB-3. The highest fruit yield per plant (1.38 kg/plant) was displayed by the hybrid AVT-II 2020/BIGHYB-6, which was comparable to AVT-II 2020/BIGHYB-2 with 1.34 kg/plant. In AVT-II 2020/BIGHYB-3, the lowest fruit yield per plant (0.82 kg/plant) was recorded.

The findings were earlier reported in studies on bitter gourd by Ramya et al. [23] Kumar and Topno [22].

3.4 Quality Parameters

The highest TSS (4.30 °Brix) was displayed by the hybrid AVT-II 2020/BIGHYB-9, which was comparable to Shriram Samridhi with 4.27 °Brix. In AVT-II 2020/BIGHYB-8, the lowest TSS (2.93 °Brix) was recorded. The highest ascorbic acid content (1.67mg) was displayed by the hybrid AVT-II 2020/BIGHYB-1, which was comparable to AVT-II 2020/BIGHYB-6 and F₁ hybrid Aman with 1.53mg. In AVT-II 2020/BIGHYB-3, the lowest ascorbic acid content (0.93mg) was recorded. The findings were earlier reported in studies on bitter gourd by Poornima et al. [24] Triveni et al., 2022.

4. CONCLUSIONS

It is concluded that AVT-II 2020/BIGHYB-6(H6) recorded highest in terms of growth, yield (122.48q/h), and quality fruit characteristics. Net returns and benefit cost ratio was best in the AVT-II 2020/BIGHYB-6(H6). In terms of quality, hybrid AVT-II 2020/BIGHYB-5(H5) was found to be best for purpose of chips.

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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