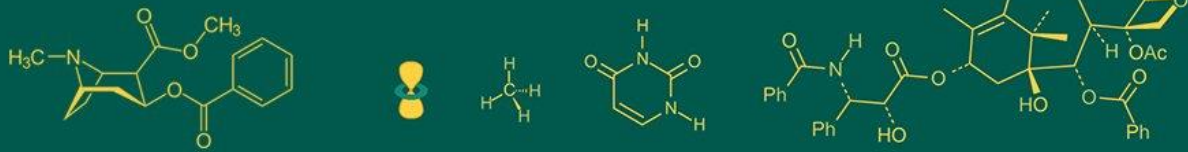


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Performance of bitter gourd (*Momordica charantia* L.) hybrids for growth, yield and quality under Prayagraj agro climatic conditions

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Abstract

Field experiment was conducted during February to May, 2023 at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj to study "Performance of Bitter Gourd (*Momordica charantia* L.) Hybrids for Growth, Yield and Quality Under Prayagraj Agro Climatic Conditions". The experiment was laid out in randomized block design (RBD) with three replications of 10 varieties. The allocation of treatments of the individual plots using random number in each replication. Based on the results obtained, to find out the most promising variety of hybrid bitter gourd for better growth, high yield and quality. The results revealed that H5 (SW 826) performed the best in term in vine length (145.04 cm), no. of branches (6.06), no. of leaves (60.8), days to first male flower appearance (36.4), days to first female flower appearance (40.13), fruit number per plant (13), fruit weight (101.8 kg), fruit length (13.93 cm), fruit girth (17.06 cm), fruit yield per plant (3.87 kg) and fruit yield per hectare (20.31 t/ha) and quality parameters viz., total soluble solids (5.53*Brix) content and vitamin c – content (84.4 mg/100g) and highest benefit cost ratio was observed in H5 (4.47). Therefore the hybrid H5 (SW 826) is the best when compared to other hybrids.

Keywords: Growth, bitter gourd hybrids, quality and yield

Introduction

Bitter gourd (*Momordica charantia* L.), $2n=22$, is an annual, climber vine belonging to Cucurbitaceae family is one of the most popular vegetables in Bangladesh and also in other Asian countries namely China, Taiwan, Vietnam, Thailand, India and the Philippines. The origin of bitter gourd is Indo-Burma Region. It is adapted to a wide range of environments and can be grown in tropical and subtropical climates. It requires a minimum temperature of 18 °C during early growth, but optimal temperature are in the range of 24-27 °C.

Bitter gourd is an important plant of the Cucurbitaceae family with high nutritional content. It is also used by people in the treatment of many diseases. It is also known as bitter gourd, African cucumber, balsam apple, balsam pear, papilla, and karela. Bitter melon is a tropical plant that likes moist and warm areas. Its homeland is India. It is grown in open areas in temperate regions of Turkey and greenhouse environments in cold regions. This plant is used both for treatment and food in many regions where it grows and is grown. The bitter melon plant is grown in Turkey by sowing from its seed in May and the ripe fruits are harvested in August. The bitter melon is an annual, herbaceous, and climbing plant, and its delicate stem can be up to 1-2 m in length. The leaves come out of the armpits, and the body extensions called leeches extend from the same area. The leaves are hand-shaped, long-stalked, and lobed, and the lobes are elongated, oval-shaped, toothed, and pointed. Its flowers are yellow and produce fruit in summer. The fruit, which looks like a lumpy shuttle, turns orange when ripe. The fruits are approximately 10 cm in width and 20 cm in length, with flat and 20-30 seeds that turn brown as they mature. Bitter melon seeds are very rich in oil and protein and contain high amounts of vitamins C and A, beta-carotene, alfa-carotene, potassium, magnesium, and zinc.

In general, the plant is a monoecious slender, tendril climbing annual vine of almost 2 to 4 m high. The plant possesses characteristic leaves with serrate margins which typically giving a look like bites. Each plant has separate yellow coloured male and female flowers. Different varieties of bitter gourd have different shapes of fruits, being discoid or ovoid or ellipsoid to oblong and pointed towards the end (Kole *et al.* 2020) [10]. Usually fruits are 2 to 10 cm long. The exterior of the fruits is warty and the cross section is hollow with a thin layer of flesh. Flattened seeds and pith are seen in the central cavity which is surrounded by the thin flesh layer (Gupta *et al.* 2011) [7]. The immature fruits are whitish or pale green in colour whereas the mature ones can be seen in light green, green and dark green depending on the varieties and while ripening the colour turns to orange yellow.

The fruit of bitter gourd takes 45 to 80 days to gets mature (Sorifa 2018) [22]. The seed of bitter gourd is 8 to 15 mm long which are straw coloured and they are covered with flesh: white in unripe fruits and red in ripened ones (Poolperm & Jiraungkoorskul 2017) [17].

Materials and Methods

This chapter contains the details of the materials used and the methods adopted in the present study” Performance Of Bitter Gourd (*Momordica charantia* L.) Hybrids For Growth, Yield And Quality Under Prayagraj Agro Climatic Conditions” under Prayagraj agro-climatic conditions, and was carried out during 2023 at the Experimental Research Field, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, are presented under the following heads.

Experimental site: The experiment was conducted at Experimental Research Field, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, and Prayagraj (UP). All the facilities necessary for cultivation, including labour were made available in the Department.

Experimental Material: The experimental material consisting of 10 genotypes/hybrids of bitter gourd, Collected from different sources.

Table 1: List of Genotype/Hybrids:

S. No.	Hybrid Symbol	Name of Genotype/Hybrid	Source
1	H1	VISHWAS	ADVANTA SEED, TELANGANA
2	H2	SOPHIA – 7037	SAKATA SEED, KARNATAKA
3	H3	MONIKA (7004)	SAKATA SEED, KARNATAKA
4	H4	SW 811	US AGRISEEDS, TELANGANA
5	H5	SW826	US AGRISEEDS, TELANGANA
6	H6	VEENA	DOCTORS SEED, LUDHIANA
7	H7	BOSS GOLD	SAKTI VARDHAK, HISAR
8	H8	YASH	SAKTI VARDHAK, HISAR
9	H9	SAGAR	VNR SEED, CHHATISGARH
10	H10	MIRZA	GLOBAL SEED, NEW DELTHI

Results and Discussion

The results of the investigation, regarding the Study on growth, earliness, yield, quality parameters in Bitter Gourd

Growth Parameters Vine Length (cm)

Significantly maximum Vine Length of 22.72 cm at 20 days after sowing was recorded at H5 (SW 826) followed by H4 (SW 811) of 21.71 cm whereas minimum plant height of 17.04 cm was recorded in H9 (SAGAR).

Significantly maximum Vine Length of 65.52 cm at 40 days after sowing was recorded at H5 (SW 826) followed by H4 (SW 811) of 63.84 cm whereas minimum plant height of 58.04 cm was recorded in H9 (SAGAR).

Significantly maximum Vine Length of 145.04 cm at 60 days after sowing was recorded at H5 (SW 826) followed by H4 (SW 811) of 143.84 cm whereas minimum plant height of 132.04 cm was recorded in H9 (SAGAR).

The improvement in vine length might be due to local conditions, genetic characters, higher nutrients utilization efficiency, enhanced photosynthetic and other metabolic activities which lead to increase in various plant metabolites responsible for cell division and cell elongation. The variation in vine length might be due to specific genetic makeup of different hybrids, inherent properties and vigour to crop. The Similar findings were previously reported by Sravani *et al.* (2021) [23], Ramya Balaga *et al.* (2020) [19], Methela *et al.* (2019) [15] and Yadav *et al.* (2008) [26] in Bitter gourd

Number of Branches per Plant

Significantly maximum Number of Branches per plant of 2.93 at 20 days after sowing was recorded at H5 (SW 826) followed by H4 (SW 811) of 2.8 whereas minimum Number of Branches per plant of 1.06 was recorded in H9 (SAGAR). Significantly maximum Number of Branches per plant of 3.86 at 40 days after sowing was recorded at H5 (SW 826) followed by H4 (SW 811) of 3.73 whereas minimum Number of Branches per plant of 1.86 was recorded in H9 (SAGAR).

Significantly maximum Number of Branches per plant of 6.06 at 60 days after sowing was recorded at H5 (SW 826) followed by H4 (SW 811) of 5.73 whereas minimum Number of Branches per plant of 3.86 was recorded in H9 (SAGAR).

The maximum value of primary branches in genotype may be due to genetic make- up of a plant, similar results were supported by Ramya Balaga *et al.* (2020) [19], Ramesh *et al.* (2018) [18], and Yadav *et al.* (2008) [26] in Bitter gourd.

Number of Leaves per Plant

Significantly maximum Number of Leaves per plant of 15.53 at 20 days after sowing was recorded at H5 (SW 826) followed by H4 (SW 811) of 15.26 whereas minimum Number of Leaves per plant of 10.8 was recorded in H9 (SAGAR).

Significantly maximum Number of Leaves per plant of 38 at 40 days after sowing was recorded at H5 (SW 826) followed

by H4 (SW 811) of 37.4 whereas minimum Number of Leaves per plant of 32 was recorded in H9 (SAGAR).

Significantly maximum Number of Leaves per plant of 60.08 at 60 days after sowing was recorded at H5 (SW 826) followed by H4 (SW 811) of 60.26 whereas minimum Number of Leaves per plant of 55.2 was recorded in H9 (SAGAR).

The maximum value of primary leaves in genotype may be due to genetic make-up of a plant, similar results were supported by Ramya Balaga *et al.* (2020) [19], Ramesh *et al.* (2018) [18], and Yadav *et al.* (2008) [26] in Bitter gourd.

Days to First Male Flowering

Significantly minimum Days to First Male Flowering of Bitter gourd was found in H5 (SW 826) which was 36.4 days. However, maximum Day to First Male Flowering found in H4 (SW 811) which was 45.13 days respectively.

The Days to First Male flower emergence play an important role in deciding the earliness or lateness of crop in general. The variation in the first male flower emergence might have been due to internodal length, number of inter nodal and vigour of the crop. Similar finding were reported by Kumar *et al.* (2011) [14], Deepthi *et al.* (2016) [6], Thakur, P *et al.* (2013) [25] and Balaga, R *et al.* (2020) [5] in Bitter gourd.

Days to First Female Flowering

Significantly minimum Days to First Female Flowering of Bitter gourd was found in H5 (SW 826) which was 40.13 days. However, maximum Day to First Female Flowering found in H4 (SW 811) which was 47.13 days respectively.

The Days to First Female flower emergence play an important role in deciding the earliness or lateness of crop in general. The variation in the first female flower emergence might have been due to internodal length, number of inter nodal and vigour of the crop. Similar finding were reported by Kumar *et al.* (2011) [14], Deepthi *et al.* (2016) [6], Thakur, P *et al.* (2013) [25] and Balaga, R *et al.* (2020) [5] in Bitter gourd.

Fruit Length (cm)

Significantly maximum fruit length of 13.93 cm after harvesting was recorded at H5 (SW 826) followed by H4 (SW 811) of 13.4 cm. whereas minimum fruit length of 10 cm was recorded in H9 (SAGAR).

The length of fruits may be due to its hybrid vigour and adoptability to Allahabad agroclimatic conditions. the Similar findings were previously reported by Mishra *et al.* (2019) [16], Kumar, S *et al.* (2018) [12], Thakur, P *et al.* (2013) [25] and also reported more or less similar results in Bitter gourd.

Fruit Girth (cm)

Significantly maximum fruit girth of 17.06 cm after harvesting was recorded at H5 (SW 826) followed by H4 (SW 811) of 16.8 cm. whereas minimum fruit girth of 13.06 cm was recorded in H9 (SAGAR).

The diameter of fruits may be due to its hybrid vigour and adoptability to Allahabad agroclimatic conditions. the Similar findings were previously reported by Mishra *et al.* (2019) [16], Kumar, S *et al.* (2018) [12], Thakur, P *et al.* (2013) [25] in Bitter gourd

Fruit Weight (kg)

Significantly maximum fruit weight of 101.8 kg after

harvesting was recorded at H5 (SW 826) followed by H4 (SW 811) of 100.86 kg. whereas minimum fruit weight of 90.8 kg was recorded in H9 (SAGAR).

The significant variation in weight of fruits might have been due to fruit set percentage, fruit length, number of fruits per vine and fruit width, genetic nature, environmental factor and vigour of the crop and higher uptake of nutrient. The findings were supported by Sundaram, V *et al.* (2009) [24], Kumar *et al.* (2018) [12], and Mishra *et al.* (2019) [16] also reported more or less similar results in Bitter gourd.

Number of Fruits per Plant

Significantly maximum number of fruit per plant of 13 at harvesting was recorded at H5 (SW 826) followed by H4 (SW 811) of 12.86. whereas minimum number of fruit per plant of 10.13 was recorded in H9 (SAGAR).

The variation is due to the inherent character and genetic makeup of the varieties, higher uptake of nutrient and environmental conditions. the Similar findings were previously reported by Kumar, S *et al.* (2018) [12], Thakur, P *et al.* (2013) [25] Husna, A *et al.* (2011).

Fruits Yield per Plant (kg)

Significantly maximum fruit yield per plant of 3.87 kg at harvesting was recorded at H5 (SW 826) followed by H4 (SW 811) of 3.62 kg. whereas minimum fruit yield per plant of 2.69 kg was recorded in H9 (SAGAR).

Increasing of number of fruits plant is mostly influenced by genetic factor, environmental factor, hormonal factor and vigour of the crop. The Fruit plant is one of the major factors for deciding the yield of the crop. the Similar findings were previously reported by Sushil Kumar, S *et al.* (2018) [12], Thakur, P *et al.* (2013) [25] Husna, A *et al.* (2011) [1].

Fruits Yield per Hectare (t/ha.)

Significantly maximum fruit yield per hectare of 20.31 t/ha at harvesting was recorded at H5 (SW 826) followed by H4 (SW 811) of 18.18 t/ha. whereas minimum fruit yield per hectare of 12.78 t/ha was recorded in H9 (SAGAR).

The higher yield plant-1 (kg) due to its inherent characteristics, better adoptability for the environmental conditions and efficiently all available factors *viz.* water, nutrient, light and CO₂. None of the treatments significantly influenced the plant stand. the Similar findings were previously reported by Kumar, K *et al.* (2018) [12], Thakur, P *et al.* (2013) [25] Husna, A *et al.* (2011) [1].

TSS (°Brix)

Significantly maximum TSS (°Brix) of 5.53 at harvesting was recorded at H5 (SW 826) followed by H4 (SW 811) of 5.43. Whereas minimum TSS (°Brix) of 3.93 was recorded in H9 (SAGAR).

The difference may be due to the inherent character and genetic makeup of the varieties and environmental conditions and the Similar findings were previously reported by Aruna & Swaminathan *et al.* (2012) [4], Harika *et al.* (2012) [8] and Iqbal, M *et al.* (2018) [9].

Ascorbic Acid (mg/100g)

Significantly maximum ascorbic acid of 84.4 at harvesting was recorded at H5 (SW 826) followed by H4 (SW 811) of 83.53. whereas minimum ascorbic acid of 80.23 was recorded in H9 (SAGAR).

The difference may be due to the inherent character and genetic makeup of the varieties and environmental conditions the Similar findings were previously reported by

Aruna & Swaminathan *et al.* (2012) [4], Harika *et al.* (2012) [8] and Iqbal, M *et al.* (2018) [9].

Table 2: Data regarding Growth parameters of Bitter Gourd (*Momordica charantia* L.)

Treatment	Plant Height at 20 days (cm)	Plant Height at 40 days (cm)	Plant Height at 60 days (cm)	No. of Branches at 20 days	No. of Branches at 40 days	No. of Branches at 60 days	No. of Leaves at 20 days	No. of Leaves at 40 days	No. of Leaves at 60 days
H1	19.45	62.52	138.52	2.06	3.2	5.2	13.86	35.26	58.2
H2	20.65	63.08	142.45	2.66	3.66	5.66	14.8	36.86	59.8
H3	18.52	61.72	136.72	1.8	2.66	4.73	12.8	34.2	56.2
H4	21.71	63.84	143.84	2.8	3.73	5.73	15.26	37.4	60.26
H5	22.72	65.52	145.04	2.93	3.86	6.06	15.53	38	60.8
H6	20.04	62.72	140.98	2.4	3.4	5.4	14.4	36.4	58.4
H7	19.08	61.98	137.65	1.93	2.93	4.93	13.26	35	57
H8	17.84	59.84	135.08	1.4	2.2	4.06	11.8	33.2	55.8
H9	17.04	58.04	132.04	1.06	1.86	3.86	10.8	32	55.2
H10	17.98	60.72	135.98	1.6	2.4	4.4	12.4	33.8	56
S.Ed(±)	0.94	0.45	0.49	0.4	0.33	0.33	0.98	0.78	0.78
CD at 5%	0.45	0.95	1.03	0.85	0.69	0.69	2.06	1.64	1.63

Table 3: Data regarding Earliness, Yield and Quality Parameters of Bitter Gourd (*Momordica charantia* L.)

Treatment	Days to first male flowering	Days of first female flowering	Fruit Length (cm)	Fruit Girth (cm)	Average fruit weight (g)	Number of Fruit per Plant	Average fruit yield per plant (g)	Total yield (t/ha)	TSS (°Brix)	Ascorbic Acid (mg/100g)
H1	41.13	44	12.06	15.86	97.2	11.4	3.33	16.36	4.5	82.6
H2	38.86	42.8	12.93	16.4	100.06	12.26	3.53	18.06	5.33	83.43
H3	42.26	45	11.2	14.86	95	10.8	3.14	14.89	4.33	81.4
H4	38.2	40.8	13.4	16.8	100.86	12.86	3.62	18.18	5.43	83.53
H5	36.4	40.13	13.93	17.06	101.8	13	3.87	20.31	5.53	84.4
H6	40.06	43.4	12.2	15.93	98.13	11.8	3.45	17.75	4.93	82.8
H7	41	44.8	11.86	15.13	96.4	11.13	3.22	15.72	4.5	82.03
H8	44.8	46.2	10.13	13.2	93.06	10.26	2.84	13.87	4.06	80.43
H9	45.13	47.13	10	13.06	90.8	10.13	2.69	12.78	3.93	80.23
H10	42.8	45.26	10.93	14.2	93.93	10.4	2.95	14.1	4.06	81.06
S.Ed(±)	0.7	0.75	0.71	0.71	0.79	0.67	0.01	0.11	0.23	0.72
CD at 5%	2.02	1.57	1.5	1.48	1.65	1.41	0.02	0.23	0.48	0.51

Conclusion

It is concluded from trial that the performance of bitter gourd (*Momordica charantia* L.) hybrids for growth, yield and quality under prayagraj agro climatic conditions

It is concluded from the investigation that SW 826 was recorded maximum vine length (145.04cm), primary branches (6.06), number of leaves (60.8), days to first male flowering (36.4), days to first female flowering (40.13), Fruit length (13.93cm), fruit girth (17.06cm), fruit weight (101.8gm), number of fruits per plant (38), fruit yield per plant (3.87kg), fruit yield per hectare (20.31/ha), B: C ratio (4.47) followed by SW 811 which recorded vine length (143.84cm), primary branches(5.73), number of leaves (60.26), days to first male flowering(38.2), days to first female flowering (40.8), fruit length (13.4cm), fruit girth (16.8cm), fruit weight (100.86gm), number of fruits per plant (12.86), fruit yield per plant (3.62kg), fruit yield per hectare (18.18t/ha), B:C ratio (3.74) which statistically on par with each other. The results show that among all hybrids SW 826 and SW 811 were observed superior with respect to growth, yield and quality

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