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## Studies on growth, yield and quality parameters in bitter melon (*Momordica charantia* L.)

Som Prakash, RS Verma, Viplaw Kumar, Harvindra Pal and Bhag Chand Shivran

#### Abstract

A field experiment was conducted during 2018-19 and 2019-20 at Horticulture Research Farm-1, BBAU, Lucknow, "Studies on growth, yield and quality parameters in bitter melon (*Momordica charantia* L.)", revealed that node number to first staminate flowers, node number to first pistillate flowers, days to anthesis of first staminate flowers, days to anthesis of first pistillate flowers, days to first fruit harvest, vine length (m), fruit length (cm), nodes per plant, number of branches per plant, number of seeds per plant, fruit diameter (cm), number of fruits per plant, seeds weight per fruit (g), average fruit weight (g), ascorbic acid (mg/100 g), reducing sugar (%), non-reducing sugar (%), total sugars (%), T.S.S.<sup>0</sup>(Brix), titratable acidity (%) and marketable fruit yield per plants (kg) were maximized.

**Keywords:** Growth, quality, parameters, bitter, *Momordica charantia* L.

#### Introduction

Bitter melon (*Momordica charantia* L.;  $2n=2x=22$ ) is a commercial and medicinal vegetable belonging to the Cucurbitaceae family. It has become an annual as well as perennial herbaceous climber. Bitter melon, balsam pear and maidan apple are some of its other names. Being monoecious in nature. It is a highly cross pollinated crop. Recently, it has been found that six species closely related to bitter melon are found in India, of which four species in dioecious and two species monoecious in nature. *Momordica charantia* and *Momordica balsamina* are monoecious, while *Momordica dioica*, *Momordica sahyadrica*, *Momordica cochinchinensis* and *Momordica subangulata* are dioecious. The 100 g edible fruit part constitutes 83.2% water, 10.5% carbohydrates, 0.2–1.0% fat, 0.5-1.0% minerals, 1.7% fiber, 2.1 g protein, 2 mg iron, 23 mg calcium, 96 mg vitamin C, 38 mg phosphorus, 171 mg potassium, 2.40 mg sodium, 0.19 mg copper, 0.08 mg manganese, 0.46 mg zinc and 126 mg  $\beta$  carotene. The evaluation of variability in every crop species is a foundation for developing successful selective breeding, since the existent variation may be exploited to optimize cultivar yields when breeding techniques can be applied correctly. *Yield is a complicated feature that is influenced by a number of yield contributing factors.* The greater the genetic distance between two groups, the higher the odds of producing better hybrids and segregates through hybridization.

#### Materials and Methods

The present investigation was done at the field of the Horticulture Research Farm-I of the Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Vidya Vihar Raebareilly Road, Lucknow- 226025 (U.P.), India during the *summer season* of 2018-19 and 2019-20. The experimental material comprised of 20 genotypes of bitter melon obtained from various institutes. Geographically Lucknow is situated at 26° 76' North latitudes, 80° 92' East longitudes and the altitude of 123 meters above mean sea level (MSL). The experiment was laid out in Randomized Complete Block Design (RCBD) and replicated thrice at individual plot size of 3.0 m × 2.0 m. Plant-to-plant and row-to-row distances were maintained as 0.5 m and 2.5 m, respectively. The field had sandy clay loam soil, low in organic carbon and slightly alkaline in nature (pH 8.2). Intercultural practices were carried out on a regular basis across the cropping season to ensure optimum growth and development of plants. Healthy seedlings were maintained per pit. All conventional agronomic methods were used. Similarly for recording on the crop, observations, 15 physical characters and 6 chemical characters in the field as well as laboratory conditions were considered *viz.*,

node number to first staminate flowers, node number to first pistillate flowers, days to anthesis of first staminate flowers, days to anthesis of first pistillate flowers, days to first fruit harvest, vine length (m), fruit length (cm), nodes per plant, number of branches per plant, number of seeds per plant, fruit diameter (cm), number of fruits per plant, seeds weight per fruit (g), average fruit weight (g), ascorbic acid (mg/100g) by titration against 2,6 dichlorophenol indophenol dye (A.O.A.C., 2000), reducing sugar (%), non-reducing sugar (%), total sugars (%) were determined by titrating the sample against Fehling solution using methylene blue as an indicator, total soluble solids or TSS (<sup>0</sup>Brix) were determined by using hand refractometer, titratable acidity (%) by titration method and marketable fruit yield per plant (kg). The data so obtained were analyzed statistically as suggested by Panse and Sukhatme, (1985).

## Results and Discussion

A perusal of data presented in Table 1 shows that significant response in the maximum node number to first staminate flowers Pusa Vishesh (15.16) followed by Pusa hybrid-2 (14.50), Pusa hybrid-1 (14.16). Whereas, Ultima-1405 (7.33) followed by MC-23 (8.00) which as the minimum were recorded in node number to first staminate flowers. The data clearly revealed that the maximum node number to first pistillate flowers Pusa Vishesh (16.50) followed by Sagar (15.33), Pusa Hybrid-2 (14.83) respectively. Whereas, Selection-5 (7.83) followed by MC-23 (8.83) were found lower significant for node number to first pistillate flowers. Maximum days to anthesis of first staminate flowers was found in Sagar (51.43) followed by Arka Sujat (43.26), Narendra Barahmasi-2 (43.10). VRBT-23 (33.68) followed by Ultima-1405 (35.35), Narendra Barahmasi-1 (34.22) of lower days to anthesis of first staminate flowers. Maximum days to anthesis of first pistillate flowers was found in Selection-5 (55.05) followed by Kalyanpur Sona (50.88), UDIT-008 (50.42) and the lowest days to anthesis of first pistillate flowers was observed in US-484 (32.59) and Amanshri (35.97). Maximum days to first fruit harvest was found in Kashi Urvasi (63.51) followed by Selection-5 (61.83), UDIT-008 (60.66) and the lowest days to first fruit harvest was observed in Narendra Barahmasi-1 (44.51) and Kalyanpur Barahmasi (46.33). Maximum vine length was found in Narendra Barahmasi-1 (5.80 m) followed by Selection-5 (5.65 m), Arka Harit (5.60 m) and the lowest vine length was observed in Amanshri (3.25 m) and Pusa Hybrid-2 (3.46 m). Maximum fruit length was recorded in selection-5 (24.39 cm) followed by Ultima-1405 (23.94 cm), Sagar (22.90 cm) and minimum in Pusa hybrid-2 (13.09 cm). Maximum nodes per plant was observed in Arka Sujat (73.00) followed by

Kalyanpur Sona (72.16), Arka Harit (64.83) and Selection-5 (40.83). Highest number of branches per plant was noted in Amanshri (24.83) followed by VRBT-23 (23.83), UDIT-008 (22.50) whereas, the lowest number of branches per plant was recorded in Ultima-1405 (8.16). Highest number of seeds per fruit was observed in US-475 (31.00) followed by Kalyanpur Barahmasi (28.16) and Narendra Barahmasi-2 (27.33) and lower in Pusa hybrid-1 (18.66) and MC-23 (17.16). Highest fruit diameter was found in Kalyanpur Barahmasi (9.42 cm) followed by US-475 (8.31 cm), Amanshri (7.75 cm) and lower in Narendra Barahmasi-1 (4.58 cm) and Ultima-1405 (4.62 cm). Maximum number of fruits per plant was observed in Pusa Vishesh (20.16) followed by Amanshri (18.50), UDIT-008 (17.83) and lowest number of fruits per plant was found in MC-23 (9.83) followed by Selection-5 (9.16). Maximum seeds weight of per fruit (g) was found in Kashi Urvasi (3.84 g) followed by Pusa Vishesh (3.80 g), UDIT-008 (4.22 g) and lowest number of fruits per plant was found in MC-23 (2.56 g) followed by Selection-5 (2.54 g). Maximum Average fruits weight (g) was observed in Kalyanpur Barahmasi (126.83 g) followed by VRBT-23 (120.83 g), Pusa Vishesh (119.16 g) and lowest number of fruits per plant was found in Sagar (55.00 g) and MC-23 (53.66 g). The highest ascorbic acid (mg/100 g fruit juice) was recorded in Amanshri (95.50 mg/100 g) followed by Ultima-1405 (94.33 mg/100 g), Pusa hybrid-1 (93.16 mg/100 g) and the lowest in Kalyanpur Barahmasi (79.83 mg/100 g) fruit followed by Narendra Barahmasi-2 79.50 mg/100 g) under the lowest ascorbic acid. The maximum reducing sugar, non-reducing sugar and total sugars content was obtained from Amanshri (0.98%, 0.72% and 1.71%) followed by UDIT-008 (0.95%, 0.70% and 1.66%), US-475 (0.90%, 0.64% and 1.36%) and the minimum value (0.75%, 0.30% and 1.13%) were found in US-484. The results, further, advocated that higher concentration of all treatments proved effective as compared to the lower concentrations. The maximum TSS (%) was recorded in Amanshri (5.31 <sup>0</sup>Brix) followed by Selection-5 (5.22 <sup>0</sup>Brix), US-475 (4.83 <sup>0</sup>Brix) and the lowest in Narendra Barahmasi-1 (2.59 <sup>0</sup>Brix) and Kalyanpur Sona (2.50 <sup>0</sup>Brix) under the lowest TSS. The minimum titratable acidity was recorded in Pusa hybrid-1 (0.32%) followed by Narendra Barahmasi-2 (0.31%) and Arka Harit (0.30%). However, produced significantly less acidic fruits of bitter gourd when compared with rest of the genotypes. The fruits under control gave significantly lowest in Pusa Hybrid-2 (0.11%). Maximum marketable fruit yield per plant was recorded in Kalyanpur Barahmasi (5.24 kg) followed by Kashi Urvasi (4.30 kg), Arka Harit (3.70 kg). Significantly lower yield per plot was recorded in Arka Sujat (1.61 kg).

**Table 1:** Studies on growth, yield and quality parameters in bitter gourd (*Momordica charantia* L.)

S. No.	Characters Genotypes	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	C <sub>4</sub>	C <sub>5</sub>	C <sub>6</sub>	C <sub>7</sub>	C <sub>8</sub>	C <sub>9</sub>
1.	Akra Harit	13.17	13.50	36.48	41.11	43.67	5.60	16.54	64.83	13.83
2.	Pusa Vishesh	15.17	16.50	36.81	41.53	47.67	5.25	15.70	57.67	21.17
3.	Narendra Barahmasi-1	12.00	13.00	34.23	36.89	44.50	5.81	19.87	47.17	16.50
4.	Kalyanpur Sona	13.50	12.67	42.52	50.88	54.17	4.29	22.44	72.17	16.83
5.	Pusa Hybrid-1	14.17	11.33	36.94	36.59	56.17	4.70	21.22	48.33	15.17
6.	Sagar	12.33	15.33	51.44	49.27	46.33	5.56	22.90	61.33	15.50
7.	Kalyanpur Barahmasi	11.33	13.33	41.91	36.38	45.33	4.60	22.03	64.00	19.83
8.	Kashi Urvasi	12.00	13.83	40.71	42.30	63.50	5.53	21.10	55.17	21.50
9.	Arka Sujat	11.83	11.00	43.26	44.05	52.33	4.49	14.83	73.00	21.50
10.	Amanshri	13.83	14.33	37.81	35.97	52.50	3.25	20.24	42.00	24.83
11.	Meghana-2	11.83	12.00	41.74	45.00	50.50	4.55	22.26	63.83	10.67
12.	US-475	8.67	10.67	42.45	47.53	57.83	4.27	17.10	63.67	22.17

13.	Pusa Hybrid-2	14.50	14.83	37.14	42.40	47.67	3.47	13.91	53.67	18.33
14.	Narendra Barahmasi-2	13.67	11.00	43.10	36.21	53.83	4.71	16.09	52.67	8.83
15.	Selection-5	11.67	7.83	36.33	55.06	61.83	5.65	24.40	40.83	19.83
16.	VRBT-23	13.17	10.50	33.68	41.60	53.50	4.53	21.60	52.17	23.83
17.	UDIT-008	12.67	9.50	35.34	50.42	60.67	3.32	21.56	62.67	22.50
18.	Ultima-1405	7.33	10.67	35.35	45.10	57.67	4.84	23.95	55.50	8.17
19.	US-484	12.00	11.17	41.86	32.60	60.33	4.43	17.65	54.33	20.83
20.	MC-23	8.00	8.83	41.10	37.43	47.00	5.40	15.61	44.33	20.50
	S.E.	0.50	0.48	0.45	0.42	0.89	0.11	0.42	0.71	0.43
	C.D. at 5%	1.40	1.35	1.28	1.17	2.51	0.31	1.19	1.98	1.20

## Continue:

S. No.	Characters Genotypes	C <sub>10</sub>	C <sub>11</sub>	C <sub>12</sub>	C <sub>13</sub>	C <sub>14</sub>	C <sub>15</sub>	C <sub>16</sub>	C <sub>17</sub>	C <sub>18</sub>	C <sub>19</sub>	C <sub>20</sub>	C <sub>21</sub>
1.	Akra Harit	20.67	5.46	15.00	3.18	71.67	82.83	0.78	0.55	1.32	3.19	0.31	3.70
2.	Pusa Vishesh	17.50	4.58	20.17	3.81	119.17	80.33	0.86	0.44	1.31	2.60	0.26	2.43
3.	Narendra Barahmasi-1	16.17	6.81	14.17	3.82	75.33	84.00	0.73	0.52	1.39	3.38	0.27	2.42
4.	Kalyanpur Sona	19.50	5.95	13.50	3.62	85.00	81.00	0.90	0.53	1.43	2.50	0.14	2.95
5.	Pusa Hybrid-1	18.67	7.52	15.17	3.26	87.67	93.17	0.77	0.55	1.33	3.20	0.32	3.40
6.	Sagar	20.50	5.90	12.50	3.22	55.00	86.33	0.94	0.62	1.61	4.54	0.27	3.10
7.	Kalyanpur Barahmasi	28.17	9.42	16.17	3.03	126.83	91.17	0.97	0.57	1.54	2.55	0.16	5.25
8.	Kashi Urvasi	20.17	5.00	13.17	3.84	65.83	79.83	0.84	0.34	1.18	4.29	0.28	4.31
9.	Arka Sujat	26.50	6.82	13.50	3.60	62.67	81.50	0.93	0.46	1.26	3.25	0.33	1.61
10.	Amanshri	21.17	7.75	18.50	3.50	61.83	95.50	0.98	0.73	1.72	5.31	0.22	2.80
11.	Meghana-2	24.83	6.34	14.83	3.05	115.67	90.50	0.72	0.46	1.18	2.62	0.22	3.22
12.	US-475	31.00	8.31	12.83	3.91	94.17	82.67	0.90	0.64	1.63	4.83	0.16	2.23
13.	Pusa Hybrid-2	19.67	5.87	15.83	3.52	110.33	91.17	0.72	0.42	1.36	2.42	0.12	2.24
14.	Narendra Barahmasi-2	27.33	3.53	11.00	3.19	55.83	85.83	0.77	0.53	1.48	3.17	0.32	2.99
15.	Selection-5	22.00	7.49	12.17	2.54	63.83	79.50	0.70	0.45	1.40	5.23	0.31	3.55
16.	VRBT-23	22.17	7.31	11.33	3.61	120.83	92.17	0.78	0.37	1.15	2.72	0.17	1.74
17.	UDIT-008	25.50	7.13	17.83	4.23	84.00	85.00	0.96	0.70	1.66	3.62	0.25	2.90
18.	Ultima-1405	18.50	4.63	9.17	2.63	62.17	94.33	0.79	0.53	1.53	4.41	0.24	1.94
19.	US-484	21.33	6.09	12.17	3.32	73.50	88.67	0.83	0.31	1.14	3.71	0.23	2.74
20.	MC-23	17.17	6.49	9.83	2.56	53.67	87.50	0.54	0.47	1.46	3.82	0.23	1.63
	S.E.	0.44	0.26	0.45	0.20	1.16	0.58	0.01	0.01	0.01	0.06	0.01	0.29
	C.D. at 5%	1.22	0.73	1.27	0.57	3.26	1.63	0.03	0.02	0.03	0.16	0.01	0.83

## Characters

C<sub>1</sub>: Node number to first staminate flowers,  
 C<sub>3</sub>: Days to anthesis of first staminate flowers,  
 C<sub>5</sub>: Days to first fruit harvest,  
 C<sub>7</sub>: Fruit length (cm),  
 C<sub>9</sub>: Number of branches per plant,  
 C<sub>11</sub>: Fruit diameter (cm),  
 C<sub>13</sub>: Seeds weight per fruit (g),  
 C<sub>15</sub>: Ascorbic acid (mg/100 g),  
 C<sub>17</sub>: Non-reducing sugar (%),  
 C<sub>19</sub>: Total soluble solids (T.S.S.)<sup>0</sup>Brix,  
 C<sub>21</sub>: Marketable fruit yield per plant (kg)

C<sub>2</sub>: Node number to first pistillate flowers,  
 C<sub>4</sub>: Days to anthesis of first pistillate flowers,  
 C<sub>6</sub>: Vine length (m),  
 C<sub>8</sub>: Nodes per plant,  
 C<sub>10</sub>: Number of seeds per plant,  
 C<sub>12</sub>: Number of fruits per plant,  
 C<sub>14</sub>: Average fruit weight (g),  
 C<sub>16</sub>: Reducing sugar (%),  
 C<sub>18</sub>: Total sugars (%),  
 C<sub>20</sub>: Titratable acidity (%) and

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