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K Rajendar Sagar

PG Scholar, Department of Vegetable Science, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

B Ramesh Babu

Senior Scientist, Department of Fruit Science, HRS, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

M Ravindra Babu

Senior Scientist, Department of Vegetable Science, HRS, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

M Paratpara Rao

Senior Scientist, Department of Vegetable Science, HRS, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

Corresponding Author:

K Rajendar Sagar

PG Scholar, Department of Vegetable Science, College of Horticulture, Dr. YSR Horticultural University, Venkataramannagudem, West Godavari, Andhra Pradesh, India

Mean performance of different bitter gourd genotypes for various growth and yield characters

K Rajendar Sagar, B Ramesh Babu, M Ravindra Babu and M Paratpara Rao

Abstract

An investigation is carried out at the College of Horticulture, Dr. Y.S.R Horticulture University, Venkataramannagudem (AP), during *rabi* season of 2021-22, to evaluate thirty-six genotypes of bitter gourd for various growth and yield traits. The experiment is conducted in RBD model and replicated thrice. Analysis of variance showed highly significant variations among the genotypes for all the growth and yield traits under study. Two genotypes VBGC-7 (25.75), VBGC-24 (30.00) were recorded higher number of fruits per plant than check variety Arka Harit (18.75). Among thirty- six genotypes, three genotypes were recorded with average fruit weight of above 70 g *viz.*, VBGC-21 (74.00), VBGC-22 (87.25), VBGC-23 (70.75) compared to check variety Arka Harit (51.84 g). One genotype VBGC-22 (17.63 cm) recorded higher fruit length than Check variety Arka Harit (13.25 cm). Two genotypes VBGC-12 (15.25), VBGC-27(15.75) were recorded higher number of seeds per fruit than Check variety Arka Harit (12.75). Among thirty-six genotypes twenty two genotypes (VBGC-5 to 7, VBGC-9 to VBGC-13, VBGC-15, VBGC-18, VBGC-19 to VBGC-23, VBGC-24, VBGC-26 to 28, VBGC-30 to VBGC-35) recorded significantly higher number of primary branches per vine than Check Variety Arka Harit (8.82). Sixteen genotypes (VBGC-1 to 3, VBGC-6, VBGC-11, VBGC-12, VBGC-15, VBGC-19, VBGC-20 to 22, VBGC-24, VBGC-25, VBGC-27, VBGC-30, VBGC-31) recorded higher inter nodal length than Check Variety Arka Harit (5.95 cm).

Keywords: Bitter gourd, genotypes, fruit, season

Introduction

Bitter gourd (*Momordica charantia* L. $2n = 22$) is an important commercial cucurbit belonging to genus *Momordica* and family Cucurbitaceae. It is a large genus with many species of annual and perennial climbers of which *Momordica charantia* L. is widely cultivated. It is known by different names such as balsam pear or bitter cucumber in english, Kerala in hindi, kakarakai in telugu. The crop is highly cross pollinated due to monoecy.

The fruits are used as a vegetable in many ways and quite commonly consumed in cooked, fried and stuffed forms. The fruits are also pickled, canned and dehydrated. Every part of the plant is used medicinally. The fruits consists of cooling, digestive, laxative, antipyretic and antidiabetic properties and its administration is useful in biliousness, blood diseases, rheumatism and asthma. The leaf is used internally as a laxative and as an ointment for sores. It is claimed that the fruit powder is used for healing wounds, leprosy and malignant ulcers. It is reported for its usefulness in snakebites. The roots have abortifacient activity. It has been reported that protein of bitter gourd inhibited the growth of immune deficiency virus (HIV-1) in human beings. In Ayurveda, the juice of fresh leaves is prescribed for diabetes (Tewari *et al.* 2001) [6]. Bitter gourd ranks first among the cucurbits in respect of iron and vitamin C. It has good nutritional value with 2.1 g of protein, 4.2 g of carbohydrates 1.8 mg iron, 20 mg of calcium, 55 mg of phosphorus, 210 IU of vitamin A and 88 mg of vitamin C per 100 gram of edible portion (Ahmed *et al.* 2001) [1]. During the past decade, the antidiabetic properties of the crop have been studied extensively and a hypoglycemic principle called "charantin" has been isolated. The bitter principle in bitter gourd is momordicine, an alkaloid which is different from cucurbitacins present in other genera of cucurbits.

Most of the cucurbitaceous vegetables including bitter gourd are usually cultivated in relatively small areas for local consumption and not entered the production statistics in a significant way. The genus *Momordica* comprises nearly 23 species in Africa alone (Jeffery, 1980) [3]. Regions of Eastern India and Southern China are the centres of domestication (Stands, 1928). The crop is extensively grown in China, Japan, India, Malaysia, South East

Asia, Tropical Africa and South and North America. Most of the cucurbitaceous vegetables are usually cultivated in relatively small areas of local consumption in India with annual production of 1,214 million tonnes from an area of 101 million hectares (NHB 2019-2020) [4]. In Andhra Pradesh, bitter gourd production is of 108 million tonnes from an area of 10.40 million hectares (NHB 2019-20) [4].

Material and Methods

The experiment was carried out at College farm, College of Horticulture, Dr. Y.S.R. Horticultural University, Venkataramannagudem, West Godavari Dist. during Rabi, 2021–22. The experiment was laid out in Randomized Block Design (RBD) with 36 genotypes in 2 replications. Total fourteen characters are studied *viz.* days to appearance of first female flower, days to appearance of first male flower, node number at which female flower appeared, node number at which male flower appeared, fruit yield per plant (kg/plant), number of fruits / plant, average fruit weight (g), fruit length (cm), days to first harvest, days to last harvest, number of seeds per fruit, number of primary branches per vine, vine length (cm), internodal length (cm). Genotypes were collected from NBPGR regional station Thrissur. The experimental site was well prepared, cultural practices include training, pruning, weeding, irrigation, fertilizer application and plant protection measures were followed for the healthy growth of crop. Observations on growth parameters were recorded upto 3 months of planting. Data on yield and yield attributes were collected at appropriate stages.

Results and Discussion

Growth attributes

Analysis of variance of different bitter gourd genotypes shows significant variation among all characters. Days to appearance first male flower appearance twenty-seven genotypes are statistically on par with check variety Arka Harit (34.80). Days to appearance of first female flower among the 36 genotypes, thirty- one genotypes are statistically on par with check variety Arka Harit (40.37). Node at which first male flower appears all the genotypes are statistically on par with standard check variety Arka Harit (6.87) except six genotypes VBGC-7 (8.24), VBGC-13 (7.75), VBGC-21 (8.57), VBGC-27 (8.25), VBGC-30 (8.75), VBGC-33 (8.30). Node at which first female flower appears all the genotypes are statistically on par with check variety (18.25) except the genotypes VBGC-3 (21.07), VBGC-6 (21.20).

Earliness is an important trait in a vegetable like bitter gourd. Earliest flowering genotypes VBGC-24 took 37.62 days for days to appearance of first female flower and 32.50 days for days to appearance of first male flower. Earliness is required in such crops for realizing the potential economic yield because of prolonged harvestings. This indicates that earlier

flowering genotypes could be used in the breeding programme to necessitate serial harvesting over wide number of days to avoid glut in the market and exploit higher prices during certain parts of the year. Present results are in harmony with the findings of Talukder *et al.* (2018) [7] in bitter gourd.

Yield attributes

Fruit yield per plant (kg) out of 36 bitter gourd genotypes, eighteen genotypes (VBGC-2, VBGC-3, VBGC-5, VBGC-8 to 13, VBGC-15, VBGC-16, VBGC-18 to 22, VBGC-25, VBGC-29, VBGC-31) statistically on par with check variety Arka Harit (2.57 kg). Number of fruits per plant among 36 genotypes, two genotypes VBGC-7 (25.75), VBGC-24 (30.00) are significantly superior than check variety Arka Harit (18.75). Average fruit weight (g) among 36 genotypes, three genotypes (VBGC-21 (74.00), VBGC-22 (87.25), VBGC-23 (70.75) are significantly higher than check variety Arka Harit (51.83). Fruit length (cm) one genotype VBGC-22 (15.70) was significantly higher than check variety Arka Harit (13.25). Days to first harvest all the, thirty- five genotypes (VBGC-1 to VBGC-35) are statistically on par with the check variety Arka Harit (47.85). Days to last harvest all the thirty-five genotypes (VBGC-1 to VBGC-35) are statistically on par with the check variety Arka Harit (86.00).

Number of primary branches per vine among 36 genotypes, Twenty-two cultivars (VBGC-5 to 7, VBGC-9 to VBGC-13, VBGC-15, VBGC-18, VBGC-19 to VBGC-23, VBGC-24, VBGC-26 to 28, VBGC-30 to VBGC-35) are significantly higher than check variety Arka Harit (8.81). Vine length (cm) among 36 genotypes, sixteen genotypes (VBGC-11 (297.27 cm), VBGC-14 (382.5 cm), VBGC-15 (397.00 cm), VBGC-16 (295.84 cm), VBGC-19 (293.25 cm), VBGC-22 (320.25 cm), VBGC-25 to 34) are statistically on par with the check variety Arka Harit (349.70 cm). Internodal length (cm) among 36 genotypes, sixteen genotypes (VBGC-1 to 3, VBGC-6, VBGC-11, VBGC-12, VBGC-15, VBGC-19, VBGC-20 to 22, VBGC-24, VBGC-25, VBGC-27, VBGC-30, VBGC-31) are significantly higher than check variety Arka Harit (5.95).

Generally, the increase in average fruit weight (g) in the present findings is attributed to increased fruit length. The increase in average fruit weight (g) in genotype VBGC-22 (87.25) leads to increased fruit length (17.62 cm). Similar results of increased average fruit weight (97.6) and increased fruit length (cm) (29.08) in bitter gourd was reported by Saho *et al.* (2015) [5].

Among the genotypes, VBGC-1 was recorded with lower vine length (185 cm) and produced lowest number of fruits per plant (16.94). Thus, in bitter gourd, genotypes producing lowest vine length also produce less number of fruits per plant and these findings are in accordance with the findings of Gupta *et al.* (2015) [2] in the same bitter gourd.

Table 1: List of genotypes used in the study and their sources

S.no	Genotype	NBPGR accession number	Source
1	VBGC-1	IC33275	NBPGR, Thrissur
2	VBGC-2	IC44413	NBPGR, Thrissur
3	VBGC-3	IC44418	NBPGR, Thrissur
4	VBGC-4	IC44419	NBPGR, Thrissur
5	VBGC-5	IC44420A	NBPGR, Thrissur
6	VBGC-6	IC44423	NBPGR, Thrissur
7	VBGC-7	IC44424	NBPGR, Thrissur
8	VBGC-8	IC44426	NBPGR, Thrissur

9	VBGC-9	IC68232	NBPGR, Thrissur
10	VBGC-10	IC68275	NBPGR, Thrissur
11	VBGC-11	IC68309	NBPGR, Thrissur
12	VBGC-12	IC68314	NBPGR, Thrissur
13	VBGC-13	IC68335	NBPGR, Thrissur
14	VBGC-14	IC470554	NBPGR, Thrissur
15	VBGC-15	IC470556	NBPGR, Thrissur
16	VBGC-16	IC470557	NBPGR, Thrissur
17	VBGC-17	IC470558	NBPGR, Thrissur
18	VBGC-18	IC470559	NBPGR, Thrissur
19	VBGC-19	IC213307	NBPGR, Thrissur
20	VBGC-20	IC213308	NBPGR, Thrissur
21	VBGC-21	IC264770	NBPGR, Thrissur
22	VBGC-22	IC469512	NBPGR, Thrissur
23	VBGC-23	IC427433	NBPGR, Thrissur
24	VBGC-24	IC433630	NBPGR, Thrissur
25	VBGC-25	IC427694	NBPGR, Thrissur
26	VBGC-26	IC541218	NBPGR, Thrissur
27	VBGC-27	IC541435	NBPGR, Thrissur
28	VBGC-28	IC596980	NBPGR, Thrissur
29	VBGC-29	IC599421	NBPGR, Thrissur
30	VBGC-30	IC599424	NBPGR, Thrissur
31	VBGC-31	IC599429	NBPGR, Thrissur
32	VBGC-32	IC599434	NBPGR, Thrissur
33	VBGC-33	IC541436	NBPGR, Thrissur
34	Amalapuram Local	Local germplasm	Amalapuram (East Godavari)
35	Venkataramannagudem Local	Local germplasm	Venkataramannagudem (West Godavari)
36	Arka Harit (check)	-	IIHR, Bengaluru

Table 2: Performance of bitter gourd germplasm evaluated at COH VENKATARAMANNAGUDEM for growth characters

S. No	Treatment	Genotype	IC NO	Days to appearance of first Female flower	Days to appearance of first male flower	Node at which first female flower	Node at which first male flower	Fruit Yield per plant (kg)	No. of fruits/plant	Average weight of fruit (g)	Fruit length (cm)	Days to First harvest	Days to last harvest	No of seeds per fruit
1	T1	VBGC-1	IC33275	39.40	37.34	16.90	7.37	1.63	16.94	32.65	9.50	49.20	86.30	9.55
2	T2	VBGC-2	IC44413	41.40	33.90	16.40	7.10	2.27	18.90	41.65	11.15	47.93	87.30	14.25
3	T3	VBGC-3	IC44418	41.55	36.60	21.07	7.40	2.26	18.10	46.25	11.03	48.90	87.20	13.00
4	T4	VBGC-4	IC44416	41.40	35.80	16.50	6.90	1.72	18.59	32.25	7.05	51.50	85.40	10.25
5	T5	VBGC-5	IC44420A	39.80	35.75	20.05	8.00	2.27	19.00	40.55	10.35	49.13	86.90	12.75
6	T6	VBGC-6	IC44423	40.20	36.40	21.20	6.70	1.77	21.78	47.45	13.55	49.50	85.40	12.00
7	T7	VBGC-7	IC44424	42.40	35.84	17.80	8.24	1.52	25.75	39.80	12.35	48.75	85.25	13.50
8	T8	VBGC-8	IC44426	39.75	36.45	18.80	7.90	2.24	21.60	52.50	10.30	49.35	87.20	11.40
9	T9	VBGC-9	IC68232	41.17	37.67	17.59	7.59	2.97	18.50	34.83	10.85	49.50	84.50	11.88
10	T10	VBGC-10	IC68275	45.00	37.50	17.25	7.75	2.94	21.00	42.65	8.90	50.25	83.75	8.50
11	T11	VBGC-11	IC68309	41.15	37.00	17.80	7.20	2.03	19.09	46.75	14.50	49.50	86.00	13.00
12	T12	VBGC-12	IC68314	44.45	35.25	18.00	7.75	2.75	18.75	45.00	9.83	48.90	87.20	15.25
13	T13	VBGC-13	IC68335	42.75	37.50	16.75	8.25	2.37	19.25	41.75	14.25	49.88	85.25	14.25
14	T14	VBGC-14	IC470554	38.50	41.50	19.00	7.75	1.61	17.50	52.50	15.25	48.75	88.00	14.25
15	T15	VBGC-15	IC470556	43.25	35.25	17.50	7.00	2.66	20.00	57.50	8.50	48.50	86.00	9.25
16	T16	VBGC-16	IC470557	40.17	35.88	18.55	7.50	2.22	17.75	59.15	14.63	47.25	86.00	10.25
17	T17	VBGC-17	IC470558	46.90	36.34	19.75	7.30	1.19	19.00	42.75	6.70	48.00	86.00	11.75
18	T18	VBGC-18	IC470559	47.67	37.00	17.00	7.92	2.28	20.25	62.00	12.50	47.25	82.50	12.25
19	T19	VBGC-19	IC213307	44.75	37.38	17.50	7.63	2.47	19.75	54.58	12.53	50.25	88.25	10.00
20	T20	VBGC-20	IC213308	43.50	34.63	18.38	6.88	2.22	18.42	41.25	10.25	47.25	84.50	13.00
21	T21	VBGC-21	IC264770	45.00	36.59	15.25	8.59	2.34	18.25	74.00	15.70	47.25	84.50	11.75
22	T22	VBGC-22	IC469512	42.25	34.50	16.50	7.50	2.95	18.25	87.25	17.63	48.00	85.25	11.75
23	T23	VBGC-23	IC427433	41.17	35.67	18.75	6.67	1.37	20.75	70.75	9.60	48.75	84.50	13.25
24	T24	VBGC-24	IC433630	37.63	33.75	17.00	6.00	1.63	30.00	39.25	12.75	45.75	83.00	12.75
25	T25	VBGC-25	IC427694	43.50	34.00	20.00	7.50	2.24	17.00	35.50	7.25	48.75	83.75	13.75
26	T26	VBGC-26	IC541218	40.85	36.80	17.90	7.90	1.84	18.92	49.32	8.00	49.50	84.75	14.25
27	T27	VBGC-27	IC541435	43.13	37.38	18.00	8.25	1.69	17.45	38.17	10.65	47.25	87.50	15.75
28	T28	VBGC-28	IC596980	40.75	36.95	20.25	7.80	1.68	17.25	34.75	9.93	48.00	83.75	12.00
29	T29	VBGC-29	IC599421	42.25	33.75	20.00	7.00	2.32	21.00	58.25	10.50	48.75	84.50	8.00
30	T30	VBGC-30	IC599424	41.17	37.09	18.75	8.75	1.38	17.50	48.25	10.50	50.50	84.50	5.75
31	T31	VBGC-31	IC599429	42.90	36.30	18.65	7.45	2.22	18.50	34.79	8.83	48.30	85.40	6.20
32	T32	VBGC-32	IC599434	40.00	35.90	18.37	7.67	1.18	18.00	36.08	10.60	47.70	87.50	7.50
33	T33	VBGC-33	IC541436	40.10	36.20	18.70	8.30	1.21	19.05	43.00	6.84	47.25	85.25	7.00
34	T34	Amalapuram Local	Local germplasm	38.75	34.50	19.00	7.75	1.62	19.00	42.09	11.14	48.00	89.00	6.00
35	T35	Venkatarama	Local	42.09	32.50	20.00	7.25	2.16	18.00	44.09	11.65	47.25	85.25	10.25

		nnagudem Local	germplasm											
36	T36	VBGC-36	Variety	40.38	34.80	18.25	6.88	2.58	18.75	51.84	13.25	47.85	86.00	12.75
CD at 5%	-	-	-	4.20	2.39	2.36	1.16	0.60	3.56	14.31	3.50	9.286	6.47	2.1347
S.E.	-	-	-	1.4645	0.8328	0.8215	0.4047	0.2077	1.2391	4.9851	1.2185	1.3294	1.5719	0.7435

Table 3: Mean Performance of bitter gourd germplasm evaluated at COH, VENKATARAMANNA GUDEM for Vegetative Characters

S. No	Treatment	Genotype	IC NO	No. of primary branches per vine	Vine length (cm)	Intermodal length(cm)
1	T1	VBGC-1	IC33275	7.49	185.00	6.57
2	T2	VBGC-2	IC44413	8.77	230.75	7.60
3	T3	VBGC-3	IC44418	8.07	257.75	9.30
4	T4	VBGC-4	IC44419	8.21	224.30	6.50
5	T5	VBGC-5	IC44420A	10.05	219.50	5.55
6	T6	VBGC-6	IC44423	12.18	245.58	7.10
7	T7	VBGC-7	IC44424	9.06	215.85	5.60
8	T8	VBGC-8	IC44426	8.01	235.30	6.40
9	T9	VBGC-9	IC68232	9.02	230.00	6.92
10	T10	VBGC-10	IC68275	8.99	241.00	6.50
11	T11	VBGC-11	IC68309	9.59	297.47	7.13
12	T12	VBGC-12	IC68314	7.02	229.80	7.25
13	T13	VBGC-13	IC68335	9.80	218.13	6.59
14	T14	VBGC-14	IC470554	7.93	382.50	7.00
15	T15	VBGC-15	IC470556	10.20	397.00	7.75
16	T16	VBGC-16	IC470557	7.05	295.84	6.75
17	T17	VBGC-17	IC470558	8.66	254.60	6.60
18	T18	VBGC-18	IC470559	9.16	238.42	6.00
19	T19	VBGC-19	IC213307	9.02	293.25	9.30
20	T20	VBGC-20	IC213308	9.24	201.50	7.50
21	T21	VBGC-21	IC264770	8.08	243.25	7.59
22	T22	VBGC-22	IC469512	8.97	320.25	10.25
23	T23	VBGC-23	IC427433	9.11	210.92	6.50
24	T24	VBGC-24	IC433630	9.74	247.10	7.63
25	T25	VBGC-25	IC427694	8.76	214.75	7.50
26	T26	VBGC-26	IC541218	10.45	250.80	6.50
27	T27	VBGC-27	IC541435	8.92	236.25	7.50
28	T28	VBGC-28	IC596980	10.49	218.95	5.63
29	T29	VBGC-29	IC599421	8.71	252.10	5.50
30	T30	VBGC-30	IC599424	9.22	269.42	7.25
31	T31	VBGC-31	IC599429	9.05	236.85	7.20
32	T32	VBGC-32	IC599434	11.68	210.20	6.70
33	T33	VBGC-33	IC541436	9.35	219.13	7.00
34	T34	Amalapuram Local	Local germplasm	10.05	228.17	6.42
35	T35	Venkataramannagudem Local	Local germplasm	9.21	238.25	6.50
36	T36	VBGC-36	Variety	8.82	349.70	5.95
CD at 5%	-	-	-	0.15	76.5632	1.461
S.E.	-	-	-	0.0551	26.6679	0.8664

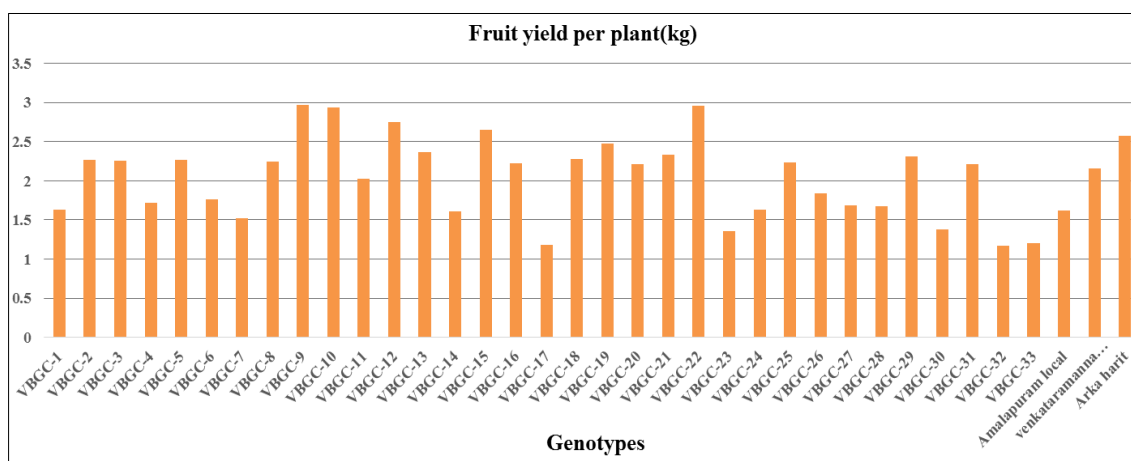


Fig 1: Mean performance of Fruit yield per plant (kg) of different bitter gourd genotypes

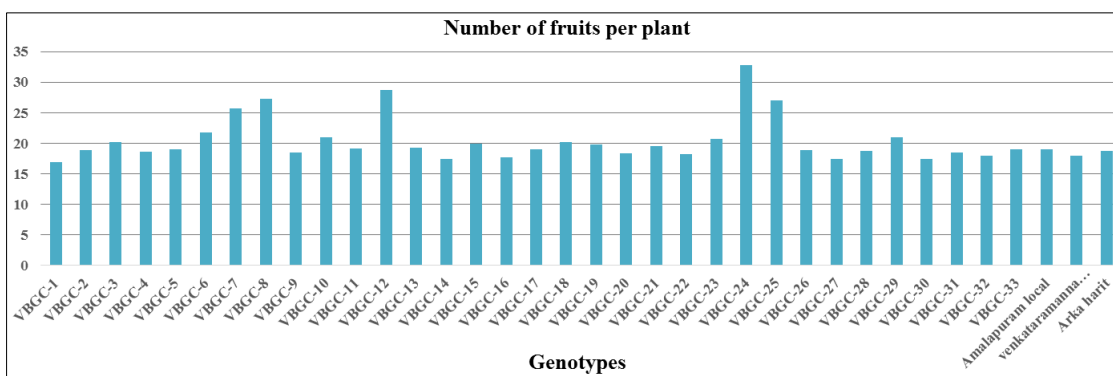


Fig 2: Mean performance of number of fruits per plant of different bitter gourd genotypes

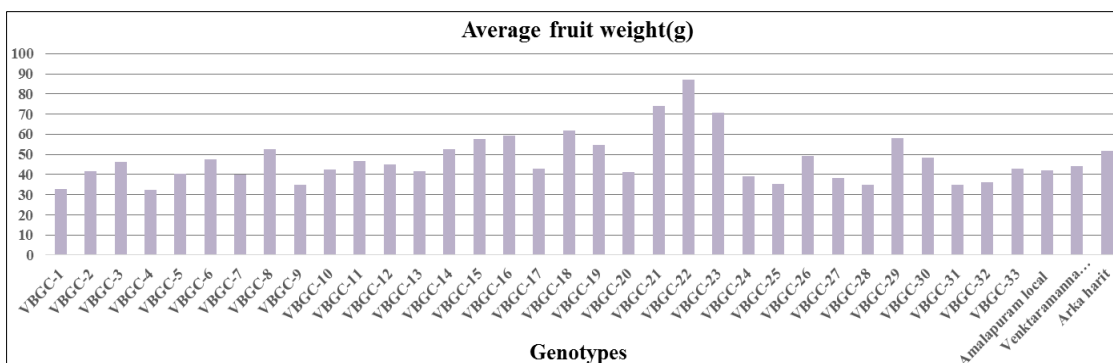


Fig 3: Mean performance of average fruit weight (g) of different bitter gourd genotypes

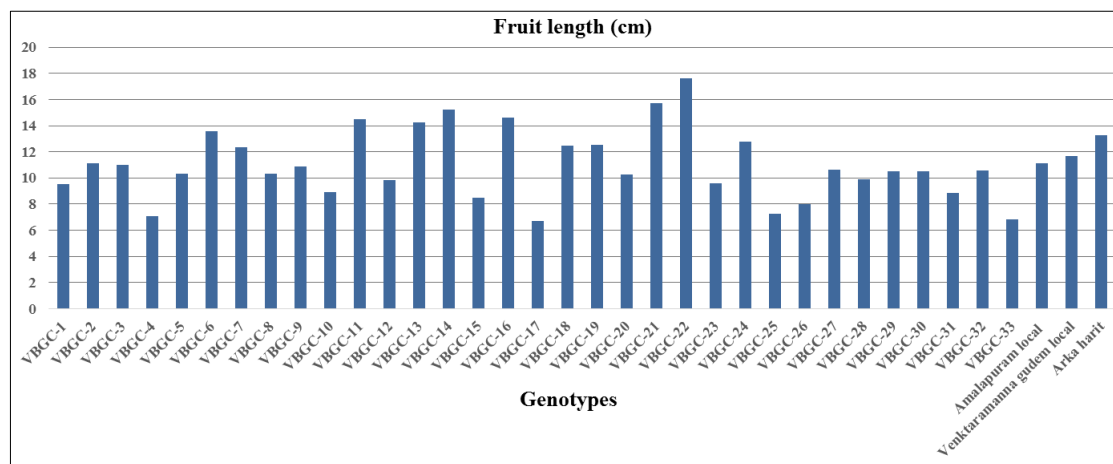


Fig 4: Mean performance of fruit length (cm) of different bitter gourd genotypes

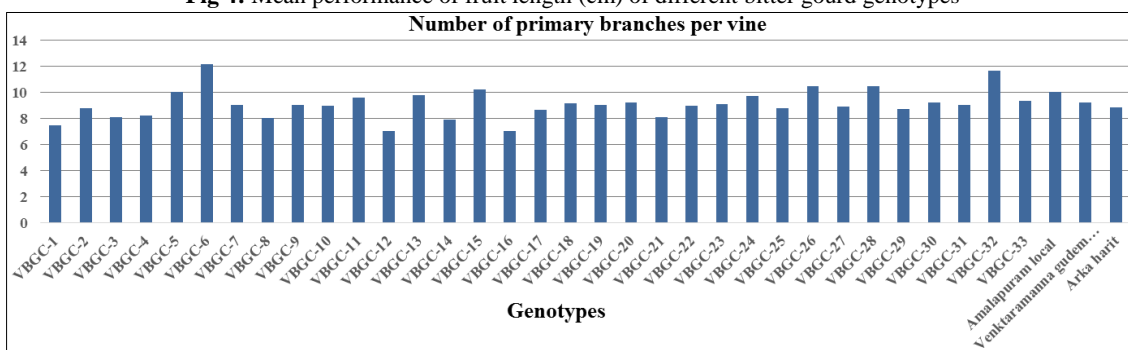


Fig 5: Mean performance of number of primary branches per vine of different bitter gourd genotypes

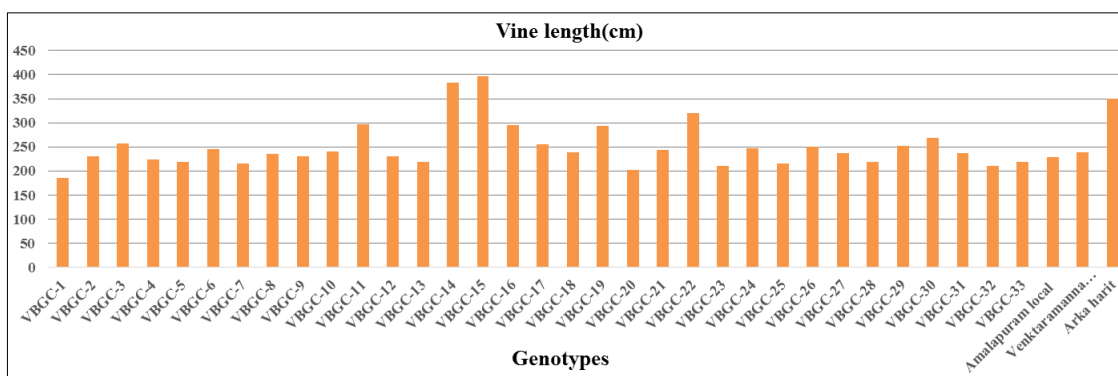


Fig 6: Mean performance of vine length (cm) of different bitter gourd genotypes

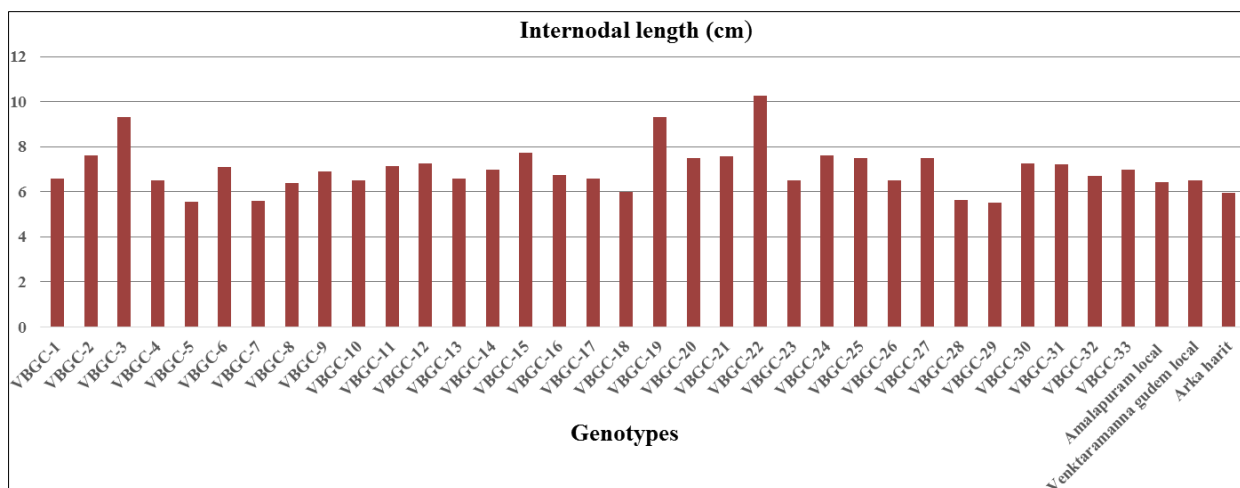


Fig 7: Mean performance of internodal length (cm) of different bitter gourd genotypes

Conclusion

The genotypes which are significantly superior than check variety Arka Harit in 19 characters can be used for future breeding work for further crop improvement programme. Evaluation of promising genotypes over generations to attain the homozygosity and studying them over different environments before they are recommended for commercial cultivation.

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