



Evolution of new high yielding bitter gourd variety safeena for autumn season cultivation in Punjab

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Abstract

Safeena a high yielding, disease resistant and autumn season bitter gourd variety developed to provide bitter gourd fruits in scarcity period Sep-Nov in Punjab, Pakistan. Recurrent selection method was used to develop the variety at Vegetable Research Institute, Faisalabad. The variety was tested in replicated varietal/ station yield trials and multi-locational trials from 2013 to 2015. Results of Autumn season 2013 and 2014 yield trials showed that average yield of Safeena was 28.3 t/ha that was considerably higher than the average yield of commercially cultivated bitter gourd varieties i.e. Black King (9.71 t/ha) and Faisalabad Long (6.01 t/ha). In multi-locational yield trials, Safeena showed the higher average yield (28.08 t/ha) than the respective checks (11.82 t/ha and 10.83 t/ha) and commercial varieties over all locations. It competes with commercially cultivated imported varieties and hybrids in autumn season cultivation. Safeena has the potential to produce yield 31.5 t/ha in season with more threats of fungal and viral diseases. Its fruits have dark green skin color, smooth ridges, spindle shape and average length of 25-30 cm. Average flowering days are 35-40 days. Its 1000 seed weight is 130-135 g. Safeena has good cooking quality. Commercialization of this variety will meet the scarcity period of bitter gourd throughout the Punjab in Pakistan.

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Introduction

Bitter gourd (*Momordica charantia*) a member of the cucurbit family is one of the most popular vegetables in Southeast Asia. Bitter gourd is believed to be native to tropics, being widely grown in China, India, Malaysia and Pakistan. Depending on location, bitter gourd is also known as bitter melon, karella, or balsam pear. The immature fruits and tender vine tips are used in a variety of culinary preparations. The fruit of bitter gourd fruit is similar in nutritional value compared to other cucurbits, with the notable exceptions that it is much higher in foliate and vitamin C (Bakare *et al.*, 2010; Islam *et al.*, 2011; Anilakumar *et al.*, 2015). The vine tips are an excellent source of vitamin A. The medicinal value of the bitter gourd in the treatment of infectious diseases and diabetes is attracting the attention of scientists worldwide (El-Said and Al-Barak, 2011; Parmar *et al.*, 2011; Joseph and Jini 2013). In Pakistan, 64975 tonnes of bitter gourd were produced from an area of 6696 hectares during 2015-16 with an average yield of 9.70 t/ha. The production of this crop was 45432 tonnes from an area of 4214 hectares in Punjab (Fruits, Vegetables and Condiments Statistics of Pakistan, 2015-16). Bitter gourd sowing is distinguished into three prominent growing seasons in Punjab. The November to December sowing under plastic tunnels is called off season cultivation.

February to march in open field is the normal sowing and June to July cultivation is called autumn season cultivation. Among all seasons the autumn season crop faces more threats to crop failure due to intensive fungal and viral diseases attack due to increased humidity and temperature in environment. Bitter gourd mosaic virus causes malformation of leaves, deformation of fruits and stunted plant growth (Khan *et al.*, 2002). *Myrothecium* leaf spot, a fungal disease causes the severe yield losses in bitter gourd growing areas of the world including Pakistan (Costa *et al.*, 2006). The disease appears in the form of dark brown to black color water soaked small spots (Kim *et al.*, 2003). These spots combine on later stages causing the infected leaves to dry out in hot and humid environment (Shaukat *et al.*, 1988).

Bitter gourd variety "Safeena" is developed for the autumn season cultivation. Yet none of variety has been developed and approved for autumn season cultivation due to severe attack of fungal and viral diseases on autumn crop. In Punjab since autumn season starts from June- July and ends in December –January, the variety planted in this period has to tolerate the extremes of temperatures. In the months of July–August monsoon rains start in Punjab which increases humidity in air and resultantly fungal and viral diseases attack takes place on crop which leads to crop failure. Keeping in view the above climatic challenge the variety Safeena was developed. It provides the bitter gourd fruits in the scarcity period. Morphological traits like fruit size, shape and colour are highly attractive and farmers found to be inclined to cultivate this variety. Furthermore, the variety has good yield potential and tolerates fungal and viral diseases as compared to other commercially cultivated varieties in Punjab.

Materials and methods

Safeena is a selection from the indigenous material. Selection process for the development of variety was started in 2005 and line was developed through recurrent selection method. The evaluation of variety was started in 2013 in yield trials to check its performance and adaptability. The newly developed variety "Safeena" was passed through varietal yield trials during autumn season, 2013 and 2014 to check its suitability for autumn season cultivation. Yield performance of variety "Safeena" was also tested in spring season, 2014. Yield trials were conducted using Randomized Complete Block Design with three replications. Black King and Faisalabad Long were used as checks. Second order statistics were employed using estimates of variances and co-variances. All quantitative traits were analyzed using analysis of variance (Steel *et al.*, 1997) with MSTATC (Ver.1.5 Michigan state University, East Lansing Mich.). Data on fruit yield at marketable stage was recorded. During evaluation it showed encouraging results and found tolerant against bitter gourd mosaic virus and yellow mosaic virus disease which is a serious threat to bitter gourd crop in autumn season. Due to its

encouraging performance it was evaluated in the Multi-locational trials in 2015 at three different locations i.e. Faisalabad, Multan and Layyah. Agronomic studies were carried out at Agronomic Research Institute, AARI, and Faisalabad during 2013-14 to test the performance of Safeena at different plant spacings. To measure the susceptibility and resistance of the variety against bitter gourd mosaic virus, Myrothecium, leaf spot and insect pests (American boll worm and fruit fly) trials were also conducted along with checks during 2014-2015. Moreover, foliage (stem hairiness, leaf color and leaf margins) flower (ave. flowering days, flower color and

stigma color), marketable fruit (skin color, surface, length, shape and fruit yield) and seed characteristics (seed color, seed shape and ave. 1000 seed weight) were also recorded

Results and discussion

Varietal yield trials

To check the yield potential and tolerance against different biotic stresses the line Safeena was tested in different trials. Yield trials conducted in autumn season, 2013 and 2014 showed the superior yield performance of Safeena over both checks and commercially cultivated hybrids (Table 1).

Table 1. Performance of bitter gourd variety “Safeena” in yield trials at VRI, Faisalabad during autumn season 2013 and 2014.

Year	Variety/Hybrid	Fruit yield (T/ha)
2013	Safeena	27.2
	Black King (Check)	11.21
	Pali (Commercial hybrid)	7.45
	Faisalabad Long (Check)	6.28
	Winner (Commercial hybrid)	5.90
	No.888 (Commercial hybrid)	5.78
	LSD (0.05)	3.78
2014	Safeena	29.4
	Black King (Check)	8.21
	Pali (Commercial hybrid)	6.17
	Faisalabad Long (Check)	5.74
	No. 888 (Commercial hybrid)	5.21
	Prince (Commercial hybrid)	4.97
	LSD (0.05)	4.10
Average	Safeena	28.3
	Black King (Check)	9.71
	Faisalabad Long (Check)	6.01
Percentage increase in yield over checks	Black King (Check)	191%
	Faisalabad Long (Check)	370%

During 2013, average yield of Safeena was 27.2 t/ha (Table1) that was considerably higher than the average yield of Black King (11.21 t/ha), Faisalabad Long (6.28 t/ha) and commercial hybrids viz; Pali (7.45 t/ha), Winner (5.90 t/ha) and No. 888 (5.78 t/ha). Likewise, yield trials conducted in autumn

season 2014, depicted higher average yield of Safeena (29.4 t/ha) than that of Black King (8.21 t/ha), Faisalabad Long (5.74 t/ha) and commercial hybrids (Table1). Average of two year data depicted excellent performance of Safeena (28.3 t/ha) in terms of marketable fruit yield in autumn season over checks

(9.71 t/ha and 6.01 t/ha). The results exposed the better acclimatization and potential of newly developed variety "Safeena" in autumn season i.e. normally off season for bitter gourd cultivation in Punjab due to maximum threat of biotic (Fungal and viral diseases) and a biotic factors (Rainfall,

humidity, and temperature fluctuation in day and nights) over commercially cultivated varieties/hybrid. New bitter gourd variety exhibited 191 percent and 370 percent higher fruit yield than commercially cultivated varieties Black King and Faisalabad Long respectively.

Table 2. Performance of bitter gourd variety "Safeena" in yield trials at VRI, Faisalabad during spring season 2014 against respective checks (Black King and Fsd. long).

Rank. No.	Variety/Hybrid	Fruit Yield (t/ha)
1	HBG-82	15.03
2	Sakuna -208 F ₁	14.23
3	Black King (Check)	14.07
4	Fsd. Long (Check)	13.20
5	Safeena	6.59
6	KHBG-153b	2.52
LSD (0.05)		7.1

Table 3. Performance of bitter gourd variety Safeena during 2015 in multilocational trials.

Rank	Variety/Line	VRI, Faisalabad	BZU sub campus- Layyha	VRSS, Multan	Average fruit yield (t/ha)
1	Safeena	28.41	24.32	31.53	28.08
2	Black King (Check)	10.72	9.55	15.20	11.82
3	Faisalabad Long (Check)	8.74	10.03	13.73	10.83
4	BIG-14	9.12	7.79	11.00	9.34
5	Noor F ₁	9.74	6.38	7.93	8.01
Percentage increase in yield over checks		Black King (Check)			137%
		Faisalabad Long (Check)			159%

BZU= Bahauddin Zakrariya University, VRSS= Vegetable Research Sub Station.

Data of yield trial (Table 2) conducted in spring 2014 showed lower yield of bitter gourd variety, Safeena (6.59 t/ha) than check varieties, Black King (14.07 t/ha) and Fsd. Long (13.20 t/ha) and commercial varieties, HBG-82 (15.03 t/ha) and Sakuna-208 F₁ (14.23 t/ha). Spring and autumn season yield trials indicated that Safeena performance was excellent in Autumn cultivation as it ruled over other varieties used in that trial. Thus the goal to develop bitter gourd variety for cultivation in autumn season to provide the bitter gourd fruits in the scarcity period achieved.

Multilocational yield trials

Safeena along with checks was also tested in multilocational yield trials in 2015 to check adaptation in different regions of Punjab. The data

(Table 3) showed the higher average yield of variety Safeena (28.08 t/ha) than the respective checks black king (11.82 t/ha) and Faisalabad long (10.83 t/ha) over all the locations.

Safeena displayed the highest yield in Multan (31.35 t/ha) followed by yield in VRI, Faisalabad and BZU sub campus-Layyaha (28.41 t/ha and 24.32 t/ha respectively). Percentage increase in its yield was 137% and 159% over Blank King and Faisalabad Long respectively.

Pathological studies

Pathological studies were carried out at VRI and Plant Pathological Research Institute, AARI, Faisalabad depicted that no serious disease has been recorded on Safeena.

Table 4. Pathological studies on bitter gourd variety "Safeena" against bitter gourd mosaic virus (2014).

S. No.	Variety name	Total no of plants	Infected plants	Disease incidence rate
1	Safeena	200	5	2.5%

Result: Moderately resistant against disease

Source: Plant Virology Section, Plant Pathology Research Institute Faisalabad.

It is moderately resistant to bitter gourd mosaic virus (Table 4). Myrothecium leaf spot is a serious bitter gourd disease. This variety is also moderately resistant against Myrothecium leaf spot and other viral diseases as reported by Plant Pathologist (2015), Ayub Agricultural Research Institute, Faisalabad.

Entomological studies

No serious insect/pest on Sarsabz has been recorded by Entomological Research Institute, Faisalabad. Negligible attack of American boll worm and fruit fly was observed (Table 5).

Table 5. Entomological studies on bitter gourd line "Safeena" against insect pests at Entomological Research Institute, Faisalabad (2014-15).

S. No.	Variety	American Boll Worm	Fruit Fly
1	Safeena	1.02b	0.51b
2	Faisalabad Long	7.38a	4.14ab
3	HBG-54	2.43b	1.62b
4	Coll. no 3	5.23ab	7.22ab
5	Black King	4.57ab	1.71b
LSD(0.05)		4.32	4.40

Any two means having a common letter are not significantly different at 5% level based on LSD test.

Agronomic studies

Agronomic studies were carried out at Agronomic Research Institute, AARI, and Faisalabad. The data (Table 6) showed that Safeena gave highest yield (24.7 t/ha) at plant spacing of 150 cm (5ft). This line

has maximum canopy on plastic nets as compared with other varieties/checks so plant spacing should be kept 150cm to get maximum yield potential of the crop accordingly to the findings.

Table 6. Performance of Safeena at different plant spacing's at Agronomic Research Institute Faisalabad during 2013-14.

S. No.	Treatments	Fruit yield (t/ha)
1	120 cm	18.3
2	150 cm	24.7
3	180 cm	21.8
LSD (0.05)		2.6

Conclusion

It could be concluded that bitter gourd variety Safeena is superior over existing commercially cultivated varieties/hybrids in autumn season cultivation for green fruit yield. This variety is tolerant to fungal and viral diseases of bitter gourd and suitable for june-july cultivation in Punjab. Cultivation of this variety on large scale will surely

end the scarcity period and prolong the availability of bitter gourd fruit in Punjab throughout the year and will also prove beneficial for farmers increasing their income.

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