

RELEASE OF HIGH YIELDING, EARLY MATURING AND DROUGHT TOLERANT GUAR VARIETY BR-2017

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ABSTRACT

The new guar variety BR-2017 was evolved at Agricultural Research Station, Bahawalpur. The BR-2017 was evaluated/tested in Preliminary Guar Yield Trial (A-Trial), Regular Guar Yield Trial (B-Trial), Advance Guar Yield Trial (C-Trial), Zonal Guar Yield Trial and National Uniform Guar Yield Trial at different locations of Punjab in comparison with two check varieties BR-90 and BR-99. The BR-2017 produce high yield as compared to check varieties at all locations in different trials. The yield potential of BR-2017 was also assessed under drought stress conditions for areas experiencing water shortage. The performance of BR-2017 was good as compared to the check varieties under drought conditions which showed that this variety can be better adapted to the drought stress conditions and can produce better grain yield. The response of BR-2017 variety to insect pests and disease attack was studied and results showed tolerance to insect pests and diseases infestation compared with checked variety BR-99. The chemical analysis showed that the protein and gum contents of BR-2017 were comparatively better than the check variety BR-99. The gum contents are about 35.20% which is about 2% higher than check variety BR-99 and similarly crude protein, meal and ash of BR-2017 was also greater than check variety. The BR-2017 retains better quality traits and gave best yield in drought and irrigated conditions and also resistant/tolerant to all diseases and insect pests. This variety has the capability to replace the other previous guar varieties.

Keyword: Guar, Variety, Drought, BR-2017

INTRODUCTION

Cluster bean [*Cyamopsis tetragonoloba* (L.) Taub] is a deep rooted drought and heat tolerant legume crop. The emerging properties of the crop are well adapted in rainfed areas, different uses in industry and its importance due to such factors as nutrient increasing in soil, minimum requirement of fertilizer and has become most important crop in arid and semiarid areas of Pakistan. Guar contains a high content of nutritional quality protein so it has a large role in the plants that provide the food and needs of human beings.

The new variety BR-2017 has ability of high yielding and early maturing which also replace the earlier varieties and has important role to increase the production of farmer which ultimate improve the living standard of farming community. World climate change and also increase in temperature ultimate drought conditions is increasing due to shortage of water. There is need to develop such varieties which give better yield in the shortage of water. The new variety BR-2017 has been developed keeping in view these change climatic conditions and has ability give high yield in drought conditions and also best suited for rainfed areas.

Guar gum is a significant component used in food as emulsifier, additive and thickener and other products. Due to these qualities, guar gum powder has obtained a greater importance in international market. The endosperm has major component of galactomannan gum (19 to 43% of the seed), which forms a sticky gel in cold water. Guar is a legume crop which is excellent soil-building and capable of nitrogen fixation.

Drought is an abiotic stresses which is most widespread in all over the world (Chaves *et al.*, 2003; Farooq *et al.*, 2009), and due to climate change drought condition is increasing worldwide (Sheffield and Wood, 2008; Dai, 2013). The drought severity depends on many factors such as amount and rotation of rainfall, evaporation demands and storing capacity of moisture of soils (Wery *et al.*, 1994).

Several breeding and genetic engineering strategies have been used in order to increase ability of plants to tolerate drought stress conditions. The improvement in drought tolerance has been slower in past due to genetic complexity of drought stress. (Timmusk *et al.*, 2011; Yang *et al.*, 2009).

The earlier guar varieties were late maturing due to this farmer face problem in sowing of Rabi crops, therefore scientists developed new variety which is early maturing and timely sowing of Rabi crops. Keeping in view the importance of guar crop, there is need of evolution of new high yielding, short duration and early maturing varieties of guar for general cultivation in rainfed (Thal and Tharparker) and irrigated areas to facilitate the timely sowing of

wheat, raya and other rabi crops. The newly developed variety BR-2017 is high yielding, short duration and early maturing than existing varieties of guar (2/1, BR-90 and BR-99) and has also a wide range of adaptability.

MATERIAL AND METHODS

BR-2017 was developed from a single plant selection at Agricultural Research Station, Bahawalpur. The selection was carried out during 2008-09 to develop this variety. This single planting was continued with rejection of unwanted/diseased plants in natural conditions. The seed harvested from desirable plants and were bulked. This line was checked in different yield trials for yield assessment and disease response. These guar trials were conducted at Agricultural Research Station, Bahawalpur before testing in Zonal Trials. All guar trials were sown in Randomized Complete Block Design with 3 replications. The distance between two rows was kept at 45 cm. The Planting was completed with use of single row drill and each genotype contained in 4 rows of 5 m length. One to two (1-2) approved varieties used as checks were used in each trial for the comparison. For the production technology, yield trials were performed for consecutive 3 years (2013-2015) to check its response to different sowing dates and various NPK combinations with the comparison of the standard varieties. The selected line was tested in National Uniform Guar Yield trials. The NUGYT trial was performed at 3 different locations in 2013 and 2014 and the trial was sown in RCBD with 4 replications. The each genotype contained 6 rows in each plot and distance between the two rows was 45 cm. The sowing time and cultural practices were similar at all the places. The data of each location in replicated form were averaged and converted to kg ha⁻¹ for comparison (Mustafa *et al.*, 2004, 2005 and 2007).

Breeding History (2008-09 to 2015-16).

S. No.	Year	Generation / Trial	V. Code
1	2008-09	Single Plant Selection	S-5274
2	2009-10	Progeny Row Trial	-do-
3	2010-11	Preliminary Guar Yield Trials (A-Trial)	-do-
4	2011-12	Regular Guar Yield Trials (B-Trial)	-do-
5	2012-13	Advance Guar Yield Trials (C-Trial)	-do-
6	2013-14	Zonal Trial, NUGYT, DUS, Agronomic Trials	-do-
7	2014-15	Zonal Trial, NUGYT, DUS, Agronomic Trials	-do-
8	2015-16	Seed Multiplication	-do-

RESULTS AND DISCUSSION

The strain was evaluated/tested in Preliminary Guar Yield Trial (A-Trial), Regular Guar Yield Trial (B-Trial) and Advance Guar Yield Trial (C-Trial) at Agricultural Research Station Bahawalpur from 2010 to 2012. The data showed that grain yield of BR-2017 ranged from 1919 to 2470 kg ha⁻¹ as compared to BR-99 and BR-90 for which yield ranged from 1149 to 1682 kg ha⁻¹. This strain produced 27.93% and 99.12% higher yield than check varieties BR-99 and BR-90, respectively (Table 1).

The Zonal Guar Yield Trial was conducted at 3 locations at Agronomic Research Stations Khanewal, Bahawalpur and Karore Lal Eison for two years. On the basis of average of these locations, BR-2017 gave 53.92% and 81.60% higher yield as compared to check varieties during 2013 while BR-2017 gave 46.95% and 61.14% higher yield as compared with check varieties during 2014 (Table 2).

This variety also checked in National Uniform Guar Yield Trials at 3 locations for two years (2013 and 2014) by the Coordinator Fodder, NARC Islamabad. The results from the Tables 3-4 showed that this variety gave 11.69 to 11.91% higher yields as compared to the standard variety BR-99 at all locations.

Table 1. Result of Station Yield Trials (2010 to 2012).

Year	Trial	Yield Kg/ha			% increase over check		LSD (0.05)
		BR-2017	BR-99 (Check)	BR-90 (Check)	BR-99	BR-90	
2010	A	1919	1500	1149	27.93	67.01	205.15
2011	B	2280	1545	1145	47.51	99.12	178.98
2012	C	2470	1682	1263	46.85	95.57	254.72

Table 2. Results of Zonal Guar Yield Trial (2013 to 2014).

Years	Varieties	Locations/Grain Yield (Kg ha ⁻¹)			Average Kg ha ⁻¹	%age increase over check
		ARS, Khanewal	ARS , Karor	ARS, Bahawalpur		
2013	BR-2017	2224	1987	2392	2201	-
	BR-99 (Check)	1484	1210	1595	1430	53.92
	BR-90 (Check)	1218	1083	1335	1212	81.60
2014	BR-2017	1991	1784	2235	2003	-
	BR-99 (Check)	1205	1344	1541	1363	46.95
	BR-90 (Check)	1081	1110	1537	1243	61.14

Table 3. Results of National Uniform Guar Yield Trial of Guar (2013).

Varieties	Locations/ Grain Yield (Kg ha ⁻¹)				%age increase over check
	A ZRI, Bhakkar	AZRI BWP	NARC-ISD	Average	
BR-2017	901	1720	1621	1414	-
BR-99 (Check)	840	1549	1410	1266	11.69

Table 4. Results of National Uniform Guar Yield Trial of Guar (2014).

Varieties	Locations/ Grain Yield (Kg ha ⁻¹)				%age increase over check
	AZRI, Bhakkar	BARI Chakwal	AZRI, BWP	Average	
BR-2017	1244	2030	1178	1484	-
BR-99(Check)	1261	1400	1318	1326	11.91

Table 5. Yield Performance at different locations.

S. No.	Year	Location	Area Sown (acre)	Yield (Kg ha ⁻¹)	
				BR-2017	BR-99
1	2013	Haronabad	3	2540	1730
2	2013	Khairpur Tamewali	2	2210	1644
3	2013	Chumb Kuliar, Lodhran	2	2300	1650
4	2013	Chak 126/DRB, Ahmad Pur	4	2450	1895
5	2013	Noorpur Thal, Nawan Kot	2	1890	1380
6	2013	Mankera, Bhakkar	3	2010	1495
7	2013	Chak No. 321/WB, Dunyapur	1.5	2200	1630
8	2014	Havelli Naseer Khan, Lodhran	2	2395	1756
9	2014	Jalal Pur Peer Wala, Lodhran	4	2505	1820
10	2014	Chack No.126/DRB, Ahmad Pur	3	2430	1698
11	2014	Chak 71Alaf/DB, Yazman	2	1995	1250
12	2014	Baghu-bahar, Khanpur	4	2500	1958
13	2014	Liaqatpur	1	2340	1613
14	2014	Chak No.193/7R Haroonabad	4	2580	1920
15	2014	Chak No. 321/WB, Dunyapur	1.5	2320	1712
Average				2345	1676

Table 6. Results of Drought Stress Trial-2013.

Strains	Grain yield (Kg ha ⁻¹)	
	No irrigation after sowing	3 irrigations after sowing
BR-2017	1710	2355
BR-99 (check)	1263	1627
BR-90 (check)	858	1060
LSD (0.05)	104.12	196.82

Table 7. Effect of Sowing Dates on Grain Yield of BR-2017.

Treatments/Sowing dates	Grain Yield (Kg ha ⁻¹)		Average
	2013	2014	
D1 (01/05)	1450	1395	1422
D2 (15/05)	1695	1767	1731
D3 (01/06)	2415	2497	2456
D4 (15/06)	2392	2374	2383
D5 (01/07)	2024	1978	2001
D6 (15/07)	1737	1648	1692
LSD (0.05) V=75.45 T=158.77			

Table 8. Fertilizer Requirement of BR-2017.

Treatments				Grain Yield Kg/ha		Average
Tr.	N (Kgha ⁻¹)	P (Kgha ⁻¹)	K (Kgha ⁻¹)	2013	2014	
T1	0	0	0	885	1085	985
T2	0	60	0	1275	1241	1258
T3	15	60	0	1455	1473	1464
T4	30	0	15	1266	1298	1282
T5	30	30	30	1876	1907	1891
T6	30	60	30	2430	2358	2394
T7	30	90	45	2390	2271	2330
T8	45	60	60	2345	2205	2275
LSD (0.05) V: 187.15 T: 270.12 Vx T: 354.10						

Table 9. Effect of Different Row Spacing on Grain Yield of BR-2017.

Treatments/ Row Spacing		Grain Yield Kgha ⁻¹		Average
		2013	2014	
T1	30cm	1910	2071	1990
T2	45cm	2347	2478	2412
T3	60cm	1510	1584	1547
LSD (0.05) V=99.433 T=121.78				

The yield potential of BR-2017 was also assessed at farmer's fields. The results summarized in the table-5 proved that the variety BR-2017 produced significantly higher yield than the check variety BR-99 at all the 15 different locations.

Table 10. Response of BR-2017 to different irrigation levels.

Treatments/ Irrigation levels		Grain Yield Kg ha ⁻¹		Average
		2013	2014	
T1	One irrigation a/f 35 days of sowing	1413	1448	1430
T2	One irrigation at flowering stage	1285	1209	1247
T3	(T1+T2)	1823	1929	1876
T4	T3+ irrigation at pod formation stage	2434	2465	2449
T5	No irrigation (Control)	1167	1094	1130
LSD (0.05) V=86.14 T=233.19				

Table 11. Response of BR-2017 to Insect Pests attack (2013 and 2014).

Varieties	Jassid leaf ⁻¹			Whitefly leaf ⁻¹		
	BWP	FSD	AV.	BWP	FSD	AV.
BR-2017	1.33	1.10	1.22	1.52	0.13	0.83
BR-99 (check)	1.54	1.50	1.52	1.82	0.60	1.21
LSD (0.05)	NS	0.10		NS	0.21	

Table 12. Response of BR-2017 to diseases.

Varieties	2013		2014	
	PPRI, FSD Bacterial blight was observed and plant reaction is as under:	RARI, BWP Bacterial blight was observed and plant reaction is as under:	PPRI, FSD Leaf spot and blight was observed and plant reaction is as under:	RARI, BWP Only bacterial blight was observed and plant reaction is as under:
S-5274	Moderately Resistant	Moderately Resistant	Moderately Resistant	Moderately Resistant
BR-90 (Check)	Moderately Resistant	Susceptible	Moderately Resistant	Moderately Susceptible
BR-99 (Check)	Moderately Susceptible	Moderately Resistant	Moderately Susceptible	Moderately Resistant

Several earlier workers like Sarwar and Ahmad (2003), Bakhsh *et al.* (2005), Ahmad *et al.* (2002a,b), Tariq *et al.* (2003), Siddiqi *et al.* (2001), Saleem *et al.* (2002), Ahmad *et al.* (2005), Khan and Din (1999) and Hussain *et al.* (2010a,b,c) reported higher yield in different crops as compared to the check varieties.

The yield potential of BR-2017 was also assessed under drought stress conditions for areas experiencing water shortage. No irrigation was applied from sowing till harvesting except soaking dose (*rowni*). Under drought conditions, the strain BR-2017 out yielded the check varieties as shown in table-6. It is concluded that this strain can be better adapted to the drought stress conditions and can produce better grain yield.

Agronomic Studies

The sowing date trials were conducted for two years during 2013 to 2014 to find out optimum sowing time of guar strain BR-2017 at Agricultural Research Station, Bahawalpur. The results on the basis of average yield of two years are presented in Table 7.

The results obtained showed that BR-2017 gave maximum grain yield when sown on 1st June followed by sown on 15th June, therefore, its sowing is recommended in 1st fortnight of June.

The response of BR-2017 was studied at Agriculture Research Station, Bahawalpur at 8 different levels of NPK for two years during 2013 to 2014 to find out optimum fertilizer doze. The results on the basis of average yield of

two years are presented in Table 8. The results obtained revealed that the strain BR-2017 gave maximum yield at fertilizer doze of 30:60:30 NPK Kg ha⁻¹.

The results of sowing of BR-2017 at different row spacing are shown in Table-9 which indicates that sowing of crop at 45cm apart rows is most appropriate to get better grain yield.

Five different irrigations were applied to BR-2017 from sowing till harvesting of crop to find out optimum number of irrigations in order to get maximum grain yield in irrigated areas. The results obtained showed that strain BR-2017 produced maximum grain yield with three irrigations after sowing i.e. after 35 days of sowing, at flowering stage and at pod formation stage (Table 10). The same results were also stated by Ahmad *et al.* (2002a, b) and Hussain *et al.* (2010a,b,c).

Table 13. Results of chemical analysis of BR-2017.

Quality Trait	BR-99	BR-2017
Gum Contents (%)	33.33	35.20
Crude Protein (%)	29.75	31.50
Germ+Meal	37.28	40.87
Husk	11.53	10.10
Ash	3.43	3.85

Source: Agricultural Chemist (Bio), Post Harvest Research Centre, Ayub Agricultural Research Institute, Faisalabad.

Entomological Studies

The response of BR-2017 variety to insect pests attack was studied at the Entomological Research Institute, AARI, Faisalabad and Regional Agriculture Research Institute, Bahawalpur during Kharif, 2013 and 2014. The insect pest data recorded by the Entomologists of these Research Institutes for two growing seasons are given in Table 11. The data recorded indicated that only attack of sucking pests i.e. whitefly, jassid and aphid was observed in traces and the strain BR-2017 has shown tolerance to insect pests infestation compared with checked variety BR-99.

The disease reaction of BR-2017 was studied at the Plant Pathological Research Institute, AARI, Faisalabad and Regional Agriculture Research Institute, Bahawalpur during Kharif, 2013 and 2014. The data regarding disease incidence recorded by the Pathologists of these research institutes for two consecutive years are given in Table 12. The data given in the above table revealed that attack of diseases i.e. bacterial blight and leaf spot were observed and the variety BR-2017 was resistant against disease attack as compared to the check varieties i.e. BR-99 and BR-90.

Chemical Analysis

The results in the Table 13 shown that the protein and gum contents of BR-2017 are comparatively better than the check variety BR-99. The gum contents are about 35.20% which is about 2% higher than check variety BR-99 and similarly crude protein, meal, ash of BR-2017 was also greater than check variety and results are given in Table 13.

CONCLUSION

BR-2017 contained quality characters and also gave high yield with ability to tolerate /resist to all diseases and insect pests which is best suited under drought conditions. This variety can replace all other varieties due to its above mentioned characters. The BR-2017 was accepted and approved by the Punjab Seed Council, Lahore, during its 48th meeting held on 06 March, 2017 under the Chairmanship of Minister for Agriculture, Government of the Punjab, for general cultivation for irrigated and rainfed areas of Punjab under the name of "BR-2017".

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