



Research Article

Barani Mash a Newly Developed Disease Resistant and High Yielding Mash Cultivar for Rainfed Areas of Punjab, Pakistan

Ghulam Rabbani¹, Uzma Javed^{1*}, Javed Iqbal², Ruqeah Mustafa³, Ghulam Shabbir² and Fida Hassan Shah⁴

¹Pulses Section, Barani Agricultural Research Institute Chakwal, Pakistan; ²Plant Breeding and Genetics Dept., PMAS Arid Agriculture University Rawalpindi, Pakistan; ³Oilseeds Section, Barani Agricultural Research Institute Chakwal, Pakistan; ⁴Groundnut Section, Barani Agricultural Research Institute Chakwal, Pakistan.

Abstract | New cultivars development is a continuous process as older genotypes become increasingly susceptible to biotic and abiotic stresses. The newly developed mash cultivar “Barani Mash” is an elite mash cultivar with yield potential of 1743 kg/ha. This cultivar has resistance against diseases and lodging, the pod size is medium and 100-seed weight is 4.73 g. It has been developed through screening from the local material. It was further evaluated in yield trials for six years from 2012 to 2016. The line 11CM-707 had higher yield than check cultivars per all replicated yield trials. In addition, it has resistance to yellow mosaic. The main yield contributing characters were number of pods per plant, number of primary branches per plant, yield per plant and 100-kernal weight. Based on desirable traits and higher yield, this line was approved with name of “Barani Mash” by the Punjab Seed Council for its cultivation on commercial level in rainfed areas of Punjab. “Barani Mash” will prove to be a good alternative of existing cultivars and cultivation of this cultivar would help to increase the productivity and income of mash growers in Barani tract.

Received | August 11, 2020; **Accepted** | October 25, 2020; **Published** | February 06, 2021

***Correspondence** | Uzma Javed, Pulses Section, Barani Agricultural Research Institute Chakwal, Pakistan; **Email:** uzma_raja18@yahoo.com

Citation | Rabbani, G., U. Javed, J. Iqbal, R. Mustafa, G. Shabbir and F.H. Shah. 2021. Barani mash a newly developed disease resistant and high yielding mash cultivar for rainfed areas of Punjab, Pakistan. *Sarhad Journal of Agriculture*, 37(1): 115-119.

DOI | <http://dx.doi.org/10.17582/journal.sja/2021/37.1.115.119>

Keywords | New mash cultivar, Barani Mash, Rainfed areas, High yielding, Disease resistant

Introduction

Black gram (*Vigna mungo*) or Mash belongs to family leguminosae, is an important pulse crop of Pakistan. Southern Asian countries especially India, Myanmar, Thailand and Bangladesh are the main growing regions of the mash crop. Mash is a densely hairy erect or sub-erect annual herb. It has a tap root system that produces branched roots with smooth and rounded nodules. The pods of the crop are cylindrical, narrow and up to 6 cm long. It contains amino acids, sulphur, cysteine, methionine, and lysine which are excellent components of balanced human diet. It is also a good source of iron, sodium, potassium,

calcium, magnesium, phosphorus, sulphur, copper, and vitamins. Mash being an important source of protein is increasingly used as a substitute for animal protein. The mash crop splits or dried whole seeds are used to make curries, sours and dahl, and are added to various fried or spiced dishes. Sprouted seeds of mash are also utilized as a quality vegetable ingredient in different parts of world. Therefore, emphasis should be given to develop Mash cultivars which may ultimately be helpful to achieve self-sufficiency in the production of pulses.

During 2018-19, mash crop was cultivated over an area of 14.1(000) hectares in Pakistan, with a total

production of 6.9(000) tones (GOP, 2018-19). Mash crop is cultivated in all four provinces of Pakistan; however, Punjab has the largest area under mash cultivation.

In Punjab, a total of 12.17(000) hectares is under mash cultivation giving a production of 3.6(000) tones. Rain fed areas contribution is 84% while irrigated contributes only 16% (AMIS, 2017-18). A wide range of agro-ecological zones of Pakistan are suitable for mash cultivation. This crop has potential to produce high yield, however, due to a variety of factors, crop yield remains below its potential. Therefore, our country is not self-sufficient in mash production, each year government spends a substantial amount of funds and spends its foreign exchange to import mash for consumption. Last year alone, Pakistan imported 64.08 thousand tons of mash with value of 7824.55 million rupees (AMIS, 2019-20).

Mash bean introduction in cereal cropping system can potentially benefit by improving net returns, soil fertility and agriculture sustainability. Hence, development of a high yielding and disease resistant mash cultivars is of vital importance. Barani Agricultural Research Institute, Chakwal, Pakistan has developed a high yielding disease resistant mash cultivar "Barani Mash" that has the potential to produce 1743 kg ha⁻¹. This paper illustrates breeding history of cultivar "Barani Mash". This cultivar is which approved by the Punjab Seed Council for general cultivation in rainfed areas of Punjab, Pakistan.

Materials and Methods

The procedure developed and adopted by Naeem-ud-Din *et al.* (2009) was followed for varietal development. An elite line of Mash genotype 11CM-707 was screened from local material. Performance evaluation of this line was carried out in different replicated yield trials along with check cultivars for three consecutive years (2012 to 2014) at BARI, Chakwal Pakistan. Regional adaptability, plant protection and agronomic trials were conducted during 2015 and 2016. All the trials were conducted according to randomized complete block design (RCBD). Plant to plant and row to row spacing was kept at 10 and 30 cm, respectively. Standard cultural practices and inputs including fertilizer were used to conduct the trials at different environments. Field

trials were conducted on sandy loam soil. Data were recorded for different plant traits in various experiments and analyzed statistically using software statistix 8.1.

Results and Discussion

Yield performance trials

Mash preliminary, regular and micro-yield trials were conducted during 2012, 2013 and 2014, respectively at Barani Agricultural Research Institute (BARI) Chakwal, Punjab, Pakistan. National uniform yield trials were performed during 2015 and 2016. Spot examination was performed during 2018 and its case was submitted to the Expert Sub-Committee for approval. All the experts/members of Expert Sub-Committee unanimously recommended the case of this new mash line 11 CM-707 "BARANI MASH" developed by Barani Agricultural Research Institute, Chakwal for the consideration by the Punjab Seed Council for its approval. Finally, it was approved by the Punjab Seed Council for general cultivation in the Pothowar area of the Punjab province. Table 2 shows the significant differences ($P < 0.05$) among the varietal means for seed yield in preliminary yield trial of mash. Genotype 11 CM-707 produced a seed yield of 628 kg ha⁻¹ and was ranked 4th among the tested genotypes. 11 CM-707 produced 24% higher seed yield than check cultivar Arooj. Likewise, 11 CM-707 produced 11% and 16 % higher seed yield than check cultivars Chakwal Mash and Arooj respectively in the regular yield trials, as mentioned in Table 3. In micro- yield trial on an average the proposed line 11 CM-707 produced 23% and 25% higher seed yield than check cultivars Chakwal Mash and Arooj (Table 4).

Table 1: Chronological development of BARANI MASH (11CM-707).

Year	Pedigree	Remarks
2012	11CM-707	Preliminary Yield Trial
2013	11CM-707	Regular Yield Trial
2014	11CM-707	Micro Yield Trial
2015	11CM-707	National Uniform Yield Trial (5 locations); Sowing dates Trial; Fertilizer Requirement Trial; Screening against Diseases
2016	11CM-707	National Uniform Yield Trial (5 locations); Sowing dates Trial; Fertilizer Requirement Trial; Screening against Diseases
2018	11CM-707	Spot Examination Report

Table 2: Seed yield of various mash genotypes in PYT-2012.

S.No	ENTRIES	Yield (kg/ha)
1	11CM-709	750
2	11CM-705	681
3	11CM-710	653
4	11CM-707	628
5	11CM-701	618
6	11CM-706	618
7	MASH-97	614
8	CH-MASH (c)	606
9	11CM-704	542
10	11CM-703	528
11	11CM-702	514
12	Arooj (c)	500
13	11CM-708	424
	LSD (0.05)	67.81
	CV (%)	6.79

Table 3: Seed yield of various mash genotypes in RYT-2013.

Sr. No.	Entries	Seed yield (Kg/ha)
1	11CM-707	1743
2	11CM-705	1667
3	11CM-709	1653
4	11CM-701	1604
5	11CM-703	1587
6	11CM-706	1580
7	CH-MASH(c)	1577
8	Arooj (c)	1506
9	MASH-97(c)	1306
10	11CM-710	1194
11	11CM-702	1160
12	11CM-704	1083
	LSD (0.05)	86.69
	CV (%)	7.39

Table 4: Seed yield of various mash genotypes in MYT-2014.

Sr. No	Genotypes	Seed yield (kg/ha)
1	11CM-707	528
2	11CM-705	500
3	11CM-703	486
4	11CM-709	458
5	11CM-701	438
6	11CM-710	438
7	CH-MASH(c)	431
8	Arooj (c)	424
9	11CM-702	382
10	11CM-706	375
11	11CM-704	361
	LSD(0.05)	126.27
	CV %	09.09

Regional adaptability trials

The yield performance of 11 CM-707 was tested in the National Uniform Yield Trials (NUYT) during 2015 and 2016. Mash genotype 11 CM-707 was found higher yielder as compared to check cultivar Arooj. On an average, genotype 11 CM-707 showed 22.0% higher seed yield than the check cultivar Arooj based on two-year yield data collected on field trials on ten locations, (Table 7).

Agronomic trials

In the agronomic trials conducted during 2015 and 2016 at BARI, Chakwal, on an average of both years, 11 CM-707 produced the highest yield of 934.9 kg ha⁻¹ when planted on 10th July followed by 1st July which produced 868.15 kg ha⁻¹ (Table 8). Therefore, optimum sowing time for genotype 11 CM-707 is from July 1 to 10.

Table 5: Yield performance of 11CM-707(kg/ha) at different locations in NUYT 2015.

Entry No.	Entry name	Source	Locations (kg/Ha)					Entry mean
			ISD	FSD	FJ	CHK	DIK	
1	10CM-707	BARI	182	705	313	825	1306	666
2	10CM-703	BARI	167	855	601	883	819	665
3	11CM-707	BARI	154	640	559	998	657	602
4	10CM-702	BARI	118	717	361	869	755	564
5	Arooj	Check	160	592	438	984	418	518
6	NARC-Mash -014	NARC, ISD	381	480	420	1013	223	503
7	Mash-010-2	NARC	145	490	389	854	560	488
8	Mash-010-1	NARC	238	586	378	1013	162	475
	Location mean		193	633	432	930	613	

Table 6: Yield performance of 11CM-707(Kg/ha) at different locations in NUYT 2016.

Entry No.	Entry name	Source	Locations (Kg/Ha)					Entry mean
			U Kot	FSD	Quetta	ISD	CHK	
1	11CM-707	BARI	696	499	1346	1268	1368	1035
2	MASH-010-2	NARC	506	664	860	1753	1271	1011
3	NARC Mash-3	NARC	728	754	929	1173	1250	967
4	NARC-Mash 2014	NARC	715	436	826	1453	1389	964
5	10CM-707	BARI	742	567	944	903	1278	887
6	10CM-702	BARI	567	439	738	1329	1229	860
7	10CM-703	BARI	671	425	446	1354	1313	842
8	Arooj	Check	894	494	964	863	931	829
Location Mean			690	535	882	1262	1253	

Table 7: Average yield performance of 11CM-707at 10 different locations.

Year	Locations	Seed yield (kg/ha)	
		11CM-707	Arooj (c)
2015	5	602	518
2016	5	1035	829
Average		819	674
Yield of 11CM-707			22%
Increase/Decrease (%) over Checks.			

Table 8: Seed yield (kg/ha) as influenced by various sowing dates of 11CM-707.

Cultivar	Year	Sowing dates (Yield in Kg/ha)					
		10 th June	20 th June	1 st July	10 th July	20 th July	1 st August
11CM-707	2015	800.0	820.2	890.5	990.5	800.0	760.5
11CM-707	2016	838.8	846.2	845.8	879.3	852.6	732.6
Means		819.4	833.2	868.15	934.9	826.3	746.55

Table 9: Seed yield as affected by different levels of fertilizers.

Sr. No.	Fertilizer levels (Kg/ha)			Genotypes yield (kg/ha)		
	N	P2O5	K2O	11CM-707 2015	11CM-707 2016	Mean
1	0	0	0	580	749	665
2	0	60	30	600	800	700
3	20	60	30	710	910	810
4	40	60	30	570	796	683
5	20	30	30	610	823	717
6	20	90	30	620	844	732
7	20	60	60	650	832	741
	Varieties		Fertilizer		Interaction	
	LSD (0.05) = 49		26		44	
	CV% = 4.8					

To optimize the fertilizer requirements, mash genotype 11CM-707 was tested at ten different fertility levels during 2015 and 2016 on sandy loam soil having organic matter (0.5%) and available phosphorus (5.3 mg kg⁻¹). On an average of two years study, genotype 11 CM-707 responded better to fertilizer dose of 20-60-30 NPK kg ha⁻¹ (Table 9).

Plant protection trials

Screening trials on mash entries were conducted against diseases at BARI, Chakwal during 2015 and 2016. Genotype 11 CM-707 tested against check cultivars CH-Mash and Arooj and was found resistant against yellow mosaic virus, leaf spot and leaf curl virus (Table 10).

Table 10: Screening of mash genotypes against diseases.

S. No.	Entry	YMV	Leaf SPOT	ULCV
1	10CM-707	2	1	1
2	11CM-707	2	2	2
3	CH-MASH	3	3	2
4	Arooj	2	3	2

Note: 1: Immune; 2: Resistant; 3: Tolerant; 4: Susceptible; 5: Highly Susceptible.

Distinctive characteristics of newly developed mash cultivar "Barani Mash"

Mash genotype 11 CM-707 has dark green foliage, semi erect plant type and medium seeded as compared to Arooj. Under rainfed conditions, flowering occurs in 49 days with maturity reached in 78 to 80 days. It has medium sized pods and its 100-seed weight is 4.73 g. This genotype has an average yield of 1743 kg ha⁻¹ (Table 12). Genotype 11 CM-707 has also been proved to a disease and lodging resistant mash genotype.

Table 11: Average yield of 11-CM-707 in 19 experiments.

Year	Name of trial	No. of trial	11-CM-707	Chakwal mash	Arooj
2012	PYT	1	628	606	500
2013	RYT	1	1743	1577	1506
2014	MYT	2	528	431	424
2015	NUYT	5	602	-	518
2016	NUYT	5	1035	-	829
2017	Multi location trial	3	345	235	238
2015	SDT	1	990.5	-	-
2016	FT	1	710	-	-
MEAN			823	712	670
Yield increase (%) over Checks				+16%	+23 %

Table 12: Description of mash genotype 11CM-707.

Days to 50% flowering:	49	Pod size	Medium
Growth habit	Semi Erect	Seeds per pod	6.5
Plant height	46cm	Pods per plant	42
Plant color	Dark green	100 seed weight	4.73
Canopy spread	Medium	Yield potential kg/ha	1743
Primary branches attitude	Semi Erect	Lodging	Resistant
No. of pri. branches /plant	2.5	Resistant to diseases	YMV, Leaf spot, ULCV
Days to Maturity	78-80		

Novelty Statement

This paper describes the development of a new high yielding and disease resistant mashbean variety "BARANI MASH" for rainfed areas of Punjab.

Author's Contribution

GR and JI designed and performed the research. UJ statistically analyzed the data and drafted the manuscript. RM assisted in drafting the manuscript. GS statistically analyzed the data. FH assisted in designing and performing the research. All authors read and approved the final manuscript. All authors

declare that there is no conflict of interests regarding the publication of this article.

Conflict of interest

The authors have declared no conflict of interest.

References

- AMIS (Agriculture Marketing Information Service). 2019-20. Directorate of Agriculture (Economics and Marketing) Punjab, Lahore, Pakistan.
- AMIS (Agriculture Marketing Information Service). 2017-18. Directorate of Agriculture (Economics and Marketing) Punjab, Lahore, Pakistan.
- Dasgupta, T. and P.K. Das. 1991. Genetic divergence in black gram. Indian J. Agric. Res., 25: 7-13.
- Eberhart, S.A. and W.A. Russel. 1966. Stability parameters for comparing varieties. Crop Sci., 6: 36-40. <https://doi.org/10.2135/cropsci1966.0011183X000600010011x>
- Ghafoor, A., Z. Ahmad and A. Qayyum. 2003. Black gram (*Vigna mungo* L. Hepper) germplasm catalogue. Plant Genetic Resources Program, PARC/JICA, Islamabad, Pakistan. pp. 75-80.
- GOP (Government of Pakistan). 2018-19. Economic survey of Pakistan. Economic Advisory Wing, Finance Division, Islamabad.
- Naeem-ud-Din, A. Mahmood, G.S.S. Khattak, I. Saeed and M.F. Hassan. 2009. High yielding groundnut variety Golden. Pak. J. Bot., 41(5): 2217-2222.
- Nazir, M.S., 1994. Crop Production, National Book Foundation, Islamabad. pp. 308-313.
- Qayyum, A., J. Iqbal, L. Barbanti, A. Sher, G. Shabbir, G. Rabbani, M.K. Rafiq, M.N. Tareen, M.J. Tareen and B.A.Z. Amin. 2019. Mash Bean [*Vigna mungo* (L.) Hepper] Germplasm evaluation at different ecological conditions of Pakistan. Appl. Ecol. Environ. Res., 17(3): 6643-6654. https://doi.org/10.15666/aer/1703_66436654
- Shrivastava, S.N., 1977. Effect of row spacing on yield of black gram. Thesis Absts. India, pp. 3-20.