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Research Article

A new high yielding MYMV disease resistant blackgram variety VBN 8

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Abstract
The high yielding blackgram variety VBN 8 is a cross derivative of VBN 3 x VBG 04-008. Average yield of VBN 8 is 900 kg/ha which is 11.9 and 13.5 percent increased yield over the check varieties VBN 6 (804 kg/ha) and CO 6 (793) respectively. It matures in 65 – 70 days. Under irrigated condition, it performed well by recording 988 kg/ha and the yield increases was 15.29 and 22.28 per cent over the check varieties VBN 6 (857 kg/ha) and CO 6 (808 kg/ha) respectively. Under rainfed condition, this variety recorded 871 kg/ha with 23.20 and 25.87 per cent yield increase over the above checks varieties. The special features of this new variety is determinate plant type with synchronized maturity and highly resistant to Mungbean Yellow Mosaic Virus (MYMV) disease, resistant to leaf crinkle and moderately resistant to powdery mildew diseases.

Key words
Blackgram, VBN 8, High yield, MYMV disease resistance

Introduction

Blackgram (*Vigna mungo*) is one of the most important pulse crop in India. It is a cheap source of dietary protein 20 – 25%. Pulses are important to low income countries where the major sources of protein are non-animal products (Benbelhassen, 2005). In Tamil Nadu, it is cultivated in an area of 3.73 lakh hectares with a production of 3.60 lakh tones and productivity of 645 kg/ha. (Annual report 2016-17 of AICRP on MULLaRP). MYMV is a serious disease in blackgram and it is one of the main factors for decreased yield and production. Based on several studies, it has been confirmed that at least two virus species causing Yellow Mosaic Virus Disease (YMVD) are prevalent in Indian sub continent. One of these species, mungbean yellow mosaic India virus (MYMIV) is commonly occurring in northern part of Indian sub continent while Mungbean Yellow Mosaic Virus (MYMV) is mostly confined to peninsular region of India (Varma and Malathi 2003; Malathi and John 2008). The losses due to Mungbean Yellow Mosaic Virus Disease (MYMVD) have been observed from 60 to 100 %. Since the virus transmission is attributed by the vector-whitefly (*Bemisia tabaci*), control of MYMVD based upon limiting the vector population by using insecticides is ineffective under severe whitefly infestations. Further, this is also not an eco friendly approach. The most effective way to prevent the occurrence of this disease is to develop genetically resistant cultivars (Mahalingam *et al*., 2018). Hence, VBN 8 was developed to identify a high yielding new variety with resistant to Mungbean Yellow Mosaic Virus (MYMV) disease.

Material and Methods

VBN 3 and VBG 04-008 were used as parents in hybridasation programme during the year 2005. The F_1 to F_6 were evaluated at National Pulses Research Centre, Vamban.The homozygous F_6 progeny was identified as high yielding and named as VBG 09-005 during 2009. Preliminary and Advanced Yield Trials (PYT & AYT) were conducted along with the local check varieties from 2009 to 2011. Further, based on its superiority at station trials it was tested under Multilocation Trials (MLT) at different research station of the Tamil Nadu Agriculturtal University from 2011 to 2013 and also nominated for evaluation under AICRP trials during *Kharif* and Rabi 2011-12. The culture was VBG 09-005 promoted to Adaptive Resaearch Tiral (ART) and On Farm Tiral. The culture VBG 09-005 was also screened for there resistance against major diseases and insect-pests. The resistance against MYMV disease were confirmed artificially through agro- inoculation technique. Pest resistance was confirmed through field screening. Bassed on the yield superiority over

station, MLT, ART and OFT results it was proposed for release as Blackgram VBN 8. In 2016, State Variety Relase Committee approved and relaesed it as Blackgram VBN 8.

Results and Discussion

The blackgram culture VBG 09 - 005 is a cross derivative of VBN 3 x VBG 04-008 and matures in 65-70 days. It is suitable for cultivation in *kharif* and *rabi* seasons of Tamil Nadu. The average yield is 900 kg/ha which is 11.9 and 13.5 percent increase over VBN 6 (804 kg/ha) and CO 6 (793 kg/ha) respectively **(Table 1.).** Under irrigated condition, it recorded an average yield of 988 kg/ha. The yield increases was 15.3 and 22.3 per cent over the check varieties VBN 6 (857 kg/ha) and CO 6 (808 kg/ha) respectively **(Table 2).** Under rainfed condition, the culture VBG09-005 has recorded 871 kg/ha with 23.2 and 25.9 per cent yield increase over the above checks varieties **(Table 3).**

In Preliminary row yield trial (PRYT), Preliminary yield trial (PYT) and Advance yield trial (AYT) at NPRC, Vamban the culture VBG 09-005 recorded mean yield of 1095 kg/ha which is 35.4, 27.8, 36.0, 41.4 and 32.6 per cent increase over the checks VBN (Bg) 7 (809 kg/ha), VBN 6 (857 kg/ha) , VBN (Bg) 5 (805 kg/ha), CO 5 (775 kg/ha) and CO 6 (826 kg/ha) respectively over two years of evaluation.

Based on the performance at station trials, the culture was promoted to Multi Location Trial and evaluated in MLT for two seasons (*kharif* 2011 and *rabi* 2011-12). It recorded a mean yield of 831 kg/ha which is 7.0 and 14.8 per cent increased yield over the checks VBN 6 (777 kg/ha) and CO 6 (724 kg/ha) respectively **(Table 1.).**

Further, the culture VBG 09-005 was promoted to Adaptive Research Trial (ART). ART was conducted over two years in 2012-14 (*kharif* and *rabi*) at 143 locations. It recorded an average yield of 875 kg/ha which is 8.7 (805 kg/ha) and 9.1 (802 kg/ha) per cent increased yield over the checks CO 6 and VBN 6 respectively **(Table 1.).**

In the On Farm Trials (20 Nos.) conducted at Pudukkottai, Tanjore and Trichy districts, the culture VBG 09-005 recorded an average yield of 1073 kg/ha which is 34.1 and 40.6 per cent increased yield over checks VBN 6 (800 kg/ha) and CO 6 (763 kg/ha) respectively **(Table 1.).**

At national level in AICRP - MULLaRP trails (IVT, AVT1 & AVT 2) conducted at 54 locations in different zones, the culture VBG 09-005 recorded 970 kg/ha with an yield increase of 60.86% (NDU 5-7), 39.57% (TU 94 -2), 38.77% (Pant U 30), 26.14 % (LBG 645), 23.25% (Pant U 31), 19.46% (LBG 752), 18.29% (IPU 2-43), 17.86% (WBU 108), 16.30% (KU 96-3), 14.93% (COBG 653) and 9.11% (Shekar 1) **(Table 4).**

The blackgram variety Vamban 8 was evaluated for their resistance against major diseases *viz.*, Mungbean Yellow Mosaic Virus (MYMV), Powdery mildew and Leaf crinkle virus over four years from 2011to 2015. It was found to be highly resistance to Mungbean Yellow Mosaic Virus (MYMV), resistance to leaf crinkle and moderate resistance to Powdery mildew diseases **(Table 5 & 6).** It was also screened against major pests and was found to be moderately resistant to Pod borer, white fly and web larva **(Table 7** and **8).**

The Blackgram culture VBG 09-005 has protein and arabinose content of 21.9 % and 7.5% respectively. It has bold seeds (4.5g/100 seed) with good battering quality **(Table 9).**

The key morphological characters to distinguish other varieties during seed production are, Purple colour splash on the petiole and the green colour of ventral suture of immature pod is with dense hairs. The description as per the DUS characters are presented in **Table 10**.

The blackgram variety VBN 8 was differentiated from other popularly grown genotypes *viz*., VBN(Bg) 4 and VBN 6 using the molecular marker technology. Twelve SSR markers *viz*., CEDG 015, CEDG 018, CEDG 024, CEDG 048, CEDG 065, CEDG 090, CEDG 133, CEDG 198, CEDG 232, CEDG 248, CEDG 295 and CEDG 298 were taken for the study. Among the twelve SSR markers, CEDG 048 and CEDG 198 differentiated the VBN 8 with other genotype. The marker CEDG 048 showed different product size for VBN(Bg) 4, VBN 6 and VBN 8 at 200, 190 and 190 bp respectively. The marker CEDG 198 showed different product size for VBN (Bg) 4, VBN 6 and VBN 8 at 210, 220 and 200 bp respectively (**Fig.1& 1a**).

Due to the superiority over the check varieties the culture VBG 09-005 was released as VBN 8 by the 46th SVRC during 2016. It is recommended for both

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kharif and *rabi* season cultivation. The national identity of this variety is IC 617172.

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Table 1. Overall yield performance of Blackgram VBN 8 (VBG 09-005) in different trials in Tamil Nadu

Trials	No. of trials / Locations	Yield kg/ha		
		VBG 09-005	VBN 6 (Ch)	CO 6 (Ch)
Station	5	1095	857	826
MLT	13	831	777	724
ART	143	875	805	802
OFT	20	1073	800	763
Weighted mean (181)		900	804	793
Per cent yield increase			**11.9**	**13.5**

Table 2. Performance of blackgram VBN 8 (VBG 09-005) under irrigated condition

Trials	No. of locations (15)	Yield (kg/ha)		
		VBG 09-005	VBN 6	CO 6
Station trials (*Kharif, Rabi & Summer*)	5	1095	857	826
MLT (Kharif & Rabi)	10	881	856	789
	Mean	988	857	808
	Per cent yield increase		**15.3**	**22.3**

Table 3. Performance of blackgram VBN 8 (VBG 09-005) under rainfed condition

Trials	No. of locations (166)	Yield (kg/ha)		
		VBG 09-005	VBN 6	CO 6
MLT(Rabi)	3	666	515	510
ART(Kharif, Rabi)	143	875	805	802
OFT(Kharif, Rabi)	20	1073	800	763
Mean		**871**	**707**	**692**
	Per cent yield increase	**23.20**	**25.87**	

Table 4. Performance of blackgram VBN 8 (VBG 09-005) under AICRP - MULLaRP trials

Trials	No. of trials/ Locations (54)	Yield kg/ha													
		VBG 09-005	Uttara (Ch)	Pant U 31 (Ch)	WBU 108 (Ch)	Pant U 30 (Ch)	LBG 752 (Ch)	TU 94-2 (Ch)	Shekar 1 (Ch)	IPU 2-43 (Ch)	KU 96-3 (Ch)	NUL 7 (Ch)	NDU 5- 7 (Ch)	LBG 645 (Ch)	COBG 653 (Ch)
IVT – *Kharif* 2011															
SZ	9	813	-	-	-	699	754	695	889	820	-	-	-	-	-
CZ	8	884	-	-	-	-	-	-	-	-	834	974	-	-	-
NWPZ	5	1315	1219	-	906	-	-	-	-	-	-	-	-	-	-
NEPZ	7	1249	1222	-	1046	-	-	-	-	-	-	-	-	-	-
IVT *Rabi* 2011-12															
SZ	5	943	-	-	-	-	794	-	-	-	-	-	-	743	712
CZ	1	975	-	-	-	-	1239	-	-	-	-	-	-	808	-
AVT2 + 1 –Kharif 2012															
NWPZ	5	692	687	787	517	-	-	-	-	-	-	-	603	-	-
AVT 1 - *Rabi* 2012-13															
SZ	3	909	-	-	-	-	513	-	-	-	-	-	-	912	857
AVT 1 - Rabi 2013-14															
SZ	4	968	-	-	-	-	864	-	-	-	-	-	-	614	864
AVT 2 - Rabi 2014-15															
SZ	7	956					707								944
Weighted mean		**970**	**1043**	**787**	**823**	**699**	**812**	**695**	**889**	**820**	**834**	**974**	**603**	**769**	**844**
Per cent yield increase			**-**	**23.25**	**17.86**	**38.77**	**19.46**	**39.57**	**9.11**	**18.29**	**16.30**				

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Table 5. Reaction of blackgram VBN 8 (VBG 09-005) against Yellow Mosaic Virus Disease

Sl. No	Season & Year	VBG 09-005	VBN 6	CO 6
3.	*Rabi* 2014-15	1.0	1.0	2.0
4.	*Summer* 2015	1.0	1.0	4.0
5.	*Kharif* 2015	2.0	1.0	4.0

Table 6. Reaction of blackgram VBN 8 (VBG 09-005) against Leaf crinkle and Powdery mildew diseases

SI. No	Season and Year	Leaf crinkle (%)			Powdery mildew (0-5 grade)		
		VBG 09-005	VBN 6	CO 6	VBG 09-005	VBN 6	CO 6
1.	*Rabi* 2014-15	5.00	8.88	24.74	2	3	3
2.	*Summer* 2015	2.85	0.00	1.78	0	0	0
3.	*Kharif* 2015	5.00	2.00	4.34	0	0	0

Table 7. Performance of blackgram VBN 8 (VBG 09-005) against pod borer (%) in MLT

Sl.No.	Season and year	VBG 09- 005	VBN 6	Pant U – 19
1.	*Kharif* 2011	9.72	9.29	26.34
2.	*Rabi* 2011 – 2012	6.33	8.45	11.33

Table 8. Reaction of blackgram VBN 8 (VBG 09-005) against major pests in AVT during 2012-13 and 2013-14

Sl. No.	Season and year	VBG 09- 005					IPU 2 – 43 (Ch)			Pant U – 19 (Ch)		
		Whitefly / Plant	Web larva/ Plant	CPD (%)	IPU 2 – 43 (PSI)	Pant U 19 (PSI)	Whitefly / Plant	Web larva/ Plant	CPD (%)	Whitefly / Plant	Web larval / Plant	CPD (%)
1.	*Kharif* 2012	1.1	1.0	11.5	4	3	1.8	0.7	22.7	2.0	4.7	25.0
2	*Rabi* 2012 – 2013	1.1	3.5	12.5	6	3	1.25	2.5	13.5	2.6	6.7	31.0
3.	*Kharif* 2013	1.3	0.8	15.0	7	6	1.1	1.1	12.0	1.8	1.9	14
4	*Rabi* 2013 – 2014	1.3	0.2	10	3	3	1.5	0.3	26	1.1	0.4	21

CPD- Cumulative pod damage; PSI- Pest susceptibility index.

Table 9. Physical and chemical properties of blackgram VBN 8 (VBG 09-005)

Sl. No.	Culture/ Checks	Physical		Chemical	
		Weight (g.)	Volume (ml)	Protein (%)	Arabinose (%)
1	VBG 09-005	25	45	21.9	7.5
2	VBN (Bg) 6	25	48	21.0	6.6
3	MDU 1	25	45	21.8	7.5

Table 10. Descriptor of blackgram VBN 8 (VBG 09-005)

1	General		
1.1	Name of the variety	:	VBG 09-005
1.2	Pedigree	:	Vamban 3 x VBG 04-008
1.3	Year of development	:	2005
1.4	Year of identification	:	2018
1.5	Origin (Name of the Institute)	:	National Pulses Research Centre Vamban – 622 303
2	Habit		
2.1	Plant growth habit	:	Semi erect
2.2	Plant habit	:	Determinate
3	Stem characters		
3.1	Stem colour	:	Green with light purple wash
3.2	Stem pubescence	:	Present
4	Leaf characters		
4.1	Shape of leaf pinnae	:	Broad to narrow lanceolate terminal leaflet
4.2	Colour of the leaf	:	Green
4.3	Leaf pubescence	:	Present
5	Petiole colour	:	Green with light purple wash
6	Pod characters		
6.1	Pod colour: intensity of colour of premature pods	:	Green
6.2	Pod pubescence	:	Present
6.3	Pod colour at maturity	:	Black
7.	Seed characters		
7.1	Seed colour	:	Black
7.2	Seed lusture	:	Dull
7.3	Seed shape	:	Oval
8	Agronomic traits		
8.1	Days to 50% flowering	:	35-40 days
8.2	Days to maturity (days)	:	65-70 days
8.3	Plant height (cm)	:	35-40 cm
8.4	Seeds per pod	:	7-8
8.5	100 seed weight (g)	:	4.9g
8.6	Single Plant Yield (g)	:	15
9	Disease reaction	:	Highly resistant to MYMV, resistant to LCV and moderately resistant to PMD

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SSR marker	Forward / Reverse	Primer Sequence 5' to 3'	Product size (bp)		
			VBN (Bg) 4	VBN 6	VBN8
CEDG 048	F R	TCTCTTCCTCTATGGCTTGG GCTCCTCTTTTTGCTGCATC	200	190	190
CEDG198	F R	CAAGGAAGATGGAGAGAATC CCTTCTAAGAACAGTGACATG	210	220	200

Fig.1. Details of the polymorphic SSR markers with sequences

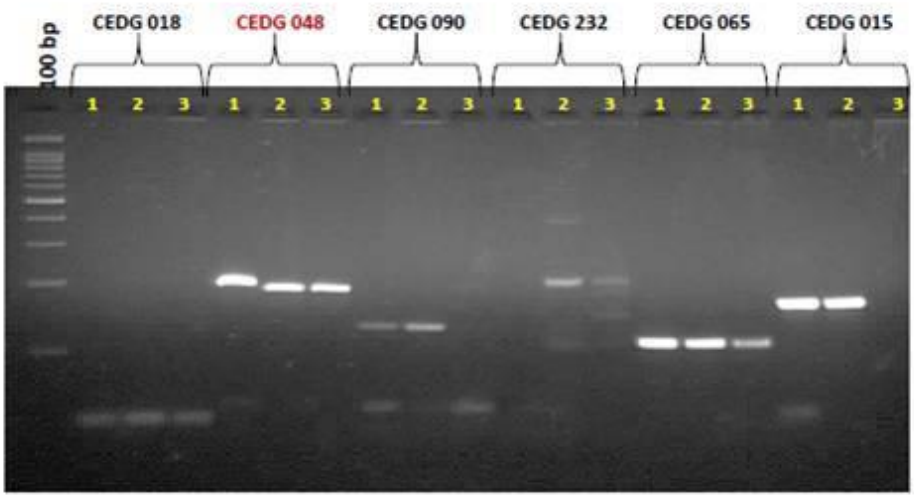

Fig. 1a. DNA fingerprinting of blackgram VBN 8 (VBG 09-005)