NIAB MUNG 2006: A HIGH YIELDING AND DISEASE RESISTANT MUNGBEAN VARIETY

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ABSTRACT

NIAB Mung 2006 (NM 2006) is an elite high yielding mungbean variety developed at Nuclear Institute for Agriculture and Biology, Faisalabad. It was derived from a cross between an exotic AVRDC accession VC 1560 D and an adopted variety NM 92. It was evaluated with the name of NM 1 for yield performance and adaptability in different yield trials during 1898-2002. In adaptation yield trial, NM 2006 surpassed at all locations during summer 2001 and 2002 by giving an average seed yield of 1898 and 1921 kg per hectare respectively. NM 2006 was also evaluated in national uniform yield trials during 2001 and 2002 under the name of NM 1. On overall mean basis it ranked first by producing 822 kg and 864 kg per hectare, respectively during the year 2001 and 2002. At NIAB, NM 2006 produced higher seed yield (1935 kg/ha) when sown on July 1, 2003 whereas during summer 2004, it produced maximum seed yield (1457 kg/ha) when sown on July 10. During both years it produced significantly higher seed yield than NM 92. At Agronomic Research Station, Karor, maximum seed yield of NM 2006 was obtained (1158 kg/ha) in case of June 15 sowing and significantly differed to standard check variety NM 92 (1028 kg/ha) during 2003. Higher seed yield of NM 2006 as compared to NM 92 was due to significantly higher number of pods per plant and 100-seed weight. Based on sowing date trials, optimum sowing time of mid June to Ist week of July is recommended for NM 2006. NM 2006 has distinctness of purple hypocotyls and stem, semi erect growth habit , synchronymous pod maturity, light green leaves, higher number of clusters and pods and is resistant to mungbean yellow mosaic virus (MYMV) and cercospora leaf spot (CLS) diseases.

KEYWORDS: *Vigna radiata radiata;* high yielding varieties; disease resistance; Pakistan.

INTRODUCTION

Mungbean [*Vigna radiata* (L.) Wilczek] is a major summer pulse crop and constitutes an important source of readily available protein in the cereal-based diet of people in Pakistan. It is regarded as quality pulse for its rich protein seed and excellent digestibility, especially when combined with cereals (4, 12, 14). It is consumed as 'dhal' and boiled dry beans. It is also used as fodder for livestock or often incorporated in soil for enriching the organic matter. Mungbean is grown on 18.7 and 19.4 percent of total pulses area in Pakistan and Punjab, respectively (3).

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Before the start of varietal research on mungbean, two major types of local or desi mungbean were available viz. (i) photoperiod sensitive and (ii) photoperiod insensitive (1). The photoperiod sensitive “desi mung” varieties (indigenous) were low yielding, asynchronous and late maturing. The photoperiod insensitive indigenous varieties gave relatively better yields but these were also susceptible to mungbean yellow mosaic virus (MYMV) and cercospora leaf spot (CLS) diseases.

At Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad mungbean improvement programme has culminated in the development of nine varieties. Five small seeded varieties were developed through induced mutation technique, two large seeded from hybridization between an indigenous and an exotic Asian Vegetable Research and Development Center (AVRDC) germplasm followed by radiation treatment. The improvement culminated in evolution of three bold seeded varieties (NM-51, NM-54 and NM-92) with high yield potential and one small seeded variety (NM-98) (5, 6, 7, 8, 9). There has been phenomenal increase in area and production due to the development of these varieties. This increase was possible due to the availability of high yielding and short duration varieties. Punjab covers 90 percent of mungbean acreage (2). Out of released varieties, NIAB Mung 92 and NIAB Mung 98 are predominantly grown at commercial scale in major mungbean growing areas of the Punjab province. Due to high acreage under cultivation of NIAB Mung 92, it is showing sparsely symptoms of MYMV. Moreover, the adoption of only these two varieties may narrow the genetic base of mungbean (10). To combat the impending risk of breakdown of resistance of existing varieties in the field and to wide genetic base, there is a need to have a new variety in hand, so as to maintain farmers productivity.

In view of this a proposal for approval of an elite candidate mungbean line; NM 1 with proposed name NIAB Mung 2006 (NM 2006) was submitted to the Punjab Seed Council and was approved for cultivation in irrigated areas of the Punjab. The release of this variety due to its high yield potential will be expected to alleviate the pulse shortage in the country.

MATERIALS AND METHODS

NM 2006 is an elite high yielding mungbean line derived from a cross between an exotic AVRDC accession VC 1560 D and an adopted variety NM 92 during summer 1991. The VC 1560 D is a bold seeded exotic AVRDC Thailand accession, showing susceptibility to MYMV, whereas NM 92 is bold

seeded variety derived from a cross between NM-36 x VC 2768 B and released as a commercial variety during 1996. The cross was made during 1991 and F_1 was sown during 1992. Selection in segregating generations (F_2-F_7) based on seed yield, yield related traits and reaction to different diseases (MYMV/CLS) was made during 1992-97 and true-breeding progenies were bulked for yield evaluation in different sets of trials.

After vigorous selection in the segregating generations during succeeding years, this elite line was tested under the name NM 1 in preliminary yield trials during summer 1998. It was also tested in advanced yield trials conducted during summer 1999 and 2000. Adaptation trials were conducted during summer 2001 and 2002 in major mungbean growing areas. NM 92 and NM 98, both approved varieties of mungbean, were included as check in these trials. It was further tested in national uniform yield trials during summer 2001 and 2002. In both adaptation and national yield trials it was also tested under the name NM 1.

Uniform recommended agronomic practices were applied. Data on seed yield and yield related traits were analyzed following standard statistical method (13).

RESULTS AND DISCUSSION

Preliminary yield trial

Plant selections having true breeding behaviour in single plant progeny rows were evaluated in replicated preliminary yield trial at NIAB, Faisalabad during the year 1998. Thirty genotypes were included. NM 36-13-1-3 (NM 1 or NM 2006) gave significantly higher seed yield (2988 kg/ha) as compared to standard check varieties NM 92 (2081 kg) and NM 98 (2333 kg) (Table 1).

Advanced yield trial

In this trial NM 2006 also produced higher seed yield of 1359 kg during 1999 and 2475 kg per hectare during 2000 than NM 92 (1075 kg during 1999 and 1990 kg during 2000). NM 98 as a standard check produced minimum (Table 1). On two years mean basis, NM 2006 (bold seeded) yielded 1917 kg per hectare with an increase of 25 percent over bold seeded variety NM 92.

Table 1. Seed yield performance of NM 2006 as compared to NM 92 and NM 98 in different yield trials.

Trial	Year	Mean seed yield (kg/ha)			% Increase over		Total entries	Total Locations	Overall position
		NM 2006	NM 92	NM 98	NM 92	NM 98			
Preliminary yield trial	1998	2988	2081	2333	44	28	30	1	Ist
Advanced yield trial									
NIAB Faisalabad	1999	1359	1075	714	26	90	16	1	Ist
	2000	2475	1990	1574	24	57	16	1	Ist
Adaptations yield trial									
NIAB, Faisalabad	2001	1817	1171	1468	55	24	15	5	Ist
Pipplan,Mianwali		2218	1366	1361	62	63			
Shorkot, Jhang		1871	1167	1463	60	28			
PSC, Khanewal		1792	1171	1445	53	24			
AARI, Faisalabad		1792	1190	1514	50	18			
Mean (5 locations)		**1898**	**1213**	**1450**	**56**	**31**			
NIAB, Faisalabad	2002	2269	1277	1352	78	68	15	5	Ist
PAEC Farm Kundian		2241	1269	1366	76	64			
PSC, Pipplan		2144	1370	1389	56	54			
AZRI, Bhakkar		1518	1425	1404	6.5	8.1			
Yousafwala, Sahiwal		1435	833	1343	72	6.8			
Mean (5 locations)		**1921**	**1235**	**1371**	**56**	**40**			
National yield trial									
Mean (11 locations)	**2001**	**822**	**648**	**-**	**27**	**-**	14	11	Ist
Mean (19 lcoations)	**2002**	**864**	**683**	**766**	**27**	**13**	19	15	Ist

Adaptation yield trial

NM 2006 ranked first at all locations during summer 2001 with an average yield of 1898 kg as compared to standard check NM 92 (1213 kg) and NM 98 (1450 kg/ha) (Table 1). NM 2006 also surpassed during 2002 at all locations (1921 kg/ha) as compared to standard check NM 92 (1235 kg) and NM 98 (1371 kg/ha) (Table 1).

National uniform yield trial

NM 2006 was evaluated in national uniform yield trials coordinated by National Coordinator (Pulses), NARC, Islamabad during 2001 and 2002 at different agro-climatic conditions in the country (Table 1). On overall mean basis, NM 2006 ranked first during both years 2001 (822 kg) and 2002 (864 kg). Standard check NM 92 produced 648 and 683 kg per hectare during 2001 and 2002 respectively.

Different sowing date trials were conducted during summer 2003 at NIAB, Faisalabad and Agronomic Research Station, Karor, Layyah. At NIAB, higher seed yield (1935 kg/ha) was noted in sowing date of July 1, 2003 (Table 2). At Agronomic Research Station, Karor, maximum seed yield of NM 2006 (1158 kg/ha) was obtained from June 15 sowing which was significantly

differed from standard check variety NM 92 (1028 kg/ha) (Table 2). Higher seed yield of NM 2006 as compared to NM 92 was due to significantly higher number of pods per plant and 100-seed weight (Table 3). From the results of sowing date trials, optimum-sowing time was found as mid June to first week of July for NM 2006.

Table 2. Seed yield (kg/ha) performance of NM 2006 and NM 92 at different sowing dates.

Sowing dates	NM 2006	NM 92
NIAB, Faisalabad		
June 15, 2003	1259 a	1255 a
July 1, 2003	1935 a	1589 b
July 15, 2003	1588 a	1597 a
August 1, 2003	796 b	856 a
NIAB, Faisalabad		
July 10, 2004	1457 a	1250 b
Agronomic Research Station, Karor		
June 15, 2003	1158 a	1028 b
July 1, 2003	454 a	306 b
July 15, 2003	111 b	304 a
August 1, 2003	28 b	102 a

Table 3. Morphological, seed yield traits and disease reaction of NM 2006.

S. No.	Character	Range NM 2006	Mean NM 2006	NM 92
1	Plant height (cm)	54-62	58	48
2	Clusters	10-12	11	9
3	Seed colour		Light green	Light green
4	No. of branches	1-2	2	2
5	Seed shape		Drum	Drum
6	100-seed weight	58-60 (g)	59	53
7	No. of pods/plant	16-24	20	14-17
8	No. of seeds/pod	10-12	11	8-9
9	Protein contents	24-28%	26.0%	25%

For MYMV, ratings were made six to seven weeks after sowing when the plants had shown maximum disease symptoms followed by late recovery by using scoring method suggested by Shukla *et al.* (11). The disease assessment was based on the number and size of yellow patches developed on the leaves. NM 2006 exhibited desirable level of resistance to MYMV (Table 4). For CLS, disease infection ratings were made in preliminary and advanced lines yield trials during 1998 and 1999 at pod filling stage. In

advanced lines yield trial conducted during the year 2000 there was no appearance of CLS disease.

Table 4. Mungbean yellow mosaic virus infection in different sets in trials (1998-2001)

Genotype	Preliminary yield trial (1998)			Advance lines yield trial (1999)			Adaptation yield trial (2001)		
	% Infection	Score	Rating	% Infection	Score	Rating	% Infection	Score	Rating
NM 2006	10	3	R	12	4	MR	11	4	MR
VC 1560 D	60	8	S	65	8	S	82	9	HS
NM 92	12	4	MR	15	4	MR	19	4	MR
NM 98	11	4	MR	14	4	MR	15	4	MR

MYMV disease scoring

Disease reaction	Percent infection	Disease score
Immune	0	1
Highly resistant	1-5	2
Resistant	6-10	3
Moderately resistant	11-20	4
Tolerant	21-30	5
Moderately tolerant	31-40	6
Moderately susceptible	41-50	7
Susceptible	51-80	8
Highly susceptible	81-100	9

NM 2006 having high seed yield potential alongwith distinctness i.e. purple hypocotyls and stem, semi erect growth habit, synchronymous pod maturity, light green leaves, higher number of clusters and pods, resistant to mungbean yellow mosaic virus (MYMV and cercospora leaf spot diseases (CLSD). The release of this variety due to its high yield potential will be expected to alleviate the pulse shortage in the country.

ACKNOWLEDGEMENT

IAEA assistance to test this variety in RMMTs in RCA member States under IAEA/RCA project entitled “Enhancement of Genetic Diversity in Food, Pulses and Oil Crops and Establishment of Mutant Germplasm Network” is greatly acknowledged.

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