http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences, 2 (2): 455-458, 1999 **Research Article**

NIAB MUNG 98: A Diverse, High Yielding, and Disease Resistant Mungbean Variety

Muhammad Siddique Sadiq, Ghulam Sarwar and Gul Sanat Shah Khattak
Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad, Pakistan

Abstract

Concerted breeding efforts on mungbean improvement at NIAB Faisalabad, Pakistan has resulted in the development of a diverse, high yielding, and disease resistant elite line; NM 89, derived from hybridization between a small seeded variety; NM 20-21 and an exotic large seeded AVRDC accession VC 1482E, after vigorous sifting in different segregating generations. True breeding plant progenies were bulked and were evaluated for yield potential in various yield trials laidout at NIAB, Faisalabad from 1990-95. NM 89 produced seed yield of 1971 kg ha^{-1} on an overall basis which was 42.77 and 21.77 per cent higher as compared to check varieties NM 20-21 and NM 51 respectively. Based on 1996 and 1997 mean yield performance in adaptation yield trials, NM 89 produced seed yield of 1213 kg ha^{-1} which was 17 per cent higher as compared to standard check NM 51. Among yield components, NM 89 had the highest number of pods per plant. It had shown resistance against Cercospora leaf spot (CLS) and mungbean yellow mosaic virus (MYMV). Based on desirable morphological characteristics and superb seed yield criteria, NM 89 was approved as NIAB MUNG 98 in November, 1998 by the Punjab Seed Council for general cultivation in the Province.

Introduction

Mungbean (*Vigna radiata* L. Wilczek) is a major summer pulse crop and constitutes an important source of readily available proteins in the cereal based diet of common man in Pakistan. It is consumed as dhal and boiled dry beans. It is also utilized as fodder for livestock or often incorporated in the soil for enriching organic matter. In Pakistan, mungbean is grown on an area of 192400 ha with an annual production of 89500 tons, having an average seed yield of 465 kg ha^{-1} (Anonymous, 1997). To enhance low per ha seed yield, concerted breeding efforts at Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad have resulted in the development of eight mungbean varieties; five small seeded viz. NM 28, NM 13-1, NM 20-21, NM 121-25, and NM 19-19 through induced mutation and three large seeded varieties viz. NM 51, NM 54 and NM 92 from hybridization between an indigenous and an exotic Asian Vegetable Research and Development Centre (AVRDC) germplasm followed by gamma radiation.

At present among these approved varieties, NIAB MUNG 92 was adapted at a faster rate and its cultivation covered more than 51% area (Ali *et al.*, 1997). NIAB MUNG 51 has shown susceptibility to Cercospora leaf spot (CLS) and is prone to lodging.

To broaden genetic base, to avoid vulnerability to diseases, and to maintain farm productivity, development of genetically diverse mungbean genotypes is an essential breeding strategy for enhancing the country production. The present paper describes the development of a diverse high yielding, and disease resistant variety "NIAB MUNG 98" which was approved in November, 1998 by the Punjab Seed Council for general cultivation in the province.

Materials and Methods

The experimental material comprised of a small seeded variety NM 20-21 (A derivative of local cultivar Pak 22, 400 Gy released as a commercial variety in 1986, Punjab, Pakistan) and an Asian Vegetable Research and Development Centre (AVRDC) large seeded accession viz. 1482E. Single and reciprocal crosses (Boling *et al.*, 1961) were attempted during summer 1984, and an F_1 generation was raised in next growing season. The F_2 generation was planted in 4 m. single row, spaced 0.3 m, keeping 0.1 m distance from plant to plant during summer 1986. Mung Kabuli, a highly susceptible cultivar to mungbean yellow mosaic virus (MYMV) and Cercospora leaf spot (CLS), was repeated after four rows as a spreader to intensify disease infection under natural epiphytotic environment. Visual field selection on the basis of semidwarf plant growth habit, disease resistance, high number of pods per plant, synchronous pod maturity, and seed yield contributing attributes, was carriedout. Progeny rows of F_2 selections were grown and selected true breeding progenies were further evaluated from F_3 to F_6. Selected true breeding lines were bulked and were evaluated in different sets of yield trials for seed yield and yield related traits. Yield screening nurseries (22 genotypes) were sown in randomized complete block design with three replications during 1990-91. Each genotype consisted of 4 rows, 4 m long spaced 0.3 m having plant to plant distance of 0.1 m. Thirteen high yielding lines were evaluated in microplot yield trials (1992-93) and four lines in advanced yield trials (1994-95) at NIAB farm, Faisalabad. Experimental design and other cultural practices were similar except number of rows which were four in microplot yield trials and six in advanced lines yield trials. Performance of NM 89 alongwith ten high yielding elite lines/varieties were evaluated in adaptation yield trials during 1996-97 in major mungbean growing areas. Disease scoring for mungbean yellow mosaic virus (MYMV) and Cercospora leaf spot (CLS) was performed (Shukla *et al.*, 1978 and Mew *et al.*, 1975) both in the segregating generations and true breeding lines. Data for days to flower, days to mature, plant height, disease reaction to MYMV and CLS, seed yield, and yield related traits were recorded and were analyzed statistically on the basis of mean values (Singh and Chaudhry, 1979).

Results and Discussion

An elite line NM 89 was evaluated in yield screening nurseries, microplot yield trials, and advanced yield trials at NIAB Farm, Faisalabad and in adaptation trials in the major mungbean growing areas in the Punjab province. The results are presented and discussed hereafter:

Yield Screening Nurseries: NM 89 gave 1799 kg ha $^{-1}$ seed yield during summer 1990 as compared to 1664 kg ha $^{-1}$ produced by parent variety NM 20-21 (Table 1). In 1991, NM 89 produced 1654 kg ha $^{-1}$ seed yield whereas NM 20-21 gave 1079 kg ha $^{-1}$. Highly significant differences in seed yield between NM 89 and NM 20-21 were observed for both the years. On two years mean basis, NM 89 showed superiority in seed yield (1726 kg ha $^{-1}$) over NM 20-21 (1371 kg ha $^{-1}$).

Microplot Yield Trials: In 1992, NM 89 produced significantly the highest seed yield of 2138 kg ha $^{-1}$ (Table 1) as compared to 1394 kg ha $^{-1}$ and 1624 kg ha $^{-1}$ produced by NM 20-21 and NM 51 respectively. NM 89 gave seed yield of 2902 kg ha $^{-1}$ as compared to 1387 kg ha $^{-1}$ of NM 20-21 and 1789 kg ha $^{-1}$ of NM 51 during 1993. The mean seed yield of NM 89 was 2520 kg ha $^{-1}$ whereas NM 20-21 and NM 51 produced 1390 kg ha $^{-1}$ and 1706 kg ha $^{-1}$ respectively.

Advanced Yield Trials: In 1994, NM 89 produced 1529 kg ha $^{-1}$ as compared to check variety NM 51 which gave 1279

Table 1: Yield performance (kg ha $^{-1}$) of different mungbean varieties/ elite lines in various trials conducted during 1990-95 at NIAB, Faisalabad.

Nature of trial	Elite Line/ Variety				
	NM 89	NM 20-21 (Parent)	NM-51 (Check variety)	LSD (5%)	LSD (1%)
Yield Screening Nurseries					
1990·	1799	1664	-	195.23	260.85
1991	1654	1079	-	77.31	103.28
Mean	1726	1371	-	-	-
Microplot Yield Trials.					
1992	2138	1394	1624	119.8	162.5
1993	2902	1387	1789	162.8	220.6
Mean	2520	1390	1706	-	-
Advanced Yield Trials					
1994	1529	-	1279	124.10	167.8
1995	1806	-	1785	186.00	250.0
Mean	1667	-	1532	-	-
Overall Mean	1971	1380	1619		
Yield increase (%)	-	43	22		

Table 2: Seed Yield Performance (kg ha $^{-1}$) of NM 89 in an adaptation trials during 1996-1997 in the Punjab.

Location	NM 89	NM-51	LSD (5%)	LSD (1%
Summer 1996				
Khanewal	930	468	184.89	248.8
Piplan	1139	611	267.33	360.0
Bhakar	868	844	28.53	38.8
Kalorkot	832	818	30.48	41.0
Karor	245	234	12.52	16.8
Faisalabad	2281	1667	125.33	168.7
Mean	1049	777	156.22	206.0
Summer 1997				
PSC, Khanewal	1602	1272	112.30	151.6
NIAB, Faisalabad	1154	1311	191.50	261.2
Mean	1378	1292		
Overall Mean	1213	1034		
Yield increase(%)	-	17		

kg ha $^{-1}$ seed yield. NM 89 produced 1806 kg ha $^{-1}$ in 1995 followed by check variety NM 51 with seed yield of 1785 kg ha $^{-1}$. Highly significant differences for seed yield were observed for both the years. On overall mean performance of NIAB yield trials (1990-1995), NM 89 produced seed yield of 1971 kg ha $^{-1}$ as compared to 1380 kg ha $^{-1}$ of NM 20-21 and 1619 kg ha $^{-1}$ of NM 51. NM 89 gave 42 and 21 per cent higher seed yield as compared to NM 20-21 and NM 51 respectively.

Adaptation Yield Trials: In 1996, at PSC farm Khanewal, NM 89 produced significantly higher seed yield (930 kg ha $^{-1}$). NM 89 showed similar trend of highest seed yield at Piplan, and Faisalabad. On mean basis, NM 89 produced seed yield of 1049 kg ha $^{-1}$. In 1997, NM 89 and NM 51 showed significant differences for seed yield at PSC, Khanewal whereas at NIAB, Faisalabad, these differences were nonsignificant (Table 2). NM 89 indicated 17 per cent higher seed yield on an overall basis.

Seed Yield and Yield Components: NM 89 produced significantly the highest number of pods per plant and seed yield per plant (Table 3). Nonsignificant differences for pod length and number of seeds per pod were observed among all the genotypes. 1000 seed weight was significantly high in NM 51, followed by NM 89, and NM 20-21.

Compatible hybridization can greatly enlarge the genetic base and may permit significant increases in productivity of legumes. Thus an enlargement of the genetic base and the enhancement of recombination to generate a greater range of desirable genotypes is of great importance (Rashid *et al.*, 1988). Hybridization between an AVRDC line and mungbean BINA mutant resulted in the evolution of high yielding genotype in Bangladesh (Shaikh *et al.*, 1988). Mungbean improvement programme at NIAB, Faisalabad, Pakistan also resulted in the development of high yielding genotypes through conventional breeding approach (Sadiq *et al.*, 1998). Among seed yield components, number of pods per plant was the major yield contributing component in this germplasm. These findings are in confirmity with an earlier reported work (Poehlman, 1991).

Table 3: Seed yield and yield components in mungbean genotypes.

Variety		Pod plant $^{-1}$	Pod length (cm)	Seed pod $^{-1}$	1000 seed (g)	Yield plant $^{-1}$ (g)
NM 89		47.10	8.4	11.0	38.00	20.70
NM 51		36.30	9.7	12.1	42.10	16.00
NM 20-21		30.00	7.8	10.7	36.30	13.00
LSD	5%	4.51	NS	NS	0.42	1.94
	1%	6.56	NS	NS	0.61	2.81

Reaction to Diseases: Data on mungbean yellow mosaic virus infection indicated that NM 89 showed resistant to moderately resistant reaction to MYMV while its exotic parents VC 1482E showed highly susceptible reaction (Table 4). The other parent NM 20-21 showed moderately resistant reaction. NM 89 showed also moderate resistance to Cercospora leaf spot. The paternal parent VC 1482E showed moderately resistant reaction whereas the female parent NM 20-21 showed moderately susceptible response.

Mungbean diseases especially MYMV and CLS can cause colossal damage to crop when these occur in severe form (Nene, 1972; Rath and Grewal, 1973; and Pandher, 1979). Yield losses vary depending upon the severity of disease. Chand and Verma (1983) reported 26% and 67% loss in seed weight and plant seed yield in India whereas these varied from 16-20% in Pakistan (Ali, 1982). An Exotic AVRDC accession VC 1482E showed 70-80% reduction in seed yield due to diseases in present studies.

Based upon the desirable morpho-physiological attributes and superb yield performance, NM 89 was approved as a commercial variety 'NIAB MUNG 98' by the Punjab Seed Council for general cultivation in the province.

Table 4: Mungbean Yellow Mosaic Virus infection in different sets of trials from 1992-1997.

Genotype	NM-89	VC1482E	NM 20-21
Micro Plot Trials			
Infection	13	92	13
	(10)	(10)	(32)
Rating	MR	HS	MR
	(MR)	(MR)	(MR)
Advanced Yield Trials			
Infection	8	84	16
Rating	R	HS	MR
Adaptation Trials			
Infection	15	95	17
Rating	MR	HS	MR

Values in parentheses show Cercospora leaf spot (CLS) infection/ reaction

References

Ali, M. M., 1982. Grain Legume Production in Pakistan; *In*: Asian Productivity Organization, Tokyo, Nordica International Ltd.; Hong Kong, pp: 473-490.

Ali, M., I.A. Malik, H.M. Sabir and B. Ahmed, 1997. The Mungbean Green Revolution in Pakistan. Tech. Bulletin No. 24, AVRDC, Shanhua, Taiwan, ROC, pp: 66.

Anonymous, 1997. Agri. Statistics of Pakistan. Ministry of Food and Agri., Pakistan.

Boling, M., D. A. Sander and R. S. Matlock, 1961. Mungbean hybridization technique. Agron. J., 53: 54-54.

Chand, P. and J. P. Verma, 1983. Effect of yellow mosaic on growth components and yield of mungbean and urdbean. Haryana Agri. Univ. J. Res., 13: 98-102.

Mew, I-Pin, C., T. C. Wang and T. W. Mew, 1975. Inoculation production and evaluation of mungbean varieties for resistance to *Cercospora canescens* (Plant Dis. Rep., 59: 397-401.

Nene, Y. L., 1972. A Survey of viral diseases of pulse crops in Uttar Pradesh. Res. Bull.4, G.B. Plan, Univ. Agri. Tech. Pantnagar, p: 191.

Pandher, R. S., 1979. Studies on Cercospora leaf spot of mungbean (*Vigna radiata* L. Wilczek). M.Sc. thesis, Punjab Agri. Univ. Ludhiana, p: 1-70.

Poehlman, J. M., 1991. The Mungbean. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi India. pp: 195-217.

Rashid, K. A., J. Smart and N. Haq, 1988. Hybridization in the Genus *Vigna*. *In*. Mungbean, Proc. 2nd Int. Symp. AVRDC, Shanhua, Taiwan, pp: 205-214.

Path, G. C. and J. S. Grewal, 1973. A note on Cercospora leaf spot of *Phaseolus aureus*. Ind. J. Mycol. Pl. Pathol., 31: 204-207.

Sadiq, M. S., G. S. S. Khattak, M. Saleem and G. Sarwar, 1998. Exotic mungbean (*Vigna radiata* L. Wilczek) germplasm; its utilization through conventional breeding approach. Trop. Res. Ext. (accepted).

Shaikh, M. A. Q, Z. U. Ahmed and R. N. Oram. 1988. Winter and summer mungbean breeding for improved disease resistance and yield. *In* Mungbean; Proc. 2nd Int. Symp. AVRDC, Shanhua, Taiwan, pp: 124-129.

Shukla, G. P., B. P. Pandya and D. P. Singh, 1978. Inheritance of resistance to yellow mosaic in mungbean. Ind. J. Genet. Pl. Breed, 38: 358-360.

Singh, R. K. and B. D. Chaudhry, 1979. Biometrical methods in quantitative genetic analysis. Kalyani Publishers, Ludhiana, India, pp: 1-301.