INTERNATIONAL JOURNAL OF APPLIED AND EXPERIMENTAL BIOLOGY
(ISSN PRINT: 2790-6523; ISSN ONLINE: 2790-6531)
2026, Vol. 5, NO. 2, ???
doi: https://doi.org/10.56612/ijaaeb.v5i2.203
ARK: https://n2t.net/ark:/71142/IJAaEB.v5i2.203
https://eminentscientists.com/

'NIFA Mung-25': A newly developed high-yielding mungbean [*Vigna radiata* (L.) Wilczek] variety with improved resistance to major diseases

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Abstract
An exotic mungbean genotype 'V2802' acquired from the World Vegetable Center (WVC) was hybridized with the Mungbean Yellow Mosaic Virus (MYMV) tolerant variety 'Ramzan' in spring 2012 at the Nuclear Institute for Food & Agriculture (NIFA), Peshawar, Pakistan. The F_1 generation was raised in spring 2013, whereas F_2-F_6 populations were planted during the Kharif (Summer to Monsoon) seasons 2013-2017. Single plants/progenies' selections were based on specific criteria, i.e., green seed color, better plant type, higher grain yield, and MYMV tolerance. A best-performing progeny, NFM-103-30 (NIFA Mung-25), was selected and evaluated in replicated yield trials at NIFA, various locations in Khyber Pakhtunkhwa (KP), and in the National Uniform Yield Trials (NUYTs) across Pakistan during 2018–2023. At NIFA and other locations of the Khyber Pakhtunkhwa (KP) province, NFM-103-30 (NIFA Mung-25) outperformed the check varieties, producing the highest average yield of 2,062 kg ha^{-1} compared to the check varieties Ramzan (1,768 kg ha^{-1}), AZRI Mung-18 (1,698 kg ha^{-1}), and NIFA Mung-19 (1,757 kg ha^{-1}), with an average yield increase of 23.2%. In NUYTs conducted in 2022, NFM-103-30 (NIFA Mung-25) produced the highest mean yield of 1,323 kg ha^{-1} against the national check variety AZRI Mung Jumbo (1,267 kg ha^{-1}) across KP. Similarly, during evaluation in NUYT-2023, NFM-103-30 (NIFA Mung-25) produced a grain yield of 1,207 kg ha^{-1}, out-yielding the check variety NIAB Mung-2021 (1,010 kg ha^{-1}). The candidate genotype/line also showed resistance to MYMV under field conditions. Based on its excellent performance in terms of grain yield across KP, the KP Seed Council approved NIFA Mung-25 as a new commercial mungbean variety for general cultivation in KP on August 6, 2025.

ARTICLE TYPE
Research Paper (RP)

SECTION
Plant Biology (PB)

HANDLING EDITOR
İbadullayeva, S.J. (PB)

ARTICLE HISTORY
Received: 06 Oct, 2025
Accepted: 30 Oct, 2025
Online: 05 Jan, 2026
Published: ?????????

KEYWORDS
Breeding;
Disease resistance;
Field trials;
Pulse crop;
Selection

Introduction

Mungbean is a vital warm-season legume crop cultivated on reasonable acreage in Pakistan, including Khyber Pakhtunkhwa (KP) province, both in irrigated and rainfed areas. In the year 2023-24, mungbean was planted on an area of 0.201 million hectares with a total production of 153.7 thousand tonnes (Agriculture Management Information System, 2024). Despite its importance as an edible legume, its average national yield is far below that of neighboring countries. One of the underlying reasons for the low average national yield is the shortage of improved commercial varieties adapted to local growth conditions (Ullah et al., 2025). Therefore, to enhance the overall productivity of mungbean in the country, development of more high-yielding commercial varieties is of utmost importance, as development and adoption of new improved varieties is an indicator of the effectiveness of an agricultural research system (Witcombe et al., 2016; Pepjin et al., 2019; Khattak et al., 2021, 2022, 2023).

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CITATION (APA): Khattak, G.S.S., Saeed, I., Ahmad, S., Ullah, G. (2026). High yielding mungbean variety 'NIFA Mung-25': A newly developed high-yielding mungbean [*Vigna radiata* (L.) Wilczek] variety with improved resistance to major diseases. *International Journal of Applied and Experimental Biology*, 5(2). https://doi.org/10.56612/ijaaeb.v5i2.203

Article No. 203; GP Master v202601

Conventional plant breeding is still considered an efficient tool to gather genetic variability for yield or any other trait of interest from different genotypes of mungbean and other crop plants into a single variety through hybridization (Buzdar et al., 2025). It has significantly contributed to enhancing the overall productivity of crop plants. Around the globe, conventional plant breeding has resulted in the development of many new commercial varieties in various crop plants having favorable traits of economic importance (Jayashree et al., 2013; Singh et al., 2003; Gupta et al., 2015; Singh et al., 2018; Pratap et al., 2019; Singh et al., 2020; Rekha et al., 2025).

Nuclear Institute for Food & Agriculture (NIFA) is actively engaged in the improvement of mungbean through developing high-yielding green and black-seeded varieties. The institute has so far evolved three commercial green-seeded and two black-seeded varieties, which are being successfully grown in Kurram and other mungbean growing areas of the KP. In this backdrop, the NIFA scientists felt it necessary to develop high-yielding mungbean varieties that must excel the contemporary varieties. Thus, this manuscript discusses the development of a new high-yielding green-seeded mungbean variety 'NIFA Mung-25' using classical plant breeding protocols.

Materials and Methods

An exotic genotype "V2802" acquired from the Asian Regional Center-Asian Vegetable Research Development Center (ARC-AVRDC), now the World Vegetable Center, Taiwan, was hybridized with a Mungbean Yellow Mosaic Virus (MYMV) resistant mungbean commercial variety "Ramzan" as a single cross-combination (V2802 × Ramzan) at the Nuclear Institute for Food and Agriculture (NIFA), Peshawar, in spring 2012, following the procedure outlined elsewhere (Khattak et al., 1998). The F_1 generation was raised from crossed pods in spring 2013. All recombinant plants were picked, threshed, and bagged individually. The F_2 population, along with both parents, was planted in Kharif 2013. The MYMV-susceptible genotype "VC1560D" was repeatedly planted in rows in the F_2 population for use as a MYMV spreader to intensify MYMV inocula from natural sources. Chemical pesticides were avoided to maintain the natural population of whitefly (*Bemisia tabaci*). Single plants were selected for high yield (more pods per plant), semi-erect growth habit, more productive branches, and MYMV resistance. The F_4-F_6 generations were raised for generation advancement and confirmation of breeding behavior/genetic stability of the desired traits during 2014-2017.

The selected recombinants were tested along with the check varieties in replicated trials to evaluate for seed yield and related components at NIFA and other locations in KP, in the National Uniform Yield Trials (NUYTs) across the country during 2018-2023. Each trial was planted in a Randomized Complete Block Design (RCBD) with each genotype sown in 04 rows of 04 m length. Row-to-row distance was maintained at 30 cm, and plant-to-plant space was kept at 10 cm. Each plot of each test genotype was replicated thrice. The experiments were sown under irrigated conditions, and need-based irrigation was applied. The lines were also screened for MYMV in a separate nursery at NIFA in the same seasons.

Statistical analysis of data

Means of all parameters were computed from the data. The original raw data were processed for appropriate analysis of variance (ANOVA) for each variable following Steel and Torrie (1980).

The breeding history of NIFA Mung-25 is given below in a chronological order in Table 1.

Table 1: Breeding history of NIFA Mung-25 (NFM-103-30)

Year	F. Gen./Trial	Remarks
2012	Hybridization	A single cross "V2802 × Ramzan" was attempted at NIFA
2013	F_1	F_1 generation of the cross "V2802 × Ramzan" was raised
Kharif 2013	F_2	The F_2 population was raised. Single plant selections for traits of interest and screening for MYMV resistance
Kharif 2014	F_3	Raised the F_3 population for confirmation of breeding behavior and generation advancement. Single plant selections for traits of interest and screening for MYMV resistance were done
Kharif 2015-17	F_4-F_6, and screening against MYMV	Planting of the F_4-F_6 generations to confirm the breeding behavior of the traits. Selection of true breeding with desired traits was carried out. MYMV resistance recorded
Kharif 2018-23	Yield trials and screening against MYMV	Evaluation of elite lines in replicated yield trials and NUYTs, and MYMV resistance screening were done. The best line 'NFM-103-30' was evaluated for Distinctness, Uniformity, and Stability (DUS).

Results and Discussion

Yield performance of NIFA Mung-25 in different replicated yield trials, other locations in KP, and NUYTs is presented in Tables 2 to 11. In preliminary yield trials planted at NIFA in Kharif 2018 and 2020, NFM-103-30 (NIFA Mung-25) out-yielded the check variety Ramzan with statistically significant ($p \leq 0.05$) higher seed yield of 1,834 and 2,269 kg ha^{-1}, respectively, against seed yield of Ramzan (1,444 and 2,092 kg ha^{-1}, respectively) (Tables 2 & 3). In the advanced lines yield trial (ALYT), conducted at NIFA in Kharif 2021, NFM-103-30 (NIFA Mung-25) produced statistically significant ($p \leq 0.05$) yield of 2,361 kg ha^{-1} compared with 1,760 kg ha^{-1} seed yield of the check variety NIFA Mung-19 (Table 4). During the same season in adaptability yield trial conducted at the Agricultural Research Stations (ARS), Karak and Agricultural Research Institute (ARI), Dera Isamail Khan (D.I. Khan), NFM-103-30 (NIFA Mung-25) performed better and produced statistically significant higher seed yield of 1,879 and 1,845 kg ha^{-1}, respectively in comparison with the check variety NIFA Mung-19 (1,698 & 1,623 kg ha^{-1}, respectively) (Tables 5 & 6). In the advanced lines yield trial (ALYT) conducted at NIFA in Kharif 2022, NFM-103-30 (NIFA Mung-25) significantly ($p \leq 0.05$) out-yielded (2,189 kg ha^{-1}) the check variety NIFA Mung-19 (1,742 kg ha^{-1}) (Table 7). During the same season, in the adaptability yield trial planted at ARS, Karak, and ARI, D.I. Khan, NFM-103-30 (NIFA Mung-25) produced statistically significant ($p \leq 0.05$) higher seed yield of 1,879 and 1,947 kg ha^{-1}, respectively against the seed yield of 1,627 and 1,771 kg ha^{-1}, produced by the check variety NIFA Mung-19 (Tables 8 and 9). In Mungbean NUYT conducted during Kharif 2022, NFM-103-30 under code name NIFA Mung-10 (NIFA Mung-25) produced a higher average yield of 1322 kg ha^{-1} across Khyber Pakhtunkhwa compared with the average seed yield of 1,267 kg ha^{-1} produced by the check variety AZRI Mung Jumbo (Table 10). Similarly, during evaluation in NUYT conducted in 2023, NIFA Mung-10 (NIFA Mung-25) produced an average higher seed yield of 1,207 kg ha^{-1} compared with the check variety 'NIAB Mung-2021' (1,010 kg ha^{-1}) across KP (Table 11).

Development of new crop varieties having strong genetic potential for enhanced seed yield plays a key role in increasing per unit economic yield, coupled with an increase in overall productivity (Ahmad et al., 2007; Zulfiqar and Hussain, 2014; Joshi et al., 2017; Khattak et al., 2022, 2023). Additionally, genetic potential for high seed yield is of high preference for growers of specific crops (Hossain, 2012; Walker et al., 2015; Sedhom et al., 2024). Accordingly, the enhanced yield potential of NIFA Mung-25 across the Khyber Pakhtunkhwa province against the check varieties, i.e., AZRI Mung Jumbo and NIAB Mung-2021 in NUYTs (Tables 11 & 12), may play a positive role in increasing overall production of mungbean in the province. To be readily adopted by growers, a newly developed commercial variety of a crop must have a strong genetic potential for higher seed yield than other commercial varieties of the same crop under cultivation. NIFA Mung-25 produced an average of 8.8 and 15.1% more seed yield in NUYTs across the KP province compared with the National check varieties, AZRI Mung Jumbo and NIAB Mung-2021, respectively. Mungbean growers in the province will likely adopt NIFA Mung-25 to harvest substantial economic yield by exploiting its better genetic potential. In the contemporary age, growers are more inclined towards traits of economic value with high market acceptability and significant positive contribution to seed yield in a commercial crop variety (Carlson, 2007; Wale and Yalew, 2007; Poudel and Jhonsen, 2009; Asrat et al., 2010; Blazy et al., 2011; Smith and Fennessy, 2011; Ward et al., 2013; Kassie et al., 2017; Khattak et al., 2022, 2023). In Pakistan, bold seed size with shiny green color in mungbean is preferred by growers because of high market acceptability and economic returns. NIFA Mung-25 has a shiny green color with 4% average increase in seed size over the local check varieties. It is, therefore, expected that NIFA Mung-25 will positively contribute to enhancing mungbean productivity in the KP province in particular and the country in general.

Disease tolerance in new commercial crop varieties protects the genetic potential for high seed yield of the varieties. Chemical control is not economically viable on one hand, while on the other hand, it significantly contaminates the environment, thus posing potential threats to human and livestock health. The efficient way to avoid disease-induced damage to the yield of a potential crop variety is to incorporate genetic potential for disease resistance into the variety. Mungbean Yellow Mosaic Virus (MYMV) disease is highly detrimental to final economic yield, and resistance against MYMV is induced through aggregation of different beneficial genes having a modifying effect (Khattak et al., 2000). As inherent genetic potential for disease resistance plays a key role in the protection of yield potential (Oerke, 2006; Savary et al., 2012; Derbyshire et al., 2024), NIFA Mung-25 carries the genetic factors responsible for conferring resistance against the MYMV disease. This variety is therefore capable of performing better under MYMV disease prevalence.

Table 2: Performance of NFM-103-30 (NIFA Mung-25) in preliminary yield trial at NIFA Peshawar in Kharif-2018

Genotype	Parentage/Pedigree	TSW (g)	SY (kg ha^{-1})
NFM-99-1	NM98 × NFM-5-36-24	48	1690
NFM-99-2	-do-	49	1732
NFM-99-9	-do-	40	1273
NFM-99-29	-do-	44	1786
NFM-103-16	V2802 × Ramzan	49	1139
NFM-103-30	-do-	51	1834
NFM-103-57	-do-	47	1556
Ramzan	Standard Check	42	1444
CV (%)		3.5	9.0
LSD (*P* = 0.05)		2.6	69.4

TSW: Thousand-seed weight; SY: Seed yield

Table 3: Performance of NFM-103-30 (NIFA Mung-25) in preliminary yield trial at NIFA Peshawar in Kharif-2020

Genotype	Parentage/Pedigree	TSW (g)	SY (kg ha^{-1})
NFM-99-1	NM98 × NFM-5-36-24	44	2083
NFM-99-2	-do-	48	1597
NFM-99-9	-do-	43	1944
NFM-99-38	-do-	48	1724
NFM-103-16	V2802 × Ramzan	48	1493
NFM-103-30	-do-	49	2269
NFM-103-57	-do-	46	1828
Ramzan	Standard Check	48	2092
CV (%)		2.82	9.14
LSD (*P* = 0.05)		2.19	103.72

TSW: Thousand-seed weight, SY: Seed yield

Table 4: Performance of NFM-103-30 (NIFA Mung-25) in the advanced yield trial conducted at NIFA Peshawar in Kharif-2021

Genotype	Parentage/Pedigree	TSW (g)	SY (kg ha^{-1})
NFM-98-119	NFM-5-36-24 × NFM-5-63-18	52	1646
NFM-99-2	NM98 × NFM-5-36-24	48	1694
NFM-99-4	-do-	48	2188
NFM-99-38	-do-	48	2312
NFM-103-16	V2802 × Ramzan	50	1583
NFM-103-30	-do-	50	2361
NFM-103-57	-do-	41	1715
NFM-103-90	-do-	52	2233
NIFA Mung-19	Standard Check	50	1760
CV (%)		1.46	6.60
LSD (*P* = 0.05)		1.20	152.94

TSW: Thousand-seed weight, SY: Seed yield

Table 5: Performance of NFM-103-30 (NIFA Mung-25) in the adaptability yield trial conducted at ARS, Karak in Kharif-2021

Genotype	Parentage/Pedigree	TSW (g)	SY (kg ha^{-1})
NFM-98-85	NFM-5-36-24 × NFM-5-63-18	51	1708
NFM-98-119	-do-	52	1698
NFM-99-2	NM-98 × NFM-5-36-24	50	1613
NFM-99-34	-do-	48	1498
NFM-103-16	V2802 × Ramzan	50	1686
NFM-103-30	-do-	50	1879
NIFA Mung-19	Standard Check	49	1698
AZRI Mung-18	-do-	48	1627
CV (%)		1.36	5.42
LSD (*P* = 0.05)		1.12	81.87

TSW: Thousand-seed weight, SY: Seed yield

Table 6: Performance of NFM-103-30 (NIFA Mung-25) in the adaptability yield trial conducted at AZRC, D.I. Khan in Kharif-2021

Genotype	Parentage/Pedigree	TSW (g)	SY (kg ha^{-1})
NFM-98-85	NFM-5-36-24 × NFM-5-63-18	50	1565
NFM-98-119	-do-	51	1745
NFM-99-2	NM-98 × NFM-5-36-24	50	1654
NFM-99-34	-do-	49	1649
NFM-103-16	V2802 × Ramzan	50	1765
NFM-103-30	-do-	51	1845
NIFA Mung-19	Standard Check	49	1623
AZRI Mung-18	-do-	49	1602
CV (%)		1.13	7.24
LSD (*P* = 0.05)		1.16	109.63

TSW: Thousand-seed weight, SY: Seed yield

Table 7: Performance of NFM-103-30 (NIFA Mung-25) in the advanced yield trial conducted at NIFA Peshawar in Kharif-2022

Genotype	Parentage/Pedigree	TSW (g)	SY (kg ha^{-1})
NFM-99-2	NM98 × NFM-5-36-24	42	1785
NFM-99-4	-do-	48	1607
NFM-99-38	-do-	47	1938
NFM-103-16	V2802 × Ramzan	50	1715
NFM-103-30	-do-	51	2189
NFM-103-36	-do-	52	1950
NFM-103-90	-do-	50	1815
NIFA Mung-19	Standard Check	52	1742
CV (%)		1.43	5.20
LSD (*P* = 0.05)		1.14	97.58

TSW: Thousand-seed weight, SY: Seed yield

Table 8: Performance of NFM-103-30 (NIFA Mung-25) in the adaptability yield trial conducted at ARS, Karak in Kharif-2022

Genotype	Parentage/Pedigree	TSW (g)	SY (kg ha^{-1})
NFM-98-85	NFM-5-36-24 × NFM-5-63-18	51	1597
NFM-98-119	-do-	52	1424
NFM-99-2	NM-98 × NFM-5-36-24	50	1767
NFM-99-34	-do-	48	1661
NFM-103-16	V2802 × Ramzan	50	1795
NFM-103-30	-do-	50	1879
NFM-2019	Standard Check	49	1627
AZRI Mung-18	-do-	48	1599
CV (%)		1.13	7.69
LSD (*P* = 0.05)		1.42	92.17

TSW: Thousand-seed weight, SY: Seed yield

Table 9: Performance of NFM-103-30 (NIFA Mung-25) in the adaptability yield trial planted at AZRC, D.I. Khan in Kharif-2022

Genotype	Parentage/Pedigree	TSW (g)	SY (kg ha^{-1})
NFM-98-85	NFM-5-36-24 × NFM-5-63-18	52	1647
NFM-98-119	-do-	50	1523
NFM-99-2	NM-98 × NFM-5-36-24	51	1491
NFM-99-34	-do-	49	1623
NFM-103-16	V2802 × Ramzan	50	1787
NFM-103-30	-do-	51	1947
NIFA Mung-19	Standard Check	48	1771
AZRI Mung-18	-do-	49	1758
CV (%)		1.56	8.72
LSD (*P* = 0.05)		1.92	101.40

TSW: Thousand-seed weight, SY: Seed yield

Table 10: Mungbean National Uniform Yield Trial (seed yield, kg ha^{-1}) conducted by the Pulses Coordinator during Kharif 2022

Entry name	Institutes	Locations											Mean kg ha^{-1}	Disease Reaction
		1	2	3	4	5	6	7	8	9	10	11		
MH-14027	NIAB, Faisalabad	1283	1928	1646	813	1485	1042	961	1163	547	891	958	1156	R
MH-13060	NIAB, Faisalabad	1176	1475	1528	684	1964	924	908	1265	433	1287	680	1120	R
TM 1820	AZRI, Bhakkar	1331	1875	1320	937	1471	861	872	1068	476	1090	708	1092	R
MMH-7142	NIAB, Faisalabad	1218	1744	1597	934	1569	910	610	1029	439	956	701	1064	MR
MH-16006	NIAB, Faisalabad	1075	1656	1528	860	1388	917	872	1059	561	926	785	1057	MR
PARB Mung 07	AZRI, Bhakkar	1139	1895	1444	823	1492	861	778	1044	513	669	611	1024	R
MH-13089	NIAB, Faisalabad	1171	1813	903	985	1103	847	1074	1008	534	795	868	1009	R
NIFA Mung-7	NIFA, Peshawar	1303	1824	1625	707	1180	924	877	994	288	698	611	1003	R
PARB Mung 18	AZRI, Bhakkar	1323	1911	1458	720	1180	1028	771	993	310	757	562	1001	MR
MM-17062	NIAB, Faisalabad	1137	1885	764	804	1438	889	922	1083	576	643	757	991	R
PARB Mung 12	AZRI, Bhakkar	1225	1941	1181	842	1173	868	882	974	387	599	624	972	R
TM-1821	AZRI, Bhakkar	1315	1315	1077	724	1520	993	883	1132	365	671	625	965	R
NIFA Mung 10	NIFA, Peshawar	1392	1673	903	820	1180	840	714	911	460	915	653	951	R
18007	PRI, Faisalabad	1172	2174	868	636	1006	792	992	930	394	744	659	943	R
MSPS 119	PRP, NARC, Islamabad	1101	1785	903	789	1117	972	763	951	420	862	611	934	R
NIFA Mung-8	NIFA, Peshawar	1442	1664	937	770	1215	743	765	908	413	691	701	932	R
AZRI Mung Jumbo (C)	AZRI, Bhakkar	1127	1564	1111	767	1180	764	858	934	428	663	576	907	R
NIFA Mung-9	NIFA, Peshawar	1286	1753	764	654	930	889	872	897	369	432	403	841	R
17002	PRI, Faisalabad	1216	1703	660	649	777	854	879	837	400	674	549	836	R
Locations average		1233	1781	1159	785	1289	889	864	1014	440	790	665	-	

Locations: 1, ARI, Swat; 2, AZRC, D.I. Khan; 3, NIFA, Peshawar; 4, PRP, NARC; 5, NIAB Faisalabad; 6, BARI, Chakwal; 7, AZRI, Bhakkar; 8, AZRI, Umerkot; 9, PRI, Faisalabad; 10, GBRSS, Kallurkot; 11, BARI, Bahawalpur. R, Resistant; MR, Moderately resistant

Table 11: Mungbean National Uniform Yield Trial (seed yield, kg ha^{-1}) conducted by the Pulses Coordinator during Kharif 2023

Code	Decode	Institutes	Locations											Mean kg ha^{-1}
			1	2	3	4	5	6	7	8	9	10	11	
MG23011	MB-20009	PRI, Faisalabad	1140	1269	1479	811	599	660	2000	622	983	1018	1139	1065
MG23012	MH-13060	NIAB, Faisalabad	1024	1387	1667	547	796	646	1623	668	1087	1172	986	1055
MG23013	MHR-18032	NIAB, Faisalabad	983	1637	1778	523	652	611	1800	637	931	1049	986	1053
MG23002	PARB-Mung 12	AZRI, Bhakkar	940	1532	1681	700	671	479	1650	669	1076	1045	1049	1045
MG23004	MHR-18038	NIAB, Faisalabad	1089	1304	1688	819	559	549	1741	626	806	1160	1090	1039
MG23007	18007	PRI, Faisalabad	892	1477	1639	507	862	493	2069	616	747	1042	1014	1033
MG23015	TM 1821	AZRI, Bhakkar	835	1505	1542	527	579	688	1481	750	1351	917	1153	1030
MG23005	NIFA-Mung-10	NIFA, Peshawar	610	1089	2153	858	593	438	1612	644	1201	845	1132	1016
MG23018	MB-20005	PRI, Faisalabad	1133	1338	1667	555	586	528	1711	605	896	1073	1042	1012
MG23017	E-8	AZRC, D.I. Khan	879	1172	1743	718	697	625	1616	631	698	1146	1035	996
MG23016	NIFA-Mung-7	NIFA, Peshawar	669	1609	1854	500	818	521	1372	599	993	1139	875	995
MG23006	NIAB Mung 2021 (C)	NIAB, Faisalabad	1065	1304	1389	691	577	528	1807	727	858	997	917	987
MG23021	TM-1820	AZRI, Bhakkar	972	1484	1319	690	598	431	1469	640	1139	1087	993	984
MG23009	MH-16006	NIAB, Faisalabad	874	1054	1500	625	685	556	1829	687	781	1063	1070	975
MG23020	MM-17062	NIAB, Faisalabad	783	1255	1354	568	598	444	1729	725	840	1045	1250	963
MG23001	MB-20008	PRI, Faisalabad	1078	1137	1514	500	566	569	1866	623	813	931	986	962
MG23003	NIFA Mung-8	NIFA, Peshawar	706	853	2083	709	590	465	1333	695	1128	979	1007	959
MG23019	NIFA Mung-9	NIFA, Peshawar	639	1186	1750	583	696	597	1390	653	821	1083	882	935
MG23010	PARB Mung-7	AZRI, Bhakkar	619	1179	1646	526	564	569	1471	676	899	1067	972	926
MG23014	PARB Mung-18	AZRI, Bhakkar	532	832	1285	628	569	438	1946	778	924	1031	1028	908
MG23008	NCM-11-22	PRP, NARC, Islamabad	790	1130	1611	531	667	431	1237	684	924	912	882	891
Locations average			869	1273	1635	625	644	536	1655	665	947	1038	1023	-

Table 12: Response of NFM-103-30 (NIFA Mung-25) to MYMV as compared to the parents and standards during Kharif 2018, 2020, and 2021

Entry	Mungbean Yellow Mosaic Virus (MYMV) disease rating								
	At NIFA, Peshawar-2018			At NIFA, Peshawar-2020			At NIFA, Peshawar-2021		
	% Infection	Score	Rating	% Infection	Score	Rating	% Infection	Score	Rating
NFM-99-1	7.5	2	R	7.2	2	R	7.3	2	R
NFM-99-2	6.8	2	R	7.9	2	R	7.4	2	R
NFM-103-16	7.4	2	R	7.4	2	R	7.7	2	R
NFM-103-30	4.0	1	HR	4.3	1	HR	4.1	1	HR
V2802	4.4	1	HR	4.1	1	HR	4.3	1	HR
Ramzan	4.5	1	HR	4.2	1	HR	3.9	1	R
VC 1560D (Disease spreader)	95.8	8	HS	96.4	8	HS	97.0	8	HS
NIFA Mung-19 (Std. check)	7.4	2	R	7.7	2	R	7.5	2	HR

Plant parts infected/disease (%)	Score	Disease reaction
No infection	0	Immune (I)
1-5	1	Highly resistant (HR)
6-10	2	Resistant (R)
11-20	3	Moderately resistant (MR)
21-30	4	Tolerant (T)
31-40	5	Moderately tolerant (MT)
41-50	6	Moderately susceptible (MS)
51-80	7	Susceptible (S)
81-100	8	Highly susceptible (HS)

Author(s), Editor(s) and Publisher's declarations

Acknowledgement
The authors acknowledge the financial assistance from the PARC-PSDP Pulses Project (Promoting Research for Productivity Enhancement in Pulses) for conducting adaptability trials across KP. Institutional support provided by the NIFA/PAEC is also highly acknowledged.

Source of funding
Financial support for carrying out the field work was provided through the PARC-PSDP Pulses Project.

Contribution of authors
Conceptualization and study design: GSSK, IS. Research supervised: GSSK, SA, GU. Conduction of experiment: IS, SA, GU, GSSK. Data collection, visualization, and interpretation: IS, SA, GSSK. Preparation of initial draft: GSSK, IS, SA. Review of initial draft: GSSK, IS, SA, GU.

Permissions and ethical compliance
This study does not involve human/animal subjects, and thus no ethical approval is required.

Handling of bio-hazardous materials
The authors certify that all experimental materials were handled with great care during collection and experimental procedures. After completion of the study, all materials were properly discarded to minimize/eliminate any types of bio-contamination(s).

Supplementary material
No supplementary material is included with this manuscript.

Conflict of interest
The authors declare no conflict of interest.

Availability of primary data and materials
As per editorial policy, experimental materials, primary data, or software codes are not submitted to the publisher/Journal management. These are available with the corresponding author (s) and/or with other author(s) as declared by the corresponding author (s) of this manuscript.

Authors' consent
All authors have critically read this manuscript and agreed to publish in IJAaEB.

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It is declared that the authors did not use any AI tools or AI-assisted services in the preparation, analysis, or creation of this manuscript submitted for publication in the International Journal of Applied and Experimental Biology (IJAaEB).

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