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EVALUATION OF SELECTED GERMPLASM OF MUNGBEAN *(VIGNA RADIATA(L.)* WILCZEK)

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Abstract

One hundred and twelve mungbean genotypes selected from a broad based local as well as exotic germplasm during last three years, were evaluated for agronomic characters and incidence of yellow mosaic and leaf crinkle virus under natural infection conditions. Twenty eight genotypes were found to be superior on the basis of yield potential and resistance/tolerance to YMV and LCV. A high yielding line (NCM 201) showed resistance to both viral diseases. Maximum CV was observed for pods per plant, biological yield per plant and grain yield per plant indicating greater scope of selection for these traits. A strong correlation of yield was observed with pods per plant and biological yield per plant. Large scale testing of selected lines and their utilization in breeding programme would be of great use in mungbean improvement.

Introduction

A sound breeding programme for any crop improvement is primarily based on extensive evaluation of broad based germplasm. In recent pest considerable improvement of mungbean has been made on the basis of evaluation and utilization of genetically diverse germplasm obtained from indigenous and exotic sources (Anon., 1984, 1985, 1986, 1987). Virmani *et al.*., (1983) classified mungbean germplasm in various groups for different traits. Singh & Srivastava (1985) categorized pea germplasm into various groups for different characters. The present germplasm evaluation and subsequent exploitation of desirable genotypes would prove to be invaluable to the breeding programme at National Agricultural Research Centre (NARC), Islamabad, Pakistan.

Materials and Methods

One hundred and twelve mungbean genotypes selected from local and exotic material evaluated during last three years, were planted in an augmented design during Summer-1988 in the experimental fields of the National Agricultural Research Centre, Islamabad, Pakistan. Six rows of four meter length were planted for each entry with the spacings of 30 and 10 centimeters between and within rows, respectively.Recommended cultural practices were followed. The data were recorded on days to 90 % maturity, plant height (cm), branches per plant, pods per plant, pod length (cm), seeds per pod, 100-seed weight (g), biological yield per plant (g), harvest index (%) and grain yield per plant (g). Observations were also taken for viral diseases i.e., yellow mosaic virus (YMV) and leaf-crinkle virus (LCV). Except days to 90 % maturity and viral diseases, data for other plant characters were recorded on 10 randomly selected plants chosen at the time of harvest. The data were subjected to statistical analysis. The correlation coefficients between yield and other characters were calculated. The data recorded for each character were also categorized into 4 groups in each case on uniform class interval basis.

Table 1a. Variation for days to maturity and plant height.

Days to maturity			Plant height		
Range	Freq.	Percentage	Range	Freq.	Percentage
61-67	44	39.29	21-33	5	4.46
68-74	52	46.43	34-46	53	47.32
75-81	14	12.50	47-59	38	33.93
82-88	2	1.79	60-72	16	14.29
Total:	112			112	
CV:	6.51			20.25	
Mean:	70.14±00.43			47.35±00.91	

Results and Discussion

Days to 90 percent Maturity: Days to 90 % maturity ranged from 61 to 88 days (Table 1a). Maximum frequency of 52 out of 112 (46.43 %) genotypes/lines matured between 68 to 74 days. Forty four lines matured up to 67 days and these might be considered short duration. The co-efficient of variability (CV) for this character was 6.51 which was low, indicating restriction for improving earliness in the existing mungbean material.

Plant Height: Plant height stretched from 21 to 72 cm with mean value of 47.35 cm (Table 1a). The CV in this case was 20.25 that suggested the scope of selection for various plant stature. The high frequency (53 lines) was between the range of 34-46 cm. Five genotypes were short statured, which ranged between 21-33 cm.

Branches per plant: Branches per plant ranged from 4 to 15 with mean value of 7.81 (Table 1b). Genotypes with 7-9 branches were most frequent (64.29 %) followed by genotypes having 4-6 branches (16.07 %). The coefficient of variability was high (24.90) manifesting a good scope for further improvement of these lines with regard to this trait.

Pods per plant: In case of pods per plant, 64 genotypes ranged from 7-26 pods per plant which were 57.14 % of the total population (Table 1b). The CV for this character was 42.22 which was quite a high figure recommending the scope of direct selection for further improvement of mungbean from the existing material. Three genotypes (NCM 205, NCM 222 and NCM 123) exhibited high pod bearing (65-83 pods per plant) which could be used in the breeding programme to improve pod number.

Table 1b. Variation for branches per plant and pods per plant.

Branches per plant			Pods per plant		
Range	Freq.	Percentage	Range	Freq.	Percentage
4- 6	18	16.07	7-26	64	57.14
7- 9	72	64.29	27-45	42	37.50
10-12	15	13.39	46-64	3	2.68
13-15	7	6.25	65-83	3	2.68
Total:	112			112	
CV:	24.90			42.22	
Mean:	7.81±00.18			27.09±1.08	

Table 1c. Variation for pod length and seeds per pod.

Pod length			Seeds per pod		
Range	Freq.	Percentage	Range	Freq.	Percentage
3.5-5.0	3	2.68	7- 8	5	4.46
5.1-6.5	38	33.93	9-10	30	26.79
6.6-8.0	63	56.25	11-12	65	58.04
8.1-9.5	8	7.14	13-14	12	10.71
Total:	112			112	
CV:	12.84			13.11	
Mean:	6.74±00.08			10.67±00.13	

Pod Length: Pod length ranged from 3.5 to 9.5 cm with mean value of 6.74 cm. The co-efficient of variability for pod length (12.84) was not very high revealing a narrow scope of improvement. Sixty three genotypes (56.25 %) produced the pod length within the range of 6.6-8.0 cm (Table 1c).

Seeds per pod: All the genotypes ranged from 7 to 14 seeds per pod with mean value of 10.67 (Table 1c). A considerable amount of CV (13.11) was observed for this trait. Maximum number of entries were grouped in the range of 11 to 12 seeds per pod. Twelve genotypes produced 13-14 seeds per pod.

100-Seed Weight: One hundred-seed weight for all the entries ranged from 2.1 to 4.7 g (Table 1d). Seventy seven genotypes which were 68.75 % of the total population were containing between 2.8-3.4g 100-seed weight. The co-efficient of variability for this parameter was 13.96 indicating the effectiveness of selection for improving seed weight in mungbean. Patel & Shah (1982) suggested that selection on the basis of highly heritable characters like 100-seed weight could be very effective for improvement in grain yield of mungbean.

Biological Yield per Plant: Biological yield per plant widely ranged from 8 to 63 g (Table 1d) Fifty seven genotypes (50.89 %) produced dry matter within the range of 8 to 21 g. For this character a high co-efficient of variability (40.18) was observed showing high scope of selection to improve dry matter production.

Table 1d. Variation for 100-seed weight and biological yield.

100-seed weight			Biological yield		
Range	Freq.	Percentage	Range	Freq.	Percentage
2.1-2.7	7	6.25	8-21	57	50.89
2.8-3.4	77	68.75	22-35	43	38.39
3.5-4.1	22	19.64	36-49	10	8.93
4.2-4.7	6	5.36	50-63	2	1.79
Total:	112			112	
CV:	13.96			40.18	
Mean:	3.18±00.04			23.66±00.90	

Table 1e. Variation for harvest index and grain yield

Harvest index			Grain yield per plant		
Range	Freq.	Percentage	Range	Freq.	Percentage
14-20	10	8.93	0.1- 4.0	18	16.07
21-27	54	48.21	4.1- 8.0	74	66.07
28-34	47	41.96	8.1-12.0	17	15.18
35-41	1	0.89	12.1-16.0	3	2.68
Total:	112			112	
CV:	16.08			41.84	
Mean:	26.21CC±DD00.40			6.14CC±DD00.24	

Harvest Index: Harvest index varied from 14 to 41 %(Table 1e). Fifty four genotypes which were 48.21 % of the total population partitioned via dry matter into effective economic yield from 21 to 27 %. The co-efficient of variability for this parameter was 16.08 indicating the effectiveness of selection for improving seed yield in mungbean.

Yield per Plant: Yield per plant varied from 1.0 to 16.0 g (Table 1e). Seventy four genotypes which were 66.07 % of the total population yielded within the range of 4.1 to 8.0 g per plant. Twenty lines which gave over 8 g average yield per plant, might be exploited for general cultivation after systematic and wide range testing. The same lines could be used in breeding programme for improving the yield potential of the existing material. The co-efficient of variability for yield per plant was also very high (41.84) which gave a clue for improving yield by selection.

Viral Diseases: The data on viral diseases were recorded under natural infection on 0-5 scale (Table 1f). In case of Yellow Mosaic Virus (YMV), maximum number of genotypes (66) showed moderately resistant reaction. The CV for this trait was very high (135.72) which revealed un-even distribution of the disease. One genotype (NCM 206) was immune to YMV and twelve (10.71 %) were found to be resistant. These lines might be used as a resistant source for breeding mungbean cultivars to YMV resistance.

Table 1f. Variation for yellow mosaic virus and leaf crinkle virus.

Yellow Mosaic Virus (YMV)			Leaf crinkle virus (LCV)	
Score	Freq.	Percentage	Freq.	Percentage
0	1	0.89	0	0
1	12	10.71	5	4.46
2	66	58.93	100	89.29
3	23	20.54	6	5.36
4	8	7.14	1	0.89
5	2	1.79	0	0
Total:	112		112	
CV:	135.72		95.65	
SE:	00.77		0.25	

0- Immune, 1- Resistant, 2- Moderately resistant, 3- Tolerant 4- Moderately susceptible, 5- Susceptible.

Table 2. Simple correlation coefficients of yield with quantitative characters in mungbean (*Vigna radiata* (L.) Wilczek.)

Characters	Correlation with Grain yield per plant
Days to maturity	0.2816 **
Plant height	0.5015 **
Branches per plant	0.5834 **
Pods per plant	0.8102 **
Pod length	0.1868 *
Seeds per pod	0.2062 *
100-seed weight	0.2059 *
Biological yield	0.9027 **
Harvest index	0.2298 *

* - Significant at 0.05, ** - Significant at 0.01

Like YMV disease, most of the genotypes (89.29 %) showed moderately resistant reaction to leaf crinkle virus. The CV for this trait was also very high (95.65) which indicated un-even distribution of the disease. None of the genotypes was immune to leaf crinkle virus whereas five were observed as resistant. The resistant genotypes viz., NCM 107, NCM 201, NCM 224, NCM 238 and NHM 45 were of indigenous origin and these might be exploited as a resistant source in breeding mungbean cultivars resistant to LCV. ***Correlation Coefficient:*** The simple correlation coefficients of grain yield per plant with other important characters studied showed that all the characters had positive correlation with grain yield per plant. Grain yield was highly significant with days to maturity, plant height, branches per plant (Table 2), pods per plant and biological yield per plant whereas it was significant with pod length, seeds per pod, 100-seed weight and harvest index. A very strong association of grain yield was observed with pods per plant ($r = 0.8102$) and biological yield per plant ($r = 0.9027$).

In the present studies, high variability was found in almost all the characters except days to maturity. The maximum CV was observed for pods per plant, biological yield per plant and grain yield per plant. Twenty eight genotypes were observed to be superior on the basis of yield potential and resistance/tolerance to YMV and LCV (Table 3). One genotype (NCM 201) showed resistant reaction to both viral diseases. The potential of these lines might be further exploited in breeding programme. Virmani *et al.*, (1983) also reported 13 lines in mungbean which possessed desirable traits like early maturity, high-yield potential, resistance to yellow mosaic virus suggesting their use in breeding programme. Similarly Singh & Srivastava (1985) reported high magnitude of variation for pods per plant, seed yield per plant and seed weight in pea germplasm, while Venkateswarlu *et al.., (1981) showed high genetic variability for grain yield per plant in the pigeonpea germplasm.*

Large-scale testing of selected lines and their use in breeding programme is suggested. Moreover, broad-based genepool of mungbean need to be built up by making extensive local collections and obtaining its germplasm from abroad. This would help in making improvement in mungbean through the selection of genotypes possessing desirable traits and development of mungbean ideotypes through component breeding.

Table 3. List of mungbean genotypes with desirable economic traits and disease rsistance.

S. No.	Geno-type/ line	Source	X 1	X 2	X 3	X 4	X 5	X 6	X 7	X 8	X 9	X 10	A	B
1-	V5861	AVRDC	72	63.6	7.0	35.8	6.7	9.7	2.8	37.4	9.0	24.1	3	2
2-	NCM91	"	70	50.2	12.64	0.6	7.2	12.0	3.1	33.3	9.1	27.2	2	2
3-	V4808	"	65	40.2	7.2	14.8	6.0	8.3	3.8	23.1	4.3	18.5	1	2
4-	NCM96	"	79	58.2	5.8	41.6	6.7	11.7	3.2	36.2	11.0	30.5	2	2
5-	NCM107	NARC	70	48.0	5.0	29.0	6.7	11.7	3.2	24.1	7.6	31.7	2	1
6-	NCM229	"	78	62.6	7.2	53.2	7.7	11.3	2.9	39.1	11.3	28.9	2	2
7-	NCM117	"	73	56.8	9.0	31.6	7.0	14.0	3.1	28.8	9.7	33.8	2	2
8-	NCM118	"	72	64.8	8.6	32.2	6.7	12.7	2.8	37.6	9.5	25.2	2	2
9-	NCM205	"	70	58.2	11.6	65.6	7.3	12.0	4.0	61.3	14.5	23.7	3	3
10-	NCM123	"	72	50.4	13.8	70.4	8.7	12.7	4.1	57.0	16.0	27.3	3	3
11-	NCM222	"	81	56.2	11.0	75.3	7.0	12.0	2.8	44.1	11.3	25.6	3	2
12-	NCM211	"	70	47.6	12.8	42.4	7.2	12.0	2.9	30.4	9.5	31.2	2	2
13-	NCM201	"	69	47.4	12.8	42.0	6.7	10.3	2.9	29.6	8.8	29.7	1	1
14-	NCM122	"	70	58.0	8.6	37.0	7.0	11.3	3.2	38.5	9.8	25.5	2	2
15-	NCM206	"	66	53.0	12.8	47.6	4.1	12.3	3.5	34.5	9.4	27.2	0	2
16-	NCM115	"	80	68.0	8.2	30.2	7.2	9.3	3.0	29.3	6.7	22.9	1	2
17-	NCM141	"	71	53.6	7.4	22.2	6.0	9.7	3.5	18.1	5.0	27.4	1	2
18-	NCM139	"	68	48.8	8.6	43.0	6.7	13.0	3.1	29.7	7.6	25.7	1	2
19-	NCM125	"	65	41.4	6.0	26.0	6.7	10.3	3.4	23.8	5.1	21.3	1	2
20-	NCM124	"	70	59.6	13.8	29.4	6.3	11.0	3.6	28.7	7.7	26.9	1	2
21-	NCM203	"	71	56.0	9.8	32.6	6.7	11.0	3.6	35.4	8.0	22.5	1	2
22-	NCM238	"	67	42.6	8.4	17.6	6.8	11.7	2.9	15.5	5.0	32.0	2	1
23-	NCM224	"	65	42.4	6.2	16.8	7.0	10.0	3.0	14.9	4.5	29.9	2	1
24-	NHM51	NIAB	67	39.4	6.8	14.4	6.7	8.7	4.5	15.9	4.3	26.9	1	2
25-	NHM18	"	66	43.6	5.2	12.8	7.8	9.0	4.2	13.2	4.2	31.7	1	2
26-	NHM37	"	70	56.4	9.4	15.0	9.0	13.0	4.2	26.1	6.8	26.1	1	2
27-	NHM45	"	65	39.0	6.0	8.0	7.2	11.3	3.9	11.2	1.6	14.5	2	1
28-	7-2	AARI	71	21.5	6.2	12.8	6.3	10.7	2.8	14.5	3.1	21.5	1	2

AVRDC- Asian Vegetable Research and Development Centre, Taiwan, NARC - National Agricultural Research Centre, Islamabad. Pakistan, NIAB - Nuclear Institute for Agriculture and Biology, Faisalabad, Pakistan. AARI-Ayub Agricultural Research Institute, Faisalabad, Pakistan.

X 1-Days to maturity, X 2-Plant height (cm), X 3-Branches per plant, X 4-Pods per plant, X 5-Pod length (cm), X 6-Seeds per pod, X 7-100-seed weight (g), X 8-Biological yield per plant (g), X 9-Grain yield per plant (g), X 10- Harvest index (percentage), A - Yellow Mosaic Virus (YMV) rating at 0-5 scale, B- Leaf Crinkle Virus (LCV) rating at 0-5 scale

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