Pak. J. Agri. Sci., Vol. 30, No. 4, 1993

RELATIVE EFFECTIVENESS OF DIFFERENT SELECTION METHODS IN M_3 OF MUNGBEAN VARIETIES FOR IMPORTANT PLANT TRAITS

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Three mungbean varieties were exposed to ultraviolet radiations and their M_3 generations were subjected to three different selection procedures, viz. single plant selection, line selection and bulk method of selection. The varieties differed significantly for various plant traits. The three selection methods were found to have significant differences among themselves. Single plant selection was relatively more effective procedure for the improvement of plant height, pods plant^{-1}, 100-grain weight and grain yield.

INTRODUCTION

Hybridization in mungbean has always been a tedious process, mainly due to its complex and delicate floral structure as well as due to micro-conditions required for pollen dehiscence and fertilization. Thus, the crop has been facing the problem of low genetic variation. Mutation breeding offers an attractive alternative to conventional breeding for the creation of variability and its ultimate use for developing strains with better yield potential and other desirable qualities.

The existing varieties of mungbean possess several undesirable characters, like indeterminate branching, excessive vegetative growth and low harvest index. Moreover, its improvement for a long time has mainly been confined to simple selection from local cultivars commonly grown by farmers. Therefore, the present studies were planned to exploit the inherent potential of some exotic germplasm through treatment with ultraviolet radiation followed by three selection methods, i.e. single plant, line and bulk method of selection.

MATERIALS AND METHODS

The present research work was conducted in the Research Area of the Department of Plant Breeding and Genetics, University of Agriculture, Faisalabad during Kharif, 1988. The experimental material comprised M_3 plants raised from the seeds of M_2 plants of the three mungbean cultivars namely, Mung 411, Mung 588 and Mung 562-1. Thus M_3 plants were obtained from the parent varieties treated with 6.010×10^{14} ergs S^{-1} m^{-2} and 6.678×10^{14} ultraviolet exposure by 1000 lux m^{-2} ultraviolet Fluorescent Lamp at germinating stage. The material was sown following Randomized Complete Block Design (RCBD) with three replications in a split-split layout. Three different methods of selection viz. Single plant, line and bulk method of selection were used. The efficiency of these selection methods was tested on the basis of their relative performance with regard to plant height, pods plant^{-1}, 100-grain weight and yield plant^{-1}. The data obtained were analysed by using the analysis of variance technique (Steel and Torrie, 1980) with the help

of Microcomputer Statistical Programme, MSTAT (1986).

RESULTS AND DISCUSSION

Analysis of variance revealed significant ($P<0.05$) differences among mungbean varieties for 100-grain weight and grain yield plant^{-1}. Dose x variety interaction was significant for number of pods plant^{-1} (Table 1). However, highly significant ($P<0.01$) differences existed among selection methods for plant height, number of pods plant^{-1}, 100-grain weight and grain yield plant^{-1}. The interaction between mungbean varieties and the selection method was significant for 100-grain weight. The three-way-interaction (Dose x variety x selection method) was highly significant for plant height and number of pods plant^{-1}.

Mung 411 occupied the top position for 100-grain weight (3.90 g). The other two varieties (Mung 588 and Mung 562-1) did not differ statistically from each other for grain weight. Likewise, Mung 411 (Table 2) also showed maximum grain yield plant^{-1} (6.21 g) followed by Mung 562-1 (5.44 g).

The data (Table 2) revealed that plant height was maximum (30.37 cm) for bulk method of selection and was the lowest (21.86 cm) for single plant selection. In general, shorter plants are more responsive to fertilizers and are considered to be more desirable. Therefore, under the present circumstances, single plant selection in variety Mung 411 is comparatively more effective for providing an opportunity to have shorter plants. These results get support from the findings of Sinha (1988), Pande and Reghuvanshi (1988) who obtained high yielding

Table 1. Mean squares from the analysis of variance for the indicated traits of three mungbean varieties treated with two doses of ultraviolet radiations and evaluated in M_3 by using three selection methods

Source of variation	df	Plant height (cm)	Pods plant^{-1}	100-grain weight (g)	Grain yield plant^{-1} (g)
Replication	2	34.41	94.12	0.11	8.27
Doses (D)	1	38.00	1.59	0.44	9.89
Error (a)	2	23.53	68.32	0.69	3.20
Varieties (V)	2	18.95	40.92	5.64*	9.05*
D x V	2	36.75	139.75*	0.84	3.39
Error (b)	8	32.80	19.71	1.16	1.57
Selection methods (S)	2	326.02**	784.86**	50.71**	82.12**
D x S	2	0.15	14.62	0.79	3.20
V x S	4	9.86	8.43	2.78*	1.45
D x V x S	4	41.30**	60.30**	0.85	0.86
Error (c)	24	5.50	7.04	0.91	1.09

*, **Significant at 0.05 and 0.01 probability levels, respectively.

Plant height and number of pods plant^{-1} revealed non-significant differences among mungbean varieties (Table 2). The cultivar,

dwarf mutants in *Vigna* species with gamma-radiations.

Table 2. Comparison of mungbean varieties and the selection methods for the indicated plant traits

	Plant height (cm)	Pods plant^{-1}	100-grain weight (g)	Grain yield plant^{-1} (g)
Mungbean varieties				
Mung 411	25.01	16.84	3.90 a*	6.21 a
Mung 588	26.99	17.70	3.03 b	4.80 b
Mung 562-1	26.45	19.78	2.86 b	5.44 ab
Selection methods				
Single plant selection	21.86 a*	25.72 a	5.20 a	7.93 a
Line selection	26.21 b	14.59 b	2.46 b	4.53 b
Bulk method	30.37 c	14.01 b	2.14 b	3.99 b

*Means sharing the same letter(s) in a column do not differ statistically at $P \leq 0.05$.

Single plant selection resulted in the highest number of pods plant^{-1} (25.72), heaviest 100-grain weight (5.20 g) and maximum grain yield plant^{-1} (7.93 g) and was statistically different from the remaining two methods of selection (Table 2). The results are supported by the findings of Wilcox and Schapaugh (1988). However, line selection and bulk method of selection were statistically at par for number of pods plant^{-1}, 100-grain weight and grain yield plant^{-1}.

treated at the dose of 6.678×10^{14} ergs S^{-1} m^{-2} responded differently giving 13.3 pods plant^{-1}. The effect on the other two mungbean varieties were almost similar for the two doses of radiation for this trait (Table 3 a). Similar results have been reported by Sumanggone (1987) and Malik *et al.* (1988).

The interaction of variety x selection method for 100-grain weight was the highest (5.97 g) for variety Mung 411 when single

Table 3 a. Comparison of dose x variety for number of pods plant-1

Mungbean variety	Radiation dose (ergs S^{-1} m^{-2})	
	6.010×10^{14}	6.678×10^{14}
Mung 411	15.1 b*	18.6 ab
Mung 588	21.1 a	13.3 b
Mung 562-1	18.7 ab	20.9 a

The variety Mung 588 receiving ultraviolet dose of 6.010×10^{14} ergs S^{-1} m^{-2} gave the maximum pods plant^{-1} (21.1) but when

plant selection was practiced and the lowest (1.65 g) for Mung 588 when line selection was followed (Table 3 b). Mung 411 and

Mung 588 showed similar response for grain weight to single plant selection while Mung 562-1 was less responsive. For line selection, the highest response was observed in Mung 411, the remaining two varieties showed similar response to line selection. Bulk method of selection showed similar effectiveness for the three mungbean varieties for 100-grain weight (Table 3 b).

(Table 4) indicated that a range of plant stature is available to select the plants with desirable stature. In general, bulk method of selection gave the maximum plant height for the mungbean varieties especially for Mung 588 and Mung 562-1 with ultraviolet dose 6.010×10^{14} ergs S^{-1} m^{-2}. Short statured plants of mungbean varieties were obtained from single plant selection method.

Table 3 b. Comparison of variety x selection method for 100-grain weight (g)

Selection method	Variety		
	Mung 411	Mung 588	Mung 562-1
Single plant selection	5.97 a*	5.24 ab	4.38 bc
Line selection	3.72 c	1.65 d	2.01 d
Bulk method	2.02 d	2.21 d	2.19 d

*Means sharing the same letter(s) do not differ statistically at $P \leq 0.05$.

Table 4. Comparison of dose x variety x selection method for plant height (cm) and number of pods plant^{-1}

Selection method	6.010×10^{14} ergs S^{-1} m^{-2}			6.678×10^{14} ergs S^{-1} m^{-2}		
	Mung 411	Mung 588	Mung 562-1	Mung 411	Mung 588	Mung 562-1
Plant height (cm)						
Single plant selection	19.89 e*	25.97 bcd	22.50 de	20.28 e	19.61 e	22.92 cde
Line selection	26.75 bcd	25.99 bcd	28.12 b	26.72 bcd	26.50 bcd	23.16 cde
Bulk method	29.24 b	36.38 a	28.03 b	27.15 bc	24.47 bc	33.97 a
Number of pods plant^{-1}						
Single plant selection	18.67 e*	30.17 ab	25.84 b	31.34 a	18.06 e	30.28 ab
Line selection	14.30 cdef	15.28 cdef	15.48 cdef	12.92 def	12.54 ef	16.98 cde
Bulk method	12.23 ef	17.74 cd	14.78 cdef	11.60 f	12.42 ef	15.29 cdef

*Means sharing the same letter(s) do not differ statistically at $P \leq 0.05$.

A comparison of mean from dose x variety x selection method for plant height

Multiple comparison (Table 4) showed that the highest mean value for number of

pods plant^{-1} was 31.34 for variety Mung 411 followed by Mung 562-1 (30.28) with 6.67 x 10^{14} ergs S^{-1} m^{-2} when single plant selection was followed. However, Mung 411 and Mung 588 behaved differently for the two doses of radiation. Nevertheless, single plant selection appeared to be most effective method for increasing the number of pods plant^{-1}. The results are supported by the findings of Wilcox and Schapaugh (1980).

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