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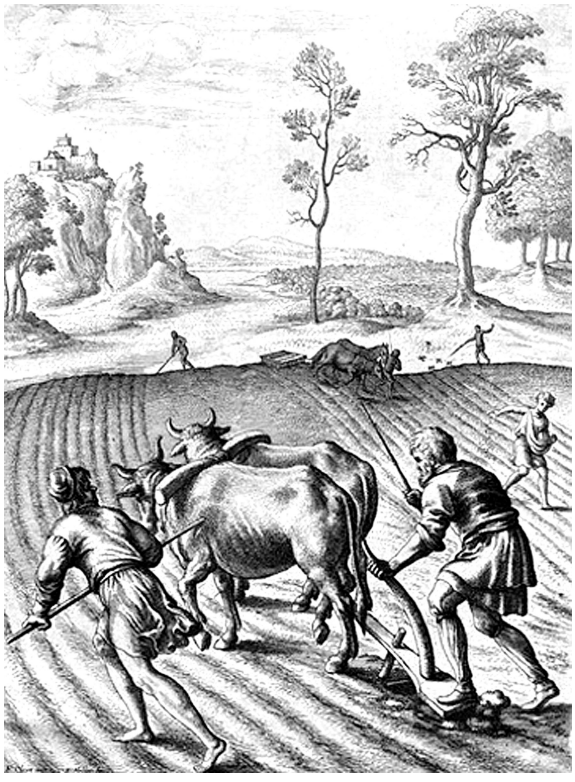

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Assessment of Grain Yield Potential of Mungbean in Shivalik Foothills of India

Anil Kumar and Reena
Pulses Research Sub-Station and Samba,
Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (J & K)-184121, India

Abstract: Several experiments were conducted during 2001-04 to select high yielding biotic stress resistant variety of mungbean, that is responsive to the various production factors, under rainfed conditions of Pulses Research Sub-Station, Samba. Station selection, SMS-1 proved superior to the check varieties, PDM-54 and ML-131 with respect to grain yield and reaction to yellow mosaic virus and *Cercospora* leaf spot. Performance assessment of SMS-1 in on farm trials during 2003 also showed its superiority over the local check variety, ML-131. Further, the entry gave better response to the various production factors viz., fertilizer application, weed control and plant protection measures in comparison to the local variety, ML-131. Yield was highest (1042.0 kg ha^{-1}) in the treatment where all the production factors were clubbed. Percent defoliation by general defoliators showed a significant decrease with improved variety or application of plant protection measures.

Key words: Mungbean, production factors, biotic stress resistance, yield

INTRODUCTION

Green gram or mung (*Phaseolus aureus* Roxb.) does best on deep well drained loams in the alluvial tract in the north as well as on the red and black soils of peninsular and southern India. This is largely grown as a rainfed kharif crop, however in the sub-mountain regions and in the northwestern ranges of the Himalayas as a summer crop, while as a rabi crop in Southern India. The all India area under mungbean is declining owing to the lack of availability of suitable biotic stress resistant, high yielding varieties. Further, mungbean is seriously inflicted by diseases like yellow mosaic, leaf curl, leaf crinkle transferred by vectors; whiteflies, aphids, etc. and other foliar diseases like *Cercospora* leaf spot. Insect pests viz., general defoliators (grasshoppers, lepidopteran larvae, flea beetles, etc.), sucking pests (pod bugs, dusky cotton bugs, whiteflies, aphids, thrips, mites, etc.) and pod borers too severely damage the crop, thereby affecting the yield significantly. Another major problem in mungbean is its non-synchronous and late maturity.

Development of synchronous, early maturing, yellow mosaic virus resistant and high yielding varieties of mungbean can therefore bring additional areas of mungbean under cultivation.

MATERIALS AND METHODS

A series of experiments were conducted during four consecutive years (2001-2004) on mungbean under rainfed conditions of Pulses Research Sub-Station, Samba, Jammu. Several mungbean varieties were assessed for their higher yield potential as well as resistance to biotic stresses along with suitable checks for three years (2001-2003). In the year 2003 and 2004, the variety found best was supplied to farmers for Front Line Demonstrations. Further, in the year 2004, a complete technology package was evaluated for the best variety.

An experiment was carried out at the research farm of pulses Research Sub-Station, SKUAST-J, Samba in a randomized block design, replicated thrice to assess the impact of production factors on performance of improved variety (SMS-1) versus farmer's practice (ML-131). The experiment comprised of fifteen treatments with various combinations of agronomic practices (fertilizer application, weed control, plant protection) to evaluate the impact of integrated approach. Seeds were sown in 3.75×3 m plots with a row spacing of 30 cm. FYM at the rate of 5 t ha^{-1} and DAP at the rate of 100 kg ha^{-1} was applied in the plots where the effect of fertilizer application was to be evaluated. For weed control, pendimethaline at the rate of 1 L ha^{-1} was applied as pre-emergent weedicide. Further, two hand weeding was carried out after 30 days of sowing at 15-20 days interval. Endosulfan at the rate of 0.007% was sprayed as plant protection measure to protect against whiteflies and defoliators.

Observations were made on yield and various yield attributes viz., days to 50% flowering, plant height, number of branches per plant, number of pods per plant, seeds per pod, 100 seed weight

Corresponding Author: Anil Kumar, Pulses Research Sub-Station and Samba,
Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu (J & K)-184121, India

Table 1: Reaction of mungbean variety SMS1 to Yellow mosaic virus and *Cercospora* leaf spot

	Percent YMV infected plants				
Entry	2001	2002	2003	Mean	Reaction to YMV infection
SMS1	3.38	0.00	0.68	1.35	Resistant
PDM 54 (ch.)	21.16	0.00	1.89	7.68	Susceptible
ML 131 (ch.)	7.23	0.00	1.26	2.83	Resistant
	CLS rating on 1-9 scale				Reaction to CLS infection
SMS1	1	3	3	2.33	Resistant
PDM 54 (ch.)	3	7	3	4.33	Moderately resistant
ML 131 (ch.)	3	7	5	5.00	Moderately resistant

and grain yield (kg ha^{-1}). Further, whitefly population on three leaves (top, middle and bottom leaf) was recorded when the crop was 45-50 days old. Percent yellow mosaic virus affected plants were calculated on the basis of total plant stand in the plot and plants infected by YMV. Defoliators population was assessed by calculating the Percent defoliation as a result of feeding by those defoliators. The data were analyzed using simple RBD after suitable transformation as mentioned in Table 1.

The data were subjected to analysis of variance (ANOVA) in a Randomized Block Design after appropriate transformations. The difference of two means between treatments exceeding Critical Difference (CD) value is significant (Panse and Sukhatme, 1978).

RESULTS AND DISCUSSION

For the three consecutive years (2001-2003), five mungbean entries (three station selections and two check varieties) were evaluated for their comparative yield performance. On the overall, selection, SMS-1 proved best (990.3 kg ha^{-1}) showing consistently higher yield (17.1% superior over best check) except in the year, 2001 as evident from Fig. 1. Further, SMS-1 took average number of days (82.5 days) to mature (Fig. 2). The entry SMS-1 when simultaneously screened for its susceptibility/ resistance to yellow mosaic virus and *cercospora* leaf spot infection, showed considerable resistance during all the three years, 2001-2003 (Table 1). Similar differences in mungbean yellow mosaic virus incidence with the cultivars have been reported by Kumar *et al.* (2006).

During 2003, several on farm trials were conducted in different villages of two districts, Kathua and Jammu of Jammu and Kashmir, to assess the performance of mungbean selection, SMS-1 in comparison to check variety, ML-131 (Fig. 3). At all the locations, SMS-1 performed better than the check variety, showing on an average an increase of 25.097%.

Wherever, the improved selection SMS-1 was used as one of the production factors, number of days taken to flower by mungbean was significantly less (45.00 days), while the local variety, ML-131 took 50.00 days to flower

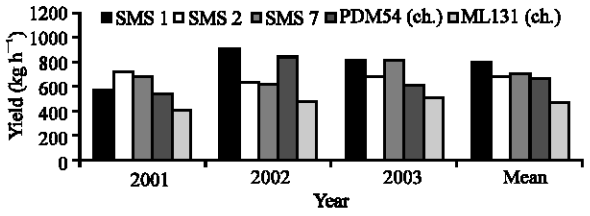

Fig. 1: Comparative performance of mungbean variety SMS1 (kg ha^{-1}) over the years

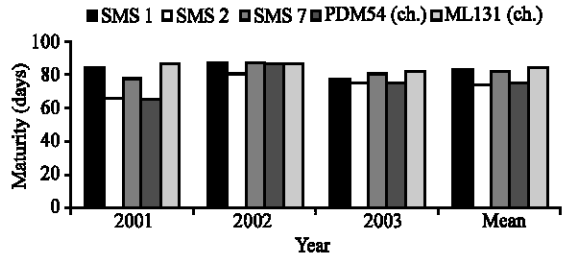

Fig. 2: Comparative days to maturity of mungbean variety SMS1 over the years

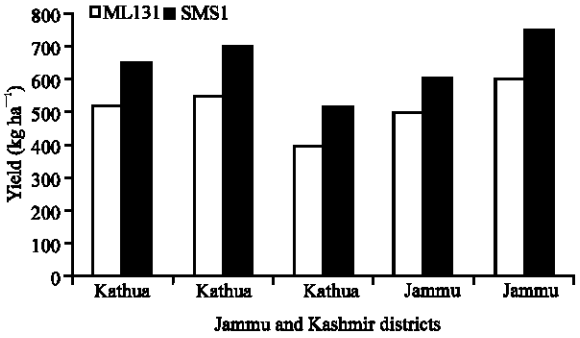

Fig. 3: Performance of mungbean variety SMS1 in on farm trials conducted in different villages of two districts during the year 2003

(Table 2). Further, plant height was significantly reduced in the improved variety (88.54 cm) in comparison to the local variety (101.79 cm). Where fertilizer application was one of the factors, an increase in plant height was recorded both in case of improved as well as local variety. Number of branches per plant was not affected by the

Table 2: Impact of various production factors on days to flowering, plant height and number of branches per plant

Treatments	Days to 50% flowering	Plant height	No. of branches/plant
Farmer's practice	50.00	101.79	3.33
Improved variety	45.00	88.54	2.53
Fertilizer only	51.00	106.56	3.20
Weed control only	50.67	96.17	3.27
Plant protection only	50.00	102.68	3.00
Improved var.+fertilizer	45.00	91.78	3.00
Improved var.+weed control	45.00	85.99	3.20
Improved var. +plant protection	44.00	82.97	2.87
Improved var.+fertilizer+weed control	45.33	98.77	3.13
Improved var.+fertilizer+plant protection	45.00	93.26	3.13
Fertilizer+weed control	51.00	104.43	3.27
Fertilizer + plant protection	50.67	103.77	3.13
Fertilizer+weed control+plant protection	50.00	104.81	2.60
Plant protection+weed control	50.67	103.09	3.07
Improved var.+fertilizer+weed control+plant protection	45.00	94.21	2.47
SE (m)	0.53	2.46	0.22
CD at 5%	1.54	7.17	NS

NS: No Significant

Table 3: Impact of several production factors on yield and its attributes

Treatments	No. of pods/plant	Seeds/pod	100 seed weight	Grain yield (kg ha^{-1})
Farmer's practice	31.47	11.80	3.40	715.63
Improved variety	29.40	12.73	6.87	890.00
Fertilizer only	27.93	11.40	3.43	759.50
Weed control only	26.47	11.67	3.37	744.04
Plant protection only	26.60	11.53	3.27	743.15
Improved var.+fertilizer	29.00	12.33	3.67	1026.33
Improved var.+weed control	28.53	12.40	3.50	975.74
Improved var.+plant protection	27.27	12.13	3.53	919.67
Improved var.+fertilizer+weed control	27.93	12.80	3.73	1034.67
Improved var.+fertilizer+plant protection	25.93	12.87	3.70	982.67
Fertilizer+weed control	30.00	11.60	3.43	785.50
Fertilizer + plant protection	25.00	11.87	3.30	771.33
Fertilizer+weed control+plant protection	25.00	12.20	3.33	818.83
Plant protection+weed control	24.80	11.53	3.40	789.83
Improved var.+fertilizer+weed control+plant protection	29.20	12.87	3.73	1042.00
SE (m)	2.31	0.41	0.07	43.08
CD at 5%	NS	NS	0.19	125.44

NS: No Significant

various production factors. Contrarily, non-significant change in plant height in urdbean in response to nitrogen management has been noted by Mishra and Mishra (1995) and Singh and Singh (2004).

Likewise, the yield attribute, number of pods per plant as well as seeds per pod showed no significant variation with the different production factors (Table 3). Similarly, Mishra and Mishra (1995) and Singh and Singh (2004) found number of pods/plant and number of grains/pod to increase with fertilizer application. Selection, SMS-1 per se or in combination with the other production factors showed higher 100 seed weight as compared the local check variety, ML-131. Mung crop grown with conventional farmer's practice recorded significantly lowest grain yield (715.63 kg ha^{-1}) and it increased with improved production technology (Table 3). Individual effect of the four factors on grain yield of mung was observed to be most significant due to improved variety. Two factor treatments having improved variety out-yielded all other treatments where local mung variety was used as seed material.

Significantly highest grain yield (1042.00 kg ha^{-1}) of mungbean was obtained in the treatment where improved variety was grown with recommended dosage of fertilizers, weed control and plant protection measures (Table 3). This was closely followed by the treatments where improved variety and fertilizer application were clubbed with weed control (1034.67 kg ha^{-1}) or plant protection (982.67 kg ha^{-1}). However, in the other three-factor treatment (fertilizer) +weed control+plant protection) where improved variety was not one of factors, the grain yield of mung declined conspicuously. The results were in accordance with those of Bhalu *et al.* (1995) and Mishra and Ali (1998), who observed an increase in seed yield of urdbean with the application of phosphorus. Likewise, application of 45 kg P_2O_5 increased number of pods/plant, number of seeds/pod, test weight as well as seed yield in mungbean (Shukla and Dixit, 1996; Sharma and Singh, 1997; Singh and Pareek, 2003). Similar significant increase in urdbean seed yield and its attributes as influenced by weed management practices have been recorded by Singh *et al.* (2006).

Table 4: Pest incidence as affected by the various production factors

Treatments	Defoliation (%)**	No. of whiteflies/3 leaves *	Yellow mosaic infected plants (%)**
Farmer's practice	5.28 (13.26)	0.53 (1.23)	0.83 (4.19)
Improved variety	4.48 (12.06)	1.63 (1.62)	0.20 (1.49)
Fertilizer only	8.62 (17.03)	0.53 (1.24)	0.66 (3.79)
Weed control only	4.65 (12.41)	1.00 (1.41)	0.42 (2.15)
Plant protection only	2.03 (8.17)	1.07 (1.41)	0.47 (3.22)
Improved var.+fertilizer	5.92 (13.99)	1.20 (1.47)	0.37 (2.85)
Improved var.+weed control	4.01 (11.54)	1.17 (1.45)	1.01 (4.40)
Improved var. +plant protection	1.64 (7.35)	0.40 (1.18)	0.36 (2.78)
Improved var.+fertilizer+weed control	5.93 (14.06)	0.63 (1.27)	0.58 (2.54)
Improved var.+fertilizer+plant protection	2.50 (9.06)	0.43 (1.19)	0.47 (3.21)
Fertilizer+weed control	5.48 (13.52)	0.73 (1.32)	0.73 (2.83)
Fertilizer + plant protection	4.35 (11.99)	1.53 (1.59)	0.34 (1.93)
Fertilizer+weed control+plant protection	4.95 (12.85)	1.50 (1.55)	0.20 (1.46)
Plant protection+weed control	2.87 (9.73)	0.67 (1.28)	0.74 (3.89)
Improved var.+fertilizer+weed control+plant protection	2.98 (9.89)	0.93 (1.38)	2.02 (3.56)
SE (m)	(0.62)	(0.12)	(2.21)
CD at 5%	(1.81)	(NS)	(NS)

**Figures in parenthesis are arc-sine transformed values, *Figures in parenthesis are square-root transformed values, NS: No Significant

Percent defoliation by general defoliators significantly increased by fertilizer application and decreased by the application of plant protection measures irrespective of the mung variety grown (Table 4). Hence the two factor treatment (improved selection + plant protection) recorded the lowest defoliators attack (1.64%), while where only fertilizer was applied to the local variety, maximum Percent defoliation (8.62%) was noticed. Further, the whiteflies number as well as% YMV infected plants did not differ significantly with any of the treatments and the overall infestation of whiteflies or infection of YMV was low.

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