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Influence of Sowing Date on Growth and Yield of Summer Mungbean Varieties

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ABSTRACT

Four mungbean [*Vigna radiata* (L.) Wilczek] varieties viz. BINA moog2, BINA moog5, BINA moog6 and BINA moog7 were sown at 10 day intervals starting from 20 February to 11 April to identify the suitable variety (s) and optimum sowing date for getting maximum yield of summer mungbean. Among the varieties BINA moog7 was ranked first in terms of seed yield (938.40 kg ha^{-1}) followed in order of BINA moog6 (711.72 kg ha^{-1}), BINA moog5 (684.00 kg ha^{-1}) and BINA moog2 (547.80 kg ha^{-1}). BINA moog6 matured earlier than the other three varieties. The highest seed yield (969.62 kg ha^{-1}) was obtained from 2 March sowing followed by 20 February (917.54 kg ha^{-1}) and 12 March sowing (869.52 kg ha^{-1}). Sowing after 2 March gradually decreased the seed yield producing the lowest value (388.87 kg ha^{-1}) at 11 April sowing. In general, delayed sowing enhanced the maturity. BINA moog7 yielded the highest (1201.32 kg ha^{-1}) when sown on 2 March, which was statistically similar to 20 February and 12 March sowing. Therefore, summer mungbean variety BINA moog7 may be sown during the period from 20 February to 12 March for higher seed yield and for late sowing, BINA moog6 may be considered as it matures earlier than others.

Key Words: Sowing date; Variety; Seed yield; Summer mungbean

INTRODUCTION

Mungbean (*Vigna radiata* L. Wilczek) is one of the important pulse crops, which contains high quality vegetable protein and satisfactory amounts of minerals and vitamins. Due to easy digestibility, better palatability and high market price, mungbean is the first choice to the farmers. The agro-ecological condition of Bangladesh is favorable for growing mungbean in the winter season although it is cultivated in both summer and winter seasons in many countries of the world (Bose, 1982). Recently, farmers are not much interested in growing pulse crops in winter season. Besides these, increasing area under wheat and irrigated *boro* rice cultivation has further reduced the area under pulses. Therefore, it has become imperative to shift the cultivation of some of the low yielding pulses from winter to summer seasons.

The possibility of growing mungbean in the summer season in Bangladesh is tried with some success (FAO, 1984). A good number of high yielding mungbean varieties are available now in Bangladesh but, farmers generally grow the local varieties using almost no fertilizer and they rarely maintain the proper sowing time. Moreover, farmers are loosing interest in producing mungbean due to low income per unit of resources invested. Therefore, attention should be given to increasing yield through selection of suitable varieties and adoption of improved cultural practices for establishing mungbean as a profitable crop.

For any yield improvement programme selection of superior parents is a prerequisite i.e., possessing better heritability and genetic advance for various traits (Ahmad *et al*., 2008). Sowing time, a non-monetary input, is the single most important factor to obtain optimum yield from mungbean (Samanta *et al*., 1999). So determination of optimum sowing time for mungbean is inevitable. Optimum time of sowing of mungbean may vary from variety to variety and season to season due to variation in agro-ecological conditions. Therefore, there must be a specific sowing dates, especially in the summer season for different varieties to obtain maximum yield. Delayed sowing after March and early sowing before February reduce yield of summer mungbean (Chovatia *et al*., 1993). February may be considered as the optimum time for summer mungbean and late planting after March may subject to rain damage during maturity period (Dharmalingam & Basu, 1993). The present investigation was therefore, undertaken to identify the suitable variety (s) and sowing time of summer mungbean.

MATERIALS AND METHODS

The experiment was carried out at the Agronomy Field laboratory, Bangladesh Agricultural University,

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Mymensingh, Bangladesh during February to June 2007 with four high yielding summer mungbean varieties viz. BINA moog2, BINA moog5, BINA moog6 and BINA moog7 sown at six different dates viz. 20 February, 2 March, 12 March, 22 March, 1 April and 11 April. The experiment was laid out in a randomized complete block design and was replicated twice. The experimental site was located at $24^o75^/$ north latitude and $90^o50^/$ east longitude at an elevation of 18 m above the mean sea level. The site was non-calcareous dark grey flood plain soil under Old Brahmaputra Floodplain "AEZ-9" (UNDP & FAO, 1988).

The climate of the area was sub-tropical characterized by high temperature and heavy rainfall during the summer season (April to September) and low rainfall associated with moderately low temperature during *rabi* season (October to March). The average temperature recorded in different months during the experimental period were 20.57^{o}C (February), 23.45^{o}C (March), 26.30^{o}C (April), 29.05^{o}C (May) and 30.36^{o}C (June), while the total monthly rainfall was 55.2, 18.5, 207.9, 96.8 and 862.3 mm, respectively. The experimental field was a medium highland with well drained clay loam textured soil having a pH value of 6.8. The unit plot size was 2.5 m × 2.0 m. The experimental plots were fertilized with triple super phosphate and muriate of potash @ 75 and 40 kg ha^{-1} at the time of final land preparation. No nitrogenous fertilizer was applied but seeds were inoculated with *Rhizobium* bio-fertilizer before sowing. Spacing was maintained as 25 × 10 cm. Weeding was done twice at 15 and 30 days after sowing followed by thinning, where necessary. Irrigation was not given since the crop was grown as rainfed and sufficient rainfall occurred during the growing season. Data on yield components were taken from five randomly selected plants of each plot and grain and stover yields were taken from the whole plot. Data on days to first flowering and first harvesting were also recorded. The recorded data were analyzed statistically following the computer package MSTAT and means were separated by Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Effect of variety. Mungbean varieties differed significantly among themselves in respect of yield contributing characters and yield (Table I). BINA moog7 was ranked first in terms of seed yield followed in order of BINA moog 6, BINA moog 5 and BINA moog2. Highest number of pods plant^{-1}, seeds pod^{-1} and seeds plant^{-1} mostly contributed to the highest seed yield of BINA moog 7. The lowest seed yield on the other hand, was recorded with BINA moog 2, which was the consequence of lowest numbers of pods plant^{-1}, seeds pod^{-1}, seeds plant^{-1} and lower 1000-seed weight. BINA moog 6 produced the second highest seed yield, which was mostly the outcome of maximum 1000-seed weight along with greater number of pods plant^{-1} and seeds pod^{-1}. The differences among the varieties might be due to their genetic constituents. These findings closely resembles to those obtained by BINA (2007), BINA (2006), Siddique *et al*. (2006), Mondal (2004) and Patil *et al*. (2003).

Like seed yield the highest stover yield and harvest index were also recorded with BINA moog7. Variation in stover yield and harvest index among mungbean genotypes have also been reported by many researchers (Tomar & Tiwari, 1996; Sarkar *et al*., 2004; BINA, 2007). BINA moog5 and BINA moog2 produced the highest and statistically similar plant height. BINA moog 2 performed the worst in terms of seed yield but required maximum days to first flowering and accordingly maximum duration for first harvesting, which was statistically similar to that required by BINA moog 5. BINA moog 6, on the other hand, took minimum time for first flowering and for first harvest as well. Variation in flowering and maturity time among varieties are mostly governed by the genetic make up of the respected variety.

Effect of sowing date. Seed yield of summer mungbean was significantly influenced by sowing date (Table I). Results revealed that 2 March sowing produced the highest seed yield, which resulted from the highest number of pods plant^{-1}, seeds pod^{-1} and seeds plant^{-1}. Sowing after 2 March gradually decreased the seed production and 11 April sowing produced the lowest yield. Soomro (2003) reported that delay in sowing causes a substantial decrease in all the growth and development parameters of mungbean. The highest seed yield obtained from 2 March sowing might be due to suitable temperature prevailing accompanied by higher soil moisture content due to sufficient rainfall in April, which enhanced the vegetative as well as reproductive growth of the crop. This findings closely resembles to those reported by Sinha *et al*. (1989) and Poehlman (1991) who opined that mungbean being a warm season plant produces higher yield at the optimum mean temperature range of 25-30^{o}C. Sowing in the month of April (1 April & 11 April) resulted in lower yield than other sowing dates, which was the consequence of high insect (flower & pod borer) infestation occurred due to high air temperature (above 30^{o}C) and excessive rainfall during pod filling stage in the month of June. Pohelma (1991) also concluded that high air temperature accompanied by heavy rainfall caused flower shedding and pod damage, which resulted in reduced seed yield.

Sowing on 11 April (last sowing date) produced the highest stover yield, which was closely followed by 1 April sowing. The lowest stover yield on the other hand, was observed in 12 March sowing. Harvest index followed the similar trend as found in seed yield producing the highest value at 2 March sowing. The lowest harvest index was calculated from the last sowing (11 April), which might be due to elevated ambient temperature and higher cumulative rainfall that enhanced vegetative growth of the crop resulting in larger canopy but few pods, as reported by Gaaster (1993).

Among the yield contributing characters seeds plant^{-1} and pods plant^{-1} were the highest on 2 March, but the lowest

Table I. Yield contributing characters and yield of summer mungbean as influenced by variety and sowing date

Treatments	Plant height (cm)	Days to first flowering	Days to first harvesting	Pods plant^{-1} (no)	Seeds pod^{-1} (no)	Seeds plant^{-1} (no)	1000-seed weight (g)	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)
Variety										
BINA moog2	58.6a	35.8a	67.4a	12.4c	6.6c	106.3d	34.4c	547.8c	1695.1d	24.0d
BINA moog5	59.3a	35.3a	67.0a	14.8b	7.2b	120.4c	39.8b	684.0b	1873.7b	26.1c
BINA moog6	35.9c	29.4c	56.8c	14.7b	7.8b	130.4b	46.7a	711.4b	1662.9c	28.1b
BINA moog7	47.6b	34.3b	65.9b	18.9a	9.7a	170.8a	27.6d	938.4a	2254.0a	29.2a
Level of significance	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
S_X	0.88	0.20	0.25	0.28	0.10	1.38	0.89	12.08	8.08	0.14
Sowing Date										
20 February	34.3e	41.4a	70.6a	21.9b	9.1b	202.5b	38.6	917.5b	1824.9d	33.4b
2 March	43.7d	36.9b	67.9b	23.9a	10.1a	241.2a	37.4	969.6a	1856.32c	34.2a
12 March	51.5c	34..0c	65.6c	20.1c	8.8b	182.1c	36.4	869.5c	1764.5e	32.7c
22 March	53.9c	31.5d	62.6d	13.7d	6.9c	95.7d	35.5	720.5d	1881.6c	26.8d
1 April	59.2b	30.1e	60.4e	8.6e	5.2d	44.0e	37.5	456.4e	1982.0b	18.4e
11 April	63.0a	27.2f	58.1f	6.1f	4.2e	26.4f	37.6	388.8f	2069.3a	15.5f
Level of signifance	0.01	0.01	0.01	0.01	0.01	0.01	NS	0.01	0.01	0.01
S_X	1.08	0.25	0.30	0.34	0.12	1.69	1.09	14.79	9.89	0.18
CV %	7.21	4.63	4.66	7.64	5.98	4.64	6.06	7.11	3.92	4.36

In a column, figures having similar letter(s) or without letter does not differ significantly whereas, figures with dissimilar letters differ significantly as per DMRT

NS= Not significant, S_X= Standard error of means, CV= Coefficient of variation

Table II. Yield contributing characters and yield of summer mungbean as influenced by the interaction between variety and sowing date

Interaction (variety × sowing date)		Plant height (cm)	Days to first flowering	Days to first harvesting	Pods plant^{-1} (no)	Seeds pod^{-1} (no)	Seeds plant^{-1} (no)	1000-seed weight (g)	Seed yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Harvest index (%)
	20 February	51.5 hi	44.5 a	73.4 a	18.5 d-f	8.0 f-h	151.8 h	35.4	708.6 ef	1617.4 mn	30.5 ef
	2 March	52.8 gh	38.7 c	71.4 bc	20.1 c-f	8.8 d-f	178.5 fg	34.7	771.3 de	1652.4 lm	31.7 d
	12 March	58.8 d-g	35.5 de	68.3 d	14.4 fg	7.8 f-h	136.8 i	33.4	659.2 fg	1575.5 n	29.5 f
BINA moog2	22 March	58.9 d-g	32.5 gh	65.4 e	14.6 gh	6.9 h-j	101.5 j	32.9	501.7 hi	1704.7 kl	22.5 h
	1 April	62.3 a-d	32.5 gh	63.2 fg	9.9 ij	4.4 m	44.4 lm	35.5	353.6 jk	1785.5 ij	16.6 k
	11 April	67.4 ab	26.3 kl	60.4 hi	6.1 k	3.6 m	25.2 n	34.5	291.7 k	1835.3 hi	13.3 m
	20 February	45.3 ij	42.4 b	72.4 ab	21.6 bc	8.6 ef	186.5 m	42.4	884.6 c	1824.6 hi	32.5 cd
	2 March	53.5 f-h	39.2 c	70.6 bc	23.4 b	9.9 b-d	233.6 d	38.3	915.2 bc	1860.2 gh	33.1 c
	12 March	60.1 c-f	36.3 d	68.3 d	21.5 b-d	8.2 fg	178.1 fg	38.2	834.8 cd	1785.5 ij	31.7 d
BINA moog5	22 March	62.4 a-d	33.3 fg	65.3 e	9.8 ij	6.3 i-k	61.5 k	39.5	686.9 e-g	1875.5 gh	26.7 g
	1 April	66.4 a-c	31.3 h	63.3 fg	6.9 jk	5.6 kl	38.5 l-n	40.7	433.8 ij	1911.5 fg	18.3 j
	11 April	68.0a	29.4 i	62.2 gh	5.67 k	4.3 m	24.6 n	39.5	349.32 jk	1985.4 e	14.5 l
	20 February	28.8 k	34.4 ef	64.3 ef	21.1 b-e	9.5 c-e	202.4 e	48.0	907.5 bc	1660.8 lm	35.4 ab
	2 March	28.8 k	31.5 h	59.2 ij	23.6 b	10.6 ab	250.4 c	48.4	990.4 b	1744.2 jk	36.2 a
	12 March	41.1 j	29.4 i	57.5 j	18.4 e-f	8.9 d-f	164.3 gh	46.4	853.5 cd	16.6.5 mn	34.4 b
BINA moog6	22 March	43.8 j	28.3 ij	55.2 k	12.7 hi	7.3 g-i	95.6 j	44.0	703.7 e-g	1739.3 jk	27.6 g
	1 April	53.9 e-h	27.3 j-l	53.4 l	7.2 jk	6.1 jk	44.3 lm	47.3	423.5 ij	1885.3 f-h	18.3 j
	11 April	60.9 b-e	25.7 l	51.5 m	5.5 k	4.4 m	25.6 n	46.6	389.8 j	1941.1 ef	16.4 k
	20 February	39.5 j	44.3 a	72.4 ab	26.5 a	10.3 a-c	269.7 b	28.5	1170.2 a	2196.9 c	35.5 ab
	2 March	39.9 j	38.3 c	70.2 c	28.5 a	11.2a	302.6 a	28.3	1201.3 a	2168.3 c	36.3 a
	12 March	45.9 ij	34.6 ef	68.3 d	23.1 bc	10.4 a-c	249.3 c	27.7	1130.6 a	2090.5 d	35.3 ab
BINA moog7	22 March	50.5 hi	32.0 gh	64.4 ef	17.6 fg	7.0 h-j	1247.4 i	25.3	989.9 b	2207.1 c	30.6 e
	1 April	54.1 e-h	29.2 i	61.5 gh	10.5 i	4.7 lm	48.6 kl	26.4	614.4 g	2345.6 b	20.5 i
	11 April	55.8 d-h	27.3 jk	58.3 j	7.0 jk	4.3 m	30.2 mn	29.5	524.5 h	2515.4 a	17.7 j
Level of significance		0.01	0.01	0.01	0.01	0.01	0.01	NS	0.01	0.01	0.01
S_X		2.17	0.50	0.61	0.98	0.35	4.78	2.18	29.59	19.80	0.36
CV		7.21	4.63	4.66	7.64	5.98	4.64	6.06	7.11	3.92	4.36

In a column, figures having similar letter(s) or without letter does not differ significantly whereas, figures with dissimilar letters differ significantly as per DMRT

NS= Not significant, S_X= Standard error of means, CV= Coefficient of variation

on last sowing (11 April). Plant height increased gradually with delay in sowing due to increased temperature as reported by Poehlman (1993). Number of days required for first flowering was reduced with delay in sowing; the resultant effect might be due to increased temperature. Crop sown on 20 February required 41 days to reach first flowering stage, while crop sown on 11 April attained the same stage in 27 days only. Days required for first harvesting also followed the similar trend. The last sown crop took only 58 days to allow first harvesting, which was mainly due to earliest flowering. On the other hand, the crop sown earliest required more than 70 days for first harvesting this might be due to delayed flowering.

Effect of interaction. Interaction between variety and sowing date significantly influenced all the yield contributing characters (except 1000-seed weight) and yield of summer mungbean (Table II). Results revealed that BINA moog7 yielded the highest when sown on 2 March, which was statistically similar to 20 February and 12 March sowings. Yield contributing characters like number of pods plant^{-1}, seeds pod^{-1} and seeds plant^{-1} contributed to the highest seed yield. The interactions of BINA moog5 × 2 March sowing, BINA moog6 × 20 February sowing, BINA moog6 × 2 March sowing and BINA moog7 × 22 March sowing produced similar and the second highest seed yield. On the other hand, BINA moog2 sown on or after 1 April and BINA moog5 sown on 11 April yielded the lowest. BINA moog7 interacted favorably with 11 April sowing to produce the highest stover yield. The interaction between BINA moog7 and 2 March sowing showed the highest harvest index statistically followed by the interaction of BINA moog7 and 20 February sowing, BINA moog6 and 2 March sowing and BINA moog6 and 20 February sowing. The least time for first flowering was required by BINA moog2 and BINA moog6 when sown on the last date (11 April). BINA moog2 and BINA moog7 required the maximum days to initiate flowering when sown early in the season (20 February). All the varieties except BINA moog6 required maximum duration for first harvests when sown on 20 February. However, BINA moog6 took minimum time to allow first harvesting when sown on 11 April followed by 1 April, 20 March and 12 March sowings.

CONCLUSION

Summer mungbean genotypes differ in their yield potential and sowing date tremendously influences their yield performance. Among the varieties, BINA moog7 was the most promising. Sowing should preferably be done around12 March and no sowing is desirable beyond 22 March. For obtaining higher seed yield, summer mungbean variety BINA moog7 may be sown during the period from 20 February to 12 March. The other options may be BINA moog5 sown around 2 March or BINA moog7 sown around 22 February. However, when late sowing is inevitable BINA moog5 can be considered as it matures earlier than others.

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