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Bangladesh J. Agril. Res. 34(2) : 335-342, June 2009 **Short Communication**

EFFECT OF SOWING TIME AND CULTIVARS ON THE GROWTH AND YIELD OF CHICKPEA UNDER RAINFED CONDITION

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A study was conducted to see the effect of sowing time and cultivars on the growth and yield performance of chickpea under rainfed condition. Three chickpea varieties viz., BARI Chola-2, BARI Chola-4, and BARI Chloa-6, and five different sowing times viz., i) 22 November 2000, ii) 2 December 2000, iii) 12 December 2000, iv) 22 December 2000 and 1 January 2001 were tested. The varieties showed significant difference in case of plant height, canopy coverage, 100-seed weight, yield/ha, and harvest index. Sowing time showed significant difference with respect to plant height, crop growth rate, canopy coverage, number of pods/plant, number of seeds/pod, yield/ha and harvest index. Interaction effects between variety and sowing time had shown significant difference on plant height, canopy coverage, number of pods/plant, seed yield/ha, and harvest index. Results revealed that the performance of BARI Chola-4 was the best in case of pods/plant, yield and also harvest index among the varieties. However, seed yield was reduced consequently as the date of sowing was delayed. The late November sowing produced the highest seed yield and harvest index. The study further revealed that sowing date could be delayed upto early December to get satisfactory yield. So, it was suggested that BARI Chola-4 could be sown upto early December under rainfed condition for better yield.

Chickpea ranks third in terms of area contributing around 12% of total pulse production of Bangladesh (BBS, 2000). It is grown in Bangladesh as rainfed *rabi* crop. Cropping system in Bangladesh is mainly rice based where chickpea is grown in the post-rainy season, mainly in two sequential cropping patterns: Rice/Jute (April-August) - Fallow (August-October) - Chickpea (November-April); and Rice (July-December)-Chickpea (December-April)-Fallow (April-June). The November-April period is considered optimal for chickpea; thus about 60-65% of chickpea is grown in the first pattern. In the second pattern, chickpea sowing is delayed until rice harvest. However, mid November is considered to be the optimum time for sowing chickpea in Bangladesh except in Barind Tract (Rashid *et al.,* 1999). But at that time in most cases, land is not ready for chickpea sowing due to late harvesting of T. Aman rice. The low yield of the

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crop is characterized by several biotic and abiotic factors. Yield loss in chickpea can vary between 30% and 60% depending on genotype, sowing time, location, and climatic conditions during sowing season. Some chickpea genotypes have capacity to tolerate drought and in that case sowing time can be delayed. However, earlier or late sowing caused drastic reduction in yield and net profit compared with timely sowing (Dixit *et al.*, 1993). Hence, the study was aimed to identify suitable variety, appropriate sowing time and their interaction with respect to growth and yield performance.

The experiment was conducted at Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur, Bangladesh during November 2000 to April 2001. The experimental area is shallow red-brown terrace soil under Madhupur Tract (AEZ-28), Salna series (Haider *et al.*, 1991). The soil was silty-clay loam. The experiment was laid out in a factorial randomized complete block design (RCBD) with three replications. Three chickpea varieties viz., BARI Chola-2 (V_1), BARI Chola-4 (V_2), and BARI Chola-6 (V_3) and five different sowing times viz., i) 22 November 2000 (S_1), ii) 2 December 2000 (S_2), iii) 12 December 2000 (S_3), iv) 22 December 2000 (S_4) and 1 January 2001 (S_5) were included in the study. Before final land preparation N, P, and K at the rate of 20, 25, 30 kg/ha were applied through urea, Tirple Super Phosphate (TSP), and Muriate of Potash (MP), respectively. The unit plot size was 4m x 3m, Spacing was maintained 40 cm between rows and 10 cm within the rows. No irrigation was applied during the experimentation, but a starter irrigation of 3.33 cm was provided to facilitate germination. Seeds were treated with Vitavax-200 @ 3g/kg before sowing. Plants were thinned to give a uniform plant stand. Ripcord 60 EC @ 0.2% was sprayed 2 times to control pod borer. The harvesting was done at different dates, as the maturity period of the treatment was not same. Data on plant height, dry matter accumulation (TDM), number of pods/plant, number of seeds/pod, seed yield/plant and seed yield/ha were recorded and analyzed statistically. The difference between treatments means were compared by Duncan's Multiple Range Test (DMRT).

The varieties showed significant difference in case of plant height and insignificant in case of total dry matter production and crop growth rate. BARI Chola-4 produced the tallest plants (32.30 cm) being closely followed by BARI Chola-2 (30.9 cm). The shortest plants (29.26 cm) were found in BARI Chola-6. Variation among the varieties in respect of plant height appears due to genotype variation. Chickpea varieties showed significant difference with respect to plant height and crop growth rate in different sowing times. The tallest plants (33.63 cm) were observed in early sowing in the last week of November, which was statistically significant over delay sowing at late December and at early January. Interaction effects of variety and sowing time had shown significant difference on plant height and canopy coverage but insignificant in case of total dry mater

production (Table 1). The tallest plant height (36.91 cm) was observed in BARI Chola-4 at 22 November sowing, which was statistically similar to BARI Chola-2 at 12 December and 22 November sowing, BARI Chola-4 at 2 December sowing and also BARI Chola-6 at 2 December sowing. The lowest plant height was observed in BARI Chola-6 at 1 January sowing. The cause of plant height reduction might be happened due to rapid rise in temperature as well as depletion of soil moisture. Siddique *et al.* (1999) reported that drought stress reduced plant height by 4% and 8% at vegetative and anthesis stage, respectively, in wheat. Bahl (1984) also found significant differences in plant height between sowing time and genotype interactions in chickpea. Maximum canopy coverage was found in BARI Chola-6 in late November sowing and the lowest was in BARI Chola-2 in early January sowing.

Table 1. Interaction effect of variety and sowing time on plant height, canopy coverage and total dry matter (TDM).

Variety x Sowing time	Plant height (cm)	Canopy coverage (cm^2)	TDM (g/m^2)
V_1S_1	33.98 ab	934 bc	27.42
V_1S_2	30.92 bc	756 cde	24.78
V_1S_3	36.37 a	642 defg	20.42
V_1S_4	27.93 cde	481 fghi	18.90
V_1S_5	25.30 de	291 i	13.70
V_2S_1	36.91 a	1002 b	23.25
V_2S_2	33.23 abc	855 bcd	23.08
V_2S_3	30.44 bcd	692 cdef	20.00
V_2S_4	30.00 bcde	584 efgh	18.88
V_2S_5	30.93 bc	360 hi	18.55
V_3S_1	30.00 bcde	1220 a	28.33
V_3S_2	31.93 abc	788 bcde	27.45
V_3S_3	29.15 bcde	733 cde	25.03
V_3S_4	30.37 bcd	574 efgh	20.55
V_3S_5	24.83 e	431 ghi	20.20
CV (%)	8.97	18.86	9.07

V_1= BARI Chola-2, V_2=BARI Chola-4, V_3= BARI Chola-6

S_1=22 November sowing, S_2= 2 December sowing, S_3= 13 December sowing, S_4= 22 December sowing and S_5= 1 January sowing.

The crop growth rate (CGR) increased gradually as the plant grew up from emergence to 75 DAE irrespective of variety, but declined afterwards (Fig. 1) Sowing date influenced the crop growth rate variably. Hussain *et al.* (1997) observed the comparative, superior performance of early sowing to late sowing in TDM production and explained that this might be due to higher leaf area index (LAIs). Post-flowering CGR was higher than pre-flowering CGR (Fig. 1). However, as sowing was delayed to early January, the CGR was decreased. Hussain *et al.* (1997) also found the similar results.

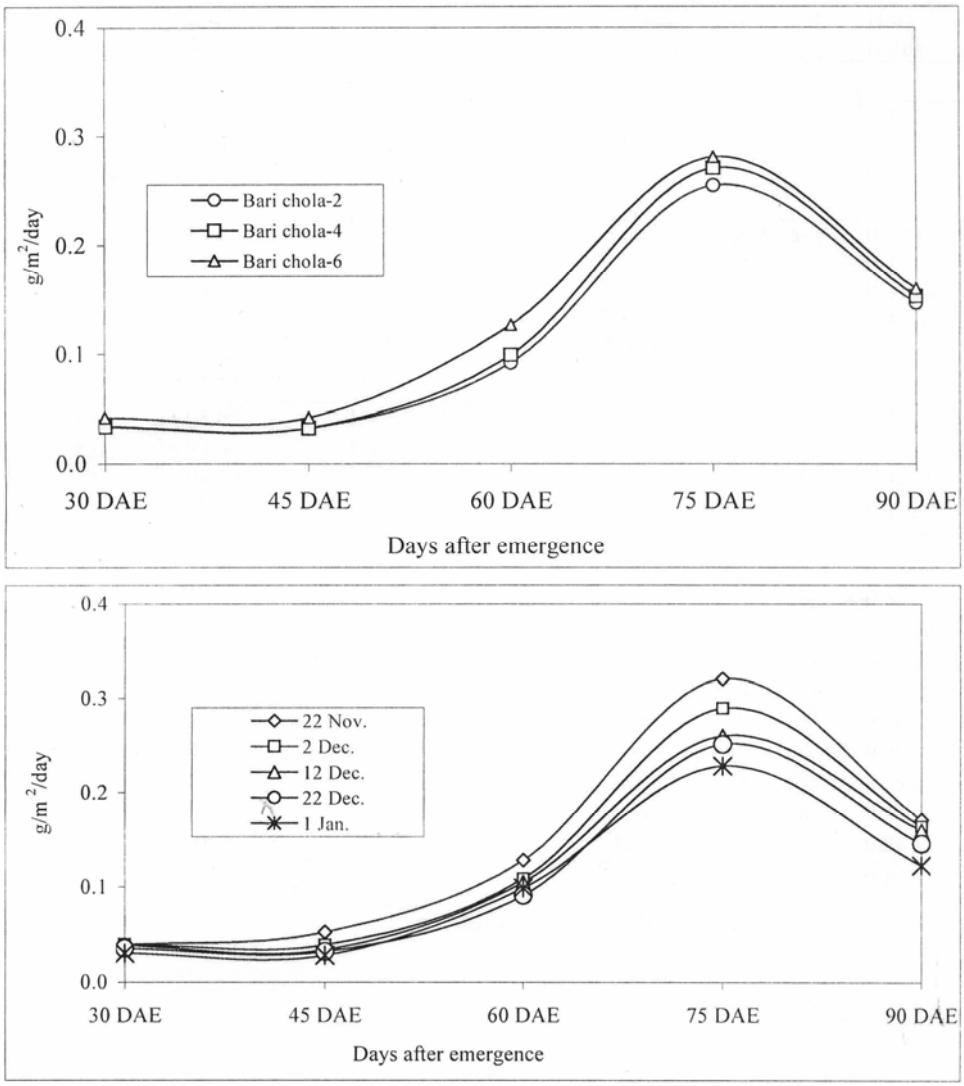

Fig. 1. Crop growth rate (CGR) as affected by variety and sowing time.

Chickpea varieties did not show significant difference in case of number of pods/plant, number of seeds/pod and seed yield/plant, but significant in case of 100-seed weight, seed yield/ha and harvest index (Table 2). The highest number of pods/plant and seeds/pod were observed in BARI Chola-4, which was statistically at par with BARI Chola-2. But the heaviest seed weight was observed in BARI Chola-6 and lowest seed weight was observed in BARI Chola-4, which was statistically at par with BARI Chola-2, which might be due to genotypic variation. The highest seed yield per plant was found in BARI Chola-4, which was statistically similar with BARI Chola-2. This was because of higher number of pods/plant and also number of seeds/pod. Therefore, the highest seed yield per hectare was found in BARI Chola-4. The lowest seed yield per hectare was found in BARI Chola-6, which was statistically similar with BARI Chola-2. Similar result was found for harvest index in three chickpea varieties. Sowing time of chickpea varieties showed significant differences in number of pods/plant, number of seeds/pod, yield/plant, yield/ha, and harvest index, but insignificant in case of 100-seed weight (Table 2). The highest number of pods was obtained from 22 November sowing and it was statistically identical to 2 and 12 December sowing, although a declining trend was observed upto 1 January sowing. So, variation in sowing time beyond optimum was found to decrease the number of pods per plant and it was also reported earlier by Dixit *et al.* (1993). The highest number of seeds per pod was observed in 22 November sowing, which was statistically at par with 2 and 12 December sowing, but the lowest number of seeds per pod was found in January sowing. As no rainfall occurred during the growing season and gradual depletion of soil moisture may affect on the growth of chickpea plants as a result, a declining trend of number of pods per plant and also seeds per pod was observed. The 100-seed weight was not influenced by the variation in sowing dates, which was supported by Nawaz *et al.* (1995). The 100-seed weight is an inherent conservative character, which was not usually affected by environmental changes unless the change was extreme. The highest yield/plant was found in 22 November sowing, which was significant over all other sowing dates. However, the yield/plant of 2, 12, and 22 December sowing were statistically identical. The highest seed yield/ha was found in 2 December sowing, which was statistically identical to 22 November sowing. The lowest seed yield per hectare was observed in 1 January sowing, which was statistically similar with 22 December sowing. As soil moisture at 0-20 cm depth decreases with the passes of time, there is a tendency to less availability of soil moistures which affects yield contributing characters and subsequently on seed yield per hectare. The highest harvest index was observed in 22 November sowing, which was statistically at par with 2 and 12 December sowing and the lowest harvest index was observed in 1 January sowing.

Table 2. Yield and contributing characters of chickpea as affected by variety, sowing time and their interaction.

Treatments		Pods/pant (No.)	Seeds/pood (No.)	100-seed wt (g)	Seed yield/ plant (g)	Seed yield (kg/ha)	Harvest Index
Variety							
BARI Chola-2		24.21 ab	1.32 ab	16.65 b	3.68 ab	764.46 b	0.42 b
BARI Chola-4		26.37 a	1.37 a	15.70 b	4.05 a	855.80 a	0.47 a
BARI Chola-6		21.27 b	1.26 b	20.87 a	3.50 b	709.57 b	0.40 b
Sowing time							
22 November		30.18 a	1.39 a	17.99	4.68 a	980.57 a	0.49 a
2 December		25.83 ab	1.37 a	17.06	3.98 b	895.51 a	0.44 ab
12 December		24.24 abc	1.31 ab	17.99	3.50 bc	727.24b	0.43 ab
22 December		21.79 bc	1.26 b	18.04	3.52 bc	681.38 bc	0.43 b
1 January		17.71 c	1.24 b	17.61	3.03 c	598.36 c	0.34 c
Interaction (Variety and sowing time)							
	S_1	24.93 bc	1.43	16.67	4.68	975.90 ab	0.48 abc
	S_2	28.93 bc	1.35	16.00	4.08	882.40 bcd	0.41 cd
V_1	S_3	31.07 ab	1.27	17.70	3.29	960.40 efgh	0.45 abcd
	S_4	18.50 bc	1.22	16.57	3.41	651.60 ghi	0.39 d
	S_5	17.60 bc	1.32	16.30	2.96	592.00 hi	0.38 d
	S_1	42.57 a	1.35	16.63	5.12	1057.00 a	0.51 ab
	S_2	21.30 bc	1.52	15.77	4.40	979.50 ab	0.53 a
V_2	S_3	21.30 bc	1.41	15.07	3.56	812.40 cdef	0.46 abcd
	S_4	26.77 bc	1.33	16.17	3.76	752.00 defg	0.46 abcd
	S_5	19.93 bc	1.22	14.87	3.39	678.10 efgh	0.39 d
	S_1	23.03 bc	1.40	20.67	4.25	899.70 bc	0.50 ab
	S_2	27.27 bc	1.24	19.40	3.46	824.60 cde	0.39 d
V_3	S_3	20.37 bc	1.25	21.20	3.66	678.90 fgh	0.39 d
	S_4	20.10 bc	1.23	21.40	3.39	610.60 ghi	0.44 bcd
	S_5	15.60 c	1.18	21.67	2.75	525.00 i	0.26 e
CV (%)		22.34	7.84	10.70	11.89	9.97	9.84

V_1= BARI Chola-2, V_2=BARI Chola-4, V_3= BARI Chola-6

S_1=22 November sowing, S_2= 2 December sowing, S_3= 12 December sowing, S_4= 22 December sowing and S_5= 1 January sowing.

The interaction between variety and sowing time showed significant difference in case of number of pods/plant, seed yield/ha and harvest index, but showed insignificant in case of number of seeds/pod, 100-seed weight and seed yield/plant (Table 2). The higher number of pods/plant was recorded from V_2S_1, which was statistically identical to V_1S_3. The lowest pods/plant was found in V_3S_5, which indicate that in delay sowing conditions, all the varieties showed poor pod formation. The highest seed yield was recorded in BARI Chola-4 in 22 November sowing and it was identically followed by V_1S_1 and V_2S_2. Bahl et al. (1984) reported that dates and genotypes interaction was highly significant for seed yield. The highest index was recorded from V_2S_2, which was statistically similar to V_1S_1, V_1S_3, V_2S_1, V_2S_4, V_3S_1, and V_3S_2 but higher over rest of the combinations. The harvest index was decreased as the sowing time delays irrespective of varieties. The lowest harvest index was recorded from V_3S_5. Bahl *et al.* (1984) reported that the harvest index was highly significant between sowing dates and genotypes interaction. Plainiappan (1985) stated, that increased harvest index resulted in the increased crop yield probably due to more partitioning of dry matter to reproductive parts. Overall poor yield of the chickpea varieties may be resulted from the higher evaporation rate, depletion of soil moisture over time as there was no rainfall during the growing season.

Interaction effect between variety and sowing time showed significant difference within plant height and canopy coverage. The performance of BARI Chola-4 was the best in terms of yield and harvest index among the varieties. However, seed yield was reduced consequently as the date of sowing was delayed. The study further revealed that sowing date could be delayed upto early December to get satisfactory yield. So, it was suggested that BARI Chola-4 could be sown upto early December under rainfed condition for better yield.

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