Indian J. Genet., **67**(3): 254-256 (2007)

Breeding for photo-period insensitive Tossa jute (*Corchorus olitorius* L.) with high fibre yield

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(Received: December 2006; Revised: October 2007; Accepted: November 2007)

Abstract

The reported photo-period insensitive *olitorius* mutant (German, maturing in 35-40 days after sowing) was crossed with photo-period sensitive standard variety, JRO 7835 and two selections (named as BCO 100 and BCO 120) were isolated from segregating F_2 generation based on flowering in 90 and 110 days respectively after sowing. Pedigree selection continued up to 8th generation when the flowering character became stable. These two selections and the standard JRO 7835 were sown every month throughout the year to test their sensitivity to photoperiod under varied day length in different months. The two selections flowered in almost 90 and 110 days throughout the year whereas the standard had variable days to flowering. The two selections (BCO 100 and BCO 120) along with three standard varieties (JRO 524, JRO 7835, JRO 878) were put to yield trial twice - on 1st April and 1st June. In case of the 1st sowing all entries were harvested at 100 days when only BCO 100 had flowering on 90 days. Here the yield of BCO 100 and BCO 120 significantly exceeded that in the standards. In case of the second sowing BCO 100 was also harvested on 100 days (flowering in 90 days) while others including BCO 120 were harvested at 120 days when all were in flowering stage as the critical photo-period prevailed on and around 15th September. Here the fibre yield of BCO 120 significantly exceeded all entries including BCO 100. However, the fibre yield of BCO 100 was at par with the standards though numerically slightly less. The yield trials and the sowing throughout the year conclusively proved the photoperiod insensitiveness of BCO 100 and BCO 120 and yield of BCO 120 had better yield as compared to that in the standard while BCO 100 had advantage of 20 days over the entries with equal fibre yield.

Key words: Tossa jute, photoperiod insensitive, fibre yield, jute

Introduction

The two cultivated species of jute (*Corchorus capsularis* L. & *C. olitorius* L.) are photo-period sensitive and their sowing time is scheduled in such a way to get maximum vegetative period before flowering (on and around 15th September as critical photoperiod 12 to 12.15 hours prevails at that time [1]) that enhances longer plant height producing more fibre yield. It is the established fact that more the plant height and basal diameter the more fibre yield. Recently two photoperiod insensitive *capsularis* varieties have been reported [2] and those were evolved by utilizing photoperiod insensitive capsularis mutant maturing in 60 days [3]. But so far no such olitorius variety has been evolved and reported. A photoperiod insensitive *olitorius* mutant (German) has been reported [4] which flowers in and around 35 days having very short vegetative period with very negligible fibre yield. Photoperiod insensitive varieties with economic fibre yield have the advantage of having wide sowing time without loss of fibre yield and can be fitted in multiple cropping system of cultivation. In the present investigation an attempt has been made to evolve photoperiod insensitive recombinants with economic fibre yield by utilizing the reported photoperiod insensitive *olitorius* mutant.

Materials and methods

The F_1 seeds were raised by crossing the photoperiod insensitive mutant with standard variety, JRO 7835 that is sensitive to photoperiod. F_1 and parental seeds were sown and F_2 seeds were collected. From the segregating F_2 generation two recombinants (designated as BCO 100 and BCO 120) were selected based on their flowering on 90 and 110 days after sowing. Pedigree selection of these two recombinants continued up to 8th generation when the flowering behavior at 90 and 110 days became stable.

These two recombinants and their photo-period sensitive parent JRO 7835 were sown on the 1st day of every month throughout the year for noting their flowering behaviour. These two along with three sensitive controls (JRO 524, JRO 878, JRO 7835) were sown twice on 1st April and 1st June to evaluate their fibre yield at two different conditions with four replications and in 6m × 4.5 m plot (5.4m × 3.9 m net plot). Harvesting of 1st sowing was at 100 days after sowing and in 2nd sowing harvesting at 100 days for BCO 100 and at 120 days for the rest. Normal fertilizer

doses of NPK in 60:30:30 kg/ha was applied and normal agronomic practices were followed. The collected data were analyzed following standard statistical methods.

Results and discussion

Photoperiod insensitivity would be confirmed if any variety flowers on a fixed period throughout the year after sowing even under variable day length in different months. This was proved in case of *olitorius* German mutant and photo-insensitive *capsularis* recombinants [2, 5] Accordingly the two recombinants and one standard variety (which is sensitive to day length) were sown every month throughout the year, The flowering pattern showed the fixed period of flowering in the recombinants, BCO 100 and BCO 120, in 90 and 110 days, respectively throughout the year. But the standard variety, JRO 7835, had wide range of flowering – 53.6 to 139.5 days – depending on the available day length. The days to flower in JRO 7835 decreased in subsequent sowings up to July depending on the period available before prevailing critical photo-period on and around 15th September [1] and for sowing during September to March the flowering was observed in 53.6 to 96.3 days (Table 1). However, the day length during this period was below the critical photo-period. The same trend of flowering was also reported in case of photoperiod insensitive *capsularis* recombinants maturing in 90 and 110 days [2]. The scenario of flowering clearly indicates the photoperiod insensitiveness of the selections (BCO 100 and BCO 120.) and sensitiveness of the standard variety, JRO 7835.

The recombinants and three controls (JRO 524, JRO 878, JRO 7835) were put to yield trial twice at different times (1st April and 1st June) of the year to evaluate the yield performance. The yield data (Table 2) indicated the superiority of the recombinants over the controls when all entries were harvested at 100-day growth stage after sowing. Only the recombinant, BCO 100 was in flowering stage. Actually BCO 100 flowered on 90 -day after sowing and harvest was on 100-day at small pod stage since this is the right stage of harvest for maximum fibre yield with standard fibre quality (Table 2). The same type of harvest was also made in case of the *capsularis* insensitive recombinants [2]. In this yield trial BCO 120 was with BCO 100 in the same group though it had numerically more fibre yield (Table 2). Almost same type of observation was reported in *capsularis* photoperiod insensitive recombinants.

The other yield trial with same entries also proved superiority of BCO 120 over the rest when all except BCO 100 were harvested at 120 days after sowing. BCO 100 was harvested at 100 days when it was at small pod stage and others were in such stage at 120 days. However, the rest were at flowering stage at the time of harvest as critical photoperiod prevailed at the time of harvest though BCO 120 had no effect of photoperiod and flowered at 110 days. On the contrary, BCO 100 was with the controls in the same group with respect to fibre yield but significantly different from BCO 120 (Table 2) The yield performance showed the advantage of 20 days of BCO 100 over the controls with the same fibre yield as in the controls even in late sowing (1st June) But early sowing had the superiority of BCO 100 over the controls with respect to fibre yield. The same type of advantage of 20 days of the *capsularis* recombinant over the control was reported [2].

Table 1. Days to flower in the recombinants (BCO 100, BCO 120) and the photoperiod sensitive standard variety (JRO7835)

Days to flower in different thermo-photoperiodic regimes (Sowing on the 1st day of every month)			
Months	BCO 100	BCO 120	JRO 7835
April	90.2	110.6	139.5
May	90.8	110.8	131.8
June	91.2	108.9	110.3
July	90.7	109.7	65.0
August	91.8	110.3	62.5
September	91.1	109.7	54.5
October	90.6	109.6	53.6
November	89.6	109.7	47.8
December	90.3	110.4	96.3
January	91.6	110.9	94.7
February	90.7	109.9	94.7
March	90.2	110.2	60.3
Mean	90.8	110.6	83.3

Table 2. Fibre yield trials of the recombinants and the controls sown in April and June

	1st April sowing (Harvested at 100-day growth crop age)		1st. June sowing (Harvested at 120-day crop age except BCO 100 being harvested at 100-day)	
Varieties	Yield (kg/plot)	Yield (q/ha)	Yield (kg/plot)	Yield (q/ha)
BCO 100	5.57	26.44	5.60	26.59
BCO 120	5.62	26.68	6.30	29.91
JRO 524	4.57	21.69	5.34	25.35
JRO 7835	4.73	22.45	5.79	27.49
JRO 878	4.80	22.79	5.71	27.11
C.D. at 5%	0.27		0.60	

The periodical sowing (every month) has conclusively proved that the two recombinants BCO 100 and BCO 120 of *olitorius* jute are photoperiod insensitive and can be sown any time between 1st April to 1st June without losing fiber yield BCO 120 yields significantly more fibre compared to that of the controls and BCO 100 has 20 days advantage over the controls with same yield at late sowing and at 100-day harvest its yield is significantly more than that in the controls.

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