

Sequel of divergent sowing dates on phenological event with yield and quality of Tossa jute (*Corchorus olitorius* L.) seed

M. R. Debnath^{1*}, M. M. Rahman¹, S. N. Islam² and P. N. Nandi³

¹Physiology department, Agronomy division, Bangladesh Jute Research Institute, Dhaka-1207.

²Jute Research Sub Station, Jashore, Bangladesh

³Former consultant, International Rice Research Institute, Dhaka, Bangladesh

Abstract

This experiment was conducted at Jute Research Sub Station, Bangladesh Jute Research Institute, Jashore to determine phenology, yield and quality of Tossa jute seed at different sowing times starting from 15 July to 1 October, 2020. Variety O-9897 was used as plant material. Randomized Complete Block Design was followed with 4x3m plot size. Line sowing was practised. The result revealed that phenology, seed yield and quality varied significantly with different sowing dates. The earliest flowering (at 42 days) was observed from the sowing on 1 October and the most delayed flowering (at 89 days) from the sowing on 15 July. Sowing from 15 August to 1 September gave the highest yield with good quality seed. Sowing on 15 August, 2020 required 150 days and sowing on 1 September, 2020 required 139 days for pod maturation.

Received: 10 November 2021

Revised: 29 November 2021

Accepted: 01 December 2021

DOI: <https://doi.org/10.3329/bjsir.v57i1.58901>

Keywords: Flowering; Pod formation; Pod maturation; Germination; Yield

Introduction

Jute (*Corchorus* spp.) is a natural fibre producing crop that belongs to the family Malvaceae. For its environmental friendly nature, it has worldwide popularity. Jute has been playing a vital segment of the culture of Bengal for centuries, precisely in the southwest of Bangladesh. It is a very important cash crop of Bangladesh. Bangladesh holds 2nd position in producing raw jute and 1st position in jute export (Jegade, 2019). It is not only involved with the economic development of Bangladesh but also the genesis of Bangladesh (Debnath *et al.*, 2020). Tossa jute covers about 85% of the total jute production area of Bangladesh (Saha, 2011). Bangladesh Jute Research Institute (BJRI) has released 28 Tossa jute varieties and among the total cultivated Tossa jute variety, O-9897 is the most popular variety in Bangladesh. The primary cause of jute cultivation is fibre production and less heed is given to seed production. Availability of jute seed is

the main constraint for the popularization of BJRI released jute variety. We have to import about 6000-6200 MT jute seed for the fulfillment of demand per year. Due to climate change, it has been observed that unwanted rain occurs at different areas of Bangladesh, particularly excess rain at late jute seed production time. Normally Tossa jute seed is sown from July to August for seed production (Islam and Uddin, 2019), but due to different cropping patterns and many other causes jute seed is also required for sown during September-October. The appropriate time of sowing is an important agronomic practise which deals with the increment of yield along with seed quality. The information about the phenology of Tossa jute seed plant is also very important for the popularization of seed production. In this background, it is needed to know the jute seed crop phenology, yield and seed quality potentials during different sowing times from July to October.

*Corresponding author e-mail: manika00474@yahoo.com

Methodology

Experimental site

This experiment was conducted at Jute Research Sub Station (JRSS), Jashore (N 23° 10' 0.0012", E 89° 13' 0.0012") from July, 2020 to March, 2021. JRSS, Jashore is one of the main seed producing station of Bangladesh Jute Research Institute. It remains at the part of AEZ 9 (High Ganges River Flood plain). Soil of the experimental site was mainly clay to clay loam with high and medium high land and calcareous type.

Plant material

O-9897, the most popular Tossa jute variety released by Bangladesh Jute Research Institute during 1987 was used as plant material. This variety is full green plant with ovate lanceolate shaped leaf and bluish green seed. O-9897 is very high yielding variety which can be sown earlier during jute growing season. Seed was collected from JRSS, Jashore.

Design

The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replication and six treatments as S_1 = Sowing at 15 July, S_2 = Sowing at 1 August, S_3 = Sowing at 15 August, S_4 = Sowing at 1 September, S_5 = Sowing at 15 September and S_6 = Sowing at 1 October. Unit plot size was 4m x 3m.

Procedure

Seed was sown in line according to treatments. Line to line distance was 30 cm. Fertilizer was applied @ 50-36-12-18-4 kg/ha N, P_2O_5 , K_2O , S and Zn, respectively. Bangladesh Jute Research Institute recommended Jute fibre production techniques were followed. Harvesting was done when pod reached at 70-80% maturity. After sun drying 2-3 days, threshing was done. Then seeds were sun dried 5-6 days and cleaned properly. Seeds were stored at 7-9% moisture content.

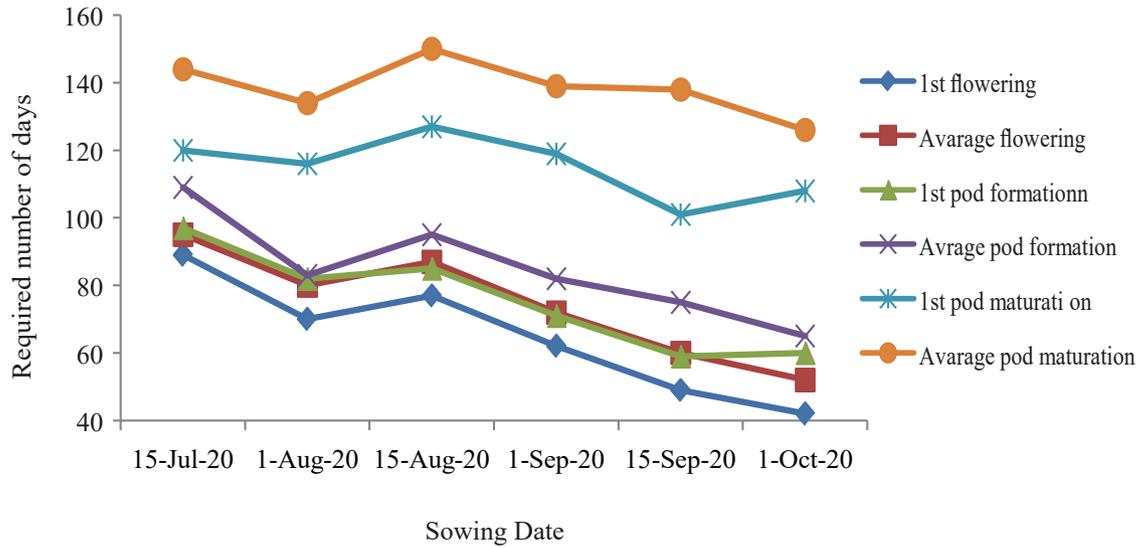
Data collection and analysis

Very carefully data on 1st flowering, average flowering (when 70-80% plant of the plot was bloomed), 1st pod formation, average pod formation (when 70-80% plant of

the plot was fruited), 1st pod maturation and average pod maturation (when 70-80% fruit of the plant was matured) was recorded. After pod maturation plants were harvested and yield related data were recorded. After proper drying seeds from the different plots were then considered for seed assessment as germination test at Physiology Laboratory of BJRI following the rules of ISTA. Hundred seeds of each variety of each plot were considered for germination test on paper method in 3 Petridishes for 5 days. The seed testing period was March, 2021. Numbers of germinated seedlings were observed at each day up to 5th days. Germination percentages, normal and abnormal seedlings were counted following the ISTA rules. All recorded data were analyzed statistically following the ANOVA technique and the means were separated using Least Significant Difference (LSD) by "Statistix 10" software.

Results and discussions

It was observed that time requirements for reproduction of Tossa jute varied with its sowing date (Fig. 1). The highest day's requirement for 1st flowering, average flowering, 1st pod formation, average pod formation, 1st pod maturation and average pod maturation was observed at the sowing 15 July as 89, 95, 97, 109, 120 and 144 respectively and the lowest day's requirement for most of such reproductive phenomena was observed at the sowing of 1 October. Laconic growth duration for late sowing and prolonged growth duration for early sowing was observed. Such findings were also corroborated by Talukder *et al.* (2001). Kar (1961) reported the critical day length of jute as 12 hours. Khan (1984) reported that *C. olitorius* was more photosensitive than *C. capsularis* and late sowing under shorted day length conditions than the critical values may cause remarkable modification of vegetative development. The time required from average flowering to visible average pod formation was about 03-15 days and from average pod formation to average pod maturity required about 35-63 days depending on soil moisture and other factors. It was supported by Islam and Uddin (2019). It was also supported by Talukder *et al.* (2001) as they found seed filling period (SFP) as 36 days from anthesis. They reported that at 60 days after anthesis characteristic seed coat colour developed, at 70 days half pod became brown and at 80 days pod became dry. Talukder *et al.* (2001a) also reported that it had taken 54-67 days for pod maturation after anthesis in case of O-9897 at Manikganj, Bangladesh location, which also favored our findings.

Fig. 1. Timeline for Tossa jute seed phenology**Table I. Yield related morphological traits of Tossa jute seed at different sowing times**

Sowing Time	PH (m)	BD (mm)	Pod /Plant	Seed/ pod	Yield (kg/ha)
15-Jul-20	1.80	10.70	17.77	194.57	394.44
1-Aug-20	1.65	12.80	25.73	181.60	483.33
15-Aug-20	1.17	11.80	34.80	210.50	727.78
1-Sep-20	1.34	9.83	19.30	174.43	816.67
15-Sep-20	1.15	8.10	18.50	193.30	136.11
1-Oct-20	1.14	8.40	17.77	169.97	119.44
LSD	0.23	0.23	0.30	9.80	38.14
CV	9.49	1.21	0.73	2.88	4.70

Table II. Quality parameters of Tossa jute seed at different sowing times

Sowing Time	Thousand seed weight (g)	Germination percentage	Normal seedling percentage	Abnormal seedling percentage
15-Jul-20	1.97	91.00	82.33	8.67
1-Aug-20	1.91	88.00	78.00	10.00
15-Aug-20	1.94	91.00	85.00	6.00
1-Sep-20	1.91	87.00	82.67	4.33
15-Sep-20	1.88	89.33	76.67	12.67
1-Oct-20	1.81	85.00	80.67	4.33
LSD	0.09	1.68	0.98	2.13
CV	2.51	1.04	0.66	15.25

Fig. 2. Intensive supervision signifying in experimental field for good agricultural practices. (A) Land preparation (B) Experimental field, (C) Pod of Tossa jute

Field duration of tossa jute seed production was varied as 126 to 150 days depending on sowing time. It was reported by Talukder *et al.* (2001a) as field duration of O-9897 seed production as 103-144 days in another location.

At Table I, it was found statistically significant difference at plant height (PH), base diameter (BD), pod/plant, seed/plant and yield. Highest base diameter (12.80 mm) and 2nd highest plant height (1.65 m) was found at the sowing of 1 August. Elevated vegetative growth was observed for gaining more time to critical day length. Day length 12 hours was observed at the 2nd half of September, 2020. (<https://www.timeanddate.com/sun/bangladesh/dhaka?month=9 & year=2020>). Apex performance of pod/plant (34.80) and seed/pod (210.50) was observed at the sowing of 15 August. Best seed yield (816.67 kg/ha) was observed at the sowing of 1 September (Table I). Debnath *et al.* (2018) was also found best seed yield (557.56 kg/ha) from the same variety with the sowing during September at another location in Bangladesh. The highest seed yield was observed with 19.30 no. of pod/plant and 174.43 no. of seed/pod. There may be present another influential factors besides these two, as plant population, branch/plant etc. which had much contribution on the yield of seed.

At Table II, statistically significant difference at germination percentage, normal and abnormal seedling percentage was also perceived. The highest germination percentage (91) and normal seedling percentage (85) was observed from the plant sowing at 15 August. It was also observed that the highest time requirement for pod maturation as 150 days was also observed at the sowing of 15 August. Due to taking longest time for grain maturation, seeds offered from 15 August sowing showed best quality. It was also succored by Talukder *et al.* (2001a), Alam and Haque (2019). Sowing at 15 August gave the 2nd highest seed yield as 727.78 kg/ha and sowing at 1st September gave the germination percentage as 87 and normal seedling percentage as 82.67.

Conclusion

From the above observation it may be concluded that the best sowing time for Tossa jute seed production was 15 August to 1 September. The sowing after 1 September,

seed quality started to decrease with the seed yield. This experiment also revealed opportunity to relate weather related data with the seed yield and quality along with phenology of tossa jute seed production.

Acknowledgement

The authors expressed their gratitude to the authority of Bangladesh Jute Research Institute for providing support for conducting this research and to the field staffs of Jute Research Sub Station, Jashore for taking related data and cultural practices.

References

- Alam ATMM and Haque MM (2019), Genotype and sowing date effects on seed yield of olitorius jute in late season, *Bangladesh J Agron.* **22**(2): 43-89. DOI: [org/10.3329/baj.v22i2.47623](https://doi.org/10.3329/baj.v22i2.47623)
- Debnath MR, Biswas SK, Hoque ABMZ, Nandi PN, Chowdhury MH and Roy BP (2018), Performance of seed yield of tossa jute O-9897, *Int J Busin Soc Sci Res.* **6**(4): 15-17.
- Debnath MR, Rafiq MZA, Kamal TB and Nandi PN (2020), Conservation tillage: Approach of jute cultivation, *Int J Res Anal Rev.* **7**(1): 61-64.
- Islam MM and Uddin MN (2019), Research and development advances of jute seed in Bangladesh: A Review, *Haya: Saudi J Life Sci.* **4**(22): 52-68. DOI: [org/10.21276/haya.2019.4.2.2](https://doi.org/10.21276/haya.2019.4.2.2)
- Jegade A (2019, 1 January), Top 10 largest jute producing country in the world, *The Daily Records*. Retrieved from <http://www.thedailyrecords.com/2018-2019-2020-2021/world-famous-top-10-list/world/largest-jute-producing-countries-world-states/6861/>.
- Kar BK (1961), Assessment of flowering behavior of different varieties of *Corchorus capsularis* and *Corchorus olitorius*. *In*: Investigation on the Physiology of Jute, Proc. Nat. Inst. Sci. Ins. Part B. Jute agricultural research Institute, Brrackpore, India **28**: 49-76,
- Khan MAH (1984), Photoperiodic response of jute plants-A Review, *Bangladesh J Agric Sci.* **2**: 161-165.

- Saha CK (2011), Jute seed management in Bangladesh, Proc. International Seminar on Strengthening of Collaboration for Jute, Kenaf and Allied Fibers Research and Development, June. International Jute Study Group (IJSG), Dhaka, Bangladesh. pp 8-9.
- Talukder FAH, Chanda SC, Islam MS and Sarwar AKM Golam (2001), Effect of seed filling period on quality of white jute seed, *J Biol Sci.* 1(5): 365-367. DOI: org/10.3923/jbs.2001.365.367
- Talukder FAH, Islam MM, Chanda SC, Ahmed I and Ahmed Z (2001), Phenology of jute, kenaf and roselle seed crops at different date of sowing, *Pakistan J Biol Sci.* 4(11): 1316-1318. DOI: org/10.3923/pjbs.2001.1316.1318