

Effects of Low Temperature on Sugarcane Germination

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ABSTRACT

Impact of low temperature on germination of seven BSRI bred commercial sugarcane varieties was investigated at BSRI farm. Germination decreased as ambient temperature decreased irrespective of varieties. It was observed that minimum (night) temperature was more critical compared to maximum (day) temperature on germination. Double time (days) required during December 1 and January 15 plantings to attain the highest germination compared to before November 15 and after February 1 plantings. Suggested to avoid sugarcane sett planting between December 1 and January 15 period to higher and uniform germination resulting higher yield.

Key words : Sugarcane, germination, temperature

INTRODUCTION

In Bangladesh, yield of sugarcane is low due to various factors. One of the important factors is gappy germination in the field. Higher population in a unit area is pre-requisite for higher cane yield, while good germination of a crop is the precondition for higher plant population. Germination of sugarcane crop is influenced by several internal and external factors (Yang and Chen, 1980; Miah *et al.* 1988; Hossain *et al.* 1993). Among external factors, ambient temperature and soil moisture is very important. Lower the ambient temperature, lower the rate and slower the speed of germination (Yang and Chen, 1980; Miah *et al.* 1988). It was reported earlier from this laboratory that sugarcane planted in winter (mid November to mid February) while ambient temperature was below 20°C, gave poor germination irrespective of varieties and methods of planting (Miah *et al.* 1988; Hossain *et al.* 1989). In Taiwan, Yang and Chen (1980) reported that rate of sugarcane bud germination decreased as the ambient temperature decreased. The optimum temperature for good germination was reported between 32-38°C (Humbert, 1968; Barnes, 1974), and minimum temperature should not be below 20°C (Miah *et al.* 1988; Hossain *et al.* 1989). But the facts are major sugarcane plantation in south-west and north-west part of Bangladesh is done during December to February when ambient temperature goes down even upto 5°C resulting severe germination failure. Considering the above facts, an investigation was conducted to know germination response of BSRI released seven sugarcane varieties under low ambient temperature.

MATERIALS AND METHODS

A trial was conducted at Bangladesh Sugarcane Research Institute (BSRI) farm. Seven BSRI bred commercial varieties such as Isd 18, Isd 20, Isd 22, Isd 24, Isd 28, Isd 29 and Isd 2-54 were taken as test materials. A set of 20 single-budded setts of each variety was planted in a plastic tray containing 4.5 kg pure sand at an interval of 15 days. Distilled water was applied in the sand medium upto saturation. The trays were covered by another plastic tray and placed in a polythene made house. Distilled water was applied regularly to keep moisture at a desired level. Covers were removed after initiation of buds. The trial was started from November and continued upto February. Temperature data were collected from meteorology section of BSRI, and presented in the Figure 1. Germination of buds were recorded daily from the first date of shoot emergence, and continued upto last shoot emergence. Data on germination per cent, and number of days required in attaining the highest germination have been presented in the Tables 1 and 2 respectively.

RESULTS AND DISCUSSION

Results of the trial have been presented in the Tables 1 and 2. Tables show that speed and per cent of germination were affected by low ambient temperature in all varieties. Speed and per cent of germination decreased as ambient temperature (especially minimum temperature) decreased irrespective of varieties. It is seen that impact of minimum (night) temperature on germination was greater compared to maximum (day) temperature. These results confirmed our earlier results (Miah *et al.* 1988; Matin *et al.* 1988; Hossain *et al.* 1989). It is seen from the Tables 1 and 2 that the highest germination was recorded in variety Isd 20 and took 43.1 d to attain this level of germination, while the lowest germination was recorded in variety Isd 24 and took 49.6 d to attain this level of germination. The Tables 2 shows that variety Isd 2-54 took the lowest number of days (38 d) to attain the 3rd highest germination per cent (77.5%; Table 1). This indicates that the variety Isd 2-54 is the most cold tolerant although variety Isd 20 produced the highest germination (87.0%; Table 1).

Table 1 . Effects of ambient temperature on germination.

Planting Dates Varieties	Germination (%)								
	1 Nov	15 Nov	1 Dec	15 Dec	1 Jan	15 Jan	1Feb	15 Feb	Mean
Isd 18	86.0	85.0	70.0	73.0	75.0	76.0	73.0	76.0	76.8
Isd 20	81.0	78.0	86.0	86.0	90.0	90.0	92.0	93.0	87.0
Isd 22	85.0	83.0	70.0	66.0	68.0	71.0	75.0	76.0	74.3
Isd 24	68.0	63.0	40.0	36.0	35.0	38.0	36.0	45.0	45.1
Isd 28	85.0	88.0	78.0	76.0	70.0	85.0	90.0	96.0	83.5
Isd 29	70.0	66.0	60.0	51.0	53.0	58.0	53.0	63.0	59.3
Isd 2-54	85.0	83.0	76.0	71.0	65.0	66.0	86.0	88.0	77.5
Mean	80.0	78.0	68.6	65.6	65.1	69.1	72.1	76.7	

Table 2 shows that December 1 to January 15 plantings took higher time (days) to attain the highest germination since minimum ambient temperature (night temperature) remained below 20°C (Figure 1). February plantings (Feb. 1 to Feb. 15) required similar time period of November 15 planting although minimum ambient temperature was below 20°C because minimum ambient temperature increased after February 15. The Table 2 shows that November 1 planted setts completed germination within 16-34 d, while November 15 planted completed germination within 24-37 d when ambient minimum (night) temperature mostly above 20°C. But December 1, December 15, January 1 and January 15 planted setts took 46-66 (Mean: 61.4); 52-70 (Mean: 64.6); 52-62 (Mean: 59) and 47-57 (Mean: 51.7) days to complete germination respectively. It is seen from the Tables 1 and 2 that similar germination may be obtained in half time through delaying of planting by 15 d from January 15 to February 1. Therefore, it may be suggested that sett planting should be completed either by November 15 (while night ambient temperature mostly remains above 20°C) and there after not before February 1 (so that night ambient temperature rise above 20°C). These results suggest to avoid setts planting between December 1 to January 15 period to get similar and uniform germination resulting higher initial plant population using lower rate of seeds. Before November 15 and after February 1 plantings would also save cost of weeding, mulching and irrigation through reducing number of irrigations avoiding dry period because usually no or less rainfall occurs during the months of December and January in Bangladesh.

Table 2 . Time required to attain the highest germination.

Planting Time Varieties	Time (Days)								Mean
	1 Nov	15 Nov	1 Dec	15 Dec	1 Jan	15 Jan	1Feb	15 Feb	
Isd 18	28.0	34.0	59.0	60.0	57.0	52.0	33.0	32.0	44.4
Isd 20	19.0	24.0	66.0	65.0	62.0	50.0	30.0	29.0	43.1
Isd 22	26.0	34.0	66.0	67.0	62.0	47.0	31.0	31.0	45.5
Isd 24	34.0	37.0	66.0	70.0	62.0	57.0	36.0	35.0	49.6
Isd 28	28.0	31.0	66.0	70.0	57.0	50.0	32.0	31.0	45.6
Isd 29	30.0	36.0	61.0	68.0	61.0	54.0	30.0	24.0	45.5
Isd 2-54	16.0	24.0	46.0	52.0	52.0	52.0	31.0	31.0	38.0
Mean	25.9	31.4	61.4	64.6	59.0	51.7	31.9	30.4	

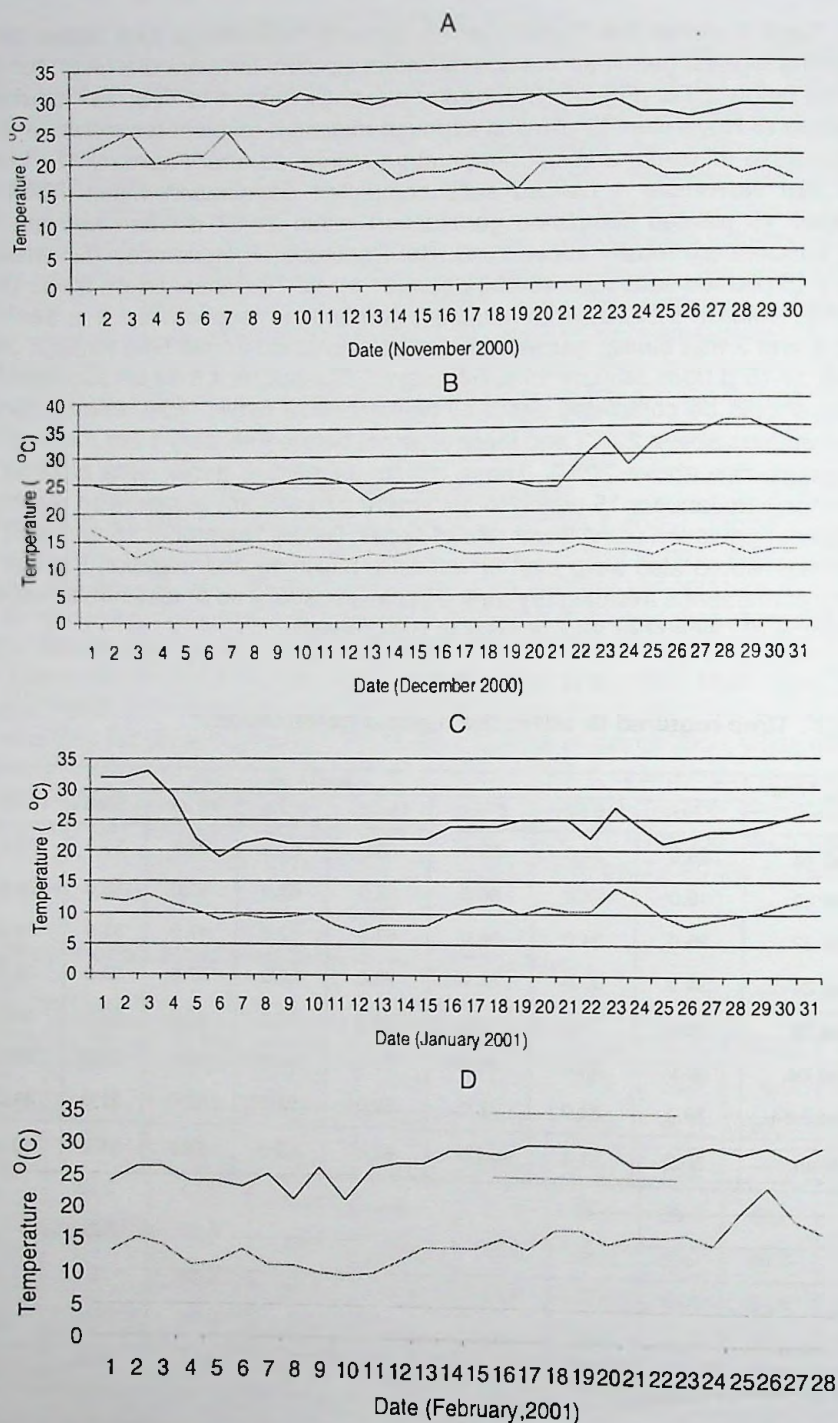


Figure 1 : Minimum and maximum ambient temperature at trial site(ABCD).

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