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Tolerance of Some Sugarcane Clones to Water-logging

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ABSTRACT

Eleven promising clones of sugarcane including a standard were tested for their tolerance to water-logging. Under an artificially induced flooding stress, significant clonal differences in respect of growth and adaptation were observed. Among the clones tested, Isd-17 (a recently released variety) and I-147/77 (an advanced promising strain) were found to have quite a high degree of tolerance to water-logging. Results indicated strong possibilities of present technique to screen sugarcane clones for superior tolerance to water-logging.

INTRODUCTION

One of the major causes of poor yield of sugarcane in Bangladesh is the vulnerability of the existing varieties to water-logging. Estimates show that about one-third of the total acreage of sugarcane is planted on land where water remains stagnant for long period resulting in low productivity (Anon. 1983). Higher water table during active growing season adversely affect stalk weight and plant population leading to yield reduction of about one ton per acre for each one inch increase in excess water (Carter, 1976 ; Carter and Floyd, 1974). The deliterious effects of water-logging on crop growth and survival have been examined on other crops namely, maize (Ho and Scandalios, 1975), tobacco (Willey, 1970 ; Kramer, 1951), sunflower (Torres and Diedenhofen, 1981), wheat and barley (Pomeroy and Andrews, 1978) etc, but little attention has been given to screening suggarcane varieties for tolerance to water-logging. Sugarcane varieties that are being cultivated in Bangladesh donot have proven capabilities to grow under water-logging stress. This is mostly because of the lack of breeding priorities in the past. With increasing pressure on land for food crops, sugarcane is being pushed to very marginal land often prone to seasonal inundation and unprecedented flood. The current situation demands that suitable cane varieties with built-in potential to grow under water-logging stress be selected in order to ensure a reasonable productivity. The present experiment was aimed at screening some advanced promising clones of sugarcane for superior tolernace to water-logging.

MATERIALS AND METHODS

The experiment was conducted at the Sugarcane Research & Training Institute, Ishurdi, with eleven promising sugarcane clones such as ISD 16, ISD 17, I-59/74, I-96/74, I-21/75, I-491/76, I-147/77, I-5 /80, I-6/80, I- 14/80, with Isd 2/54 as the standard. Single-bud setts prepared from stalks were planted in PVC pipe (10 cmX5.5 cm dia) in the third week of January. Six-week old settlings were transplanted to medium sized (32 cmX24 cm dia) plastic pots (@one plant per pot) containing soil. Fifteen plants were raised per clone. Plants were watered regularly and fertilized uniformly every month with NPK-fertilizers. Six months after transplanting, ten plants of each clone were immersed in stagnant water (30 cm deep) above the soil while the remaining five plants per clone were kept as untreated control. At the on-set of the root submergence test, measurement on plant height upto the TVD (topmost visible dewlap) and periodic observations on the growth rate (stalk elongation) during five weeks were recorded. At the end of test, primordial water roots were collected, placed in paper bags of known weight, and oven-dried at 85°C until constant weight. Two plants comprised a replicate, and mean values presented in the Table 1 represent the average of five replications. In order to obtain clonal differences, data were subjected to F-test. LSD (least significant difference) values were worked out only when a significant difference was obtained by the F-test.

RESULTS AND DISCUSSION

The effect of water-logging on the growth and production of primordial water root of the different clones is presented in Table 1. In the first week of root submergence, no significant clonal difference in respect of growth (stalk elongation) was observed ; but significant differences were recorded with increased duration of flooding. It was apparent that under sustained water-logging, the rate of growth significantly declined. Results further show that the clones significantly differed in their ability to produce primordial water root which is considered an important

Table 1. Growth rate and production of primordial water roots by different sugarcane clones subjected to water-logging stress.

Clone	Growth Rate (cm/day)			Water Root Dry weight
	First week	Third week	Fifth week	(g/node)
ISD. 16	4.08	0.53	0,57	0.64
ISD. 17	3.67	0.38	0.41	1.60
I-59/74	6.55	0.58	0.65	0.50
I-96/74	3.52	0.50	0.19	0.72
I-21/75	1.58	0.16	0.25	0.26
I-491/76	3.73	0.64	0.78	0.54
I-147/77	3.95	0.78	1.18	1.54
I-5/80	2.25	0.63	0.65	0.84
I-6/80	2.42	0.37	0.45	0.66
I-14/80	4.45	0.61	0.66	1.00
ISD 2/54	4.83	0.98	1.23	2.07
LSD (.05)	—	0.27	0.37	0.62

adaptation to water-logging stress. Variety ISD-2/54 well-adapted to water-stress, produced the highest quantity of water root and was followed by ISD-17 (a newly released variety) and promising strains I-147/77 and I-14/80. Visual observations also indicated superior tolerance of these clones compared to the rest. The quantity of water root produced was found to contribute mostly to the clonal tolerance ; although, this parameter had no significant correlation with the growth rate (r = 0.46, n = 11).

The inevitable consequence of water-logging or flooding is the absence of molecular oxygen in the root zone leading to anoxia and anaerobic metabolism of the submerged roots. Under such condition, the survival of plants largely depend on some kind of suitable adaptation such as production of water roots which takes advantage of the dissolved oxygen from the over-lying water. Literature shows that in addition to having such morphological adaptations, plants may have anatomical, physiological and biochemical adaptation, and that these adaptations may not be mutually exclusive (Barclay and Crawford, 1982 ; Hook and Scholtens, 1978). Rahman (1983) reported that the tolerance of different species of *Saccharum* was positively correlated with their ability to produce root under an artificially induced anoxia (Redox potential about 205 mV). Quantitative estimate on water root production appears to hold marit for rapid screening for superior talerance to water-logging in sugarcane.

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