

Screening Sugarcane for Flood Tolerance

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In Bangladesh, yield of sugarcane is very poor due to various reasons which vulnerability of sugarcane to water stress such as flood, water-logging and drought are most important. Due to higher demand for food, high and medium high lands are occupied by cereal and vegetable crops, and sugarcane is being pushed to marginal and low lying "char" lands often prone to seasonal inundation and flash flood, and frequently hits by unpredicted flood. Estimate shows that about 50% sugarcane is planted on lands where water remains stagnant for longer period or become submersed during monsoon flood resulting in very poor yield. In Bangladesh, 1.2 million and 5.0 million hectares cultivable lands are severe and moderately severe flood prone respectively (Karim, 1992). Among 1.2 million hectares severe-flood prone lands, 0.2 million hectares low lying "char" lands are suitable for sugarcane cultivation. But sugarcane varieties currently being under cultivation do not have proven capability to grow under extreme water stress such as flood and water-logging, and suffers immense loss in productivity. In the existing level of economy and land holding patterns, neither subsurface drainage nor irrigation could be considered an economic and reasonable means of boosting up sugarcane yield. At present, serious crisis of varieties built-in-potential to water stress is existing and it is the crying need for the development of sugarcane varieties built-in superior tolerance to flood and water-logging stress to ensure a reasonable productivity to meet present national requirement of 3 lac tons of white sugar and 6 lac tons of "gur". Therefore, an experiment was conducted at flood prone areas in Gaibandha and Tangail with the objective to screen sugarcane varieties with built-in superior tolerance to flood stress.

After initial screening at Sugarcane Research & Training Institute (SRTI) under induced flood condition, nine sugarcane clones including three commercial varieties were tested at Katlamari (Gaibandha), and Bhuapur (Tangail). The experimental field inundated 30 to 90 cm by flood water, and lasted for 15 to 45 d. The sugarcane clones included in the test were Nagarbari, I-197/83, I-267/83, I-226/83, I-48/81, I-150/82, L. Jaba-C, Isd-20 and Isd-21. The trial was conducted following randomized block design with three replications. Paired Spaced Planting (PSP) method was followed having pit to pit 45 cm and row to row 1m distance. Recommended doses of commercial fertilizers were applied, and cultural practices were done as and when required. Data recorded on germination, greenness and stalk elongation rate during flood inundation, and yield, millable canes at harvest.

The salient results of the trial have been presented in the Table 1. It is revealed from the Table 1 that the clones Nagarbari and I-48/81 were found highly tolerant to flood stress having tolerance rating 1 (one), and rest of the clones were found to be tolerant to flood stress, and showed tolerance rating 2 (two). The table shows that the highest

millable canes and yield were obtained in I-48/81 followed by Nagarbari. These results partially differ from our previous reports published elsewhere on water-logging stress (Anon. 1987: 1988). It is observed that tolerance rating of different clones/varieties is not uniform under water-logging and flood stress. It has been found that the behaviour of clones I-150/82 and I-48/81 are similar and shows highly tolerant rating under water-logging stress (data not shown), but under flood stress I-48/81 shows highly tolerant while I-150/82 shows tolerant rating.

Table 1. Flood tolerance and yield parameters in different sugarcane clones/varieties.

Varieties/ clones	Germination (%)	Tolerance rating (1-5)	Stalk elongation rate (mm/day)	Millable cane ($\times 10^3 \text{ha}^{-1}$)	Yield (TCH)
Nagarbari	32.5	1	10.05	92.4	83.9
I-197/83	34.3	2	11.85	77.1	52.8
I-267/83	29.8	2	13.70	80.9	46.5
I-226/83	31.5	2	13.50	78.2	68.0
I-48/81	39.1	1	10.80	101.1	106.4
I-150/82	29.7	2	10.90	67.3	59.8
L. Jaba-C	33.4	2	12.45	84.3	75.8
Isd-20	32.4	2	11.85	68.0	61.0
Isd-21	30.4	2	13.05	54.4	53.5

* Tolerance rating (1-5) was done on eye estimation on the basis of greenness of leaves. where,
1 = Highly tolerant, 2 = Tolerant, 3 = Moderately tolerant, 4 = Intolerant, 5 = Highly intolerant.

The sugarcane clones grown under stagnant water (water-logging stress) recorded different tolerance rating compared to running water (flood stress) is not clear. However, this might be due to difference in response to oxygen and dissolved nutrients level in stagnant and running water. It is reported elsewhere that water-logging tolerant clones produce higher rate primordial water root to takes dissolved oxygen in water (Rahman and Alam, 1985). Besides, morphological adaptations, plant might have anatomical, physiological and biochemical adaptations (Barclay and Crawford, 1982; Hook and Scholtens, 1978). It is also seen from the table that the stalk elongation rate is negatively correlated with tolerance rating. The higher the tolerance level to stress lower the elongation rate. The process of flood stress is not clearly understood, and the present results sought for further investigation regarding physiological especially biochemical studies and morphological basis for flood stress tolerance.

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