

Effects of Heat Therapy on Germination of Six Sugarcane Varieties

S. Rahman, M. A. Hossain and M. Ali

Sugarcane Research & Training Institute,
Ishurdi, Pabna, Bangladesh.

ABSTRACT

An experiment was conducted to study the effect of moist hot air treatment (MHAT) and hot water treatment (HWT) in different duration and temperature on germination in mature cane of six sugarcane varieties such as Isd-16, Isd-16 (M), Isd-18, Isd-19, Isd-20 and Isd-21. MHAT at 54°C for 2 and 3 h with 95% relative humidity did not affect germination compared to control rather it (germination) increased significantly over HWT at 50°C for 3 h. But MHAT at 54°C for 4 h and HWT at 50°C for 3 h showed no significant difference on germination over control.

INTRODUCTION

The heat therapy of sugarcane planting material has been in practice in most of the sugarcane growing countries of the world. Heat treatment of seedcane along with regular nursery programme is an important measure to ensure healthy stocks (Nogendran and Alexander, 1987). In India, three systems of heat therapy, such as HWT, MHAT and AST are in vogue for disease control. The extent of disease control varies with the system of heat therapy, disease-to-disease, variety-to-variety, treatment temperature and duration as also with the age of seedcane (Singh and Agrihotri, 1987). It is reported that HWT is detrimental to buds of immature cane (Scheynyder, 1956, Liu *et al.*, 1966). This treatment also cause leaching of nutrients from the cuttings and asphyxiation of host tissues (Baker, 1962). On the other hand both AST and MHAT, the medium of heat transfer is humidified hot air MHAT does not impair the germination of young buds on canes or parts there of (Singh *et al.*, 1980). Recently, few MHAT plants have been imported in respect to produce disease free nurseries/Foundation seed plots to strengthen clean seed programme in Bangladesh. Therefore, an experiment was conducted to compare the efficacy of MHAT and HWT regarding germination of sugarcane buds of the commercial varieties Isd-16, Isd-16 (M), Isd-18, Isd-19, Isd-20 and Isd-21 under field conditions.

MATERIALS AND METHODS

The experiment was conducted at the sugarcane Research and Training Institute (SRTI) farm, Ishurdi with six sugarcane varieties such as Isd-16, Isd-16 (M), Isd-18, Isd-19, Isd-20 and Isd-21. Approximately 12 months old mature canes of these varieties were brought from a grower's plot of Mohimagonj, Gaibandha district. The canes were detashed and cut into 1 to 1.5 m long pieces depending on the size of the trays and placed side by side in trays of MHAT plants, and in bundles in crates of HWT plants. The seedcane then subjected to the following treatments in the auto regulating arrangement of MHAT and HWT plants.

- T₀ : Control (No heat treatment but soaked in Bavistin solution (1 : 1000) for 30 min,
T₁ : MHAT at 54°C for 2 h with 95% and above relative humidity,

- T₂ : MHAT at 54°C for 3 h with 95% and above relative humidity,
T₃ : MHAT at 54°C for 4 h with 95% and above relative humidity,
T₄ : HWT at 50°C for 3 h.

The treatments were done excluding the initial heating time to raise the required temperature and humidity. After heat treatment, three-budded setts of each varieties and categories were prepared and kept in a heap separately after fungicidal treatment with Bavistin (1 : 1000) for 30 min and then covered with rice straw for 3 d for initiation of germination. Watering was done once a day to heap. After 3 d slightly sprouted fifty number of three-budded setts of each variety and categories were planted in the soil bed for germination and covered with thin layer of straw. Watering and other intercultural operations were done as and when required. Germination percentage was recorded at an interval of two weeks starting from the date of planting and continued upto 8 weeks. The final germination data on 8 weeks were subjected to statistical analysis.

RESULTS AND DISCUSSION

MHAT at 54°C for 2 and 3 h with above 95% RH (excluding initial heating time to raise the temperature and humidity) showed better germination and did not significantly affect mean germination compared to control rather germination increased significantly over HWT at 50°C for 3 h (Table 1). Similar results obtained by Singh *et al.* (1979) who reported increased germination in the GSD affected setts of the varieties Bo 54, Bo 70, Co 5633 and Co 5459 when treated at 54°C for 2 h with 99% RH. Shukla *et al.* (1979) reported that MHAT resulted better germination in the infected canes in the varieties Bo 3 and Co. 1158. In case of hot water treatment at 50°C for 3 h, the mean germination percentage though not significantly reduced but it hampered greatly than the untreated check (control). Scheynayder (1956) and Liu *et al.* (1966) also reported that MHAT reduced the germination and is detrimental to the buds of immature canes. This is perhaps due to the boiling effect of hot water during the treatment. MHAT treatment at 54°C for 4 h did not significantly affect germination than other treatment durations and control.

From the Table 1, it is revealed that the test varieties differed in their tolerance to heat treatment. Isd-16 differed from Isd 16(M) and Isd 18 and found more tolerant to MHAT while the other varieties showed the similar response to the treatments. This results corresponds with the findings of Rahman and Alam (1984). They reported that the clone Isd 16 and 1.60/74 differed in their tolerance and Isd-16 was found more tolerant to hot water treatment. Singh *et al.* (1979) and Ongoma (1981) reported that apparently healthy seedcane on heat treatment shows differential behaviour in respect to germination and subsequent growth. In some cultivars, germination is enhanced, in other it remains at per and still others it is reduced as compared to untreated check.

In Bangladesh, MHAT is a borrowed technology and extensive research works has been done on its for germination and disease control for last 14 years in India. From this preliminary experiment it is observed that MHAT has no adverse effect on germination

Tabel 1. Effects of MHAT and HWT on germination.

Treatment	Germination percentage on 8 week						Mean
	Isd. 16	Isd. 16(M)	Isd. 18	Isd. 19	Isd. 20	Isd. 21	
T ₀	56.5	45.1	60.4	57.6	46.8	64.2	55.1 AB*
T ₁	64.0	56.7	55.2	69.5	55.1	64.5	60.3 A
T ₂	73.3	44.7	43.2	78.8	55.5	60.0	59.3 A
T ₃	63.0	50.8	51.0	41.6	55.7	53.0	52.5 AB
T ₄	49.0	49.0	39.7	41.4	48.9	45.8	45.6 B
Mean (%)	61.2A	49.3B	50.0B	58.8AB	52.4AB	56.9AB	

* Figures accompanied by the same letters do not differ significantly at 5% level as per DNMR test.

compared to both control and hot water treatment. In a preliminary investigation on the control of WLD, red rot and Smut has also been found effective in our Bangladesh. On the other hand in the production of disease free seed materials for commercial purposes, only apparently healthy seedcane is used. This eliminates chances of disease incidence in the heat treated seed plots and by chance if there is few escapes that can be rogued out. As such MHAT at 54°C for 2 - 3 h after attaining desirable temperature and 95% and above humidity may be recommended for bulk seedcane treatment, however, further research works are needed improve germination as well as disease control.

REFERENCES

- Baker, K. F. 1962. Thermotherapy of planting material. *Phyto pathology*, **52** : 1244 - 1256.
- Liu, H.P.; Lee, S.M.; Ten, W.S. and Hsieh, P.T. 1966. Studies on the ratoon stunting disease of sugarcane. III. Effect of thermal treatments on germination of sugarcane. *Rept. Taiwan Sugar Expt. Sta.*, **42** : 9 - 21.
- Nagendran, K. and Alexander, K.C. 1987. Effect of heat therapy on germination, growth parameters and smut incidence in sugarcane. *Sugarcane Spring Suppt.* pp. 22 - 24.
- Ongoma, G.I.B. 1981. The effect of hot water treatment on sugarcane germination. *Sugarcane Pathol. News*, No. **27** : 3 - 6.
- Rahman, A.B.M.M. and Alam, M.R. 1984. Tolerance of Isd-16 and L-60/74 to hot water treatment. *Bangladesh J. Sugarcane*, **6** : 38-42.
- Scheynyder, C.A. 1956. The ratoon stunting disease of sugarcane in Louisiana with notes on its control. *Proc. ISSCT*, **9** : 1058 - 1065.
- Shukla, U.S.; Singh, K.; Madan, V.K. and Sexena, Y.R. 1979. Effect of moist hot air treatment on germination and invertase activity in RSD affected sugarcane buds. *Sugarcane Pathol. Newsletter*, **23** : 21-22.

- Singh, K.; Singh, R.P.; Yadav, R.A. and Misra, S.R. 1979. Moist hot air therapy of sugarcane : Effect on germination. *Indian J. Sugarcane Technol.*, **2** : 1 - 6.
- Singh, R. P. and Agnihotri V. P. 1987. Thermotherapy of sugarcane for disease control. *Rev. Trop. Pl. Patho.*, pp. 306 - 329.