

Control of White Leaf Disease by Hot Water Treatment

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ABSTRACT

An experiment was conducted for controlling white leaf disease (WLD) of sugarcane by hot water treatment at 50°C/3 h, 51°C/2 h, 52°C/1 h, 53°C/50 min, 54°C/40 min and 55°C/30 min with cent percent infected setts of the variety Isd. 16 and Isd. 17. All the treatments significantly reduced the disease infection of the 1st generation crop of both the varieties but did not control the disease completely except at 54°C/40 min of the variety Isd. 17. The variety Isd. 16 showed 86.6, 88.4, 83.2, 95.6, 98.4 and 97.2% control while Isd. 17 showed 97.8, 94.5, 94.4, 96.7, 100.0 and 98.6% control of the disease when treated at 50°C/3 h, 51°C/2 hr, 52°C/1 h, 53°C/50 min, 54°C/40 min and 55°C/30 min respectively. In untreated check, the variety Isd. 16 and Isd. 17 showed 85.7 and 99% WLD respectively. The treatment at 54°C/40 minutes was found most effective among all the treatments. All the treatments also significantly increased number of millable canes/clump, weight of cane/stalk and yield of cane due to control of white leaf disease.

INTRODUCTION

The white leaf disease (WLD) is one of the most serious disastrous disease of sugarcane in Bangladesh. It is spreading very fast in a recent years and is found in most of the commercial varieties and promising strains ranging from 0.5 to 70% (SRTI Annual Report, 1985). It causes extensive damages to crop which could reach upto 77-78% if diseases setts are used (Liu *et al.*, 1963). Chuang-Yang and Ling (1963) also reported that loss in sugar content was 81% compared to healthy canes. Rahman *et al.* (1982) found 52.5% and 57.5% loss in cane and sugar yield respectively in the infected canes compared to healthy cane in the variety Co. 1158 due to WLD. The variety Isd. 16 and Isd. 17 also showed loss in yield by 59.9% and 58.0% and sugar by 60.6% and 59.1% respectively (Talukder *et al.*, 1986). Ling and Chuang-Yang (1963) reported 14.9 and 1.7% WLD incidence when treated single eyed infected setts at 54°C/30 and 54°C/40 min respectively and 80% infection in the untreated check. Leu (1983) concluded that hot water treatment of setts at 54°C/40 min or dipping them into tetracycline group of antibiotics could cure the white leaf disease. Liu and Lee (1963) studied white leaf disease and found

complete control of the causal agent (*Mycoplasma*) by hot water treatment at 54°C/40 min. Ling and Chuang-Yang (1963) also worked on control of white leaf disease by hot water treatment using different temperatures and treatment durations and found 91.7, 8.3 and 10.0% disease incidence when the setts were treated at 53°C for 10, 20 and 30 min respectively and 2.5% disease incidence was recorded when setts were treated at 54°C for 20 min. No disease symptoms were noticed at 55°C/20 min or at 55°C/40 min.

As the disease causes a great loss both in cane and sugar yield and poses a serious problem now for cane cultivation in Bangladesh, the experiment was undertaken to find out effective temperature with compatible treatments duration to control the disease.

MATERIALS AND METHODS

The experiment was conducted at the experimental farm of Mobarakganj Sugar Mills Ltd. during the cropping year 1984-85. Cent percent WLD infected setts of the varieties Isd. 16 and Isd. 17 were used and two-eyed setts were prepared with sterilized knives at least one day before the hot water treatment. The setts were placed in mini crates and treated in large hot water treatment plant (designed by the Davy Agro Eng. Co., Australia) equipped with easy manual temperature control device. The temperature was cross checked by a long thermometer. The hot water treatments (HWT) were done using six temperatures and six treatment durations. The followings were the treatment combinations.

T₀ : Control (No HWT, but soaked in Aretan-6 for 10 minutes)

T₁ : HWT at 50°C for 3 hours (50°C/3 h)

T₂ : HWT at 51°C for 2 hours (51°C/2 h)

T₃ : HWT at 52°C for 1 hour (52°C/1 h)

T₄ : HWT at 53°C for 50 minutes (53°C/50 min)

T₅ : HWT at 54°C for 40 minutes (54°C/40 min)

T₆ : HWT at 55°C for 30 minutes (55°C/30 min)

After hot water treatment, the setts were kept overnight and then treated in Aretan-6 (1:400) before planting. The experiment was set up in RCB design with 4 replications and 25 two budded setts of each variety were planted for each treatment in each block. Data on final germination, tillering, and number of millable canes were collected after 2, 6 and 12 months of the crop respectively. Data on white leaf disease incidence in different treatments were recorded at tillering phase and maturing stage of cane, and statistically analysed.

RESULTS AND DISCUSSION

The results on the WLD incidence in different treatments have been shown in the Table 1. At the germinating stage no white leaf incidence was found in any treatment except in control plots. In control plots the development of disease symptoms started from germination stage and continued upto maturity of canes and the incidence was recorded at the end of tillering stage in June and maturing stage in December, 1985. No disease symptoms were found in the treated plots at the tillering stage except in Isd. 16 treated at 53°C for 1 h while 68.7% and 52.1% disease infection was found in the untreated plots of the varieties Isd. 16 and Isd. 17, respectively at the end of tillering stage (Table 1). In the maturing stage of crop the WLD was found in all the treatments of both varieties except in the treatment at 54°C/40 min in the variety Isd. 17. The incidence of the disease was 11.5, 11.7, 14.4, 3.8, 1.4 and 2.4% in the variety Isd. 16 when treated at 50°C/3 h, 51°C/2 h, 52°C/1 h, 53°C/50 min, 54°C/40 min and 55°C/30 min respectively, and 85.7% in control. The variety Isd. 17 also showed 2.2, 5.5, 5.6, 3.3, 0 and 1.4% WLD infection when the setts

Table 1. Effect of hot water treatment at different temperatures and treatment duration on WLD incidence.

Treatments	WLD at tillering stage (%)		WLD at maturing stage (%)		Control of WLD (%)	
	Isd. 16	Isd. 17	Isd. 16	Isd. 17	Isd. 16	Isd. 17
T ₀ (Control)	68.7a	52.1	85.7 a*	99.0 a	—	—
T ₁ (50°C/3 h)	—	—	11.5 b	2.2 bcd	86.6	97.8
T ₂ (51°C/2 h)	—	—	11.7 b	5.5 b	86.4	94.5
T ₃ (52°C/1 h)	0.01b	—	14.4 b	5.6 bc	83.2	94.4
T ₄ (53°C/50min)	—	—	3.8 c	3.3 bcd	95.6	96.7
T ₅ (54°C/40 min)	—	—	1.4 c	0.0 c	98.4	100.00
T ₆ (55°C/30min)	—	—	2.4 c	1.4 cd	97.2	98.6

* Figures in columns accompanied by similar letter (s) do not differ significantly at 5% level as per DNMR test.

were treated in the above treatments respectively and 99% infection in control.

Table 1 shows that all the treatments significantly reduced the disease incidence in both the varieties compared to control. There was significant difference of the efficacy of treatment temperatures on control of the disease. The higher treatment temperature at 53°C/50 min, 54°C/40 min and 55°C/30 min were significantly effective in controlling the disease than rest treatments. The variety *Lsd. 16* showed 86.6, 88.4, 83.2, 95.6, 98.4 and 97.2% control and *Lsd. 17* showed 97.8, 94.5, 94.4, 96.7, 100.0 and 98.6% control of the disease when treated at 50°C/3 h, 51°C/2 h, 52°C/1 h, 53°C/50 min, 54°C/40 min and 55°C/30 min respectively. Among the treatments the HWT at 54°C/40 min was found best followed by 55°C/30 min to control the disease. This corresponds with the findings of Rahman *et al.* (1982), and Chuang-Yang (1963) who found best control of the disease at 54°C/30 min and 55°C/20 min. It is evident from the result that both the higher temperature as well as treatment duration are equally important factors for controlling the disease. Though 55°C was higher temperature than 54°C but the hot water treatment at 54°C for 40 min was found more effective to control the disease compared to HWT at 55°C for 30 min possibly due to its longer treatment duration by 10 min. From Table 1, it is also seen that the control of WLD incidence is higher in *Lsd. 17* than *Lsd. 16* perhaps due to varietal response towards cure of the disease. It is assumed that the temperatures and treatment durations used in the present study did not completely kill the mycoplasma causing white leaf disease as the disease symptom gradually expressed in the maturing stage of cane though it was suppressed at least six months (upto tillering stage) and controlled the disease to a great extent. However, this could also possibly be due to re-infection of the causal agent.

Other than the control of the disease by different HWT temperatures, the effects of the temperature on germination, number of millable canes and weight of canes were also assessed and have shown in Table 2. As the selected setts were treated, the sett basis germination was very satisfactory in all the treatments and ranged from 71 to 94% and 72 to 92% in case of *Lsd. 16* and *Lsd. 17* respectively. Table 2 shows that germination (sett basis) was significantly increased in *Lsd. 16* due to HWT at 50°C/3 h, 51°C/2 h, 52°C/1 h, and 55°C/30 min while significant reduction was recorded when treated at 54°C/40 min. However, reverse was the case in *Lsd. 17* where germination significantly decreased at 51°C/2 h, 52°C/1 h, 54°C/40 min, and 55°C/30 min. Similar results were obtained by Rahman and Alam (1984) who reported that the effect of higher HWT temperatures and duration were more deleterious in the clone 1.60 (now *Lsd. 17*) than *Lsd. 16*.

Significant increase in unit cane weight was recorded in all the treatments compared to control in both the varieties. Rahman *et al.* (1982) also found

Table 2. Effect of HWT at different temperatures and treatment durations on germination, tillering and millable canes/clump, wt. of cane/stalk and percent increase in yield.

Treatment	Germination % sett basis		No. of millable canes/clump		Weight of cane /stalk (kg)		% increase in yield due to WLD control.	
	lsd. 16	lsd. 17	lsd. 16	lsd. 17	lsd. 16	lsd. 17	lsd. 16	lsd. 17
T ₀ (Control)	77 d*	96 a	4.0 a	6.91a	0.7 f	0.7 g	100	100
T ₁ (50°C/3h)	97 bc	92 ab	9.1 b	10.6 b	1.1 c	1.1 c	152.7	145.9
T ₂ (51°C/2h)	94 a	91 b	9.8 b	10.4 b	1.1 e	1.2 e	143.2	166.2
T ₃ (52°C/1h)	90 ab	90 b	8.4 b	10.3 b	1.2 b	1.2 b	155.4	158.1
T ₄ (53°C/50min)	89 d	92 ab	9.6 b	10.3 b	1.1 d	1.1 d	147.3	148.6
T ₅ (54°C/40min)	71 c	85 c	9.9 b	11.7 b	1.2 a	1.1c	162.2	154.1
T ₆ (55°C/30min)	84 c	72 d	10.3 b	13.20b	1.1 e	1.0 f	143.2	137.8

* Figures in columns accompanied by same letter(s) do not differ significantly at 5% level as per DNMR test.

significant difference in yield of cane between treated and untreated WLD infected canes. The highest unit cane weight was obtained when treated at 54°C/40 min and 51°C/2 h, in case of Isd. 16 and Isd. 17 respectively. The increase in unit cane weight also significantly differed among the treatments in case of both the cultivars except treatments between 51°C/2 h and 55°C/30 min in the case of Isd. 16. The varieties Isd. 16 and Isd. 17 showed 162.2 and 166.2% increase in yield respectively compared to control when former was treated at 56°C/40 min and latter at 51°C/2 h due to control of the white leaf disease.

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REFERENCES

- Leu, L.S. 1983. White leaf disease. In diseases of sugarcane. V.P. Agnihotri(ed), First edition, Oxford and IBH publishing Co. 66 Janpath, New Delhi 110001. pp. 250-267.
- Ling, K.C. and Chuang-Yang, C. 1963. Studies on the white leaf disease of sugarcane. II. Efficacy of hot water treatment in the disease. *Rept. Taiwan Sugar Exp. Sta.*, **30** : 75-89.
- Liu, H.P. and Lee, S.M. 1963. Study on the nature of the causal agent of the white leaf disease of sugarcane (1) Transmissibility of the disease as evidenced from special hot water treatment of white leaf disease of sugarcane. *Rept. Taiwan Sugar Exp. Sta.*, **31** : 107-116.
- Rahman, A.B.M.M. and Alam, M.R. 1984. Tolerance of Isd. 16 and I. 60/74 to hot water treatment. *Bangladesh J. Sugarcane*, **6** : 38-42.
- Rahman, S.; Kamal, M.M. and Malek, M. A. 1982. The white leaf disease and its control by hot water treatment. *Bangladesh J. Sugarcane*, **4** : 75-79.
- SRTI Annual Report, 1985. Sugarcane Research and Training Institute, Ishurdi, Pabna, Bangladesh. pp. 54-55.