

The White Leaf disease and Its Control by Hot Water Treatment

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ABSTRACT

An experiment was conducted with the variety Co.1158 to study the effect of white leaf disease on the yield losses and its control by hot water treatment. In the germinating stage, a high incidence of the disease upto 32.6% and in maturing stage upto 10.82% were obtained in plantation with control (untreated infected setts). In mature stalks of the treatment at 52° C for 0.5 hour, 16.6% infection was also obtained. Hot water treatment at 50° C for three hours greatly reduced the white leaf infection but did not cure the disease. The treatment at 54° C for 0.5 hour was found to be effective for complete cure of the disease. In a separate study significant differences between healthy and diseased canes were observed in respect of tillering, millable canes per clump, weight loss per stalk and in percent recovery of sugar. Losses in weight and sucrose content of the white leaf infected canes were 52.54% and 57.54% respectively of the healthy canes.

INTRODUCTION

Sugarcane white leaf disease was first discovered in Taiwan in 1958. There is evidence that this systemic disease is caused by *Mycoplasma* (Lin and Lee, 1968 ; Shikata *et. al.*, 1969). In Bangladesh, it was so long known to be an albino disease. From the external apparent symptoms, the disease was first recorded in the varieties Co.1158, Isd.2/54 & Isd.16 in different mills zones, (Rahman *et. al.*, 1980). Subsequently the name of the disease was confirmed through communication to Dr. L. S. Leu of Plant Protection Centre, Taiwan. Later the disease was also recorded in the varieties Co. 975, BS.96, BO. 70 & L.Jaba-C in different localities. In an investigation at Kushtia Sugar Mills Ltd., 50% loss in sugar due to white leaf infection was reported in the variety Isd.2/54 (Hutchinson, 1982) (Personal observation). In Taiwan, white leaf incidence was over 10% in the crop year 1965-66 to 1972-73 (Len, 1974). In Thailand, it is an epidemic disease and it is impossible to get a plantation free from this disease.

Evans (1981) described the disease symptoms quite elaborately in Bangladesh. He arbitrarily described the disease as of three types, i.e. pure white, striped and mottled pattern, so far as the markings and arrangement of green and white colours on the leaves are concerned. The disease occurs usually in the spindle portion of the affected stalks, the germinating shoots from the diseased materials and the tillers of the affected stalks (Evans, 1981). Chen *et. al.* (1974) reported

three components of chlorophyll: chlorophyll a, b & prochlorophyll that are found in the leaf tissue of both healthy and diseased leaves but the total content of the chlorophyll in infected leaves are reduced to about 7.6%. The affected stalk is normally stunted, poor in growth profuse in tillering. There is also proliferation of the auxillary buds. A symptom masking phenomenon is also noticed in white leaf disease (Evans, 1981). Ling and Chuang Yang (1963) also reported the cure of the disease by hot water treatment in 55°C for 20 minutes. Considering the severity of the disease and its frequent appearance in most of the commercial varieties in the country from mild to severe form, the present study on controlling the disease through hot water treatment was undertaken.

MATERIALS AND METHODS

The experiment was conducted in the experimental farm at Jaipurhat Sugar Mills Ltd. The white leaf affected seed materials of Co. 1158 were collected from a grower's plot. The particular stalks showing white leaf symptoms and other stalks from the same stools were choosen and exposed to different temperature at varying durations (Table 1). Plantation was done in December, 1980. The seeds were harvested one day before the treatment and were kept overnight after the treatment prior to planting. Sterilized cutting instruments were used in cutting of the stalks and preperation of the setts. Before planting, the seed materials were treated in Aretan-6 (1:400). Untreated setts of white leaf infected canes were used as control.

The experiment was set up in a RCB design and 34 three-eyed setts were planted in each row for each treatment with five replications. Germination and tillering were counted on 60th & 180th day respectively following plantation. Symptoms of the disease, its incidence (%) and recovery due to hot water treatment were observed and recorded in the germinating, tillering and maturing stages respectively (Table 1). An assesment on tillering/clump, weight loss/stalk and recoverable sugar (%) at different treatments were done (Table 2). A separate study of the above parameters was also done exclusively between healthy canes (First generation HWT seed) and white leaf infected canes (Table 3).

RESULTS AND DISCUSSION

The disease re-occurance in the hot water treated canes treatments of different duration and temperature and in the control has been reported for three different stages of cane growth (Table 1). In control plots 13.6% & 32.6% white leaf infections were observed in January and February respectively. Mortality (22.45%) due to white leaf disease was observed in March. The incidence again showed an increasing tendency upto 11.22% in June and then started a gradual decline showing 10.82% in December, 1981 and 8.94% in February, 1982. In mature stage, the disease symptoms appeared either in spindle leaf or in side shoots or in

late tillers produced at the base of affected stalk. In some cases a combination of one or two symptoms were found. In the treatment at 50°C for three hours only one stalk produced a little side tiller showing the diseased symptoms. It is presumed that although the treatment at 50°C was for three hours, it did not completely kill the white leaf pathogen inside the sett. It was quite apparent that the treatment at 50°C for three hours greatly reduced or inactivated the pathogen inside the affected stalks. The treatment at 52°C for 0.5 hour expressed the highest incidence at harvest. It is probable that exposure to 52°C for a short duration only partially inactivate the pathogen with probability remains for reoccurrence of the disease in the maturing stage. The treatment at 54°C for 0.5 hour proved to be the best of all since it completely cured the disease. It may be due to higher temperature (54°C) needed for short exposure (0.5 hour) to inactivate or kill the pathogen. Ling and Chuang-Yang (1963) also found complete cure of the disease by hot water treatment at 55°C for 20 minutes. It was further observed that all the temperatures inactivated the pathogen at least for a period of 90 days after planting whereas the control began to show symptoms right from the germinating stage.

In Bangladesh although this disease has not yet become a very serious one but it is often observed that in most of the varieties in commercial cultivation.

Table 1. Disease reappearance (%) at germinating, tillering and maturing stage of cane growth.

Treatment	Germinating stage		Tillering phase		In mature stalks	
	Jan. '81	Feb. '81	March '81	June '81	Dec. '81	Feb. '82
Untreated infected cane.	13.6%	32.6%	9.15%	11.22%	10.82%	8.94%
Treated in 50°C for 3 hours.	—*	—	—	—	Single shoot only	—
Treated in 52°C for 0.5 hours.	—	—	—	0.5%	4%	16.6%
Treated in 54°C for 0.5 hour.	—	—	—	—	—	—

—* indicate no disease appearance.

Therefore, it is suggested that the hot water treatment of seed setts at 54°C for 0.5 hour may be followed although such exposure badly affects the germination, but the plants growing out of these hot water treated seeds will be superior in respect of yield contributing and disease control factors (Table 3). The seeds from these first generation hot water treated canes will be free from white leaf disease.

Effect of temperature on six other factors such as germination (%), tillers/clump, millable canes/clump, weight of cane/stalk and percentage sugar recovery were also taken into consideration.

Highest percentage of germination was obtained in untreated cane. Significant difference between treatments were also obtained (Table 2). However difference between untreated and treated setts at 52°C for 0.5 hour was insignificant (Table 2). The germination was greatly reduced by 36.5% and 61.08% over control due to long hot water treatment at 50°C for 3 hours and higher temperature at 54°C for 0.5 hour respectively. Tillering of cane was not affected by any treatment. Highest millable canes/clump were obtained in hot water treatment at 54°C/0.5 hour followed by treatment at 50°C/3 hours, 52°C/0.5 hour and untreated cane (Table 2). Weight of cane stalk as well as sucrose recovery (%) were not at all affected by hot water treatment.

Table 2. Effect of different temperature on germination, tillering millable, cane, weight of cane and recovery of sugar.

Treatments	germination %	No. of tiller/clump	No. of millable cane/clump	Weight of cane (kg)	(%) Recovery	Decrease in germination due to heat treatment %
Untreated infected cane	51.4a*	7.98a	3.19a	1.21a	7.65a	100
Treated in 50°C for 3 hours.	32.6b	7.79a	4.45bc	1.09a	8.05a	36.50
Treated in 52°C for 0.5 hour	48.8a	7.38a	3.65ab	1.05a	8.14a	8.94
Treated in 54°C for 0.5 hour	20.0c	8.42a	4.76c	1.07a	7.75a	61.08
S. E. of mean	2.62	6.98	8.27	11.10	10.42	

*Different letters indicate significant difference at 5% level as per DNMR test.

Table 3. Some growth and yield parameters between exclusively diseased canes and healthy canes.

Treatment	Germination (%)	No. of tiller/clump	No. of millable cane/clump	Weight of cane/stalks (kg)	(%) Recovery	Loss due to infection in weight (kg) and recovery (%)
Untreated infected cane	51.4a	3.66a	1.47a	0.58a	3.76a	52.54 wt. loss
Healthy cane of Foundation seed plot.	59.2a	6.27b	3.59b	1.22b	8.95b	57.98 recovery

Different letters indicate significant difference as per T-test at 1% level of significance.

In a separate experiment, germination (%), tillering/clump, millable canes/clump, weight/cane and percentage sugar recovery (%) were compared exclusively between the white leaf infected cane and healthy canes. Significant differences were obtained in case of all criteria except germination (%). Loss in weight and sugar recovery (%) between the untreated infected and healthy canes were compared and 52.54% loss in weight and 57.98% loss in sugar recovery were obtained in infected canes.

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REFERENCES

- Chen, C. T. and Chen, N. J. 1974. Pathological effects of the sugarcane white leaf agent on chlorophyll content and chloroplast ultrastructure. *Proc. ISSCT*. 15 : 343—347.
- Evans, S. J. 1981. Field reference manual for Bangladesh. Bangladesh Australia Sugar Industry Project, 1981, p. 18.
- Hutchinson, P. B. 1982. Report of Pathology Advisor, Bangladesh Australia Sugar Industry Project, March 1982, Part 1, p. 7.
- Len, L. S. 1974. An insectary method for testing sugarcane varieties for resistance to white leaf disease. *Proc. ISSCT*. 15 : 266—274.
- Lin, S. C. and Lee, C. S. 1968. Mycoplasma or mycoplasma like micro organism in white leaf disease. *Ann. Rep. Taiwan. Sug. Exp. Sta.*, 17—22 (1967—68).
- Ling, K. C. and Chuang Yang, C. 1963. Studies on white leaf disease of sugarcane II. Efficacy of hot water treatment in the disease. *Rept. Taiwan Sugar Expt. Sta.*, 30 : 75—88.
- Rahman, S. ; Ali, S. and Mostafa, G. 1980. Survey of Sugarcane diseases in early stages of plantation, its incidence and distribution in Sugar Mills Zone in Bangladesh, *Bangladesh. J. Sugarcane*, 2 : 43—47.
- Shikata, E.; Teng, W. S. and Matsuvoto, T. 1969. Mycoplasma or PLT like organisms detected in leaves of sugarcane infected with white leaf and the suppression of symptoms by the antibiotics of tetracycline group. *J. Fac. Agric. Hokkaido Univ.*, Japan, 56 : 79—90.