Evaluation of Commercial Heat-Treatment Methods for Control of Ratoon Stunting Disease of Sugarcane

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ABSTRACT

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In the greenhouse, seed cane of the sugarcane clone L 62-96 germinated better when commercially heat treated for control of ratoon stunting disease (RSD) than when left untreated. Averages for shoots with RSD symptoms were: untreated 77%, hot-water treated 8%, and aerated-steam treated 5%. Averages for seed cane with one or more shoots per stalk with symptoms were: untreated 98%, hot-water treated 17%, and aerated-steam treated 16%. The commercial heat treatments decreased the incidence of RSD but did not eliminate RSD from L 62-96.

Ratoon stunting disease (RSD) of sugarcane is caused by a small xylem-limited bacterium (1,4,5) that is mechanically transmitted at harvest to the subsequent plant cane and stubble or ratoon crops (7). The disease can be controlled by heat treating seed cane. The three heat-treatment methods recommended for RSD control in Louisiana are 1) hot water (HW), 50 C for 2 hr, 2) aerated steam (AS), 53 C for 4 hr, and 3) hot air (HA), 58 C for 8 hr (2). Eighteen of Louisiana's 24 sugar mills operating in the fall of 1980 provided heat-treatment facilities to the growers; 13 had HW and five had AS units. Some growers operated their own facilities, primarily aerated-steam and hot-water units.

There has been no evaluation of the efficacy of hot-water and aerated-steam methods since the original research was done to recommend them. The purpose of this research was to determine the commercial utilization and efficacy of two widely used heat-treatment methods for control of RSD in Louisiana, namely HW and AS.

MATERIALS AND METHODS

Information concerning the number and type of heat-treatment facilities and the amount of commercial sugarcane (*Saccharum* interspecific hybrid) treated by each was compiled from a survey conducted in the fall of 1980 by the county agent of each sugarcane-growing parish.

Diseased stalks (20 per sample) of clone L 62-96 grown at the St. Gabriel Experiment Station were distributed to the 15 heat-treatment facilities. Stalks of the samples were included with commercial batches of cane being heat treated on 18 or 24 September or 2 October 1980. Each stalk in the samples had been checked previously for presence of the RSD bacterium; the vascular contents of the basal internode were blown onto a microscope slide and viewed with dark-field optics at ×500 (6). The sample stalks, all containing the RSD bacterium, were marked with red flagging tape to permit their recovery from the other seed cane being treated. Samples were treated the day of delivery and picked up the next day, then whole stalks were planted in vermiculite on greenhouse benches at the USDA Sugarcane Field Laboratory in Houma, LA. Two untreated samples were also planted. Plants were fertilized with soluble fertilizer every other week.

Data were taken on 16 or 17 February 1981, after 4.5–5.0 mo of growth. Germination was determined by counting the number of nodes with one or more viable shoots and the total number of nodes per seed-cane stalk. Each shoot was sliced longitudinally and visually checked for the internal mature-node symptom of RSD. The clone L 62-96 is susceptible to RSD and consistently shows good symptoms. Data were recorded as the number of nodes with shoots with RSD-positive symptoms per seed-cane stalk. This also allowed determination of the number of seed-cane stalks having at least one node with RSD-positive shoots per 20-stalk sample.

RESULTS AND DISCUSSION

Table 1 indicates the utilization of the three heat-treatment methods for commercial control of RSD in Louisiana. Hot-water-treated cane comprised 63.3% of the cane heat treated in 1980. The ease of temperature control and the shorter treatment time (2 hr) probably accounts for the greater use of HW. About half as much cane was treated by AS (31.4%) as by HW even though there were more AS units. The longer treatment time of 4 hr may preclude greater use. The low use of HA (5.3%) may be due to the 8-hr treatment time and the labor-intensive necessity to strip leaves and sheaths from cane stalks. No HA units were evaluated for efficacy because none were operated by mills for their growers. The approximately 6,000 tons of cane heat treated in the fall of 1980 produced sufficient yield to plant progeny of heat-treated cane on about 10–20% of the area to be planted in the fall of 1982.

Table 2 shows germination and symptom production in shoots from treated stalks. Untreated samples are also included and show that 98% of the diseased stalks produced a symptomatic shoot. The average germination of the non-heat-treated controls was 49%, HW-treated was 62%, and AS-treated was 57%. Heat treatment increases both the amount and rate of germination over the controls. This increase in germination is probably due to a stimulatory, more than a curative or therapeutic, effect of heat.

Both methods of heat treatment, on the average, show fewer seed cane having one or more shoots with RSD symptoms (HW 17%, AS 16%, and untreated 98%) and fewer shoots per sample with symptoms (HW 8%, AS 5%, and untreated 77%) (Table 2). The two methods, HW and AS, appear to be

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Table 1. Utilization of RSD control methods in Louisiana in 1980

Method	Units (no.)	Treated (tons)	Treated (%)	Average use (tons/unit)
Hot water	18	3,887	63.3	216
Aerated steam	31	1,927	31.4	62
Hot air	14	327	5.3	23
Total		6,141		

Table 2. Effects of heat treatment on germination and symptoms of ratoon stunting disease in shoots from samples of 20 stalks each

Treatment facility	Germination[a] (%)	Symptomatic seed cane[b] (%)	Symptomatic shoots[c] (%)
Untreated	49	100	68
Untreated	49	95	85
Average	49	98	77
Hot water			
Breaux Bridge	63	45	9
Cajun	65	10	3
Caldwell	55	20	7
Helvetia	64	15	4
Iberia	68	40	13
Lula	58	15	3
S. Coast	68	15	8
St. James	55	10	30
St. Martin	62	5	5
Sterling	63	15	3
Westfield	61	0	0
Average	62	17	8
Aerated steam			
A. V. Allain & Sons	64	10	2
Caire & Graugnard	52	20	7
Poplar Grove	62	35	9
White Castle	50	0	0
Average	57	16	5

[a] Number of buds germinated per total buds expressed as a percent.
[b] Symptomatic seed cane represents the number of stalks of the 20-stalk sample exhibiting at least one symptomatic shoot.
[c] Symptomatic shoots represent the frequency of symptomatic shoots out of all shoots produced by a 20-stalk sample.

similar in efficacy. Averages are believed to represent what might be expected over a treatment season by a properly operating individual unit. These averages included one sample completely free of symptoms for each method. There was also one sample from each method in which there were no cures; therefore, these data were discarded because it was likely that the samples had not been treated.

Much variation in efficacy is apparent from the data (Table 2). Monitoring of the temperature and duration of these treatments by the operator indicated that the treatments had been within the recommended guidelines. The sources of variability in efficacy are assumed to be inherent in the system and include equipment and operator differences. Sugarcane clones vary in the ease of cure from RSD by heat treatment. Clone L 62-96 is rated difficult to free of RSD (3) and therefore provided a rigorous test of efficacy. Many growers use cane for heat treatment that has a lower incidence of RSD than the cane used experimentally because, as the recommended practice, the progeny (first stubble) of heat-treated cane is heat treated.

The significance of the 16–17% escapes from successful heat treatment in this variety depends on the rate of spread of RSD by the mechanical harvester. Experiments to evaluate rate of spread are in progress.

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