

PATHOLOGY RESEARCH

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RATOON STUNTING DISEASE TESTING

A fourth year of testing for ratoon stunting disease (RSD) was conducted during 2000 as part of the Sugarcane Disease Detection Lab operations. RSD was monitored in commercial fields on farms, in the Sugarcane Variety Selection and Release Programs, at all levels of Kleentek[®] seedcane production, and in the local quarantine that provides healthy plant material for tissue culture of Kleentek seedcane (Table 1). A large-scale, statewide survey was conducted, and 535 commercial fields were sampled on 123 farms. The results indicate that RSD incidence and therefore impact was low in 2000 (Table 2). The results of the large-scale survey were similar to the results from the two previous years, so RSD stalk infection levels within fields have been 3% or less for three years of testing. From 1997 to 2000, RSD stalk infection levels within fields decreased from 12 to 2%, and the proportion of fields with RSD decreased from 52 to 14%. The reduction of RSD represents a major positive development for the Louisiana sugarcane industry. One survey statistic, percentage of farms with RSD in at least one tested field, indicated the need to continue efforts to reduce RSD in the industry. RSD was detected on 83% of farms tested during 1997. This decreased to 35% by 2000, indicating substantial progress, but this infection level indicates that RSD is still present in the industry.

Factors associated with decreased RSD infection levels are increased cultivation of LCP 85-384, a variety with some resistance to spread of RSD, and use of tissue cultured seedcane. The area under cultivation with LCP 85-384 increased from 29 to 68% between 1997 and 2000. Stalk infection and field infection levels in tested fields of LCP 85-384 were 0.4% and 7%, respectively, during 2000. Kleentek progeny was grown in 55% of tested fields during 2000. The RSD stalk infection level within Kleentek progeny fields was 1% or less, and the field infection level averaged 6% for the last three years (Table 3). One negative note detected by the survey was that, during 2000, one-third of the tested fields were not progeny of a healthy seedcane program.

Variability among varieties in the resistance to spread and increase of RSD was detected in previous field experiments. The survey results demonstrate that this type of resistance can affect the occurrence of RSD. For the varieties LCP 82-89, CP 70-321, and LCP 85-384, which have high, moderate, and low rates of RSD spread, respectively, the average stalk infection levels within fields were 20, 10, and 0.4%, and the average field infection levels were 75, 41, and 7%, respectively. Test results from 2000 suggest that HoCP 91-555, the most recently released variety, has a high rate of disease spread, as well as high potential for yield loss when infected, so this variety needs to be carefully monitored for RSD. Research will continue to evaluate resistance to RSD spread. Experiments were planted to compare rates of spread caused by combine and whole stalk harvesting in the new varieties.

The Kleentek seedcane production system was monitored for RSD at four stages: initial plant material to be used to start Foundation stock plants for tissue culture, established Foundation stock plants, primary increase farms, and secondary increase farms (Table 1). No RSD was detected at any stage of Kleentek seedcane production.

In Louisiana, on-farm healthy seedcane programs using Kleentek seedcane produced through tissue culture and the growth of a variety with resistance to RSD spread have brought about a high degree of control of what has long been the most damaging disease of sugarcane. This has been accomplished through a partnership of farmers, the LSU AgCenter, a state regulatory agency, and a private company. On-going research and farmer participation in healthy seedcane programs and RSD testing will be needed to prevent RSD from becoming re-established in the sugarcane industry.

PATHOGEN ASSAYS, LOCAL QUARANTINE, AND SUGARCANE YELLOW LEAF

The tissue-blot immunoassay was used for RSD testing during 2000. Tissue-blot immunoassays also were adapted for detection of leaf scald and a new virus disease, sugarcane yellow leaf. These methods were used to test promising experimental varieties from the Louisiana Cooperative Sugarcane Breeding Program for RSD, leaf scald, and yellow leaf, then stalks were heat-treated and plants were grown in a local quarantine greenhouse to provide plant material to initiate Foundation stock plants for tissue culture production of Kleentek seedcane. Plants growing in the local quarantine greenhouse were observed for disease symptoms, re-tested for RSD, leaf scald, and yellow leaf, and heat-treated again before release to Kleentek. Seven clones were delivered from quarantine, and eight clones were started in quarantine during 2000.

The tissue-blot assay using leaf mid-ribs for detection of sugarcane yellow leaf virus (SCYLV) was adapted for use in Louisiana. A total of 6,514 samples were run through the lab. The mid-rib blot was used to test Kleentek seedcane sources for the virus. Infection was detected in some Kleentek seedcane fields, and cane was not sold to growers from these fields. Stalks were collected from one field and used to plant a field experiment to determine the effect of SCYLV infection on yield of LCP 85-384.

SELECTION OF DISEASE-RESISTANT VARIETIES

Leaf scald symptoms resulting from inoculation by the decapitation method were mild during 2000. The highly susceptible former commercial variety, CP 74-383, was rated as moderately susceptible. Evaluation of the resistance levels in the experimental varieties rated four of 35 clones (11%) as moderately susceptible (Table 4). Natural mosaic infection levels in outfield yield trials were low during 2000. Only six of 10 experimental varieties exhibited any mosaic symptoms, and all had infection levels of 1% or less (Table 5). In the smut inoculated test, 21 (60%), 11 (31%), and three (9%) of 35 experimental varieties were found to be resistant, moderately susceptible, and highly susceptible, respectively, to smut (Table 6).

Table 1. RSD testing summary for 2000.

Source	Location	No. of fields	No. of varieties	No. of stalks
La Growers	Statewide	535	11	10,525
LSU AgCenter	St. Gabriel/Iberia		17	221
Variety Release Program	Primary and secondary stations		12	715
Kleentek	Foundation Stock		1	8
Kleentek	Primary increase	17	5	417
Kleentek	Secondary increase	14	5	408
Local Quarantine	LSU AgCenter		12	54
Research	LSU AgCenter		4	80
Totals		566		12,428

Table 2. RSD infection levels for fields and within fields by crop cycle year over four years of testing.

Crop year	Average percentage of infected stalks within fields				Average percentage of fields with RSD			
	1997	1998	1999	2000	1997	1998	1999	2000
Plantcane	9	2	0	2	42	12	0	8
1st stubble	10	3	0	2	50	19	0	14
2 nd stubble	21	1	6	5	55	13	13	17
Older	13	18	0	3	73	33	0	22
Unknown	10	0.4	0	-	100	10	0	-
Total	12	3	2	2	52	15	3	14

Table 3. RSD infection levels for fields and within fields by healthy seedcane program over four years of testing.

Program	Average percentage of infected stalks within fields				Average percentage of fields with RSD			
	1997	1998	1999	2000	1997	1998	1999	2000
Heat treated	24	4	0	2	70	32	0	13
Kleentek [®]	12	1	0	1	52	10	0	10
Cleenseed [®]	-	0	0	2	-	0	0	6
Other	9	7	12	6	44	24	25	23
Total	12	3	2	2	51	15	3	14

Table 4. Experimental variety evaluation for leaf scald resistance in an inoculated test.

Variety	Rating ^a	Variety	Rating ^a	Variety	Rating ^a
CP 65-357	4.5	HoCP 96-503	3.9	HoCP 97-665	3.2
CP 70-321	4.7	HoCP 96-509	4.2	L 98-158	2.9
CP 73-351	3.8	HoCP 96-540	3.1	L 98-165	3.0
CP 74-383	5.0	HoCP 96-561	3.1	L 98-168	2.8
TucCP 77-42	2.2	L 97-102	3.5	L 98-173	3.0
CP 81-335	2.4	L 97-128	3.0	L 98-174	2.8
LCP 85-384	3.7	L 97-137	3.8	L 98-181	4.1
HoCP 85-845	2.5	HoCP 97-606	3.4	L 98-183	3.0
HoCP 91-555	2.8	HoCP 97-609	2.8	L 98-186	2.8
L 95-462	3.3	HoCP 97-621	2.8	L 98-192	2.7
L 95-485	3.3	HoCP 97-628	4.0	L 98-197	2.9
Ho 95-988	2.0	HoCP 97-629	3.4	L 98-198	2.8
L 96-26	5.3	HoCP 97-641	2.5	L 98-207	2.6
L 96-40	3.2	HoCP 97-645	3.9	L 98-209	2.5
L 96-92	2.8	HoCP 97-646	3.3		

^a Resistance ratings assigned on a 1-9 scale in which 1-3 = resistant, 4-6 = moderately susceptible, and 7-9 = highly susceptible.

Table 5. Sugarcane mosaic natural infection levels in yield trials on farms (outfield tests).

Variety	Infection (%)	Rating ^a	Variety	Infection (%)	Rating ^a
CP 70-321	0.53	2	Ho 95-988	0.02	2
CP 70-321 KT ^b	0.00	1	L 96-26	0.16	2
LCP 85-384	0.02	2	L 96-40	0.00	1
LCP 85-384 KT	0.00	1	L 96-92	0.00	1
HoCP 85-845	0.16	2	HoCP 96-503	1.16	2
HoCP 85-845 KT	0.00	1	HoCP 96-509	0.25	2
HoCP 91-555	0.00	1	HoCP 96-540	0.00	1
L 95-462	0.07	2	HoCP 96-561	0.01	2
L 95-485	0.00	1			

^a Resistance ratings assigned on a scale of 1-9 in which 1-3 = resistant, 4-6 = moderately susceptible, and 7-9 = highly susceptible.

^b KT = plants produced from Kleentek[®] seedcane.

Table 6. Smut infection level and resistance ratings for experimental varieties determined from an inoculated test.

Variety	Infection (%)	Rating ^a	Variety	Infection (%)	Rating ^a	Variety	Infection (%)	Rating ^a
CP 65-357	54	9	L 96-92	0	1	HoCP 97-646	1	2
CP 70-321	2	2	HoCP 96-503	0	1	HoCP 97-665	34	6
CP 73-351	71	9	HoCP 96-509	0	1	L 98-158	1	2
CP 74-383	25	5	HoCP 96-540	4	2	L 98-165	54	8
TucCP 77-042	4	3	HoCP 96-561	6	3	L 98-168	14	4
CP 80-004	81	9	L 97-102	0	1	L 98-173	6	3
CP 81-335	51	8	L 97-128	20	5	L 98-174	69	9
LCP 85-384	12	4	L 97-137	1	2	L 98-181	27	6
HoCP 85-845	1	2	HoCP 97-606	21	5	L 98-183	8	3
HoCP 91-555	0	1	HoCP 97-609	2	2	L 98-186	40	7
L 95-462	0	1	HoCP 97-621	7	3	L 98-192	1	2
L 95-485	0	1	HoCP 97-628	1	2	L 98-197	7	3
Ho 95-988	9	4	HoCP 97-629	8	4	L 98-198	14	4
L 96-26	22	5	HoCP 97-641	0	1	L 98-207	1	2
L 96-40	10	4	HoCP 97-645	32	6	L 98-209	4	3

^a Resistance ratings assigned on a 1-9 scale in which 1-3 = resistant, 4-6 = moderately susceptible, and 7-9 = highly susceptible.