PATHOLOGY RESEARCH

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Pathology research addresses the important diseases affecting sugarcane in Louisiana. The overall program goal is to minimize losses to diseases in the most cost-effective manner possible. Projects receiving major emphasis during 2004 were billet planting, ratoon stunting disease (RSD) management, breeding and selection of disease-resistant varieties, evaluating the effect of rust on yield of LCP 85-384, assessing the threat posed by yellow leaf, and improving our understanding of root disease. Research results on billet planting are reported separately.

RATOON STUNTING DISEASE

RSD testing was conducted by the Sugarcane Disease Detection Lab for the seventh year during 2004. RSD was monitored in fields on commercial farms, in the American Sugar Cane League Variety Release Program, in the Local Quarantine (to provide healthy source material for commercial seedcane production through tissue culture), and at all levels of Kleentek® seedcane production (Table 1). In 1997, the first year of on-farm testing, the number of farms with RSD detected in at least one field, the frequency of fields with RSD-infected cane (across the entire industry), and the frequency of stalks within a field with RSD averaged 83, 51, and 12%, respectively. In 2004, these statistics had decreased to 14, 7, and 1%, respectively. RSD no longer exhibits a typical pattern for a disease spread mechanically during planting and harvest, in which infection levels increase progressively with more harvests and higher levels of disease are detected in ratoon or stubble crops, although infection levels were higher in fields of ratoon crops than plant cane, except for second ratoon (Table 2). The incidence of RSD was lower in recent progeny of tissue culture produced seedcane compared to “field-run” cane (Table 3). The frequency of stalk infection in field-run cane was only 3%. However, many of the fields listed as field-run were LCP 85-384 from Kleentek® seedcane that had been increased more than three times. There is very little heat-treated progeny in the industry any more. Factors associated with reductions in RSD are planting of certified healthy seedcane and widespread planting of LCP 85-384, a variety with some resistance to RSD spread. The testing results are encouraging. However, the sample size (20 stalks per field) used for RSD testing on farms is too small to reliably detect low levels of RSD infection. The results suggest that RSD is persisting on many farms in the industry at a low level. The frequency of detection on farms was 32% in 2003, when an effort was made to test more fields per farm and more farms were tested. This situation could lead to a resurgence of RSD, if a susceptible variety becomes widely planted in the future. If farmers continue to use a healthy seedcane program, they have the opportunity to eliminate RSD from their farms.

Results were collected from third ratoon of an RSD spread experiment comparing rates of disease spread in different varieties caused by harvest with a whole stalk or chopper harvester. The highest rates of RSD spread again occurred in LCP 82-89 and HoCP 91-555. Rates of RSD spread caused by the two harvester types were compared, and the whole stalk harvester caused more disease spread than the chopper harvester.

Table 1. RSD testing summary for 2004.

Source	Location	No. of fields	No. of varieties	No. of samples
Louisiana growers	State-wide	89	10	1787
Variety Release Program	1° & 2° stations	-	23	1163
Goosecreek®	Foundation stock	-	0	0
Helena®	Foundation stock	-	8	15
Kleentek®	Foundation stock	-	24	49
Kleentek®	1° increase farms	14	2	241
Kleentek®	2° increase farms	26	2	512
Local Quarantine	LSUAC	-	20	116
Research	LSUAC	-	-	985
Totals		129	-	4,898

Table 2. RSD field and stalk infection frequencies in different crop cycle years for all varieties combined during 2004.

Crop Year	Total number of fields	Average field infection (%)	Total number of stalks	Average stalk infection (%)
Plant cane	35	2.9	647	0.2
First ratoon	23	13.0	459	3.1
Second ratoon	11	0	221	0
Older ratoons	20	10.0	460	1.3
Totals	89	6.7	1787	1.2

Table 3. RSD field and stalk infection frequencies as affected by healthy seedcane programs for all varieties combined during 2004.

Seedcane program	Total number of fields	Average field infection (%)	Total number of stalks	Average stalk infection (%)
Heat-treated	3	0	30	0
Kleentek®	37	2.7	742	0.1
Goosecreek®	6	0	120	0
Field-run	26	15.4	585	3.1

SUGARCANE YELLOW LEAF

Sugarcane yellow leaf virus (SCYLV) causes yellow leaf, our most recent disease in Louisiana. Research is continuing to determine the potential impact under Louisiana conditions and develop appropriate disease management practices. Results have been obtained from two experiments to determine the effect of SCYLV on yield of LCP 85-384 (conducted in cooperation with Dr. Mike Grisham at the USDA-ARS Sugarcane Research Unit Ardoyne experimental farm). No significant yield loss was detected in plant cane or first ratoon, but a 2.2 ton yield loss was detected in second ratoon in the first experiment. In the second experiment, tonnage yields in plant cane were 36.9 and 34.3 tons/acre in control and virus-infected plots, respectively.

A tissue-blot, enzyme immunoassay using imprints from leaf mid-veins was used in the Sugarcane Disease Detection Lab for the detection of SCYLV (Table 4). Testing on commercial farms was expanded during 2004. The testing results from 40 fields on 10 farms indicated that the average infection levels were 80% for farms, 52% for fields, and 5% for stalks. These results are similar to a survey conducted in single fields on 42 farms in 2002, in which 48% of the fields and 7% of stalks were infected. Yellow leaf was included in the seedcane certification standards for the first time during 2004, and Louisiana Department of Agriculture and Forestry inspectors collected leaves from Kleentek and Goosecreek seedcane fields during the June inspection. The LSU AgCenter Sugarcane Disease Detection Lab then tested the samples for SCYLV. No tested field exceeded the yellow leaf infection standard. It is hoped that providing the industry with near-virus-free seedcane will prevent a buildup of virus infection levels in commercial fields and help prevent this disease from becoming a problem in the future.

Table 4. Sugarcane yellow leaf virus testing summary for 2004.

Source	Location	No. of fields	No. of varieties	No. of samples
Louisiana growers	State-wide	46	5	1744
LSUAC	St. Gabriel & Iberia	-	8	502
Helena	Foundation stock	-	8	15
Kleentek®	Foundation stock	-	24	110
Kleentek®	1° increase farms	57	7	2135
Kleentek®	2° increase farms	62	5	2413
Local Quarantine	LSU AgCenter	-	20	113
Research	LSUAgCenter	-	-	2166
Totals		165		10,682

SELECTION OF DISEASE RESISTANT VARIETIES

Experimental varieties in the selection program are screened and rated for resistance to mosaic, smut, and leaf scald. Natural mosaic infection levels were determined in breeding program outfield yield trials. Little infection was detected in experimental varieties during 2004. Smut resistance in experimental varieties was evaluated in an inoculated test in which stalks were dipped in a smut spore suspension then planted during August 2003. Smut infection levels were determined during July 2004 and compared to infection levels in varieties with known resistance reactions. Within the experimental varieties, 29 (88%), 2 (6%), and 2 (6%) of 35 were rated as resistant, moderately susceptible, and highly susceptible to smut, respectively (Table 5). Leaf scald also was evaluated in experimental varieties using an inoculated test. During June, shoots were cut above the growing point and sprayed with leaf scald bacteria. Symptoms were evaluated later in the growing season, and clones were rated for their resistance level (Table 6). Four (12%), 26 (74%), and 5 (14%) of 35 experimental varieties were rated as resistant, moderately susceptible, and highly susceptible to leaf scald.

RUST IMPACT ON LCP 85-384 YIELD

Two experiments were conducted to evaluate the impact of brown rust on yield of LCP 85-384. Experiments were located in Iberia and St. Mary parishes in plant-cane fields. A combination of three fungicides was applied at two-week intervals to attempt to control natural infection by rust. Tebuconazol (Folicur, 6 oz FP per acre), propiconazol (Tilt, 6 oz FP per acre), and azoxystrobin (Quadris, 6.2 oz FP per acre) were applied with a backpack sprayer to 4 row x 60 ft. plots replicated four times. Fungicide treatments were started and stopped at different times during the epidemic period in an attempt to determine when rust might cause yield loss to occur. Severe rust developed only at the Iberia Parish location (Table 7). Rust significantly reduced stalk weight, tons of cane per acre, and sugar per acre. It did not significantly affect stalk population, fiber, or sucrose content. Application of fungicides only at the beginning of the epidemic in April or only at the end of the epidemic during June did not result in a yield increase (Table 7). Sugar per acre was only increased when fungicides were applied during April through June and during May and June. Sugar per acre was not increased by fungicide treatments at the St. James location (Table 8).

ROOT DISEASE

A basic research project is in progress addressing the effects of root disease on sugarcane growth and productivity. Pythium root rot and nematodes have been shown to be constraints to sugarcane growth and yield. However, evidence suggests that long-term cultivation of sugarcane can result in the development of a total soil microorganism community that is detrimental to sugarcane growth. Indirect evidence for this can be seen in the high yields obtained when cane is planted in “new ground” with no recent history of sugarcane cultivation. Three sites with paired fields, one with a long-term sugarcane cultivation history and one with no recent cultivation history, were compared previously for culturable microorganisms present in the rhizosphere soil (soil in close proximity to roots exposed to root exudates). Differences in the pattern of utilization of multiple substrates (potential food sources) were detected between soils from fields with and without a recent sugarcane cropping history. Differences also were detected between

soil microbial communities from fields with and without a sugarcane cropping history in the quantity and type of culturable microorganisms. An additional site of paired fields was compared during 2004, and differences between "new" and "old" fields were detected.

These differences provide information about the possible changes in microbial community makeup that can result from sugarcane monoculture. We are attempting to identify the organisms that account for the differences in community makeup in soil from "new" and "old" ground fields. The hope is that improved understanding of the effects of the total soil microbial community on sugarcane root development will allow us to determine ways to manipulate or manage the community to promote root system health and improve plant growth.

Table 5. Smut infection level and resistance ratings for experimental varieties determined from an inoculated test during 2004.

Variety	Infection (%)	Rating[x]	Variety	Infection (%)	Rating[x]
CP 65-357	12	4	HoCP 01-534	1	2
CP 70-321	0	1	HoCP 01-544	1	2
CP 73-351	66	9	HoCP 01-551	0	1
CP 74-383	63	9	HoCP 01-553	0	1
TucCP 77-42	0	1	HoCP 01-558	0	1
CP 81-335	10	4	HoCP 01-561	0	1
LCP 85-384	0	1	HoCP 01-564	20	5
L 97-128	0	1	L 02-316	0	1
L 98-209	1	2	L 02-320	0	1
L 99-226	1	2	L 02-322	0	1
L 99-233	4	2	L 02-323	0	1
HoCP 00-927	0	1	L 02-324	1	2
HoCP 00-930	5	3	L 02-325	0	1
HoCP 00-950	0	1	L 02-326	1	2
L 01-283	0	1	L 02-333	39	7
L 01-292	0	1	L 02-336	34	7
L 01-299	17	5	L 02-341	0	1
HoCP 01-517	0	1	L 02-342	1	2
HoCP 01-520	0	1	L 02-343	0	1
HoCP 01-523	0	1	L 02-353	2	2
HoCP 01-529	0	1	L 02-354	0	1

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

Table 6. Leaf scald resistance ratings for experimental varieties determined from an inoculated test during 2004.

Variety	Rating[x]	Variety	Rating[x]	Variety	Rating[x]
CP 65-357	7	L 01-283	4	L 02-316	3
CP 70-321	6	L 01-292	6	L 02-320	2
CP 73-351	6	L 01-299	7	L 02-322	5
CP 74-383	9	HoCP 01-517	6	L 02-323	6
TucCP 77-42	4	HoCP 01-520	4	L 02-324	5
CP 81-335	6	HoCP 01-523	7	L 02-325	6
LCP 85-384	1	HoCP 01-529	5	L 02-326	3
L 97-128	5	HoCP 01-534	4	L 02-333	8
L 98-209	5	HoCP 01-544	5	L 02-336	5
L 99-226	5	HoCP 01-551	5	L 02-341	6
L 99-233	6	HoCP 01-553	5	L 02-342	5
HoCP 00-927	4	HoCP 01-558	3	L 02-343	7
HoCP 00-930	5	HoCP 01-561	5	L 02-353	5
HoCP 00-950	8	HoCP 01-564	5	L 02-354	5

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

Table 7. Effect of rust on plant cane yield of LCP 85-384, Iberia Parish, 2004.

Fungicide treatment dates						Sugar/acre (lbs)
None						7308 B
4/8	4/20*					7538 B
4/8	4/20*	5/7	5/19**			8390 AB
4/8	4/20*	5/7	5/19**	6/1	6/19	9330 A
		5/7	5/19**	6/1	6/19	9095 A
				6/1	6/19	7538 B

* Rust first observed.

** Rust very evident.

Table 8. Effect or rust on plant cane yield of LCP 85-384, St. James Parish, 2004.

Fungicide treatment dates					Sugar per acre (lbs)
None					6378
4/5	4/22				5663
4/5	4/22	5/6	5/21*		6876
4/5	4/22	5/6	5/21*	6/9	6339
		5/6	5/21*	6/9	6767
				6/9	5901

* Rust first observed.