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 2001 were ratoon stunting disease (RSD) management; assessing the threat posed by our newest disease, sugarcane yellow leaf; improving our understanding of root disease; and breeding and selection of disease-resistant varieties. Stalk rot research is a component of research on billet planting that is reported separately.

RATOON STUNTING DISEASE

RSD testing was conducted as part of the Sugarcane Disease Detection Lab operations for the sixth year during 2002. RSD was monitored in fields on commercial farms, in the LSU AgCenter Variety Selection Program, in the American Sugar Cane League Variety Release Program, in the Local Quarantine (to provide healthy source material for commercial seedcane production), 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. By 2002, these statistics had decreased to 10, 5, and 1%, respectively. These numbers have been declining progressively each season. 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. The highest infection levels detected during 2002 were 11% for fields with RSD and 3% for stalks infected in first stubble fields (Table 2). 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 very 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. Testing results with HoCP 91-555, a highly susceptible variety, found that 22% of the fields tested had RSD. This variety will become infected if RSD is persisting on a farm. The results suggest that this may be the case and emphasize the need for farmers to continue to use a healthy seedcane program.

SUGARCANE YELLOW LEAF

Sugarcane yellow leaf virus (SCYLV) causes our most recent disease in Louisiana. Research is under way to determine the potential impact to LCP 85-384 under Louisiana conditions. Results have been obtained from an experiment to determine the effect of SCYLV on yield of LCP 85-384 (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. This experiment has been re-planted. A tissue-blot immunoassay using imprints from leaf mid-ribs was used in the Sugarcane Disease Detection Lab for the detection of SCYLV (Table 3). Sources of Kleentek® seedcane were monitored for SCYLV for the third year. The results from the yield loss experiment with LCP 85-384 suggest that yellow leaf may not significantly reduce yield. Nonetheless, if a problem was detected in a Kleentek® seedcane field, cane was not sold from that field. LCP 85-384 will become infected with the virus. 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 to manage this disease in the future.

A graduate student project conducted by Chris McAllister under the supervision of Dr. T. E. Reagan and Dr. J. W. Hoy is investigating the entomological and pathological factors affecting the spread and increase of sugarcane yellow leaf. A statewide survey was conducted, in which 42 fields of LCP 85-384 first ratoon were sampled. The virus was detected in fields in all areas of the industry. Field infection levels ranged from 0-63%. However, no virus was detected in over half of the sampled fields. Rates of increase and patterns of disease spread were determined in two plant cane and two ratoon fields of LCP 85-384. The sugarcane aphid that spreads the virus from plant to plant was detected in all fields, but only low levels of virus infection occurred in three fields, while a moderate level of infection was detected in one ratoon field.

ROOT DISEASE

A basic research project is in progress addressing the effects of root pathogens and disease on sugarcane growth and productivity. Pythium root rot and nematodes are known 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 for culturable microorganisms present in the rhizoshere 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. However, fields with a long-term sugarcane cropping history from different sites showed differences in substrate utilization profiles. 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. These differences provide information about the possible changes in microbial community make-up that can result from sugarcane monoculture. 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.

Additional research conducted during 2002 in cooperation with Dr. Ed McGawley evaluated the effects of a potential new chemical for the control of nematodes and a general biocide that can kill all organisms in the soil. In a field experiment conducted at the Sugar Research Station, nematode numbers were decreased, but no increases in yield were obtained. The general biocide showed some potential for weed control, but cane germination was delayed. Another experiment is planned to evaluate different chemical application rates and time intervals between treatment and planting.

SELECTION OF DISEASE RESISTANT VARIETIES

Experimental varieties in the selection program are screened and rated for resistance to mosaic, leaf scald, and smut. Natural mosaic infection levels were determined in breeding program outfield yield trials. Little infection was detected in experimental varieties during 2002. Leaf scald 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, but few symptoms resulted from the inoculation. Smut resistance in experimental varieties also was evaluated in an inoculated test in which stalks were dipped in a smut spore suspension then planted during August 2001. Smut infection levels were determined during July 2002 and compared to infection levels in varieties with known resistance reactions. Within the experimental varieties, 19 (68%), six (21%), and three (11%) of 28 were rated as resistant, moderately susceptible, and highly susceptible to smut, respectively (Table 4).

Table 1. RSD testing summary for 2002.

Source	Location	No. of fields	No. of varieties	No. of samples
Louisiana growers	State-wide	195	5	3900
LSUAgCenter	St. Gabriel & Iberia	-	5	110
Variety Release Program	1° & 2° stations	-	23	1297
Kleentek®	Foundation stock	-	-	28
Kleentek®	1° increase farms	15	5	336
Kleentek®	2° increase farms	16	3	326
Local Quarantine	LSUAC	-	14	95
Research	LSUAC	-	8	805
Totals		226		6897

Table 2. RSD field and stalk infection frequencies in different crop cycle years for all varieties combined during 2002.

Crop Year	Total number of fields	Average field infection (%)	Total number of stalks	Average stalk infection (%)
Plant cane	142	4.2	2820	0.6
First stubble	35	11.4	700	2.7
Second stubble	13	0.0	281	0.0
Older stubble	5	0.0	99	0.0
Totals	195	5.1	3900	0.9

Table 3. Sugarcane yellow leaf virus testing summary for 2002.

Source	Location	No. of fields	No. of varieties	No. of samples
Louisiana growers	State-wide	1	1	39
LSUAgCenter	St. Gabriel & Iberia	-	8	85
Kleentek®	Foundation stock	-	15	187
Kleentek®	1° increase farms	57	4	1260
Kleentek®	2° increase farms	33	3	880
Local Quarantine	LSUAC	-	14	95
Research	LSUAC	46	14	7978
Totals		137		10,412

Table 4. Smut infection level and resistance ratings for experimental varieties determined from an inoculated test.

Variety	Infection (%)	Rating[x]	Variety	Infection (%)	Rating[x]
CP 65-357	12	4	HoCP 99-825	1	2
CP 70-321	0	1	HoCP 99-866	4	2
CP 73-351	41	8	HoCP 99-870	0	2
CP 74-383	28	6	L 00-247	23	5
TucCP 77-042	4	2	L 00-249	3	2
L 97-128	0	1	L 00-250	0	1
L 97-137	0	1	L 00-255	0	1
L 98-207	1	2	L 00-257	38	7
L 98-209	4	2	L 00-259	4	2
HoCP 98-741	31	6	L 00-263	0	1
L 99-213	1	2	L 00-264	11	4
L 99-226	1	2	L 00-266	23	5
L 99-231	2	2	L 00-268	9	4
L 99-233	6	3	L 00-270	23	5
HoCP 99-804	1	2	L 00-271	0	1
HoCP 99-808	0	1	L 00-273	67	9
HoCP 99-815	51	9			

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