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 a cost-effective manner. Projects receiving emphasis during 2010 included: improving control methods for brown rust; support of healthy seedcane programs to manage ratoon stunting disease (RSD), yellow leaf, and other systemic diseases; development of new pathogen detection methods; determining the molecular nature of resistance to leaf scald; evaluating disease resistance and resistance screening methods in the variety selection program; and billet planting. Research results on billet planting are reported separately.

BROWN RUST

Cold winter conditions resulted in low brown rust severity during 2010. However, enough rust occurred during the summer to obtain information on the ability of fungicides to control the disease. Three commercial fungicides and three experimental fungicides were compared, and two experimental fungicides provided brown rust control comparable to that provided by the recommended rate of Headline fungicide.

A study to determine the plant growth characteristics and/or environmental conditions that result in the development of a severe brown rust epidemic continued for the second year in 2010. The low brown rust severity during 2010 allowed a comparison of conditions resulting in low disease with those resulting in severe disease during 2009. Winter freeze conditions were quantified and compared. The results suggest it may be possible to better quantify freeze conditions and more accurately predict the threat of brown rust during the subsequent growing season. The start of an epidemic is determined by the occurrence of daily minimum temperatures of 63^{o} F. The decline of an epidemic is determined by the repeated occurrence of days with a mean temperature of 90^{o} F. Within the time period during the spring with temperatures favorable for rust development, disease severity was determined by the number of days with dew present on the leaves for 7 or more hours per day. Monitoring these environmental conditions using existing weather stations at research farms may allow the prediction of the start of rust epidemics on an area-wide basis. The goal is to forecast an outbreak of rust in plant cane of susceptible varieties. This would allow farmers to know if and when to apply a fungicide and thereby maximize the economic benefit of fungicidal control of rust.

Experiments were conducted with greenhouse grown plants of Ho 95-988 and HoCP 96-540 inoculated in the laboratory to determine whether minor nutrients, nickel, copper, chloride, and silicon, can suppress rust. The results suggest that nickel and copper can suppress rust. This alternative approach to rust control shows promise and will be further evaluated.

Spores of the brown rust pathogen, *Puccinia melanocephala*, were collected and used for preliminary evaluation of a laboratory inoculation method to determine resistance in seedling populations. Differences were detected among crosses with parents varying in resistance level to

rust. More resistant progeny and lower disease severity were evident in crosses with resistant parents. This method will be further evaluated during 2011.

EVALUATING RESISTANCE TO RED ROT

The basic germplasm collection was screened during 2009 to identify new sources for resistance to red rot in cooperation with Anna Hale. Clones in the genus *Erianthus* developed little if any red rot symptoms. Clones resulting from crosses with *Erianthus* were inoculated with red rot; however, all of the clones were susceptible to the disease. Limited crossing was initiated during 2010 with sources of red rot resistance in other *Saccharum* species.

MOLECULAR NATURE OF RESISTANCE TO LEAF SCALD

A proteomics analysis of the molecular nature of resistance is underway. Proteins up and down-regulated in response to leaf scald infection are evident, and the identity of these proteins will be determined during 2011. These proteins may provide the means to develop molecular markers for marker assisted selection for resistance. A quantitative polymerase chain reaction (qPCR) assay for leaf scald was developed, and initial testing suggests it has potential to provide an alternative screening method to determine leaf scald resistance levels in experimental varieties in the selection program. Plantings were established to further evaluate the potential of qPCR for resistance screening during 2011.

HEALTHY SEEDCANE PROGRAM SUPPORT AND DISEASE DETECTION METHODS

Disease testing was conducted by the Sugarcane Disease Detection Lab for the 15th year during 2010. Kleentek and SugarTech seedcane production was monitored for RSD, and no disease was detected. A total of 3,324 stalk samples from research farms, variety increase plots, and grower fields were tested for RSD with no positives detected (Table 1). Limited testing was conducted on commercial farms, but no RSD was detected (Table 2). A total of 8,410 leaf samples were tested for yellow leaf (Table 3). Commercial tissue-culture seedcane sources were tested as part of the LDAF seedcane certification program. No field failed to certify due to virus infection. The Local Quarantine supplied healthy plant material of promising experimental varieties to the seedcane companies. The real-time PCR assay established for leaf scald represents the most sensitive assay possible for pathogen detection. Real-time PCR assays for RSD and yellow leaf will be established during 2011.

VARIETY SELECTION

Disease susceptibility in experimental varieties in the Variety Selection Program was determined. Resistance ratings for smut and leaf scald were determined for experimental varieties in the selection program in the annual inoculated test (Table 4). Rust severity resulting from natural infection was not adequate in nurseries and outfield tests to identify rust susceptible experimental varieties. Plantings established during 2010 to determine if planted “spreader” rows of a brown rust susceptible variety could improve evaluation of rust resistance in experimental varieties by providing heavy spore pressure and more reliable natural infection were not successful due to low natural disease severity. These results demonstrate again the limitations of relying on natural infection to determine brown rust resistance levels and indicate the need to

evaluate inoculation methods to assess resistance.

Table 1. RSD testing summary for 2010.

Source	Location	No. of fields	No. of varieties	No. of samples
Louisiana growers	State-wide	65	10	1337
Variety Release Program	1° & 2° stations	-	12	720
Helena SugarTech®	Foundation stock	-	2	20
Kleentek®	Foundation stock	-	14	96
Kleentek®	Other than foundation	36	18	806
Local Quarantine	LSUAC	-	4	12
Research	LSUAC	-	47	333
Totals		101	107	3324

Table 2. RSD field and stalk infection frequencies in different crop cycle years for all varieties combined during 2010.

Crop Year	Total number of fields	Average field infection (%)	Total number of stalks	Average stalk infection (%)
Plant cane	7	0	141	0
First stubble	19	0	390	0
Second stubble	22	0	449	0
Older stubble	15	-	317	-
Totals/Averages	63	0	1297	0

Table 3. Sugarcane yellow leaf virus testing summary for 2010.

Source	Location	No. of fields	No. of varieties	No. of samples
LDAF	Seed Certification	181	-	6334
Helena SugarTech®	Foundation stock	-	2	20
Helena SugarTech®	Other than foundation	-	5	50
Kleentek®	Foundation stock	-	17	64
Local Quarantine	LSUAC	-	4	12
Research	LSUAC	-	-	1930
Totals		181	28	8410

Table 4. Smut and leaf scald resistance ratings determined in an inoculated test for commercial and experimental sugarcane varieties during 2010.

Variety	Smut rating[x]	Scald rating[x]	Variety	Smut rating[x]	Scald rating[x]
CP 65-357	7	6	HoCP 00-950	2	8
CP 70-321	1	4	L 01-283	3	6
CP 73-351	7	7	L 01-299	7	9
LCP 82-89	2	7	L 03-371	3	1
HoCP 85-845	3	8	HoCP 04-838	4	8
CP 89-2143	4	4	HoCP 06-537	6	4
HoCP 89-846	7	9	HoCP 06-563	6	6
HoCP 91-555	4	7	L 07-57	3	4
Ho 95-988	8	5	L 07-68	1	6
HoCP 96-540	4	6	HoCP 07-604	3	2
L 97-128	9	1	HoCP 07-612	2	2
L 99-226	5	8	HoCP 07-613	1	1
L 99-233	6	8	HoCP 07-617	1	8

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