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SUSTAINABLE BIOENERGY RESEARCH GRANT: CROP PROTECTION

MANAGING INSECT PESTS AND DISEASES IN MULTI-USE LANDSCAPES OF BIOENERGY AND CONVENTIONAL CROPPING SYSTEMS IN THE GULF COAST

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The expected large-scale production of bioenergy crops will significantly impact the abundance of different plant inhabiting insects and diseases, and will require modification of existing pest management programs. The overall goal of this research is to build a landscape-wide pest management program that will mitigate insect pest and disease pressures and damage to energy crops in interaction with conventional crops in the U.S. Gulf Coast region. A portion of the first year of our research documenting susceptibility of sugarcane and energycane cultivars to the Mexican rice borer, *Eoreuma loftini*, and the sugarcane borer, *Diatraea saccharalis*, was assessed with replicated small plot evaluations in East Texas and Louisiana. Data revealed energycane cultivar L 79-1002 sustained more than 2-fold greater stalkborer injury (% bored internodes) compared to the resistant sugarcane cultivar HoCP 85-845. L 79-1002 had the greatest yield potential in terms of biomass with 1.7-fold more total biomass (3800 kg/hectare) than sugarcane cultivars (2318 kg/ha); however, the average sugar content (brix) was 1.4-fold higher in sugarcane cultivars. Energycane Ho 08-9003 was identified as being highly susceptible to *E. loftini* with a 3-fold increase in injury (33.9% bored internodes) over the susceptible commercial sugarcane HoCP 04-838 (11.7% bored). Additionally in our studies, recorded secondary insect and disease pests of potential bioenergy crops included the sugarcane aphid (*Melanaphis sacchari*), the yellow sugarcane aphid (*Sipha flava*), the Banks grass mite (*Oligonychus pratensis*), and sugarcane smut (*Ustilago scitaminea*). Data suggest L 79-1002 is more vulnerable to these secondary pests than any of the other crops examined, including two high biomass sorghums and a sweet sorghum. Phenological surveys revealed early season drought substantially reduced *D. saccharalis* infestations in central Louisiana; however, as much as 25% of stalks were infested in coastal Louisiana during one sampling period. Additionally, the drought significantly reduced emergence of newly planted sorghum. On-going research is examining the effect of crop rotation systems, including wheat and soybean production during the sugarcane fallow period on nematode populations in sugarcane. The results of this research will be integrated into an analysis and forecast system that provides the capability to identify optimal pest management strategies.

National Institute of Food and Agriculture:
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MEXICAN RICE BORER RANGE EXPANSION INTO LOUISIANA

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Cooperative studies on the Mexican rice borer (MRB) between the LSU AgCenter, Texas A&M University AgriLIFE research station at Beaumont, the Texas Department of Agriculture, and the Louisiana Department of Agriculture and Forestry have been on-going since 1999 to monitor the movement of this devastating pest. As previously anticipated, MRB spread into Louisiana by the end of 2008, and was collected in two traps near rice fields northwest of Vinton, LA on December 12. While no MRB specimens were detected in Louisiana in 2009, data from 2010 showed that this invasive pest had expanded its range into Cameron and Calcasieu parishes. Additional MRB moths captured in 2011 indicate the species has expanded its range further to include Beauregard and Jefferson Davis Parishes.

The first specimens trapped since 2008 were collected in non-crop habitat with wild grass hosts 6.8 miles southeast of Vinton, Calcasieu parish, La, on 22 November 2010. Since that date numerous specimens have been collected in traps from 44 different locations in Louisiana (Table 1, Fig. 1). Currently, most of positive traps have been in rice or wild-host areas; however, the more eastern locations are south of Welsh, where some commercial sugarcane fields occur. Surveys conducted by LSU AgCenter entomologists along with 2 County Agents on November 30 examined several sugarcane areas in Jefferson Davis and Calcasieu Parishes including abandoned cane fields and plant cane. While no MRB larval infestations were detected, more extensive sampling is expected to reveal the presence of larvae. Low population densities of MRB in the area, and high numbers of red imported fire ants in sugarcane habitats likely contribute to reduced larval infestations.

MRB numbers are continuing to increase with more than 200 MRB trapped in Calcasieu parish so far in 2011 (Table 1), indicating the species has established a clear presence. Additionally, rice growers and agents in these parishes have begun to report MRB larval infestations in their fields. In August, traps were retrieved and/or re-deployed by LADF east of their previous locations in an attempt to stay ahead of the eastern MRB movement (Table 2). Continued monitoring of MRB populations will be conducted with additional traps at locations further east and north. Currently, LDAF has a total of 25 MRB pheromone traps in Calcasieu, Cameron and Jefferson Davis parishes, with 3 additional traps in Beauregard and Vermilion parishes. In September, 12 traps were added in St. Mary and Iberia parishes near sugarcane processing and off-loading facilities. As the pest's eastward expansion continues, effective management strategies such as a combination of varietal resistance, improved chemical control tactics and management of non-crop hosts are becoming critical to slow the spread of this devastating insect.

Table 1: 2011 Louisiana MRB Trap Captures

Parish	# Sites	# + Sites	# MRB
Calcasieu	34	28	209
Cameron	14	11	27
Beauregard	2	1	4
Jefferson Davis	12	5	15

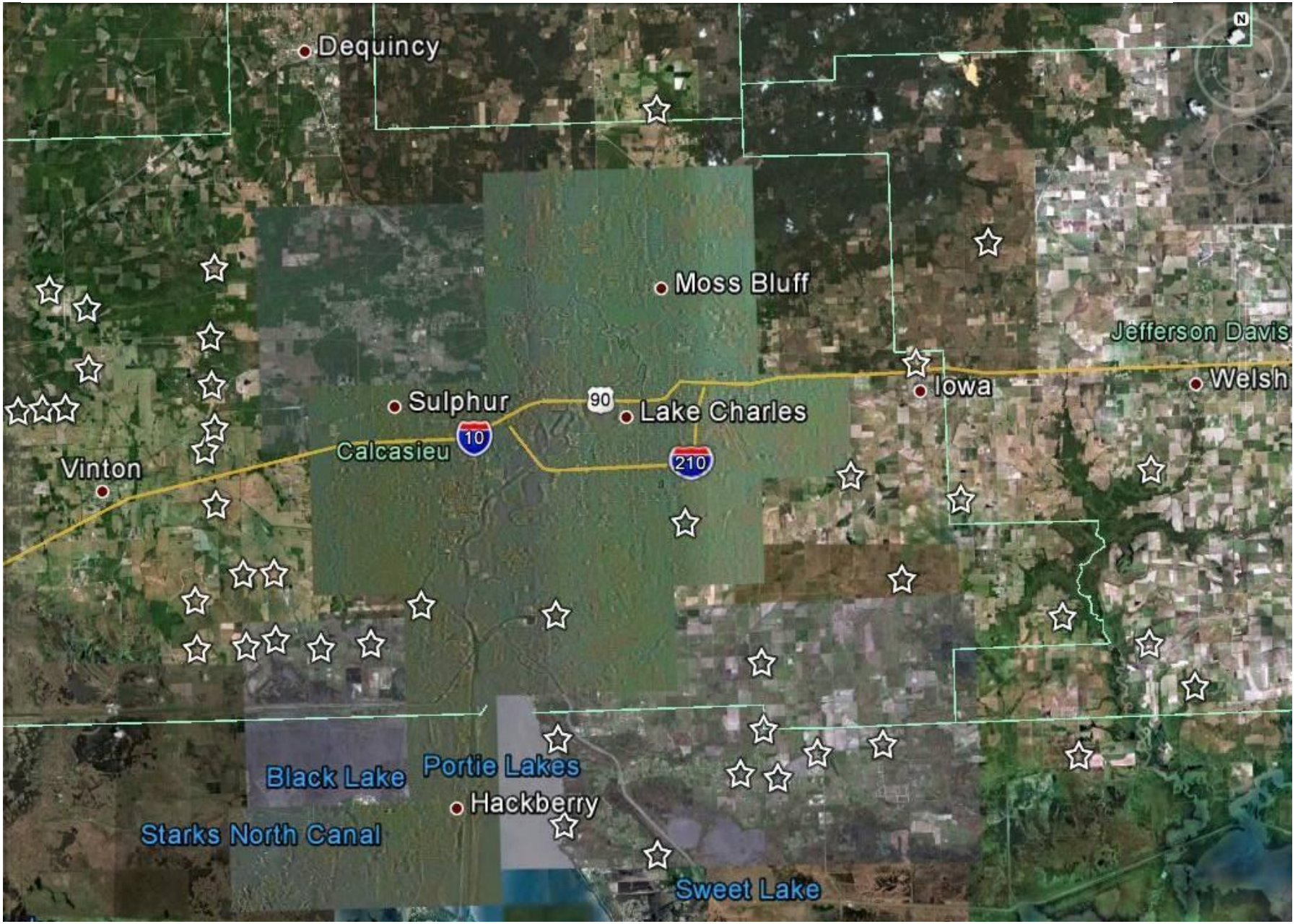
*LDAF field personnel work

Table 2: Monthly Total MRB Captures in LA

Month	# MRB
March	**36**
April	**59**
May	**36**
June	**57**
July	**19**
August	**32**
September	**35**
October	**11**

*LDAF Data

Figure 1: Monitoring MRB movement in Louisiana, 2010 and 2011. Stars indicate positive trap locations.



EVALUATION OF COMMERCIAL AND EXPERIMENTAL SUGARCANE CULTIVARS FOR RESISTANCE TO THE MEXICAN RICE BORER, BEAUMONT, TX, 2010 AND 2011

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Because of the limitations of chemical and biological control against the Mexican rice borer (MRB), *Eoreuma loftini*, host plant resistance is an important part of management. As a control tactic, host plant resistance can not only aid in reducing stalkborer injury, but can also reduce area-wide populations and potentially slow the spread of the MRB. The effect of cultivars on reducing area-wide populations is examined by comparing the number of adult emergence holes. In addition, recent research suggests resistant cultivars which impede stalk entry and prolong larval exposure on plant surfaces may enhance the efficacy of insecticide applications. Continued evaluation of stalkborer resistance is necessary as host plant resistance remains a valuable integrated pest management (IPM) tool.

A 2-year field study was conducted at the Texas A&M AgriLIFE Research and Extension Center at Beaumont, TX, to assess resistance to MRB among commercial and experimental sugarcane cultivars. Over both years, 38 cultivars were evaluated. The tests included a wide range of cultivars developed with breeding programs in St. Gabriel, LA, Houma, LA, Canal Point, FL and Natal, South Africa. In addition, the tests examined resistance in 4 biomass energy cultivars. In both years, the tests had 1-row, 12-foot plots arranged in a randomized block design with 5 replications.

2010 Evaluation

The 25 varieties evaluated in 2010 include: 5 in commercial use (HoCP 85-845, HoCP 96-540, HoCP 00-950, L 01-299, and L 03-371), 11 experimental clones (HoCP 05-902, HoCP 05-961, HoCP 04-838, Ho 06-563, Ho 07-613, Ho 07-604, Ho 07-617, Ho 07-612, Ho 06-537, L 07-68, and L 07-57), 3 clones bred for high fiber content (Ho 06-9610, US 93-15, and US 01-40), 2 energycanes (US 08-9001 and US 08-9003), and 4 South African cultivars (N-17, N-21, N-24, N-27). The cultivars from the South African Sugar Research Institute in KwaZulu-Natal (N-cultivars) have potential resistance to MRB because they have demonstrated varying levels of resistance to African stalkborers, especially *Eldana* sp., which shares many characteristics with MRB.

Differences were detected in percentages of bored internodes among cultivars ($F=3.56$, $P<0.001$). Results showed infestations ranging from 1.0% bored internodes (N-21 and HoCP 85-845) to 20.4% (Ho 06-563). See Table 3. Of the commercial varieties HoCP 85-845 and L 01-299 were the most resistant, while L 03-371 and HoCP 96-540 were the most susceptible. HoCP 96-540, currently the most widely planted cultivar in Louisiana, experienced nearly 8-fold more injury than the most resistant varieties. All of the South African cultivars showed some level of resistance with N-21 being the most resistant. Adult emergence data followed the same trend as percent bored internodes with moth production ranging from < 0.01 to 0.38 emergence holes/stalk (Table 3); however, differences in emergence among cultivars were not detected ($F=1.57$, $P=0.065$).

Table 3: Borer Injury and Moth Production Beaumont Variety Test 2010

Variety	% Bored Internodes	Emergence per Stalk
Ho 06-563	20.4	0.38
HoCP 05-902	14.5	0.32
HoCP 04-838	11.0	2.0
Ho 07-612	10.1	0.18
L 03-371	9.6	0.14
HoCP 96-540	7.9	0.08
L 07-57	7.2	0.31
Ho 07-604	6.4	0.04
US 01-40	5.9	0.06
N-27	5.8	0.12
Ho 06-537	5.8	0.18
Ho 07-613	5.5	0.02
N-17	5.4	0.08
HoCP 05-961	5.3	0.12
****US 08-9001**	5.3	0.04
Ho 06-9610	5.0	0.04
HoCP 00-950	4.6	0.04
L 07-68	4.1	0.12
Ho 07-617	3.9	0.06
****US 08-9003**	2.7	0.06
N-24	2.4	<0.01
L 01-299	2.3	0.04
US 93-15	1.2	0.011
HoCP 85-845	1.0	<0.01
N-21	1.0	<0.01

*Means which share a line are not significantly different (LSD, α=0.05)

** Designates energycanes

2011 Evaluation

The 2011 test evaluated resistance in 19 cultivars. Cultivars from the 2010 test which were reevaluated include: HoCP 85-845, HoCP 00-950, Ho 07-613, L 07-57, HoCP 05-961, and HoCP 04-838. HoCP 85-845 has been a resistant standard for many years. HoCP 04-838, which appears to have little resistance to the MRB, has recently been released to commercial growers. Experimental cultivars in the early stages of varietal development which were evaluated include: HoCP 08-726, Ho 08-706, L 08-090, L 08-088, Ho 08-711, Ho 08-717, HoL 08-723, L 08-075, L 08-092, Ho 08-709. Two energycane varieties, L 79-1002 and Ho 02-113, were also evaluated.

Results showed significant differences (F=2.71, P= 0.0017) in injury which ranged from 1.9-17.2% bored internodes (Table 4). The most resistant cultivars examined were HoCP 85-845 and L 08-075. Experimental cultivar, L 08-075, is potentially highly resistant as it demonstrated >8-fold reductions in MRB injury compared to susceptible cultivars. The most susceptible cultivars were HoCP 08-726, L 08-090, and HoCP 04-838. Differences in adult emergence (F= 1.99, P =0.0187) followed the same trend as injury data ranging from 0.02-0.45 emergence holes per stalk (Table 4). Results from the cultivars which were reevaluated were consistent with findings from 2010. Energycane varieties showed intermediate levels of resistance.

Table 4: Borer Injury and Moth Production, Beaumont Variety Test 2011

Variety	% Bored	Emergence/stalk
HoCP 08-726	17.2	0.45
L 08-090	13.7	0.35
HoCP 04-838	13.4	0.28
HoL 08-723	13.1	0.10
Ho 08-711	13.1	0.46
Ho 08-717	12.4	0.20
Ho 08-706	9.5	0.18
Ho 07-613	9.0	0.27
**L 79-1002	8.5	0.21
L 07-57	8.5	0.21
Ho 08-709	8.0	0.07
L 08-088	8.0	0.23
HoCP 00-950	7.9	0.08
**Ho 02-113	7.7	0.08
L 08-092	7.7	0.08
Ho 05-961	7.6	0.24
HoCP 91-552	7.6	0.23
HoCP 85-845	3.9	0.10
L 08-075	1.9	0.02

*Means which share a line are not significantly different (LSD α=0.05).

** Designates energycanes