SMALL PLOT ASSESSMENT OF INSECTICIDAL CONTROL OF SUGARCANE STALK BORERS, 2010

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A small plot assessment of insecticidal control of sugarcane stalkborers, particularly the Mexican rice borer and the sugarcane borer, was conducted at Douget's farm in Nome, TX in 2010. The experiment was conducted in a commercial sugarcane field of variety L79-1002. The treatments included in this study were Diamond®, 4 different rates of Belt®, 3 rates of DPX-EZY45, and an untreated control. The treatments were arranged in a randomized block design with 4 replications. Treatment plots were 1 row, 5.25 ft row spacing, 30 ft long and were separated by buffer rows. Treatments 2 – 9 were applied with a hand-held 3 nozzle boom (11002VS, 50 gal/acre) on 15 July and 22 August. On 5-6 October stalk counts (10 ft of row) per plot were recorded and 10 stalk samples per plot were removed for wet weight and inspection for stalk borer damage. Prior to data analysis, percent data was transformed using arcsine. All data was analyzed by ANOVA and means separated by LSD.

Unfortunately, populations of stalkborers, primarily Mexican rice borer, were low in the untreated, so data should be viewed with caution. However, the percentage of stalks with borer damage was higher in the untreated and the low rate of DPX-EZY45 than in the other treatments (Table 1). If this test is repeated in the future, fire ants will be controlled in the plots using a granular insecticide applied to the soil in early spring. These insects are excellent predators of stalkborer larvae.

Table 1. Wet weight and stalk damage data for sugarcane insecticide screening for stalk borer control. Nome, TX. 2010.

Treatment	Rate (fl oz/A)	Stand (stalks/10 ft)	Wet weight (lb/10 stalks)	Wet wt. (tons/A)	No. internodes / stalk	% stalks with borer damage	% damaged internodes / stalk
Untreated	---	126	10.5	54.9	13.4	15.3 a	1.1 a
Diamond 0.83EC	12	109	12.1	54.7	13.0	5.0 bc	0.4 abc
Belt 480SC	1	114	11.3	53.4	13.1	2.5 c	0.2 c
Belt 480SC	2	122	10.9	55.2	11.3	5.0 c	0.7 bc
Belt 480SC	3	119	11.6	57.3	13.3	0 c	0 c
Belt 480SC	4	113	11.7	54.8	13.6	2.5 c	0.2 c
DPX-EZY45	6.8	122	10.9	55.2	13.3	10.0 ab	0.8 ab
DPX-EZY45	13.3	124	10.8	55.6	12.9	2.5 c	0.2 c
DPX-EZY45	19.9	122	11.7	59.2	12.6	2.5 c	0.4 bc

All data collected from 10 stalks per plot except stand.
Means in a column are not significantly different (*P* = 0.05 and ANOVA).

AERIAL APPLICATION OF INSECTICIDES FOR CONTROL OF THE MEXICAN RICE BORER IN SUGARCANE, 2010

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Evaluation of aerial insecticidal control of the Mexican rice borer (MRB), *Eoreuma loftini*, was conducted in a randomized block design with five replications (fields). Insecticide treatments were assigned randomly to field plots (10 acres/treatment) in fields ranging from 36-85 acres, of variety CP 72-1210 second ratoon cane in the Lower Rio Grande Valley (Cameron County) of Texas. The use of pheromone traps to assist scouting and effectively time insecticide applications was also evaluated. Weekly monitoring of larval infestations was conducted by sampling 20 stalks from two locations in each 10 acre field plot. On 13 Aug live larval infestations ranged from 7.5 to 18.5%, all fields exceeding the treatment threshold of 5% of stalks containing larvae on plant surfaces. Applications were made during the morning of 14 Aug by fixed wing aircraft (145mph) at 10 gal/acre with less than 5 mph wind. Bored internode and emergence hole counts were recorded on 8 Nov; 30 stalks from two locations (15 - front, 15 - back) per treatment plot were sampled. All plots were harvested completely and yield data was collected using the core sampling method. Data were analyzed using generalized linear mixed models and means were separated using Tukey's HSD (α=0.05).

Linear regression revealed a significant correlation (F = 280.7, P <0.0001, R^2=0.71) between the number of MRB/trap/week and percent of stalks infested with treatable larvae (Figure 1). Both Baythroid® (β-cyfluthrin) and Diamond® (novaluron) treated plots had significantly lower percentage of bored internodes than the untreated check plots (Table 1). Adult emergence (moth production) per stalk followed the same trend as percent bored internodes with both Baythroid® and Diamond® having significantly less injury than untreated checks (Table 1). Yield data indicate that insecticide treatments improved juice purity, percentage sucrose, brix, and sugar/ ton cane, tons of cane per acre, and tons of sugar/acre, (Table 2). A single application of Diamond® increased sugar yield by 14% (8.03 tons sugar/acre) over untreated controls (7.04).

The use of pheromone traps demonstrated the potential to improve scouting efficiency by focusing scouting efforts when population densities are high. A scouting threshold of 20-25 MRB/trap/week is appropriate to initiate scouting for larval infestations. Insecticide treatments reduced MRB injury and adult emergence resulting in enhanced sugar yield and quality. The recently labeled (Section 3 for sugarcane) environmentally friendly insecticide, Diamond® (MANA) applied at 12oz/a provided the best control. The superior control provided by Diamond® is likely due to longer residual activity which better targets exposed larvae which have not yet become protected within stalks. Based on the current price of raw sugar, the Diamond® treatment would be expected to increase revenue by >$700 per ha. This study demonstrates insecticide application strategies which are expected to enhance efficacy of chemical MRB control.

Figure 1. The relationship between adult population densities (no. of MRB/trap/week) and larval infestation (percent of stalks infested with treatable larvae feeding in leaf sheaths), 2010

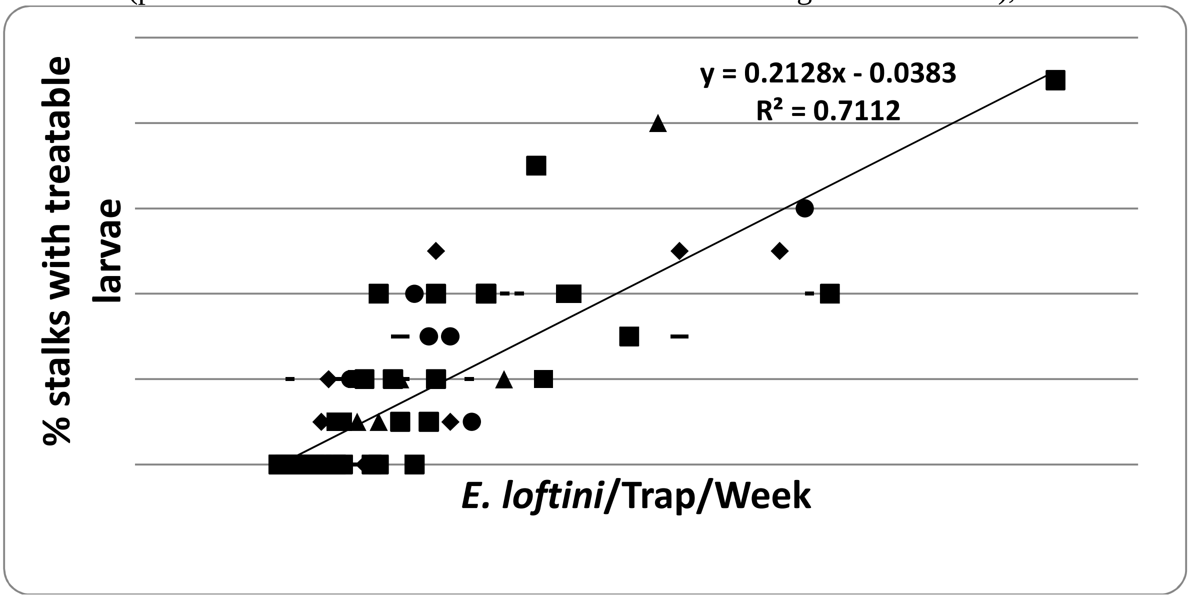

Table 1: Mean percent bored internodes and moth emergence per stalk.

Treatment	Rate	% Bored Internodes	Emergence per stalk
Untreated	NA	24.7 a	0.72 a
Baythroid®	2.8 oz/a	10.1 b	0.38 b
Diamond®	12.0 oz/a	7.1 b	0.17b
	F=	13.7	14.5
	P=	0.0024	0.0022

*Means which share a letter group are not significantly different (Tukey's HSD, α=0.05).

Table 2. Sugar Yield and Quality as Effected by Insecticide Treatments
Cameron and Hildalgo Counties, TX. 2010

	Purity	POL (% Sucrose)	Brix	Sugar (lbs)/ ton of cane	Cane (tons)/ha	Sugar (tons)/ha
Novaluron	85.3 A	14.5 A	17.0 A	208.2 A	77.20 A	8.03 A
Baythroid	85.0 AB	14.2 B	16.7 B	203.0 B	64.67 B	6.58 B
Control	84.4 B	14.0 B	16.5 B	197.8 C	70.94 AB	7.04 AB
F	4.15 [a]	13.94[a]	7.47[a]	16.03[a]	5.60[b]	6.78 [b]
P >F	0.018	<0.0001	0.0009	<0.0001	0.03	0.019

*Means which share the same letter are not significantly different (Tukey's HSD α=0.05)
[a] df= 2, 124
[b] df= 2,8

MONITORING MEXICAN RICE BORER MOVEMENT: RANGE EXPANSION INTO LOUISIANA

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Cooperative studies on the Mexican rice borer (MRB), *Eoreuma loftini* (Dyar), 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 2000 to monitor the movement of this devastating pest of sugarcane towards Louisiana. The MRB has been the major economic pest in Texas sugarcane since it established in 1980, quickly surpassing the pest severity of the sugarcane borer, *Diatraea saccharalis* (F.). Monthly totals for the eastern Texas rice counties for 2010 are included in Table 1, with the majority of specimens collected near rice fields. MRB was collected for the first time in Orange Co. in September 2010. 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 15. While no MRB specimens were detected in Louisiana in 2009, data from 2010 showed that invasive pest has expanded its range into Cameron and Calcasieu Parishes.

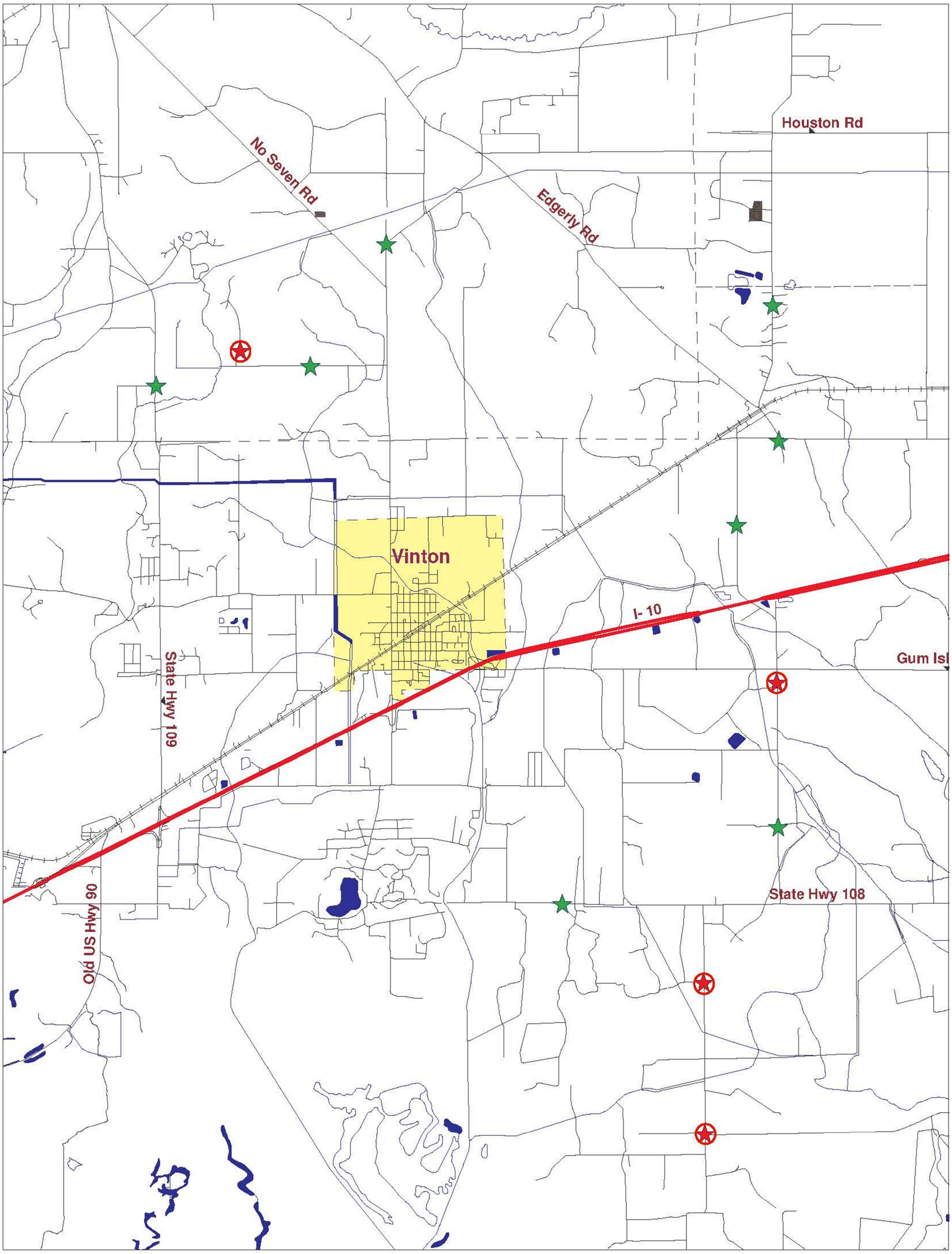
The first specimens trapped since 2008 were collected in non-crop habitat with wild grass hosts 6.8 miles southeast of Vinton, Calcasieu Par., La, on 22 November 2010. Since that date multiple specimens have been collected in traps from 4 locations (Fig. 1). More than 20 MRB were trapped in the 2 southern-most traps in early spring 2011, indicating the species has established a clear presence in that area. Continued monitoring of MRB populations will be conducted with additional traps at locations further east and north. Effective management strategies including the use of varietal resistance, improved chemical control tactics and management of non-crop grass host are critical to slow the spread of this devastating pest.

Table 1. Monthly totals of Mexican rice borer adults from pheromone traps (2 traps/county) located next to rice, sugarcane or fallow fields on the Texas Upper Gulf Coast in 2010.

	Chambers Co.	Colorado Co.	Jackson Co.	Jefferson Co.		Liberty Co.	Orange Co.
Month	rice	rice	rice	rice	sugarcane[a]	rice	fallow
January	0	0	0	0	NA	NA	NA
February	0	2	5	0	NA	2	NA
March	15	60	27	18	NA	21	NA
April	703	2259	41	160	NA	46	0
May	216	154	71	31	NA	78	0
June	379	181	336	109	87	343	0
July	116	112	81	88	96	74	0
August	347	144	93	118	150	70	0
September	248	267	308	49[a]	82	272	2
October	997	380	700	26[a]	NA	707	3
November	303	104	449	19[a]	NA	441	1
December	206	59	919	10[a]	NA	784	NA

[a] Monthly total for one trap

Figure 1. Monitoring Mexican rice borer movement in Cameron and Calcasieu Parishes, Louisiana, 2010 and 2011. Stars designate pheromone trap locations; circled stars indicate traps which are MRB-positive.


Houston Rd
No Seven Rd
Edgerly Rd
Vinton
I- 10
Gum Isl
State Hwy 109
State Hwy 108
Old US Hwy 90

GREENHOUSE ASSESSMENT OF FEEDING BEHAVIOR AND DURATION OF EXPOSURE OF MEXICAN RICE BORER LARVAE ON SUGARCANE

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Newly hatched larvae, neonates, are the target life stage for chemical and biological control of Mexican rice borer (MRB), *Eoreuma loftini*. There is a short window of vulnerability before larvae bore into stalks where they remain protected until adult emergence. A greenhouse study was conducted at the USDA ARS Kika de La Garza Subtropical Agricultural Research Center (Weslaco, TX) to investigate larval feeding behavior on immature (6 internodes) and mature (12 internodes) stalks of resistant (HoCP 85-845) and susceptible (HoCP 00-950) sugarcane cultivars. Plants were arranged in a completely randomized design with each of the four treatments (2 cultivars x phenological stages) and 12 stalks per treatment. Strips of freshly laid MRB eggs were attached to the leaf sheaths at locations consistent with normal egg laying activity. Egg strips were removed after hatching (7 days) and position and feeding behavior of all larvae were recorded daily. Dispersal distance (no. internodes from oviposition site) and the duration of vulnerability (time to stalk entry) were recorded.

Over all treatments and replications, establishment and behavior of a total of 277 larvae was monitored. On the first day after egg hatch, numerous entry holes in the mid-rib of sugarcane leaves were observed where neonates (1st stage after hatch) had bored into leaves within one day of hatching. The percentage of larvae to enter the mid-rib within one day after eclosion ranged from 24.1–67.5%. The percentage of larvae surviving to stalk entry ranged from 27.4–72.4%, and mean duration of exposure ranged from 3.5–6.4 d (Table 1). Over both growth stages, the percentage of eclosed neonates (hatched eggs) which became established feeding on the stalk was 1.4-fold greater on susceptible cultivar HoCP 00-950 than on resistant HoCP 85-845. The proportion of established larvae which bored into the leaf mid-rib within one day was twice as high for HoCP 00-950 than HoCP 85-845 (Table 1). Average dispersal distance was 19% greater on HoCP 85-845 than HoCP 00-950, but differences were not statistically significant. The duration of exposure of all established larvae was 40% longer on HoCP 85-845 than HoCP 00-950. The percentage of eclosed larvae (hatched eggs) that established feeding was 1.6-fold greater on mature than immature stalks. The percentage of established larvae surviving to stalk entry was 1.9-fold greater on immature than mature stalks. Duration of exposure was 1.2-fold greater on mature stalks than immature.

This research the duration of larval exposure is very limited and supports the need for development of management tactics which target vulnerable neonates. Differences in larval behavior between cultivars suggest resistant varieties which impede larval establishment have potential to improve efficacy of other control tactics by prolonging larval exposure. Rapid neonate entry into the mid-rib and the short duration of sheath feeding strongly suggest that MRB larvae are protected from foliar applied contact insecticides. Thus, residual activity will be expected to contribute to improved chemical control of MRB neonates before they become protected within stalks. Prior to this research, larval entry into the mid-rib of sugarcane leaves and potential applications to MRB IPM had not been documented, and was assumed to be comparable to the sugarcane borer (which was not the case).

Table 1: MRB neonate establishment and behavior on two phenological growth stages of sugarcane cultivars HoCP 84-845 (resistant) and HoCP 00-950 (susceptible), Weslaco, TX, 2010

	Percent of eclosed larvae established feeding	**Percent of established larvae which entered midrib within 1 day**	**Percent of established larvae surviving to stalk entry**	**Mean dispersal distance (nodes from oviposition site)**	**Mean duration of exposure (days) all larvae**
Growth Stage					
Immature	16.02	44.84	64.17	1.46	4.676
Mature	26.15	37.58	33.89	1.15	5.895
F	15.43	0.91	16.77	1.81	4.23
P > *F*	0.0003	0.3447	0.0002	0.1815	0.0417
Cultivar					
HoCP 85-845	17.63	28.30	49.88	1.419	6.181
HoCP 00-950	23.99	55.36	47.98	1.193	4.391
F	5.08	13.27	0.06[a]	0.99	9.13
P > *F*	0.0176	0.0007	.8047	0.3214	0.0038
Growth Stage X Cultivar					
Immature					
HoCP 85-845	14.08	24.14	72.41	1.756	5.952
HoCP 00-950	18.18	67.50	55.00	1.161	3.400
Mature					
HoCP 85-845	21.86	32.88	27.40	1.082	6.409
HoCP 00-950	30.95	42.54	41.04	1.225	5.381
F	0.28	5.42	5.08	2.65	1.65
P > *F*	0.5990	0.0246	0.0293	0.1073	0.2006

This research is a portion of the M.S. Thesis program of Blake Wilson in the Department of Entomology.

EVALUATION OF 25 COMMERCIAL AND EXPERIMENTAL SUGARCANE CULTIVARS FOR RESISTANCE TO THE MEXICAN RICE BORER, BEAUMONT, TEXAS, 2010

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A field study was conducted at the Texas A&M AgriLIFE Research and Extension Center in Beaumont, TX, to assess cultivar resistance to the Mexican rice borer (MRB), *Eoreuma loftini,* among 25 commercial and experimental sugarcane cultivars. The 25 varieties evaluated in 2010 include: five in commercial use (HoCP 85-845, HoCP 96-540, HoCP 00-950, L 01-299, and L 03-371), eleven 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), three clones bred for high fiber content (Ho 06-9610, US 93-15, and US 01-40), two clones from recurrent selection for sugarcane borer resistance (US 08-9001 and US 08-9003), and four South African cultivars (N-17, N-21, N-24, N-27). One commercial cultivar which has consistently demonstrated a high level of MRB resistance is HoCP 85-845, while susceptible cultivars include L 03-371, LCP 85-384, and HoCP 05-961. 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 stalk borers, especially *Eldana* spp., which shares many characteristics with MRB. Of the SA cultivars, the most resistant is N-21 and the most susceptible is N-26, but the levels of resistance to MRB have not been assessed. The experiment was conducted using a randomized complete block design five replications. Block replicates had one-row plots (3.66 m long, 1.60 m row spacing and 1.22 m alleys). Ten stalk samples were collected after season long natural MRB infestations and the no. bored internodes and emergence holes was recorded.

Differences were detected in percentages of bored internodes between 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 1. 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 damage than the most resistant varieties, however, adult emergence for this cultivar was only 0.08 emergence holes/stalk. Ho 06-563 and HoCP 05-902 were the most susceptible of all cultivars tested. All of the South African cultivars showed some level of resistance with N-21 being the most resistant of all cultivars examined. 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 1); however, differences in emergence between cultivars were not detected ($F=1.57$, $P=0.065$). This research demonstrates the importance of assessing stem borer resistance in commercial and experimental sugarcane cultivars. Host plant resistance continues to be an integral part of MRB IPM programs.

Table 1: 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)