SMALL PLOT ASSESSMENT OF INSECTICIDES AGAINST THE SUGARCANE BORER, 2009

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Six different insecticide treatments, in addition to an untreated check, were assessed for season-long control of the sugarcane borer (SCB) in a randomized complete block design RCBD with five replications in a field of variety HoCP 96-540 plantcane near Burns Point, La. Insecticide treatments were applied to 3-row plots (24 ft) on July 7 and August 6, 2009. Treatments were mixed in 2 gallons of water and applied using a Solo back pack sprayer delivering 40 gpa at 20 psi. Borer injury to sugarcane was assessed by counting the total number of internodes (12 stalks/plot), number of bored internodes and moth emergence holes in each stalk at the time of harvest (October 13). The proportion of bored internodes and emergence holes were analyzed using a generalized linear mixed model (Proc Glimmix, SAS Institute) with a binomial distribution for percentage of bored internodes and a Poisson distribution for number of exit holes per plot. The means were separated with Tukey's HSD ($\alpha = 0.05$).

The percentage of bored internodes in the treated plots ranged between 1-5% and was significantly less than the 28% observed in the untreated check (Table 1). Coragen at 5.0 oz/acre rate showed a trend for the most reduction in internode damage; however, significant differences were not detected among the insecticide treatments. The numbers of exit holes made by the prepupa in the stalks were also lower in all insecticide treatments than in the untreated check (Table 1).

Table 1. Insecticidal control of the sugarcane borer in a small plot test near Burns Point, LA.

Treatment[a]	Rate (oz/acre)	% Bored Internodes/plot	Exit Holes/stalk
Check	-	28.07a	1.49b
Confirm	8.0	4.97b	0.05a
Belt	3.0	3.09b	0.13a
Baythroid	2.1	3.07b	0.14a
Belt	4.0	2.46b	0.14a
Diamond	9.0	1.82b	0.10a
Coragen	5.0	1.38b	0.10a

[a]Insecticide treatments were applied with Induce surfactant at 0.5% v/v.
Means within column followed by the same letter are not significantly different ($P \geq .05$, Tukey's HSD).

SMALL PLOT ASSESSMENT OF WIREWORM CONTROL IN SUGARCANE, 2009

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Three new environmentally friendly insecticides along with Mocap® (ethoprop), an organophosphate, were compared to the untreated check for wireworm control near Burns Point, La. Whole stalks of variety HoCP 96-540 were planted on September 29, 2008. The treatment plots consisted of three 24 ft rows with 10 ft gaps between plots, with a total of 5 replications. The granular formulations were mixed with corn cob grits for even distribution of the chemical. Liquid formulations were mixed in water and sprayed using a backpack sprayer. The number of shoots emerged in the center row of each plot was counted on December 8, 2008 and again on April 7, 2009. Plots were harvested in January 2010 using a combine harvester, and the central row of each plot was weighed and sampled to assess yield.

Differences were not detected in the number of shoots emerged by December 2008. April sampling indicated the highest numbers of shoots in plots treated with liquid Coragen (rynaxypyr), significantly greater than the granular formulation but not from the untreated check or other insecticide treatments. Cane and sugar yields ranged from 32-41 tons/acre and 229-238 lbs/ton, respectively, with no differences among treatments (Table 1). In contrast to several rice studies with treated seed, this experiment did not show any systemic activity with Coragen against the sugarcane borer.

Table 1. Soil insecticides targeting wireworm injury on sugarcane emergence and yield.

Treatment	Formulation	Rate[a]	Shoots/acre		Yield (ton/acre)	Sugar (lbs/ton)
			Dec 08	Apr 09		
Admire Pro[b]	Liquid	14	14,037 a	41,820 ab	40.5 a	229 a
Mocap	Liquid	20	16,457 a	43,078 ab	40.3 a	236 a
NUQ05055	Granular	13.4	15,005 a	44,676 ab	39.8 a	234 a
Coragen	Liquid	7	14,279 a	45,015 a	38.1 a	234 a
Coragen	Granular	21	13,117 a	38,722 b	32.6 a	237 a
Control		-	13,746 a	39,884 ab	31.7 a	238 a

[a]oz/acre for liquid formulation, lbs/acre for granular formulation; [b]active ingredient is imidacloprid
Means within column followed by the same letter are not significantly different ($P \geq .05$, Tukey's HSD).

EVALUATION OF AERIAL INSECTICIDAL CONTROL OF THE MEXICAN RICE BORER IN SUGARCANE, 2009

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Evaluation of aerial insecticidal control of the Mexican rice borer (MRB), *Eoreuma loftini*, was conducted in a large area Randomized Block Design (RBD) with five replications. Insecticide treatments were assigned randomly to plots (10 acres/plot) in fields ranging from 36-85 acres of variety CP 72-1210 first stubble cane in the Lower Rio Grande Valley (Cameron County, Texas). Pheromone-trap-assisted-scouting was used to monitor MRB population densities and effectively time the need for insecticide applications. Trap catches of >20-25 moths/trap/week were used as a scouting threshold to initiate monitoring for larval infestations (Table 1). Treatable larval infestations (present in leaf sheaths) were determined by collecting two ten stalk samples per plot. Infestations ranged from 5.0 to 32.1% with a mean of 13.8% stalks infested (Table 1) on 20 Aug. Applications were made the morning of 21 Aug by fixed wing aircraft at 10 GPA with less than 5 mph wind. Bored internode and emergence hole counts were recorded on 28 Oct; 30 stalks from two locations (15 - front, 15 - back) per treatment plot were sampled.

The recently labeled (Section 3 for sugarcane) environmentally friendly insecticide, Diamond® (MANA), applied at 12oz/a showed the best control with 6.9% bored internodes, which was significantly less than both the untreated plots (20.4% bored) and the Baythroid (2.8oz/a) treated plots (Figure 1). Baythroid® (Bayer) treated plots (12.6% bored) were not significantly different from untreated plots (Figure 1). Differences in moth emergence followed the same trend although significant differences were not detected among treatments (Figure 2). Results indicate that Diamond® provided superior control to the traditionally used pyrethroid insecticide, Baythroid (Bayer). This study demonstrates the potential of pheromone-trap-assisted-scouting to reduce scouting effort and optimally time insecticide applications. Ongoing research will determine if insecticide treatments increased subsequent sugarcane yields and will further correlate adult densities to larval infestation levels.

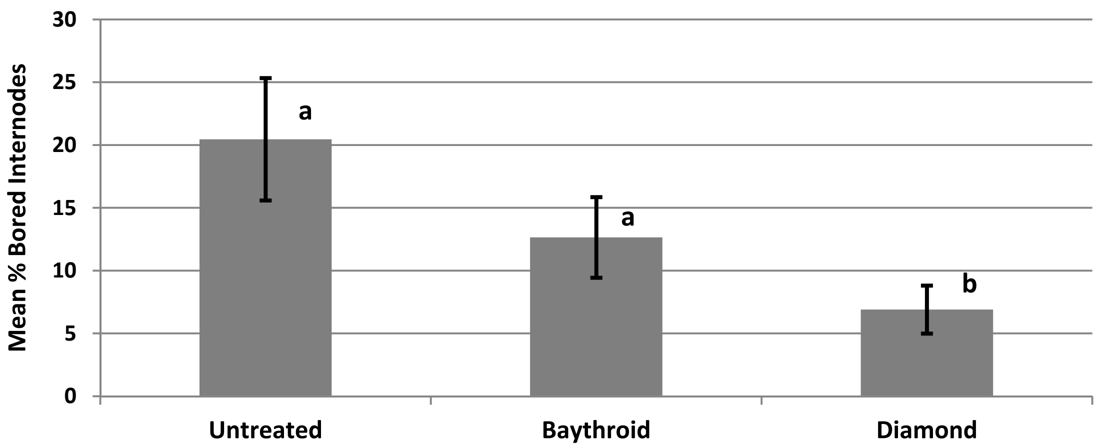
This research is a portion of the M.S. Thesis program of Blake Wilson in the Department of Entomology.

Table 1: Season long pheromone trap catches.

	Number of male MRB moths per trap													% Infestation[a]
Field #	7/15	7/22	7/29	8/5	8/12	8/19	8/20 1day	8/26	9/2	9/9	9/16	9/23	10/14	8/20
1	7	5	5	12	35	18	6	27	15	6	13	8	2	5.0
2	4	11	22	37	31	20	5	40	21	7	2	8	2	10.5
3	5	9	5	17	16	12	6	29	19	10	7	2	2	12.5
4	16	9	15	15	22	24	3	23	29	24	12	20	3	8.8
5	7	14	13	12	37	20	6	21	38	16	8	21	4	32.1

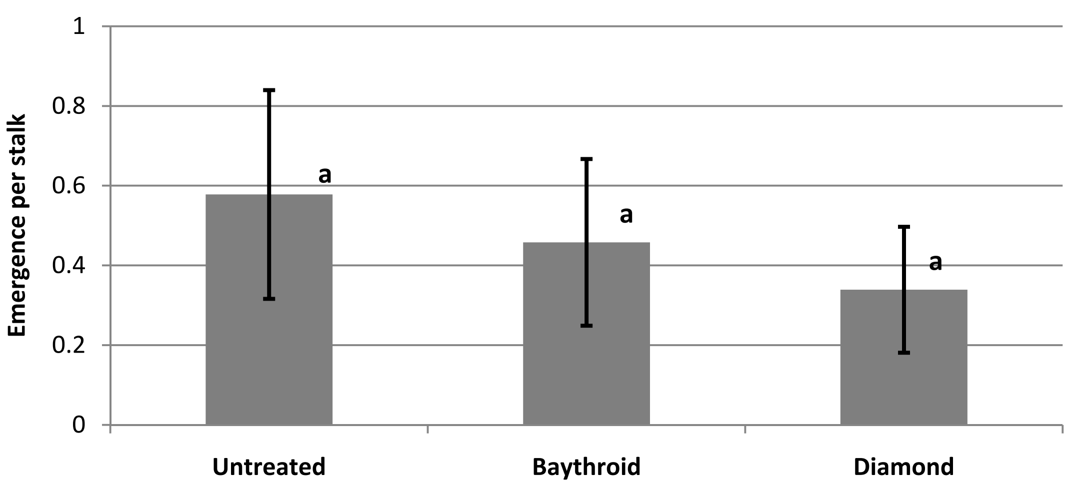
[a]live larval infestations in leaf sheath

Figure 1: Percent Bored Internodes



Data was analyzed using a generalized linear mixed model with a binomial distribution. *F=16.37, Df=2,7.2, P=0.0021*. Means were separated using Tukey's HSD (P≤0.05).

Figure 2: Moth Emergence



Data was analyzed using a generalized linear mixed model with a Poisson distribution. *F=.71; Df=2,7.1; P=0.525.* Means were separated using Tukey's HSD (P≤0.05).

OVIPOSITION PREFERENCE AND IMMATURE DEVELOPMENT OF THE MEXICAN RICE BORER ON MAJOR NON-CROP HOSTS

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A greenhouse experiment was conducted at the Texas A&M AGRILife Research and Extension Center at Beaumont, TX to determine the oviposition preference and duration of development of Mexican rice borers (MRB) on primary non-crop hosts as affected by plant species and stage. An annual crop grass, rice (cv. Cocodrie), two perennial grasses (johnsongrass, vaseygrass), and two annual grasses (brome, ryegrass) were used. Plantings were scheduled to obtain the different phenological stages at the same time. Rice and the perennials were evaluated at three phenological stages while the annuals were evaluated at two phenological stages for a total of 13 plant species by phenology combinations (Table 1). This experiment was arranged as a complete randomized block design with cages (n = 13) used as blocks. Cages (1.3 m by 1.3 m by 1.80m) were constructed from 1.27 cm PVC and covered with a fine white mesh cloth. Each cage contained all of the 13 plant species by phenology combinations. Ten MRB females and 5-10 MRB males (mated, ca. 36h old), obtained from a USDA Weslaco, TX colony were released in each cage between 6:00 and 7:00 PM. Prior to MRB adult release in the cages, plant fresh weight was determined using separate samples of 5 representative plants from each of the 13 plant species by phenology combinations.

Three days after adult release, each plant was inspected and the number of eggs recorded. In this study, 95%< of the eggs were laid on dry plant material. Oviposition preference was expressed as the proportion of total eggs laid per gram of plant fresh weight. Rice plants consistently had the greatest proportion of eggs (Fig. 1). Johnsongrass and vaseygrass received 2-3 fold fewer eggs than rice, whereas brome received an insignificant proportion of the eggs. MRB did not lay eggs on ryegrass. A greater proportion of eggs were laid on intermediate and older plants (Fig. 1), likely associated with the increased availability of dry foliage.

Plants were dissected for MRB larvae and pupae 6 weeks after oviposition determination. Under greenhouse experimental conditions, substantial interplant movement of early MRB instars was observed, and all of the 13 plant species by phenology combinations were infested with borers. Recovered larvae and pupae were reared in the greenhouse on artificial diet until adult eclosion. For each recovered MRB immature, full development duration was estimated. Because the development of cold-blooded organisms such as insects is temperature dependent, development durations were expressed in physiological time. The minimum temperature when development occurs is called the lower developmental threshold (T_L), and the physiological time needed for development is expressed in degree-days (°D) above T_L that are accumulated:

$$\textit{Development time in °D} = (\textit{Daily temperature} - T_L) \times \textit{Development time in days}$$

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This research is part of the Ph.D. dissertation research program of Julien Beuzelin

A lower developmental threshold T_L = 14.5 °C and development time of 576 °D on artificial diet was determined from previous studies on MRB biology (van Leerdam 1986). Because MRB larvae and pupae recovered after plant dissection were reared on artificial diet until adult emergence, development time completed on diet after plant dissection was recorded, and full development duration on a plant until adult emergence could be estimated. MRB development was the fastest on rice (Fig. 2) although brome and ryegrass were also suitable hosts. Development on johnsongrass and vaseygrass slowest (Fig. 2), 1.6 and 1.5-fold slower than on rice, respectively. Trends for slower development on younger plants were observed.

Previous multi-area transect studies showed that non-crop hosts could play a key role in MRB population dynamics and identified primary non-crop hosts. This greenhouse study quantified MRB egg laying and larval development on rice and primary non-crop grasses. This quantification provides a better understanding of MRB ecology and will assist in the development of management tactics impacting non-crop hosts.

Table 1**.** Plant species by development stage combinations tested in a greenhouse experiment assessing MRB oviposition and immature development duration on major non-crop hosts.

	Young plants	**Intermediate plants** (age in weeks after planting)	**Old plants**
Rice (*Oryza sativa*)	5	9	13
Johnsongrass (*Sorghum halepense*)	6	10	14
Vaseygrass (*Paspalum urvillei*)	7	12	17
Brome (*Bromus* spp.)	6	10	--
Ryegrass (*Lolium* spp.)	6	10	--

Reference cited:

Van Leerdam, M. B. 1986. Bionomics of *Eoreuma loftini*, a pyralid stalk borer of sugarcane. PhD dissertation, Texas A&M University, College Station, TX.

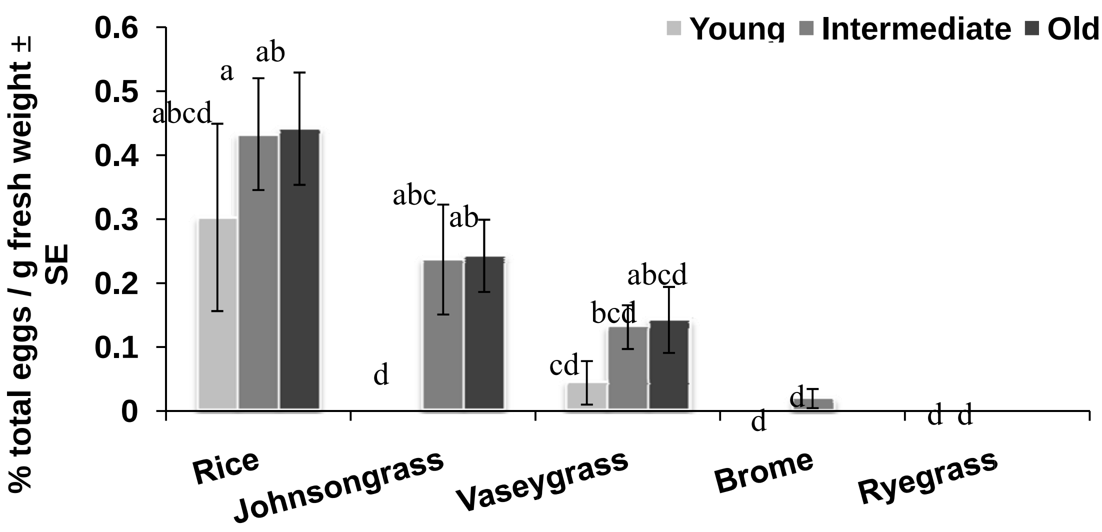

Fig. 1 MRB oviposition preference on rice and primary non-crop hosts
SAS Proc MIXED: Plant species: *P<0.001*, Stage(Plant species): *P<0.001*
Bars with the same letter are not significantly different (Tukey's HSD, α = 0.05)

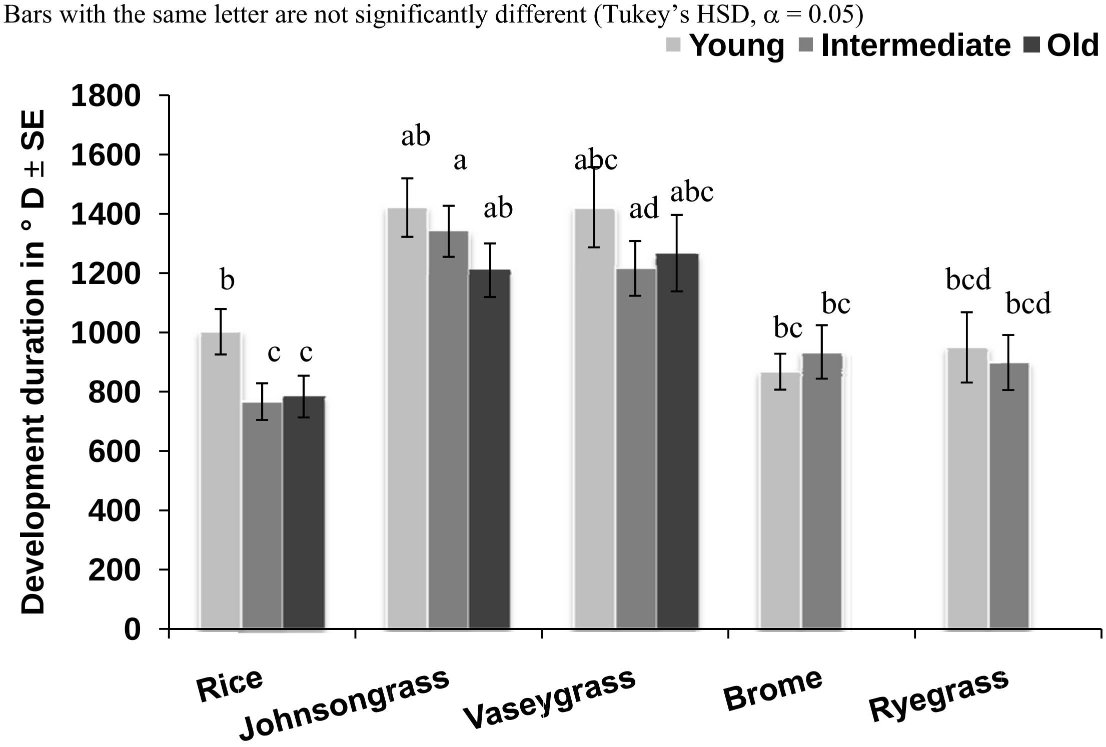

Fig. 2 MRB immature development duration on rice and primary non-crop hosts
SAS Proc MIXED: Plant species: *P<0.001*, Stage(Plant species): *P=0.006*
Bars with the same letter are not significantly different (Tukey's HSD, α = 0.05)

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A study was conducted at the Texas A&M University research site at Ganado, TX (Jackson County) to evaluate insecticides for management of the Mexican rice borer (MRB) in sugarcane. Four insecticide treatments, in addition to an untreated check, were assessed for season-long control of MRB. The experiment was arranged following a randomized complete block design (RCBD) with 4 replicates and 1-row plots (15 ft each, cultivar Ho 95-988) planted in Nov 2008. Insecticides were applied to plots on 19 Jun, 22 Jul, and 20 Aug, 2009. Insecticides were mixed in 2 gal of water and applied using a Solo backpack sprayer delivering 10 gpa at 14 psi. MRB injury was assessed by recording the number of bored internodes and the total number of internodes from 12 stalks per plot at the time of harvest (24 Sep, 2009). MRB moth production recorded as the no. adult emergence holes for each stalk was also assessed. The proportion of bored internodes and emergence hole frequency were analyzed using generalized linear mixed models (Proc GLIMMIX, SAS Institute) with binomial and Poisson distributions, respectively. Means were separated using Tukey's HSD.

Under extremely heavy MRB infestations (ca. 65% bored internodes in the untreated control), Belt decreased MRB injury to a greater extent than Diamond (Table 1). However, MRB control with Belt was not different from that observed with Baythroid. Confirm applications were not associated with significant decreases in MRB injury. Numerical trends ($P \leq 0.10$) for differences in no. moth emergence holes indicate that in addition to decreasing MRB injury, insecticides have the potential to decrease the production of MRB populations.

Table 1. Insecticidal control of Mexican rice borer, small plot test at Ganado, TX, 2009.

Insecticide[a]	Rate (oz/a)	% Bored Internodes (LSMeans ± SE)[b]	No. emergence holes / stalk (LSMeans ± SE)[b]
Baythroid	2.8	22.0 ± 4.81 bc	0.46 ± 0.18 a
Belt	4.0	8.12 ± 2.32 c	0.00 ± 0.00 a
Confirm	12.0	41.54 ± 6.79 ab	0.83 ± 0.30 a
Diamond	12.0	25.52 ± 5.34 b	0.60 ± 0.22 a
Check	NA	64.79 ± 5.65 a	0.98 ± 0.35 a
F value		16.75	2.41
p value		<.0001	0.0987

[a]All treatments were applied with the nonionic surfactant Induce at 0.25% v/v.
[b]Means within columns followed by the same letter are not significantly different (P ≥ .05,Tukey's HSD).