EFFICACY OF CORAGEN® FOR PRE-HARVEST CONTROL OF MINT ROOT BORER IN WESTERN IDAHO

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INTRODUCTION

Coragen® (Chlorantraniliprole) is a relatively new insecticide for the mint industry. It has a significant amount of residual activity as well as being systemic in the plants. These properties provide the new possibility of controlling mint root borers (MRB) before harvest. This could be useful, especially in furrow irrigated mint, where post harvest MRB control, can be difficult. Coragen also controls foliar feeding cutworms. Controlling two mint pests at the same time provides the possibility of reduced insecticide applications.

In 2011 and 2012, studies were done in furrow-irrigated mint, to determine if pre-harvest applications of Coragen would control MRB. The results in both previous years, showed limited to no significant MRB control.

This 2013 study is a continuation of the previous studies, with two additional variables added. These 2013 experiments compared the results in furrow-irrigated mint compared to overhead-irrigated fields, in addition to the monitoring of the peak flight of the adult MRB moths.

OBJECTIVES:

1. Test the efficacy of Coragen to control mint root borers when applied at different pre-harvest dates.
2. Compare the efficacy of Coragen to control mint root borers between furrow-irrigated and overhead sprinkled mint.
3. Compare the MRB peak moth catches with pheromone traps to the IPMP degree-day models' prediction for peak moth catch, in Western Idaho.

MATERIALS AND METHODS

Six identical experiments were conducted in six production peppermint fields. Three of the fields were furrow-irrigated and three were overhead irrigated. All the fields were located between Wilder and Nampa Idaho. Plots were arranged in a randomized block design. Plots of 18'x 20' were replicated five times. Coragen was applied with a $C0^2$ powered backpack sprayer in 20 GPA of water. A mentholated seed oil/organosilicone surfactant blend called SYL-TAC was added at a rate of 1% V/V to each treatment.

The maximum rate of Coragen (5 oz/ac) was applied in all treatments of all the experiments.

Treatment dates were determined by using local data from the Nampa, ID Agmet station and the degree-day model found on the IPMP website (mint.ippc.orst.edu). The four application dates were chosen so they would coincide with the accumulated Degree-Days (DD) of 800, 1100, 1300 and 1700 DD.

The peak egg-laying time occurs around 1100 DD, according to the model. These four dates were determined to give a good spread of times that should determine when the best time would be to apply the Coragen. In addition, one treatment had the insecticide applied twice, before and after peak egg laying. Each of the treatments that were applied on each of the six experiments was applied within five hours of each other.

Two of the six experiments were not sampled after preliminary sampling showed MRB levels to be too low to obtain useful data. Of the four experiments that were sampled, the first two were in furrow-irrigated fields, (experiments one and two) and the third and fourth experiments were in overhead sprinkle irrigated fields (experiments three and four).

Experiments one and two were on second and first year fields respectively. Experiments three and four were on third or fourth year mint fields.The swathing dates and sampling dates of each experiment are as follows:

Experiment one, (furrow-irrigated): swathed, 7-31 sampled 8-3
Experiment two, (furrow-irrigated): swathed, 8-31, sampled 9-5
Experiment three, (overhead sprinkle irrigated with a pivot) swathed, 8-19 sampled 8-21
Experiment four, (overhead sprinkle irrigated with wheelines) swathed, 8-18, sampled 8-29

Evaluation of the MRB control was done by digging eight 0.75 ft^2 soil samples in each plot. The soil was shaken off the mint rhizomes and sifted through a 0.25" screen. The rhizomes were placed in Berlese funnels until dry. The number of MRB larvae found in the Berlese funnels was combined with those found when the soil was sifted.

RESULTS AND DISCUSSION

In the furrow-irrigated experiments, the earliest application date did provide significant control of the mint root borers, in both experiments, however it did not lower the MRB levels below the treatment threshold. In experiment two, the double application of Coragen also reduced the MRB levels significantly, but to a lesser extent than did the earliest application. The three later applications of Coragen were completely ineffective in controlling the MRB larvae. The high level of MRB infestation clearly shows that a single application of Coragen is completely ineffective on or after 1127 accumulated degree-days.

Table 1. Mint Root Borer levels after harvest from pre-harvest applications of Coragen, on two furrow-irrigated peppermint experiments, located near Nampa, Idaho. (Summer 2013)

Trmt. #	Treatment	Accumulated degree-days (Nampa ID)	Application date(s)	Average live mint root borer larvae (per. sq. ft)	
				Exp. 1	Exp. 2
1	UTC			16.8 b	21.5 c
2	Coragen 5 oz/a	797	6-20	4.0 a	5.3 a
3	Coragen 5 oz/a	1127	7-4	16.6 b	20.1 c
4	Coragen 5 oz/a	1339	7-12	16.0 b	19.6 c
5	Coragen 5 oz/a	1677	7-24	15.8 b	22.2 c
6	Coragen 5 oz/a	1127 + 1339	7-4 & 7-12	17.1 b	13.3 b
	LSD			5.4	6.3

Coefficient of variation, experiment one=28.4%
Coefficient of variation, experiment two=28.2%
Sample means were compared with Fisher's Protected LSD (p=0.05).

The results in the overhead-irrigated experiment are very different from the furrow irrigated experiments: Coragen provided nearly 100% control of the MRB, at all application dates.

It is noteworthy that the MRB control was effective in all the application dates because at that time, it is likely that some MRB larvae that had already infested the mint rhizomes. It is speculated that the Coragen was controlling the mint root borers after they infested the mint rhizomes as well as controlling any future MRB larvae that infest the rhizomes.

It is speculated that the overhead irrigation is washing the Coragen into the soil where it is taken up by the mint roots and is translocated throughout the plant. However, some control of the MRB may still be occurring if the first instar MRB larvae feed on the foliage treated with Coragen.

Experiment number three was located in a pivot-irrigated field. Most of the Coragen applications were applied within a few hours of the pivot irrigating the field. Experiment number four was located in a wheeline-irrigated field, and most of the Coragen treatments were applied four to six days before the plot area was irrigated. This would indicate that it is not critical for a field to be irrigated immediately after the Coragen application, to be effective.

Table 2. Mint root borer levels after harvest from pre-harvest applications of Coragen, on two overhead irrigated peppermint experiments, located near Greenleaf, Idaho. (Summer 2013)

Trmt. #	Treatment	Accumulated degree-days (Nampa ID)	Application date(s)	Average live mint root borer larvae (per. sq. ft)	
				Exp. 3[PV]	Exp. 4[wl]
1	UTC			19.8 b	16.29 b
2	Coragen 5 oz/a	797	6-20	0.7 a	0.08 a
3	Coragen 5 oz/a	1127	7-4	0.1 a	0.00 a
4	Coragen 5 oz/a	1339	7-12	0.2 a	0.00 a
5	Coragen 5 oz/a	1677	7-24	0.3 a	0.08 a
6	Coragen 5 oz/a	1127 + 1339	7-4 & 7-12	0.0 a	0.13 a
	LSD			1.9	1.5

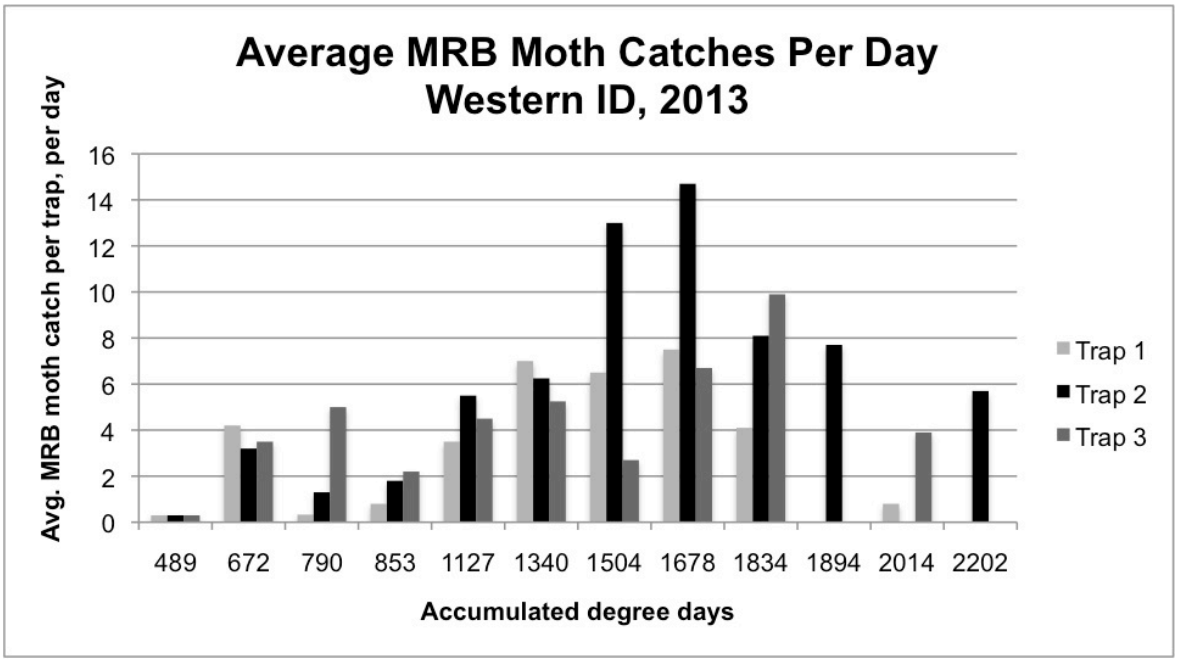
Coefficient of variation, experiment one=40.7%
Coefficient of variation, experiment two=41.0%
Sample means were compared with Fisher's Protected LSD (p=0.05).

The furrow-irrigated experiment that was not sampled for MRB had an infestation of foliar feeding cutworms in early July. It was observed on July 4th, that the plot areas that had been treated with 5 oz/a Coragen on June 20th had no visible cutworm damage while all other plots and the remainder of the field had very visible cutworm damage. No cutworm counts were taken for fear of disrupting the MRB experiment, but it was very clear that Coragen controlled the cutworms and stopped most leaf chewing. Further data could not be collected on the cutworm damage due to the grower treating the entire field with Orthene shortly after July 4th.

The sprinkle-irrigated fields that contained experiments three and four were not treated post harvest to control the MRB larvae. On September 24th visual observations were made of these two fields with experiments three and four in them. In the plot area of experiment three the mint in the treated and untreated areas looked the same. In experiment four, the mint in most of the plots that were treated with Coragen, pre-harvest, looked substantially healthier, and had more regrowth and rhizomes than did the untreated plots or the surrounding field.

Pheromone traps were placed in or near some of the fields where the experiments were located. The traps showed the first moth catches were around June 3rd (489 degree-days). The IPMP degree-day model using the Nampa, Agrimet site, predicted the first moth catch to be on May 29, or at 430 accumulated degree-days (Table 3). This indicates that the model predicted the first moth catch about five days earlier that it really occurred.
The moth catch data shows the peak moth flight to occur around 1678 accumulated degree-days, which occurred around July 24. The model predicted that the peak moth flight would occur around 910 accumulated degree days or on June 28. The model predicted peak moth catch to occur over three weeks earlier than it actually occurred.
This moth catch data supports previous findings by this researcher indicating that the model is consistently predicting the MRB development stages too early.

Table 3 Mint root borer pheromone trap catches of adult males in the central Treasure Valley area of Idaho.



CONCLUSIONS

In furrow-irrigated mint, most pre-harvest Coragen applications were completely ineffective in controlling MRB larvae. The only exceptions were when the Coragen was applied early, on June 20. This early application of Coragen did significantly reduce the MRB levels, but did not lower the level below the treatment threshold. In addition, a double application, of Coragen, pre-harvest, in furrow-irrigated mint, can in some cases reduce the MRB somewhat. Further studies should be conducted to determine if even earlier applications (May-June) of Coragen could be more effective in furrow-irrigated mint.

In overhead sprinkle irrigated fields, all pre-harvest applications of Coragen successfully controlled nearly all the MRB larvae. It appears that the timing of the overhead irrigation is not critical and does not need to be timed with the IPMP degree-day model. The Coragen needs to be applied between late June and before the last irrigation. The timing of the Coragen application in relation to the next overhead irrigation is not critical, as long as it is irrigated within approximately six days of the Coragen application.

Visual observations indicated that Coragen was very effective in controlling foliar feeding cutworms that occurred in July.

Pheromone trap counts indicate that the IPMP degree-day model for the Nampa area, predicts the MRB peak moth flight, at least three weeks too early. The IPMP model becomes more inaccurate for predicting the life stages of the MRB, as the growing season progresses.