University of California
Agriculture and Natural Resources
Intermountain Research & Extension Center

RESEARCH REPORT
Number 142, 2011

Maggot Control in Processing Onions

Rob Wilson, Center Director/Farm Advisor; Don Kirby, Superintendent of Agriculture; Brooke Kliewer & Kevin Nicholson, Staff Research Associates. University of California Intermountain Research & Extension Center, 2816 Havlina Rd. Tulelake, CA. 96134 Phone: 530/667-2719 Fax: 530/667-5265
Email: rgwilson@ucdavis.edu

Introduction: Maggots (the larval stage of flies) including the onion maggot, *Delia antiqua*, and the seed corn maggot, *Delia platura*, are problem pests of onion. Larvae attack seedlings and young onion plants feeding on the developing epicotyls and roots. A single maggot can kill up to 10 seedlings. Control of the first generation is often sufficient**,** as long as the onion crop is not otherwise stressed. Diseased or physically injured onions are susceptible to damage by second- and third-generation maggots because bulbs from damaged plants attract flies and are more penetrable by the maggots. Maggots are typically most problematic in soils with high organic matter or in fields with a large amount of decaying crop residue.

In 2011, a maggot control study was established at the Intermountain Research and Extension Center with funding support from the California Garlic and Onion Research Board. Study objectives were to compare insecticides and insecticide application methods (in-furrow at planting versus seed treatment) to the current in-furrow standard (Lorsban). The preceding crop at the study site was alfalfa which was rototilled shortly before planting the onions. The abundant decaying organic matter after alfalfa stand removal created optimal conditions to attract maggot flies. During May and June, sticky traps placed throughout the trial area captured high numbers of both seed corn maggot and onion maggot flies. ***Some pesticides listed in this report may not be labeled for use in onions. Please consult pesticide labels for use instructions.***

General Trial Information

Location:	Tulelake, CA
Soil Type:	Tulebasin mucky silty clay loam 4.2% organic matter
Planting Date:	May 2, 2011
Harvest Date:	September 29, 2011
Irrigation:	Solid-set sprinklers
Plot Size:	6 ft (2 beds) by 25 ft
Bed (row) Spacing:	36 inches; 4 seed-lines per bed spaced 6 inches apart
Trt Replication:	6 replications; CRD design
Onion Seed Source:	Sensient S32 (87% germination)
Seeding Rate:	1200 seeds per plot (348,500 seeds per acre)

Insecticide Application Methods:

- Insecticides were applied as a seed treatment or in-furrow at planting. In-furrow treatments were applied using Teejet AI80015VS nozzles @ 30 psi. The nozzles were mounted on the onion planter to apply a 4 inch band directly over the seed after seed placement but before furrow closure. All seed treatments, except FarMore FI500, were applied as an encrustment by Alan George Taylor at Cornell University. FarMore FI500 was commercially applied as a pelleted coating.

Onion Stand Count and Onion Vigor:

- Onion stand density was measured in each plot by counting the number of green onions in the entire plot on June 16th, June 29th, and July 15th. A visual evaluation of onion stand and vigor was estimated in each plot on June 6th (1-leaf stage), June 16th (2-leaf stage), June 29th (3-leaf stage), and July 15th (6-leaf) using a 0 to 5 scale. 0 = 100% stand loss and 5 = highest stand and vigor in the trial.

Insecticide Treatment List

			Insecticide Application Method	
			In-furrow	Seed
trt#	Insecticide Treatment	Rate per Acre	at planting	treatment
1	Untreated Control-raw seed	**		
2	Thiram-treated Control	**		
3	Sepresto (clothianidin+imidacloprid)	5.42 g ai/ 100g of seed		X
4	Entrust (spinosad)	4.52 g ai/ 100g of seed		X
5	Cruiser 70 WS (thiamethoxam)	4.52 g ai/ 100g of seed		X
6	FarMoreFI500 (fludioxonil, mefenoxam, azoxystrobin, spinosad, and thiamethoxam)	manufacturer rate		X
7	Coragen (rynaxypyr)	5 fl oz product/A	X	
8	HGY86 SC (cyazypyr 200g/L)	13.5 fl oz product/A	X	
9	Lorsban 15-G (chlorpyrifos)	6.6 lbs product /acre	X	
10	Lorsban 4E (chlorpyrifos)	32 fl oz product/A	X	
11	Entrust (spinosad)	2 oz product/A	X	
12	Entrust (spinosad)	6 oz product/A	X	
13	Admire Pro (imidacloprid)	7 fl oz product/A	X	
14	Admire Pro (imidacloprid)	14 fl oz product/A	X	
15	Admire Pro (imidacloprid) + Entrust (spinosad)	7 fl oz product/A 2 oz/A	X	

*Thiram 42S at 188 mg ai/100 g of seed applied as a seed treatment was included in all treatments except the untreated control.

Results

The influence of insecticide treatments on onion stand/vigor ratings, onion stand density, and onion yield are presented in Table 1. Average onion stand density for all treatments at the 1.5 leaf stage was 70 percent or less of the potential stand that could occur with a seeding rate of 1200 pure live seeds per plot. Stand density in all treatments continued to decrease until the 3-leaf evaluation, and then onion stand appeared to stabilize. Stand counts at the 3-leaf and 6-leaf stages were very similar. Maggot damage was the primary cause for the reduction in onion stand, but wind damage and disease also contributed to stand loss.

Onion stand density was highest in the Sepresto (clothianidin + imidacloprid) and Entrust (spinosad) seed treatments at all evaluations (Figure 1). These seed treatments along with FarMore FI500

(thiamethoxam + spinosad) seed treatment, Cruiser (thiamethoxam) seed treatment, and Lorsban in-furrow treatments increased onion stand density compared to the Thiram-treated control (Table 1 & Figure 1). Onion stand density for most in-furrow insecticide treatments apart from Lorsban was similar to the Thiram-treated control suggesting they did not prevent maggot damage (Figure 1). Onion stand density and onion stand/vigor ratings for Admire Pro at 14 fl oz/A applied in-furrow was lower than the Thiram-treated control. In fact, all three Admire Pro treatments had the numerically lowest stand density of all the treatments. Plants in the Admire Pro treated plots appeared stunted suggesting the treatments caused phytotoxicity. The highest rate of Admire had the poorest stand, further suggesting imidacloprid was phytotoxic.

Sepresto, Entrust, and FarMore FI500 seed treatments and Lorsban in-furrow treatments had the highest onion yields in the trial (Figure 2). Onion yields for all insecticide seed treatments and Lorsban in-furrow treatments were higher than the Thiram-treated control (Figure 2). Admire Pro at 14 fl oz/A applied in-furrow was the only treatment with lower onion yield compared to the Thiram-treated control supporting the idea that the high rate of imidacloprid was phytotoxic (Figure 2). In general, onion yield data was well correlated with onion stand density data suggesting that the main effect on yield was the insecticides' influence on onion stand density.

Neonicotinoid and spinosyn insecticides applied as a seed treatment provided similar or superior protection from maggot damage compared to the current standard Lorsban. Applying neonicotinoid and spinosyn insecticides as a seed treatment was far more effective than applying them in-furrow at planting. In fact, the in-furrow treatments were no more effective than the untreated control. The reason seed treatment provided better protection from maggot damage compared to in-furrow application is unknown. In-furrow applications actually have higher active ingredient rates on a per acre basis and larger soil coverage zone around the seed compared to seed treatment. The superior performance from seed treatment is likely related to the precise placement of concentrated insecticide on the seed coat.

Special Thanks: The research team would like to thank the California Garlic and Onion Research Advisory Board for financial support of this research and Alan George Taylor at Cornell University for seed treatment.

Table 1. Influence on Insecticide Treatments on Onion Stand, Vigor, and Yield at IREC in 2011.

trt#	Insecticide Treatment[1]	Onion Stand & Vigor Ratings[2] 1-leaf 0 to 5 rating scale	1.5-leaf	Onion Stand Density 1.5 leaf plants per plot	3-leaf	6-leaf	Onion Yield 9/29/2011 tons/acre
1	Untreated Control-raw seed	2.6	2.5	348	177	177	7.09
2	Thiram-treated Control	2.7	2.7	309	193	190	8.19
3	Sepresto (clothianidin + imidacloprid) seed trt	4.9	4.8	719	622	625	13.72
4	Entrust (spinosad) seed trt	5.0	5.0	812	673	676	14.34
5	Cruiser (thiamethoxam) seed trt	4.0	3.8	430	390	384	11.68
6	FarMoreFI500 (thiamethoxam + spinosad) seed trt	4.6	4.6	572	586	550	13.22
7	Coragen (rynaxypyr) in-furrow	2.6	2.5	265	192	179	7.24
8	HGY86 (cyazypyr) in-furrow	3.0	2.4	306	204	211	8.24
9	Lorsban 15-G (chlorpyrifos) in-furrow	3.8	4.3	591	471	464	13.18
10	Lorsban 4E (chlorpyrifos) in-furrow	4.8	4.8	646	565	561	13.58
11	Entrust (spinosad) 2 oz/A in-furrow	2.8	2.5	257	151	160	6.79
12	Entrust (spinosad) 6 oz/A in-furrow	3.3	3.1	356	215	211	8.43
13	Admire Pro (imidacloprid) 7 fl oz/A in-furrow	2.5	2.1	231	136	133	6.11
14	Admire Pro (imidacloprid) 14 fl oz/A in-furrow	2.1	2.1	187	99	104	4.89
15	Admire Pro (imidacloprid) + Entrust (spinosad) in-furrow	2.4	2.1	230	131	136	6.09
	95% Confidence Interval	*0.4*	*0.5*	*91*	*74*	*58*	*2.10*

[1] Thiram 42S at 188 mg ai/100 g of seed applied as a seed treatment was included in all treatments except the untreated control

[2] Visual evaluation of onion stand and vigor in each plot. 0 -5 scale; 0 = 100% stand loss and 5 = highest stand and vigor in the trial

Figure 1. Influence of Insecticides Applied for Maggot Control on Onion Stand Density

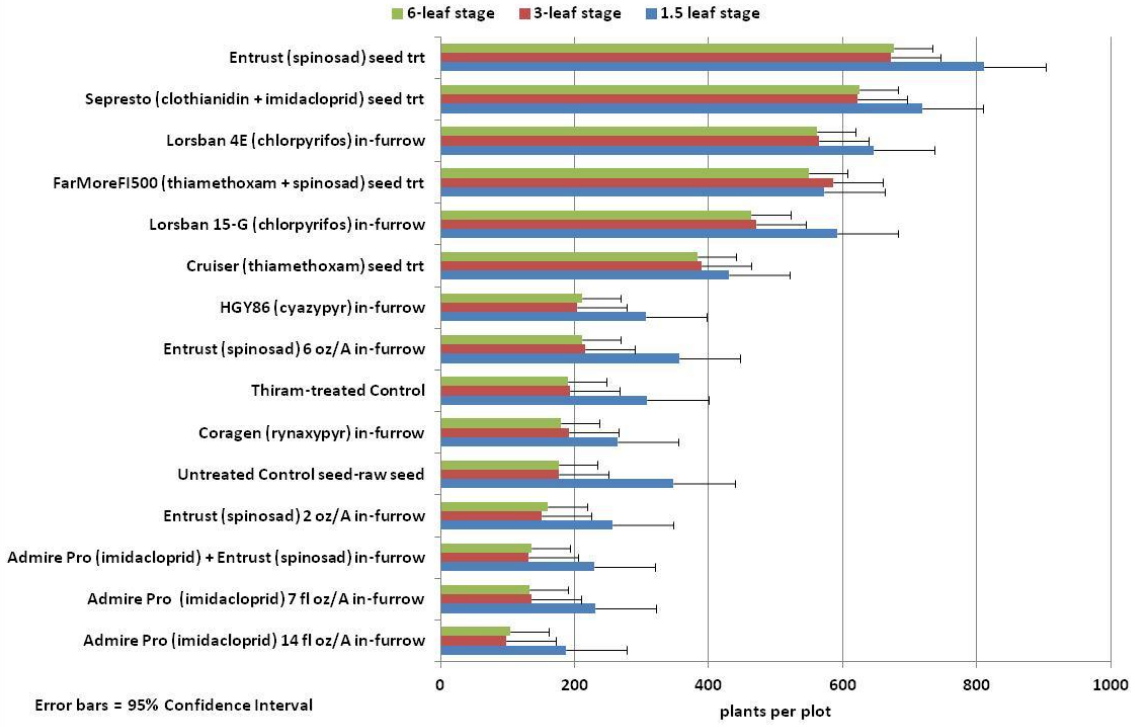

Figure 2. Influence of Insecticides Applied for Maggot Control on Onion Yield