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Insecticide Options for Protecting Spring-Seeded Processing Onions from Seedcorn Maggot and Onion Maggot

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Introduction

Onion maggot, *Delia antiqua*, and seed corn maggot, *Delia platura*, are destructive pests of onions. Larvae of both species feed on young onion plants, often resulting in seedling mortality. Heavy infestations can reduce onion plant populations by more than 50 percent of the desired population, causing crop failure or the need to re-plant. In recent years, seed corn maggot damage has been particularly bad in Tulelake, California, with many growers experiencing more than 15 percent stand loss across field locations.

Seed corn maggot larvae live in the soil and feed on seeds and developing plants of several crops including onions. Tillage of green plants, plant residues and manures attract egg-laying seed corn maggot females, and crop damage can be severe when crops are planted within the first few weeks after tillage. Cool, wet weather and delayed plant emergence are other factors that often promote crop damage from seed corn maggot. Preventative measures include late planting, increasing seeding rates, no-till seeding, and tilling manures and residues three to four weeks before planting. Tillage of green plant residue and manures is the primary event that attracts seed corn maggots.

Onion maggot larvae live in the soil and are specific to onion and related allium crops. Flies lay their eggs on soil near young onion plants. First-generation larvae usually cause the most damage feeding on developing seedlings, but later generations feed on expanding bulbs and can cause significant crop loss. Preventative measures include avoiding successive rotations of onion crops, placing fields at least ¾ mile from last year's fields, removing cull piles, and removing onions left in the field. Growers can monitor temperature degree days using an onion maggot degree day model and delay planting until after the predicted first-generation flight.

The key to managing seed corn maggot and onion maggot is prevention! There are no rescue insecticide options for maggot after onion planting, and it's impossible to recover lost onion plants. If maggots are anticipated, growers should strongly consider insecticide seed treatment or applying an insecticide in-furrow at planting.

For many years, chlorpyrifos applied in-furrow provided good maggot suppression in Tulelake, but growers recently started looking for more effective alternatives to chlorpyrifos due to increased crop damage. Environmental concerns associated with chlorpyrifos also encouraged growers to find alternative insecticides. ***Some pesticides listed in this report may not be labeled for use in onions. Please consult pesticide labels for use instructions.***

2017 Site Information

- **Soil type-** mucky silty clay loam-4.2% OM
- **Growing season-** early May to late September
- **Irrigation –** solid-set sprinklers
- **Onions-** 36 inch beds with 4 seed-lines spaced 6 inches apart; 2-inch seed spacing; Sensient Technologies processing variety
- **Design-** RCB with 6 blocks (reps)

2017 Study Methods

Studies were conducted at the UC Intermountain Research and Extension Center and a commercial field in Tulelake to compare insecticides and insecticide application methods for preventing maggot damage. Seed corn maggot and onion maggot were present at the study sites with seed corn maggot being the dominant pest. Insecticide efficacy was determined by measuring onion plant density and vigor at multiple times during onion establishment and onion plant density and bulb yield at harvest. A big focus for 2017 was evaluating several seed treatment options. A smaller study was conducted at IREC to determine if the duration between initial tillage and onion planting influences maggot damage and resulting onions stands. The primary study goal was determine if delaying onion planting three to four weeks after planting significantly decreased onion loss from maggots.

- **Seed treatments**: filmcoat, encrustment, and full-size (bb-sized) pellets.
- **In-furrow treatments**: 3-inch band of insecticide applied directly over the seed after seed placement but before furrow closure using Teejet even fan 8001 nozzles at 30 psi mounted on the onion planter

Onion Measurements

Onion stand density was measured in each plot by counting the number of green onions in the entire plot at the 2-3 leaf stage, 5 leaf stage, and immediately before harvest. Onion yield was determined by weighing all topped onion bulbs in each plot.

Study Results

The 2017 insecticide study focused on comparing the efficacy of several seed treatment options. Onion stands for most seed treatments were statistically similar and higher than the control (Table 1). The exceptions were Capture LFR applied in furrow, Trigard, and seed not treated with insecticide (control). These treatments had lower stands at one or both sites compared to the top-performing insecticide treatments. When seed treatments were grouped across insecticides, pelleted seed had slightly higher stand and yield compared to encrustment (Table 2). When insecticides were grouped across coatings, OI100, FI500, and Sepresto had similar stand and yield (Table 2). Incotec offers a film-coat option for OI100. Grouped across fungicide packages, film-coated OI100 resulted in higher stands and yield compared to encrustment (Table 3). Yields at IREC were similar across most insecticide treatments except for FarMore 0I100 + ProGro+ Bacillus which was lower than several treatments and similar to the untreated control (Table 4). This treatment may have a negative influence on onion growth as the onion stand associated with the treatment was similar to other FarMore OI100 treatments.

A side study looking at the influence of planting date on onion stand showed delaying onion planting 13 and 21 days after initial tillage increased onion stand compared to planting one day after tillage (Tables 5-7). The most likely cause for the stand increase in delayed planting treatments was maggot larvae resulting from eggs laid at the time of tillage were nearing the end of their lifecycle during onion seedling development. Onion yield increased for the 13 days after tillage planting treatment compared to planting one day after initial tillage treatment. Onion yield for the 21 days after tillage planting treatment was lower than the other treatments. The low yield for the 21 days after tillage treatment was likely related less growing season and early bulbing associated with the variety since onion stands were high. Delayed planting may be an effective non-chemical control strategy for organic growers, but stand benefits must be weighed against a shorter-growing season in cold climates.

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Table 1. Onion Stands for Insecticide Seed Treatments and In-furrow Insecticides Tested in Tulelake in 2017

			5-leaf Growth Stage			Harvest		
			IREC Site	Grower Site	Average Across Sites	IREC Site	Grower Site	Average Across Sites
Trt#	Treatment	Seed Coating	onions per bed ft			onions per bed ft		
14	FarMore OI100 + Thiram	filmcoat	20.4 a	23.8 a	22.1 a	19.7 a	22.3 a	21.0 a
12	FarMore OI100 (no fungicide package)	filmcoat	19.8 abc	23.0 ab	21.4 ab	19.3 a	21.6 ab	20.4 a
6	FarMore FI500	full size-pellet	19.8 ab	22.3 abc	21.1 ab	19.3 a	21.2 ab	20.2 a
5	FarMore FI500	encrustment	19.9 a	22.0 abc	20.9 ab	19.5 a	20.3 ab	19.9 a
4	FarMore OI100 + FarMore 300	full size-pellet	18.5 abcd	22.9 ab	20.7 abc	17.5 ab	21.3 ab	19.4 a
17	FarMore OI100 + FarMore 300 & Fontelis & Capture in-furrow	encrustment	18.9 abcd	22.4 abc	20.7 abc	18.7 ab	20.9 ab	19.8 a
16	FarMore OI100 + FarMore 300 & Fontelis at 24 fl. oz/A in-furrow	encrustment	18.5 abcd	22.3 abc	20.4 abc	18.1 ab	21.2 ab	19.6 a
8	Sepresto 75WS + FarMore 300	full size-pellet	19.5 abc	20.6 bc	20.0 abc	18.7 ab	20.9 ab	19.8 a
10	FarMore OI100 (no fungicide package)	pellet	18.1 abcd	21.2 abc	19.6 abc	18.4 ab	21.0 ab	19.7 a
13	FarMore OI100 + FarMore 300 + ProGro	encrustment	17.5 abcd	21.6 abc	19.6 abc	17.6 ab	21.1 ab	19.3 a
7	Sepresto 75WS + FarMore 300	encrustment	18.1 abcd	21.0 abc	19.5 abcd	18.1 ab	20.4 ab	19.3 a
3	FarMore OI100 + FarMore 300	encrustment	17.7 abcd	20.2 bc	19.0 abcd	17.4 ab	18.9 ab	18.1 ab
11	FarMore OI100 (no fungicide package)	encrustment	17.6 abcd	19.8 bc	18.7 abcd	17.6 ab	19.4 ab	18.4 ab
19	FarMore OI100 + ProGro + Bacillus	encrustment	16.3 abcd	20.7 abc	18.5 abcd	16.8 ab	20.7 ab	18.8 ab
15	FarMore 300 & Capture LFR (bifenthrin) at 8.5 fl. oz/A in-furrow	encrustment	15.2 de	21.4 abc	18.3 bcd	15.3 bc	20.3 ab	17.5 ab
18	FarMore 300 and Bacillus	encrustment	15.7 bcde	20.6 bc	18.1 cd	15.9 abc	20.1 ab	18.0 ab
9	Trigard + FarMore 300	pellet	15.6 cde	20.5 bc	18.1 cd	16.1 abc	20.1 ab	18.1 ab
2	FarMore 300 (no insecticide control)	full size-pellet	15.7 bcde	20.2 bc	17.9 cd	15.8 abc	19.1 ab	17.3 ab
1	FarMore 300 (no insecticide control)	encrustment	12.0 e	19.7 c	15.9 d	12.3 c	18.4 b	15.3 b

Data was analyzed using ANOVA and Tukey-Kramer mean comparison. Treatments with the same letter are not statistically different.

Table 2. Onion Stand & Yield for Encrustment & Pellet Seed Treatments Tested in Tulelake

Treatment	5-leaf stage	Harvest	Harvest
	Onion Stand averaged across sites		Onion Yield at IREC
	– onions per bed ft –		tons per acre
Encrustment seed coating averaged across insecticides	18.5 a	18.2 b	24.2 b
Full-size pellet seed coating averaged across insecticides	19.1 a	19.3 a	25.5 a
FarMore FI500 averaged across coatings	20.7 a	20.1 a	26.3 a
FarMore OI100 (no fungicide package) averaged across coatings	18.6 b	19.1 a	25.5 a
FarMore OI100 + FarMore 300 averaged across coatings	19.0 ab	18.8 a	25.6 a
Sepresto 75WS + FarMore 300 averaged across coatings	19.2 ab	19.5 a	25.1 a
FarMore 300 (no insecticide control) averaged across coatings	16.5 c	16.3 b	21.8 b

Data was analyzed as a Factorial using Student T test and Tukey-Kramer mean comparisons. Treatments with the same letter are not statistically different. Treatment interactions were not significant for all variables.

Table 3. Onion Stand & Yield for OI100 Seed Coatings Tested in Tulelake

Treatment	5-leaf stage	Harvest	Harvest
	Onion Stand averaged across sites		Onion Yield at IREC
	– onions per bed ft –		tons per acre
Film-coat seed coating averaged across fungicide packages	21.0 a	20.7 a	26.7 a
Encrustment seed coating averaged across fungicide packages	18.5 b	18.3 b	25.1 b
Full-size pellet seed coating averaged across fungicide packages	19.1 b	19.6 ab	26.0 ab

Data was analyzed using ANOVA and Tukey-Kramer mean comparison. Treatments with the same letter are not statistically different.

Table 4. Onion Stand and Onion Yield for Insecticide Treatments Tested at IREC in 2017

Trt#	Treatment	Seed Coating	7/10/2017 5-leaf onion stand (onions per bed ft)	9/29/2017 Harvest onion stand (onions per bed ft)	10/5/2017 Onion yield (ton/acre)
14	FarMore OI100 + Thiram	filmcoat	20.4 a	19.7 a	26.8 a
6	FarMore FI500	full size-pellet	19.8 ab	19.3 a	26.7 a
12	FarMore OI100 (no fungicide package)	filmcoat	19.8 abc	19.3 a	26.6 a
17	FarMore OI100 + FarMore 300 & Fontelis & Capture in-furrow	encrustment	18.9 abcd	18.7 ab	26.1 ab
4	FarMore OI100 + FarMore 300	full size-pellet	18.5 abcd	17.5 ab	26.0 ab
16	FarMore OI100 + FarMore 300 & Fontelis at 24 fl. oz/A in-furrow	encrustment	18.5 abcd	18.1 ab	25.9 ab
10	FarMore OI100 (no fungicide package)	pellet	18.1 abcd	18.4 ab	25.9 ab
5	FarMore FI500	encrustment	19.9 a	19.5 a	25.9 ab
8	Sepresto 75WS + FarMore 300	full size-pellet	19.5 abc	18.7 ab	25.7 ab
3	FarMore OI100 + FarMore 300	encrustment	17.7 abcd	17.4 ab	25.1 ab
11	FarMore OI100 (no fungicide package)	encrustment	17.6 abcd	17.6 ab	25.1 ab
7	Sepresto 75WS + FarMore 300	encrustment	18.1 abcd	18.1 ab	24.5 ab
13	FarMore OI100 + FarMore 300 + ProGro	encrustment	17.5 abcd	17.6 ab	24.4 ab
9	Trigard + FarMore 300	pellet	15.6 cde	16.1 abc	24.2 ab
18	FarMore 300 and Bacillus	encrustment	15.7 bcde	15.9 abc	23.9 ab
15	FarMore 300 & Capture LFR (bifenthrin) at 8.5 fl. oz/A in-furrow	encrustment	15.2 de	15.3 bc	23.7 abc
2	FarMore 300 (no insecticide control)	full size-pellet	15.7 bcde	15.8 abc	23.4 abc
19	FarMore OI100 + ProGro + Bacillus	encrustment	16.3 abcd	16.8 ab	22.8 bc
1	FarMore 300 (no insecticide control)	encrustment	12.0 e	12.3 c	20.2 c

Data was analyzed using ANOVA and Tukey-Kramer mean comparison. Treatments with the same letter are not statisically different.

Table 5. Influence of Onion Planting Date on Onion Stand at the 5-leaf Stage in 2017

		Sepresto seed	Untreated seed	Average across seed
Trt #	Time of Planting Treatment	—— onions per bed ft ——		
1	Onions planted one day after intitial tillage	14.67	12.33	13.50
2	Onions planted 13 days after intitial tillage	16.54	12.92	14.73
3	Onions planted 21 days after initial tillage	17.69	18.10	17.90

Initial tillage of the field occurred on 5/9/2017. Emerging maggot flies were captured from plots starting 5/25/17 and ending 6/15/17 with the majority being captured during 6/2/17 to 6/8/17 (24 to 30 days after tillage).

Table 6. Influence of Onion Planting Date on Onion Stand at Harvest in 2017

		Sepresto seed	Untreated seed	Average across seed
Trt #	Time of Planting Treatment	—— onions per bed ft ——		
1	Onions planted one day after intitial tillage	15.89	11.13	13.51
2	Onions planted 13 days after intitial tillage	18.54	13.27	15.91
3	Onions planted 21 days after initial tillage	17.25	16.68	16.97

Table 7. Influence of Onion Planting Date on Onion Yield in 2017

		Sepresto seed	Untreated seed	Average across seed
Trt #	Time of Planting Treatment	—— tons per acre ——		
1	Onions planted one day after intitial tillage	17.67	14.77	16.22
2	Onions planted 13 days after intitial tillage	18.49	15.93	17.21
3	Onions planted 21 days after initial tillage	14.51	15.44	14.98