INSECTICIDE ROTATIONS FOR THRIPS CONTROL IN ONIONS, 2012

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Introduction

Onion thrips and the iris yellow spot virus (IYSV) that these thrips can transmit are major production limiting factors in the Treasure Valley. There are about 20,000 acres of onions produced within a 50-mile radius of Ontario, Oregon. This high concentration of onions makes for unique production challenges, especially for onion thrips and IYSV management. Thrips can rapidly develop resistance to insecticides, and new insecticides may rapidly lose their effectiveness. Therefore, it is important to assess the effectiveness of currently registered insecticides and to develop alternative management methods as part of an overall integrated pest management (IPM) program. A field experiment was conducted to evaluate six currently registered insecticides and one nonregistered insecticide applied in different rotation patterns.

Materials and Methods

Onions were grown on an Owyhee silt loam with a pH of 7.7 and 1.7 percent organic matter, previously planted to wheat. In the fall of 2011, the wheat stubble was shredded and the field was irrigated. Based on a soil analysis, 100 lb of phosphorus/acre, 200 lbs of sulfur/acre, 1,000 lbs of gypsum/acre, and 1 lb of boron/acre were broadcast. The field was then disked, moldboard plowed, and groundhogged. On September 25, the field was fumigated with Vapam® at 15 gal/acre and bedded at 22 inches.

Onion seed ('Vaquero'; Nunhems, Parma, ID) was planted on March 13 in double rows, spaced 3 inches apart using 150,000 seeds/acre. Each double row was planted on beds spaced 22 inches apart. Planting was done with a Beck planter. Onions were grown under drip irrigation. Drip tape (Toro Aqua-Traxx, Toro Co., El Cajon, CA) with emitters spaced 12 inches apart and an emitter flow rate of 0.22 gal/minute/100 ft was laid 2-4 inches deep between 2 onion beds at the time of planting. The distance between the tape and the center of each bed was 11 inches. The water application rate was 0.06 inch/hour. Immediately after planting, Lorsban® 15G insecticide was banded at 3.7 oz/1,000 ft of row (0.82 lbs ai/acre), and the soil surface was rolled.

The field was irrigated as necessary to maintain soil water tension at 20 cb at 8-inch depth. Soil water tension was monitored by six granular matrix sensors (Watermark Soil Moisture Sensors Model 200SS, Irrometer Co. Inc., Riverside, CA) centered at 8-inch depth below the onion row. The sensors were automatically read three times a day with an AM-400 meter (Mike Hansen Co., East Wenatchee, WA).

Onion emergence started on April 12. Weekly thrips counts were made, starting on May 14. Thrips counts were made by counting the number of thrips on 15 consecutive plants in one of the middle 2 rows of each plot. Each treatment plot was 4 double rows wide by 27 ft long.

Insecticides were applied weekly beginning May 30, according to the schedule and rates listed in Tables 1 and 2. Fifteen treatments were compared to an untreated check treatment. Insecticides were applied with a CO_2 backpack sprayer using a 4-nozzle boom with 11004 nozzles at 30 PSI and 35 gal/acre.

Onions in each plot were evaluated subjectively for severity of symptoms of IYSV on August 15. Fifteen consecutive plants in one of the middle 2 rows of each plot were rated on a scale of 0 to 5 of increasing severity of symptoms, where the rating was 0 if there were no symptoms, 1 if 1-25 percent of foliage was diseased, 2 if 26-50 percent of foliage was diseased, 3 if 51-75 percent of foliage was diseased, 4 if 76-99 percent of foliage was diseased, and 5 if 100 percent of foliage was diseased.

The onions were lifted on September 13 to field cure. Onions from the middle two double rows in each plot were topped by hand and bagged on September 24. The onions from each plot were graded on October 19. During grading, bulbs were separated according to quality: bulbs without blemishes (No. 1s), split bulbs (No. 2s), neck rot (bulbs infected with the fungus *Botrytis allii* in the neck or side), plate rot (bulbs infected with the fungus *Fusarium oxysporum*), and black mold (bulbs infected with the fungus *Aspergillus niger*). The No. 1 bulbs were graded according to diameter: small (<2¼ inches), medium (2¼-3 inches), jumbo (3-4 inches), colossal (4-4¼ inches), and supercolossal (>4¼ inches). Bulb counts per 50 lb of supercolossal onions were determined for each plot of every variety by weighing and counting all supercolossal bulbs during grading. Marketable yield consisted of No. 1 bulbs larger than 2¼ inches.

Results and Discussion

Fifteen insecticide rotations plus an untreated control were evaluated for their effectiveness in controlling thrips and IYSV. Thrips populations and onion bulb yield varied significantly between treatments, suggesting that thrips were a limiting factor. Thrips populations reached an average of one thrips per plant on May 21 and peaked in late June and early July (Table 3). For the season and at the peak thrips counts, all insecticide sequences resulted in lower average number of thrips per plant than the untreated check treatment. Sequences that had Movento® in the first two applications had thrips populations reaching a peak later in the season than sequences with Movento applied later or that did not include Movento (Figs. 1 and 2). Sequences that included applications of Movento were among those that had the lowest average number of thrips per plant for the season and at the peak. The two sequences that did not include Movento were among those with the highest average number of thrips per plant for the season and at the peak.

Treatments 8, 13, 14, 15, and 16 were among those with the highest marketable yield and yield of bulbs larger than 4 inches in diameter (Table 4). Treatments 1 and 5 were among those with the lowest marketable yield and yield of bulbs larger than 4 inches in diameter. The severity of IYSV symptoms in 2012 was low, with no significant differences between treatments.

Movento and Agri-mek® were effective in early season thrips control. Lannate® and Radiant® were effective in mid- to late season thrips control. Other materials (Aza-Direct®, M-Pede®) may help early in the season.

Table 1. Conventional insecticide rotation sequence treatments tested for efficacy against onion thrips. Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.

Date	5/30/2012	6/5/2012	6/12/2012	6/19/2012	6/26/20122	7/3/2012	7/12/2012	7/19/2012
Treatment	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**
1	Control	-	-	-	-	-	-	-
2	Movento	Movento	Lannate	Lannate	Radiant	Radiant	Lannate	Lannate
3	M-Pede + Aza-Direct	M-Pede + Aza-Direct	Movento	Movento	Radiant	Radiant	Lannate	Lannate
4	M-Pede + Movento	M-Pede + Aza-Direct	M-Pede + Aza-Direct	Aza-Direct + Radiant	Lannate	Lannate	Lannate	Lannate
5	Radiant + M-Pede	Radiant + M-Pede	Movento	Radiant	Radiant	Lannate	Lannate	Lannate
6	Agri-Mek	Agri-Mek	Movento	Movento	Radiant	Radiant	Lannate	Lannate
7	Movento	Movento	Agri-mek	Agri-Mek	Radiant	Radiant	Lannate	Lannate
8	Radiant + M-Pede	Radiant	Movento	Movento	Lannate	Lannate	Lannate	Radiant
9	Movento	Movento	Radiant	Radiant	Lannate	Lannate	Lannate	Radiant
10	Radiant	Cyazypyr	Lannate	Radiant	Cyazypyr	Lannate	Radiant	Cyazypyr
11	Radiant	Radiant	Cyazypyr	Cyazypyr	Lannate	Lannate	Radiant	Radiant
12	Radiant	Radiant	Movento	Movento	Lannate	Lannate	Radiant	Radiant
13	Cyazypyr	Cyazypyr	Movento	Movento	Lannate	Lannate	Radiant	Radiant
14	Movento	Movento	Cyazypyr	Cyazypyr	Lannate	Lannate	Radiant	Radiant
15	Movento	Movento	Lannate	Lannate	Cyazypyr	Cyazypyr	Radiant	Radiant
16	Movento	Movento	Lannate	Lannate	Radiant	Radiant	Cyazypyr	Cyazypyr

Table 2. Characteristics of insecticides tested in 15 treatments for efficacy against onion thrips. Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.

Product	**Rate**	**Adjuvant**	**Active Ingredient**	**Mode of Action Group**
Agrimek	3 fl oz	Ballast 1.5 oz/100 gal; Preference 0.25% v/v	Abamectin	6
Aza-Direct	12 fl oz	-	Azadirachtin	unknown
Cyazypyr	13.5 fl oz	Ballast 1.5-2 oz/100 gal	Cyantraniliprole	28
Lannate	3 pt	Preference 0.25% v/v	Methomyl	1A
M-Pede	5.6 pt	-	Potassium salts of fatty acides	unknown
Movento	5 fl oz	Ballast 1.5-2 oz/100 gal; MSO Destiny 2.8 pt	Spirotetramat	23
Radiant	8 fl oz	Dyne-Amic 0.7 pt	Spinetoram	5

Table 3. Average number of thrips per onion plant by sampling date in response to 15 insecticide treatments and an untreated check treatment (1). First insecticide application was made May 30. Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.

Treatment	14 May	21 May	29 May	4 Jun	11 Jun	18 Jun	25 Jun	2 Jul	9 Jul	16 Jul	23 Jul	30 Jul	6 Aug	13 Aug	20 Aug	Avg
1	0.3	0.7	4.4	7.6	12.8	25.1	33.4	28.9	34.7	25.2	11.8	9.1	6.4	3.9	3.3	14.1
2	0.3	0.5	4.1	7.0	8.0	4.3	6.6	5.9	9.6	15.2	15.2	12.2	7.3	3.9	3.9	6.9
3	0.4	0.6	3.6	8.4	12.6	18.8	13.9	5.8	4.1	5.7	8.9	14.1	8.0	4.9	3.9	7.6
4	0.3	0.7	4.5	5.8	7.3	2.8	4.8	8.4	11.9	22.1	16.3	13.7	7.7	5.8	4.1	7.7
5	0.4	0.8	3.3	6.3	7.2	17.6	6.1	8.1	5.5	15.4	13.0	17.0	5.8	5.0	4.6	7.7
6	0.3	0.5	3.9	11.7	11.1	20.9	11.3	6.7	4.7	5.6	8.5	13.3	7.0	6.2	3.8	7.7
7	0.4	1.2	4.3	8.0	9.7	5.4	6.8	4.2	4.3	14.8	16.6	18.2	7.5	4.5	3.5	7.3
8	0.4	1.1	5.1	7.8	7.8	17.2	8.9	7.5	7.7	7.1	6.6	9.9	7.6	4.4	3.8	7.0
9	0.3	0.6	3.0	7.2	6.1	2.9	4.7	3.9	7.8	17.7	12.1	11.8	5.9	4.9	3.7	6.2
10	0.4	1.4	6.3	8.5	10.0	5.8	10.9	20.3	18.7	14.7	9.9	15.6	7.5	5.5	3.9	9.3
11	0.3	1.0	4.7	7.2	11.1	16.2	33.3	20.4	12.7	15.4	8.1	11.5	7.4	5.8	3.3	10.6
12	0.4	1.1	6.0	9.4	9.3	17.6	19.6	7.3	10.7	9.0	6.3	8.0	6.0	3.9	3.9	7.9
13	0.4	0.7	5.7	9.0	12.6	20.9	12.9	10.6	8.8	3.8	7.1	11.1	5.5	4.1	2.5	7.7
14	0.3	1.0	4.2	5.4	8.5	4.9	8.9	4.8	8.4	17.2	9.2	10.9	6.6	5.0	3.4	6.6
15	0.4	0.8	2.8	6.2	7.5	3.5	5.1	6.9	13.4	8.8	5.9	9.7	5.6	5.2	2.9	5.6
16	0.6	0.9	4.4	7.0	8.4	3.9	5.5	2.7	5.1	13.0	13.2	9.5	5.4	4.4	3.5	5.8
Avg	0.4	0.8	4.4	7.6	9.4	11.7	12.0	9.5	10.5	13.2	10.5	12.2	6.7	4.8	3.6	7.9
LSD (0.05)	NS	NS	NS	2.5	NS	8.1	9.5	4.5	7.2	7.2	4.9	5.4	NS	NS	NS	2.5

Table 4. Onion yield and iris yellow spot virus (IYSV) symptom severity in response to 15 insecticide rotation treatments and an untreated check treatment (1). Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.

		Marketable yield by grade										
Treatment	Total yield	Total	>4 in	>4¼ in	4-4¼ in	3-4 in	2¼-3 in	No. 2s	Small	Total rot	Bulb counts >4¼ in	IYSV
	cwt/acre									% of total yield	#/50 lb	0-5*
1	1059.7	1050.7	440.3	63.1	377.2	588.1	22.3	0.0	6.0	0.27	31.3	0.9
2	1161.0	1152.3	688.5	124.5	564.0	445.4	18.4	0.0	5.3	0.28	30.7	1.1
3	1195.4	1189.5	742.4	186.1	556.3	432.8	14.4	0.0	3.6	0.18	31.2	1.0
4	1170.4	1160.6	704.1	170.5	533.6	437.7	18.8	0.0	8.3	0.13	31.4	1.1
5	1098.9	1090.1	651.0	109.2	541.8	422.8	16.3	0.0	5.4	0.31	30.7	1.1
6	1161.1	1156.6	735.6	146.5	589.1	409.6	11.4	0.0	2.9	0.14	29.9	1.0
7	1191.2	1177.7	759.6	211.2	548.4	397.9	20.2	2.2	7.2	0.32	30.8	1.0
8	1222.2	1215.9	795.2	234.2	561.0	404.2	16.5	0.0	4.6	0.15	30.3	1.1
9	1181.3	1172.7	757.9	209.1	548.9	398.4	16.4	0.0	6.0	0.26	30.1	1.0
10	1206.3	1193.0	726.5	168.0	558.5	448.5	18.1	0.0	3.3	0.82	29.8	0.9
11	1156.2	1144.3	691.7	137.3	554.3	436.4	16.3	0.0	3.6	0.73	30.0	1.0
12	1184.8	1169.8	758.5	207.0	551.5	392.0	19.4	0.0	5.5	0.81	29.1	1.0
13	1309.1	1300.8	830.8	202.5	628.2	451.9	18.2	0.0	3.4	0.37	30.8	0.9
14	1230.4	1221.4	836.9	228.5	608.4	366.0	18.6	0.0	5.3	0.30	30.8	1.1
15	1229.9	1224.2	846.0	244.5	601.5	368.3	9.8	0.0	3.3	0.20	31.2	1.0
16	1276.7	1259.7	814.2	261.5	552.7	432.4	13.2	0.0	5.5	0.90	29.8	1.0
average	1189.7	1180.0	736.2	181.5	554.7	427.0	16.8	0.1	4.9	0.39	30.5	1.0
LSD (0.05)	50.2	52.8	274.2	15.6	258.6	NS	NS	NS	NS	0.5	NS	NS

* IYSV: 0 = no symptoms, 1 = 1-25% of foliage diseased, 2 = 26-50% of foliage diseased, 3 = 51-75% of foliage diseased, 4 = 76-99% of foliage diseased, and 5 = 100% of foliage diseased.

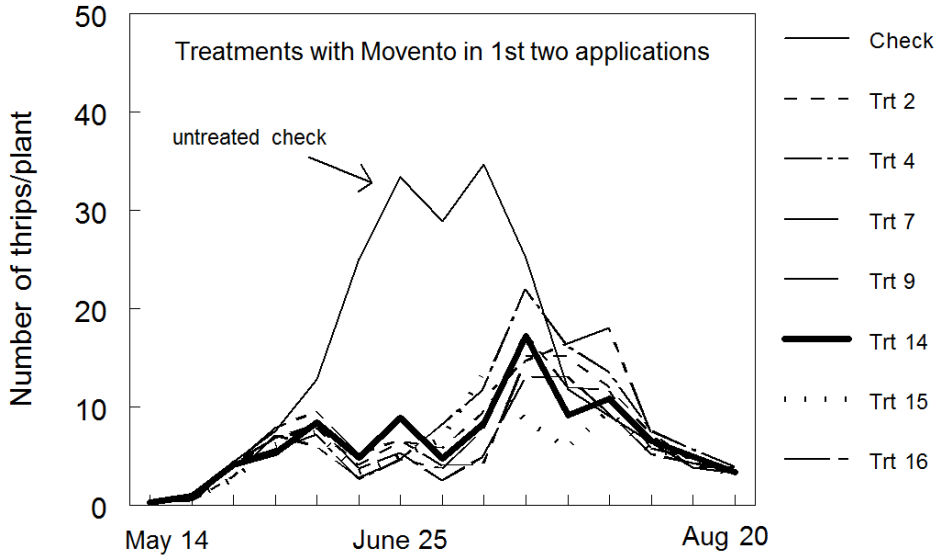

Figure 1. Average number of thrips per plant over time for insecticide rotations with Movento in the first two applications and an untreated check. Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.

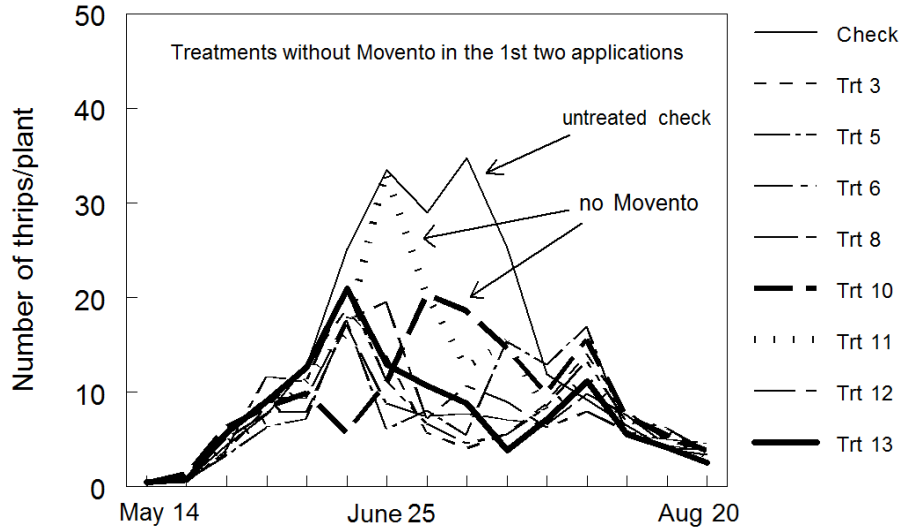

Figure 2. Average number of thrips per plant over time for insecticide rotations without Movento in the first two applications, 2 rotations with no Movento (Trts 10 and 11), and an untreated check. Malheur Experiment Station, Oregon State University, Ontario, OR, 2012.