

## HOW TO WIN THE BATTLE AGAINST ONION THRIPS

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Onion thrips, *Thrips tabaci*, is the major insect pest of onion and its control is critical to the production and profitability of this crop. Thrips feeding can reduce bulb yields by 30-50% and losses can be exacerbated if thrips infect the crop with *Iris yellow spot virus* or create damage that permits other pathogens to infect the crop. Insecticide use is the most important tactic for thrips control and advancements in our understanding about how to effectively manage thrips with insecticides has resulted in many successful battles. Winning the war against thrips, however, will require additional management tactics. To win battles against onion thrips, insecticides should be applied only when needed and in a manner that should reduce the development of insecticide resistance. There are three areas that should be considered before making insecticide applications: (1) **general information about commonly used products like Radiant, Movento and Agri-Mek**, (2) **timing applications of these products**, and (3) **an approach for using these products to manage thrips all season long**. This article provides guidance for managing onion thrips infestations in onion fields using insecticides following these three areas.



**General Information. What works?** Few products registered for thrips control on onion in New York work well (**Table 1**). Three products have consistently demonstrated good to excellent control of onion thrips: Radiant, Movento and Agri-Mek. **Radiant** is highly effective against both thrips larvae and adults and has residual activity lasting >7 days. **Movento** is systemic and has residual activity of >10 days, but it does not work well late in the season or against adults. Therefore, Movento should be used early when it easily moves systemically throughout the plant and when adult populations are often lower than they are later in the season. **Agri-Mek** provides moderate to excellent control of onion thrips adults and larvae and has a residual activity of 5-7 days. The Agri-Mek label states “thrips suppression” rather than “thrips control” because this product is mediocre against western flower thrips, which is a serious pest of onion in the western US, but not in New York. You must have a Section 18 label before applying Movento; Agri-Mek has a Section 3 label and is pending approval by NYS DEC.

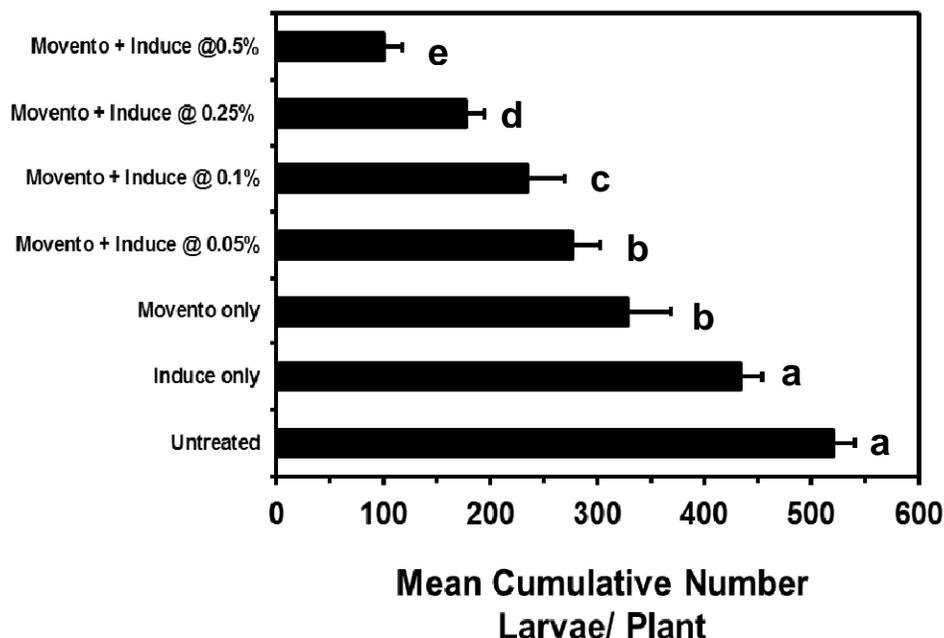
**Table 1. Conventional products labeled to manage onion thrips on onion in New York in 2012.**

Tetramic Acid	Avermectin	Spinosyn	Neonicotinoid	Carbamate	Organophosphate	Pyrethroid
Movento <sup>a</sup>	Agri-Mek SC*	Radiant SC	Assail 30SG	Lannate LV	MSR Spray	Ambush or OLF**
		Entrust			Pennacap-M	Mustang Max
						Pounce or OLF**
						Warrior or OLF**

<sup>a</sup> Pending Section 18 approval. \*Labeled for onion thrips suppression only. \*\*OLF: other labeled formulation.

**Are Penetrating Surfactants Important?** Radiant, Movento and Agri-Mek must penetrate the leaves to maximize effectiveness against thrips. Therefore, a penetrating surfactant must be included in the spray tank. There are many types of penetrating surfactants to choose from, and research in NY in 2010 showed that these insecticides performed equally well against thrips when either the non-ionic surfactant **Induce**, the methyated seed oil **MSO** or the organosilicone surfactant **Silwet L-77** was added to the spray mixture.

In 2011, thrips control was evaluated using Movento with varying rates of Induce. Larval thrips in the untreated control and Induce only treatment were significantly greater than the number of larvae in all Movento treatments (mean cumulative number larvae/plant) (**Fig. 1**). The level of thrips control significantly increased as the rate of Induce increased, with the best control being achieved with the 0.5% vol:vol rate.



**Figure 1.** Mean number of onion thrips larvae per plant in plots treated with Movento and various rates of Induce.

**Do Tank Mixes with Fungicides Affect Control?** Two years ago, we noticed a drop in thrips control when Agri-Mek and Movento were “tank mixed” with a fungicide that included a spreader sticker (*e.g.*, Bravo WeatherStik). We were concerned that the spreader sticker used to aid in leaf disease control interfered with the insecticide’s ability to penetrate the leaf surface. While spraying these insecticides separately from fungicides would eliminate this problem, it also would be a more costly and less efficient approach to managing thrips and foliar diseases. Therefore, studies were carried out in 2010 to understand how various combinations of insecticides, penetrators, fungicides and spreader stickers affected the level of thrips and foliar disease control. As we feared, when Radiant, Movento or Agri-Mek were combined with Chloronil 720, which contains a spreader sticker, **thrips control was significantly reduced by 12 to 35%**. In some cases, this problem was overcome when a high rate of one of the penetrating surfactants mentioned above was added to the mixture, but not consistently.

In 2011, the efficacy of Agri-Mek SC and Movento were evaluated when tank mixed with other fungicides to determine if the reduction in efficacy observed with tank mixes of Chloronil 720 occurred with other fungicides. In addition to the insecticide x fungicide mixtures, half of the treatments included Induce @ 0.5% vol:vol, while the other half did not include a

penetrating surfactant. Two applications were made one week apart and the numbers of thrips larvae were recorded one week after each spray.

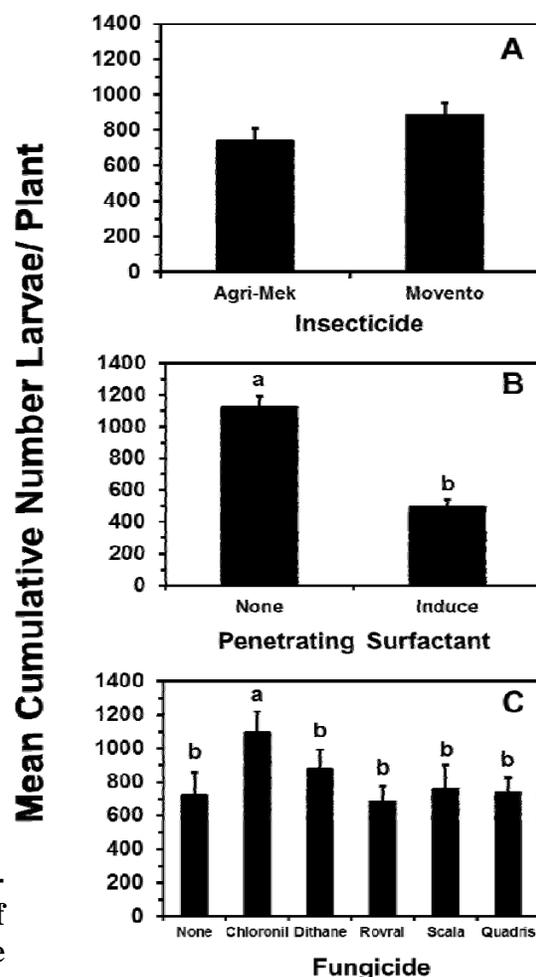
The total number of thrips in the untreated control over the two sampling dates was very high, exceeding 1,500 larvae per plant in the untreated control (over 150 larvae per leaf; data not shown). When averaged across all fungicide and penetrating surfactant treatments, Agri-Mek and Movento provided an equivalent level of thrips control (**Fig. 2A**). When compared with numbers in the untreated control, these products reduced the thrips population by around 50%.

The total number of onion thrips larvae per plant in plots that did not include Induce was significantly higher than the number in plots that included Induce, indicating the importance of using a penetrating surfactant with Agri-Mek and Movento for controlling thrips (**Fig. 2B**).

When all Movento and Agri-Mek treatments were averaged (with and without Induce), the mean cumulative number of thrips larvae in the Chloronil 720 treatment was significantly greater than the untreated control and all other fungicide treatments (**Fig. 2C**). No significant differences existed among the other fungicide treatments. **Our results indicated that Chloronil 720 interfered with the ability of Movento and Agri-Mek to control thrips. Co-applications of Chloronil 720 and these insecticides should be avoided.**

***Managing Insecticide Resistance.*** Insecticide resistance in thrips populations is a major concern. Resistance in thrips populations to the pyrethroid Warrior has been documented in many New York onion fields. Resistance in thrips to organophosphates and carbamates maybe common throughout New York. Caution should be taken when using products in these three classes. If you see that you are not getting the control you should and think resistance may be the cause, contact your CCE educator.

Because only a few highly effective products are available for thrips control and insecticide resistance is a concern, targeting the same generation of thrips with one product is suggested. **Based on past studies, two applications of the same product timed 7 to 10 days apart may be necessary to see a reduction in the thrips population.**



**Figure 2.** Total number of onion thrips larvae per plant in various insecticide, penetrating surfactant or fungicide treatments in New York in 2011.

**Timing Insecticide Applications.** Onion fields should be scouted for onion thrips each time before a decision is made to spray the field. In many cases, infestations will begin along an edge or edges of the field. When this occurs, many thrips may be seen along edges and much fewer or none in other parts of the field. If possible, only spray the infested edges rather than the entire field. Otherwise, wait to spray the entire field when the average number of thrips sampled throughout the entire field reaches a threshold (see more below). When weather is hot and dry, thrips populations can build rapidly and thresholds can be reached very quickly. In this case, scouting may need to occur more frequently. In contrast, if weather is cool and wet, weeks may go by before the thrips population increases to the threshold.

Timing insecticide applications following an action threshold can be challenging because of weather events (*e.g.*, rain) and other farming practices (*e.g.*, timing fungicide sprays). However, using an action threshold to determine when to spray can save money and time and keep resistance from developing as quickly. Based on results from field studies from 2006 - 2011, we found that the utility of an action threshold is highly dependent on the efficacy of the product used (**Table 2**). For example, Radiant continues to be the most effective product and provides excellent thrips control when applied at a threshold of 3 thrips larvae/leaf. Basically, Radiant has such good activity against onion thrips that it can control a population even when it has been allowed to build to a relatively high level. In contrast, Movento, Lannate LV and often Agri-Mek need to be applied using a more conservative threshold (only 1 thrips larva per leaf) to manage the population.

**Table 2. Action thresholds for selected insecticides suggested for managing onion thrips on onion.**

Products	Action Threshold
Radiant SC	3 thrips per leaf
Agri-Mek SC	1 thrips per leaf
Movento	1 thrips per leaf
Lannate LV	1 thrips per leaf

**Sequences of Insecticide Applications for Season-Long Control.** Sequences of insecticides used to manage onion thrips infestations are shown in **Tables 3 & 4**. Sequences and products selected for these examples are based on experience from several small-plot onion research trials.

Onion thrips infestations typically occur in onion fields in downstate NY before upstate NY because temperatures are warmer earlier in the season in downstate NY. The treatment window for onion thrips varies considerably among fields because the period between thrips colonization and harvest varies considerably. In most cases, transplanted fields will need to be sprayed earlier and for a shorter period compared with direct-seeded fields. For transplanted fields, action thresholds for thrips control are often reached in early to mid-June and protection is needed for about 4 to 6 weeks. For direct-seeded fields, action thresholds are often reached in late June to early July and protection is needed for 6 to 8 weeks. These generalizations were

taken into consideration to estimate the total number of sprays needed in a sequence to protect the onion crop from thrips (**Tables 3 & 4**).

Sequences begin with Movento and end with Radiant (**Table 3 & 4**). Do not use Movento if onion thrips adults have recently migrated into the field from nearby alfalfa or small grains because Movento is very weak against adults. Agri-Mek and Lannate LV are options between Movento and Radiant applications. Agri-Mek has a 30-day pre-harvest interval, so this product should be used during the first half of the season. **Radiant is the most effective product against larvae and adults, so it is positioned at the end of the insecticide use sequence when thrips populations are highest.**

**Table 3. Sequence of insecticides to apply for onion thrips control in transplanted onion fields. Two applications of each product should be applied based on action thresholds.**

### Transplanted onions\*

Application #	Product	Action threshold/ Timing of spray to consider
<b>1</b>	Movento	1 thrips larva per leaf
<b>2</b>	Movento	7 to 10 days after 1 <sup>st</sup> Movento spray if needed <sup>1</sup>
<b>3</b>	Agri-Mek SC	1 thrips larvae per leaf
<b>4</b>	Agri-Mek SC	7 days after 1 <sup>st</sup> Agri-Mek spray
<b>5</b>	Radiant SC	3 thrips larvae per leaf
<b>6</b>	Radiant SC	3 thrips larvae per leaf

\*Note: If after using Movento and Agri-Mek (first four sprays) there are at least 4 weeks remaining before onions are pulled, consider inserting two applications of Lannate between the Agri-Mek and Radiant sprays (see direct seeded onions below). Conversely, if after using Movento there are only 2 to 3 weeks remaining before onions are pulled, eliminate the Agri-Mek sprays and go to Radiant.

<sup>1</sup> If the thrips population is reduced to a low level (e.g., below 1 thrips per leaf) after the first Movento spray and does not reach threshold again until 3 weeks later, consider avoiding another application of Movento. Based on insecticide resistance management principles, the second application would affect the next generation of thrips and this should be avoided if possible. The recommendation would be to continue the sequence with the next product, which would be Agri-Mek or Radiant.

Insecticides that belong to the same insecticide class or have the same mode of action used sequentially against some insect pests can accelerate the development of insecticide resistance. The Colorado potato beetle is notorious for rapid increases in insecticide resistance and rotation of insecticide classes has extended the life of products used to manage it. Obviously, we want to avoid insecticide resistance development in onion thrips populations. Therefore, we encourage the use of products belonging to different insecticide classes (a class of insecticide is based on its mode of action- see <http://www.irac-online.org/teams/mode-of-action/>) and suggest following the guidelines outlined in **Tables 3 & 4**. Additionally, for each product (Radiant, Movento and Agri-Mek), only two applications should be applied during the season and they must be applied consecutively.

**Table 4. Sequence of insecticides to apply for onion thrips control in direct-seeded onion fields. Two applications of each product should be applied based on action thresholds.**

**Direct-seeded onions\***

<b>Application #</b>	<b>Product</b>	<b>Action threshold/ Timing of spray to consider</b>
<b>1</b>	Movento	1 thrips larvae per leaf
<b>2</b>	Movento	7 to 10 days after 1 <sup>st</sup> Movento spray if needed <sup>1</sup>
<b>3</b>	Agri-Mek	1 thrips larva per leaf
<b>4</b>	Agri-Mek	7 days after 1 <sup>st</sup> Agri-Mek spray
<b>5</b>	Lannate*	1 thrips larvae per leaf
<b>6</b>	Lannate*	7 days after 1 <sup>st</sup> Lannate spray
<b>7</b>	Radiant	3 thrips larvae per leaf
<b>8</b>	Radiant	3 thrips larvae per leaf

\*Note: If control of thrips using Movento and Agri-Mek (first four sprays) has provided control up to 2 or 3 weeks before onions will be pulled, eliminate the Lannate applications and go to Radiant. <sup>1</sup>  
**Same as comment in footnote #1 in Table 3.**

**Additional Thoughts on Controlling Thrips.** Insecticides should be applied with ground rigs using moderate pressure and a high volume of water and proper nozzle types and spacing. The goal should be to cover as much of the onion canopy as possible. Research at Cornell showed that applications made using at least 40gpa, 40psi and twin-flat fan nozzles achieved excellent coverage and also should minimize drift.

Other ways of controlling thrips besides using insecticides are being studied. For example, our research team has shown that thrips populations can build on early season volunteers and that some of these volunteers may be infected with *Iris yellow spot virus*, so removing volunteers as early as possible should be part of an overall management strategy. Our team also has shown that reducing the amount of nitrogen at planting will reduce populations of onion thrips larvae during the season. Reducing the amount of nitrogen applied to onion fields will save money and potentially may reduce the percentage of bacterial rot problems in storage. Additionally, we have shown a difference among onion cultivars in their susceptibility to thrips feeding. Cultivars that have a yellow-green leaf color and lower levels of wax were less susceptible to thrips feeding compared with blue-green color foliage with higher levels of wax. While additional work needs to be done on these alternative management practices, experimenting with other ways of reducing thrips infestations will be important to preserve the very few effective insecticides.