Great Lakes Fruit, Vegetable & Farm Market EXPO
Michigan Greenhouse Growers Expo
December 8-10, 2009
DeVos Place Convention Center, Grand Rapids, MI

Onion

Wednesday morning 9:00 am

Where: Gallery Overlook (upper level) Room A-B
Recertification credits: 1 (1B, PRIV OR COMM CORE)
CCA Credits: PM(2.0)

9:00 a.m. Downy Mildew and Foliar Diseases of Onion

- Mary Hausbeck, Plant Pathology Dept., MSU

9:25 a.m. Onion Thrips Control in New York

- Brian Nault, Entomology Dept., Cornell Univ.

10:10 a.m. Cover Crop Options to Improve Your Onion Rotation

- Mathieu Ngouajio, Horticulture Dept., MSU

10:35 a.m. Onion Weed Control Update

- Bernard Zandstra, Horticulture Dept., MSU

DOWNY MILDEW AND FOLIAR DISEASES OF ONION

Dr. Mary K. Hausbeck (517-355-4534)
Michigan State University, Department of Plant Pathology, East Lansing, MI

Purple Blotch and Stemphylium Leaf Blight. Purple blotch first appears as small water-soaked lesions that quickly develop white centers. As they age, the lesions turn brown to purple, surrounded by a zone of yellow. Lesions can coalesce, girdle the leaf, and cause tip dieback (Fig 1). Occasionally, bulbs are infected through the neck or wounds on the scales. Spores of *Alternaria porri* can form repeatedly on lesions with cycles of low and high relative humidity. When free water is available, spores can germinate in 45-60 minutes at 82-97°F. Spores can form after 15 hours of relative humidity $\geq$90% and can be spread by wind, rainfall, and irrigation. Fungal growth is favored by temperatures of 43-93°F, with an optimum temperature of 77°F. Old and young leaves injured by onion thrips are more susceptible to infection. Symptoms can appear 1-4 days after infection, and new spores can appear by the 5th day. The pathogen can overwinter in onion debris.

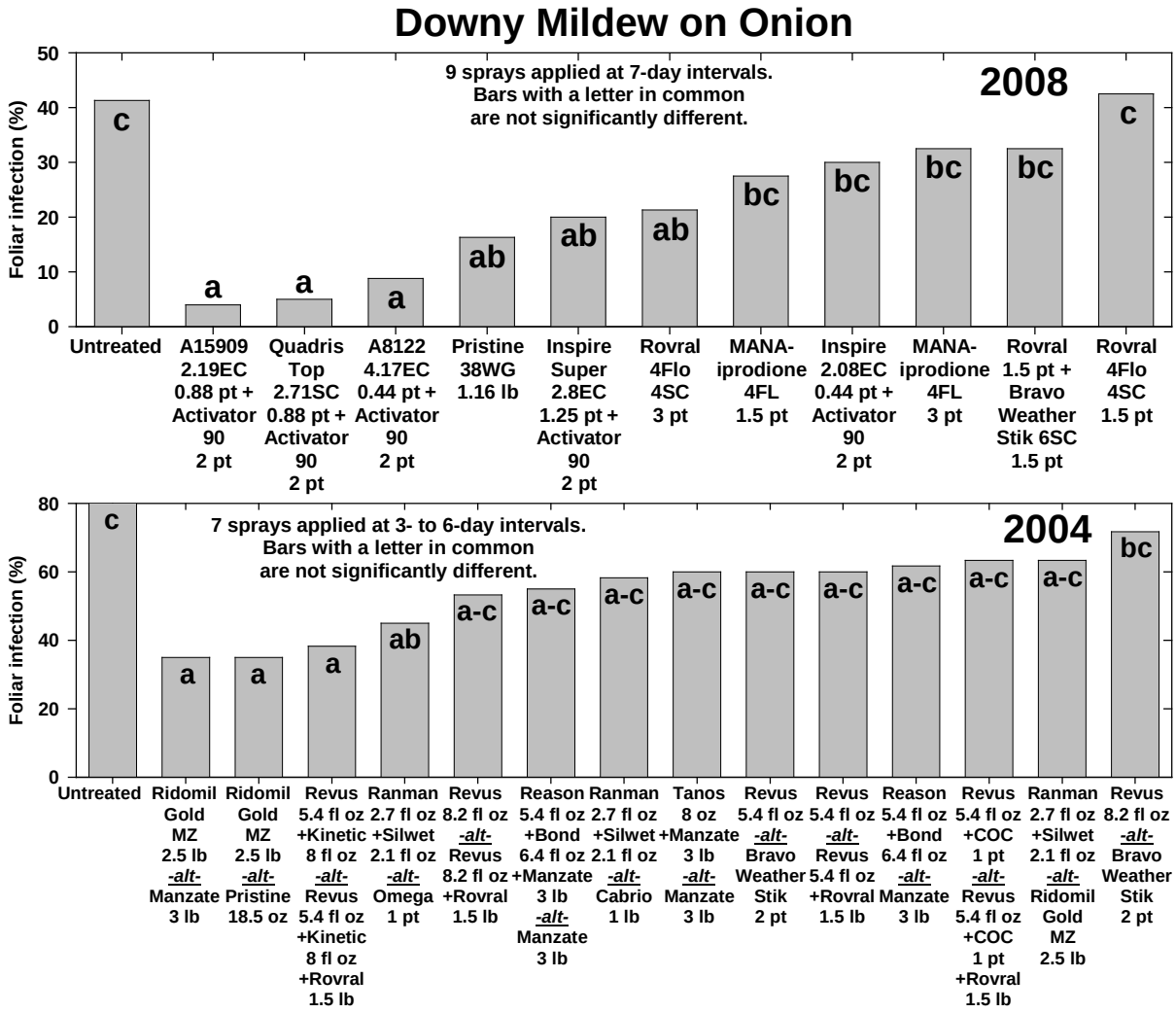
Stemphylium leaf blight is an occasional foliar problem in Michigan that can be confused with purple blotch. Symptoms begin as small, light yellow to brown, water-soaked lesions that develop into elongated spots that turn dark olive brown to black with spore development. Coalescing spots can blight leaves but rarely affects the bulb. The pathogen normally invades dead and dying tissue. Disease development is favored by long warm periods with leaf wetness. Fungicides effective against purple blotch are also effective against Stemphylium leaf blight.

Onion Downy Mildew. Downy mildew of onion is caused by the pathogen, *Peronospora destructor*, and first infects older leaves, occurring as pale, elongated patches that may have a grayish-violet fuzzy growth. Symptoms of the disease are best recognized when dew is present in the morning. Infected leaves become pale green, then yellow and can fold over and collapse. Premature death of onion leaves reduces bulb size. The downy mildew pathogen initiates infection during cool temperatures (less than 72°F) and wet conditions. Multiple infection cycles can occur in a season. Spores are produced at night and are easily blown long distances in moist air. They can germinate on onion tissue in one and a half to seven hours when temperatures are 50°F to 54°F. High daytime temperatures and short or interrupted periods of humidity at night can prevent sporulation. Overwintering spores, called oospores, can form in dying plant tissue and can be found in volunteer onions, onion cull piles, and in stored infected bulbs. Oospores have thick walls and a built-in food supply so they can withstand unfavorable winter temperatures and survive in the soil for up to five years.

Onion Downy Mildew Study Results

Research studies in Michigan have shown that weekly applications of mancozeb (available as Dithane, Manzate, or Penncozeb) protect against downy mildew when spray coverage is good and sprays are begun before disease appears (Figure 1. Years 2000, 2003, 2004). Some growers choose to include Ridomil Gold MZ in alternation with mancozeb although this program is more costly. We have tested Pristine 38WG in rotation with Ridomil Gold MZ for downy mildew control. The program with Pristine and Ridomil Gold MZ in alternation was effective for downy mildew, but is very costly. It is likely that Pristine alternated with mancozeb would also be effective, but needs to be tested. In addition to downy mildew, Pristine 38WG has activity against the leaf blights including purple blotch, Stemphylium, and Botrytis. New products such as Tanos, Revus, and Ranman have been effective some years of our studies

but have not been tested as a stand alone product with much success. New unregistered products such as Quadris Top (azoxystrobin/difenoconazole), Inspire Super, and newly released numbered products were very effective in controlling downy mildew in our 2008 research studies. At this time none of these products are currently labeled for use on onions. In the 2004 Ridomil Gold MZ alternated with either Manzate or Pristine provided the most consistent control of downy mildew. Revus and Tanos provided early season control of downy mildew but disease levels increased as the season continued and pressure approached epidemic levels. Ranman alternated with Omega provide a modest level of control, however neither of these products are registered for use on onions.

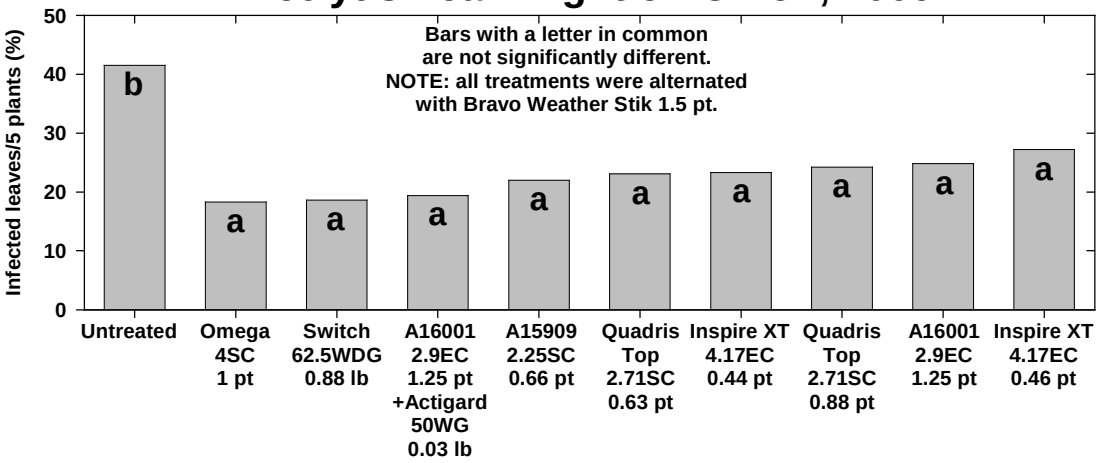


Onion Leaf Blight and Purple Blotch Study Results

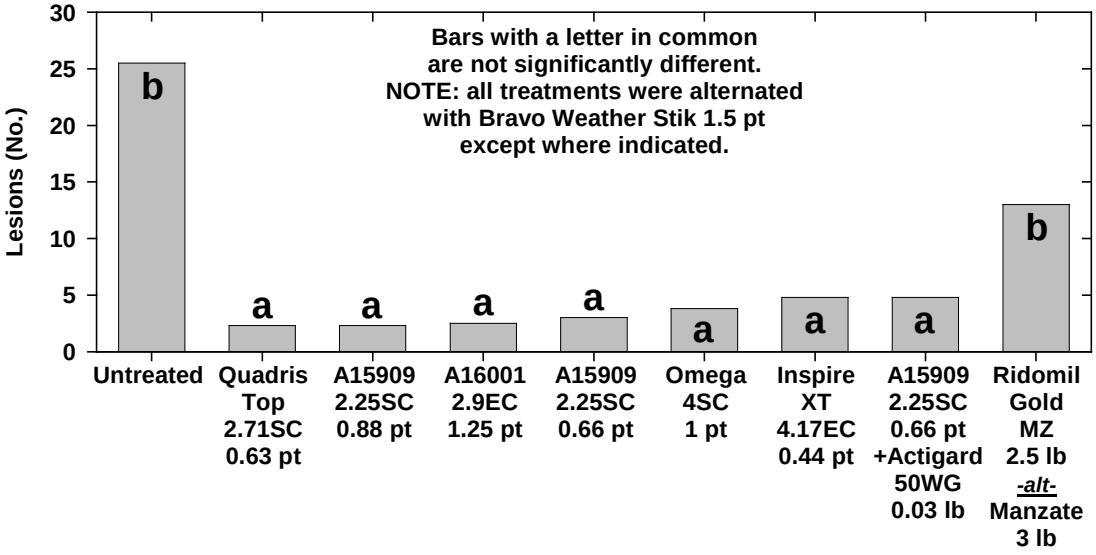
Historically any product containing chlorothalonil (Bravo, Equus, Echo) and iprodione (Rovral), were effective in controlling both onion leaf blight and purple blotch. Some of the new stroblilurin products such as Quadris, Pristine, and Flint are also very effective for purple blotch control.

In our recent studies (Figure 2), Quadris Top, Inspire (difenoconazole), Omega, and numbered compounds were effective in controlling both onion Botrytis leaf blight and purple blotch. The product Switch was also effective in controlling Botrytis leaf blight and is the only product tested in these studies that is currently labeled for use on onion.

Botrytis Leaf Blight on Onion, 2009



Purple Blotch on Onion, 2009



ONION THRIPS CONTROL IN NEW YORK

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Onion thrips, *Thrips tabaci* Lindeman, is the principal insect pest of onion in the Great Lakes region. Onions unprotected from onion thrips can suffer severe foliar damage and serious reductions in bulb yield (**Fig. 1**). Insecticide use is the principal tactic for managing onion thrips, but control has become more challenging because populations have developed resistance to insecticides. In addition to the difficulty of controlling thrips with insecticides, this pest has become even more problematic because it is the vector for *Iris yellow spot virus* (IYSV) (Bunyaviridae: *Tospovirus*), a virus that causes foliar damage to onion plants resulting in additional yield loss (**Fig. 2**). IYSV incidence is positively correlated with onion thrips densities, so effective control of onion thrips can reduce yield loss resulting directly from thrips feeding and indirectly from IYSV. **The purpose of this article is to provide (1) an overview of onion thrips biology and (2) an approach for managing onion thrips with insecticides.**

Fig. 1. Onion field near Sodus, NY, in which a portion of the field was unprotected with insecticides and a portion that was protected with insecticides.

Fig. 2. Onion field infected with *Iris yellow spot virus* in Elba, NY.

Thrips Population Biology. Onion thrips have overlapping generations during the season, and populations can increase quickly when it is hot and dry. When it is hot (e.g., 86° F), the time necessary for onion thrips to complete a generation is shorter than when it is cool or wet, and a generation can be completed in only 2 to 3 weeks. Under high temperatures, exponential population growth occurs and 4 generations can be completed within 2 months (**Table 1**). The Great Lakes region has experienced hot and dry conditions in 5 of the last 9 years and thrips populations have been very high. The implication of this information is that onion thrips infestations must be prevented from reaching a point when the population increases dramatically. If insecticides are applied after the population has already exploded, even effective insecticides may not reduce the population to an acceptable level. Therefore, thrips densities and weather conditions must be monitored closely for making a decision when to spray.

Table 1. Effect of temperature on onion thrips population growth under ideal conditions (i.e., no mortality). Estimates were derived from Murai (1982) and assumed that each population began with a single parthenogenic female.

	Number of Females		
Date	68^0 F	77^0 F	86^0 F
July 1	1	1	1
July 8			
July 15			63
July 22			
July 29		165	3,969
August 5			
August 12			250,047
August 19	210		
August 26			15,752,961
September 2		27,225	
Number generations	1	2	4

Products for Thrips Control. Insecticide use is the main tactic for managing onion thrips in onion. Yet, there are few products registered on onion that perform well enough to effectively control high infestations (**Table 2**). Dow AgroSciences recently announced that they will no longer produce SpinTor, eliminating one of the better products from this list. There is a great need for new products to be identified and registered on onion for thrips control. To address this issue, small-plot research trials are conducted every year in commercial onion fields under high onion thrips pressure to identify products that are most efficacious. Over the years, this research has produced information necessary to register new products nationally as well as support emergency registrations (i.e., Section 18s).

In NY in 2009, a number of novel insecticides were evaluated for onion thrips control. Products that most effectively reduced thrips densities were cyantraniliprole (HGW86-434 10 OD), spinetoram (Radiant SC), spirotetramat (Movento 240SC) and abamectin (Agri-Mek 0.15EC) **(Fig. 3)**. With the exception of Movento, these other treatments provided nearly perfect protection of onion foliage (data not shown). Because Movento does not control thrips adults, feeding by adults in Movento-treated plots late in the season resulted in moderate damage. For this reason, the use of Movento should occur earlier in the season at times when adults are less abundant. Lannate reduced thrips densities relative to the untreated control, but it did not provide the level of thrips control provided by Movento, Agri-Mek, Radiant or HGW86-434 **(Fig. 3)**. MBI-205, Neemazad, Clutch, Requiem and Neemix provided poor control of onion thrips in this trial.

Table 2. Performance of products registered on onion in USA for managing high infestations of onion thrips. Performance grades by B. Nault (Cornell University).

Product	Active Ingredient	Class	Performance
MSR	oxydemeton-methyl	OP	D
Penncap-M	methyl parathion	OP	D
Diazinon AG500	diazinon	OP	D
Vydate L	oxamyl	Carbamate	C
Lannate LV	methomyl	Carbamate	B-
Warrior	lambda-cyhalothrin	Pyrethroid	F
Assail 30SG	acetamiprid	Neonicotinoid	D
SpinTor/ Entrust	spinosad	Spinosyn	A-
Radiant SC	spinetoram	Spinosyn	A

Action Thresholds. Treatment guidelines for onion thrips control in onion varies from 1 to 3 thrips per leaf. The effectiveness of an insecticide affects which action threshold would be most appropriate. For example, let's assume that insecticide 'A' kills 10% of the thrips on a plant (because of resistance or because it is not very toxic to thrips) and insecticide 'B' kills 90%. If the threshold is 3 thrips per green leaf and there are 10 thrips per leaf, then a treatment with insecticide 'A' will result in 9 surviving thrips per green leaf, and this still is above the 'treatment threshold'. Using insecticide 'B' would result in 90% kill and only 1 surviving thrips per green leaf and this is below the 'treatment threshold'. Based on this scenario, each insecticide would require a different threshold, but no such information exists for products currently used to manage onion thrips.

Fig. 3. Season total number of thrips larvae per plant after 8 weekly applications in an onion field near Potter, NY 2009.

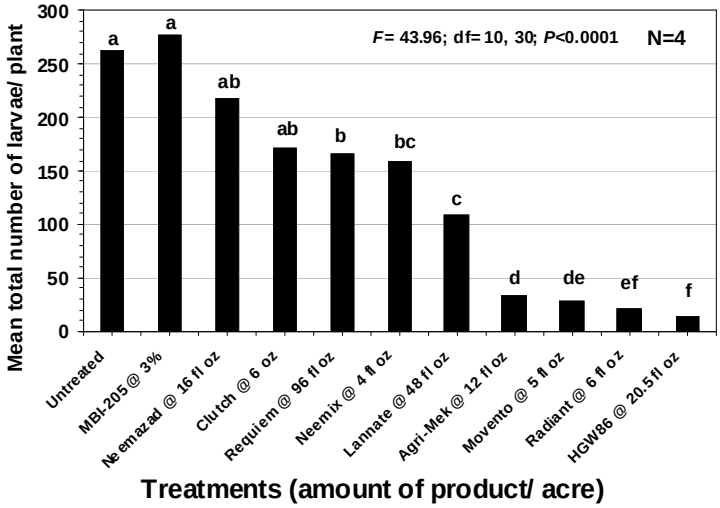
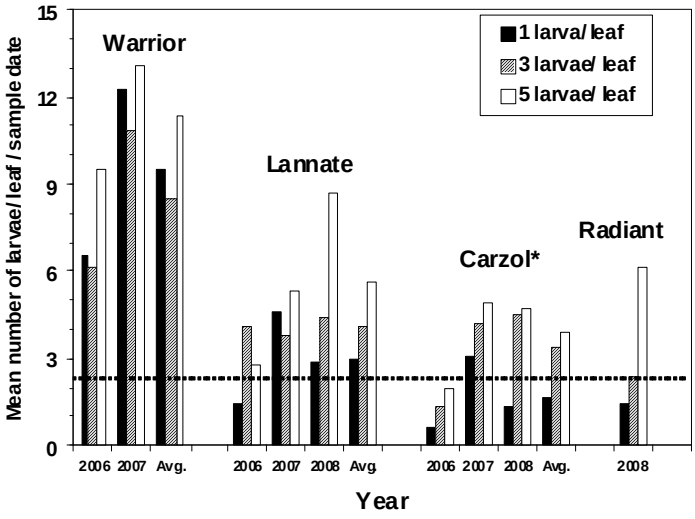


Fig. 4. Performance of insecticides using different action thresholds for managing onion thrips in onion in NY. All are registered for use on onion except Carzol. The horizontal dashed line represents the target number of larvae/plant over the season that should not be surpassed.

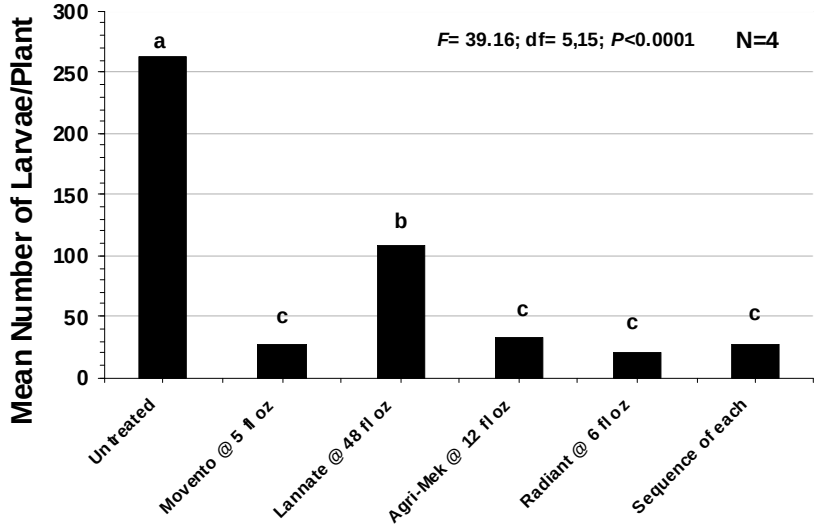


Over the past few years, three action thresholds have been investigated for four products (**Fig. 4**). All but Carzol are currently registered for use on onion. Each bar on the graph illustrates the mean number of thrips larvae/ leaf/ sample date over the season for each insecticide and action threshold combination. An average of these means across years also was calculated for all products, except Radiant because there was only one season of data. For reference, a horizontal line at 2.2 larvae/ leaf/ sample date marks a research-based economic threshold developed for *T. tabaci* control in onion in northeastern North America. The insecticide and action threshold combination in which the overall mean population density averaged nearest to 2.2 larvae/ leaf/ sampling

date was selected as the most appropriate. None of the action thresholds evaluated in our study were appropriate for Warrior (**Fig. 4**). This population tested positive for resistance to this product and was not controllable using any threshold. Although none of the thresholds examined for Lannate reduced the overall mean thrips density below 2.2 larvae/ leaf/ sampling date, the 1 larva/ leaf threshold provided results closest to this density (**Fig. 4**). Carzol applied at 1 larva/ leaf threshold reduced the overall mean thrips density below 2.2 larvae/ leaf/ sampling date (**Fig. 4**), while Radiant applied at either 1 or 3 larvae/ leaf reduced the overall mean thrips density below 2.2 larvae/ leaf/ sampling date (**Fig. 4**). Although more data are needed before a firm decision should be made for recommending an action threshold for Radiant, the 3 larvae/ leaf threshold appears the best.

Sequences of Products for Season-Long Control. Most onion fields in NY need protection against thrips for 6 to 8 weeks. Weekly insecticide applications may be required to control infestations (total of 6 to 8 sprays). Radiant is one of the best products and Dow AgroSciences wants it to remain viable in the marketplace for as long as possible. Therefore, avoiding resistance development in thrips populations to Radiant is a priority. Consequently, the label reads "no more than two consecutive applications of spinetoram should be made". Products that may become labeled on onion in the future will have similar restrictions and this presents a challenge for a crop like onion that must be protected for up to two months.

Fig. 5. Season total number of thrips larvae per plant after 8 weekly applications of insecticides in an onion field near Potter, NY 2009.

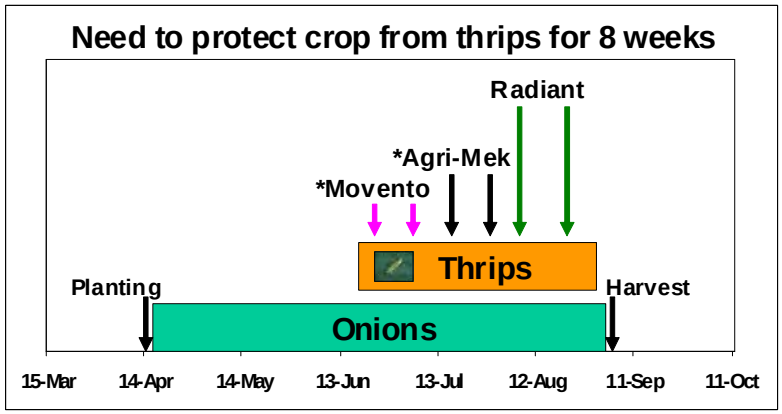


Applying sequences of effective insecticides belonging to different classes of chemistry should (1) control thrips for the entire season and (2) mitigate resistance development in thrips populations. In 2009, we demonstrated this approach **(Fig. 5).** Four insecticides were selected for the sequence treatment: Movento, Lannate, Agri-Mek and Radiant. In NY in 2009, Section 18s were granted for both Movento and Agri-Mek. Each product in the sequence treatment was applied twice in successive weeks (in the order listed above) for a total of eight applications spanning two months **(Fig. 5)**. Although we do not know if this strategy mitigated resistance development to these products, the infestation was effectively managed. <u>These results show the importance of using effective products sparingly for thrips control over the entire course of the season</u>!

Combining Sequences of Products and Action Thresholds for Season-Long Thrips Control. Radiant can be used to manage onion thrips infestations following a more liberal action threshold (e.g., 3 thrips larvae/ leaf) and will still provide 7 to 10 days or more control. Consequently, there is not likely the need to apply Radiant and products with similar efficacy on a weekly basis. If the onion crop needs 8 weeks of thrips protection and products like Radiant are used, it is likely that fewer than 8 applications will be

needed (less that one application per week). For example, a possible approach for controlling a thrips infestation in onion using highly effective products and action thresholds is illustrated in **Fig. 6**. Because Movento does not work well against adult thrips and adult thrips populations are highest late in the season, Movento should be used first in the sequence. Radiant is the most effective product, so it is positioned at the end of the sequence when thrips populations are highest. Because action thresholds have not been identified for Movento and Agri-Mek, a conservative threshold of 1 thrips larva/ leaf is recommended. However, both products provide 7 to 10 days of thrips control, so timing sprays would likely occur less than one time per week. Overall, maybe 6 applications or fewer would be needed to control the infestation over an 8-week period.

Fig. 6. Example of combining insecticide sequences and action thresholds to mitigate resistance development and reduce insecticide use.



*** Not federally registered on onion**

Summary

New insecticides for thrips control are in the registration pipeline. Ensuring that these new products remain viable for thrips control for many years to come is imperative and the thrips management strategy described herein should accomplish this goal. More research is needed to identify action thresholds for these new products and how this new management approach affects the incidence of IYSV. Additionally, a long-term management approach for onion thrips should consider incorporating non-chemical tactics, such as thrips-tolerant or thrips-resistant varieties as well as cultural practices.

USE OF COVER CROPS TO IMPROVE ONION ROTATION

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Many onion growers use a 2- to 3-year rotation with crops like celery, carrot, field corn or potatoes. With the exception of field corn, most of those crops leave low residues after harvest. As a consequence of these cropping systems, cultivated muck soils (used by many onion growers) may subside up to 2 inches every year because of wind erosion, compaction, and organic matter oxidation. Under dry conditions, a strong wind can remove 1 to 10 inches of muck soil in less than 2 hours. A cover crop planted after cash crop harvest may help reduce soil erosion and compaction. Cover crops and other soil organic amendments could therefore be used as management strategies for sustainable onion production. Benefits could include weed suppression, reduced nitrate leaching, and improved yields.

Challenges for using cover crops in onion production in Michigan

In Michigan, onions are usually seeded in April and harvested in September. This long growing season does not provide adequate window to grow cover crops, especially warm season species. Fall-seeded winter cover crops like wheat and cereal rye are the few cover crop species that could easily fit into onion production in Michigan. When these species are used, they are usually killed in the spring by cultivation or by herbicide application, followed by onion planting. However, the large amount of biomass produced and its slow decomposition make those cover crops unsuitable for onion production. In Michigan most of the onion is direct-seeded and requires a well prepared seedbed for adequate seed emergence and establishment. Cover crops that grow in the spring may limit soil warming and their residues may interfere with onion seeding. Many onion growers are interested in improving their short-term onion rotations with cover crops if they do not interfere with field operations at the time of onion seeding.

Opportunities for using cover crops in onion production in Michigan

Because of the long growing cycle of onions, it is important to develop cover crop strategies that would fit into the entire rotation. The most appropriate time for integrating a cover crop into the production system is the fall that precedes the onion season. Cool season cover crops like brassicas could be effectively integrated into the rotation systems and planted in fall, after harvest of a short cycle crop. Their residues break down easily and do not interfere with field operations the following spring. Several studies showed that brassica species suppressed seed germination, emergence, and seedling growth of many weed species in the laboratory, greenhouse, and field conditions. Brassica cover crops are also known to produce glucosinolates, which upon hydrolysis release biocidal compounds including isothiocyanates with activity on phytophagous insects, nematodes, and fungi. Various studies were undertaken by our team to evaluate the potential to integrate several cover crops into onion rotations.

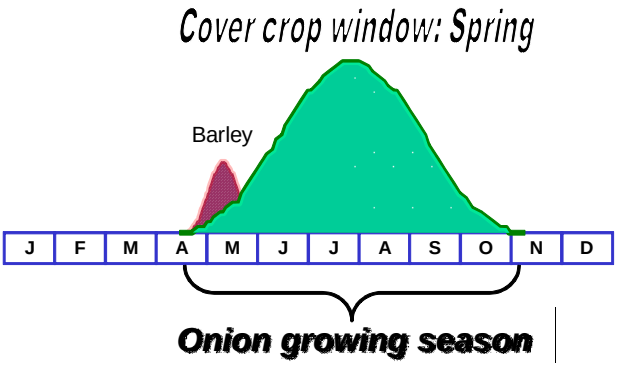
Benefits of cover crops in onion production

- Protection against wind damage especially on sandy soils
- Erosion control especially wind erosion on muck soil
- Drainage improvement (especially with large taproots of species like oilseed radish)

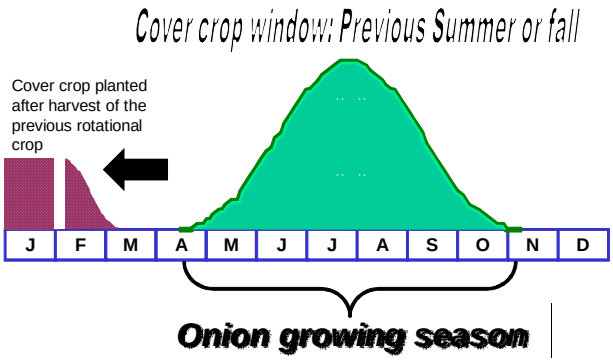
- Nutrient recycling: uptake of excess nutrient and residues acting as slow release fertilizer
- Nematode and other pest suppression
- Weed suppression
- Enhancement of soil mycorrhizal fungi with sorghum sudangrass (note that brassica species do not form mycorrhizae)
- Yield improvement as a result of improved rotation systems

Cover crop options for onion production in Michigan

Cover cropping during onion growing season: Barley has been used successfully in many regions as a living mulch with onions to reduce soil erosion and protect the onions from wind damage. Rye is also used but may present a risk of injuring onions by chemicals produced through its root system. To avoid yield losses Barley should not exceed 8 inches and rye 7 inches when killed with a grass herbicide.



Cover cropping the fall or summer prior to onion growing season: This requires building the practice of cover cropping into the entire rotation system. In tests conducted on muck soils, sorghum sudangrass and mustard cover crops have provided excellent results when planted late summer or EARLY fall prior to onion growing season. Their residues break down easily and do not interfere with field operations in the spring.



Onion stand establishment and yield responded positively to brassica (yellow mustard and oilseed radish) and sorghum sudangrass cover crops under muck soil conditions. Overall, onion stand was about 40% greater in the cover crop plots compared with the control without cover crop. The excellent onion stand in the cover crop plot allowed reducing onion seeding rate by 25-40% with no reduction in total yield.

Onion Weed Control for 2010

GREAT LAKES EXPO

Chad Herrmann
Bernard Zandstra
Michigan State University

December 9, 2009

Onion Weed Control Projects 2009

- 1. Preemergence
- 2. Postemergence
- 3. Postemergence with Chateau
- 4. Postemergence with Basagran
- 5. Postemerge with Goaltender
- 6. Grant and Hudsonville

MSU Muck Farm - 2009

- 1. Onion plots were flooded twice. Rows near edges of raised beds were thinned by flood.
- 2. Nutsedge expanded rapidly in plots under wet conditions.
- 3. The combination of water damage and nutsedge competition reduced onion yields considerably.

Preemergence Weed Control (1) – Muck Farm 2009

Herbicide	Rate (lb ai) and no. of applications	Onion 6/10	Onion 7/14	Kg/plot 10/15
1. **Prowl H20**	2 lb x 3	1.0	3.5	15.7
2. **Prowl H20**	4 lb x 3	1.3	2.7	16.9
3. **Prowl EC**	2 lb x 3	1.3	3.8	19.1
4. **Dual Magnum**	1.3 lb x 3	2.3	4.8	12.1
5. **Outlook**	0.98 lb x 3	3.2	3.6	10.4

Preemergence Weed Control (2) – Muck Farm 2009

Herbicide	Rate (lb ai) and no. of applications	Onion 6/10	Onion 7/14	Kg/plot 10/15
6. **Surpass**	1 lb x 3	3.1	3.3	18.9
7. **Chateau**	0.032 lb x 3	2.1	4.3	11.9
8. **Prowl H20** **Prowl EC**	2 lb x 1 2 lb x 2	1.0	2.8	21.3
9. **Prowl H20** **Surpass**	2 lb x 1 1 lb x 2	1.0	2.8	20.9
10. Handweeded		1.0	7.1	1.1

Postemergence Weed Control (1) – MF 2009- Onion Response

Herbicide	Rate (lb ai) and no. of applications	Onion 6/24	Onion 7/23	Kg/plot 10/8
1. **Goal EC**	0.063 lb x 2	2.1	2.8	14.9
2. **Goaltender**	0.063 lb x 2	1.3	2.2	14.8
3. **Chateau**	0.032 lb x 2	1.8	2.5	15.8
4. **Chateau**	0.064 lb x 2	2.1	2.4	19.8
5. **Starane**	0.125 lb x 2	3.8	5.3	4.7

Postemergence Weed Control (2) – MF 2009- Onion Response

Herbicide	Rate (lb ai) and no. of applications	Onion 6/24	Onion 7/23	Kg/plot 10/8
6. **Goaltender** **Chateau**	0.063 lb x 2 0.032 lb x 2	3.0	3.8	19.6
7. **Goaltender** **Starane**	0.063 lb x 2 0.125 lb x 2	4.5	3.8	15.1
8. **Goaltender** **Buctril**	0.063 lb x 2 0.125 lb x 2	4.9	3.3	15.9
9. Handweeded		1.0	3.9	6.6

Postemergence Weed Control with Chateau (1) MF – 2009- Onion Response

Herbicide	Rate (lb ai) and no. of applications	Onion 6/24	Onion 7/22	Kg/plot 10/12
1. Chateau **Prowl H20**	0.064 lb x 2 2 lb x 2	2.1	2.0	25.2
2. Chateau **Prowl EC**	0.064 lb x 2 2 lb x 2	7.8	8.0	5.5
3. Chateau **Outlook**	0.064 lb x 2 0.98 lb x 2	7.7	7.5	10.8
4. Chateau **Dual Magnum**	0.064 lb x 2 1.3 lb x 2	7.8	7.8	9.6

Postemergence Weed Control with Chateau (2) MF – 2009-Onion Response

Herbicide	Rate (lb ai) and no. of applications	Onion 6/24	Onion 7/22	Kg/plot 10/12
5. Chateau	0.064 lb x 2	2.8	1.8	22.1
6. Chateau	0.032 lb x 2	2.0	2.3	21.9
7. Untreated		1.0	2.9	10.6

Onion Weed Control Hudsonville - 2009

Herbicide	Rate (lb ai) and no. of applications	MAYC 5/28	MAYC 6/21	MAYC 7/9
1. **Prowl H20** **Goaltender** **Poast** **Chateau**	2 lb x 3 0.063 lb x 2 0.19 lb x 2 0.064 lb x 2	7.0	3.7	4.7
2. **Prowl H20** **Goaltender** **Poast** **Starane**	2 lb x 3 0.063 lb x 2 0.19 lb x 2 0.064 lb x 2	7.0	5.0	4.7
3. **Prowl H20** **Goal XL** **Poast** **NIS**	2 lb x 1 0.063 lb x 2 0.19 lb x 2 0.25 lb x 2	6.3	1.7	1.3
4. **Prowl H20** **Chateau**	1.9 lb x 3 0.032 lb x 3	9.7	8.3	7.3

Summary – Hudsonville Onion Weed Control

- 1. Highest yields were obtained with **Prowl H20** plus **Chateau** applied 3 times (Pre and 2 Post).
- 2. Lack of control of 1 weed (marsh yellowcress (MAYC) resulted in serious yield loss.
- 3. **Chateau** was safe on onions preemergence. This use not labeled yet.

Use of **Starane Ultra** 2.8 L on Onion

- 1. Rate: 0.35 pt (5.6 fl. oz., 0.123 lb ai)/acre.
- 2. Maximum 2 applications.
- 3. Apply to onions with 2-6 leaves.
- 4. To control: volunteer potato, chickweed, ragweed, mustards (MAYC, VIPW), nightshade, bindweed.
- 5. Use with **Goaltender**.
- 6. **Starane** may reduce yields if onions are under stress at application.

Use of **Chateau** 51W on Onions

- 1. Apply to onions with 3-6 leaves.
- 2. Maximum of 3 oz. product/acre/year.
- 3. One oz. gives good pre and post activity on most weeds.
- 4. **Chateau** controls seedling mustards preemergence.
- 5. Other weeds controlled : nightshades, groundsel, smartweeds, pigweeds, lambsquarters.
- 6. Do not mix with any EC formulations.

Recommendations for 2010

- 1. **Prowl H20** 2 qt 1-2 weeks after seeding onions and barley; add **Buctril** 4 EC 4-8 fl. oz. for emerged broadleaves.
- 2. June 1-15, apply **Prowl H20** 2 qt + **Chateau** 1-2 oz. for pre control of most broadleaves and grasses. Use the higher rate only if needed.
- 3. Apply **Dual Magnum** or **Outlook** to control nutsedge. Use the max rate for max control.
- 4. Apply **Goaltender** + a grass herbicide + **NIS** as needed to control emerged weeds. Add **Starane** if needed.
- 5. July 1-15, apply **Prowl H20** + **Chateau** for pre control.
- 6. Apply **Goaltender** as needed. 45 day PHI.

Conclusions – Onion Weed Control 2010

- 1. Maximum weed control should be your objective.
- 2. Stay ahead of weeds. Kill when small.
- 3. Avoid fields with heavy infestation of nutsedge.
- 4. Avoid crop injury as much as possible.
- 5. Rotate crops and fields often to avoid build up of weeds.

Acknowledgements

MSU Project GREEEN

Michigan Onion Research Committee

Brink Farms

Schreur Farms

BASF

Dow Agrosciences

Syngenta Crop Protection

Valent USA