



# Great Lakes Fruit, Vegetable & Farm Market EXPO Michigan Greenhouse Growers EXPO

December 5-7, 2017

DeVos Place Convention Center, Grand Rapids, MI



## Asparagus

**Where:** Gallery Overlook (upper level) Room C & D

**MI Recertification credits:** 2 (1B, COMM CORE, PRIV CORE)

**OH Recertification credits:** 1.5 (presentations as marked)

**CCA Credits:** SW(0.5) PM(1.5)

**Moderator:** Ben Werling, West Michigan Vegetable Educator, MSU Extension, Hart, MI

- 9:00 am Asparagus Irrigation Update: Effects on Spear Cooling, Quality, and Yield
- Daniel Brainard, Horticulture Dept., MSU
- 9:30 am Asparagus Insect Pest Management (OH: 2B, 0.5 hr)
- Adam Ingrao, Vegetable Entomology Lab, Entomology Dept., MSU
  - Amanda Buchanan, Vegetable Entomology Lab, Entomology Dept., MSU
  - Zsafia Szendrei, Vegetable Entomology Lab, Entomology Dept., MSU
- 10:00 am Asparagus Weed Control Update (OH: 2C, 0.5 hr)
- Bernard Zandstra, Horticulture Dept., MSU
- 10:30 am Asparagus Pathology Research - Results of 2017 Trials (OH: 2B, 0.5 hr)
- Mary Hausbeck, Plant, Soils and Microbial Sciences Dept., MSU
- 11:00 am Session Ends

## Asparagus Weed Control

Bernard Zandstra

Great Lakes Expo

December 5, 2017

## Asparagus Weed Control – Hart Research Farm

1. Repeated applications for 5 years
2. Planted: 2011 Variety: Millennium
3. Sprayed: 2013, 2014, 2015, 2016, 2017

### 5 Year Asparagus Yield, Hart (1)

Treatment and Rate	Yield, kg/plot					
	2013	2014	2015	2016	2017	Average
1 Sinbar 1	3.7	6.2*	7.1	6.2*	7.7*	6.2*
2 Karmex 1.6 + Sencor 1.6	3.8	7.4	8.7	7.6	9.3	7.4
3 Alion 0.085	3.9	8.2	8.5	8.1	9.7	7.7
4 Command 2	3.6	7.5	8.9	7.7	8.6	7.3
5 Matrix 0.063	3.3	7.9	8.6	7.8	8.9	7.3

### 5 Year Asparagus Yield, Hart (2)

Treatment	Yield, kg/plot					
	2013	2014	2015	2016	2017	Average
6 Trellis 1.5 + Dual Mag 1.9	3.3	6.8	8.2	7.4	8.1	6.8
7 Zidua 0.267	3.5	7.7	8.3	7.4	7.6	6.9
8 BIR 0.045	3.4	6.8	7.0	5.8*	6.1*	5.8*
9 Callisto 0.241 + Prowl H <sub>2</sub> O 1.9	3.4	7.2	7.0	6.3*	7.1*	6.2*
10 Untreated	4.1	7.4	7.9	6.6	7.3*	6.7

### Weed Control Year 5 – 2017

Treatment and Rate	6/19 <u>COLQ</u>	6/19 <u>POAM</u>	6/19 <u>RUTH</u>	6/19 <u>SFGE</u>
1. Sinbar 1	10	1.7	10	10
2. Karmex 1.6 + Sencor 1.6	10	1.7	10	10
3. Alion 0.085	9.7	10	8.7	10
4. Command 2	7.7	4.7	8	9
5. Matrix 0.063	6	8.7	6.3	6.3

### Weed Control Year 5 – 2017

Treatment and Rate	6/19 <u>COLQ</u>	6/19 <u>POAM</u>	6/19 <u>RUTH</u>	6/19 <u>SFGE</u>
6. Trellis 1.5 + Dual Mag 1.9	4	3.7	1	5.3
7. Zidua 0.267	3.7	10	10	1.7
8. BIR 0.045	1	6.3	5.7	1
9. Callisto 0.241 + Prowl H <sub>2</sub> O 1.9	10	5	4	3
10. Untreated	1	1	1.7	1.7

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### Weed Control Year 5 – 2017

Treatment and Rate	8/8 COLQ	8/8 POAM	8/8 RUTH
1. Sinbar 1	10	5.3	7.3
2. Karmex 1.6 + Sencor 1.6	8.7	8.7	10
3. Alion 0.085	10	10	10
4. Command 2	4.3	7.3	7.7
5. Matrix 0.063	4.7	9	7

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### Weed Control Year 5 – 2017

Treatment and Rate	8/8 COLQ	8/8 POAM	8/8 RUTH
6. Trellis 1.5 + Dual Mag 1.9	3	7	5
7. Zidua 0.267	2	10	10
8. BIR 0.045	1.3	4.7	9
9. Callisto 0.241 + Prowl H2O 1.9	9	5	7
10. Untreated	1	6	10

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### Powell Amaranth in Asparagus Control – 2017 (1)

	Treatment	POAM 6/19	POAM 8/17
1.	Karmex 3	2.7	4.3
2.	Lorox 2	3	3.3
3.	Tricor 1	3	5
4.	Spartan 0.375	2	4
5.	Sinbar 1	6.3	5

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### Powell Amaranth in Asparagus Control – 2017 (2)

	Treatment	POAM 6/19	POAM 8/17
6.	Dual Mag 1.9	4.3	2
7.	Prowl H2O 3.8 Sanda 0.023	8.3	5.7
8.	Chateau 0.192	7	6.7
9.	Callisto 0.241	4.7	3.3
10.	Untreated	1.7	4.7

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### Smallflower Geranium Control in Asparagus – 2017 (1)

	Treatment	SFGE 6/1	SFGE 6/19
1.	Karmex 3	5	6.3
2.	Lorox 2	4.7	4.3
3.	Tricor 1	10*	10*
4.	Spartan 0.375	1.3	2
5.	Sinbar 1	8.7*	10*

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### Smallflower Geranium Control in Asparagus – 2017 (2)

	Treatment	SFGE 6/1	SFGE 6/19
6.	Dual Mag 1.9	4.7	6
7.	Prowl H2O 3.8 Sanda 0.023	1.3	1
8.	Chateau 0.192	4.7	5
9.	Callisto 0.241	3	4
10.	Untreated	1.3	1.7

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### Command 3ME

**Asparagus label:** 3-16-17  
**Supplemental section 3 label expire:** 2-2-20

**Weeds Controlled:** annual grasses, chickweed, lambsquarters, ragweed, velvetleaf, mustard

**Use:** 1 lb ai (2.6 pt) in spring; 1 appl./yr  
 Use with another pre herbicide

**PHI:** 14 days

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### Aim 2EC

**Weeds controlled postemergence:**  
 lambsquarters, ragweed, nightshade, pigweeds, velvetleaf, geranium, seedling asparagus

**Use:** 0.008-0.03 lb ai (0.5-1.92 fl oz/a)

**PHI:** 5 days

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### Smallflower Geranium Control

- Sinbar
- Karmex
- Tricor
- Command

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### Russian Thistle Control

- Sinbar
- Karmex
- Tricor
- Command
- Chateau

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### Powell Amaranth Control

- Dual Magnum
- Prowl H2O
- Chateau
- Callisto
- ~~▪ Spartan~~
- ~~▪ Sandea~~

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### Field Pansy Control

- Callisto
- Chateau
- Sandea
- Sinbar
- Alion
- Goal
- Matrix

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**Quinstar 4L (Quinclorac)**  
**Pria date:** 11-15-17  
**Weeds controlled:** large crabgrass, barnyardgrass, foxtails, morning glory, prickly lettuce, bindweed  
**Weeds suppressed:** com. lambsquarters, com. ragweed, Russian thistle, velvetleaf, per. sowthistle, Canada thistle  
**Use:** 1 application after last harvest  
 0.375 lb ai (12 fl oz)/acre + 1% COC

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**SPECIMEN LABEL**

**Agri Star®**  
By Albaugh Inc. GROUP 4 HERBICIDE

**QUINSTAR® 4L**  
Herbicide

Manufactured for:  
**ALBAUGH, INC.**  
 1525 NE 36th Street  
 Ankeny, Iowa 50021

FOR CHEMICAL SPILL, LEAK, FIRE, OR EXPOSURE, CALL CHEMTREC (800) 424-9300

**KEEP OUT OF REACH OF CHILDREN CAUTION**

FIRST AID

**IF SWALLOWED:** Call a poison control center or doctor immediately for treatment advice. Have person sip or drink water to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not get anything to eat or drink until told to do so.

**IF ON SKIN OR CLOTHING:** Wash thoroughly with plenty of water for 15-20 minutes. Remove contaminated clothing and shoes. Wash separately. Wash skin immediately.

**IF IN EYES:** Hold eye open and flush slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first flushing. Do not breathe vapors.

**IF INHALED:** If person is not breathing, get 911 or an ambulance. Then give artificial respiration, preferably by mouth-to-mouth respiration. If person is breathing, give 911 or an ambulance. Then give artificial respiration, preferably by mouth-to-mouth respiration. If person is breathing, give 911 or an ambulance. Then give artificial respiration, preferably by mouth-to-mouth respiration.

See the precautionary statements on this label for additional PRECAUTIONARY STATEMENTS.

Table 3. Weeds Controlled or Suppressed

Weeds Controlled		Weeds Suppressed*	
<b>Annual Grasses</b>	<b>Annual Broadleaves</b>		
Barnyard Grass	Kochia		
Crabgrass, large	Lambsquarters, common		
Foxtail, giant	Ragweed, common		
green	giant		
yellow	Sunflower, wild		
Signalgrass, broadleaf	Thistle <sup>1</sup> , Russian		
	Velvetleaf		
Weeds Controlled		Weeds Suppressed*	
<b>Annual Broadleaves</b>	<b>Perennial Broadleaves</b>		
Bedstraw, catchweed	Dandelion		
(cleavers)	Sowthistle <sup>1</sup> , perennial		
Clovers	Sourge <sup>1</sup> , leafy		
Lettuce, prickly	Thistle <sup>1</sup> , Canada		
Morningglory spp.			
Flax, volunteer			
<b>Perennial Broadleaves</b>			
Bindweed <sup>1</sup> , field			
hedge			

\*Do not exceed a total of 1.5 pints of QuinStar® 4L per acre per calendar year. Apply QuinStar® 4L at yellow bract (pre-bloom) or in the fall prior to the first killing frost. For best performance on this species, tank mix 0.75 pint per acre of QuinStar® 4L with 4-6 ounces per acre of Distinct herbicide.

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**FIELD AND HEDGE BINDWEED CONTROL**

For most effective bindweed control, apply QuinStar® 4L herbicide in the fall just prior to the first killing frost. Bindweed plants should be actively growing and at least 4 inches long. If tillage is a part of local post-harvest practices, allow a minimum of 30 days for bindweed plants to regrow after tillage prior to application. For best long-term bindweed control, make yearly applications of QuinStar® 4L at 0.5-0.75 pint per acre in the Fall. Use the higher rate for dense populations or large plants.

QuinStar® 4L may be applied as either a broadcast or spot spray application. Applications must be made to actively growing weeds.

**SPRAY ADDITIVES**

To achieve consistent weed control, the use of spray additive(s) with QuinStar® 4L is required. The recommended spray additive with QuinStar® 4L is methylated seed oil. The use of crop oil concentrate with QuinStar® 4L is also permitted. A nitrogen fertilizer source (AMS or UAN) can be added to enhance efficacy, but cannot be used in place of methylated seed oil or crop oil concentrate. Refer to the following table for spray additive rates.

SPRAY ADDITIVE	GROUND APPLICATION
Methylated Seed Oil	1.0-2.0 pints <sup>2</sup>
Crop Oil Concentrate	2.0 pints
AMS <sup>1</sup>	2.5 pounds
UAN Solution <sup>1</sup>	0.5-1 gallon

<sup>1</sup>Optional  
<sup>2</sup>For best grass control, use at least 1.5 pints/acre of Methylated seed oil.

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**Potential Label for Asparagus**

**Alion indaziflam (3-4 yr)**  
 Fall application – annual weeds

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**Weed Control with Alion HTRC - 2017**

		Total good/plot		Total cull/plot	
		Spears	Kg	Spears	Kg
1.	Alion 0.065 PRE	360	8.5	41	0.97
2.	Gramoxone 1 EEPRE Alion 0.026 EPRE	305	7.2	25	0.53
3.	Gramoxone 1 EEPRE Alion 0.046 EPRE	296	7.5	24	0.58
4.	Gramoxone 1 EEPRE Alion 0.065 EPRE	285	7.7	26	0.73
5.	Gramoxone 1 EEPRE	378 NS	8.4 NS	21 NS	0.40 NS

### Preemergence Combinations for Pigweed Control in Spring

1. Karmex + Prowl H<sub>2</sub>O + Gramoxone
2. Karmex + Dual Mag. + Roundup
3. Solicam + Tricor + Gramoxone
4. Spartan + Prowl H<sub>2</sub>O + Roundup

### Preemergence Combinations with Command

1. Karmex + Command + Prowl H<sub>2</sub>O
2. Tricor + Command + Prowl H<sub>2</sub>O
3. Callisto + Command + Spartan

### Post final harvest for the season:

1. Callisto + Chateau + Gramoxone
2. Solicam + Karmex + Sandea + Aim
3. Tricor + Sandea + Clarity or Spur + Aim
4. Karmex + Callisto + 2,4-D + Aim

### Acknowledgements

- Hart Research Farm and Staff
- Michigan Asparagus Research Committee
- MSU AgBio Research
- MSU Extension
- USDA-NIFA
- USDA-IR4
- Dow AgroSciences
- Syngenta Crop Protection
- Kumiai Chemical Co.
- FMC

### Thank You

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**Questions?**

# Asparagus Pathology Research – Results of 2017 Trials

Dr. Mary K. Hausbeck, 517-355-4534 and Katie Goldenhar  
Michigan State University, Department of Plant, Soil & Microbial Sciences

Asparagus is a perennial crop that should be in production for many years with proper horticultural and pest management. Michigan is ranked second nationally in asparagus production. With an average of 9,200 acres harvested, Michigan asparagus growers produced 12,880 tons of spears at a value of \$20.2 million in 2016. These totals are similar to previous years. Major asparagus-producing counties in Michigan include Mason and Oceana in the northwest. Asparagus is also produced in Cass and Van Buren counties in the southwest.

Unlike annual crops where an epidemic in one year will not necessarily influence yields in subsequent years, premature defoliation of the asparagus fern from a plant pathogen may reduce plant vigor. Consecutive years of premature defoliation have been shown to critically reduce subsequent yields. The primary pests of asparagus include both foliar and soilborne pathogens that are currently managed in seedbed and production sites through the use of fungicides. The goal of our 2016 field research was to test new tools and strategies for managing diseases in asparagus.

**Foliar Diseases.** Fungicides are applied to asparagus fern that develop following spear harvest to manage rust and purple spot, which are the most important foliar fungal diseases of asparagus in Michigan. Purple spot (caused by *Stemphylium vesicarium*) occurs on both fern and the edible spears. Purple spot lesions may result in spears being rejected for the fresh market. Rust (caused by *Puccinia asparagi*) only affects the fern. Both rust and purple spot can develop on the main stem, secondary branches, and cladophylls and can be present together exacerbating defoliation. Premature defoliation decreases carbohydrate stores in the crown, which can limit yield in subsequent years and cause plant stress that may increase susceptibility to soilborne pathogens such as *Fusarium*.

**Soilborne Diseases.** *Fusarium* spp. cause stem, crown, and root rot of asparagus and *Phytophthora asparagi* causes spear, crown, and root rot. While both pathogens may infect asparagus seedlings in the nursery and crowns after establishment in production fields, *Phytophthora* is especially devastating. Since asparagus is a perennial crop, crown rot may progress unnoticed initially. Heavy rainfall tends to favor *Phytophthora* whereas high heat and drought stress may favor *Fusarium*. Control of *Fusarium* and *Phytophthora* rot is challenging as the pathogens persist in the soil and cultural and chemical control options are limited. Treating crowns with fungicides before planting and fumigating crown nurseries and production fields have been used in recent years to improve crown health and enhance the longevity and productivity of the asparagus planting. Fungicide soil applications for direct-seeded crown nurseries may improve crown health and vigor by reducing soilborne diseases and has been the focus of our recent research.

**Research trials.** Two efficacy trials in Oceana County, MI evaluated fungicides for control of purple spot and seedling root rots. Products tested are listed in Table 1.

**Table 1.** Products tested.

Product	Active ingredient	FRAC code <sup>1</sup>	Labeled
Aprovia Top EC	difenoconazole/benzovindiflupyr	3/7	no
Bravo WeatherStik SC	chlorothalonil	M05	yes
Cannonball WP	fludioxonil	12	yes
Fontelis SC	penthiopyrad	7	no
Inspire EC	difenoconazole	3	no
Luna Experience SC	fluopyram/tebuconazole	7/3	no
Luna Sensation SC	fluopyram/trifloxystrobin	7/11	no
Manzate DF	mancozeb	M03	yes
Omega SC	fluzinam	29	no

Product	Active ingredient	FRAC code <sup>1</sup>	Labeled
Orondis	oxathiapiprolin	49	no
Presidio 4FL	fluopicolide	43	no
Quadris Opti SC	azoxystrobin/chlorothalonil	11/M05	no
Quadris Top SC	azoxystrobin/difenoconazole	11/3	no/IR-4
Revus SC	mandipropamid	40	no
Ridomil Gold SL	mefenoxam	4	yes
Tebuzol 3.6F	tebuconazole	3	yes
Topsin M WSB	thiophanate-methyl	1	no
Experimental	--	--	no

<sup>1</sup>Numbers and letters are used to define the fungicide groups by their mode of action. M = multi-site inhibitors. Visit [www.frac.info](http://www.frac.info) for more information about FRAC codes.

### Evaluation of registered and unregistered fungicides for control of purple spot in asparagus.

'Millennium' asparagus crowns were established on sandy loam soil on a research plot for this trial. There were four replications in a randomized complete block design, with one 35-foot row representing a plot. Sprays were made with a CO<sub>2</sub> backpack sprayer with a three nozzle boom equipped with XR8003 flat fan nozzles, operating at 50 psi, delivering 50 GPA. Applications were made on a 7-day schedule on 23 June; 5, 14 and 24 July; 3, 11, 21 and 31 August; 7, 15, 21 and 29 September; and 6 October. Foliar disease was evaluated on the ferns 15 August; 13, 26 September; and 10 October using the Horsfall-Barratt scale of 1 to 12, where 1=0% plant area diseased, 2=>0 to 3%, 3=>3 to 6%, 4=>6 to 12%, 5=>12 to 25%, 6=>25 to 50%, 7=>50 to 75%, 8=>75 to 87%, 9=>87 to 94%, 10=>94 to 97%, 11=>97 to <100%, 12=100% plant area diseased. Data were analyzed using an analysis of variance, with means separation performed using Fisher's protected least significant difference (LSD).

All ratings were taken within the spray interval. On the first rating date, the untreated control had <12% diseased area. All treatments were better than the untreated control except for Inspire EC on the first rating date (Fig. 1). Quadris Opti SC, Tebuzol 3.6F, Luna Experience SC, Manzate DF and Aprovia Top EC all had <3% disease. On 13 September, Inspire EC, Manzate and Tebuzol were similar to the untreated control. On 26 September, the untreated check was rated 5.8 (6=25 to 50% diseased area), and by the last rating date on 10 October, the untreated control was rated 6.5 (7=50 to 75% diseased area). All treatments significantly limited foliar disease compared with the untreated control on 26 September

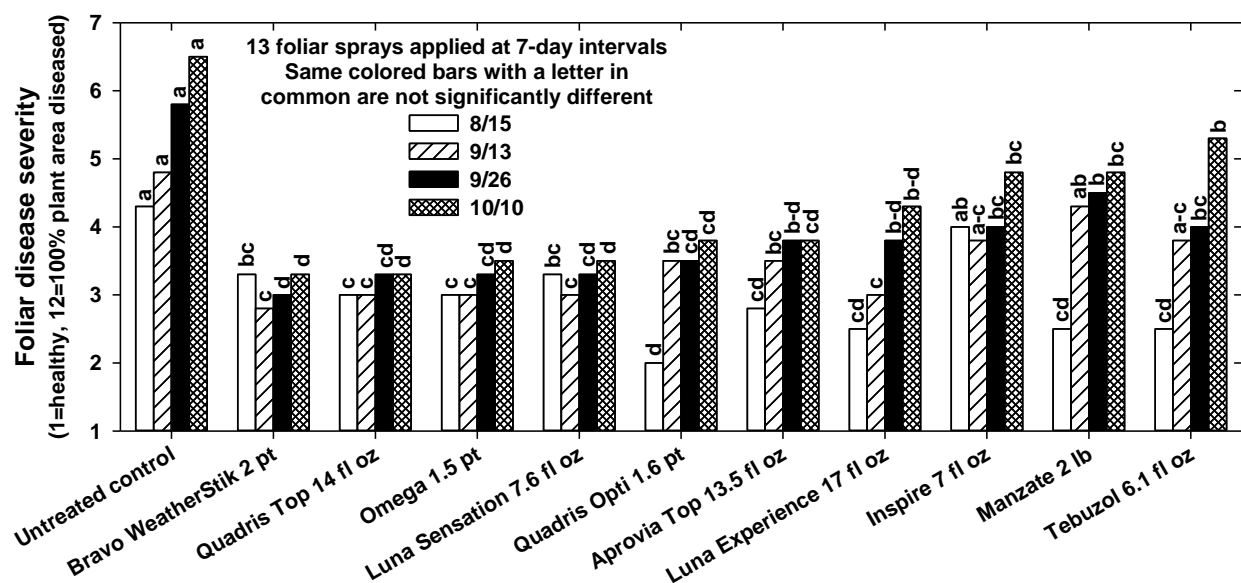


Fig. 1. Foliar disease severity of asparagus treated with fungicides for control of purple spot.



and 10 October. Bravo WeatherStik, Quadris Top, Omega and Luna Sensation controlled disease better than Tebuzol, Inspire and Manzate.

**Evaluation of fungicides for control of asparagus soilborne seedling diseases in a crown nursery.**

This trial was established on a sandy loam soil previously planted to broccoli. The field was sown with ‘Millennium’ seeds at a rate of 196,000 seeds per acre on May 18, 2016. Weeds and insects were controlled to commercial production standards. The trial was replicated four times, with treatments arranged in a randomized complete block design. Each plot consisted of three 25-foot long rows with a five-foot buffer between each replicate. Soil treatments were applied at a 21-day schedule on 8 and 29 June, 20 July, 11 and 30 August. Treatments were applied with a handheld, CO<sub>2</sub> pressurized backpack sprayer, operating at 35 psi to deliver 33 gallons per acre. A three nozzle boom was used with XR8002 flat-fan nozzles. Stand counts were taken from a 10-foot section of the center row of each plot on 29 June and 16 August 2016. Twenty crowns were dug from each plot on 12 April 2017, washed and assessed for size using a 1 to 4 scale (Fig. 2) and weighed on 19 April.

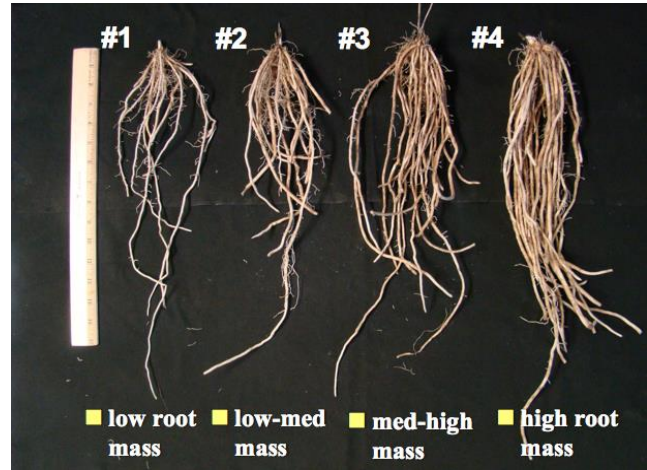


Fig. 2. Crown rating scale of 1-4.

There were no significant differences among treatments for stand counts. Significant differences occurred only in crown rating category 2. Ridomil Gold tankmixed with Topsin or Cannonball produced the greatest number of crowns (41.3-47.5%) receiving a rating of 2=low-medium root mass; significantly more than both rates of the Experimental and Revus + Cannonball (18.8-23.8%). Although not significant, the Experimental product at the high rate produced the lowest number of crowns in category 1 (low root mass) and both rates of the Experimental produced among the highest number of crowns in categories 3 (medium-high root mass) and 4 (high root mass). Plants treated with Orondis tankmixed with Cannonball and Ridomil Gold tankmixed with Cannonball and resulted in the lowest crown weight (1.14-1.24 oz), significantly less than plants treated with both rates of the Experimental (1.64-1.88 oz).

Treatment and rate/A, applied at 21-day intervals	Stand counts 2016		Crown ratings* (%) 2017				Crown weight (oz)
	29 Jun	16 Aug	1	2	3	4	
Untreated control	70.5**	65.3	8.8	28.8 b-d	52.5	10.0	1.51 a-d
Presidio 4 fl oz + Cannonball 7 oz	66.5	61.0	8.8	31.3 a-d	43.8	8.8	1.51 a-d
Ridomil Gold 2 pt + Cannonball 7 oz	71.0	65.5	12.5	47.5 a	37.5	2.5	1.14 d
Orondis 9.6 fl oz + Cannonball 7 oz	75.0	65.0	10.0	33.8 a-d	48.8	7.5	1.24 cd
Revus 8 fl oz + Cannonball 7 oz	72.0	63.5	5.0	23.8 cd	60.0	11.3	1.54 a-c
Revus 8 fl oz + Topsin M 1.5 lb	70.3	62.8	6.3	37.5 a-c	45.0	11.3	1.40 b-d
Fontelis 24 fl oz	69.3	60.3	13.8	27.5 b-d	51.3	7.5	1.42 b-d
Orondis 9.6 fl oz + Topsin M 1.5 lb	69.8	64.3	15.0	37.5 a-c	40.0	7.5	1.27 b-d
Presidio 4 fl oz + Topsin M 1.5 lb	72.3	60.3	17.5	27.5 b-d	43.8	11.3	1.29 b-d
Ridomil Gold 2 pt + Topsin M 1.5 lb	69.3	59.0	12.5	41.3 ab	40.0	6.3	1.21 cd
Experimental 13.7 fl oz	71.0	61.8	11.3	18.8 d	57.5	12.5	1.64 ab
Experimental 10 fl oz	72.5	63.5	3.8	18.8 d	55.0	22.5	1.88 a

\*Crowns rated on a scale of 1-4, where 1=low root mass, 2=low-medium root mass, 3=medium-high root mass, 4=high root mass.

\*\*Column means with a letter in common or with no letter are not significantly different (LSD t Test; P=0.05).

**Acknowledgement.** Partially funded by the Michigan Asparagus Advisory Board.