# Asparagus

## Tuesday morning 9:00 am

**Where:** Gallery Overlook (upper level) Room A & B

**MI Recertification credits:** 2 (1B, COMM CORE, PRIV CORE)
**OH Recertification credits:** 1 (presentations as marked)
**CCA Credits:** PM(1.0) CM(1.0)

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

| | |
|---|---|
| 9:00 am | Development of *Phytophthora* Tolerant Cultivars and Production of AV2 Virus-Free, High Health Crown Transplants |
| | • Peter Falloon, AsparaPacific, Lincoln, New Zealand |
| 9:45 am | Asparagus Irrigation Update- Effects on Spear Cooling, Quality, and Yield |
| | • Zachary Hayden, Horticulture Dept., MSU |
| 10:10 am | Asparagus Insect Pest Management (OH: 2B, 0.5 hr) |
| | • Zsofia Szendrei, Entomology Dept., MSU |
| 10:35 am | Asparagus Pathology Research – Results of 2014 Trials (OH: 2B, 0.5 hr) |
| | • Mary Hausbeck, Plant, Soil and Microbial Sciences Dept., MSU |
| 11:00 am | Session Ends |

# Development of *Phytophthora*-Tolerant Asparagus Cultivars and Production of Virus-Free, High Health Crown Transplants.

Dr Peter G Falloon, Aspara Pacific Ltd, Lincoln, New Zealand

## Phytophthora Rot

**Phytophthora rot** of asparagus is a significant disease that affects production in many of the main asparagus growing countries of the world. The soil-borne fungi that cause the disease (*Phytophthora asparagi*. and *P. cryptogea* ) can cause establishment failures, yield losses of over 50% and post-harvest rot of harvested spears.

Breeding asparagus for tolerance to Phytophthora rot started in 1985 with mass screening of thousands of asparagus seedlings to identify a source of resistance genes. Surviving plants were randomly mated and progeny were challenged with a mixture of isolates of *P. asparagi* and *P cryptogea* from Europe, North America and New Zealand, in both a field disease nursery and in the greenhouse. Surviving plants were then randomly mated again and this cycle of recurrent selection was repeated several times before individual male and female plants were crossed and their progeny evaluated for yield, spear quality and tolerance to Phytophthora rot.

Replicated field trials at multiple sites in New Zealand and North America in soil both infested with and free of *Phytophthora* have shown that the new variety **Pacific Challenger** is both tolerant of Phytophthora rot and yields the same or significantly more than commercial standard varieties UC 157 and Jersey Giant.

In Michigan, field trials in soil heavily infested with Phytophthora showed that Pacific Challenger 2 out-yielded both Guelph Millenium and Mondeo.

Table 1. Marketable yields of three asparagus cultivars grown in Phytophthora-infested soil at Hart, Michigan. (data courtesy of J. Bakker).

| Cultivar | Cumulative Marketable Yield (lb/acre) 2010-12. |
|---|---|
| Pacific Challenger 2 | 18, 016 |
| Mondeo | 15, 494 |
| Guelph Millennium | 13, 297 |

# Asparagus Virus 2

**Asparagus Virus 2** (sometimes called Asparagus Latent Virus) is seed transmitted in asparagus. It spreads from plant to plant in infected pollen and by sap transmission on cutting knives during harvest or when the fern is mulched in the fall.

AV 2 has been shown to make asparagus plants more susceptible to Fusraium crown and root rot.

**Symptoms:** Plants infected with AV-II show no distinct symptoms although vigor and productivity are reduced.

AV-II is transmitted through seed and up to 67% of seeds may be infected. Within asparagus fields AV-II may be spread from plant to plant via mechanical transmission e.g. on cutting knives. AV-II may also spread via pollen from infected male plants to seed produced by females. As the incidence of infected plants increases with time, the proportion of infected seed harvested from AV-II infested seed fields will also increase.

**Effect on yield:** Recent work has shown that the marketable yield of asparagus can be reduced by up to 50% and that the yield reduction is greater in older plants than younger plants. The roots of asparagus plants infected with AV-II exude seven to eight times more amino acids and two to three times more glucose and carbohydrate than roots of healthy plants. These exudates stimulate *Fusarium* and are involved in attraction of *Phytophthora* zoospores to root surfaces. Thus AV-II infected plants are more susceptible to Fusarium rot than AV-II free plants. This may also apply to Phytophthora rot.

Significant reduction in vigor may occur when the asparagus plant is infected with both AV 2 and the aphid transmitted virus, asparagus virus 1.

**Control:** Because plant-to-plant spread within asparagus fields results in increased incidence of AV-II infected seed, F2 seed should not be harvested from fields established from older cultivars.

Meristem culture combined with the highly sensitive virus detection techniques (PCR) can be used to eliminate AV- 2 from the parents of new asparagus hybrids. The wider adoption of this technique by asparagus breeders and seed producers could eventually eliminate AV2 from commercial fields of asparagus.

# Management Strategies for Purple Spot Control of Asparagus

Dr. Mary K. Hausbeck, 517-355-4534, Carolina Escobar-Ochoa
Michigan State University, Department of Plant, Soil & Microbial Sciences

In 2014 Michigan ranks second in asparagus production after California with a total estimated value of $19.37 million. In the state, the main asparagus production areas are located in the north (Mason and Oceana counties) and southwest (Cass and Van Buren counties).

Asparagus is a perennial crop with a production estimate of more than a decade under the appropriate conditions. Initially, the seeds are planted in seedbeds of nursery fields in early spring and grown until the following spring, when the young crowns are dug and transplanted into production fields. The young stands grow for one to two years more before harvest. The fern stage begins in the spring after harvest is completed and is particularly critical for crop production because of the photosynthetic energy provided for spear production the following season.

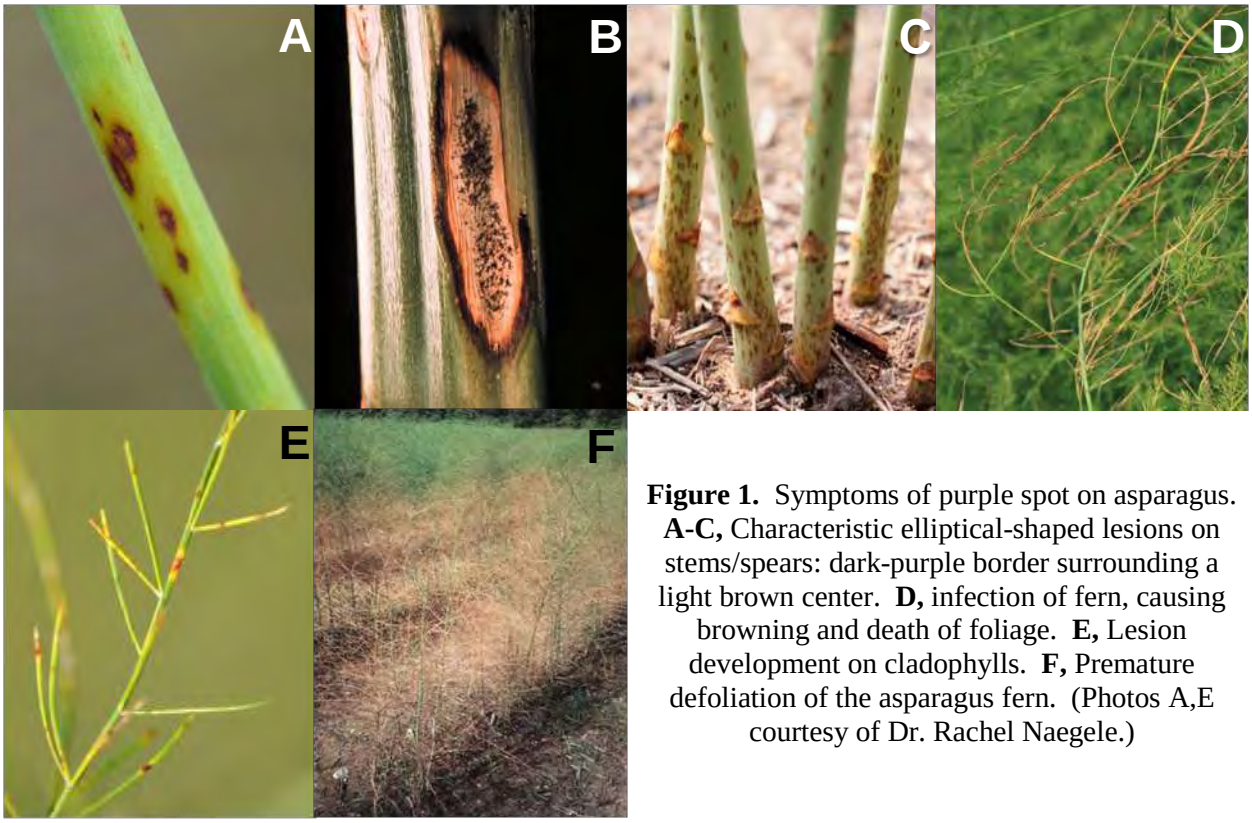


**Figure 1.** Symptoms of purple spot on asparagus. **A-C,** Characteristic elliptical-shaped lesions on stems/spears: dark-purple border surrounding a light brown center. **D,** infection of fern, causing browning and death of foliage. **E,** Lesion development on cladophylls. **F,** Premature defoliation of the asparagus fern. (Photos A,E courtesy of Dr. Rachel Naegele.)

Limiting diseases affecting the fern and cladophylls has been shown in previous Michigan and Washington studies to be economically important. Purple spot caused by the fungus *Stemphylium vesicarium* infects the stems and cladophylls of the asparagus fern resulting in yield losses as high as 52% after consecutive years of premature defoliation. The disease is favored by cool, wet weather conditions. The symptoms are characterized by small, elliptical purple lesions with brown centers (Figure 1). Lesions may occur on 60 to 90% of the spears, which impacts the quality of the spears intended for the fresh market.

Currently, fungicides containing mancozeb (Manzate Pro-Stick), chlorothalonil (Bravo Weather Stick), or azoxystrobin (Quadris), are approved for use on asparagus fern and provide disease control when used as protectants on asparagus cultivars that have some level of tolerance to purple spot disease. In the field, reduced defoliation has been observed in some cultivars indicating that there are varying levels of purple spot resistance. Therefore, screening asparagus varieties suitable for Michigan conditions to determine their level of resistance to purple spot is helpful in a disease management strategy.

**Evaluation of asparagus breeding lines and commercial cultivars for purple spot resistance.** A trial was established with one-year-old asparagus plants in May of 2014 at Hart, MI. The asparagus seedlings were initially grown in plastic pots with Baccto ® professional potting mix and maintained under greenhouse conditions. A representative number of plants per cultivar and experimental line were selected, transplanted to 2-gallon plastic pots and placed near to an asparagus field with natural purple spot pressure. The experiment was arranged as a complete randomized unbalance design with a potted asparagus plant serving as one replicate. Purple spot severity (expressed as the percentage of the aerial plant tissue affected) was visually assessed according to the Horsfall-Barratt grading system, 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. Ratings were taken at 90, 105 and 118 days. The area under the disease progress curve (AUDPC) was calculated through the trapezoidal method. Data were squared root transformed to meet statistical assumption of normality. Analysis of variance was performed using the general linear models procedure of SAS (version 9.4) and means were separated using Fisher's least significant difference test.

**Table 1**. List of asparagus cultivars and breeding lines evaluated for purple spot tolerance.

| Cultivars/breeding lines | Seed source | Cultivars/breeding lines | Seed source |
|---|---|---|---|
| Bacchus | Bejo Seeds Inc. | NJ1191 | Rutgers University |
| Cumulus | Bejo Seeds Inc. | NJ938 | Rutgers University |
| Hybrid 73x22 | Aspara Pacific Ltd | Pacific 2000 | Aspara Pacific Ltd |
| Hybrid 74x22 | Aspara Pacific Ltd | Pacific Challenger 1 | Aspara Pacific Ltd |
| Jersey Giant | Walker Bros Inc. | Pacific Challenger 2 | Aspara Pacific Ltd |
| Magnus | Bejo Seeds Inc. | UG10 | University of Guelph |
| Millennium | University of Guelph | UG05 | University of Guelph |
| Mondeo | Vilmorin | UG09 | University of Guelph |

Temperatures during the growing season were relatively cool and conducive for asparagus purple spot development. Results in the disease severity assessment are showed in the Table 2. Significant differences in varietal susceptibility to asparagus purple spot were detected, with the UG09 line demonstrating the highest level of resistance (Figure 2). This variety showed the lowest AUDPC value over the period of time evaluated. A total of thirteen lines included in the test showed moderate levels resistance, whereas Millennium and UG05 showed the highest disease susceptibility when compared to UG09 in this particular trial.

**Table 2.** Response of sixteen cultivars and breeding lines of asparagus to purple spot disease.

| Cultivar/breeding line | Purple spot severity | | |
|---|---|---|---|
| | **8/20** | **9/3** | **9/16** |
| UG09 | 1.54 | 2.14 | 2.36 |
| Mondeo | 2.50 | 3.07 | 3.57 |
| Bacchus | 2.56 | 2.89 | 3.56 |
| Hybrid 73x22 | 2.83 | 3.29 | 3.50 |
| NJ938 | 2.83 | 3.46 | 3.69 |
| UG10 | 2.86 | 3.23 | 3.36 |
| Pacific Challenger 2 | 2.92 | 3.79 | 4.07 |
| Pacific 2000 | 2.93 | 3.43 | 3.86 |
| Hybrid 74x22 | 3.00 | 2.73 | 3.36 |
| Pacific Challenger 1 | 3.09 | 3.07 | 3.71 |
| Jersey Giant | 3.18 | 3.31 | 3.92 |
| NJ1191 | 3.29 | 4.00 | 4.71 |
| Magnus | 3.30 | 3.08 | 3.38 |
| Cumulus | 3.33 | 3.57 | 4.07 |
| Millennium | 3.82 | 4.91 | 5.27 |
| UG05 | 4.11 | 4.56 | 5.22 |

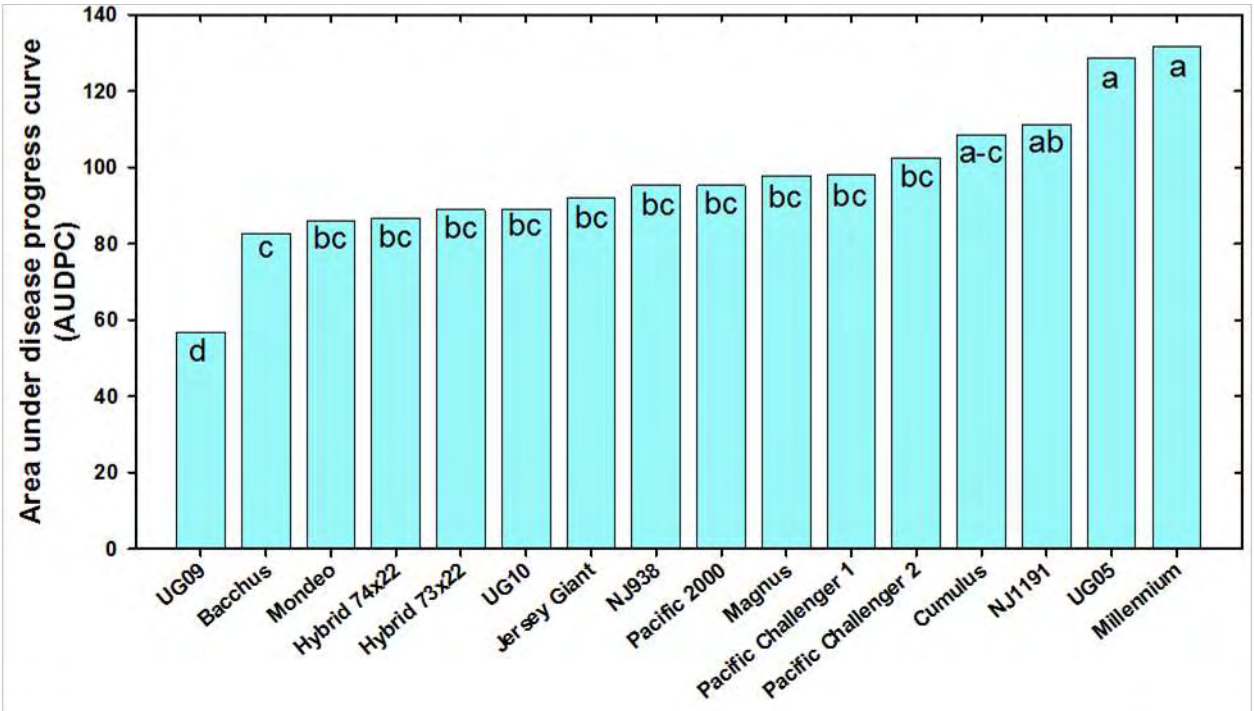


***Figure 2.*** *Area under disease progress curve (AUDPC) of asparagus cultivars and breeding lines evaluated for purple spot resistance in Hart, MI. Disease was rated according to the Horsfall-Barratt disease scale, where 1=no visible symptoms, 2=0 to 3%, 3=3 to 6%, 4=6 to 12%, 5=12 to 25%, 6=25 to 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. Bars with a letter in common are not significantly different (Fisher LSD; P=0.05)*

**Evaluation of fungicides for control of purple spot of asparagus, 2014.** Experimental plots were set up in an established asparagus field at a research farm in Oceana County, MI. Plots consisted of 13-rows wide by 100 ft long. Each row had 20-ft with an untreated section of 5 ft separating plots within the row. Crowns were spaced 9 in. apart in the row and rows were spaced 5 ft apart. A total of twelve chemical treatments including an untreated control were replicated four times in a randomized complete block design (Table 3). The crop was managed according to standard cultural practices. Fungicide sprays were applied with a $CO_2$ backpack boom sprayer equipped with three 8003XR nozzles spaced 19 in. apart, operating at 50 psi, and delivering 50 gal/A. Treatments (Table 3) were applied to the fern on a 7- to 10-day schedule on 6, 17 and 27 Jun; 3, 11, 18 and 28 Jul; 8, 18 and 25 Aug. Disease severity was visually assessed according to the Horsfall-Barratt grading system on 13 and 20 Aug; 3, 16 and 29 Sep. Analysis of variance was performed using the general linear models procedures of SAS (version 9.4) and means were separated using Fisher's least significant difference test.

Disease pressure was severe with the untreated control plants receiving a disease severity rating of 11.5 (>97% but less than 100% plant area diseased) by the end of the trial. Especially effective treatments that limited disease severity rating to ≤5.0 (>12% to 25% plant area diseased) were Priaxor SC, Quadris Top SC and Quadris Opti SC. Plants treated with Bravo Weather Stik SC and Tebuzol 3.6F were statistically similar to the untreated control plants (Figure 3).

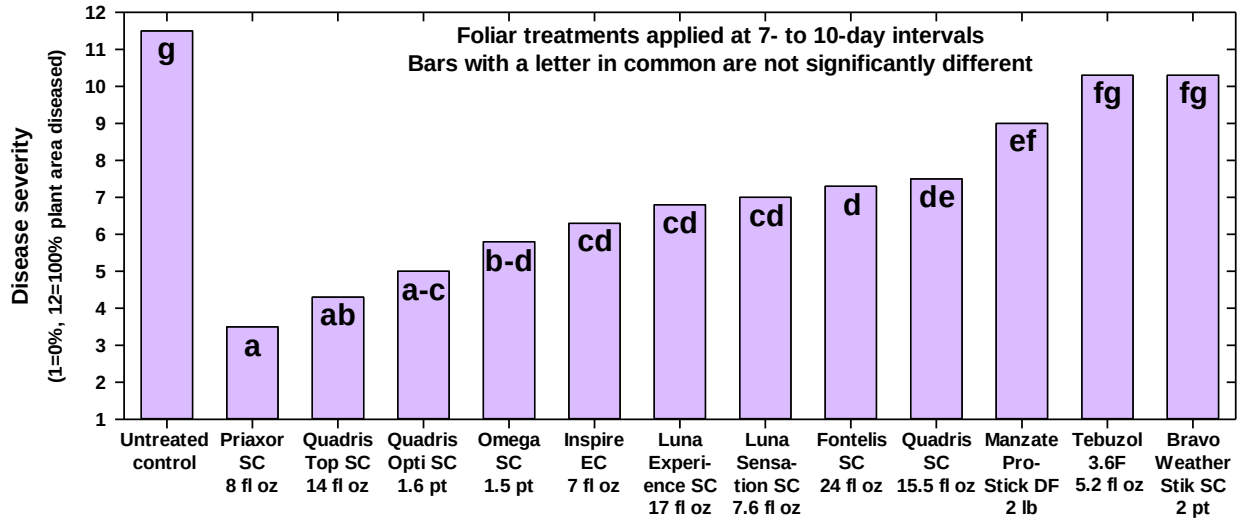


***Figure 3****. Evaluation of fungicides for control of purple spot disease on 'Millennium' asparagus. Disease was rated according to the Horsfall-Barratt disease scale, where 1=no visible symptoms, 2=0 to 3%, 3=3 to 6%, 4=6 to 12%, 5=12 to 25%, 6=25 to 50%, 7=50 to 75%, 8=75 to 87%, 9=87 to 94%, 10=94 to 97%, 11=97 to 100%, 12=100% plant area diseased. Bars with a letter in common are not significantly different (Fisher LSD; P=0.05).*

**Managing asparagus purple spot** requires multiple strategies including the following:

1) Minimizing plant debris to reduce overwintering inoculum.
2) Using the Tom-Cast disease forcasting system to schedule fungicide sprays to the fern.
3) Applying effective fungicides.

**Acknowledgements.** This research was supported by funding from the Michigan Asparagus Advisory Board, and by a State Block Grant administered by the Michigan Asparagus Advisory Board.