MAPPING YOUR ROUTE TO THE FUTURE

Great Lakes Fruit, Vegetable & Farm Market EXPO
DeVos Place Convention Center
Grand Rapids, MI
December 7-9, 2004

Celery

Wednesday afternoon 2:00 pm

Where: Gallery Overlook Room E (upper level)

Recertification credits: 1 (Private, 1B)

CCA Credits: IPM(1) CM(1)

Moderator: Amy Irish-Brown, MSU Extension Fruit & Vegetable

2:00 p.m. Using Cropping Systems to Improve Celery Growth, Yield, and Quality

- Mathieu Ngouajio, Horticulture Dept., MSU
- Kevin Charles, Horticulture Dept., MSU

2:25 p.m. Weed Management for Celery

- Bernard Zandstra, Horticulture Dept., MSU

2:50 p.m. New Products for Celery Disease Management

- Mary Hausbeck, Plant Pathology Dept., MSU

3:15 p.m. Celery Cultivar Development for Fusarium Resistance and Horticultural Quality (To be confirmed)

- Rebecca Grumet, Horticulture Dept., MSU

3:40 p.m. Celery Research Inc. Annual Meeting

New Products for Celery Disease Management

Dr. M.K. Hausbeck (517-355-4532; hausbec1@msu.edu) and R.S. Bounds (Graduate Student)
Department of Plant Pathology, Michigan State University

Late blight, caused by *Septoria apiicola*, has historically been the most important foliar disease of celery in Michigan. Symptoms of the disease initially appear on leaves as irregularly-shaped brown spots containing several small black fruiting bodies (pycnidia) of the fungus. Each pycnidium can release thousands of infective spores when wet. Spores of the fungus are spread by splashing water to nearby plants and can be carried in water droplets on machinery to other fields. Infected petioles must be manually removed at harvest; a time-consuming process which decreases the size of stalks. Methods to reduce disease pressure include planting disease-free transplants, following a 2-year crop rotation, minimizing overhead irrigation, and applying fungicides. Methods to effectively schedule fungicide applications according to environmental conditions are being developed.

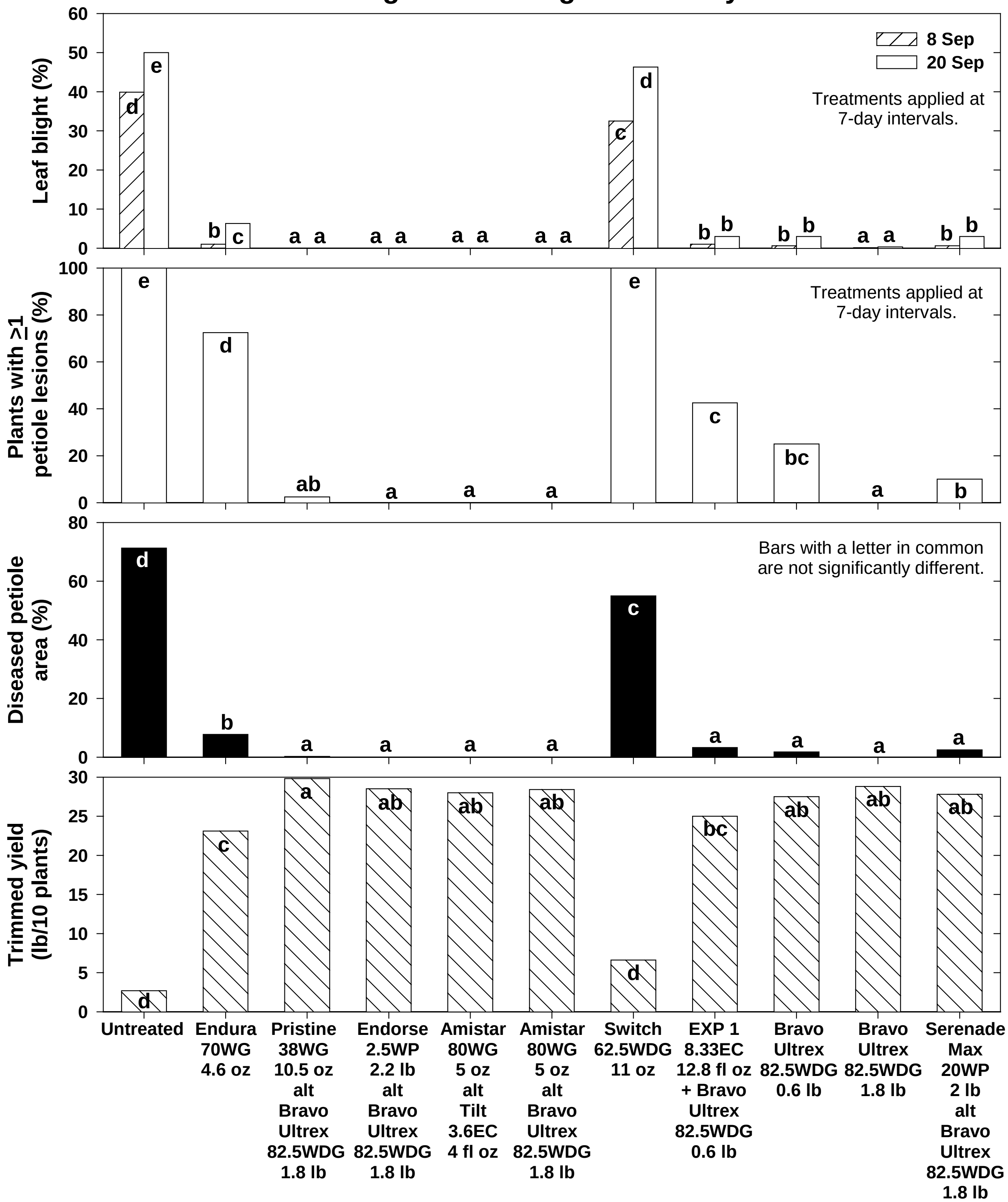
New Product Testing.
Fungicides were evaluated at the MSU Muck Soils Research Farm in 2004 (Table 1). Eight-week old celery 'Dutchess' transplants were planted 7 in. apart in rows spaced 32 in. apart on 21 June. Treatment plots consisted of one row 20 ft long with 5 ft of unsprayed buffer between plots in the same row. Two buffer rows were left unsprayed between each treatment row. Eleven treatments were replicated four times in a randomized complete block design. *Septoria* inoculum (2.9 x 10^7 spores/fl oz) was prepared by soaking dried infected celery leaves for 10 min in water and straining through two layers of cheesecloth. Inoculum was applied with a hand-pump backpack sprayer to all plants in the trial on 30 Jul using one hollow cone nozzle that delivered 12 gal/A. Fungicides were applied with a CO_2 backpack sprayer equipped with three XR8003 flat fan nozzles spaced 18 in. apart and calibrated to deliver 50 gal/A at a nozzle pressure of 52 psi. Nine applications were made at weekly intervals on 19 and 26 July; 2, 9, 17, 23, and 30 August; and 6 and 14 September. Leaf blight severity was evaluated on 8 and 20 September, and ten plants from the middle of each treatment row were hand-harvested and trimmed to fresh market specifications (14 in. length) on 21 September. Petiole disease incidence and severity were assessed, diseased petioles were removed from the plants, and yields were recorded.

Table 1. Fungicides tested for control of late blight of celery, 2004.

Product	Active ingredient(s)	Manufacturer	Registered
Amistar 80WG	azoxystrobin	Syngenta	yes
Bravo Ultrex 82.5WDG	chlorothalonil	Syngenta	yes
Endorse 2.5WP	polyoxin D zinc salt	Arvesta	no
Endura 70WG	boscalid	BASF	no
EXP 1	experimental	--	no
Pristine 38WG	boscalid + pyraclostrobin	BASF	no
Serenade Max 20WP	*Bacillus subtilis*	Agraquest	no
Switch 62.5WG	cyprodinil + fludioxonil	Syngenta	no
Tilt 3.6EC	propiconazole	Syngenta	yes

Disease symptoms appeared throughout the trial on 11 August. Untreated plants had severe disease on leaves (50%) and petioles (71%) at harvest which resulted in extensive trimming and low yield (Table 2, Fig. 1). Three fungicide programs provided season-long disease prevention on leaves and petioles and included Endorse 2.5WP alternated with Bravo Ultrex 82.5WDG, Amistar 80WG alternated with Tilt 3.6EC, and Amistar 80WG alternated with Bravo Ultrex 82.5WDG. Applications of Pristine 38WG

Fig. 1. Late Blight on Celery



alternated with Bravo Ultrex 82.5WDG or Bravo Ultrex 82.5WDG (1.8 lb/A) applied alone were also effective programs. Applications of Endura 70WG resulted in a lower trimmed yield than programs that prevented disease. Mixing EXP 1 with a reduced rate of Bravo Ultrex 82.5 (0.6 lb/A) provided no disease control benefit when compared to the reduced rate Bravo Ultrex 82.5WDG (0.6 lb/A) treatment. Disease control and yield of the Serenade Max 20WP alternated with Bravo Ultrex 82.5WDG treatment and the reduced rate Bravo Ultrex 82.5WDG (0.6 lb/A) treatment did not differ. Applications of Switch 62.5WG were ineffective and resulted in a low yield similar to the untreated. No phytotoxicity was observed from any treatment.

Table 2. Efficacy of fungicides tested for controlling late blight of celery.

Treatment and rate/A (application sequence[z])	Leaf blight (%)[y]		Petiole blight		Trimmed yield (lb)[v]
	8 Sep	20 Sep	Incidence (%)[x]	Severity[w]	
Untreated	39.9 d[u]	50.0 e	100.0 e	71.3 d	2.7 d
Endura 70WG 4.6 oz (1-10)	1.0 b	6.3 c	72.5 d	7.8 b	23.1 c
Pristine 38WG 10.5 oz alt. Bravo Ultrex 82.5WDG 1.8 lb	0.0 a	0.0 a	2.5 ab	0.3 a	29.8 a
Endorse 2.5WP 2.2 lb alt. Bravo Ultrex 82.5WDG 1.8 lb	0.0 a	0.0 a	0.0 a	0.0 a	28.5 ab
Amistar 80WG 5 oz alt. Tilt 3.6EC 4 fl oz	0.0 a	0.0 a	0.0 a	0.0 a	28.0 ab
Amistar 80WG 5 oz alt. Bravo Ultrex 82.5WDG 1.8 lb	0.0 a	0.0 a	0.0 a	0.0 a	28.4 ab
Switch 62.5WG 11 oz	32.5 c	46.3 d	100.0 e	55.0 c	6.6 d
EXP 1 12.8 fl oz + Bravo Ultrex 82.5WDG 0.6 lb	1.0 b	3.0 b	42.5 c	3.3 a	25.0 bc
Bravo Ultrex 82.5WDG 0.6 lb	0.6 b	3.0 b	25.0 bc	1.8 a	27.5 ab
Bravo Ultrex 82.5WDG 1.8 lb	0.1 a	0.3 a	0.0 a	0.0 a	28.8 ab
Serenade Max 20WP 2 lb alt. Bravo Ultrex 82.5WDG 1.8 lb	0.6 b	3.0 b	10.0 ab	2.5 a	27.8 ab

[z] Application sequence: 1 = 19 Jul; 2 = 26 Jul; 3 = 2 Aug; 4 = 9 Aug; 5 = 17 Aug; 6 = 23 Aug; 7 = 30 Aug; 8 = 6 Sep; 9 = 14 Sep.
[y] Evaluated using a leaf blight assessment key representing the percentage of diseased leaf area.
[x] Percentage of trimmed plants with one or more petiole lesions.
[w] Percentage of petiole area with disease symptoms.
[v] Ten plants from the center of each plot were hand-harvested, trimmed to 14 in. length, and stripped of diseased petioles prior to weighing.
[u] Means within a column followed by the same letter are not significantly different according to Waller-Duncan Bayesian k-ratio t-test (k-ratio = 100).

Celery Breeding for Development of Enhanced Fusarium Resistance

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Fusarium yellows (causal agent: *Fusarium oxysporum* f. sp. apii, race 2) continues to be a major factor limiting celery production in Michigan and nationally. The Michigan State University celery breeding program has used a combination of somaclonal variation, recurrent selection, and hybridization with commercial lines to develop Fusarium-resistant celery breeding lines that are nearing release. These materials combine two sources of Fusarium resistance [somaclonally-derived and celeriac-derived (from the commercial lines)] with high yield, and good stalk quality derived from Florida 683 (FL683).

This past summer, 2004, replicated trials were performed with selected F4 progeny bulked lines, and several commercial lines on a highly Fusarium-infested field in Hudsonville, MI. Disease conditions in the Hudsonville field were very severe. The susceptible control (original parent for the somaclone lines), 'FL683', received a mean disease rating of 4.4 (rated on a scale of 1 - 5, where 1=no disease and 5=dead). None of the 'FL683' plants were marketable. The range of performance for the commercial cultivars was 1.3 - 2.9. Greenbay (XP166), Picador, and XP85, all performed well, with ratings $\leq$ 1.5. XP266 and Dutchess did not perform as well, with ratings of 2.1 and 2.9, respectively. Somewhat greater susceptibility also has been observed for these cultivars in previous years.

Yields for the commercial cultivars ranged from 15.7 - 22.4 lbs/10 plants (990 - 1410 55 lb crates/A), with a mean of 1290 crates/A. Decreased yield accompanied increased disease ratings, suggesting that lower yields may be a reflection of disease occurrence, rather than yield potential. In some cases the commercial cultivars were shorter than expected. This again correlated with higher disease ratings, suggesting a stunting effect of the disease, rather than growth potential of the plants. Late blight ratings were variable (23 - 83% of the examined plants showing blight symptoms).

Overall, the somaclone hybrid F4 bulk lines showed a high level of Fusarium resistance. Six of the eight lines had very good disease ratings of 1.2-1.4, the highest line rated 1.7. Mean yields of the F4 somaclone hybrid lines ranged from 20.0 - 25.5 lbs/10 plants (1260 - 1610 55 lb crates/A), with a mean of 1450 crates/A. This compares very favorably with the commercial cultivars. Three of the lines had good height ratings below 1.0; two had somewhat poorer height ratings of 2.3. Many of the somaclone lines also had good horticultural quality with full stalks conatining many petioles per stalk.

The somaclone hybrid bulk lines also were tested in row trials on two cooperator farms. In both cases the disease ratings were excellent (all 1.2 or less). The check commercial cultivar, Dutchess, also gave a very low disease rating one farm (1.3), but somewhat higher on the other (1.7), suggesting a difference in disease pressure at the two locations. Yield, however, was different for the somaclone hybrid lines. In one location, yields were equivalent to Dutchess, in the second location they were lower. The reason for this difference is not clear, although it appears from other observations that the somaclone lines may require longer to reach maturity, and if harvested too soon, will not have reached full marketable stage.

F4 families contributing to the bulk lines were also examined individually in non-replicated plots. Selection for propagation in the 2004-2005 winter season was based on individual families. Seed from these families also was sent to California where they will be propagated by Dr. Bill Waycott (Seminis Seeds) for moderate scale seed increase. Seed from this increase should be available for testing in Michigan in summer 2006. Facsimiles of the blends to be produced in California will be made from greenhouse-produced seed in Michigan in 2005 for field testing in 2005.