



Great Lakes Fruit, Vegetable & Farm Market Expo
DeVos Place Convention Center
Grand Rapids, MI
December 9-11, 2003



Carrot

Wednesday morning 10:00 am

Where: Gallery Overlook Room C (upper level)

Summary: Growers can receive insight into disease control through proper seed selection in the opening lecture of this session. The latest weed, insect and disease control measures will be presented as last year's research results and next year's recommendations are presented.

Recertification credits: 1 (Private, 1A, 1B)

CCA Credits: IPM(1) CM(0.5)

Moderator: Jim Breinling, District Vegetable Agent, MSU Extension

10:00 a.m. Bacterial Blight and Carrot Seed Quality

- Lindsey du Toit, Washington State University

10:30 a.m. Agronomic Factors that Affect Carrot Cracking

- Timothy Hartz, University of California, Davis

11:00 a.m. Highlights from the 30th International Carrot Conference

- James Breinling, Michigan State Univ Extension

11:15 a.m. 2003 MSU Research Results and 2004 Recommendations: Weeds

- Bernard H. Zandstra, Michigan State University

11:30 a.m. 2003 MSU Research Results and 2004 Recommendations: Insects

- Beth A. Bishop, Michigan State University

11:45 a.m. 2003 MSU Research Results and 2004 Recommendations: Diseases

- Mary K. Hausbeck, Michigan State University

Disease Research Results for 2003 and 2004 Recommendations

Dr. Mary Hausbeck, Brian Cortright, and Ryan Bounds
Michigan State University
Office: 517-355-4534, email: hausbec1@msu.edu

Carrot disease pressure began early this year as *Cercospora* leaf blight was found in several commercial carrot fields in late June. Predicting disease outbreaks across the state was difficult as different areas of the state experienced uneven rain patterns with moderate to severe drought conditions occurring in most of the carrot growing regions. *Cercospora* development was favored by periods of high humidity and the frequent irrigation needed to produce the crop. When foliar disease developed early, applications of fungicides using the high label rates and short intervals kept most epidemics under control. Scouting and use of the disease forecaster Tom-Cast, helped many growers stay ahead of disease development. Several research plots were established across the state and at the MSU Muck Soils Research Farm in Bath, MI to determine the effectiveness of registered and experimental fungicides in controlling foliar blight and to further validate the Tom-Cast disease forecaster (Table 1.).

Table 1. Fungicides tested for the control of foliar blights of carrot, 2003.

Product	Active ingredient	Manufacturer
Bravo Weather Stik 6SC	chlorothalonil	Syngenta
Cabrio 20WG	pyraclostrobin	BASF
Quadris 2.08SC	azoxystrobin	Syngenta
KP 481 50WG	famoxate/cymoxanil	DuPont
Rovral 50WG	iprodione	Bayer
Cuprofix Disperss	copper sulfate	Cerexagri
710-145F	<i>Bacillus licheniformis</i>	Novozymes
Endorse	polyoxin D zinc salt	Arvesta
EXP 702010	experimental	

In early June, a foliar disease spray trial in a commercial carrot field near Fremont, MI was conducted to test registered and experimental compounds. The field was planted to the a cut and peel variety (Sugar Snax) at a density of 900M seed per acre. Plots were staked out in a randomized complete block pattern with four replicates. Each treatment section was comprised of a three row bed (18 in. row spacing) 20 ft long with a buffer of 5 ft between treatment sections within the row. The bed spacing was 68 in. wide and the seed population at planting was 900M per acre. One buffer bed was left between each treatment row to provide equal disease pressure to all treatments and avoid drift contamination of treatments. Total plot dimensions were 12 beds wide by 300 ft long. Fungicide sprays were applied with a CO₂ backpack boom sprayer equipped with three 8002 nozzles spaced 19 in. apart, operating at 50 psi, and delivering 50 gal/A. Eleven spray applications were applied to treatments on a 7- 10 day schedule on 20

and 27 Jun; 3, 10, 22, and Jul; 5, 12, 20, and 27 Aug; and 3 Sep. Visual foliar disease assessments were taken on 27 Aug and 10 Sep utilizing a disease scale of 1 to 10 (1=no disease to trace, 10=complete defoliation). On 10 Sep diseased petiole incidence and infection severity were taken by evaluating each carrot in the inner 5 ft of the center row. Petiole infection rates were determined by counting the number of plants with at least one infected petiole. A petiole infection severity rating was given to the carrot tops and was based on a 1 to 5 scale (0= no lesions, 1=1-5 lesions per petiole, 2=5-10, 3=10-25, 4=25-50, and 5=>50 lesions per petiole). Carrots were then topped by a mechanical roller bed and then weighed on a platform scale.

Disease was observed in the untreated sections of the plot seven days after the first application in Jun. Disease progressed steadily even during severe drought conditions with the untreated plots having 84.6% petiole infection (Table 2.) and disease severity of 3.0 at harvest. *Cercospora* was the main disease of the infected petioles and also was observed on the carrot leaves. *Alternaria* pressure was only evident on the carrot leaves. For both foliar ratings, all treatments except EXP 702010 8.33EC provided significant control of foliar diseases. Treatments that were very effective (ratings below 1.5) included both rates of Cabrio 20WG alternated with Bravo Weather Stik (1.5 pt/A), both rates of Quadris 2.08SC alternated with Bravo Weather Stik (1.5 pt/A), Pristine 38WG alternated with Bravo Weather Stik (1.5 pt/A), and both treatments of Bravo Weather Stik (1.5 pt/A, 7 & 14 day). Only the treatments of Cabrio 20WG or Quadris 2.08SC alternated with Bravo Weather Stik (1.5 pt/A) and Pristine 38WG alternated with Bravo Weather Stik (1.5 pt/A) provided significant reductions in the amount of infected petioles. Both rates of Cabrio alternated with Bravo Weather Stik held petiole infection severity below a rating of 1.8 (0=no disease, 5= complete defoliation). Significant yield differences were noted among the different treatments. Treatments that effectively controlled disease on the foliage had higher yields compared to the untreated control. Yields from treatments of KP 481 50WG (8.0 oz/A) tank mixed with Rovral 50WG and alternated with Bravo Weather Stik, Cuprofix Disperss 20DF (2.5 lb/A) alternated with Bravo Weather Stik, Endorse 2.5WP (1.4 lb/A), and EXP 702010 8.33EC (12.8 fl oz/A) had significantly similar yields to the untreated plots.

Another study was conducted at the Michigan State University Muck Soils Research Farm in Laingsburg, MI on a Houghton muck field previously planted to carrot. The objective of this study was to determine the effectiveness of the Tom-Cast Disease forecasting system on different varieties of carrots that have different levels of disease resistance. 'Bolero' (resistant) and 'Fontana' (susceptible) carrot seeds were planted in separate plots at a density of 22.8 seeds/ft of row on 19 May in three seed lines per row with rows centered 18 in. apart on three-row beds centered 64 in. apart. Treatment plots consisted of one row 22.5 ft long with 2.5 ft of unsprayed buffer between plots in the same row. One bed was left unsprayed between every two treatment beds. Seven treatments were replicated four times in a randomized complete block design for each variety. Fungicides were applied with a CO₂ 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. The initial application for all fungicide treatments was applied when disease symptoms were observed in the field. Subsequent applications were applied on a weekly schedule or according to Tom-Cast using a spray threshold of 15 Disease Severity Values (DSV). Ten applications were made according to the 7-day spray schedule on 15, 22, and 30 Jul; 5, 13, 19, and 26 Aug; and 2, 9, and 16 Sep. The Tom-Cast 15 DSV schedule resulted in 5 sprays with applications prompted on 15 Jul; 4, 13, and 26 Aug; and 16 Sep. Disease assessments were recorded 22 and 28 Aug; 5, 12, and 18 Sep from plants in the center 10 ft of the middle row of each plot. Carrots in the center 10 ft of the middle row were hand-harvested, the foliage was removed with a mechanical topper, and root yields were recorded on 26 Sep.

Table 2. New product testing for the control of foliar blights of carrot, Fremont, MI, 2003.

Treatment (Application schedule)	Foliar blight ratings	Infected petioles (%)	Severity ^x	Yield (lbs/5 row ft)
Untreated	6.0 f ^y	84.6 c	3.0 d	9.1 gh
Bravo Weather Stik 6SC 1.5 pt (1-11)	1.5 ab	73.4 c	2.0 ab	12.8 bcde
Cabrio 20WG 8.0 oz (1, 3, 5, 7, 9, & 11) Bravo Weather Stik 6SC 1.5 pt (2, 4, 6, 8, & 10)	1.0 a	1.5 a	1.8 a	13.4 abcde
Cabrio 20WG 12.0 oz (1, 3, 5, 7, 9, & 11) Bravo Weather Stik 6SC 1.5 pt (2, 4, 6, 8, & 10)	1.0 a	3.1 a	1.8 a	13.6 abcd
Quadris 2.08 SC 6.0 fl oz (1, 3, 5, 7, 9, & 11) Bravo Weather Stik 6SC 1.5 pt (2, 4, 6, 8, & 10)	1.0 a	13.1 ab	2.0 ab	14.9 ab
Quadris 2.08 SC 12.0 fl oz (1, 3, 5, 7, 9, & 11) Bravo Weather Stik 6SC 1.5 pt (2, 4, 6, 8, & 10)	1.3 a	20.0 ab	2.0 ab	15.4 a
KP 481 50WG 8.0 oz +Bravo Weather Stik 6 SC 1.5 pt (1, 3, 5, 7, 9, & 11) Rovral 50WG 1.0 lb (2, 4, 6, 8, & 10)	2.5 bcde	87.1 c	2.3 abc	11.5 cdef
KP 481 50WG 8.0 oz +Rovral 50WG 1.0 lb (1, 3, 5, 7, 9, & 11) Bravo Weather Stik 6SC 1.5 pt (2, 4, 6, 8, & 10)	2.8 cde	78.3 c	2.3 abc	10.4 fg
Bravo Weather Stik 6 SC 1.0 pt +Rovral 50WG 1.0 lb (1-11)	2.0 abcd	75.0 c	2.3 abc	11.8 cdef
Cuprofix Disperss 20DF 2.5 lb (1, 3, 5, 7, 9, & 11) Bravo Ultrex 82.5WDG 1.4 lb (2, 4, 6, 8, & 10)	2.5 bcde	75.5 c	2.1 ab	11.3 defg
Pristine 38WG 10.5 oz (1, 3, 5, 7, 9, & 11) Bravo Ultrex 82.5WDG 1.4 lb (2, 4, 6, 8, & 10)	1.8 abc	8.6 ab	2.3 abc	12.9 bcde
710-145f 5.7 pt (1, 3, 5, 7, 9, & 11) Bravo Weather Stik 6SC 1.5 pt (2, 4, 6, 8, & 10)	3.0 de	86.1 c	2.9 cd	11.6 cde
Endorse 2.5WP 1.4 lb (1-11)	3.5 e	80.6 c	2.5 bcd	11.2 efg
Bravo Weather Stik 6SC 1.5 pt (1, 3, 5, 7, 9, & 11)	1.5 ab	81.1 c	2.0 ab	13.7 abc
EXP 702010 8.33EC 12.8 fl oz (1-11)	5.5 f	87.5 c	3.1 d	7.9 h

^yFoliar ratings based on visual estimation utilizing a 1 to 10 scale (1=no sign of foliar infection, 10=complete defoliation).

^yColumn values with a common letter are not significant different, Fisher LSD, $P=0.05$.

^xSeverity of petiole infection based on visual estimation utilizing a 0 to 5 scale (0=no lesions, 5=>50 lesions per petiole).

Cercospora and Alternaria blight symptoms were detected on both cultivars during mid-Jul and mid-Aug, respectively. Disease on untreated ‘Bolero’ plants was severe but did not have an effect on the hand-harvested yield of plots (Fig 1.). All fungicide treatments significantly improved disease control compared with the untreated. Using Tom-Cast was comparable to a 7-day application schedule and reduced fungicide use by 50 %.

Petiole blight of untreated ‘Fontana’ plants was severe with each plant having > 50 lesions (Fig 2). All fungicide treatments were effective in reducing disease compared with the untreated, except Bravo Ultrex 82.5WDG applied according to Tom-Cast 15 DSV. When Cabrio 20WG alternated with Bravo Ultrex 82.5WDG was used the yield was significantly higher than the untreated for both the 7-day and Tom-Cast programs.

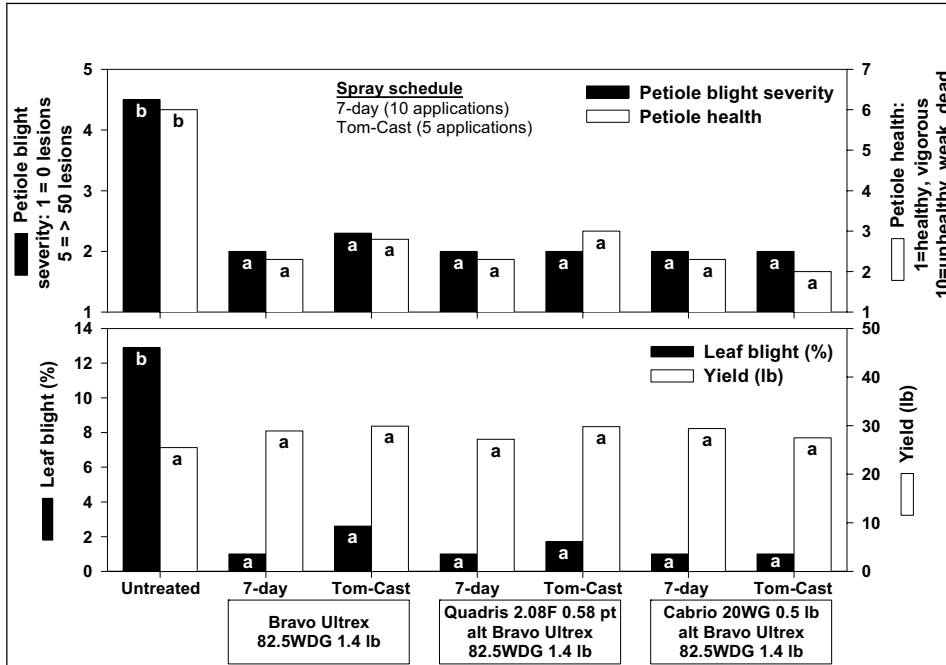


Figure 1. Foliar blight control comparison of Tom-Cast versus 7-day calendar sprays on Bolero (resistant) carrots.

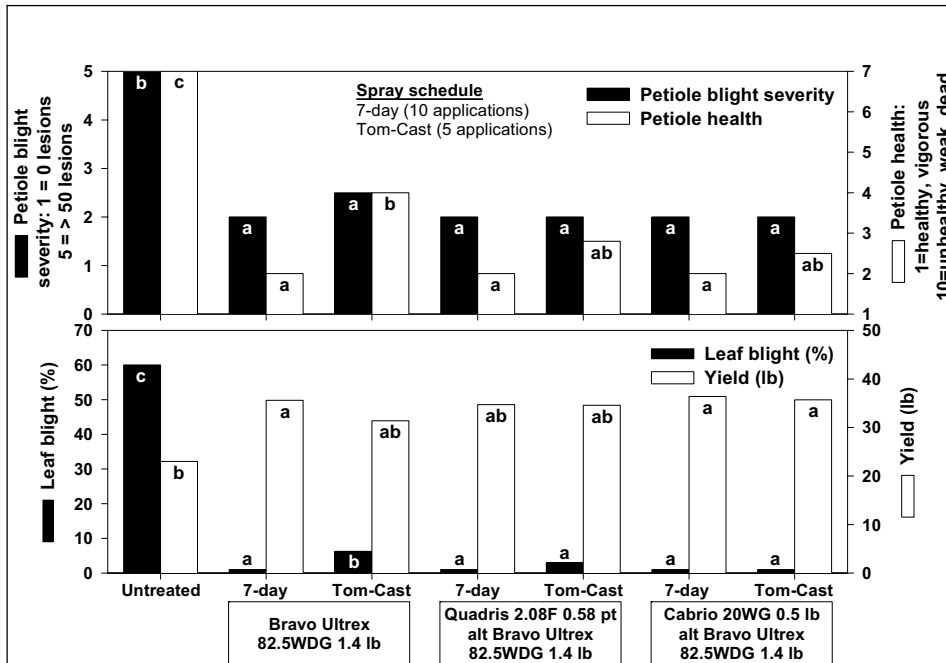


Figure 2. Comparison of the Tom-Cast disease forecaster and a 7-day calendar spray program for the control of foliar blights of 'Fontana' (susceptible) carrots.