CARROT (*Daucus carota* subsp. *sativus*)
Alternaria Leaf Blight; *Alternaria dauci*
Cercospora Leaf Blight; *Cercospora carotae*

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EVALUATION OF FUNGICIDES TO CONTROL CARROT FOLIAR BLIGHTS - HANCOCK, 2000: A field trial was established at Paul Miller Farms, Inc., in central Wisconsin to evaluate fungicide efficacy for control of Alternaria and Cercospora blights. This location was chosen because of previous cropping to carrots and the presence of Alternaria and Cercospora blights on previous crops. Seeds of cultivar Heritage were planted by the grower May 15, approximately 14-16 seeds per foot, using standard commercial equipment. The experimental design was a randomized complete block with four replications. Each plot consisted of one, 6-foot-wide raised bed with three 18-foot-long rows planted in it. Soil type was a Plainfield loamy sand with pH 6.0. Fertilizer consisted of: 5-10-30, 350 lb/A broadcast May 5, prior to planting; 3-18-18-1S, 3 gal/A at planting; sidedress application on July 3 of NH_3SO_4, 100 lb/A + MAP (11-52-0), 50 lb/A + KMag, 200 lb/A + Boron 10 lb/A. Additional nitrogen was applied through irrigation water July 15 (28% UAN, 7.5 gal/A) and August 10 and 23 (32% UAN, 5 gal/A). Foliar applications of Asana XL were made for insect control: 6 fl oz. on June 23; 8 fl oz. on July 29. Weeds were controlled with application of Lorox DF (0.75 lb/A, May 30; 1.2 lb/A. June 15; 1.5 lb/A, July 3). Fungicide treatments were applied with a tractor-mounted boom pressurized with an air compressor. Treatments were applied July 25, August 1, 8, 15, 22, and 29 and September 5 at a rate equivalent to 35 gal water/A at 40 psi, using Tee Jet D3-23 nozzles (8 nozzles at 8-inch spacing). Disease severity was rated for four 3-ft-long sections of the center row of each treatment plot weekly from August 7 to October 2 using the Horsfall-Barratt system. Two five-foot-long sections of row were hand dug from each plot on October 2 and the yield was graded by hand into five size classes (based on diameter) and culls. The size classes were then grouped appropriately to conform to standards for slicing carrots. Yield values were calculated for each treatment based on typical processing contracts. Rainfall recorded for this field (inches) was May-5.08, June-6.93, July-2.3, August-4.55, September-3.51. An additional 5.9 inches of irrigation was applied May-September.

Disease progress in this trial was minimal through most of the growing season. Foliage infection in the untreated control plots did not exceed 50% until the final rating on October 2. All chemical treatments controlled foliar diseases and it was not possible to separate chemical treatments on the basis of disease control. It was particularly interesting that three applications of GibGro Gibberellic Acid provided disease control similar to control observed with any of the remaining fungicide treatments. Significant differences in total yield were not observed between treatments. Only minor differences were observed in the size categories of the harvested roots. Use of reduced risk strobilurin fungicides alone or alternated with chlorothalonil fungicide greatly reduces the amount of fungicide active ingredients (ai) applied in a season-long program when compared with a program using weekly sprays of chlorothalonil alone. Treatment of foliage with GibGro Gibberellic Acid, Cabrio (BAS 500), Quadris or BAS 516 materials, significantly increased the percentage of carrots over 2 inches in diameter. The gross value of yields was statistically similar for all treatments.

Table 1. Description of foliar fungicide treatments.

Treatment chemicals	Rate/Acre		Schedule summary (Application dates: 1 = 7/25, 2 = 8/1, 3 = 8/8, 4 = 8/15, 5 = 8/22, 6 = 8/29 ,7 = 9/5)	Total active ingredient (ai) used during season (lb/A)
	Formulation	a.i.		
1 Untreated Control				0
2 Bravo Ultrex 82.5 WDG	1.8 lb	1.49 lb	Weekly (Appl. 1-7)	10.4
3 GibGro Gibberellic Acid (20%)	0.06 lb	0.012 lb	Appl. 2, 4, 6	0.04
4 Bravo WS	1.5 pt	1.15 lb	Weekly (Appl. 1-7)	8.05
5 Cabrio (BAS 500 02 F 20WG)	1.0 lb	0.2 lb	Weekly (Appl. 1-7)	1.4
6 Quadris 2.08 SC Bravo Ultrex	0.7669 pt 1.0 lb	0.2 lb 0.83 lb	Alternating (1,3,5,7) (2,4,6)	3.3
7 Confidential carrot-1	0.53 lb	0.2 lb	Weekly (Appl. 1-7)	1.4

Table 2. Effect of foliar fungicide treatment on Alternaria and Cercospora leaf blight on carrots.

Treatment number	% Foliage infection (Alternaria and Cercospora blight - combined) [1]						Relative AUDPC [2]
	8/7	8/21	8/30	9/8	9/15	10/2	
1	0.1	2.3	7.6	11.7	15.9	55.5	0.152
2	0.3	1.0	2.9	4.0	3.9	11.7	0.039
3	0.7	0.6	5.4	5.0	4.8	12.9	0.048
4	0.3	1.2	3.2	4.7	4.1	10.2	0.039
5	0.0	0.6	2.3	3.4	3.1	7.3	0.027
6	0.1	1.0	2.8	4.2	3.9	10.0	0.036
7	0.7	0.1	2.3	2.6	2.8	10.0	0.030
Pr > F [3]	0.41	0.14	0.04	< 0.01	0.02	< 0.01	< 0.01
LSD [3]	NS	NS	3.5	4.1	7.2	7.3	0.028

1 Severity of leaf blight symptoms was rated on a Horsfall-Barratt scale of 0 (no infection) to 11 (all foliage dead). No attempt was made to separate symptoms of Alternaria and Cercospora blights. Ratings were converted to percent foliage infection.

2 Relative area under the disease progress curve. Data for each date were plotted on a graph and the area under the line was calculated for each treatment providing a measure of the relative severity of disease throughout the season. A disease rating of 100% foliage infection for the entire season would produce a value of 1.0. All relative AUDPC values are expressed as the proportion of this value. Either decreased disease severity or later disease development will contribute to lower relative areas under the disease progress curve.

3 Analysis of variance was performed on data, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at $P = 0.05$.

Table 3. Effect of foliar fungicide treatment on Alternaria and Cercospora leaf blight on carrots.

Treatment number	Total yield (ton/A)[1]	Percentage of yield for carrot diameter (inches)					% culls	Yield graded as slicers [2]				
								Percentage of yield			Price/ ton ($)	Gross value of yield ($)
		< ¾	¾ - 1 ¼	1 ¼ - 1 5/8	1 5/8 - 2	> 2		¾ - 1 5/8"	> 1 5/8"	Discards		
1	18.2	0.4	6.8	29.1	31.4	23.9	8.4	35.9	55.3	8.8	43.6	721.1
2	18.1	0.5	9.4	24.0	27.8	20.6	17.6	33.4	48.4	18.2	45.7	669.8
3	16.3	0.2	4.1	16.6	27.5	35.8	15.7	20.7	63.3	16.0	43.6	603.0
4	18.8	0.1	5.9	27.9	26.1	23.1	16.9	33.9	49.1	17.0	44.3	696.1
5	19.8	0.1	2.0	14.3	20.1	49.7	13.8	16.3	69.8	13.9	43.6	743.1
6	21.1	0.8	2.5	23.7	25.0	38.6	9.4	26.2	63.6	10.2	43.6	824.4
7	22.5	0.3	6.6	17.6	24.1	39.6	11.8	24.2	63.7	12.1	44.3	877.9
Pr > F [3]	0.21	0.34	0.08	0.19	0.45	< 0.01	0.42	0.08	0.01	0.43	0.03	0.12
LSD [3]	NS	NS	5.1*	NS	NS	15.8	NS	14.5*	12.5	NS	1.4	NS

1 A 10-foot section of row was hand dug in each plot and yield was converted to tons/A. Hand digging is likely to result in a higher apparent yield as fewer carrots are lost than when mechanically dug. Carrots were graded into five size classes or culls (misshapen or rotted). The size classes were then grouped appropriately to conform to standards for slicing carrots. Yield samples were intended only to permit evaluation of quality and relative size distribution of carrots.

2 Values are calculated based on a typical 1999 processing contract for **uncrowned carrots**. Minimum size accepted for slicing contract is 3/4 inch diameter; discard class includes culls and carrots below the minimum diameter. Slicing base price per ton is: <10% over 1 5/8" diameter - $54.70; 10-19%> 1 5/8" - $53.90; 20-29%> 1 5/8" - $52.40; 30-39%> 1 5/8" - $49.40; 40-49%> 1 5/8" - $46.45; >49% > 1 5/8" - $43.60.

3 Analysis of variance was performed on data, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at $P = 0.10$. * indicate differences are significant at $P = 0.10$ but not at $P = 0.05$.