

EVALUATION OF SELECTED FUNGICIDES TO CONTROL PHYTOPHTHORA BLIGHT AND FRUIT ROT OF CUCUMBER, 2000: A field trial was established at a commercial farm near Bancroft, in central Wisconsin in a field with a history of severe loss due to Phytophthora blight and fruit rot, to evaluate efficacy of several fungicides in controlling this disease. Seeds of cultivar Vlaspek M were planted July 7 by the grower, at approximately four seeds per foot, using standard planting equipment. Areas were staked in the field in mid-July to establish plots arranged in a randomized complete block design with four replications. Each plot consisted of three 6-foot-wide beds with three 20-foot-long rows planted in each bed. Soil type was sandy loam with pH 6.3. Plots were fertilized with 28 gal/A liquid formulation 9-6-6-1S at planting, 34-0-0 100 lb/A + Cal Sul 65 lb/A, July 28 and 28% UAN (30 lb N/A), August 9. Weeds were controlled with application of Curbit EC, 2 pt/A, pre-emergence, on July 7. Ridomil Gold 4 EC, 3 fl oz./A, was applied to the commercial field adjacent to the trial by the grower at planting. Plants from the this area were evaluated at harvest to provide a grower standard to compare with experimental treatments. Ridomil Gold was also applied to selected experimental plot areas at planting with a hand-held boom sprayer at a rate equivalent to 8 gal. water/A. Foliar fungicide treatments, beginning on July 31, were applied at 16 psi with a tractor-mounted boom sprayer with a roller pump, equipped with XR11004 extended range flat fan nozzles (13 nozzles, spaced 20 inches apart) delivering 39 GPA. Rainfall (inches) measured at Hancock, WI, the nearest recording weather station, was July - 2.3 and August - 4.55 for a total of 6.85 inches during the growing period. An additional 2.5 inches of water was applied as irrigation during the five days immediately preceding harvest to foster disease development. All plants from a 5-foot-long section of the center row of each of the three beds in each plot were harvested September 1 and evaluated for yield and disease symptoms. For all treatments, each plant was rated as healthy or showing symptoms of Phytophthora blight. All fruit > 1.5 in. long were picked and separated into healthy fruit and those with symptoms of Phytophthora rot. The number and weight of healthy and diseased fruit were recorded. Ten healthy appearing fruit were selected at random from the yield from each plot and stored at approximately 60° F and > 90% relative humidity. After seven days, incidence of fruit with symptoms of Phytophthora rot was recorded.

Wet and warm weather conditions during most of the flowering and fruit growth period favored disease development on vines and fruit. Several treatments appeared to reduce the incidence of vine and fruit infection. Acrobat MZ applied on weeks three and/or four of the flowering period provided only modest levels of control, but all other treatments appeared to control vine infection when compared with the untreated control. It appears that treatments including application of fungicides at planting or during weeks one or two of the flowering period were more effective for disease control than fungicide sprays applied on weeks three or four. The incidence of fruit infection at the time of harvest was lowest in plots treated with either Ridomil Gold at planting or with three sprays of Acrobat 50WP (0.4 lb/acre) + Kocide 2000 (1.86 lb/acre) on weeks 2,3, and 4 of the flowering period. The incidence of disease on fruit, stored for one week after harvest, was also lowest in plots treated with these same programs. Acrobat 50WP mixed with Kocide 2000 (1.86 lb/acre) and applied on weeks 2, 3, and 4 provided significantly better disease control than Acrobat 500 SC (0.4 lb/acre) mixed with Kocide 2000 and applied on the same schedule. Yields of marketable fruit were highest in plots with the least amount of fruit infection. Plant and fruit infection appear to reduce marketable yields by at least 50%, but it is possible, using currently available fungicide-based controls, to produce a reasonable level of disease control. Gross and net values for marketable yield were also highest in plots with the best overall disease control. While the highest crop values were observed in plots treated with Ridomil Gold at planting, resistance management concerns stress the importance of utilizing at least two or more fungicides with different modes of action to offset this resistance concern. Thus the relatively low cost for multiple treatments with Kocide 2000 plus Acrobat 50WP, in addition to the application of Ridomil Gold at planting, fits nicely into a season-long approach to managing this disease. This combination provides acceptable disease control at a relatively low cost while addressing resistance management concerns.

Table 1. Summary of treatments applied.

#	Treatment	Rate/Acre		Schedule Summary
		Product	Active ingredient	
1	Untreated			
2	Ridomil Gold	3 fl oz	0.1 lb	At planting
3	Acrobat MZ 69 WP	2.25 lb	1.553 lb	Weekly (Appl. 1-4)
4	Acrobat MZ	2.25 lb	1.553 lb	Appl. 2-4
5	Acrobat MZ	2.25 lb	1.553 lb	Appl. 3-4
6	Acrobat MZ	2.25 lb	1.553 lb	Appl. 4
7	Acrobat 50 WP + Kocide 2000 (53.8%)	0.4 lb 1.86 lb	0.2 lb 1.0 lb	Appl. 2-4

#	Treatment	Rate/Acre		Schedule Summary
		Product	Active ingredient	
8	Acrobat 50 WP + Aliette WDG	0.4 lb 5.0 lb	0.2 lb 4 lb	Appl. 2-4
9	Ridomil Gold Acrobat MZ	3.2 fl oz 2.25 lb	0.1 lb 1.553 lb	At planting Appl. 4
10	Acrobat 500 SC + Kocide 2000 (53.8%)	0.39 pt 1.86 lb	0.2 lb 1.0 lb	Appl. 2-4
11	Grower Standard - Ridomil Gold	3.2 fl oz	0.1 lb	Applied <i>by grower</i> at planting, area adjacent to trial

Application Dates: Jul. 31 (Appl. 1); Aug. 7 (Appl. 2); Aug 14 (Appl. 3); Aug 21 (Appl. 4)

Table 2. Effect of fungicide treatment on disease development on vines and fruit, and yield of cucumbers.

Treatment number	Vines/15 feet of row			Fruit harvested/15 feet of row						Yield of healthy fruit (hand harvest, ton/A)	Relative yield (as % of grower standard) ¹	Adjusted yield, relative to commercial harvest ²	Cost of chemicals/A (\$) ³	Relative gross value of yield (\$) ⁴	Net value of yield (\$) ⁵	Effect of treatment on value (\$) ⁶	% Diseased fruit after 1 week storage	
	Number		Incidence of diseased vines (%)	Number		Inci-dence of diseased fruit (%)	Weight (lb)		Diseased fruit (% by weight)									
	Healthy	Dis-eased		Healthy	Dis-eased		Healthy	Dis-eased										
1	31.5	8.5	21.1	65.0	30.0	31.4	12.8	4.3	26.7	9.3	45	2.5	0	312.50	312.50	0	62.5	
2	39.0	1.3	3.6	82.0	4.0	4.8	23.7	0.6	2.6	17.2	84	4.7	15.88	587.50	571.62	259.12	20.0	
3	38.3	2.5	7.7	80.5	12.5	12.3	19.4	1.9	10.0	14.1	69	3.9	96.57	487.50	390.93	78.43	42.5	
4	30.3	2.0	5.2	58.8	7.8	11.1	17.1	0.9	5.5	12.4	60	3.4	72.43	425.00	352.57	40.07	40.0	
5	39.8	4.8	10.7	76.8	15.3	16.0	19.6	1.6	8.6	14.2	69	3.9	48.29	487.50	439.21	126.71	55.0	
6	33.0	5.3	14.5	56.3	22.8	28.6	13.2	3.2	19.9	9.6	47	2.7	24.14	337.50	313.36	0.86	65.0	
7	43.0	0.8	1.9	83.5	2.0	2.4	25.6	0.2	0.8	18.6	91	5.1	31.53	637.50	605.97	293.47	32.5	
8	39.8	4.3	8.7	66.0	30.0	29.2	12.5	4.3	26.1	9.1	44	2.5	163.74	312.50	148.76	-163.74	65.0	
9	31.3	2.5	7.0	67.5	12.8	14.5	18.1	1.5	8.5	13.2	64	3.6	40.02	150.00	409.98	97.48	45.0	
10	39.8	1.5	4.4	75.3	14.5	17.1	20.5	2.8	14.0	14.8	72	4.1	---	512.50	---	---	67.5	
11	39.8	1.1	3.0	88.9	2.3	2.4	28.2	0.4	1.4	20.5	100	5.6	15.88	700.00	684.12	371.62	5.0	
Pr > F ⁷	0.22	0.12	0.13	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	---	---	---	---	---	---	---	0.08
LSD ⁷	NS	NS	NS	15.6	14.7	13.9	6.5	2.0	12.8	4.7	---	---	---	---	---	---	---	41.9*

1. Treatment 11 consisted of samples taken from adjacent areas of the commercial field which were not commercially harvested. Commercial harvest was done a week prior to our evaluation so fruit had grown past commercial size and total weight of yield was much higher for our trial than at the time of commercial harvest. Setting the yield for these samples from the commercial field as 100%, relative yield of the other treatments is expressed as a percentage of this.
2. Actual commercial harvest was 5.6 ton/A with a value of \$125/ton. Figures in this column are the result of multiplying this value for commercial harvest by the % relative yield (the column to the left).

3. Season-long cost of chemicals applied. Retail prices used: Acrobat 50WP - \$13.95/lb; Acrobat MZ 69 WDG - \$10.73/lb; Aliette WDG \$9.80/lb; Kocide 2000 - \$2.65/lb; Ridomil Gold 4EC - \$635/gal. Costs were not calculated for experimental treatments.
4. Adjusted yield x value of \$125/ton.
5. Gross value - cost of chemicals.
6. (Net value of yield for treatment) – (net value of yield for the untreated control [treatment #1]).
7. Analysis of variance was performed on data, and Fisher's protected least significant difference (LSD) was calculated. NS = not significant at $P = 0.10$. * indicates significant at $P = 0.10$ but not at $P = 0.05$.