

# Cucurbit Downy Mildew Control in Virginia

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## Introduction

Cucurbit downy mildew, caused by the fungus *Pseudoperonospora cubensis*, has rapidly become the worst pathogen of cucurbits in Virginia. Management of this disease over the past few years has become increasingly problematic. Recently, the fungus has developed resistance to QoI fungicides and demonstrated increased virulence and survival skills at warmer temperatures. In Virginia, the fungicides Ranman and Previcur Flex are currently recommended for control of cucurbit downy mildew. These two fungicides should be tank mixed and/or rotated with protectant fungicides containing either mancozeb or chlorothalonil on a 7 to 10 day spray regime to ensure suppression. Further research needs to be conducted on cucurbit downy mildew to increase the options available for control of this disease. Presented below are the results from our cucurbit downy mildew research trials conducted in 2006 & 2007.

## Materials and Methods

In 2006 and 2007 we screened the same 12 treatments versus downy mildew on three cucurbit crops (cucumber, cantaloupe and pumpkin) for each year for a total of 6 trials. For both 2006 and 2007 trials, the varieties used were: SMR58 (cucumber), Athena (cantaloupe), and SnackJack (pumpkin). Plots at Virginia Tech’s Eastern Shore AREC consisted of single 20-ft rows spaced 6-ft apart bordered by non-treated rows. Treatments were replicated four times and arranged in randomized complete block designs. Applications were made with a CO<sub>2</sub>-pressurized backpack sprayer calibrated to deliver 40 gal/A at 40 psi. The spray boom for these applications was equipped with three 11004 twin jet nozzles per row. The two outer nozzles were mounted on 15-in drop tubes with the remaining nozzle being centered over the row. Powdery mildew was controlled in all treatments including the nontreated with weekly sprays of Quintec 2SC at 4 fl oz/A alternated with Nova 40W at 5 oz wt/A. Treatments were applied on a 5- to 10- day schedule, specific application dates for each trial are listed in Table 1. Treatment lists for the six trials are listed in Table 2.

Table 1. Application dates for each individual downy mildew trial.

Application	2006			2007		
	Cantaloupe	Cucumber	Pumpkin	Cantaloupe	Cucumber	Pumpkin
A	11-Sep	11-Sep	23-Aug	5-Sep	4-Sep	30-Aug
B	19-Sep	18-Sep	31-Aug	13-Sep	10-Sep	6-Sep
C	27-Sep	27-Sep	8-Sep	19-Sep	14-Sep	12-Sep
D	4-Oct	4-Oct	15-Sep	25-Sep	21-Sep	19-Sep
E	13-Oct	13-Oct	21-Sep	3-Oct	28-Sep	26-Sep
F	N/A	N/A	28-Sep	13-Oct	N/A	4-Oct

Table 2. Treatment list for the six cucurbit downy mildew trials.

Treatment#	Application					
	A	B	C	D	E	F
1	None	None	None	None	None	None
2	Previcur 1.2 pt/A		Previcur 1.2 pt/A		Previcur 1.2 pt/A	
	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A
3	Ranman 2.75 oz/A		Ranman 2.75 oz/A		Ranman 2.75 oz/A	
	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A
4	Pristine 15 oz/A		Pristine 15 oz/A		Pristine 15 oz/A	
	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A
5	QuadrisOpti 3.2pt/A		QuadrisOpti 3.2pt/A		QuadrisOpti 3.2pt/A	
		BravoWS 3 pt/A		BravoWS 3 pt/A		BravoWS 3 pt/A
6	Tanos 8 oz/A		Tanos 8 oz/A		Tanos 8 oz/A	
	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A
7	Tanos 8 oz/A	Curzate 3.2 oz/A	Tanos 8 oz/A	Curzate 3.2 oz/A	Tanos 8 oz/A	Curzate 3.2 oz/A
	Manzate 1.5 lb/A	BravoWS 3 pt/A	Manzate 1.5 lb/A	BravoWS 3 pt/A	Manzate 1.5 lb/A	BravoWS 3 pt/A

8	Curzate 3.2 oz/A		Curzate 3.2 oz/A		Curzate 3.2 oz/A	
	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A
9	Revus 8 oz/A		Revus 8 oz/A		Revus 8 oz/A	
	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A
10	Revus 8 oz/A	QuadrisOpti 3.2pt/A	Revus 8 oz/A	QuadrisOpti 3.2pt/A	Revus 8 oz/A	QuadrisOpti 3.2pt/A
	BravoWS 3 pt/A		BravoWS 3 pt/A		BravoWS 3 pt/A	
11	Previcur 1.2 pt/A	Ranman 2.75 oz/A	Previcur 1.2 pt/A	Ranman 2.75 oz/A	Previcur 1.2 pt/A	Ranman 2.75 oz/A
	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A
12	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A	BravoWS 3 pt/A

For each trial, disease incidence and severity assessments were made periodically throughout the season. In 2006, Area Under Disease Progress Curve (AUDPC) values were calculated. For 2007, final disease severity values were used for analyses due to only two assessments being made. Yields were collected from each trial (other than the 2006 cantaloupe trial). Data was analyzed using analysis of variance, treatment means were separated using Fisher's LSD.

## Results and Discussion

Cucurbit downy mildew disease assessments and yield data are presented in Tables 3 and 4, respectively. In all six trials, the nontreated control (treatment 1) produced the highest disease severity values and the lowest yield. Treatments featuring combinations of Previcur and Ranman performed the best in these trials. Consistently higher yields and lower disease pressure was realized in treatments 2, 3, and 11. In most cases, these treatments outperformed the straight protectant (Bravo/chlorothalonil) spray program (treatment 12). Inconsistencies were noted with the spray treatments that relied upon strobilurin (QoI) fungicides (treatments 4-8). In some trials these treatments looked competitive, but, in others disease severity was high and yield was low. Revus is a new fungicide available in 2008 from Syngenta. Results with Revus were perplexing (treatments 9 & 10). Revus performed poorly when trialed on cucumber and cantaloupe, but looked outstanding on pumpkin.

Virginia Tech recommends the use of Previcur Flex and Ranman for cucurbit downy mildew control. No changes in this recommendation are warranted based upon the results from these trials. While other fungicides may offer marginal disease control, they cannot consistently reduce disease levels and increase yields.

Table 3. Disease assessment results for the six cucurbit trials.

Treatment#	2006 Severity AUDPC Values <sup>y</sup>			2007 Final Disease Severity (%)		
	Cantaloupe	Cucumber	Pumpkin	Cantaloupe	Cucumber	Pumpkin
1	799 a	901 a	861 a	96.3 a	71.3 a	90.0 a
2	299 bc	175 e	467 de	30.0 def	35.0 gh	51.3 fg
3	281 bc	215 cde	574 b	33.8 de	31.3 h	45.0 gh
4	348 bc	278 cd	558 bc	28.8 ef	40.0 ef	62.5 def
5	358 bc	277 cd	498 cd	38.8 cd	47.5 bc	72.5 bcd
6	367 bc	194 de	615 b	22.5 f	36.3 fg	70.0 cde
7	454 b	301 bc	556 bc	46.3 bc	50.0 b	83.8 ab
8	314 bc	268 cd	551 bc	37.5 cde	41.3 de	60.0 ef
9	225 c	381 b	489 cd	31.3 def	45.0 cd	56.3 fg
10	234 c	252 cde	473 de	37.5 cde	45.0 cd	38.8 h
11	241 c	169 e	413 e	NT <sup>z</sup>	33.8 gh	38.8 h
12	327 bc	381 b	561 bc	30.0 def	46.3 bc	78.8 abc

<sup>y</sup> - means followed by the same letter are not significantly different (p=0.05) according to Fisher's LSD.

<sup>z</sup> - NT = Not Tested

Table 4. Yields for the six cucurbit trials.

Treatment#	2006 Trials <sup>y</sup>			2007 Trials		
	Cantaloupe Not Rated	Cucumber (lb/A)	Pumpkin (ton/A)	Cantaloupe (lb/A)	Cucumber (bu/A)	Pumpkin (ton/A)
1	N/A	16 d	0.3 e	5439 b	22 d	1.2 e
2	N/A	2106 a	4.2 abc	11948 a	424 a	2.0 bcd
3	N/A	1399 ab	3.4 bcd	12764 a	519 a	2.3 abc
4	N/A	663 cd	2.2 d	12164 a	264 bc	1.8 b-e
5	N/A	1714 a	3.2 cd	13924 a	233 c	1.7 cd
6	N/A	2056 a	2.0 d	13993 a	384 abc	1.9 bcd
7	N/A	503 cd	2.4 d	11340 a	236 c	1.5 de
8	N/A	896 bc	2.1 d	14258 a	409 ab	1.7 de
9	N/A	615 cd	4.7 ab	13086 a	232 c	2.6 a
10	N/A	785 bc	5.1 a	13176 a	245 c	2.3 abc
11	N/A	1615 a	4.3 abc	NT <sup>z</sup>	510 a	2.8 a
12	N/A	387 cd	2.4 d	12378 a	241 c	1.8 b-e

<sup>y</sup> - means followed by the same letter are not significantly different (p=0.05)

according to Fisher's LSD.

<sup>z</sup> - NT = Not Tested