CoRoN Enhancement of Pumpkin Fungicides:

Effects on Foliar Diseases

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Interpretative Summary

The effect of fungicides and foliar fertilizers on pumpkin diseases and yield was evaluated in a field test of small, ornamental pumpkins. Sprays of azoxystrobin and chlorothalonil reduced the severity of downy mildew, the incidence of Microdochium blight, and plant loss to disease. Chlorothalonil also reduced the severity of powdery mildew. Foliar nitrogen (CoRoN) appeared to reduce downy mildew severity late in the season. Combining foliar nitrogen with foliar phosphorous and potassium appeared to increase powdery mildew severity. Yields were significantly increased with sprays of azoxystrobin, chlorothalonil, aluminum tris, or foliar phosphite 0-28-26.

Introduction

The purpose of this study was to evaluate the effects of CoRoN, a controlled-release foliar nitrogen source, on the efficacy of fungicides used to control pumpkin diseases and on pumpkin yield and fruit quality. Similar tests were conducted with other cooperators at two sites in Mississippi, Crystal Springs and Verona. Only the results of the Tennessee study are reported here.

Materials and Methods

The test was conducted at the University of Tennessee=s West Tennessee Experiment Station. Six foliar spray treatments, with and without CoRoN, were evaluated: Quadris 2.08F (azoxystrobin) at 15.4 fl oz/A alternated with chlorothalonil at 2 pint/A, Equus 720 (chlorothalonil) at 2 pint/A, Aliette WDG (aluminum tris) at 3 lb/A, Armicarb 100 (potassium bicarbonate) at 4 lb/A, foliar phosphite 0-28-26 (phosphorus acid and soluble potassium) at 3 pint/A, and a water control. CoRoN (28 % total N) was applied at 1 pint/A (9 August), 1 quart/A (16 August), or 2 quart/A (remaining sprays). All sprays were applied at 20 psi with a CO_2 sprayer equipped with a hand-held horizontal boom and 1 to 3 flat fan nozzles (nozzle number increased as plant size increased). Sprays were applied six times: August 9, 16, 23, and 29 and September 6 and 13.

A randomized complete block design with four replications was used. Experimental units consisted of a single row of ten Lil= Goblin pumpkins (Harris Seeds) seeded 2 ft. apart. This variety has a compact vine, no resistance to powdery mildew, and produces small 1-2 lb.

ornamental pumpkins about 4 inches in diameter. The test was planted by hand on 19 July. Plots not receiving CoRoN were sidedressed with 32 lb N/A on 14 August.Plants were rated for disease incidence and/or severity on four occasions: August 23, September 5-6, 14-16, and 27-28. Disease severity ratings were on a 0 - 5 scale where 0=no disease and 1=1%, 2=10%, 3=30%, 4=60%, and 5=100% of leaf area with disease lesions. Intermediate scale points (e.g., 1.5, 2.5, 3.5...) were used where appropriate. Ratings were changed to percentage data using the formula %leaf area = $1.5625 - 5.625x + 5.0625x^2$, where x=the severity rating. For analysis of variance, arcsin transformed percentages were used. ANOVA results in tables report these analyses; percentages are the disease ratings before transformation.

Multiple locations and multiple observations at each location were used to gather data on the severity of downy mildew. Four locations were used per one-row plot, two on the south side of the row and two on the north side of the row (rows ran nearly straight east- west). At each location, the severity of downy mildew in the upper leaf canopy and lower leaf canopy were recorded. Powdery mildew disease severity was based on only two observations per plot, one on the north side and one on the south side. Disease incidence data for Microdochium blight and yellow vine are the percentages of plants severely affected with these diseases based on the original number of plants per row.

Results and Discussion

No foliar diseases were observed on August 23. One dead plant and seven plants showing signs of decline due to yellow vine were noted. The test received several heavy rainfalls August 27 - September 4 (total rainfall: 3.38 in.). By September 5, most plants showed some signs of infection with downy mildew, and an occasional plant was infected with powdery mildew. Microdochium blight was causing the decline of many plants and yellow vine was becoming more common. Both Quadris 2.08F and Equus 720 significantly reduced the incidence of Microdochium blight (Table 1) and downy mildew severity (Table 2) compared to the control and all other treatments. Yellow vine incidence and powdery mildew severity were unaffected by treatment. CoRoN had no apparent effect on fungicide efficacy.

By September 14, severe leaf loss due to downy mildew was apparent in all plots (Table 3), and powdery mildew was becoming more common in plots receiving Equus 720. Significant interactions between CoRoN use and other treatments were noted. These were most apparent with downy mildew for the water control and with powdery mildew for foliar phosphite (Table 4). Foliage loss due to downy mildew was so severe by September 28 that further disease severity ratings were not possible. Plant losses, mainly due to Microdochium blight plus some yellow vine, were noted. Quadris 2.08F and Equus 720 significantly reduced these losses (Table 5). CoRoN had no apparent effect on plant survival.

The center eight plants in each plot were harvested 2 - 3 October. All treatments except

Armicarb 100 significantly increased pumpkin yield (Table 6) compared to the water control. Yields with Quadris 2.08F were significantly greater than those of all other treatments, both in terms of the number of pumpkins harvested and total weight of marketable fruit. Applications of CoRoN did not significantly affect yield, and there were no significant interactions between CoRoN use and the other spray treatments. A notable (P = 0.10) decrease in marketable fruit with use of CoRoN was observed, however. The numbers of unmarketable pumpkins due to rot (mean = 7%) or misshaped fruit (mean = 1%) were unaffected by treatment.

Table 1. Effects of CoRoN and fungicide treatment on the incidence of yellow vine and Microdochium blight on Lil= Goblin pumpkin, September 5 - 6, 2001, Jackson, TN.

Disease incidence ((% of plants dead or dying due to disease)				
Treatment	Yellow vine		Microdochium blight	
without CoRoN	6		12	
with CoRoN	9		10	
Quadris 2.08F	9		0	b*
Equus 720	5		0	b
Aliette 80WDG	4		21	a
Armicarb 1–	9		15	a
Foliar phosphite 0-28-26	6		14	a
water	14		14	a
ANOVA results				
Source	F Value	(Prob. >F)	F Value	(Prob >F)
fungicide	0.99	0.44	5.78	0.0006
CoRoN	0.99	0.33	1.29	0.26
Fungicide x CoRoN	0.60	0.70	0.23	0.94

Rep	2.27	0.10	0.38	0.77

*Values are the means of four replications. Means followed by a different letter are significantly different (P = 0.05).

Table 2. Effects of CoRoN and fungicide treatment on the severity of downy mildew and powdery mildew on Lil= Goblin pumpkin, September 5 - 6, 2001, Jackson, TN.

Disease severity (% leaf area)				
Treatment	Downy mildew		Powdery mildew	
without CoRoN	18		0.6	
With CoRoN	20		0.6	
Quadris 2.08F	6	c*	0.0	
Equus 720	7	c	0.7	
Aliette 80WDG	23	ab	1.4	
Armicarb 100	25	ab	0.3	
Foliar phosphite 028-26	17	b	0.9	
Water	36	a	0.3	
ANOVA results				
Source	F Value	(Prob >F)	F Value	(Prob >
fungicide	11.09	0.0001	2.04	0.10
CoRoN	0.61	0.44	0.25	0.62
Fungicide x CoRoN	1.04	0.41	0.66	0.66
Rep	9.35	0.0001	2.27	0.10

*Values are the means of four replications. Means followed by a different letter are significantly different (P = 0.05).

Other means of interest:

	upper leaf canopy	lower leaf canopy
Downy mildew severity:	23 %	15%

	south side of row	north side of row
Downy mildew severity:	16 %	22%

(rows ran nearly straight east-west)

Table 3. Effects of CoRoN and fungicide treatment on the severity of downy mildew and powdery mildew on Lil= Goblin pumpkin, September 14 - 16, 2001, Jackson, TN.

Disease severity (% leaf area)				
Treatment	Downy mildew		Powdery mildew	
without CoRoN	60		3	
with CoRoN	59		3	
Quadris 2.08F	64	ab*	4 b	
Equus 720	59	abc	8 a	
Aliette 80WDG	58	bc	2 b	
Armicarb 100	54	c	1 b	
Foliar phosphite 0-28-26	55	c	2 b	
water	666	a	1 b	
ANOVA results				
Source	F Value	(Prob >F)	F Value	(Pr >F)

fungicide	3.20	0.02	5.54	0.0008
CoRoN	0.08	0.77	0.01	0.90
Fungicide x CoRoN	2.58	0.04	2.66	0.04
Rep	12.22	0.0001	6.53	0.001

*Values are the means of four replications. Means followed by a different letter are significantly different (P = 0.05).

Other means of interest:

upper leaf canopy lower leaf canopy

Downy mildew severity: 80 % 39%

south side of row north side of row

Downy mildew severity: 58 % 61%

Powdery mildew severity: 1 % 4 %

(rows ran nearly straight east-west)

Table 4. Effects of fungicide treatments with (+) and without (-) CoRoN on the severity of downy mildew and powdery mildew on Lil= Goblin pumpkin, September 14 - 16, 2001, Jackson, TN.

Disease severity (% leaf area)				
reatment #		Downy mildew		Powdery mildew
uadris 2.08f	+	61	bc*	2 bcde
uadris 2.08F	-	66	ab	5 bcd
quus 720	+	58	bcd	10 a
quus 720	-	61	bc	5 ab

Aliette 80WDG	+	58	bcd	4 bcd
Aliette 80WDG	-	58	bcd	0 de
Armicarb 100	+	59	bcd	1 cde
Armicarb 100	-	49	d	1 cde
Foliar phosphite 0-28-26	+	59	bcd	0 e
Foliar phosphite 0-28-26	-	51	cd	4 bc
water	+	59	bcd	2 bcde
water	-	73	a	1 cde

ANOVA results

Source	F Value	(Prob >F)	F Value	(Prob >F)
treatment	2.64	0.02	3.73	0.002
rep	12.22	0.0001	6.53	0.001

*Values are the means of four replications. Means followed by a different letter are significantly different (P = 0.05).

Table 5. Effects of CoRoN and fungicide treatment on total losses of Lil= Goblin pumpkin plants, September 27-28, 2001, Jackson, TN.

reatment	Plant loss (% of plants dead or dying)	
ithout CoRoN	37	
ith CoRoN	42	
uadris 2.08F	28	b*
quus 720	25	b

Aliette 80WDG	51	a
Armicarb 100	396	ab
Foliar phosphite 90-28-26	43	ab
water	51	a
ANOVA results		
Source	F Value	(Prob >F)
fungicide	3.35	0.01
CoRoN	0.82	0.37
Fungicide x CoRoN	0.42	0.83
rep	6.31	0.002

*Values are the means of four replications. Means followed by a different letter are significantly different (P = 0.05).

Table 6. Effects of CoRoN and fungicide treatment on the yield of Lil= Goblin pumpkin, Fall, 2001, Jackson, TN.

reatment	Number fruit/acre		Number lbs/A	
ithout CoRoN	6945		7274	
ith CoRoN	5856		6098	
uadris 2.08F	8531	a	9594	a
quus 720	7115	b	7970	b
liette 80WDG	6788	b	6758	b
rmicarb 100	3993	c	3794	c

Foliar phosphite 0-28-26	7006	b	7180	b
water	4973	c	4821	c
ANOVA results				
Source	F Value	(Prob >F)	F Value	(Prob >F)
fungicide	5.90	0.002	7.50	0.0006
CoRoN	3.92	0.06	3.51	0.08
Fungicide x CoRoN	0.241	0.94	0.20	0.96
Rep	5.54	0.007	6.78	0.003

*Values are the means of four replications

This research represents one season's data and does not constitute recommendations. After sufficient data is collected over the appropriate number of seasons, final recommendations will be made through research and extension publications.