Can Mustard Cover Crops Reduce Plectosporium Blight in Pumpkin?

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RESEARCH HYPOTHESIS – The objective of this study was to determine if seeding a mustard cover crop prior to planting a pumpkin cash crop could act as a biofumigant, reducing the symptoms of Plectosporium blight in pumpkin.

INTRODUCTION

Ohio growers produced 4,000 acres of pumpkins in 2018 with an estimated farm gate value of $10.6M (USDA Quick Stats). Pumpkins are seen by many growers as one of the last cash crops heading into the fall, so a good crop is important to the farm economically. While we have trained and educated growers over the past decade to scout and treat many recurring diseases like powdery mildew and downy mildew, there are several soil borne diseases like phytophthora, fusarium and Plectosporium blight that are difficult to control using tolerant germplasm or fungicides, so it's difficult to provide useful management recommendations. Plectosporium blight, aka white speck, is a disease seen by many growers in their fields and is considered on the rise in Ohio. Instead of using a fungicide based program to control this disease, research has been undertaken to use mustard cover crops as a soil biofumigant to reduce the inoculum and therefore lower the impact of this disease.

METHODS

The experiment was conducted at the Western Agricultural Research Station in South Charleston, OH. The field site selected had pumpkin in 2018 that became severely infected by Plectosporium blight. Prior to drilling the three mustard cover crop (MCC) treatments (Pacific Gold 6 lb/A, Caliente 199 11 lb/A, and a half rate blend of both mustards) on 10 Apr, 100 lb/A of urea and 17 lb/A of ammonium sulfate were disked into the field.

At full bloom the MCC was bush hog mown, roto-tilled 3-4" into the soil, culti-mulch packed and sprayed with water (2,000 GPA) to seal the soil, all within 15 minutes (**Figure** 1). This was done on 4 Jun for Pacific Gold and on 12 Jun for Caliente 199 and the MCC blend. Pumpkin transplants were set at the first leaf stage on 27 Jun using a mechanical transplanter and side-dressed with nitrogen at 75 lb/A on 28 Jun. Each plot consisted of a single 45-ft long row planted on 15-ft center with transplants spaced 3.5-ft within the row. Plots were arranged in a randomized complete block design with four replicates of each treatment.

Figure 1. Steps to incorporate mustard cover crop as a biofumigant (A) mowing, (B) rototilling, (C) packing and (D) sealing; all performed within 15 minutes.

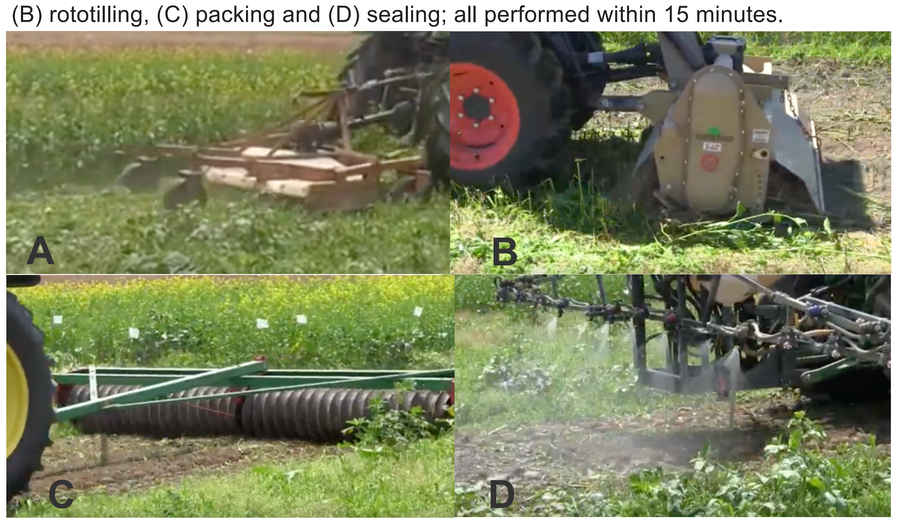

Table 1. Disease severity of Plectosporium blight on foliage.

	Symptoms of Plectosporium blight on petioles and leaves (%)[z]					
Treatment	20 Aug		4 Sep		13 Sep	
	Petiole	Leaf	Petiole	Leaf	Petiole	Leaf
Untreated check	0.7	0.8	1.7	3.1	2.7	1.2
Pacific Gold [y, x, v]	0.4	0.4	1.0	3.2	2.2	1.8
Caliente 199 [y, x, v]	0.1	0.1	0.7	0.6	1.7	1.0
Pacific Gold plus Caliente 199 blend [y, x, v]	0.5	0.1	1.6	1.1	1.3	0.7
Flint 2 oz alt. w/ Cabrio EG 16 fl oz [y, w]	0.1	0.1	0.7	0.5	0.6	0.3
P-value [u]	NS	NS	NS	NS	NS	NS

[z] 23 Jul and 7 Aug scouting revealed zero lesions on 99% of petioles and leaves, data not reported here.
[y] Foliar fungicide application dates: 1= 26 Jul; 2= 2 Aug; 3= 12 Aug; 4= 21 Aug; 5= 30 Aug; 6= 5 Sep.
[x] Fungicide program 1- Procure 8 fl oz/A (1,3,5) alternated with Quintec 6 fl oz/A (2,4,6).
[w] Fungicide program 2-Flint 2 oz/A (1,3,5) alternated with Cabrio 16 fl oz/A (2,4,6).
[v] Mustard cover crop used for biofumigation.

Table 2. Disease severity of Plectosporium blight on fruit.

	Plectosporium blight effects on fruit and yield, harvested 20 Sep.				
Treatment	Total fruit	Mean fruit wt (lb)	Mean treatment wt (lb)	Fruit infection (%)	Handles infected (<5%)
Untreated check	42	18.0 bc [u]	189.1	0	0
Pacific Gold [y, x, v]	54	17.2 bc	230.8	0	2
Caliente 199 [y, x, v]	50	20.1 a	250.0	0	0
Pacific Gold plus Caliente 199 blend [y, x, v]	55	18.8 ab	256.9	0	1
Flint 2 oz alt. w/ Cabrio EG 16 fl oz [y, w]	50	16.8 c	210.8	0	0
P-value	NS	0.01	NS	NS	NS

[z] 23 Jul and 7 Aug scouting revealed zero lesions on 99% of petioles and leaves, data not reported here.
[y] Foliar fungicide application dates: 1= 26 Jul; 2= 2 Aug; 3= 12 Aug; 4= 21 Aug; 5= 30 Aug; 6= 5 Sep.
[x] Fungicide program 1- Procure 8 fl oz/A (1,3,5) alternated with Quintec 6 fl oz/A (2,4,6).
[w] Fungicide program 2-Flint 2 oz/A (1,3,5) alternated with Cabrio 16 fl oz/A (2,4,6).
[v] Mustard cover crop used for biofumigation.
[u] Column numbers followed by same letter are not significantly different P=0.05.

METHODS CONTINUED

A Procure alternated with Quintec fungicide program was applied to all three MCC treatments for only powdery mildew control. A known control of Plectosporium blight, Flint alternated with Cabrio, was applied to one non-MCC treatment. The fifth treatment was an untreated check plot with neither MCC nor fungicides applied. Foliar fungicide applications were made on 26 Jul; 2, 12, 21, 30 Aug; and 5 Sep at 65 PSI and 38 GPA. Plectosporium blight scouting began 23 Jul when five petioles per plot were examined for symptoms. Ten petioles and leaves per plot were examined on 7 Aug, 20 Aug, 4 Sep, and 13 Sep. On 20 Sep all fruit from plots were harvested, weighed and graded. Two-way ANOVA was performed on the data with means separated using LSD (SAS v9.4).

RESULTS

Plectosporium blight was first detected in the trial on 23 Jul but remained at low infestation levels throughout the trial, likely due to lack of significant precipitation from mid Jul – early Oct. No significant differences in Plectosporium symptoms could be detected on the leaves or petioles between any treatments over all five sample dates (**Table** 1). Data trends on the foliage include the highest level of infestation on the untreated check and lowest level on the Flint alternated with Cabrio treatment, with the MCC treatments intermediate, suggesting that both specific fungicide combination and the biofumigation process may have suppressed infestation. Mean fruit weight from the Caliente 199 treatment was significantly heavier than the untreated check, Pacific Gold, or Flint alternated with Cabrio treatment (**Table** 2). No Plectosporium lesions were detected on the fruit and only very minor lesions were observed on three pumpkin handles.

CONCLUSIONS

-Dry conditions from mid to late summer reduced disease development overall

-No immediate disease reduction benefit was observed using biofumigation in this trial

-Flint alt. w/ Cabrio suppressed Plectosporium blight but did not control powdery mildew

-Non-disease benefits of mustard cover crops, e.g. pollinator habitat, increased organic matter, water holding capacity, nutrient management, etc. should not be overlooked

-This study received funding to be repeated in 2020

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