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Pumpkin Powdery Mildew Fungicide Demonstration Trial Report - 2016

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Introduction

A powdery mildew (PM) fungicide evaluation trial was conducted on pumpkin at the Western Ag Research Station in South Charleston, OH. All treatments (Table 1) were applied to a powdery mildew susceptible hybrid (Solid Gold, Rupp Seeds) to determine the efficacy the compounds on foliage health; no yield data was taken.

Methods

The trial was direct seeded on May 26th using a Monosem vacuum seeder. Each plot consisted of two 80' long rows of Solid Gold pumpkin planted on 5' centers and thinned to a final density of 2' within the row. Plots were separated by a 15' drive lane on each side with a 10' fallow space between each plot. Both spacing measures were designed to minimize spray drift between plots. The seeds were treated with Farmore (thiamethoxam) to limit striped cucumber beetle feeding and minimize transmission of bacterial wilt.

On May 23, fertilizer was added uniformly using a broadcast spreader with 50 lb N, 100 lb P, and 100 lb K actual applied per acre. Prior to vine tip each row was side dressed once with liquid 28-0-0 at the rate of 40 lb N per acre on June 17th.

Weeds were managed by spraying Strategy (5 pt /A) plus Dual Magnum (1.6 pt /A) broadcast pre emerge on May 27 followed by an application of Sandea (1.0 oz/A) via shielded sprayer between the rows prior to vines running on June 21. Any weed escapes between the rows or between plots were either hand pulled or hoed out. There was a fall planted winter rye cover crop that was rolled and killed prior to planting in this field.

Powdery mildew development was evaluated on six randomly chosen leaves per plot. Each leaf was examined on the upper and lower surface for powdery mildew colonies. Prior to each rating a pictorial guide (Fig. 1) representing percent PM infestation was used to calibrate our visual assessment to better approximate the percent infestation seen on each leaf surface. This chart was carried during the evaluation and periodically referred to for accuracy. During each evaluation an effort was made to choose leaves of a consistent age from both the lower and upper canopy that represented the product efficacy fairly. These

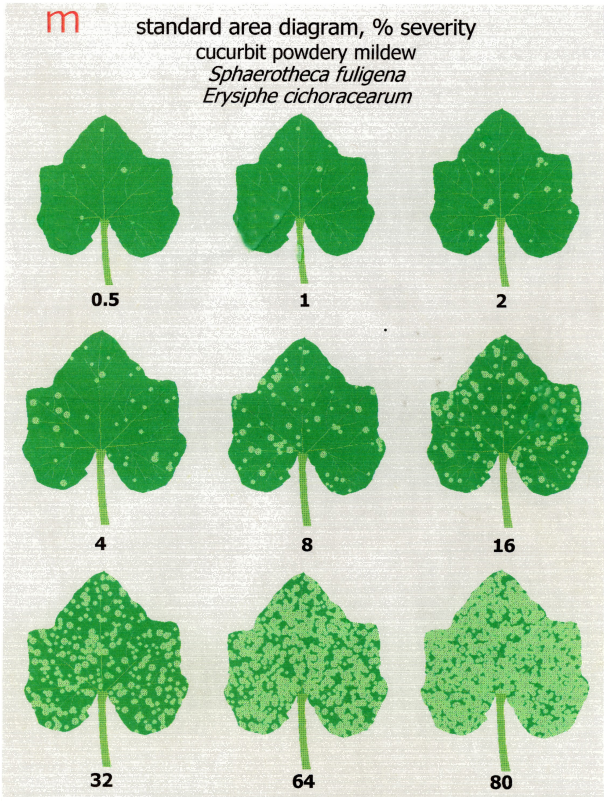

Figure 1. Percent powdery mildew infection chart.

two factors, calibration and consistency, are key to producing a reliable powdery mildew efficacy data set. The percent powdery mildew of each leaf surface was recorded and a mean value plus its standard deviation was calculated for use in the figures and tables below.

Late in the season, Downy Mildew was detected in the plots. Despite treating it with Tanos and Ranman, much of the foliage in each treatment was damaged. There was also low levels of bacterial leaf spot on the foliage and fruit in all treatments.

Powdery mildew was first detected in this trial on July 14, one day later than 2015. According to our protocol, this detection initiated treatment applications. Fifteen feet on the east side of each plot was not sprayed and served as a "check" plot to confirm the presence of PM and reflect the condition of untreated foliage. On July 18, all treatments were scouted for an initial disease rating on both the upper and lower leaf surfaces. Subsequent canopy and PM evaluations were conducted on July 28, August 8, August 16, August 25, and September 6.

Fungicide treatment sprays were applied on a 7-10 day schedule starting July 19, followed by July 29, August 8, August 17, and August 26, and September 2. All trial treatments were applied from a hydraulic boom sprayer at 35 GPA using hollow cone nozzles at 60 PSI.

Results

Data for the six PM evaluations are listed by treatment (Table 1) in Figures 2-7. Treatment 9 is an "untreated check" represented by an average of 16 leaves, two leaves from all eight treatments. Negative PM values simply represent the lower leaf surface, while positive values show the upper leaf surface infestation. In this way, both PM leaf surface values can be put into one figure.

Table 1. 2016 Powdery mildew fungicide demonstration trial treatments.

TRT	**Product, Rate, FRAC Sprays 1, 3, and 5**	**Product, Rate, FRAC Sprays 2, 4, and 6**
1	Evito 480 SC (3 fl oz/a) + Chemsurf 90 (0.25 v/v) [FRAC 11]	Procure (8 fl oz/a) + Chemsurf 90 (0.25 v/v) [FRAC 3]
2	PHD 11.3% (6.2 oz/a) + Chemsurf 90 (0.25 v/v) [FRAC 19]	Procure (8 fl oz/a) + Chemsurf 90 (0.25 v/v) [FRAC 3]
3	Evito 480 SC (3 fl oz/a) + PHD 11.3% (6.2 oz/a) + Chemsurf 90 (0.25 v/v) [FRAC 11, 19]	Procure (8 fl oz/a) + Chemsurf 90 (0.25 v/v) [Procure FRAC 3]
4	Fontelis (1 pt/A) [FRAC 7]	Quintec (4 oz/A) + Manzate (2.5lb/A) [FRAC 13 +M]
5	Fontelis (1 pt/A) [FRAC 7]	Microthiol Disperss (5 lb/A) + Manzate (2.5 lb/A) FRAC M
6	Quintec (6 oz/A) + Manzate (2.5 lb/A) [frac 13 + M]	Procure (8 oz) + Manzate (2.5 lb/A) [frac 3 + M]
7	Merivon (4.0 oz/A) + Manzate (2.5 lb/A) Chemsurf 90 (0.25 v/v) [frac 7,11 +M]	Procure (8 oz) + Manzate (2.5 lb/A) [frac 3 + M]
8	Luna Experience (6oz) + Manzate (2.5 lb/A) + Chemsurf 90 (0.25 v/v) (FRAC 7,3,M)	Manzate (2.5 lb/A) + Flint (2 oz/A) FRAC M,11
9	Untreated Check (eastern 10' of each plot)	

In the first PM evaluation on July 19, treatments 2, 4, 6, and 8 had no colonies detected. Treatments 1,3,5, and 7 had less than 1% detectable colonies on both the upper and lower leaf surface. The untreated check also had barely detectable infestations on the upper and lower leaf surface.

In the second PM evaluation on July 28, treatment 4 still had zero colonies detected, while treatments 1, 2, 5, 6, 7, and 8 were all under 1% infestation for either leaf surface. Treatment 3 had just over 3% infestation on the lower leaf surface. The untreated check (9) was nearing 5% for both surfaces, indicating that PM infestation was on the rise.

In the third evaluation on August 8, all treatments had below 10% infestation on either leaf surface but treatments 4, 6, and 8 had the lowest pressure, just below 3%. The untreated check (9) is nearing 50% infestation on both leaf surfaces.

In the fourth evaluation on August 16, powdery mildew populations began to develop quickly on the leaves. Treatments 2, 4, 5, 6, 7, and 8 had less than 11% PM infestation on the lower leaf surface. Treatments 1 and 3 had slightly elevated powdery mildew infestations on their lower leaf surface, between 17-19%. The untreated check (9) on both leaf surfaces was over 60% infested by this date.

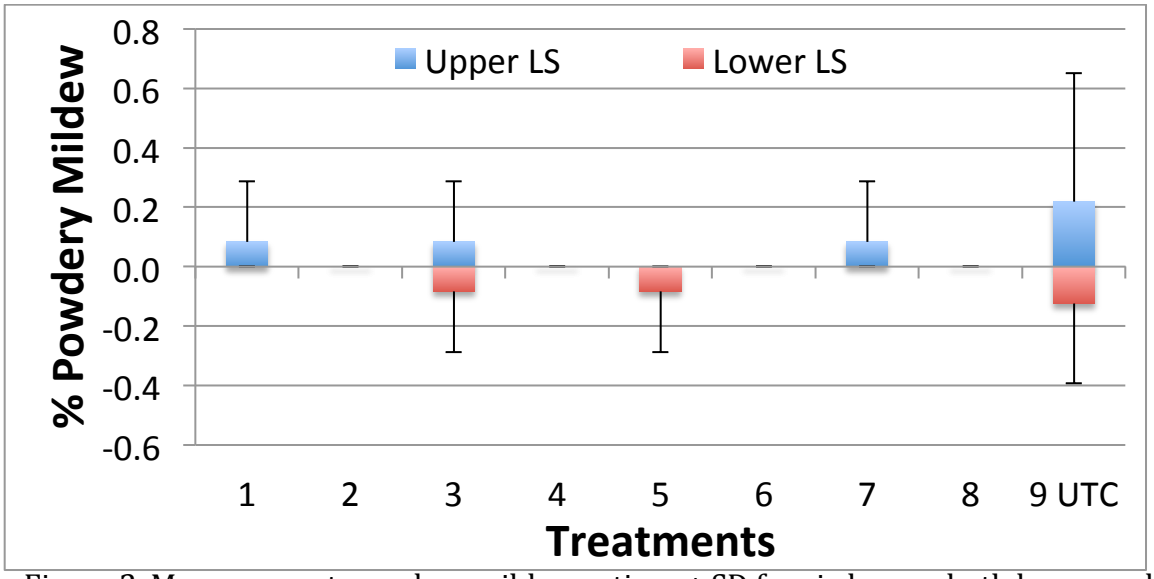

Figure 2. Mean percent powdery mildew ratings ± SD for six leaves, both lower and upper leaf surfaces (LS) taken on July 19 by treatment (Solid Gold, Rupp Seeds).

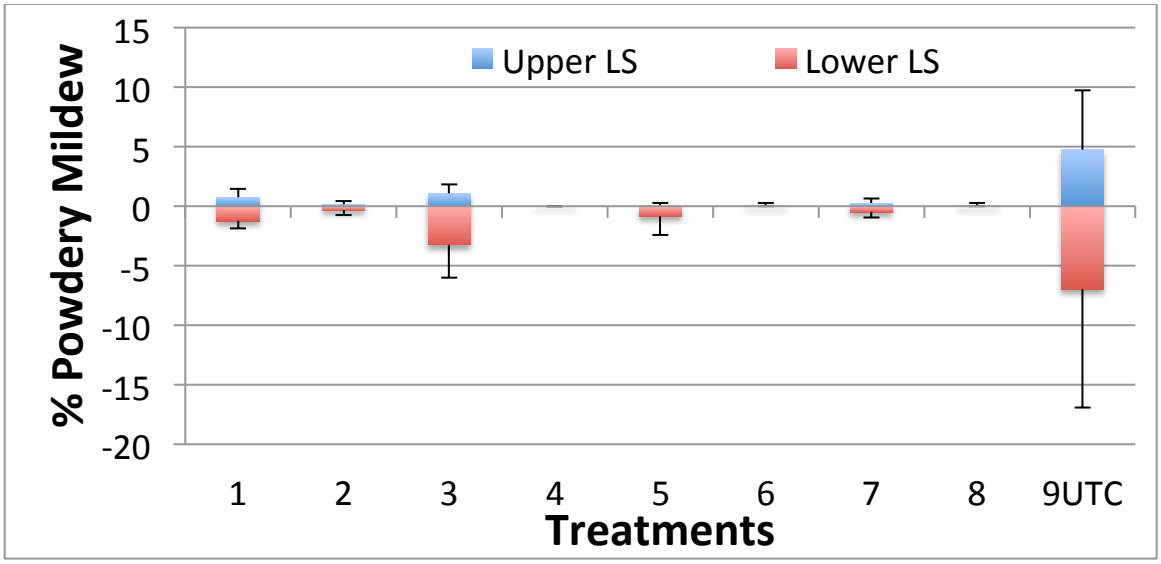

Figure 3. Mean percent powdery mildew ratings ± SD for six leaves, both lower and upper leaf surfaces (LS) taken on July 28 by treatment (Solid Gold, Rupp Seeds).

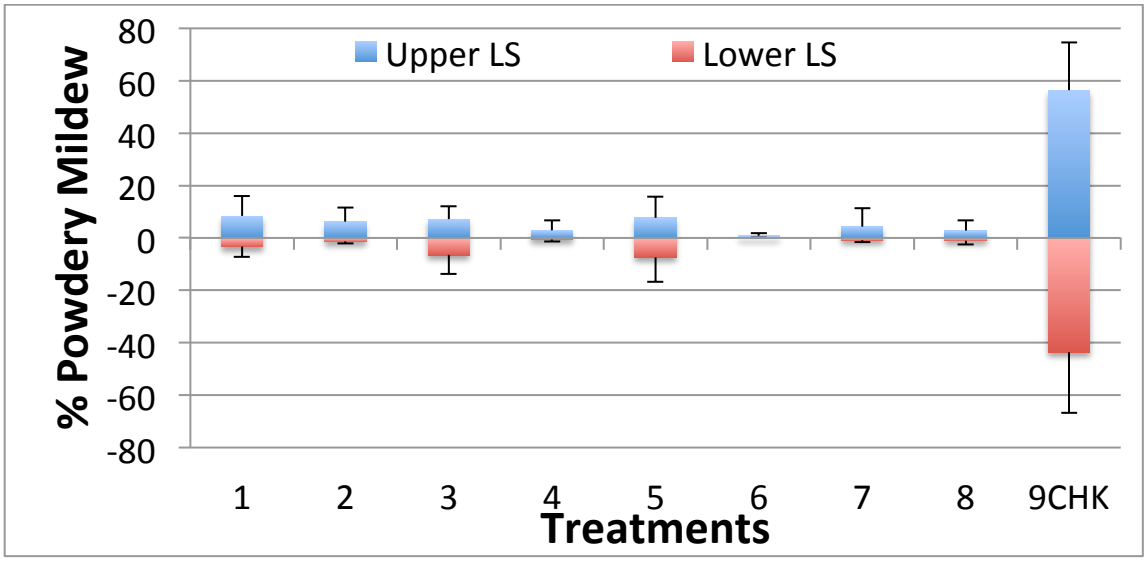

Figure 4. Mean percent powdery mildew ratings ± SD for six leaves, both lower and upper leaf surfaces (LS) taken on August 8 by treatment (Solid Gold, Rupp Seeds).

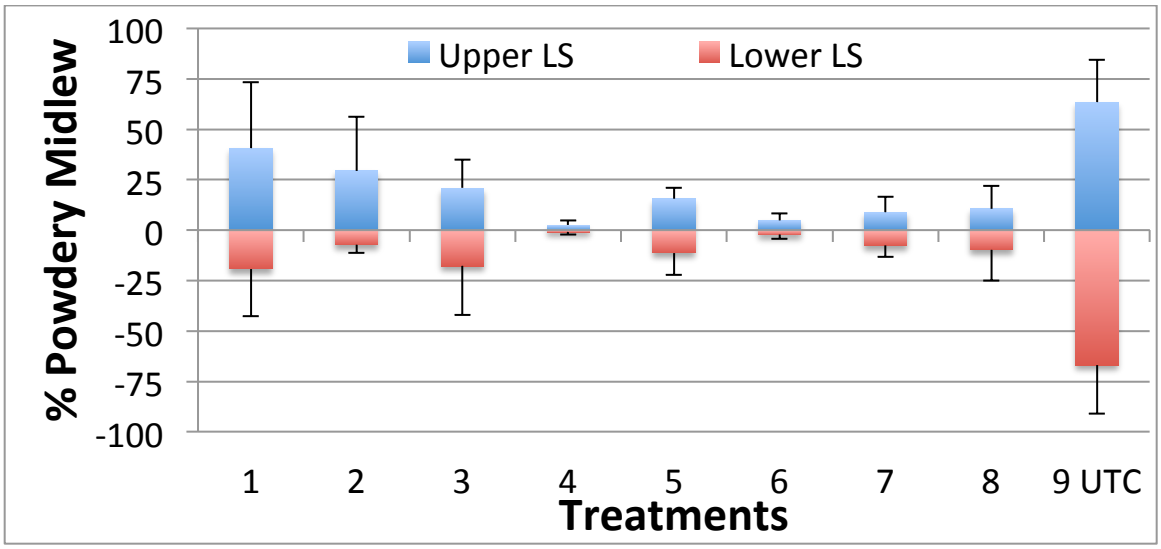

Figure 5. Mean percent powdery mildew ratings ± SD for six leaves, both lower and upper leaf surfaces (LS) taken on August 16 by treatment (Solid Gold, Rupp Seeds).

The trend for the most effective treatments continued into the fifth evaluation on August 25, with treatments 2, 4, 6, 7, and 8 under 27% lower leaf surface PM infestation, however treatments 4 and 6 were substantially lower at less than 7% lower leaf infestation. Treatments 1, 3, and 5 showed reduced efficacy at this time with over 43% infestation on the lower leaf surface, and over 29% on the upper leaf surface. The untreated check (9) is approaching 100% infestation, and large portions of the canopy are dead at this point. This is the sampling window that downy mildew was also detected and treated in the plots, and gives perhaps the most reliable estimate of PM treatment efficacy without loss of leaf tissue due to downy mildew.

In the final evaluation, treatments 4, 6, and 8 continue to have the lowest infestation on their lower leaf surfaces. Treatments 5 and 7 have relatively small upper leaf infestations at 18 and 21% respectively, but considerably higher lower leaf colonization at 35 and 51% respectively. Treatments 1, 2, and 3 all exceed 52% PM infestation on the upper leaf surface and range between 25 and 69% on the lower leaf surface. The untreated check (9) is approaching 100% infestation, and most of the canopy is dead at this point.

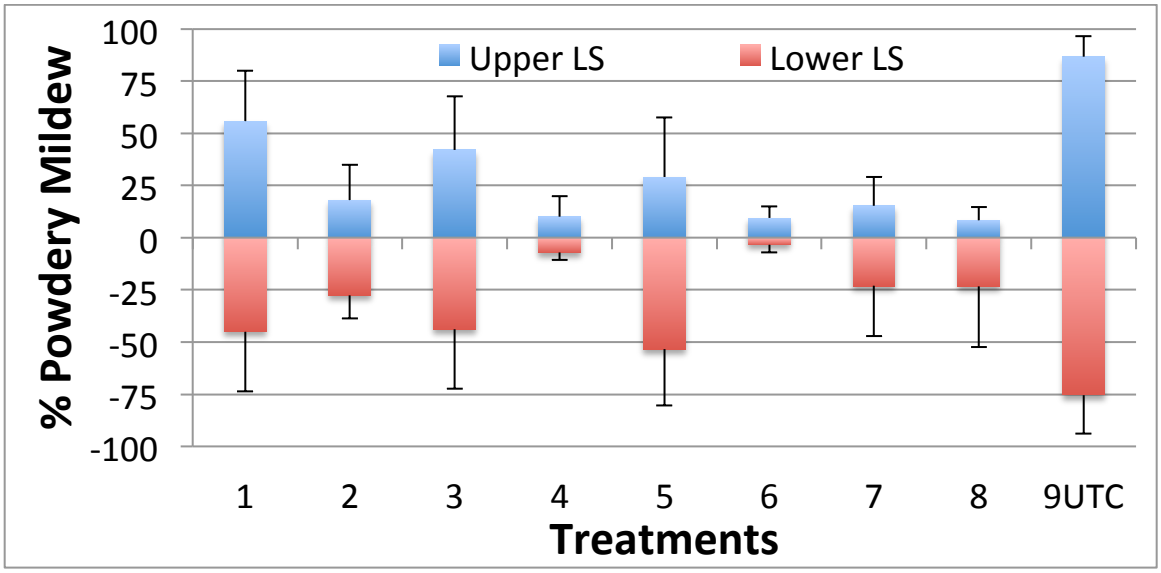

Figure 6. Mean percent powdery mildew ratings ± SD for six leaves, both lower and upper leaf surfaces (LS) taken on August 25 by treatment (Solid Gold, Rupp Seeds).

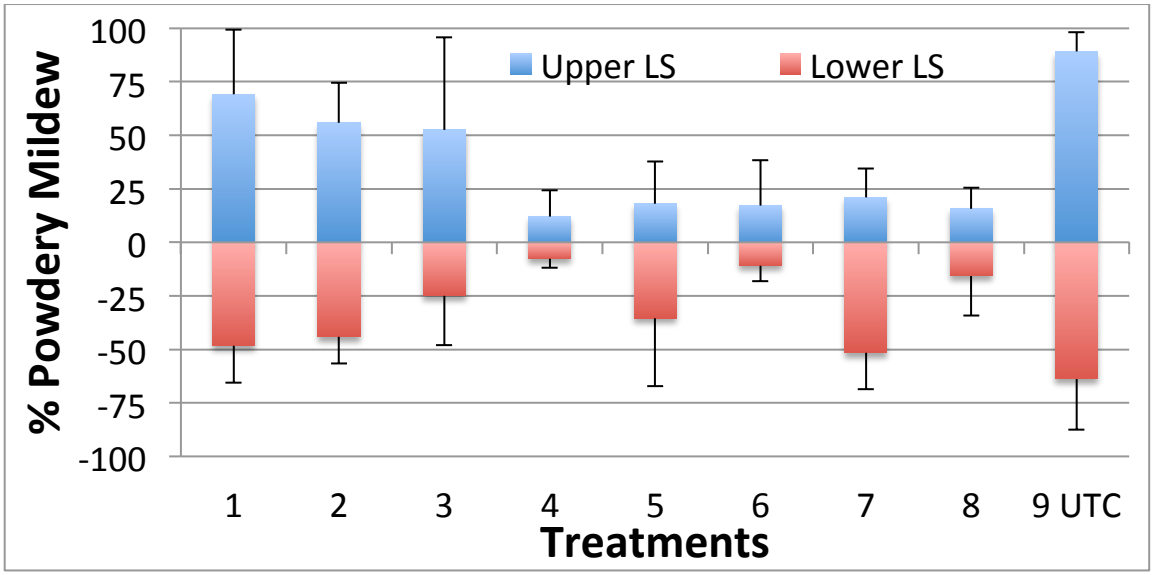

Figure 7. Mean percent powdery mildew ratings ± SD for six leaves, both lower and upper leaf surfaces (LS) taken on September 6 by treatment (Solid Gold, Rupp Seeds).

Conclusions

This goal of this powdery mildew demonstration trial is to evaluate the contribution and effectiveness of specific fungicides when used in combination with standard rotational fungicides to determine leaf and canopy health, ostensibly to maximize marketable yield and fruit quality. These fungicide programs have been designed to primarily manage powdery mildew, and may have inherent weaknesses against specific diseases such as downy mildew, bacterial diseases, and others.

In general, the upper leaf surface and upper canopy is easier to protect with fungicides, and therefore typically has lower levels of powdery mildew infestation. The lower leaf surface and mid to lower canopy is more difficult to protect due primarily to known limitations in application technology and complex plant architecture, but can reveal the extent to which materials are mobile or locally systemic. Using that criteria, this report focuses primarily on how well the lower leaf surface is protected. All products in the trial are known to have some level of systemic activity, with the exception of the general protectant fungicides Manzate Pro Stick and Bravo Weather Stik.

In terms of performance over the past several years that inform recommendations to growers, **treatment 6** would be considered a "standard" fungicide program. Relative to its performance, other fungicide programs can be compared.

The only threshold we have is for initial detection of PM to begin applying fungicides, otherwise the lower the percent infestation is considered better. In the 2016 trial, all treatment combinations looked very good through August 16.

The best performing programs in this trial would be treatments 4, 6, and 8, which did not exceed 23% PM infection on the lower leaf surface throughout the life of the trial. The MOAs in these treatments included some combination of 3, 7, 11, 13, and M, and contained some of the most effective fungicides against PM historically.

The second tier of programs in this trial would be all the remaining programs; 1, 2, 3, 5, and 7. All of these products had infection rates on the lower leaf surface between 23-51%, and included a combination of MOAs from group 3, 7, 11, 19 and M. Treatment 7 controlled PM at a level similar to the best performing program until the last rating. Treatment 2 controlled PM consistently better than Treatments 1 or 3 until the last rating, and it's combination with Treatment 1 to form Treatment 3 seemed to reduce it's overall efficacy until the last rating. Treatment 5 saw a reduction in efficacy due to a single fungicide substitution, a MOA M group fungicide in place of a MOA 13 group fungicide.

Although there were differences in efficacy between the fungicide treatments in this trial, all would be considered acceptable for use in commercial spray programs.

When PM protection is equal or nearly equal among several fungicide programs, growers will no doubt consider the cost of these programs to help guide their final disease management decisions. For this report I have not factored in the cost of the various programs.

As you consider these findings remember that this trial was designed as a large plot demonstration without randomization and replication, therefore no statistical analysis of these treatments is possible, but these observations may reveal a pattern of efficacy worth further exploring.

Imagery

We have been experimenting over the past few years with using imagery collected from Unmanned Aerial Vehicles (UAVs) to detect and measure powdery mildew, downy mildew, and general canopy health. Below are a series of RGB images collected throughout the season that will give you a different view of how these various fungicide programs are performing from an overall crop health standpoint. If you would like more details about the images or higher resolution images, please contact me.

Figure 8. Aerial image of powdery mildew fungicide plot taken July 19 at ca. 70 ft altitude. Numbers on image correspond to treatments. Eastern 10 ft of each plot represents untreated check.

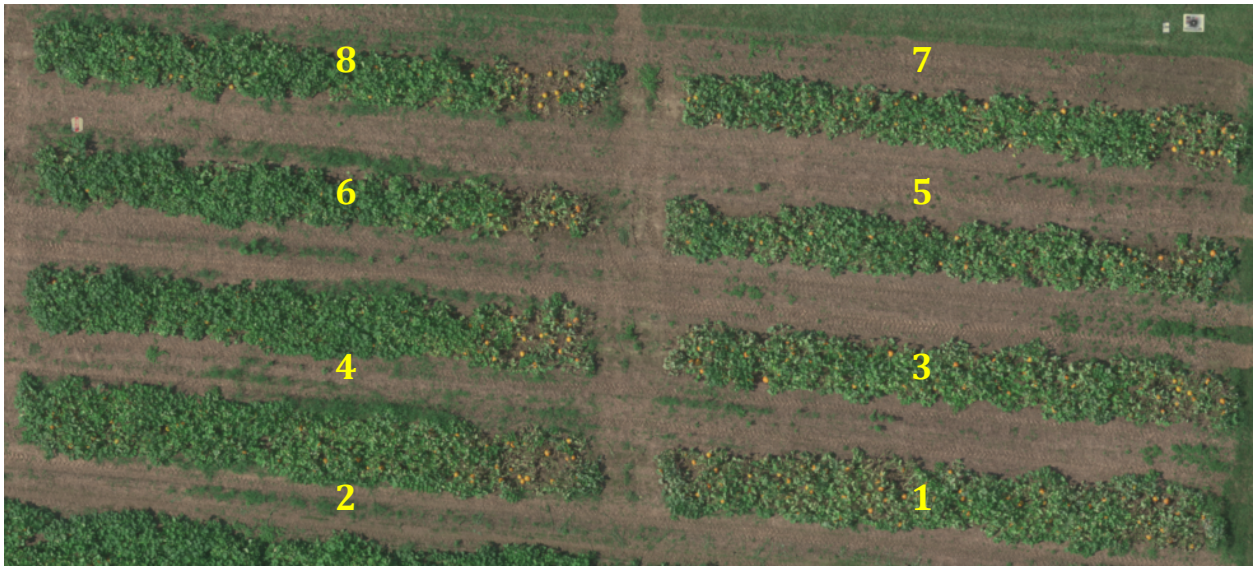

Figure 9. Aerial image of powdery mildew fungicide plot taken August 18 at ca. 70 ft altitude. Numbers on image correspond to treatments. Eastern 10 ft of each plot represents untreated check.

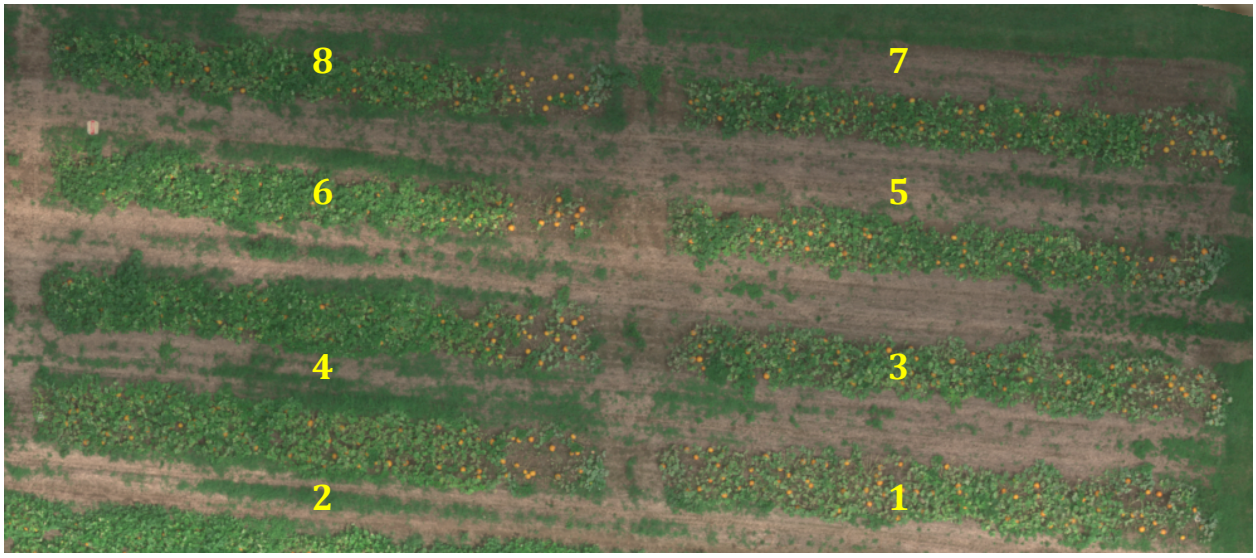

Figure 10. Aerial image of powdery mildew fungicide plot taken August 25 at ca. 70 ft altitude. Numbers on image correspond to treatments. Eastern 10 ft of each plot represents untreated check.

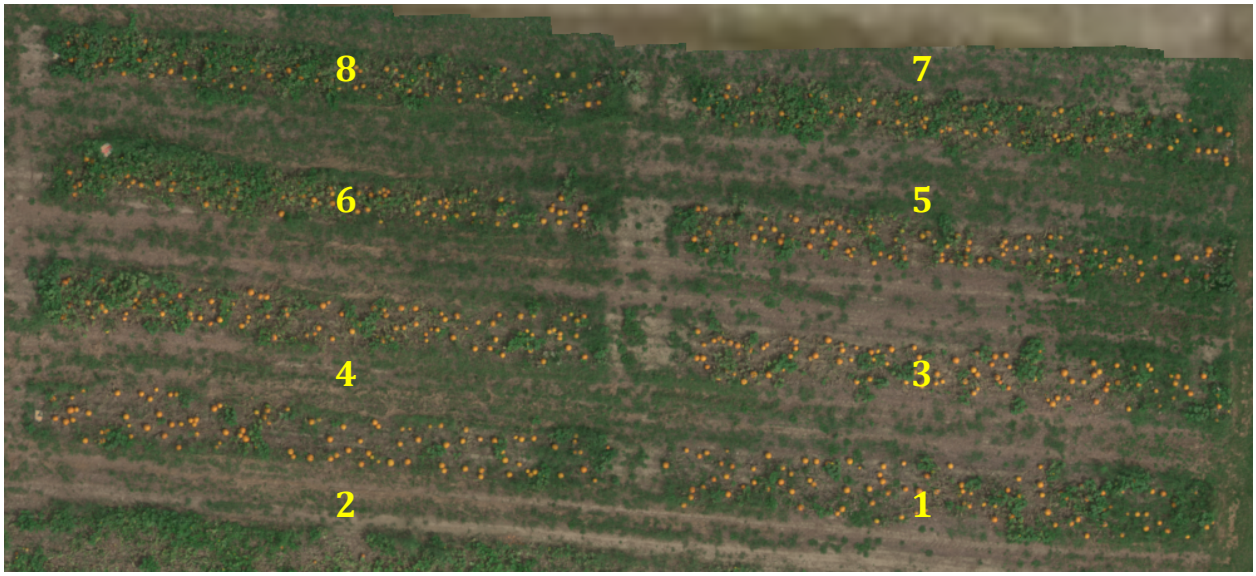

Figure 11. Aerial image of powdery mildew fungicide plot taken September 15 at ca. 70 ft altitude. Numbers on image correspond to treatments. Eastern 10 ft of each plot represents untreated check.