

Can biopesticides help you manage cucurbit powdery mildew?

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We have been working on a [2-year project](#) funded by the [New York Farm Viability Institute](#) to look at adding biofungicides to the management of two vegetable diseases: cucurbit powdery mildew and white mold. Key results from the 2019 cucurbit powdery mildew trial are discussed below. You can find a full report on the trial with all the data [here](#).

Project goals

During the second year of this project, we wanted to answer a few questions for growers:

1. Can you replace some conventional fungicide applications for cucurbit powdery mildew in winter squash with one of three OMRI-listed biofungicides (LifeGard, Regalia, or Serifel) while maintaining disease control, crop quality, and yield?
2. What are the costs (versus benefits) of using these biofungicides in these ways?
3. Can NDVI sensors help us detect disease early? Can they help us detect differences in plant health as a result of using biofungicides?

Cucurbit powdery mildew - what we did

We conducted the cucurbit powdery mildew trials on one farm in Eastern NY and on research farms on Long Island and in Western NY, always using the bush acorn squash variety 'Honey Bear'. This table summarizes the treatments we compared. Essentially, we started with two early biofungicide sprays, then shifted to rotating products when disease was detected. But, in some treatments we replaced the scheduled conventional product with a biofungicide every other week. The biofungicides we looked at were the same as in 2018: LifeGard, Regalia, and Serifel. We compared these treatments to both a regular conventional fungicide program and a "Conventional + skip" program where we just skipped every other conventional fungicide. And, we included an organic program with traditional OMRI-listed products plus the biofungicides. Important note: Luna Experience is NOT allowed for use on Long Island. We used it in a research plot in order to be able to make comparisons to trials conducted in other parts of the state. You can learn more about fungicide options for managing cucurbit powdery mildew [here](#), and [here](#).

Date	Non-treated	Conventional	Conventional + skip	Conventional + LifeGard ^a	Conventional + Regalia ^a	Conventional + Serifel ^b	Organic ^{ab}
~14 days before disease	-	-	-	LifeGard WG (4 oz/100 gal)	Regalia (2 qt/A)	Serifel (8 oz/A)	LifeGard WG (4 oz/100 gal)
~7 days before disease	-	-	-	LifeGard WG (4 oz/100 gal)	Regalia (2 qt/A)	Serifel (8 oz/A)	LifeGard WG (4 oz/100 gal)
First disease detection	-	Vivando (15 fl oz/A)	Vivando (15 fl oz/A)	Vivando (15 fl oz/A)	Vivando (15 fl oz/A)	Vivando (15 fl oz/A)	MilStop (3 lb/A)
+7-10 days	-	Luna Experience ^c (10 fl oz/A)	-	LifeGard WG (4 oz/100 gal)	Regalia (2 qt/A)	Serifel (8 oz/A)	Serifel (8 oz/A)
+14-17 days	-	Quintec (6 fl oz/A)	Quintec (6 fl oz/A)	Quintec (6 fl oz/A)	Quintec (6 fl oz/A)	Quintec (6 fl oz/A)	Suffoil-X (1% v/v)
+21-24 days	-	Vivando (15 fl oz/A)	-	LifeGard WG (4 oz/100 gal)	Regalia (2 qt/A)	Serifel (8 oz/A)	MilStop (3 lb/A)
+28-31 days	-	Luna Experience ^c (10 fl oz/A)	Luna Experience ^c (10 fl oz/A)	Luna Experience ^c (10 fl oz/A)	Luna Experience ^c (10 fl oz/A)	Luna Experience ^c (10 fl oz/A)	Serifel (8 oz/A)
+35-38 days	-	Quintec (6 fl oz/A)	-	LifeGard WG (4 oz/100 gal)	Regalia (2 qt/A)	Serifel (8 oz/A)	Suffoil-X (1% v/v)

^a LifeGard and Regalia were tank mixed with Nu Film P (1 qt/100 gal)

^b Serifel was tank mixed with EcoSpreader (4 fl oz/100 gal) when applied at spray volumes of 30 to 40 gal/A.

^c Luna Experience is not allowed for use on Long Island. The Long Island trial was conducted on a research farm.

We summarized disease severity on multiple dates over the season by calculating the area under the disease progress curve (AUDPC). This value describes with a single number how quickly disease developed and how bad it got. We also measured [NDVI](#) using a GreenSeeker as a way to quantify how green and healthy the leaves were. At the end of the season, we collected yield and Brix data.

Cucurbit powdery mildew – what we saw

Not surprisingly, there was some variability among sites. But at two sites disease severity was not statistically different when we compared the standard weekly conventional fungicide program to skipping every other fungicide spray. This was disappointing, since we were expecting more severe powdery mildew from extending the spray interval, providing room for the biopesticides to improve control. However, in the Long Island trial, although powdery mildew was more severe when the spray interval was extended, applying a biopesticide during the skip week did not improve control.

For the most part, replacing alternate conventional fungicides with biofungicides resulted in disease levels that were somewhere between the conventional fungicide program and the non-treated control. At two sites LifeGard and Serifel performed slightly better than Regalia. Data from Long Island are shown in Figure 1.

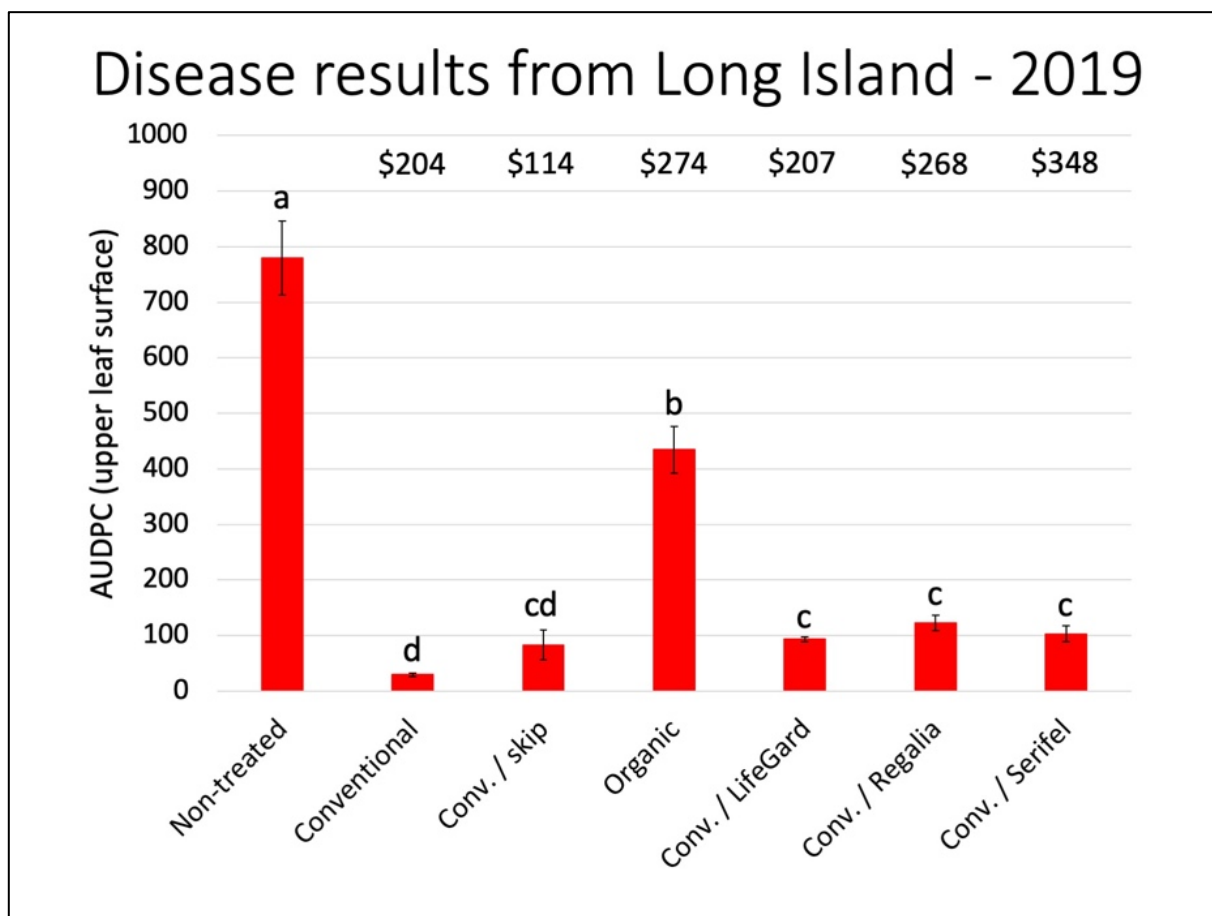


Figure 1. In the Long Island trial, the conventional, conventional + skip, and all three of the conventional/biofungicide programs provided pretty good powdery mildew control. The organic program was still better than the non-treated control. This graph shows only disease on the upper surface of the leaves (AUDPC = area under the disease progress curve). The black lines on each bar show one standard error above and below the mean value for that treatment. Bars with the same letter are not statistically different from each other. This graph also shows the cost (per acre) of the cucurbit powdery mildew fungicides for each treatment above each bar.

The above graph shows a summary of disease on the upper leaf surface over the whole season. We're not reporting the data here, but if you look at disease ratings on individual dates or on the lower surface of the leaves, skipping every other fungicide or alternating conventional fungicides with biofungicides were not as good as the weekly conventional fungicide program.

At all three sites, yield was not statistically different when we compared the standard weekly conventional fungicide program to skipping every other fungicide spray. There were no statistically significant differences in yield in the Eastern NY trial, and few differences in the Western NY trial. In both trials, when Regalia was alternated with conventional fungicides the yield was slightly but not significantly lower than the conventional/LifeGard and the conventional/Serifel treatments. In the Long Island trial, only the full conventional treatment and treatments that included LifeGard or Regalia had significantly higher yields than the non-treated control. Yield data for the Long Island trial are shown in Figure 2.

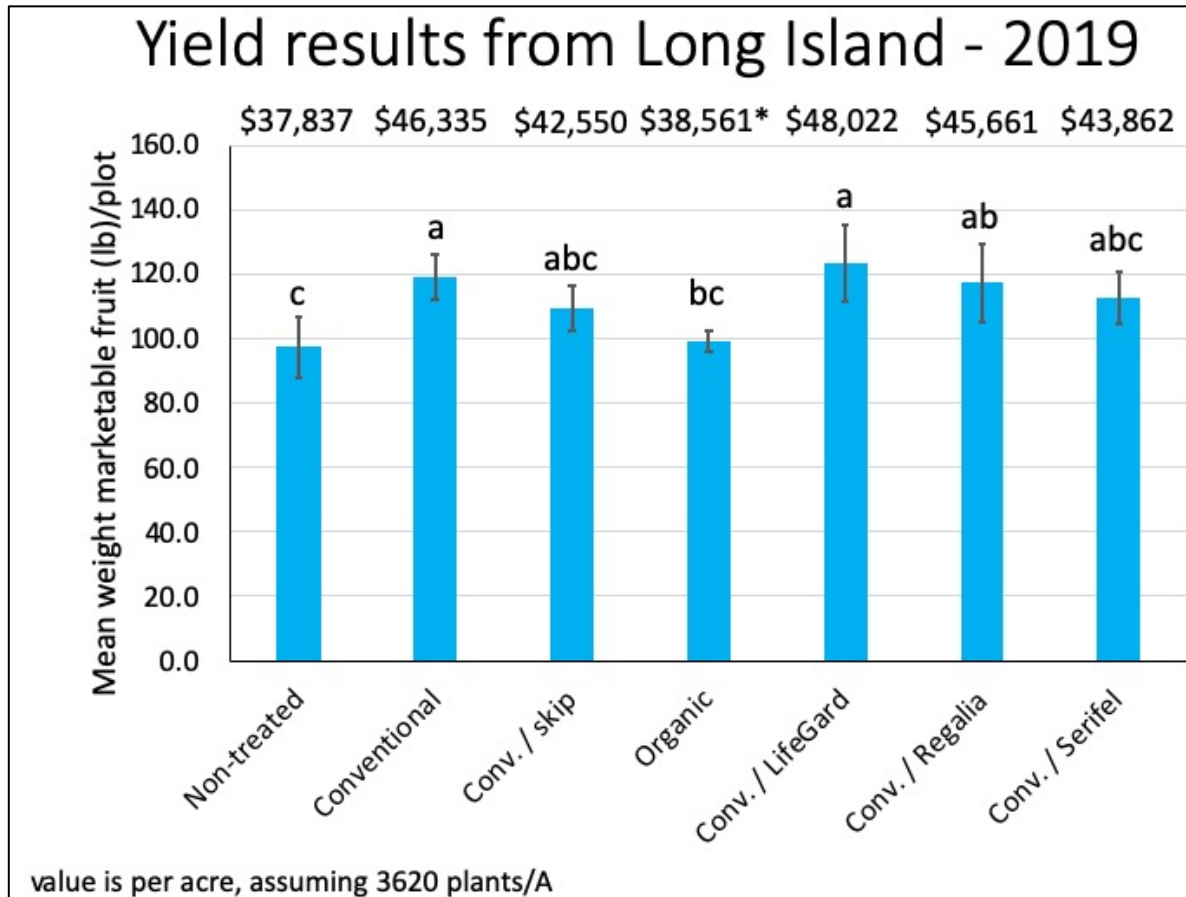


Figure 2. Yields from all treatments in the Long Island trial were pretty high. The black lines on each bar show one standard error above and below the mean value for that treatment. Bars with the same letter are not statistically different from each other. The yield per plot of 12 plants was extrapolated to the yield per acre (assuming 6 ft between rows and 2 ft between plants within rows, resulting in 3,620 plants/A) and used to estimate the average grocery store value (per acre) of each treatment, shown above each bar. The value of the organic treatment (*) was not adjusted to account for presumably higher prices for certified organic produce.

Our data did not suggest that NDVI readings taken with the GreenSeeker were a good replacement for visual scouting, or that this was a good tool for detecting differences in plant health among treatments. When NDVI readings differed among treatments, powdery mildew symptoms were readily evident. The most substantial differences in NDVI values among

treatments were in the Long Island trial, where both the non-treated control and the organic treatment had much lower average NDVI values over the season.

On the whole, Brix were unaffected by powdery mildew management strategy. The only statistically significant differences in Brix values among treatments were in the Eastern NY trial where the conventional/LifeGard treatment had significantly lower Brix than the conventional/Serifel treatment.

Cucurbit powdery mildew – what it means

When the full conventional fungicide program didn't result in statistically better disease control than skipping every other spray at 2 of the 3 sites, it's not possible to say whether or not the biofungicides were good replacements for conventional fungicides against powdery mildew. However, they did not prove to be in the Long Island trial. Our results did not suggest that measurement of NDVI values with a GreenSeeker should replace visual scouting for cucurbit powdery mildew.

Depending on the trial location (and accompanying variations in spray schedules and rates), replacing some conventional fungicides with biofungicides ranged from slightly less expensive than the full conventional program to more than twice the cost. Although in most cases there were no statistically significant differences in the value of the crop between the conventional/biofungicide programs and the full conventional program, the numerical value of the marketable crop ranged from being slightly higher (LifeGard alternated with conventional fungicides on Long Island) to lower (all other biofungicide treatments). Again, the lack of statistically significant differences between the full conventional spray program and the conventional spray program with skips in 2 of the 3 trials makes any conclusions about the economics of replacing some conventional fungicides with biofungicides, tentative, at best. There's a lot of room to fine-tune incorporation of biofungicides into spray programs to maximize cost effectiveness.

Recall from [the 2018 results](#) that we did not detect any benefit from adding biofungicides to a full cucurbit powdery mildew conventional fungicide program. So if you'd like to use biofungicides for cucurbit powdery mildew, replacing a conventional fungicide application or two is probably a better way to go. If you've tried this, we'd love to hear how it worked for you!

Remember that the information in this post is not a substitute for a pesticide label. The label is the law, and you must read and follow the label of any pesticide you are using. It is your responsibility to use pesticides legally.