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Volume 9 Number 30 May 2020

# Are You Losing the Battle Against Gray Mold?

On a recent trip to a mid-size greenhouse operation (about 30,000 square feet) I had a quick socially distanced discussion with the owner about the season and the various issues that he was dealing with in the greenhouse. He stated that botrytis or gray mold seemed to be winning the battle in his operation. While he blamed the weather and greenhouse over-crowding due to COVID-19, I thought to myself could there be other reasons afoot for this grower's botrytis troubles?

When I visit a greenhouse in full troubleshooting mode, I like to deliberately distance myself from the workers, owner, or grower until I have had a chance to walk around and get a feel for what is going on. On this day, I could not put my sunglasses on and roam around like a mystery shopper. I had to hear each person's version as to what was wrong and who was to blame in the operation for the never-ending botrytis outbreak.

First, this greenhouse operation is set-up for production and retail sales in multiple bays of a gutter connected range. The plastic is relatively new and light transmission through the double poly is good. As I walk the aisles and look at the benches, I can see large over-mature baskets with cascading growth about 5 feet from the top of the crop canopy below. I am not a very tall person, but you had to bow your head slightly to access the plants growing on the benches below. Abscising leaves and floral parts littered the benches providing fresh inoculum for new botrytis infections in the greenhouse.

The greenhouse benches were also overcrowded and there was no semblance of order. Plants that were heavy feeders were next to light feeders and plants that had taller habits were shading high sunlight plants on the same bench.

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Air movement is considered the key to limiting botrytis and other fungal diseases in greenhouses. The front of this greenhouse range is blockaded by a large gift shop and headhouse and there are no Horizontal Air Flow Fans (HAF) or fan jet tubes in the range to circulate the air. There are large side vents that can be opened manually, but on this cloudy April day the vents were cranked tightly shut.

When I visit any greenhouse operation, I usually tuck a portable hygrometer into my vest pocket to check the humidity and the temperature of the greenhouse as I walk through. This simple tool provides me with a snapshot of the growing conditions which may provide me with a clue as to why diseases like botrytis are being observed.

On this day, (about 10 a.m.) the temperature was 68<sup>o</sup> F and the relative humidity was 85% in the greenhouse. Considering the temperature, elevated relative humidity, and limited airflow this greenhouse range was like a giant petri dish for botrytis and other fungal diseases.

Next, I ventured down an aisle a few bench rows over and observed a few calibrachoa plants displaying symptoms of iron chlorosis. Iron chlorosis in calibrachos and petunias usually indicates that there is a media pH problem. While I can check the pH of the media from these chlorotic calibrachos very quickly using a 2:1 dilution of distilled water to media with my pH meter (also in my backpack); I decided to hold off until I could glean some additional information from the grower or owner.

While you may ask yourself, what does media pH have to do with a botrytis problem? Well it doesn't in most cases except when the irrigation water has a high pH or high-water alkalinity level.



Figure 1: Overpopulated greenhouses and reduced airflow increases the risk of botrytis infection. Photo by Tom Ford



Figure 2: Horizontal airflow fans can reduce botrytis outbreaks if used correctly. Photo by Tom Ford



Figure 3: Portable hygrometers can be effective in troubleshooting a greenhouse. Photo by Tom Ford

Fungicides are a critical tool deployed by growers to protect crops from diseases like botrytis. Some fungicides may rapidly degrade in alkaline water through a process known as alkaline hydrolysis. If a fungicide that is susceptible to alkaline hydrolysis is mixed into high pH water without a spray buffer, its efficacy may be quickly reduced resulting in less protection from fungal pathogens.

The owner of this greenhouse had acknowledged to me that they were losing the battle against botrytis and that they were applying fungicides regularly with limited success. They did not disclose the specific fungicides they were using or if they were rotating FRAC codes as recommended. But, what if their less than desired control of botrytis was not linked to what they were using but to the water quality problem that was clearly indicated by the chlorotic calibrachos that I mentioned earlier?

The loss in efficacy of susceptible pesticides is governed by the solution temperature, the length of the exposure of the pesticide to the water or spray solution, and the pH of the solution. A fungicide containing iprodione could see its efficacy drop by 50% in 27 minutes at a solution pH of 9.0. A tank mix containing a formulation of thiophanate methyl could see it lose 50% of its efficacy at a pH > 7.0 in 1 hour. Each fungicide that we use in the greenhouse performs best at specific target pH. In some cases if you mix a fungicide in water outside of its desired pH range, efficacy may be significantly reduced resulting in a loss of control or protection.

While most growers do not plan to mix up their fungicides in a tank mix and then let it sit for hours before applying it, things can happen that can delay the timely use

of the product resulting in a loss in efficacy. So in evaluating this specific operation and noting its water quality issue you must consider that alkaline hydrolysis could be playing a major role in their battle against botrytis.

Fungicide resistance is considered a significant problem across multiple horticultural industries. While we encourage growers to rotate FRAC codes to prevent resistance, we cannot force them to do it. The botrytis strains active in this operation could be resistant to the fungicides deployed by this grower, but I hate to assume resistance until I see what fungicides are being utilized.

As I approached my last stop on my self-guided tour through this greenhouse range, I became curious about the spray program that they were following. Out of respect, I cannot poke my head into a chemical storage area without permission, so I asked the grower what they were using for botrytis? Hesitant at first, he took me to an old wood cupboard that they had placed in one corner of the greenhouse where it could be subjected to extreme heat and humidity.

Inside the locked cupboard was their entire inventory of pesticides that they used. Some of the jugs were missing labels, some products looked like they had been sitting there since Nixon took office. As I leaned into the cupboard, I noticed that there were no **modern** fungicide products labeled for botrytis in their storage.

Personally, I do not like to leave a laundry list of problems that I see in a greenhouse. It has been years since I worked as a grower, but each business has operational constraints that may impact how effective they are in controlling pests and diseases. Here are a few things



Figure 4: Botrytis on Ivy Geranium

Photo by Tom Ford



Figure 5: Botrytis on Nonstop Begonia

Photo by Tom Ford

that I shared with the owner:

- Cloudy, damp, gray weather, and full greenhouses that extends drying times and limits airflow will promote botrytis or gray mold. **Try to reduce plant stocking or increase spacing.**
- Horizontal air flow fans (HAF) are a grower's best friend in warding off botrytis. These fans are critical in moving the moist air out of the crop canopy and away from foliage, stems. **Try to deploy them.**
- Venting at sunset to evacuate moisture laden air from the greenhouse is often overlooked as a technique to reduce botrytis infection. Heating the cooler air drawn in from outside the greenhouse will lower humidity at night resulting in a growing environment that is less conducive to botrytis infection. **Vent and vent again!**
- Plant debris can be a source of inoculum for botrytis infection. In some operations you will frequently see personnel going through and removing blighted flowers and foliage to improve the aesthetics of the greenhouse. While this practice may be conducted for aesthetic purposes the removal of plant debris is quite essential in preventing botrytis infection. **Reduce inoculum.**
- Fungicides can be an effective tool in preventing and/or managing botrytis in the greenhouse. Fungicide resistant biotypes are common so growers must rotate FRAC (Fungicide Resistance Action Committee) codes to prevent resistant strains from developing. **Rotate FRAC codes.**
- Bio-based fungicides can be a great alternative to chemical fungicides if resistance is noted in the greenhouse. Many bio-based products can be used in conjunction with many conventional chemical fungicides to augment control. **Consider bio-based products with chemical fungicides when they will augment control.**

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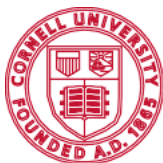
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