GROWERTALKS

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Research Says Mealybugs Can Be Managed

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I love mealybugs … such cute fuzzy things they are. For growers who have to deal with them, mealybugs are scourges they wish they didn't know.

Several species plague annuals and perennials, woodies and herbaceous, indoor and outdoor. Citrus mealybug (Planococcus citri) is the most common species. Citrus mealybug and the Madeira mealybug (Phenacoccus madeirensis) are more problematic in greenhouses and conservatories, but they'll feed happily on plants outdoor. Longtailed mealybugs (Pseudococcus longispinus) are common on foliage plants, whereas striped mealybugs (Ferrisia virgata) can be found on woodies and foliage plants. Root mealybugs (Rhizoecus spp.) are rearing their ugly heads in conservatories (and green roofs) again.

These species aren't difficult to identify using pictures and descriptions in your local extension services' bulletins. Refer to Dr. Ray Cloyd's article in *GrowerTalks* (June 2017) on general biology and management. In this article, I'll dive into the nitty-gritty of managing mealybugs.

Where do they come from?

Mealybugs don't fly. Unlike thrips and whiteflies that drift in from outside, mealybug infestation generally begins from within. Cuttings are potential sources of infestation, but I haven't received any infested cuttings from reputable propagators in the past 10 years. Inspecting incoming plant materials for mealybugs and other critters remains a good pest management practice.

The major sources of infestation are infested weeds, stock plants and pet plants. Citrus mealybug feeds on 190+ plant species, including many weeds. I've seen huge populations on oxalis and crabgrass in my own greenhouse. Many impacted growers also keep nice populations on their stock plants, pet plants and unsold crops. Excellent weed management and maintaining mealybug-free stock plants go a long way in lowering the risk of infestation. The most effective and economical solution for heavily infested plants is to throw them away.

Mealybugs can make themselves comfortable anywhere. Females often lay eggs under pots, and on benches and debris. Hatchlings (or crawlers) from infested weeds, and from eggs sacs on pots and debris can easily re-infest the next crop. When possible, an infested greenhouse should be left empty for at least two weeks before the next crop. The eggs can hatch over these two weeks, but the crawlers cannot find any plants to feed on, so they die. My research suggests that if you can shut down a greenhouse and let it heat up to 120F (48C), you can kill the majority of the eggs in a day. Of course, not every operation can interrupt a crop cycle by shutting down or emptying

greenhouses.

Table 1. A summary of the percent reduction in citrus and Madeira mealybug populations on treated plants (compared to the untreated or water-treated plants) at about two and four weeks after the first treatment. Percentages of reduction presented are averages of data from studies conducted in 2004-2006 and 2010-2012 through the IR-4 Ornamental Horticulture Program. WAT = weeks after the first treatment.

Trade Name	Label rates (per 100 gal.)	Select tested rates (per 100 gal.)	Application method and frequency tested	Citrus mealybug (9 studies)		Madeira mealybug (4 studies)	
				2 WAT	4 WAT	2 WAT	4 WAT
Mesurol (IRAC no. 1A)	0.5 to 1 lb./acre	8 oz.	Spray; 2x at 14 days	55.6%	85.4%		
Orthene T&O 75 (1B)	10.7 oz.	10.7 oz.	Spray; 2x at 14 days		96.8%	100%	100%
Orthene T&O 97 (1B)	8 oz.	8 oz.	Spray; 2x at 14 days			97.4%	99.8%
Talstar (7.9%) (3A)	10 to 20 fl. oz./acre	20 fl. oz.	Spray; 2x at 14 days	91.2%	89.1%		
TriStar 70 WSP (4A)	1.128 oz.	1.1 oz.	Spray; 2x at 14 days	94.8%	100%		
Tristar 30SG (4A)	2.7 oz.	2.7 oz.	Spray; 2x at 14 days	92.4%	99.2%		
Safari 20SG (4A)	4 to 8 oz.	4 oz.	Spray; 2x at 14 days	70.7%	83.3%	61.7%	69.4%
		8 oz.	Spray; 2x at 14 days		76.4%		
	12 to 24 oz.	12 oz.	Drench; 1x	23.2%	85.9%		
		24 oz.	Drench; 1x	90.6%	90.5%	60.2%	84.4%
Safari 2G (4A)	1/3 to 2/3 tsp./6-in. pot	2.6 g/6-in. pot	Granule; 1x			66.3%	87.9%
Marathon II (4A)	1.7 fl. oz.	1.7 fl. oz.	Spray; 2x at 14 days	49.3%	54.1%		
Merit 75 WP (4A)	3 to 4 tsp./1,000 sq. ft.	8 oz.	Drench; 1x			11.8%	10%
Flagship 25 WG (4A)	4 to 8.5 oz.	4 oz.	Spray; 2x at 14 days	13.9%	97.3%		
		8 oz.	Spray; 2x at 14 days	90.0%	94.5%	81.1%	93.6%
		8 oz.	Drench; 1x			48.1%	70.9%
Flagship 0.22G (4A)	40 to 120 lb./acre	6 g/6-in. pot	Granule; 1x			44.5%	56.3%
Distance (7C)	8 to 12 fl. oz.	8 fl. oz.	Spray; 2x at 14 or 21 days	11.9%	27.2%		
		12 fl. oz.	Spray; 2x at 14 or 21 days	18.0%	32.2%	56.9%	75.8%
Rycar (9B)	6.4 fl. oz.	8.6 fl. oz.	Spray; 2x at 14 days	86.4%	92.9%		
Talus 40SC (16)	18 fl. oz.	18 fl. oz.	Spray; 2x at 14 days	5%	90.8%	93.6%	100%
Talus 70DF (16)	12 oz.	12 oz.	Spray; 2x at 14 days	60.7%	74.2%	100%	100%
Hachi-Hachi (21A)	21 to 32 fl. oz.	32 fl. oz.	Spray; 2x at 14 days			26.8%	92.2%
Kontos (23)	1.7 to 3.4 oz.	3.4 oz.	Spray; 2x at 14 days	65.9%	77.1%	63.2%	99.4%
Kontos (23)	1.7 to 3.4 oz./1,000 6-in. pots	3.4 oz.	Drench; 1x	40.9%	20%	34.6%	66.9%
Aria (29)	2.1 to 4.3 oz.	2.1 oz.	Spray; 2x at 14 days	75.2%	88.4%		
		4.3 oz.	Spray; 2x at 14 days	61.0%	96.9%		
Horticultural oil (UC)	1% to 2%	2%	Spray; 2x at 14 days			91.1%	100%

Figure 1. Coleus infested with citrus mealybugs, but treated with water (Treatment 1); BotaniGard ES (Treatment 5: 32 fl. oz./100 gal., four times at six-day interval); and Altus (Treatment 6: 14 fl. oz./100 gal., two times at 15-day interval).

Control difficulty

Mealybugs are really hard to kill with insecticides; we've learned several lessons about controlling mealybugs with insecticides over the years.

A water-repelling layer of wax covers a mealybug's body. As a result, insecticide solution has difficulty penetrating the waxy layer and killing the mealybugs. Nymphs have only a thin wax layer, making them more susceptible to, and the targets of, treatment. Since all life stages are present at any given time and eggs often hatch over a month, repeated applications (within label-dictated frequency and interval) are needed.

Mealybugs often feed and hide on the underside of leaves and on the stems. Thorough spray coverage is therefore critical, regardless of what you spray. Adding a spreader-sticker and using a relatively high spray pressure also helps to ensure better canopy penetration and adherence to the mealybugs.

Insecticides and their effectiveness

I've summarized efficacy data extracted from the IR4 Ornamental Horticulture Program database (see the table). Some patterns are apparent:

• Most products achieved excellent efficacy (i.e., > 90% reduction) after two sprays at the label rates. For some products, two applications were necessary.

• Higher application rates did better than lower application rates—no surprise here!

• The Madeira mealybug was more difficult to control with neonicotinoids (Flagship, Marathon, Safari and Tristar), but more susceptible to insect growth regulators (Distance and Talus) than the citrus mealybug.

• Orthene, Flagship, TriStar, Talus and horticultural oil are standouts among the tested products for their consistent excellence and speed of activity.

What about new products, such as Altus? My program tested this product this summer by making two sprays at the label rate (14 fl. oz./100 gal.), 15 days apart, against citrus mealybug nymphs. Altus was able to reduce the population by 69.6% (compared to water check) by 15 days after the first treatment (DAT) and 99.3% by 22 DAT. Altus was as effective as other systemic products (neonicotinoids and Kontos), and the pictures tell the tale. In the same trial, BotaniGard ES (sprayed at 32 fl. oz./100 gal., four times at a six-day interval) didn't achieve control.

My program will investigate the efficacy of Altus applied as a drench in the coming season. Generally, systemic insecticides applied as medium drench or granule didn't perform as well as, nor did they work as fast as, the same products applied as spray (see the table). But I won't brush them off. Medium application of systemic insecticides remains a viable preventive option for operations that maintain stock plants or produce long-cycle crops (e.g., foliage) and have persistent mealybug infestations. The application doesn't eliminate the mealybug population completely, but it will knock down the population to give other options, such as biocontrol, a chance of working.

Few biocontrol agents are available. The mealybug destroyer, Cryptolaemus montrouzieri, is widely available and can be used against many mealybug species. Also available is the parasitic wasp (or parasitoid) Anagyrus pseudococci. Another parasitoid, Leptomastix dactylopii, is no longer readily available. These parasitoid species specialized on citrus mealybug. No parasitoid is available commercially for the Madeira mealybug, longtailed mealybug and striped mealybug. We'll need to work harder to find biocontrol solutions for these species.

I use the mealybug destroyer to knock down hot spots and the parasitoids to put out simmering infestations. There are concerns on how encapsulation of parasitoid eggs may influence the success of a biocontrol program. The effective encapsulation rate of A. pseudococci by the citrus mealybug was 15%. No encapsulation of L. dactylopii by the citrus mealybug was observed in my study. At these levels, I wouldn't list encapsulation as the top reason for failure while other more important factors (such as unfavorable conditions or incompatible pesticide use) are at play.

Mealybugs can be tough to manage, but it's possible to manage them. To achieve that, we need to be diligent—find them and reduce the population with the right tools quickly. **GT**

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