

Pre-mix Fungicides for Ornamentals

A. R. Chase
Chase Research Gardens, Inc.

Over the past few years, we have seen many new active ingredients in fungicides for ornamentals. These new products fall into chemical classes that we are familiar with like sterol inhibitors and relatively new ones including the strobilurins. Many of the experimental products we are currently working with belong to one of these two classes (or are closely related one). In the past two years, we have seen a trend toward introducing new pre-mix or combination fungicides. One of the first pre-mixes available to ornamental producers was Banrot 40WP, a combination of thiophanate methyl and etridiazole. This fungicide remains an important tool for ornamental production today. Some of the other pre-mix fungicides in use or under development are listed in Table 1.

Table 1. Some pre-mix fungicides for ornamentals.

Fungicide	Manufacturer	Components	Availability
Armada	Bayer Crop Science	Tebuconazole and trifloxystrobin	Under development for ornamentals
Banrot 40WP	Scotts Company	Thiophanate methyl and etridiazole	Registered in US (except CA)
Clevis (AKA Manhandle)	Prokoz and Dow Agrochemical	Myclobutanil and mancozeb	Under development for ornamentals
Concert	Syngenta Professional Products	Chlorothalonil and propiconazole	In registration process
Hurricane 48WSP (AKA Broadside)	Syngenta Professional Products	Fludioxinil and mefenoxam	In registration process
Junction	SePRO Corporation	Copper and mancozeb	Registered in US
Palladium	Syngenta Professional Products	Fludioxinil and cyprodinil	In registration process
Spectro 90WDG	Chlorothalonil and thiophanate methyl	Cleary Chemical Company	Registered in US
26/36	Bayer and Cleary	Iprodione and thiophanate methyl	Under development for ornamentals

The Pros and Cons

Pre-mixes have both positive and negative aspects. Some of the positive aspects include: 1) diagnosis is less critical, 2) mixed infections are covered, 3) plant safety is assured, 4) resistance is better managed and 5) there are fewer products on your shelf. If you do not have time for a lab diagnosis of a problem, use of a pre-mix that covers all possibilities would allow timely control. It is preferable to obtain a diagnosis since not all problems are due to bacteria or fungi. Viruses, phytotoxicity, nutritional imbalance and temperature extremes will not be cured by a fungicide whether it is a pre-mix or not. In the same vein, there are often mixed infections of two or more fungi causing a disease. This is especially common in root diseases but sometimes leaf damage is caused by more

than one fungus or bacterium. If you apply a pre-mix with the right combination of active ingredients, you will control both problems with a single application.

Since application of more than one fungicide at a time is common, using a pre-mix will give you the security of knowing that the two products are chemically suited to work together. Making your own mixtures has the drawback of possible phytotoxicity and only your experience can determine safety of the mixture under your conditions.

One of the most important aspects of pre-mixes is that if the correct partners are chosen, they are excellent for resistance management. The only requirement is that both active ingredients target the pathogen. For instance, both copper and mancozeb in the pre-mix Junction work on bacteria like *Pseudomonas* and *Xanthomonas*. Botrytis resistance can be delayed with Spectro since both thiophanate methyl and chlorothalonil target *Botrytis*. One trial we conducted a couple of years ago demonstrates the point. The trial was performed on annual vinca with *Rhizoctonia* stem rot. We saw 100% disease prevention with Spectro while all three of the thiophanate methyl formulations failed to control the disease (Figure 1). It was clear that the chlorothalonil portion of Spectro was responsible for the high degree of disease control. Table 2 shows the pre-mixes that may be beneficial for resistance management and the specific diseases this may benefit.

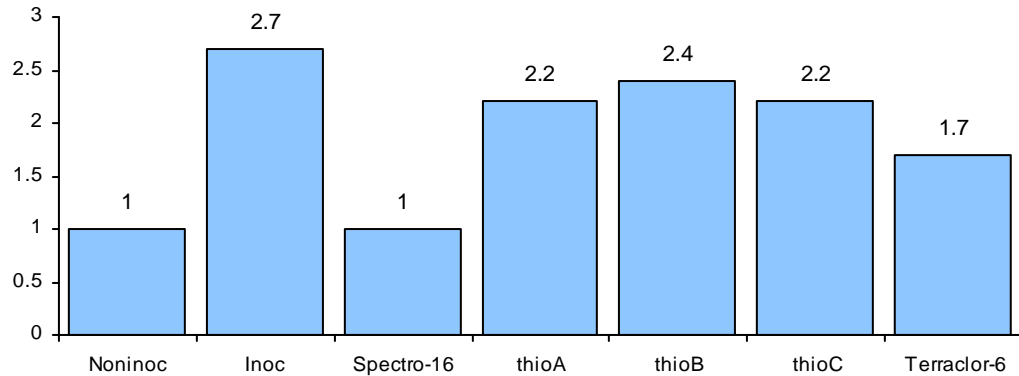


Figure 1. Efficacy of Spectro and three thiophanate methyl formulations for control of *Rhizoctonia* stem rot on vinca. The disease was rated from 1 (none-healthy) to 5 (dead).

Table 2. Pre-mixes that can act as resistance management tools and the appropriate disease target.

Product	Target pathogens in common
Armada	Powdery mildew, rust, leaf spots
Banrot	None
Clevis	Powdery mildew, rust, leaf spots
Concert	Leaf spots, rust
Hurricane	None
Junction	Bacteria, rust, powdery mildew and leaf spots
Palladium	Botrytis, Sclerotinia
Spectro	Rhizoctonia, leaf spots, Botrytis, Sclerotinia
26/36	Rhizoctonia, leaf spots, Botrytis, Sclerotinia

Finally, stocking pre-mixes is an attractive solution to the confusion that can occur by having every fungicide and bactericide that is labeled on ornamentals. It will obviously also be much more cost effective, especially for the smaller producer who might not use large quantities of these products.

Some possible negative aspects of pre-mixes are that the specific ratios of the two active ingredients may not be ideal for all diseases and that using a pre-mix may give you a false sense of security. Banrot was a new product when I started at the University of Florida in the early 1980's. I often heard comments from the growers that the ratio of thiophanate methyl and etridiazole was not ideal for *Rhizoctonia* diseases but was very effective for *Pythium* and *Phytophthora*. We have seen this in our recent trials when Banrot is used at 8 oz/100 gal rates is used. It may be necessary to increase to the upper end of the label if *Rhizoctonia* is a main concern. I also see a false sense of security descend when some growers use pre-mixes (or tank mixes). They think they have covered all of the possible bases and, unfortunately, there is always a new disease that escapes the broad-spectrum treatment. These growers usually wait until it is too late to notice that something is amiss and then the crop is ready for the dumpster. Pre-mixes are not insurance policies – they are conveniences.

Clevis and Hurricane – Trial Review

We started working on Clevis (also called Manhandle) for Rohm and Haas in 1998 and continued for four years (Table 3). Clevis was tested at either 1 or 2 lbs per 100 gal against leaf spots, *Botrytis*, downy mildew, powdery mildew and rust. Very good to excellent results were seen on most diseases we tested. The only exception is *Botrytis* control where we sometimes saw very good control but more often saw a lesser degree.

Table 3. Summary of Chase Research Gardens trials with Clevis.

Disease	Plant	Rate/100 gal	Result
Alternaria leaf spot	Impatiens	16 oz	Very good to excellent
Alternaria leaf spot	Pittosporum	16 oz	Very good to excellent
Anthrachnose	Cordyline	16 oz	Very good to excellent
Botrytis blight	Geranium	16 and 48 oz	Poor
Botrytis blight	Exacum	32 oz	Very good to excellent
Botrytis blight	Poinsettia	16 oz	Some
Downy mildew	Alyssum	16 and 32 oz	Very good to excellent
Downy mildew	Stock	16 and 32 oz	Excellent
Downy mildew	Snapdragon	16 and 32 oz	Very good
Myrothecium leaf spot	New Guinea Impatiens	16 and 32 oz	Some
Powdery mildew	Rose	16 and 3 oz	Excellent
Rust (<i>Puccinia</i>)	Geranium	18 oz	Excellent
Rust (<i>Uromyces</i>)	Hypericum	16 and 32 oz	Very good to excellent
Rust (<i>Puccinia</i>)	Snapdragon	16 and 32 oz	Very good to excellent

I was happy to hear last fall that Syngenta was launching Hurricane WP. Most of the work on Hurricane (ours and others) occurred in 1999 and 2000. This product was called Broadside at that time and is a combination of fludioxinil-32% (Medallion 50WP) and mefenoxam-15.5% (Subdue MAXX). Table 4 shows results of our trials on Hurricane. Hurricane (1.5 oz) gave very good control of *Cylindrocladium* cutting rot on Azalea, and very good to excellent control of *Rhizoctonia* aerial blight on Boston fern or *Rhizoctonia* damping-off on impatiens (sprench – not drench!!!). The product will be labeled as a drench initially with intent to add foliar applications. The most important part of this is the ability to legally use the product for downy mildew, *Botrytis*, *Alternaria* and other foliar diseases. The foliar application will likely be accompanied by a 48 hr REI.

Table 4. Summary of research trials with Hurricane 48WP.

Pathogen	Plant	Treatment	Efficacy
<i>Cylindrocladium</i>	Azalea	One drench	Very good
<i>Cylindrocladium</i>	Spathiphyllum	4 srenches 14 days apart	Excellent
<i>Fusarium</i>	Cyclamen	3 drenches 14 days apart	None
<i>Rhizoctonia</i>	Boston fern	3 sprays 14 days apart	Very good to excellent
<i>Rhizoctonia</i>	Impatiens	One srench	Excellent
<i>Rhizoctonia</i>	Impatiens	One drench	Excellent

Synergistic Combinations

I have occasionally found situations in our trials when “synergy” may be seen. We saw this first with a couple of downy mildew trials with Clevis. In these trials, we saw 100% efficacy with Clevis and little or no control with treatments of mancozeb (Protect) or myclobutanil alone (Eagle) (Figure 2). The products were sprayed twice on a 14 day interval and stock plants were naturally infected with *Peronospora parasitica* after the first spray.

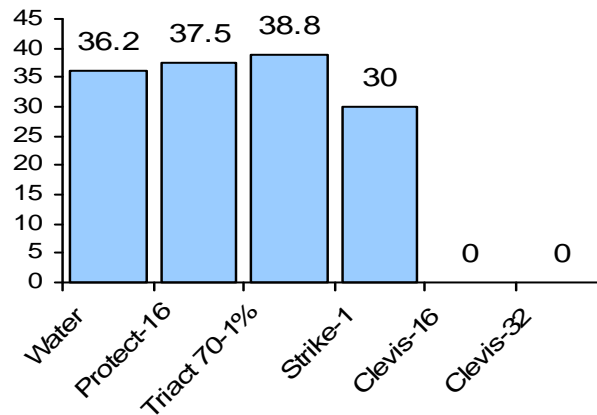


Figure 2. Effect of preventative sprays with Clevis and other fungicides for downy mildew on stock. Products were applied in oz/100 gal. The disease rating is given as the percentage of leaves with active downy mildew sporulation.

The combination of the active ingredients in Clevis is an excellent solution to fungicide resistance. Since the two active ingredients affect downy mildew fungi with unrelated mode of actions and there is little chance of resistance developing.

A trial conducted on *Vinca minor* with *Phyllosticta* leaf spot and dieback showed much the same results. As you remember Spectro is a combination of chlorothalonil (like Daconil) and thiophanate methyl (like 3336). You can see in Figure 3 that Spectro gave the best control in the trial while 3336 and Daconil were considerably less effective. This may be a simple case of additive benefits as opposed to truly synergistic benefits.

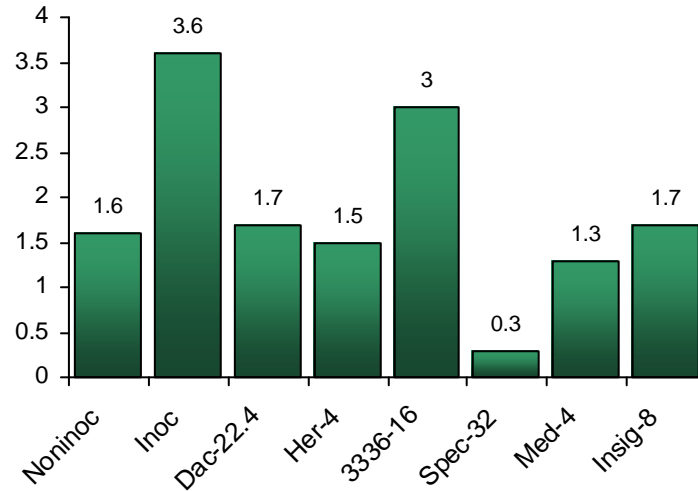


Figure 3. Effect of curative sprays on severity of *Phyllosticta* leaf spot and dieback on *Vinca minor*. Products were applied in oz/100 gal. The disease rating is given as the number of new spots per plant.

Conclusions

This article attempts to elucidate a growing trend in fungicide development to development of pre-mixes. There are good points and bad points and indeed what you do with the products will determine their success. Remember, there is no acceptable substitute for thinking about crops and how to grow them. You are the most valuable component of any production situation.