

Understanding Pre-Mix Fungicides

A growing trend in the industry, pre-mix fungicides have many benefits — from lowered costs to excellent resistance management — yet, they are not the cure-all answer for disease.

By A.R. Chase



Phyllosticta leaf spot and dieback on Vinca minor. (Photos: A.R. Chase)

Over the past few years, we have seen many new active ingredients in fungicides for ornamentals. The new products I will be presenting in this article fall into chemical classes

that we are familiar with — things like sterol inhibitors — as well as relatively new classes like the strobilurins. Many of the experimental products we are currently working with belong to one of these two classes (or a 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 from The Scotts Company. 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 Figure 1, below.

Pre-Mix 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 management and 5) fewer products to store. If you do not have time for a lab diagnosis of a problem, using a pre-mix that covers all possibilities would allow timely control. It is preferable to obtain a diagnosis since not

Some Pre-Mix Fungicides

| Fungicide | Manufacturer | Components | Availability |
|---------------------------------|-----------------------------------|---------------------------------------|-----------------------------------|
| Armada | Bayer Crop Science | Triadimefon and trifloxystrobin | Under development for ornamentals |
| Banrot 40WP | Scotts Company | Thiophanate methyl and etridiazole | Registered in U.S. (except CA) |
| Clevis | Prokoz, Inc. and Dow Agrochemical | Myclobutanil and mancozeb | Registered in U.S. |
| 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 mancozeb | Registered in U.S. |
| Palladium | Syngenta Professional Products | Fludioxinil and cyprodinil | In registration process |
| Spectro 90WDG | Cleary Chemical Company | Chlorothalonil and thiophanate methyl | Registered in U.S. |
| 26/36 | Bayer and Cleary Chemical | Iprodione and thiophanate methyl | Under development for ornamentals |

Figure 1. Pre-mix fungicides can often treat two diseases with one application.

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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 the 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 (SePRO Corporation) work on bacteria like Pseudomonas and Xanthomonas. Botrytis

resistance can be delayed with Spectro (chlorothalonil and thiophanate methyl, Cleary Chemical Company) 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-percent disease prevention with Spectro while all three of the thiophanate methyl formulations failed to control the disease (see Figure 2, below). It was clear that the chlorothalonil portion of Spectro was responsible for the high degree of disease control. Figure 3, below, shows the pre-mixes that may be beneficial for resistance management and the specific diseases this may benefit.

Finally, stocking pre-mixes is an attractive solution to the confusion that can occur from buying every fungicide and bactericide labeled for ornamentals. Stocking pre-mixes will, obviously, also be much more

Efficacy Of Spectro

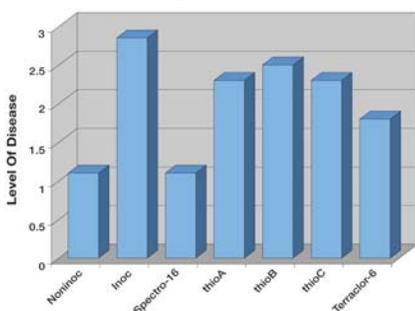


Figure 2. Efficacy of Spectro (chlorothalonil and thiophanate methyl, Cleary Chemical Company) and three thiophanate methyl formulations for control of Rhizoctonia stem rot on vinca. The disease was rated from 1 (none-healthy) to 5 (dead).

Pre-Mixes And Target Pathogens

| Product | Target pathogens in common |
|-----------|--|
| Armada | Powdery mildew, rust, |
| 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 |

Figure 3. The above pre-mixes can act as resistance-management tools on the indicated disease target.

Summary Of 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 |
| Anthraxnose | 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 32 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 |

Figure 4. Trials conducted at Chase Research Gardens tested the efficacy of Clevis (myclobutanil and mancozeb, Prokoz, Inc. and Dow Agrochemical) against various ornamental diseases.

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. Additionally, 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 1980s. I often heard comments from 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. per 100 gal. 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 treat-

ment. 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, myclobutanil and mancozeb, Prokoz, Inc. and Dow Agrochemical) in 1998 and have continued for four years (see Figure 4, below). 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 of control.

I was happy to hear last fall that Syngenta was launching Hurricane WP (fludioxinil and mefenoxam). 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 percent (Medallion 50WP) and mefenoxam-15.5 percent (Subdue MAXX).

Figure 6, below, shows results of our trials on Hurricane. Hur-

ricane (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 (sprenc — 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-hour REI.

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 (see Figure 5, left), we saw 100-percent efficacy with Clevis and little or no control with treatments of mancozeb (Protect) or myclobutanil alone (Eagle). The products were sprayed twice on a 14-day interval, and stock plants were naturally infected with *Peronospora parasitica* after the first spray.

The combination of the active ingredients in Clevis is an excellent solution to fungicide resistance. Since the two active ingredients affect downy mildew fungi

Efficacy Of Clevis

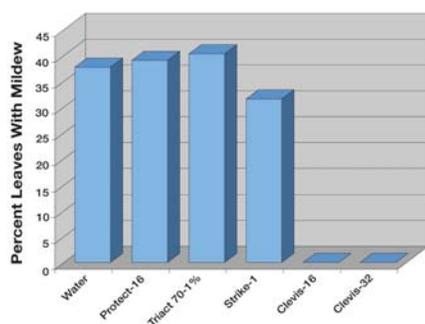


Figure 5. Effect of preventative sprays with Clevis (myclobutanil and mancozeb, Prokoz, Inc. and Dow Agrochemical) and other fungicides for downy mildew on stock. Products were applied in oz. per 100 gal. The disease rating is given as the percentage of leaves with active downy mildew sporulation.

Summary Of Hurricane 48WP Trials

| Pathogen | Plant | Treatment | Efficacy |
|------------------------|---------------|--------------------------|------------------------|
| <i>Cylindrocladium</i> | Azalea | One drench | Very good |
| <i>Cylindrocladium</i> | Spathiphyllum | 4 sprencs 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 sprenc | Excellent |
| <i>Rhizoctonia</i> | Impatiens | One drench | Excellent |

Figure 6. Trials conducted at Chase Research Gardens tested the efficacy of Hurricane 48WP (fludioxinil and mefenoxam, Syngenta Professional Products) using different treatments and against different crops.

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with unrelated modes of action, 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, page 44, that Spectro gave the best control in the trial. This may be a simple case of

additive benefits as opposed to truly synergistic benefits.

Conclusions

This article attempts to elucidate a growing trend in fungicides toward the development of pre-mixes. There are good points and bad points about pre-mixes, 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. 

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