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By A. R. Chase

Pre-mix fungicides and mode-of-action groups

This is the fifth of a 6-part series detailing mode-of-action groups for disease control comparing relative efficacy, resistance and phytotoxicity characteristics.

Although there may be multiple fungicides in a particular mode-of-action group, they're not labeled the same and don't have the same ability to control diseases.

Some of these fungicides are currently available as pre-mixes, while others are in different stages of the labeling process. If you use some of these products, you may be able to limit the need to rotate between mode-of-action groups since each pre-mix is a combination of two groups already.

Since application of more than one fungicide at a time is common, using a pre-mix provides the security of knowing that the two products are chemically suited to work together. In some cases both are effective on the target disease. If a product's range of activity does not overlap, then resistance management is not achieved with a pre-mix.

Most pre-mixes appear to have been created to broaden the range of activity of a single fungicide. Making your own mixtures could be effective in resistance management since you choose the products in the mix, but if you're not careful you could cause phytotoxicity. Table 1 lists some of the pre-mix fungicides currently available or under development for ornamental plants.

One of the most important aspects of pre-mixes is that if the correct partners are chosen, and they are each effective on the disease. This makes the pre-mix an excellent way to manage resistance.

Several pre-mix fungicides are effective on rust diseases.

For instance, both copper and mancozeb in the pre-mix Junction work on bacteria like Pseudomonas and Xanthomonas. Fungicide resistance in Botrytis can be delayed with Spectro since both thiophanate methyl and chlorothalonil target Botrytis. Table 2 shows

Table 1. Some pre-mix fungicides for ornamental plants.

FUNGICIDE	MANUFACTURER	COMPONENTS (MODE-OF-ACTION GROUP)	AVAILABILITY
Banrot 40WP	Scotts Co.	Thiophanate methyl (1) and etridiazole (14)	Registered in U.S. (except California)
Clevis	Prokoz and Dow Agrochemical	Myclobutanil (3) and mancozeb (M3)	Registered in U.S.
Concert	Syngenta Professional Products	Chlorothalonil (M5) and propiconazole (3)	In registration process
Hurricane 48WSP	Syngenta Professional Products	Fludioxinil (12) and mefenoxam (4)	Registered in U.S.
Junction	SePRO Corp.	Copper (M1) and mancozeb (M3)	Registered in U.S.
Pageant	BASF Corp.	Pyraclostrobin (11) and boscalid (7)	Registered in U.S.
Palladium	Syngenta Professional Products	Fludioxinil (12) and cyprodinil (4)	Registered in U.S.
Spectro 90WDG	Cleary Chemical Co.	Chlorothalonil (M5) and thiophanate methyl (1)	Registered in U.S.
26/36	Bayer and Cleary Chemical	Iprodione (2) and thiophanate methyl (1)	Registered in U.S.

Powdery mildew on gerbera.

the pre-mixes that may be beneficial for resistance management and the specific diseases targeted.

Pre-mix evaluations

Some of the trials at Chase Horticultural Research have evaluated pre-mix fungicides with the fungicides containing the mixes' separate active ingredients. The pre-mixes sometimes provide superior control, which may be the additive giving better control than each fungicide gives on its own.

A trial was conducted in 2005 for eradication of anthracnose (Phyllosticta) on *Vinca minor*. Control products included Spectro (thiophanate methyl and chlorothalonil as well as 3336 (thiophanate methyl) and Daconil Ultrex (chlorothalonil). The results showed the best control with Spectro and it was markedly better than the control achieved with either of the single component fungicides (Daconil or 3336).

This response is probably not due to resistance management nor does it appear to be simply the additive.

In another trial on Colletotrichum anthracnose prevention on mandevilla, Pageant (pyraclostrobin and boscalid) was compared with Insignia (pyraclostrobin). In this case, Pageant gave superior control while Insignia was not effective at all. The efficacy is clearly affected by the boscalid component and not rate since there was more pyraclostrobin in the Insignia application (2 ounces active ingredient per 100 gallons) than in the Pageant application (about 3.6 ounces active ingredient per 100 gallons).

In the case of actual resistance management, it was accidentally discovered that one isolate of *Rhizoctonia solani* was resistant to thiophanate methyl. In a trial with several different forms of thiophanate methyl compared to Spectro (thiophanate methyl and chlorothalonil), the chlorothalonil in Spectro provided 100 percent prevention of Rhizoctonia stem rot.

What you do with disease control products will determine their success. Remember, there is no acceptable substitute for thinking about crops and how to produce them. You are the most valuable component of any production situation.

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Table 2. Pre-mix fungicides that can act as resistance-management tools and the appropriate disease targets.

PRODUCT	TARGET PATHOGENS IN COMMON
Banrot	None
Clevis	Powdery mildew, rust and leaf spots
Concert	Leaf spots and rust
Hurricane	None
Junction	Bacteria, rust, powdery mildew and leaf spots
Pageant	Alternaria, Botrytis, Cercospora, powdery mildew, Rhizoctonia, rust and Sclerotinia
Palladium	Botrytis and Sclerotinia
Spectro	Rhizoctonia, leaf spots, Botrytis and Sclerotinia
26/36	Rhizoctonia, leaf spots, Botrytis and Sclerotinia

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Jerry Soukup of Southwest Perennials in Dallas, grows a variety of herb and perennial plugs, including drought-tolerant varieties.
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Photo by David Kuack

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