Fungicides for the Future

Status report and evaluations of the new fungicides that will be available in 2005 and beyond.

By A. R. Chase

I started working on fungicide efficacy about 25 years ago at the University of Florida research center in Apopka, Fla. At that time, the experimental products under investigation included fosetyl aluminum (Aliette 80WDG, Bayer Environmental Sciences), metalaxyl (Subdue 2E, originally Ciba Geigy Corp.) and iprodione (Chipco 26019, now Olympic Horticultural Products). We saw each of these fungicides successfully complete the registration process, and they remain industry standards today. For this year's article, I decided to review three new fungicides that are currently under development and are expected to be registered for ornamental use in the next year.

COMING UP

The first product is cyazofamid (sometimes called Ranman) from ISK BioSciences. Cyazofamid is a locally systemic fungicide in the cyanoimidazole family, with efficacy against oomycetes (Peronospora, Phytophthora and Pythium). We have worked on this product for three years with very good to excellent results on Pythium root rot and Phytophthora aerial blight and root rot. Last winter we tried cyazofamid for prevention of downy mildew on stock (matthiola). It was 100 percent effective at preventing disease at all rates tested. ISK has recently signed an agreement with FMC Corporation to develop cyazofamid together. The product is currently unnamed and will be marketed to our industry by FMC.

The second product is fenamidone (Fenstar) from Bayer. The product has actually been researched for the past six years and was originally identified as Exp10623. Through an agreement between Bayer and Olympic, Fenstar will be jointly brought to our market by these two companies. Fenstar is in the same general chemical class as Compass O, Cygnus and Heritage but is not a strobilurin; cross-resistance is possible. Fenstar has reduced risk status, as do many of the other imidazolinone fungicides. When applied to the soil the product is upwardly systemic, and it is locally systemic (translaminar activity) when applied to leaves. This makes it similar to Heritage in its systemic capacity. Fenstar should have national registration by the time this magazine is in print.

Last but not least, BAS500 (pyraclostrobin from BASF Corporation) is the newest strobilurin and has shown very good to excellent control of nearly all diseases in reported trials to date. The range of activity is very wide — powdery mildew and rust to Cercospora, scab and Alternaria and finally, soil-bore pathogens like Pythium, Phytophthora and Rhizoctonia. Our trials have shown this product to be a little safer to sensitive plants than currently registered strobilurins in side-by-side evaluations. BAS500 was first introduced for sale in 2002 on non-ornamentals and has recently been registered on turf.

EXPERIMENTAL RESULTS

Fenstar. Original testing targeted rates of 14-42 oz. per 100 gal., but since then, much lower rates have been found very effective in some cases. Our first trial on Phytophthora aerial blight on vinca (*Catharanthus roseus*) showed 100-percent prevention with all three rates of Fenstar when sprayed on a weekly interval (see Figure 1, bottom left). The second year, we tried the same rates but applied the product on a 14-day spray schedule. This time, we saw slight symptoms develop, especially at the 14- and 28-oz. rates. The higher rate was necessary to extend the interval of treat-

Downy mildew on limonium (statice). (All photos courtesy of A.R. Chase)

Figure 1. Efficacy of Fenstar in controlling Phytophthora aerial blight on vinca and Pythium root rot on geranium.

Treatment	Rate per 100 gal.	Vinca[x] 1999	Vinca[x] 2000	Geranium[x] 1999
Noninoculated control	—	1.0a[y]	1.0a	63b
Inoculated control	—	3.8b	2.6cd	37a
Fenstar	14 oz.	1.0a	1.4ab	52ab
Fenstar	28 oz.	1.0a	1.2ab	47ab
Fenstar	42 oz.	1.0a	1.1a	44ab
Aliette 80WDG	48 oz.	1.4a	1.4ab	36a
Subdue MAXX	0.6 oz.	1.0a	1.6ab	42ab

[x]Vinca were rated on a scale from 1 (no disease) to 5 (dead). Geranium data are given as the percentage of healthy roots.
[y]Means in the same column followed by the same letter were not statistically different using Student-Newman-Keuls method.

Figure 2. Efficacy of Fenstar in controlling downy mildew diseases on ornamentals. All data are given as the percentage of the leaf area with sporulation.

Treatment	Rate per 100 gal.	Snapdragon 1999	Alyssum 2000	Pansy 2002	Snapdragon 2003
Water	—	65cd[x]	6c	23c	18 c
Fenstar	5 oz. drench	NT[y]	NT	0a	NT
Fenstar	7 oz. drench	NT	NT	0a	NT
Fenstar	7 oz. sprench	NT	NT	0a	NT
Fenstar	7 oz. spray	NT	NT	0a	1a
Fenstar	14 oz. spray	0a	0a	NT	NT
Fenstar	28 oz. spray	0a	0a	NT	NT
Fenstar	42 oz. spray	0a	NT	NT	NT
Aliette 80WDG	16-48 oz. spray	24b	0a	5a	5ab

[x]Means in the same column followed by the same letter were not statistically different using Student-Newman-Keuls method.
[y]NT=not tested.

ment from 7 to 14 days. We also tried Fenstar out on a Pythium root rot on geraniums. We knew our isolate of *P. irregulare* was resistant to mefenoxam (active ingredient in Subdue MAXX from Syngenta), and the trial results showed this as well (see Figure 2, bottom left). The geranium data are given as the percentage of roots that appeared healthy. The best treatment was Fenstar applied as a monthly at 14 oz. per 100 gal.

We started trials on downy mildew control in 1999 and continued for the next four years. The first two trials used the same rates as those employed for Phytophthora and Pythium control, but by 2002 the rates for downy mildew control had dropped dramatically from 14-42 oz. per 100 gal. to 5-7 oz. per 100 gal. The first snapdragon trial was applied on a 14-day interval with 100-percent prevention at all rates tested (see Figure 2, bottom left). The alyssum trial also showed 100-percent prevention when applied on a 7- to 10-day interval. This was interesting but not especially exciting until our 2002 pansy downy mildew trial. This time, the protocol called for drench, sprench and spray application of much lower rates (5-7 oz. per 100 gal.). Imagine my utter shock and enthusiasm when we saw that even a 5-oz. drench gave 100-percent prevention of this downy mildew.

In 2003, we tested the 7-oz. rate as a spray for downy mildew prevention in a snapdragon trial in our greenhouses and a field trial on limonium cut flowers (see Figure 2, bottom left). We conducted this trial with Buzz Uber and Mellano and Company in Southern California. In this case, disease was active when we started the trial (we sprayed four times on a weekly interval). The best plant growth was found when plants were sprayed with Subdue MAXX and Dithane T/O (Dow AgroSciences) (1 oz. and 16 oz. per 100 gal., respectively) or Fenstar with or without Dithane T/O (7 oz. and 16 oz. per 100 gal., respectively). The use of Subdue MAXX on ornamentals for downy mildew control is not legal.

Cyazofamid. This past winter we saw Pythium attack wax begonias in a variety of ways, including a melt down or foliar blight, stem rot and root rot, which usually results in stunting (see Figure 3, below). So we decided to perform a trial with *Begonia x semperflorens* 'Olympia Red' plugs established in Sunshine No. 1 media. We used Osmocote Plus 15-9-12 as a top dressing and started each test when plants were established for about two weeks in 3½-inch pots. Plants were treated three times in June and July on a 14-day interval. They were inoculated four days after the first application, and fresh top weight was recorded 10 days after the last application. Cyazofamid was applied as a drench at 1½, 3 or 6 oz. per 100 gal., and fenamidone was applied as a spray or drench at 14 oz. per 100 gal. We compared the experimental products to a Subdue MAXX drench (1 oz. per 100 gal.) and an Aliette spray (16 oz. per 100 gal.).

Aliette resulted in phytotoxicity shown by severe stunting (50-percent size reduction compared to the noninoculated control). Even industry standards like Aliette can be unsafe on a few plants. Best growth and therefore disease control was found with cyazofamid at 1½ or 3 oz. per 100 gal. and the fenamidone spray of 14 oz. per 100 gal. (see Figure 3, below).

BAS500. BAS500 is very broad-spectrum in disease control (see Figure 5, page 26). Researchers have reported excellent control of Alternaria and Cercospora leaf spot, scab, downy and powdery mildews and Phytothora stem rot. Results on Antrhacnose have been moderate and variable on Pythium root rot. ➧

Pythium blight on wax begonia.

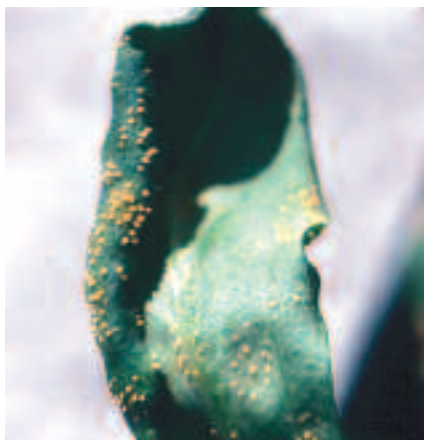
Figure 3. Summary of efficacy for BAS500.

Product	Pathogen	Average
BAS500	Alternaria	A-
	Anthracnose	C+
	Botrytis	B+
	Cercospora	A
	Diplocarpon (black spot)	B
	Downy mildew (Peronospora)	A-
	Fusarium	B+
	Phytophthora	A
	Powdery mildew	A-
	Pythium	B+ to D
	Rhizoctonia	B+
	Rust (Puccinia)	B
	Scab (Sphaceloma)	A
	Sclerotinia	B+

Figure 4. Efficacy of cyazofamid, Subdue MAXX, Aliette and Fenstar in controlling Pythium root rot on wax begonia. Rates are given as oz. per 100 gal. either as sprays (S) or drenches (D).

Figure 5. Efficacy of strobilurins and sterol inhibitors on Coleosporium rust on Bellis perenne *(English daisy). Spray rates are in oz. per 100 gal.*

Last winter, I reported in CHASE NEWS (a subscription-based, E-mail newsletter my company produces that provides up-to-date trial results and product reviews, see page 73) on an eradication experiment we performed on Coleosporium rust on *Bellis perenne* (English daisy) (see Figure 4, page 25). This disease is slowly becoming more common on English daisy. Controlling weeds in production can be very important since common groundsel is also a host of this rust fungus. We went ahead and tested prevention of Coleosporium rust later in the spring. We applied products on April 12 and 22 and finally on May 3. Bellis plants with rust pustules were dispersed throughout the trial the day after the first application. The products we included fell into two chemical classes. Strobilurins (Compass O from Olympic, BAS-500, Heritage from Syngenta and Cygnus from Scotts) and second-sterol inhibitors (Banner MAXX from Syngenta, Systhane from Dow AgriSciences, Terraguard from Crompton UniRoyal and Strike from Olympic) were compared to the non-systemic protectant — Protect T&O from Cleary Chemical.



Coleosporium rust on Bellis perenne *(English daisy).*

All of the strobilurins provided excellent prevention of Coleosporium rust. These products have differential degrees of systemic character, with Heritage the most mobile and Compass O the least mobile. We also evaluated top grade and found that none of the fungicides affected top grade significantly — thus no phytotoxicity.

CONCLUSIONS

These three new products will be welcome additions to our fungicide arsenal. All three will be helpful in fighting downy mildew, Phytophthora and to some degree Pythium. Be sure to follow rotational guidelines that come with each new product, since management of resistance will hinge on our ability to use products wisely. The trend in joint development between basic manufacturers and marketing companies that focus on ornamentals should mean more products for ornamental producers in the future.

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