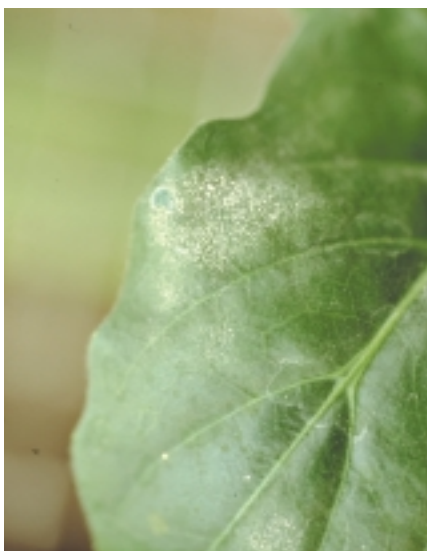
2001 Product Efficacy Update: *DISEASE CONTROL ON ORNAMENTALS*

Both old and new greenhouse chemicals help growers protect their crops from Botrytis *blight (above, on geranium) and powdery mildew (below left, on gerbera daisy). (All photos courtesy of A.R. Chase.)*

Controlling disease on ornamentals has come a long way since copper was first used in the mid-1700s. Growers now have an arsenal that includes both old and new products to protect their crops from disease.

By A. R. Chase



For the past three years, I have been asked to review new disease control products for the ornamental industry. In 1999, I tried to list newer products and their activities, including the broad range of those products now available. In 2000, a two-part article examined the newest chemical class (strobilurins) and the oldest chemical class (coppers). When GPN came to me with their request early this fall, I asked myself a question: What could I do this year to keep both the reader and myself interested? I decided to present a short history of ornamental disease control and focus on one class of products, fungicides, and their track record on fighting ornamental diseases. I've done my best in this effort and hope there is something here for most readers.

A LOOK BACK

I spend the better part of each year asking growers about their ornamental disease concerns and then performing research trials to try and address those concerns. I generally enjoy this work, thanks in no small part to the very high level of interest and participation of the product manufacturers in the ornamental industry.

When I started working on ornamental disease control about 20 years ago, ornamentals were overlooked, at best, when it came to interest from the agricultural chemical companies. The zero-tolerance for disease expression on ornamentals, the market's complexity with the multitude of segments and cultivars and the industry's relatively low dollar return made registrations on ornamentals less than appealing for many companies. In the early 1990s, we compounded the unattractiveness of the ornamentals market by involving ourselves in legal battles against the few companies who had registered their products for ornamental use. Ten years later, it's a wonder how we arrived at the present abundance of products for disease control in our industry. The explanations are no doubt complex, but the benefits are there for all to see.

We now have more products in every conceivable category for disease control on ornamentals than ever before. I can illustrate this point with a short trip down memory lane to take a look at the introduction of fungicides into agriculture — not necessarily registrations on ornamentals. (Please note that I have listed several trade names along with the active ingredients simply to remind the reader of a name they may better recognize, not to make recommendations about a product.)

Copper is one of the oldest fungicide products — with its first use in about 1761. One of the most effective applications was a Bordeaux mix, a combination of copper sulfate and lime. Sometime during the 1800s, sulfur was introduced for control of powdery mildew. In the 1930s, PCNB (Terraclor) was introduced, and in the 1940s, streptomycin and captan. In the late 1950s and early '60s, products containing mancozeb and dichloran (Botran) were introduced.

Then the real growth of the disease control industry occurred. In the 1960s, benomyl, thiophanate methyl (Fungo), triforine (no longer available) and etridiazole (Terrazole) were introduced. The 1970s could be labeled "the

Table 1. Results of trials for ornamental disease control conducted at Chase Research Gardens, 1996-2000.

FUNGICIDES — DISEASES

	Alternaria	Bacteria	Botrytis	Cylindro.	Downy Mildew	Fusarium	Myroth.	Phytophthora	Powdery Mildew	Pythium	Rhizoctonia	Rust	Thielaviopsis
Aliette		fair			exc			vgood-exc		exc			
Banner Maxx	fair								exc			vgood-exc	
Camelot	fair-good	good	good-exc	fair-good	poor-vg				vgood	fair-exc	poor	poor-good	
Chip 26019	vgood		exc			vgood/ none wilt	good	none		none	vgood		
Cleary 3336	none		poor-fair	good-vg		vgood		none	poor-good	none	vgood-exc		vgood
Cinnamite					none			none	good-exc				
Compass	vgood		vgood	good-vg	fair-vg	good	vgood-exc		vgood-exc	good		poor	none
Daconil	vgood		exc		none	vgood-exc	good-vg	none		none	exc		
Decree	fair		exc	fair	none	fair		fair	fair	none	fair	fair-good	none
Dithan NT	good		good-exc		good-vg						fair		
FirstStep					vgood		poor		exc				
Heritage	vgood		fair-good	fair-vg	exc	good-vg	vgood-exc	vgood	vgood-exc	fair-vg	exc	exc	none
Junction	good	vgood	poor-exc		none-vg		none		good	fair-exc	vgood	none	
Kocide TNO		vgood	fair	fair	poor-vg					fair-vg	poor	none	
Medallion	exc		exc	vgood-exc	none	vgood-exc	exc	none		none	exc		good
Phyton 27	fair-good	vgood-exc	poor-good	poor-good	vgood	none-vg	none	poor-vg	vgood-exc	fair-good	poor-good	poor-vgood	fair
Pipron									vgood-exc				
Plant Shield	none			good-vg	poor-fair	none wilt	fair	fair-good	fair	poor-vg	none-exc	fair-vg	fair
Protect	good-vg		vgood		fair-good		none	fair				vgood-exc	
Rubigan									good-exc			vgood	
Spectro	vgood				none		fair	vgood				vgood	
Stature MZ					exc			none-good					
Strike			good		poor-exc				good		fair	poor-exc	
Subdue Maxx								good-exc		good-exc			
Systhane									vgood-exc			exc	
Terraclor											good-exc		
Terraguard	good-exc		good-vg	good-vg		vgood	good		vgood-exc		fair-vg	vgood-exc	good
Terrazole								good-vg		vgood-exc			
Triact			fair-good		poor-fair				vgood-exc		fair	vgood-exc	

vg, vgood = very good
exc = excellent

Botrycide decade," with iprodione (Chipco 26019), vinclozolin (Ornalin) and chlorothalonil (Daconil) introduced, as well as fosetyl aluminum (Aliette), metalaxyl (Subdue), flutolanil (Contrast), triadimefon (Strike) and propiconazole (Banner Maxx). Many of these compounds were somewhat selective in the pathogens they affected, such as pythiaceous fungi (fosetyl aluminum and metalaxyl).

In the 1980s, we witnessed the introduction of many more sterol inhibitors, such as tebuconazole (Lynx) and triflumizole (Terraguard), as well as dimethomorph (Stature) and fenhexamid (Decree). Most recently, we have seen the additions of fludioxinil (Medallion — 1990), kresoxim methyl (Cygnus — 1990), azoxystrobin (Heritage —1992) and some biological controls including Trichoderma (RootShield — 1995) and Bacillus (Serenade — 1997).

New products and formulations will continue to be released. But we should never overlook the old standbys. In October, I attended an IR-4 workshop for ornamental disease control and one of the "newest" products touted was Bordeaux. It seems as if we've come full circle.

Table 2. Trials conducted at Chase Research Gardens, Inc. from 1996 to present.

DISEASE	DISEASES & PLANTS COVERED
Alternaria	Alternaria leaf spot on impatiens and pittosporum
Bacteria	Pseudomonas leaf spot on impatiens
	Xanthomonas leaf spots on geranium and ranunculus
Botrytis	Cyclamen, exacum, geranium, gerbera daisy, lisianthus, petunia, poinsettia
Cylindrocladium	Cylindrocladium root and petiole rot on spathiphyllum
	Cylindrocladium cutting rot on azalea
Downy Mildew	Downy mildew on alyssum, pansy, rose, snapdragon, stock
Fusarium	Leaf spot on dracaenas
	Wilt on cyclamen
Myrothecium	Myrothecium leaf spots on dieffenbachia and New Guinea impatiens
	Myrothecium petiole rot on spathiphyllum
Phytophthora	Phytophthora aerial blight on petunia and vinca
Powdery Mildew	Powdery mildew on crape myrtle, gerbera daisy, hydrangea, rose, verbena
Pythium	Root rot on Easter lily, geranium, lisianthus, snapdragon
Rhizoctonia	Rhizoctonia aerial blight on ferns
	Rhizoctonia root rot on poinsettia
	Rhizoctonia stem rot on impatiens, poinsettia, vinca
Rust	Geranium, hypericum, snapdragon
Thielaviopsis	Thielaviopsis (black root rot) on pansy

A REVIEW OF WHAT WORKS

In 1999, I wrote, "Some new products have characteristics, such as mode of action, source and range of efficacy, that we have become familiar with in previous products. Others have new modes of action, have been derived from novel sources or have greatly improved efficacy, which make their introduction especially exciting. Still others are biological pesticides since they are microorganisms that are living when applied to the crop and must be kept alive during the production of that crop." That statement remains true today, although the list of available products is much longer than it was two years ago. Today's list also includes many more "green" products, biological agents and

some truly new chemistry. (I will once again apologize to manufacturers of those products that are not included in some fashion in this article. Inclusion of a product is not meant as an endorsement and therefore omission is not meant as a slight.)

Many new products with new chemistries are being investigated by a number of chemical companies. Much of the new chemistry is originating in Japan, although development appears to be accomplished through U.S. or European companies. Partnerships between standard agricultural chemical companies and those dedicated to specialty crops such as ornamentals, turf and aquatics have been formed in the past five years with excellent results for the ornamental plant producer. Many of the large ag chemical companies appear intent on becoming larger by merging with other large companies (i.e., the recent merger of the ag divisions of Novartis and AstraZeneca to form Syngenta). This has been accompanied by a proliferation of smaller companies specializing in ornamentals.

A review of fungicides and their efficacy against certain diseases is summarized in Table 1 on pg. 33. This table represents four years of testing at Chase Research Gardens for ornamental disease control. The majority of the products included are currently labeled somewhere in the United States. Table 1 includes 29 products, which I admit is not comprehensive. Some products could not be included due to space constraints, as well as a lack of sufficient experience with them on my part. The 13 categories of diseases listed include subcategories for each disease. For example, *Fusarium* would encompass *Fusarium* leaf spot and *Fusarium* wilt diseases. Table 2 indicates the limits of the testing represented in Table 1.

Greenhouse chemicals that have been tested at Chase Research Gardens, such as Compass, Heritage and Systhane, show excellent efficacy on diseases like powdery mildow (shown above, on pansy).

The table results are presented using the following code system. First, a single word indicates either that a single trial was performed on that product or that the product consistently performed against that pathogen. Any range of responses indicates multiple testing over the past four years. A rating of none indicates that the product showed no control against the pathogen. In the normal course of growing, products tend to perform within a given range depending upon the disease pressure, means of applications (rates and intervals) and susceptibility of the host plant. It pays to keep in mind that even the best fungicides are not remarkably effective against very severe disease pressure such as *Cylindrocladium* root and petiole rot on spathiphyllum or *Fusarium* wilt on cyclamen. In addition, some plants are so susceptible to a disease that control is difficult (i.e., downy mildew on alyssum in the Pacific Northwest).

Note: Please use the information in the tables provided with caution. After all, these are research results and your personal experience with disease control should be your ultimate authority. And as always — follow the labels — *they are the law. Sometimes you will even find them helpful.*

A.R. Chase is plant pathologist and president of Chase Research Gardens, Inc., Mt. Aukum, Calif. You can obtain additional information on disease control at www.chaseresearchgardens.com.