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TACTICALLY SPEAKING...

by C.C. Powell, professor of plant pathology, Ohio State University

Pathogenic organisms such as fungi or bacteria commonly attack and infect stressed plants that may already show symptoms of a non-infectious disease condition.

When the pathogen is present, the health imbalance and stress of infectious disease are added to that of the previously existing non-infectious disease. There are disease organisms that are so pathogenic that they will vigorously attack even growing and reasonably healthy plants.

Nevertheless, stress management can promote the management of infectious as well as non-infectious dis-

ease problems. This is why pathologists often emphasize "disease."

Control or prevention tactics that are truly "holistic" plant health management concepts fall into three integrated areas: selection tactics, cultural or care tactics, and pesticide use tactics.

Control or prevention tactics (plant selection):

Using resistant varieties is an important disease management tactic in much of agriculture.

Plant selection tactics are a phase of plant health management that have

been difficult to successfully implement. New plants or cultivars are constantly being developed. They are bred or selected because of beauty or other growth characteristics over and above those relating to disease.

When considering a plant's future healthfulness, you should consider its known susceptibilities to particular pests and diseases, and its known tolerance or ability to handle environmental imbalances.

For instance, a new crabapple susceptible to scab would not be a wise choice. In the same way, a crabapple with scab resistance but questionable tolerance of dry sites would be an equally poor choice.

The plant lists in Table 1 illustrate the use of plant selection to prevent plant disease.

TABLE 1
Ornamental Plants Resistant to Some Common Diseases¹

I. FLOWERING CRABAPPLES:

The following cultivars are moderately to highly resistant to powdery mildew, scab, fireblight and rust:

Bob White	Ormiston Roy
Centurian	Red Baron
Coralburst	Red Jade
Donald	Sargent
Donald Wyman	Sentinel
Inglis	Tina
M. halliana 'Parkmanii'	White Angel
M. hupenhensis 'Tea'	White Cascade
Molten Lava	

II. JUNIPERS:

The following varieties are believed to be at least moderately resistant to twig blight and to rust:

J. chinensis 'Hetzii'	J. horizontalis 'Wiltonii'
J. chinensis 'Keteleeri'	J. procumbens
J. communis	J. squamata 'Meyeri'
J. horizontalis 'Douglasii'	J. virginiana 'Tripartita'
J. horizontalis 'Plumosa'	

III. TREES:

The following types are resistant to Verticillium wilt disease:

Ceridophyllum sp.-katsura	Malus spp.-flowering crabapples
Carpinus spp.-hornbeams	Morus sp.-mulberry
Crataegus spp.-hawthorns	Plantanus spp.-plant trees
Ginkgo biloba-ginkgo	Quercus spp.-oaks
Gleditsia sp.-honey locusts	Salix spp.-willows
Liquidambar sp.-sweetgum	Sorbus aucuparia-European mountain ash

Control or prevention tactics (cultural activities):

Cultural activities to modify environments may be the most important ways to manage plant health.

For example the most common reason for poor urban landscape plant health may be bad root-soil environments. Many soil environments, for many reasons, are not able to support the continued growth and functioning of healthy roots. Compacted soils, poor aeration, and nutrient or pH imbalances are stresses often encountered.

The integrated cultural tactics used to correct poor root health are increasing the root-shoot ratio (usually done by pruning back shoots), extensive irrigation and fertilization programs, and/or a restructuring of the root environment.

Restructuring the root environment recently has been emphasized throughout the country, especially where soils tend to be heavy and poorly drained.

Such root environmental improvement has been called *vertical mulching* or *core aeration*.

Vertical mulching may be the most effective root stress management tool practiced. Drilling holes into the soil, around fibrous root growth areas of trees and shrubs, can correct several imbalances and thus is applicable in a variety of situations.

¹These lists are not complete. They are intended as guides to assist in plant selection decisions. In some instances, listed plants are susceptible to other disease, insect or environmental problems. Thus, it may not be wise to plant them even though they are resistant to a specific common disease.

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DISEASE CONTROL GUIDE cool season

TABLE 2

Some common diseases of woody ornamentals and fungicides that can be used for control¹

HOST	DISEASE	FUNGICIDES
Azalea	Blight and dieback	Dithane M-45, FORE, Kocide 101, Zyban, Duosan
Crabapple	Scab	Benlate, Tersan 1991, Daconil 2787, Dithane M-45, FORE, Phaltan, Zyban, Duosan
Dogwood	Leaf Spot	Benlate, Tersan 1991, Daconil 2787, Dithane M-45, FORE, Zyban, Duosan
Hawthorne	Leaf spot	Benlate, Tersan 1991, Daconil 2787, Dithane M-45, FORE, Zyban, Duosan
Juniper	Tip blight	Benlate, Tersan 1991, Dithane M-45, FORE, Zyban, Duosan
Hawthorne	Rust	Bayleton, Daconil 2787, Dithane M-45, FORE, Zyban, Duosan
Lilac	Powdery mildew	Benlate, Tersan 1991, Bayleton, Karathane, Triforine, Zyban, Duosan
Maple	Leaf spot	Dithane M-45, FORE
Pachysandra	Blight	Kocide 101, Dithane M-45, FORE, Zyban, Duosan
Pine	Tip blight	Benlate, Tersan 1991
Pyracantha	Scab	Benlate, Tersan 1991, Daconil 2787, Kocide 101, Zyban, Duosan
Roses	Black spot	Benlate, Tersan 1991, Captan, Daconil 2787, Kocide 101, Dithane M-45, FORE, Phaltan, Triforine, Zyban, Duosan, Manzate 200

¹This list is presented for information only. No endorsement is intended for products mentioned, nor is criticism meant for products not mentioned. Registration data derived from labels and from the National Pesticide Information Retrieval Service. Before using any pesticide, read and follow all label directions.

Vertical mulching can improve aeration, improve drainage of excess water, improve penetration of water into dry soils, and provide places for roots to grow and proliferate.

Control or prevention tactics (using pesticides):

Last in integrated control or prevention tactics are those involving pesticides. Remember that pesticides only are effective when pests or infectious diseases are truly the cause of the problem. Table 2 gives some chemicals that are used against common ornamentals diseases.

Pesticides are only effective if several rules are followed.

First, the correct material must be selected. This depends on correct diagnosis and identification of the pathogen or pest.

Second, the chemical must be applied at the proper time of year and frequently enough to protect plant material adequately.

Third, pesticides must be applied properly over plant surfaces.

The rules depend on your making correct decisions based on correct knowledge.

The following chemicals are commonly used for control of diseases of trees and ornamentals:

Benomyl (Benlate, Tersan 1991)

This systemic fungicide is effective against apple scab, powdery mildews, botrytis, anthracnose, and other leaf-spots commonly seen on landscape plants. A good spreader-sticker is necessary for best results from sprays.

Bordeaux Mixture (Bordo-Mix)

This older copper-based fungicide controls a broad range of activity. It is labeled for control of many leaf spots and blights on all ornamentals. Use of Bordeaux mixture leaves a residue and may be phytotoxic to some crops.

Captan (Orthocide)

This broad-spectrum fungicide has limited registrations for use on ornamentals. It is effective on certain foliar

diseases.

Chlorothalonil (Daconil 2787)

Daconil 2787 is quite good for control of leaf spotting fungi on ornamentals. It is commonly sold as a flowable formulation.

Cupric hydroxide (Kocide 101, Kocide 404)

These are "fixed copper" fungicides, quite safe to users but potentially damaging to plants. They have a wide range of activity against many leaf spots and blights.

Cycloheximide (Actidione-PM)

This antibiotic material is effective for powdery mildew and rusts but may cause plant injury, especially spotting of new foliage on roses.

Dodemorph (Milban)

This EC fungicide is currently registered for powdery mildew control on a few ornamentals. Make sure to wear eye protection when using this restricted-use material. Do not mix Milban with other chemicals in the spray tank.

Fenarimol (Rubigan)

Fenarimol is a locally-systemic fungicide for the prevention or therapeutic control of powdery mildew in commercially-grown field or greenhouse roses, and in a few other field-grown ornamental crops. A 12.5 percent emulsifiable concentrate, it can be tank mixed with properly labeled wettable powder fungicides when needed. To avoid growth effects (phytotoxicity), use the lower end of dosage ranges given on the label whenever possible. Lower dosages are also recommended under cool, foggy, or overcast conditions.

Ferbam

This broad-spectrum carbamate fungicide, registered for control of several leaf spots, rusts and blights, is somewhat difficult to wet. The black color may leave a conspicuous residue, especially on flowers.

Folpet (Phaltan)

Folpet, a close relative of Captan, provides good control of certain leaf spots on ornamentals.

Iprodione (Chipco 26019)

Many ornamentals can be sprayed with this 50 percent WP fungicide for control of botrytis blights and a few other diseases.

Mancozeb (FORE, Dithane M-45, Manzate 200)

This is a coordination product of maneb fungicide and a zinc salt, registered for the control of leaf spots and blights. The product is a broad-spectrum material but does leave a heavy

continued on page 78



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DISEASE CONTROL GUIDE

residue. The label on the wettable powder mancozeb sold as FORE and Dithane M-45 has recently been expanded to include many common diseases of trees and shrubs.

Streptomycin (Agrimycin, Agri-strep)

This antibiotic is effective for control of some bacterial plant pathogens. Because of the diversity of bacterial diseases, check the label for specific uses. The product may cause plant damage.

Thiophanate-ethyl (3336-F)

As the trade name indicates, this is a 4-pound per gallon flowable product. Similar in mode of action to benomyl, it is labeled as a foliar spray for anthracnose, botrytis, and a few other diseases of ornamentals.

Thiophanate-m plus mancozeb (Zyban, Duosan)

This broad-spectrum, systemic-contact fungicide consists of a 15 percent WP thiophanate-methyl, 60 percent WP mancozeb mixture. It is labeled for professional use only on many herbaceous and woody ornamentals in greenhouses or fields. A good spreader-sticker is recommended for use on

hard-to-wet foliage. You may not want to use the product on French Marigold or Gloxinia.

Triadimefon (Bayleton)

This systemic fungicide is quite effective for its labeled uses, primarily involving powdery mildew and rust diseases. Labeled directions must be followed closely. Overdoses of Bayleton will stunt plants and darken foliage.

Triforine (Funginex)

This EC fungicide wets foliage well without the need for additional spreader-sticker. This may be a key to its effectiveness but you should avoid excessive runoff while spraying. Eye protection is needed when using the material.

Vinclozolin (Ornalin)

This 50 percent WP fungicide is effective for control of Botrytis spp. and Sclerotinia spp. on ornamental herbaceous, woody, and bulb crop. Similar in action to iprodione fungicide, it is said not to leave as noticeable a residue. It is labeled for professional use only.

Zineb (Dithane Z-78)

For leaf spots, rusts, and blights,

use this product a a foliar spray. It should be reapplied every seven days until the disease is under control.

The application

Scheduling fungicide sprays into routine management programs is a difficult subject which has been approached in many different ways by many different practitioners.

Generally, most combine two fungicides to get the broad spectrum of disease control needed when trying to service diversely-planted landscape accounts.

Over the years, many landscapers have found that a combination of mancozeb fungicide plus a fixed copper fungicide has given good results.

This is especially important where control of bacterial fire blight is needed because of close spacings of large blocks of susceptible plants (such as crabapples, cotoneasters, or pyracantha). Generally, these bacterial diseases are not successfully controlled with sprays because of the need to spray frequently throughout the rainy periods of the growing season.

Many landscapers, on the other hand, have gained from a combination of mancozeb plus benomyl. The combination provides long lasting, broad-spectrum control of most common ornamental plant diseases.

The new product Zyban is a combination very similar in mode of action to mancozeb plus benomyl.

Both Bayleton and Daconil 2787 are effective products that are probably best used alone.

Many landscapers and nurserymen are alternating one of the above combinations with either Daconil 2787 or Bayleton, applying sprays monthly or bi-weekly depending on prevalence of rainy weather.

Not much change

Whereas you may think that the world of fungicides has changed in recent years, you must realize that the basic approaches and the usefulness of chemicals in the landscape to control infectious diseases has remained essentially the same.

Preventive spray programs with proper intervals between applications are the secrets to successful disease management.

Obtain labels of the new products, study them, and see how they will fit into your disease management program.

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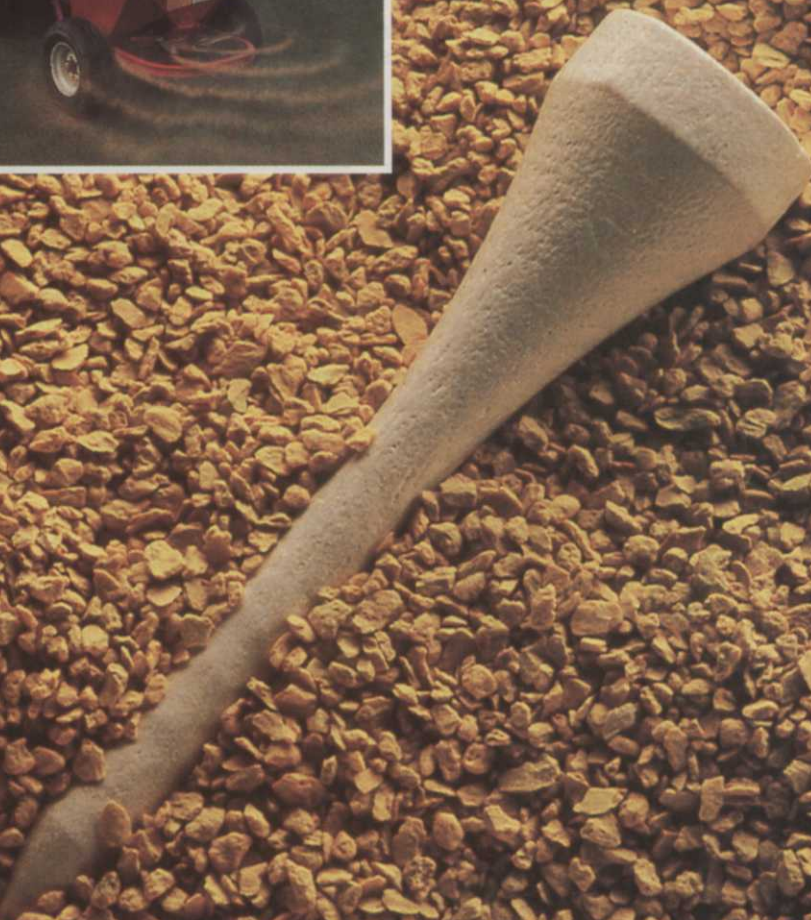
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THE RIGHT SPRUCE

The spruce varieties can be a unique feature to the commercial landscape providing you do your homework. Not all spruce is right for all areas.

by Douglas J. Chapman

Spruce can be a unique asset to the commercial and home landscapes if all factors—environmental tolerance, soil requirements, and insects and diseases—are considered.

Picea, which adapt best to the Northeast and Great Lakes region, include Norway, Engelmann, White, Colorado, Serbian, and Oriental Spruce. Colorado Spruce, due to over-planting and disease (for example, *Cytospora* Canker), should be used only sparingly. Each of these conifers has a preferred niche in the landscape.

Norway Spruce

Norway Spruce (*Picea abies*) is a European native, the most important conifer species for the European landscape and timber industry. It grows over a wide range of soil conditions, preferring cool, well-drained soils.

It needs a high humidity, thus is adapted particularly well for the Great Lakes, New York, and New England areas. Norway Spruce is particularly cold hardy, reportedly tolerant of temperatures down to minus 72 degrees F.

When young, it has a somewhat stiff, formal habit of growth, becoming a graceful, upright-arching tree at maturity. *Picea abies* effectively reaches 60 feet in height with a spread of 20 to 30 feet. There are reports of Norway Spruce, under native conditions, growing considerably larger, but one must know effective landscape height, not ultimate height, in native conditions.

Norway Spruce has been cultivated and improved selections made over such a long time period that many unique cultivars exist.

Two particularly outstanding cultivars include *Picea abies* 'Maxwellii,' a dwarf rounded plant and *Picea abies* 'Nidiformis' (Nest Spruce), a plant which reaches three to six feet in height and spread. Certainly, Norway Spruce is high on the list of desirable landscape species.

Engelmann Spruce

Engelmann Spruce (*Picea engelmannii*) is native to the western United

States. It is particularly hardy, tolerant of temperatures to minus 90 degrees F. Engelmann, a rather formal, dense plant, serves as an outstanding ornamental. It reaches 40 to 50 feet in height with a 10 to 20 foot width.

This plant grows best in extremely well-drained soils but does require frequent rain or a high water table. Among the spruce, it is probably the most resistant to sulfur-dioxide. Engelmann Spruce is difficult to obtain but should be listed as one of the truly outstanding ornamental spruce types.

White Spruce

White Spruce (*Picea glauca*) is best suited to northern areas, specifically

Colorado Spruce, due to over-planting and disease (for example, Cytospora Canker), should be used only sparingly.

northern Michigan, New England, and Ontario. It thrives in cool, moist soils, adapting to a wide range of pH from 5 to 7.5. It is resistant to chlorides (salts) and is tolerant of sun or shade conditions. These features make it particularly well suited to natural landscapes throughout the northeast and northcentral U.S.

Its habit is rather loose and open—40 to 50 feet in height at maturity with a spread of 15 to 20 feet.

White Spruce is uniquely suited to commercial or park landscapes. It is particularly tolerant of many urban problems such as low-oxygen or heavy soils, and varied light conditions.

Colorado Spruce

Colorado Spruce (*Picea pungens*) thrives over a wide range of conditions. Its rather formal, dense habit, reaching 40 to 60 feet with a spread of 20 to 30 feet in the Great Lakes region.

It is tolerant of clay to droughty, well-drained soils.

Picea pungens is particularly subject to desiccation during the winter months. Although it is the most readily-available spruce in the trade, it is also the most susceptible to *Cytospora* Canker.

When Colorado Spruce reaches 25 to 30 years of age, it frequently contracts *Cytospora kunzei* and declines. Due to this disease problem, the use of Colorado Spruce should be reduced dramatically.

Serbian Spruce

Serbian Spruce (*Picea omorika*) in the landscape is probably the most notable specimen spruce. It reaches 50 to 60 feet in height and has a spread between 15 and 20 feet. It thrives in well-drained soils but adapts to a wide range of soil conditions.

It is quite formal and is particularly well suited to either the home or commercial landscape. Of all the spruce, it seems the least susceptible to *Cytospora* Canker which should encourage its use.

Oriental Spruce

Oriental Spruce (*Picea orientalis*) is a truly outstanding spruce with a very dense habit. It reaches 50 to 60 feet in height with a 20 to 30 foot spread.

It is tolerant to a wide range of soil conditions but is not dependably hardy, thus should be grown only in areas such as southern Ontario, southern New England States, southern New York, Ohio, Indiana, and Illinois. Its color is an outstanding lime green.

Oriental Spruce is not a host to many catastrophic insect and disease problems.

As a landscape tree, Oriental Spruce is truly unique. *Picea orientalis* certainly has a place throughout the southern Northeast and middle Atlantic States. It is, however, the least cold temperature hardy of all the spruce discussed above.

Disease controls

There are numerous insect and disease problems which can affect the spruce types but probably the most single catastrophic problem is