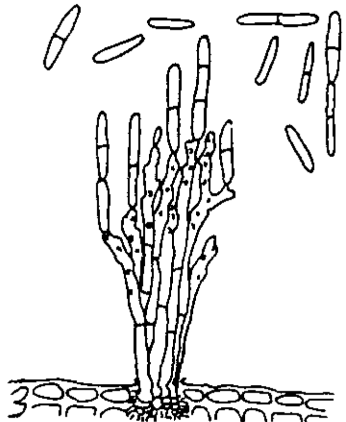

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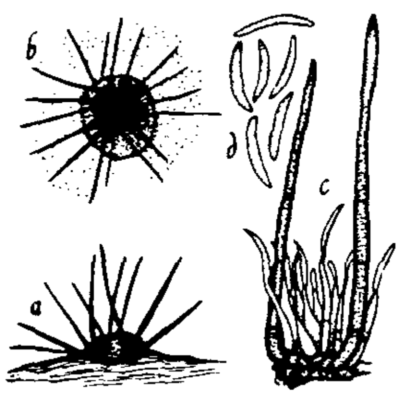

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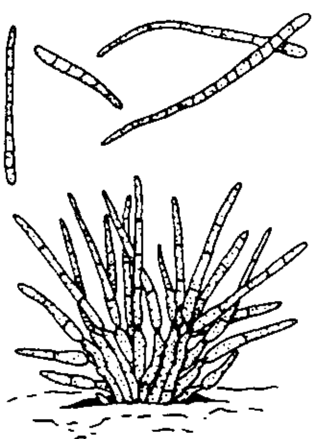

Cercospora

Volume VII Number 3

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Features

Illustrations by Lenore Gray

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PDQ Vol. VII Number 3

Editorial

November 15, 1986

PDQ was started in 1980 to improve communication among diagnostic plant pathologists. Judging from the continued enthusiastic participation and our growing subscriber base, PDQ is a success. The APS Diagnostics Committee, established 1986, is one product of this improved communication. The Diagnostics Committee uses PDQ to publish meeting minutes, agendas, and special projects such as workshops and other events sponsored at national and regional meetings.

This issue features a series of three short articles coordinated by Molly Niedbalski Cline on control of root diseases on ornamentals. The report of our first official Diagnostics Committee meeting in Orlando is included, as is a current listing of subscribers.

As we continue to work together to address problems and issues that concern us as diagnosticians, PDQ will continue to play a useful role.

Sincerely,

Ethel M. Dutky
Editor

The Root of the Matter

Molly Niedbalski Cline, Ph.D.
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All ornamentals - floriculture crops, foliage plants, bedding plants, bulb crops, and nursery crops - are susceptible to one or more soilborne fungi which are capable of causing damping-off of seedlings, cutting rot, or stem, crown, and root rot of established plants. These types of diseases are potentially serious, particularly because they can be difficult to recognize and diagnose the causal factor.

Entire seed flats of bedding annuals and perennials are often lost to damping-off. Seedlings that do survive mild infection are usually weak and nonproductive. Cutting rot will result in failure of the propagule to root. Root rot frequently causes a slow decline resulting in a less marketable plant due to quality loss or reduction in flowering. In severe cases, root rot can even result in death of the plant.

Damping-off is usually associated with Rhizoctonia solani and/or species of Pythium. Other fungi that occasionally cause damping-off include Sclerotinia sclerotiorum, Sclerotium rolfsii, species of Botrytis, Fusarium, Phytophthora, Cylindrocladium and others.

The most common root-rotting fungi of established plants are species of Pythium and Phytophthora. Rhizoctonia solani, Thielaviopsis basicola, Sclerotium rolfsii, and species of Fusarium and Cylindrocladium can also cause root and stem rot of established plants. Any one or more of these fungi can be present in the soil and can be easily introduced into soilless media. Each is dependent for spread on mechanical transfer of mycelia, sclerotia, or resting spores in infested soil particles (on flats, tools, pots, baskets, or on the end of the watering hose) or infected plant tissue. The characteristic symptoms produced by the major soilborne pathogens are given below.

SYMPTOMS

Damping-Off

Damping-off can occur shortly after planting seed. It is a most serious problem in commercial bedding plant production. When seeds rot in the soil before germination or the new sprouts are killed before reaching the soil surface, this is called pre-emergent damping-off. Preemergent damping-off results in a poor, uneven stand, a condition that is often attributed to low seed viability. Young seedlings can also be killed shortly after emergence (postemergent damping-off). Infection results in a water-soaked lesion at or below the soil line. The lesion enlarges, girdling and constricting the stem, causing the seedling to discolor, wilt suddenly, collapse, and die. A tan, gray, pink, cottony, or other type of mold may grow over affected plant parts in moist weather. Woody seedlings often wilt and remain upright (wirestem). Damping-off may be caused by a variety of seed and soilborne fungi with Rhizoctonia solani and Pythium spp. being the most prevalent.

True damping-off may be confused with plant injury caused by insect feeding, excessive fertilization, high levels of soluble salts, "drowning" in overly wet soil, desiccation in very dry soil, and death of seedlings from excessive heat or cold, flue fumes, or chemical toxicity. Correct diagnosis by laboratory culturing is recommended in order to pursue proper control measures.

Root Rot

All established plants (floriculture crops, foliage plants, bulb crops, and nursery crops) are affected by one or more root rots. Such plants may show a variety of above-ground symptoms. They may be stunted or low in vigor, and they may grow slowly or wilt easily on a warm day. The foliage of such plants may turn yellow to brown and fall prematurely, starting with the bottom or oldest leaves and moving up the plant until only the youngest tuft of leaves remains. If severely affected, plants eventually die when the roots can no longer supply sufficient water and nutrients to the above-ground parts. The severity of root rot depends upon the fungal pathogen, the susceptibility of the host plant, and the soil conditions.

If a root rot is suspected, the plant should be carefully removed, and its roots should be washed off and examined for indications of rotting. A healthy plant has numerous white roots that appear fibrous. A diseased plant's roots will show various degrees of water-soaking and will usually be some shade of brown or black.

Other pest problems that may have above-ground symptoms similar to root rots' are stem and crown (foot) rots; Fusarium and Verticillium wilts; bacterial soft rot or wilt; root-feeding by nematodes and insects; a severe infestation of mites, aphids, or soft-bodied scales; and rots of bulbs, corms, rhizomes, or tubers.

Above-ground symptoms similar to those of root rot may also be caused by such environmental factors as a lack or excess of water, poor drainage, accumulated salts in the soil, insufficient light or nitrogen, potbound roots, and a sudden change in the environment (e.g., a cold draft, or a change in temperature, lighting, or humidity). As in the category of damping-off, correct diagnosis by laboratory culturing is recommended.

DISEASES AND PATHOGENS

Rhizoctonia Rots (*Rhizoctonia solani*)

In its most severe form, this disease causes damping-off of bedding plant seedlings and a firm basal (or foot) rot of woody and herbaceous cuttings. Under favorable conditions, it may even produce a root rot of mature plants. Infection is favored by an intermediate moisture range and warm to hot temperatures. Plants infected with Rhizoctonia solani have sunken, well-defined, reddish brown to dark brown lesions on the stem at or below the soil line and on the roots. Under moist conditions, the weblike brown mycelial growth of the fungus can be seen coming from the lesions and can even attack the foliage of the plant causing a web blight such as is frequently seen on azalea.

Rhizoctonia solani is found in all natural soils. It can survive indefinitely in the soil through saprophytic mycelial growth or as hard, small (1/16- to 3/16-inch), round to egg-shaped, brown to black bodies called sclerotia.

Pythium Rots (Pythium spp.)

Species of Pythium cause damping-off of bedding plant seedlings, basal rot of cuttings, and root rots of established plants, particularly herbaceous plants. Pythium root rot is favored by cool, wet, poorly-drained soils and by overwatering. Pythium infects the younger, feeder roots and often advances into the rest of the root system. Pythium infection results in a wet, odorless rot. The roots later take on a light brown to black coloration. The soft to slimy rotted outer portion of the root (cortex) usually can be easily separated from the inner core (stele). If severe, the disease may move up into the lower portion of the stem, which then becomes slimy and black.

Species of Pythium survive for several years in soil and plant refuse as a saprophyte or as thick-walled resistant spores (chlamydospores or oospores).

Phytophthora Rots (Phytophthora spp.)

Species of Phytophthora are usually associated with root rots on established woody plants but can be involved in damping-off and a basal rot of cuttings of both herbaceous and woody plants. Like Pythium, species of Phytophthora are water molds and are favored by cool, wet, poorly drained soils. Phytophthora spp. enter the root tips and cause a water-soaked, odorless, brown to black rot very similar to Pythium root rot. In fact, because of the similiarity, it may be necessary to send a diseased specimen to a plant disease clinic where the pathogen can be isolated through culturing and identified. Fortunately, Pythium and Phytophthora root rots are controlled by the same treatments.

Species of Phytophthora survive in soil and plant debris as oospores, chlamydospores, or as saprophytes.

Thielaviopsis Rots (Thielaviopsis basicola)

This fungus, which does not have as large a host range as the previous pathogens, is primarily a problem of established plants and may attack both herbaceous and woody plants. The disease is not a problem in soil adjusted to a pH of 4.5 to 5.5. The fungus infects the plant where the lateral roots emerge from the taproot. The diseased area is very dry and soon turns a dark brown to black because of the abundant production of chlamydospores by the fungus.

Thielaviopsis basicola survives in soil and plant debris as a saprophyte or up to 10 years or more as thick-walled, resistant black chlamydospores.

DISEASE MANAGEMENT

A disease management program for root rots should be based on the concept that, in the final analysis, the source of plant pathogens for "root" diseases is the soil (including water and nonliving organic matter). Disease management can be achieved by integrating pathogen-free propagules with pathogen-free growing media.

Purchase of seed, cuttings, propagules, and whole plants from specialist propagators will increase the chances that they are actually disease free. Following sound horticultural practices after purchase of a top quality propagule will help to insure maintenance of the plant in a vigorous growth state.

Pathogen-free growing medium is achieved by steam pasteurization or chemical (soil fumigants or soil fungicides) treatment of the medium which is known not to be pathogen free. (Soil pasteurization and soil fumigant procedures will not be further discussed in this paper.) A strict sanitation program will help to prevent recontamination of "sterile" growing medium. It will also help to prevent contamination of supposedly "sterile" soilless media. Some points to consider in a sanitation program are as follows:

1. Sterilize all pots, containers, and potting benches. In this list of materials are tools, flats, pots, wire or plastic supports for plants, and watering systems. Check your Extension recommendations for appropriate disinfectants to be used in the greenhouse.

2. Avoid recontaminating pasteurized, fumigated, or fungicide-treated soil, and commercial soilless mixes. Tools used in untreated soil should not be used in treated soil unless they have been disinfected.

3. The nozzles of watering hoses should not be stored on surfaces where they can pick up soil particles which could contain pathogens and later transfer them to sterilized areas. Use tap water or deep well water, which is usually free of fungal pathogens, to water plants. Do not use water from drainage ponds, ditches, or other surface areas -- these areas

are often contaminated with root-rotting fungi and other pests.

4. Avoid spreading soil from infested areas. Carefully remove diseased plants from growing areas and place them in a covered trash container.

Despite efforts to restrict these pathogens by soil pasteurization and sanitation programs, root rot diseases continue to be rampant in all segments of the ornamental industry. Pathogens can be inadvertently introduced into the production areas by the constant flow of people, equipment, water, seed, plant material, and soil in and out of greenhouses and nurseries. It has therefore become almost universal in the past decade to apply soil fungicides in a regular preventive maintenance program coupled with sanitation and/or soil pasteurization practices in commercial ornamental production. Pesticide manufacturers have been actively developing soil fungicides for commercial use over the past twenty years and numerous products and formulations are currently offered (Table 1).

The key to using soil fungicides effectively is first to identify the problem. If a portion of plants from a crop not treated with a soil fungicide shows one or more of the symptoms which can be induced by the soilborne pathogens as described previously in this paper, then the problem must be correctly identified. After identification of the causal organism, then the proper fungicide(s) specific for the pathogen, can be applied as a preventive measure to protect other unaffected plants in the immediate area. If a soil fungicide is to be applied on a crop as a preventive measure, prior to any indication of disease symptoms, then selection of the proper soil fungicide for that crop should be dictated by consulting published information which lists the soilborne fungi that attack that particular crop. For example, it is known that Rhizoctonia frequently attacks azalea. A fungicide with activity against Rhizoctonia should be selected. The common and trade names of suggested fungicides, the formulations available, the pathogens they control, and the manufacturer are given in Table 1.

After selection of the proper fungicide, success in using these products will be dependent on following specified label recommendations for rate (for crop, soil depth, and area to be treated), frequency of application, and use pattern (drench, incorporation, side-dressing, or broadcast, according to the specific formulation), given that the plant type to be treated is already on the label. Representatives from the various pesticide manufacturers are always willing to answer questions regarding nuances of product use. The user should not hesitate to contact the manufacturer directly should additional information be required.

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presented to University of Minnesota Horticulture Industries Conference Minneapolis-St. Paul, MN January 30, 1985

Table 1. Soil Fungicides* Useful in Controlling Damping-Off, Cutting and Root Rots of Ornamentals

Common Name	Formulation(s) Available	Trade Names	Manufacturer	Fungal Pathogens Controlled
Benomyl	WP	BENLATE	DuPont	Rhizoctonia, Sclerotium, Sclerotinia, Fusarium, Botrytis, Thielaviopsis, Cylindrocladium (but not water molds)
Etridiazole	WP, F, G, EC WP, G, EC	TRUBAN TERRAZOLE	Mallinckrodt – Uniroyal	Water molds (Pythium and Phytophthora)
Etridiazole and thiophanate-methyl	WP, G	BANROT	Mallinckrodt	Rhizoctonia, Thielaviopsis, Fusarium, Pythium and Phytophthora
**Fenaminosulf	WP	LESAN	Mobay	Water molds (Pythium and Phytophthora)
Fosetyl-Al	WP	ALIETTE	Rhone Poulenc	Water molds (Pythium and Phytophthora)
Iprodione	WP	CHIPCO 26019	Rhone Poulenc	Botrytis and Rhizoctonia
Metalaxyl	EC, G	SUBDUE	Ciba-Geigy	Water molds (Pythium and Phytophthora)
PCNB	WP, G	TERRACLOR	Uniroyal	Rhizoctonia, Sclerotinia, Sclerotium, Botrytis and other sclerotia-forming fungi
Propamocarb/hydrochloride	F	BANOL	NorAm	Water molds (Pythium and Phytophthora)
Thiophanate-methyl	WP	TOPSIN M	Pennwalt	Rhizoctonia, Sclerotinia, Botrytis, Fusarium, Thielaviopsis and Cylindrocladium

**Mobay has discontinued production of LESAN

*Registered

BEHAVIOR OF SOIL FUNGICIDES IN GROWING MEDIA[1]

C. E. Bardsley[2]
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FOREWORD

Despite the broad implications in the title, the main objective is to focus on the systems created when a soil-applied fungicide is used. Further, while there are many biological interactions possible, depending on the target and non-target organisms present, these will not be considered here. Instead, the main concern will be with physical behavior of fungicide molecules in the solid-air-water complex of the growing media with only minimal consideration of the chemical factors.

THE GROWING MEDIA

Today's commercial horticulture is largely practiced using "soilless" media and little natural mineral soil. As a consequence, classical knowledge of soil physical chemistry is not directly applicable and must be adapted as necessary. Two major points of dissimilarity are important to recognize: first, clay and humus colloids which constitute the surface-active fractions of natural soils are virtually non-existent in peat-perlite and similar media; and, second, the void volume is greatly exaggerated as to quantity, size, and shape in bark, peat, sand and similar media. Thus, both the surface chemistry and the hydraulic physics of these non-mineral soils challenge our understanding.

Fonteno, et al (3), working with three growing media, showed a relationship of about 20% solids, 30% air space (macropores), and 50% water retentive voids (micropores). They demonstrated that water held in about 15 to 20% of the volume could be considered easily available to plants and about 18% would be unavailable to plants. This gives a rather clear picture of what the volume relations in such media are like, see Figure 1.

A somewhat different perspective of the solid to void relation is shown in Figure 2. This depicts a large channel or macropore, drained of all water except the films on the particles and the smaller pores full of water; both held by tension against draining by gravity. Thus, we recognize a relation of water

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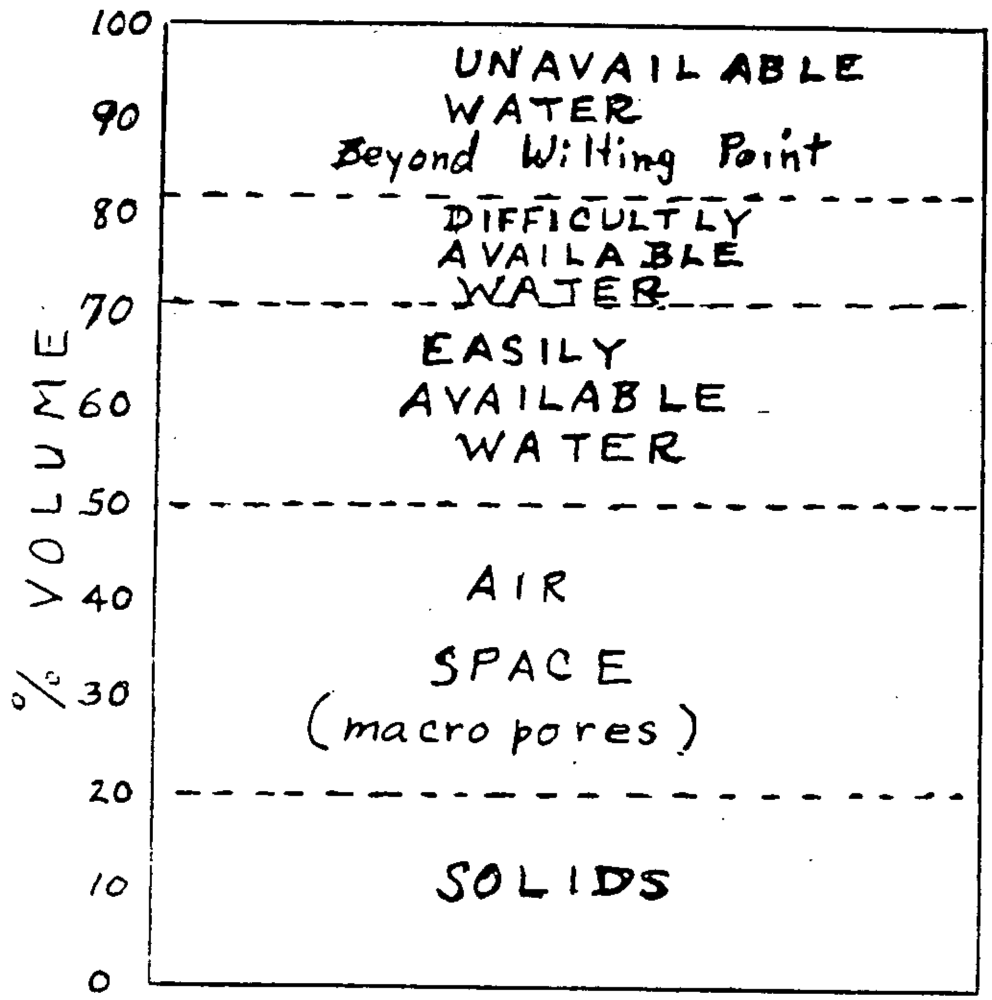
[1] Presented at the 9th Annual Georgia Commercial Flower and Plant Growers Short Course, July 18, 1982, Atlanta, GA.

[2] Chemical Division, Specialty Agriculture Research and Development



RELATIVE VOLUMES IN GROWING MEDIA
FIGURE 1.

retained in the small voids and capillaries while the large plumbing, though allowing water transport, accommodates soil gases.

STATIC AND MOBILE WATER

When water penetrates a soil, it moves relatively rapidly down large pores and much more slowly into small pores. However, after initial wetting and downward movement stops, the small pores (micropores) effectively pull the free water into tortuous side pockets and capillaries. The force with which the first molecular layer of water is held on a solid surface by adhesion is about 150,000 lb./inch^2. Succeeding layers are held with increasingly weaker cohesive forces. At about 225 lb./inch ^{2}, a plant root can begin to use the retained water. This tension is contributed to by dissolved substances in the water as osmotic pressure. In reality, plants do not put on growth if their energy is being expanded to use water held by combined tensions or pressures of over 7 atmospheres or about 100 lb./inch^2 (7).

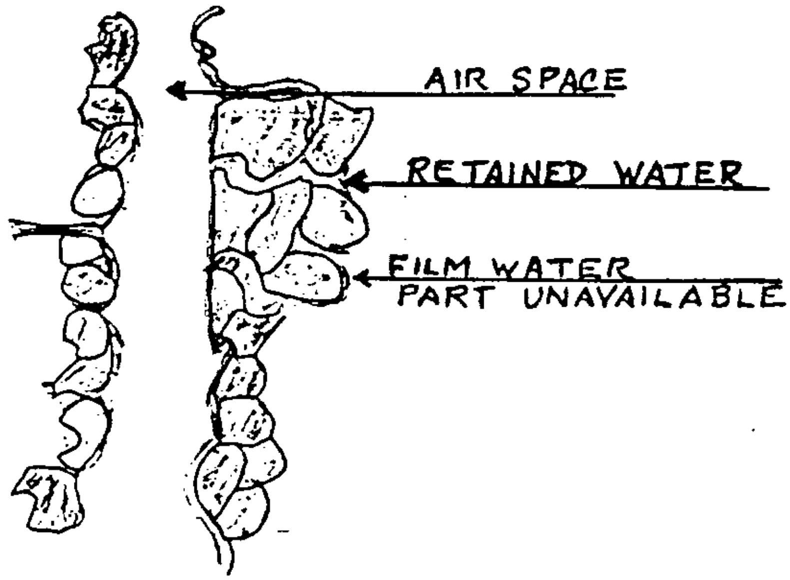
When the temperature and moisture deficit of the air permit, evaporation of water takes place. In essence, a "wick" effect causes an upward flow as molecules vaporize and are replaced from the films and capillaries (6). Too, water into the roots with resultant water movement in the soil (2). Therefore, when leaching or evapo-transpiration are in effect the water in the soil is physically flowing. When flow stops the water becomes static, much like a stagnant pool, and movement of dissolved substances (solute) is by diffusion (random thermal molecular motion).

VAPOR PHASE RELATIONS

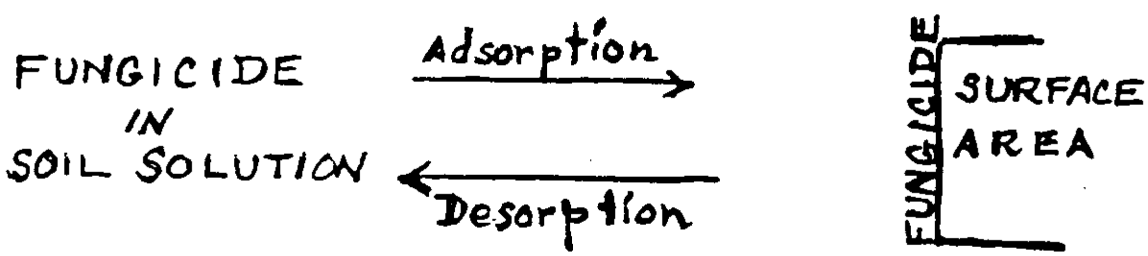
Molecules move 10,000 to 30,000 times as readily through air as through water (4). Even relatively low vapor pressure compounds vaporize and diffuse in soil air which is at 100% humidity. Diffusing upward and reaching the soil surface, the molecules escape to the atmosphere where subsequent degradation by ultra-violet light or ultimately by the ionosphere become the chief modes of loss of low-solubility pesticides from soil.

As a rule, during high temperature weather with air movement induced by ventilation, plants and soils in a greenhouse lose 0.2-inches or more water by evapo-transpiration. This is equal to 10% of the volume of a 2-inch deep bedding plant bed. Other relations can be readily discerned.

Despite some loss of active ingredient, thorough distribution of low-solubility fungicides is very dependent on diffusion through air spaces.



SOLID-AIR-WATER RELATIONS
FIGURE 2.



FUNGICIDE DISTRIBUTION PATTERN
FIGURE 3.

INCORPORATED FUNGICIDES

Due to the relatively small amount of fungicide needed to control the pathogens and the risk of phytotoxicity from direct root contact, the material used for incorporation should be lightly loaded, as a 5% granule or a low concentration powder, probably diluted with talc or clay. A cubic yard of most soilless media weighs from 350 to 800 lb and the amount of a granular fungicide needed to control pythium, etc. is from 1/4 to 1/2 lb. Due to size constraints, with uniform distribution there would be 5 to 10 granules per cubic inch with each 1 mm^3 granule affecting a volume equal to 1650 to 3300 mm^3. Thus, until the fungicide has left the granule by molecular diffusion through water and air, there is a concentration gradient from the granule out which may be injurious upon direct contact with a growing root. This is one reason why only small quantities of active ingredient are needed when fungicides are incorporated.

The granule is porous and during manufacture, the fungicide is sorbed onto the surface and into "blind" pores. Unless the granule is thoroughly wetted, active fungicide trapped in pores may truly be in slow-release form because of the energy required for the vapor phase to enter the liquid phase. Too, because of the hydrophobic nature of the fungicide, adsorption forces, and the probable crystalline nature of the sorbed fungicide, solution of active ingredient is a relatively slow process via molecular diffusion (4). The net result is an expected increase in longevity.

SURFACE-APPLIED FUNGICIDES

Commonly, wettable powder fungicides are suspended in water and constantly agitated. An amount of this agueous suspension is applied to the soil surface in sufficient quantity to leach to the bottom of the depth involved. Then additional water is usually used to further move the dissolved and particulate fungicide into the soil mass. An emulsifiable concentrate is used in a similar manner but, the fungicide is finely divided in liquid globules, like oil in vinegar, only it is dissolved in organic solvent dispersed in water.

In both powders and emulsions there are wetting agents which enhance distribution of the mixtures over the surface and into the matrix of the soil medium. In systems that are high in air space, the mixtures move down by mass flow. After drainage stops, the finer pores and capillaries pull the liquid into the matrix. However, if the water holding pores are already full or near field capacity prior to fungicide application a period of time during which evaporation and/or transpiration proceeds must be allowed in order for the fungicide to distribute into the fine pores. If the soil stays wet and more water is added, the fungicide is physically flushed through the large plumbing.

Thus, vastly different distribution patterns can obtain depending on the moisture content of the soil when "drenched" and the conditions prevailing for moisture loss to evapo-transpiration together with water frequency and rate of application.

FUNGICIDE ACTIVITY

As with most chemicals, fungicides have certain parts of the molecule that are reactive with or attracted to organic surfaces such as peat, humic acid, fulvic acid, or corky cambium materials of bark. In general, the more hydrophobic parts of the fungicide sorb on the organic surfaces. On mineral surfaces, water is very competitive for sorption sites, so the net effect is most organic molecules are associated with organic soil constituents. In the sorbed or semi-crystalline phase the concentration in water is dependent on the solutility product and thermal molecular motion to move to low concentration areas (Figure 3). Even if the amount of active ingredient is less than the solubility product, it is a fact that equilibrium is much slower to be accomplished than for a more soluble material. As evidence of this Hartley (4) pointed out that a simazine crystal in a volume of static water, exceeding the solubility product (5 ppm), would require about 30 hours to become evenly distributed by molecular diffusion while a soluble salt crystal would require only seconds.

In addition to molecular diffusion there is mass flow of soil liquid, either toward the surface due to wicking caused by evaporation, moisture tension deficits caused by transpiration, or leaching, caused by water additions saturating the air spaces (macropores). Thus, the fungicide has a degree of mobility in relation to the conditions in the soil-plant system which allow it to function by preventing or stopping pathogen activity at the root surface (Figure 4).

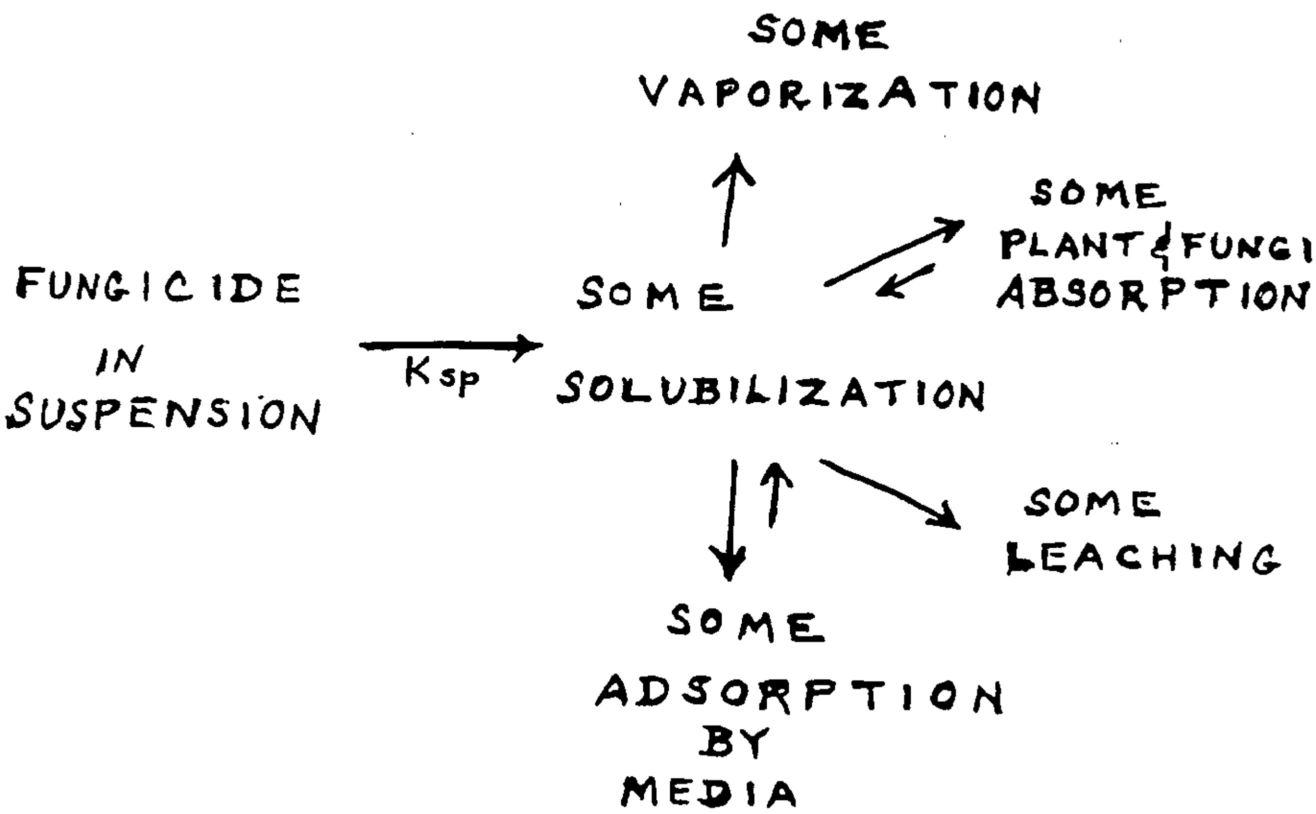
SUMMARY

A soil-applied fungicide will be distributed more or less effectively throughout a growing medium depending on:

1. the architecture of the soil, including sizes and amounts of water-retentive voids and air spaces.

2. the nature of the solid phase surfaces with organic substrates being especially attractive adsorption sites for organic fungicides.

3. the water content of the soil immediately preceeding and, for some extended period, following fungicide drench application; since effective distribution may depend on



FUNGICIDE FATE IN GROWING MEDIA

FIGURE 4.

tension forces within the matrix and diffusion in vapor form for thorough distribution.

4. the moisture content of the soil being initially high when fungicides are incorporated to ensure thorough granule wetting followed by an extended period of non-irrigation to allow diffusion of fungicide from the high to the low concentration zones.

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Fungicides for Root Rot Control - Today and Tomorrow [1]

C. E. Bardsley [2]

Root rot control is equally important for established plants, seedlings, and cuttings during propagation. Most of the soil-borne pathogens are fungi including particularly pestiferous species of the genera: Pythium, Phytophthora, Rhizoctonia, Sclerotium, Thielaviopsis, and Sclerotinia. There are several more genera which cause infection less frequently.

For many years the chief means of preventing these diseases included soil sterilization and seed disinfection. These techniques are still practiced although, the use of so-called soilless media and soil-applied fungicides is becoming almost universal in commercial horticulture.

During the last twenty years, it has been accepted as common practice to drench fungicides into the soil using saturation as the criterion for sufficiency. This point is easier to discern with pots or raised beds than with ground beds. In horticultural circles a combination of fungicides was commonly used for drench applications. First, Dexon and Terraclor and later Truban and Benlate. To meet an obvious market and need, Mallinckrodt introduced a pre-mixed combination as BANROT®, containing a ratio of two active ingredients arrived at after considerable research.

Until recently most soil fungicides used for drenching have been either wettable powders, which require tank agitation, or emulsifiable concentrates, which are less subject to density gradients in water. Results from use of the drenches has been very successful, particularly where porous potting medium, not subject to compaction and easily drained, is used. An important feature of a good soil-applied fungicide is low water solubility and thus, low leaching losses. Because most fungicide molecules are weakly charged, adsorption is primarily by physical forces and competition with water on soil surfaces is worth consideration: a soil should be reasonably dry prior to drenching if permeation at or near the surface is desired. Figure 1. depicts the tailing out of the drenched fungicide with depth and the effect of successive water increments on the moving front. Obviously, a highly soluble fungicide would move through more rapidly and, possibly, more thoroughly. However, highly soluble products require extremely skillful application.

[1] Presented to the Alabama Greenhouse & Nursery Seminar, Mobile, Alabama, June 18, 1983.

[2] Manager, Specialty Agriculture Technology, Mallinckrodt, Inc., St. Louis, MO 63147.

In contrast to the drench technique, granular fungicide can be effectively incorporated throughout the potting medium where blending equipment is available. As shown in Figure 2., the granules are point sources for release of the active ingredient throughout a "sphere of activity". Thus, the probability of thorough permeation of the soil volume and root zone is greatly increased with use of incorporated granules.

In order to address the subject of fungicides for tomorrow, it is important that we understand how the drenched and incorporated products are likely to function in different watering regimes. To illustrate why this may be important, some data on the vapor pressure of water at 15°C are plotted for water:clay molar ratios ranging from 12:1 to 4:1. These values were obtained from the work of Gruner, as quoted by Weyl [3]. The fact that the vapor pressure of water goes down as the film on a solid surface becomes thinner is logical since the molecules are more rigidly oriented. Truly oriented water is found in ice crystals. Fungicides are present at relatively low concentrations in soil water. Thus, the vapor pressure of water is of more importance in distributing the contained fungicide to areas of low concentration than the vapor pressure of the fungicide alone. This phenomenon is of no consequence when the soil is saturated and net water movement is down, but comes into play when moisture content is between field capacity and the hygroscopic coefficient; the zone where there is no free movement of liquid water.
Suffice to say, incorporated granules serving as multiple sites of concentrated fungicide are much less affected by the vagaries of watering than is the case with fungicide at the leading edge of a drenching front. For, this reason we at Mallinckrodt are working on a granular-type BANROT for those growers who desire such a product. We have found considerable flexibility in the utilization of TRUBAN 5.G in that granules are readily adapted to side-dress applications for field-grown nursery stock and to broadcasting followed by harrowing much as one incorporates some herbicides. These uses are in addition to the prime use as an additive to potting media. It is anticipated granular BANROT will be used similarly but, effectively control a broader spectrum of pathogens.

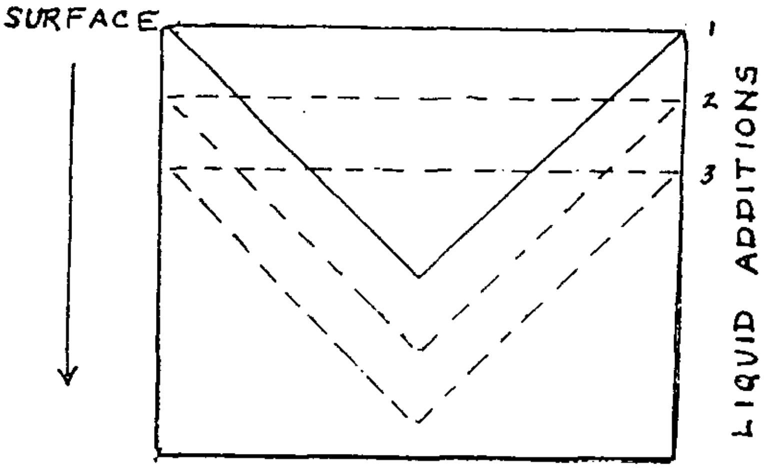
TRUBAN Flowable has recently been introduced as a particularly useful formulation for drenching. It is a dustless, finely divided suspension which provides excellent disease control and safety in use. Work will continue toward developing combination products which have broad spectrum disease control, greater efficacy, less phytotoxicity, and more fool-proof attributes. We will also bring to market specific fungicides when the need and the product (and

[3] Weyl, W. A. 1953. Wetting of solids as influenced by the polarizability of surface ions. p.147-184. In R. Gomer and C. H. Smith (ed.) Structure and properties of solid surfaces. The University of Chicago Press, Chicago.

the stars and the planets) converge. Any company prefers to replace their product themselves. Mallinckrodt is no exception.

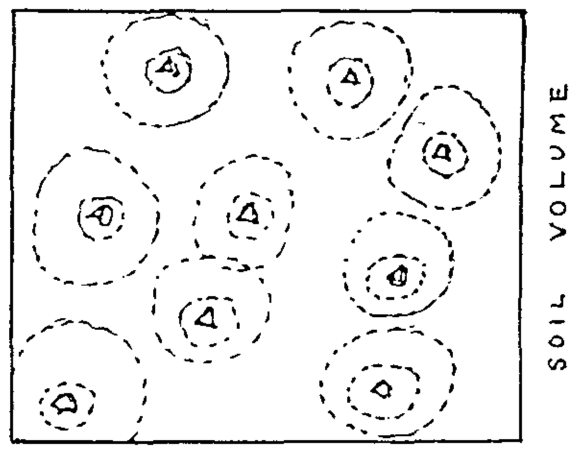
TRUBAN 5.G and TRUBAN Flowable have brought benefits in added versatility and efficacy to utilization of an established soil fungicide.

FIGURE 1.



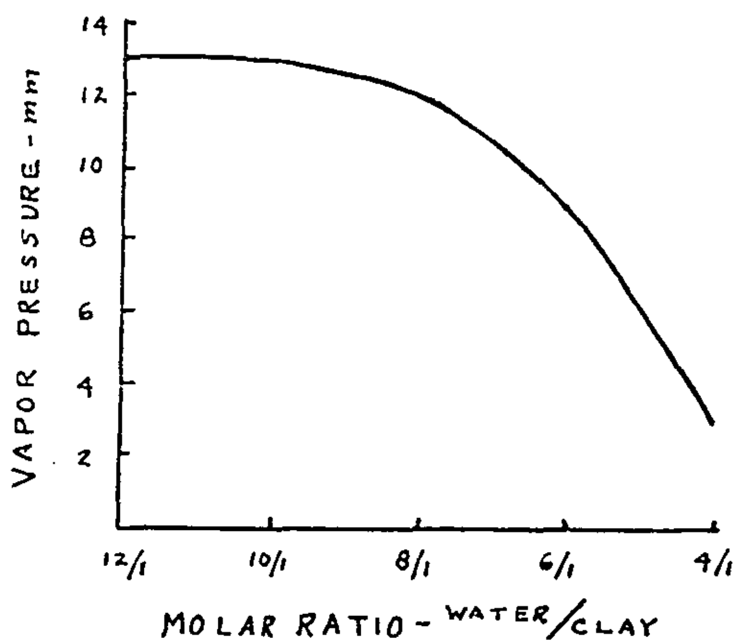
CHROMATOGRAPHIC DRENCH PATTERN

FIGURE 2.



GRANULE SPHERE ACTIVITY

FIGURE 3.



Report of Diagnostics Committee - 1986 APS National Meeting

A - Terms. Here is a list of our committee members and the date their terms expire, in parenthesis. This expiration date was chosen by lottery. If you were not present at the committee meeting, your lottery was picked by E. Dutky. This staggering allows vacancies each year, for each chair to fill.

Ethel M. Dutky (88) (Chair 86-87)
Marilyn Dykstra (88)
Cheryl Kaiser (87)
Seong Hwan Kim (89)
Stephen Nameth (89) (Chair 88-89)
John J. McRitchie (89)(Chair 87-88)
*Sally Miller (89)
*(replaces Bryan Delp)
Jacqueline Mullen (89)
Luellen Pierce (87)
Bala Krishna Rao (88)
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Rina Varma (87)
Robert Wick (88)
Susan Woodhead (87)
Richard T. Wukasch (88)

B - High points of the meeting. (For a chronological recitation see attached minutes sent only to committee members)

1) Long-term project. Creation of a Manual of Procedures for Identification of Plant Pathogens. Dr. Seong Hwan Kim leads this subcommittee. Members are: Charles Semer IV, John J. McRitchie, Mary Ann Hansen, Rick Wukasch, Jill Pokorny, Larry Barnes, Jacqueline Mullen, Stephen Nameth, Gary Simone, Susan Rosenbrock. Other APS members who are anxious to help with this project, please contact Dr. Kim. <u>Rhizoctonia</u> spp. was selected as the first pathogen to use.

2) Activities to be sponsored by the Diagnostics Committee at 1987 APS National Meeting in Cincinnati, Ohio.

a. Two or three-day workshop on Identification of <u>Phytophthora</u> species. Steve Nameth and Robert Wick coordinating. Dr. Mannon E. Gallegly providing expert instruction. Laboratory facilities at Ohio State University, Columbus. Registration strictly limited. To be held immediately prior to the APS meeting.

b. Workshop/Demonstration on Quick Tests for Identification of Plant Pathogens, to be held during the meeting. Pre-registration required and limited in number. Sally Miller coordinating.

c. A social and slide sharing session for diagnosticians/ teachers/extension. Duration 3-4 hours during the meeting, preferably in the evening. Steve Nameth and Rick Wukasch coordinating.

3) Ideas for Diagnostics Committee-sponsored activities for 1988 San Diego meeting.

a. Teach-in or workshop/demonstration on Identification of Insect/Mite Incited Symptoms on Plants. Dennis Mayhew coordinating.

b. Hands-on Workshop on Identification of Fusarium.

c. Discussion session on Private Practice.

4) Award for Gail E. Ruhl. The committee presented Gail with a certificate expressing our appreciation for her outstanding leadership, as we voted to do in 1985 at Reno.

5) Election of Chair and Chair-Elect. John J. McRitchie (FL) is chair for 1987-88, presiding at the Cincinnati meeting. Steve Nameth (OH) is chair-elect in 87-88 and chair presiding in San Diego '88.

6) Bylaws. E. Dutky distributed a start on bylaws and we decided not to spend time discussing them, but rather let E. Dutky appoint a subcommittee and report back in 1987 when we can vote on them.

7) PDQ status report. Gail Ruhl, Managing Editor, reported that PDQ is solvent and thriving. (see attachment)

PLANT DIAGNOSTICIAN'S QUARTERLY (P.D.Q.)
1986 Financial Report

Submitted by Gail E. Ruhl
Assistant Editor

August 10, 1986

1986

Total Subscribers: 140
- United States - 114
- Canada - 17
- United Kingdom - 2
- West Africa - 1
- South Africa - 1
- Costa Rica - 3
- Samoa, S.P. - 1
- Germany - 1

Total Subscription Income: $1,520.00

March and June postage: $233.18
March and June printing: $186.30

1986 Balance: $1,100.52

Charge Policies:

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HELP

Wanted For Laboratory Research

Cultures of Rhizoctonia sp. from woody or herbaceous ornamentals with symptoms of web-blight or foliar leaf spots. USDA permit for interstate movement of plant pathogens available. T. Frisina Dept. of Plant Pathology North Carolina State Univ. Box 7616 Raleigh , N.C. 27695-7616.

HELP

BOOK

Diseases of Floral Crops - edited by D. L. Strider, North Carolina State University. Reviewed by Robert Aycock

These volumes bring together detailed scientific information on diseases of the more important floral crops, prepared by the most qualified experts in the field whose writing is based on their own personal, professional and research experience. The information is current and, as indicated by the editor, ought to be useful not only for plant pathologists and students but for today's grower as well.

These two volumes are organized in a very practical way. Many of the most common problems are discussed first. This section is followed by a general consideration of control measures and practices and how they may interact or influence each other. Detailed information is then provided on a host of highly specialized crops.

A detailed glossary will aid even the novice in understanding the material presented.

The compilation will fill a real need in an expanded industry. The material has been put together thoughtfully and is based upon years of research and educational experience. It is therefore personally gratifying for me to be able to endorse it for your use and study.

The two volume set is available from Praeger Publishing Co., 521 Fifth Avenue, New York, NY 10175. The cost of the two volumes is $140, prepaid.

BOOK

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As you already know, accurate diagnosis is the first step toward effective pest control.

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Contents

(Abbreviated)

Pub. date January 1987. 464 pp., cloth (R10174). Examination copies available October 1986.

Malcolm C. Shurtleff
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JOB

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19348-0501

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DEPARTMENT: Horticulture

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During "off season" months, the Pesticide Applicator will assist with record keeping, inventorying chemicals, and planning for the coming season. In addition, this person may be required to assist with greenhouse pest control and pesticide application.

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A practical, working knowledge of pest identification, plant pest symptoms and control procedures is required for this position. A B.S. degree with an emphasis in Entomology or Plant Pathology is preferred. The individual must have the ability to teach classroom and field pest management courses; a pesticide applicator's license; a minimum of three years' practical experience applying pesticides and/or scouting; and the ability to operate a wide range of pesticide application equipment.

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DEADLINE FOR APPLICATION: December 1, 1986

CONTACT: Submit resume and 3 letters of reference to:

Donald R. Buma
Horticulture Department

salary: 20,820 - 26,700

BY: F. Joseph Carstens
F. Joseph Carstens
Head, Department of Horticulture

By [signature]
F.E. Roberts
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Research Technicians. Provide technical support to programs in microbial ecology, epidemiology, environmental fate and field research. B.S. in biological or agricultural sciences. Previous experience with bacteria, fungi and/or plants is highly desirable.

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The American Type Culture Collection will be offering the following workshops at its Rockville, Maryland facilities:

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March 16-20, 1987:	RECOMBINANT DNA
April 10-11, 1987:	ACANTHAMOEBA AND NAEGLERIA INFECTIONS: A CLINICAL LABORATORY WORKSHOP
→ April 23-24, 1987:	GAS CHROMATOGRAPHIC ANALYSIS OF CELLULAR FATTY ACIDS FOR BACTERIAL IDENTIFICATION
April 27-28, 1987:	BIOTECHNOLOGY PATENT CONFERENCE
May 19-22, 1987:	FREEZING AND QUALITY CONTROL: CELL CULTURES AND HYBRIDOMAS
June 25-26, 1987:	CLINICAL ANAEROBIC BACTERIOLOGY

For more information on ATCC's workshop series, contact Doug Drabkowski, Workshop Coordinator, American Type Culture Collection, 12301 Parklawn Drive, Rockville, Maryland 20852, USA; telephone 301-231-5566.

(see following pages for description of each workshop)

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The laboratory portion is designed to provide experience with several ATCC methods for freezing and freeze-drying, including preparation of the cells, freezing and freeze-drying, torch sealing, rehydration and subculturing.

Lecture topics include cellular responses to ice crystal formation, changes in isotonicity of the cellular environment, rates of cooling, latent heat of fusion, sublimation dynamics, collapse, meltback, factors affecting the viability of frozen and freeze-dried microorganisms, importance of residual moisture and methods for determining residual moisture, cryoprotectants and other additives, and shelf life prediction.

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CEU credits - 1.63

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GAS CHROMATOGRAPHIC ANALYSIS OF CELLULAR FATTY ACIDS FOR BACTERIAL IDENTIFICATION

April 23-24, 1987

A two-day, laboratory-intensive workshop designed to familiarize the participant with fatty acid preparation from whole bacterial cells and the GLC analysis of these derivatives.

Topics to be covered include: chemotaxonomy of microorganisms; methodology for GLC analysis of bacterial cellular fatty acids; computer identification of microorganisms by cellular fatty acid composition; preparation of bacterial fatty acid methyl esters (FAME); ancillary GLC techniques useful for identification; GLC analysis of hydrogenated and/or acetylated FAME.

CEU application in progress

For more information on any ATCC workshop, contact Doug Drabkowski, Workshop Coordinator, American Type Culture Collection, 12301 Parklawn Drive, Rockville, Maryland 20852, USA; telephone 301-231-5566.

APS PRESS
Publications of The American Phytopathological Society

November 7, 1986

Dr. Ethel M. Dutky
Univ. of Maryland
Dept. of Botany
College Park, MD 20742

Dear Dr. Dutky:

APS Press has received many inquiries during the past two years regarding development of video cassettes. At the meeting in Orlando, a subcommittee was appointed to look into the possibility for APS Press involvement in this area. In addition to answering the enclosed questionnaire and forwarding the names of interested people or groups, we would appreciate any comments you have on this topic.

Please return the questionnaire no later than December 31, 1986 to Miles Wimer at APS Headquarters. Thank you for your time and interest.

Sincerely,

Ann Chase

A. R. Chase
APS Press
Chairman, Subcommittee on Videos

AC:rk

Enc.

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QUESTIONNAIRE ON VIDEO CASSETTE INTEREST

Return to APS Headquarters by December 31, 1986; Attn: Miles Wimer
3340 Pilot Knob Road, St. Paul, MN 55121

1. Do you currently have any video cassettes which deal with plant pathology or a related subject? ______

2. What are the titles or subjects covered and the length of these tapes?

Subject	Length in Minutes

3. Are these cassettes on 1/2 inch, 3/4 inch, or 1 inch video tape? ______ VHS or Beta? ______

4. Does your institution have facilities to develop these types of video cassettes? ______

5. Are the video cassettes aimed at extension, teaching, or other use?

6. Would you or your institution be interested in marketing or distributing your cassettes through APS Press? ______

7. Would you or your institution be interested in obtaining video cassettes from APS? ______

8. What price would be acceptable for such video cassettes? ______

9. How long should the tapes be? ______

10. What subjects would you be interested in? ______

11. Are there other people who should be contacted with respect to this topic? ______

12. Would a demonstration of a few video cassettes at the Cincinnati meeting be of interest? ______

ATTACH ADDITIONAL SHEET IF NECESSARY

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