NURSERY DISEASE WORKSHOP

Western Session - Hot Springs, Arkansas

Moderator - Charles E. Cordell[1/]

Topic Discussion Leaders - T. H. Filer, Jr.[2/]
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ABSTRACT

The magnitude and variety of nursery tree seedling production and associated disease problems demands the utmost in disease protection and control applications in our southeastern nurseries. Significant disease problems on both conifer and hardwood seedlings include several root rots, stem diseases such as fusiform rust, and a variety of foliage diseases. An integrated control approach - incorporating appropriate cultural, biological, and chemical procedures - is considered as the most effective and practical method of minimizing nursery disease losses.

INTRODUCTION

There are presently over 55 state, industry, and federal forest tree nurseries in the Southeastern U.S. with an annual production exceeding 1 billion seedlings. New nurseries are being constructed annually - reflecting the present emphasis and future demands on reforestation in the south. This production represents over 75 percent of the annual tree seedling production in the U.S.. Southern nurseries produce some 15 species of conifers and over 12 species of hardwoods. The nursery sites represent a wide variety of nursery soils and environments from

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the mountains of western Virginia and North Carolina to the subtropics in southern Florida.

As might be expected, this wide variety of seedling species and nursery sites also has a corresponding wide variety of seedling disease problems. In addition, accelerating nursery operation costs and corresponding high-value products have significantly increased the impact of disease problems on both conifers and hardwoods. For example, nursery pest control costs such as soil fumigation presently average around $750-800 per acre. Seedling values have also increased sharply and presently range from $10.00 to over $200 per thousand seedlings.

Consequently, some of our highest forest resource values are represented in our nurseries, demanding the utmost in disease protection and intensive control procedures.

Our most important nursery disease problems and control procedures will be discussed in the following sections. As these selected topics are presented, full participation by all workshop attendees is encouraged.

CHARCOAL OR BLACK ROOT ROT OF SOUTHERN PINES

by

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Charcoal or black root rot, caused by the pathogenic soil fungi - Macrophomina phaseolina (Sclerotium bataticola) and several Fusarium spp., continues to cause severe widespread seedling damage in southern forest tree nurseries. During 1978, the disease was again observed in state and industry nurseries in Florida, Georgia, South Carolina, Alabama, Mississippi, and Louisiana along with the federal (Ashe) nursery in Mississippi. All species of southern pine seedlings are susceptible to this root rot disease along with some hardwoods such as sweetgum (Liquidambar styraciflua).

The most severe charcoal or black root rot damage observed to date occurred at the Andrews State Nursery in Chiefland, Florida during 1976. Approximately 16.5 million (over 50% of 30 million seedling crop) loblolly (Pinus taeda), slash (P. elliottii), longleaf (P. palustris), and south Florida slash (P. elliottii var. densa) seedlings were rendered unsaleable. This damage represented a monetary seedling value loss of approximately $150,000.

Charcoal or black root rot disease symptoms on southern hard pine seedlings involve blackening, resinosus or pitch soaking (charcoal appearance), and mortality of both secondary and primary root systems. Foliage symptoms may not be conspicuous - particularly during the early part of the growing season or where light to moderate root rot is present. Consequently, intensive root and soil examinations in both the field and laboratory are frequently required to evaluate this disease problem.

The nursery seedling losses caused by root rot, although highly significant to the nurseryman, may be relatively minor when compared with subsequent reforestation losses. Over 50 percent outplanted seedling mortality has been observed in several southern states during the past five years. Primary losses occur in field plantings of diseased seedlings resulting in submarginal tree survival and subsequent plantation failures. The major monetary losses involve those invested in site preparation, tree planting, and early plantation culture and maintenance. Field outplanting studies have also recently been established by several cooperating southern forest agencies to evaluate root rot losses on a variety of reforestation sites.

An integrated nursery disease control approach is also recommended as the most effective and practical method of minimizing root rot losses. These practices include utilization of non-host cover crops, seedling species - site manipulations, adoption of cultural practices such as soil tillage and fertilization to reduce disease spread and buildup, and effective preplant soil fumigation. The most effective fumigant for soil-borne fungi of this type is a methyl bromide formulation consisting of methyl bromide - 67% and chloropicrin - 33% accompanied with a minimum 2-mil thickness polyethylene plastic tarping.

HARDWOOD DISEASES IN PLANTATIONS AND NURSERIES[1/]

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Root disease is the most important problem of hardwoods in nurseries with most mortality from damping-off occurring during the first 6 weeks of seedling emergence. The root rots can persist throughout the growing season and cause stunting that makes seedlings unsaleable. Chemical fumigation of nursery beds is the best control method available for root disease. Methyl Bromide, Vorlex, Dowfume MC-33, Telone C, or Chlor-o-pic will reduce production cost by controlling root diseases and weeds.

In 1978, Cylindrocladium scoparium, a fungus that kills seedlings or reduces their growth, was isolated for the first time from walnut roots at the Arkansas State Nursery at Little Rock. The fungus also infected yellow-poplar, cherrybark oak and sweetgum in the Winona, Mississippi, nursery. Soil fumigation was used to control the disease. Since walnut and yellow-poplar are particularly susceptible to the disease, bed rotation with loblolly or slash pines or with less susceptible hardwoods such as green ash or sycamore should be used to control it.

Leaf diseases occasionally cause problems in hardwood nurseries. In 1978 walnut anthracnose (Gnomonia leptostyla) caused defoliation and some mortality in the Oklahoma nursery at Washington, Oklahoma. The disease was controlled by spraying with Benomyl and Dodine.

During the past two growing seasons, anthracnose (Gloeosporium) caused severe defoliation and mortality of yellow-poplar at the Mississippi Forestry Commission nursery at Winona. The disease was controlled by applying Benomyl and Copper Oxide. Also, proper fertilization and water regimes help minimize the disease.

1/ This paper reports research involving pesticides. It does not contain recommendations for their use, nor does it imply that all the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State or Federal agencies before they can be recommended.

Mention of trade names is solely to identify materials used and does not imply endorsement by the U. S. Department of Agriculture.

In hardwood plantations, canker diseases are of most concern to growers. In sycamore plantations, canker stain fungus (Ceratocystis fimbriata) is one of the most serious diseases. Losses are usually low, but in some areas a 30-percent stand loss has been observed. To keep trees free of the disease, care should be taken to avoid wounding stems. Where the disease is present, sanitation cuts of diseased sycamore trees should be made.

Canker diseases in cottonwood plantations contribute to the approximate 20-percent loss during the first and second years. Septoria canker (Septoria musiva) is the pioneer organism. Other fungi such as Fusarium solani (Fusarium canker), Cytospora chrysosperma (Cytospora canker), Phomopsis macrospora (Phomopsis canker), and Botryodiplodia sp. (Botryodiplodia canker) usually invade through wounds made by Septoria. Singly or collectively, these fungi cause mortality.

The fungi I have mentioned infect nursery stock and overwinter as mycelia or spores on cuttings stored for spring planting. When infected cuttings are planted, they may leaf out but approximately 20 percent are girdled before developing a root system. Mortality is increased by climatic factors that limit plant growth or cause plant stress. Survival can be increased by dipping cuttings in Benomyl (1 lb./100 gal. H_2O) before planting.

Leaf diseases are becoming increasingly important in cottonwood plantations. Three important leaf diseases are Melampsora rust, Septoria leaf spot and Marssonina leaf spots. In various geographic locations, each may be the prime cause of defoliation. In the lower Mississippi valley, Septoria leaf spot causes the most defoliation. In the upper Mississippi valley and in the Midwest, Marssonina and Melampsora rust cause most of the defoliation.

Septoria leaf spot caused 90 percent defoliation in several plantations during the summers of 1977 and 1978. Most damage appears to be associated with certain clones, so resistant clones are being developed at Stoneville. Several Stoneville clones released in 1970 resist the fungus. Additional clones should be released in 1979. At present, fungicides are available to control Septoria in cottonwood plantations. One or two chemical sprays annually may be necessary to break the disease cycle.

CONTROL OF BROWN-SPOT NEEDLE BLIGHT OF LONGLEAF PINE

A. G. Kais

Integrated control systems which include disease resistance, effective fungicides, and improved silvicultural practices are required to provide long-lasting control of Brown-spot needle blight of longleaf pine. The Diseases of Southern Pines Project and the Southern Institute of Forest Genetics Project at Gulfport, Mississippi are working together to develop the necessary technology for disease control.

Recent research accomplishments have been significant; (1) Outstanding resistance can be inherited in the F1 progeny of individual longleaf pine, (2) There is a gain of resistance by selection, (3) An efficient inoculation system has been developed for rapid screening of disease resistance in longleaf, (4) Pathogenic variability has been detected within the fungus, and (5) Bravo (Chlorothalonil), which has been registered for use against the disease, and Benlate, a systemic, are two fungicides showing effective control in greenhouse and field tests.

Current and future research plans are concerned with the developing of Genetical, Mycorrhizal-Cultural, and Chemical technology for controlling Brown-spot needle blight on longleaf pine. Hopefully, this program will produce; (1) an improved selection system for longleaf pine, (2) selections of brown-spot resistant populations and families of longleaf, (3) rapid, early height growth of seedlings, and (4) effective systemic fungicides for use against the disease.

Status of Fusiform Rust Control with Systemic Fungicides

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Since 1942, ferbam has been the standard fungicide used to control fusiform rust (Cronartium fusiforme) in forest nurseries. Ferbam is an effective contact fungicide; however, the number of applications (30-50/year) required to control fusiform rust in nurseries has made its continued use questionable for economic and environmental reasons.

In recent years systematic fungicides have been shown to be effective in controlling diseases of major agronomic crops. Generally, these chemicals are effective at lower rates and require fewer applications than are necessary with contact fungicides. Unfortunately, the costs of developing, registering and marketing a new fungicide are so high that chemical companies direct their efforts toward disease problems of major crops. This assures a market of sufficient magnitude to recover their investment plus a profit. New fungicides can be and often are labeled for use against pathogens of minor crops: however, such labels are secondary to the primary label for the major crop.

During the past few years several systemic fungicides have been tested for activity against C. fusiforme. Of these, benodanil (BASF-Wyandotte) and bayleton (Chemagro) are the most promising.

Benodanil has been tested more extensively than bayleton. The most promising rate and method of application was 20 kg active ingredients (ai)/ha (17.8 lb/ac) applied pre-plant soil incorporated. This treatment provided protection from fusiform rust for at least 40 days. Foliar sprays of benodanil applied at a rate of 0.99 kg/ha (0.88 lb/ac) provided protection for less than 13 days.

Unfortunately, benodanil is extremely active against ectotrophic mycorrhizae that are symbiotic with southern pines. In laboratory studies growth of these fungi was completely inhibited by benodanil at a concentration of 1.0 ug/ml in an agar medium. In the nursery, development of mycorrhizal roots was delayed through August following a soil drench treatment with benodanil at a rate of 30 kg/ha applied in April. Although seedlings had abundant mycorrhizae at lifting time, the delay caused by benodanil resulted in a high percentage of small, non-plantable seedlings.

BASF-Wyandotte has shelved further development of benodanil and it is improbable that this fungicide will ever be labeled and marketed.

Initial research results with bayleton indicate that this fungicide is more active than benodanil against C. fusiforme. Results of a test conducted at the U.S.D.A. Forest Service Rust Testing Center showed that bayleton applied pre-plant soil incorporated at a rate of 2.0 kg/ha (1.8 lb/ac) protected seedlings against fusiform rust for at least 40 days; thus, bayleton accomplished the same degree of protection as did benodanil but with a tenfold reduction in the amount of fungicide required. Applied as a foliar spray at a rate of 0.56 kg/ha (0.5 lb/ac), bayleton protected seedlings against fusiforme rust for 21 days after application and also eradicated infections that occurred up to 7 days before the fungicide was applied. Thus, with a 28 day protection period the number of fungicide applications in a nursery conceivably could be reduced to a total of 2 during the spore release period.

Bayleton is less active against mycorrhizal fungi than is benodanil. In the laboratory, isolates of mycorrhizal fungi were not completely inhibited by bayleton until the concentration was greater than 5.0 ug/ml in an agar medium. Apparently, bayleton has no adverse phytotoxic effect on pine seedling. In the study at the rust testing center, no differences in seedling height was

observed between untreated control seedlings and seedlings growing in flats treated with bayleton at a rate of 5.0 kg/ha (4.46 lb/ac).

Bayleton is being evaluated in field plots in forest nurseries in the southeast this year (1978). Results from these tests should provide sufficient efficacy data to determine whether this fungicide should be labeled as a fungicidal control for fusiform rust.