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Minimizing Disease Injury To Hybrid Poplars[1]

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Abstract

Poplars (*Populus* L.) are among the most versatile of trees, but many poplar hybrids have often failed to grow as advertised because of their high susceptibility to several diseases. Chemical and cultural controls have been developed that can minimize disease incidence in hybrid poplars, but planting resistant clones is believed to be the best long-term management strategy. Nursery operators need to produce these disease resistant clones in order to increase market acceptability.

Index words: *Populus*, disease resistance, *Septoria* canker

Significance to the Nursery Industry

Hybrids between *Populus* taxa have the potential for becoming valuable trees for many urban and rural uses. One factor that has limited their use on a larger scale has been the high disease susceptibility of many of the clones now in production. Nursery operators need to reduce the risk of disease, particularly those caused by *Septoria, Melampsora*, and *Marssonina*, in their production beds and avoid the subsequent tree damage and plantation failures that are all too common when inferior clones are planted by the customer. Production of only proven disease resistant clones will increase market acceptance and guard against costly crop failures.

Introduction

Grows fast! Grows anywhere! Super tree! These are just a few of the claims that have been made for hybrid poplars in recent years. Are they true? Depending on who you ask, the answer may be yes, no, or maybe.

It is true that poplars are among the most versatile of trees for forestry and landscape uses. Not only are they valuable as a source of fiber and energy, but they can quickly revegetate disturbed sites, create wildlife habitat, and provide shade and vegetative screening for homeowners. But it is also true that some hybrids have failed to perform as advertised, leading to conflicting opinions about their overall worth. Adding to the confusion are the large number of hybrids that have been produced through natural hybridization and controlled crossing of the various *Populus* species (1).

There have been many reasons for the failure of certain hybrid poplars to live up to growers' expectations. One stems from a general lack of awareness of the growing conditions which hybrid poplars require for survival and good growth. The fast growth and high yields reported from poplar plantations are sometimes the result of intensive culture, often as intensive as that given agricultural crops (2). Unless hybrid poplars are provided with optimum water, nutrients, and weed control, maximum yields—or even acceptable yields—may not be realized.

But another factor—and perhaps the one most responsible for limiting the success of hybrid poplar plantings—is their susceptibility to disease. Poplars are host to numerous pathogens (primarily fungi) that can lead to diseases of all parts of the tree. In addition, they are subject to insect pests and environmental stresses that can predispose them to other fungi that are not normally harmful to healthy trees (10). With so many fungi capable of damaging poplars, and hundreds of potentially damaging insect species, you might wonder how *any* poplar thrives. The answer lies in the rich genetic diversity—including disease resistance—of trees in the genus *Populus*. Native poplars have, over time, developed genetic resistance to the potentially damaging pathogens in their respective geographic areas—an advantage many hybrid poplars do not have.

It is well-known that planting crops with limited genetic diversity often results in severe disease outbreaks. Less well-known is the potential danger faced when establishing plantations of trees of unproven disease resistance. In the U.S., many readily available hybrid poplar clones have good early-growth, but are later highly susceptible to damaging diseases. Our objective in this paper is to describe these diseases and discuss some measures that can be taken by nursery managers and landscapers to minimize their impact in nurseries and hybrid poplar plantings.

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Foliar and Stem Pathogens

In the U.S., hybrid poplars have been damaged principally by two types of pathogens: those attacking the foliage, resulting in premature defoliation; and, those attacking the stem and branches, resulting in tree breakage (5). Root diseases have not been a major problem.

Leaf rust, caused by species of *Melampsora*, can cause premature defoliation resulting in growth reductions of up to 40 percent. Repeated early defoliations deplete food reserves, subjecting trees to winter damage and infection by secondary fungi. Many hybrid poplar clones now available are highly resistant to leaf rust. However, in Europe and Australia races of *Melampsora* have arisen that are able to infect previously resistant clones in those countries. Growers need to keep alert to any changes in the pathogen population by watching for rust outbreaks in previously rust-resistant clones.

A leaf anthracnose caused by species of *Marssonina* has damaged poplar clones all over the world, and limits the planting of many susceptible clones. In addition to growth reductions of 60 percent, trees that are prematurely defoliated are subject to winter injury and infection by *Dothichiza* and *Cytospora*, fungi that cause cankers and dieback. Because twigs of some clones are infected by *Marssonina*, the fungus overwinters within the tree crown, intensifying foliar infection in the spring (8).

The third major foliar pathogen of hybrid poplars, *Septoria*, also causes stem and branch cankers that result in even more damage than the premature defoliation. In the north central and northeastern U.S., plantings of susceptible clones have failed within 4 years due to stem breakage and resultant tree death (9). In addition, *Septoria* canker lowers the quality of wood fiber. The incidence and severity of this canker are greatest in nursery propagation beds and sprouts arising after stands are harvested. Clones that are even moderately susceptible cannot be regenerated from stumps because cankers kill sprouts in the first year. Although many hybrid poplar clones tested in the north central U.S. are susceptible to *Septoria*, some clones are highly resistant and should be favored (6, 7). Generally, the *P.* × *euramericana* (Dode) Guinier clones have been more resistant to *Septoria* than clones with *P. trichocarpa* Torr. and Gray as one of the parents.

While a fungus is often involved in the decline or death of a hybrid poplar, it is important to remember that many times the underlying cause is tree stress due to adverse environmental conditions or improper management.

Disease Prevention and Management Strategies

The adage "an ounce of prevention is worth a pound of cure" is especially true in the case of poplars. Planning for disease management prior to planting is important. Because insect and disease outbreaks can greatly influence the economic outcome of any planting venture, it is imperative that disease *prevention* strategies be employed rather than costly suppression tactics.

Most hybrid poplar plantings are established with unrooted cuttings collected during the previous winter and stored in various ways until spring. Cuttings collected from trees of low vigor, stored improperly, or mishandled during processing, shipment, or planting are less vigorous, less able to withstand environmental stress at the time of planting, and often more susceptible to disease. "Blackstem" is a disease of cuttings caused by fungi such as *Cytospora* and *Phomopsis* (10). Affected cuttings often fail to root. Unless properly stored and handled, even the most vigorous cuttings can become weakened and diseased.

An inherent danger with poplars, as with many vegetatively propagated plants, is the possible introduction of pathogens to other areas from infected cuttings. We have found several potentially serious foliar and stem pathogens present on cuttings, including *Marssonina, Septoria*, and *Dothichiza* (5). Spread of these pathogens into new plantings on planting stock must be avoided for successful plantation establishment. Of considerable concern is the potential introduction of pathogens not present in the U.S., such as a bacterium that causes one of the most damaging diseases of poplars in Europe. The spread of viruses is also likely because of the difficulty in detecting them. Great care needs to be exercised in the exchange of poplar material to avoid introduction of pathogens that could place our poplar resource in jeopardy.

Assuming that the cuttings themselves are free of infection, success in growing closely spaced poplars with limited genetic variability can be obtained only if highly disease-resistant clones are planted and provided with optimum nutrients and moisture. From a management perspective, planting hybrid poplar clones in mosaics of pure clonal blocks is highly desirable. First, greater uniformity can be achieved in terms of growth rate and form. Second, should one or several clones become affected by a lethal disease such as *Septoria* canker, those blocks can be managed as separate units. In nurseries, such blocks of trees can be rogued and in plantations trees can be harvested early and replaced with more resistant clones.

In contrast, when clones of unknown disease resistance are planted in a random mix and one or several clones become affected by canker diseases, it soon becomes uneconomical to manage the remaining trees. The size of the planting, of course, will dictate the size of blocks and number of clones that should be used, but risk from damaging agents can be minimized by planting several clones (3, 4).

The disease management strategies used will depend to a great extent upon the objectives of the plantation. Are trees going to be used for landscapes, fuelwood, or fiber? After harvest, will stump sprouts be used to regenerate the plantation? Is fiber quality important? What is the expected rotation? All of these factors should be considered before selecting the planting stock so that the possible impact of disease on various clones can be weighed against achieving management objectives. For example, the impact of *Septoria* canker precludes susceptible clones where rotations will exceed 5 years and stump sprouts will be regenerated. Cankers reduce fiber quality, cause stem breakage, and result in stump mortality in harvested stands. However, if fuelwood is the objective and the stump sprouts will not be used for regenerating the trees, many susceptible clones that have good early growth can be planted and managed on rotations of 5 years or more. The site should then be replanted with a disease-resistant clone (6, 7).

We now have a good understanding of the biology and impact of pathogens causing many of the important diseases of hybrid poplars within nurseries and plantations. The following are some general disease management guidelines that can help prevent or reduce disease problems.

- Plan for disease management prior to planting. Consider potential risks, impacts, and costs of control measures for the various major pathogens.
- Train workers to be alert for and to recognize insect and disease problems.
- Do not plant large areas with clones that have not been screened for growth and disease resistance under local conditions. Clones should be tested at the spacing they will be grown at in order to assess their "competitiveness," especially under narrow spacings when moisture and nutrients may be limiting.
- Do not sell or plant unknown clones or untested clones in random mixtures. Plant clones in separate blocks that can be managed as independent units if a disease outbreak occurs.
- Favor indirect disease control measures over direct disease suppression tactics. Maintain trees in a high state of vigor by supplying them with necessary moisture and nutrients. Good weed control is essential. Avoid wounding trees or injuring them with chemicals.
- Exclude pathogens from new plantings by avoiding introducing them on planting stock. Do not ship or plant visibly diseased cuttings or rooted stock. Harvest cuttings only from vigorous, disease-free trees.
- Monitor nurseries and plantations for disease development. The earlier a problem is detected the sooner it can be remedied. A clone that is highly susceptible to canker diseases early in its life should be removed.
- Remove infected trees and leaf debris to reduce inoculum within plantings. Minimizing overwintering inoculum will reduce disease incidence the following year.
- Keep records of disease incidence and severity on specific clones. A data bank of clone performance on different sites will be invaluable for future plantings of clones that are adapted to local conditions.
- Obtain information on poplar culture through your local agriculture extension office and the Poplar Council of the United States, State Division of Forestry, 2610 Claflin Road, Manhattan, KS 66502.

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