

Fusiform Rust

IMPORTANCE: Fusiform rust, caused by the fungus *Cronartium quercuum* f. sp. *fusiforme*, is native to the southern United States and has developed into the most destructive forest tree disease of pines in the South. This disease can impact growth and yield of loblolly pine (*Pinus taeda*) and slash pine (*P. elliottii*) plantations but is not considered a deterrent to profitable pine management in Texas. Information on fusiform rust incidence on slash and loblolly pine in East Texas is available from several surveys dating back to 1969. These surveys have shown that the level of rust infection increased, especially in slash pine, until the early 1990s when infection levels began to decline. This infection trend is probably associated with widespread planting of slash pine that began with the "Soil Bank" program in the 1960s. However, as rust problems began to develop in slash pine stands, planting of this species declined significantly after the mid-1980s.

It should be noted that rust incidence varies greatly from site to site, with some stands being heavily impacted and other stands being rust free. In general loblolly pine has not been seriously impacted by fusiform rust in East Texas. On the average, rust incidence in loblolly pine has declined slightly during the past 35 years, but remains relatively constant at about 10%. Slash pine infection, on the other hand, averages about 40%, a decline of about 20% from earlier surveys. Longleaf pine is fairly resistant; while shortleaf pine is highly resistant.

Economic damage caused by fusiform rust is from mortality, lost product value, and disruption of management plans. A single tree can have rust galls or cankers on the main stem, branches, or both. Branch cankers within 12-18" of the stem may grow into stem cankers. Rust infections that develop on the main stem of pines less than five years old are likely to kill the tree. Main stem and branch infections that occur after age five normally do not kill the tree, but cause a weakening of the stem or branch that can result in breakage from wind or ice. In addition, stem galls may cause merchantable volume loss at harvest. By age ten, rust infection levels usually have maximized in a stand.

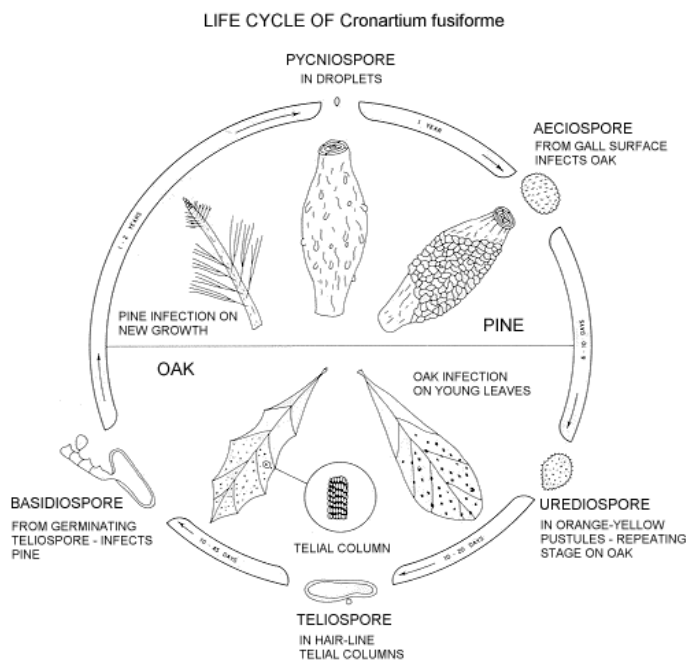
Rust galls tend to exude much resin or pitch and are easily ignited by control burns or wildfires, resulting in the death of the tree or reducing its value. Cankered stems have greatly reduced sawtimber



value. Heavily infected stands may need to be thinned earlier and more often with greater logging expenses. Residual sawtimber volume may be low, commanding a lower price.

IDENTIFICATION: The common name of the fungus is derived from the fusiform or tapered (spindle-shaped) galls that are produced on pines at the point of infection. Powdery, orange spores are produced by the fungus in early spring. On older trees, galls are often depressed on one side. Black turpentine beetles (*Dendroctonus terebrans*), coneworms (*Dioryctria* spp.), and pitch canker fungus (*Fusarium moniliforme* var. *subglutinans*), may infect fusiform cankers. These secondary agents aggravate the tree's weakened condition.

LIFE CYCLE: Fusiform rust is interesting in that oaks (alternate host) are required for the fungus to complete its life cycle and cause infection of pines. Wind currents spread fungal spores from pine to oak and then back to pine. During March, galls on pine trees produce orange, powdery spores (aeciospores). These spores are carried by wind currents to infect newly formed oak leaves, especially water oak. In turn, oaks produce basidiospores in tiny hair-like structures on the underside of leaves in the late spring or early summer. These spores are carried by wind to the growing tips of pine trees, completing the cycle by infecting pines from late April through the middle of June. The fungus does little if any harm to oak leaves. The timing of this entire process will vary from year to year and in different geographic areas, beginning earlier if the temperature is higher.



RUST HAZARD RATING: Incidence and impact of fusiform rust may be reduced by forest management activities. A stand with less than 25% infected trees has a low hazard rating. A moderate stand has 25 – 50% infection and a stand with over 50% infection has a high hazard rating.

On sites of moderate to high rust hazard, conduct site preparation as needed for planting and survival of pine, and to help suppress oak. Although enhanced pine growth results in increased incidence of rust (more surface area of growing tips to infect), it is counterproductive to recommend against site preparation, except for practices that might favor invasion of oak, e.g., windrows that are not completely burned.

MANAGEMENT OF PINE HOSTS: The following recommendations apply to moderate and high rust hazard sites. When regenerating a site with pine trees, use seedlings that are genetically resistant to fusiform rust. Fertilization practices should be delayed until trees are eight to ten years of age and less likely to develop lethal stem galls. If an adequate number of rust-free (rust-resistant) trees are available for use as seed trees, consider a shelterwood regeneration system.

Do not increase planting density to compensate for rust-infected trees unless coupled with sanitation thinnings to remove infected trees. Just as important, planting densities exceeding maximum carrying capacity often lead to additional problems (including pine bark beetles) later in the rotation.

Harvest and regenerate plantations in blocks organized in a "checkerboard" fashion so adjacent stands differ in age by 12 to 15 years. This increases diversity by creating an uneven age distribution among stands. Establish new plantations adjacent to older plantations beyond the age of maximum infection (10 years).

Fertilization practices for young pines should be delayed until trees are eight to ten years of age and less likely to develop lethal stem galls. Fertilization encourages growth and results in more growing pine tips that could become infected.

MANAGEMENT OF OAK HOSTS: When practical and not in serious conflict with other important uses of the forest, susceptible oaks (particularly water oak) in and immediately adjacent to pine plantations should be suppressed. Although spores that infect pine can be transported long distances by wind, infected oaks nearby account for most of the infection of surrounding pine.

MANAGEMENT OF PATHOGEN: Rust infection in nursery grown trees is uncommon due to modern nursery practices.

Inoculum should be reduced in young plantations (two to ten years of age) by sanitation thinnings to remove trees with stem galls and trees with many branch galls. Pruning of branch galls also reduces inoculum, but there is evidence that wounds may be colonized by the pathogen if pruning is done between February and June.

Manage rust-free stands in high hazard areas on long rotations.

Burning infected stands to remove limb galls is not recommended because residual trees with stem infections will likely be damaged. When prescribed burning, avoid igniting resinous stem cankers because igniting these cankers can result in charring and possible death of trees.

Adequately stocked stands located in high hazard areas that have escaped significant rust infection for at least eight years should be managed for poles or sawtimber. This will increase growth of healthy trees, increase uneven age distribution among stands, and avoid potential losses to young seedlings.

Stands with less than 25% of the trees with lethal stem cankers (greater than or equal to 50% of stem circumference girdled) may be grown to pulpwood rotation without sanitation cutting. Longer rotations may require a sanitation thinning.

Stands with more than 25% of the trees with lethal stem cankers should be sanitation thinned. If this would result in inadequate stocking, the stand should be clearcut and regenerated with resistant seedlings or, where appropriate, regenerated by a shelterwood system.

Consultation with a Texas Forest Service forester or a professional forestry consultant can help a forest landowner make proper management decisions regarding fusiform rust.