# Leaf Spot Diseases Of Black Walnut

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Growing black walnut in plantations can aggravate disease problems, especially leaf diseases. Factors that lead to infection and increased disease incidence and severity are high humidity (>98%), free moisture on leaves (rain, dew, fog, or from irrigation), low light intensity, and temperatures around 21° C. There are four common leaf diseases of black walnut, microstroma white mold, bull? s-eye leaf spot, mycosphaerella leaf spot, and walnut anthracnose. The most common and most serious of these is walnut anthracnose. All but microstroma white mold can cause premature leaf loss resulting in reduced growth, increased susceptibility to other diseases, and reduced quantity and quality of nuts.

All of these fungal diseases have a similar biology. Primary infections occur in the spring, May through early June, from ascospores emerging from fruiting bodies on overwintered leaves on the ground. Once primary infection occurs, lesions appear on leaves within a couple of weeks. Subsequent secondary infections occur on leaves throughout the summer by wind-dispersed spores (conidia) produced in these lesions. Production of spores increases gradually during July and reaches maximum numbers in August. The infected, fallen leaves serve as the reservoir for next year? s inoculum, completing the annual life cycles of these fungi.

**Microstroma White Mold -**
Microstroma white mold (or downy leaf spot), caused by Micrcostroma juglandis, is more unsightly than damaging. This disease does not kill the leaf and is not known to cause defoliation. The effect to the tree is minimal, probably resulting in a minor reduction in photosynthesis. Symptoms are a yellowish discoloration on the upper surface of the leaf (fig. 1), and a whitish growth on the underside of the leaf, often concentrated along the veins (fig. 2).

**Bull ?s-Eye Leaf Spot -**
Bull ?s eye leaf spot (or zonate leaf spot), caused by Grovesinia pyramidalis (asexual state = Cristulariella moricola) causes leaf spots and premature defoliation. Maple, hickory and many common weeds are also infected. Symptoms are unique in that the dark lesions on leaves are rounded and have concentric white rings, giving the spot a target-shaped appearance, hence the name bull ?s-eye leaf spot (fig. 3).

**Mycosphaerella Leaf Spot -**
Mycosphaerella leaf spot, caused by Mycosphearella juglandis (asexual state = Cylindrosporium juglandis) causes leaf spots that are angular, reaching a maximum size as large as 4mm in diameter (fig. 4). By midsummer, as lesions increase from secondary infections, affected trees look chlorotic or yellow. Coalescing lesions produce a vein pattern or a leaf scorch symptom. By late summer, severely diseased leaves fall, especially in dry weather.

**Walnut Anthracnose -**
The most serious and widespread leaf disease of black walnut is walnut anthracnose, caused by Gnomonia leptostyla (asexual state = Marssonina juglandis). The disease results in leaf spots ranging in size from a few mm to 1.25 cm in diameter. Dark spots first appear on the leaf blades and petioles in the spring (fig. 5). The older leaves in the lower and interior portions of the tree crown are most severely affected, show the most chlorosis and are the first to show premature leaf fall. The leaves infected early in the year are most important for photosynthesis during the critical period of nut formation and severe infections cause reduced yield and nut crop failure. The fungus may infect the nuts directly (fig. 6), causing nut meats to shrivel and darken.

Adjacent trees in plantations may exhibit varying levels of infection, indicating existence of natural resistance to anthracnose. This resistance is highly heritable, with provenances from the relatively arid western edge of the natural range of black walnut (Kansas and Oklahoma) being most susceptible. This is likely due to the limited natural selection for anthracnose resistance in this region.

When evaluating differences among cultivars in susceptibility to anthracnose one must take into account the nut load (William Reid, personal communication). Non-fruiting shoots have more leaves and the terminal leaves are younger. These younger leaves have fewer anthracnose lesions because they matured later in the season after the primary infection period for the fungus had passed. Thus, a tree producing a large quantity of nuts will look more susceptible to anthracnose than a tree producing few or no nuts.

## CONTROL

Most of the research on control and management of foliar diseases of black walnut has been directed against walnut anthracnose, although many of the methods available to growers probably would be effective against all the walnut leaf diseases.

Cultural management is the best approach to minimizing the impact of leaf diseases, particularly in plantations. First, plant only seedlings known to be resistant to disease. Presently, growers are at the mercy of nut collectors when planting seedlings. It is incumbent on nurseries to only sow nuts from known sources, preferably from resistant trees within the region where seedlings ultimately will be planted. Avoid shipping seedlings from the western area of the natural range of black walnut to other regions. In established plantations, growers should observe which seedlings exhibit symptoms and select against the most susceptible individuals during thinning operations.

Most cultural practices should be directed toward reducing free moisture on leaves. Dense stands are more susceptible to disease because of increased humidity, caused by reduced wind flow through these stands and the resulting increase in free moisture on leaf surfaces. Thinning improves drying of leaf surfaces and reduces leaf shading between trees thereby reducing incidence and severity of disease. Also, UV light kills spores.

Plantations should be oriented in long rows perpendicular to the prevailing winds in spring and summer as this has been shown to promote leaf drying. Spores are spread by wind, gravity, and probably insects, so avoid planting small trees under or downwind from large infected trees. Ponds, lakes and streams release heat gradually on cool nights, so establishing plantations near bodies of

water, particularly on the lee side, lessens dew formation on leaves. Avoid establishing plantations in cold seeps or small openings since this leads to increased dew formation. Avoid overhead irrigation.

Weeds also contribute to higher relative humidity in and around seedlings, so preventing leaf diseases is one more reason growers should control weeds either through cultivation or herbicides. Cultivation after leaf fall has the added benefit of incorporating infected leaves into the soil, thereby promoting their decomposition. Depending on the crop, intercropping may contribute to increased humidity. Growers will have to weigh the risk of increased potential of leaf diseases versus the benefits of intercropping.

Interplanting autumn olive, hairy vetch, crown vetch, or serecia lespedza may reduce infection by increasing total foliar nitrogen and by preventing primary infections due to increased decomposition of fallen black walnut leaves thereby lowering ascospore production.

April and June applications of nitrogen have been shown to reduce infection as well as increase growth of trees. However, ? High rates of nitrogen stimulate non-fruiting shoots to grow late into the summer well after the infection period. These leaves give the tree a healthy appearance and mask the defoliation of older leaves? (William Reid, personal communication). Soil application of ammonium sulfate, ammonium nitrate, and urea all are effective, although foliar application of urea is not. The addition of phosphorus and potassium has been shown to diminish the benefit of nitrogen fertilizer.

Direct control using fungicides can be effective, although the availability of suitable materials is in question. Benomyl has been shown to be the most effective of all the fungicides tested, however, it no longer carries a black walnut label. Only Syllit (Dodine)is registered for nut crop use. For landscape use, Botran, Daconil, Nova and Ziram have a black walnut label. Since the status of all agricultural chemicals are always under review, contact your local extension agent for the latest information.

Since infections can occur anytime during the growing season, timing of applications presents a problem. A practical approach is two applications, the first applied the last week in May to prevent the primary infection by ascospores, and the second applied the first week of July to inhibit secondary infection by conidia.

**Figure 1. Microstroma on upper leaf surface**

**Figure 2. Microstroma on lower leaf surface**

**Figure 3. Bull's-eye leaf spot**

**Figure 4. Mycosphaerella leaf spot**

**Figure 5. Anthracnose on leaves**

**Figure 6. Anthracnose on nuts**

## REFERENCES

U.S.Department of Agriculture, Forest Service. Burde, E. Lucy, ed. 1988. Walnut Notes. St. Paul, MN: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 5.01-5.02

U.S.Department of Agriculture, Forest Service. Ohman, H. John, dir. 1977. Manager's Handbook for Black Walnut. U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 22 p.

Sinclair, W.A., H.H. Lyon, W.T. Johnson. 1987. Diseases of Trees and Shrubs. Comstock Publishing associates, Cornell University Press. 574 p.

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