

Effects of fungicide sprays on foliage of Southern Magnolia

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ABSTRACT

Southern magnolia (*Magnolia grandiflora* L.) is one of our most recognizable and cherished broadleaved evergreen trees in the Southeast. However, little is known about the effects of fungicides on foliage disease incidence and leaf and tree appearance.

In south central Alabama, a large orchard of several hundred magnolia trees was established to harvest leaves for use in floral arrangements. These leaves must be attractive and free from any defects like fungal leaf spots, insect damage, or leaf scorch. Several leaf-and-tree-deforming symptoms developed in the planting, creating a problem for the owners and an opportunity for research on problems affecting the appearance of magnolia trees and foliage.

Preliminary evaluation and identification of pests associated with the symptoms in this orchard (Mullen et al., 1983) identified the fungal pathogens *Phyllosticta* sp., *Alternaria* sp., *Gloeosporium* sp., and *Colletotrichum* sp., as well as Cephaleuros algal leaf spot, and a bacterial leaf spot caused by *Pseudomonas* sp. Each of these pathogens is described in the literature as causing leaf symptoms on magnolia (USDA, 1960; Pirone, 1978; Hepting, 1971; Mullen and Cobb, 1984).

Materials and Methods

An experiment was conducted in 1991 to examine the effectiveness of various fungicides and combinations on the occurrence of symptoms associated with this complex of problems. Chemicals and formulations used were benomyl

Table 1. Treatment Combinations

Abbreviation	Combination
BKR	Benlate 50W .5 lb. + Kocide 101 77W 10 lb. + Red Panther surf. 2.0 pt.
BR	Benlate 50W .5 lb. + Red Panther surf. 2.0 pt.
C	Control (unsprayed)
DKR	Daconil 2787 4.17F 3 pt. + Kocide 101 77W 10 lb. + Red Panther surf. 2.0 pt.
DR	Daconil 2787 4.17F 3 pt. + Red Panther surf. 2.0 pt.
K	Kocide 101 77W 10 lb.
NKR6	Nova 40W 6 oz. + Kocide 101 77W 10 lb. + Red Panther surf. 2.0 pt.
NKR12	Nova 40W 12 oz. + Kocide 101 77W 10 lb. + Red Panther surf. 2.0 pt.
NR6	Nova 40W 6 oz. + Red Panther surf. 2.0 pt.
NR12	Nova 40W 12 oz. + Red Panther surf. 2.0 pt.
OKR4	Orbit 3.6EC 4 oz. + Kocide 101 77W 10 lb. + Red Panther surf. 2.0 pt.
OKR8	Orbit 3.6EC 8 oz. + Kocide 101 77W 10 lb. + Red Panther surf. 2.0 pt.
OR4	Orbit 3.6 EC 4 oz. + Red Panther surf. 2.0 pt.
OR8	Orbit 3.6 EC 8 oz. + Red Panther surf. 2.0 pt.
R	Red Panther surf. 2.0 pt.

(Benlate 50W); chlorothalonil (Daconil 2787 4.17 F); myclobutanil (Nova 40W); copper hydroxide (Kocide 101 77W); paclobutrazol (Orbit 3.6 EC), and a nonionic surfactant, (Red Panther Surfactant: alkylpolyoxyethylene ethers 90%). Treatment combinations used are listed in Table 1. Each treatment combination was applied on a two-week application schedule in April and May, then every three weeks from June 1 through the end of August, when sprays were terminated. The experiment was arranged in a randomized complete block design with four trees in each treatment. All sprays were applied with a Savage Model 500 airblast sprayer (Savage Equipment Co., Madill, OK) in 2.7 gal per tree (290 gal/acre). Trees were spaced 20 x 30 ft., were approximately 33 years old, and 30 feet tall. All treated trees were the cultivar 'Saint Mary.'

On 21 May 1991, following a wet spring, symptoms were obvious on untreated trees. An evaluation of symptom development was made. Ten individual leaves were collected from randomly selected shoots within a height of 8 to 12 ft. on each tree. The third leaf from the base was rated, since prior observation indicated that leaves in this position were more severely affected. Leaves were taken to the laboratory and rated for symptom occurrence using a modification of the Horsfall-Barratt rating system (Bertrand, 1984), which estimates the percentage of the leaf surface area affected by the symptoms. The scale uses a 1 to 8 rating, where 1 = 0% of leaf surface affected, 2 = trace - 6%, 3 = 6 - 25%, 4 = 25 - 50%, 5 = 50 - 75%, 6 = 75 - 94%, 7 = 94 - 99%, and 8 = 100%. Leaf condition was also rated, using the same scale with 8 being the best rating (100% of surface green and healthy).

An overall visual rating of the tree condition was made, using a 0 to 4 scale, where 0 = no visible symptoms on new growth, 1 = very light visible symptoms, 2 = light, 3 = moderate, and 4 = heavy symptom occurrence.

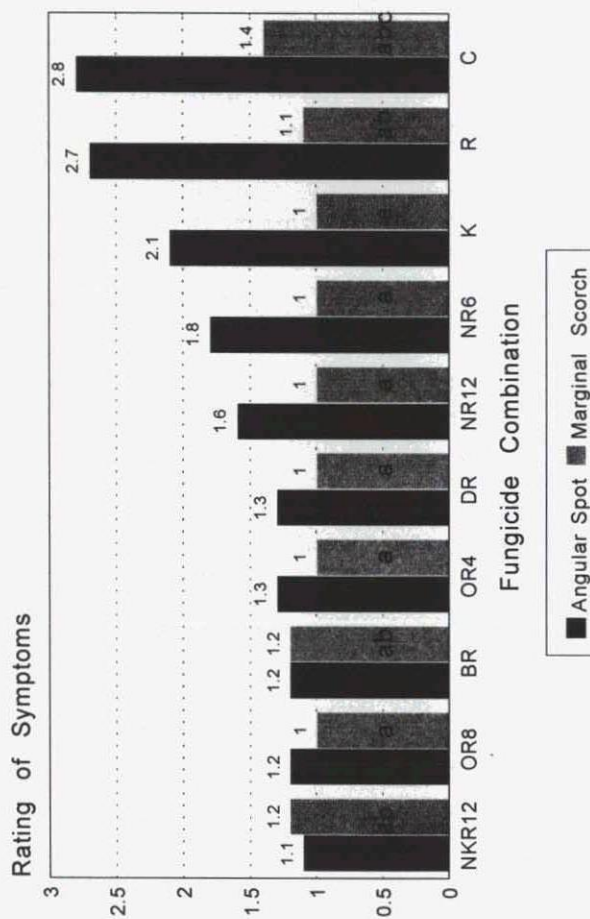
All data were analyzed according to the experimental design using analysis of variance, Duncan's Multiple Range Test where appropriate, and preselected contrasts of treatment effects.

Results and Discussion

Occurrence of individual symptoms

Numerous, distinct symptoms were present on the leaves. Each commonly-occurring symptom is described below and treatment effects are discussed. Ratings for symptom occurrence are in Figures 1 and 2.

Figure 1. Effects of Fungicides on Leaf Spot Symptoms on Southern Magnolia



Rating is 1 to 8, where 1 = 0% of leaf surface affected & 8 = 100% of leaf surface affected.

*Means followed by the same letter are not significantly different ($p=0.05$, DMRT).

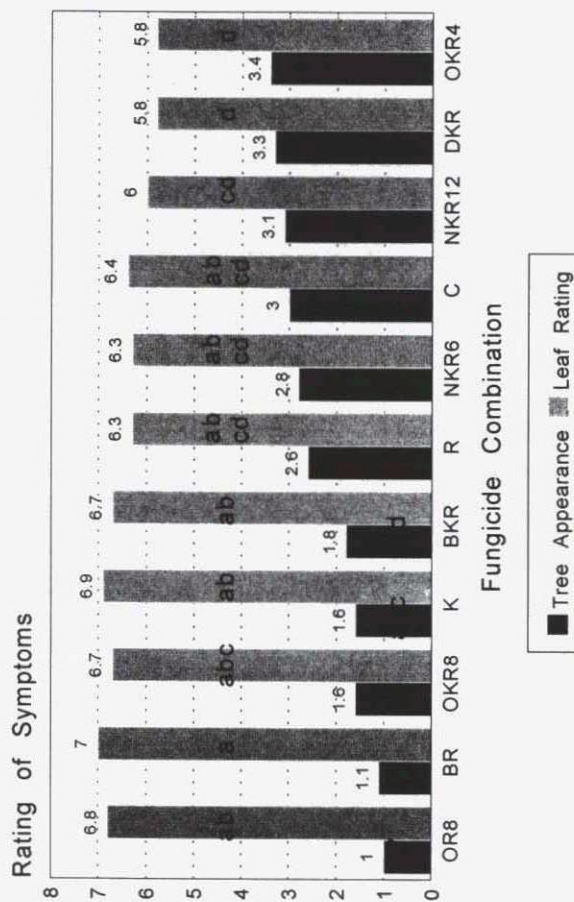
Angular Leaf Spot: The most prevalent symptoms were small sunken angular necrotic spots, 1 to 4 mm in diameter, medium to dark brown and visible on both leaf surfaces, surrounded by a yellow halo visible on the upper surface. Spores produced on lesions were *Colletotrichum* sp. Fowler (1949) described a magnolia leaf spot caused by *Glomerella cingulata*, a common fungus causing bitter rot on apple and anthracnose on many plants. Since this fungus has a *Colletotrichum* imperfect stage, our observance of *Colletotrichum* spores associated with the lesions suggests the *Glomerella* leaf spot as the cause of the angular spot symptom, even though symptoms we observed differ considerably from those described for this disease by Fowler (1949).

Although these spots appeared less prevalent when fungicides were used (Figure 1), there were no statistically significant differences among the fungicides. Addition of Kocide to the fungicides did not affect angular spot incidence compared to the fungicides used alone. Kocide alone was less effective in lowering incidence than Benlate, Daconil, or Orbit.

Marginal Scorch: This symptom was a dark brown necrosis, usually beginning at the leaf margin near the distal end of leaf. The similarity of this symptom to the angular spot, and the presence of *Colletotrichum* spores suggests that this was a more severe manifestation of the *Glomerella* leafspot described above. Those treatments which controlled angular leaf spot were not as effective in reducing marginal scorch (Figure 1).

Ring Spot: A common symptom on many leaves was a green-to-yellowish or sometimes light brown sunken line forming a ring, commonly 2 to 5 mm in diameter. These ring spots, normally several per leaf on those leaves having them, had healthy green centers and were visible on the upper leaf surface only. Our occasional observation of chemical residue in the rings led to our speculation that the rings were formed from the accumulation of chemical deposits at the borders of droplets. No ringspots were observed in the treatment receiving no sprays. Since the treatment receiving Kocide only, with no surfactant, also showed no evidence of ring spot, we suspect that the addition of surfactant was involved. It appears that the surfactant we used induced ring spots in magnolia. When we contrasted treatments receiving surfactant with the treatments not receiving surfactant, there was a significantly high ($P < .05$) incidence of ring spot in those with surfactant. Similarly, the treatment receiving surfactant only also had higher ($P < .05$) ring

Figure 2. Effects of Fungicides on Leaf and Tree Appearance in Southern Magnolia



Tree Appearance: 0 to 4 Rating, 0 = no visible symptoms & 4 = heavy symptom occurrence.
 Leaf Rating: 1 - 8 Rating, 1 = 0% of leaf surface affected & 8 = 100% of leaf surface affected.
 *Means followed by the same letter are not significantly different ($p=0.05$, DMRT).

spot occurrence than did either the unsprayed treatment or the Kocide only treatment.

Faded Patch: Some leaves showed a light brown scorched discoloration, which we referred to as a faded patch, on the upper surface. The symptom appeared to begin in the middle of one half of the leaf and progress outward toward the leaf margin an inward toward the midvein. Typically, the affected area would form an irregular ellipse 3 to 5 cm long and 1.5 to 3 cm wide. On the undersurface, a distinctive light brown elliptical discoloration was also apparent.

This symptom was completely absent in the unsprayed check; the treatment receiving Benlate, Kocide and surfactant; the treatment receiving Orbit and surfactant; the treatment receiving Benlate and surfactant; and the treatment receiving surfactant only. Evidence suggests that the discolored patch is a phytotoxic response which may be induced to some degree by spraying with some chemicals, especially if high rates and tank mixes are used. The symptom is somewhat similar to sunburn symptoms on other plants, and could be a result of increased sensitivity to sunburn on the chemically-treated leaves.

Leaf and Tree Condition

Several other relatively minor symptoms not described above were occasionally observed. The leaf and tree condition ratings, an overall evaluation of leaf and tree appearance, reflect these along with the others and provide a measure of treatment effects on the entire complex of problems.

Leaf condition ratings (Figure 2) indicate that none of the treatments significantly affected the percentage of symptom-free leaf surface area when compared to the unsprayed control. While several treatments dramatically lessened incidence of the diseases, the chemicals increased the incidence of the phytotoxicity symptoms. The addition of the surfactant, which increased the ringspot symptom, resulted in a lower leaf rating in several treatments which would have had excellent ratings otherwise. Similarly, the tank-mixing of the fungicides with Kocide, which had been aimed at bacterial spot control, increased phytotoxicity. The 8.0 oz per acre rate of Orbit had the best ranking of overall tree condition (Figure 2), and controlled the *Glomerella* leaf spot symptoms well. Benlate also gave excellent overall results. However, Benlate is no longer available. The only weakness in these treatments was the moderate incidence of ringspots, caused by the surfactant. ♡

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Disclaimer—

Use fungicides only according to the directions on the label. Follow all directions, precautions, and restrictions that are listed. Do not use fungicides on plants that are not listed on the label.

The fungicide rates in this publication are recommended only if they are registered with the Environmental Protection Agency or the Alabama Department of Agriculture and Industries. If a registration is changed or cancelled, the rate listed here is no longer recommended. Before you apply any fungicide, check with your county Extension agent for the latest information. Trade names are used only to give specific information without recommendation or guarantee.