

Title: Large Patch Control on Zoysiagrass Affected by Fungicide and Target Site of Application

Objective: Determine the amount of protection provided by four fungicides of differing modes of action applied on the leaf, sheath, or stem parts of zoysiagrass plants.

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Body:

Large patch, caused by *Rhizoctonia solani* AG 2-2 LP, is the most severe disease of zoysiagrass in the transition zone United States (Fig. 1). The disease affects the stems and sheaths of susceptible plants when temperatures are cool-to-mild with frequent rainfall (Fig. 1). Symptom expression is most visible during the fall and spring months as zoysiagrass approaches and exits winter dormancy. Large patch is often called a perennial disease because the patches reappear in the same location each year and progressively gets more severe.

Golf course superintendents often rely on fungicide applications to reduce large patch severity. However, large patch is difficult to control using traditional fungicide sprays. Much of the fungicide solution is intercepted before it makes its way into the lower plant canopy where infection occurs. Improved large patch control, and more efficient use of fungicides, could be achieved with identifying the optimal target site of application.

Greenhouse experiments were conducted in 2015 in Knoxville, TN, to evaluate large patch control using fungicides deposited on three target sites of zoysiagrass (leaf, sheath, and stem). The fungicides Heritage (0.4 oz/1000 ft²), Torque (0.6 fl oz/1000 ft²), Prostar (2.2 oz/1000 ft²), and Daconil Ultrex (3.2 oz/1000 ft²) were applied using a pipette as 2.5 microliter droplets that were dispensed singly on the leaf, sheath, or stem. Plants were inoculated with *R. solani* and kept in a growth chamber under high humidity. Measurements of visual disease severity (0-100%) and photochemical efficiency (F_v/F_m) were collected every 7 days.

In both experimental runs, zoysiagrass treated with fungicides applied on the sheath or stem exhibited significantly lower large patch severity and higher F_v/F_m values compared to zoysiagrass receiving leaf applications on most rating dates (Fig. 2). Large patch control of Heritage treated zoysiagrass was most affected by the site of application. At 28 days after treatment in the first experimental run, leaf applications of Heritage exhibited 74% disease severity, whereas the sheath and stem applications both exhibited <5% disease severity (Fig. 3,4). Daconil Ultrex, a contact fungicide, was least affected by the site of target application on most rating dates. Applications of Torque and Prostar also performed well and reduced large patch severity when applied on the sheath or stem (Fig. 3).

In conclusion, this research demonstrates that more effective use of fungicides can be achieved when the active ingredient is deposited lower in the plant canopy. These results may help explain why variable large patch control is observed on many golf courses. The selection of nozzle types, water carrier volume, spray adjuvants, and spray pressure may influence the quality and deposition of pesticide sprays.

Future research is needed to improve lower canopy fungicide deposition under field conditions. One such method may be the inclusion of surface active agents (surfactants) in spray mixtures. Surfactants are commonly used with herbicides and insecticides to improve surface coverage and plant uptake. However, the effects of surfactants mixed with commonly used fungicides are unclear. Field and spray chamber experiments will be conducted to determine the usefulness of surfactants to improve fungicide sprays targeting large patch.

Bullet points:

- Fungicides applied on the sheath or stem provided greater large patch protection compared to fungicide applied on the leaf
- Heritage, a xylem mobile fungicide, was most affected by site of application. Daconil Ultrex, a contact fungicide, was least affected by site of application.
- Future research is needed to improve lower canopy fungicide deposition under field conditions.

Figure captions:

Figure 1 caption:

Fig. 1. Large patch is a severe disease of zoysiagrass in the transition zone United States.

Figure 2 caption:

Fig 2. Fungicides applied on the sheath or stem, where the infection occurs, may improve large patch control.

Figure 3 caption:

Fig. 3. Effect of application placement (pooled across fungicides) on large patch severity and Fv/Fm.

Figure 4 caption:

Fig. 4. Effect of fungicide treatments and site of application on large patch severity and Fv/Fm.

Figure 5 caption:

Fig. 5. Differences in large patch severity affected by Heritage applied onto the stem, sheath, or leaf.

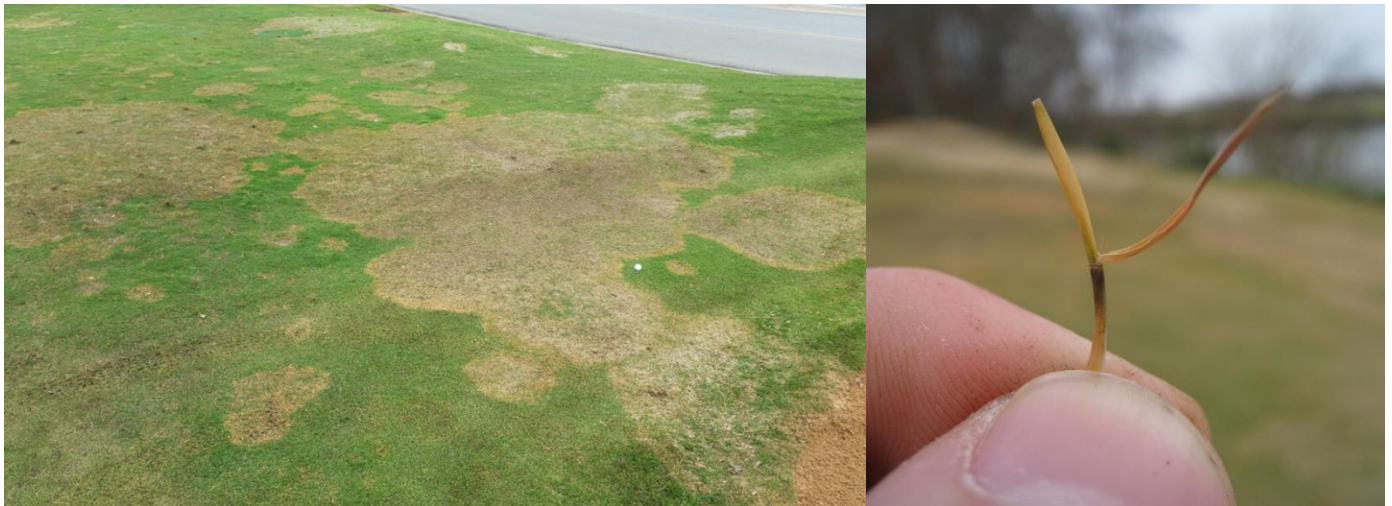


Fig. 1. (Left) Large patch is a severe disease of zoysiagrass in the transition zone United States. (Right) Fungicides applied on the sheath or stem, where the infection occurs, may improve large patch control.

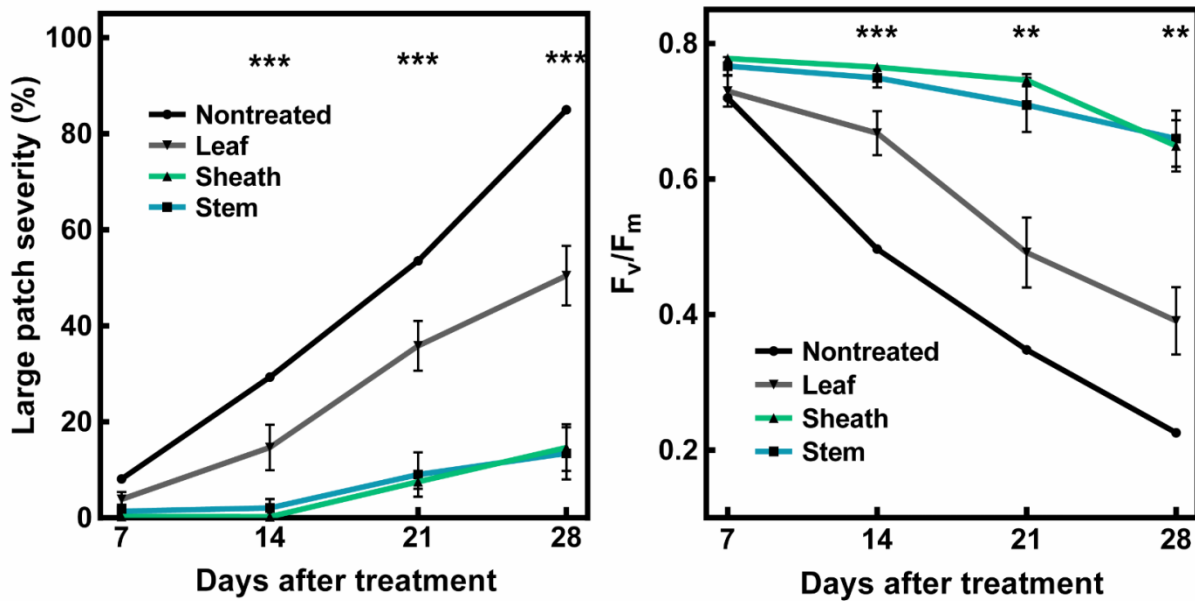


Fig. 2. Effect of application placement (pooled across fungicides) on large patch severity and F_v/F_m.

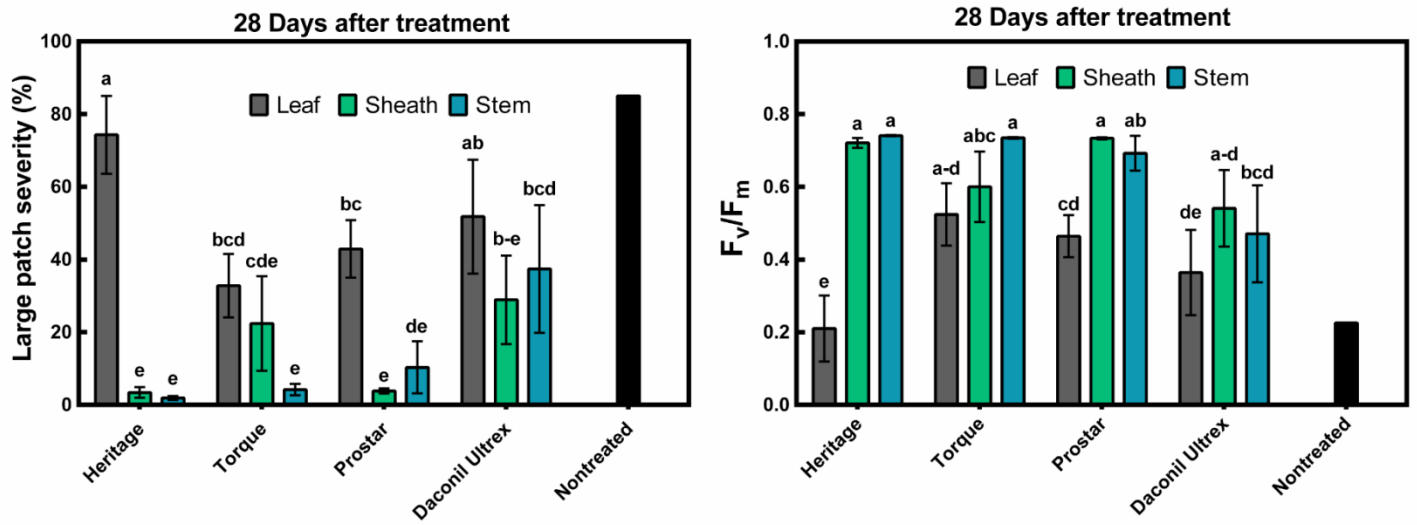


Fig. 3. Effect of fungicide treatments and site of application on large patch severity and Fv/Fm.



Fig. 4. Differences in large patch severity affected by Heritage applied onto the stem, sheath, or leaf