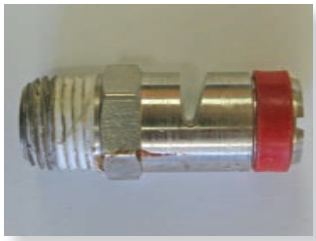
Improving spray coverage improves dollar spot control

Using the right nozzle to apply fungicide can save your grass.



Paul Vincelli, Ph.D.
Ed Dixon

Using spray nozzles that emit a coarse droplet size to apply fungicides is highly desirable because these nozzles reduce spray drift (6). However, such nozzles may not provide complete coverage of turfgrass leaf surfaces. Among other factors, changing nozzles or increasing spray gallonage or pressure may improve spray coverage (1,7). But does improving spray coverage represent a gain in plant disease control?

Common sense dictates that less-than-complete coverage of turfgrass foliage could compromise control of foliar diseases because fungal infection may occur in microscopic areas on the leaf surface where no fungicide has been deposited. However, this assumption may not be valid because contact fungicides may redistribute readily on turfgrass leaf surfaces (as a result of irrigation practices, mowing wet foliage, etc.). Furthermore, systemic fungicides may have enough mobility to compensate for poor coverage.

Experiments

Because it is not clear that complete spray coverage is necessary when applying fungicides to turfgrass, we conducted a series of field experiments to test the effect of spray coverage on dollar spot control in creeping bentgrass. Three experiments were conducted on a USGA-type putting green, and a fourth was conducted on a fairway-height grass on a native soil. Details on the experimental design and methods are available in a research publication (8).

We tested both a contact fungicide, Daconil Ultrex 82.5WDG (active ingredient chlorothalonil; Syngenta Professional Products), applied as 3.2 ounces product/1,000 square feet (9.8 kilograms/hectare), and a systemic fungicide, Eagle 20EW (myclobutanil; Dow AgroSciences), applied as 1.2 fluid ounces product/1,000 square feet (3.8 liters/hectare).

We applied each fungicide using a carbon-dioxide-pressurized hand-held sprayer fitted with one of four nozzles, delivering a total of 1.5 gallons/1,000 square feet at 35 pounds/square inch (611.2 liters/hectare at 241.3 kilopascals). Two nozzles provided incomplete spray coverage and two provided complete spray coverage (Figure 1). Applications were made to plots by spraying half of the spray material in each of two perpendicular directions.

Dollar spot was assessed weekly, and appropriate transformations and statistical analyses were conducted on the data. For the purposes of the analysis presented in this report, we pooled results for complete-coverage nozzles versus incomplete-coverage nozzles. We also excluded disease assessments where the average level of dollar spot in water-treated plots was less than 0.8 dollar spot infection centers per square foot (1 square foot = 0.09 square meter). In this way, we only included data for moderate to high dollar spot pressure in our analysis.

Results

Disease control

We tested nozzle performance over four trials on a total of 31 dates. On 15 of the 31 dates (48%), applying Daconil Ultrex with complete-coverage nozzles resulted in statistically better control than applying it with incomplete-coverage nozzles. Eagle also achieved better control with complete-coverage nozzles on 15 of the 31 dates.

Although both products achieved better disease control on 15 of the 31 dates, all the dates were not the same. On the other 16 assessment dates, complete-coverage and incomplete-coverage nozzles provided statistically equal control of dollar spot. On no date did we observe better control with the incomplete-coverage nozzles than with the complete-coverage nozzles.

Disease pressure

Sometimes when improved control was found using complete-coverage nozzles, means in those plots were in the range of 0-0.5 dollar spot infection center/square foot (0.09 square meter) versus 0.2-2.0 dollar spot infection centers/square foot (0.09 square meter) in the incomplete-coverage plots. However, in other instances, means in complete-coverage plots were in the range of 0.6-3.8 dollar spot infection centers/square foot (0.09 square meter) versus 2.8-8.1 dollar spot infection centers/square foot (0.09 square meter) in the incomplete-coverage plots. This means that complete-coverage nozzles provided improved disease control over a range of disease pressures, including high disease pressure.

Coverage

We believe that superintendents should think of the application of foliar fungicides much like trying to spray-paint a wall: achieve as good a coverage as you can. Although it is tempting to assume that your current spray configuration provides acceptable coverage, this may not be the case. For example, higher spray volumes are typically thought to provide better plant coverage, but the degree of coverage achieved also depends on nozzles used as well as other parameters (3). For example, should you increase your spray gallonage to provide better coverage? Not necessarily.

In several studies, no difference in dollar spot control was found whether fungicide applications were made in 1.0-1.1 gallons/1,000 square feet (407.5-448.2 liters/hectare) or 2.0-2.5 gallons/1,000 square feet (814.9-1,018.6 liters/hectare) (4,9). In another study (5), better control of dollar spot was found when chlorothalonil was applied at 1.1 gallons/1,000 square feet (448.2 liters/hectare) rather than 2.5 gallons/1,000

Spray patterns

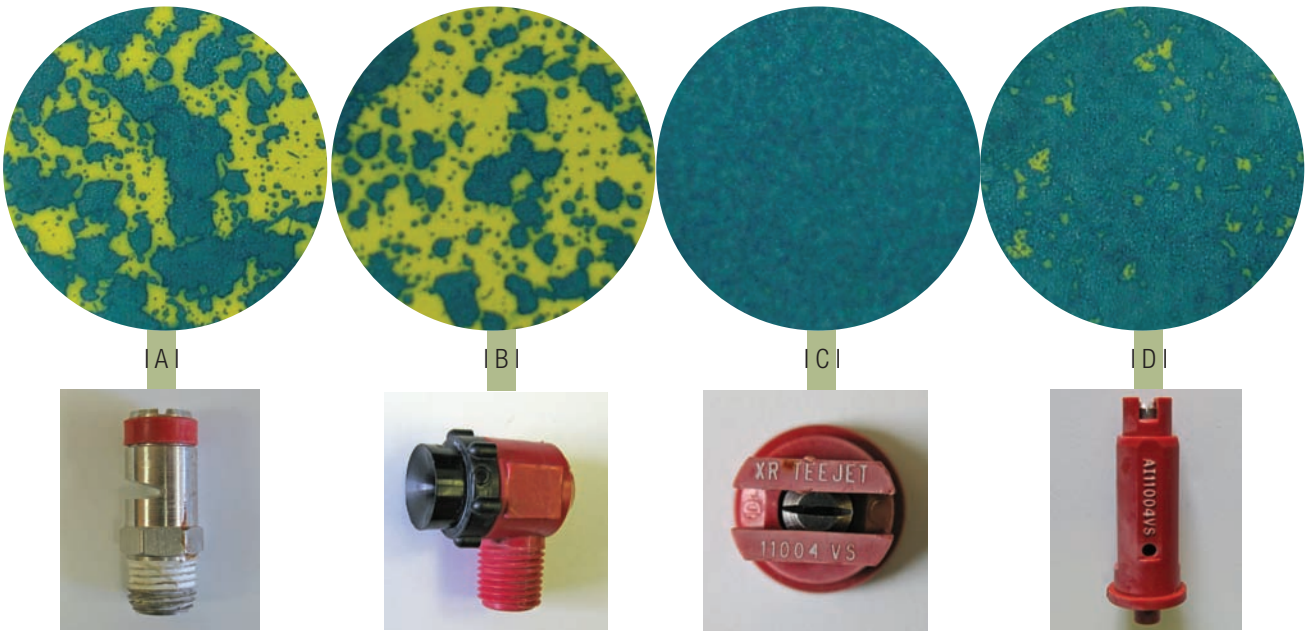


Figure 1. Spray patterns for four nozzles. Water-sensitive paper turns from yellow to dark blue when wet; uniform blue represents the most uniform spray coverage. Incomplete spray coverage is provided by: **(A)** the TeeJet TurfJet nozzle (1/4TTJ04-VS, extremely coarse droplet size) and **(B)** the Raindrop RA-4 nozzle (35654-2, coarse droplet size). Two nozzles were chosen to provide nearly complete spray coverage: **(C)** the XR TeeJet flat-fan nozzle (XR 11004-VS, medium droplet size) and **(D)** the TeeJet air-induction nozzle (AI 11004-VS, extremely coarse droplet size).
Spray-pattern photos by P. Vincelli. Nozzle photos by E. Dixon

square feet (1,018.6 liters/hectare). Those investigators used flat-fan nozzles, which our studies indicate may provide relatively good coverage even at spray volumes of 1.0 gallon/1,000 square feet (407.5 liters/hectare) (9; Vincelli and Dixon, unpublished). Therefore, you may be getting acceptable coverage already and may not need to change anything.

However, several low-drift nozzles are not designed to provide excellent spray coverage (Figure 1). If you are using such a nozzle, your coverage may be incomplete no matter what your spray volume is. It is much better to check the degree of spray coverage being achieved by your current spray configuration than to make assumptions about how well the turf is being protected. The use of water-sensitive paper is a handy way to accurately check spray coverage.

Drift

This is not to say that we should concern ourselves only with disease control while being cavalier about spray drift. Reducing drift to off-target sites is very important. Some low-drift nozzles are engineered so that air is drawn into the nozzle body and incorporated inside spray droplets as they form. This increases the size of the liquid droplet, thereby reducing drift (2). However, when this air-incorporated droplet strikes the surface of the turf leaf, it breaks apart into many smaller droplets, allowing for better coverage than other low-drift nozzles. The air-induction nozzle used in the present study is an example of this type of nozzle. Preliminary reports from other investigators also indicate that air-induction nozzles provide better disease control than other nozzles that produce a coarse droplet size.

Conclusion and recommendation

Our results clearly support the use of nozzles that provide complete spray coverage because they result in more consistent control of dollar spot than nozzles providing incomplete coverage. Water-sensitive paper is easy to use and can permit a quick check on the quality of your spray coverage.

Acknowledgment

This research was originally published online as "Does spray coverage influence fungicide efficacy against dollar spot?" by P. Vincelli and E. Dixon in *Applied Turfgrass Science* doi: 10.1094/ATS-2007-1218-01-RS. Dec. 18, 2007. (www.plantmanagementnetwork.org).

Literature cited

1. Couch, H.B. 1995. Diseases of turfgrasses. 3rd ed. Krieger Publishing, Malabar, Fla.
2. Hofman, V., and J. Wilson. 2003. Choosing drift-reducing nozzles. Online. Cooperative Extension Service Publication No. FS919. College of Agricultural & Biological Sciences, South Dakota State University, Brookings, S.D. http://agbiopubs.sdstate.edu/articles/FS919.pdf (verified Dec. 26, 2007).
3. Kaminski, J.E., M.A. Fidanza, M. Agnew and J. Gregos. 2006. Impact of nozzle type on dollar spot control. *Phytopathology* (Abstract) 96:S58.
4. McDonald, S.J., and P.H. Dernoeden. 2006. Preventive dollar spot control in creeping bentgrass as influenced by spray volume and a spring application of fungicides, 2005. *Fungicide & Nematicide Tests* 61:T017.
5. McDonald, S.J., P.H. Dernoeden and C.A. Bigelow. 2006. Dollar spot control in creeping bentgrass as influenced by fungicide spray volume and application timing. Online. *Applied Turfgrass Science* doi:10.1094/ATS-2006-0531-01-RS. www.plantmanagementnetwork.org/pub/ats/research/2006/dollar/ (verified Dec. 26, 2007).
6. Ozkan, H.E. 2001. Do "low-drift" nozzles work—an update. *Turfgrass Trends* 10:10-14.
7. Smith, J.D., N. Jackson and A.R. Woolhouse. 1989. Fungal diseases of amenity turf grasses. 3rd ed. E. & F.N. Spon, London.
8. Vincelli, P., and E. Dixon. 2007. Does spray coverage influence fungicide efficacy against dollar spot? Online. *Applied Turfgrass Science* doi:10.1094/ATS-2007-1218-01-RS. www.plantmanagementnetwork.org/sub/ats/research/2007/spray/ (verified Dec. 26, 2007).
9. Vincelli, P., E. Dixon, D. Williams and P. Burrus. 2004. Efficacy of fungicides for control of dollar spot of creeping bentgrass managed as a fairway, 2003. *Fungicide & Nematicide Tests* 59:T007.

GCM

Paul Vincelli (pvincell@uky.edu) is an Extension professor and Ed Dixon is a research analyst in the department of plant pathology at the University of Kentucky, Lexington.

The research says

- Spray nozzles that emit a coarse droplet size reduce spray drift but may not provide complete coverage of turfgrass foliage.
- A contact fungicide and a systemic fungicide were applied to turf with nozzles that provided complete coverage and nozzles that provided incomplete coverage. On 48% of the test days, significantly better disease control resulted when full-coverage nozzles were used.
- Complete-coverage nozzles provided significantly better disease control under all levels of disease pressure.
- Superintendents can use water-sensitive paper to determine whether turf foliage is receiving full coverage from the nozzles being used to apply fungicides.