University of Minnesota
UPDATE

The Art of Spraying-Fungicides

By Dr. Ward Stienstra
Extension Plant Pathologist
University of Minnesota/St. Paul

"To Put" and "To Putt." What is the difference? One is a verb, the other a noun. The first is to "place something where I want it" and the other is often a "futile attempt to do the same thing." Spraying could be likened to "a Putt" when you are reminded that approximately 85% of spray operations make significant errors in — mixing, loading, equipment set-up and operation as well as delivery rates. The National loss was estimated to be 1 billion dollars. The same study reported that less than 25% apply within 5% plus or minus of the goal. How are you doing? I expect most will not need to make changes, but some should.

Since 1991, events like Sprayer Tune-Up Week have focused on "Safe, Accurate and Environmentally Sound Application to Avoid Drift." The environmental concerns like "not in my air, water or yard" have focused most comments and research on spraying to reduce drift. What is Effective Spraying? What is golf course spraying like today? Is it only done when the course is closed? As fast as possible? At low dilution rates to reduce refill times and travel time? Are multiple products in the tank? Is spraying related to irrigation schedules and dry turf? The idea for this topic developed after seeing spray operations on golf courses by superintendents who have challenged me about product applications/recommendations I've made and because of increasing concerns about "Fungicides Resistance" and product failure reports. Are such concerns related? Does application method/technique affect the result? I believe it does and hope to convince you that effective spraying is more than drift avoidance. What is Effective Spraying?

Some basic facts about spraying you must understand:

1. Flow Rate. To double the flow rate you must increase pressure four times. Pressure adjustment up, while it is an easy way to change flow rate it also must be noted that this also reduces the drop size and increases nozzle wear rate. This can result in increased drift potential-smaller drop size and loss of uniformity in the spray pattern-ineffective nozzle openings.

2. Spray Angle. An 8002 nozzle operated at 40 PSI will cover 30 inches of turf when positioned 18 inches high, but will cover only 23 inches of turf at 18 inches high if the pressure is too low. Spray angle may be less than the reported degree if pressure is below the recommended range. A smaller spray angle results in less coverage and may produce strip or band patterns.

3. Volume Median Diameter. This is a measure of droplet size, half of the drops are larger and half are smaller. A larger Volume Median Diameter (VMD) results in less drift, but smaller VMDs may be required to obtain maximum surface coverage on the target plant. The number (VMD) is given in Microns. One Micron is equal to 0.001 millimeter or 1/25,400 inch. A 1/8 inch drop is 3,175 microns. A standard to remember is that drops less than 200 Microns are considered to be drifters. The percentage of spray volume less than 200 Microns in an 80 degree nozzle is 16% and it is 21% for a 110 degree nozzle operated at 40 PSI. These same two nozzles when operated at 20 PSI have 8% and 14% driftable droplets; clearly increasing pressure increases drift potential. Nozzles designed to reduce drift, a Drift Guard 80 degree versus the XR (Extended Range) 80 has 10% less driftable droplets when operated at the same pressure.

4. Nozzle Flow Rate. The last number in the nozzle identification number indicates its flow rate at 40 PSI. The 8008 has a greater flow rate than either an 8005 or an 8003, and it is interesting to note that at pressure from 10 to 80 PSI the larger flow rate nozzle has fewer drops in the smaller VMD range. The droplet size is smaller when 100 degree nozzles are used over the same range of pressure. The better method of increasing spray volume rates is to change nozzle size, not to increase pressure. A method of reducing drift is to lower the pressure at the nozzle. Nozzles sold to reduce drift usually operate at a lower pressure due to designs that have lower pressure at the exit opening. Standard nozzle operating pressure is 40 PSI; below that the angle of coverage can be reduced and above that a higher percentage of driftable drops result. Pressure from 35 to 40 PSI at the nozzle is desired with fan type nozzles for most effective spraying.

5. Delivery Volume or Dilution Rate. A surface area of 1,000 square feet covered to a depth of 12 inches requires 7,480 gallons of water. Sixty-two point three (62.3) gallons of water will cover that same 1,000 sq. ft. to a depth of 0.1 inch, while 6.2 gallons will only produce a layer of water 0.01 inch deep and 0.62 gallons results in a very thin water layer, 0.001 inch. How thin is a layer of water 0.001 inch? Take a 1-inch piece of paper and cut it in half ten times. What is left is 1/1024 inch. When spraying one gallon of water per 1,000 sq. ft. a layer is produced 0.0016 inch thick; at two gallons per sq. ft. the layer is 0.0032 inches thick. This assumes all of the volume is spread evenly and none is lost. Sprayer technology and operator skill are seldom so exact.

6. Disease Control/Delivery Volume. It was shown that the length of effective disease control with Bayleton was dependent on the delivery volume. Significantly less disease control was reported at 23 and even at 37 days after treatment if delivery volume was reduced from 2 to 1 gallon of water. Optimum dilution ranges are 1 to 2 gallon for many products. Some new fungicide labels provide dilution guidelines.

7. Post Spray Water. Maximum disease control was

(Continued on next page)

U of M Update —

(Continued from Page 11)

obtained from contact and some systemic fungicides when they were applied to dry turf and allowed to dry before rain or irrigation was applied. The period of time from initial wetting from spray application until dry on the leaf appears to be important for uptake and diesease control. While the mechanism is not understood, the basic effectiveness of a fungicide is reported to be established by the initial water amount when applied; therefore application to dry turf is desired and the turf should not be rewet until the product has dried. Watering systemic fungicides after the leaf is dry may not reduce effectiveness, nor will it improve product performance. Contact fungicides do suffer a significant drop in disease control if watered before they dry. Products with sticking agent(s) remain effective if the spray has dried on the leaves before wetting.

The application of fungicides for turf winter disease management last fall began a study to evaluate three dilution rates: 2, 1 and 1/2 gal. per 1,000 sq. ft., two rates of a combination, tank mix fungicide program and three nozzle types. The results are not yet completely in, but initial readings at Duluth suggest some differences related to all variables. One year does not make a good test and future results are needed. I'll be preparing a first year summary after the next set of notes are taken at Duluth.

I'd suggest that you very carefully consider the dilution rates used for fungicide application, as low dilution rates of products appear to perform poorly in research reports and in the first trial for winter disease control. It is possible, not proven, that low dilution rates are part of the problem in allowing for rapid development of fungicide resistance. Clearly the repeated use of fungicides with the same mode of action and application of such products at lower than label rates are important and significant factors in resistance development. Application of fungicides at the tested/recommended dilution rates may result in better disease control and fewer reports of resistance or product failure concerns. Nozzle type, size and pressure are significant factors affecting fungicide performance.

The sprayer output should be tested following procedures given in operation manuals or in spray nozzle catalogs. Your goal is to measure the delivery of product per unit area of turf. This is a function of nozzle size, number, pressure and speed of the sprayer. How well does your sprayer perform?