FACTORS AFFECTING SPRAYER COVERAGE

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Introduction

The options in turf spraying equipment are always changing. Sophisticated sprayers are available in many different sizes with all different types of buzzers and bells. Likewise, spray tips have also been greatly improved. Many types of spray tips are available for spraying equipment, and selection of the appropriate spray tips for an application should be based on the type of product being applied, product formulation, and the target for which the application is intended.

Due to increased environmental and safety concerns many turf managers are choosing spray tips that produce large droplets and reduce the potential for drift. Although the large droplet spray tips do reduce the potential for drift, there is a concern as to the amount of effective coverage that these style spray tips may provide. Regardless of spray tip style, calibration is always a very important step to ensure that an accurate application is made.

Calibration Process

Prior to beginning a calibration procedure, a number of things should be evaluated. All nozzles and screens should be checked to ensure they are of equal size and type across the boom. Height of the boom should be adjusted to the appropriate height to provide the required overlap between nozzles. All hoses and fittings should be examined under pressure to make sure there are no leaks or weak components in the spray lines. Finally, the pressure should be adjusted to within the recommended range of the nozzle.

The calibration procedure simply determines what the delivery rate is, in either gallons per 1,000 sq ft or gallons per acre. It involves collecting water from one or several nozzles and calculating the delivery rate, based on width of the boom and ground speed. In order to change the delivery rate, nozzles can be changed, ground speed can be changed, and pressure can be adjusted.

Nozzle Tip Selection

The type of nozzle to use for a given application depends on several factors – the type of material being applied, material formulation, target area, wind at time of application, etc. One type of nozzle will not meet the requirements of all applications.

Flat fan nozzles produce the smallest average droplet size. Droplet size is important because the smaller the droplet, the more droplets there are per unit of spray solution. Hence, smaller droplet sizes mean better coverage. Flood jet nozzles produce an average droplet size much larger than flat fan nozzles and Raindrop style nozzles produce the largest average droplet size. Unfortunately, as the average droplet size decreases, drift potential increases.

A study was conducted at Penn State University to evaluate the effect of different styles of spray tips and delivery rates on effective coverage.

Spray Tip Research

A Penncross creeping bentgrass experimental putting green at the Valentine Memorial Turfgrass Research Center in University Park, PA, was used for this experiment. The turf was 17 years old and grown on loamy sand rootzone mix. The site was mowed daily at 5/32" and clippings were removed. The site was fertilized and irrigated to maintain good turfgrass growth.

The main treatments consisted of Spraying Systems Co.'s XR TeeJet flat fan spray tip, Turbo TeeJet flat spray tip, Turbo FloodJet spray tip, and Delavan's RA series Raindrop spray tip (Table 1). The Turbo TeeJet is a new nozzle that is designed to provide good effective coverage with medium to coarse droplet sizes. The sub-treatments were delivery rates of 20 and 60 gpa. Plots were 8 x 8 ft and randomized in a split-plot design with three replications.

Table 1. Spray tip, PSI, and MPH used to obtain appropriate delivery rates.

Nozzle Type	20 GPA				60 GPA		
	Spray Tip	PSI	MPH		Spray Tip	PSI	MPH
Flat fan	XR 11005VS	20*	5		XR 11015SS	20*	5
Flat fan	XR 11003VS	50**	5		XR 11008VS	62**	5
Turbo TeeJet	TT 11005VP	20*	5		TT 11005VP	25*	2
Turbo TeeJet	TT 11003VP	50**	5		TT 11003VP	40**	1.5
Turbo FloodJet	TF-VS 2.5	18*	5		TF-VS 7.5	18*	5
Turbo FloodJet	TF-VS 2.0	28**	5		TF-VS 5.0	40**	5
Raindrop	RA-4	40**	5		RA-10	40**	5

*Considered low PSI.
**Considered high PSI.

Diquat was applied at 40 oz of material per acre to cause an initial "burn-down" and then the bentgrass was allowed to re-grow. Diquat is a contact herbicide which made the effectiveness of the applications noticeable by the amount of brown turf that was present following the treatments.

A Toro Injector Pro sprayer using one section of boom with four nozzle tips on 20" spacings at a height of 20" was used to make the applications. All nozzle tips were operated within their recommended pressure ranges and adjusted to their recommended mounting angle. All treatments were applied at 5 mph, except for the 60 gpa Turbo TeeJet spray tip treatments, which were applied at 1.5 and 2 mph.

Color was rated 6 and 14 days after treatment (DAT) on a scale of 0 to 5 with 0 being brown, 5 being dark green, and 3 and above being acceptable. The color data was subjected to Analysis of Variance and Duncan's New Multiple Range statistical procedures.

Research Results and Discussion

When reviewing the data, it is important to note that the lower the color data, the better the tip performed. This is opposite of analyzing other color data, such as color ratings from fertility trials.

At the 6 DAT rating, all of the plots treated with the flat fan, Turbo TeeJet, and Turbo FloodJet tips at both 20 and 60 gpa had significantly lower color ratings when compared to the plots treated with the Raindrop tip, except for the FloodJet tip at 20 gpa at 18 psi (Table 2). All of the color ratings were unacceptable.

The 60 gpa delivery rate provided much better coverage when compared to the 20 gpa treatments. Although the increase in delivery rate did not affect the performance of the Raindrop tip.

Table 2. Color ratings six days after treatment.

		Color*	
Spray Tip	PSI	20 GPA	60 GPA
Flat fan	Low	1.5 b**	0.5 b
Flat fan	High	1.3 b	0.2 b
Turbo TeeJet	Low	1.3 b	0.7 b
Turbo TeeJet	High	1.5 b	0.5 b
Turbo FloodJet	Low	1.7 ab	0.7 b
Turbo FloodJet	High	1.3 b	0.8 b
RA Raindrop	High	2.3 a	2.2 a

*0 = brown, 5 = dark green, and 3 and above is acceptable.
**Values followed by the same letters are not significantly different according to Duncan's New Multiple Range test with p = 0.05.

Conclusions

The increased concern over the effects of pesticides on the environment has caused many changes in the way we handle and apply pesticides, which is a very positive change for our industry. However, changes in application technology must be fully understood in order to maximize the benefits.

It appears that the spray tips used in this study perform differently at various pressures and delivery rates. These spray tips produced different size droplets which did have a direct effect on coverage.

In many cases, plots treated with the spray tips that produced a fine to medium droplet size provided significantly lower color rating than plots treated with tips that produced a coarse droplet size, especially when the coarse droplet tips were used at low pressure.

New technology in sprayers and chemicals makes equipment set-up and calibration extremely important. Turf managers must consider product mode of action and formulation, desired location for material to be placed (e.g., foliage, soil surface, etc.), intended target, and environmental concerns when choosing the type of spray tip, pressure, and delivery rate for an application. The days of using one set of spray tips and one delivery rate for all applications are long gone.