

Spray Distribution Quality

One of the most overlooked factors that can dramatically influence the effectiveness of a given crop production chemical is spray distribution. The uniformity of the spray distribution across the boom or within the spray swath is an essential component to achieving maximum chemical effectiveness with minimal cost and minimal non-target contamination. This is more than critical if carrier and chemical rates are applied at the recommended minimum rate. There are many other factors influencing a crop production chemical's effectiveness, such as weather, application timing, active ingredient rates, pest infestation, etc. However, an operator must become aware of spray distribution quality if maximum efficiency is expected.

Measurement Techniques

Spray distribution can be measured in different ways. TeeJet Technologies and some sprayer manufacturers, as well as other research and testing stations, have patternators (spray tables) that collect the spray from nozzles on a standardized or real boom. These patternators have a number of channels aligned perpendicular to the nozzle spray. The channels carry the spray liquid into vessels for measuring and analysis (see photo with TeeJet patternator). Under controlled conditions, very accurate distribution measurements can be made for nozzle evaluation and development. Distribution measurements can also take place on an actual farm sprayer. For static measurements along the sprayer boom, a patternator equal or very similar to the one described earlier is placed under the boom in

a stationary position or as a small patternator unit scanning the whole boom up to a width of 50 m. Any system of patternator measures electronically the quantity of water in each channel and calculates the values. A distribution quality test gives the applicator important information about the state of the nozzles on the boom. When much more detailed information about spray quality and coverage is required, a dynamic system—spraying a tracer (dye)—can be used. The same is true if the distribution within the swath on a boom has to be measured. Currently, only a few test units worldwide have the ability to perform a stationary test. These tests usually involve shaking or moving the spray boom to simulate actual field and application conditions.

Most of the distribution measuring devices result in data points representing the sprayer's boom swath uniformity. These data points can be very revealing just through visual observation. However, for comparison reasons, a statistical method is widely accepted. This method is Coefficient of Variation (Cv). The Cv compiles all the patternator data points and summarizes them into a simple percentage, indicating the amount of variation within a given distribution. For extremely uniform distributions under accurate conditions, the Cv can be $\leq 7\%$. In some European countries, nozzles must conform to very strict Cv specifications, while other countries may require the sprayer's distribution to be tested for uniformity every one or two years. These types of stipulations emphasize the great importance of distribution quality and its effect on crop production effectiveness.

Factors Affecting Distribution

There are a number of factors contributing to the distribution quality of a spray boom or resulting Cv percentage. During a static measurement, the following factors can significantly affect the distribution.

- Nozzles
 - type
 - pressure
 - spacing
 - spray angle
 - offset angle
 - spray pattern quality
 - flow rate
 - overlap
- Boom Height
- Worn Nozzles
- Pressure Losses
- Plugged Filters
- Plugged Nozzles
- Plumbing Factors Influencing Liquid Turbulence at Nozzle

Additionally, in the field during the spraying application or during a dynamic distribution test, the following can influence the distribution quality:

- Boom Stability
 - vertical movement (pitch)
 - horizontal movement (yaw)
- Environmental Conditions
 - wind velocity
 - wind direction
- Pressure Losses (sprayer plumbing)
- Sprayer Speed and Resulting Turbulence

The effect of distribution uniformity on the efficiency of a crop production chemical can vary under different circumstances. The crop production chemical itself can have dramatic influence over its efficiency. Always consult the manufacturer's chemical label or recommendation before spraying.

