# CALIBRATION PROCEDURES

## SPRAYER CALIBRATION

Sprayer calibration is the process of determining the correct vehicle speed, orifice size and pressure to create a desired application rate (usually in gallons per acre, or GPA) and droplet size. Most manufacturers have tables to help you determine these values. Still, differences can occur between your spray vehicle and the manufacturer's rates because of tip wear, inaccurate pressure gauges, flow meters, varying liquid viscosities (created by different chemical mixtures) and pressure losses in hoses. To properly calibrate a sprayer you should select the correct tip size, pressure, speed to obtain the desired GPA rate, and then use a sprayer calibration "jug" to make sure that your sprayer is applying this rate (note that most famers can quickly determine correct flow rate in the field from liquid usage in the tank, but this type of monitoring does not indicate plugged or non-uniformity nozzle flow). A spray tip calibrator, such as the SpotOn individual tip calibrator, works well for this purpose and will greatly speed up testing or checking. When selecting a nozzle orifice size, keep in mind that slower speeds (5 to 12 mph) typically require less pressure to achieve a chosen flowrate. In addition, sprayer calibration can be achieved using the following steps:

1) Measuring the flow rate of individual tips: Measuring the flow rate (GPM) from individual tips to determine when tips need to be changed or a problem is occurring in a boom section. Individual nozzle tests are performed by either using a calibration container (Tee Jet, etc.) or a spray tip calibrator, such as the SpotOn calibrator made by Innoquest (http://www.innoquestinc.com/). Spray tip calibrators can greatly reduce your time in performing this operation and make the test less labor and time-consuming. To check nozzles, place the calibrator under the tip of the nozzle for the set time period and read the amount of GPM for that nozzle (note: you may have to set the flow controller to a "test" mode to operate the spray system while the machine is not moving). When in the field, always perform a visual check to make sure that all nozzles are operating correctly and evenly (misting typically indicates a severe problem). The GPM of each nozzle should be within 10% of the target GPM. For that pressure If any tip varies by more than 10%, filters should be checked, and a new tip installed if necessary. If the average GPM of all nozzles is above or below the target rate, slight adjustments in the pressure, speed or even recalibration (of the flowrate sensor) may be necessary. Check the manufacturer's manual on how to clean or recalibrate the flow sensor. Flow rate tests should be performed on nozzles at least once a year. The general equation for calculating individual nozzle flow rate is given by:

$$GPM = \frac{GPA * MPH * W}{5940}$$

GPM is the gallons per minute of liquid used per application width
GPA is the gallons per acre
MPH is the average speed of the vehicle through the field
W is the nozzle application width in inches (typically the distance between the nozzles for broadcast sprayers or banding width for banding sprayers)

2) Ensure that the sprayer speed is correct: Speeds must be correctly reported to the rate controller to obtain the correct GPA rates, and this value should not vary more than 1 to 2 mph when travelling through the field. On newer sprayers, speed is typically input with a GPS sensor directly into the flow rate controller and no calibration is required. Older machines may use radar (or GPS units that outputs a radar type reading) that are based on pulsed frequencies and need calibration to indicate the correct speed. Typically this procedure is performed by travelling a prescribed distance with the rate controller set in a speed calibration mode. Consult the manufacturer's manual for this procedure and the travel distance needed for calibration. Calibration of the speed sensor should be performed at least once a year Check that the radar unit is securely affixed to the vehicle frame and that the correct angle between the unit and the ground. Consult the manufacturer's manual for the correct orientation as some radar units contain an angled emitter that allows the unit to be mounted horizontally. Wheel speed sensors should not be used for general row crop purposes but may be acceptable in pasture and other situations where terrain conditions are more consistent, or if no other option is available. To check the travelling distance versus speed for this type of system, use the equation below with at least a 500 feet or larger travel distance to ensure 0.5 mph or better accuracy.

$$MPH = \frac{360 * Distance\ Travelled\ in\ Feet}{528 * Time\ Needed\ to\ Travel\ that\ Distance\ in\ \text{Seconds}}$$