Calibration VII-1

Calibration

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The objective of calibration is to apply the correct amount of pesticide. Calibration should be done regularly and whenever any components of application equipment are replaced.

Calibrating Field Sprayers

GPA = gallons per acre

GPM = gallons per minute

MPH = miles per hours

PSI = pounds per square inch

Determine an adequate application rate (GPA) from the label. Calibrating the sprayer to apply that amount of spray volume per acre will ensure that you apply the proper amount of pesticide per acre. For example, if the label recommends 20 GPA, your sprayer holds 200 gallons, and you add a 21|2 gallon container of pesticide to fill the spray tank, you know that one quart of pesticide will be applied per acre if the sprayer is properly calibrated.

Method 1 (Measure sprayer output as it runs over a known area)

The steps are:

1. Determine the distance the sprayer must travel to cover one acre by dividing swath width (width covered by sprayer) in 43,560 (the square feet in an acre). For example, a sprayer with an effective swath of 40 feet would have to travel 1089 feet to cover an acre (43,560/40 = 1089).

2. To spray a measured acre, mark off 1089 feet in the field to be sprayed. For convenience, you could mark off a fraction of this amount and treat that fraction of an acre. (Treating 544.5 feet would be the same as treating 1|2 acre).

3. Configure the sprayer as you plan to use it (nozzles, pressure, boom height, etc.).

4. Fill the tank with a measurable amount of water.

5. Spray the marked course at a uniform speed, making sure to write down your throttle setting so that it can be duplicated. Make sure to be at full speed when you reach the start of the measured distance, and turn the sprayer on and off exactly at the start and end of the course.

6. Measure the amount of water that has been applied by measuring either the amount remaining in the tank or the amount of water needed to refill the tank to the original level.

** If an oil solution is to be applied, and water was used during calibration, add 10% to the measured volume.*

Method 2. (Measuring GPM per nozzle, MPH, and nozzle spacing).

GPA can be calculated as follows:

$$GPA = \frac{5940 \times \text{GPM per nozzle}}{\text{MPH} \times \text{nozzle spacing (inches)}}$$

If you know your swath width, this can be simplified to:

$$GPA = \frac{495 \times \text{GPM per nozzle}}{\text{MPH} \times \text{swath width}}$$

GPM is measured by filling the sprayer with water, setting sprayer pressure to the level you plan to use in the field, placing a collection container under each nozzle, and running the sprayer for 33|4 minutes. **The cups (8 oz.) of water collected equal the gallons per hour (GPH) output of the nozzle.**

Nozzles off by more than five percent of the average output should be replaced. Inconsistent output will cause streaks in application pattern.

$$MPH = \frac{\text{Distance (ft)}}{147 \times \text{seconds traveled}}$$

To measure MPH, time the sprayer over a known distance.

GPM, MPH and PSI can all be varied to achieve the desired application rate (GPA). Gallons per acre applied can be increased by slowing the sprayer down (simplest solution), increasing pressure, or increasing nozzle size. Gallons per acre applied can be reduced by the opposite actions. **Changing sprayer pressure is not a good means of changing sprayer output,** because sprayer output only increases as the square root of the pressure increase. For example, doubling the sprayer pressure would only result in increasing output 1.4 times. Furthermore, increased sprayer pressure may cause increased drift.

Calibrating Granular Applicators

Granular applicators need to be calibrated unit by unit because individual variation is enough to affect application rates significantly. Granular pesticide products have unique flow characteristics and should be calibrated separately. These products are abrasive so calibration should be checked before each application. Applicator settings given on labels are only guidelines and need to be verified by calibration. Recommended granular insecticide application rates are generally given in ounces per thousand row feet. (Granular herbicide rates may be given pounds per acre, making band-width a critical factor in calibration).

The steps to calibrate a granular applicator are:

1. Set each applicator as recommended on the label or at the setting used in your last calibrated application.
2. Fill the hoppers until they are at least one-half full with granules. Run the applicators until they all begin to feed.
3. Replace each drop tube with a container, calibration bag, or pre-marked calibration tube.
4. Travel a measured distance (several hundred feet) over a surface similar to the one that you will plant into, at your normal planting speed.
5. Weigh and record the amount of pesticide collected in each container using a scale that is accurate to 1|10 oz. Be sure to subtract the empty container weight.
6. Calibrate the application rate for each row unit.

The application rate for insecticides applied in ounces per1000 row feet can be calculated as follows:

$$\text{Oz./1000 row ft} = \frac{\text{1000 x oz product collected}}{\text{Distance traveled (ft)}}$$

Use this formula for application rates in pounds per acre:

$$\text{Lb/acre} = \frac{\text{43560 x lb product collected}}{\text{Distance traveled (ft) x row width}}$$

* *If any unit is off the label rate by more than five percent then adjust the rate control and repeat the calibration process.*

A simple method of monitoring the application rate is as follows. Place a vertical strip of tape in each hopper. Mark the tape as each pound of insecticide is added to the hopper (level the insecticide before marking the tape). The application rate now can be checked quickly by observing how many pounds of product were used while planting a known acreage.

Calibrating Chemigation Systems

The following calculations must be made to accurately calibrate a chemigation system:

1. Area irrigated
2. Amount of chemical required
3. Travel speed
4. Revolution time
5. Chemical application rate

The area irrigated for square or rectangular fields is determined by:

$$\text{Area irrigated (acres)} = \frac{\text{Length (ft) x width (ft)}}{43560}$$

For circular fields, calculate area irrigated as follows:

$$\text{Area irrigated (acres)} = \frac{\text{3.14 x radius (ft) x radius (ft)}}{43560}$$

Determining the area irrigated is made more difficult by irregular fields such as partial circles and by end guns. It is recommended to use the length of the pivot as the radius in the above formula and shut off the end gun during chemigation.

The amount of chemical required is determined by multiplying the area irrigated in acres by the amount of chemical used per acre, which is found on the label.

To measure travel speed, either:

Record the time it takes for the outer pivot tower to travel 100 feet, or

Measure the distance traveled by the outer pivot tower in 10 minutes.

** In either case, you need to figure the feet traveled per minute by the system.*

Travel speed should be measured when the system is operating at the speed and water pressure that will be used during chemigation.

If the terrain is rolling, these measurements should be made at several locations around the circle or across the field to determine an average value. Travel speed should be measured prior to each chemigation as it can change through the season as wheel track resistance is affected by changes in cover, soil compaction, track depth, etc. Always recalibrate if the system speed has been changed.

Revolution time of center pivot systems is calculated by dividing the circumference (feet) of the last wheel track by the travel speed (feet per minute). Convert this figure to hours by dividing the outcome by 60.

Circumference (ft) = 6.28 x radius (length of pivot in ft).

The chemical application rate (in gallons per hour) is calculated by dividing the amount of chemical required (in gallons) by revolution time (in hours) of the center pivot system.

Center pivot chemigation calibration – an example.

1. The field to be chemigated has a wetted radius (length of pivot) of 1300 feet without the end gun.

Area irrigated (acres) = $\dfrac{3.14 \text{ x } 1300 \text{ ft x } 1300\text{ft.}}{43560}$ =122 acres

2. The label rate for the pesticide to be applied is 1 quart/acre, so the **amount of chemical required** is: 122 acres x 1 quart/acre = 122 quarts (30.5 gallons)

3. The outer tower moved a total of 195 ft in three 10-minute measurements, so the **Travel speed** is:

Travel speed (ft/minute) = $\dfrac{195 \text{ ft}}{30 \text{ minutes}}$ = 6.5 ft/minute

4. The radius to the last wheel track is 1280 feet (system radius minus the end gun and overhang), so the circumference traveled by the last tower is:

Revolution time (minutes) = $\dfrac{8038 \text{ ft (last tower circumference)}}{6.5 \text{ ft/minute (last tower travel speed)}}$ =1237minutes = 20.6 hours

6.28 x 1280 = 8038 ft.

5. **Application rate (gallons/hr) =** $\dfrac{30.5 \text{ gallons (chemical required)}}{20.6 \text{ hours (revolution time)}}$

=1.48 gallons/hr

* *The injection pump can be set to this rate, using the calibration tube.*

Categories: Calibrating, Field sprayers,Granular applicators, Chemigation systems, Center pivot chemigation

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