Sprayer calibration to lower job costs

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Calibration!

Calibration! Probably few things are more distasteful to people who apply agricultural chemicals. Yet calibration is important. Chemicals need to be properly applied to do the intended job, without damaging desirable plants and animals in the vicinity, and without wasting increasingly expensive materials.

Still, I suspect that most landscapers could get away with ignoring calibration if it were not for the fact that you have to answer the calibration questions on the pesticide exam. While there are many scientific principles involved in calibration, it is mostly just common sense. And once you make up your mind that you have to do it, calibration isn't so difficult after all. Many kinds of equipment are used to apply pesticides to landscapes and turf. Commonly used are manually operated sprayers of various types, power sprayers, mist blowers and granular applicators.

Granular applicators

Granular applicators are mostly used on turf, but cyclone spreaders are used under certain conditions in landscape plantings. Drop spreaders are more precise and reduce drift, cyclone spreaders are less accurate, but cover a much larger area with each pass.

Manufacturers provide recommended settings for applying various products with their spreaders. These recommendations are usually accurate, but there are differences in materials and in the way each operator uses the spreader. Also, as the equipment wears, settings change.

Granular applicators should be calibrated at the beginning of each season and regularly throughout the season.

One of the easiest ways to calibrate them is to fill the hopper with a measured amount of the material to be applied. Set the spreader on the opening suggested by the manufacturer and apply the material to a measured area, such as 1,000 square feet. (10' x 100', 20' x 50', 32' x 32', etc.) Weigh the remaining material in the spreader to find the actual amount spread. Adjust the setting if necessary.

Or, suspend a tray beneath the spreader to collect the material deposited as the spreader is pushed a measured distance at the proper speed.

A third method might be to walk an empty spreader over a measured area, noting the number of revolutions made by the wheel. Support the spreader so the wheel can be turned by hand. Fill the hopper, then spin the drive wheel at the same speed and for the same number of revolutions, while collecting the granules. This system avoids misapplication on turf areas and allows reuse of the granules.

It is essential that granular applicators be calibrated using the material to be spread. Since each operator will walk at a different speed, and hold the spreader at a different angle, the intended operator should perform each test.

Manual sprayers

Manual sprayers are used on turf and small ornamentals. To calibrate them for applying pesticides to ornamentals, simply add the recommended amount of concentrate to the correct amount of water in the sprayer, and spray the foliage to the point of run-off.

Spot spraying of small turf areas can be handled in the same manner.

For larger turf areas, practice spraying a measured area with water. When you are able to make a uniform application, fill the tank and spray the area. Measure the amount of water needed to refill the tank. That amount is the rate applied to the measured area. For instance, if it takes 1½ gallons to refill the tank after spraying 1,000 square feet, the rate is 1½ gallons per 1,000. The correct amount of chemical for 1,000 square feet of area, mixed in each 1½ gallons of water and applied as above, will result in the proper application rate.

Power sprayers

Power sprayers most commonly used in the landscape industry are hand-held guns.

Hydraulic sprayers for applying pesticides to trees and shrubs operate at high pressures to provide thorough coverage of leaves, stems and trunks.

Hollow-cone nozzles provide the best coverage for smaller plants.

Large droplets at high pressure are needed to reach the tops of tall trees. Distance increases only slightly be increasing pressures above 400 psi because the spray becomes atomized. When vertical reach becomes a problem, use a higher volume nozzle with a narrower spray pattern instead of increasing pressure.

Label directions for the use of pesticides on trees and shrubs will specify the amount of material to mix per 100 gallons of spray. Apply to the point of run-off to assure thorough coverage.

Many kinds of spray equipment are used for turf, including hand-held booms, tractor-mounted booms and guns.

Various kinds of nozzles are employed, each with its advantages. For turf applications, the plastic low-pressure gun has become the standard. Wide-angle solid-cone nozzles are used, delivering 2½ to 4 gallons per minute. Uniform application with this kind of equipment requires skill on the part of the applicator, in addition to careful calibration. Both the speed of the operator and the delivery rate of the equipment should be considered.

Calibrate by clocking the applicator as he sprays a pre-measured area with water. Repeat this several times to establish an average.

Then, run a bucket test on the equipment. Measure the amount of spray the equipment delivers in a given time. If you are using a 4 gpm (gallon per minute) nozzle, it should fill a 4-gallon container in one minute. If not, adjust the pressure slightly or change nozzles.

Multiply *the time in minutes* the applicator takes to spray the 1,000 square feet by *gallons per minute* the equipment delivers to find the rate per 1,000 square feet.

Example: 1.25 minutes to spray 1,000 sq. ft. times 4 gallons per minute equals 5 gallons per 1,000 sq. ft.

Once the system is adjusted, run a bucket test before the start of each day, and again during the day, to make sure the equipment if functioning correctly. Remember, nozzles wear or become plugged; equipment goes out of adjustment.

By knowing the gallons of spray delivered per 1,000 square feet, it is easy to compute the area that can be covered by a tankful of spray.

Divide the *gallons in the tank* by the *gallons per 1,000 square feet* to find the 1,000's of square feet per tank ...

Example: 400 gallons per tank

5 gallons per 1,000 square feet equals 80 x 1,000 square feet per tank.

Conversely, if you know the area to be sprayed, you can find out the gallons of spray needed.

Example: 50 (000) sq. ft. to be sprayed times 5 gallons per 1,000 sq. ft. equals 250 gallons of spray needed.

Deciding how much chemical to put into the tank creates several problems. In the landscape industry, areas are usually determined in thousands of square feet. But labels often specify amounts to be applied per acres.

To convert *pounds per acre* to *ounces per 1,000 square feet*, multiply by 0.37.

Example: 4 pounds per acre times 37 equals 1.48 ounces per 1,00 sq. ft.

To convert *quarts per acre* to *ounces per 1,000 square feet*, multiply by 7.3.

Example: 2 quarts per acre times .73 equals 1.46 ounces per 1,000 sq. ft.

In either case, roughly 1½ ounces of material is needed per 1,000 square feet, which is reasonable since a quart weighs 2 pounds.

Another problem occurs when recommendations specify application in pounds A.I.A. This verbal shorthand means "active ingredient per acre". Since some chemicals are available in many forumlations, this recommendation assumes the applicator will mix the material correctly.

Malathion is formulated as 25WP, 50%EC and 4E, etc. The 25WP,50%EC and 57%EC refer to the percent of active ingredient by weight; therefore 4E indicates 4 pounds of active ingredient per gallon.

If the recommendation calls for 4 pounds malathion A.I.A., and you are applying 50%EC on a small lawn, you can easily convert to ounces per 1,000 square feet using the method already

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given (4 x .37 equals 1.48 ounces). But ... the material you are using is only half active. So you know you need more ... how much more?

Divide 1.00 percent by the percent active ingredient to see how many times more material you will need.

Example: 1.00 percent

.50 percent active ingredient equals 2 times more

So,

1.48 ounces times 2 equals 2.96 ounces or roughly 3 ounces per 1,000 square feet.

Using the 4E material, you can find how many times more material you will need by dividing 8, which is roughly the number of pounds per gallon by the pounds active material.

Example: 8 pounds per gallon

4 pounds active ingredient equals 2 times more material.

We have been discussing application using hand-held guns. The same principles apply to boom sprayers with multiple nozzles.

Determine output by bucket testing each nozzle on the boom. The output of the nozzles should vary less than ten percent. The total of all nozzles is the delivered gallons per minute.

Since a boom sprays a specific swath, application is more precise than with a gun.

To calculate coverage, measure the swath width in feet. Divide 1,000 by that number to find length of pass 1,000 square feet.

Example: 1,000

4 foot swath width equals 250 square feet.

Each pass of 250 feet covers 1,000 square feet. If the turf area is 125 feet long, two passes equals 1,000 square feet, and so forth.

Calculate the time in minutes it takes to cover the 1,000 square feet, and multiply by the gallons delivered per minute to find gallons per 1,000 square feet.

Example: .5 gallons per minute output times 2 minutes to spray 1,000 sq. ft. equals 1 gallon per 1,000 sq. ft.

The output of nozzles can be increased by increasing pressure, but this is not a good system for large increases. To double the output, it takes four times as much pressure, not twice as much, as is commonly thought, it is better to change nozzles.

Mist blowers

Mist blowers are the most sophisticated application equipment used in the landscape industry, and are the most complex to calibrate. The chemicals are mixed in mist blowers with very little water and applied at a low volume, using a blast of air to propel the spray. Calibration involves nozzle output, cubic feet of air delivered per minute by the blower, volume of the target tree, and concentration of chemical in the spray.

You determine the total nozzle output in gallons per minute by bucket test. Assume, for the purposes of this example, an output of 6 gallons per minute. The volume of air is constant for a given piece of equipment, often 25,000 to 100,000 cubic feet per minute. Assume this equipment delivers 50,000 CFM.

Adequate coverage of a tree means replacing the air in the tree with air containing the chemical. To do this, you need to determine the volume of the crown of the tree. If it is considered a cylinder, the volume is equal to the area of the circle under the tree, times the height of the crown. The area of the circle is the radius (½ the diameter) squared, times 3.14.

To find the area under tree (radius squared x 3.14), see the following example:

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12.5 feet times 12.5 feet equals 156.25 feet
156.25 feet times 3.14 equals 490 square feet under tree
Then, multiply by the height of the tree:
490 square feet times 50 feet tall equals 24,500 cubic feet

To find out how long it takes your blower to displace the volume of the tree, divide the volume of the tree by the blower's output in CFM.

Example: 24,500 cubic feet tree
50,000 CFM blower output equals 0.49 (about ½ minute)

From the bucket test, you can calculate the amount of spray applied in the ½ minute it takes to displace the air from the tree. Six gallons per minute times ½ equals 3 gallons per tree.

When spraying large numbers of trees, most contracts specify the amount of chemical per tree. For instance, one pint of methoxychlor per tree is commonly specified for Dutch elm disease control.

Knowing that the above equipment sprays an average tree in about ½ minute, and making an assumption that the bucket test shows nozzle output of 6 gallons per minute, or 3 gallons per tree, how much methoxychlor should be mixed in the tank to apply one pint per tree? Obviously, this is one pint per 3 gallons. Or, dividing the capacity of the tank by 3 (gallons per tree) times pints of methoxychlor per tree.

Example: 100 gallon tank
3 gallons equals 33 (trees) times 1 pint per tree
33 pints methoxychlor per tank

The advantage of low-volume sprayers is obvious when comparing the 3 gallons of spray applied per tree with this equipment to the 40 or 50 gallons required to spray the same tree with a hydraulic spray system. The disadvantages include greater drift, a greater chance of inadequate coverage due to the wind, evaporation or careless application.

Once the equipment is set up for the correct nozzle pressures and mixing rates, routine checks are all that are necessary to keep the system calibrated. Equipment dealers can help you set up your system. Be sure to keep a record with each piece of equipment.

Develop a routine for servicing and checking the equipment. Unless properly maintained, even the most carefuly calibrated equipment will not perform correctly. The best time for cleaning equipment is at the end of the day. A few minutes spent in maintenance to prevent the plugging of nozzles and screens, or residue from solidifying in the bottom of a tank is time well spent. It is easy to lose your enthusiasm for a day's work if you are confronted with a nasty cleanup job the first thing in the morning. If the equipment is clean and ready to go in the morning, a quick bucket test to make sure everything is in order will get the crew on their way.

Be sure to provide a card or notebook with each piece of equipment so the crew can record performance of each of the required service chores, and by whom. As supervisor, be sure you regularly check these records to make sure they are being filled out. If *you* don't use them, your crews won't either.

Credit: The Landscape Contractor/February 1984

The greater danger for most of us is not that our aim is too high and we miss it, but that it is too low and we reach it.

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