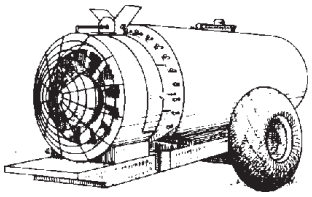
MEASURING SPRAYER OUTPUT



Once the nozzles are in place, measure the actual sprayer output in gallons per minute. Relatively inexpensive flow meters for both high and low pressure sprayers are commercially available. When pressed onto a nozzle (or manifold line for low pressure, air shear sprayers), the meter indicates the flow rate in gallons per minute. While not as easy as using a flow meter, individual nozzles can also be checked by collecting their output into a measured container for a measured time. Checking individual high pressure nozzles will reveal those that are misfiring because of a partial plugging or because of a worn orifice. A nozzle that varies by more than 10% from its rated output at a given pressure should be replaced. In addition to error in spray volume, spray pattern and droplet size can also be affected as an orifice enlarges with wear.

To measure overall output, fill the tank to the top with water, and operate the sprayer for 3 minutes. After 3 minutes, turn off the sprayer and measure how much water it takes to refill the tank. A 5-gallon bucket marked like a measuring cup is useful for this. Calculate the gallons per minute output. For large adjustments, change cores or nozzles. For small adjustments (to vary gallons per minute by roughly 10% or less), set the pump pressure up or down as needed to bring the total output as close as possible to the desired gallons per minute.

How close is close enough? Consider this: if the yearly expense for pesticide, foliar nutrients and growth regulators is $250 per acre for a 50-acre orchard, then improving calibration accuracy by 10% represents $1,250 in spray materials. The benefits of precise calibration include: more uniform crop protection; less unexplained variability; reduced risks from poor control, russeting or overthinning; lower application costs by getting the job done right the first time; accurate estimation of spray costs per block; less chance of neighbor problems, documentation of your precision if problems do occur; less guesswork and more peace of mind.

As a final check, fill the sprayer with water and spray a known acreage. Measure how much water is needed to replace the water sprayed out, calculate the rate per acre, and compare it to the desired output per acre.

ADJUSTMENTS FOR DIFFERENT BLOCKS

Often the same sprayer and tankmix is used to treat orchard blocks with different tree size and row spacing. When moving from one block into another one that has different spray pattern and spray volume requirements, the sprayer can be quickly adjusted to provide optimal spray delivery for the second block. While each block is unique, for simplicity of planning and adjustments, blocks with similar spray requirements can be lumped into groups. As long as the range of difference among blocks combined in a group is minor, the spray requirements for the group can be defined by the block with the highest spray volume requirement. The following example shows how a grower plans the adjustments to make for a block (or group of similar blocks) called Block C.

EXAMPLE C: The grower with the 13-foot high trees described in Example A is planning the sprayer adjustments to make so that the same sprayer and tankmix can be used to treat Block C. The trees in Block C are 16 feet high, 15 feet wide, and with 23 feet between rows.

Row length = 43,560/23 = 1,894 feet
TRV = 16 x 14 x 1,894 = 424,256 cubic feet
DG/A = 424,256 x 0.7 gallon/1,000 cubic feet
= 297 gallons per acre.

The block in Example A was sprayed at 3X, so in order to use the same tankmix for Block C, it will also have to be sprayed at 3X.

ConcG/A = 297/3 = 99 gallons per acre.

Because the trees in Block C are taller than in Block A, the grower will turn on an additional nozzle on each side of the manifold. For this example, let's say that the added nozzles are rated at 0.60 gallons per minute at the operating pressure chosen for Block A. By adding the two nozzles, the total output becomes 7.76 (see Example B) + 1.20 = 8.96 gallons per minute.

The grower knows that after spring calibration, the sprayer output with the top nozzles on will be close to 8.96 gallons per minute.

To calculate what the travel speed will have to be to get the desired 99 gallons per acre in Block C, the grower uses this formula (for DEFINITION OF TERMS see Example B):

Travel speed = (Gallons per minute x 495) divided by (Swath x Concentrate gallons per acre)
TS = (**GPM** x 495) / (**S** x **CG/A**)
TS = (8.96 x 495) / (23 x 99)
TS = (4,435) / (2,277) = 1.95 miles per hour.

Thus, by adding the two top nozzles and slowing the travel speed to 1.95 mph, the grower can use the same tankmix to make 3X applications to both Block A and Block C.

Flow monitors for sprayers are commercially available. They account for manifold output, travel speed, and row spacing to give a running report of the gallons per acre being sprayed. This can help the driver detect calibration errors, plugged nozzles, and other problems during the application.

There are several ways to vary sprayer output for different blocks. Methods can be combined to get the desired result. Adding or subtracting nozzles is the simplest and most common method. As long as the sprayer operator knows what happens to pesticide delivery by adding or subtracting nozzles, it is also probably the best. Other ways include: adjusting travel speed, adjusting pump pressure (within a limited favorable range of roughly 100 to 200 psi on high pressure sprayers), changing the manifold flow meter settings (low pressure, air shear sprayers), or by switching nozzle size or disc/core selection at one or more nozzle positions. Caution is advised in adjusting travel speed. Research trials have indicated that going slower than 1.5 mph or faster than 2.5 mph can cause problems with airblast spray penetration into tree canopies and affect spray coverage. For power take-off driven sprayers, the gear and RPM settings needed to properly operate the sprayer may limit the options for adjusting travel speed.

Continuing with the example of Block C, what if the grower wants to go no slower than 2.1 mph? The grower can use the Gallons per Minute formula from Example B to calculate the necessary Gallons per Minute output if the sprayer will be used to make a 3X spray to Block C at 2.1 mph.

GPM = (**CG/A** x **S** x **TS**) divided by 495
GPM = (99 x 23 x 2.1) / 495
GPM = (4782) / 495 = 9.66 gallons per minute

In this case, the grower will have to boost output from 8.96 to 9.66 gallons per minute, either by adjusting pressure and/or substituting one or more pairs of nozzles.

SPRAYER SETUP CHART

With this preseason planning, one result can be a sprayer setup plan which records the following: Blocks to be sprayed with this setup, Spray concentration, Nozzle positions used, Nozzle orifice/disc/core selection for each position, Pump pressure, Travel speed.

For the blocks described in Examples A and C, the sprayer setup plans might look like this (You might want to also record RPM and gear setting for the desired speed):

Block B, for 3X spray
Pressure: 180 psi
Travel speed: 2.40 mph

Nozzle position	Disc and whirlplate
1	Off
2	#5 disc, 2 hole
3	#4 disc, 2 hole
4–8	etc.

Block C, for 3X spray
Pressure: 180 psi
Travel speed: 1.95mph

Nozzle position	Disc and whirlplate
1	#3 disc, 3 hole
2	#5 disc, 2 hole
3	#4 disc, 2 hole
4–8	etc.

It is very important to verify the output of each setup by doing a preseason sprayer calibration, find the adjustments needed to get the desired output, and record them.

Finally, the different setups can be recorded in a small durable notebook kept with the tractor. This will insure that the person operating the sprayer will have the information they need to make quick adjustments to the sprayer when moving between blocks with different spray requirements.