Tractor-Mounted Air Blast Sprayers
Michigan State University
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Tractor-Mounted Air Blast Sprayers

their use and calibration for disease and pest control in small fruit crops

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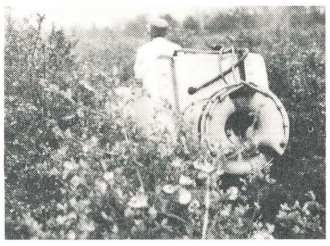

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The recent development of small, 3-point hitch, power take off driven air blast sprayers for blueberries, grapes, and brambles has given the grower an excellent and economical method of disease and pest control, even in muddy springtime conditions. Ten to twenty gallons of spray/acre applied with these sprayers has given very satisfactory control both in controlled tests and commercially. The coverage is excellent with this type of sprayer if it is set up correctly and run properly.

Some Important Considerations

In general, a ground speed of about 3.5 mph is desirable. More than 4 mph is probably too fast. Spraying pressure should be somewhere between 75 and 200 pounds/square inch (psi). Three or four nozzles/side should be sufficient and they should be positioned so as to give good coverage of bushes from top to bottom.

When spraying, there are several critical things to watch for, especially when using low gallonages of spray/acre. Ground speed should be set at a desired speed at which the rig is calibrated and this speed should be maintained, without speeding up or slowing down. The spraying pressure should be set at a certain level and maintained. Changes in pressure will result in a change in sprayer output. Nozzles should be constantly watched for plugging or fouling. These should be cleaned immediately when problems are detected. Nozzle wear should be watched closely. Nozzle output should be checked after each 8 hours of running. Abrasive pesticides rapidly wear out nozzles. Worn nozzles allow too much spray to be applied and should be changed frequently. They cost much less than pesticides wastefully sprayed. Periodically check nozzle position. Branches can sometimes move nozzles and change the spray pattern.

The strainer at the bottom of the sprayer should be removed and cleaned after one day's spraying. These can get plugged up and cause output of spray to drop below the preset level.

There are several factors that govern how much spray a sprayer will put out. Ground speed, sprayer pressure, number of nozzles, nozzle size, and nozzle swirl disc (the perforated plate beneath the nozzle disc) all govern sprayer output. These factors are all important when calibrating a sprayer. The largest change in sprayer output is governed by the number of nozzles used and their orifice size. However, ground speed and pressure changes can also affect sprayer output.

How to "Set Up" and Calibrate a Sprayer

Experience has shown that grapes, blueberries and brambles can be adequately sprayed with 10 to 20 gallons of water/acre. Once it has been decided how many gallons/acre output is needed, the calibration process can proceed.

Let us assume that 20 gallons/acre is decided upon. Now, the number of nozzles to be used per side of the rig should be decided for proper coverage of the bush or vine. Figure 1 shows proper alignment for single overlap nozzle arrangement.

There should not be any "holes" in the spray pattern—the individual nozzle patterns should just meet at the spray target. A double overlap pattern (Figure 2) is good also.

The manufacturer's guide or one of several nozzle manufacturer's catalogs give a list of nozzle sizes and output rates/nozzle in terms of gallons/nozzle/minute at various pressures. The number of nozzles needed depends on the height of the bushes or vines. Install enough nozzles to completely cover the bushes from the top to the ground. Once the number of nozzles/side is decided upon and speed is selected, calibration can be figured.

AN EXAMPLE

If we assume that three nozzles/side are needed, a speed of 3.6 mph will be used, and the crop spacing is 5 x 10 feet, the calculations are as follows, for a 20 gallon/acre spray application.

Figure 1. Single overlap spray pattern.

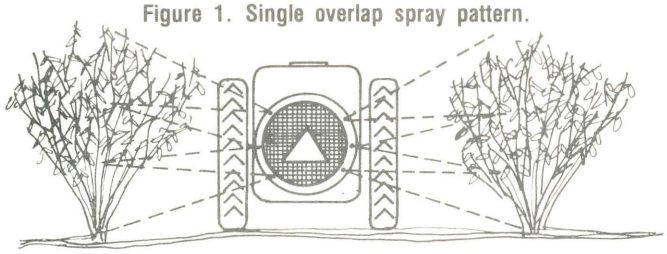
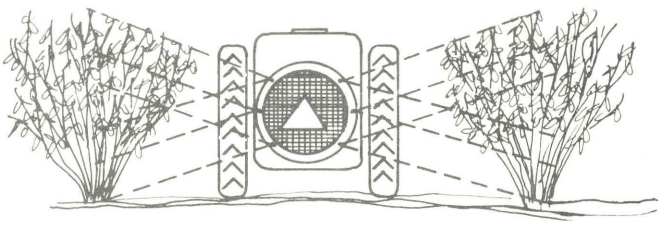


Figure 2. Double overlap spray pattern.



Determine Bushes/Acre

First calculate the number of bushes or vines/acre. Since the spacing is 5 x 10 feet, then 5 x 10 = 50 square feet between four vines or bushes. Divide 50 square feet into 43,560 square feet/acre (43,560 ÷ 50 = 871). There are 871 bushes/acre. Our speed of 3.6 mph is converted to feet/minute by multiplying by 88 (1 mph = 88 feet/minute). Therefore 3.6 mph x 88 = 317 feet/minute.

Now, visualize the 871 vines or bushes/acre all in a row and 5 feet apart in that row. The row would be 871 x 5 = 4,355 feet long. At a steady ground speed of 3.6 mph (317 feet/minute) it would take 4,355 ÷ 317 or 13.7 minutes to spray the one acre. Therefore, our total nozzle output will be 20 gallons/13.7 minutes or 1.4 gallons/minute. Since three nozzles are used/side, a total of six nozzles are used. The output of spray per nozzle, then, is 1.4 ÷ 6 or 0.23 gallons/minute (or 29.4 ounces/minute).

Find Nozzle Output

Next, look in the nozzle chart and find a nozzle and swirl disc combination that will give an output of about 29.4 ounces/minute within a range of pressures shown. Install the nozzles. Put 10 or 20 gallons of water in the tank, start the sprayer by engaging the power take off. Set the throttle at the power take off rpm indication on the tachometer. Adjust the pressure to that indicated by the nozzle chart (let us assume 150 psi). Put the tractor into the middle of an isle and, with the sprayer turned on, adjust all nozzles for proper coverage of the row on each side of the sprayer.

After nozzle adjustments are made, catch the water from each of several nozzles while the sprayer is running at power take off speed and at the indicated nozzle pressure (150 psi in this case). A one gallon plastic or glass jug works very well to catch the spray from a nozzle. Catch the spray for one minute and measure it. Remembering that we calculated a per nozzle output of 29.4 ounces/minute, assume that only 28 ounces/nozzle is caught. The output can be brought up to 29.4 ounces by slightly increasing the pressure at the pressure regulator. If the output is too high, reduce the pressure until the output drops sufficiently.

Figure Ground Speed

A ground speed of 3.6 mph or 317 feet/minute should be calibrated as follows. With the sprayer going at the set pressure, the nozzles turned on, and the tractor engine set at power take off speed, find a gear setting that will give a ground speed of 317 feet/minute. A handy way to do this is divide the distance between bushes in a row (5 feet) into 317 feet (317 ÷ 5 = 63.4 spaces). Find a gear setting that will come very close to 63.4 bush or vine spaces per minute as you test drive the sprayer down between the rows. The speed is now set.

At this point, the sprayer should be putting out almost exactly 20 gallons of spray/acre. Check this by spraying an acre or part of an acre with a full tank of water. Then measure the water used to fill the tank back up to full.

Amount of Chemical

Next, we must decide on the amount of chemical to put in the tank. Let us assume that the tank capacity is 100 gallons and that we are going to apply 5 lbs. of formulated pesticide/acre. Since that 5 lbs. is going onto one acre in 20 gallons of water, then we will need to put 25 pounds of pesticide in the tank. If a liquid formulation is used, for example one quart/acre, then a total of 5 quarts should be put in the tank.

The tank should be filled one-third to one-half full of water with the agitator going. If a wettable powder is to be used, make a well-mixed slurry out of it in a 5 to 10 gallon bucket and slowly pour the slurry into the tank. Then finish filling the tank. Spraying can now commence.

Summary

In summary, spraying at low gallonages/acre can result in an excellent spray job and save both fuel and labor. However, since the gallonages/acre used are quite low, chances for error are greater than with dilute spraying. Extra care and accuracy are critical in calibration in order to assure that the proper amount of chemical per acre is used. An error at these concentrations could be costly because of too much or too little material being used. The result would be either wasted chemical or poor control. Proper attention must be given to the sprayer during operation to make sure everything is working correctly.

Always observe safe pesticide handling rules and procedures.

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