CALIBRATION of Herbicide Sprayers

BEFORE YOU GO TO THE FIELD

SERVICE THE ENTIRE SPRAYER

LINES AND STRAINERS - Clean all main lines and strainers.

Check to be sure that all strainers are 50 mesh or larger and are in place.

TANK - Check for scale and sediment.

OPERATING CONDITION - Check overall operation.

NOZZLES - Check nozzles.

For a complete-coverage broadcast application, the flat-fan Teejet 8003 or 8004 nozzles, or equivalent from other manufacturers, are recommended.
If you plan single-band incorporation work, use even-flow, flat-fan Teejet 8003E or 8004E nozzles, or equivalent.

CAUTION Never use a metal object to clean nozzles.

BOOM - Adjust boom height and nozzle spacing for correct application pattern.

FLOW RATE - Check nozzle flow into a marked container (baby formula bottle type) for 30 seconds.
Replace nozzles if uneven flow is noted.
Minor flow-rate changes can be made with pressure change, but nozzle sizes must be changed for major flow-rate changes.

AREA LAYOUT

Obtain some flag markers and a tape measure or rope to measure distances. (Do not plan to pace off distances.) Take these to the field with you.

TANK VOLUME

Install and calibrate a sight gauge unless the tank has an effective liquid level guage, or calibrate a dipstick by notching it at 5-gallon levels. These operations can be accomplished by starting with an empty tank and adding 5 gallons at a time, marking each level on the dipstick or level indicator.

WATER

Use clean water -- clean enough in appearance, at least, to drink.

Cooperative Extension **University of California**
Division of Agriculture and Natural Resources

LEAFLET
2710

IN THE FIELD

> **NOTE** Do the calibration work in the field, not on a road or in a parking lot, because condition of the ground may have a marked effect on speed and performance.

HOW FAR - Mark off a ground distance. Multiples of 88 feet are good because 88 ft/min is equal to 1 mph. 176 feet works well.

HOW FAST - Run the sprayer over the distance you marked off and check the time.

Examples: If you travel 352 feet in 60 seconds, your speed is 4 mph.
88 feet in 60 seconds = 1 mph
88 feet in 20 seconds = 3 mph

Distance (ft)	88	88	88	176	176	176	352	352	352
Time (secs)	20	15	12	40	30	24	80	60	48
Speed (mph)	3	4	5	3	4	5	3	4	5

Adjust your speed to that desired--2 to 4 mph is best for herbicide work. Mark the throttle or speedometer so that the speed will always be the same. A positive throttle stop is a good idea. You will note that speedometer readings rarely agree with your calculated rate. This is due to wheel slippage. A tachometer can be most useful in adjusting ground speed to a given engine speed and gear.

HOW MUCH AREA - Measure off a distance in the field to give a convenient area. There are 43,560 square feet in an acre, but you can use 43,600 to make it easier. For full boom-width broadcast, the boom width in feet divided into 43,600 gives the distance in feet to travel for 1 acre. If that distance is too large to be convenient, use 1/2 or 1/4 of that distance for the same fraction of 1 acre.

Another Good Method

Length x width in feet = area in square feet

110 x 85 = 9,350

Multiply
Area in square feet x 23

9,350 x 23 = 215,050

Count off 6 decimal places

area = .215 acres

HOW MUCH WATER PER ACRE - Make a run over the distance and calculate the gallons of water used per acre. This is the key fact disclosed by calibration of your sprayer:

How many acres' worth of water can the tank hold? If 20 gallons were sprayed on 1 acre and the tank is 100 gallons, then the tank holds 5 acre's worth of water.

NOTE	Before you ask, "How much chemical should I put in my tank?", you must know how many acres the water in your tank will cover with your particular nozzle and pumping arrangement at your operating speed. That's what calibration tells you. The amount of chemical to be added then follows.

AMOUNT OF HERBICIDE - Read the manufacturer's label or recommendation and add the correct amount of herbicide. For instance, if the recommendation is 2 pounds per acre and the tank holds enough water to cover 5 acres, add 10 pounds (5 x 2) of material. Make correction if commercial material is less than 100% active ingredient. (See UC Agricultural Engineering Leaflet, "How Much Chemical Should You Put In The Tank?") If the herbicide is a wettable powder, it should be made up as a slurry in a bucket and then added to the tank of water. Be sure to use proper protective equipment.

FINAL CORRECTION - After the chemical has been added and thoroughly mixed, make a brief re-check of the nozzle flow rate. It probably will be slightly different than it was with plain water. The flow can be corrected this small amount with a slight change in pressure.

BAND APPLICATION

It is common practice to spray only part of the entire field when, for example, spraying is done only in a 10-inch band over the planted area on beds in crops (such as lettuce, sugar beets, etc.) where a bed-planting system is used.

Always treat the band area covered as the acres covered, and adjust the sprayer accordingly. Thus, if you are setting the sprayer to actually cover several 10-inch wide bands only on 40-inch bed plantings, the area in acres covered by spray material is:

$$\text{Acres sprayed} = \frac{\text{band width (in.) x number of bands x length of field (ft)}}{12 \times 43{,}560}$$

For example: Assume the sprayer will extend over three beds with two crop rows per bed for a total of six bands in a field 1/2 mile (2,640 feet) long.

$$\text{Acres sprayed} = \frac{10 \times 6 \times 2{,}640}{12 \times 43{,}560} = 0.303$$

Acres sprayed = 0.3 (rounded off)

Now if you find by filling the sprayer and spraying the length of the field that 15 gallons of spray mixture is discharged, the gallons applied per acre of sprayed ground can be found as follows:

$$\frac{15 \text{ gallons}}{0.3 \text{ acres}} = 50 \text{ gallons/acre}$$

If the sprayer tank holds 250 gallons, then:

$$\frac{250 \text{ gallons}}{50 \text{ gal/acre}} = 5 \text{ acres}$$

Thus, the tankful of material will cover 5 acres of ground actually sprayed in the bands.

If the chemical advised for use is an EC liquid, which contains 4 lbs of active ingredient per gallon, and the recommendation calls for 2 lbs of active ingredient per acre, the amount of chemical to be placed in the tank can be determined as follows:

$$\frac{2.0 \text{ lb ai}}{\text{acre}} \times \frac{5 \text{ acres}}{\text{tankful}} = 10 \text{ lb ai/tankful}$$

Each gallon contains 4 lbs of active ingredient, so:

$$\frac{10 \text{ lb ai/tankful}}{4 \text{ lb ai/gallon}} = \frac{2\ 1/2 \text{ gallons}}{\text{tankful}}$$

It is customary to use a uniform or even-flow discharge fan nozzle per band. When initially setting up the sprayer, the size of nozzle to be used is a function of:

* width of band covered
* distance traveled per minute
* total liquid desired per acre sprayed

Thus, if you cover a band 10 inches wide at 5 miles per hour and want to apply 50 gallons per acre, the gallons per minute desired at the nozzle can be found by:

$$\text{gpm/nozzle} = \frac{\text{band width (in)} \times \text{mph} \times 88 \times 50}{12 \times 43{,}560}$$

Note: The 88 comes from the fact that 88 feet per minute is equal to 1 mile per hour.

$$\text{gpm/nozzle} = \frac{10 \times 5 \times 88 \times 50}{12 \times 43{,}560} = 0.421$$

If you look in the manufacturer's catalog, it may be noted that one even-flow fan nozzle operating at 30 psi pressure will deliver 0.43 gpm, or that another size operating at 20 psi will deliver 0.42 gpm. Both are so close that the accuracy of measurement could not detect a difference in the field.

If the sprayer is already equipped with nozzles somewhat too large or too small, it may be possible to use them "as is" by merely altering ground speed (provided that an unreasonably high speed or uneconomical low speed would not be required).

HAND SPRAYER USE FOR HERBICIDES

You must have --

- o Right dosage
- o Uniform coverage

} IMPORTANT KEY TO GOOD JOB AND NOT EASY TO ATTAIN

To get the best dosage possible you must --

- o Accurately determine area to get fraction of acre. (Assume 1 acre equals 43,600 square feet.) See "Another Good Method" on page 2.
- o Measure active ingredient accurately. If area is small and amount of herbicide extremely small, perhaps you can mix a larger quantity and use part of it. Use accurate measuring spoons or cups -- not dinnerware.
- o Use a flat-fan nozzle if possible and walk at a uniform rate. Practice with plain water first, if desired.
- o Wettable powders settle out, so shake sprayer frequently if it does not have an agitator.
- o Try to pump up sprayer often so pressure will be as uniform as possible. Pressure will not decline as fast if sprayer is not filled too full -- try 1/2 or 2/3 full.
- o To avoid plant damage, use materials such as 2,4-D, dicamba (Banvel), or picloram (Tordon) in a SEPARATE sprayer. You cannot easily wash out a sprayer to use for other materials on sensitive plants. Use red paint or otherwise mark the hand sprayer so that no mistake can be made.

NOTE Always clean and rinse hand sprayer or spray rig after use to be sure no residue is left. Residues can affect the dosage next time and can plug nozzles while the sprayer is not in use.

Never leave a sprayer with wettable powder in it standing while you go to lunch, or away for a night or weekend. Mix what you need and use it at once. Otherwise the powder will settle out and cake so that remix may be difficult or perhaps overlooked. You may also forget what dosage is in the sprayer.

This information is provided by Cooperative Extension, an educational agency of the University of California and the United States Department of Agriculture. Support for Cooperative Extension is supplied by federal, state, and county governments. Cooperative Extension provides the people of California with the latest information in agriculture and family consumer sciences. It also sponsors the 4-H Youth Program. Cooperative Extension representatives, serving 56 counties in California, are known as farm, home, or youth advisors. Their offices usually are located in the county seat. They will be happy to provide you with information in their fields of work.

The author is Robert W. Brazelton, Extension Agricultural Engineer, Davis

To simplify information, trade names of products have been used. No endorsement of named products is intended, nor is criticism implied of similar products which are not mentioned.

CAUTION

PLANT PESTICIDE USE WARNING — READ THE LABEL

CAUTION

Pesticides are poisonous and must be used with caution. READ the label CAREFULLY BEFORE opening a container. Precautions and directions MUST be followed exactly. Special protective equipment as indicated must be used.

STORAGE: Keep all pesticides in original containers only. Store separately in a locked shed or area. Keep all pesticides out of the reach of children, unauthorized personnel, pets and livestock. DO NOT STORE with foods, feeds or fertilizers. Post warning signs on pesticide storage areas.

USE: The suggestions given in this publication are based upon best current information. Follow directions: measure accurately to avoid residues exceeding tolerances, use exact amounts as indicated on the label or lesser amounts given in this publication. Use a pesticide only on crops, plants or animals shown on the label.

CONTAINER DISPOSAL: Consult your County Agricultural Commissioner for correct procedur for rinsing and disposing of empty containers. Do not transport pesticides in vehicles with foods, feeds, clothing, or other materials, and never in a closed cab with the vehicle driver.

RESPONSIBILITY: The grower is legally responsible for proper use of pesticides including drift to other crops or properties, and for excessive residues. Pesticides should not be applied over streams, rivers, ponds, lakes, run-off irrigation or other aquatic areas except where specific use for that purpose is intended.

BENEFICIAL INSECTS: Many pesticides are highly toxic to honey bees and other beneficial insects. The farmer, the beekeeper and the pest control industry should cooperate closely to keep losses of beneficial species to a minimum.

PROCESSED CROPS: Some processors will not accept a crop treated with certain chemicals. If your crop is going to a processor, be sure to check with the processor before making a pesticide application.

POSTING TREATED FIELDS: When worker safety reentry intervals are established be sure to keep workers out and post the treated areas with signs when required indicating the safe reentry date.

PERMIT REQUIREMENTS: Many pesticides require a permit from the County Agricultural Commissioner before possession or use. Such compounds mentioned in this publication are marked with an asterisk (*).

PLANT INJURY: Certain chemicals may cause injury or give less than optimum pest control if used: at the wrong stage of plant development; in certain soil types; when temperatures are too high or too low; the wrong formulation is used; and excessive rates or incompatible materials are used.

PERSONAL SAFETY: Follow label directions exactly. Avoid splashing, spilling, leaks, spray drift or clothing contamination. Do NOT eat, smoke, drink, or chew while using pesticides. Provide for emergency medical care in advance.

Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. Jerome B. Siebert, Director of Cooperative Extension, University of California.

1.5m-rev-4/85-LE/FB