Texas Agricultural Extension Service

Texas Citrus Orchard Herbicide Application Guide

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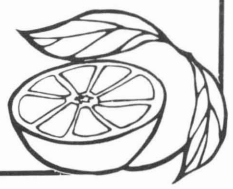

Precise application of a specific rate of herbicide is an important factor affecting efficient, economical weed control. The information in this guide includes suggested application equipment and an easy-to-use calibration guide. Calibrate equipment carefully and accurately as a part of any pesticide application program.

Improperly used agricultural pesticides are dangerous. It is extremely important to observe safety precautions, wear protective clothing when working with pesticides and follow directions for each specific chemical as given on the label.

Application Equipment

Manufactured herbicide sprayers are available commercially but many growers use equipment built to specific orchard conditions. Standard equipment includes a tank, pump, boom, pressure regulator, pressure gauge, control valves, hoses, screens and nozzles (Figure 1).

Many types of pumps are used for herbicide application but roller and centrifugal pumps are most common. Roller pumps are popular for small sprayers because of their low initial cost, compact size, easy repairability and efficient operation at tractor PTO speeds. Centrifugal pumps are popular because of their low maintenance requirements and ability to handle abrasive materials and generate a high volume of output. Centrifugal pumps can be driven with hydraulic motors or belt-and-sheave assembly from the PTO. When selecting a pump, make sure the volume is high enough to provide adequate tank agitation. Agitation with jet nozzles requires an additional pump capacity of about 6 gallons per minute. The use of a siphon nozzle requires a pump capacity of about 3 gallons per minute for sufficient agitation.

Sprayer tanks are available in many sizes, shapes and materials. The types of chemicals used, volume

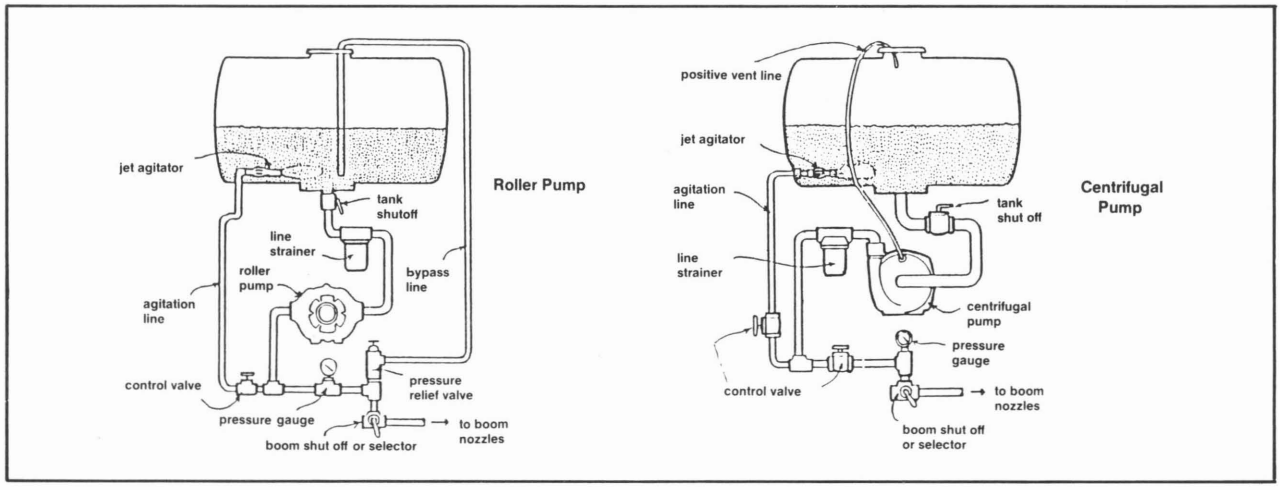

Figure 1. Illustration of system plumbing for roller pump and centrifugal pump.

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needed and frequency of use are factors to consider when selecting a tank. Tanks should be easy to clean and resistant to the corrosive action of most commonly used spray materials. All tanks, if not transparent, should have a sight gauge to accurately determine fluid levels. Efficiency is greatly increased if tanks have sufficient capacity for jobs that require large volumes of spray material. Small tanks will result in a high percentage of refill time rather than spraying time. Thus, for many orchard conditions, trailered tanks are used.

The pressure regulator and gauge are used to control operating pressure and allow excess flow to be by-passed through the regulator back to the tank. A reliable pressure gauge is a required feature on all sprayer systems. The gauge should be located as close to the spray nozzles as practical. Boom control valves and pressure regulator also must be mounted close to the operator, or electrically operated valves can be used for remote control of spray booms and nozzles from the operator's location.

Spray booms may be classified as wet or dry types. Wet booms use the material of the booms as the conduit for the spray liquid. Pipes, tubes or other rigid material through which the material can pass are utilized. Dry booms have a rigid boom constructed of angle iron, channel iron, pipe or similar material to which hoses and fittings carrying he liquid are attached. The spray material passes through the hoses and not the boom itself, allowing more flexibility in set-up.

For orchard herbicide application, the booms should be shielded (covered) to reduce drift and prevent spraying low-hanging foliage. The boom must have a breakaway feature to avoid damage to trees and/or the boom. Booms should be constructed so that boom height is easily adjusted and easily converted to travel position. Hydraulic cylinders make this job simple on many spray rigs.

Some citrus herbicide sprayers spray both sides of the row middle, but most only spray one side because of maneuverabilty problems. This is accomplished using a side and center boom. Spray coverage from the side boom extends from the tractor tire to the tree row. The center boom is on the rear of the trailer or tractor to provide coverage from the side boom to the center of the tractor.

Nozzles on a chemical sprayer serve several functions. They meter the liquid, atomize it into droplets and disperse the droplets in a specific pattern and size for proper impact with plants or soil. Nozzles are available in many materials but brass, nylon and stainless steel are the most common for herbicide application.

Nozzles have four basic parts: body, cap, tip and strainer. The tip and strainer fit inside the body and cap to make a complete unit. Nozzle tips are interchangeable and available in a wide range of capacities and patterns. For broadcast herbicide application, flat fans or flood nozzles are popular. Nozzle strainers are usually 50- to 100-mesh, depending upon nozzle size. The purpose of the strainer is to remove the particles that could clog the nozzle opening. Tips with small openings such as a Tee jet #8001 or Delavan LF-1-80° should have a 100-mesh strainer. Larger tips such as Tee jet #8003 or Delavan LF-3-80° should have a larger, 50-mesh strainer. Slotted strainers should be used with wettable powders and are sized in equivalent mesh sizes of 50 and larger.

The side boom must be operated at a height of 6 to 12 inches to pass beneath tree skirts. To operate a boom that low, close nozzle spacing or wide angle nozzles can be used. For example, at a boom height of 11 inches, 80° flat fan nozzles must be spaced 12 inches apart to provide adequate overlap coverage. At that same height, 110° flat fan nozzles can be spaced 20 inches apart to provide good overlap coverage. Moreover, 110° nozzles spaced 12 inches apart provide good overlap coverage at a boom height of 6.5 inches. Flat fan nozzles are available in 65°, 73°, 80°, 110° and 150° spray angles.

Sprayer Calibration

The most important aspect of preparing a sprayer for the season is calibration. Proper calibration is essential for safe, economical and effective weed control. Users should calibrate a sprayer prior to its initial use and periodically during operation.

Factors which determine the rate of application are: (1) nozzle spacing on the boom, (2) nozzle type, (3) pressure at the nozzle, (4) ground speed and (5) nozzle wear. All of these factors must be considered to calibrate a sprayer, and the first four can be changed individually or collectively for different applications.

Calibration — 1/128th-acre Method

An easy method to use for calibration is the 1/128th of an acre method. This method is based on nozzle spacing and the time to travel a specific course length. The table below provides the course length for different nozzle spacings on the boom.

			inches				
Nozzle spacing	**20**	**18**	**16**	**14**	**12**	**10**	**8**
			feet				
Course length	**204**	**227**	**255**	**292**	**340**	**408**	**510**

Mark off the specified course distance according to the nozzle spacing on the boom. Drive that distance while recording the time. Collect and measure nozzle output from one nozzle in ounces for the recorded time. This amount will be equal to gallons per acre being applied.

Example: A herbicide sprayer with a nozzle spacing of 12 inches travels 340 feet in 77 seconds at 3 mph. Nozzle output for the 77-second period equals 42 ounces, which is equal to 42 gallons per acre.

10 acres to be sprayed
10 x 42 gpa = 420 gallons
Herbicide application rate of 2 lb/acre
10 acres x 2 lb = 20 lb chemical to 420 gallons

Many of the decisions needed for sprayer calibration are made long before going to the field. The nozzle type and spacing are determined by grower preference and the physical requirements of the boom. Moreover, herbicide labels require that the material be applied in a specified minimum spray volume per acre. The most common volume recommended is 40 gallons per acre, but some applications may require more or less total gallonage.

Select a ground speed suitable for both the equipment and field conditions. Speeds in excess of 4 mph are not practical in most citrus orchards. At a given speed, nozzle spacing and total application rate, the necessary nozzle spray rate in gallons per minute (GPM) can be calculated by the following formula:

$$\text{GPM} = \frac{\text{speed (mph)} \times \text{nozzle spacing (inches)} \times \text{gallons per acre}}{5{,}940}$$

From this calculated GPM, select the size of nozzle with the optimum pressure range in mind. For herbicide application, consider using the lowest recommended pressures to reduce drift. Also consider "new" low pressure nozzles developed specifically for herbicide application.

Before calibrating, be sure that all components are clean and in good working condition. Make sure the pressure gauge is working accurately by keeping a second gauge on hand to check pressure readings of the gauge in use. It also is a good idea to have a pressure gauge mounted on the boom because catalog capacity charts are based on pressures at the nozzle.

To fine tune the sprayer for accurate application, collect water from several tips with the tractor parked, the tank full and the engine running at the same speed to be used in the field. Adjust the pressure regulating valve until the tip delivers the required GPM as calculated by the formula or calibration charts. Note the pressure for future reference.

Finally, the tractor must be operated at the speed selected initially. The speedometer may be inaccurate because of different tire sizes and wheel slip. There are many short cuts and gimmicks used to measure tractor speed, but all that is needed is to measure the time in minutes required to travel a known distance in feet. Then use this formula to convert to miles per hour (mph):

$$\text{mph} = \frac{\text{distance (feet)}}{\text{time (minutes)} \times 88}$$

where 88 is the feet per minute traveled at a speed of 1 mph.

Example: Using flat fan nozzles, Tee Jet #11003, spaced 12 inches apart, chemical application rate of 40 gallons per acre, and a tractor speed of 3.2 mph, determine the nozzle size and nozzle pressure.

$$\text{GPM} = \frac{\text{mph} \times \text{nozzle spacing (inches)} \times \text{GPA}}{5{,}940}$$

$$= \frac{3.2 \times 12 \times 40}{5{,}940}$$

$$= .24 \text{ GPM}$$

At 25 psi, a Tee Jet #11003 = .24 gpm
Using a 300-gallon spray tank, this will cover 7.5 acres.

Periodically check nozzle wear to prevent excessive increases in application rate. If nozzles vary more than 10 percent of their specified flow rate, install new nozzles. To check nozzle flow rate, measure flow from each nozzle to calculate gallons per minute and compare this to nozzle rate charts. As nozzles wear, spray patterns also change and affect particle distribution.

Before tank mixing chemicals and additives, read the labels for proper mixing instructions. Always wear protective clothing and equipment as required by the chemical label to avoid chemical contact. Reducing errors saves chemicals, time, potential health problems and money, while providing effective weed control.

Sprayer Maintenance

More pumps are ruined by improper maintenance than are worn out. Pump wear and deterioration occur with ordinary use but these are accelerated by misuse. The following suggestions help to minimize problems and prolong the useful life of the pump and sprayer.

- Put only clean chemicals, solutions and water in the sprayer. Small amounts of silt or sand particles rapidly wear pumps and parts of the sprayer system.
- Use chemicals that the sprayer and pump were designed to used. For example, liquid fertilizers are corrosive to copper, bronze, ordinary steel and galvanized surfaces. If the pump is made of these materials, it can be ruined by just one application of liquid fertilizer. Use stainless steel pumps and nozzles for fertilizer application.
- Before using a new sprayer, clean the screens and nozzles of all metal chips and other foreign material.
- Flush the spray system with clean water after each day of spraying.
- Inspect screens and nozzle tips after each day of spraying. Clean by soaking and using a soft brush such as a toothbrush. Tips and screens may be damaged if cleaned with metal objects such as a knife or wire.
- Clean the sprayer thoroughly after each use or when chemicals are changed. Many chemicals cause metal corrosion and sometimes a chemical residue will react with succeeding chemicals, causing a loss of effectiveness.

Safety

Pesticides are potentially dangerous when not used properly. Sprayer operators should be thoroughly familiar with both chemicals and equipment before spraying. Read the pesticide label for all safety instructions. Wear protective clothing and equipment such as goggles, respirator, gloves, hat, boots, long-sleeved shirt and long trousers during mixing and application of pesticides. Prohibit smoking and eating while handling chemicals.

Always store and dispose of chemicals and containers properly. Empty containers should be triple rinsed into the spray tank and disposed of in accordance with the pesticide label instructions.

Make sure that sprayer operators and chemical handlers have the telephone numbers of poison control centers and physicians and know the chemicals being applied. Know the signs and symptoms of pesticide poisoning and what to do if it occurs.

Equipment and machinery can be dangerous. Some important safety practices in machine operation include:

- Stop the engine, disconnect the power source and wait for all machine movement to stop before servicing, adjusting or cleaning equipment.
- Make sure all persons are clear of machinery before starting the engine, engaging power or operating a machine.
- Keep all guards in place when machines are in operation.
- When operating a tractor with a sprayer, watch for dangers and obstacles, especially at row ends, on roads and around trees.
- When possible, avoid operating the sprayer near ditches, embankments and holes.
- Allow no riders on equipment.

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture. Zerle L. Carpenter, Director, Texas Agricultural Extension Service, The Texas A&M University System.
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