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USING LOW PRESSURE SPRAYERS

Using Low Pressure Sprayers

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For Sale Publication

CAUTION

AGRICULTURAL CHEMICALS CAN BE DANGEROUS. IMPROPER SELECTION OR USE CAN SERIOUSLY INJURE PERSONS, ANIMALS, PLANTS, SOIL OR OTHER PROPERTY. *BE SAFE:* SELECT THE RIGHT CHEMICAL FOR THE JOB. HANDLE IT WITH CARE. FOLLOW THE INSTRUCTIONS ON THE CONTAINER LABEL AND OF THE EQUIPMENT MANUFACTURER.

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Control of pests depends on (1) correct identification of the pest, (2) selection of an appropriate means of control, (3) selection of the proper chemical(s) if chemical control is used, (4) application of the proper amount of chemical per unit of area or unit of volume, (5) sufficient coverage to completely and uniformly control the pest, and (6) prevention of drift that may cause damage outside the target area.

Items 4, 5 and 6 are discussed in this bulletin to assist owners and operators of low pressure sprayers in selecting and using equipment to obtain the most effective pest control.

Pest control is often difficult to achieve even under optimum conditions. A very important factor in obtaining optimum control is application of the proper quantity of active ingredient (A.I.) per unit of area. Excessive rates may cause damage to the present or succeeding crops, harm to animals or result in environmental concerns. Application rates less than recommended likely will result in inadequate pest control, which leads to decreased crop yields. Excessive or inadequate application rates increase the cost of production because expensive chemicals are wasted.

Although good pest control depends on applying the proper amount of active ingredient per acre (A.I.A.), adequate and uniform coverage is also necessary. That is, the chemical must be properly mixed with water (in the case of sprays) and enough gallons per acre (GPA) of the mixture applied to obtain control. Thus, the right quantity of chemical and the recommended number of gallons per acre must be uniformly applied. The correct amount of material may be applied on each acre but the material may be so unevenly distributed that pest control is not obtained (Fig. 1). In addition, some pesticides can cause damage if they drift outside the target area.

The amount of chemical applied, adequacy of coverage and prevention of drift depend on proper selection and use of equipment.

Fig. 1: Uniform distribution of the recommended GPA is absolutely essential

Spray Equipment

How Sprayers Work

Typical field type sprayers consist of spray nozzles, lines, pump, tank, pressure regulator, pressure gauge, strainers, shutoff valve and agitator (Fig. 2). Some sprayers are equipped with pressure activated shutoff valves at each nozzle to stop nozzle flow without dripping. The pump takes the spray material from the tank and pumps it to the spray nozzles. Pressure at the spray nozzles is determined by the setting of the agitator control valve and the pressure regulator, the capacity of the pump and the pressure loss in lines and fittings between the pressure gauge and the nozzles. A portion of the pump discharge is sent back to the tank through the agitator to mix the chemical with the water in the tank.

System components are protected from dirt by tank filler, line and nozzle strainers. The tank filler strainer should be about 20 mesh (20 openings per inch). A line strainer, 50 mesh, should be used ahead of a roller pump to protect the pump. A line strainer may follow a centrifugal pump to protect the nozzles. Strainers may or may not be used at the nozzle, depending on orifice size. Nozzle manufacturers recommend mesh sizes for each nozzle tip.

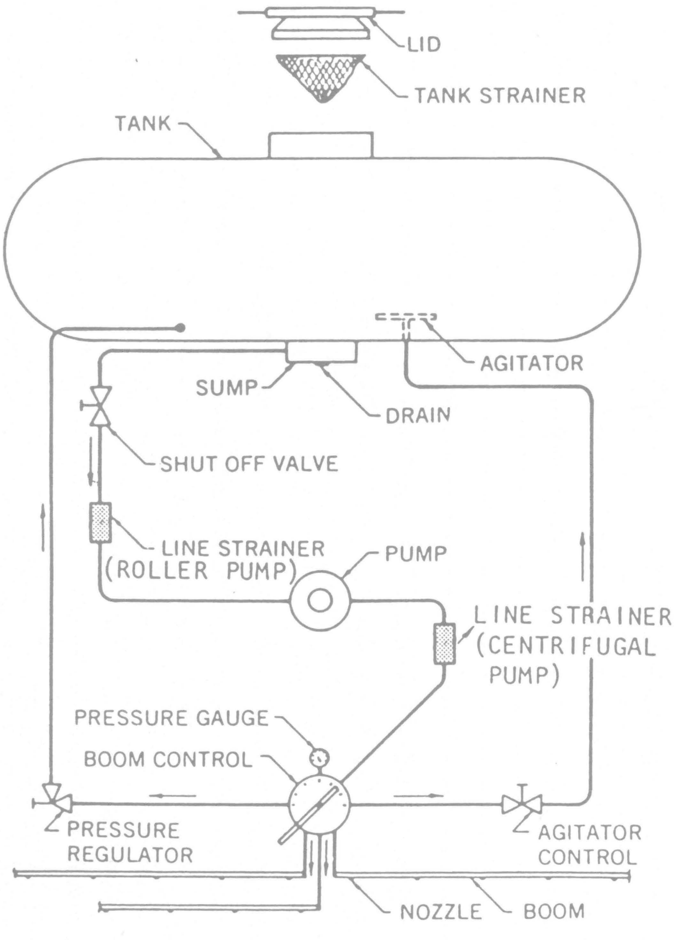


Fig. 2: Typical field sprayer

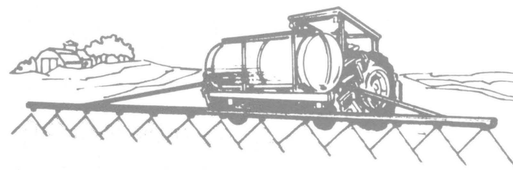


Fig. 3: Overlapping boom spraying

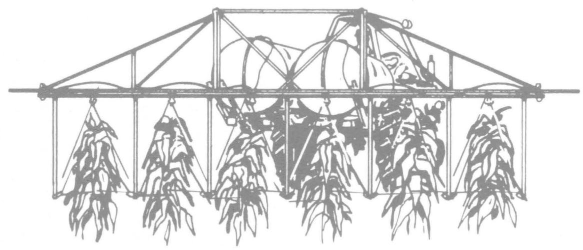


Fig. 4: Row crop spraying

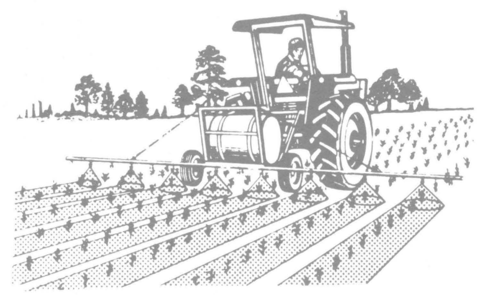


Fig. 5: Band spraying

Some field type sprayers use a boom with nozzles spaced uniformly along the boom (Fig. 3) or on drop pipes for a row crop spraying (Fig. 4). Spray may also be applied in bands directly over the row (Fig. 5)

Uniformity of Distribution

Nozzle spacing and boom height: Spray nozzles used for broadcast spraying do not deliver a uniform quantity of material over the width of the spray pattern (Fig. 6). The distribution pattern is determined by nozzle design, nozzle wear, nozzle clogging and pressure at the nozzle.

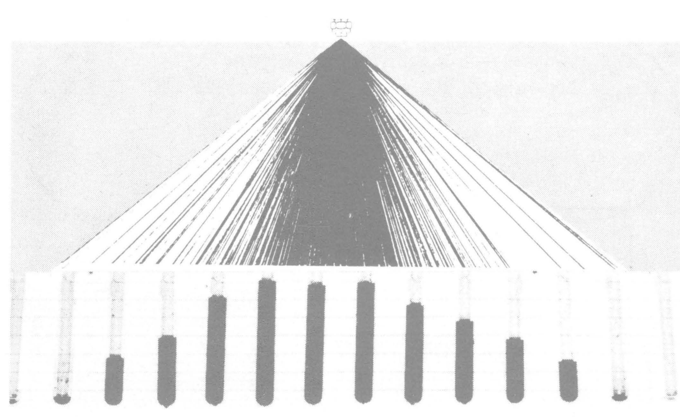


Fig. 6: Spray nozzle distribution pattern—flat fan

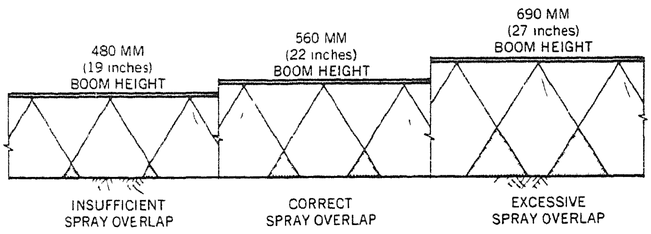


Fig. 7. Effect of boom height on spray overlap

When a number of nozzles are spaced on the boom, the individual nozzle spray patterns must overlap to obtain more uniform distribution over the entire boom width. Nozzle manufacturers recommend a boom height for each particular nozzle and nozzle spacing. Improper boom height will result in uneven distribution patterns (Fig. 7). Anything that changes boom height such as rolling land that causes the boom to tilt and rough land that causes the boom to bounce up and down as well as forward and back will affect the distribution pattern.

Effect of pressure: Pressure may also affect distribution patterns. In tests conducted at the Prairie Agricultural Machinery Institute in Canada, poor distribution was obtained at 20 pounds per square inch (PSI) (Fig. 8). The actual application varied by more than 40 percent above and below the recommended

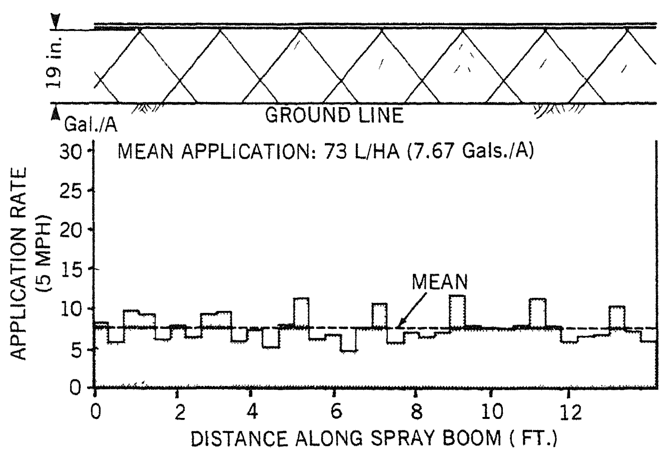


Fig. 8: Distribution patterns for a section of broadcast spray boom — 20 PSI

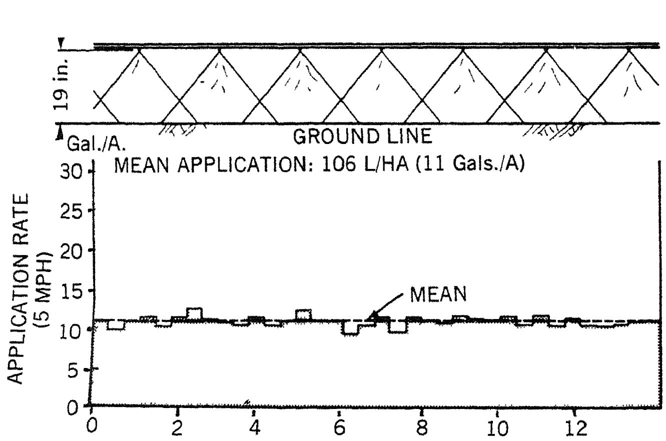


Fig. 9: Distribution pattern for a section of broadcast spray boom — 40 PSI

application rate. However, when the pressure was increased to 40 PSI, a good distribution pattern was obtained (Fig. 9). This illustrates that if the pressure is changed, boom height should be checked to make certain uniform distribution is being obtained.

Double application or skips can result from either the boom overlapping or not matching with the boom pattern of the previous trip across the field. Boom markers that spray a readily visible material will help solve this problem.

Uniformity of distribution can be checked by operating the sprayer as it is crossing a dry, smooth surface such as concrete and observing the drying pattern.

Completeness of Coverage

Coverage required: The completeness of coverage required depends primarily on how the chemical acts and characteristics of the pest being controlled. Some of the more common ways a pesticide might function are as a protectant, contact poison, systemic poison and translocated herbicide. Systemic insecticdes and herbicides that are translocated within plants do not require complete coverage. Also, complete coverage is not required for insecticides that kill by ingestion. However, the coverage required is somewhat dependent on the mobility of the insect. Coverage required for contact insecticides is dependent on both insect size and mobility. Chemicals used for control of plant diseases usually require more thorough coverge to provide a protective barrier.

Coverage obtained: Coverage obtained is determined primarily by droplet size and the volume of material applied. As droplet size is decreased, better coverage is obtained with a given volume of material. If the diameter of spray droplets is reduced by one-half, the number of droplets produced with a given volume is increased by eight times. Conversely, doubling the diameter will reduce the number produced by eight times. Using small droplets to achieve good coverage can result in problems due to drift.

Drift: With some chemicals, drift of droplets outside the target area may cause damage. An applicator is financially liable for such damage. Always **read the label** on the chemical container to learn of possible drift hazards and to obtain application recommendations.

The amount of drift is determined by droplet size and wind velocity. The smaller the droplet and the higher the wind velocity, the farther a droplet will travel before being deposited. Little or no wind can be tolerated when using a chemical with a high drift hazard and with targets susceptible to damage in the vicinity.

Vertical air movement is also important when applying pesticides. Vertical air movement is affected by the change in air temperature as the elevation above ground level increases. If the temperature decreases with increasing distance above the ground, air near the ground rises, creating a ventilating condition (a lapse condition). If the air temperature increases with height (a temperature inversion), air near the ground will have very little or no vertical movement. This is the condition that exists when smoke is trapped near the ground. On a daily basis, ventilating (lapse) conditions normally exist from about midday to evening. Temperature inversions normally occur from late evening to morning.

A ventilating condition is desired when applying sprays with large droplets, which have only a small percent of small driftable droplets. The small droplets are dispersed over such a large area that the possibility of damage from drift is greatly reduced. A temperature inversion is desired for pesticides being applied as aerosols or dusts.

Volume applied: The quantity of material applied per unit of area by a sprayer depends on the shape and size of the hole (orifice) in the nozzle, pressure in pounds per square inch (PSI) at the nozzle, nozzle spacing on the boom, speed of travel and concentration of the A.I. in the chemical-water mixture.

A discussion of each of these items follows:

Nozzle size: Nozzles are selected that deliver the correct amount of material per unit of time. However, during use the size of the hole in the nozzle may change rather rapidly due to wear, plugging with dirt and damage caused by trying to clean a plugged nozzle with wire, etc. The rate of nozzle wear depends on the type of material being sprayed, the amount of dirt in the water and the material from which the nozzle is made. Wettable powders (WP or W) will cause rapid wear in aluminum, brass and plastic nozzles. Stainless steel nozzles and nozzles having tungsten carbide orifices are more resistant to wear.

The Prairie Agricultural Machinery Institute in Canada has found nozzle tip wear sufficient to cause a 10 percent increase in nozzle delivery after only 50 hours of use. This is the major reason for checking the flow rate of a nozzle frequently.

Pressure: As the pressure in pounds per square inch (PSI) at the nozzle increases, the flow rate through the nozzle increases. The flow rate is directly related to the square root of the pressure. Thus, doubling the pressure increases the nozzle flow rate by 1.4 times; tripling the pressure increases the flow rate by 1.73 times; and increasing the pressure by four times doubles the flow rate.

Nozzle manufacturers publish flow rate in gallons per minute (GPM) versus pressure for their nozzles. You may find that nozzles do not deliver the amount specified by the manufacturer. This might be caused by an inaccurate pressure gauge. It could also be caused by the fact that the actual pressure at the nozzle is less than that indicated by the pressure gauge. Such pressure losses can be caused by restrictions in the line, buckling of supply hoses or partially clogged nozzle strainers. Using nozzles larger than those for which the sprayer was designed may cause a reduction in pressure at the nozzle.

Nozzle spacing: If a given size nozzle is spaced farther apart on the boom, the application rate in gallons per acre (GPA) is reduced. For example, spacing nozzles (of the same size) 40 inches instead of 20 inches apart on the boom reduces the GPA by one-half.

Speed of travel: Application rate varies inversely with the speed of travel. That is, if the speed of travel in miles per hour (MPH) is doubled, the GPA is reduced by one-half. If the MPH is reduced to one-half, the GPA is doubled. Thus, speed of travel is very important in obtaining proper application rate. If the chosen MPH is not maintained, improper application rates result. To find the speed in MPH, divide 120 by the number of seconds required to travel 176 feet. For example, if 20 seconds are required, the speed in MPH is 120 divided by 20, or 6 MPH.

Concentration of the mixture: The spray applied is usually a mixture of the material containing the active ingredient (A.I.) and water. Because a fixed number of GPA of the mixture is applied, the amount of active ingredient applied per acre (A.I.A.) is determined by how much of the A.I. is mixed with each gallon of water.

Placing the proper quantity of A.I. in a spray tank of water does not assure proper amounts of A.I.A. Some spray materials tend to settle to the bottom of the spray tank. Thus unless adequate agitation is provided, the first material from the tank will have a higher concentration of A.I. Wettable powders (WP or W) have the greatest settling tendencies and require continuous agitation. Emulsifiable concentrates (EC or E) require little agitation. Soluble powders require little agitation after they are dissolved. Flowables (F or L) require moderate agitation.

Adequate agitation requires about three gallons perminute of flow through the agitation line per 100 gallons of tank capacity. Inadequate agitation can result if the agitator control valve is not adjusted properly or if the pump has inadequate capacity. The pump must have sufficient capacity to provide nozzle flow plus agitation flow plus a reserve capacity to allow for pump wear. Centrifugal pumps require only a small reserve capacity (10 to 15%) because of low wear rates. Roller pumps usually wear more rapidly and should have more reserve capacity (25 to 30%).

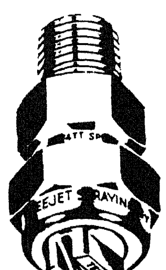
Over-agitation may result in foaming, which can be corrected by restricting agitation flow rate by adjusting the agitator control valve.

Selecting a Nozzle Type

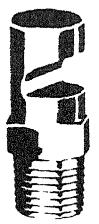
Many different types of nozzles are available. Some produce primarily large droplets not subject to drift. However, they would not provide good coverage without using a large volume of material. Others produce a mixture of droplet sizes including many small ones subject to drift. Generally, within any one type of nozzle, droplet size decreases with a decrease in nozzle size and with an increase in nozzle pressure.

A partial list of nozzles and typical uses is given in Table 1. Refer to manufacturers catalogs for descriptions of other nozzles and their use.

Table 1: General Guide to Nozzle Selection

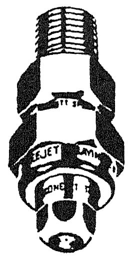
Nozzle Type	Application
Flat fan, regular 	Broadcast spraying of herbicides (15 to 30 PSI) and some insecticides (40 to 60 PSI) when foliar penetration and complete coverage is not required. Large numbers of driftable droplets will be produced, particularly with higher pressures and smaller sizes of nozzles. Nozzles are available in spray pattern angles of 65, 73, 80 and 110 degrees. As the angle of the spray pattern is increased, boom height may be lowered. Nozzle patterns should be overlapped by 30 percent (6 inches on a 20-inch nozzle spacing).
Flat fan, LP (low pressure)	Broadcast spraying of herbicides (10 to 25 PSI). Larger droplets than regular flat fan.
Flat fan, even	Banding of pesticides over the row or for spraying flat surfaces-walls, etc.

Flooding



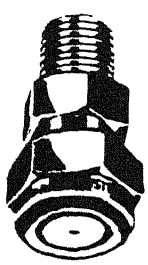
Broadcast applications of herbicides and herbicide-fertilizer mixtures (10 to 40 PSI). For uniform application, nozzle spacing should not exceed 40 to 60 inches with a 100 percent pattern overlap. Even though these nozzles produce large drops, they also produce driftable droplets. These can be reduced by operating at pressures less than 20 pounds per square inch.

Hollow cone (low volume)



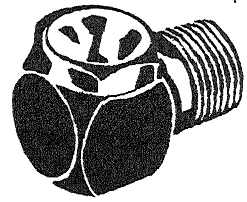
Directed applications of insecticides, defoliants and other chemicals (30 to 120 PSI). Produce small droplets that give good coverage and are subject to drift. May be used with drop pipes supporting two nozzles for row crop application.

Hollow cone disc core (high volume)



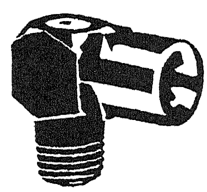
Foliar applications of insecticides and fungicides at higher flow rates and pressures (40 to 400 PSI). Produce larger numbers of small droplets, particularly at higher pressures. Also used in mist blowers.

Whirl-chamber hollow cone



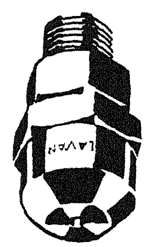
For soil incorporated herbicides (10 to 40 PSI). Produce large droplets at the lower pressures.

Raindrop hollow cone



Application of herbicides for incorporation. Use where drift is a problem.

RD



Broadcast applications for incorporation at low pressures or foliar applications at higher pressures. Use at low pressures where drift is a problem.

Precalibration Procedures

Selecting the Proper Size Nozzle

First, select the GPA from the pesticide label or from other written recommendations. These recommendations usually assume that the material is applied uniformly (broadcast) over the entire area.

Second, select an appropriate speed of travel in miles per hour (MPH) as determined by ground roughness, etc.

Third, determine the effective spray width (W) in inches per nozzle. For boom type sprayers, W is equal to the nozzle spacing on the boom in inches. For band sprayers, W equals the band width in inches. For row crop sprayers, W equals the row spacing in inches divided by the number of nozzles per row.

Fourth, determine the required gallons per minute (GPM) for each nozzle from the formula:

$$GPM = \frac{GPA \times MPH \times W}{5940}$$

GPA = gals/ac. (to be applied uniformly over an acre)
MPH = miles per hour
W = effective spray width, inches

Example I

Twenty gallons per acre is to be applied at 4 MPH broadcast by a boom sprayer.
Nozzles are spaced 20 inches apart on the boom.

$$GPM = \frac{20\ GPA \times 4\ MPH \times 20\ in.}{5940} = 0.27 \text{ gallons per minute}$$

Example 2

Material is to be band sprayed at the broadcast rate of 20 GPA. Band width is 10 inches.

$$GPM = \frac{20\ GPA \times 4\ MPH \times 10\ in.}{5940} = 0.13 \text{ gallons per minute}$$

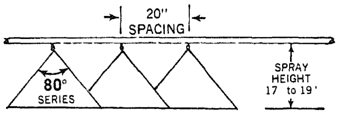
Fifth, select a nozzle tip that will give the required GPM when operating within the desired pressure range.

Example 3

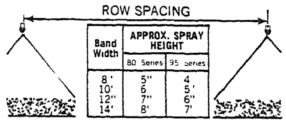
Select a broadcast nozzle which will deliver 0.27 GPM. Refer to Fig. 13a. Follow down the column titled Capacity 1 nozzle GPM. An 8003 nozzle deliveres 0.26 GPM at 30 PSI. Pressure could be increased slightly to obtain the desired capacity.

Example 4

Select a band spray nozzle which will deliver 0.13 GPM. Refer to Fig. 13b. Follow down the column titled Nozzle Capacity in GPM. An 80015E or a 95015E nozzle delivers 0.13 GPM at 30 PSI. Either nozzle could be used.



TeeJet FLAT SPRAY TIP NO. and strainer screen size	Liquid Pressure in p.s.i.	Capacity 1 Nozzle in G.P.M.	GALLONS PER ACRE 4 M.P.H	5 M.P.H.	7 5 M.P.H	10 M.P.H
800067 •4.3 GPA (100 Mesh)	20	.05	3.5	2.8	1.8	1 4
	25	.055	3.9	3.1	2.1	1.6
	30	.06	• 4 3	3 4	2.3	1 7
	40	067	4.9	4 0	2 6	2.0
	50	.07	5.5	4 4	3.0	2.2
	60	.08	6 0	4 9	3.3	2.5
8001 •6.4 GPA (100 Mesh)	20	.07	5.3	4.3	2.8	2.2
	25	.08	5.9	4 7	3.1	2.4
	30	.09	• 6.4	5 1	3.4	2.6
	40	.10	7.4	6.0	4.0	3.0
	50	.11	8.3	6.7	4.5	3 4
	60	.12	9.1	7.4	4.9	3.7
80015 •9.7 GPA (100 Mesh)	20	.11	7.8	6.3	4.3	3.2
	25	12	8.8	7 1	4.7	3 6
	30	.13	• 9.7	7 7	5.2	3.9
	40	.15	11 1	8.9	6.0	4 5
	50	.17	12.4	10 0	6.7	5.0
	60	18	13.6	10 9	7.4	5.5
8002 •12.9 GPA (50 Mesh)	20	.14	10.5	8.4	5.6	4.2
	25	.16	11.8	9.4	6 3	4.7
	30	.17	•12.9	10.3	6 9	5 2
	40	20	14.8	11 8	7.9	5.9
	50	.23	16.5	13.2	8.8	6 6
	60	25	18 1	14.4	9.7	7.2
8003 •19 GPA (50 Mesh)	20	.21	15.7	12.6	8.4	6.3
	25	.24	17 6	14.1	9.4	7.1
	30	.26	•19	15.4	10.3	7.7
	40	.30	22	17.8	11.8	8 9
	50	.34	25	20	13.2	10.0
	60	.37	27	22	14.4	10.9



TeeJet EVEN FLAT SPRAY TIP NO 80° Series	95° Series	Liquid Pressure in p.s i	Nozzle Capacity in G.P M.
8001E (100 Mesh)	9501E (100 Mesh)	20	.07
		30	.09
		40	.10
80015E (100 Mesh)	95015E (100 Mesh)	20	.11
		30	.13
		40	15
8002E (50 Mesh)	9502E (50 Mesh)	20	.14
		30	.17
		40	20
8003E (50 Mesh)	9503E (50 Mesh)	20	.21
		30	26
		40	30
8004E (50 Mesh)	9504E (50 Mesh)	20	.28
		30	.35
		40	.40
8005E (50 Mesh)	9505E (50 Mesh)	20	.35
		30	.43
		40	50
8006E (50 Mesh)	9506E (50 Mesh)	20	.42
		30	.52
		40	.60
8008E (50 Mesh)	9508E (50 Mesh)	20	.57
		30	69
		40	.80
8010E (No Strainer)	9510E (No Strainer)	20	71
		30	.87
		40	1.00
8015E (No Strainer)	9515E (No Strainer)	20	1.06
		30	1 30
		40	1.50

Fig. 10: Typical manufacturer's nozzle data, a) nozzles for broadcast spraying, b) nozzles for band spraying

Check the sprayer for leaks at hose connections, etc.

Sixth, make certain that the proper size nozzle tip is installed in each nozzle.

Seventh, adjust the spray height to that recommended by the nozzle manufacturer. You will note from Fig. 13a that a 17 to 19 inch height is recommended for the broadcast nozzles listed.

Checking Operation of Sprayer

Partially fill the spray tank with water. When filling the tank from surface waters or a public water supply, you must use an effective anti-siphon device to prevent backflow. Operate at the selected pressure and observe the spray patterns at each nozzle. If the spray patterns are not uniform, clean or replace the nozzle. Use containers (quart jars will work) to catch the spray from each nozzle for a measured length of time. Either measure the amount in ounces or measure the depth of water in each jar. Record the amounts and compare nozzles. Replace any nozzle with an output 5 percent more or less than the average of all nozzles.

When using flat fan nozzles, adjust the nozzle tips so that the spray patterns are about perpendicular to the direction of travel but with no interference of the patterns.

Set the nozzles at the manufacturers recommended height. Check uniformity of distribution as suggested earlier.

Example 5

Nozzle No.	Nozzle Output ounces	Difference from Average ounces
1	28	0.2
2	27	0.8
3	28	0.2
4	25	2.8
5	29	1.2
6	31	3.2
7	30	2.2
8	28	0.2
9	29	1.2
10	27	0.8
11	26	1.8
12	27	0.8
13	27	0.8

Total 362 ozs ÷ 13 nozzle = 27.8 ozs/nozzle
5% variation = 27.8 × 0.05 = 1.4 ounces
Nozzles 4, 6, 7, and 11 exceed the 5% variation allowed and should be replaced.

Obtaining Proper Application Rates

Determine GPA: Fill the tank with water and operate briefly to fill all parts with water. Refill the tank and spray for a measured distance at the selected pressure and speed of travel. Measure the number of gallons of water required to refill the tank. The application rate is the gallons required to refill the tank divided by the area covered.

In much of Ohio, the length of fields is known accurately from the method of surveying used. A section (640 acres) is 320 rods (1 mile) on a side. A quarter section is 160 rods (½ mile) on a side. Thus, typical field lengths are 160, 80, or 40 rods.

Example 6

Nineteen gallons of water is required to fill the tank after travelling 40 rods (1 rod = 16.5 feet). The sprayer has 35 nozzles spaced 20 inches apart.

$$\text{Acres sprayed} = \frac{\text{width of spray pattern in feet} \times \text{distance travelled in feet}}{43{,}560 \text{ sq. ft./ac.}}$$

$$\text{Width of spray pattern} = \frac{35 \text{ nozzles} \times 20 \text{ in./nozzle}}{12 \text{ inches/foot}} = 58.33 \text{ ft.}$$

Distance travelled = 40 rods x 16.5 feet/rod = 660 ft.

$$\text{Acres sprayed} = \frac{58.33 \text{ ft.} \times 660 \text{ ft.}}{43{,}560 \text{ sq. ft./ac.}} = 0.88 \text{ acres}$$

$$\text{GPA} = \frac{19 \text{ gal.}}{0.88 \text{ acres}} = 21.5 \text{ gallons per acre}$$

If in Example 6, you had been attempting to obtain an application rate of 20 GPA at 4 MPH, you would probably not be concerned that 1.5 gallons more liquid is being applied than planned for. The mixture of water and A.I. is formulated by using the actual quantity of liquid being applied per acre.

Formulating the mixture: After determining the gallons being applied per acre, find the number of acres to be covered with each tank of material. The number of acres covered with each tank equals the tank capacity in gallons divided by the gallons applied per acre.

Example 7

Assume an application rate of 21.5 GPA (from Example 6) and a tank capacity of 200 gallons.
acres/tank = 200 gal/tank ÷ 21.5 GPA = 9.3 acres/tank

To find the amount of chemical to add to the tank, multiply the acres covered with each tank by the amount of material to be applied to each acre.

Example 8

The chemical manufacturer recommends that 4 75 pints of chemical be applied per acre Assume that 9 3 acres will be covered with each tank of material (from Example 7)

Pints of chemical to add to 200 gallon tank
= 4 75 pts/ac × 9 3 acres = 44 2 pints

There are 8 pints per gallon Gallons to add to 200 gallon tank
= 44 2 pts − 8 pts/gal = 5 5 gallons of chemical

Some recommendations will give the pounds of A.I. to be used per acre rather than the total amount of the chemical as in the preceding example. In such cases the amount of material to be applied may be calculated as in Example 9.

Example 9

Two pounds of A I are to be applied per acre The material to be used is a wettable powder containing 50% A I

Pounds of material per acre =

$$\frac{\text{2 lbs A I}}{\text{Ac}} \quad \text{X} \quad \frac{\text{1 lb mat'l}}{\text{0 5 lb A I}} = \text{4 lbs mat'l}$$

When using wettable powders, fill the spray tank one-third to one-half full of water. Mix the WP with water in a bucket to form a slurry. Start the agitator and pour the slurry into the tank. Fill the tank with water. Keep the agitator running until the tank is empty.

Check the acres covered per tank of material. If you find the application rate slightly high or low, either change the speed of travel slightly or adjust the pressure to obtain the correct application rate.

Maintenance of Application Equipment

Sprayers should be cleaned after each day's use.

1. Open the tank drain plug and hose down the inside of the tank.
2. Close the drain plug and put 50 gallons or so of water in the tank.
3. Remove and clean all nozzles and screens.
4. Run water through the system.
5. Replace all nozzles and screens.

To clean after using a herbicide:

1. Clean the system with a detergent (1 pound to 50 gallons of water) and rinse.
2. Fill the tank with a solution of one part household ammonia to 100 parts water.
3. Circulate for five minutes.
4. Run some through the nozzles.
5. Let stand six to 12 hours.
6. Spray out and then rinse the system with water.
7. Test on sensitive plant for positive test.

Read the instruction manual provided by the equipment manufacturer. Follow manufacturer's recommendations. Parts requiring frequent checking are: pressure gauges, nozzles, strainers and leaking connections. Pumps must be checked to make certain they have enough capacity to supply the nozzles and provide for agitation.

Record Keeping

Ohio Regulations require commercial applicators to keep accurate records of all applications of pesticides. However, such records should be kept by anyone applying pesticides. Their main use, with respect to equipment, is to assure that the desired quantity of material was applied. You should record:

1. Date of application
2. Location
3. Area treated in acres or square feet
4. Pesticide used—trade name and lot number—amount in pounds or gallons
5. Equipment used
6. If spraying, the number of tankfuls used
7. Swath width
8. Wind direction and velocity
9. Date of re-entry, if applicable

From this data you can determine actual application rates. The equipment can be adjusted to correct for things such as nozzle wear and changing characteristics of the material being applied. It is only through careful checking of equipment performance that proper application of pesticides can be obtained.

Appendix

Abbreviations

A.I.—active ingredient
A.I.A.—active ingredient per acre
EC or E—emulsifiable concentrate
F or L—flowable
GPA—gallons per acre
GPM—gallons per minute
MPH—miles per hour
PSI—Pounds per square inch
RPM—revolutions per minute
SP—soluble powder
WP or W—wettable powder

Weights and Measures

Length: 1 mile = 5,280 feet
1 mile = 320 rods
1 rod = 16.5 feet

Area: 1 acre = 43,560 sq. ft.
1 acre = 160 sq. rods

Weight: 1 pound = 16 ounces
1 gallon water = 8.34 pounds

Liquid Measure: 1 fluid ounce = 2 tablespoons
1 pint = 16 fluid ounces
2 pints = 1 quart
4 quarts = 1 gallon
1 gallon = 231 cubic inches

Speed: 1 mile per hour = 88 feet per minute

References

For equipment selection:
Aply Pesticides Correctly, A Guide for Commercial Applicators. USDA and USEPA.