CALIBRATING and MAINTAINING SPRAY EQUIPMENT

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Spraying insecticides on corn with three nozzles per row.

CALIBRATING AND MAINTAINING SPRAY EQUIPMENT

THE USE OF SPRAY EQUIPMENT for weed and insect control offers unlimited possibilities, particularly in the light of the rapid development of new chemicals. While as yet perfect control with chemicals cannot be expected, more and more cases are being found where they can be economically justified to supplement sound cultural practices. Sprayers cost less than many other farm machines and most of the chemicals are not expensive. These useful chemicals, however, are no better than the way they are applied. A poor application can easily cause damage that runs into thousands of dollars. Spraying for weed and insect control is a precision operation. It has tremendous potential for saving a crop or increasing yields, but misuse may completely ruin a crop.

To be precise and accurate, spray applications should meet the following conditions.

1. Nozzles should be selected to provide the proper particle size and application rate within the recommended range of pressures.

This corn was sprayed with 2,4-D at a rate higher than was recommended. (Fig. 1)

Urbana, Illinois September, 1961

Cooperative Extension Work in Agriculture and Home Economics: University of Illinois, College of Agriculture, and the United States Department of Agriculture cooperating. Louis B. Howard, *Director*. Acts approved by Congress May 8 and June 30, 1914.

2. The pressure should be regulated to give proper nozzle discharge rate and spray pattern.

3. The location of the nozzle should be such that the target area will be well covered with a minimum amount of spray escaping from that area and falling onto or drifting into undesired areas.

4. The ground speed should be regulated to apply the correct rate and should be kept uniform.

5. The application should be as economical as possible and still provide good control.

All these items except the last are important and closely related. A single variation from these requirements may give poor control or, much worse, extensive crop damage.

Selecting nozzles

Three types of nozzles are recommended for applying sprays to field crops in Illinois. They are the hollow cone, the flat-fan, and the flooding flat-fan types. The broadcast nozzle is sometimes used, but is more satisfactory for use on fence rows, pastures, and roadsides.

This corn row has been kept clean by band spraying with a pre-emergence chemical. (Fig. 2)

The hollow cone breaks up the spray into smaller droplets than does the flat-fan nozzle, thus giving more complete coverage of a sprayed surface. These smaller droplets, however, will cause more fogging and drifting (Fig. 3). Using a hollow cone nozzle is more desirable than using a flat-fan nozzle with some insecticides and most fungicides where more complete coverage of surfaces is needed and where some drifting is not necessarily a hazard.

The regular flat-fan nozzle produces a fairly coarse spray in a flat-fan pattern. The pattern overlaps and gives better distribution of spray than it is possible to get with the hollow cone. This nozzle gives very satisfactory results when used for applying most weed killers, either pre- or post-emergence, and for applying many insecticides. At the same gallonage and pressure, the spray has much less tendency to drift than spray from the hollow cone nozzle (Fig. 3).

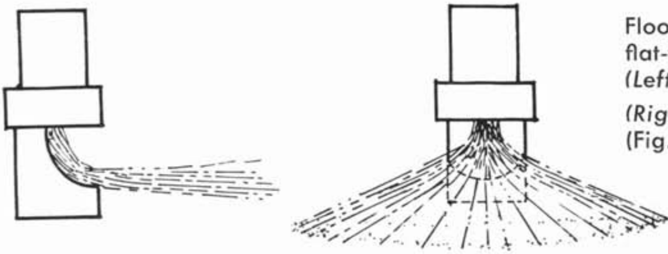
At low pressures, the flooding type flat-fan nozzle will produce a satisfactory distribution pattern that is very resistant to drifting (Fig. 4). Even at the same pressures, the spray has less tendency to drift than the spray from either the regular flat-fan or hollow cone nozzles. It is recommended for use in areas where damage from drift is likely to occur.

The broadcast nozzle provides wide coverage with a single nozzle. Under favorable conditions, it will cover up to 20 feet to one side or

(Left) Hollow cone nozzle.

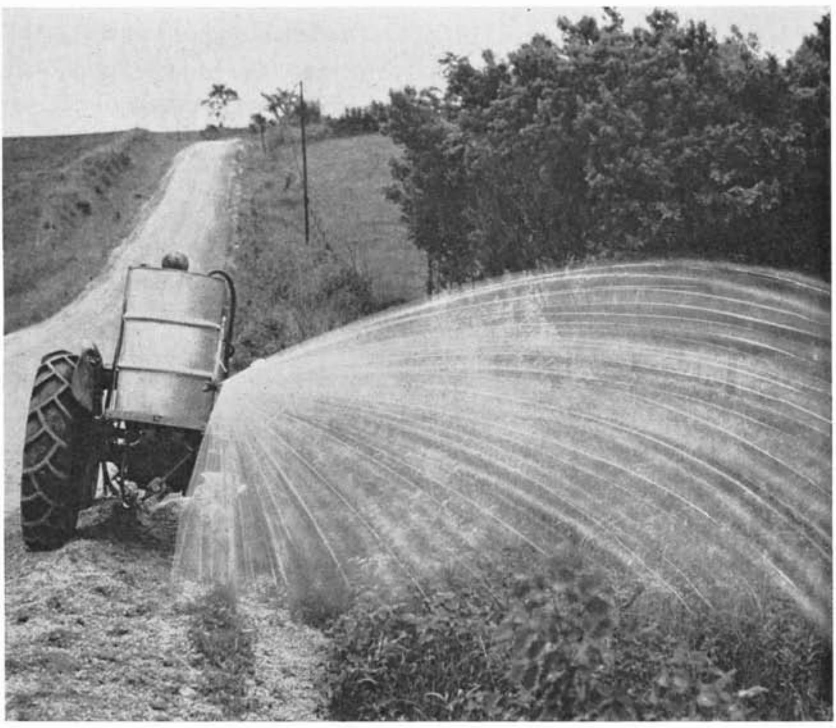
(Right) Regular flat-fan nozzle.

(Fig. 3)



Flooding type flat-fan nozzle. *(Left)* side view. *(Right)* front view. (Fig. 4)

up to 40 on both sides. The spray is much more affected by wind than is spray from nozzles placed along a spray boom (Fig. 5) and distribution across the swath is poorer. The nozzle produces small droplets under the nozzle but extremely large droplets at the outer end of the swath. Consequently the distance between droplets on the sprayed surface may be too great for complete control.



A broadcast nozzle works well on roadsides such as these, fence rows, and brushy pastures. (Fig. 5)

The broadcast nozzle can be used where increased amounts of pesticide can be used and where good surface coverage is not absolutely necessary. Therefore it is not recommended for field crops, but is suggested for spraying pastures, fence rows, and roadsides where obstructions make a boom undesirable (Fig. 5).

More information about the various types of nozzles is given in Table 1.

Most weed control chemicals and insecticides used to any large extent in Illinois do not require complete coverage of sprayed surfaces. The most desirable nozzle for field crops is usually the flat-fan nozzle used at a low pressure and with low outputs per minute. The combination of low pressures and low capacity flat-fan nozzles results in low application rates that permit spraying a maximum area with a minimum of solution and with little danger of drift. Even slight drifting of 2,4-D and other herbicides can cause damage to sensitive crops and ornamentals at fairly great distances so spraying on windy days is highly undesirable. Extensive drifting also causes a decrease in effectiveness of the spraying since the amount applied to the area needing treatment is reduced (Fig. 6).

In most cases pressures of 20 to 30 p.s.i. (pounds per square inch) are desirable, never over 40 p.s.i. for applying 2,4-D and other herbi-

Table 1. — Nozzle Types for Use on Field Crops

Type	*Suggested Use*	*Recommended Pressures*	*Types of Spray Pattern*
Hollow cone	Most insecticides and fungicides	60 p.s.i. and above; below 40 p.s.i. if used for weed control	Circular with light application in center; fine spray droplets
Flat fan	Pre-emergence and post-emergence herbicides; some insecticides	15–30 p.s.i., never over 40 p.s.i. for weed spraying	Fan-like pattern of medium droplets
Flooding flat	Pre-emergence and post-emergence herbicides where drift is hazardous	5–20 p.s.i. for maximum drift control; below 40 p.s.i. otherwise	Fan-like pattern of coarse droplets that are still numerous enough for weed control
Broadcast	Weed and brush control in pastures, fence rows, and along roadsides	10–30 p.s.i., never over 40 p.s.i.	Fan-like wide coverage with fine droplets under nozzle increasing to very coarse droplets at outer edge of 15–25 ft. pattern

High nozzle pressure is causing excessive atomization of the spray and drifting that will damage ornamentals in the area. (Fig. 6)

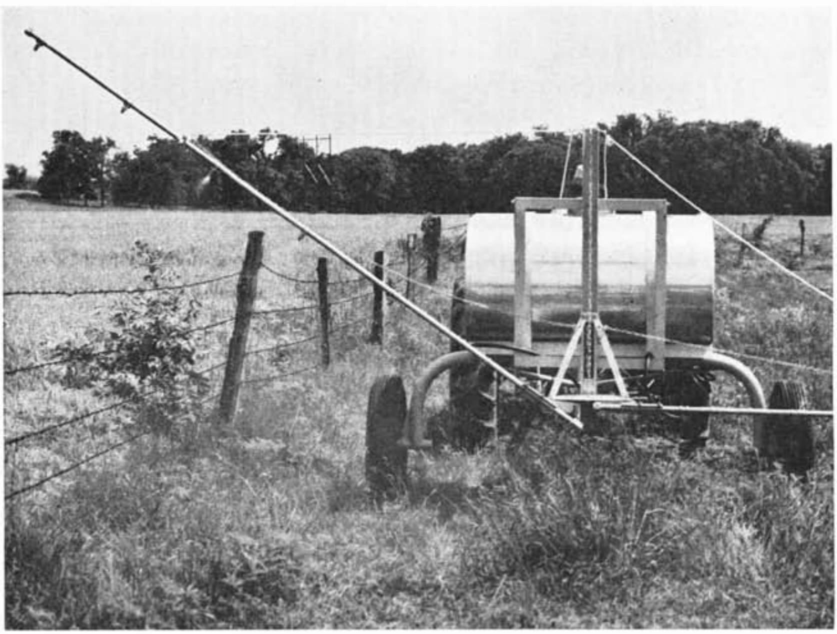
cides. Never use nozzles rated at less than 5 gallons per acre, because such small orifices will produce fine spray particles that will drift easily and the nozzles or nozzle screens will clog too often for practical use.

Regulating nozzle pressure

Within rather narrow limits, nozzle pressure can be regulated to vary the output of the sprayer. The lower pressure limit is the one that will give an adequate spread or fanning. The upper limit is normally 30 p.s.i. for weed spraying, but in nonsensitive crop areas it may be as high as 40 p.s.i., never over 40 p.s.i. For other types of spraying, where drift is not a problem and as long as wind does not affect delivery of the spray onto the plant or ground, higher pressures for obtaining finer droplets or for obtaining higher output can be used up to the limits set by the spray pump (Fig. 7).

WARNING: Do not operate at high nozzle pressures to compensate for selecting the wrong nozzle size. If your nozzle produces only half as much spray as you want at 30 p.s.i., you must increase the pressure on the nozzle to 120 p.s.i. to get the output you want. This increased pressure will produce so many small droplets that you will have little control over drift.

Using a hand gun with increased pressure to reach distant brush and weeds is practical where drift is not a problem. (Fig. 7)

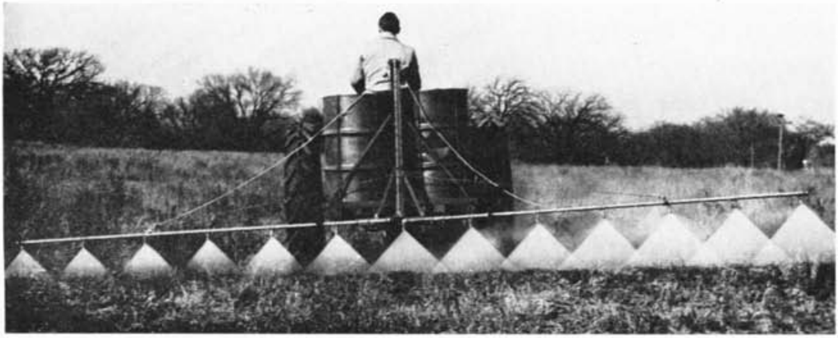


Raising one section of a boom to spray a fence row is satisfactory as long as the wind is low and susceptible crops are not nearby. (Fig. 8)

Location of nozzles

Proper location of nozzles depends on the type of spraying being done. Place nozzles with these two things in mind: (1) spraying a certain surface and no more; and (2) keeping the nozzle close to the surface; the farther away it is the more danger there is of drift away from the area.

Use a nozzle arrangement and nozzle distance from the area being sprayed that will give a good pattern. Increasing the distance encourages drifting (Fig. 9). In broadcast spraying with the normal 20-inch spacing of the nozzles, the height of the nozzles should be 12 to 16 inches above the ground or above the foliage as the case may be. For band spraying with the normal 13-inch band, the height of the nozzles should normally be about 8 inches. Always check nozzle patterns in the field.



On the left, this boom is too low; coverage is incomplete with gaps between nozzle patterns. The pattern of overlapping for the three center nozzles is correct. On the right, the boom is too high, giving improper coverage where the patterns overlap. Also, spray at this height is more likely to drift. (Fig. 9)

Ground speed

Higher ground speeds permit the use of nozzles with larger orifices to apply the same rates as would be applied at lower speed. Or, if the same nozzles and pressures are used, application rates are lower at the higher speed. Using the larger orifices will decrease the danger of drift and cut down on nozzle clogging. Speeds of 3 to 8 miles per hour are reasonable, depending on field conditions, but speeds of more than 8 miles per hour may cause parts of the sprayer to break or the bouncing of the sprayer may cause gaps in the pattern. Once nozzle spacing, size, and pressure have been selected, the only major factor left for changing rate of application is ground speed. A change in ground speed changes the rate of application much faster than does a change in nozzle pressure. For instance, spraying at 6 miles an hour instead of at 3 miles an hour with nozzles of the same size, spacing, and pressure will cut the rate of application in half.

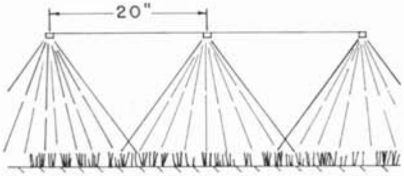
Economical pest control

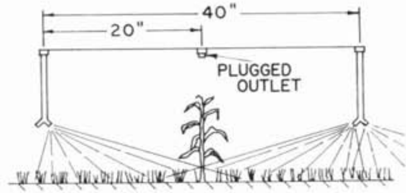
Economical pest control means using only enough chemical to control the pest without damaging susceptible crops or animals. By not using too much, you may not only save on cost, but may also save your crop; this is especially true of herbicides. The chemicals approved for field use are highly selective and entirely safe when used at the rates recommended. When used at higher rates, however, they lose their selectivity and may very well kill not only your pests, but your crop.

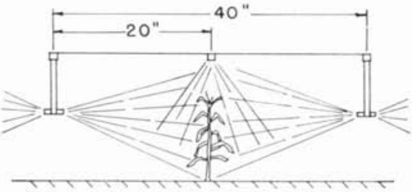
Sprayer calibration

Most sprayers are equipped with nozzle outlets spaced on 20-inch centers along the boom (Fig. 10). If drops are used for weed spraying, every other nozzle outlet is plugged and two nozzles per drop used. In effect this means that you can consider that you are using a 20-inch nozzle spacing when spraying broadcast or when using drops for weed control in 40-inch rows. For insect control in row crops, if drops are used in every other boom outlet and a nozzle is used above the row, three nozzles per 40-inch row give an apparent nozzle spacing of 13⅓ inches (Fig. 10). (For calculations, use 13 inches.)

If 20-inch nozzle spacing is considered standard, the volume of spray applied per acre depends only on nozzle output and ground speed. For post-emergence weed control, not less than 5 or more than 10 gallons per acre is normally applied. Pre-emergence weed control and field spraying for insects rarely call for more than 20 gallons per acre. Table 2 was prepared for this range of gallonages per acre and for a reasonable range of ground speeds.







(Top left) 20-inch spacing for broadcast spraying of weeds or insects. *(Top right)* two nozzles for spraying crops in 40-inch rows; every other outlet plugged. *(Bottom left)* three nozzles for spraying insecticides in 40-inch row crops. (Fig. 10)

Use of Table 2

The nozzle outputs for each combination of ground speeds and gallonages per acre are given in both gallons per minute and ounces per minute. The ounces-per-minute figure is much more convenient for calibrating nozzles than the gallons-per-minute figure, but the gallons-per-minute figure is useful for selecting nozzles.

Table 2 can be used in many ways. One way is to find what gallonage per acre you would apply if you set your pressure to produce a given output and you wished to travel at a given speed. For instance, suppose you set your pressure at 15 p.s.i. to minimize drift. At this point you measure output and find each nozzle sprays 15 ounces per minute. A quart measuring jar (such as is used for mixing baby formula) marked in ounces is excellent for measuring nozzle output (Fig. 11). Then, following directions for using Table 5, you go to the field and try operating the tractor at various speeds. From using the tables, you find that the best speed is 6 miles an hour with the tractor operated in a higher gear and the throttle partially closed.

Now you find that at this speed you would apply 6 gallons per acre with an output of 15.5 ounces per minute. Since at this pressure and speed, your nozzles spray 15 ounces per minute, you could increase pressure slightly to get 15.5 ounces per minute, or you could close the throttle slightly to decrease speed and apply exactly 6 gallons per acre. Or, since the error would be slight, you could mix the

Table 2. — Nozzle Outputs; 20-inch Nozzle Spacing

Output	Ground speed, miles per hour					
	3	4	5	6	7	8
			5 gallons per acre			
Gallons per minute	.05	.067	.084	.101	.118	.135
Ounces per minute	6.4	8.6	10.8	12.9	15.1	17.2
			6 gallons per acre			
Gallons per minute	.06	.081	.101	.121	.141	.162
Ounces per minute	7.8	10.3	12.9	15.5	18.1	20.6
			7 gallons per acre			
Gallons per minute	.071	.094	.118	.141	.165	.189
Ounces per minute	9.0	12.1	15.1	18.1	21.1	24.2
			8 gallons per acre			
Gallons per minute	.081	.108	.135	.162	.189	.216
Ounces per minute	10.3	13.8	17.2	20.7	24.1	27.6
			9 gallons per acre			
Gallons per minute	.091	.121	.152	.182	.212	.242
Ounces per minute	11.6	15.5	19.4	23.3	27.1	31.0
			10 gallons per acre			
Gallons per minute	.101	.135	.168	.202	.236	.269
Ounces per minute	12.9	17.2	21.5	25.9	30.1	34.4
			15 gallons per acre			
Gallons per minute	.152	.202	.253	.303	.354	.404
Ounces per minute	19.4	25.9	32.3	38.8	45.2	51.8
			20 gallons per acre			
Gallons per minute	.202	.269	.337	.404	.472	.538
Ounces per minute	25.9	34.5	43.1	51.8	60.2	69.0

material for a 6 gallon per acre application rate without changing either pressure or speed.

You can also use Table 2 for selecting the proper ground speed when operating at a given nozzle pressure and output. Suppose you want to spray at 30 p.s.i. At this pressure, your nozzles produce an output of 15 ounces per minute. By looking in the various columns of Table 2, you find you can put on 5 gallons per acre at 7 miles per hour, slightly less than 6 gallons per acre at 6 miles per hour, or 7 gallons per acre at 5 miles per hour. The speed you select should depend on the roughness of the ground and the speeds you can get from your tractor or self-propelled sprayer. If you select 5 miles per hour and adjust the machine speed accordingly, you will put on 7 gallons per acre.

You can use Table 2 for selecting a new set of nozzles. Suppose

Using a quart measuring jar to determine the output of a nozzle in ounces per minute. (Fig. 11)

that you want a set of flat-fan nozzles to apply 5 to 10 gallons per acre and your ground speed can be varied from 4 to 7 miles per hour. Your lowest speed will put on the highest rate. At 4 miles per hour and the desired 10 gallons an acre, you need an output of 0.135 gallon per minute; at 7 miles per hour and 5 gallons per acre, you need an output of 0.118 gallon per minute (Table 2). A nozzle having an output of 0.118 gallon per minute at 15 p.s.i. will also produce the 0.135 gallon per minute needed to apply 10 gallons per acre at less than 40 p.s.i. Such a nozzle will be satisfactory for applying 5 to 10 gallons per acre at speeds from 4 to 7 miles per hour.

Use of Table 3

After determining the nozzle pressure, speed, and gallons per acre that you will be using, you must prepare the proper amount of pesticide in the proper strength.

Table 3 can be used to determine how many acres you can spray per tankful once gallonage per acre is known. If only a small acreage is to be sprayed, Table 3 can be used to determine how much solution to prepare.

Suppose you intend to apply 7 gallons per acre and the capacity of your tank is 150 gallons. Go to Table 3 and find the 7 gallon-per-acre line (left side of page) and then the 150 gallon column (top, third from the right). There you will find that at 7 gallons per acre 150 gallons will spray 21.4 acres. If you have less acreage

Table 3. — Acres Sprayed per Tankful

Gallons per acre	Acres per tankful for various tank capacities, gallons									
	30	50	55	60	75	100	110	150	200	500
5	6.0	10	11	12	15	20	22	30	40	100
6	5.0	8.3	9.2	10	12.5	16.7	18.3	25	33.3	83.3
7	4.3	7.1	7.9	8.6	10.7	14.3	15.7	21.4	28.6	71.4
8	3.8	6.3	6.9	7.5	9.4	12.5	13.7	18.8	25.0	62.5
9	3.3	5.6	6.1	6.7	8.3	11.1	12.2	16.7	22.2	55.6
10	3.0	5.0	5.5	6.0	7.5	10.0	11.0	15.0	20.0	50.0
15	2.0	3.3	3.7	4.0	5.0	6.7	7.3	10.0	13.3	33.3
20	1.5	2.5	2.8	3.0	3.8	5.0	5.5	7.5	10.0	25.0

To find from this table acreage actually covered when band spraying, apply the following formula:

$$\text{crop acres band sprayed} = \frac{\text{acres per tankful} \times \text{row width (inches)}}{\text{width of band (inches)}}$$

to spray, say 15 acres, look across the 7-gallons-per-acre column; there you will find that you need an amount halfway between 100 and 110 gallons, so you put enough pesticide in the tank for 15 acres and add enough liquid to make 105 gallons. If you want to be sure you have enough spray and if the chemical is fairly inexpensive (for instance 2,4-D) you can make up 110 gallons of solution.

Your tank should be marked for every 5 gallons of solution or you should have a stick marked at 5-gallon intervals (Fig. 13, back cover) so the amount of solution to be added or remaining to be sprayed can be easily determined.

Use of Table 4

After you know how many acres you can spray with the amount of solution the tank holds, you can find out how much chemical you will need to use from Table 4. If you can spray 20 acres with a tank of solution and you are to apply 1 pound of active ingredient per acre, you will have to add 20 pounds of active ingredient to the tank. If the chemical has 2.33 pounds of active ingredient per gallon, go to the column on the extreme left in Table 4 and find 20.0; then go to the top of the table and find the 2.33 pounds of active-ingredient-per-gallon column. Read from the top down to the line opposite the 20.0 pound figure. This shows you will need to add 34 quarts and 9 ounces to the tank.

If you are going to spray 15 acres at the rate of one-half pound

Table 4. — Quarts of Pesticide per Tankful

Pounds of active ingredients to be added to the tank	Active ingredients — pounds per gallon													
	2	2.33		2.5		3		3.5		4	5		6	
	qt.	qt.	oz.	qt.	oz.	qt.	oz.	qt.	oz.	qt.	qt.	oz.	qt.	oz.
0.5	1		27.5		26		22		18	0.5		13		11
1.0	2	1	23	1	19	1	11	1	5	1		26		21
2.0	4	3	14	3	6	2	22	2	9	2	1	19	1	11
3.0	6	5	5	4	26	4		3	14	3	2	13	2	0
4.0	8	6	28	6	12	5	11	4	18	4	3	6	2	22
5.0	10	8	18	8	0	6	22	5	23	5	4	0	3	11
10.0	20	17	5	16	0	12	11	11	14	10	8	0	6	21
20.0	40	34	9	32	0	26	22	22	28	20	16	0	13	11
40.0	80	68	18	64	0	53	11	45	23	40	32	0	26	22
60.0	120	102	27	96	0	80	0	68	19	60	48	0	40	

of active ingredient per acre, you will have to add 7.5 pounds of active ingredient to the tank. If the chemical has 4 pounds of active ingredient per gallon, go to the column on the extreme left and find the combination of numbers that adds up to 7.5 pounds of active ingredient. In this case, 0.5, 2.0, and 5 pounds. Then go to the top of the table and find the 4-pounds-of-active-ingredient-per-gallon column and add the numbers in this column that correspond to 0.5, 2.0, and 5 pounds of active ingredient per gallon. In this instance, 0.5 quarts, 2 quarts, and 5 quarts that, added up, means you add 7 quarts and 16 ounces of chemical to enough water to spray 15 acres.

In the same way, this table can be used to find out how much chemical to use for any number of pounds of active ingredient.

Use of Table 5

To use Table 5 properly, you should stake out, preferably in the field, 88 feet for slow speeds and 176 feet for fast speeds. Then with the rig up to speed before you pass the first stake and kept there until you pass the second, find how many seconds it takes to go between the two. (Use a watch with a second hand or a stop watch.) When you find the proper speed, mark the throttle setting so that you can easily duplicate it. You can use the table to convert time in seconds to miles per hour.

Table 5. — Finding Ground Speed From Time Required to Travel a Set Distance

Distance, feet	88	88	88	176	176	176
Time, seconds	20	15	12	20	17	15
Ground speed, miles per hour	3	4	5	6	7	8

Sprayer maintenance

Most trouble with sprayers can be traced to foreign matter that clogs nozzles or strainers or even wears out pumps. Here are some suggestions for avoiding maintenance problems and prolonging the life of your sprayer.

1. Use only clean water. As a rule of thumb, use only water that looks clean enough to drink. Even tiny particles, such as are often found in water from ponds or a watering trough, can easily clog a nozzle screen. Some of these screens have as many as 40,000 openings per square inch. Take the water directly from a well if possible. If in doubt, filter the water as you fill the sprayer tank.

2. Do not permanently remove the screens from the sprayer. A sprayer will normally contain screens at three locations. One is a coarse screen on the end of the suction hose. Another is in the line between the pump and boom. The third and finest screen is in the nozzle. The nozzle screens should not normally be finer than 100 mesh. In most cases 200-mesh screens have much smaller openings than the nozzle orifice, which is not necessary or desirable. The screens should remain in the sprayer at all times with one possible exception. The exception is removing the screens when wettable powders are used. It is very difficult to keep wettable powders in 100-percent suspension and therefore they sometimes cause an excess amount of clogging of the nozzle screens. Otherwise you are more likely to get proper spray patterns and outputs by using all the screens.

3. Never use a metal object for cleaning nozzles. Always remove the nozzle and clean out the dirt. Do not try to pick it out with a pin or knife. The nozzle orifice is precisely made to extremely close tolerances. One thrust of a hard metallic object will completely ruin the orifice.

4. Flush new sprayers before you use them. Unless properly cleaned, new sprayers will invariably clog. The reason is that the sprayer contains a large quantity of metal chips and dirt from the manufacturing process. Remove the nozzles and flush the sprayer and booms with clean water. Dismantle each nozzle and give it a thorough cleaning. Also check and clean the screens to remove all foreign particles completely.

5. With 2,4-D, use separate barrels or tanks if possible. One of the biggest problems in spraying is contamination from 2,4-D. Just rinsing a sprayer with water will not remove 2,4-D residues. These residues are worse in the sprayer tank than in the other parts of the sprayer. A simple solution on some sprayers is to use separate barrels when you spray with 2,4-D.

6. Clean the sprayer thoroughly after each period of use. When you change chemicals, it is often necessary to remove all residues completely. There are many reasons for this. The primary one is the removal of contamination that may cause damage. For example, spraying a legume crop to control insects after the sprayer has been used for applying 2,4-D may seriously damage the legume crop unless the sprayer has been thoroughly cleaned. In other cases there may be a reaction between chemicals that causes loss of effectiveness. Agents in emulsions may react with chemicals in wettable powders and cause loss of effectiveness or coagulation. When you are changing chemicals, especially from herbicides such as 2,4-D to other chemicals, the following procedure for cleaning sprayers is recommended.

(a) Remove and clean all screens and boom extensions with kerosene and a small brush.

(b) Mix one box of detergent with 30 gallons of water in the tank. Circulate through by-pass for 30 minutes; then drain.

(c) Replace the screens and boom extensions.

(d) Fill the tank one-third to one-half full with one part of household ammonia to 49 parts of water. Circulate this mixture through the pump and by-pass, allowing a small amount to go out through the nozzles. Let the remainder of the solution stand over night, and then run it out through the nozzles.

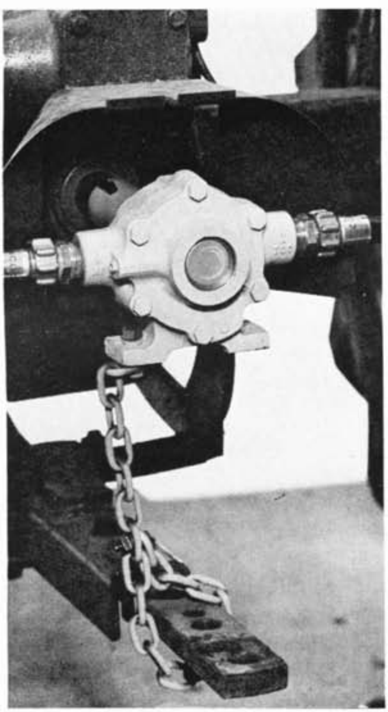
(e) Flush with two tankfuls of clean water by spraying through the boom with the nozzles removed.

7. Do not lock pump solid to the tractor. Most power take-off pumps should be held with a chain to prevent rotation. Locking the pump solid with a metal bar usually results in misalignment of the bearing and consequently a short life for the pump (Fig. 12).

8. Prolong the life of the pump with proper care. Little damage will occur to the pump while it is in use. Water actually lubricates the working parts of the pump and prevents wear unless the water contains abrasive material. When the pump is not in use, store it in a dry place with the pump full of a light oil. Pumps so protected should last for years. If pumps have a grease fitting, lubricate them moderately from time to time. Overlubrication can break seals causing leakage.

9. Do not use corrosive fertilizer solutions in ordinary sprayers. Liquid fertilizers are very corrosive to copper, galvanized surfaces, brass, bronze, and steel. Just one use of a liquid fertilizer can completely ruin an ordinary sprayer. Sprayers made completely of stainless steel or aluminum are available for applying liquid fertilizers. Aluminum is satisfactory for liquid nitrogen but not mixed liquid fertilizers.

10. Off season storage of sprayers is important. To prevent accumulation of corrosion or dirt particles, remove screens and nozzles and store them in light motor oil. Store sprayer booms and hoses in a cool, dry location.



Using a short chain to prevent turning of the pump casing. (Fig. 12)

For tanks not marked at 5-gallon intervals, use a stick calibrated at 5-gallon intervals to find out how much solution is left in the tank. (Fig. 13)

HOW TO AVOID SPRAY DAMAGE

1. Use only low-volatile esters or amines of 2,4-D and 2,4,5-T. Do not spray with 2,4-D and 2,4,5-T within one-half mile of tomato plants or grape vineyards.

2. Read the label on the chemical container and follow directions carefully and specifically.

3. To keep the particles large, use just enough pressure to produce a proper spray pattern.

4. Keep the nozzles close to the ground by using wide fan-angle nozzles. Use a single overlap of nozzle patterns.

5. Spray at the rate of at least 5 gallons to the acre and at as high a ground speed as is reasonable and safe.

6. Spray early in the morning, late in the evening, and at other times when there is little or no wind. If in doubt, don't spray.

This circular was prepared by B. J. Butler, Assistant Professor of Agricultural Engineering, and Wendell Bowers, Associate Professor of Agricultural Engineering.

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