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Guidelines for Using Pipewick and Other Selective Applicators*

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The use of selective applicators is being rapidly adopted by farmers to supplement their weed control programs. A low-cost method of removing tall, escaped weeds from short stature crops, selective application is also environmentally appealing since the herbicide is applied only to the target weeds and thus only small amounts of herbicides are used.

The concept of selective herbicide application was discovered several years ago but found little practical use until the development of Roundup (glyphosate). Short-lived in the environment, this herbicide is very active and kills most plants it contacts. Since it is rapidly translocated, it is useful for controlling both annual and perennial weeds.

Selective applicators place the herbicide on tall weeds growing in short crops without contacting the crop itself. Although registration for use of Roundup in selective applicators is currently restricted to soybeans and cotton (April 1981), excellent potential exists for its use in grain sorghum, dry beans, potatoes and range and pastureland.

Annual weed species that can be controlled with this type of application include volunteer corn, shattercane, common sunflower and velvetleaf. Perennial weeds, such as common milkweed, hemp dogbane, Jerusalem artichoke and several species of thistle, can also be suppressed or controlled with selective applications of Roundup.

Weeds must be at least 10 inches (25 cm) taller than the crop before adequate herbicide coverage can be obtained with selective applicators without injurying the crop. Because of this, weeds compete with crop plants for four to eight weeks before the adequate height differential is obtained. Substantial yield losses may result if dense weed populations are allowed to develop before they can be controlled with selective applicators. Therefore, selective applicators should be used to supplement, rather than replace, other weed control practices.

*Evaluation and improvement of these applicators was made possible by a grant from the Nebraska Soybean Development, Utilization and Marketing Board.

Types of Applicators

Three basic types of applicators are available — ropewicks, recirculating sprayers (RCS) and carpeted rollers.

Ropewick applicators are available in several designs *(Figure 1)*. The herbicide solution is transferred from a reservoir to the weeds via ropes. As weeds come into contact with the ropes, the herbicide solution is wiped onto them. Most ropewick units are relatively simple in design, have few or no moving parts and have no nozzles to plug.

The simplest ropewick unit is the pipewick *(Figure 1a)*. For most uses it provides adequate results with minimal investment in equipment. The major advantages of a pipewick as compared to other ropewick applicators are its ease of construction with inexpensive, readily available materials and its ease of operation. The pipewick also requires the least amount of herbicide of any ropewick to wet the ropes. For information on constructing a pipewick applicator, see Extension Folder 606-1981, "Guidelines for Constructing a Pipewick Applicator."

Disadvantages of pipewicks include: the wicking action of the ropes may dispense the herbicide too slowly to give good coverage in dense stands; there is limited control of the wicking rate; two passes may be necessary in dense stands or for hard-to-control weeds; and the glue that secures the ropes into the pipe may break loose, causing dripping, loss of chemical and crop injury.

The Bobar applicator has a series of ropes positioned at a 14 degree angle inside a metal framework *(Figure 1b)*. The reservoir tank can be raised or lowered to help control the wicking rate.

The Wedgewick unit is a pressurized ropewick with ropes extending in a "V" in front of the frame *(Figure 1c)*. The framework serves as a reservoir for compressed air to pressurize the chemical reservoir which is attached to the frame. A pressure regulator can be adjusted to help control the flow of herbicide. The ability to control wicking and improve coverage with a pressurized system may offer some advantages over the pipewick. The "V"

shaped design may also give more rope contact with the weeds.

The major disadvantages of the Wedgewick and Bobar are the initial cost of the equipment and the herbicide solution may drip from the ropes and fittings. Also, large weeds may catch on the ropes and pull them off, resulting in the loss of the costly herbicide solution. This is particularly true of Wedgewick.

Recirculating sprayers (RCS) were the first selective applicators to be developed. With this system, solid spray streams are directed horizontally from each nozzle above the crop onto a collection mat. As weeds pass through the spray streams, herbicide is deposited on them. Material not intercepted by the weeds strikes the mat, drains into a collection basin and is then recirculated through the system *(Figure 2)*.

An antifoaming agent is needed when using Roundup in RCS units. A drift control agent also helps reduce fine spray particles that may drift and cause crop injury.

The major advantage of the RCS is that the solution is sprayed onto the weeds. This normally results in good herbicide coverage even in dense weed stands. Disadvantages associated with the RCS are high initial investment costs, contamination of spray solution with dust and debris, nozzle plugging, and a relatively high probability of crop injury due to splashing and drift of the herbicide.

Roller applicators consist of a steel drum covered with nylon carpet *(Figure 3)*. Herbicide solution is pumped from the supply tank and sprayed onto the carpet as the drum rotates at 20-60 rpm. Electronic sensors are available on some models to aid in automatically controlling the carpet wetness.

The carpet is normally operated at approximately 50 percent saturation. The degree of saturation can be assessed by pressing an object lightly against the carpet as the drum is turning. When solution drips from the object, the carpet is at approximately 50 percent saturation and ready to use. The roller must rotate continuously after wetting since the herbicide solution will drain off the carpet if rotation stops. As weeds pass under the roller, herbicide solution is wiped onto them.

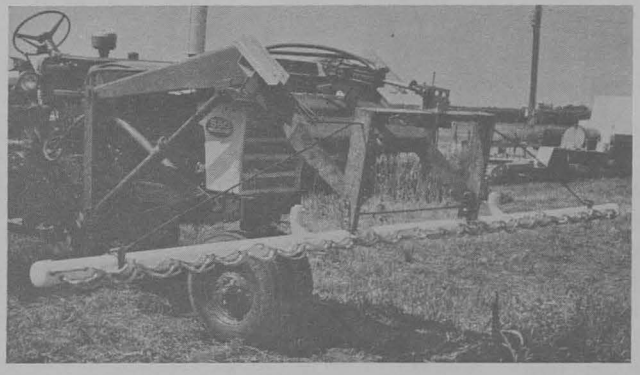
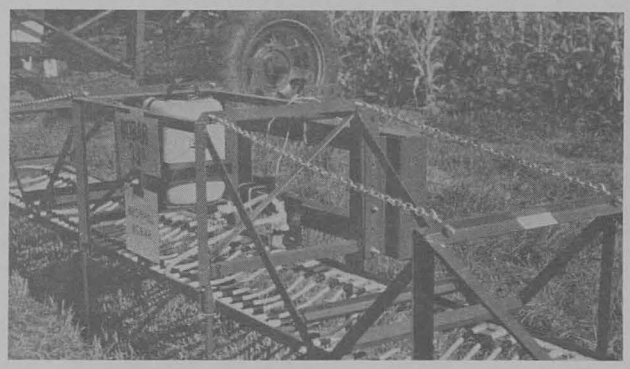
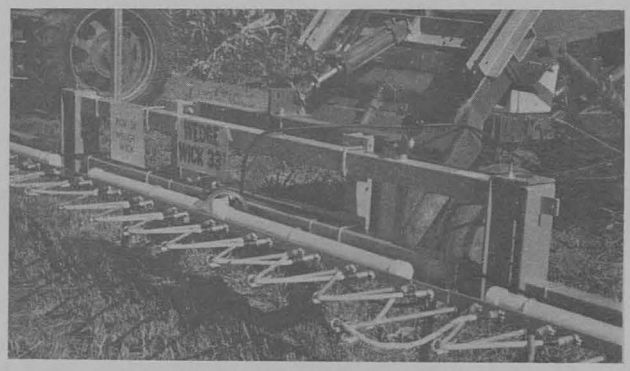


Figure 1. Three types of ropewick applicators.

a) Pipewick



b) Bobar



c) Wedgewick

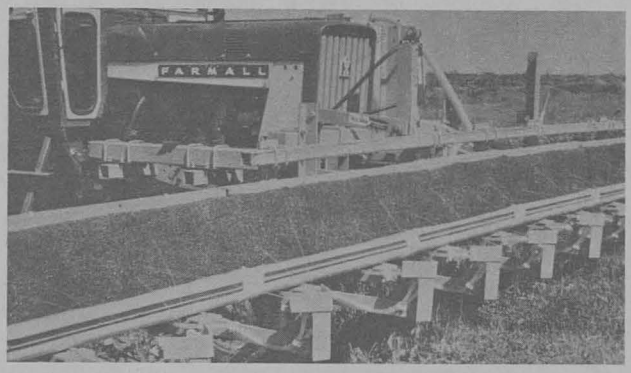


Figure 2. A recirculating sprayer.

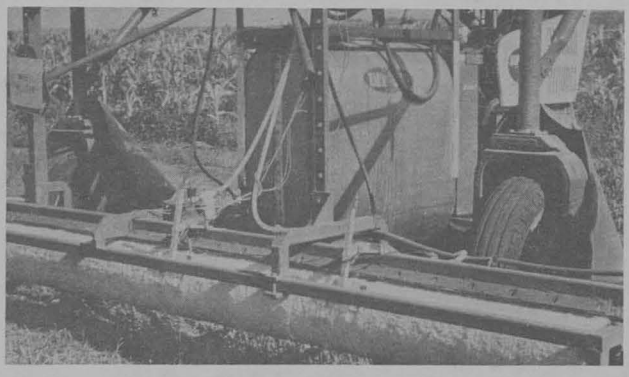


Figure 3. A roller applicator.

Even in dense weed stands, good herbicide coverage can normally be achieved with this system if proper saturation is maintained. Other advantages include no contamination of herbicide solution in the supply tank, no herbicide drift and minimal crop injury.

The major disadvantages of roller applicators are high initial cost and the large quantity of herbicide wasted when the unit is shut down. Before each use, the carpet must be saturated with about 5 gallons (19 l) of herbicide solution. When the drum stops rotating, this solution drains off the carpet.

Herbicide Concentration

The concentration of herbicide used varies with the application equipment *(Table 1)*. The RCS units are normally operated with 2 1/2 to 5 percent Roundup solution. The lesser concentration is adequate for volunteer corn or shattercane, but the higher concentration should be used for perennial or annual broadleaf weeds.

Table 1. Concentrations of Roundup for different selective applicators.

Applicator	*Roundup: Water**	*Percent Concentration*
RCS	1:39	2 1/2
	1:19	5
Roller	1:19	5
	1:9	10
Ropewicks	1:5	16 2/3
	1:2	33 1/3

* Units of Roundup and units of water used to give the herbicide concentration listed.

The roller applicator is operated with 5 to 10 percent Roundup solution. As with the RCS unit, the higher concentration should be used for perennial or annual broadleaf weeds.

Ropewick applicators are normally operated with 33 1/3 percent Roundup solution. In laboratory tests at the University of Nebraska on the effects of herbicide concentration on wicking rate of 1/2-inch (1.3 cm) diameter solid braid nylon rope, the wicking rate of the 16 2/3 percent solution was nearly twice as fast as the 33 1/3 percent solution *(Table 2)*. Thus, both concentrations results in nearly the same amount of herbicide wicked per time unit. Concentrations greater than 33 1/3 percent wicked very slowly and are not recommended. Concentrations less than 16 2/3 percent are also not recommended because they may reduce the amount of Roundup applied, and cause rapid wicking and excessive dripping *(Table 2)*.

Farmers can take advantage of these differences in wicking rates to help control flow rate. If a particular concentration wicks too rapidly, the concentration can be increased. Conversely, if faster wicking is desired, the concentration of herbicide can be reduced.

Table 2. Effects of Roundup concentration on wicking rate of solid braid nylon rope.

Percent Concentration	*Relative Wicking Rate**
66 2/3	11
50	12
33 1/3	33
16 2/3	63
8 1/3	73

* Relative Wicking Rate equals the wicking rate of the herbicide solution divided by the wicking rate of water. The larger the number, the faster the wicking action.

Field studies with various selective applicators using Roundup on broadleaf weeds have resulted in less than ideal control. Because of this, interest has developed in using 2,4-D in combination with Roundup to attempt to improve control of broadleaf weeds, especially common sunflower and velvetleaf. Research has generally indicated that the addition of either the amine or the ester formulation of 2,4-D to Roundup did not improve control. In some cases, less control of velvetleaf and shattercane resulted from the combination as compared to 33 1/3 percent Roundup used alone.

Laboratory studies indicate that the wicking rates of 33 1/3 percent 2,4-D amine (alkanolamine) or 2,4-D ester (propylene glycol butyl ether ester) solutions were about 65 and 15 percent, respectively, of the rate for a 33 1/3 percent Roundup solution. Therefore, 2,4-D does not appear to be beneficial and *is not recommended.*

Reusing Roundup Solutions

It is difficult to predict the amount of solution needed to treat an area, and some herbicide solution may be left in the unit after completing the job. Although Roundup can be degraded rapidly by microorganisms and inactivated by organic material and soil, the Roundup solution used in pipewick applicators can be saved for reuse. The material should be stored in properly labeled original containers. *Do not use galvanized containers* as Roundup reacts with the zinc in galvanizing and produces highly explosive hydrogen gas.

Some loss in activity may occur if Roundup is stored for several days, but this loss will usually not greatly affect performance. The best policy is to mix up no more than will be used in a few days. If reasonable care is taken to keep the Roundup solution clean while filling and draining the applicator, its reuse should not be a problem with pipewick applicators.

Water quality has also been shown to affect Roundup performance. However, since Roundup concentration used in ropewick applicators is relatively high (33 1/3 percent), water quality should not be a major factor. It would be more of a factor with RCS or roller applicators, which use lower Roundup concentrations.

Factors to Consider

The solution level in the pipewick and the location of the ropes in the pipe affect the wicking rate. Studies were conducted to determine the differences in wicking rate of three kinds of ropes at two levels in a pipewick applicator. The fluid level was maintained approximately midway between the two rows of ropes (pipe approximately half full), and the rows of ropes were approximately one inch (2.5 cm) apart.

The ropes in the bottom row of the pipe wicked two and a half to three times faster than those in the upper row *(Table 3)*. This difference was caused by the fluid pressure on the bottom row of ropes. The top row had no pressure on it; movement through the rope was completely by wicking. Therefore, if increased wicking is necessary, raising the level of the solution in the applicator will give faster wicking. Conversely, if wicking is too fast, the fluid level can be lowered. It is suggested that the pipe be filled about half full to start with—more solution can be added if needed to increase wicking. If satisfactory wicking can be obtained with the pipe half full, chemical cost can be reduced. One gallon (3.8 l) will normally treat 10 to 100 acres (4 to 40 ha).

Table 3. Effects of type of rope and location in a pipewick applicator on wicking rate of 33 1/3% Roundup.

*Rope**	*Location in Pipe*	
	Top	*Bottom*
	ml/hr	
Wellington Puritan	9	28
Gulf-Peppermint	50	128
Gulf-Pistachio	127	297

* Wellington Puritan 1/2" (1.3 cm) solid braid nylon, Cat. No. G-1032. Gulf Rope and Cordage Company Peppermint is 1/2" (1.3 cm) solid braid nylon; Pistachio is 1/2" (1.3 cm) diamond braid polyester covering over an acrylic core.

The type of rope also affects wicking rates *(Table 3)*. The Peppermint rope wicked nearly five times faster than the Wellington rope, and the Pistachio rope wicked nearly two and a half times faster than Peppermint. Although it has not been field tested in our trials, we feel the Peppermint rope offers some advantages where improved wicking is desirable. This rope may help reduce the need for two passes with the pipewick and may also improve broadleaf weed control. The Pistachio rope will probably wick too rapidly and cause excessive dripping in most cases.

The Wellington Puritan solid braid nylon rope has given relatively satisfactory results, especially for control of shattercane and volunteer corn. This rope may be preferred where reduced wicking is desirable, such as in grain sorghum should Roundup be registered in this crop.

Attaching the applicator to a height adjustable framework is necessary to prevent crop injury and to allow the maximum number of weeds to be treated. As the applicator moves across the field, the operator can keep the unit as close as possible to the crop canopy without contacting it. A front mounting gives the operator maximum visibility and helps to prevent dust created by implement tires from collecting on the applicator.

Groundspeed of the applicators can vary depending upon weed density, height differential between crop and weeds, the uniformities of the crop and of the terrain, and the rate of wicking in the case of ropewick units. However, a groundspeed of 4 to 5 mph (6.4 to 8.1 km) is a practical speed since this allows the operator to make necessary height adjustments with minimal crop injury. With ropewick applicators, groundspeed should be reduced in heavy weed patches to allow the ropes time to recharge with herbicide.

With annual broadleaf weeds, perennial weeds or where weed populations are heavy, a second pass with the pipewick applicator may be necessary for good control. This may also be true of other applicators as it is nearly impossible to contact all weeds with one application. Some weeds may be too small to treat with the first pass and a second pass 10 to 14 days later may be necessary. Weeds in clumps, such as volunteer corn, may require a second pass in the opposite direction as the plants first contacted in the clump may protect those on the back side of the clump.

Care of Ropewick and Other Applicators

To maintain the pipewick unit, it is advisable to rinse the ropes and fill the unit with water after each use, allowing the water to wick through the ropes. This will help keep the ropes clean. The RCS and roller units should be flushed out after use, and any unused solution properly stored in labeled containers.

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