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Guidelines for Constructing A Pipewick Applicator*

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The use of selective applicators to control tall weeds in shorter crops is rapidly being adopted as a new weed control method. Effective use of this system requires that weeds be at least 10 inches (25 cm) taller than the crop. Roundup (glyphosate), a non-selective herbicide, is normally used and must be applied without contacting the crop. At present, the use of selective applicators allows weeds to compete with the crop for about 60 days in order to attain the required height differential. Since serious yield reductions could result if dense weed populations occur, selective applicators should be viewed as a method to supplement, rather than to replace, other chemical and cultural weed control methods.

Several types of applicators have been developed for selective herbicide applications. Among them are recirculating sprayers, roller applicators and rope-wick applicators, which involve the wicking action of ropes.

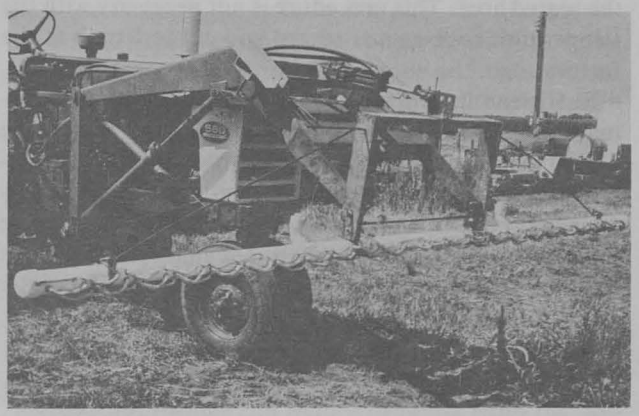


Figure 1. Completed and mounted pipewick applicator.

The simplest ropewick applicator, the pipewick, consists of a series of ropes that are placed in polyvinyl chloride (PVC) pipe. The ropes transfer the herbicide from the pipe reservoir onto the weeds by wicking action.

The pipewick, an easily constructed, low-cost and non-pressurized system with no moving parts, has performed satisfactorily. Following are instructions for constructing a pipewick applicator. For information on the use of selective applicators, including the pipewick, refer to Extension Folder 607—1981, "Guidelines for Using Pipewick and Other Selected Applicators."

The Pipe

The pipe that serves as the chemical reservoir is 3-inch (7.6 cm) diameter PVC Schedule 40 (1120) tubing commonly used in sewer and drain installations. This pipe is tan in color; black ABS pipe is not recommended because it absorbs heat from the sun and may pressurize the system.

Although the length of pipe may vary, the maximum should be 20 feet (6.1 m). On uneven terrain, a longer applicator increases the chances of dipping one end into the crop canopy, resulting in serious crop injury. Also, longer pipes may tend to sag from the weight of the solution, making it difficult to maintain uniform chemical distribution in the pipe and proper height above the crop canopy.

Pipe lengths should be approximately 12 inches (30 cm) longer than necessary to cover a prescribed number of rows. For example, a 16-foot (4.9 m) applicator should be used to cover six 30-inch rows [15 feet (4.6 m)] to account for irregularities in row spacings.

Since PVC pipe normally comes in 10-foot (3 m) lengths, it is necessary to connect the pipes together. A 3-inch (7.6 cm) tee is suggested to join the pipe sections. A tee should also be placed on each end of the pipe. Placing adapters and caps on the end tees, as illustrated in *Figure 3,* provides a convenient place to fill and drain the unit. This also allows the pipe to be cleaned easily.

Because most fields are not completely level, the solution tends to flow to one end of the pipe regardless of pipe length. To help slow this solution shift, a baffle can be made by placing a large sponge or a plastic disc in the center tee of the pipewick. The sponge is easily installed and can be removed as needed. If a removable sponge is

*Evaluation and improvment of the pipewick applicator was made possible by a grant from the Nebraska Soybean Development, Utilization and Marketing Board.

used for the baffle, a solid end cap can be used on one end of the pipe, and a tee with appropriate fitting on the other end.

A vent must be provided to prevent a partial vacuum from developing inside the pipe, which will greatly reduce the wicking rate. Drilling a 1/8- to 1/4-inch (0.3-0.6 cm) diameter hole in the fill cap will provide sufficient venting for the system. This vent must be plugged when the pipe is rotated.

The Support Frame

The pipe should be attached to a rigid frame capable of supporting it without sagging while in operation. An angle iron or wood frame with appropriate support rods or cables will help prevent sagging. The support frame should be located on the back and/or top side of the pipe so it does not contact the weeds, pushing them away from the ropes.

A front mounting on a hydraulic loader or other height adjustable framework is advisable. This allows for best visibility and prevents dust created by the tractor from collecting on the applicator.

The pipe can be mounted to the rigid framework by large band type hose clamps or similar devices. One clamp every 4 feet (1.2 m) of pipe will provide adequate support. Attachment to the framework should allow the pipe to be rotated so that the ropes can be turned up to prevent dripping when not in use, or to prevent chemical loss if a leak developes.

The Rope

Although additional research is still needed to determine the best kind of rope or combination of ropes, laboratory research at the University of Nebraska indicates that wicking rates of different kinds of rope vary greatly *(Table 1)*. Be sure to select a rope that has been evaluated for this purpose since some nylon ropes may give extremely slow wicking rates.

Table 1. A comparison of wicking rates of four kinds of ropes.

*One half-inch (1.3 cm) diameter rope**	*ml/5 hrs***
Dare Co. S.B.N.	7
Wellington Puritan Mills S.B.N.	46
Gulf Rope and Cordage S.B.N. (Peppermint)	166
Gulf Rope and Cordage Poly/AC (Pistachio)	385

*S.B.N. = Solid braid nylon; Poly/AC = Diamond braid polyester covering over acrylic core.

**Laboratory study with 8 replications.

When pipewick applicators were first developed, Wellington Puritan Mills 1/2-inch (1.3 cm) diameter solid braid nylon rope (catalog number G1032) was recommended. This rope has given relatively satisfactory results for control of volunteer corn and shattercane, and may be desirable where reduced wicking is preferred. For example, if Roundup receives approval for use with pipewick applicators in sorghum, reduced wicking may be desirable to avoid crop injury.

In our research, two ropes from the Gulf Rope and Cordage Co. (Box 5516, Mobile, Alabama, 36605) were compared to the Wellington Puritan rope. The Gulf rope, called Peppermint (style 109A), is a 1/2-inch (1.3 cm) diameter solid braid nylon that is precut and preshrunk at the factory. This rope had a wicking rate nearly three and one-half times that of the Wellington rope. The second rope from the Gulf Rope and Cordage Co., called Pistachio, is 1/2 inch (1.3 cm) in diameter, with a diamond braid polyester outer covering and an acrylic core. Wicking rate of this rope was more than twice as fast as the Peppermint rope. In many cases, the Pistachio rope may wick too rapidly and cause excessive dripping, resulting in crop injury.

Although it has not been field tested, we suggest using the Peppermint rope where dense weed populations are encountered. Using this rope may help reduce the need for two passes with the pipewick to get adequate weed control.

Most rope will shrink after wetting and drying, breaking the glue seals if ropes are installed too tightly. As much as 25 percent shrinkage may occur. Thus, the rope should be alternately soaked and dried a couple of times to shrink it before cutting it to the desired length. This is suggested even for factory preshrunk ropes like Peppermint.

To prevent unraveling of rope ends, heat the rope slightly in a flame to sear the outer fibers. After shrinking the rope, mark it to the desired length. Sear, but do not melt, a 1-inch (2.5 cm) segment near the mark by rotating the rope in a flame. Then cut in the center of the seared area. This procedure is not necessary with the Peppermint rope as it is seared and cut to length at the factory.

Sufficient length should be used to allow approximately 4 inches (10 cm) of each end of the rope to be placed inside the pipe. If the holes for the rope are 8 inches (20 cm) apart, a preshrunk length of approximately 18 inches (46 cm) is required. This allows the rope to be installed with approximately 1 1/2 inches (3.8 cm) of slack in the rope, measured from the pipe to the center of the tightly pulled rope.

Rope Installation

Holes in the pipe for rope installation should be 6 to 8 inches (15 to 20 cm) apart, with 1 1/2 to 2 inches (4 to 5 cm) between adjacent ropes *(Figure 3)*. Although two rows of ropes along a pipe may be sufficient, three rows are suggested to improve coverage. Rows of ropes should be approximately 1 inch (2.5 cm) apart. When in operation, orient the lowest row of ropes on the pipe about 30 degrees forward from a vertical position so it is not at the lowest point of the pipe. This reduces dripping and gives good rope-to-weed contact.

Grommets and compression fittings have been used to

secure ropes into the PVC pipe. However, these reduce the wicking rate and increase construction cost.

The recommended method for rope installation is to insert the rope directly into the pipe without grommets or compression fittings. Clean the pipe thoroughly and then glue the rope into place, using several layers of glue to form a good seal.

The best type of glue for rope installation still needs considerable research. At present, 3M 'Super Weather Strip Adhesive' appears to give satisfactory results. A limited number of other glues have been evaluated but have not been found to be superior to this 3M product.

The hole size is very important when ropes are installed without fittings. Use a high speed wood bit to drill the holes. Since the actual diameters of "1/2-inch" (1.3 cm) diameter ropes have been observed to vary, several experimental hole sizes should be tried to find the one that gives a snug fit. Do not install ropes too tightly as this reduces the wicking rate. For example, our research with the Wellington Puritan 1/2-inch (1.3 cm) nylon rope installed into a 7/16-inch (1.1 cm) diameter hole reduced wicking rates to about two thirds that of the same rope placed in 1/2-inch (1.3 cm) diameter holes.

Although direct gluing of the ropes into the pipe has advantages, the potential for ropes to pull out and break the glue seal can be a disadvantage with this method. To prevent this, a small, nongalvanized, finishing nail (or screw) about 1 1/4 inches (3.2 cm) long can be inserted perpendicularly through the rope approximately 1/4 inch (0.6 cm) behind the point where the rope will emerge from the pipe. This will be about 4 inches (10 cm) from the rope ends. Place the nail inside the pipe by tipping the nail parallel to the rope and pushing it and the rope through the hole in the pipe simultaneously. Once inside the pipe, pull the rope out slightly so the nail is perpendicular through the rope and tight against the inside wall of the pipe *(Figure 2)*. Seal the rope with several layers of glue. This technique anchors the rope.

Since the wicking rate of the lowest row of ropes will be faster than the other rows because of differences in the amount of fluid pressure on them, it may be necessary to make some modification on this row to prevent excessive dripping. Drilling smaller holes [7/16-inch (1.1 cm) rather than 1/2-inch (1.3 cm) diameter for Peppermint rope installation], the use of a slower wicking rope (Wellington Puritan solid braid nylon), or the use of compression fittings can reduce dripping from the bottom row of ropes if necessary. It should be noted that a 4 mph (6 km/hr) ground speed is nearly 6 feet (1.8 m) per second and an occasional drip will not result in excessive crop injury.

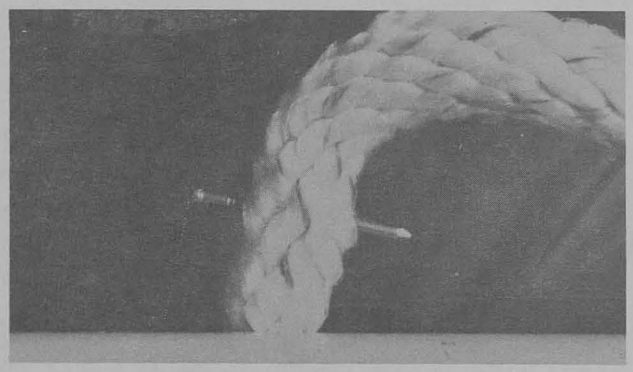
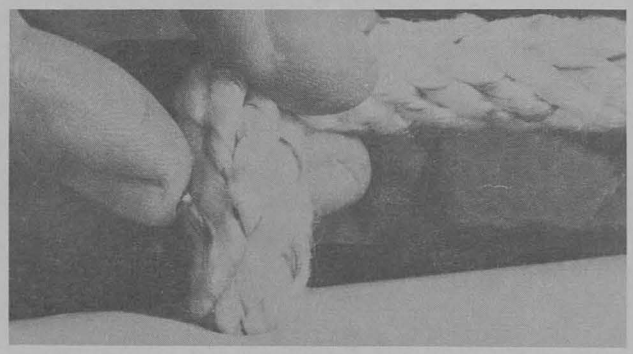
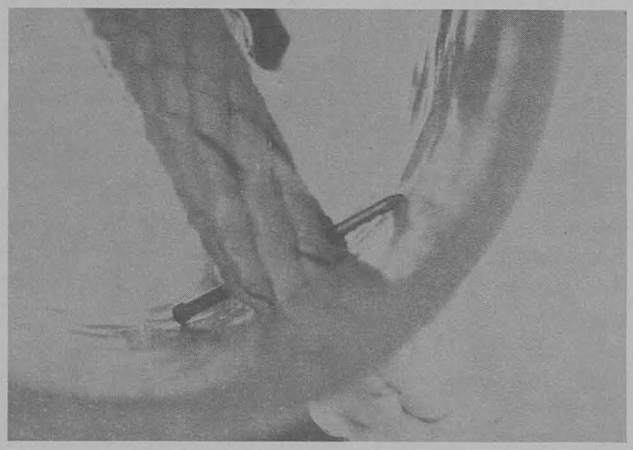


Figure 2. Technique for inserting nail into rope.
A. Nail perpendicular through rope.



B. Nail tipped parallel to rope and inserted into hole.



C. Nail tight against inside pipe wall.

Use of Pipewick Applicators

A 33 1/3 percent Roundup solution is normally used in pipewick applicators, and has given satisfactory results. This concentration is obtained by mixing one part Roundup with two parts water. Wicking rates can

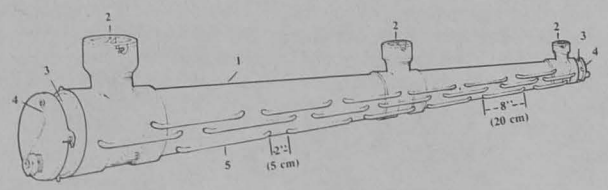


Figure 3. A diagram showing component parts of a pipewick applicator. Numbers on diagram correspond to the numbers in *Table 2.*

be increased by reducing the Roundup concentration or decreased by increasing it.

The pipe should be filled one half full of solution. This reduces both the amount of chemical needed for operation and the amount of dripping, especially from the bottom row of ropes. However, if faster wicking is desired, filling the pipe increases the wicking rate. When preparing the herbicide solution for the applicator, keep in mind that one gallon (3.8 l) of Roundup in two gallons (7.6 l) of water will treat 10 to 100 acres (4 to 40 ha) depending on the weed density.

Table 2. Materials needed to construct a 16-foot (4.9 m) pipewick applicator.

	Item	*Supplier*[1]	*Function*	*Quantity Required*	*Estimated Unit Cost*	*Total*[2] *Cost*
1.	Pipe; PVC-1120, SCH 40, 3" (7.6 cm) SDR, 260 PSI	Plumbing dealer.	Reservoir-boom.	15 feet (4.6 m)	$1.00/ft. (30 cm)	$15.00
2.	Sanitary Tee with twist lock cap, PVC SCH 40	Plumbing dealer; Genova part numbers Tee #71130; Twist Cap #71873.	Pipe end fitting, fill spout, center access.	3	5.50 ea.	16.50
3.	3" (7.6 cm) Anonda Hub Adapter	Camping and trailer supplies outlet. Part #V29-3B3S.	End cap adapter.	2	2.15	4.30
4.	3" (7.6 cm) Anonda Hub with garden hose attachment	Camping and trailer supplies outlet. Part #V29-3B3S.	End cap and drain.	2	2.90	5.80
5.	Rope; ½" (1.3 cm) diameter, solid braid nylon	a. Peppermint[3] Gulf Rope & Cordage Co. P.O. Box 5516 Mobile, AL 36605 b. Cat. No. G1032 Wellington Puritan Ind. Box 521 Madison, GA 30659	Wick.	100 feet (30 m)	0.47/ft. (30 cm)	47.00
6.	1-1¼" (2.5-3.2 cm) nongalvanized finishing nails (or screws)	Hardware store.	To secure ropes.	50	--	1.00
7.	Rubber-vinyl cement	3M Company, super weather strip adhesive (automotive) Part No. 051135-08001.	To cement ropes into PVC reservoir-boom.	2 tubes	3.00/tube	6.00
8.	Glue, PVC	Local dealer.	To seal PVC pipe joints.	1	2.50/can	2.50
						$98.10 TOTAL COST

[1] Reference to commercial products or trade names is made with the understanding that no discrimination is intended and no endorsement by the Cooperative Extension Service is implied.

[2] Price as of 3/81.

[3] This rope has a faster wicking rate than Wellington Puritan ½ inch (1.3 cm) solid braid nylon rope, and should give improved performance in dense weed stands. Other ropes may be used, but wicking rates vary greatly among nylon ropes. Only ropes evaluated for use in wicking units should be used. Gulf 'Peppermint' and Wellington Puritan G1032 are available from local suppliers.

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