Weed Wiper Technology and Usage

THE SAMUEL ROBERTS NOBLE FOUNDATION

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Wick applicators have been around since the early 1900s (McWhorter and Derting, 1985). Usage of wicks, wiper applicators or weed wipers greatly increased in the late 1970s with the introduction of Roundup™ (glyphosate)* herbicide (Blank, 1981). Many farmers growing soybeans or cotton in the 1980s used weed wipers to apply non-selective herbicides such as Roundup™ selectively to weeds growing taller than the crop. However, with the introduction of Roundup Ready™ technology, weed wipers became unnecessary in many crops because glyphosate could be broadcast with no crop injury. Now, one short generation later, they have been cast aside to the junk piles and fence rows of equipment yards scattered across farm country.

While weed wipers have been all but forgotten among row crop farmers, many pasture and range producers in the United States have never heard about them. There is great potential for using wick applicators for weed control in meadows and pastures in the Great Plains of the United States. Cattle and other grazing animals consume forage and typically avoid weeds. This results in weeds taller than the desirable forage, allowing the weeds to be easily treated with a wick applicator.

There are many benefits to using a wiper applicator for weed control in fields. One advantage is the ability to selectively control weeds in pastures made up of mixed grass and legume forages, grassy weeds in grass pastures or broadleaf weeds in clover pastures. Another benefit is reduced chemical use per acre. Herbicide is only applied to weeds as opposed to broadcast application methods which spray herbicide on the weed, crop and soil. This diminished chemical use can reduce cost per acre for weed control. Since no spray is released, another advantage is the ability to make herbicide applications when it would be too windy for conventional broadcast application methods. This also allows application adjacent to susceptible crops without the risk of particle drift.

The concept of a wiper applicator is fairly simple and is similar to painting with a pad or roller. Absorbent material is saturated with herbicide solution and used to "wipe" the herbicide onto plants. The absorbent material may be burlap, canvas, rope, sponge, carpet, etc. The wiping surface/absorbent material can be saturated from the inside out in a variety of ways or it can be saturated by spraying the solution onto the outside of the wiping surface.

* *Glossary on page 7.*

Western ragweed treated with wiper and glyphosate on right and untreated on left.

Healthy clover growing below dying western ragweed treated with wiper and glyphosate

Types of Wipers

There are four main types of wipers. Two are **wick types**.

1. **Rope Wick Wiper**
   This wick type wiper uses rope made from absorbent nylon or other material, plumbed into a pipe reservoir filled with herbicide solution. The rope "wicks" the solution out of the reservoir to stay saturated.
2. **Canvas Type Wiper**
   This second wick type wiper also uses a pipe reservoir, but the pipe is covered with an absorbent canvas-like

material. In this type of wiper, the reservoir has small holes along its length so the herbicide solution can dribble out and keep the cloth saturated.

3. **Rotating Type Wiper**
   This non-wick type of wiper uses an enclosed spray boom mounted above a rotating wiping surface. This enclosed boom applies the herbicide solution onto the wiping surface to keep it wet.
4. **Primitive Type Wiper**
   This fourth style is similar to the third, except the spray boom is positioned inside, or wrapped within, the absorbent material.

There are many variations of each of these four main types. One worth mentioning is a mechanism that adds pressurized air to the reservoir on either of the wick type applicators. This helps force more herbicide out of the reservoir and into the wick material faster, allowing it to stay saturated in dense weed conditions.

There are problems and benefits associated with each type of wiper. For both the rope wick and the canvas type, it is difficult to control the flow of chemical onto the wiper surface since the solution moves by capillary flow and gravity. The main way to control chemical application rate with these is by adjusting travel speed to match weed density. This requires some operator skill and experience. Travel speeds are usually around 3 miles per hour. For denser stands of weeds, the operator must slow down, and for less dense stands of weeds, the operator should speed up. If travel speed is too slow, the wiper will drip herbicide onto the crop, causing crop injury. However, poor weed control will result if the operator travels too fast. A common practice when using these types of wipers is to go

Small 12-volt pump on rotating type wiper

The spray boom, which wets the carpet-like wiping surface on a rotating-type wiper, is enclosed by the black and yellow shield

A hydraulic motor counter rotates the wiping surface on this rotating-type wiper. Some units use a ground drive wheel instead of a motor.

over the weeds twice, but in opposite directions to be sure to get adequate herbicide coverage on the surface of the weeds. Benefits to these types of wipers are that they are relatively inexpensive to purchase and require little maintenance. They can be mounted on the front of a tractor or ATV, or pulled behind on various cart-like contraptions.

The most common concern with the rotating-type applicator is the initial purchase price, which can be 10 times the price of a rope or canvas type for the same size unit. Since the rotating type has a spray boom, a pump is needed. This requires a battery or other power supply to operate a small 12-volt pump. However, since the pump can be turned on and off manually, with a timer or with a moisture sensor, it is much easier to maintain the desired wetness on the wiping surface at a wider range of travel speeds with a rotating type. This makes a rotating-type unit much more user friendly. Rotating types typically have bicycle tires at each end and are pulled behind a tractor or ATV. However, some are mounted on the rear or front of a tractor. A benefit to the rotating type is that the wiper surface counter rotates. This allows it to do a more thorough and uniform job of applying the herbicide to the surface of the weeds. Due to the increased efficiency of application with a rotating type, one can use lower concentrations of herbicide, a single pass across the weeds and faster travel speeds compared to the wick types.

The lack of commercial availability is the biggest limitation to primitive wipers. However, a person with some creative shop skills can build one. A primitive wiper has the benefit of controlling the wetness of the wiping surface like a rotating type, but lacks the rotating wiping surface.

Mounting

Regardless of how they are mounted, all wipers require a mechanism for adjusting the operating height. It is important that this mechanism be as easy to adjust as possible. Since conditions change within each field, preferably the height can be adjusted on the go. It is best to position the wiper just 1 or 2 inches above the top of the crop or forage. One easy way to control the height during application is to mount the wiper on a front end loader or three-point hitch on a tractor. Other systems that adjust height with hydraulic cylinders can also be adapted.

Front mounted wipers allow the weeds to be wiped before they are driven over and makes it easier for the operator to observe. With front mounting, however, there is the possibility that herbicide will be picked up by the tires of the tractor or ATV and transferred onto the crop, causing ghost kill. Since small amounts of herbicide are being used, ghost kill in the wheel tracks is rare, but possible.

Rear-mounted or pull-behind units nearly eliminate the concern for ghost kill. However, since the weeds in the wheel tracks are driven over before they are wiped, some weeds may be smashed down to the point where they do not come in contact with the wiping surface. This leaves untreated weeds in the tire tracks.

Operating Tips

Terrain must be considered when choosing the wiper and its length. If the wiper is mounted to a fixed point on an ATV, for instance, and the ATV encounters uneven terrain, one end of the wiper will be too low and one end will be too high. For this reason, it may be beneficial to have the wiper mounted on a cart with wheels on each end to better follow the contour of the land.

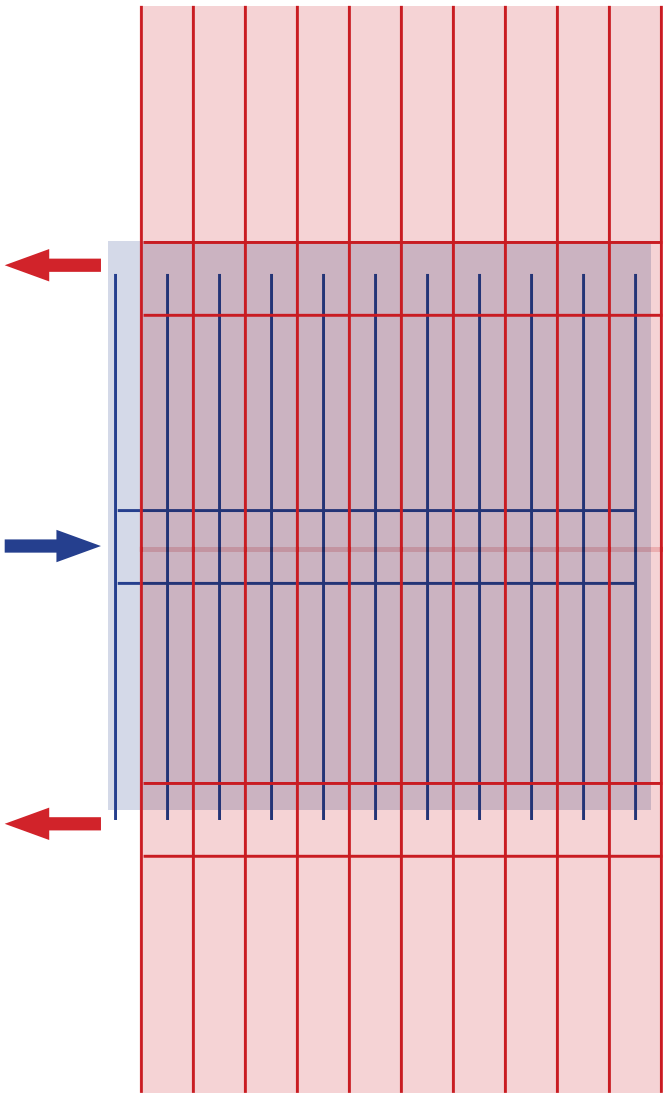

Illustration of overlapping paths

For any wiper, the appropriate wetness is slightly less than dripping. As previously mentioned, this can be better controlled on wipers that rotate or have a pump or both. On rope- or canvas-type wick applicators, the operator should drive only fast enough to keep the wiper from dripping.

There are different driving patterns that can be used when making two passes in opposite directions. Perhaps the best strategy is to move over half of the length of the wiper each time. This allows the operator to line up the end of the wiper on the next pass with the middle of the wheel tracks from the previous pass.

After each use, all types of weed wipers should be rinsed thoroughly according to the manufacturer's instructions and stored out of sunlight to prevent weathering and damage from the sun's ultraviolet rays.

Notice difference in height from side to side on sloping terrain

Herbicides

The primary chemicals labeled for wiper application are the various formulations of glyphosate, but there are also labels for using dicamba in a wiper. While different formulations of glyphosate and other herbicides may have the same active ingredient, the inert ingredients can be different. These different inert ingredients in herbicide formulations can make a difference in how well they perform in a wiper. The main factor affecting performance appears to be the amount and type of surfactant. Some surfactants are oilier than others. These oily surfactants tend to form a waxy coating on rope- and canvas-type wicks that prevents new solution from wetting the surface as the wiper is used. One possible remedy to this problem is to choose formulations that are known to perform well in wipers. To find information about the formulation, contact the manufacturer or consult the label and Material Safety Data Sheet (MSDS). Many formulations will not list what the inert ingredients are, but be cautious if the formulation contains a high surfactant load, as many glyphosate formulations do.

Always read and follow label directions.

Product A

1.0 INGREDIENTS

Active Ingredient

*Glyphosate, N-(phosphonomethyl)glycine, in the form of its isopropylamine salt	41.0%
Other Ingredients	59.0%
	100.0%

*Contains 480 grams per liter or 4 pounds per U.S. gallon of the active ingredient glyphosate, in the form of its isopropylamine salt. Equivalent to 356 grams per liter or 3 pounds of U.S. gallon of the acid, glyphosate.

6.4 Surfactants

No additional surfactant in the spray solution is needed or recommended. This includes additives containing surfactants, buffering agents or pH adjusting agents when this product is the only pesticide used unless otherwise directed. Ammonium sulfate, drift control additives, or dyes and colorants may be used. See the "Mixing" section of this label for instructions.

Product B

1.0 INGREDIENTS

Active ingredients

*Glyphosate, N-(phosphonomethyl)glycine, in the form of its isopropylamine salt	41.0%
Other Ingredients	59.0%
	100.0%

*Contains 480 grams per liter or 4 pounds per U.S. gallon of the active ingredient glyphosate, in the form of its isopropylamine salt. Equivalent to 356 grams per liter or 3 pounds of U.S. gallon of the acid, glyphosate.

6.4 Surfactants

This product requires the use of a nonionic surfactant. When using this product, mix 2 or more quarts of a nonionic surfactant per 100 gallons of spray solution. Increasing the rate of surfactant may enhance performance.
Examples of when to use the higher surfactants rate include, but are not limited to: hart-to-control woody brush, trees and vines, high water volumes, adverse environmental conditions, tough-to-control weeds, weeds under stress, surfactants with less than 70 percent active ingredient, tank mixes, etc. These surfactants should not be used in excess of 1 quart per acre when making broadcast applications. Always read and follow the manufacturer's surfactant label recommendations for best results. Carefully observe all cautionary statements and other information appearing in the surfactant label. When applied as recommended under conditions described, this product controls annual and perennial weeds listed in the label booklet.

Labels for two glyphosate formulations of the same strength by the same manufacturer, but the first does not need additional surfactant and the second does. The first has surfactant already in the formulation, but this is not clear when looking only at "Section 1.0" ingredients.

Product A

Section 2 – Composition/Information on Ingredients

Ingredients	CAS#	% (weight)	ACGIH TLV (mg/m³)	OSHA PEL (mg/m³)
*Glyphosate as insopropylamine salt	38641-94-0	40-70†	N/Av	N/Av

*Note: The product contains about 650 g/L of the active ingredient Glyphosate as its isopropylamine salt, equivalent to 480 g/L of the free acid Glyphosate (CAS#1071-83-6).
†Note: The product contains no surfactant.

Product B

Section 2 – Composition/Information on Ingredients

Ingredients	CAS#	% (weight)	ACGIH TLV (mg/m³)	OSHA PEL (mg/m³)
*Glyphosate as insopropylamine salt	38641-94-0	30-60	N/Av	N/Av
Surfactant	61791-26-2	2-7†	N/Av	N/Av

*Note: The product contains about 480 g/L of the active ingredient Glyphosate as its isopropylamine salt, equivalent to 360 g/L of the free acid Glyphosate (CAS#1071-83-6).
†Note: The product contains a low percentage of surfactant.

Product C

Section 2 – Composition/Information on Ingredients

Ingredients	CAS#	% (weight)	ACGIH TLV (mg/m³)	OSHA PEL (mg/m³)
*Glyphosate as insopropylamine salt	38641-94-0	30-60	N/Av	N/Av
Surfactant	61791-26-2	5-15†	N/Av	N/Av

*Note: The product contains about 480 g/L of the active ingredient Glyphosate as its isopropylamine salt, equivalent to 360 g/L of the free acid Glyphosate (CAS#1071-83-6).
†Note: The product contains a high percentage of surfactant.

Material Safety Data Sheet information for three different formulations of glyphosate by the same manufacturer with differing amounts of surfactant. High surfactant loads can cause problems by building up waxy coatings on the rope and canvas surfaces of wick-type wipers.

Construction Tips

A rope wick may be the easiest weed wiper to build yourself. The following Web pages give detailed descriptions of how to build one and where to order parts you may need.
www.caes.uga.edu/commodities/spray/pubs/documents/ArkansasRopeWickTips.pdf
www.caes.uga.edu/commodities/spray/pubs/documents/Aavimhowtomakearopewick.pdf
www.grnleafinc.com/catalog/ropewick_fittings/Green_SW_WT.asp
www.agrisupply.com/category.asp?c=4200053&bhcd2=1290529397

A handy person can build a canvas type, but may have to use trial and error to determine the right diameter and spacing of the holes in the pipe. Old denim from blue jeans is a readily available, inexpensive material for covering the pipe.

If a person already has a conventional boom sprayer, it can be converted to a primitive wiper. The main modification needed is closer spacing of nozzles. If a tapered flat spray tip with a 110° spray angle and 30 percent overlap is used, and the material wrapped around the boom has 3 inches between the bottom of the nozzle and the inside of the material, then the nozzles need to be spaced 5.5 inches apart. If the same equipment is used, but the inside of the material is 2 inches from the bottom or the nozzle, then the nozzles need to be spaced 3.5 inches apart. Given these limitations, one of the other types of weed wiper may be more practical.

Websites

In addition to the previously mentioned websites, the following may also be useful.
www.rodgersinc.com
www.vogelswickweeders.com
www.acrsales.com
www.qualitymetalworks.com
www.marketfarmequipment.com/ApplicatorCarts.htm
www.weedproblems.com
http://smuckermfg.net
www.rotowiper.net
www.c-dax.com/efx/include/common/category.asp?country=NZ&CatID=21
www.noble.org/Ag/Soils/WeedWiper

References

Blank SE (1981) Selective equipment to apply glyphosate. In: Proceedings 1981 Annual Meeting Southern Weed Science Society, 1, 300.

McWhorter CG and Derting CW (1985) Methods of application of glyphosate. In: The herbicide glyphosate, Butterworths, London, UK.

Glossary

Active ingredient: The chemical that is responsible for killing the weed.
Formulation: The combination of active and inert ingredients.
Glyphosate: The common name for the active ingredient in Roundup™.
Ghost kill: Crop death in the wheel tracks caused by nonselective herbicide being transferred from wet weed foliage to the crop by the tires of application equipment.
Inert ingredient: Additional chemicals added to a formulation to carry the active ingredient and help it perform better.
Legume: A broadleaf plant with the ability to reintroduce nitrogen into the soil. Many desirable forages, such as clovers, are legumes. Since legumes are broadleaves, most broadleaf weed herbicides also kill legumes.
Meadow: A field used for producing hay.
Nonselective herbicide: A herbicide that kills almost any plant it is used on.
Particle drift: The carrying of fine spray droplets by wind.
Pasture: A field used for grazing.
Roundup™: The original brand name for glyphosate.
Roundup Ready™ technology: The breeding of crops to be resistant to broadcast applications of glyphosate.
Surfactant: A product which lowers the surface tension of the solution.
Weed: A plant out of place. Typically, this is an undesirable plant for a location or a plant in an undesirable location. ■

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