

TECHNICAL NOTE

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Weed Control in Woody Plantings: Herbicides and Application Techniques

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Introduction: Competition for soil moisture, nutrients, and light from competing vegetation contributes significantly to the failure of tree and shrub (woody) plantings in the northern Great Plains and Intermountain West. Although several weed control options are available for between-row maintenance (mechanical cultivation, mowing, mulching, weed barrier fabric, spot spraying, desirable ground covers), within-row vegetation control options in high-density, lineal woody plantings is more limited. Within-row weed control in established lineal plantings of woody plants, not utilizing weed control fabric, is generally limited to hand rouging or the use of pre-emergent herbicides. Some granular pre-emergent herbicides can be broadcast in the fall and are activated by winter precipitation, providing weed control the following spring. Other pre-emergent herbicides are spring- or summer-applied, and require mechanical incorporation or irrigation within a specified amount of time after application, to properly distribute and activate the product. Effective and timely activation of spring-applied pre-emergent herbicides may not be possible on many dryland sites in low precipitation areas or areas with erratic or undependable late winter and early spring rains. On irrigated sites, access to water is usually too late in the spring to be useful for timely activation of pre-emergent herbicides for controlling the first flush of cool-season weeds. This technical note describes practical techniques for landowners, to deliver and activate pre-emergent herbicides for within-row control of competing vegetation in woody conservation plantings, when natural precipitation or supplemental water is limited. Some pre-emergent herbicides are not appropriate for new woody plantings, or require backfilling with untreated soil to prevent plant toxicity. Always read and follow herbicide label instructions.

Delivery of Pre-Emergent Herbicides: Proper delivery of pre-emergent herbicides may be limited by the formulation of the product (dry formulations versus water-based solutions), the design of the planting (high within-row density), as well as the growth habit of the species (sprouting, fast growing), and availability of equipment.

- A. **DRY FORMULATIONS:** Dry, granular formulations can be spread by hand, with a broadcast spreader, or by pressured air. Granular herbicides are generally applied to the soil surface in late fall and depend on natural precipitation during the winter to incorporate and distribute the product in the upper soil profile. Uniform application of granular herbicides over the target area is

important but can be difficult. It may also be difficult to accurately direct granular herbicides to the area being treated.

Staff at the Aberdeen Plant Materials Center have developed tractor and 4-wheeler mounted spreaders to facilitate the application of granular herbicides to windbreaks and other linear woody conservation plantings as shown below in FIGURE 1.



FIGURE 1 Granular Herbicide Applicator Developed at Aberdeen PMC

The tractor spreader is mounted on a platform attached to the three-point hitch of a tractor (see FIGURE 1 for components of the spreader). The platform includes an elevated hopper that stores the granular herbicide. The bottom of the hopper is funnel-shaped with a spout opening measuring 5/8-inch inside diameter (ID). A 3/4-inch ID, 34-inch long-braided plastic hose is clamped to the spout. The hose is clamped to a 45 degree angled fitting on the application gun (see FIGURE 2).



FIGURE 2 Detail of Application Gun

Granular herbicide flows by gravity down the hose to the application gun. The back end of the gun is attached to a vacuum hose that blows air from the vacuum head propelling granules out of the gun. The application gun is sized to fit the vacuum hose. The vacuum cleaner head is powered by a portable generator mounted on the front of the tractor. The operator sits on a seat and directs the flow of herbicide along the windbreak as the tractor moves (FIGURE 3). Contact the Plant Materials Center staff at Aberdeen, Idaho, for a materials list and design.



FIGURE 3 Applying Granular Herbicide to a Shelterbelt

EXAMPLE: Dichlobenil (Casoron® 4G) is a pre-emergent herbicide used for weed control in woody plantings. The application rate generally used for weed control along windbreaks and shelterbelts is 150 pounds per acre. Calibration is calculated by the rate at which granular herbicide free flows out of the funnel, the band width applied, and ground speed.

STEP 1: To calibrate the spreader, first compute the area to be treated based on 100-foot long test of a fixed width. This width represents the width of the windbreak requiring weed control, in our example, 3 feet.

$$\frac{\text{Application width (feet)} \times 100\text{-foot test run}}{43,560 \text{ ft}^2/\text{acre}} = \text{area (acres) of test run}$$

Example:

$$\frac{3 \text{ foot application width} \times 100\text{-foot test run}}{43,560 \text{ ft}^2/\text{acre}} = 0.006887 \text{ acre}$$

STEP 2: Next, calculate the amount of Casoron® 4G required for the test area.

150 pounds per acre x 0.006887 acre = 1.033 pounds of Casoron® 4G for 300 ft² test area

STEP 3: Next, determine the flow rate of granular herbicide from the spreader. For our example, place 1 pound of Casoron® 4G in the hopper and measure the time it takes for the entire pound to flow out of the funnel. The spreader developed at the Plant Materials Center flows Casoron® 4G at a rate of 1 pound per 20 seconds.

STEP 4: Next, determine the time it will take to apply the required amount of granular herbicide to the test area using the following formula:

Time (seconds) needed to apply required herbicide to test area = (Granular herbicide required for test area [lb.]) x (Flow rate of application gun [seconds per lb.])

Example:

1.033 lb. (for 300 ft²) x 20 seconds/lb. = 20.66 seconds to spread Casoron® 4G uniformly across a 3 ft. wide by 100-foot-long test area.

STEP 5: Next, determine the miles per hour (mph) that the tractor must move during application using the following formula:

Length of test run (ft.) x 3,600 (seconds/hour)
Time to apply required herbicide to test area (seconds) x 5,280 (feet/mile)

Example:

$$\frac{100 \times 3,600}{20.66 \times 5,280} = 3.3 \text{ mph}$$

With the application gun and flow rate, a tractor driving at 3.3 mph will apply Casoron® 4G at the recommended rate in a 3-foot wide band for any length of planting (FIGURE 4). Any band width of application can be calibrated by using these formulas. Always read and follow label directions when applying pesticides.



FIGURE 4 Aberdeen Plant Materials Center's Granular Herbicide Applicator

A less expensive version of the granular herbicide applicator can be fabricated with a coffee can and funnel to create the apparatus demonstrated in FIGURE 5.



FIGURE 5 “Coffee Can” Granular Herbicide Applicator

The coffee can is attached to a funnel, which in turn is mounted to a tube to create the application gun. The back end of the gun is attached to a vacuum head that propels herbicide granules out of the gun. FIGURE 6 illustrates from another angle, the coffee can hopper, funnel, and application gun.

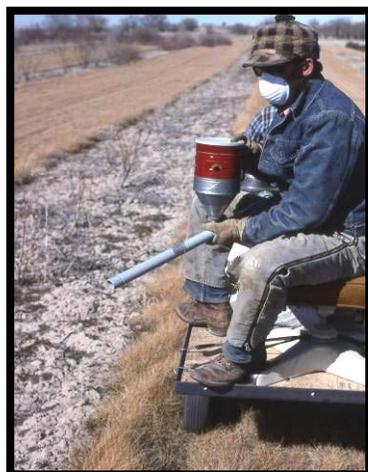


FIGURE 6 Detail of Hopper



FIGURE 7 “Coffee Can” Applicator Pulled by an ATV

The spreader, vacuum head, portable generator, and operator's seat can be installed on a small trailer pulled by an ATV as shown in FIGURE 7.

The “coffee can” applicator is relatively simple to construct and is small and light enough that a tractor is not necessary to pull the unit. Calibration of this type of spreader is identical to the procedure previously outlined except that most ATVs do not have speedometers; therefore, the rate of travel needed to calibrate the spreader has to be calculated by timing the vehicle over a fixed distance and then calculating and adjusting ground speed accordingly. The Aberdeen Plant Materials Center calculated the necessary rate of travel and then adjusted the set screw on the ATV throttle so that the

ATV traveled at a constant desired speed during herbicide application. Contact the Plant Materials Center staff at Aberdeen, Idaho, for a materials list and design.

B. **LIQUID FORMULATIONS:** Application of liquid solutions is difficult in dense, mature woody plantings when boom sprayers are impractical. When boom sprayers cannot be used, apply herbicide solutions with hand guns fitted with air induction or other low drift nozzle that operates at pressures as low as 15 psi using minimal solution volumes. Since pre-emergent label directions often provide application instructions in amounts of product per-acre delivered via boom sprayers, it is necessary to calculate the corresponding volume of product and/or mix that will be applied with a spray gun fitted with a certain size and type nozzle at a fixed operating pressure.

EXAMPLE: A dryland, living snow fence consisting of one, 500-foot long row of common lilac *Syringa vulgaris* and one, 500-foot long row of Rocky Mountain juniper *Juniperus scopulorum* has a serious infestation of kochia *Kochia scoparia*. It has been decided to treat the planting with isoxaben (Gallery® 75 Dry Flowable) at the recommended application rate of 1.33 lb./ac. Since it will be necessary to apply the mix within the rows with a hand gun, we must determine: 1) the area (acres or square feet) to be treated, 2) the amount of chemical needed to treat that area, 3) the volume of product and/or mix that a hand gun will deliver under actual operating conditions, and 4) the amount of water needed to activate the herbicide after it has been applied.

STEP I. CALCULATING THE AREA TO BE TREATED: The within-row area to be treated should consist of soil surface not maintained by between-row maintenance. In this case, the width to be treated is estimated at 3 feet on either side of the center of each row, or 6 feet total. The area to be treated is calculated as width (6 feet) multiplied by length (1,000 feet) or 6,000 square feet (ft²). In order to calculate acres-to-be-treated, divide 6,000 ft² by 43,560 ft² (the number of square feet per acre) to arrive at 0.14 acres.

STEP II. CALCULATING THE AMOUNT OF HERBICIDE NEEDED: To calculate the amount of herbicide and/or mix to apply to the area to be treated, use the following formula:

(Label Rate per Acre) X (Acres to be Treated) = (Amount of Product to Apply per Acre)

(1.33 lb./ac.) (0.14 ac.) = 0.1862 lb.

Apply 0.1862 lb. of product in liquid solution to the area to be treated.

STEP III. CALCULATING THE VOLUME OF MIX APPLIED WITH A SPRAY GUN: In order to apply the proper amount of herbicide per unit area using a hand gun, the volume of spray solution that is applied under fixed operating conditions, and considering applicator technique, must first be determined. There are numerous ways to simulate the application of mix using water and dye. A simple and quick method is to measure an area 18.5 feet by 18.5 feet. Measure the time it takes to completely spray the measured area. Repeat several times and then average the times. Spray into a container for the same amount of time as it took to cover the test area. The amount collected in the container in ounces equals gallons per acre. Multiply this number by the area to be treated (acres) to determine how much mix will be applied to the area to be treated. Add the amount of herbicide calculated in Step II to this volume of water to create the appropriate tank mix for hand spraying. **Make sure that this volume of water meets the minimum per-acre volume of water recommended on the label to carry the herbicide.**

Example: In a test, it took an average of 20 seconds to completely cover an 18.5-foot by 18.5-foot area with spray. After spraying into a container for 20 seconds, 30 ounces of liquid were collected indicating that 30 gallons of spray solution would be applied by the sprayer per acre. Multiply 30

gallons per acre by 0.14 acres to determine that we would apply 4.2 gallons of spray solution to our planting area.

STEP IV. CALCULATING THE VOLUME OF WATER NEEDED TO ACTIVATE HERBICIDE:

After application, many herbicides require distribution and activation of the chemical, often within a specified interval after application, using water. The herbicide label specifies the volume of water per unit area (acres in this example) that is needed to activate the herbicide. In our example, the label states that 0.5 inches of water per acre are needed to properly distribute and activate the herbicide mix. Given 1 acre-inch equals 27,154 gallons of water, use the following conversions to determine how many gallons of water will be needed per acre:

A. Multiply 27,154 gallons by the number of acre-inches of water need to activate the herbicide.

In our example:

$$(27,154 \text{ gallons}) \times (0.5 \text{ acre-inches}) = 13,577 \text{ gallons per acre}$$

B. Multiply the number gallons needed per acre to activate the herbicide by the number of acres to be treated to determine the total amount of water needed to treat the planting.

$$(13,577 \text{ gallons per acre}) \times (0.14 \text{ acres}) = 1,901 \text{ gallons per 0.14 acres}$$

APPLYING WATER TO ACTIVATE PRE-EMERGENT HERBICIDES: Water can be applied relatively quickly and inexpensively with a trailer-mounted stock tank (see FIGURE 8). Use conventional 2-inch PVC pipe or other materials to direct the water. In most cases, duct tape can be used in lieu of glue to secure unions (FIGURE 9). Leave unions connected to nozzles un-taped and unglued to facilitate adjustment. Water breakers that create a uniform wetting pattern of fairly large droplets work well, although two nozzles are usually needed in order to provide adequate coverage (see FIGURE 10). An in-line 12-volt, normally-closed valve can be installed, in lieu of a manual ball valve, so that the tractor driver can control water flow without leaving the tractor seat, but these



FIGURE 8 Activating herbicide with a water tank



FIGURE 9 Watering Tank on Trailer

units are relatively expensive. Pull cords and a pulley system attached to a large-handled ball valve may also work. Make sure that the PVC pipe is well supported where it leaves the stock tank, and that the stock tank is secured to the trailer to prevent shifting (see FIGURE 11). Situate the end nozzle so that it does not interfere with tight turns.



FIGURE 10 Water Breaker Nozzle



FIGURE 11 Well Secured Watering Tank

It will be necessary to experiment with various ground speeds and volumes of water, as controlled by a valve, to guarantee that the proper volume of water, as determined in Step III, is applied per unit area. Please note that the volume of water applied, as well as the wetting pattern, will vary as the water level in the stock tank changes. As a result, it may be necessary to adjust the nozzle direction and/or reduce ground speed as the water level drops. In addition, it may be necessary to limit the weight of the trailer and water to avoid compaction of some soils.

THE MENTION OF ANY PRODUCT NAME IN THIS DOCUMENT IS SOLELY FOR DEMONSTRATION PURPOSES AND DOES NOT REPRESENT AN ENDORSEMENT.

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