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USE OF A "FLOW CONTROL PLATE" TO MODIFY AN EARTHWAY EV-N-SPRED® CRANK SPREADER FOR THE APPLICATION OF PRONONE 10G® GRANULAR HERBICIDE

Introduction

Pronone 10G is a granular form of the soil active herbicide hexazinone. In Nova Scotia, it is registered for ground application and is used by the Christmas tree, blueberry, and forest industries to selectively control a wide range of weeds including grasses and raspberries. One of the main factors limiting its use is the lack of appropriate equipment designed for low volume applications (10 to 20 kg/ha) in rugged terrain. Most of the available equipment is designed for the agricultural application of fertilizer at delivery rates of 200 to 300 kg/ha (McLaughlan, 1992).

The purpose of this report is to describe the use of a "flow control plate" installed in an EV-N-SPRED Model 3100 crank spreader to regulate Pronone application rates. The "plate" enables controlled adjustment of flow at the low rates required. The equipment is most suitable for small to medium scale operations, and typically produces a **3.7 m (12 foot) swath** at a coverage rate of **0.8 ha (2 acres) per productive hour.**

This report details the construction and installation of a flow control plate and describes proper application technique as well as methods for calibrating flow and determining swath width.

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® Earthway Products Inc., Bristol, IN
® E.I. Du Pont de Nemours & Co. (Inc.), Wilmington, DE

Canada

Nova Scotia

Flow Control Plate Installation (Figure 1)

This method of applying Pronone 10G requires a modification to the Ev-N-Spred to provide greater control over the chemical flow rates. The modification consists of the installation of a "flow control plate" (plate construction details on page 8), which is secured in the bottom of the tub (hopper) to regulate flow.

1. Select a **hole size** to meet desired application rate (see Application Rate - Calibration, pg. 4).
2. Remove **Agitating Wire** from post in tub.
3. Position **FLOW CONTROL PLATE** in bottom of tub so that the two matching holes of desired size are over the leading (oval shaped) and central ("tear drop" shaped slot) **flow slots** in the spreader. The **guide hole** in the flow control plate fits over a **projection** in the tub, ensuring that the flow control plate is properly positioned. Make sure that the flow control plate is right side up, otherwise alignment will be incorrect.
4. Secure **FLOW CONTROL PLATE** in place with a half inch screw. Use only one screw, positioned through the **screw hole** located in the "right front corner" of the flow control plate (if you are looking down into the tub while wearing the spreader).
5. Replace **Agitating Wire** in *bottom* hole in post. This is essential for proper flow.
6. Flow rates are adjusted by rotating **FLOW CONTROL PLATE** to select a new hole size.

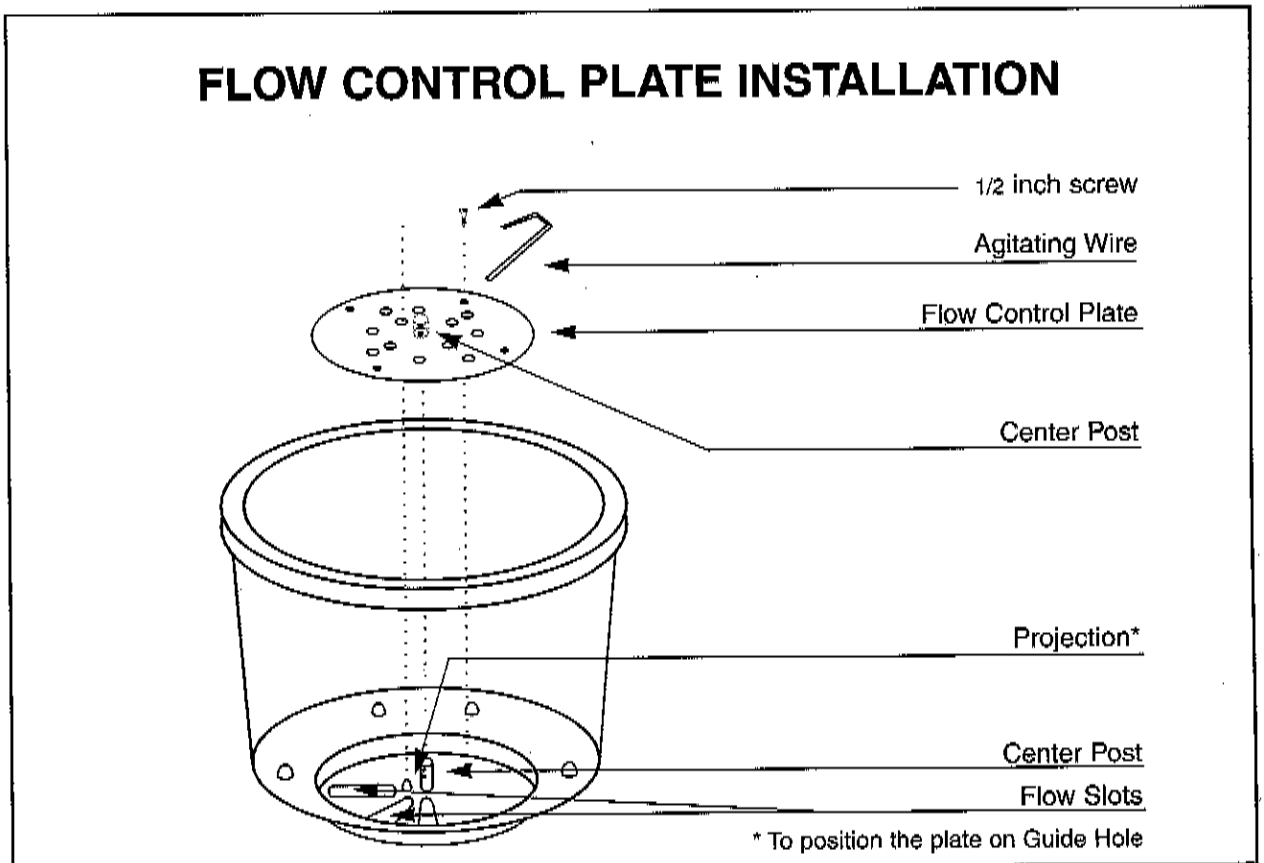


Figure 1. Exploded diagram illustrating installation of flow control plate.

Application Technique

The following application techniques are recommended for consistent results. Although complex at first glance, they are quickly mastered with practice. These methods typically produce an average swath width of 12 feet (3.7 m) at a production rate of 24 square feet per second (2 acres per productive hour). Prior to use, applicators should measure their swath width, and calibrate the flow rate, using the methods described on pages 6 and 4.

1. **Loading**: Fill tub up to one half full. **Do Not Overfill**, the extra weight will make cranking difficult.

2. **Machine Setting:** Fully open the leading (oval shaped) and central ("tear drop" shaped, middle slot) **flow slots** on the Ev-N-Spred. Rear flow slot must be closed!

3. **Walking Speed:** Walk 2 feet per second. Establish a pace of 1 step per second with a stride of 2 feet. This requires small steps of 4 to 5 inches from toe to heel, and provides a comfortable walk in moderately rugged terrain.

4. **Cranking Speed:** Turn crank at 1 revolution per second, keeping time with the walking pace (ie. crank is at bottom on each step). Faster speeds will increase swath width, and will also substantially increase chemical flow and application rate.

5. **Swath Width:** The application rates and machine settings described in this report are based on a 12 foot swath. The prescribed application technique should produce a swath width of 12 feet, however, swath widths may vary for different operators and should be measured using the methods described in "Swath Width Calculation" (pg. 6).

6. **Swath Marking:** Swaths are normally marked using range poles, one at each end of the swath. These should be 12 feet long (3.7 m), enabling them to be used to measure the distance to the next swath. Measurements between swaths must be made *perpendicular to the swath direction.* Often a site must be broken into treatment strips (with flagging tape or traverse string) so that poles remain visible over the entire length of swath. If unfamiliar with the use of range poles, visit a N.S. Dept. of Natural Resources office for instruction.

7. **Metronome** (optional): A 1 second operating rhythm (beat) is an important part of the delivery technique. Although most operators achieve this through practice, some use a tape recording with a 1 second beat or some other pace setting device.

8. **Practice:** Practice is essential to achieve consistent results, and is particularly important for developing a 1 second operating rhythm. Mark off a 40 foot strip (12 m) and practice covering this distance in 20 seconds while performing the application technique. Adjust travel speed by increasing or decreasing stride length. Do not use active chemical during this exercise. If available, load the tank with **blanks** and make swath width measurements at the same time (see Swath Width Calculation). Blanks consist of inactive "Pronone" pellets that do not contain live chemical. They are useful for practice and should be available upon request from the Pronone supplier

Application Rate-Calibration

Application rates are regulated by selecting different sizes of paired holes in the **flow control plate.** Figure 2 provides a quick reference guide to help determine the hole sizes required. The rate calculations are based on a coverage rate of 24 ft^2/second (12 ft. swath X 2 ft/sec travel speed). If actual swath widths are not equal to 12 feet (see Swath Width Calculation) adjust the rate calculation using step 6.

Important: Flow rates may vary with different machines and product formulations. They are also very sensitive to slight variations in hole diameters in the flow control plate. To obtain precise application rates individual calibrations should be made at several settings using the following method:

1. Load tub half full with the specific Pronone formulation intended for use. **DO NOT** use blanks, they yield different flow rates.
2. At prescribed cranking speed (1 revolution per second), apply chemical into collecting bag (eg. plastic garbage) for specific time period (eg. 30 seconds). Be careful not to obstruct spinning platter.
3. Weigh total output in ounces (grams) and divide by the number of seconds to determine flow rate in ounces/second (grams/sec).
4. Repeat at least 3 times to obtain average.
5. Calculate application rate by applying appropriate formula:

A) Pounds per Acre = ounces per second x 110

B) Kilograms per Hectare = grams per second x 4.5

EXAMPLE

The 11/32's setting is tested 3 times for 30 seconds/time. The following outputs are measured:

1) 3.2 ounces, 2) 2.8 ounces, 3) 3.0 ounces

The application rate is calculated as follows:

Average Output = $\frac{3.2 \text{ oz} + 2.8 \text{ oz} + 3.0 \text{ oz}}{3 \text{ trials}} = 3.0 \text{ ounces}$

Output per Second = $\frac{\text{average output}}{30 \text{ seconds}} = \frac{3.0}{30} = 0.100 \text{ ounces/second}$

Pounds per Acre = 0.100 ounces/second x 110 = 11 pounds per acre

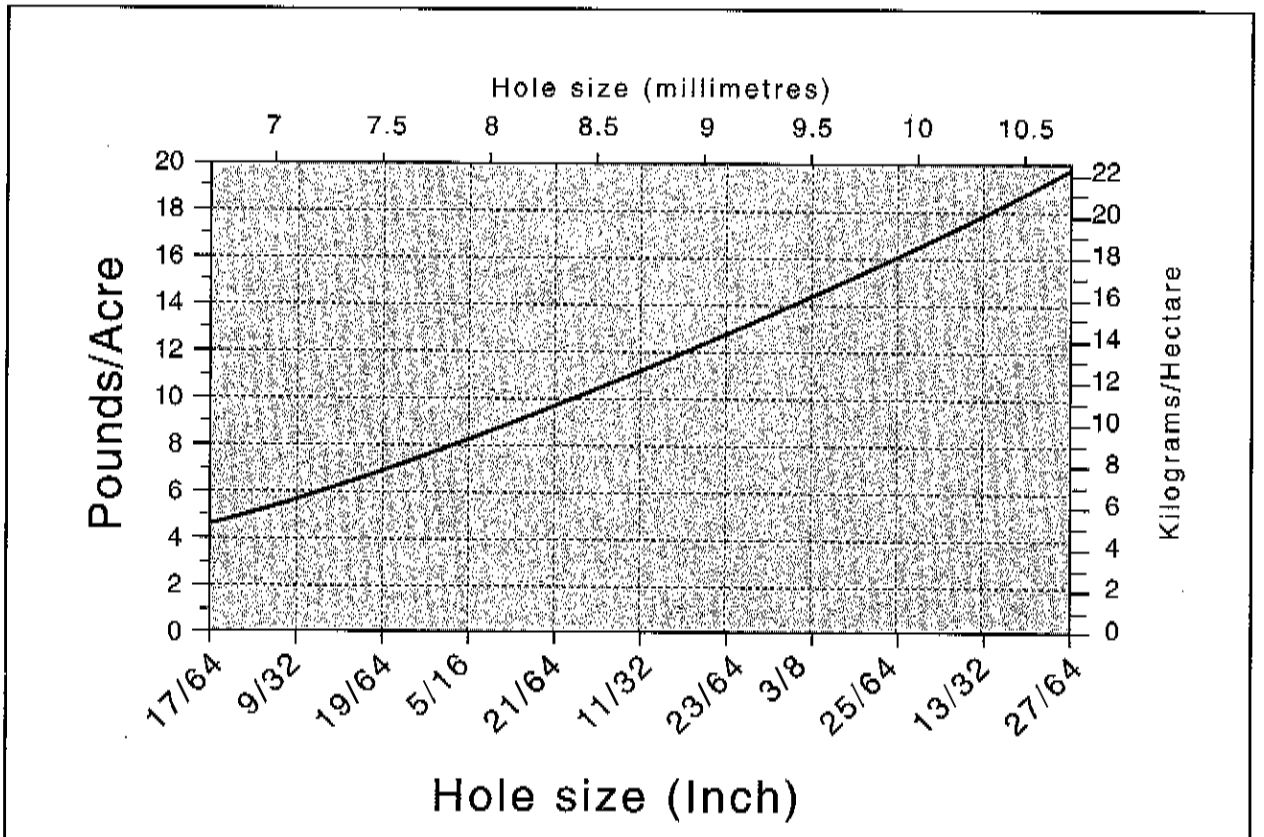
6. The above calculations are accurate for a 12 foot swath (24 ft^2/sec). However, if the measured swath width (see Swath Width Calculation, pg. 6) differs significantly from the prescribed 12 feet, adjust the application rate as follows:

$$\text{Adjusted Application Rate} = \text{Calculated Application Rate} \times \frac{12\ (ft)}{\text{swath width (ft)}}$$

7. Although less accurate for calibration, measuring cups are often more convenient than weight scales. The following formulas can be used to determine application rates from output volumes, instead of the weight based formulas presented in step 6. These calculations are based on an average "Product" density of 38 pounds per cubic foot (Material Safety Data Sheet for Pronone reports a density of 35 to 40 lbs/ft^3).

A) Pounds per Acre = "Imperial Fluid" Ounces per Second x 70

B) Kilograns per Hectare = Millilitres per Second x 2.7



Note: This graph assumes a 12 foot swath width, at a 2 foot/second travel speed (24 sq.ft./sec. coverage rate). Since flow rates may vary for different machines, calibrations should be made using the methods described in "Application Rate - Calibration".

Figure 2. Application Rates by Hole size.

Swath Width Calculation (Figure 3)

Field tests using the recommended application technique commonly produced a 12 foot (3.7 m) swath. **HOWEVER**, swath widths vary for different operators and should be measured. If, after practising and adjusting application technique, a swath width of 12 feet is not attained, the application rates should be adjusted using step 6 in the "Application Rate - Calibration" section.

The following instructions provide an accurate method for determining swath width, with allowance made for overlap at the edges. Avoid windy conditions when testing.

Materials:

Enough cardboard boxes of equal size to stretch end to end a distance of 16 feet (eg. 16 boxes 1 foot wide). The best box width is 1 foot with widths up to 1.5 feet being acceptable. Boxes should be 1 foot deep. If too shallow pellets may bounce out, and if too tall, pellets will be obstructed from reaching their maximum distance.

1. Set up boxes in a solid line across (perpendicular to) line of travel. They should stretch 8 feet to either side, with a small space at the centre to walk through.

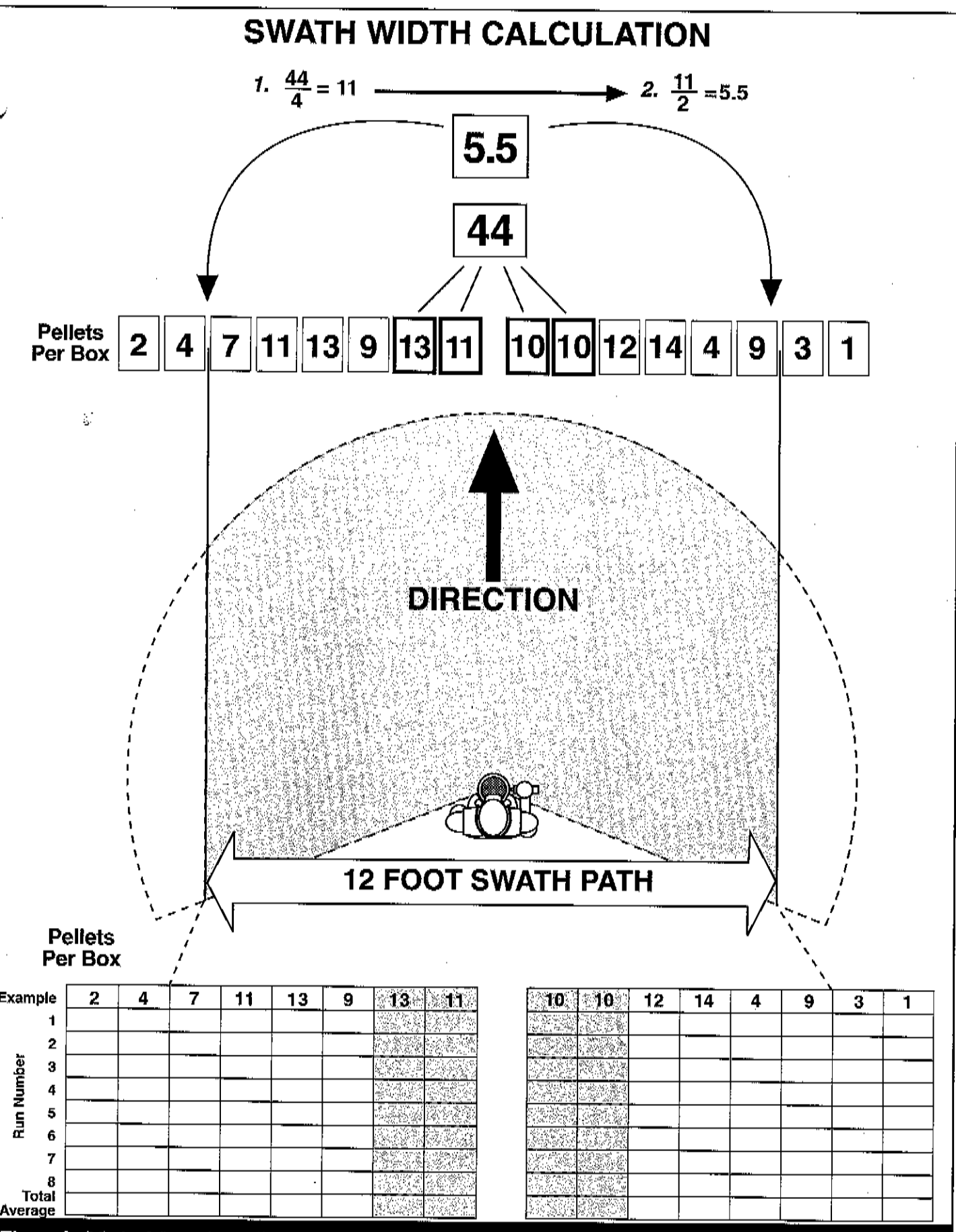
2. Beginning approximately 15 feet before setup, make a pass through the collection box setup, applying pellets using the recommended delivery technique.

3. Count the number of pellets landing in the 4 central boxes. Calculate the average of the central boxes by summing these 4 individual box counts and dividing the sum by 4.

4. Count the pellets in the outer boxes. The number of pellets landing in these boxes will decrease as the distance from centre increases. The swath edge is located at the edge (closest to centre) of the box where the pellet counts decrease, and *remain*, below **half of the "central box average"**. Measure the distance between the swath edges to obtain the swath width.

5. Repeat this procedure several times to get the average result, always travelling in the same direction during testing. Adjust delivery technique until a swath width of 12 feet is being consistently attained, and swath is well centred.

If available use blanks (Pronone pellets without herbicide - available from supplier), they will allow repeated testing at the same location. Use of live chemical will require repositioning the setup for each pass.



Pellets Per Box

	2	4	7	11	13	9	13	11	10	10	12	14	4	9	3	1
Example																
Run Number 1																
2																
3																
4																
5																
6																
7																
8																
Total																
Average																

Figure 3. Method for using collection boxes to determine effective swath width (sample tally sheet at bottom).

Flow Control Plate Construction (Figure 4)

Material:

- 6 inch square or circular sheet metal - 20 to 24 gauge, preferably rust resistant

Tools:

- drill bits
  Inches: 1/8, 3/8, 3/4 - screw, guide, and centre holes
  17/64 to 27/64 - flow hole options
  Millimetres: 3, 10, 19 - screw, guide, and centre holes
  7 to 10.5 - flow hole options
- centre punch
- metal shears
- file

Method:

1. Tape template guide (Figure 4) to metal sheet
2. Mark hole location centres with centre punch
3. Using Figure 2, select 4 flow hole sizes to meet desired application rates.
4. Drill holes as indicated on guide. Note that flow holes occur in *pairs* of equal size. Work with precision - hole size and location are critical. Small variations, including the difference between drill press and hand drilled holes, can alter flow. Plate should be clamped before drilling.
5. Cut out flow plate with shears, following edge of template guide.
6. File off burrs.
7. Label hole sizes on "bottom" face of plate for future reference.
8. Install according to directions in "Flow Control Plate Installation" (pg. 2).

FLOW CONTROL TEMPLATE (TO SCALE)

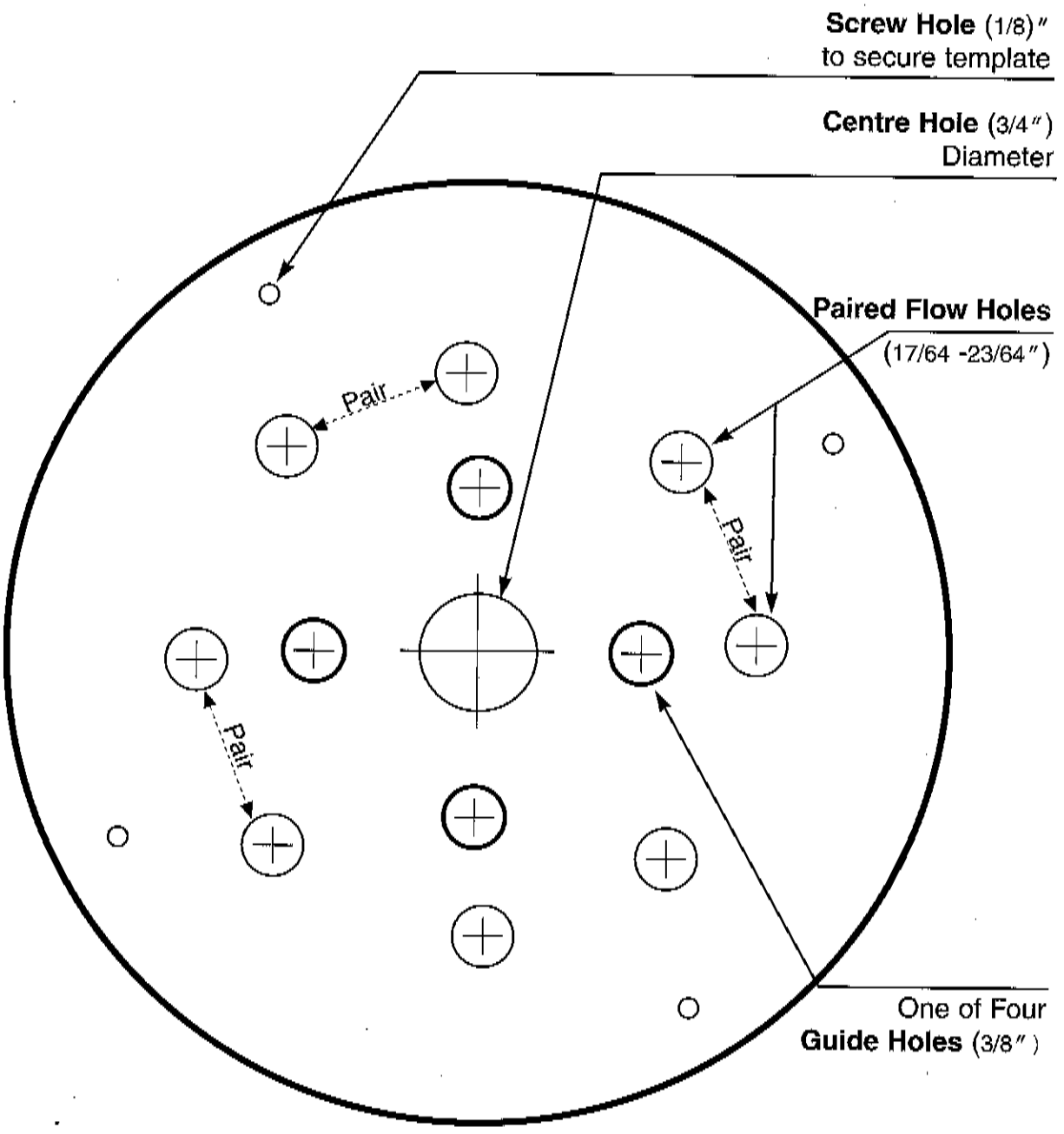


Figure 4. Template Guide for the construction of a flow control plate.
IMPORTANT: Centre holes at indicated crosses

Disclaimer

Mention of trade names of equipment or herbicides is for reader convenience and does not constitute endorsement of a particular product by the N.S. Dept. of Natural Resources to the exclusion of any other suitable product.

Literature Cited

McLaughlan, M.S. 1992. *Hexazinone and granular herbicide applicators: a review of the herbicide and available application equipment*. Thunder Bay: Ont. Min. Nat. Res. Northwest Region Science and Technology Technical Report No. 71, 65 pp.

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