

11. E9 Application Equipment and Techniques



Application Equipment and Techniques

Introduction

The function of application equipment is to deliver the proper rate of chemical and to apply it uniformly to the target area.

Factors to consider in selecting spray equipment

- Type of application.
- Pesticide formulation.
- Type of area to be treated.
- Frequency of applications.

Application Equipment and Techniques

Introduction

Read the label for any applicable restrictions to the use of specific application equipment.

Application Equipment and Techniques

Types of Spray Equipment

- Backpack and handheld sprayers
- Ride on sprayers
- Truck-mounted sprayers with hose reel
- Pull-behind and three-point mounted sprayers
- Rotary spreaders
- Drop spreaders

Application Equipment and Techniques

Backpack and Handheld Sprayers

- **Low pressure sprayers** are the most common sprayer for residential and commercial.



Application Equipment and Techniques

Backpack and Handheld Sprayers

- 1. Capacity of hand sprayers 0.5-3.0 gallons.
Pump frequently to maintain an even pressure.**
- 2. Backpack or handheld sprayers are used to treat individual plants, small areas, or hard-to-reach areas. Do not have agitators so they must be shaken frequently.**
- 3. Backpack sprayer capacity 2.5-5.0 gallons.**

Application Equipment and Techniques



Ride –on sprayer

Application Equipment and Techniques

Ride-on Sprayers

- Ride-on sprayer may be an integrated piece of equipment or maybe mounted on an ATV or utility vehicle.
- May be equipped with a boom or spray wand.
- Powered sprays deliver more consistent pressures than backpack or handheld sprayers

Application Equipment and Techniques

High Pressure Sprayers



42 gpm 700 psi tree sprayer

Application Equipment and Techniques

High Pressure Sprayers

- High pressure sprayers are used on shade trees, ornamental plants and orchards. Can penetrate heavy foliage and tall canopies
- The fine droplet sizes at high pressure are susceptible to drift unless there is a containment system.
- Powered sprays deliver more consistent pressures than backpack or handheld sprayers.

Application Equipment and Techniques



3-point hitch sprayer

Application Equipment and Techniques

Pull-behind Sprayer

Generally have capacity of up to 200 gallons

Application Equipment and Techniques



Airblast Sprayers

Application Equipment and Techniques

Airblast Sprayers

- Use a blast of air to propel the spray. Used in orchards and on shade trees. Usually have an electric charge to help the pesticide stick to the leaves.
- Provide good coverage and penetration but spray is susceptible to drift.
- Mist blowers produce air velocities of 120-200 mph.

Application Equipment and Techniques



Sprayer boom

Application Equipment and Techniques

Sprayer Boom.

- **Used for larger areas.**
- **Range in size from hand-held to tractor-mounted.**
- **Different nozzles can be selected as well as changing the nozzle angle/height/spacing to change the delivery rate.**

Short Summary

Low pressure sprayers are the most common sprayer for residential and commercial.

Powered sprays deliver more consistent pressures than backpack or handheld sprayers.

**Low/moderate pressure range 15-80 psi.
Used on large turf areas e.g., golf courses,
sports fields, general grounds.**

Quick Questions

How are most applications made?

Most applications are made with sprayers

What is the most frequently used carrier?

Water

What are fine droplet size sprays susceptible to?

Drift

Short Summary

Spray booms are used to treat larger areas.

Controlled droplet sprayers use a rotating cup to produce a more uniform droplet size.

Truck mounted sprayers have larger capacity tanks.

Quick Questions

What are metered spray guns?

Metered spray guns deliver a precise volume of spray and are useful for spot sprays especially in nurseries and greenhouses.

What are spray wands useful for?

Spray wands are useful for accurate low-volume spot treatments on ornamentals and smaller turf areas.

Application Equipment and Techniques

Spreaders

The two most common spreaders are

- Rotary
- Drop



Rotary spreader

Application Equipment and Techniques

Rotary Spreaders

Rotary spreaders use a rotating disc or fan to distribute granular pesticides or fertilizer.

- Most rotating spreaders produce a swath width of 6-12 feet.



Rotary spreader

Application Equipment and Techniques

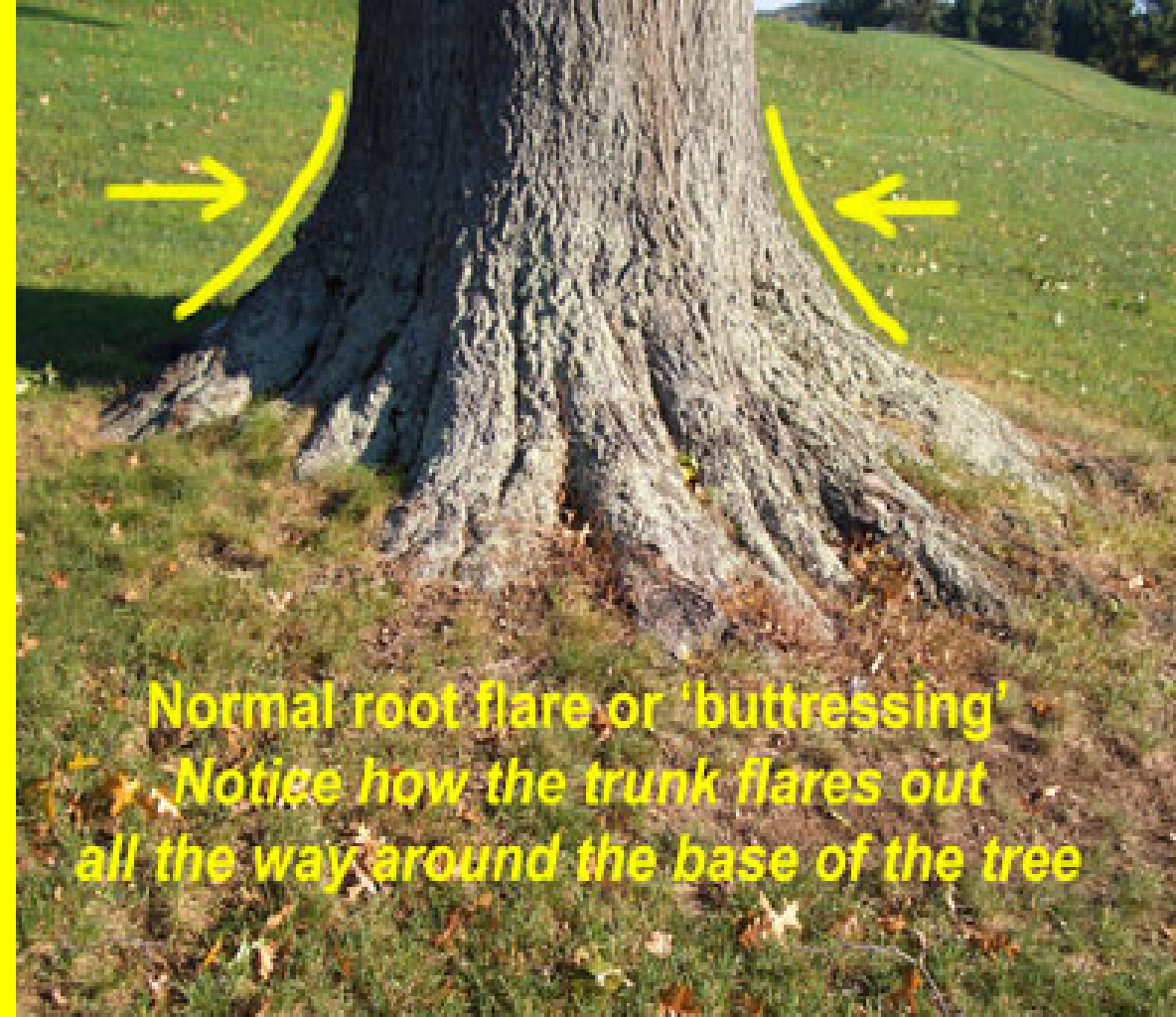
Rotary Spreaders

- Rotary spreaders are less precise than drop spreaders.
- A change in ground speed produces a change in distribution pattern.
- Heavy granules travel further than light granular particles
- Rotary grinders, push-type in front of the body. 'Belly grinders' that are strapped over the shoulders.

Application Equipment and Techniques

Tree Injection

- Trees may be treated with liquid injections or encapsulated pesticide implants.
- Treatment is made at the *root flare* into the active xylem (near the first few rings)



Tree root flare

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Tree Injection

Advantages of injections

- Lower amount of pesticide needed for treatment.
- Pesticide is applied to the location of the target organism.
- Does not impact people and non-target organisms.

Application Equipment and Techniques

Bark Spray and Stump Treatments

- **Bark spray**, also called basal bark treatment, is an application to the bottom 4-5 feet of the tree covering the entire stem, root collar, and any exposed roots. A oil-based carrier is usually added to improve penetration into the bark.
- Use of tracer dye will help you visually determine adequate coverage.

Application Equipment and Techniques

Stump Treatment

- For larger stumps apply herbicide to the outer 2 inches of the stump
- For tree stumps less than 3 inch diameter, apply to the entire stump
- Tracer dye is helpful in confirming herbicide coverage.

Application Equipment and Techniques



Application Equipment and **Soil Injection**

Some injectors are hand held or truck mounted high pressure sprayer.

The injector can be calibrated to deliver the same amount of chemical with each injection.



Application Equipment and Techniques

Soil Drench

- A shallow trench around the base of the tree will help prevent the pesticide from moving away from the target.
- If the soil is dry irrigate prior to applying the drench.



Application Equipment and Techniques

Wick or Wiper Applicators

- Wick or rope applicators can be used for foliar application in ornament beds.
- Non-selective herbicide is used to manage a variety of weeds without risk of pesticide drift.



Short Summary

Tree injection is the treatment of trees with pesticides by delivering systemic pesticides, usually insecticides, through a hole drilled through the active xylem of the tree.

Rotary spreaders are less precise than drop spreaders.

Most rotary spreaders produce a swath width of 6-12 feet.

Quick Questions

In a rotary spreader, heavier granules travel further than or not as far than lighter granules.

Further

What are the two types of spreaders?

Drop and rotary

Are the pesticides used for tree injections systemic?

Yes

Short Summary

Tree injections can be safely made during rainy and windy weather.

The height of a wick applicator can be set so that it will only contact weeds

Soil injectors can be calibrated to deliver the same amount of chemical with each injection.

Quick Questions

When should pesticide applications be made?

Applications should be made at those times in the pest life cycle when the pest is most vulnerable.

Why are shallow trenches made for soil drenches?

To prevent the pesticide from going off target.

Why is tracer dye included in stump treatments?

The tracer confirms coverage.

Application Equipment and Techniques

Indoor, Greenhouse and Nursery Application

- **Verify that you are treating for the correct problem.**
- **Schedule treatments outside normal work hours so that people are not present.**
- **Spot spray when possible.**
- **Follow the reentry interval REI specified on the pesticide label.**

Application Equipment and Techniques

Indoor, Greenhouse and Nursery Application

Sprayers for indoor plants.

- **Make sure you are managing the right problem. Verify the organism you are selecting to treat for is the cause.**
- **Schedule pesticide applications with odors during off hours when people are not present.**
- **Keep the applicator closer to the target area.**
- **Minimizing overhead spraying will reduce risk to the applicator and possible off-target pesticide application.**

Application Equipment and Techniques

Indoor, Greenhouse and Nursery Application

| Indoor Plant Height | Spray Equipment Recommendation |
|---|--|
| \leq 6 feet tall | Small pump sprayer |
| \geq 6 feet tall | Backpack sprayer with watering wand and breaker head nozzle |
| Larger trees or plants located near the building ceiling | Hydraulic lift platform plus sprayer |

Application Equipment and Techniques

Chemigation

- **Chemigation** the application of any chemical through an irrigation system.
- **Chemigation advantages** less application equipment and less labor.
- **Chemigation has the risk of chemical backflow into the water supply.**

Application Equipment and Techniques

Chemigation

MN chemigation regulations require an MDA chemigation system user permit, pay a fee, install antipollution/safeguard devices and compliance with MN Dept. of Health regulations on well separation distance.

Application Equipment and Techniques

Ensuring Application Accuracy

- Calculate the target area.
- Calibrate your application equipment.
- Follow label instructions and calculate the amount of pesticide you need to apply.

Application Equipment and Techniques

Ensuring Application Accuracy

Why calibrate?

- Regulate calibration to ensure accuracy.
- Charts and tables cannot account for equipment wear.
- Minimum calibration frequency annual calibration

Application Equipment and Techniques

Ensuring Application Accuracy

Why calibrate?

- Recommended calibration liquids. Calibrate when there are any changes in the equipment or when you use new equipment e.g., changes in boom height, pressure and nozzles that may affect the application rate.
- Recommended calibration granular. Calibrate for each of the products used.

Application Equipment and Techniques

Ensuring Application Accuracy

Speed and rate.

- The faster you go the lower the application rate.
- The slower you go the higher the application rate
- Ideally, calibrate for the walking speed of each applicator. Maintain a steady speed.

Application Equipment and Techniques

Ensuring Application Accuracy

Pressure and rate.

- The higher the pressure the greater the rate.
- Each pressure will deliver a different rate.
- Maintain steady pressure.

Application Equipment and Techniques

Ensuring Application Accuracy

Height above ground and spray pattern.

- Calibrate for each of the heights the sprayer will be used.
- These concepts also apply to backpack sprayers.

Application Equipment and Techniques

Summary

- **Speed and rate, the faster you go the lower the rate of application.**
- **Pressure and rate, the higher the pressure the more chemical you will apply.**
- **Height above ground and spray pattern, the closer to the ground the tighter the spray pattern and the higher the rate.**

Short Summary

MN chemigation regulations require an MDA chemigation system user permit, pay a fee, install antipollution/safeguard devices and compliance with MN Dept. of Health regulations on well separation distance.

Ideally, calibrate for the walking speed of each applicator.

The slower you go the higher the rate of application.

Quick Questions

A higher sprayer pressure will produce a higher or lower rate of application?

Higher

Why should you calibrate your application equipment?

To ensure you are legally and effectively applying pesticides.

What is volume per unit area?

The amount of material applied over a set area.

Application Equipment and Techniques

Calibration

- Calibration is vital to ensure you are applying the appropriate rate of a chemical.
- If you don't calibrate your equipment you don't know the rate at which you are applying chemical.
- Without calibration you could be making costly and potentially dangerous mistakes.
- Manufacturer charts and tables do not account for equipment wear.

Application Equipment and Techniques

Ensuring Application Accuracy

Calibration chart.

- Document the calibration by transferring the data to a chart.
- Keep a copy of the calibration chart with the applicator equipment and in the office.
- Based of the chart, adjust the settings, pressure, and nozzles for each piece of equipment and product based on the chart.

Application Equipment and Techniques

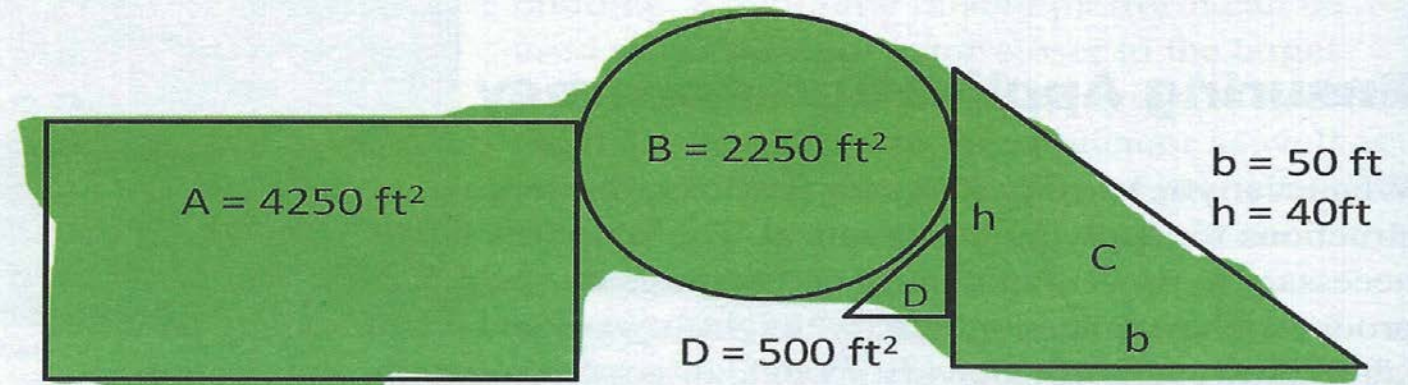
Ensuring Application Accuracy

Volume per unit area

- **Volume per unit area** amount of material applied over a set area.
- The **pesticide label may specify annual limits** e.g., products to manage emerald ash borer have an annual limit per acre based on tree diameter. **Be careful not to exceed the limit!**

Calculate the target area by splitting into different forms, square, circle, trapezoid

If the area has an irregular shape (like the turf area of the landscape pictured below) try to visually break the area into regular shapes and measure the areas accordingly.



To calculate the total area for the example above:

The area of the circle is $(r \times r) \times \pi$. In this example, $(20 \times 20) \times 3.14 = 1256 \text{ ft}^2$

The area of the rectangle is $l \times w$. In this example, $50 \times 35 = 1750 \text{ ft}^2$

The area of the triangles is $\text{area} = \frac{b \times h}{2}$

In this example the large triangle is $\frac{40 \times 40}{2} = 80 \text{ ft}^2$

and the small triangle is $\frac{8 \times 10}{2} = 40 \text{ ft}^2$

For a total target area of $1256 + 1750 + 121 + 40 = 3167 \text{ ft}^2$

Application Equipment and Techniques

Calibrating Properly Reduces Drift

Pesticide drift to non-target areas is a violation of Minnesota State law.

- Increase droplet size by lowering application nozzle pressure.
- Pesticide droplets that are smaller have a greater likelihood to volatilize and drift
- Equipment manufacturers often provide charts that show the droplet sizes produced by various nozzles and pressure settings.

Application Equipment and Techniques

Calibration

- Check that nozzle tips are correct type and size, check pesticide label.
- Use soft, non-abrasive material to clean nozzles, nozzle tips, and screens.
- Check spray operation with water (only). Watch for irregular spray patterns.
- Replace any nozzle that is more than 10 % different from the average output.

Application Equipment and Techniques

Calibration Examples

Factors that affect calibration

| Factor | Application Rate |
|---------------------|------------------------------------|
| Speed | Faster = lower rate |
| Pressure | Higher = higher rate |
| Height above ground | Lower = higher rate |
| Droplet size | Higher pressure = smaller droplets |

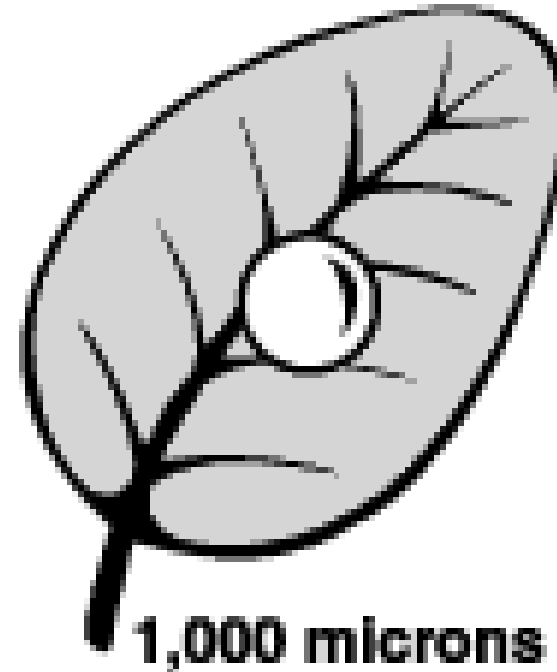
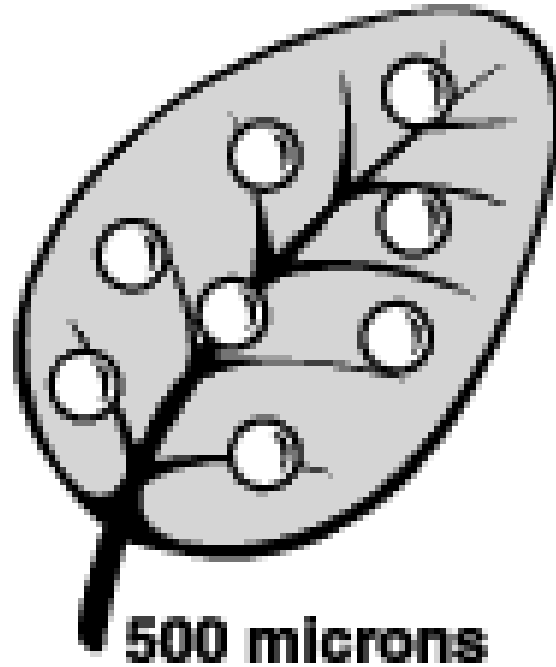
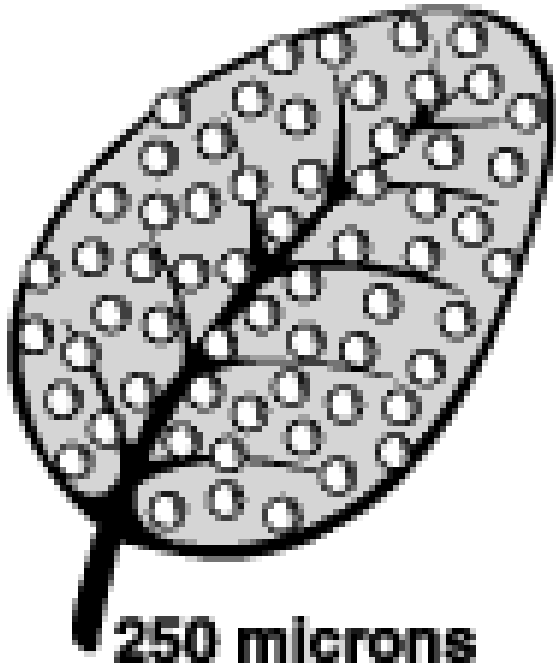
Application Equipment and Techniques

Optimum Droplet size for Herbicides

An average droplet diameter or volume mean diameter (VMD) of about 250-300 microns offers the best combination of effective coverage and drift reduction for post application of many systemic and contact herbicides.

Application Equipment and Techniques

Droplet Size and Surface Coverage



NDSU Agriculture Communication

Ag Spray Droplet Relates to Coverage and Drift

Short Summary

Calibration is vital to ensure you are applying the appropriate rate of a chemical.

If you don't calibrate your equipment you don't know the rate at which you are applying chemical.

Without calibration you could be making costly and potentially dangerous mistakes.

Quick Questions

What is the purpose of the edge guard on a spreader?

To prevent granular material from being applied off target

Why is overlapping application made with rotary spreaders?

Because of the lack of uniformity in rotary spreaders

Are foliage applications on ornamentals 2D or 3D?

3D

Short Summary

Apply drenches and injections for trees and shrubs based on diameter at breast height (DBH) measured at 4 ½ feet for an adult (1.3 m).

An average droplet diameter (VMD) of about 250-300 microns offers the best combination of effective coverage and drift reduction for post application of many systemic and contact herbicides

Quick Questions

What is the preferred method for changing sprayer output.

Change the nozzle

Replace any nozzle that is more than ___% different from the average output.

10%

When is recalibration required for a boom sprayer?

Changes in speed, nozzles or pressure require recalibration.

Application Equipment and Techniques

Operating Procedures Before application

- Rinse the applicator with clean water at the beginning of each season.
-
- Check boom sprayers to ensure all nozzles are the same type, size and boom angle.
- If nozzles have check valve confirm proper operation.

Application Equipment and Techniques

Operating Procedures Before application.

- Check applicators for leaks and proper output
- Replace a single nozzle if output is $> 10\%$ different from average.
- Replace all nozzles if more than one nozzle is $> 10\%$ different from average.

Application Equipment and Techniques

Operating Procedures Before application.

- Replace damaged or deteriorated strainers. Use progressively smaller strainers. **Strainer mesh** the number of openings per lineal inch, Higher numbers denote a finer screen.
- Replace hoses at the first sign of wear. Use weather- resistant hoses/fittings. Ensure sufficient burst strength of hoses.

Application Equipment and Techniques

Operating Procedures Before application.

- Check nozzle height—the distance between nozzle tip and the target.
- Know the true volumetric measures of your equipment—ensure tank is level during filling.

Application Equipment and Techniques

Operating Procedures During application

Prevent drift. Ensure appropriate

- Nozzle selection.
- Pressure.
- Application speed.
- Weather, wind, temperature, and humidity.

Application Equipment and Techniques

Operating Procedures During application

- Check pressure gauge and tachometer frequently. Replace pressure gauge if necessary.
- Periodically check hoses and fittings for leaks.
- Check nozzles for unusual patterns.
- Wear the personal protective equipment specified by the pesticide label.

Application Equipment and Techniques

Operating Procedures. During application.

- Use an old toothbrush to unclog nozzles—never use metal wire which may distort the spray pattern and change the output.
- Never operate a sprayer pump above speeds recommended by the manufacturer.
- Never allow a pump to run dry—pumps are dependent on spray liquid for lubrication and to prevent heat buildup.
- **Prevent drift!**

Application Equipment and Techniques

- **Operating Procedures** After application
- Flush spray system inside and out with fresh water. Includes sprayer pumps, tank, hoses and boom.
- Apply **rinsate** to target site to avoid buildup in the clean-up area.
- Clean inside and outside of equipment Rinse hoses, inside and out.
- Clean strainers after each use.
- Visually inspect equipment before the next use.

Application Equipment and Techniques

Operating Procedures Storage of equipment

- Tape the nozzle openings to keep dirt out.
- For winter storage drain water from pumps to keep them from freezing and cracking (if not stored in a heated building). Add 1 tablespoon of radiator rust inhibitor antifreeze into the pump inlet—turn the pump over several revolutions to coat the internal surfaces.

Application Equipment and Techniques

Operating Procedures Calibration checks and documentation

1. After the initial calibration, periodic checks will verify that the calibration has not changed. During application you can do a quick check to verify accuracy i.e. if you have covered $\frac{1}{4}$ of the target area you should have consumed $\frac{1}{4}$ of the pesticide.

2. Spray documentation should include date, equipment type, operator name, calibrator name, calibration chart

Short Summary

Signs of pesticide misapplication

- Pesticide granules visible on hard surfaces adjacent to the target area.
- Uneven coverage evident on weeds or pests.
- Lack of coverage in swathes e.g. areas missed by applicator or caused by clogged nozzles.
- Lack of control due to inaccurate pest identification.
- Using the wrong product

Quick Questions

What should you use to clean clogged sprayer nozzles?

A used tooth brush

What is pesticide misapplication?

Misapplication is the placement of pesticide or fertilizer beyond the target area or in improper amounts.

If you spill a pesticide what must you do?

Call the Minnesota Duty Officer 1-800-422-0798