Equipment

CHAPTER 21

Learning Objectives

- Understand and be able to describe application methods covered in this chapter
- Be able to describe components of each (i.e. nozzles for sprayers),
- Know how to select application method
- Describe how to use & store safely

Application methods

- Band application - strips
- Basal application – directed to lower portions of brush or small trees
- Broadcast application over entire field
- Directed spray to pest, avoid non-targets
- Foliar application – to leafy parts
- Rope or wick –wipes herbicide on weeds
- Spot treatment – to small distinct areas
- Soil application directly on soil
- Soil incorporation tillage, rainfall, irrigation
- Soil injection under pressure beneath soil surface
- Tree injection under the bark
- Space treatment small distinct areas
- Crack and crevice of buildings (i.e. baseboards, cabinets)

Sprayers

Most pesticides applied as liquids

Sprayer selection

- Formulation to apply
- Spray volume and pressure
- Size of area to treat
- Components: tank, pressure, nozzle

Sprayer Components

Tanks

- Size reasonable to limit refills
- Does not corrode and cleanable
- Drain to clean out
- Large top opening for filling, cleaning and inspecting
- Watertight cover
- Agitation

Pump

- Supplies pressure and volume to nozzle
- Must resist corrosion
- Operate at recommended pressures, not higher
- Depends on spray liquid for lubrication

Sprayer components

Nozzle functions:

- Control amount applied
- Control droplet formation & size
- Control distribution and pattern
- Size of nozzle opening
  - Coarse droplets to minimize drift
  - Fine droplets for maximum surface coverage
  - Target pest type of application coverage desired, potential for drift, label instruction

Nozzle Spray Patterns:

- Flat spray – require overlapping, even fan for band applications.
- Flooding – fertilizers, herbicides, defoliants, less drift potential
- Hollow and solid cone – handguns and row crops for crop protectants, penetrate foliage
- Multi-pattern – adjustable to pin stream, flat fan, cone

Materials:	Hardened stainless steel Ceramic Plastic and nylon Stainless steel	Aluminum Brass

Sprayers for liquid solutions:

Describe uses, delivery, and advantages, disadvantages.

- Low pressure boom sprayer – roller or centrifugal pump – dilute pesticide mixes, low volume cover large area quickly, hydraulic agitator.
- High pressure (Hydraulic) sprayers 200-500 psi– piston pumps, mechanical agitation, heavy, drift potential
- High pressure handgun
- Airblast – fan helps deliver pesticide to target, high or low volume spray, good coverage, high drift potential
- Hand operated sprayers – compressed air, no agitation, small jobs
- Backpack – various pump types, to 100 psi

Sprayers for **granular** applications:

Describe uses, delivery, and advantages, disadvantages.

- Gravity feed with adjustable opening to adjust flow rate.
- Band, in furrow, and broadcast applications used in agriculture
- Rotary and drop spreaders (more precise) in turf and small areas
- Airblast granular spreader for aquatic areas

Other applicator equipment:

Describe uses, delivery, and advantages, disadvantages.

- Rubs, walk-through, dipping vats for animals
- Bait dispensers for rodents, insects
- Foggers for indoor pests, and outdoor (mosquitos)
- Chemigation
- Dusters
- Aerosol cans

Engineering controls:

Describe how they reduce applicator exposure?

- Low drift nozzles
- Enclosed cab – wear PPE specified on label, supplement to PPE, replacement?
- Check valves
- Multiple nozzle bodies – in case of plugging
- Tank rinse systems, clean water supply mounted to sprayer for in-field rinsing

Cleaning equipment:

Describe why and how?

- Can contaminate future applications
- Hazard for equipment maintenance
- PPE specified on label + eye protection
- Clean at application site
- Clean outside, fill tank 1/3 full with tank cleaning agents as per label
- Compressed air for blowing nozzles

Prepare equipment for storage:

Describe why and how?

Review steps on page 174

- Clean
- Touch up paint
- Lubricate wheel bearings
- Remove and clean nozzles, store in baggie
- Plug nozzle outlets with cork
- Remove and clean filter screens, O-rings
- Loose lid
- Winterize pump and store sprayer inside.

Questions?

Calibration
Chapter 24

- Define Calibration
- Purpose of Calibration
- Why is it important?
  What are the consequences of incorrect calibration?
- Label information
- How to prepare
- Using equations provided, determine:
  - Spray rate of equipment
  - Amount of granules that should be applied to an area
  - Ground speed of equipment
  - Dimensions of a suitable test area
- What 3 things can you change to adjust your spray rate?
- List factors affecting flow rate. How?
- Why do you need to recalibrate granular application between products?

Calibration

- Calibration – the measurement of the delivery rate of your application equipment under controlled conditions
- Purpose – To apply correct amount uniformly

Over-apply

- Waste product ($)
- Damage treated surface
- Higher risk to human health & environment

Under-apply

- Inadequate control
- Reapply = more $ and time

In Either Case: Violating Label

Calibration equipment:

- Stopwatch
- Tape measure 100 Ft.
- Collection container
- Graduated cylinder to measure output
  - Scale to weigh dry formulation
- Paper/pencil
- Calculator

- Label info: spray rate or application rate
- PPE: sprayer is likely to contain residues

Calibration Prep:

1. Clean nozzles, screens, disc/whirls
2. **Use clean water!**
3. Check nozzle size and manufacturer specs
4. Check for uniform spray pattern – boom
5. Measure output for each nozzle over given time with flowmeter or measuring cup
6. Change nozzles off by 5% of average
7. Measure travel speed

Calibration – Methods

- Known area method: gallons per acre
  1. Mark out an acre: 43560 ft^2 (~209 x 209 ft)
  2. Fill tank & spray the area
  3. Measure how much you need to refill

  This is the amount / acre

No information on individual nozzle wear, uniformity!

Boom Sprayer Calibration

- Determine nozzle spacing
- Determine travel course length (**Check chart pg 197)**
- Measure time required to travel course
- Sprayer standing still – set pressure and rpm, catch water from each nozzle for time it takes to travel course

Average nozzle output per nozzle in fl oz. = **Calibrated Spray Rate in GPA**

How does this work?

- You sprayed 1/128 of an acre per nozzle
- 1 fl oz = 1/128 of a gallon

So applying 1 fl oz per 1/128 acre is the same as 1 gal per acre

Airblast sprayer calibration

Attach hoses over nozzles and collect into buckets for 60 seconds = **GPM (gal per minute)**	2 GPM
Check travel speed (ft/s x 0.682)	5 ft/s = 3.41 MPH
Measure between row spacing	14 ft
Gal/acre = $\frac{\text{GPM} \times 495}{\text{MPH} \times \text{row spacing}}$	$\frac{1 \times 495}{3.41 \times 14}$ **= 22.8 gal/A**

Andrew Landers YouTube
Part 1: https://www.youtube.com/watch?v=6izHj0GF1rY
Part 2: https://www.youtube.com/watch?v=eAfEIjwg5HI

Hand sprayer calibration

- Fill sprayer to known level
- Mark area and measure square feet (length x width) 20 x 50
- Spray uniform pattern at constant speed
- Measure amount of water needed to refill sprayer = gallons per 1000 ft^2

Granular Applicator – size, shape, density of product

- USE PPE since using actual chemical
- Set up test run area on driveway that can be swept (tarp) or place a bag or catch pan under spreader
- Spread over test area at intended speed
- Measure area of spread
- Sweep up material and measure amount collected
- = lb/area of spread, convert to lb/100 ft^2

Flow rate depends on size, shape, & density of material – recalibrate each time you change products

Changing Delivery Rate

- **Pressure**
  for small changes
  - need 4x pressure to double output
- **Speed**
  for small changes
  proportional decrease in spray rate
  - Double speed to decrease rate by 1/2
- **Nozzle size**
  preferred method of change
  - Start all over with calibration

Questions?

Calculations
Chapter 25

- Give reasons why it is important to add the correct amount of product and carrier
- Given formulas, calculate
  - Total area of site
  - How much spray mix and/or product you need
  - How much carrier/product to add to a spray tank
  - Total area you can spray is a full or partial tank
  - How much pesticide product it takes to apply a specific amount of a.i. per acre
  - How much pesticide product and carrier are need to mak a given percentage spray
- Convert the amount of spray mix and product from per acre to per 1000 ft^2 and vice versa

Why do we need to get it right?

Over-apply

Waste product ($)

Damage treated surface

Higher risk to human health & environment

Under-apply

Inadequate control

Reapply = more $ and time

In Either Case: Violating Label

Need to know:

- Calculate area of site, ft ^{2} or acres
- Total spray mix/product needed for spray?
- How much product in the tank?
- How much carrier (water) in tank?
- Total area sprayed with full tank?
- How much product to apply ai/acre?
- How much product/carrier for % spray.
- Convert rate per acre to rate/1000 ft^2

Standard Measure

- 1 acre = 43560 ft^2
- 1 gallon of water weighs = 8.3 lb.
- 1 gallon of kerosene = 6.6 lb
- 1 lb. = 16 oz.
- 1 pt = 16 fl oz.
- 1 qt. = 32 fl oz.
- 1 lb. WP per 100 gal = 1 Tablespoon/gal
- 1 pt. EC per 100 gal = 1 tsp/gal

Determine spray volume needed?

- You have 20 acres to treat, your sprayer is calibrated to spray 40 gallons/acre. How much total spray needed?

20 acres X 40 gallons/acre = 800 gallons

Determine number of tanks needed?

- You have 20 acres to treat, your sprayer is calibrated to spray 40 gallons/acre. How much total spray needed?
- 20 acres X 40 gallons/acre = 800 gallons of spray
- 500 gallons per tank =
  - 800/500 = 1.6 tanks
  - How many gallons in partial tank?

Determine acres sprayed by each tank?

- 500 gallons per tank =
  40 gallons per acre

  12.5 acres
- 300 gallons of spray = 7.5 acres

  Or

  12.5 acres x 0.6 tank= 7.5 acres

Determine how much product?

- Total acres treated x amount per acre = product to buy
  20 acres x 3 lb/acre = 60 lb. product
- Amount per tank =

  7.5 acres x 3 lb = 22.5 lb product

  12.5 acres x 3 lb = 37.5 lb product

How much product per 1000 ft ^{2}

- Herbicide from hand sprayer at 2 gallons/1000 ft^2 on 6500 ft^2

  Spray volume needed?

  $\underline{\text{Total } ft^2}$ x 2 gallons/1000 ft^2 = Total Gals 1000 ft^2

  6500/1000 X 2 = 13 gallons of spray

- Number of tankfuls? 3 gallons/tank

Gallons needed/tank capacity = # tanks

13 gallons needed/3 gal/tank = 4.33 tanks

How much area per 3 gallon tank?

- Herbicide from hand sprayer at 2 gallons/1000 ft^2 on 6500 ft^2

  Gallons in tank x 1000ft^2 = area by tank
  Gals/1000 ft^2

  3/2 X 1000 = 1500 ft^2

- If 5 oz/1000 ft^2, how much pesticide/tank?

  ft^2 per tank/1000 x 5 oz./1000 =

  1500 ft^2/1000 x 5 oz. = 7.5 oz./tank

  6500 ft^2/1000 x 5 oz. = 32.5 oz. (2.03 lb)

Label rate – pounds a.i. per acre?

Label calls for 1 lb a.i. per acre.
Pesticide product has 8 lbs. a.i. per gallon.
How much pesticide product is needed?

lbs a.i. per acre / lb a.i. per gallon of product = gallons of product per acre

1/8 = 1/8 gallon or 1 pt.

How much product per spray tank (500 gallons for 12.5 acre)?

12.5 acres x 1 pt/acre = 12.5 pt , 6 qt 8 oz

500 gal tank – 1.56 gallons product =498.4 gal H_2O

Label rate – percentage spray mix? liquid formulation – look at label chart!

Volume spray wanted x % spray wanted = volume product - 100%

Label calls for 3% spray and need 3 gallons water.
How much pesticide/water is needed?

3 gallons x 3%/100% = 3 x .03 = .09 gallons

.09 gallons x 128 fl oz/gal = 11.5 fl oz product

How much water?

3 gallons - .09 gallons = 2.91 gallons

2.91 gallons = 2 gallons and 116.5 fl oz.