Simple Calibration and Maintenance of Small Sprayers

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Why Maintenance & Calibration are Important

• Critical to:
  – Effective applications from
    • Well maintained & calibrated sprayers
    • Saves money, pesticides
    • Good stewardship

• Ineffective applications from
  – Worn or plugged nozzles
    • Poor coverage
    • Poor control

  – Poor calibration
    • Too much or too little
    • Haven’t got a clue?
What Makes a Sprayer?

• Most sprayers have
  – Tank
    • Stainless steel
    • Plastic
  – Pressure system
    • PTO pumps
    • Electric pumps
    • Hand-pumps
    • Compressed gas
  – Screen filters
  – Spray nozzles
    • Many types
    • Many materials
Spray Tanks

• Materials
  – Stainless steel
  – Plastic


http://www.amazon.com/NorthStar-Spot-Sprayer-Tank-Capacity/dp/B0000AX5PO/ref=sr_1_9/189-8342415-2204643?ie=UTF8&qid=1420496630&sr=8-9&keywords=sprayer+tank

http://www.zoro.com/i/G0810135/?utm_source=google_shopping&utm_medium=cpc&utm_campaign=Google_Shopping_Feed&gclid=CM5ic7w_cICFYXtMgodDxoAfA
Sprayer Outfits

http://www.amazon.com/Chapin-61900-Commercial-Backpack-4-Gallon/dp/B001FA09S2/ref=sr_1_5?ie=UTF8&qid=1420497049&sr=8-5&keywords=sprayers


http://www.amazon.com/NorthStar-ATV-Broadcast-Spot-Sprayer/dp/B008YE3UOW/ref=sr_1_12?ie=UTF8&qid=1420497683&sr=8-12&keywords=sprayer+tank
Nozzle Selection

- 3 basic types
  - Flat fan
  - Reflex-deflector-flood
  - Hollow cone

- Use of constant flow valves for hand-pump sprayers
Nozzle Materials

- Plastic
- Brass
- Stainless steel
- Ceramic
Nozzle Spray Pattern Angles

• Pattern angle determines:
  – Boom height
    • Higher angle = lower
    • Want 30-50% pattern overlap
  – Yellow tip = 80° pattern
  – Red tip = 110° pattern
Setting Up A Boom Sprayer

• Decide on a target GPA
  – 25 GPA, 15 GPA, whatever

• Figure out boom spray width
  – Effective spray width

• Decide speed to travel
  – Tractor gear
  – RPM

• Adjust pressure to obtain target GPA

• Write it down!
Spray Boom & Nozzle Setup

- Select nozzles
- Determine boom length
- Space between nozzles based on nozzle specs
How to Mount Nozzles
Sprayer Maintenance

• So it sat all winter:
  – Rinse & clean tank & boom
    • Use household ammonia
    • 1qt. Per 25 gallons
    • Fill tank, pump, boom
      – Let set for 30 min.
      – Spray out then flush system
    • Remove nozzle tips, soak & brush
  – Check for leaks
    • Cracked nozzle bodies, etc.
  – Check sprayer calibration
# Handy Conversions

## Fluid Conversions

<table>
<thead>
<tr>
<th></th>
<th>1oz=6tsp</th>
<th>1oz-2tbs</th>
<th>1oz=30ml</th>
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</thead>
<tbody>
<tr>
<td><strong>Ounces</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pints</strong></td>
<td>1pt=16 oz</td>
<td>8pts=1gal</td>
<td>1pt=473ml</td>
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<tr>
<td><strong>Quarts</strong></td>
<td>1qt=32oz</td>
<td>4qts=1gal</td>
<td>1qt=946ml</td>
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<tr>
<td><strong>Gallons</strong></td>
<td>1gal=8pts</td>
<td>1gal=128oz</td>
<td>1gal=3785ml</td>
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</table>

## Dry Conversions

<table>
<thead>
<tr>
<th></th>
<th>1lb=16oz</th>
<th>1lb=454gms</th>
<th>1lb=0.454kgms</th>
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<tbody>
<tr>
<td><strong>Pounds</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ounces</strong></td>
<td></td>
<td></td>
<td>1oz=28gms</td>
</tr>
</tbody>
</table>
Sprayer Calibration

• One of many ways to calibrate
  1. Determine spray pattern width
  2. Measure 100’ course
     – Record seconds to travel course
  3. Fill tank with clean water & ck system
  4. Catch spray from each nozzle
     – Determine average
     – If a nozzle varies >10% replace that nozzle
  5. Determine rate per acre i.e. GPA
     – Calculate rate per nozzle
  6. Catch spray from one nozzle & compare with target amount
     – Adjust to obtain target amount
Calibration Example

• My spray boom sprays 12’ wide
• Recorded 17 seconds for 100’
• Desired rate per acre is 25 GPA
• Area sprayed in 100’
  – 100’ x 12’ = 1,200 sqft
  – 43,560 sqft/acre / 1,200 = 36.3
• 25 GPA desired / 36.3 = 0.69 gal
• 0.69 gal x 3,785 ml/gal = 2,612ml
• 2,612 ml / 7 nozzles = 373 ml/nozzle
• Should catch 373 ml from 1 nozzle in 17 seconds
We Did All That & It’s Not the Right Amount!!

• Now what???
  – Adjustments we can make
    • Speed
      – Slow down for more
      – Speed up for less
    • Pressure
      – Reduce pressure for less
      – Increase pressure for more
    • Nozzle tips
      – Larger orifice for more
      – Smaller orifice for less
  – Go through calibration steps again
  – Or. . . Just figure out what the existing rate is and go with it! (If you’re in the ballpark)
Determining What the Existing Rate Is

• Back to our example
  – What we wanted was 373 ml in 17 seconds which = 25 GPA
  – What we got was 475 ml in 17 seconds
  – So what rate is 475 ml?
    • 475 ml x 7 nozzles = 3,325 ml for entire sprayer
    • 3,325 ml per 1,200 sqft
    • 43,560/1,200 = 36.3
    • 36.3 x 3,325 ml = 120,698 ml
    • 120,698/3,785 ml/gal = 31.9 GPA
      – i.e. 40 GPA

• Question: Can we live with a 40 GPA rate? Y or N?
  – I’d probably shift to higher gear
    • To reduce spray rate
    • Recheck calibration
How About Small Sprayers?

• Second verse nearly same as first!
  – Except smaller scale
    • Fewer adjustments available

• Spray known area with water
  – Test area 5’ x 10’ = 50 sqft
  – Begin with known amount of water
    i.e. 2,000 ml
  – Spray area at steady pressure & speed
  – Re-measure water = 500ml used
  – 43,560 sqft/acre / 50 sqft = 871.2
  – 871.2 x 500ml = 435,600 ml/acre
  – 435,600 ml/3,785 ml/gal = 115.1 GPA
Adjusting Rate for Small Sprayers

• Same as larger sprayers
  – Could change
    • Speed
    • Pressure
    • Nozzle

• Regarding our example
  – 115.1 GPA (too high for me)
  – I’d probably walk faster
    • Refigure rate and decide from there

Example of Calculating Spray Loads

- **Determine size of area to spray**
  - Length x width = Square feet
  - 260’ x 40’ = 10,400 sqft

- **Determine acreage to spray**
  - Sqft/43,560 sqft/acre
  - 10,400 sqft/43,560 = 0.24 acres

- **Know sprayer’s rate/acre**
  - i.e. my sprayer calibrated to 25GPA

- **Determine water to put in tank**
  - 0.24 acres x 25GPA = 6 gallons
  - Apply fudge factor to this amount
  - 6 gal x 1.25 = **7.5 gallons** H₂O

- **Determine rate of pesticide to apply per acre (read the label)**
  - i.e. 1 pint per acre & convert to milliliters
  - 1pt/8pt/gal x 3785 ml/gal = 473ml
  - Apply fudge factor 473ml x 1.25 = **591ml** of pesticide

- **Why use a fudge factor?**
  - Takes spray mix to fill boom
  - You might be off on your calibration a little
  - It’s a mess to mix a tiny amount if you run short of spray
Useful Items for Calibration

- Stop watch
- Set of graduated cylinders
- Pencil & paper
- Calculator

http://utahbiodieselsupply.com/graduated_cylinders.php
Useful Items for Sprayers

- Cone-tanks
- Quick couplers
- Electric solenoid valves
Useful Items for Cleaning Your Sprayer

• Cleaners
  – Household ammonia
  – Commercial sprayer detergents

• Spray-boom clean-out hose

Reducing Crop Damage Risk

• Separate sprayers for:
  – Herbicides
  – Insecticides & fungicides

Herbicides only

Insecticide & fungicides only
References

• Nozzle manufactures from stewardship community.com:
  – http://www.lechler-agri.de/englisch/company.html

• Constant flow valves: http://gate-llc.com/cfvalve001.htm

• Hand sprayer calibration steps worksheet, Robert Wolf, Kansas State University from: http://www.ksre.ksu.edu/bookstore/pubs/MF2915.pdf