Simple Calibration and Maintenance of Small Sprayers

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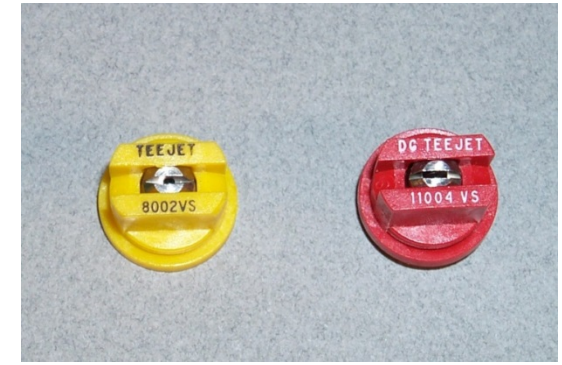
Why Maintenance & Calibration are Important

- 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.spraysmarter.com/ace-roto-mold-white-inductor-tank-40-gallon-open-flow.html?gclid=CJmSssLx_cICFYlcMgodrGoA1Q

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=CMC5ic7w_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.northerntool.com/shop/tools/product_200329207_200329207?cm_mmc=Google-pla-_-Lawn%20%2B%20Garden-_-Sprayers-_-268170&ci_src=17588969&ci_sku=268170&ci_src=17588969&ci_sku=268170&gclid=COK4hPr0_cICFasRMwodPVUA2Q

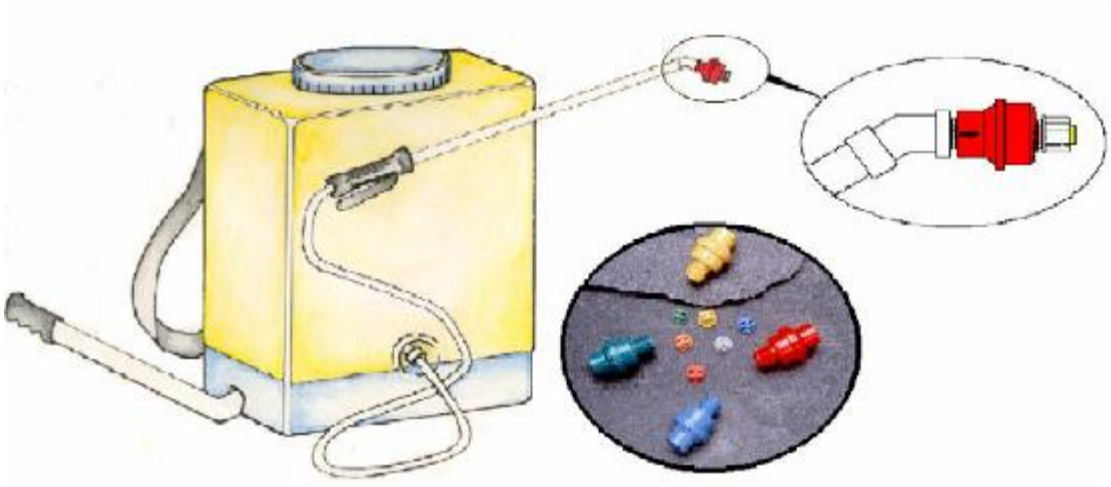
http://www.amazon.com/NorthStar-ATV-Broadcast-Spot-Sprayer/dp/B008YE3UOW/ref=sr_1_12?ie=UTF8&qid=1420497683&sr=8-12&keywords=sprayer+tank

Nozzle Selection

- 3 basic types
  - Flat fan
  - Reflex-deflector-flood
  - Hollow cone
- Use of constant flow valves for hand-pump sprayers

Type of Product / Direction of application	Reflex nozzle	Flat fan	Hollow cone
Herbicide, Systemic Fungicide	✓	✓	⛔
Contact Fungicide, Insecticide	✓	✓	✓
Contact Fungicide, Insecticide	⛔	✓	✓
Drift Risk	Low	Medium	High

http://www.stewardshipcommunity.com/best-spraying-practices/knapsack-spraying/nozzle-selection-and-their-optimised-use/nozzle-selection-slides-21-end.html



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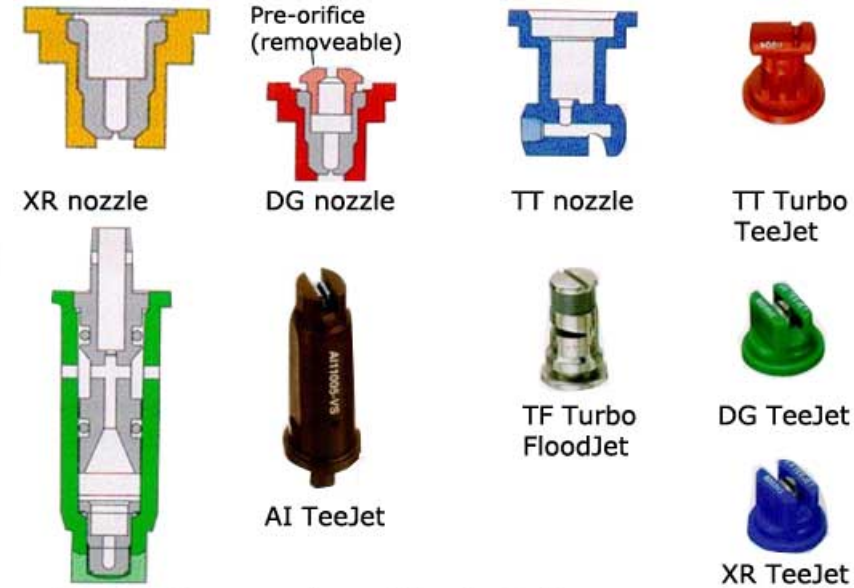
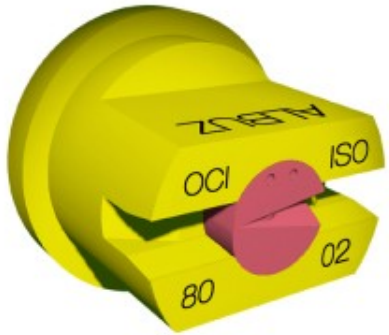


Nozzle Materials

- Plastic
- Brass
- Stainless steel
- Ceramic

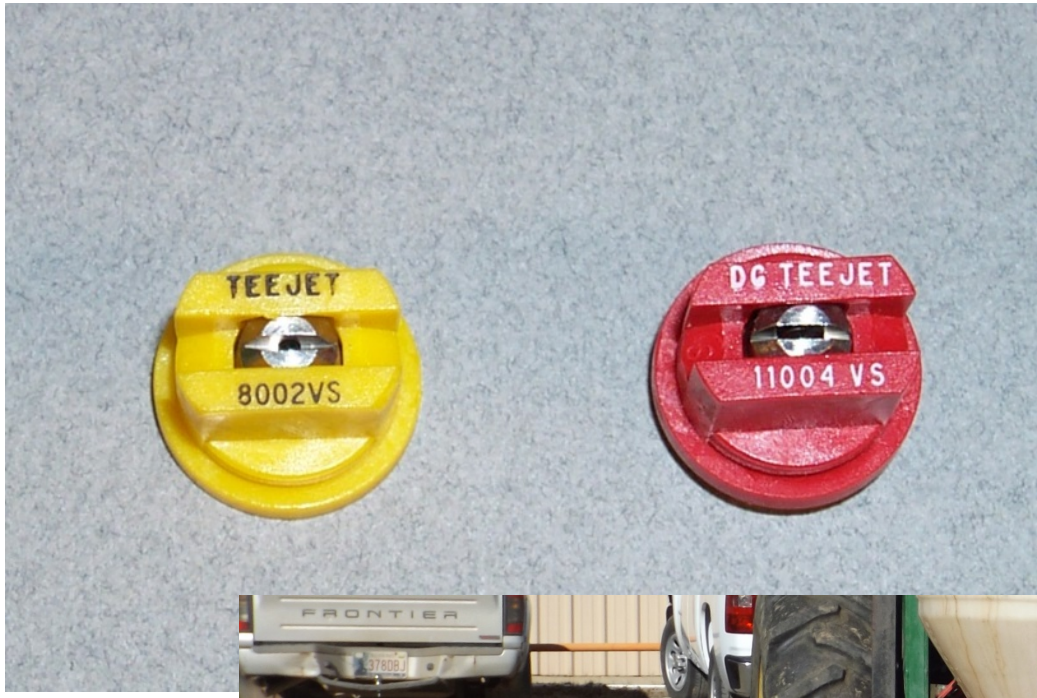
http://www.lechler.de/index-en_US?stage=1

http://www.agratech.co.uk/Hypro-and-Lurmark-Spraytips-and-Nozzles/



http://www.c-spray.com/oci-off-center-ceramic-spray-nozzle.html

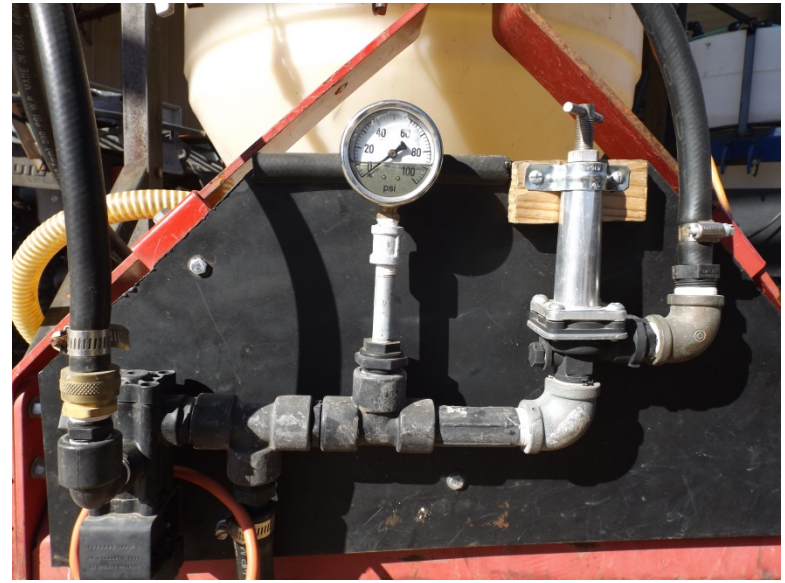
Nozzle Spray Pattern Angles



- Pattern angle determines:
  - Boom height
    - Higher angle = lower
    - Want 30-50% pattern overlap
  - Yellow tip = 80^{o} pattern
  - Red tip = 110^{o} 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			
Ounces	1oz=6tsp	1oz-2tbs	1oz=30ml
Pints	1pt=16 oz	8pts=1gal	1pt=473ml
Quarts	1qt=32oz	4qts=1gal	1qt=946ml
Gallons	1gal=8pts	1gal=128oz	1gal=3785ml
Dry Conversions			
Pounds	1lb=16oz	1lb=454gms	1lb=0.454kgms
Ounces			1oz=28gms

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 = 120,698ml
    - 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

http://vtpp.ext.vt.edu/pesticide-safety-education-program/pesticide-application-equipment/hand-sprayers/images/main-8.jpg?isImage=1

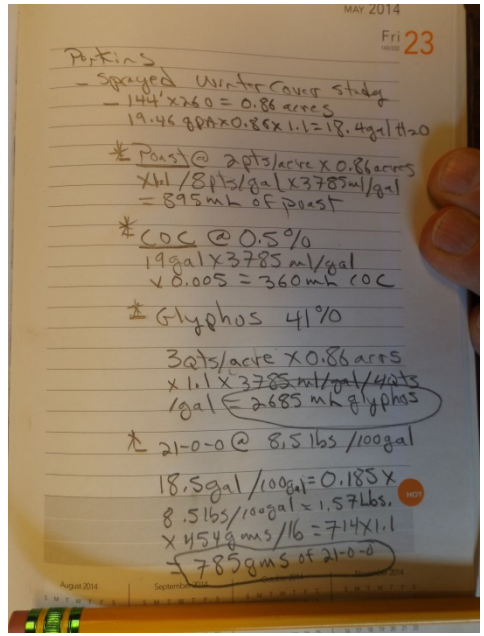
Example of Calculating Spray Loads

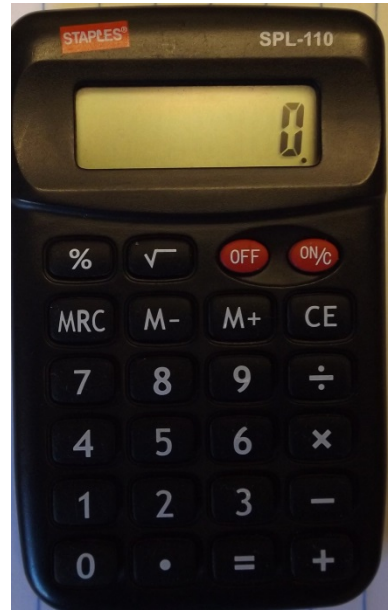
- **Determine size of area to spray**
  - Length x width = Square feet
  - 260’ x 40’ = 10,400 sqft
- **Determine acreage to spray**
  - Sqft/43,560 sqft/acre
  - 10,400 sqft/43,560 = 0.24 acres
- **Know sprayer’s rate/acre**
  - i.e. my sprayer calibrated to 25GPA
- **Determine water to put in tank**
    - 0.24 acres x 25GPA = 6 gallons
    - Apply fudge factor to this amount
      - 6 gal x 1.25 = **7.5 gallons** H_2O
- **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

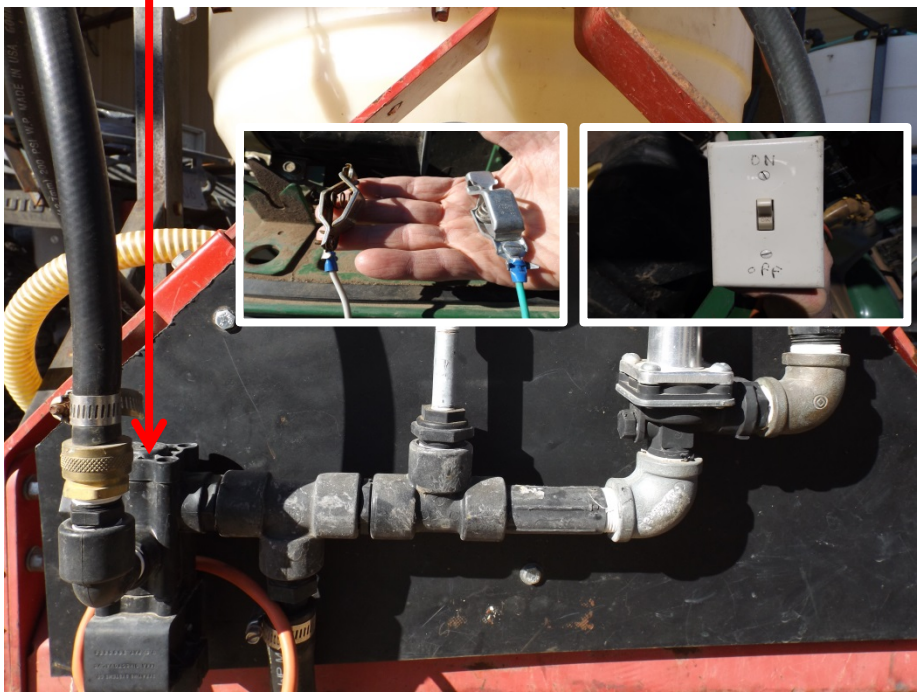
http://utahbiodieselsupply.com/graduatedcylinders.php

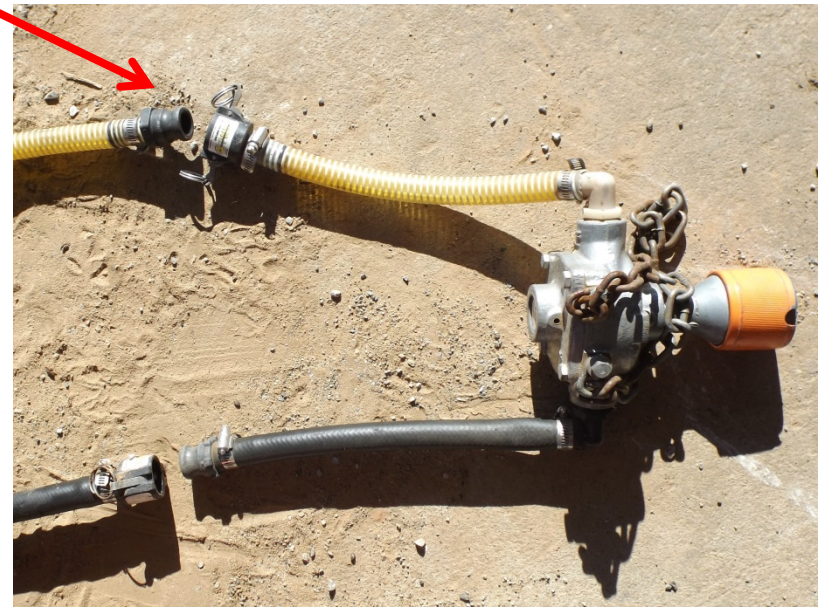




Useful Items for Sprayers

- Cone-tanks
- Quick couplers
- Electric solenoid valves





Useful Items for Cleaning Your Sprayer

- Cleaners
  - Household ammonia
  - Commercial sprayer detergents
- Spray-boom clean-out hose

http://www.gemplers.com/product/PL10/GEMPLERSreg-Spray-Tank-Cleaner-1-Gal

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
  - http://www.spray.com/products/default.asp
  - http://www.agratech.co.uk/sprayers-and-nozzles/lurmark-and-hypro-spraytips-nozzles.html
    http://www.teejet.com/english/home.aspx
  - http://www.hardi-nozzles.com/Hand%20Operated.aspx
- 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