Nozzle Selection for Spraying Herbicides

Everglades Research & Education Center
Nozzles

• Complete nozzle includes the nozzle body, strainer, tip, cap
  – Nozzle body holds the strainer and tip in the proper position
  – Cap secures the strainer and tip

• Nozzle helps control the rate, uniformity, thoroughness, and safety of herbicide application
Nozzles

• Nozzle performance is the key to total system performance in most sprayers systems

• Factors to consider are
  – Nozzle type, size, condition, height, orientation (position on the boom), and spacing on the boom
Types of nozzle tips

- Flat Fan
  - Spray droplets arranged in a fan shape as they leave the spray nozzle
  - Sprays heaviest at the center and dissipates towards the outer edges
    - Less material is applied along edges of the spray pattern
  - Uniform distribution is achieved through proper boom height and nozzle spacing
    - Patterns of adjacent nozzles must overlap to give a uniform spray distribution across the length of the boom
      - Overlap should be 30-50% of the nozzle spacing for maximum uniformity
  - Used for broadcast spraying
Types of nozzle tips

- Even Fan
  - Modified flat fan
  - Produce a fan-type pattern with uniform spray distribution across the spray width
  - Non-tapered pattern provides even coverage without overlapping
  - Used for band spraying
Types of nozzle tips

- Flooding fan
  - For applying liquid fertilizers or fertilizer-pesticide mixture
  - Produce a wide-angle, flat-fan spray pattern
    - Pattern is not as uniform across its width as regular flat fan nozzles
  - Most uniform distribution is obtained when spray patterns have 100% overlap to provide double coverage
Other nozzle types

• Cone nozzles
  For applying insecticides and fungicides
  – Hollow Cone
    • Forms a round ring pattern
      – Spray pattern with most of the liquid concentrated at the outer edge of a conical pattern
    • Direct spraying
    • Creates a very fine droplet size (atomized)
  – Full Cone
    • Creates a full round pattern
      – Nozzles distribute spray droplets over the entire conical pattern
      – Four types: Cone-type hollow cone, whirl chamber hollow cone, disc-core hollow cone, raindrop hollow cone
Air induction nozzles

• Create large air filled droplets that are less prone to drift
• Can reduce drift by as much as 50%
• Typically used for broadcast applications
• Require overlap to create a uniform pattern
Identification of nozzle tips

• Nozzle tips are stamped with information identifying the performance specifications of the tip i.e.
  – Spray angle, output at a given pressure
• Spraying Spraying Systems Co.
  – First two numbers indicate spray angle at 40 psi, codes for nozzles of 100-degree angle or wider use the first three numbers to indicate spray angle
  – Numbers after that indicate gallons per minute (gpm) of liquid delivered by the nozzle at 40 psi
Identification of nozzle tips

- **Examples**
  - 650067  
    - 65-degree angle
    - 0.067 gpm at 40 psi
    - Regular flat fan nozzle tip
  - 8001E  
    - 80-degree angle
    - 0.1 gpm at 40 psi
    - Even flat fan nozzle
  - 110015  
    - 110-degree angle
    - 0.15 gpm at 40 psi
    - Even flat fan nozzle
Nozzle tip materials

- **Hardened stainless steel**
  - Most wear resistant of the readily available metals

- **Stainless steel**
  - Excellent wear resistance with corrosive or abrasive materials

- **Nylon or plastic**
  - Resists corrosion or abrasion; however, materials will swell when exposed to some solvents

- **Brass**
  - Wears quickly when used to apply abrasive materials such as wettable powders (WP), flow rates can increase wear as much as 10-15% after 50 hours of use

- **Ceramic**
  - Highly resistant to abrasion and corrosion, typically provide a constant flow over a longer period of time

- **Tungsten carbide**
  - Highly resistant to abrasion and corrosion, frequently used for the orifice plate in hollow cone nozzles

- **Combinations of plastic and stainless steel** usually cost less than ceramic and last longer than brass
## Comparison of nozzle tip materials

<table>
<thead>
<tr>
<th>Nozzle materials</th>
<th>Life compared to brass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum</td>
<td>same</td>
</tr>
<tr>
<td>Plastic or nylon</td>
<td>same to near stainless steel</td>
</tr>
<tr>
<td>Stainless steel</td>
<td>3.5 times</td>
</tr>
<tr>
<td>Hardened stainless steel</td>
<td>10 to 15 times</td>
</tr>
<tr>
<td>Tungsten carbide</td>
<td>150 to 200 times</td>
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</tbody>
</table>
Strainers

• Remove large particles immediately before the nozzle tip to minimize plugging of the tips
  – Screened strainer
  – Ball-check strainer
  – Slotted strainer
Selecting the right nozzle

• What and how are you spraying?

• What is your tolerance to drift?

• What is the pressure range of the sprayer?

• What is the nozzle spacing on the boom?
What and how are you spraying?

- Herbicides, fungicides, insecticides
- Soil incorporated, preemergence, postemergence
- Broadcast, banded, direct
- Refer to a manufacturers nozzle guide
- Herbicide labels often recommend nozzle types and gallons per acre
Tolerance to drift

- Do you apply near residential areas?
- Do you apply near different highly sensitive crops?
- Have you had a drift complaint in the past?
- Do time restrictions result in your spraying in less than ideal conditions
Effect of pressure on output

- Flow rate through a nozzle varies with the size of the tip and nozzle pressure.
- Nozzle tip with large orifice (hole) or increasing pressure will increase flow rate.
- Nozzle flow rate varies in proportion to the square root of the pressure.
- Doubling the pressure will not double the flow rate.
- To double the flow rate, you must increase pressure four times.
  - To change 0.28 gpm at 20 psi to 0.56 gpm, pressure increases to 80 psi (4 \times 20).
Adjusting volume output of the sprayer

- Change of nozzle tips is the best method for making major changes (>25%) in the delivery rate of the sprayer
  - Smaller orifice means less spray delivered, larger orifice increases delivery
- Change of travel speed is practical for smaller changes (<25%) in the delivery rate
  - Volume applied per acre is inversely proportional to the speed
  - Slower speed means more spray delivered and faster speed means less spray delivered per unit area
- Change of pressure is the least desirable way for making significant changes
  - Pressure change will change the droplet size and may change the spray pattern
  - Relatively large change in pressure is required for small change in volume
- Pressure cannot be used to make major changes in application rate, but can be used for minor changes because of nozzle wear
Effect of worn nozzles

- **NEW SPRAY TIPS**: Produce a uniform distribution when properly overlapped.
- **WORN SPRAY TIPS**: Have a higher output with more spray concentrated under each tip.
- **DAMAGED SPRAY TIPS**: Have a very erratic output – overapplying and underapplying.