Calibrating Application Equipment

David Gerken
Oklahoma State University – Oklahoma City
Turfgrass Management

Calculations

• Simple calculations are the key to many day-to-day activities of a turf manager.
• Fertilizers, pesticides, irrigation, topdressing
• Budgeting, ordering and application

• Requires the ability to relate math principles to real-world situations.
Area Calculations

- 1 Acre = 43,560 sqft.
- Area of a square/rectangle = Length x Width.
  - Example: and lawn area is 60 ft. long and 25 ft. wide.
    - 60 ft. x 25 = 1500 sqft.
- Area of a Circle = 3.14(radius)^2
  - Example: a circle has a diameter or 80 ft.
    - 3.14(40ft)^2 = 5024 sqft.
- Area of a Triangle = Base x Height / 2
  - Example: base is 30 ft. long and height is 26 ft. high
    - 30 x 26 / 2 = 390 sqft.

Conversion Factors

- 1 gallon = 4 quarts = 8 pints = 128 ounces
- 1 quart = 2 pints = 32 fl.oz.
- 1 pint = 16 oz.
A Pesticide Label:

- **Common name** - A generic term assigned to the chemical and often is simpler version of the chemical name.
- **Active Ingredient** - Amount of actual chemical in the product.
- **Pounds of AI per Gallon for liquid formulations**
- **% AI for dry formulations**

---

**Pendulum**

FOR USE IN TURFGRASSES, ORNAMENTALS, LANDSCAPE OR GROUNDS MAINTENANCE, AND NONCROPLAND AREAS

ACTIVE INGREDIENT:
- pendimethalin, N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine .......................... 37.4%

INERT INGREDIENTS* .................................................................................. 62.6%

TOTAL .............................................................................................................. 100.0%

(1 gallon contains 8.3 lbs. of pendimethalin)

*Contains Petroleum Distillates


KEEP OUT OF REACH OF CHILDREN

CAUTION!/¡PRECAUCION!

Si usted no entiende la etiqueta, busque a alguien para que le la explique a usted en detalle.
MIXING INSTRUCTIONS FOR PENDULUM 3.3 EC (continued)

Ground Driven Sprayer:
1. Fill tank one-half to three-quarters full with clean water.
2. Add Pendulum 3.3 EC to the partially filled tank while agitating and then fill the remainder of the tank with water.
3. Maintain continuous agitation while adding Pendulum 3.3 EC and until spraying is completed. If the spray mixture is allowed to settle for any period of time, thorough agitation is essential before spraying is resumed. Continue agitation while spraying.
4. If Pendulum 3.3 EC is to be used in tank mixtures with other registered herbicides, then follow directions on the labels of those products which recommend tank mixing.

Backpack Sprayer: Begin with a clean spray tank. Fill the spray tank 1/2 full of water and add the required amount of Pendulum 3.3 EC to the sprayer. Cap sprayer and agitate to ensure mixing. Uncover sprayer and finish filling tank to desired level. Cap sprayer and agitate once again. During application it is desirable to agitate the mixture occasionally to ensure mixing. If the spray mixture is allowed to settle for any period of time, thorough agitation is essential before spraying is resumed.

Liquid Fertilizer: Prior to mixing, small quantities should always be tested using a simple or split test. Add the required amount of Pendulum 3.3 EC to half-filled spray tank while agitating then add the fertilizer product. Complete filling spray tank to desired level.

Dry Bulk Fertilizer: Pendulum 3.3 EC may be incorporated on dry bulk fertilizers. When applied as directed, Pendulum 3.3 EC Dry Bulk Fertilizer mixtures provide weed control equal to that provided by the same rates of Pendulum 3.3 EC applied in water.

SPRAYING INSTRUCTIONS FOR PENDULUM 3.3 EC

Apply with properly calibrated ground equipment sufficient water per acre to provide uniform spray distribution at least 60 gallons of water per acre. Low pressure (e.g., 20-40 psi) sprayers are recommended. Maintain continuous agitation during spraying with good mechanical or hydraulic agitation.

Check sprayer routinely to determine proper calibration. Avoid overlaps that will increase rates above those recommended. Avoid application when winds may cause drift.

Avoid unintentional contact of spray solution with driveways, stone, wood or other porous surfaces. Rinse immediately to avoid staining.

<table>
<thead>
<tr>
<th>Turfgrass Species</th>
<th>Weeds Controlled</th>
<th>Rates of Pendulum 3.3 EC</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>WARM SEASON GRASSES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bahiagrass</td>
<td>Ironweed, knotweed, lamb's quarters, puncture weed, ragweed, redroot pigweed, winter cress</td>
<td>Apply a repeat application of 2.5 to 3.5 pts./Acre (1 to 1.3 oz./1000 sq. ft.) 5 to 6 weeks after 3-0 weeks if necessary.</td>
<td></td>
</tr>
<tr>
<td>Bermuda grass</td>
<td>Fall and early spring.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buffalo grass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Centipede grass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fescue, tall fescue, St. Augustinegrass, Zoysiagrass</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential Turf Uses Only: 5.0 to 4.8 pts./Acre or 1.3 to 1.8 oz./1000 sq. ft. Initial application prior to weed germination is spring.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.6 pints/Acre</td>
<td>16 oz/pint</td>
<td>43,560 sqft, X 1,000 = 1.3 oz/1000 sqft</td>
<td></td>
</tr>
</tbody>
</table>

40 gallons/ac x 1,000 = 0.92 gal/1,000 sq ft
43,560 sqft/ac x 1,000 = 1.3 oz/1000 sq ft
How much Product to Order?

- Rate is 3.6 pints per acre
- You take care of 25 acres of lawn turf.
- How much do I order?

\[
\frac{3.6 \text{ pts}}{\text{acre}} \times \frac{25 \text{ acre}}{} \times \frac{\text{Gallon}}{8 \text{ pts}} = 11.25 \text{ gallons}
\]

Hand Held Spray Gun Calibration

- Sprayer Volume Output
  - At least 40 gpa.
- Product Rate
  - 3.6 pts/acre
- For every 40 gallons of water in the tank, you add 3.6 pts.
- That is assuming your sprayer output is 40 gallons per acre.
Hand Held Spray Gun Calibration

• Fill the sprayer with a known amount of water. A turf colorant could also be added to insure uniformity.
• Mark off 1,000 sqft. Area.
• At a consistent walking speed and pressure, uniformly spray the marked area.
• Determine the amount of water it takes to re-fill the tank to the known mark.
• You sprayed out:
  – 1.5 gallons per 1,000 sqft.

or 65 gal./ac (1.5 x 43,560) / 1,000

Hand Held Spray Gun Calibration

• The spray volume:
  – 1.5 gallons per 1,000 sqft.

• The pesticide rate:
  – 3.6 pts/ac or 1.3 oz/1,000 sqft.

\[
\text{Label Rate per 1,000 sqft.} \times \frac{1.3 \text{ ounces per 1,000 sqft.}}{1.5 \text{ in gallons/1,000 sqft.}} = \text{Amount of pesticide added to 1 gallon of water}
\]

\[
\frac{1.3}{1.5} = 0.87 \text{ oz. product to 1 gallon of water}
\]
Calibrating a Lawn Gun
Lawn gun

• Lay out a rectangular area 50 ft long by 20 ft wide (1,000 ft²).
• Record the amount of time it takes for an applicator to uniformly apply water to this area.

![35 Seconds](image)

• Spray into a five-gallon bucket for the same amount of time. (35 Seconds)
• Measure the amount of water collected in the bucket in fluid ounces. (64 oz)
• Divide the amount of water collected by 128 (1 gallon = 128 fluid ounces) to calculate spray volume in gal/1,000 ft².

64 oz. ÷ 128 oz./gal = 0.5 gal/1,000 ft²
• For every 0.5 gallons of water in spray tank, add 1.3 oz. of product.

\[
\text{200 gallon water} \times \frac{1}{0.5 \text{ gal water}} \times 1.3 \text{ oz.} = 520 \text{ oz. or 4 gal product}
\]

• To calculate the area that can be covered with one tank:
• Divide the gallonage in the spray tank by the spray volume

\[
\text{200 gallon spray tank} \div 0.5 \text{ gallons/1,000 ft}^2 = 400 \text{ ft}^2/\text{tank}
\]
Sprayer Calibration

The amount of chemical solution depends upon

- speed of travel
- nozzle pressure
- size of the nozzles
- spacing of nozzles

- **speed:**

  \[
  \text{speed (mph)} = \frac{\text{distance traveled (ft)} \times 60}{\text{time (sec) to travel distance} \times 88}
  \]
## TeeJet® Broadcast Nozzle Selection Guide

<table>
<thead>
<tr>
<th>HERBICIDES</th>
<th>POST EMERGENCE</th>
<th>CONTACT</th>
<th>SYSTEMIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCELLENT</td>
<td>EXCELLENT</td>
<td></td>
<td>GOOD</td>
</tr>
<tr>
<td>GOOD</td>
<td>GOOD</td>
<td>GOOD</td>
<td>VERY GOOD</td>
</tr>
</tbody>
</table>

### Soil Incorporation

<table>
<thead>
<tr>
<th>SOIL INCORPORATED</th>
<th>PRE EMERGENCE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### XR TeeJet

Reference page 10

- Excellent

### XRC TeeJet

Reference page 11

- Good

### Turbo Floodjet

Reference page 30

- Excellent

---

**Optimum Spray Height**

- 20°
- 24°
- 30°
- 30°
- 40°

*Wide angle spray nozzle height is influenced by nozzle orientation. The critical factor is to achieve a minimum 30% overlap. See page 153 for more information.*

**How to order:** Specify up number.

- **TF-VS4** - Stainless Steel with VisitDo color-coding
- **TF-VP4** - Polymer with VisitDo color-coding

---

**Notes:** Always double check your application rates. See pages 153-157 for useful formulas and information.
Things we Know!

- speed of travel = 4 mph
- nozzle pressure = between 20 & 30
- size of the nozzles = TF-7.5
- spacing of nozzles = 20 inches
- Spray Volume = 40 gallons per acre

Useful Formulas

\[
\text{GPM (Per Nozzle)} = \frac{\text{GPA} \times \text{MPH} \times W}{5,940}
\]

\[
\text{GPA} = \frac{5,940 \times \text{GPM (Per Nozzle)}}{\text{MPH} \times W}
\]

\[
\text{GPM (Per Nozzle)} = \frac{\text{GAL/1000FT}^2 \times \text{MPH} \times W}{136}
\]

\[
\text{GAL/1000FT}^2 = \frac{136 \times \text{GPM (Per Nozzle)}}{\text{MPH} \times W}
\]
- speed of travel = 4 mph
- nozzle pressure = between 20 & 30
- size of the nozzles = TF-7.5
- spacing of nozzles = 20 inches
- Spray Volume = 40 gallons per acre (minimum.)

\[
\text{GPM} = \frac{\text{GPA} \times \text{MPH} \times W}{5,940}
\]

\[
\text{GPM} = \frac{40 \text{ gpa} \times 4 \text{ mph} \times 20 \text{ in.}}{5,940} = 0.54 \text{ gpm}
\]

\[
\frac{0.54 \text{ gallons}}{\text{Min.}} \times \frac{128 \text{ oz.}}{\text{Gal.}} = 69 \text{ oz. per minute}
\]

- Adjust pressure to achieve desired output.
- Modify other factors, ie. Speed, nozzle size, etc.

\[
\text{GPM} = \frac{\text{GPA} \times \text{MPH} \times W}{5,940}
\]

\[
\frac{0.54 \text{ gallons}}{\text{Min.}} \times \frac{128 \text{ oz.}}{\text{Gal.}} = 69 \text{ oz. per minute}
\]
• You have determined sprayer output is 40 gallons per acre.
• Pesticide rate is 3.6 pints/ac.
• For every 40 gpa of water add 3.6 pts/ac.
• Example:
  – 300 gallon tank / 40 gallons = 7.5 x 3.6 = 27 pints