FIELD CALCULATIONS

Valen Straub, LABServices

2011 NAICC Annual Meeting, Fort Worth, TX
Field Calculations

Where do we start?
- Read the Protocol
  - Wealth of information

- Test substance formulation
- Plot size
- Application equipment
- Application rate
- Adjuvant
- Spray volume
Field Calculations

Test substance formulation

**X-2009 0.4 EC**

- 0.4
  - 1 gallon contains 0.4 pounds of ai (active ingredient) (or 48 grams of ai in 1 liter)

**EC (Emulsifiable Concentrate)**

- First indication that you are dealing with a liquid
How do I know 0.4 pounds ai in 1 gallon equal 48 grams ai in 1 liter

Do the math...

**Long way:**

0.4 lb \( \times \) 454 grams/lb \( = \) 181.6 grams

1 gallon \( \times \) 3.785 liters/gallon \( = \) 3.785 liters

181.6 grams/3.785 liter \( \times \) N / 1 liter \( = \) 48 grams / 1 liter

**Shortcut:**

0.4 \( \times \) 120 (constant) \( = \) 48
One untreated control (UTC) plot and treated plot(s)
- Treated plots in tree studies will consist of a block of 6 consecutive trees
- Applications will be made to both sides of the row
Air blast sprayer
18.14 grams ai (active ingredient)/A) or (0.04 lb ai/A)
Typically there are several ways that application rates may be listed:

- Amount of active ingredient per unit of area or per volume of mixture (In our case 18 grams ai/A or 0.04 lb ai/A)
- Amount of formulation per unit of area or per unit of volume (lb fp/A)
- Amount of formulation per volume of mixture (pint/100 gallons of water)
- Percentage of final dilution (% by volume or % by weight)
Field Calculations

No Crop Oil needed

Test substance will be applied alone
Field Calculations

100 GPA (gallons per acre)

Why is this information needed?

This is standard by which we need to calibrate the airblast sprayer

Calibration is how the airblast sprayer output is adjusted to reach the desired GPA

In our case 100 GPA, (+/- 5%) as per protocol requirement

Spray volume
Are we ready to do the math now?

Not quite...
Field Calculations

- First order of business is to check the test plot
  - If time permits, run a tape measure and check plot length and width
  - If you don’t have the time to measure, check the plot map carefully and make sure what you see listed on the map is what you see in the field
**Field Calculations**

**Step 1:** Determine your Plot Area

- Plot Width (ft) $\times$ Plot length (ft) of a treated area $=$ Plot Area to be sprayed (ft. sq.)
- In our case,
  - $20 \text{ ft} \times 75 \text{ ft} = 1500 \text{ ft. sq.}$

- $1500 \text{ ft. sq.} \div 43560 \text{ ft. sq. /Acre} = 0.034 \text{ Acres}$

Estimate mix size based on protocol GPA (100 GPA)

- $0.034 \text{ A} \times 100 \text{ GPA} = 3.4 \text{ gallons (minimum mix size)}$
- PI uses 5 gallons to calibrate equipment
Step 1: Fill in the information on your calculation sheet

<table>
<thead>
<tr>
<th>LIQUID TEST SUBSTANCE CALCULATION SHEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Gallon = 3.785 L or 3.785 Liters or 128 oz or 8 pints or 4 quarts</td>
</tr>
<tr>
<td>1 quart = 0.946 L; 1 Pint = 0.473 L; 1 ounce = 29.6 mL</td>
</tr>
</tbody>
</table>

**PLOT AREA:**
plot width (ft) x plot length (ft) of a treated area = plot area to be sprayed (ft sq)

**Step 1:**
\[
20 \text{ ft} \times 75 \text{ ft} = 1500 \text{ sq ft}
\]

plot area (ft sq) ÷ 43560 ft sq/Acre = Plot Area (Acre)

**Step 2:**
\[
\frac{1500 \text{ ft sq}}{43560 \text{ ft sq/A}} = 0.034 \text{ A}
\]
Pre-calibration inspection (what the PI should be looking at and QA should be aware of):
- The spray tanks are clean
- All hoses and fittings are sound
- All screen and nozzles are clean
- Tire pressure on the tractor is correct
- Start the pump and set the tractor engine speed to the desired rpm
Pre-calibration inspection, *continued*:

- Open the manifold valve to fill the lines and begin spraying
- Adjust the pressure regulator and obtain the desired operating pressure
- Check that each nozzle shut-off valve is working
- Check that the agitation system is functioning properly
- Search for and correct any leaks
- Adjust the air stream, if needed
Step 2: Calibrate the airblast sprayer

- Check SOP is available and accurate
  - Read the SOP so you are familiar with the calibration process
- Calibrate the sprayer in an area that is representative of the plot area that will be sprayed.
  - Never calibrate a sprayer on a hard surface (such as pavement) which can induce errors as high as 15% compared to the field site
  - The location of the where the calibration spray flags are placed should be equal to the terrain in the treated area
Step 2: Calibrate the airblast sprayer, continued

The airblast sprayer is filled with the correct amount of water and is ready for the start of the calibration spray runs.

From the calibration worksheet - 5 gallons (18925 mls) is the amount of water being used for each calibration run.
Field Calculations

Step 2: Calibrate the airblast sprayer, *continued*

What should you be looking for:
- Closely watch the shut-off times and make sure the person timing the spray passes between the spray flags, starts and stops and the same location
- Sprays should mimic actual spray
  - Protocol requires two sides of the tree to be sprayed
    - Spraying both sides of the tree is referred to as a full cover spray in commercial applications.
- Is this being done in the calibration run?
Step 3: Field Calculations

It’s time to do some math!!!

Why is it important to apply the correct amount of X-2009 0.4 EC to the trial plot area?

If you apply too little pesticide you may not be fully controlling the pest
If you apply too much pesticide you may cause damage or injuries, leave illegal residues, and you can be fined or liable for damages
Step 3: Field Calculations, continued

**MIX SIZE:**

* from the Calibration Worksheet: \[
\begin{array}{c}
101.16 \\
382.89
\end{array}
\] GPA \times \frac{3.785 \text{ liters/gallon}}{} = \frac{\text{LPA (liters per Acre)}}{}

**Step 1:** Plot Area in acres (A) \times Sprav Volume (GPA or LPA) = minimum mix size needed for spray application

\[
\begin{array}{c}
0.034 \\
0.034
\end{array}
\] \text{A (PLOT AREA)} \times \begin{array}{c}101.16 \\382.89\end{array} \text{GPA} = \begin{array}{c}3.44 \\13.02\end{array} \text{gallons minimum mix size} \text{LPA} = \begin{array}{c}13.02 \text{liters minimum mix size}\end{array}

**Step 2:** minimum mix size + 25% overage for boom fill and spray out = mix size volume

\[
\begin{array}{c}
3.44 \text{gallons (min. mix size)} \times 1.25 = \begin{array}{c}4.3 \text{gallons (MIX SIZE)} \\
13.02 \text{liters (min. mix size)} \times 1.25 = \begin{array}{c}16.3 \text{liters (MIX SIZE)}
\end{array}
\end{array}
\end{array}
\]
Step 3: Field Calculations, continued

Liquid Rate Calculation of Active Ingredient:

Test Substance: X-2009 0.4 EC

Rate = 0.04 lb ai of active ingredient per 1 acre

Formulation = 0.4 lb of active ingredient per 1 gallon of formulated product

Step 1: Formulation (lbs of ai) 0.4 lb ai 0.4 lb ai
1 gallon (or equivalent) 1 gallon 3785 ml

Ready to convert rate of ai (active ingredient) to rate of formulated product/A
**Step 3: Field Calculations, continued**

**Liquid Rate Calculation of Formulated Product:**

**Step 2:**

\[
\begin{align*}
\text{0.4 lb ai} & \times \frac{0.04 \text{ lb ai/A}}{378.5 \text{ mls}} \\
& = 378.5 \text{ mls} \text{ of fp/A (Rate of formulated product (fp)/A)}
\end{align*}
\]

* by using 3785 mls instead of the 1 gallon, X will be solved in mls saving a conversion step

**Step 3:**

\[
\begin{align*}
\text{rate fp/A (mls)} & \times \frac{X (\text{amount of product needed})}{\text{spray volume (LPA)}} \times \frac{\text{mix size (liters)}}{X \text{ mls of Test Substance needed in X Mix Size}} \\
\text{378.5 mls fp/A} & \times \frac{382.89 \text{ LPA}}{16.3 \text{ litre mix size}} = 16.11 \text{ mls of Test Substance in 16.3 litres or 4.3 gallons of water (Mix Size)}
\end{align*}
\]
Field Calculations

Any questions????

Valen Straub, LABServices

2011 NAICC Annual Meeting, Fort Worth, TX