

Sprayer Calibration

NMVMA - 2015

Judd Fitzgerald
Product Manager
Helena Chemical

LEADING THE PACK



Why is sprayer calibration important?

LEADING THE PACK



How about our industry is under attack?

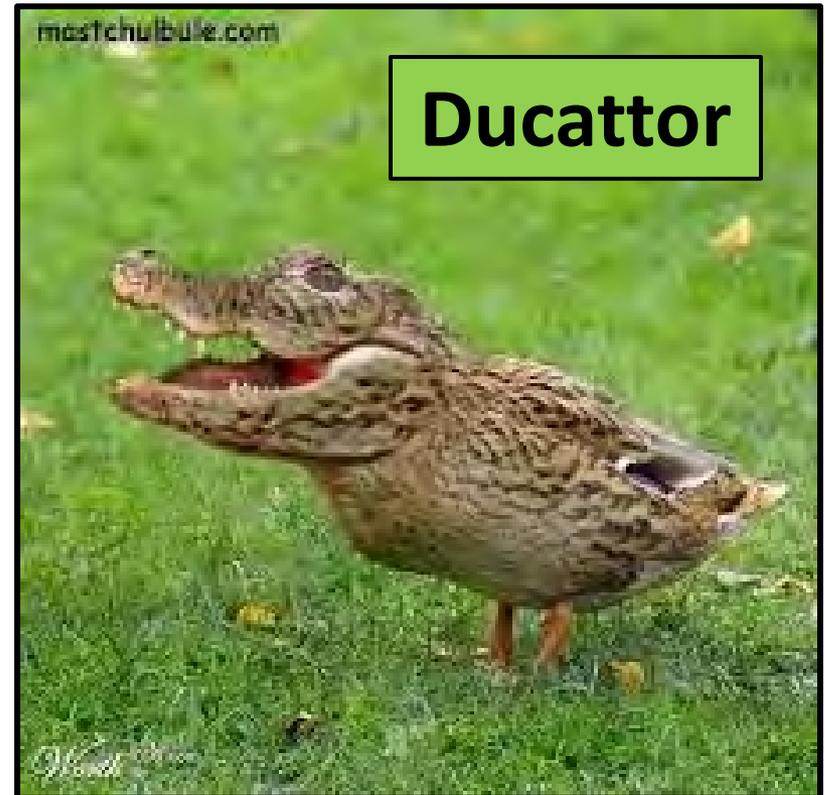


Why not frequently calibrate our sprayers and record the date of calibration simply for liability purposes?

LEADING THE PACK



Chemical's Produced:



LEADING THE PACK



Chemical's Produced:



LEADING THE PACK



Chemical's Produced:



LEADING THE PACK



Chemical's Produced:



LEADING THE PACK



Step #1 to Calibration (Boom or Directed Spray)

SUPPLIES NEEDED

- Measuring cup
- Measuring Wheel
 - Stop watch

LEADING THE PACK



Step #2 to Calibration

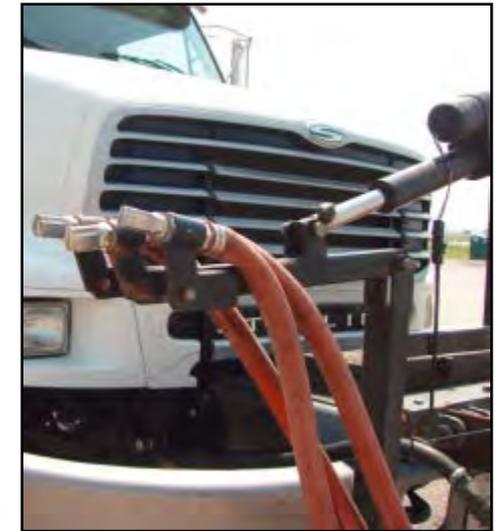
Step 2 (Boom Sprayer)

- 1.) Measure boom length
- 2.) Count nozzles



Step 2A (Directed Spray)

- 1A.) Measure Spray length
- 2A.) Count nozzles



LEADING THE PACK



Importance of Step 2?

- You need to be able to create an area formula.
- Knowing the length of boom or effective width of spray allows you to produce 1 side of the area equation.

Example: Length X Width = Area
_____ X 8 feet = Area

LEADING THE PACK



Step #3 to Calibration

Step 3A

Choose a length that will make for easy math:

Example: 120 feet (length) X 8 feet (wide) = 1000 f2

- **43,560 f2 = 1 Acre**
- **5227 linear ft at 8 foot effective spray = 1 Acre**
- **1 mile of roadside spray at 8 foot effective spray = 1 Acre application**

LEADING THE PACK



Step #3 to Calibration

Step 3B

- Take your chosen length and measure it on pavement or whatever surface you will be applying to.
- Drive a comfortable speed you would like to spray at and time yourself from start to finish.
 - Repeat this step 3 times to achieve an average.

Example: Pass 1 = 16.2 seconds, Pass 2 = 15.8 seconds, Pass 3 = 17 seconds
 $16.2+15.8+17 / 3 = 16.33$ seconds to cover 1000 ft/2

LEADING THE PACK



Step #3 to Calibration

TeeJet® Broadcast Nozzle Selection Guide

	Herbicides		Fungicides		Insecticides		Drift Mgmt.	Spray Angle	Tip Capacities	
	Soil Applied	Post-Emergence		Contact	Systemic	Contact				Systemic
		Contact	Systemic							
 Turbo TeeJet®		Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	Very Good	110°	01-08
 Turbo TeeJet® at pressures below 30PSI	Good	Good	Excellent	Good	Excellent	Good	Excellent	Very Good		
 Turbo TwinJet®	Good	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Very Good	110°	02-06
 Turbo TwinJet® at pressures below 30PSI	Very Good	Very Good	Excellent	Very Good	Excellent	Very Good	Excellent	Excellent		
 XR, XRC TeeJet®		Excellent	Good	Excellent	Good	Excellent	Good	Good	XR 80° XR 110°	01-15
 XR, XRC TeeJet® at pressures below 30PSI	Good	Good	Very Good	Good	Very Good	Good	Very Good	Very Good		

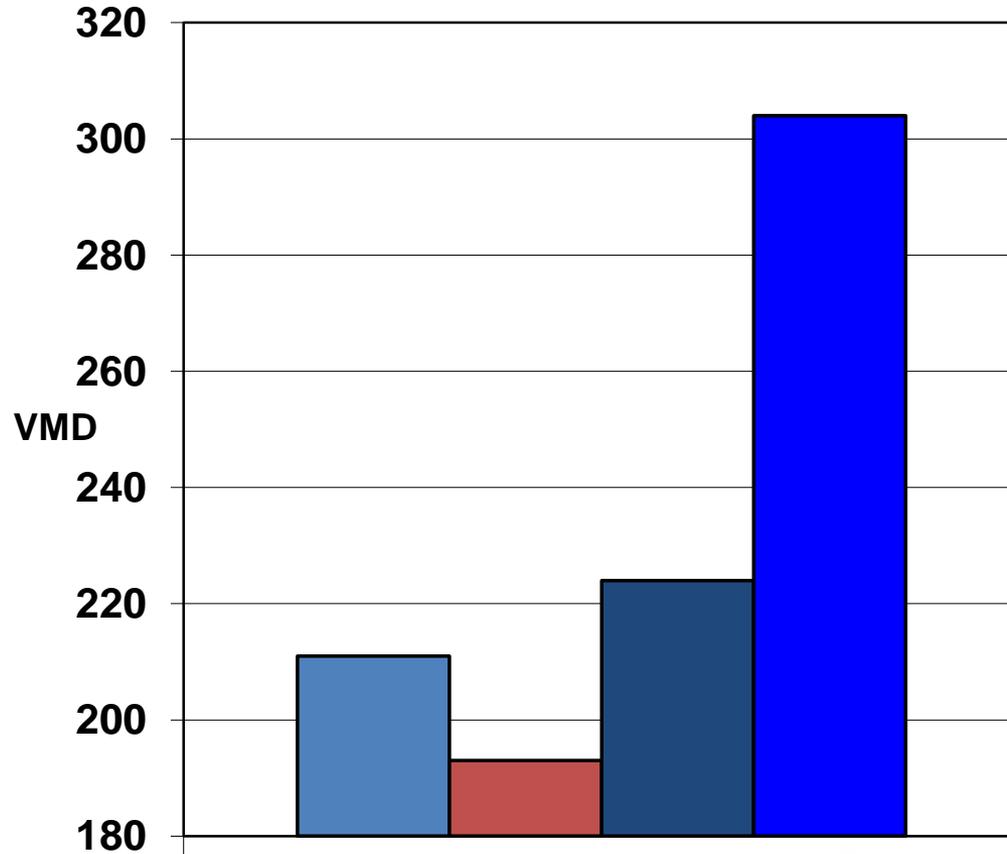
Step 3C

- Choose an operating pressure that is within the specs of the nozzle you spray with.

LEADING THE PACK



Something to consider while calibrating:



Trial conducted by Andrew Hewitt, Ph.D., University of Queensland, 2010

Spray Application Info

- 11002 XR spray tips
- 10 gpa
- 40 psi
- 15 mph

■ Water

■ PowerMax @ 22 oz/A

■ PowerMax @ 22 oz/A + Ground Zero @ 2 oz/100

■ PowerMax @ 22 oz/A + Ground Zero @ 4 oz/100

Volume Median Diameter (VMD) = half of the spray volume contain droplets larger than the VMD while the remaining half is smaller. Adapted from Mathews, 1992.

LEADING THE PACK



Step #4 to Calibration

Putting all the numbers together:

- Time (Ex. 16.33 seconds)
- Consistent Pressure (Ex. 30 PSI)
- Use a measuring cup to catch the water coming out of the nozzle for the given time.

Example: 16.33 seconds = 14 oz

Repeat 3 times – 14.2 oz, 15.1 oz, 13.9 oz = 14.4 oz

LEADING THE PACK



Step #4 to Calibration



Example: 16.33 seconds = 14.4 oz
Repeat 3 times – 14.2 oz, 15.1 oz, 13.9 oz = ?

14.4 oz X 6 nozzles = 86.40 oz.

.67 gal/1000 f2

.67 gal X 43.56 f2 (1 Acre) = 29.18 gallons

29 gallons per Acre

LEADING THE PACK



Why is the end number so important?

14.4 oz X 6 nozzles = 86.40 oz.

.67 gal/1000 f2

.67 gal X 43.56 f2 (1 Acre) = 29.18 gallons

29 gallons per Acre

30 gallon sprayer covers 1 Acre per load

Rate of Glyphosate is 1 quart (32 oz) per Acre

You need 1 quart RoundUp mixed per load no more no less

LEADING THE PACK



What if I want my 30 gallon sprayer to cover 5 Acres – what variable do I change?

Speed?

You could go faster and cover your 1000 f2 in 9 seconds

Example: 9 seconds = 8 oz.

$$8 \text{ oz} \times 6 = 48 \text{ oz per 1000 f2}$$

$$.37 \text{ gal} \times 43.46 = 16 \text{ gallons per Acre}$$

I achieved 2 Acres per tank on my sprayer by going faster – I need 5 Acres per tank!

Nozzle?

You could change nozzles and still go a comfortable speed

Example: 16 seconds = 3 oz.

$$3 \text{ oz} \times 6 = 18 \text{ oz per 1000 f2}$$

$$.14 \text{ gal} \times 43.46 = 6 \text{ gallons per Acre}$$

I achieved 5 Acres per tank on my sprayer by changing nozzels!!!

LEADING THE PACK



Great – So how do I select the correct nozzle?

You currently have: **14.4 oz (16 seconds) X 6 nozzles = 86.40 oz.**

.67 gal X 43.56 f2 (1 Acre) = 29.18 gallons per Acre

You need: **3 oz (16 seconds) X 6 = 18 oz per 1000 f2**

.14 gal X 43.46 (1 Acre) = 6 gallons per Acre

3 oz per 16 seconds (60/16 = 3.75) – 3.75 X 3 = 11.25 oz per minute

**Go back to your Teejet catalog and find a nozzle
that puts out 11.25 oz per minute at 30 PSI**

LEADING THE PACK



Step #1 to Calibration (Gun or Backpack)

SUPPLIES NEEDED

- Measuring cup
- Measuring Wheel
 - Stop watch
- 5 gallon Bucket

LEADING THE PACK

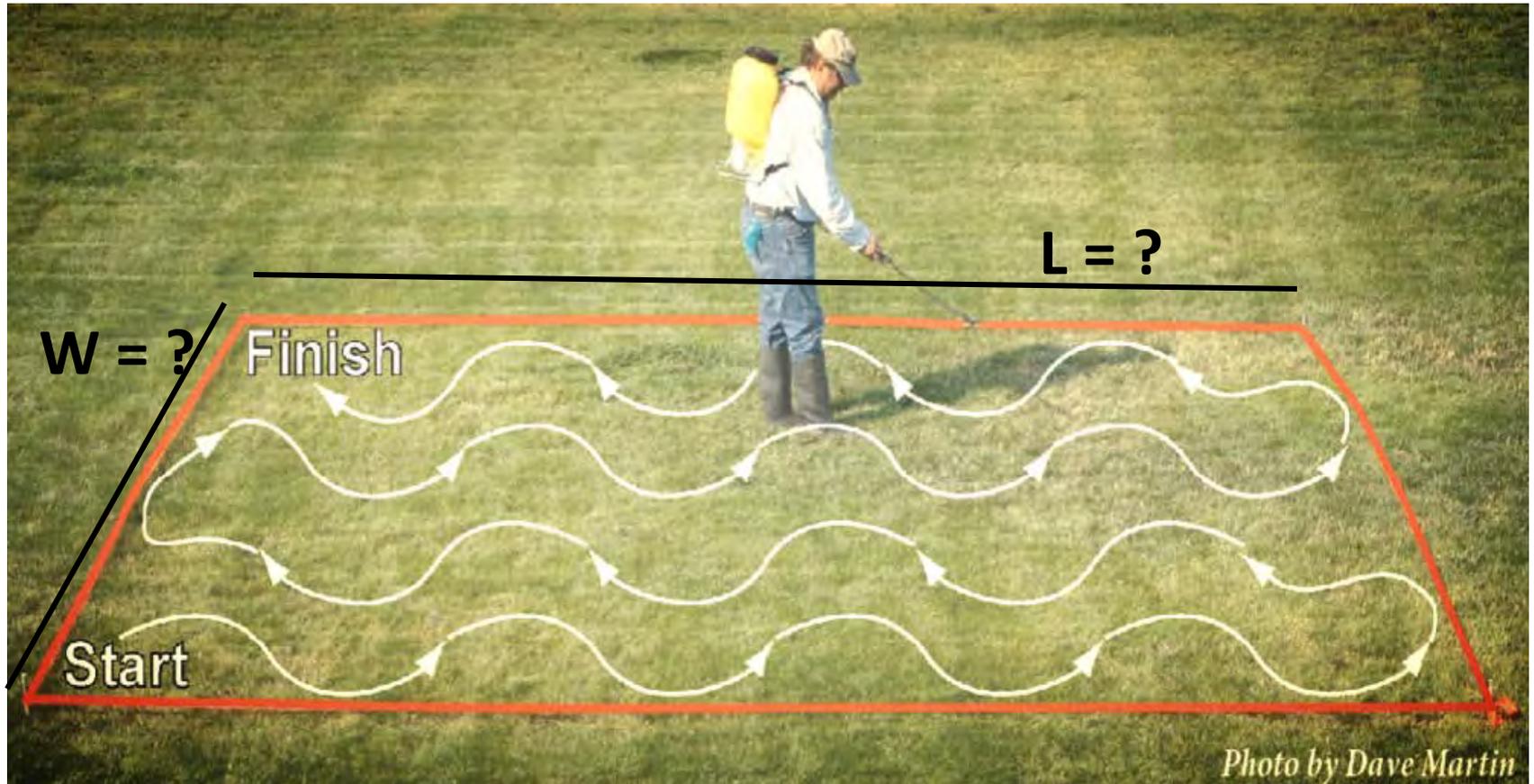


**“You are calibrating
the person more
than the sprayer”**

LEADING THE PACK



Step #2 to Calibration



LEADING THE PACK



Importance of Step 2?

- You need to be able to create an area formula.
- Choosing the length & width of an area to treat will give you a constant
- I would do easy numbers that can be converted back to 1000 f² or simply an area 1000 f².

Example: Length X Width = Area

50 X 20 feet = 1000 f²

LEADING THE PACK



Step #3 to Calibration

Time yourself how long it takes to spray the given area.

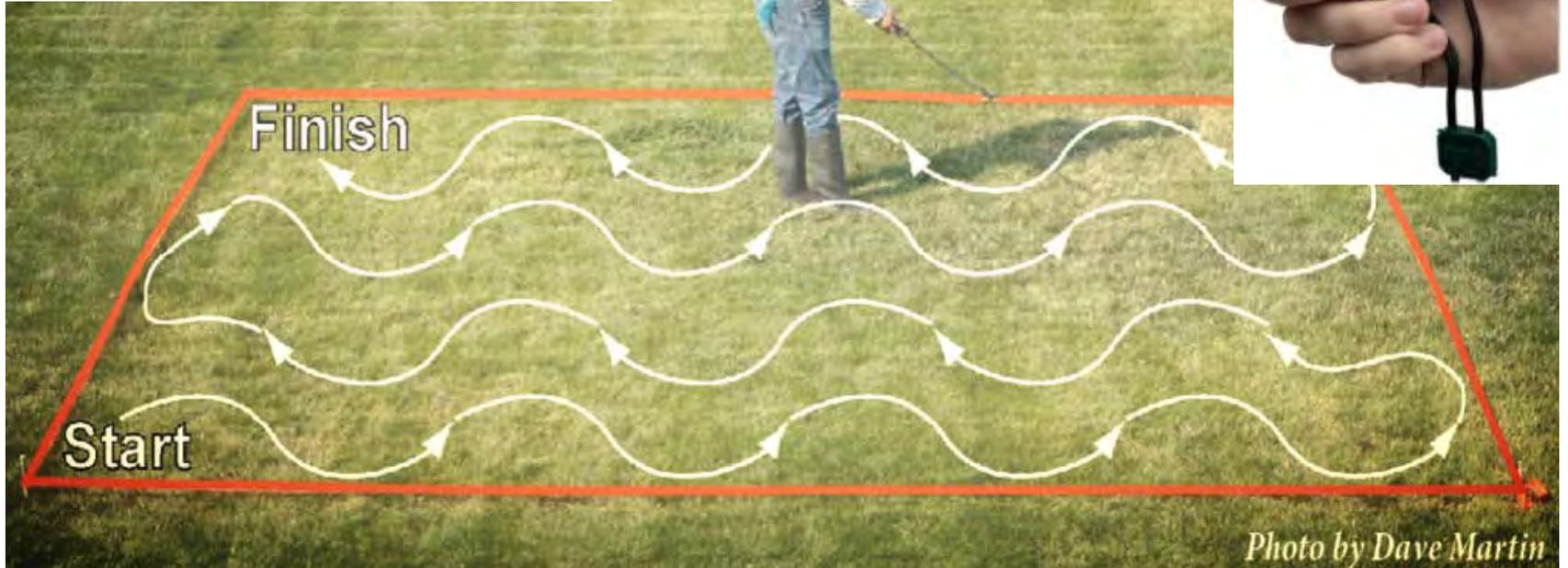


Photo by Dave Martin

LEADING THE PACK



Importance of Step 3?

- The biggest variable is speed with gun and backpack sprayers.
- Choosing a comfortable speed and swath width is critical.
- Repeat this step 3 times to find a comfortable speed and average to use in your calculation.

Example: 1000 f2 = 3.7 minutes

3.3 minutes, 3.9 minutes, 4.1 minutes = 3.76 minutes to cover 1000 f2

LEADING THE PACK



Step #4 to Calibration

Putting all the numbers together:

- Time (Ex. 3.76 minutes)
- Consistent Pressure (Ex. 30 PSI)
- Use a 5 gallon bucket or measuring cup to catch the water coming out of the nozzle for the given time.

Example: 3.76 minutes = 128 oz

Repeat 3 times – 120 oz, 127 oz, 139 oz = 128.66 oz

LEADING THE PACK



Why is the end number so important?

128 oz (1 gallon) = 1000 f2

1 gallon X 43.56 (1 Acre) = 44 gallons per Acre

2 gallon Backpack Sprayer = 2000 f2

30 gallon Sprayer w/ Gun = .68 Acres

Rate of Glyphosate is 1 quart (32 oz) per Acre

You need 1.46 oz RoundUp mixed per backpack load

You need 21.76 oz RoundUp mixed per 30 gallon load

LEADING THE PACK



What if I want my 2 gallon sprayer to cover 5000 f2 – what variable do I change?

Speed?

You could go faster and cover your 1000 f2 in 2 minutes

Example: 2 minutes = 51 oz.

$$51 \text{ oz} \times 5000 \text{ f2} = 2 \text{ gallons}$$

I achieved 5000 f2 per tank on my sprayer by going faster – I feel like I'm running?

Pressure or Nozzle?

You could decrease your pressure from 30 to 20 and apply less volume thus increasing your potential area.

Example: 3.76 minutes @ 20 PSI = 51 oz.

$$51 \text{ oz} \times 5000 \text{ f2} = 2 \text{ gallons}$$

If you achieved a uniform application at a lower pressure you don't need to change nozzles, but if your uniformity was compromised you will have to change nozzles

LEADING THE PACK



My rig is not so simple or manually operated – what now?



LEADING THE PACK



Questions:

Have you checked effective width of spray?

What is your effective width of spray?

What is your common speed of application?

What device on your rig is measuring ground speed?

What is your operating spray pressure?

What nozzle do you spray with?

What size droplet does that nozzle produce?

What is the ideal pressure for that nozzle?

LEADING THE PACK



Step #1

- Your onboard computer should monitor speed.
- Check your vehicle speedometer to your computer.
- If the 2 speeds do not match your ground speed module needs to be calibrated.

LEADING THE PACK



Step #2

- You need to identify your effective spray width of spray.
- Check this using water and make a few passes at your normal operating speed and normal operating pressure.
- This is best done on concrete or another hard surface to see the true width.

LEADING THE PACK



Step #3

- Turn on your direct spray nozzle manually.
- Place a heavy duty garbage bag over the nozzle to capture the water.
- Choose a desired amount of time (make it 15 second intervals to help with math).
- Measure the volume.

LEADING THE PACK



Step #4

- Drive your normal operating speed the distance you choose to make a simple area formula.
- Time the travel to cover that distance.

LEADING THE PACK



Step #4A – Note the variables:

- You have a normal operating speed.
Ex. 12 MPG
- You have an effective width of spray.
Ex. 18 feet
- You have a normal operating pressure.
Ex. 30 PSI
- You have a time it takes to cover 1000 f2.
Ex. 6.8 seconds
- You have a constant volume applied.
Ex. 260 oz per minute

LEADING THE PACK



Step #4B – Do the math:

- You have a normal operating speed.
Ex. 12 MPG – Given
- You have an effective width of spray.
Ex. 18 feet - **Important**
- You have a normal operating pressure.
Ex. 30 PSI - Given
- You have a time it takes to cover 1000 f2.
Ex. 6.8 seconds - **Important**
- You have a constant volume applied.
Ex. 260 oz per minute - **Important**

LEADING THE PACK



Step #4C – Are you calibrated:

- You have a normal operating speed.

Ex. 12 MPG – Given

- You have an effective width of spray.

Ex. 18 feet X 56 feet long = 1000 f2

- You have a normal operating pressure.

Ex. 30 PSI - Given

- You have a time it takes to cover 1000 f2.

Ex. 6.8 seconds X 43.56 = 4.93 minutes to cover 1 Acre.

- You have a constant volume applied.

Ex. 260 oz per minute X 4.93 minutes = 10 gallons per Acre

LEADING THE PACK



Step #4D

Is the final number what you wanted?

10 gallons per Acre

If so... you are calibrated

LEADING THE PACK



Record of calibration?

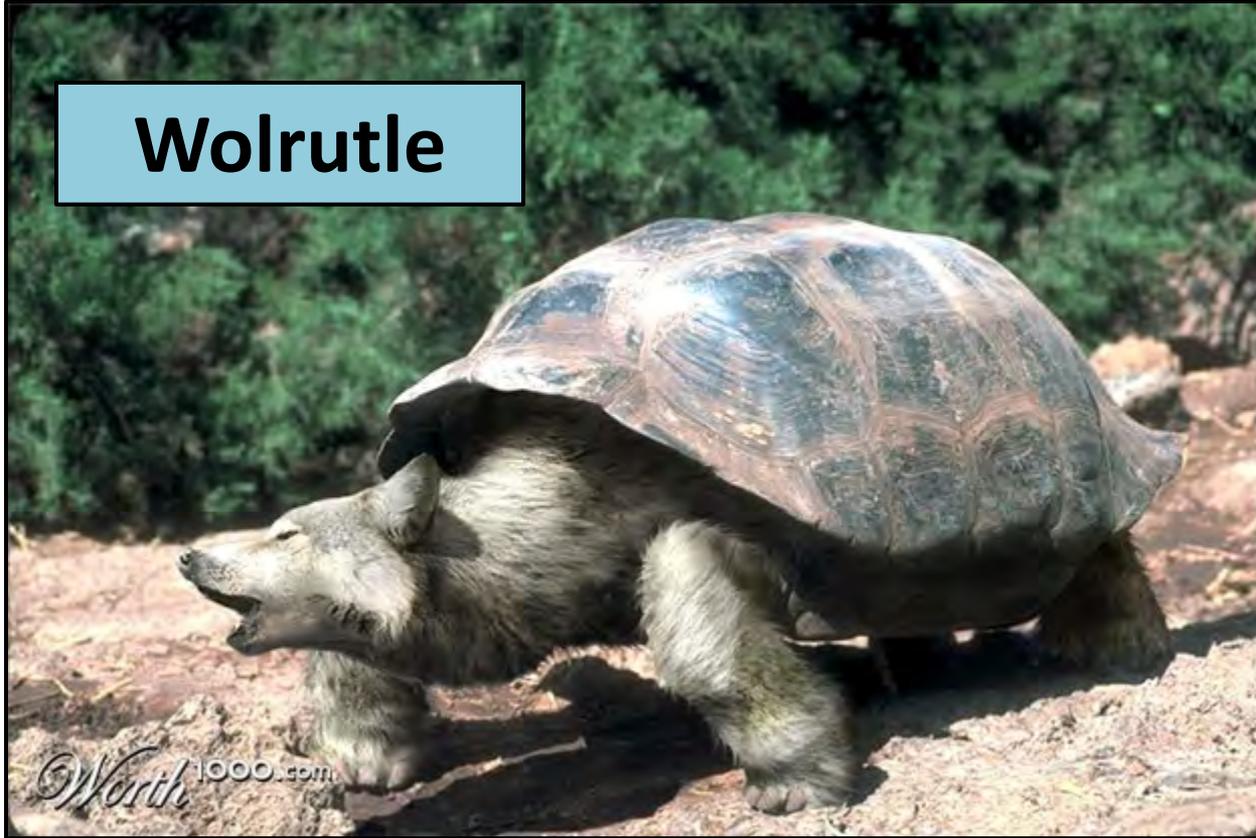
- How often are you calibrating?
- How often should you calibrate?
- Where are you recording your calibrations?
- What does it matter how often & where are records are stored?

LEADING THE PACK



You can refute that your pesticide applications did not produce a “Wolrutle”

Wolrutle



LEADING THE PACK

