

# Calibration



# Tools Needed for Calibration

- Stopwatch
  - Measuring tape
  - Calibrated liquid container
  - Scale
  - Calculator
  - Pressure gauge
  - Flow meter
  - Flagging tape
- 

# Dry Applicators

- Information needed
  - Travel speed
  - Swath width
  - Output rate



# Dry Applicators

## ➤ Travel speed

- Measure under working conditions (full tank)
- Don't use speedometer – slippage
- Measure and time

# Dry Applicators

## ➤ Swath Width

- Operate equipment under field conditions
- Place cans, trays, etc. at even intervals across swath
- Run spreader across plastic
- If applicator applies bands, measure bands and add
- Swath width = width of band x number of bands

# Dry Applicators

## ➤ Output rate

- Measure granules applied to known area
  - Swath width x tarp length
  - Tarp width x tarp length
- Collect granules over a known time period
  - Similar to collecting from nozzles
  - For applicators with multiple ports
- Refill hopper after a measured time

# Liquid Sprayers

## ➤ Calibrate Frequently

- Pump wear – decreases amount and pressure
- Nozzle wear – increases volume of output

## ➤ Information needed

- Tank capacity
  - Travel Speed
  - Flow rate
  - Swath width
- 

# Liquid Sprayers

## ➤ Tank Capacity

- Physically measure
  - **Mfg may est. size**
  - **Calibrate sight gauge**
  - **Dipstick**

## ➤ Travel speed

- Measure under working conditions (full tank)
- Don't use speedometer – slippage
- Measure and time

# Liquid Sprayers

- Flow Rate (low-pressure systems)
  - Measure actual output from nozzles
  - Measure in GPM
  - Run agitators
  - If PTO driven pump, make sure RPM's same as used in speed calibration
  - Make sure pressure is correct
  - Variation among nozzles – 5%
  - Recheck all nozzles when nozzles are replaced

# Liquid Sprayers

- Flow Rate (air blast or high-pressure systems)
    - Move to level spot
    - Fill tank to a level you can duplicate
    - Run at normal speed and pressure
    - Record time
    - Measure amount needed to refill
    - Repeat several times
    - Calculate GPM
- 

# Liquid Sprayers

## ➤ Swath Width

- Solid boom
  - Number of nozzles x nozzle spacing
  - Adjust boom - 30% overlap of spray from nozzles
- Banded application
  - Swath width = width of band x number of nozzles
- Air blast sprayer (orchard)
  - Swath width = distance between plant rows (2 sided)
  - Swath width = 1/2 distance between plant rows (1 sided)

# Spray Drift Factors

1. Applicator attitude
2. Equipment set-up
3. Viscosity of spray
  - a liquid's resistance to flow
4. Weather conditions



# Spray Drift Factors

## ➤ **Applicator Attitude**

- Assess what sensitive sites are near the application area
  - No-spray buffer necessary?
- Assess weather conditions: air stability, wind direction and speed
- Set up equipment with appropriate boom height, nozzles, and pressure
- Make decision to spray or not to spray

# Spray Drift Factors

## ➤ Equipment Set Up

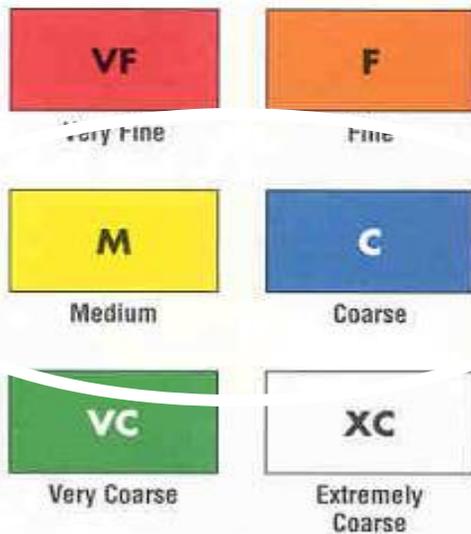
- Nozzle size and pressure set to give an appropriate size droplet to reduce drift
  - Use nozzles that produce medium and coarse droplet sizes
    - Smaller orifice = smaller droplet
  - Use lower pressures
    - except with certain nozzles
- Boom height - drift potential increases as distances increase



## Driftable Droplets\*

Nozzle Type (.50 GPM Flow)	Approximate Percent of Spray Volume Less Than 200 Microns.	
	15 PSI	40 PSI
XR TeeJet® 110°	14%	22%
XR TeeJet 80°	6%	12%
DG TeeJet® 110°	N/A	11%
DG TeeJet 80°	N/A	7%
TT – Turbo TeeJet®	<1%	<6%
TF – Turbo FloodJet®	<1%	<1%
AI TeeJet® 110°	N/A	<1%

\*Data obtained by spraying water at room temperature under laboratory conditions.



XR8005	C	C	C	C	C	M	M
XR8006	C	C	C	C	C	C	C
XR8008	VC	C	C	C	C	C	C
XR11001	F	F	F	VF	VF	VF	VF
XR110015	F	F	F	F	F	VF	VF
XR11002	M	F	F	F	F	F	F
XR11003	M	M	M	F	F	F	F
XR11004	M	M	M	M	F	F	F
XR11005	M	M	M	M	M	M	F
XR11006	C	M	M	M	M	M	M
XR11008	C	C	M	M	M	M	M

TP8005	C	C	C	M	M
TP8006	C	C	C	C	C
TP8008	C	C	C	C	C
TP11001	F	VF	VF	VF	VF
TP110015	F	F	F	VF	VF
TP11002	F	F	F	F	F
TP11003	M	F	F	F	F
TP11004	M	M	F	F	F
TP11005	M	M	M	M	F
TP11006	M	M	M	M	M
TP11008	M	M	M	M	M

## TwinJet® (TJ)

	PSI				
	29	36	44	51	58
TJ60-8001	F	VF	VF	VF	VF
TJ60-8002	F	F	F	F	F
TJ60-8003	F	F	F	F	F
TJ60-8004	M	M	M	M	F
TJ60-8006	M	M	M	M	M
TJ60-8008	C	C	M	M	M
TJ60-8010	C	C	C	M	M
TJ60-11002	F	VF	VF	VF	VF
TJ60-11003	F	F	F	F	F
TJ60-11004	M	F	F	F	F
TJ60-11005	M	M	M	F	F
TJ60-11008	M	M	M	M	M
TJ60-11010	M	M	M	M	M

## DG TeeJet® (DG E)

	PSI				
	29	36	44	51	58
DG95015E	M	M	F	F	F
DG9502E	C	M	M	M	M
DG9503E	C	C	M	M	M
DG9504E	C	C	C	M	M
DG9505E	C	C	C	C	M

## Turbo FloodJet® (TF)

	PSI				
	29	36	44	51	58
TF-2	XC	XC	XC	XC	XC
TF-2.5	XC	XC	XC	XC	XC
TF-3	XC	XC	XC	XC	XC
TF-4	XC	XC	XC	XC	XC
TF-5	XC	XC	XC	XC	XC
TF-7.5	XC	XC	XC	XC	XC
TF-10	XC	XC	XC	XC	XC

## DG TeeJet® (DG)

	PSI				
	29	36	44	51	58
DG80015	M	M	M	F	F
DG8002	C	M	M	M	M
DG8003	C	C	M	M	M
DG8004	C	C	C	C	M
DG8005	C	C	C	C	C
DG110015	M	F	F	F	F
DG11002	M	M	M	M	M
DG11003	C	M	M	M	M
DG11004	C	C	M	M	M
DG11005	C	C	C	M	M

Droplet size classifications are based on BCPC specifications and in accordance with ASAE Standard S-572 at the date of printing. Classifications are subject to change.

# Spray Drift Factors

## ➤ Viscosity of Spray Mix

- Thickness of spray batch
- Invert emulsions – thick like mayonnaise – low drift formulation
- Water-based formulations affected by evaporation: temperature and humidity
- Drift-reducing adjuvants may form an increased number of larger droplets

# Spray Drift Factors

## ➤ Weather Conditions – Read the Wind

- What's downwind?  
Direction
- How far will it move?  
Speed



- 0-3 mph:  
could be very stable with airflow, just not sure which direction the air is moving
- 3-7 mph:  
manage for off-target movement downwind
- >7 mph:  
carries more material off-target

# Spray Drift Factors

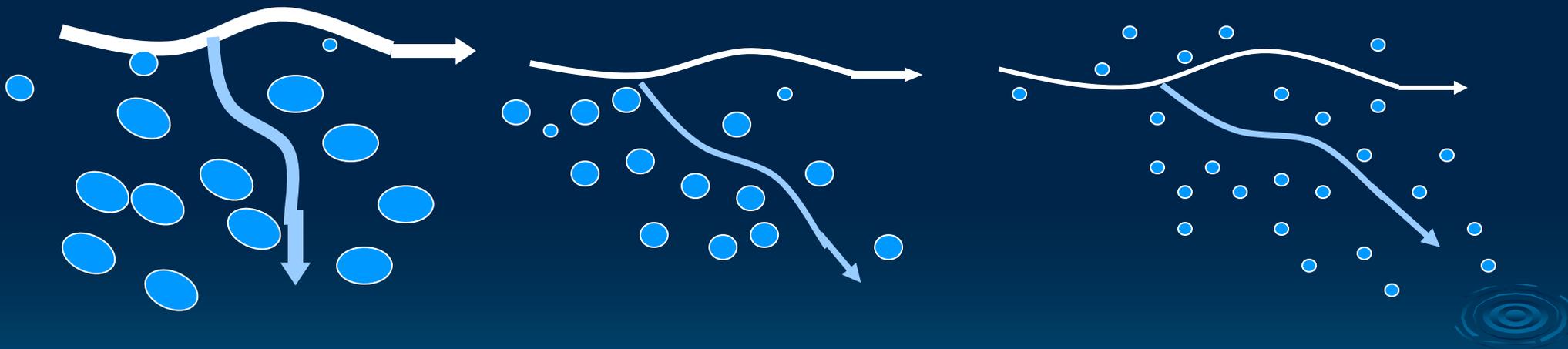
## ➤ Weather Conditions

- Temperature – droplet evaporates to smaller droplets as temperatures increase
- Humidity – droplets do not evaporate as humidity increases



# Equipment Set Up: Droplet Size

The **Larger** the Spray Droplet  
Size



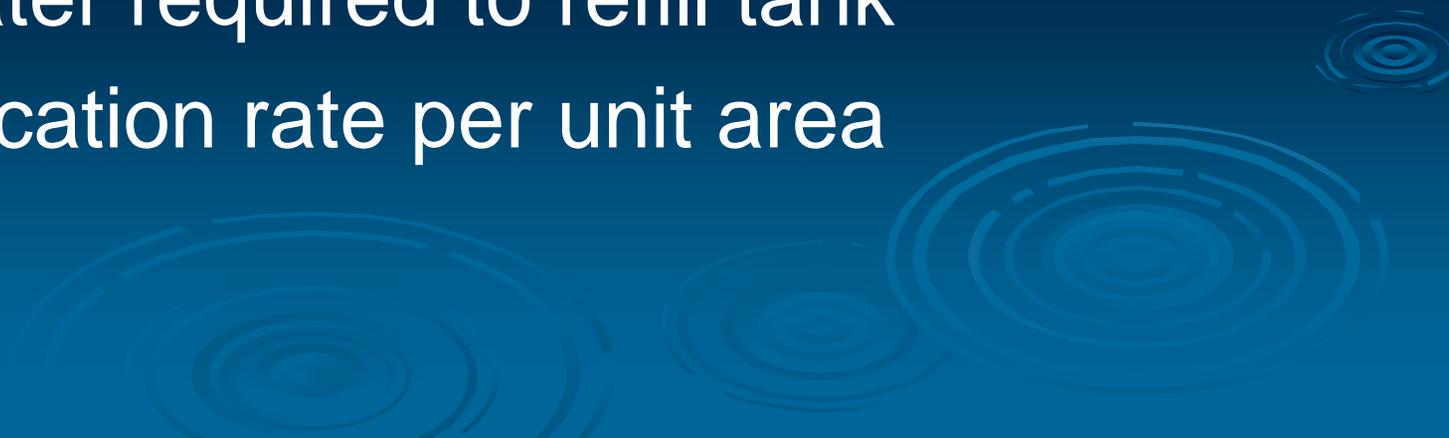
The **Less** Distance the Droplet  
Drifts

# Liquid Sprayers

## Changing Sprayer Output

- Change speed
  - Change pressure
  - Change nozzle size
- 
- After changing one or more of these, you must recalibrate your sprayer

# Determine the pumping rate (GPA) - simple measurement method

- Chose speed, pressure and nozzles
  - Fill tank and operate to fill plumbing
  - Refill tank and spray a measured area
  - Spray an area large enough to use at least 10% of tank capacity
  - Measure water required to refill tank
  - This is application rate per unit area
- 

# Determine the pumping rate (GPA) - simple measurement method

- Measure  $\frac{1}{2}$  acre
- Spray area
- Refill tank and measure amount to refill
- If 10 gallons required to refill:

$$10 \text{ gallons} \div \frac{1}{2} \text{ acre} =$$

20 gpa

# Determine the pumping rate (GPM) – arithmetic method

- Fill spray tank and sprayer plumbing
  - Put vehicle in neutral at throttle setting (rpm) desired
  - Open spray valve and pump for a set time
  - Collect liquid (water only) from each nozzle
  - Add amount collected from each nozzle
  - Divide the number of gallons to refill by pumping time
- 

# Determine the pumping rate (GPM) – arithmetic method

- If it takes 10 gallons to refill your spray tank after operating the pump for 5 minutes, what is your pumping rate?

Pumping rate = gallons/min

10 gallons ÷ 5 minutes =

2 gallons/minute

# Determine the pumping rate (GPM) – alternative calculation

- Your boom has 10 nozzles. You collect an average of 12.8 ounces per nozzle for 30 seconds. What is your gpm?

$$10 \text{ nozzles} \times 12.8 = 128 \text{ oz}$$

$$128 \text{ oz} = 1 \text{ gallon}$$

$$1 \text{ gallon} \div 0.5 \text{ minutes} =$$

$$2 \text{ gallons/minute}$$

# Determine gallons per acre (GPA) – arithmetic method

- Determine the number of feet the sprayer moves at the desired speed and throttle
- Measure the width of the sprayer boom
- Determine the pumping rate (gpm)
- Calculate the area that the sprayer covered in one minute (distance traveled x boom width)

# Determine gallons per acre (GPA) – area treated

- Your sprayer with a 20 ft boom traveled 435 feet in one minute. How many square feet were treated?

$$435 \text{ feet/minute} \times 20 \text{ feet} =$$

$$8700 \text{ sq ft / minute}$$

Determine gallons per acre (GPA) –  
minutes to treat one acre

➤ Minutes/acre = sq ft / acre x minutes / sq ft

$$\frac{43,560 \text{ sq ft}}{1 \text{ acre}} \times \frac{1 \text{ minute}}{8700 \text{ sq ft}} =$$

$$\frac{43,560 \text{ minutes}}{8700 \text{ acres}}$$

5 minutes / acre

# Determine gallons per acre (GPA) – calculate GPA

➤  $\text{GPA} = \text{gal} / \text{minute} \times \text{minutes} / \text{acre}$

2 gallons / minute  $\times$  5 minutes / acre =

$$2 \times 5 =$$

10 gallons / acre



1a

What is the pumping rate?

15 gallons in 5 minutes

Speed = 6 mph

Swath width = 15 feet

15 gallons/5 minutes =

3 gpm

1b

How many sq. ft covered in 1 minute?

How many feet are we traveling?

How many sq ft covered?

6 miles/hr

X

1 hr/60 min

X

5280 ft/1 mile =

528 ft/1 min

528 ft/1 min

X

15 ft/ boom(swath) =

7920 sq ft/min

1c

How many minutes to cover one acre?

1 min/7920 sq ft

X

43,560 sq ft/acre =

5.5 min/acre



1c revisited

How many acres covered in one minute?

7920 sq ft/minute

X

1 acre/ 43,560 sq ft =

0.18 acres/min



1d

How many gallons applied per acre?

From 2a: 3 gal/min

OR

From 2c: 0.18 acres/min

From 2c: 5.5 min/acre

3gal/min

X

1 min/0.18 acres =

16.6 gpa

3 gal/min

X

5.5 min/acre =

16.6 gpa

# Problem 2

- What do we need to know first???



2a

How many acres covered by one tank ?

300 gallons spray solution/tank

30 gallons/acre

300 gallons/tank

x

1 acre/30 gallons

or

$300/30 = 10$  acres/tank

2b

How much of pesticide A do you need?

Apply one quart of A/acre

From 1a: cover 10 acres/tank

10 acres/tank

x

1 quart/acre =

10 quarts/tank

2c

How much of pesticide B do you need?

Apply five pounds of B/acre

From 1a: cover 10 acres/tank

10 acres/tank

x

5 pounds/acre =

50 pounds/tank

2d

How much of pesticide C do you need?

Apply one gallon of C/acre

From 1a: cover 10 acres/tank

10 acres/tank

x

1 gallon/acre =

10 gallons/tank

3

Add surfactant at  $\frac{1}{2}$  percent by volume

300 gallons spray solution per tank

5% = 0.05

1% = 0.01

$\frac{1}{2}$  % = 0.005

300 gallons/ tank

X

0.005 =

1.5 gallons/tank

4a

How many pounds product/acre?

80% WP; want 4 pounds  
a.i./acre

$$4\#/80 = X\#/100$$

Tank treats 10 acres

$$80X = 400$$

Want 4# a.i./acre

Have 80% (0.8#)

$$X = 5 \text{ pounds}$$

$4\# \text{ a.i./acre} / 0.8\# \text{ a.i./prod} =$   
 $5 \# \text{ product/acre}$

4b

How many pounds product per tank?

10 acres/tank

X

5#/acre =

50#/tank

## 5a

How many gallons product per acre?

Liquid 6# a.i./gal; want 4  
pounds a.i./acre

$$6\#/1 \text{ gal} = 4\#/X \text{ gal}$$

Tank treats 10 acres

$$6X = 4$$

Want 4# a.i./acre

Have 6# a.i./gal

$$X = 4/6$$

$4\# \text{ a.i./acre} / 6\# \text{ a.i./gal} =$   
 $0.67 \# \text{ product/acre}$

$$X = 0.67 \# \text{ product/acre}$$

5b

How many gallons product per tank?

10 acres/tank

X

0.67 gal/acre =

6.7 gallons/tank

6a

How many acres will be treated?

Rate = 20 #/acre

30 inch rows; apply in 14 inch band

$14''/30'' = 0.46$  (X100% = 46%)

200 acres x 0.46 =

92 acres treated in bands

6b

How much product do you need to buy?

Want 20# product/acre

$$20\#/acre \times 92 \text{ acres} = 1840\#$$

or

$$20\#/acre \times 200 \text{ acres} = 4000\#$$

$$4000\# \times 0.46 =$$

$$1840\#$$

7a

What is the pumping rate?

10 gallons in 5 minutes

Speed = 5 mph

Swath width = 20 feet

10 gallons/5 minutes =

2 gpm

7b

How many sq. ft covered in 1 minute?

How many feet are we traveling?

How many sq ft covered?

5 miles/hr

X

1 hr/60 min

X

5280 ft/1 mile =

440 ft/1 min

440 ft/1 min

X

20 ft/ boom(swath) =

8800 sq ft/min

7c

How many acres covered in one minute?

8800 sq ft/minute

X

1 acre/ 43,560 sq ft =

0.20 acres/min



## 7c revisited

How many minutes to cover one acre?

1 min/8800 sq ft

X

43,560 sq ft/acre =

4.95 min/acre

7d

How many gallons applied per acre?

From 2a: 2 gal/min

OR

From 2c: 0.20 acres/min

From 2c: 4.95 min/acre

2gal/min

X

1 min/0.2 acres =

10 gpa

2 gal/min

X

4.95 min/acre =

9.9 gpa

8a

How many acres covered by one tank ?

250 gallons spray solution/tank

10 gallons/acre

250 gallons/tank

x

1acre/10 gallons

or

$250/10 = 25$  acres/tank

8b

How much of pesticide A do you need?

Apply 1.5 quart of A/acre

From 1a: cover 10 acres/tank

25 acres/tank

x

1.5 quart/acre =

37.5 quarts/tank

8c

How much of pesticide B do you need?

Apply 2 pounds of B/acre

From 1a: cover 10 acres/tank

25 acres/tank

x

2 pounds/acre =

50 pounds/tank

8d

How much of pesticide C do you need?

Apply  $\frac{3}{4}$  gallon of C/acre

From 1a: cover 10 acres/tank

25 acres/tank

x

0.75 gallon/acre =

18.75 gallons/tank

9

Add surfactant at 3/4 percent by volume

250 gallons spray solution per tank

5% = 0.05

1% = 0.01

3/4% = 0.0075

250 gallons/ tank

X

0.0075 =

1.875 gallons/tank

10a

How many pounds product/acre?

75% WP; want 0.5 pounds  
a.i./acre

$$0.5\#/75 = X\#/100$$

Tank treats 10 acres

$$75X = 50$$

Want 0.5 a.i./acre

Have 75% (0.75#)

$$X = 0.67 \text{ pounds}$$

$$0.5\# \text{ a.i./acre} / 0.75\# \text{ a.i./prod} = \\ 0.67 \# \text{ product/acre}$$

10b

How many pounds product per tank?

10 acres/tank

X

0.67#/acre =

6.7#/tank

# 11a

How many gallons product per acre?

Liquid 4# a.i./gal; want 1.5  
pounds a.i./acre

$$4\#/1 \text{ gal} = 1.5\#/X \text{ gal}$$

Tank treats 20 acres

$$4X = 1.5$$

Want 1.5# a.i./acre

Have 4# a.i./gal

$$X = 1.5/4$$

$1.5\# \text{ a.i./acre} / 4\# \text{ a.i./gal} =$   
 $0.375 \# \text{ product/acre}$

$$X = 0.375 \# \text{ product/acre}$$

11b

How many gallons product per tank?

20 acres/tank

X

0.375 gal/acre =

7.5 gallons/tank

12a

How many acres will be treated?

Rate = 5 #/acre

36 inch rows; apply in 14 inch band

$12''/36'' = 0.33$  (X100% = 33%)

300 acres x 0.33 =

100 acres treated in bands



12b

How much product do you need to buy?

Want 5# product/acre

$$5\#/acre \times 100 \text{ acres} = 500\#$$

or

$$5\#/acre \times 300 \text{ acres} = 1500\#$$

$$1500\# \times 0.33 =$$

$$499.99\#$$

Read the label carefully and often. It is a violation of Federal Law to misuse a pesticide.



It is  
YOUR  
Responsibility

