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Airblast Sprayer Calibration

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UC AG EXPERTS TALK Webinar

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Q1. My airblast sprayer is a: (choose all that apply)

a) PTO drive, conventional axial fan airblast sprayer (Nelson, Rears, AirOFan, etc.)
b) Engine drive, conventional axial fan airblast sprayer (Nelson, Rears, AirOFan, etc.)
c) Engine drive, Electrostatic/airshear sprayer (LectroBlast)
d) PTO Electrostatic/airshear sprayer (LectroBlast, Windmill, Gearmore, etc.)
e) Specialty compressed air electrostatic sprayer (On-Target, etc.)

CALIBRATION DEFINED

SELECT

VERIFY

MAINTAIN

YOUR SPRAYER SET UP

FOR A

KNOWN

DESIRED

UNIFORM

APPLICATION

Q2. What information do you need to know to calibrate your sprayer? (choose all that apply)

a) Row spacing
b) Number of nozzles
c) Pump capacity
d) Tractor speed
e) Nozzle flow rate (GPM)
f) Operating pressure
g) 495- a conversion factor

The Basic Formula-
there's a relationship between the variables and GPA

$$\text{GPA} = \frac{\text{Flow rate (gal/min)}}{\text{Land rate (ac/min)}}$$

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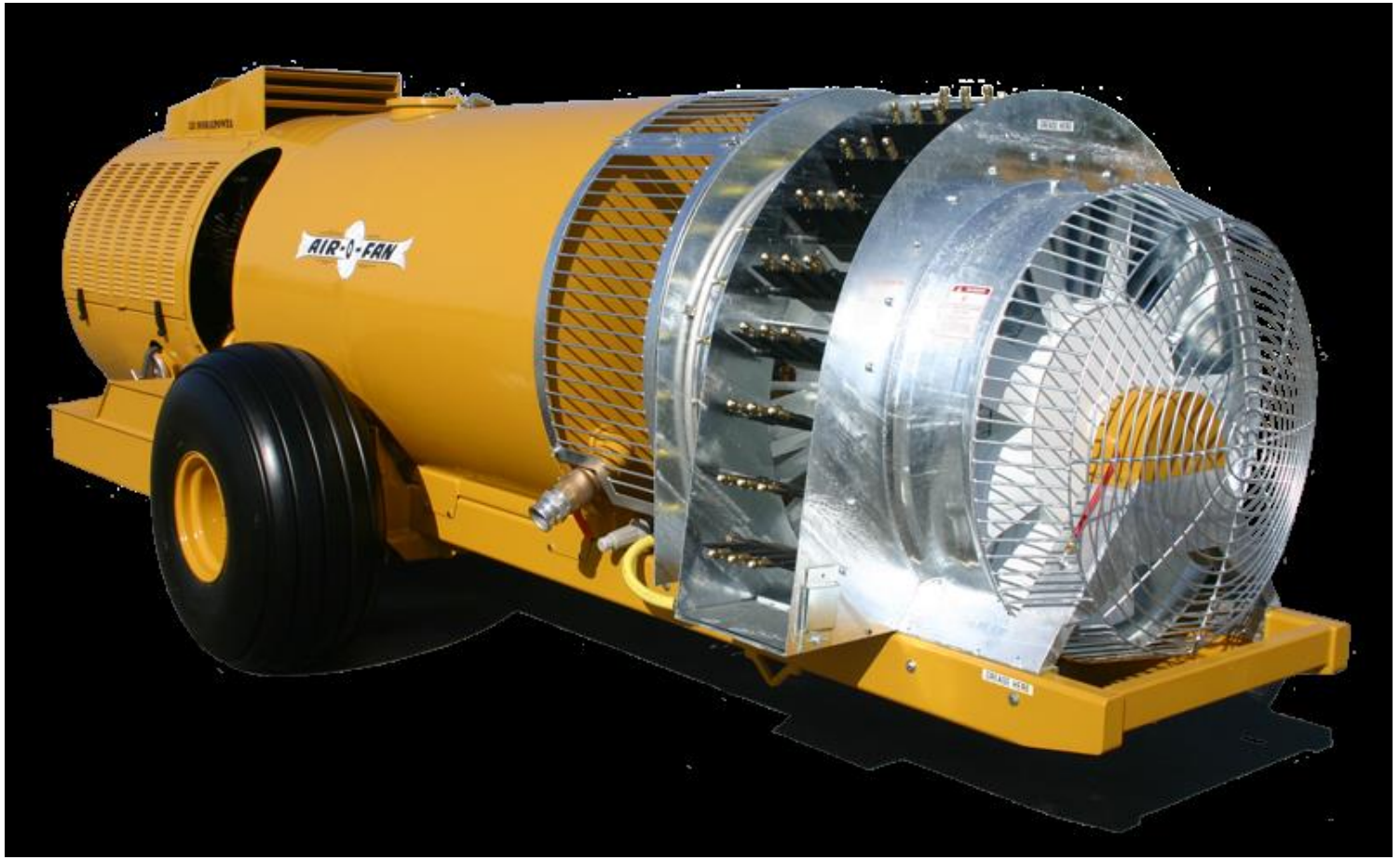
This one formula can be used to calibrate a one gallon hand sprayer or a monster twin 45” fans, engine drive sprayer.



How much is the sprayer putting out (spray rate) divided by how much land is being treated in the same amount of time (land rate).

Flow rate and land rate are the variables you need to check, no matter what formula or sprayer you use.

The Basic Formula:

GPA= $\frac{\text{Flow rate (gal/min)}}{\text{Land rate (ac/min)}} = \frac{\text{GPM}}{\text{Speed (ft/min)} * \text{row width (ft)}}$

Or, solving for flow rate:

GPM=GPA * [Speed (Feet/min) * Row width (Feet)]

Here is a commonly used formula for GPM. This is the Basic Formula reworked to use speed in MPH with a conversion factor 495.

GPM= $\frac{\text{GPA* Speed (Miles/Hour) * row width (feet)}}{495}$

The Basic Formula

From the nozzles

$$\text{GPA} = \frac{\textbf{Flow rate (gal/min)}}{\textbf{Land rate (ac/min)}}$$

What's this?
Speed, right?

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Land Rate: AREA covered by the nozzles over time

not just tractor ground speed

Area covered by the nozzles per unit time

USE the row spacing to give us “swath width”

SPEED x WIDTH gives us

ACRES/MIN

Measure speed (in seconds) and convert to feet per minute.

Multiply speed (ft/min) by row spacing in feet=area covered by the sprayer ($ft.^2$/min)

- **Speed (ft/min) x Row spacing (ft.)**
- Convert $ft.^2$/min to acres/min

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Q3. When is the last time you measured your tractor speed?

a) This spring
b) I don’t own a tractor
c) When I bought it
d) Speedometer is broken, can’t measure speed
e) Last time I sprayed

Steps to calibrate a sprayer…

1. **Determine ground speed that best fits the orchard and crop stage**
2. **Measure that ground speed**
3. **With the sprayer parked in the orchard, determine the number of nozzles you want to use.**
4. **Find a recommended volume per acre (GPA)**
5. **Calculate GPM to deliver the GPA at the given land rate.**
6. **Ground truth GPM**
7. **Check spray coverage**

In vigorous, large trees, sprayer speed is the most critical management option/input for effective coverage and pest management

First step…

Get ground speed right. That's the biggest influence on air movement in the canopy.

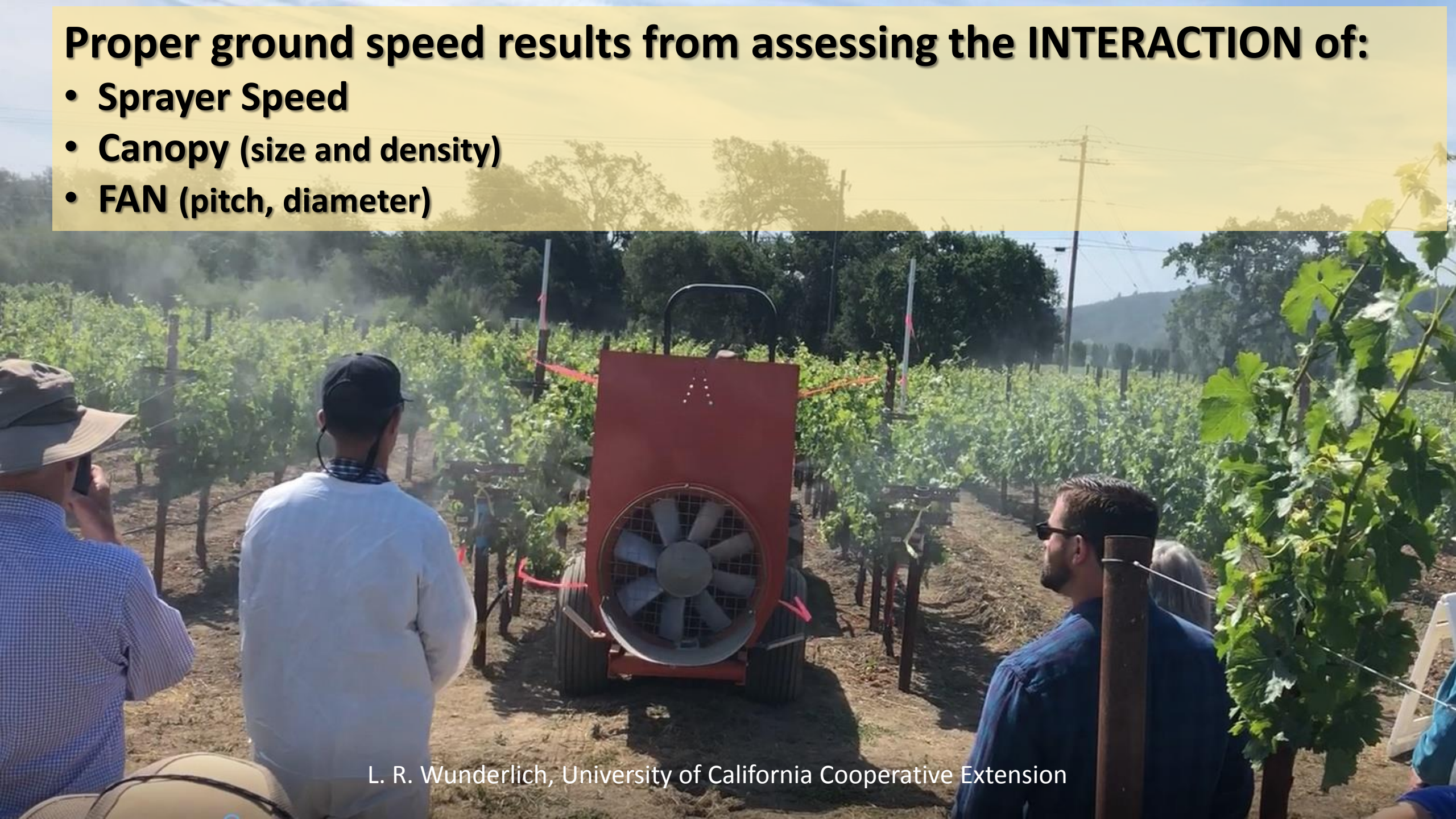
Air carries the spray.

"Poor coverage is possible at any spray gallonage."

Tim Smith, WSU Extension, retired

Proper ground speed results from assessing the INTERACTION of:

- **Sprayer Speed**
- **Canopy** (size and density)
- **FAN** (pitch, diameter)



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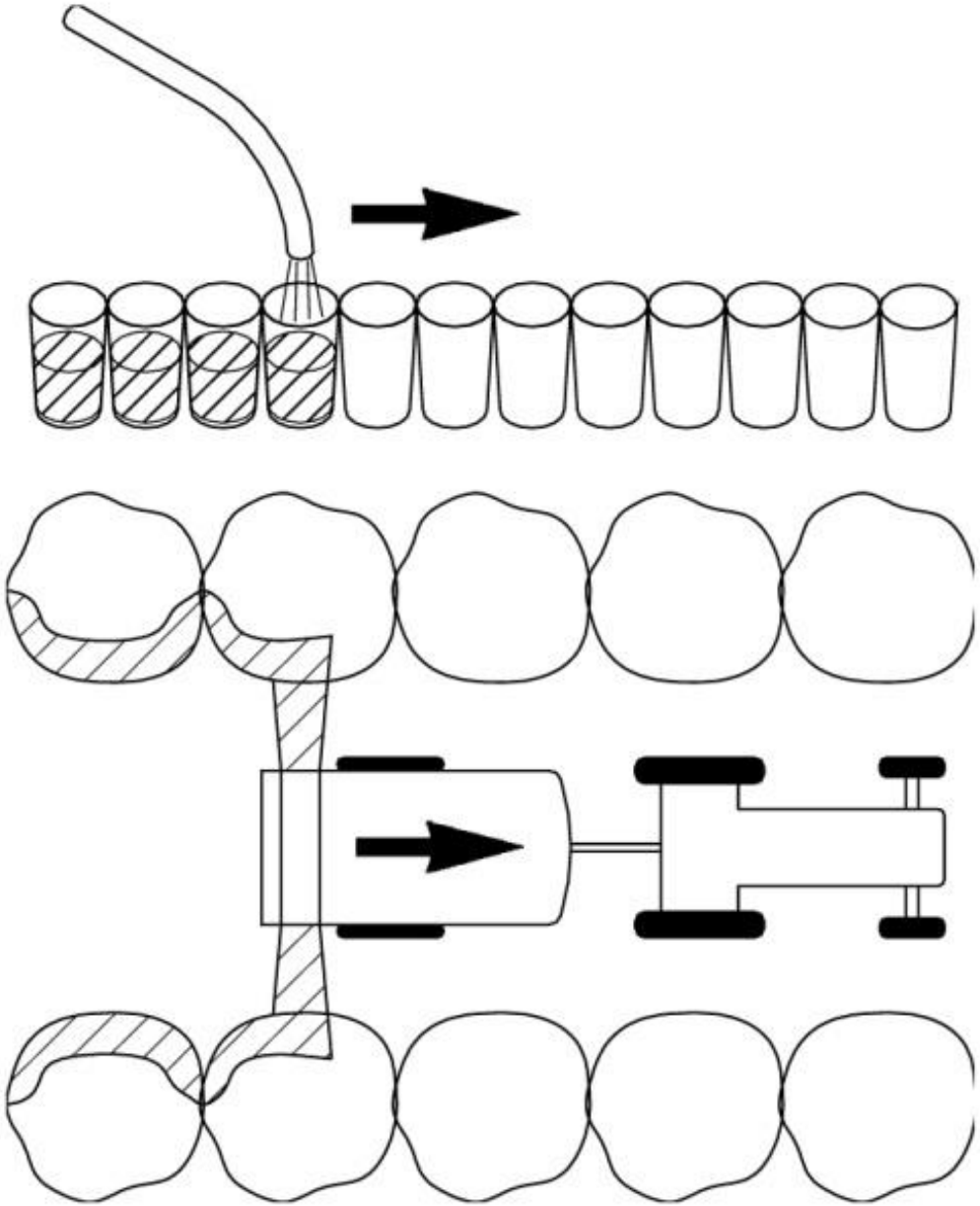
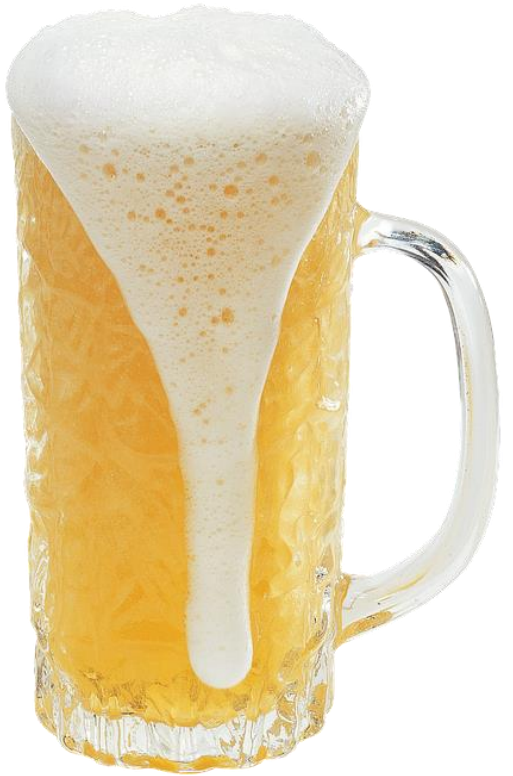


Like the hose filling glasses, the sprayer should move slow enough so the fan delivers air through the entire canopy but fast enough that is isn't blasting above the tree tops. (fill the glasses, but not overfill them)

NOW control (preharvest, full canopy) is reduced with increasing sprayer speed. Data from J. Siegel, USDA

Height in tree (ft)	% Loss in NOW control Going from 2 to 2.5 MPH	% Loss in NOW control Going from 2 to 3.25 MPH
6	-10	-4
8	-10.5	-11
10	-12.5	-22.5
12	-23	-36
14	-36	-52
16	-51	-69
18	-70	-90
20	-95	-100

The size of the glass influences how fast the hose should move to fill each glass without overflowing it. How big is the “glass” in an orchard or vineyard at any time?



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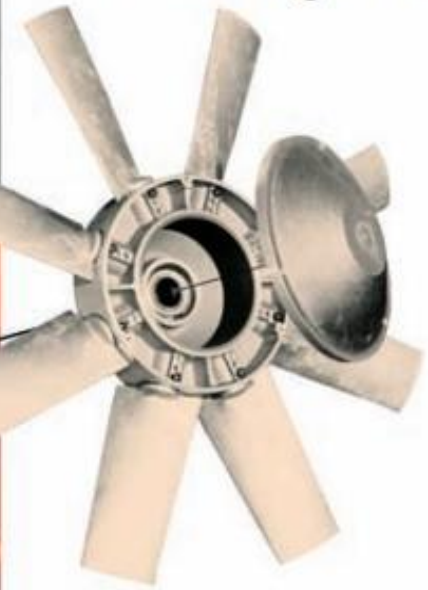
Most important consideration: site specific CROP size

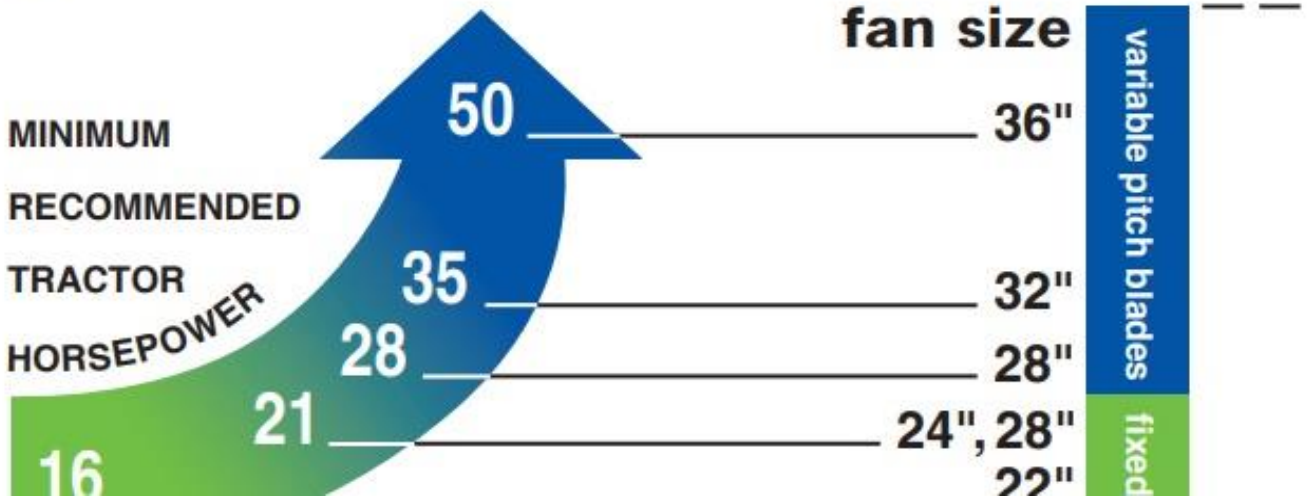
From Rears

selecting fan size.



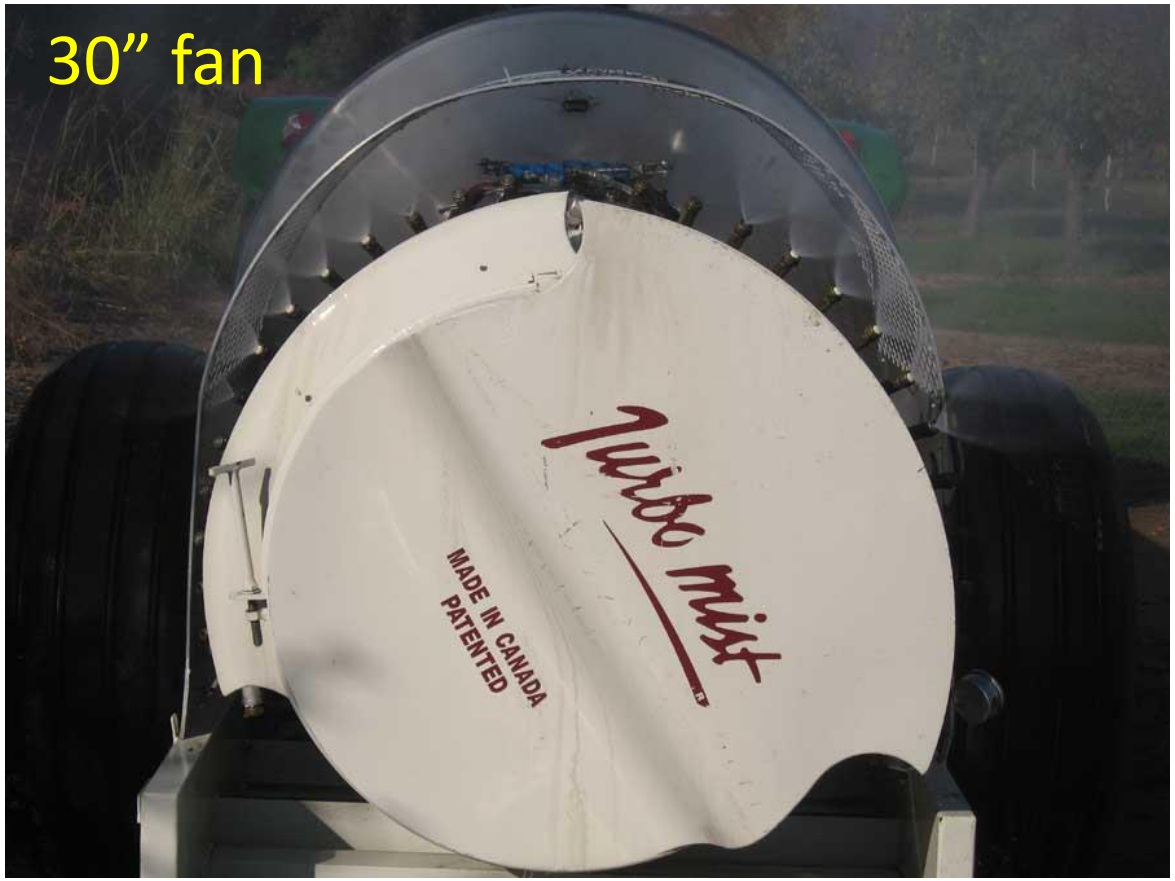
The Pul-blast has a selection of aluminum alloy axial flow fans ranging from 22"-36" diameter. Each fan is fitted to its fan housing to produce optimal performance. 22" and 24" diameter fans have six blades with a fixed pitch. 32" and 36" fans have 8 blades, each with a 3-position variable pitch. 28" diameter fans are available with 6 fixed blades or 8 variable pitch blades.

Louvered air straightening vanes are mounted in line with the fan to take the twist out of the air stream and equalize the velocity around the periphery of the air slot.



Gearing and PTO tractor's RPM also influence fan air delivery (flow of water in hose to fill glasses).

engine RPM	Fan air MPH in low fan gear	Fan air MPH in high fan gear
1000	**47**	**51**
1250	**58**	**63**
1500	**67**	**78**
1650	**76**	**85**
1750	**81**	**92**
1800	**87**	**96**
2000	**94**	**105**
2100	**96**	**107**



Without adequate air speed from the fan, salty nutrient spray isn’t carried into the canopy but accumulates on exterior leaves. It then pools at the bottom of the leaf, is concentrated and phyto occurs.

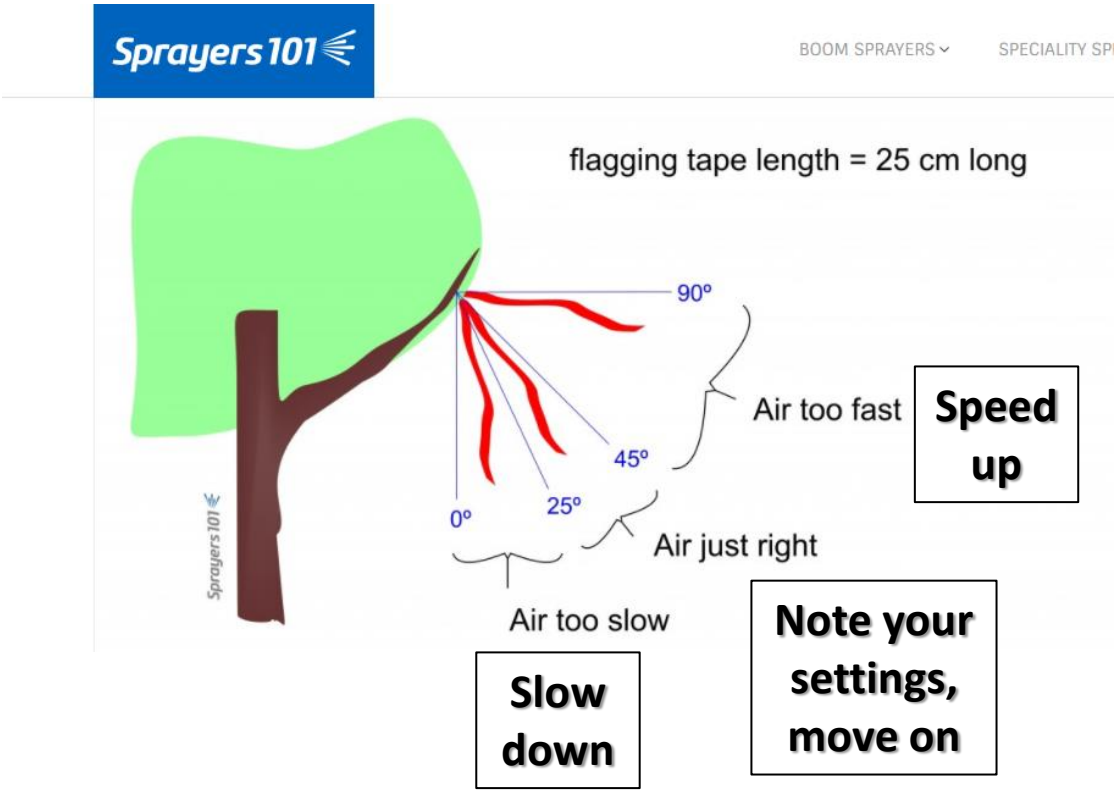
Faster ground speed
Less air flow (fan gear, tractor RPM, etc.)
Everyother row effective

Faster ground speed
Less air flow (fan gear, tractor RPM, etc.)
~~Everyother row effective~~

Slow ground speed
Max air flow (fan gear, tractor RPM, etc.)
~~Everyother row effective~~

Flagging shows where fan air is headed and reaches.

Tie flagging on the far side of the vines and watch as the sprayer passes at certain tractor/sprayer settings



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In nut trees, the upper canopy is the hardest area to reach. Use flagging to make sure air is traveling to the tree tops and just above.

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With known tractor/sprayer gearing & RPMs for good coverage in an orchard @ a certain crop stage, measure how fast you are really going. How long to travel 100+'?

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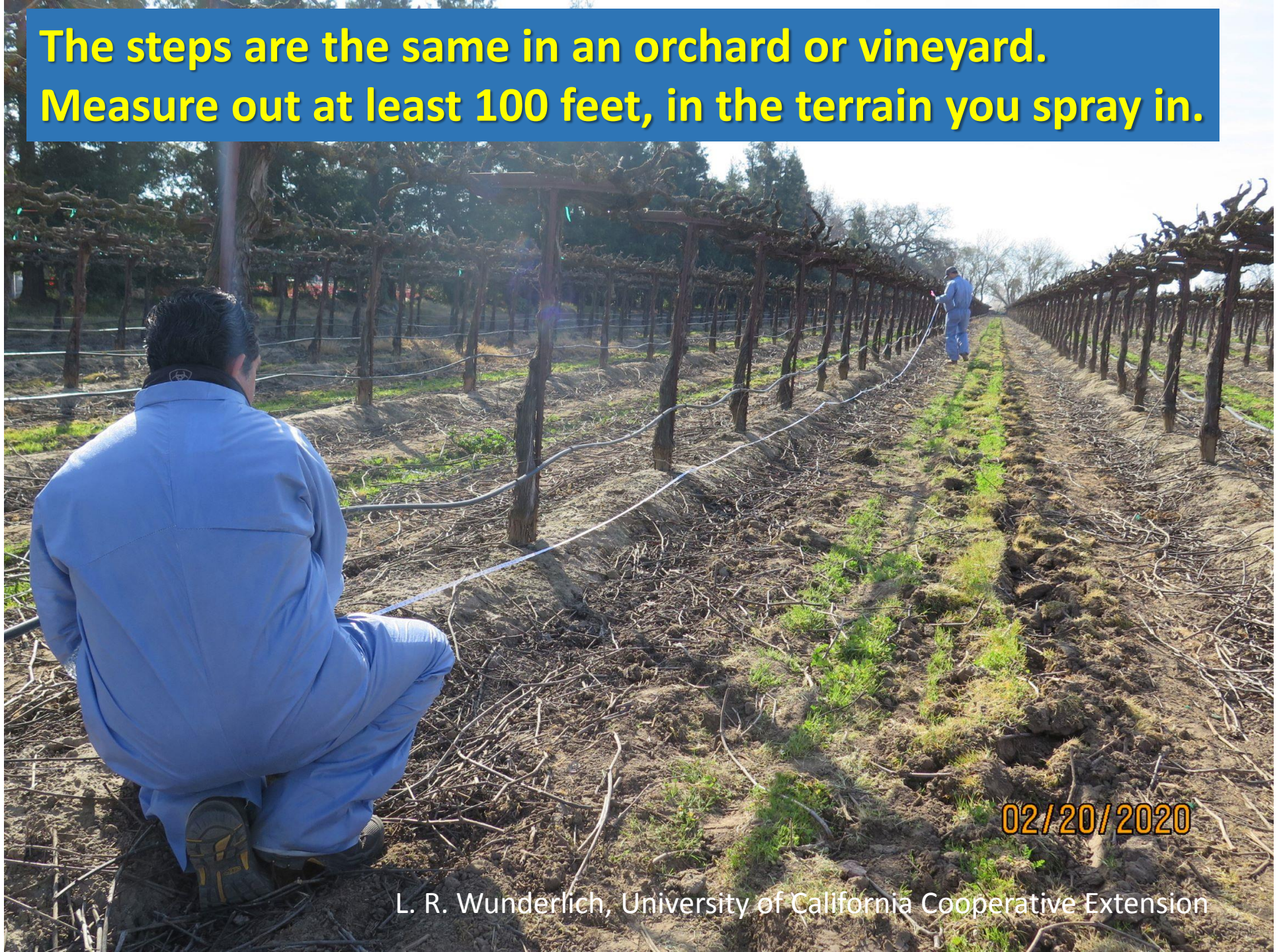
The steps are the same in an orchard or vineyard.
Measure out at least 100 feet, in the terrain you spray in.



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Then, drive the tractor down the row using the previously chosen settings. Time the 100+’ run. Make sure the sprayer is up to speed when it reaches the starting point.

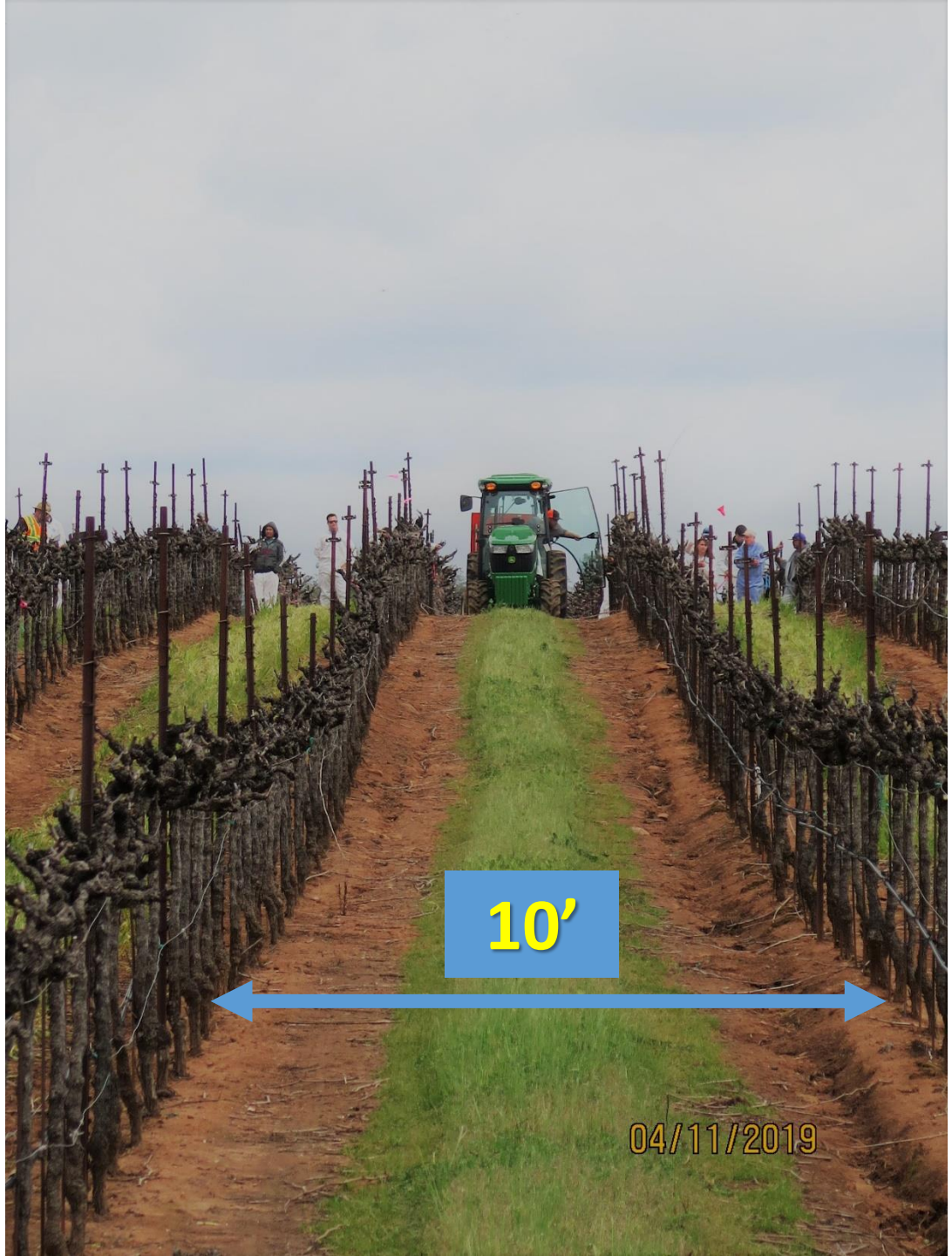
LAND RATE: Speed (ft./min) * Width (ft.) covered by nozzles

Vineyard Example:

222 ft./min * 10 ft. row spacing=
2220 $ft.^2$/min

Then convert to acres/min:

$$\frac{2220\ ft.^2/min}{43{,}560\ ft.^2/acre} = 0.05\ acre/minute$$



LAND RATE: Speed (ft./min) * Width (ft.) covered by nozzles

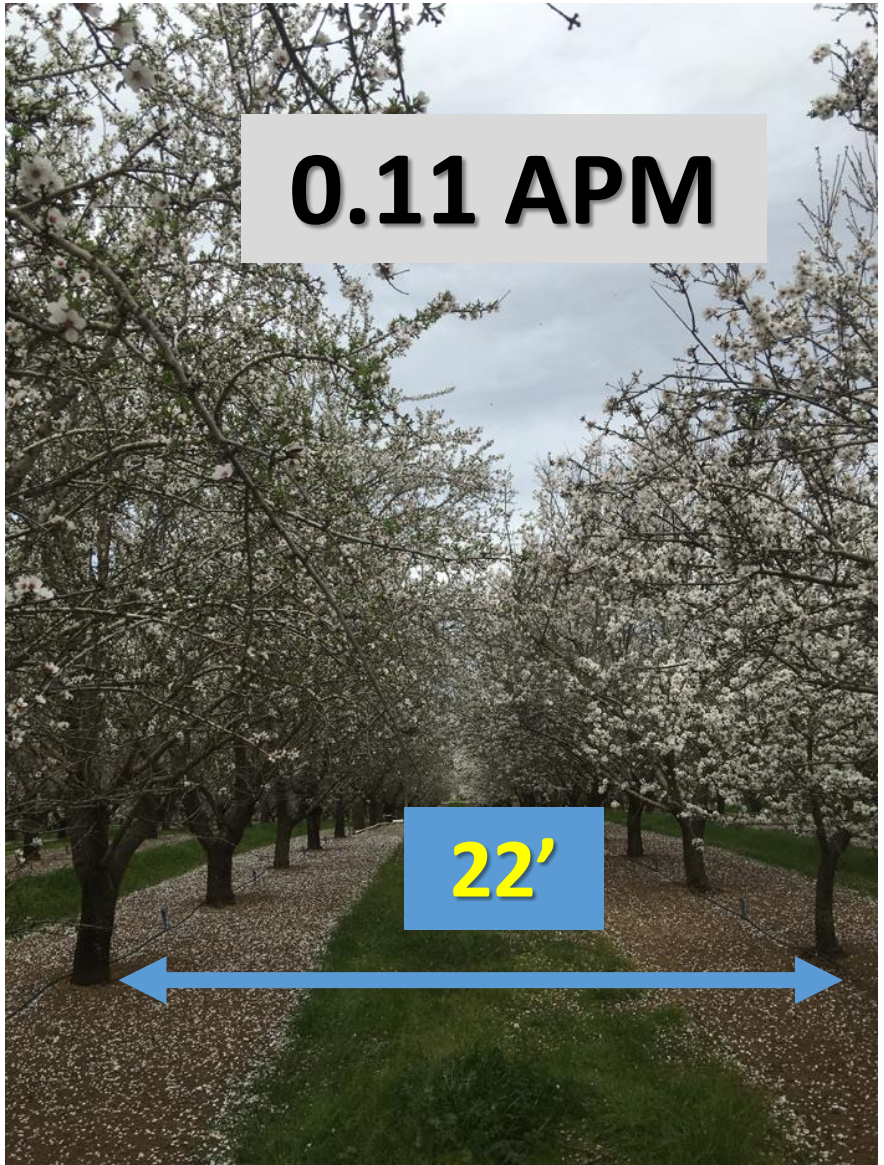
Orchard Example:

222 ft./min * 22 ft. row spacing=
4,884 $ft.^2$/min

Then convert to acres/min:

$$\frac{4{,}884\ ft.^2/min}{43{,}560\ ft.^2/acre} = 0.11\ acre/minute$$

Review: At 222 ft/min (= 2.5 MPH), APM more than doubles as the swath width goes from 10 ft to 22 ft.



Q4. Your sprayer is calibrated for 100 GPA. You move from a 20 foot block spacing to a 22 foot block spacing, without changing any tractor or sprayer settings. How is your GPA changed as you spray the new (22’) block?

a) No change
b) GPA goes up
c) GPA goes down