Calibration of herbicide sprayers

Guy Kyser, Plant Sciences Department, UC Davis

- Broadcast applications
- Directed treatments

Why calibrate?

- Underapplication
- Overapplication

Weed Research & Information Center

UNIVERSITY OF CALIFORNIA • COOPERATIVE EXTENSION & AGRICULTURAL EXPERIMENT STATION

The Weed Research and Information Center is an interdisciplinary collaboration that fosters research in weed management and facilitates distribution of associated knowledge for the benefit of agriculture and for the preservation of natural resources.

What's New

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- Weeds featured in IPM News
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Susceptibility Chart — Learn more
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Control Techniques

Principles of Weed Control

In order to control weeds

Calibration in Natural Areas

Joe DiTomaso of UC Weed

Weed Identificatio

Joe DiTomaso, of UC Davis, takes us on a tour

Search

Recent Posts

- Applying Herbicide Selectively and Application Safety
- Find the Right Concentration of Herbicide
- Biological and Herbicide Control of Weeds

http://ucwric.org/?p=102

Broadcast application

- Usually uses selective herbicide
- Small amount of herbicide in water
- Requires careful calibration, application

Pressure

- nozzles
- boom height

Output

- flow rate
- overall spray volume

Speed

- spray width
- acre length
- pacing yourself

Pressure

- nozzles
- boom height

Output

- flow rate
- overall spray volume

Speed

- spray width
- acre length
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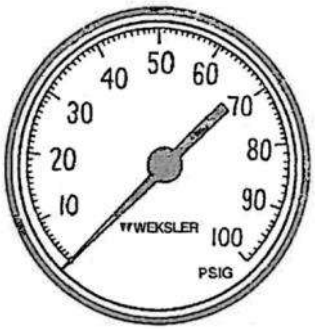
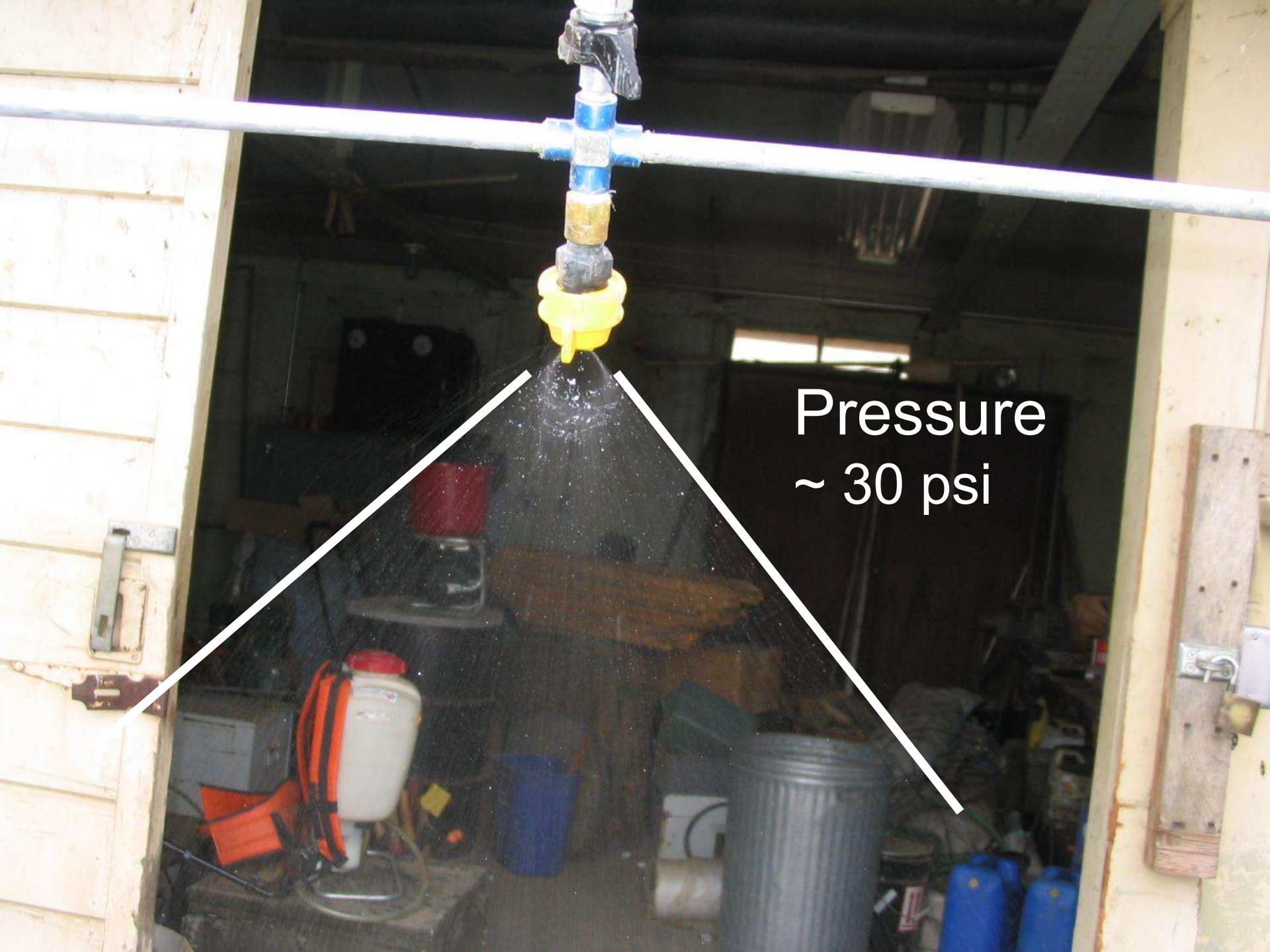
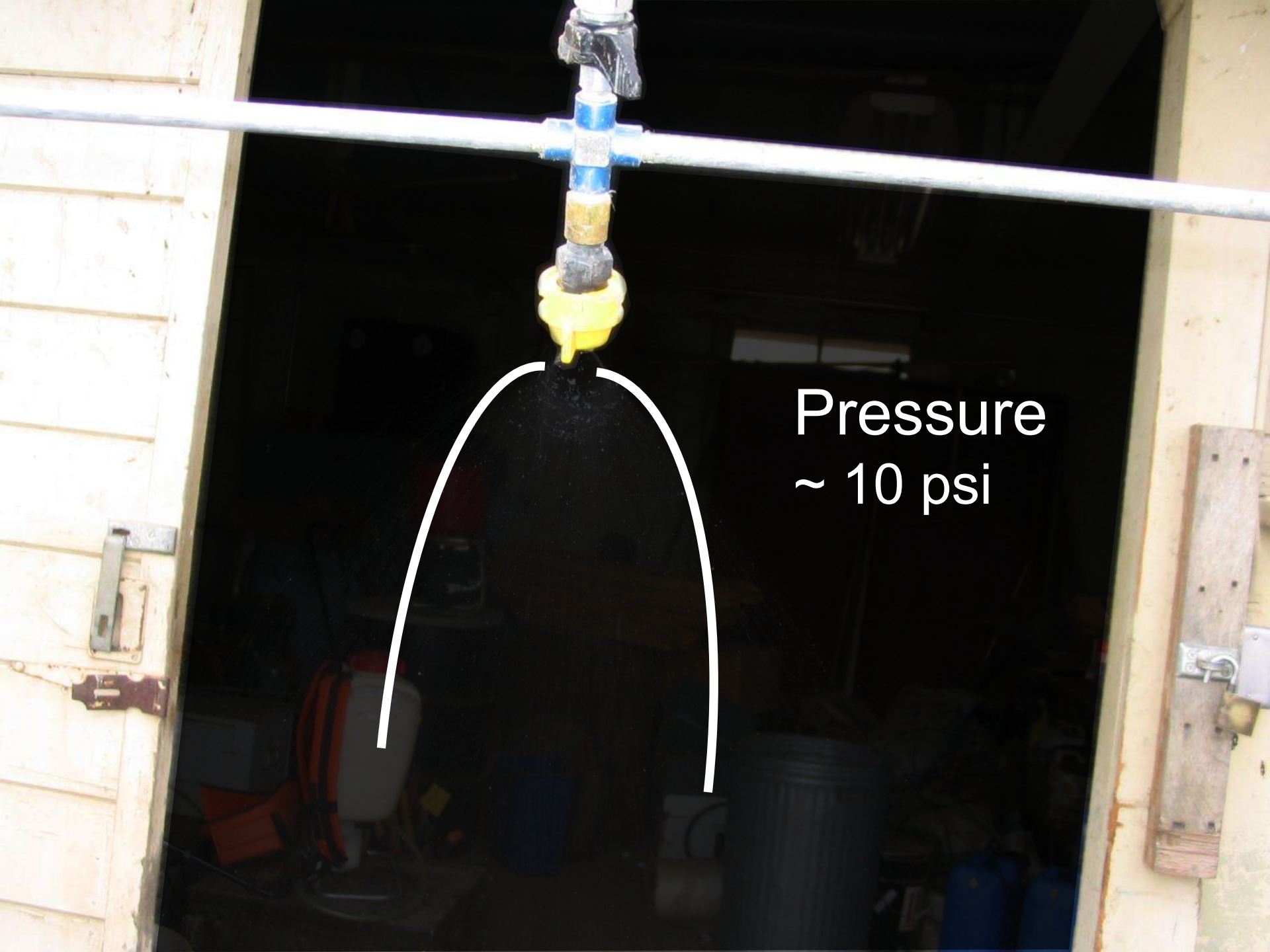
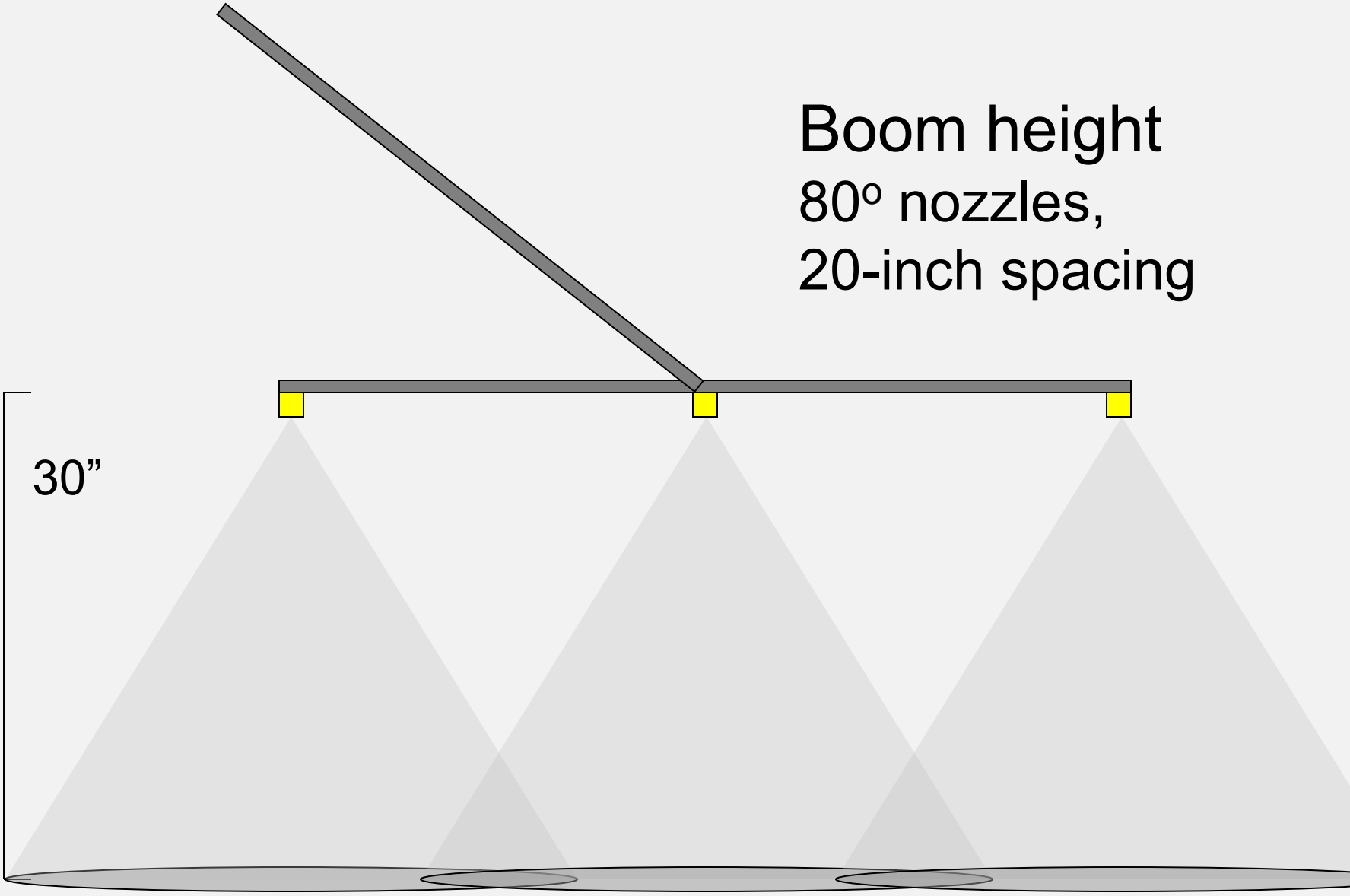


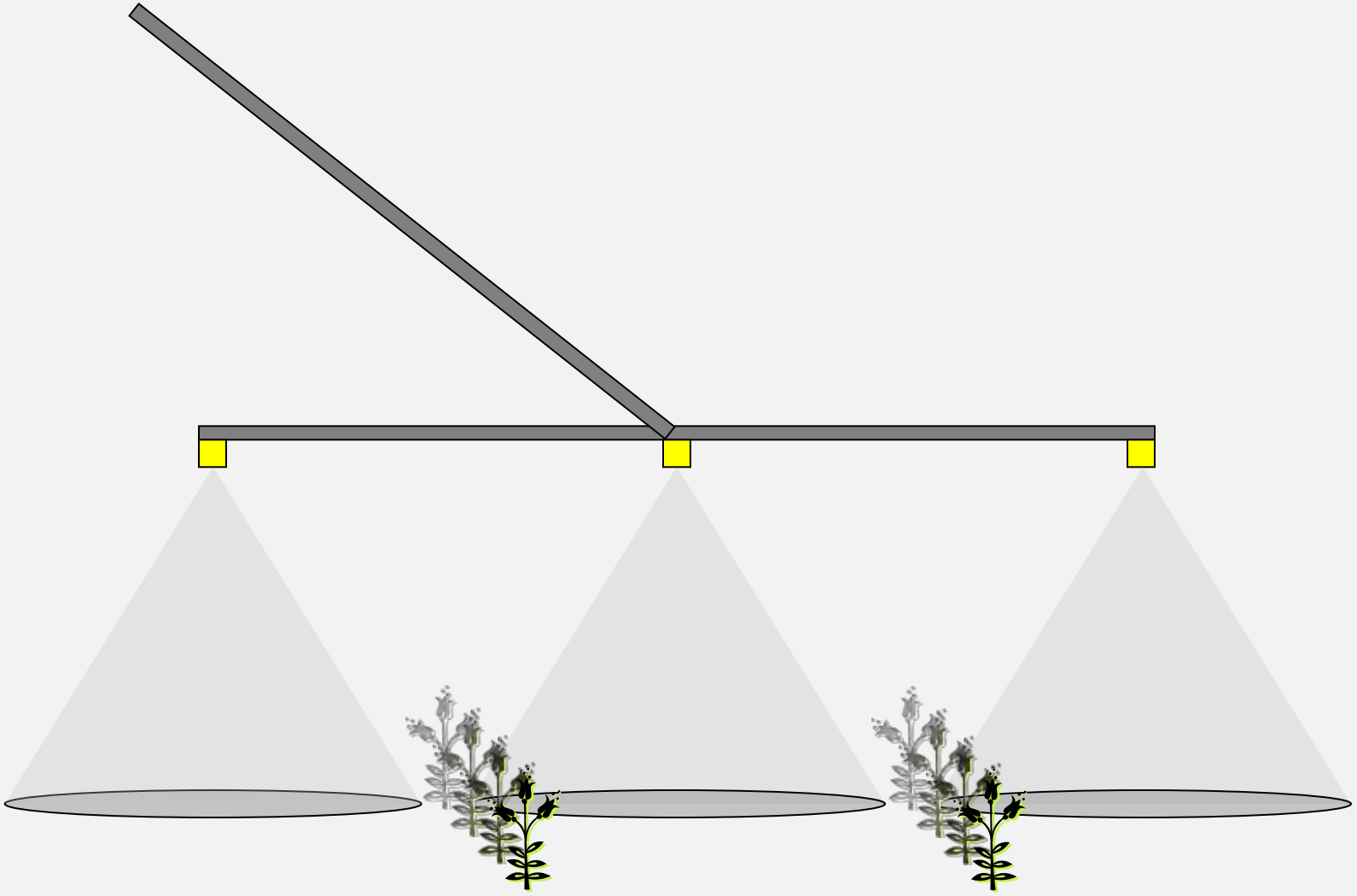
Pressure


Pressure
~ 30 psi


Pressure
~ 30 psi


Pressure
~ 10 psi


Boom height
80º nozzles,
20-inch spacing
30”



TeeJet XR (“Extended Range”) nozzles

TeeJet XR8002

80^{o} fan, “02” means 0.2 gpm / 40 psi

- Works at a range of pressures
- Good for 10 to 25 gallons per acre at a walking pace, 30 psi

TeeJet XR8002

TeeJet AIXR11002

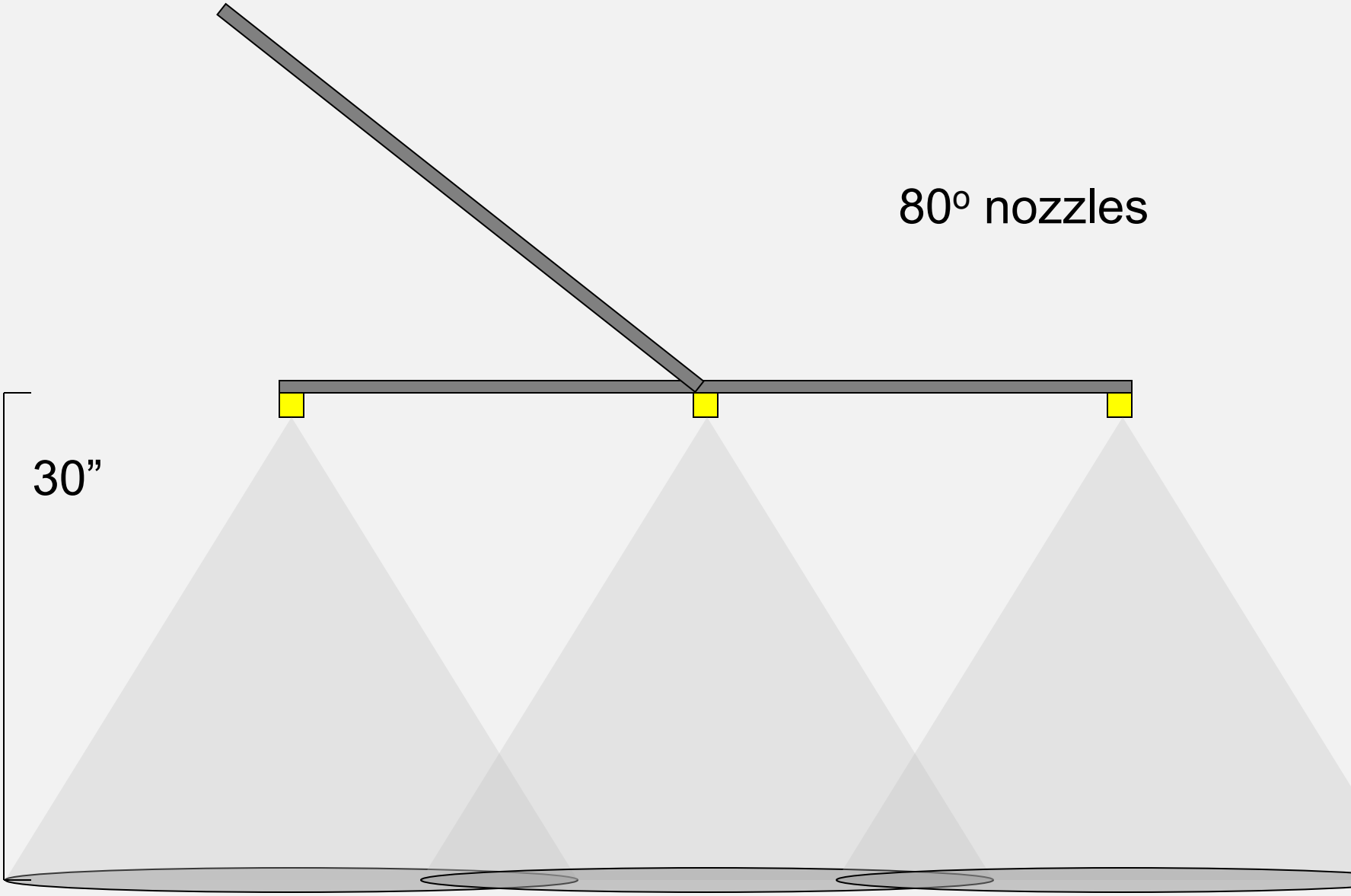
"Air Induction
Extended Range"

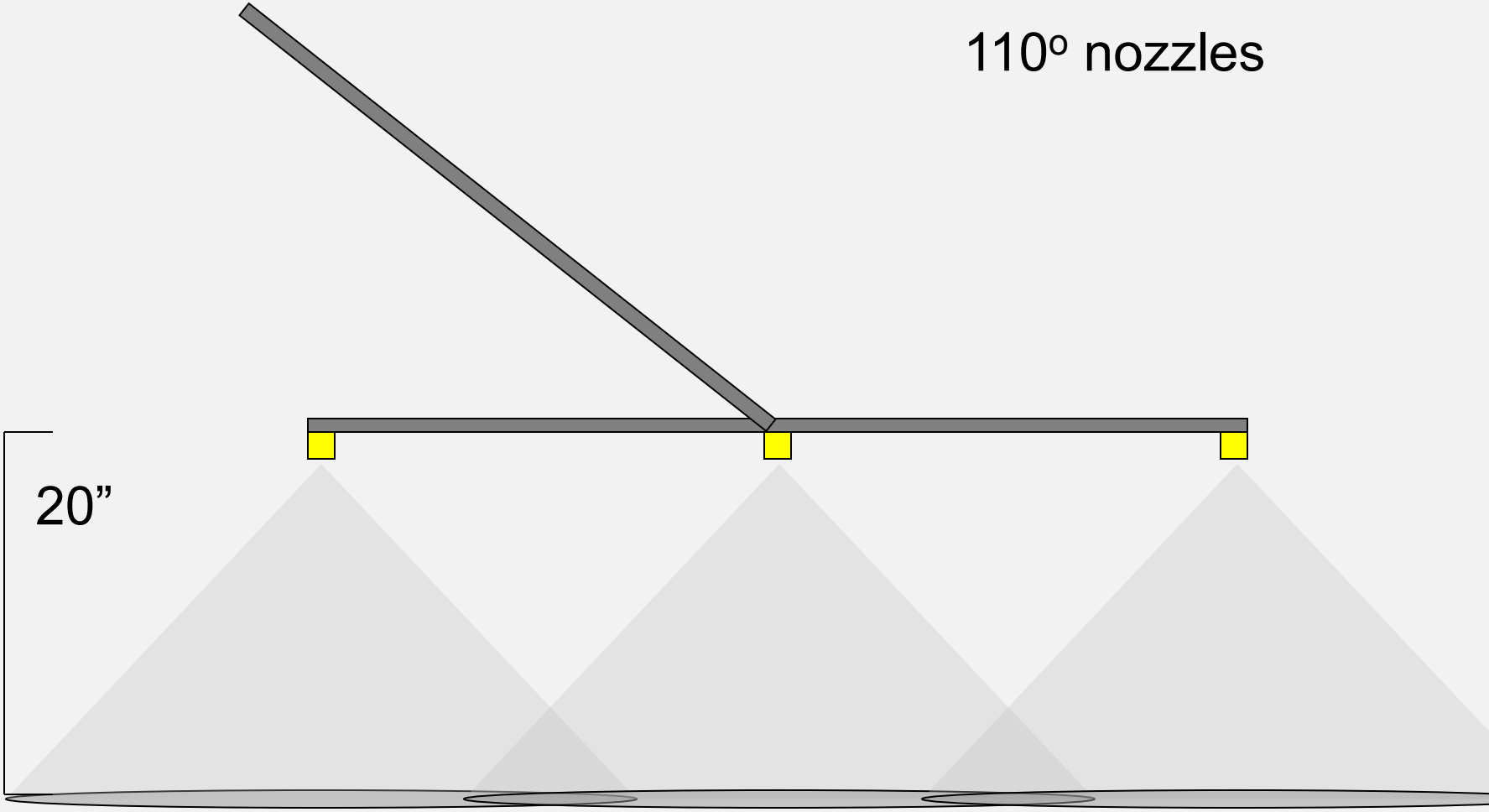
TeeJet XR8002

TeeJet AIXR11002

“Air Induction Extended Range”

- Bigger droplets
- Less drift
- 110^{o} fan


80º nozzles
30”


110º nozzles
20”

Pressure

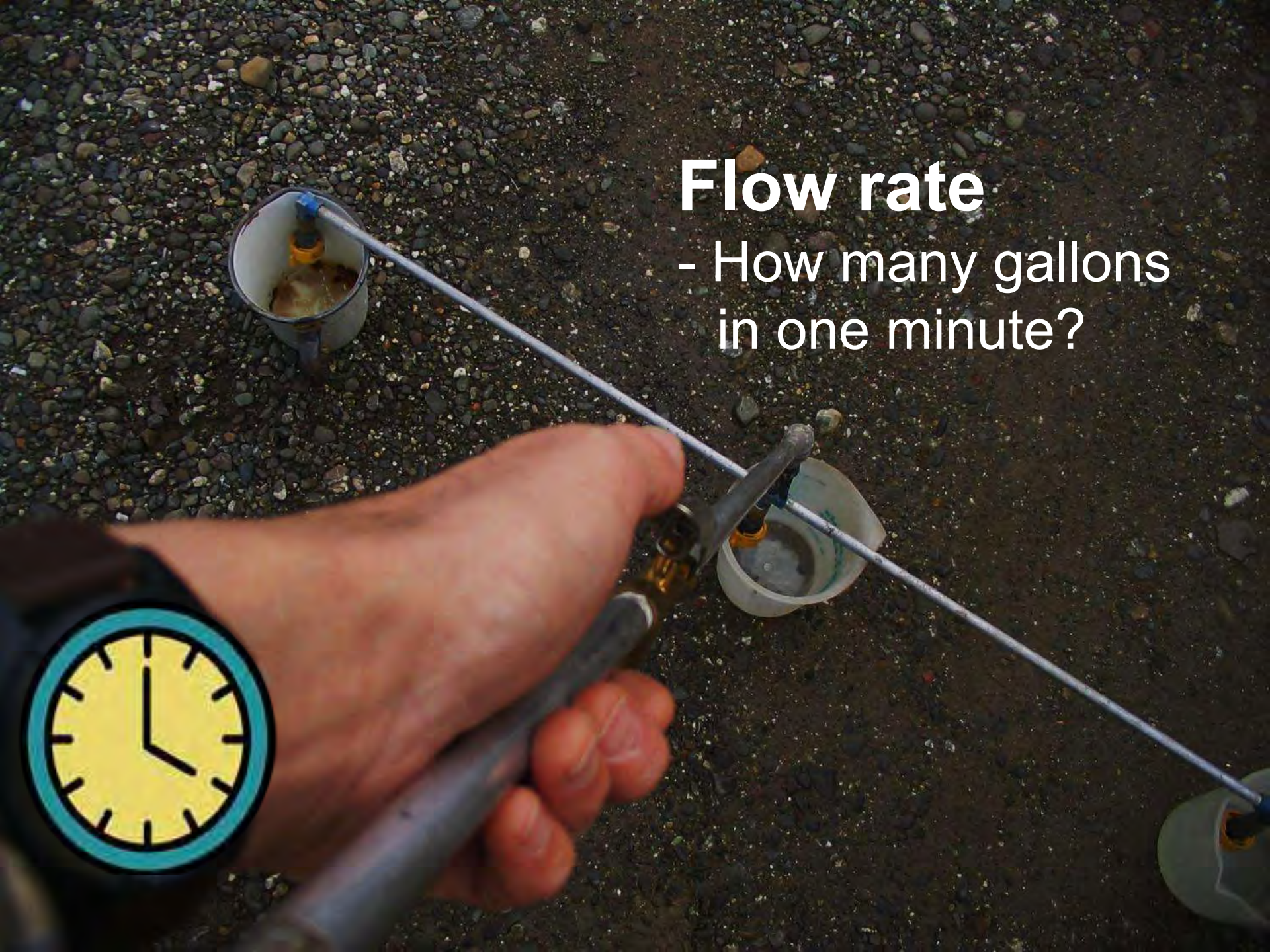
- nozzles
- boom height

Output

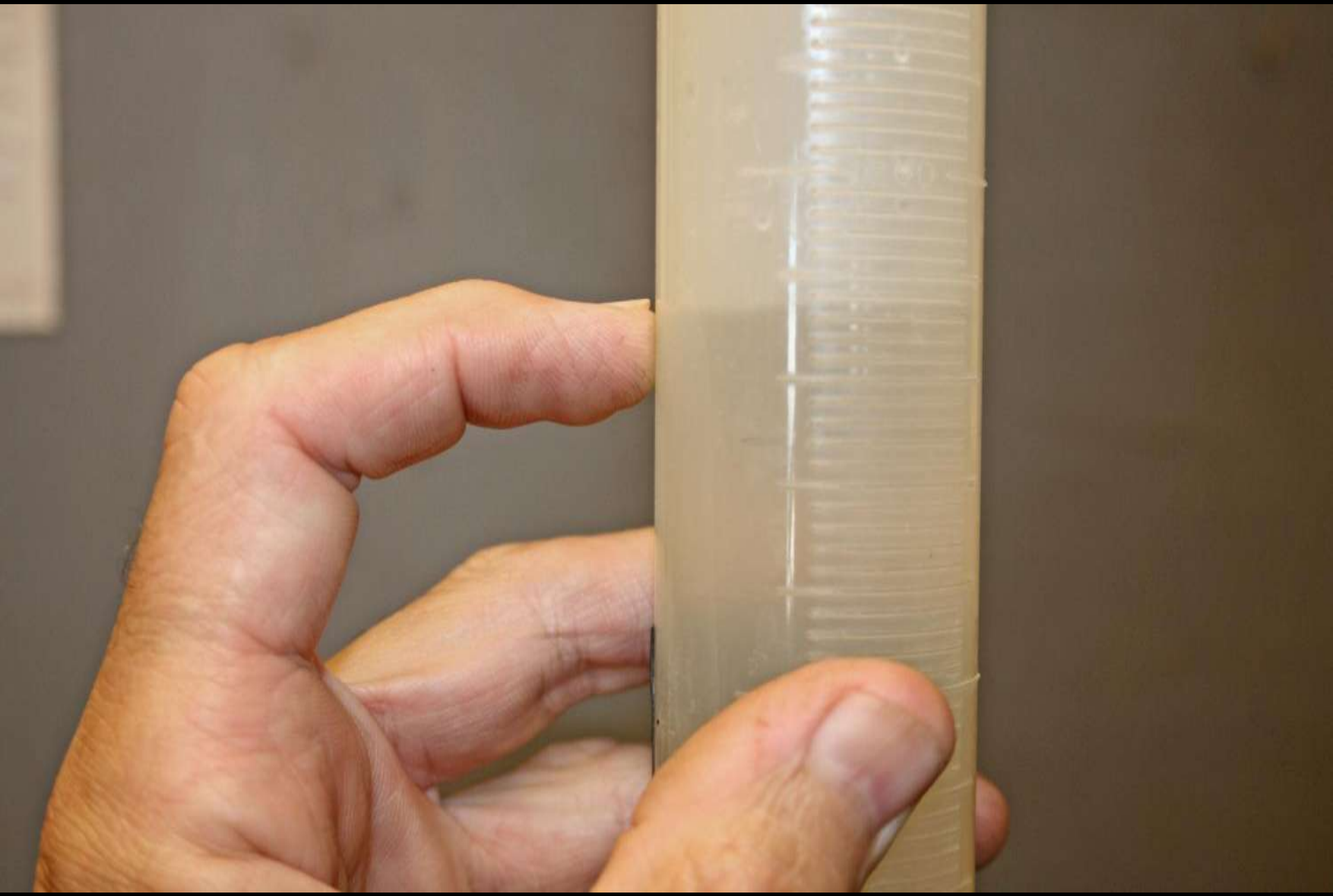
- flow rate
- overall spray volume

Speed

- spray width
- acre length
- pacing yourself

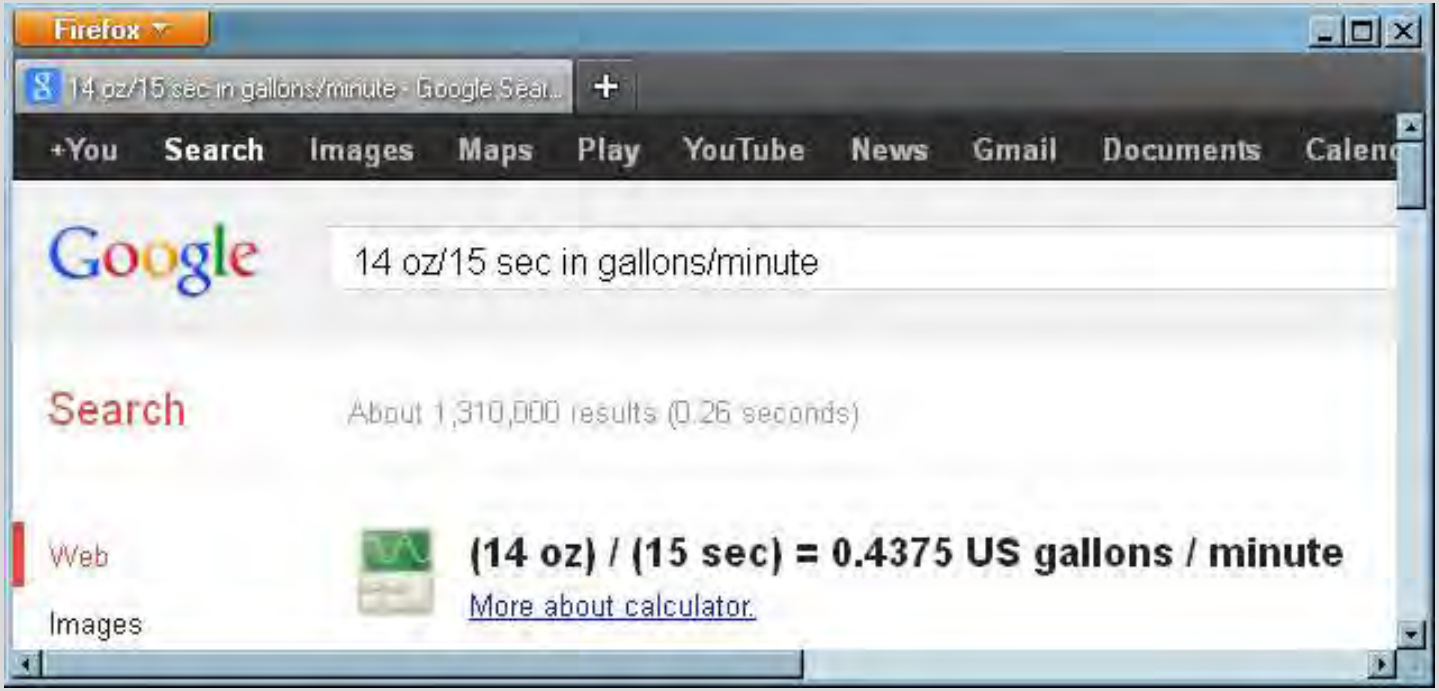

Flow rate
- How many gallons
in one minute?

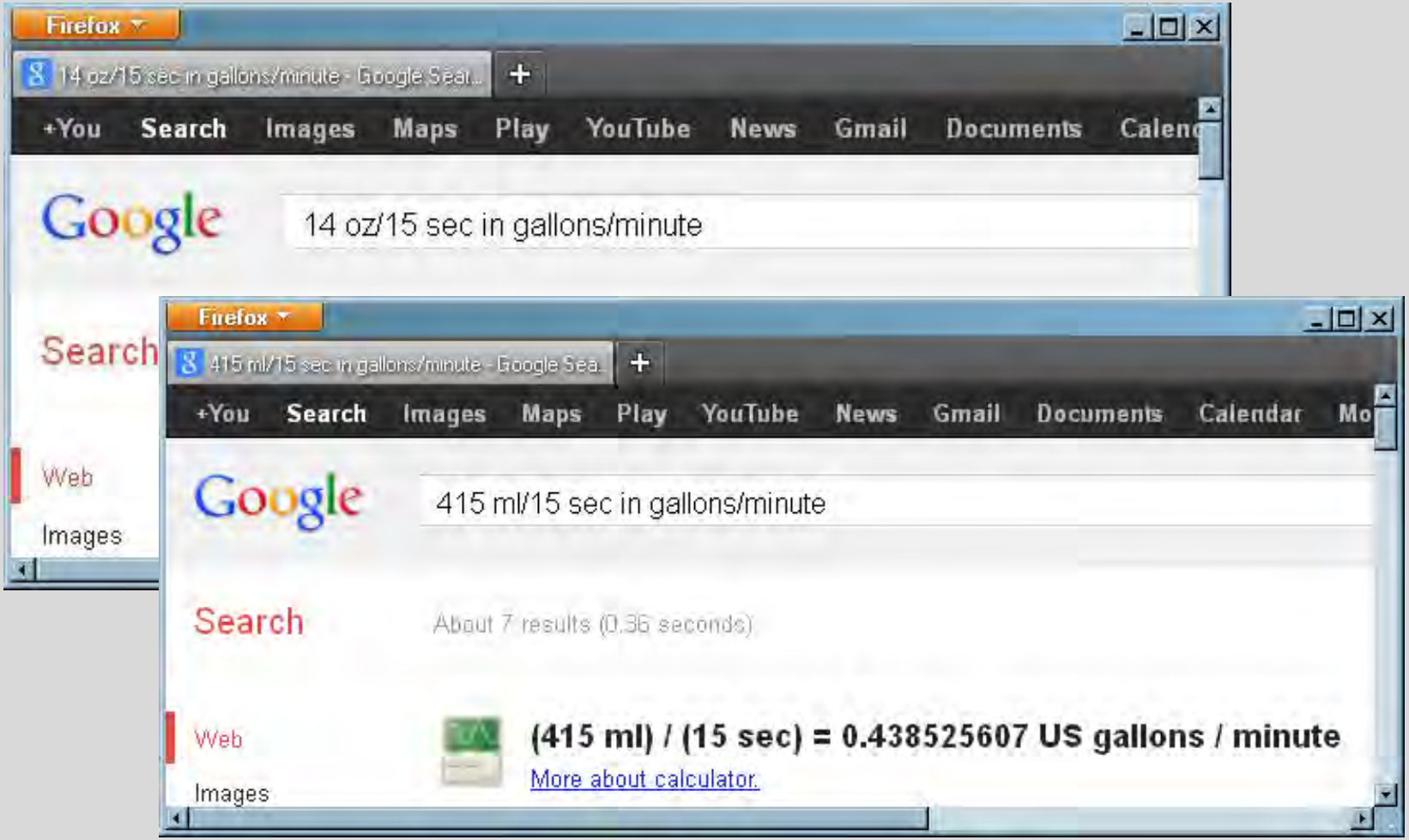

TC/TD
25° C
ML



Output, each nozzle, 135 to 140 ml (~ 4 ⅔ oz)

- 3-nozzle total = 14 oz
- 15-sec spray time x 4 → 56 oz/minute
- 56 oz/128 oz (1 gal) = 0.44 gal per minute


Firefox
14 oz/15 sec in gallons/minute - Google Sear...
+You
Search
Images
Maps
Play
YouTube
News
Gmail
Documents
Google
14 oz/15 sec in gallons/minute
Search
About 1,310,000 results (0.26 seconds)
Web
Images
(14 oz) / (15 sec) = 0.4375 US gallons / minute
More about calculator.


Firefox
14 oz/15 sec in gallons/minute - Google Sear...
+You Search Images Maps Play YouTube News Gmail Documents
Google
14 oz/15 sec in gallons/minute
Search
Web
Images
Firefox
415 ml/15 sec in gallons/minute - Google Sea...
+You Search Images Maps Play YouTube News Gmail Documents Calendar
Google
415 ml/15 sec in gallons/minute
Search
About 7 results (0.36 seconds)
Web
Images
(415 ml) / (15 sec) = 0.438525607 US gallons / minute
More about calculator.

Pressure

- nozzles
- boom height

Output

- flow rate
- overall spray volume

Speed

- spray width
- acre length
- pacing yourself

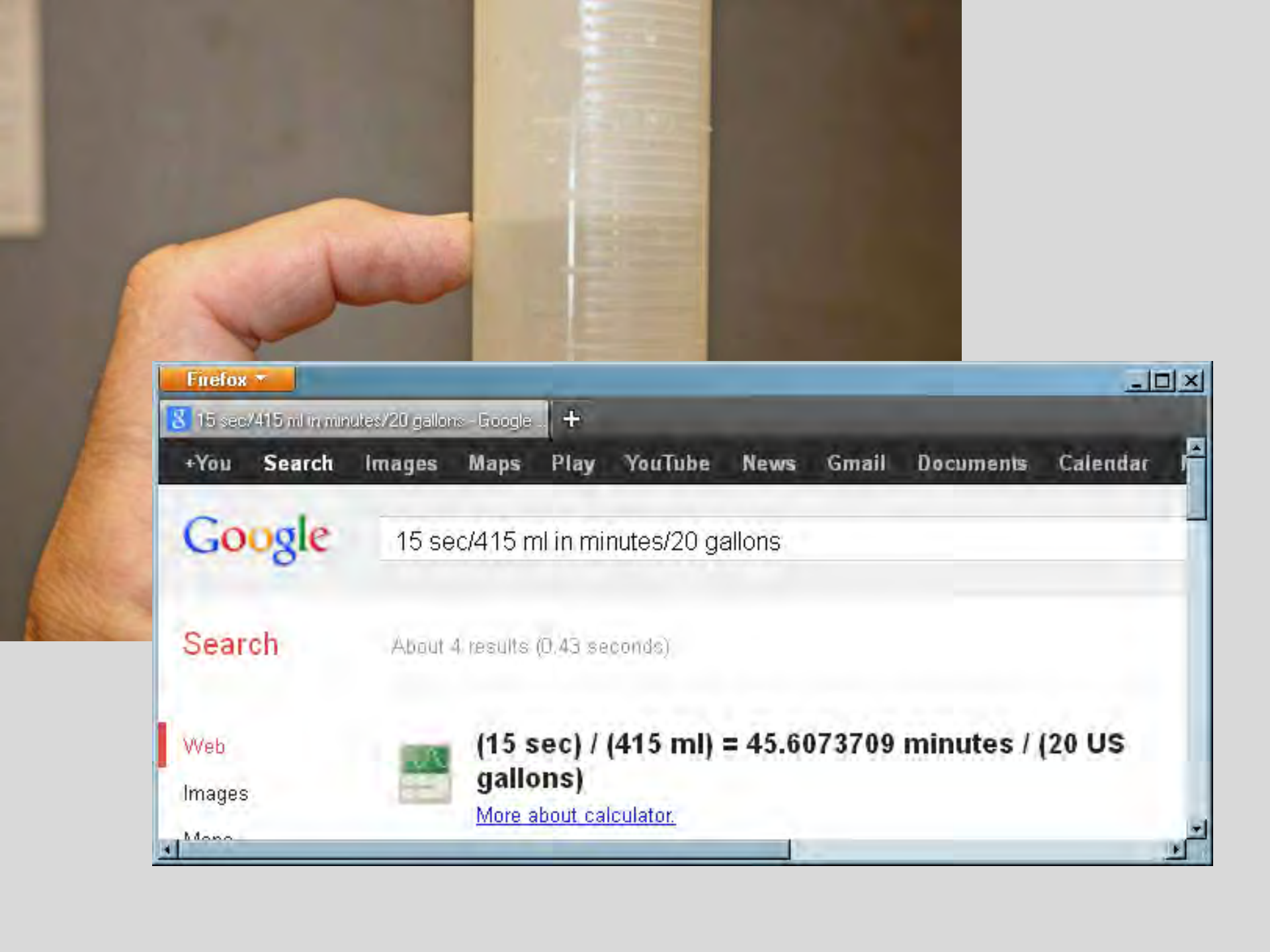
Spray volume

Total gallons of diluted herbicide solution applied per acre (g.p.a.)

- Usually ounces or pints of herbicide in gallons of water
- Spray volume and speed are connected*!*
- For walking applications with 02 size nozzles, 10 to 25 g.p.a. is good

Spray volume

- Spray volume / flow rate =
  number of minutes to treat one acre
- In our example,
  20 g.p.a. / 0.44 gal per min =
  45.5 minutes to put out 20 gallons


Firefox
15 sec/415 ml in minutes/20 gallons - Google ...
+You
Search
Images
Maps
Play
YouTube
News
Gmail
Documents
Calendar
Google
15 sec/415 ml in minutes/20 gallons
Search
About 4 results (0.43 seconds)
Web
Images
(15 sec) / (415 ml) = 45.6073709 minutes / (20 US gallons)
More about calculator.


Application
speed

Pressure

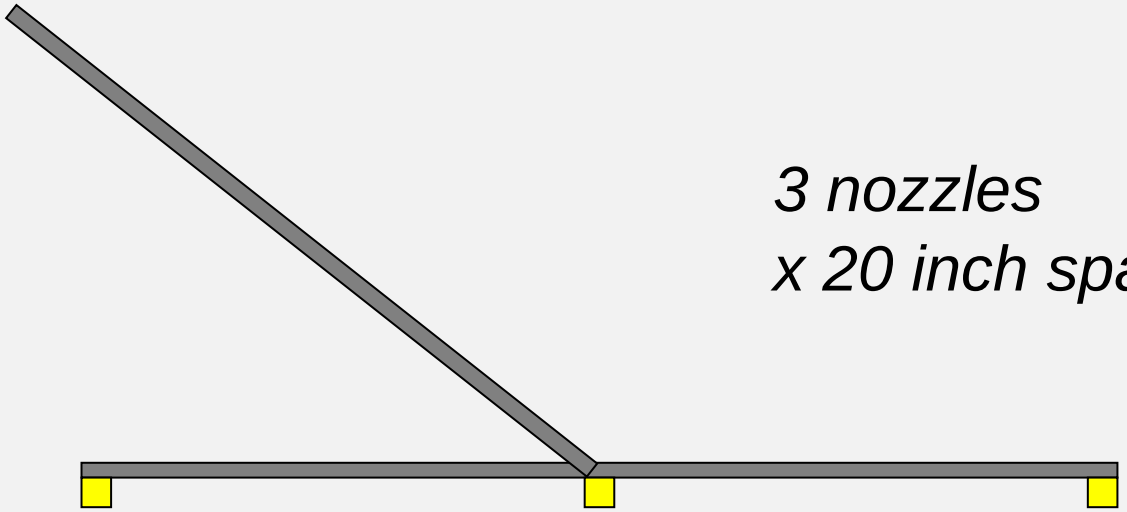
- nozzles
- boom height

Output

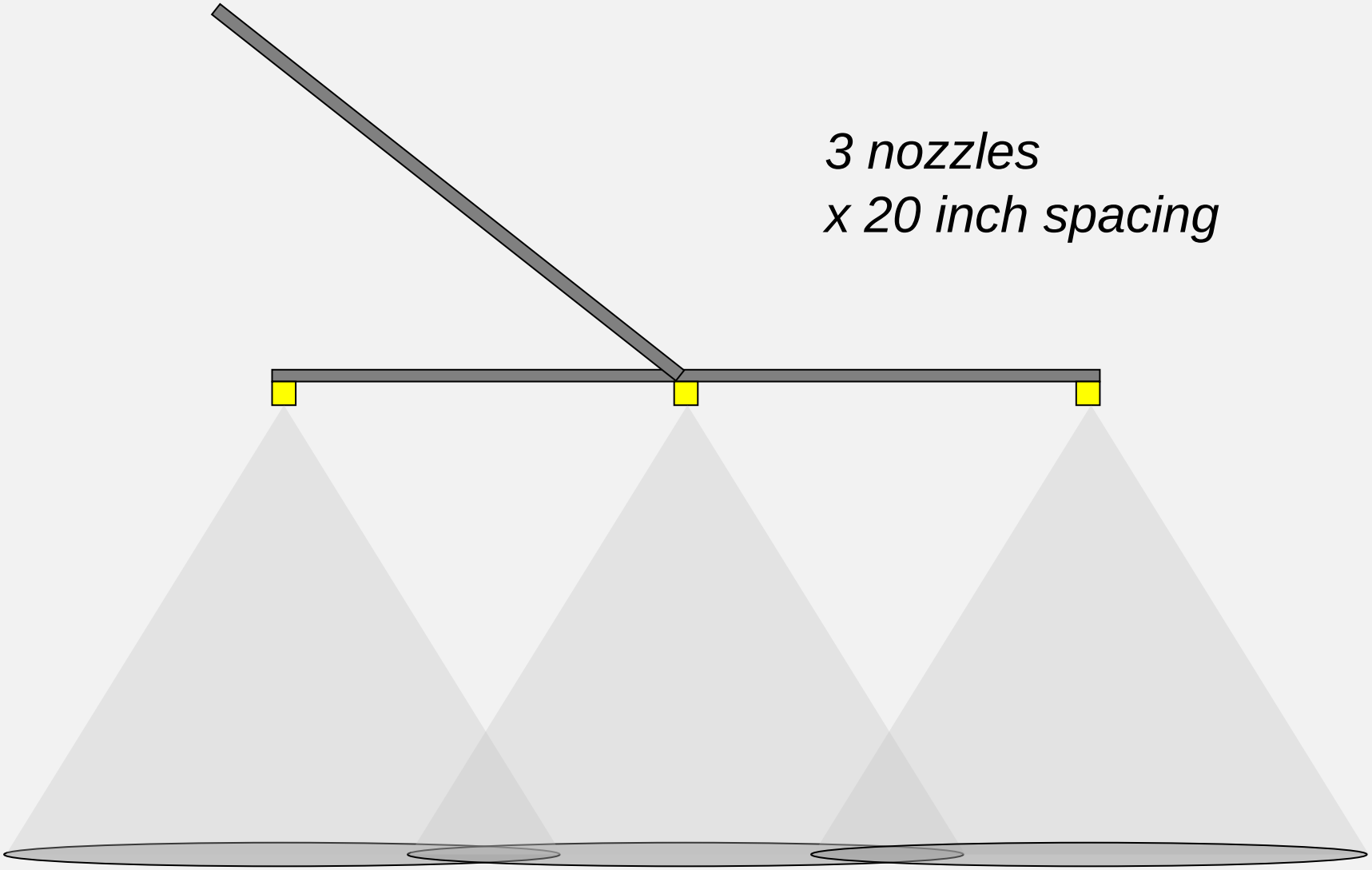
- flow rate
- overall spray volume

Speed

- spray width
- acre length
- pacing yourself

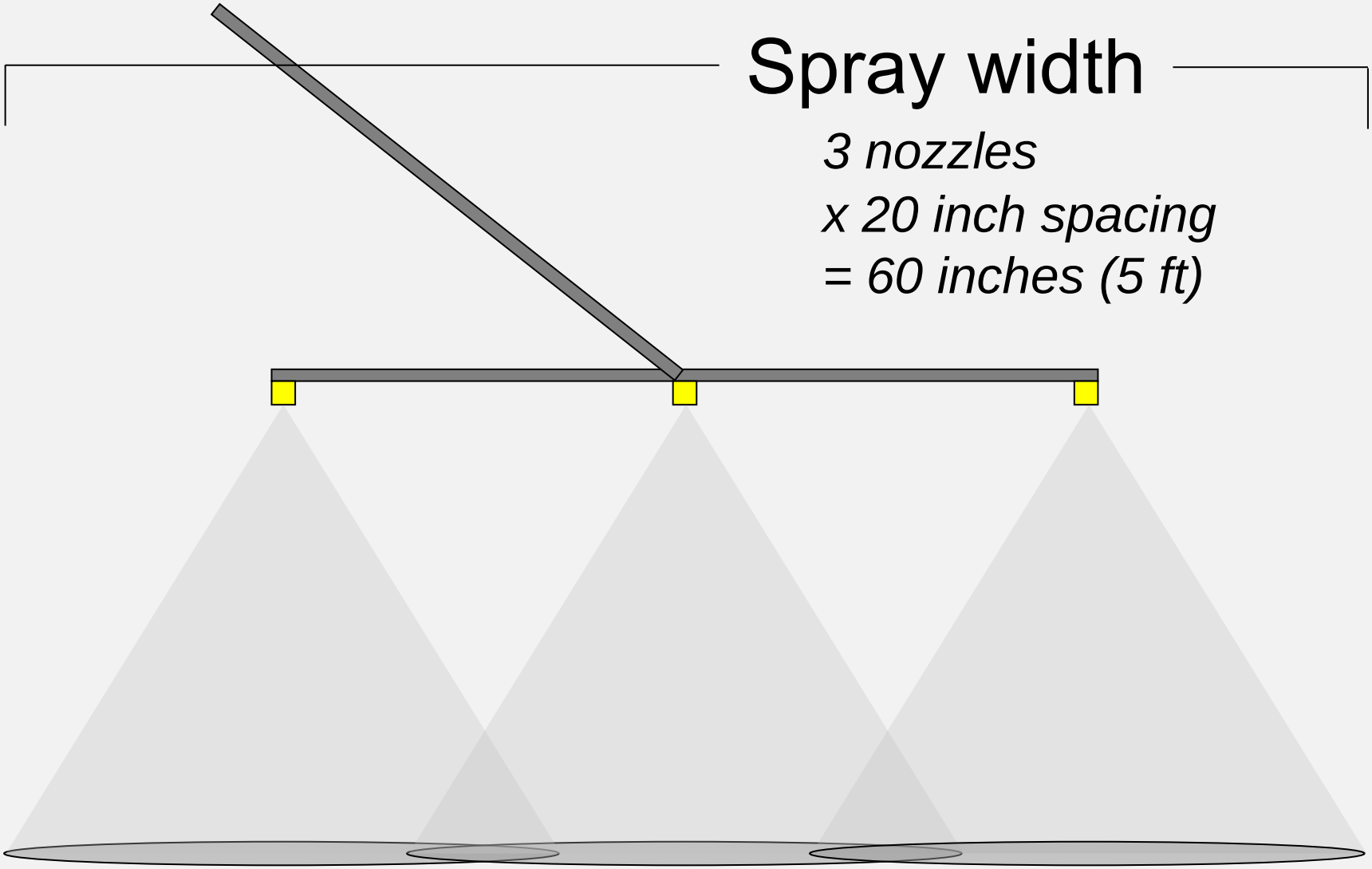


3 nozzles
x 20 inch spacing


3 nozzles
x 20 inch spacing

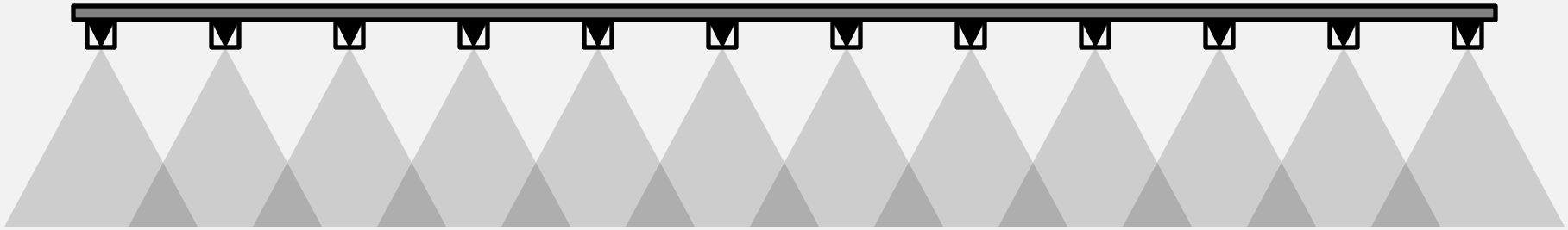
Spray width

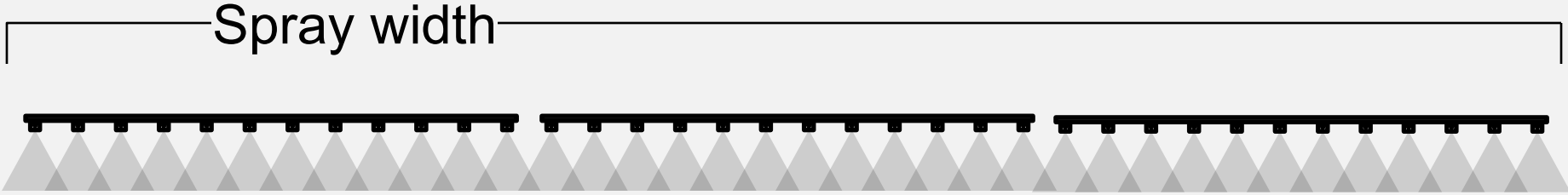
3 nozzles
x 20 inch spacing
= 60 inches (5 ft)

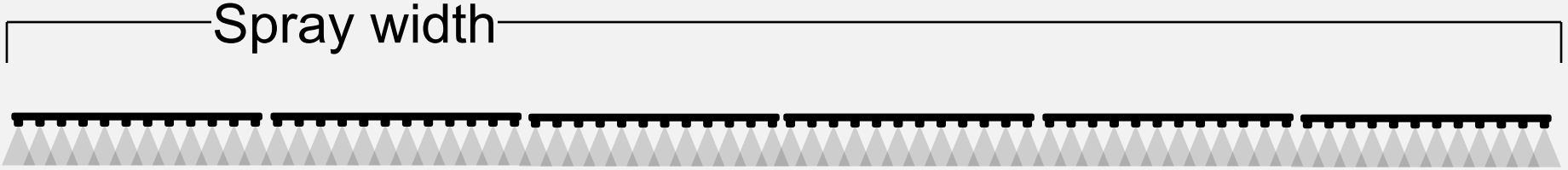


Spray width

12 nozzles x 20-inch spacing
= 240 inches (20 ft)




Spray width


Spray width

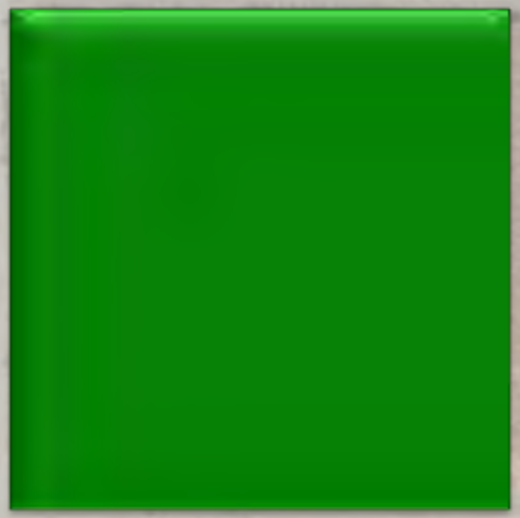

1 acre
(43560 ft²)
209 ft
209 ft


1 acre
(43560 ft²)
209 ft
209 ft

“Acre length”

43560 ft^2 / 5 ft (spray width) = 8712 ft

1 acre
(43560 ft^2)



209 ft

209 ft

Application speed:

how fast you have to go to put out the desired spray volume on your acre length.

Application speed:

how fast you have to go to put out the desired spray volume on your acre length.

Speed = distance / time

so

(acre length) / (number of minutes for 1 acre)

Application speed:

how fast you have to go to put out the desired spray volume on your acre length.

(acre length) / (number of minutes for 1 acre)

In our example,

8712 ft (acre length)

÷ 45.5 minutes (time for 20 gal)

= 191 ft / minute

Application speed:

how fast you have to go to put out the desired spray volume on your acre length.

Cool Applicator Trick:

Divide speed (feet per minute) by 88 to get miles per hour.

191 ft/minute ÷ 88 = 2.2 mph


Pacing yourself
Practice walking at application speed over a known distance.

Pacing yourself

In our example (191 ft/min), try measuring out 95 feet and walk it in 30 seconds…

Or 38 ft in 12 seconds (maybe close enough).

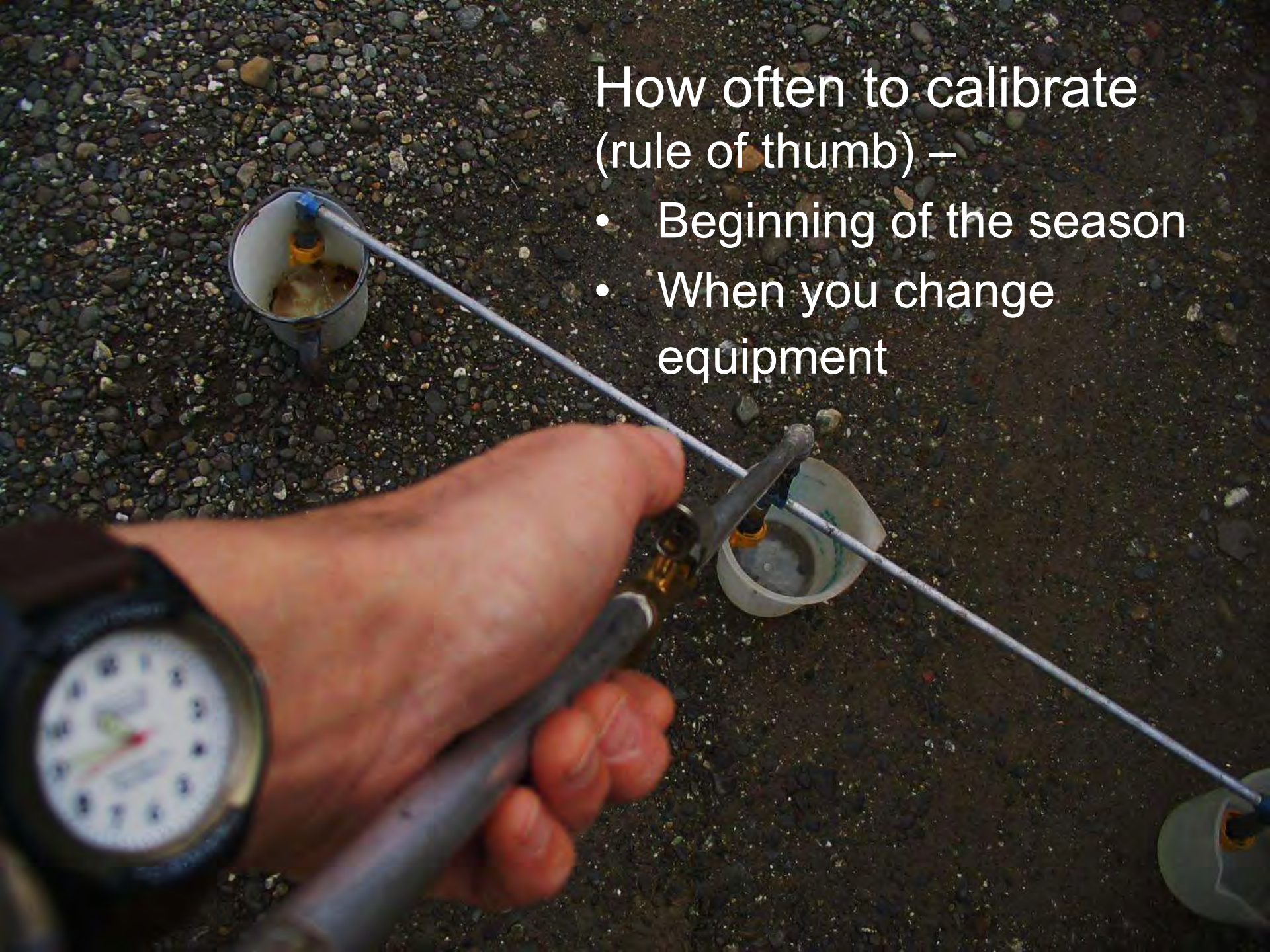
Pacing yourself

If this is too fast or too slow…

you can change your spray volume (g.p.a.)!

Seiko metronome

metronome app



How often to calibrate

(rule of thumb) –

- Beginning of the season
- When you change equipment

Filling the tank

- Based on tank size and g.p.a., figure out how many acres you can spray with one tank.

  4 gallon tank / 20 g.p.a. = 0.2 acre

- Use the right amount of chemical for that acreage.

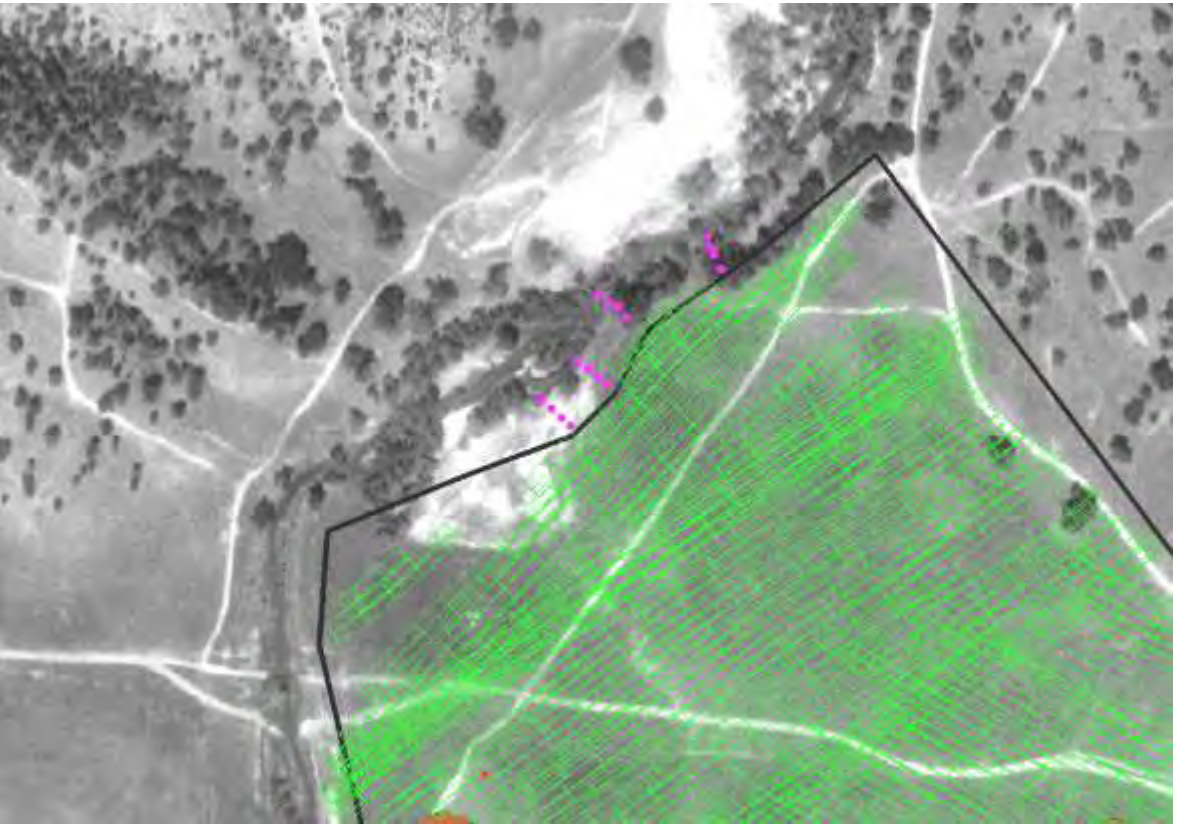
  0.2 acre x 1 pt per acre (16 oz) = 3.2 oz

- Mix it up*!*


Keeping
track


8
9
10
11
5F
1
2
3

Dyes, GPS




ATV
sprayers

Pressure

- nozzles
- boom height

Output

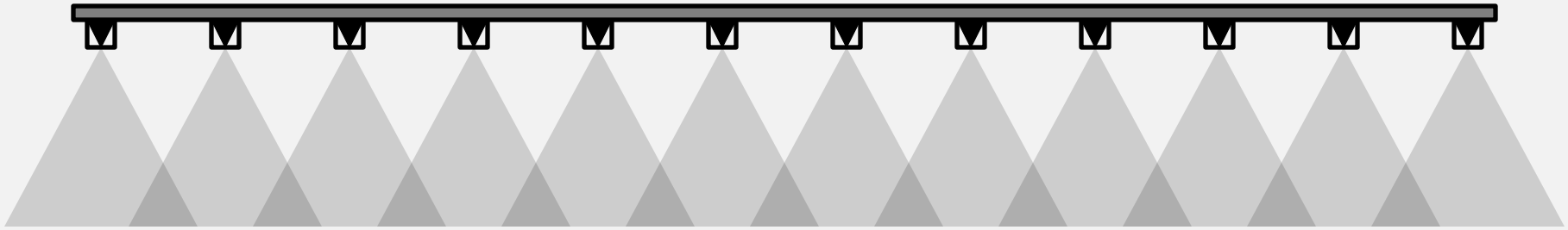
- flow rate
- overall spray volume

Speed

- spray width
- acre length
- pacing yourself

Spray width

12 nozzles x 20-inch spacing
= 240 inches (20 ft)



Output, each nozzle, 135 to 140 ml (~ 4 ⅔ oz)

- 3-nozzle total = 14 oz
- Multiply up for 12 nozzles → 56 oz
- 15-sec spray time x 4 → 224 oz/minute
- 224 oz/128 oz (1 gal) = 1.75 gal / minute

Pressure

- nozzles
- boom height

Output

- flow rate
- overall spray volume

Speed

- spray width
- acre length
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Pressure

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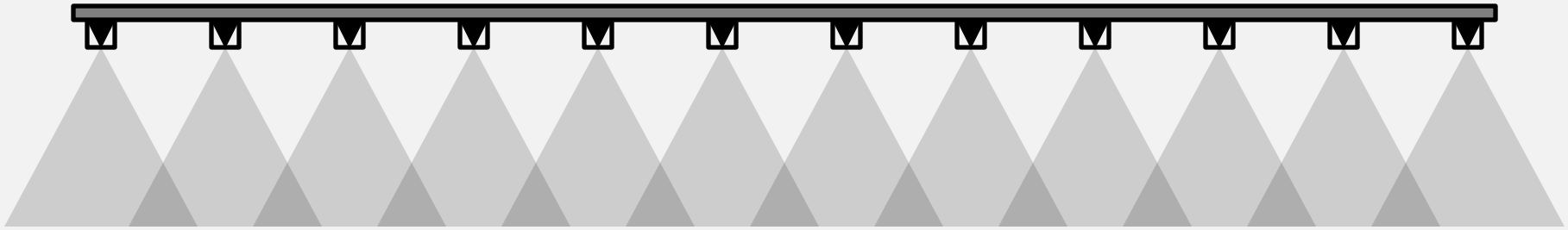


43560 sq ft (acre) / 20 ft (spray width)
= 2178 ft acre length

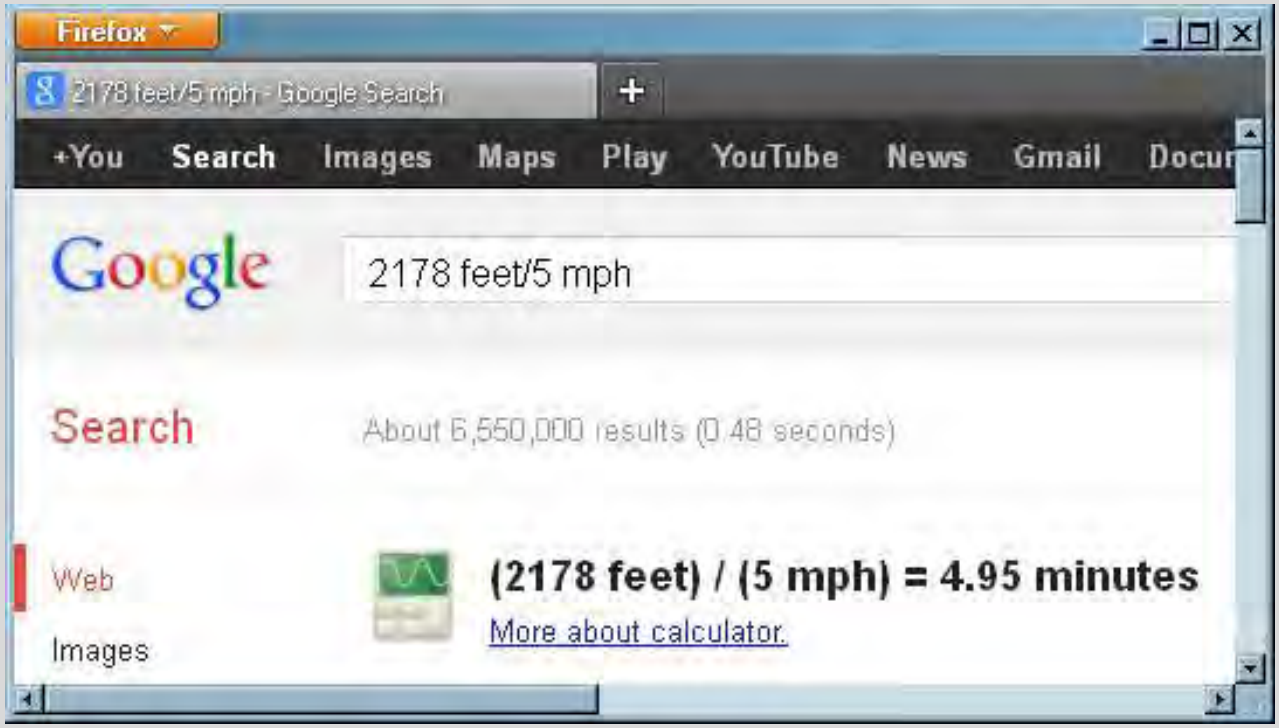
ATVs usually have an ideal travel speed for a given terrain.

- Use low gear, high RPMs
- Find a sweet spot in 3 to 10 mph
- If no speedometer, time yourself over a known distance *on site* (or use GPS)

Estimate total spray volume based on ATV speed:

- 2178 ft (acre length)
- 5 mph = 440 ft/min
  - ✓ 2178 ft ÷ 440 ft/min = 4.95 minutes

Estimate total spray volume based on ATV speed:



Estimate total spray volume based on ATV speed:

- 2178 ft (acre length)
- 5 mph = 440 ft/min
  - ✓ 2178 ft ÷ 440 ft/min = 4.95 minutes
- 1.75 gal / min
  - ✓ 1.75 gal/min X 4.95 min = 8.7 g.p.a.

Spot treatments

- For individual plants
- Can use nonselective herbicides
- Use a percent solution (i.e., 2% to 4% *Roundup*)

TeeJet XR (“Extended Range”) nozzles

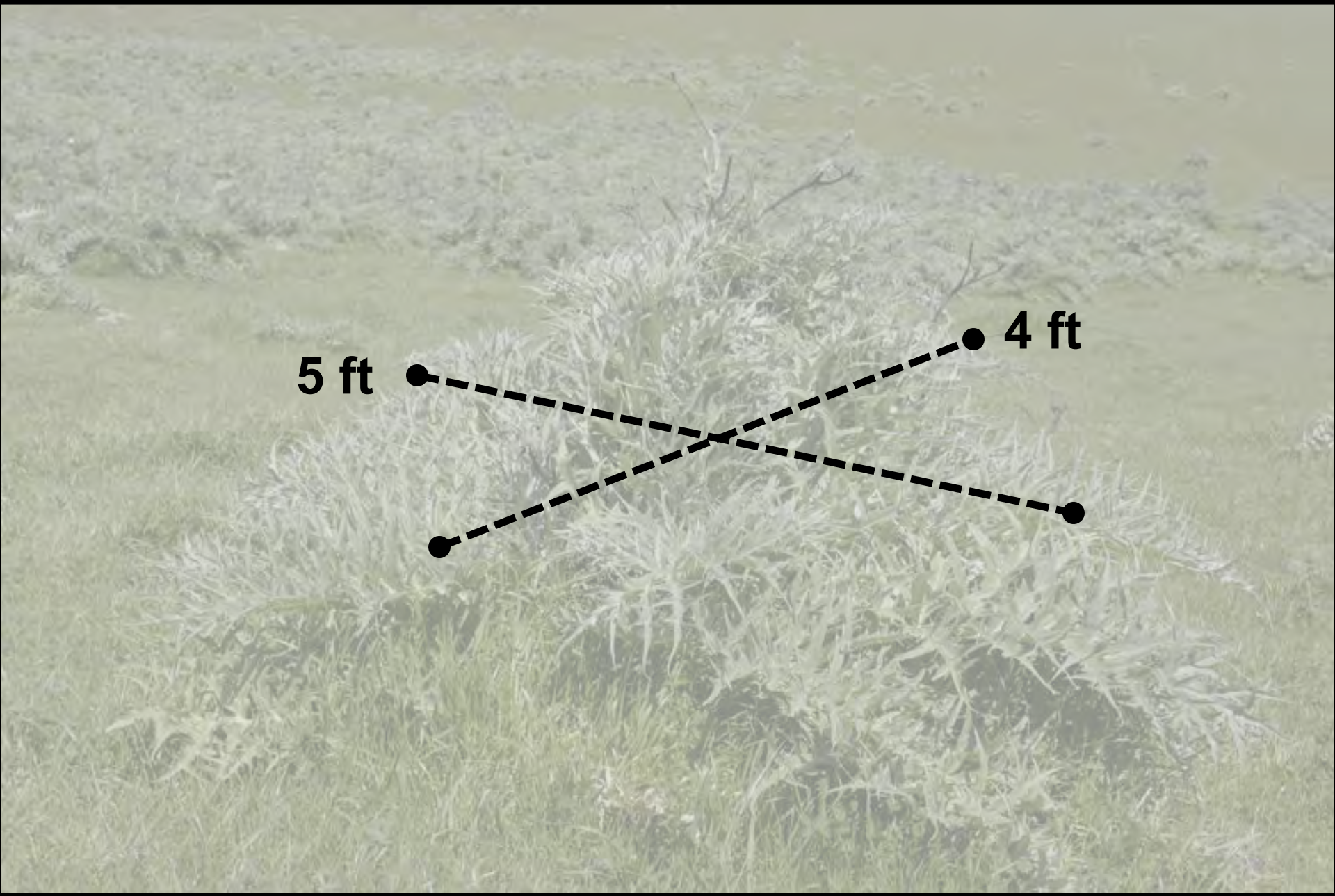
TeeJet XR 8004

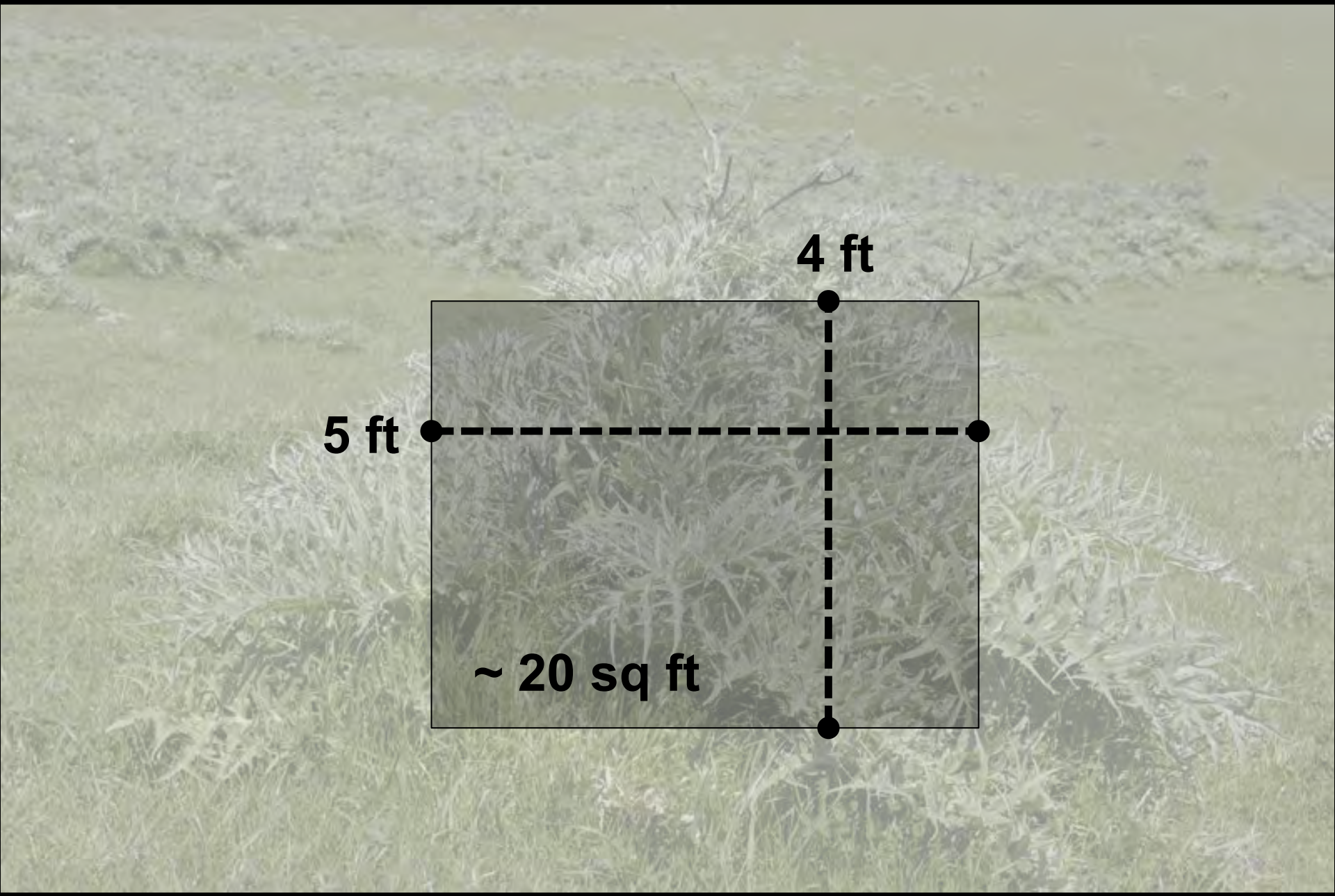
Lower pressure
(15-20 psi)

Making a spray-to-wet treatment

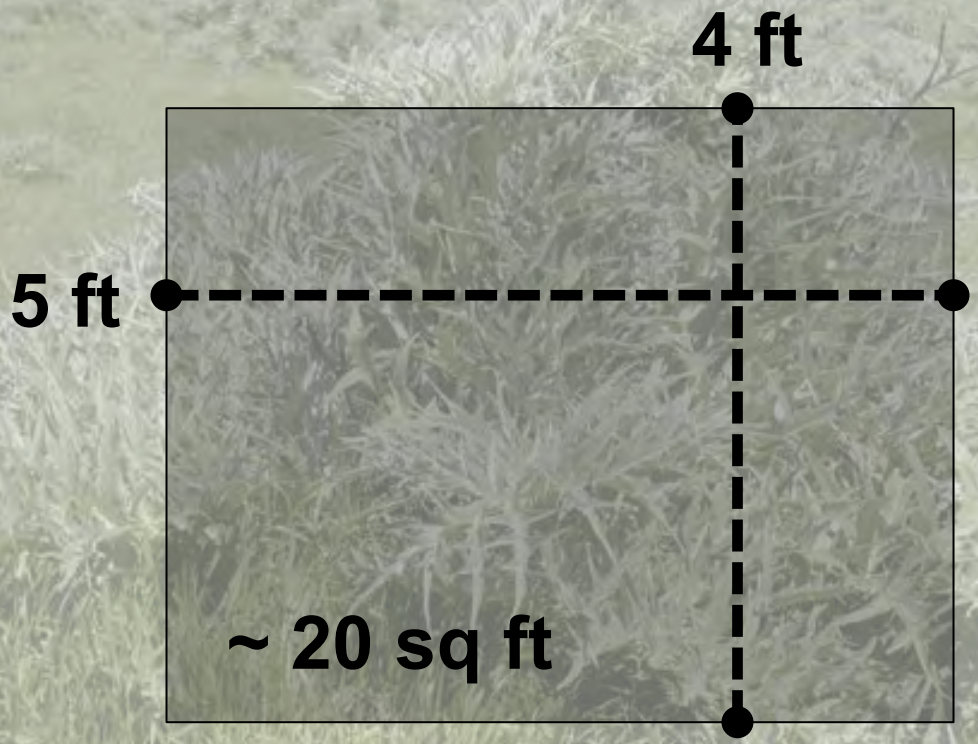
- Spray to wet, not to run-off
- Practice applying on a known size plant (or patch)
- Teach the crew for consistency


Calibrating
spray-to-wet?


5 ft
4 ft


4 ft
5 ft
~ 20 sq ft

8004 nozzle, 15 psi, 14 seconds
→ 160 ml (~5 oz) / 20 sq ft
→ 92 g.p.a.



To make spray-to-wet consistent, train the spray crew:

- Learn what spray-to-wet looks like
  - Memorize the application motion
- Measure (or estimate) individual plants
  - Categorize plants

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