

Backpack Sprayer Calibration

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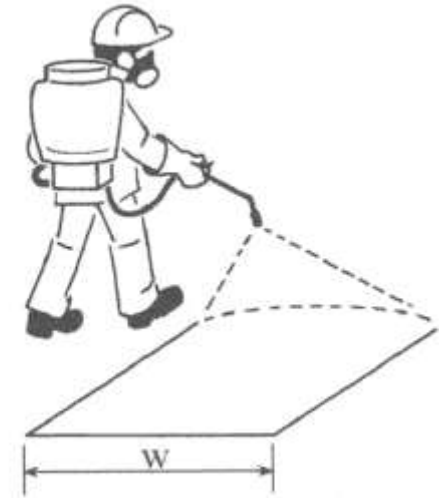
What is Sprayer Calibration?

Ensuring the correct volume of pesticide is coming out of the sprayer over a given area.

Carrier Volume = gallons per *acre*

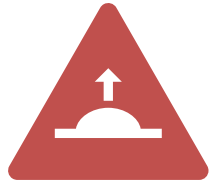
$$GPA = \frac{\text{Flow Rate} \left(\frac{\text{gallons}}{\text{time}} \right)}{\text{Land Rate} \left(\frac{\text{acres}}{\text{time}} \right)}$$

$$GPA = \frac{\text{Nozzle Output (GPM)} \times 5940}{\text{Speed (MPH)} \times \text{Spray Width (inches)}}$$



- Influenced by nozzle flow rate, speed, spray width, and pressure

How do I change GPA?



Pressure

- * Adjust pressure only to make small changes in application rate (fine tuning)
- * Must quadruple pressure to double GPA. Most nozzles will not tolerate quadruple pressure changes



Speed

- * Speed and GPA is a 1:1 relationship
- * 100% decrease in GPA = 100% increase in speed

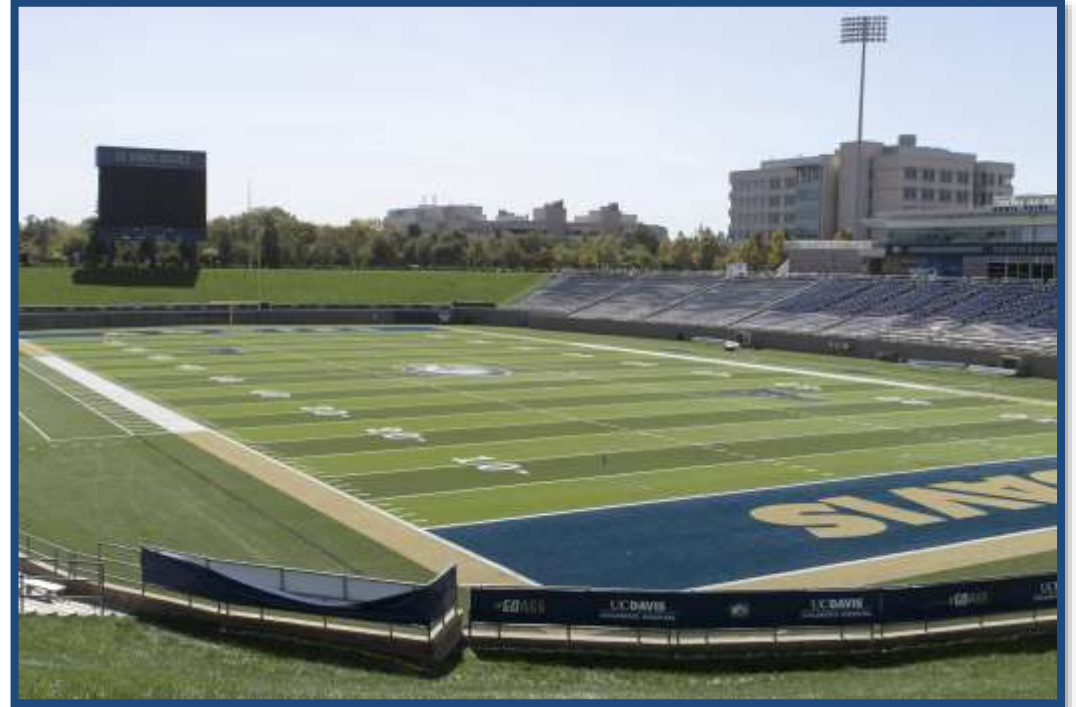


Nozzle

- * Best way to adjust output
- * Can choose desired output, pattern, and droplet size

Herbicide Rates

- Amount of Product Per Acre
 - 1 Acre- is about 1 football field
 - Glyphosate-1 Quart
 - Aminopyralid-7oz
 - Chlorsulfuron-1oz
- Carrier Volume
 - 20-150 Gallons/acre (backpacks)



Why is Sprayer Calibration Important?

Efficacy

- Proper application of herbicides is only possible with an accurately calibrated sprayer
- Too much vs too little
- Resistance

Economics

- Pesticides are expensive
- Chlorsulfuron 1 oz = \$19.30
- Aminopyralid 7 oz = \$17.70
- Labor: \$16/hr minimum wage, more for pesticide applicators

Legal/Environmental

- Label is the law
- Water, wildlife, pets, etc.

Backpacks

- EVERYONE NEEDS TO CALIBRATE!
- Variables include
 - Speed
 - Walking
 - Arm movement
 - Person to Person
 - Fast vs Slow
 - “Spray to Wet”
 - Pressure
 - Nozzle
- Need to Know Output!



Importance of Nozzle Selection

- 1. Spray Pattern:** Nozzles break the liquid into droplets and form the spray pattern.
- 2. Spray Rate:** Nozzles determine the application volume at a given pressure, travel speed and spacing.
- 3. Spray Drift:** Selecting nozzles that produce the largest droplet size, while providing good coverage will minimize drift.



Decoding Nozzles

- Most nozzles use a 4-5 digit number to identify multiple characteristics
 - First number is the spray angle (most common are 80^o and 110^o)
 - Second number represents spray volume at rated pressure



80-degree spray angle
0.2 GPM (Gallons per Minute) at 40 psi



110-degree spray angle
0.4 GPM (Gallons per Minute) at 40 psi

Decoding Nozzles

- Other designations can include materials
 - BR: Brass
 - SS: Stainless Steel
 - HS: Hardened Stainless Steel
 - VP: Polymer with VisiFlo color coding
 - VH: Hardened stainless steel with color coding
 - VK: Ceramic with color coding
 - VS: Stainless steel with color coding



Color Coding Nozzles



Is there a correct GPA?

- Dependent on numerous factors
 - Crops: 10 to 20 GPA is standard
 - Rangeland: 20 to 40 GPA is more common
 - Backpack or spray guns with a hose: 20 to 150 GPA
- Type of herbicide being applied generally dictates GPA
 - Contact herbicides require higher rates (Pre's)
 - Systemic herbicides lower rates
- Herbicide labels provide a range of recommended carrier volumes

Sprayer Calibration Doesn't Have to be Hard

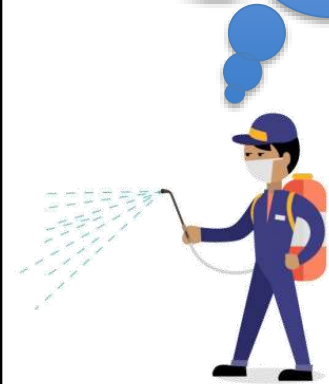
- Easy - 128th method



There must be a
better way!

1 Acre
(43,560 ft²)

How am I supposed
to figure out my
output?



***Since there are
128 ounces in a
gallon, ounces
sprayed in this
area equals
gallons per acre!***

**1/128th
Acre
(360 ft²)**

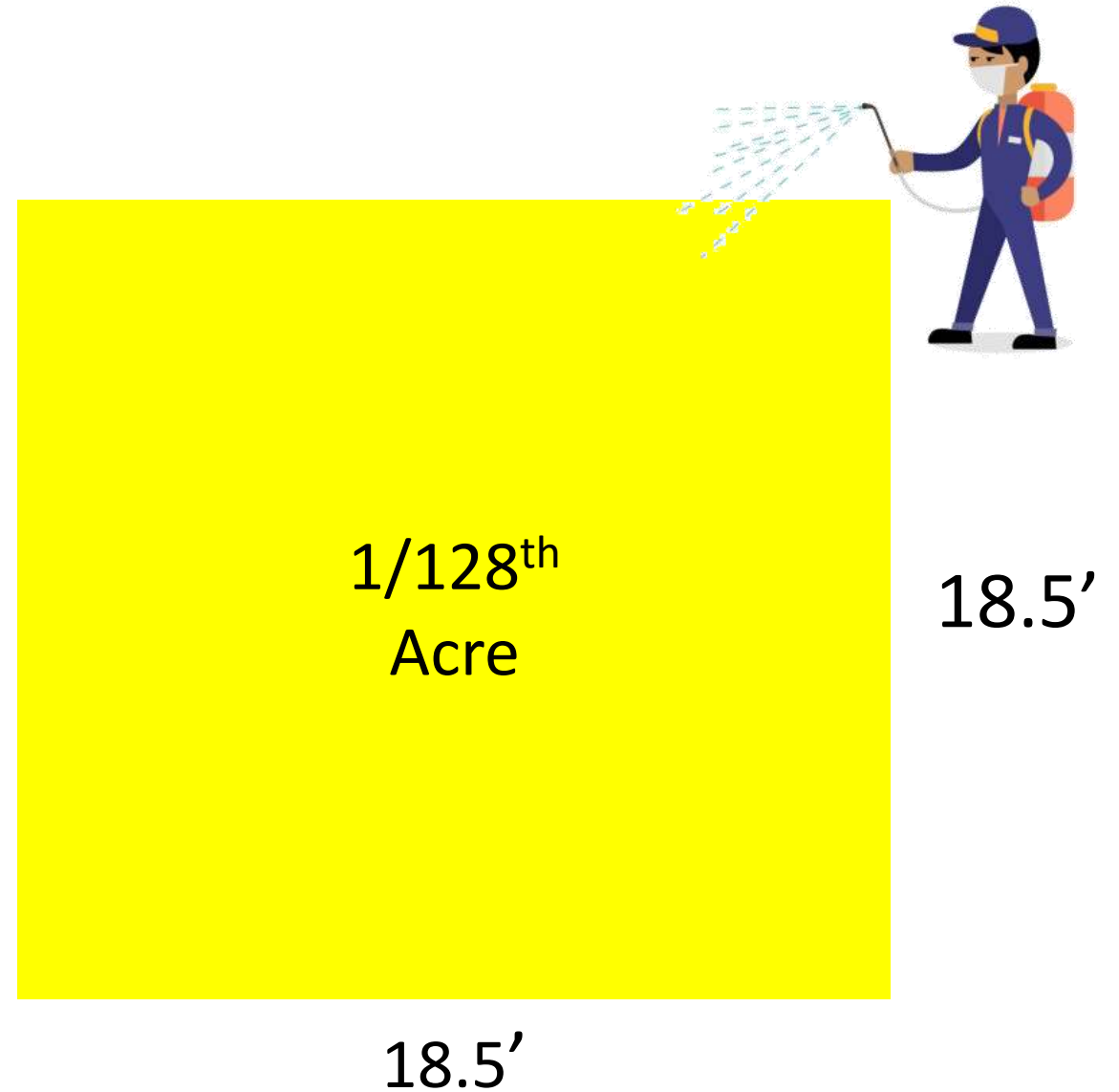
18.5'



18.5'

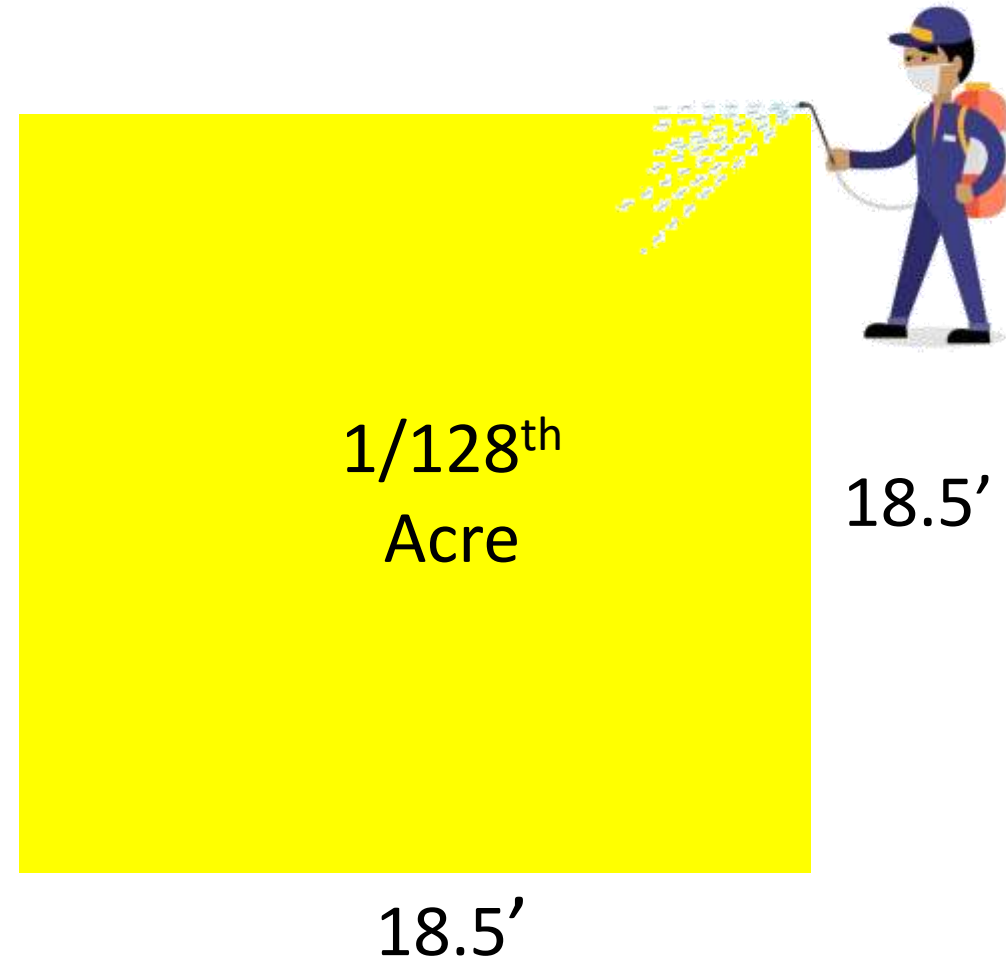
Items you will need to calibrate

1. Clean sprayer
2. Water
3. Personal protective equipment
4. Stopwatch
5. Measuring tape
6. Four flags or markers
7. Clear measuring cup or pitcher (in ounces)



Calibration Steps

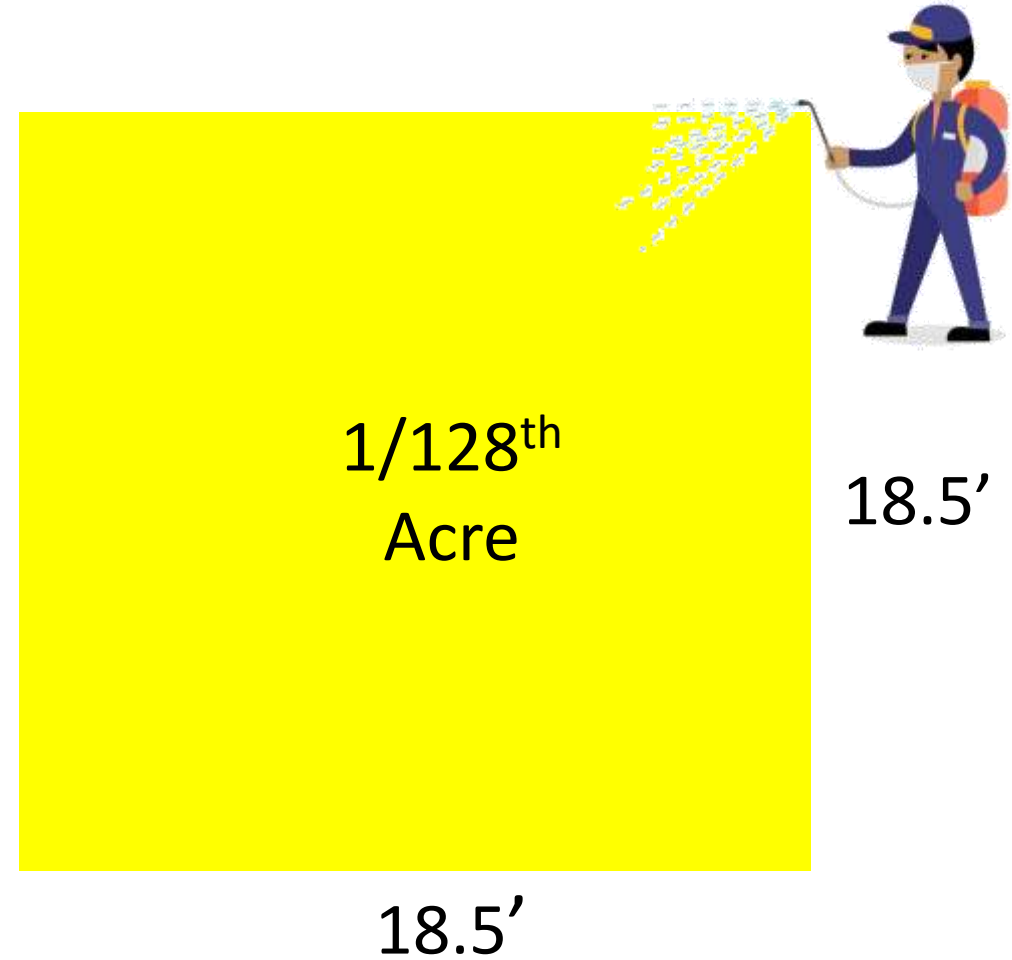
1. Measure and mark $1/128^{\text{th}}$ of an acre (340 ft^2).
Area should represent area to be treated.
 - $18.5' \times 18.5'$
 - $10' \times 34'$
2. Wear PPE.
3. Fill clean sprayer with water.
4. Spray area and record the amount of time.
Repeat 2 or 3 times to get average.
5. Spray for the same amount of time into a bucket.
6. Measure volume of water in ounces.
7. Volume in ounces = gallons per acre.



128 Method Example

Calibration Steps

1. Measure and mark $1/128^{\text{th}}$ of an acre (340 ft²). 18.5' x 18.5'
2. Wear PPE
3. Fill clean sprayer with water
4. Spray area and record the amount of time
35 seconds
5. Spray into a bucket for 35 seconds
6. Measure volume of water in ounces =
30 ounces
7. Volume in ounces = gallons per acre
30 ounces = 30 GPA (gallons per acre)



What if I want to spray at 20 GPA?



How do I change GPA?



Pressure

- * Adjust pressure only to make small changes in application rate (fine tuning)
- * Must quadruple pressure to double GPA. Most nozzles will not tolerate quadruple pressure changes

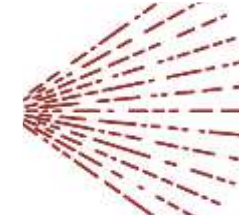
30 GPA @ 40 PSI = 15 GPA @ 10 PSI



Speed

- * Speed and GPA is a 1:1 relationship
- * 100% decrease in GPA = 100% increase in speed

30 GPA @ 4 MPH = 15 GPA @ 8 MPH



Nozzle

- * Best way to adjust output
- * Can choose desired output, pattern, and droplet size


Current Nozzle = 8004XR

Change to 8002XR

TIP PART NO. (STRAINER MESH SIZE)	PSI	DROP SIZE		CAPACITY ONE TIP IN GPM	CAPACITY ONE TIP IN OZ/MIN	APPLICATION RATE FOR 20" SPRAY TIP SPACING											
						GALLONS PER ACRE (GPA)								TURF APPLICATION GALLONS PER 1000 SQ. FT.			
		80°	110°			4 MPH	5 MPH	6 MPH	8 MPH	10 MPH	12 MPH	15 MPH	20 MPH	2 MPH	3 MPH	4 MPH	5 MPH
XR8001 XR11001 (100)	15	F	F	0.061	7.8	4.5	3.6	3.0	2.3	1.8	1.5	1.2	0.91	0.21	0.14	0.10	0.08
	20	F	F	0.071	9.1	5.3	4.2	3.5	2.6	2.1	1.8	1.4	1.1	0.24	0.16	0.12	0.10
	30	F	F	0.087	11	6.5	5.2	4.3	3.2	2.6	2.2	1.7	1.3	0.30	0.20	0.15	0.12
	40	F	F	0.10	13	7.4	5.9	5.0	3.7	3.0	2.5	2.0	1.5	0.34	0.23	0.17	0.14
	50	F	F	0.11	14	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6	0.37	0.25	0.19	0.15
	60	F	VF	0.12	15	8.9	7.1	5.9	4.5	3.6	3.0	2.4	1.8	0.41	0.27	0.20	0.16
XR80015 XR110015 (100)	15	M	M	0.092	12	6.8	5.5	4.6	3.4	2.7	2.3	1.8	1.4	0.31	0.21	0.16	0.13
	20	F	F	0.11	14	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6	0.37	0.25	0.19	0.15
	30	F	F	0.13	17	9.7	7.7	6.4	4.8	3.9	3.2	2.6	1.9	0.44	0.29	0.22	0.18
	40	F	F	0.15	19	11.1	8.9	7.4	5.6	4.5	3.7	3.0	2.2	0.51	0.34	0.26	0.20
	50	F	F	0.17	22	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5	0.58	0.39	0.29	0.23
	60	F	F	0.18	23	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
XR8002 XR11002 (50)	15	M	M	0.12	15	8.9	7.1	5.9	4.5	3.6	3.0	2.4	1.8	0.41	0.27	0.20	0.16
	20	M	M	0.14	18	10.4	8.3	6.9	5.2	4.2	3.5	2.8	2.1	0.48	0.32	0.24	0.19
	30	F	F	0.17	22	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5	0.58	0.39	0.29	0.23
	40	F	F	0.20	26	14.9	11.9	9.9	7.4	5.9	5.0	4.0	3.0	0.68	0.45	0.34	0.27
	50	F	F	0.22	28	16.3	13.1	10.9	8.2	6.5	5.4	4.4	3.3	0.75	0.50	0.37	0.30
	60	F	F	0.24	31	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6	0.82	0.54	0.41	0.33
XR80025 XR110025 (50)	15	M	M	0.15	19	11.1	8.9	7.4	5.6	4.5	3.7	3.0	2.2	0.51	0.34	0.26	0.20
	20	M	M	0.18	23	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
	30	M	M	0.22	28	16.3	13.1	10.9	8.2	6.5	5.4	4.4	3.3	0.75	0.50	0.37	0.30
	40	F	F	0.25	32	18.6	14.9	12.4	9.3	7.4	6.2	5.0	3.7	0.85	0.57	0.43	0.34
	50	F	F	0.28	36	21	16.6	13.9	10.4	8.3	6.9	5.5	4.2	0.95	0.63	0.48	0.38
	60	F	F	0.31	40	23	18.4	15.3	11.5	9.2	7.7	6.1	4.6	1.1	0.70	0.53	0.42
XR8003 XR11003 (50)	15	M	M	0.18	23	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
	20	M	M	0.21	27	15.6	12.5	10.4	7.8	6.2	5.2	4.2	3.1	0.71	0.48	0.36	0.29
	30	M	M	0.26	33	19.3	15.4	12.9	9.7	7.7	6.4	5.1	3.9	0.88	0.59	0.44	0.35
	40	F	F	0.30	38	22	17.8	14.9	11.1	8.9	7.4	5.9	4.5	1.0	0.68	0.51	0.41
	50	F	F	0.34	44	25	20	16.8	12.6	10.1	8.4	6.7	5.0	1.2	0.77	0.58	0.46
	60	F	F	0.37	47	27	22	18.3	13.7	11.0	9.2	7.3	5.5	1.3	0.84	0.63	0.50
XR80035 (50)	15	M		0.21	27	15.6	12.5	10.4	7.8	6.2	5.2	4.2	3.1	0.71	0.48	0.36	0.29
	20	M		0.25	32	18.6	14.9	12.4	9.3	7.4	6.2	5.0	3.7	0.85	0.57	0.43	0.34
	30	M		0.30	38	22	17.8	14.9	11.1	8.9	7.4	5.9	4.5	1.0	0.68	0.51	0.41
	40	M		0.35	45	26	21	17.3	13.0	10.4	8.7	6.9	5.2	1.2	0.79	0.60	0.48
	50	F		0.39	50	29	23	19.3	14.5	11.6	9.7	7.7	5.8	1.3	0.88	0.66	0.53
	60	F		0.43	55	32	26	21	16.0	12.8	10.6	8.5	6.4	1.5	0.97	0.73	0.58
XR8004 XR11004 (50)	15	M	M	0.24	31	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6	0.82	0.54	0.41	0.33
	20	M	M	0.28	36	21	16.6	13.9	10.4	8.3	6.9	5.5	4.2	1.0	0.63	0.48	0.38
	30	M	M	0.35	45	26	21	17.3	13.0	10.4	8.7	6.9	5.2	1.2	0.79	0.60	0.48
	40	M	M	0.40	51	30	24	19.8	14.9	11.9	9.9	7.9	5.9	1.4	0.91	0.68	0.54
	50	F	F	0.45	58	33	27	22	16.7	13.4	11.1	8.9	6.7	1.5	1.0	0.77	0.61
	60	F	F	0.49	63	36	29	24	18.2	14.6	12.1	9.7	7.3	1.7	1.1	0.83	0.67



@ 40 PSI = 30 GPA

TIP PART NO. (STRAINER MESH SIZE)	PSI 	DROP SIZE		CAPACITY ONE TIP IN GPM	CAPACITY ONE TIP IN OZ/MIN	APPLICATION RATE FOR 20" SPRAY TIP SPACING							
		80°	110°			GALLONS PER ACRE (GPA)							
						4 MPH	5 MPH	6 MPH	8 MPH	10 MPH	12 MPH	15 MPH	20 MPH
XR8004 XR11004 (50)	15	M	M	0.24	31	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6
	20	M	M	0.28	36	21	16.6	13.9	10.4	8.3	6.9	5.5	4.2
	30	M	M	0.35	45	26	21	17.3	13.0	10.4	8.7	6.9	5.2
	40	M	M	0.40	51	30	24	19.8	14.9	11.9	9.9	7.9	5.9
	50	F	F	0.45	58	33	27	22	16.7	13.4	11.1	8.9	6.7
	60	F	F	0.49	63	36	29	24	18.2	14.6	12.1	9.7	7.3



@ 40 PSI = 30 GPA @ 4 MPH

TIP PART NO. (STRAINER MESH SIZE)	PSI	DROP SIZE		CAPACITY ONE TIP IN GPM	CAPACITY ONE TIP IN OZ/MIN	APPLICATION RATE FOR 20" SPRAY TIP SPACING											
						GALLONS PER ACRE (GPA)								TURF APPLICATION GALLONS PER 1000 SQ. FT.			
		80°	110°			4 MPH	5 MPH	6 MPH	8 MPH	10 MPH	12 MPH	15 MPH	20 MPH	2 MPH	3 MPH	4 MPH	5 MPH
XR8001 XR11001 (100)	15	F	F	0.061	7.8	4.5	3.6	3.0	2.3	1.8	1.5	1.2	0.91	0.21	0.14	0.10	0.08
	20	F	F	0.071	9.1	5.3	4.2	3.5	2.6	2.1	1.8	1.4	1.1	0.24	0.16	0.12	0.10
	30	F	F	0.087	11	6.5	5.2	4.3	3.2	2.6	2.2	1.7	1.3	0.30	0.20	0.15	0.12
	40	F	F	0.10	13	7.4	5.9	5.0	3.7	3.0	2.5	2.0	1.5	0.34	0.23	0.17	0.14
	50	F	F	0.11	14	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6	0.37	0.25	0.19	0.15
	60	F	VF	0.12	15	8.9	7.1	5.9	4.5	3.6	3.0	2.4	1.8	0.41	0.27	0.20	0.16
XR80015 XR110015 (100)	15	M	M	0.092	12	6.8	5.5	4.6	3.4	2.7	2.3	1.8	1.4	0.31	0.21	0.16	0.13
	20	F	F	0.11	14	8.2	6.5	5.4	4.1	3.3	2.7	2.2	1.6	0.37	0.25	0.19	0.15
	30	F	F	0.13	17	9.7	7.7	6.4	4.8	3.9	3.2	2.6	1.9	0.44	0.29	0.22	0.18
	40	F	F	0.15	19	11.1	8.9	7.4	5.6	4.5	3.7	3.0	2.2	0.51	0.34	0.26	0.20
	50	F	F	0.17	22	12.6	10.1	8.4	6.3	5.0	4.2	3.4	2.5	0.58	0.39	0.29	0.23
	60	F	F	0.18	23	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
XR8002 XR11002 (50)	15	M	M	0.12	15	8.9	7.1	5.9	4.5	3.6	3.0	2.4	1.8	0.41	0.27	0.20	0.16
	20	M	M	0.14	18	10.4	8.3	6.9	5.2	4.2	3.5	2.8	2.1	0.48	0.32	0.24	0.19
	30	F	F	0.17	22	12.1	10.1	8.4	6.3	5.0	4.2	3.4	2.5	0.58	0.39	0.29	0.23
	40	F	F	0.20	26	14.9	11.9	9.9	7.4	5.9	5.0	4.0	3.0	0.68	0.45	0.34	0.27
	50	F	F	0.22	28	16.2	13.1	10.9	8.2	6.5	5.4	4.4	3.3	0.75	0.50	0.37	0.30
	60	F	F	0.24	31	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6	0.82	0.54	0.41	0.33
XR80025 XR110025 (50)	15	M	M	0.15	19	11.1	8.9	7.4	5.6	4.5	3.7	3.0	2.2	0.51	0.34	0.26	0.20
	20	M	M	0.18	23	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
	30	M	M	0.22	28	16.3	13.1	10.9	8.2	6.5	5.4	4.4	3.3	0.75	0.50	0.37	0.30
	40	F	F	0.25	32	18.6	14.9	12.4	9.3	7.4	6.2	5.0	3.7	0.85	0.57	0.43	0.34
	50	F	F	0.28	36	21	16.6	13.9	10.4	8.3	6.9	5.5	4.2	0.95	0.63	0.48	0.38
	60	F	F	0.31	40	23	18.4	15.3	11.5	9.2	7.7	6.1	4.6	1.1	0.70	0.53	0.42
XR8003 XR11003 (50)	15	M	M	0.18	23	13.4	10.7	8.9	6.7	5.3	4.5	3.6	2.7	0.61	0.41	0.31	0.24
	20	M	M	0.21	27	15.6	12.5	10.4	7.8	6.2	5.2	4.2	3.1	0.71	0.48	0.36	0.29
	30	M	M	0.26	33	19.3	15.4	12.9	9.7	7.7	6.4	5.1	3.9	0.88	0.59	0.44	0.35
	40	F	F	0.30	38	22	17.8	14.9	11.1	8.9	7.4	5.9	4.5	1.0	0.68	0.51	0.41
	50	F	F	0.34	44	25	20	16.8	12.6	10.1	8.4	6.7	5.0	1.2	0.77	0.58	0.46
	60	F	F	0.37	47	27	22	18.3	13.7	11.0	9.2	7.3	5.5	1.3	0.84	0.63	0.50
XR80035 (50)	15	M		0.21	27	15.6	12.5	10.4	7.8	6.2	5.2	4.2	3.1	0.71	0.48	0.36	0.29
	20	M		0.25	32	18.6	14.9	12.4	9.3	7.4	6.2	5.0	3.7	0.85	0.57	0.43	0.34
	30	M		0.30	38	22	17.8	14.9	11.1	8.9	7.4	5.9	4.5	1.0	0.68	0.51	0.41
	40	M		0.35	45	26	21	17.3	13.0	10.4	8.7	6.9	5.2	1.2	0.79	0.60	0.48
	50	F		0.39	50	29	23	19.3	14.5	11.6	9.7	7.7	5.8	1.3	0.88	0.66	0.53
	60	F		0.43	55	32	26	21	16.0	12.8	10.6	8.5	6.4	1.5	0.97	0.73	0.58
XR8004 XR11004 (50)	15	M	M	0.24	31	17.8	14.3	11.9	8.9	7.1	5.9	4.8	3.6	0.82	0.54	0.41	0.33
	20	M	M	0.28	36	21	16.6	13.9	10.4	8.3	6.9	5.5	4.2	1.0	0.63	0.48	0.38
	30	M	M	0.35	45	25	21	17.3	13.0	10.4	8.7	6.9	5.2	1.2	0.79	0.60	0.48
	40	M	M	0.40	51	30	24	19.8	14.9	11.9	9.9	7.9	5.9	1.4	0.91	0.68	0.54
	50	F	F	0.45	58	33	27	22	16.7	13.4	11.1	8.9	6.7	1.5	1.0	0.77	0.61
	60	F	F	0.49	63	36	29	24	18.2	14.6	12.1	9.7	7.3	1.7	1.1	0.83	0.67



@ 40 PSI = 15 GPA



@ 40 PSI = 30 GPA

Rate based on ounces/acre

- Example: You need to apply an herbicide at 32 ounces per acre with a 4-gallon backpack sprayer. How much herbicide goes in each tank?

– **Step #1: Need to know your output in GPA!**

- Do the 128th method “or”
- Use nozzle rating in catalog

– Output: 40 GPA

$$\frac{1 \text{ ac}}{40 \text{ gal}} \times \frac{4 \text{ gal}}{\text{tank}} \times \frac{32 \text{ oz}}{\text{ac}} = 3.2 \text{ oz/tank}$$

Breakdown the math

- Backpack
 - 4-gallon/load
 - 40 GPA

- How many tanks per acre? $\frac{40 \cancel{\text{gal}}}{\text{ac}} \times \frac{1 \text{ tank}}{4 \cancel{\text{gal}}} = 10 \text{ tanks/ac}$

- How much material per tank? $\frac{\cancel{\text{ac}}}{10 \text{ tanks}} \times \frac{32 \text{ oz}}{\cancel{\text{ac}}} = 3.2 \text{ oz/tank}$

Rate based on quarts/acre

- Example: You need to apply an herbicide using a 4-gallon backpack sprayer at 20 GPA at a rate of 4 quarts/acre. How much herbicide and solution will be needed to treat 8,000 ft². If you want to add a surfactant at 0.5% volume, how much goes in the tank?

$$\frac{20 \text{ gal}}{\text{ac}} \times \frac{1 \text{ ac}}{43,560 \text{ ft}^2} \times \frac{8,000 \text{ ft}^2}{1} = 3.67 \text{ gallons}$$

$$\frac{4 \text{ qts}}{\text{ac}} \times \frac{1 \text{ ac}}{43,560 \text{ ft}^2} \times \frac{8,000 \text{ ft}^2}{1} = 0.73 \text{ quarts} \quad 0.73 \text{ quarts} \times 32 \text{ ounces/qt} = 23.3 \text{ oz}$$

$$\frac{3.67 \text{ gal}}{1} \times \frac{128 \text{ oz}}{\text{gal}} \times \frac{0.5\% \text{v}}{100\% \text{v}} = 2.3 \text{ oz}$$

Rate given as percent solution

- Example: You need to apply an herbicide at a 2% solution in a 4-gallon backpack sprayer. How much herbicide goes in each tank?
- Backpack sprayer:
 - 4-gallon capacity
 - Output: 20 gpa

$$\frac{\cancel{2\% \text{ v herbicide}}}{\cancel{\% \text{ v total solution}}} \times \frac{128 \text{ oz}}{\cancel{\text{gallon}}} \times \frac{\cancel{4 \text{ gal}}}{\text{tank}} = 10.24 \text{ oz/tank}$$

% Volume Rate Doesn't Account for Output

GPA	% Volume Rate	Amount of Herbicide Gallons/Acre
20	2	.2
50	2	.5
100	2	1.0
150	2	1.5

IMPORTANT: % Volume rates on labels are based on an application rate of 20 GPA.

Study Examining the Efficiency of Hand Weed Spraying

Carl Bell, Cheryl Wilen and Milt McGiffen, Jr 2012 https://www.cwss.org/wp-content/uploads/2018/05/24_Bell.pdf

- Conducted a series of sprayer calibration workshops
 - 80 experienced applicators
 - Backpack
 - Orchard gun
 - Spot

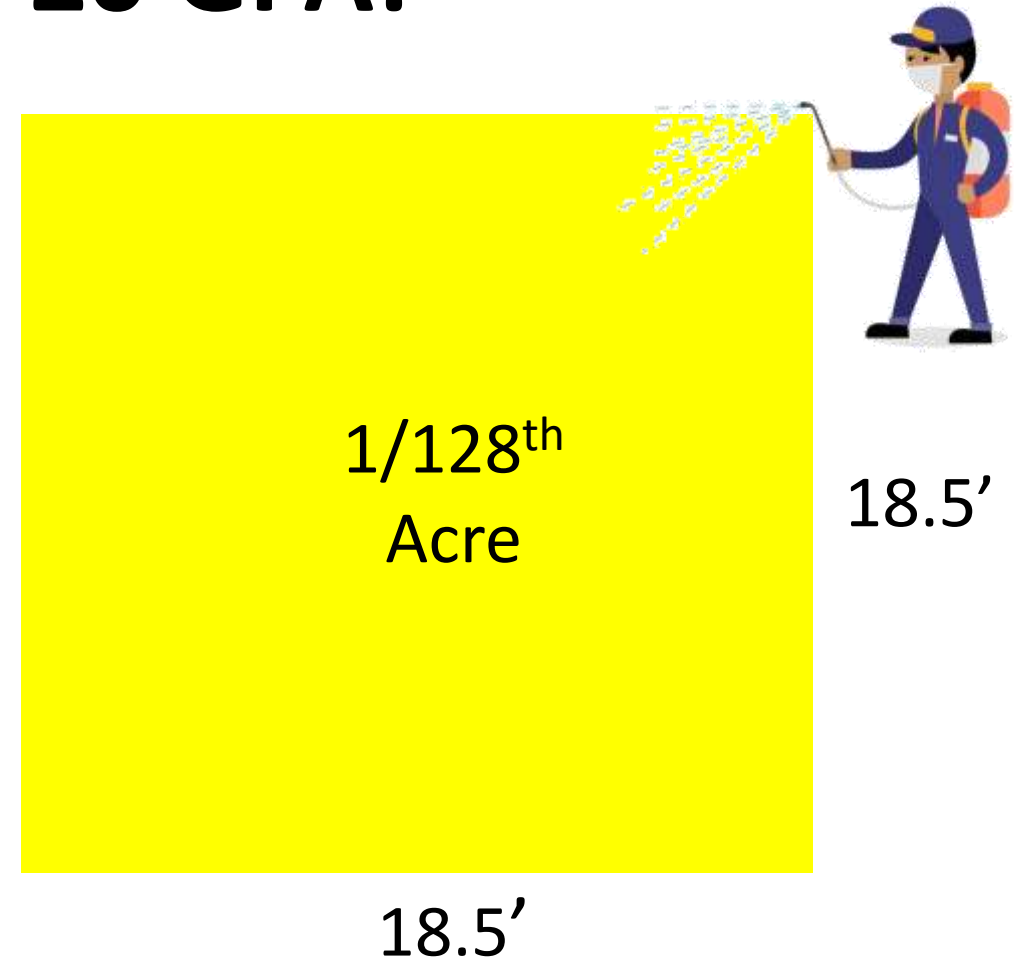
Sprayer type	Mean GPA	GPA Range	1% glyphosate Gallons/acre
Backpack	41	10-100	0.41
Orchard Gun	127	24-352	1.3
Spot Spray	628	80-1560	6.3

What if you have a spray crew and want everyone to be at 20 GPA?

Do the 128th in reverse!

- Determine the time it takes to spray 20 ounces
- Practice spraying the marked 128th area in that amount of time

Or modify equipment (different nozzle) for each user.



Questions?



Post Test!

Post Test

1. Which of the herbicide toxicity categories (warning, danger, caution) is the most toxic?

DANGER

Post Test

2. If you are applying a foliar herbicide at a 2% (v/v) to treat Himalayan blackberries, how many ounces of herbicide would you put in a 4-gallon sprayer?

$$\frac{128 \text{ oz}}{\text{gallon}} \times \frac{4 \text{ gal}}{\text{tank}} = 512 \text{ oz/tank}$$

$$\frac{512 \text{ oz}}{\text{tank}} * .02 (2\%) = 10.24 \text{ oz herbicide/tank}$$

Post Test

2. a. For your same Himalayan blackberry application, you want to add a surfactant at 0.25% v/v. How much surfactant (in oz) would you add to your 4-gallon tank?

$$\frac{128 \text{ oz}}{\text{gallon}} \times \frac{4 \text{ gal}}{\text{tank}} = 512 \text{ oz/tank}$$

$$\frac{512 \text{ oz}}{\text{tank}} * .0025 (0.25\%) = 1.28 \text{ oz surfactant/tank}$$

Post Test

3. You are spraying a patch of perennial pepperweed with another herbicide. This herbicide does not give instructions on a %v/v basis, but gives rates on a per acre basis. If your backpack sprayer volume output is 37 gallons/acre (HINT: This is step 5 in the 1/128th acre worksheet), how many ounces of the herbicide would you put in the 3-gallon tank, to spray 2 oz/acre?

$$\frac{1 \cancel{\text{ ac}}}{37 \cancel{\text{ gal}}} \times \frac{3 \cancel{\text{ gal}}}{\text{tank}} \times \frac{2 \text{ oz}}{\cancel{\text{ ac}}} = 0.16 \text{ oz/tank}$$

Questions?

