

Calculations Worksheet

1 MPH = 88 ft. / minute	5,280 ft. = 1 mile
43,560 ft ² = 1 acre	27 ft ³ per yd ³
43.56 M = 1 acre	M = 1,000 ft ²
128 fluid oz. = 1 gallon	4 quarts = 1 gallon
GPM = gallons per minute	GPA = gallons per acre
N/M = nitrogen per 1,000 ft ²	1.0 lb. = 454 grams 16 oz = 1 lb
One acre inch of water = 27,154 gallons	
One acre inch of water = 3,630 cubic feet	

FERTILIZER:

NOTE : The symbol M = 1,000 ft²

- You want to apply 0.9 lb. N /M and you will use 25-2-10 fertilizer.

How much fertilizer per M ? *[how much is the same as how many pounds]*

$$\frac{0.9 \text{ lb. N /M}}{0.25} = 3.6 \text{ lb fertilizer /M}$$

How much fertilizer is needed per acre ?

$$3.6 \text{ lb fertilizer /M} * 43.56 \text{ M/A} = 156.82 \text{ lb fertilizer per acre}$$

Need to spread 45 acres, how much fertilizer is needed ?

$$156.82 \text{ lb fertilizer per acre} * 45 \text{ A} = 7,056.72 \text{ lb fertilizer per 45 acres}$$

How many 50 lb bags are required for the 45 acres ?

$$\frac{7,056.72 \text{ lb fertilizer per 45 acres}}{50 \text{ lb /bag}} = 141.1 = 142 \text{ bags per 45 acres}$$

- How many pounds of plant available N, P, & K are in a 1,250 lb of 5-10-20 fertilizer?

N _____ P _____ K _____

$$1,250 \text{ lb fertilizer} * 0.05 = 62.5 \text{ lb of Nitrogen}$$

$$1,250 \text{ lb fertilizer} * 0.10 = 125.0 \text{ lb of } P_2O_5$$

$$1,250 \text{ lb fertilizer} * 0.20 = 250.0 \text{ lb of } K_2O$$

- You want to apply 0.7 lb. N /M and you will use 16-2-8 fertilizer.

How much fertilizer per M ? *[how much is the same as how many pounds]*

4.37 lb fertilizer /M

How much fertilizer is needed per acre ?

190.57 lb fertilizer per acre

Need to spread 45 acres, how much fertilizer is needed ?

8,575.9 lb fertilizer per 45 acres

How many 50 lb bags are required for the 45 acres ?

172 bags per 45 acres

- How many pounds of plant available N, P, & K are in a 2,000 lb of 16-4-8 fertilizer?

N _____

P _____

K _____

320.0 lb of Nitrogen

80.0 lb of P₂O₅

160.0 lb of K₂O

- If 1.2 lbs. of **Phosphorus** per M is desired, how much of a 29-3-6 fertilizer would be needed?

40.0 lb fertilizer /M

- How much of a 29-3-6 fertilizer would be needed to supply 29.0 lb of nitrogen?

100.0 lb fertilizer /M

- You want to put 0.90 lb N / M with a 23 - 0 - 14 fertilizer over 65,000 ft².

How much product is needed per M?

3.91 lb fertilizer /M

For the whole area [65,000 ft²]?

254.35 lb fertilizer /65 M

- How much 14-14-14 fertilizer will you need, to supply the annual requirement of 3 lbs of N per 1,000 sq ft to 45,000 sq ft of greens?

964.29 lb fertilizer /45 M

***The problem is to find the least expensive price per pound of nitrogen
[or any other nutrient you select]***

KEY: REMEMBER YOU WANT TO FIND THE "PRICE PER POUND OF N" = $\frac{\$ \text{ of bag}}{\text{Lb nitrogen in the bag}}$

- Find the price of a pound of nitrogen from the following:

A 50 lb bag of 38-0-0 fertilizer costing \$39.95

Remember the "formula" $\frac{\$39.95}{\text{XX.X}}$ is the *cost of the bag*
Lb nitrogen in the bag

To find the amount of nutrient in a container you **MULTIPLY** the size of the container by the % of nutrient.

$$50 \text{ lb bag} * 38\% \text{ n} === 50 \text{ lb} * 0.38 = 19.0 \text{ lb nitrogen in the bag}$$

NOTE: In a 50 lb bag, the amount of nutrient will be ½ the number on the bag. Ex. 46-0-0 has 23 lb N 12-0-0 has 6 lb N 25-0-0 has 12.5 lb N

SO: $\frac{\$39.95}{19.0}$ is the cost of the bag = ***\$2.10 per lb nitrogen***

NOW USE THIS INFORMATION TH COMPARE SEVERAL FERTILIZERS WITH DIFFERENT PRICES.

$$\begin{array}{l} 16-3-0 \text{ at } \$ 22.25 \text{ per } 50\text{lb bag} \\ 50 \text{ lb} * 0.16 = \end{array} \quad \frac{\$ 22.50}{8.0 \text{ lb N}} = \text{ ***\$2.81 per lb nitrogen*** }$$

$$\begin{array}{l} 21-4-18 \text{ at } \$ 28.50 \text{ per } 50 \text{ lb bag} \\ 50 \text{ lb} * 0.21 = \end{array} \quad \frac{\$ 28.50}{10.5 \text{ lb N}} = \text{ ***\$2.71 per lb nitrogen*** }$$

So the 21-4-18 is a better deal for the nitrogen.

THIS TECHNIQUE CAN COMPARE ANY SIZE CONTAINER AND ANY PRICE BECAUSE IT GIVES YOU THE COST OF A POUND OF NITROGEN FOR EACH.

$$\begin{array}{l} 46-0-0 \text{ at } \$ 32.25 \text{ per } 50\text{lb bag} \\ 50 \text{ lb} * 0.46 = \end{array} \quad \frac{\$ 32.25}{23.0 \text{ lb N}} = \text{ ***\$1.40 per lb nitrogen*** }$$

$$\begin{array}{l} 32-0-0 \text{ at } \$ 780.50 \text{ per TON} \\ 2000 \text{ lb} * 0.32 = \end{array} \quad \frac{\$ 780.50}{640.0 \text{ lb N}} = \text{ ***\$1.28 per lb nitrogen*** }$$

So the 32-0-0 is a better deal for the nitrogen.

YOU TRY -----

26-3-0 at \$ 30.25 per 50lb bag	= \$2.33 per lb nitrogen
32-4-18 at \$ 36.50 per 50 lb bag	= \$2.28 per lb nitrogen
5-3-0 at \$ 12.25 per 50lb bag	= \$4.90 per lb nitrogen
16-3-0 at \$ 20.25 per 36 lb bag	= \$3.52 per lb nitrogen
25-2-15 at \$ 74.99 per 100 lb bag	= \$3.00 per lb nitrogen
24-2-18 at \$ 836.50 per 1500 lb bag	= \$2.32 per lb nitrogen

IRRIGATION:

Acre inch Irrigation problems

1 acre inch = 27,154 gallons 0.134 cu ft = one gallon One acre inch of water = 3,630 cubic feet

FIRST- FOR ALL THE PROBLEMS, YOU NEED TO FIND THE NUMBER OF ACRE INCHES REQUIRED
Find this by: Multiplying the acre inches by the acres then by the weeks

SECOND - Multiply the total acre inches by 27,154 to find the total gallons needed

- How many acre inches of water are required to supply 0.8 inch of water per week to 10 acres for 8 weeks?

0.8 inches of water * 10 acres = 8 acre inches

8 acre inches * 8 weeks = 64 acre inches are needed total

-How many gallons does 64 acre inches equal?

64 acre inches * 27,154 gallons per acre inch = 1,737,856 gallons

- How many gallons of water are needed to supply 0.75 acre inches of water to 5 acres for 10 weeks?

0.75 acre inch * 5 Acres * 10 weeks = 37.5 acre inches total FIND THE TOTAL ACRE INCHES REQUIRED FIRST

37.5 acre inches * 27,154 gallons = 1,018,275 gallons total

-The irrigation system will spray 1.20"acre inch of water per week for 7 months over 25 acres.
How many gallons will this be?

$$1.20 \text{ acre inch} * 25 \text{ Acres} = 30 \text{ acre inches}$$

$$30 \text{ acre inches} * (7 \text{ months} * 4 \text{ weeks/month}) = 30 * 28 = 840 \text{ acre inches total}$$

$$840 \text{ acre inches} * 27,154 \text{ gallons} = 22,809,360 \text{ gallons total}$$

-How many cubic feet of dirt must be dug for the pond to contain the water needed to hold 22,809,360 gallons?

$$22,809,360 \text{ gallons are needed for the pond} * 0.134 \text{ cu ft/gallon} = 3,056,454.24 \text{ ft}^3 \text{ [cubic feet]}$$

-How many cubic yards is this? [27 cubic feet = a cubic yard]

$$\frac{3,056,454.24 \text{ ft}^3}{27 \text{ ft}^3/\text{yd}^3} = 113,202 \text{ yd}^3 \text{ [cubic yards]}$$

YOU TRY !!

HINT: FOR ALL THE PROBLEMS, YOU NEED TO FIND THE NUMBER OF ACRE INCHES REQUIRED FIRST
Then calculate time, finally multiply the total acre inches by 27,154 to find the total gallons needed

-How many acre inches of water are required to supply 1.1 inches of water to 10 acres for 7 weeks?

$$77 \text{ acre inches are needed total}$$

-How many gallons does the answer above equal?

$$2,090,858 \text{ gallons}$$

-How many gallons of water are needed to supply 0.6 acre inches of water to 15 acres for 8 weeks?

$$1,955,088 \text{ gallons total}$$

-How many cubic feet of dirt must be dug for the pond to contain 4,500,00 gallons
[0.134 cu ft/gallon]

$$603,000 \text{ ft}^3 \text{ [cubic feet]}$$

-How many cubic yards is this? [27 cubic feet = a cubic yard]

$$22,333.33 \text{ yd}^3 \text{ [cubic yards]}$$

-If a 1000 gallon roadside sprayer sprays 20 gallons per acre and you are applying a product that requires 0.5 quarts of product per acre.

Acres per tankload = 50 acres

Product needed to cover a full tankload = 25 quarts

-If a 750 gallon fairway sprayer sprays 20 gallons of solution per acre and you are applying a product that requires 1.5 quarts per acre, how much product is needed to cover a full tankload? IN GALLONS

14.06 gallons/ tankload

TOPDRESSING CALCULATIONS

-How much topdressing mix is needed to spread 1/8 inch over 5,000 sq ft?

STEP #1 CONVERT THE THICKNESS INTO A DECIMAL [is still in inches]

$$1/8 = 0.125 \text{ inch}$$

STEP # 2 CHANGE THE INCHES INTO FEET BY DIVIDING BY 12 [12 inches per foot]

$$0.125 \text{ inch} / 12 \text{ in per foot} = 0.0104 \text{ ft} \quad [\text{don't round, keep 4 decimals}]$$

This gives you the thickness (height) in feet not inches.

We are trying to find volume of material and volume is in cubic feet (ft³).

(Volume is surface area times thickness)

STEP # 3 Multiply the area (ft²) times the thickness (in ft) equals volume (ft³).

$$5,000 \text{ ft}^2 \text{ times } 0.0104 \text{ ft} = 52.08 \text{ ft}^3 = \text{the volume of material needed}$$

STEP # 4 If you want to find the amount of cubic yards of material needed.

Divide by 27 [27 cubic ft in one cubic yd]

$$\frac{52.08 \text{ ft}^3}{27 \text{ ft}^3/\text{yd}^3} = 1.929 \text{ cubic yards on topdressing needed}$$

-Now use 3/16 inch over 5,000 sq ft

STEP #1 $3/16 = \underline{0.1875 \text{ inches}}$ thick

STEP #2 divide by 12 = $\underline{0.0156 \text{ ft}}$ is thickness in feet

STEP #3 Area * thickness = volume $5,000 \text{ ft}^2 \text{ times } 0.0156 \text{ ft} = \underline{78.125 \text{ ft}^3}$

STEP #4 Divide by 27 to get cubic yards $78.125 \text{ ft}^3 / 27 = \underline{2.894 \text{ yd}^3}$

-You will topdress 220,000 sq. ft. of greens with $\frac{1}{4}$ " on material. How much material will be needed? Answer in cubic ft. and also cubic yards

$$4,583.33 \text{ ft}^3$$

$$169.75 \text{ yd}^3$$

How much material will be needed to topdress 125,000 sq. ft. of greens with $\frac{1}{2}$ " on material. Answer in cubic ft. and also cubic yards

$$5,208.33 \text{ ft}^3$$

$$192.90 \text{ yd}^3$$

How much top dressing material is needed to cover 9,200 ft^2 green $\frac{5}{16}$ inch deep – answer in yd^3

$$8.87 \text{ yd}^3$$

How much mulch is needed to cover 1,200 ft^2 flower bed with a layer 3 inches deep – answer in ft^3

$$\text{Worked example : } 3''/12 = 0.25\text{ft} \quad 0.25 \text{ ft} * 1,200 \text{ ft}^2 = 300 \text{ ft}^3$$

-You will mulch 20,000 sq. ft. of flower beds with 3" of material. How much material will be needed? Answer in cubic ft. and also cubic yards

$$5,000.0 \text{ ft}^3$$

$$185.2 \text{ yd}^3$$

Granular pesticide formulations

16 ounces = 1 pound [lb.] 1 pound = 453.6 grams **43.56 M = one acre**

Granular products = calculations just like fertilizer

[Active ingredient is a percentage of the weight]

E.G. A formulation of "50 G" = AI is 50%

Remember to find the amount of product is a division

- Team 2G = **2% ACTIVE INGREDIENT [ai] by weight.**

Want to spread 3 lb ai per A. How much product is needed?

$$\frac{\text{WANT}}{\text{HAVE}} = \frac{3 \text{ lb / A}}{0.02} = 150 \text{ lb product / A} \quad \text{[just like a 2\% nitrogen fertilizer]}$$

-Merit 0.5G = **0.5% ACTIVE INGREDIENT [ai].** An application rate is 0.4 lb ai per acre. How much product is needed? 0.5 % = 0.005

$$\frac{\text{WANT}}{\text{HAVE}} = \frac{0.4 \text{ lb / A}}{0.005} = 80 \text{ lb product / A}$$

[remember if the rate is per acre then the answer will be per acre]

-Using Dathal 75 WP at a rate of 10.25 lb ai per acre, How much product is needed ?

$$\text{Per Acre ?} = 13.67 \text{ lb product / ai per acre}$$

$$\text{Per 1,000 ft}^2 \text{ ?} = 0.31 \text{ lb / M}$$

$$\text{Per 30,000 ft}^2 \text{ ?} = 9.41 \text{ lb / 30m or 150.6 oz / 30M}$$

Remember to find the amount of AI is a multiplication

-How much active ingredient is in a 50 lb bag of Drive 75 DF?

$$\text{Size of container} * \% \text{ ai} = 50\text{lb} * 0.75 = 37.5 \text{ lb of AI}$$

-You spread 600 lb of Team 2G over 3 acres. How much ai is applied per acre ?

600 lb Team * 0.02 (2%) = 12 lb ai in the container divided by 3 acres = *4 lb ai per acre*

-How much active ingredient is in 80 lb of Sevin 10 G?

= 8.0 lb of AI

-You spread 360 lb of Mach 1.5 G over 3 acres. How much ai is applied per acre ?

= 1.8 lb ai per acre

- Use Sentinel 40 WG. The label says use 0.25 oz [of product] per 1,000 ft².
How much ai is applied per acre? 43.56 M = one acre

Hint:

= 0.625 product oz / 1,000ft²

= 27.23 ai oz / acre

Liquid Formulations

128 fl oz = 1 gallon 1 ounce = 2 tablespoons 1 ounce = 29.6 milliliters

The formulation number indicates the pounds of active ingredient [ai] per Gallon

-A **2.5** liquid has how much active ingredient PER GALLON?

-----By definition it has *2.5 lb ai per gallon* -----

EXAMPLE:

-You want to apply 1.5 lb ai per acre of 2,4-D with a formulation of 4L to control weeds.

How much product will you need for one acre?

Remember to find the amount of product is a division

$\frac{\text{WANT}}{\text{HAVE}} = \text{NEED}$

$\frac{1.5 \text{ lb ai} / \text{A}}{4.0 \text{ lb ai} / \text{gallon}} = 0.375 \text{ gallon} / \text{A} * 128 \text{ fl oz} / \text{gallon} = 48 \text{ fl oz/acre}$

- You want to apply 0.75 pound AI per acre of “Sabre Slime” 3.5 L

How many gallons of product are needed per acre?

$$= 0.214 \text{ gallons / acre}$$

How many ounces of product?

$$= 26.43 \text{ fl oz / acre}$$

If 3.0 gallons of a Wahoo Whiz 2.5 EC is applied to an acre.

How much ai is put on an acre ?

Remember to find the amount of AI is a multiplication

$$3.0 \text{ gallons} * 2.5 \text{ lb ai /gallon} = 7.5 \text{ lb ai per acre}$$

How much per 1,000ft² [M]? [43.56 M = one acre]

$$7.5 \text{ lb ai per acre} / 43.56 \text{ M/acre} = 0.17 \text{ b ai / 1,000 ft}^2$$

- If your team applied Betasan 4E at a rate of 8.8 fluid ounces [of product] per 1,000 ft² .

How much ai was applied per acre ?

Hint: How much product was applied per acre? Then determine the ai in that amount.

Hint: 383.33 fl oz of product per acre

$$= 11.98 \text{ lb ai / acre}$$

- You have 5 gallons of “Great Stuff” 6.0 EC. The directions say to apply 1.0 pound of AI per acre. How many acres can 5 gallons of product treat?

Hint: how many lb of ai are in 5 gallons

$$= 30 \text{ acres can be treated with 5 gallons}$$

Pure Live Seed (PLS) Calculations

Seeding rates for the various turfgrasses are on the basis of Pure Live Seed per unit area. This is important because seed purity and germination percentages vary depending on the variety/species of the grass selected and the seed source.

The information you need to work with to determine Pure Live Seed is found on the seed tag.

Pure live seed %'s are calculated by multiplying the % purity and % germination for each variety in a seed blend or mixture.

Each variety's % pure live seed values are calculated independently **and then totaled for a %PLS** value for the entire blend/mixture to use in determining how much seed product is required to deliver a targeted rate of pure live seed per unit area.

For instance, if a seed tag has the following information, one calculates the % PLS for each of the three varieties and totals these up to determine the %PLS for this blend of perennial ryegrasses. In this example, that is 74.1% PLS for the entire blend.

SEED LABEL

Pure Seed	Germination:
34.62% RunHard Perennial Ryegrass	80% $0.3462 * .80 = 0.277$
37.33% KickFar Perennial Ryegrass	80% $0.3733 * .80 = 0.299$
21.97% ThrowLong Perennial Ryegrass	75% $0.2197 * .75 = 0.165$
Other ingredients:	PLS = 0.741 or 74.1%
1.19% other crop seed; 4.89% Inert Matter	

If the goal is to apply 20 lbs of pure live perennial ryegrass seed per 1000 sq ft to a bermudagrass sports field (2.5 Acres).

Then the field manager would need $20 \text{ lbs product} \div 0.741 = 27 \text{ lbs}$ of this product to deliver 20 lbs of pure live seed per 1000 sq ft.

$2.5 \text{ A} * 43,560 \text{ sq ft per A} = 108,900 \text{ sq ft}$.

$$\frac{27 \text{ lbs}}{1000 \text{ sq ft}} :: \frac{x \text{ lbs}}{108,900 \text{ sq ft}} = \mathbf{2940.3 \text{ lbs}}$$

of perennial ryegrass blend for the field

OR

$$27 \text{ lb} / 1,000 \text{ ft}^2 * 109.9 \text{ M} = \mathbf{2940.3 \text{ lbs}}$$

of perennial ryegrass blend for the field

Practice problem:

SEED LABEL

<u>Pure Seed</u>	<u>Germination:</u>	
33.34% Fiesta Perennial Ryegrass	85%	=0.283
33.16% Karma Perennial Ryegrass	83%	=0.275
32.40% Blazer Perennial Ryegrass	80%	=0.259
Other ingredients:		PLS = 0.817%
0.00% other crop seed;	1.11% Inert Matter	

If your goal is to apply 6 lbs of pure live perennial ryegrass seed per 1000 sq ft for a new home lawn establishment, how many pounds of this seed product would you need per 1000 sq ft of area ?

= 7.34 lbs

If your lawn measures 12,500 sq feet, how many pounds of this seed blend are required to seed the entire lawn at 6 lbs of pure live seed per 1000 sq ft?

= 44.0 lbs