Who's afraid of turfgrass MATH?

-- Necessary Calculations

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Fertilizer bag labels

- **Fertilizer labels all have 3 numbers on the label. They are important !!**
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- **The sequence [order of the numbers] is important.**
- **N - P - K –other plant available nutrients not the ELEMENTAL form of the nutrients**
- **P_2O_5 = plant available Phosphorus (P)**
- **K_2O = plant available Potassium (K)**

Topics

- FERTILIZER CALCULATIONS
  - How much product is needed
  - How much nutrient was spread
  - Find the lowest cost nitrogen
- IRRIGATION CALCULATIONS
  - Acre inches to gallons
- TOPDRESSING
- POSSIBLY Granular and liquid Active Ingredients

Fertilizer labels

- **ORDER is important –First 3 # are <u>the same order on EVERY bag</u>** it's the law
- **NITROGEN - PHOSPHORUS - POTASSIUM**

N P K

Fertilizer Topics:

- What's in the bag - what do those number mean?
- How to figure the amount of nutrients in a given bag
- How much fertilizer to apply - per acre, per 1,000ft^2
- Which is the least expensive fertilizer?

NUMBERS ON A FERTILIZER BAG ARE A PERCENTAGE

- **46-0-0 =** 46% NITROGEN - 0% PHOSPHORUS - 0% POTASSIUM
- **0-46-0 =** 0% NITROGEN - 46% PHOSPHORUS - 0% POTASSIUM
- **0-0-60 =** 0% NITROGEN - 0% PHOSPHORUS - 60% POTASSIUM
- **25-5-15 =** 25% NITROGEN - 5% PHOSPHORUS - 15% POTASSIUM
- **15-30-15 =** __% NITROGEN -__% PHOSPHORUS - __% POTASSIUM

- To find amount of nutrient = **multiplication**
- To find amount of **fertilizer = division**

Practice

- A 50 lb Bag of 26-8-16
  - Has **13** lb Nitrogen?
  - Has **4** lb Phosphorus?
  - Has **8** lb Potassium?

NUMBERS ON A FERTILIZER BAG ARE A PERCENTAGE

- A 100 lb bag of 46-0-0 has
  100 lb * 0.46 = 46 lbs on Nitrogen

SO **TIP # 1**

A 50 lb bag has ½ of a 100 lb bag = 23 lb N
50 lb * 0.46 = 23 lbs of N

- A 100 lb bag of 6-0-0 has
  100 lb * 0.06 = 6 lbs on Nitrogen

How much is in a 50 lb bag of 6-0-0 ? *3.0 lb of Nitrogen*

What is this "per thousand square feet" thing about?

Several ways to figure amount of nutrients:

- **Using a %:** A 50 lb bag has a label of 28-0-0. How much nitrogen is in the bag?
  -bag method =
  100 lb = 28 lb N so ½ of 28 = 14 lb N

Remember percentages? Math way = ?

50 lb /bag * 0.28 = 14 lb N /bag

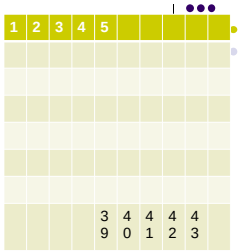
size of package * % nutrient = amount of nutrient in the package

This the method to determine how much nutrient is in a given amount of fertilizer

- **How much potassium?**

If one acre = 43,560 ft²

Then, there are 43.56 blocks of 1,000ft² each in one acre



1 acre has **43.56 1,000 ft² boxes**

10% = 0.10 5% = 0.05
1,000 ft² = M

- To find amount of nutrient = **multiplication**
- To find amount of **fertilizer = division**

WANT / HAVE = NEED

Rate / Fertilizer % *in decimal*

You want 1.0 lb N / **1,000 ft²** using 20-0-10. *How much fertilizer is needed?*

WANT >> 1.0 lb. N/1,000ft² >> 1.0

HAVE >> 20 % N fertilizer >> 0.20

= ***5.0 lb of Product*** *[20-0-10]* ***per 1,000 ft²***

How much fertilizer do you need to apply?

DIVISION

- There are several methods to calculate the amount of material needed.
- This is the easiest!

The amount of fertilizer will always be larger than the rate

- **NO SUCH THING AS 100% NUTRIENT FERTILIZER**
- EXAMPLE: One pound of 50 %
  - = 50 orange balls and 50 maroon balls
- YOU want one lb of orange balls:
  - That will be 100 orange balls
- How many lbs of 50% are needed?
  - WANT / HAVE = NEED
  - **1.0 lb** orange / 0.5 orange = **2.0 lbs** of product

WANT / HAVE = NEED

Rate / Fertilizer % *[in decimal]*

YOU WANT TO APPLY 35 LB OF NITROGEN PER ACRE
YOU HAVE 46 - 0 – 0

WANT / HAVE 35 LB N /A / 0.46 = **76 .09 LB PRODUCT / ACRE**

YOU WANT TO APPLY 0.75 LB OF NITROGEN PER 1,000 FT²
YOU HAVE 21 – 0 – 0

WANT / HAVE 0.75 LB N /A / 0.21 = **3.57 LB PRODUCT / 1,000 FT²**

Your boss **wants to apply 0.75 lb. N /M** and you have some 25-5-15 in the shed.

How much fertilizer per *1,000ft² ?*

$$\frac{\text{WANT}}{\text{HAVE}} \quad \frac{0.75 \text{ LB N /A}}{0.25} = 3.0 \text{ LB PRODUCT / } 1{,}000 \text{ FT}^2$$

0.75 / 0.25 = *3.0 lb fertilizer / 1,000ft²*

How much fertilizer per Acre ?

3.0 lb/M * 43.56 M/A = ***130.68 lb fertilizer/A***

What if you want to find the amount of Nitrogen that you applied?

- To find amount of **fertilizer needed = division (or how much product)**

- To find amount of nutrient = **multiplication**

- PRACTICE

You want 0.7 lb N / **1,000 ft²** using 25-0-10. ***How much fertilizer is needed?***

2.8 lb fertilizer / 1,000 ft²

You want 30.5 lb N / **acre** using 16-0-10. ***How much fertilizer is needed?***

190.62 lb fertilizer / Acre

You want 0.9 lb N / **1,000 ft² [M]** using 46-0-0. ***How much fertilizer is needed?***

1.96 lb fertilizer / 1,000 ft²

Find the amount *of nutrient*

MULTIPLICATION

TIP # 2

- The size of the package times the % nutrient.
- How much N is a 500 lb of a 25-5-15?

500lb *package* * 0.25 *% of N* = 125 lb of Nitrogen

125 lb nitrogen in that size package

MAKE SENSE ??

How many pounds of N, P, & K are in a ton of 5-10-20?

Ton = 2,000 lb

- N_____

2,000 * 0.05 = **100 lb N per ton**

- P_____

2,000 * 0.10 = **200 lb N per ton**

- K_____

2,000 * 0.20 = **400 lb N per ton**

Notice a pattern?

Practice time = Find the N

- A 100 lb bag of 32-0-0 has
  100 lb * 0.32 = 32 lbs on Nitrogen
- A 2,000 lb bag of 25-0-0 has
  2,000 lb * 0.25 = 500 lbs on Nitrogen
- A 50 lb bag of 28-0-0 has
  50 lb * 0.28 = 14 lbs on Nitrogen
- A 50 lb bag of 16-0-0 has
  50 lb * 0.16 = 8.0 lbs on Nitrogen

Which is the cheapest source of plant available N?

A) 34-0-0 @ $22.10/ 50 lb bag
$22.10 / 17 lb N = $1.30 lb N

B) 21-0-0 @ $14.70/ 50 lb bag
$14.70 / 10.5 lb N = $ 1.40 lb N

C) 46-0-0 @ $1,104.00/ ton
$1,104 / 920 lb N = $1.20 lb N

Money saver alert **Money saver alert**

Find the lowest cost per pound of Nitrogen?

- Compare several fertilizers quickly
- Using "cell phone calculator"

Questions

How much does one lb of N cost?

If the cost of a 50 lb bag of 28-5-17 is $30.25
How much is one lb of Nitrogen?

First – remember you want **Dollar per lb N**

this is **Cost of *the package*** / **Lb N in *the package*** **TIP # 2**

so $\frac{\$30.25}{14 \text{ lb. N}}$ = **$2.16 per lb N**
50 lb * 0.28 =

HOW MUCH NITROGEN is "size of the package times the % of Nitrogen"

Quick IRRIGATION calculations

TWO STEPS

- **1)** FIND THE TOTAL NUMBER OF ACRE INCHES NEEDED

THEN

- **2)** MULTIPLY ACRE INCHES BY 27,154 GALLONS

Total acre inches

- Multiply
  - inches of water required per week by
    - Acres [of your fields] by
      - Weeks [you need to irrigate]

Example: **How many acre inches of water are needed to irrigate 10 acres with 1.25 inches per week for 8 weeks?**

1.25 inches * 10 acres * 8 weeks = **100 acre inches**

Example: How many acre inches of water are needed to irrigate 10 acres with 1.25 inches for 8 weeks?

1.25 inches/week * 10 acres * 8 weeks = **100 acre inches**

HOW MANY GALLONS IS THIS?

- MULTIPLY THE REQUIRED ACRE INCHES BY 27,154 [GALLONS IN ONE ACRE INCH]
- SO: 100 acre inches * 27,154 gallons/ acre inch =

2,715,400 gallons

Examples of acre inches

Example: **How many acre inches of water are needed to irrigate 18.5 acres with 0.75 inches per week for 8 weeks?**

0.75 inches/week * 18.5 acres * 8 weeks = **110 acre inches**

Example: **How many acre inches of water are needed to irrigate 60 acres with 1.0 inch per week for 4 weeks?**

1.0 inches/week * 60 acres * 8 weeks = **480 acre inches**

EXAMPLES

- How many gallons are used to irrigate 15 acres with 0.75 inches of water for 8 weeks?
  - **Use 90 acre inches = 2,443,860 gallons**
- How many gallons are saved if you use ½ acre inch less of water per week over 40 acres for 10 weeks?
  - **Save 200 acre inches = 5,430,800 gallons**

FIND THE GALLONS OF WATER NEEDED

- FIND THE ACRE INCHES
  - MULTIPLY ACRE INCHES PER WEEK BY
  - ACRES THEN BY
  - WEEKS
- EQUAL TOTAL ACRE INCHES REQUIRED
  - **MULTIPLY THIS BY GALLONS IN AN ACRE INCH**
    - **27,154 gallons per acre inch**
- **EQUALS THE TOTAL GALLONS REQUIRED**

Questions

TOP DRESSING CALCULATIONS

- Again two steps:
- 1) FIND THE THICKNESS USED ***IN FEET***
  - **This is the tricky bit !!!**
- 2) MULTPLY THICKNESS BY TOTAL AREA [IN SQUARE FEET]

- How much topdressing is needed to put 3/16" over 5,000 ft^2?
- 3/16" = 0.1875"
- 0.1875" / 12 = 0.0156'
- 0.0156' * 5,000 ft^2 =

78.13 cubic feet

- How much **MULCH** is needed to put 3" over 5,000 ft^2?
- 3" = 3.0"
- 3.0" / 12 = 0.25'
- 0.25' * 5,000 ft^2 =

1,250.0 cubic feet

1) Thickness (must be) in feet

- **Convert measurement to a decimal**
  - Usually starts with a fraction of an inch
    - 1/2" = 0.50 3/8" = 0.3750" 3/16" = 0.1875"
  - Convert the inch to feet by **dividing by 12**
    - 12 inches in one foot number gets smaller – divide
    - 0.50" / 12 = 0.0417' 0.1875" / 12 = 0.0156'
    - OMG, that's a small number – yes it is!

- YOU TRY:
- How much topdressing is needed to put 9/16" over 35,000 ft^2?
- 3/16" = 0.5625"
- 0.5625" / 12 = 0.0469'
- 0.0469' * 35,000 ft^2 =

1640.6 cubic feet

- How much **MULCH** is needed to put 2.5" over 2,000 ft^2?
- 2.5" = 2.5.0"
- 2.5" / 12 = 0.2083'
- 0.2083' * 2,000 ft^2 = **416.67 cubic feet**

2) Multiply the thickness by area

[feet times square feet = cubic feet]

ft * ft^2 = ft^3

Thickness * Area = Volume

- How much topdressing is needed to put ½" over 25,000 ft^2?
- ½" = 0.50"
- 0.50" / 12 = 0.0417' [note: the answer is **in feet**]
- 0.0417' * 25,000 ft^2 =

1,041.7 cubic feet

Questions

Control products = Active ingredients (AI)

KEY POINTS:

Granular products = calculations just like fertilizer
[Active ingredient is **a percentage of the weight**]
E.G. A formulation of "50G" = AI is 50%
[*just like a fertilizer problem*]

Liquid products = the formulation numbers mean
POUNDS OF AI PER ONE GALLON OF PRODUCT
E.G. A formulation of "2.5 EC" = AI is 2.5 lb AI **per gallon product**

The label says to apply 1.5 lb of AI per acre of Grub Go Away "1.0G". How much product is needed per acre?

1.5 lb AI/acre = 150.0 lb product per acre
0.01 remember that 1% is 0.01

The label says to apply 3.0 lb of AI per acre of Bug Me Not "50G". How much product is needed per acre?

3.0 lb AI/acre = 6.0 lb product per acre
0.50

*To find amount of granular AI = **multiplication***

How much AI is in a 50 lb bag of a 10G product? *[10G = 10%]*
size of the bag times the % AI = amount of AI in the bag

50 lb bag * 0.10 = **5 lb AI in the bag**

Granular products = calculations just like fertilizer

[Active ingredient is a percentage of the weight]
just like nitrogen in a bag of fertilizer

You want to apply 1.25 lb of AI per acre of Good Stuff "2G".
How much product is needed **per acre?**

*To find amount of **PRODUCT = division***

WANT = NEED
HAVE

Remember "2G" = 2% AI = 0.02

1.25 lb AI/acre = 62.5 lb product per acre
0.02

LIQUID FORMULAS

Granular products = calculations just like fertilizer

[Active ingredient is a percentage of the weight]

Want 4.5 lb of AI per acre of Cricket B Gone "50G". How much product is needed per acre?

To find amount of **product = division**

WANT = NEED
HAVE

Remember "50G" = 50% AI so, use 0.5

4.5 lb AI/acre = 9.0 lb product per acre
0.50

Liquid products = the formulation numbers mean the number of

POUNDS OF AI in ONE GALLON OF PRODUCT

Want 0.5 lb of AI per acre of Wet and Wild "4EC". How much product is needed per acre?

To find amount of **product = division**

WANT = NEED
HAVE

Remember "4EC" = 4 lb AI per gallon

THE ANSWER WILL BE IN GALLONS [This is a liquid product]

0.50 lb AI/acre = 0.125 *gallons* product per acre
4.0

0.125 gallons * 128 oz/gal = 16 fl oz product/acre

Liquid products = the formulation numbers mean
POUNDS OF AI PER ONE GALLON OF PRODUCT

Want to apply 1.0 lb of AI per acre of Wahoo Whiz "2.5 EC".
How much product is needed per acre?

Remember "2.5 EC" = 2.5 lb AI per gallon

THE ANSWER WILL BE IN GALLONS [This is a liquid product]

$$\frac{1.00 \text{ lb AI/acre}}{2.5} = 0.4 \text{ gallons product per acre}$$

0.4 gallons * 128 oz/gal = 51.2 fl oz product/acre

The label says apply 0.25 lb of AI per acre of Good Stuff 1.5EC.
How many gallons of product is needed?

$$\frac{0.25 \text{ lb AI/acre}}{1.5} = 0.1667 \text{ gallons product per acre}$$

FYI : 0.1667 gallons * 128 oz/gal = 23.33 fl oz product/acre

The label says apply 0.02 lb of AI **per thousand feet** of Golden Whiz 0.5EC.
How many gallons of product is needed?

$$\frac{0.02 \text{ lb AI/acre}}{0.5} = 0.04 \text{ gallons product per thousand feet}$$

FYI : 0.04 gallons * 128 oz/gal = 5.12 fl oz product/thousand feet

FOR MORE PRACTICE QUESTIONS GO TO:

HTTP://WWW.TURFPROFESSIONAL.ORG/PUBS/CALCULATIONS_REVIEW_SOME_ANSWERS.PDF

Most answers are correct!