Fertilizer Calculations

LET’S SEE IF WE CAN FIGURE THIS OUT
Four “Finds” in Fertilizer Calculations

- Find the area
- Find the rate (per area)
- Find the amount of nutrient (area * rate)
- Find the amount of fertilizer (nutrient / concentration)
Two Basic Types of Calculations

- You have a given amount of fertilizer and you need to calculate how much nutrient is in it.
- You have a given amount of a nutrient to apply and you need to calculate how much fertilizer to use.
Memorize and Understand This!

- # of fertilizer * % of nutrient = # of nutrient
  - # of urea * 0.46 #N/#urea = # of N

- # of nutrient / % of nutrient = # of fertilizer
  - # of urea = # of N / 0.46 #N/#urea

- There are 43,560 ft² in 1 acre (ac)

- There are 10,000 m² in 1 hectare (ha)

- 1 ac = 0.4047 ha; thus, 1 ha = 2.471 ac
Memorize and Understand This!

- $N = \%$ elemental Nitrogen
- $P = \% \text{P}_2\text{O}_5$ (phosphate) equivalent
  - Elemental $P = 0.437 \times \text{P}_2\text{O}_5$
- $K = \% \text{K}_2\text{O}$ (potash) equivalent
  - Elemental $K = 0.83 \times \text{K}_2\text{O}$
How many pounds of N are in a 50# bag of ammonium nitrate (35-0-0)?

\[ 50 \text{ #35-0-0} \times 0.35 \frac{\text{#N}}{\text{#35-0-0}} = 17.5 \text{ #N} \]
Converting From Nutrient to Fertilizer:

- How many pounds of ammonium nitrate (35-0-0) do you need to give you 5# of N?

\[
x \times 35-0-0 = 5 \# N / 0.35 \# N/#35-0-0 = 14.3 \# \text{fertilizer}
\]
Example #1

- The area of a home lawn is 15,000 ft$^2$

- You want to apply 1#N per 1000 ft$^2$ using ammonium sulfate (21-0-0)

- Total amount of N = 1 #N/1000 ft$^2$ * 15,000 ft$^2$ = 15 #N

- Total fertilizer = 15 #N / 0.21 #N/#21-0-0 = 71# ammonium sulfate
Example 1, more difficult

- You want to apply 1#N per 1000 ft² to the same lawn, using 75% isobutylene diurea (IBDU) and 25% urea
  - 15#N * 75% = 11.25#N from IBDU (31 %N)
  - $x \text{ #IBDU} = \frac{11.25 \text{ #N}}{0.31 \text{ #N/#IBDU}} = 36.3 \text{ #IBDU}$
  - 15 #N * 25% = 3.75 #N from urea (46 %N)
  - $y \text{ #urea} = \frac{3.75 \text{ #N}}{0.46 \text{ #N/#urea}} = 8.2 \text{ #urea}$
Example 2, Acres

- How much ammonium nitrate (AN) (33-0-0) would you buy for 75 acres if you want to apply a total of 4#N/1000 ft$^2$ during the next year, in 4 separate applications? It comes in 50 # bags. How many bags would you order?
Continued

- $4 \text{ #N/1000 ft}^2 \times 43,560 \text{ ft}^2/\text{ac} = 174.2 \text{ #N/ac}$
- $174.2 \text{ #N/ac} \times 75 \text{ ac} = 13,065 \text{ #N}$
- $x \text{ #AN} = 13,065 \text{ #N} / 0.33 \text{ #N/#AN} = 39591 \text{ #AN}$
- $39591 \text{ #AN} / 50 \text{ #AN/bag} = 792 \text{ bags}$
- $792 \text{ bags} / 4 \text{ applications} = 198 \text{ bags/appl.}$
Example 3

- You are growing 25 acres of tall fescue and plan on applying a total of 160 #N/ac on the following schedule:
  - 80 #N/ac as methylene urea (MU) (39-0-0) on Mar 1
  - 40 #N/ac as 26-4-8 on May 1
  - 40 #N/ac as 26-4-8 on Oct. 1

- Question 1: How much of each fertilizer do you need to order?
First, you apply 80 #N/ac using each fertilizer

80 #N/ac * 25 ac = 2,000 #N

2,000 #N / 0.39 #N/#MU = 5,128 #MU

2,000 #N / 0.26 #N/#26-4-8 = 7,692 #26-4-8
You also want to apply 60 #elemental P/ac and 120 #actual K/ac.

Question 2: How much actual P and K are applied per acre in the 26-4-8 applications?
There are a couple ways to approach this.

Figure out how much fertilizer is applied per acre:
- \( \frac{7,692 \text{ #26-4-8}}{25 \text{ ac}} = 307.7 \text{ #26-4-8/ac} \)

Now calculate how much elemental P and K are applied in 307.7 #26-4-8/ac.
For P: 307.7 #26-4-8/ac * .04 #P₂O₅/#26-4-8 = 12.3# P₂O₅/ac

12.3# P₂O₅/ac * 0.437 #P/#P₂O₅ = 5.38 #P/ac

To apply a total of 60 #elemental P/ac, need additional 44.62 #P/ac (60 − 5.38) from some other source.
  ○ Let’s use super phosphate (0-20-0).
• Need 44.62 #P/ac from 0-20-0 for 25 acres

• How much total P?
  ○ 44.62 #P/ac * 25 acres = 1,115.5 #P

• How much 0-20-0 is needed?
  ○ First calculate the amount of \( \text{P}_2\text{O}_5 \) equal to 1462 #P:
    \[
    \frac{1115.5 \text{ #P}}{0.437 \text{ #P}/\text{#P}_2\text{O}_5} = 2,553 \text{ #P}_2\text{O}_5
    \]
  ○ 2,553 #P\(_2\)O\(_5\) / 0.20 #P\(_2\)O\(_5\)/#0-20-0 = 12,765 #0-20-0
Now figure out how much K must be applied:

Remember we applied 307.7 #26-4-8/ac

How much elemental K is applied in 307.7 #26-4-8/ac?

- $307.7 \text{ #26-4-8/ac} \times 0.08 \#K_2O/#26-4-8 = 24.62 \#K_2O$

- $24.62 \#K_2O \times 0.83 \#P/#K_2O = 20.43 \#K/ac$
To apply a total of 120 #elemental K/ac, need 99.57 #K/ac (120 – 20.43) from some other source.
  - Let’s use KCl (0-0-60)

How much extra K is needed?
  - 99.57 #K/ac * 25 ac = 2,489 #K

Convert from actual K to K₂O:
  - 2,489 #K / 0.83 #K₂O/#K = 2,999 #K₂O
How much 0-0-60 is needed?:

2,999 \( \#K_2O \) / 0.60 \( \#K_2O/\#KCl \) = 4,998 \( \#KCl \)