

LOOK UP

A Plant's Grocery Store ppt

CASE

6.1.3 Fertilizer Figures

...ates is a skill all plant producers must master. Fertilizer nutrient content is always ...s with primary nutrients listed first in a specific order of N-P-K. The values are ...ages of elemental nitrogen, phosphate (P₂O₅), and potash (K₂O). Other numbers ...represent other macronutrients, such as sulfur. If micronutrients are included, these ...identified not to confuse the consumer.

...ers are sold in bags or other smaller containers by the pound to nursery managers ... However, for field crops dry fertilizer is sold in larger bags or in bulk. Pricing for commercial fertilizer is typically done on a tonnage basis. This means producers must know how to calculate how much fertilizer they need and compare sources of fertilizer on a tonnage basis to determine the lowest price.

Liquid or water-soluble fertilizers are common for greenhouse operations because of automated systems that apply fertilizer and water at the same time. Liquid fertilizers are normally calculated by parts per million (ppm). This activity will have you work through some of the situations that producers face concerning fertilizer calculations. Refer to formulas recorded in your notes from PowerPoint® A Plant's Grocery Store.

Materials

Per student:

- Calculator
- *Plant and Soil Science: Fundamentals and Applications* textbook
- Pencil
- *Agriscience Notebook*

Procedure

Work through the following scenarios to determine nutrient content of a fertilizer, amount of fertilizer needed, and product comparisons.

Part One – Determine Pounds of Nutrient per Pounds of Fertilizer

For the fertilizer sources listed in Table 1, determine the pounds of each nutrient in the container.

Table 1. Fertilizer Nutrient Content

Analysis of Fertilizer	Weight	Lbs. of N	Lbs. of P	Lbs. of K
1 Container mix of 15-16-17	100 lbs.	15	16	17
2 Urea 46-0-0	50 lbs.	23	0	0
3 Complete fertilizer 20-20-20	25 lbs.	5	5	5
4 Miracle Gro® All Purpose 24-8-16	5 lbs.	1.2	0.4	0.8
5 Flowering mix 5-21-18	1 lb.	0.05	0.21	0.18

- give cond color of lollipop = what table to complete, then SHARE w/group

Show how you set up the formula to calculate the values of each nutrient in Table 1:

$\frac{15}{100} \times 100 \# = 15 \# N$
 $\frac{46}{100} \times 50 = 23$
 $\frac{20}{100} \times 25 = 5$
 $\frac{180 \times 35 = 6300 \# K}{6300 \#} = \frac{17}{100}$ $17x = 630,000$
 $x = 37,058 / 2000 \text{ tons} = 18.5$

Part Two – Determine Fertilizer Rates

Fertilizer in a granular form can be applied to field crops, lawns, and gardens. The following problems are provided to determine practical situations involving fertilizer rate calculations. You will need to calculate area in order to compute fertilizer needs. Remember the "N" represents nitrogen.

Some helpful formulas:

area = width x length

1 ton = 2000 lbs.

$$\frac{\text{value of N-P-K from fertilizer}}{100 \text{ lbs.}} = \frac{\text{nutrient rate}}{X \text{ lbs. of fertilizer}}$$

*This means
16#
100 is N*

Table 2. Fertilizer Rate Calculations (in square footage)

	Size of Area	Nutrient Rate Needed	Fertilizer Analysis	Amount of Fertilizer
1	10' x 100' parking strip	1 lb. of N per 1000 sqft.	16-8-4	6.25#
2	50' x 80' lawn	2 lbs. of N per 1000 sqft.	16-16-16	50#
3	75' x 125' playground	1 lb. of N per 1000 sqft.	20-10-20	47#
4	150' x 360' football field	3 lbs. of N per 1000 sqft.	46-0-0	352.17#

Show the formula and the steps you used to solve the problems in Table 2:

$10 \times 100' = 1000 \text{ ft}^2$
 $\frac{16}{100} = \frac{1}{x}$
 $16x = 100$
 $x = 6.25$

$50 \times 80 = 4000 \text{ ft}^2$
 $\frac{4000}{1000} = 4$ (need 4 of)

$150 \text{ ft} \times 360 \text{ ft} = 54000 \text{ ft}^2$
 $\Rightarrow 54$
 $54 \times \left(\frac{46}{100} \times \frac{3}{x} \right) = 352.17 \text{ #}$
 $46x = 300$
 $x = 6.52$

$4 \times \left(\frac{16}{100 \#} = \frac{2}{x \#} \right)$
 $4 \times (16x = 200)$
 $x = 12.5 = 50 \#$

Table 3. Fertilizer Rate Calculations (for acreage)

	Size of Area	Nutrient Rate Needed	Fertilizer Analysis	Total Amount of Fertilizer (lbs.)	Total Amount of Fertilizer (tons)
1	6-acre nursery plot	45 lbs./acre of P	16-16-18	1688 #	0.85
2	20-acre field of oats	72 lbs./acre of N	20-10-20	7200 #	3.60 tons
3	15-acre pasture	60 lbs./acre of N	46-0-0	1958 #	0.98 tons
4	180-acre field of corn	35 lbs./acre of K	15-16-17	37,058 #	18.5 tons

$6 \text{ acre} \times \frac{45 \#}{\text{acre}} = 270 \#$
 $\frac{16 \#}{100} = \frac{270 \#}{x}$
 $16x = 27,000 \#$
 $x = 1687.5 \# \times \frac{1 \text{ ton}}{2000 \#}$
 $= 0.85$

Show the formula and the steps you used to solve the problems in Table 3:

$$6 \text{ acres} \times \frac{45 \#}{\text{Acre}} = 270 \#s$$

$$270 \# \times \frac{16}{100} = 43.2 \#$$

Part Three – Calculating ppm Fertilizer Rates

Liquid or water-soluble fertilizers are mixed to create a desired concentration expressed in parts per million (ppm). The nutrient requirements for greenhouse plants are typically listed in ppm rates. The following are a few scenarios involving ppm problems.

Some helpful formulas:

For a dilution ratio of 1:100 = 1 oz. per 100 gal
 You use:
 % of nutrient in fertilizer x 75 = ppm in 1 oz./100 gal

$$\frac{\text{ppm desired}}{\text{ppm in 1 oz./100 gal}} = \text{ounces of fertilizer needed per 100 gallons of water}$$

$$\frac{20}{100} \times 75 = 15 \text{ ppm} \quad \frac{250 \text{ ppm}}{15 \text{ ppm}} = 16.7 \text{ oz}$$

Table 4. Fertilizer Rates in ppm

	Crop	Rate Needed	Fertilizer Analysis	Ounces of fertilizer needed per 100 gal of water
1	Bedding Plants	100 ppm of N	15-16-17	8.89 oz
2	Hanging Basket	150 ppm of N	20-9-20	10 oz
3	Poinsettias	250 ppm of K	20-10-20	16.67 oz
4	Chrysanthemums	100 ppm of P	15-10-30	13.3 oz

Show the formula and the steps you used to solve the problems in Table 4:

① $\frac{150}{100} \times 75 \rightarrow 11.25 \text{ ppm in 1 oz/100 gal} \quad (11.25 \text{ ppm} = 1 \text{ oz/100 gal})$

② $\frac{100 \text{ ppm}}{11.25 \text{ ppm}} = \frac{8.89 \text{ oz}}{100 \text{ gal}}$

① $\frac{20}{100} \times 75 = 15 \text{ ppm} = 1 \text{ oz/100 gal}$

② $\frac{150 \text{ ppm}}{15 \text{ ppm/100 gal}} = 10 \text{ oz/100 gal}$

Part Four – Determine Cost Comparison for Fertilizer

Profit margins on greenhouse plants and crops can be slim depending upon the market. Producers try to limit the cost of inputs in an effort to net more profit in the end. One way to do this is buying smart when searching for inputs, such as fertilizer.

Fertilizers are formulated at different nutrient ratios depending upon specific growing conditions for the plants. Much of the composition of commercial fertilizers is inert materials that have no mineral or nutrient value. However, the cost may not be reflective of the non-essential components of a fertilizer. It only takes a little knowledge of fertilizers and some calculating to sort out the fertilizers that are the best to buy.

Some helpful formulas:

$$\frac{\text{value of N from fertilizer}}{100 \text{ lbs.}} = \frac{X \text{ lbs. of N}}{\text{lbs of fertilizer}}$$

$$\frac{\text{price per unit of fertilizer}}{\text{pounds of N/unit of fertilizer}} = \text{cost of N/lb.}$$

Handwritten notes at top of page:

$$\frac{46\#}{100\#} = \frac{X \text{ lbs. of N}}{2000 \text{ lbs.}}$$

$$X = \frac{46(2000)}{100} = 920 \text{ lbs. N}$$

Handwritten calculations on the right:

$$\frac{\$278}{920} = \$0.30 \text{ of N/lb}$$

Base your decision on nitrogen (N) content. Refer to pages 152-153 in the *Plant and Soil Science: Fundamentals and Applications* textbook for the nutrient content of fertilizer sources.

Table 5. Price Comparisons of Fertilizers

Your Choice	Product A	Price for Product A	N Cost/lb. Product A	Product B	Price for Product B	N Cost/lb. Product B
1	A or B	46-0-0	\$278/ton	46-0-0	\$7.50/50 lb bag	0.33 N/lb
2	A or B	32-8-8	\$6.75/50 lb bag	45-8-12	\$6.99/ 50 lb bag	0.31
3	A or B	sewage sludge	\$45/ton	cattle manure	\$20/ton	1.67
4	A or B	16-16-16	\$3.85/50 lb bag	broiler manure	\$30/ton	0.48

Show the formula and the steps you used to solve the problems in Table 5:

Handwritten formula for Product A:

$$\frac{46N}{100 \#} = \frac{X \# \text{ of } N}{2000 \# \text{ of fert}}$$

$$\frac{(46N) \times (2000 \# \text{ of fert})}{100 \# (X \# \text{ of } N)} = \frac{100 \times 2000}{100}$$

Handwritten formula for Product B:

$$\frac{46}{100\#} = \frac{X \# N}{50 \#}$$

$$100x = 46(50)$$

$$x = \frac{46(50)}{100}$$

$$X = 23 \# N$$

$$\frac{\$7.50}{23 \#} = 0.33$$

Conclusion

- Your neighbor is confused about fertilizer information. He purchased a 25-pound bag of 20-10-20 fertilizer, but does not understand how there could possibly be 20 pounds of nitrogen, 10 pounds of phosphorus, and 20 pounds of potassium in this 25-pound bag. How many actual pounds of N-P-K are in the bag and why was your neighbor incorrect in his calculations?

Handwritten calculations for question 1:

$$\frac{20}{100} \times 25 = 5 \# N, \quad \frac{10}{100} \times 25 = 2.5 \# P, \quad \frac{20}{100} \times 25 = 5 \# K$$

- How do organic fertilizers, such as manures compare to chemical fertilizers?

Handwritten answer for question 2: *weaker fertilizer is organic, more conc. is chem. fertilizers*

- Why is the percentage of nutrient in fertilizer important to understand?

Handwritten answer for question 3: *- To know how many nutrients are there
- TO NOT overfertilize*

Handwritten note: *(only) 12.5# of fertilizer rest filler*