Fertilizer Calculation Worksheet

Background Review

The fertilizer elements are present in various compounds (e.g., urea, ammonium nitrate, phosphoric acid, calcium phosphate, potassium chloride). The composition by percentage of each of the 'big 3' elements present in the fertilizer must be stated on the bag and is referred to as the **fertilizer guarantee**, which expresses each of elemental N, phosphate, and potash as a percentage of the contents. For example, suppose your fertilizer has the numbers 10-5-8 (an unconventional fertilizer but useful as an example). This fertilizer contains 10% (1st number) elemental nitrogen, 5% (2nd number) available phosphate (P_2O_5) and 8% (3rd number) water soluble potash (K_2O). The remainder of the material is comprised of the other elements in the compounds and **filler**. The filler may be ground limestone to offset the acid potential of the fertilizer, along with some inert material. The filler facilitates spreading of small amounts of nutrients over a large area.

In order to make sure that those values are understood, we will calculate the amount of elemental N, P and K in a bag of fertilizer.

Calculate the weight of the three elements (N, P, K) contained in a 100 pound bag of 10-5-8 fertilizer.

<u>We begin with N, the easier calculation.</u>

The **100 lb** of **fertilizer** is ____**% N**.

1. Convert 10% to a decimal. _____. (fill in the answer)

2. Compute the weight of N in the 100 lb bag of 10-5-8:
   = **100 lb** * _____ = ____ lb N in a 100 lb bag of 10-5-8

Check your answer. *You should have 10 lb of N in the 100 lb bag of 10-5-8 fertilizer.*

P is more difficult, so we move on to the next page

Elemental P requires another step

The guarantee is expressed as phosphate (P_2O_5). We need to find out how much P is in P_2O_5. The next step shows you that P_2O_5 is **43.7%** P.

Atomic weight: P = 31 O = 16

P_2: two of them so 2 X 31 = 62g

O_5: five of them so 5 X 16 = 80g

Total weight for P_2O_5 142g

The proportion of P in P_2O_5 is [62 / 142] = **0.437**

Now we can calculate elemental P.

The **100 lb bag** of 10-5-8 **fertilizer** is ____**% P_2O_5,** which is ____ lb P_2O_5

So the amount of P in that bag is

0.437 * 5 lb

= _____ lb P in the 100 lb bag of 10-5-8 fertilizer

Check your answer- *You should have 2.185 lb of P in the 100 lb bag of 10-5-8.*

Elemental K requires a step similar to P

The guarantee is expressed as potash (K_2O). We need to find out how much K is in K_2O. The next step shows you that K_2O is **83.0%** K.

Atomic weight: K = 39 O = 16

K_2: two of them so 2 X 39 = 78g

O: one of them so 1 X 16 = 16g

Total weight for K_2O = 94g

The percentage of K in K_2O is [78 / 94] * 100 = **83.0%** (or 0.830 as a proportion)

Now we can calculate elemental K.

The **100 lb bag** of 10-5-8 **fertilizer** is ____**% K_2O,** which is ____ lb K_2O

So the amount of K in that 8 lb of K_2O

= .830 * 8 lb

= _____ lb K

Check your answer- *You should have 6.64 lb of K in the 100 lb bag of 10-5-8.*

Computing Application Rates for Individual Trees

How many ounces of 33-15-15 fertilizer should you apply around one tree if the recommendation is to supply 2 oz of elemental N?

This fertilizer is 33% N, so we ask the question: What quantity of 33-15-15 supplies two oz of elemental N?

Algebraically, that can be written as: $0.33\ x = 2$ oz
Solve for x (fertilizer needed)

$x = 2 \text{ oz} / 0.33$
$= 6.06$ oz

Approximately 6 oz 33-15-15 fertilizer provides 2 oz N

You can now easily solve the last two problems below:

If you add 2 oz of 33-15-20 to a single tree, (a) how much elemental P did you apply, and (b) how much elemental K did you apply?

Finally, if you use a 46-0-0 fertilizer, how much do you need to add to a tree to provide 2 oz of N?

Answers on following page.

Answers to questions above.

If you add 2 oz of 33-15-20 to a single tree,
(a) how much elemental P did you apply, **Answer = 0.1311 oz**
(b) how much elemental K did you apply? **Answer = 0.332 oz**

If you use a 46-0-0 fertilizer, how much do you need to provide 2 oz of N?
Answer = **4.35 oz**

<u>The quick take</u> – the 30 second version of fertilizer guarantee:

First Number - **N**itrogen percentage of the fertilizer

Second Number - **P_2O_5** phosphate percentage; multiply by 0.437 to get P

Third Number - **K_2O** potash percentage; multiply by 0.83 to get K