UNIVERSITY OF MARYLAND EXTENSION

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Fertilizer Calculations for the Home and Farm

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Introduction

Whether the goal is a great looking lawn, or farm profitability, it is essential that homeowners and farmers apply the correct amount of plant nutrients to their lawns, gardens, and crops. Applications of the wrong fertilizer grade and, or in the incorrect amount, can be harmful to the environment, or lead to a yield loss hurting the farm's profitability. Correct fertilizer calculations are as important to plant fertility as making sure that the fertilizer spreader is properly calibrated. This fact sheet will provide some simple, basic calculation methods of the most important steps when trying to determine what fertilizer to use and how much is needed to do the job.

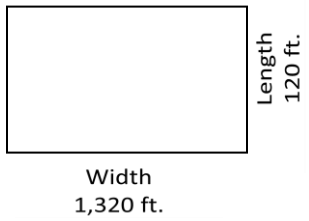
What is the size of the area to be fertilized?

The first task to be done before the amount of fertilizer needed is calculated, is to determine the size, or area of the field to be fertilized. This is done by calculating the square feet in this area by using one of the formulas below. Since homeowner fertilizer units are typically based on units of 1,000 ft^2, this is usually all that is needed, unless the area is under this unit size. If this is a farm field, after the area has been calculated, the results in square feet need to be converted to acres, since agriculture areas are expressed in acre units. An acre is 43,560 square feet.

The first thing to do when determining the area of a field is to draw its shape, this will determine which formula to use when doing the calculations. Next, measure the perimeter sides/edges of the field, writing the measurements down on the drawing. The formulas are:

Rectangle or Square

Area = length x width



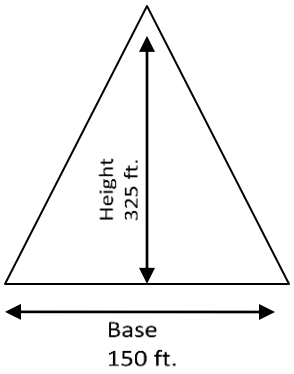
Area in square feet (sq. ft.)

1,320 ft. x 120 ft. = 158,400 sq. ft.

Area in acres (A.) = $\frac{158{,}400 \text{ sq. ft.}}{43{,}560 \text{ sq. ft.}}$ = 3.6 A.

Triangle

Area = $\frac{\text{Base x height}}{2}$

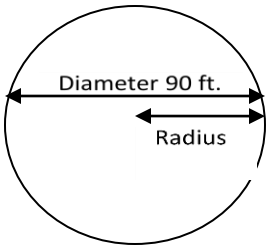


Area in square feet = $\frac{325 \text{ ft. x } 150 \text{ ft.}}{2}$ = 24,375 sq. ft.

Area in acres = $\frac{24{,}375 \text{ sq. ft.}}{43{,}560 \text{ sq. ft.}}$ = 0.6 A.

Circle

Area = $3.14r^2$ Note: r represents radius which is ½ of the diameter.



Area in square feet =

$3.14 \times 45^2 = 3.14 \times 2{,}025 = 6{,}358.5$ sq. ft.

Area in acres = $\frac{6{,}358.5 \text{ sq. ft.}}{43{,}560 \text{ sq. ft.}}$ = 0.15 A.

If the area where the fertilizer is to be applied has areas within that will not be part of the application, such as clumps of trees, the pool, the shed, or a large rocky outcrop, calculate the area of these objects and deduct them from your total area; this will be the total net area for the fertilizer application.

What type/grade of fertilizer needs to be purchased?

Commercial fertilizer is marketed based on its "guaranteed analysis" or grade. This appears on the front of the fertilizer bag as three numbers, which represent the nutrient content; these numbers always appear in the same order:

% total nitrogen (N) % available phosphate (P_2O_5) % soluble potash (K_2O)

These three numbers also refer to the ratio of nitrogen, phosphate, and potash in the fertilizer grade. An example would be the fertilizer grade 5 – 10 – 5, which is a 1 – 2 – 1 ratio fertilizer. When applying this grade at 20 lbs per 1,000 sq. ft., the area is receiving 1 lb. of nitrogen, 2 lbs. phosphate, and 1 lb. potash. Some other examples of common bagged fertilizer grades include 10 – 10 – 10 (1 – 1 – 1 ratio) and 10 – 6 – 4 (2 – 1 – 1 ratio).

To ensure that the correct fertilizer grade is used in the fertilizer application, a soil test analysis should be obtained. The results of this test will show the total amount of the three primary nutrient ratios needed to achieve the desired plant production goal. Farmers, after consulting with their nutrient management advisor, can take these results to a fertilizer dealer and have a custom fertilizer blended to meet the exact fertility requirements as shown in the nutrient management recommendations. Homeowners will typically look to a bagged commercial fertilizer most closely meets their plant nutrient needs.

Which fertilizer grade should to be purchased and how much?

Often homeowners will not have a soil test done, so they are buying a fertilizer grade at random from a store. If this is the case, the fertilizer still should be applied at a proper rate. For lawns, the typical recommended rate is 1 lb. of nitrogen per 1,000 sq. ft. For example; how much bag fertilizer with a grade of 23 – 7 – 7 would be needed for a 10,000 sq. ft. lawn?

- How much 23 – 7 – 7 does it take to get 1 lb. of nitrogen?
- .23 (the % nitrogen expressed as a decimal) divided into 1 lb. = 4.3 lbs.
- 10,000 sq. ft. divided by 1,000 (homeowner unit) = 10 units
- Answer: 4.3 lbs. x 10 = 43 lbs. of 23 – 7 – 7 will be needed to cover the entire lawn.

These steps can be used with any fertilizer grade when there is a need to determine how much of a fertilizer grade is needed to meet a nutrient need.

With the soil test results in hand, a farmer can multiply the number of acres in the field times the recommended fertilizer per acre rate to arrive at the total fertilizer needed. While some soil test labs will provide homeowners with a rate and fertilizer grade to apply in 1,000 sq. ft. units, occasionally a homeowner will receive a recommendation expressed in total nutrients per acre units. If this happens, the soil test results can be converted, so that a comparable bagged fertilizer can be used.

The first step in matching a bagged fertilizer to a farm-based recommendation is to identify the nutrient ratio of the fertilizer recommendation. For example, a homeowner received a recommendation of total nutrients for sweet corn of 120 – 60 – 60 per acre; this is equivalent to a 2 – 1 – 1 ratio fertilizer; a close fit in bagged fertilizer would be 10 – 6 – 4.

Next determine the square feet in the garden to be planted to sweet corn; for example the sweet corn area is a rectangle 45 ft. x 50 ft. The area is 2,250 sq. ft.

Next determine how much 10 – 6 – 4 will be needed to supply the recommended 120 – 60 – 60 per acre. The result is .10 divided into 1 lb. = 10 lbs., therefore I0 lbs. of 10 – 6 – 4 will yield:

(N) .10 x 10 lbs. = 1.0 lb. (P_2O_5) .06 x 10 lbs. = .6 lb. (K_2O) .04 x 10 lbs. = .4 lb.

Multiply 10 lbs. x 120 lbs /A. (nitrogen needed) = 1,200 lbs / A. to calculate the amount of 10 – 6 – 4 needed to meet the fertilizer recommendation; this yields 120 – 72 – 48, which is close enough to the fertility recommendation.

Now convert the results to 1,000 sq. ft. Remember that an acre is 43,560 sq. ft.

$$\frac{1{,}200 \text{ lbs. } (10-6-4)}{43{,}560 \text{ sq. ft.}} \times \frac{X \text{ lbs. } (10-6-4)}{2{,}250 \text{ sq. ft.}} = \frac{2{,}700{,}000 \text{ lbs.}}{43{,}560 \text{ sq. ft.}} =$$

X = 62 lbs. The homeowner needs 62 lbs. of 10 – 6 – 4 for the sweet corn patch.

Conclusion

These calculations can also be used to determine the size of an area to be treated with a pesticide and how to covert recommendation units to the home or farm. When doing calculations, be sure to pay attention to the units being used and do not mix them up. Make sure that decimal points are put in the correct place; a decimal point in the wrong place can lead to a tragic ending with a crop whether it's on the farm or around the home. For example, homeowners may need to factor down a product to a fraction of an ounce to meet the recommended rate in a small garden area, in this situation, a decimal point in the wrong place when using a strong herbicide would most likely injure the crop. Therefore, it is always a good idea to double check the calculations before weighing, mixing, and applying fertilizers and pesticides.