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Determining Your Fertilizer Needs for the Growing Season

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This worksheet is designed to help you calculate how much fertilizer you will need to grow your selected crops. This will first help you determine the nutrient recommendations for your crops, adjusted to the scale you will be planting. Then you will calculate how much fertilizer of your choosing you will need to apply to meet that recommendation. Finally, you will determine how much total fertilizer you will need to purchase for the growing season.

Using appropriate crop nutrient recommendations and planning your fertilizer applications to match those recommendations is important for two reasons. First, when you over apply nutrients to your farm or garden, you are paying for nutrients that do not influence your final yield, which affects your overall farm or garden budget. Second, nutrients not used by the crops are often leached out of the field. These nutrients often end up in ground or surface waters and affect their quality. Nitrogen and phosphorus, in particular, contribute to a process called eutrophication. Excess nitrogen and phosphorus contribute to algae growth in surface waters, which is unsightly and can affect recreation directly, especially if the algae blooms include toxic species. Worse, when the algae dies, the bacteria that break it down use up the oxygen in the water. When oxygen levels get too low, or hypoxic, it can cause fish and invertebrates to die, giving those areas the name "dead zones." Agriculture is one of the largest contributors of nutrients that lead to eutrophication and hypoxia. The Gulf of Mexico dead zone is one of the world's largest dead zones and reached a record size of 8,776 square miles in 2017.

The following instructions will help you gather the information you need to calculate your fertilizer needs. Before getting started, make sure to have your planting calendar and planting plan on hand, and have access to a soil test that was submitted in the last three years. If you need help developing a planting calendar, check out our fact sheet Developing a Crop Planting Calendar (KYSU-CEP-FAC-0078), available at: https://www.kysu.edu/documents/school-of-agriculture-communities-and-the-environment/planting_calendar_with_tables_accessible_031021.pdf.

Table 1: Converting Growing Area into Square Feet for Each Crop

A. If you are planning a small mixed vegetable garden and plan to follow fertilizer recommendations for a mixed vegetable garden, you will just need the total area of your garden. See step B for recommendations on how to calculate this area.

B. If your farm or garden uses intensive growing practices and not row agriculture, you can measure the size of the beds or planned growing area for each crop and calculate the area with the following equation:

   Width of bed x length of bed = growing area

   If your beds are evenly rectangular, you may want to take several length and width measurements and take an average. If you bed is another shape, do the same but use the area equation for that shape. Be sure to keep track of your units. If you have multiple beds in the same crop, add the growing areas together. You can use the first and last columns of Table 1 to keep track of the growing areas for each of your crops. This information will be needed in Table 4.

C. If your farm or garden uses row agriculture, you can calculate area one of two ways. If you already have the space planned out that you will plant in a given crop, you can measure the length and width of that area. This may be easier if you plan to plant multiple rows of a crop or a whole field of that crop. If you plan to plant smaller areas, single rows, or partial rows of a crop, you can use Table 1 to convert feet of row into square feet using the following instructions:

   1. Enter all the crops you will be growing in the first column.
   2. Enter the total number of row feet that will be planted for each crop in column 2. Consult your planting plan or map to get the number of row feet that will be planted for each crop. If you have multiple plantings of a croup through the growing season, add up all the row feet that will be planted for each harvest.
   3. Enter the recommended distance between rows for each crop in column 3. This can be found in Table 5 of UK ID-128 Home Vegetable Gardening in Kentucky (available at http://www2.ca.uky.edu/agcomm/pubs/ID/ID128/ID128.pdf; table 4 in versions from 2020 or earlier) or another source. This distance may be given in inches; for our calculation, convert it into feet by dividing by 12 before entering it into the table.
   4. Multiply columns 2 and 3 and enter the growing area in square feet in column 4. This information will be needed in Table 4.

Table 2: Fertilizer Application Rate Recommendations

If you are growing larger areas of a specific crops or plan to fertilize for specific crops in smaller areas, follow these instructions:

1. Enter all the crops you plan to grow into the first column of Tables 2 and 3. Note that some crops may require additional applications of fertilizers throughout the growing season. These additional applications, or side dressings, should receive a separate line in the table.
2. Enter the nutrient recommendations in lb/acre into columns 2-4 in Table 2. These can be found in UK ID-36 Vegetable Production Guide for Commercial Growers (available at http://www2.ca.uky.edu/agcomm/pubs/id/id36/id36.pdf), where each crop is listed separately. Add together all recommended applications of N and enter them in the table. For P and K, use the rate for the appropriate soil test value. If you have done a soil test and are still waiting on the results, use a low soil test rate as a conservative

estimate for budgeting and planning purposes. Convert the nutrient recommendations to oz per square feet by multiplying by 16 (oz/lb) and dividing by 43,560 (square feet per acre). If your operation is large enough that your growing areas is in acres, you can skip this step and continue with the lb/acre units.

If you are planting a small mixed vegetable garden and plan to follow those fertilizer recommendations, follow these instructions:

1. Enter mixed vegetable garden under crops in the first column of Tables 2 and 3.
2. Enter the nutrient recommendations in lb/1000 sq ft from Table 4 of UK ID 128 (Table 3 in editions from 2020 or earlier). For P and K, use the rate for the appropriate soil test value. If you have done a soil test and are still waiting on the results, use a low soil test rate for nitrogen as a conservative estimate for budgeting and planning purposes. Most soil tests for P in Kentucky are high to very high, so the general recommendation is not to add P from fertilizers. You will need to recalculate your applications once the soil test results come in.
3. Convert the nutrient recommendations to oz per square feet by multiplying by 16 (oz/lb) and dividing by 1000.

Table 3: Fertilizer Application Rates

1. Choose the fertilizer that you want to use. If you do not have to add any P or K, or very little P or K, consider using a single nutrient fertilizer to provide the N. Additional single nutrient fertilizers can be used to add small amounts of P or K if they are needed. You can also select fertilizer with more than one nutrient in it, then apply it for the smaller amount of P or K that you need and add additional N from a single nutrient fertilizer. You can also look for a fertilizer that has a higher N content than P and K content. If you wish to determine which combination of fertilizers will be most cost effective or compare fertilizers to be sure that you supply enough of one nutrient without supplying too much of the others, you can complete Tables 3, 4, and 5 for each fertilizer choice and compare them.
2. Enter its name and nutrient analysis into columns 2 and 3 of Table 3. Commercial fertilizers, both conventional and organic, will have the nutrient analysis on the packaging. This should appear as three numbers representing the percent by weight of Nitrogen-Phosphorus-Potassium (N-P-K).
3. Calculate the amount of fertilizer needed for your first nutrient. Making the calculation for the nutrient that will be supplied in the highest quantity by the fertilizer will prevent overapplication of the other nutrients in the fertilizer. You will need to start with the application recommendation (lb/acre) or nutrient requirement (oz/sq ft) from Table 2. Multiply this by 100 and divide by the amount of that nutrient in your fertilizer. In the equation below, y will come from the nutrient analysis of the fertilizer. Enter the nutrient name and the amount of fertilizer required into column 4 of Table 3.

   Application recommendation/ nutrient requirement x $\frac{100 \text{ fertilizer}}{y \text{ nutrient}}$ = amount of fertilizer required

4. Calculate the amount of the other nutrients supplied by that fertilizer using the following equation for both the remaining nutrients:

   Amount of fertilizer applied x $\frac{y \text{ nutrient}}{100 \text{ fertilizer}}$ = amount nutrient supplied

   Enter the nutrient name and amount supplied into column 5 and 6 of Table 3.

5. Determine if your fertilizer supplies all the needed nutrients for your crops. Subtract the amount of each nutrient supplied (calculated in the precious step and entered in columns 5 and 6) from their recommended application rate (lb/ acre) or nutrient requirement (oz/sq ft) from Table 2. If additional nutrients are needed, choose a second fertilizer and enter its name and analysis into column 7 of Table 3.
6. Repeat steps 5-7 for the second fertilizer and enter the information into columns 8 and 9 of Table 3.
7. If needed, repeat steps 5 and 6 for a third fertilizer.

You now know how much fertilizer to put down in your garden for each of your crops. To determine how much fertilizer you need to purchase for a growing season, continue with Tables 4 and 5.

Table 4: Amount of Fertilizers Needed for Each Crop

1. Transfer the fertilizer name and fertilizer application rates calculated in Table 3 to columns 3 and 4 in Table 4 for each crop you are going to grow. Keep in mind that you may have more than one fertilizer for each crop and growing area. Each fertilizer used for each crop should have its own row.
2. As you do this, enter the crop names in column

3. Add the growing areas for each crop from column 4 of Table 1 into column 2 of Table 4. Remember that each crop may appear more than once in the table.
4. Multiply the growing area by the fertilizer application rates to determine the total amounts of fertilizer needed for each crop. Enter this in column 5.

Table 5: Total Amount of the Fertilizers Needed.

1. Write each fertilizer that you need to purchase (from Table 4) into column 1 of Table 5. In this table, each fertilizer should only appear once.
2. Add up the total quantity of fertilizer needed (column 5 of Table 4) to get a total amount of fertilizer needed for each fertilizer you plan to use. If your operation is large enough that your growing areas are in acres and you completed tables 3 and 4 in lb/acres instead of oz/square feet, write the total in column 3. If you are working in ounces, write the total in column 2.
3. If you were working in pounds, you are finished and have the amount of fertilizer you need to purchase. If you are working in ounces, you still need to convert this quantity into pounds. Divide the values in column 2 by 16 to get the total pounds of fertilizer needed and write this value in column 3. This is the amount of each fertilizer you will need to purchase for the growing season.

References:

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Slaff, J and M. Drane-Maury. 2019. NOAA forecasts very large 'dead zone' for Gulf of Mexico. National Oceanic and Atmospheric Administration. Available at https://www.noaa.gov/media-release/noaa-forecasts-very-large-dead-zone-for-gulf-of-mexico

Vegetable Production Guide for Commercial Growers. ID-36. University of Kentucky Cooperative Extension Service.

Tables:

Table 1: Converting Growing Area into Square Feet for Each Crop

Crops	Growing Area (feet or row)	Distance between rows (feet)	Growing area

Table 2: Fertilizer Application Rate Recommendations

	Application recommendation (1b/acre)			Unit conversion rate	Nutrient requirement (oz per square feet)		
Crop	N	P	K		N	P	K

Table 3. Fertilizer Application Rates

Table 4: Amount of Fertilizers Needed

Crops	Growing Area (sq ft)	Fertilizer	Quantity to apply (oz/sq ft)	Total need (oz)

Table 5: Total Amount of Fertilizers Needed

Fertilizers to be used	Total amount needed (oz)	Total amount needed (lb)