

# MU Guide

## Steps in Fertilizing Garden Soil: Vegetables and Annual Flowers

Manjula Nathan, MU Soil Testing and Plant Diagnostic Service Laboratories,  
Division of Plant Sciences

### Step 1: Have soil tested

You can't look at the soil, or smell it, or feel it and tell whether it has 10 pounds or 100 pounds of available phosphorus per acre. But if you bring a sample of this soil to your local University Extension center or mail it to an MU soil testing laboratory, it can be tested to determine the level of available nutrients it contains.

Why is it so important to know how much phosphorus is in your soil? Because vegetables and flowers grow poorly where soils contain less than 60 pounds per acre.

Your soil test report also tells you the level of potassium, calcium, and magnesium in your garden, and provides the pH of the soil. In addition, it tells you the percent of organic matter, which is an indicator of the naturally available nitrogen that is released as the organic matter breaks down. This is about all you have to know to fertilize your garden soil properly.

To make it easy for you to interpret the soil test results, your report form will indicate how much fertilizer (nitrogen, phosphorus and potassium) and lime you should apply in carrying out Step 2.

#### How do you take a soil sample?

1. Take a spade and clean pail.
2. Push spade deep into soil.
3. Throw out a spade full of soil.
4. Cut a ½-inch to 1-inch slice of soil from the back of the hole with the spade. Be sure the slice goes 7 inches deep and is fairly even in width and thickness. Place this sample slice in the pail.
5. Repeat five or six times at different spots over your garden.
6. Thoroughly mix the six or seven slices you have in the pail.
7. After thoroughly mixing, take out about one pint of soil and mail it or, preferably, take it to your University Extension center or mail it to an MU soil testing lab.

#### How long will it take to get the results?

Results usually take from one to two weeks, depending on the mailing time and number of samples coming in to the soil testing lab.

#### When should the sample be taken?

Any time of the year — but if you can take your sample during October, November or December, you probably will get faster service than in the rush season, January through March. This also provides sufficient time to plan your fertilization schedule.

#### How often should your soil be tested?

Once every three years is sufficient if you follow Steps 3, 4, 5 and 6.

#### Is there a charge for this soil test?

Yes, a nominal fee covers costs of chemicals and a technician.

### Step 2: Establish basic fertility level

This just means putting fertilizer — the right kind and right amount — on your garden. Your soil test report will indicate the kind and amount to apply.

#### MU soil testing laboratories

##### Soil and Plant Testing Laboratory

University of Missouri (573) 882-0623  
23 Mumford Hall Fax: (573) 884-4288  
Columbia, MO 65211

##### Soil Testing Laboratory

University of Missouri (573) 379-5431  
Delta Research Center Fax: (573) 379-5875  
P.O. Box 160  
Portageville, MO 63873

Soil samples may also be submitted to any **County Extension center**.

For more information on sampling, testing and interpreting results, see <http://soilplantlab.missouri.edu/soil/>.

Remember that this basic application is a fertility-building process and will not be needed every year. After this level is established, it can be maintained by following Steps 3, 4 and 5.

The best method for making the basic application is to put on half the recommended fertilizer and plow or spade deeply, then apply the other half and disc or rake in lightly. This distributes the fertilizer throughout the upper 7 inches.

Important: Your soil test report may recommend “no basic application.” This means the fertility level of your garden is fine. If the report shows you have too much of an element, leave it out of fertilizer applications. Plowing just a little deeper for a year or two and sowing green manure crops also will help reduce the effects of those elements present at levels that are too high.

### Step 3: Apply maintenance fertilizer

You can skip this step if you are establishing the basic level this year. But each year thereafter, it is important that you apply maintenance fertilizer. It is usually applied in the spring before the soil is worked into a seedbed. It need not be worked deeply into the soil — the upper 3 to 5 inches will do. The purpose of this maintenance application is to replace the fertility you took off in the form of vegetables, flowers and crop residue the preceding year.

Again the question comes up: “How much of what kind of fertilizer should I use?” A mixed fertilizer is used for this maintenance application. A mixed fertilizer contains three elements: nitrogen, phosphorus, and potassium.

When you see a fertilizer bag with a combination of numbers such as 5-10-5, 12-12-12 or 6-24-24, you are dealing with mixed fertilizers. The first number tells how many pounds of nitrogen are in 100 pounds of the fertilizer. The middle number always refers to the pounds of phosphorus, and the last to the pounds of potassium per 100 pounds of the fertilizer.

Thus, for example, in every 100 pounds of a 5-10-5 fertilizer you buy, you get 5 pounds of nitrogen, 10 pounds of phosphorus, and 5 pounds of potassium.

The mixed fertilizers most commonly sold in Missouri are listed in Table 1. Check your bag of fertilizer and find the corresponding analysis in the table. The second column indicates the amount to use per 1,000 square feet of garden area. If the analysis on your bag is different from those listed, choose the analysis that is nearest to it, and use the rate indicated.

Table 1. Analysis and application of mixed fertilizers.

Mixed fertilizer analysis	Maintenance application: (pounds per 1,000 ft <sup>2</sup> )
<b>Bagged types</b>	
6-24-24	6
12-12-12	6
13-13-13	6
<b>Small package types</b>	
5-10-5	10
5-10-10	10
10-10-10	8

### Step 4: Use starter fertilizer

A starter fertilizer is a water-soluble fertilizer used in the transplant water.

Phosphorus is the most important element needed in getting your transplants off to a good start. Select a water-soluble fertilizer with a high phosphorus content in relation to the nitrogen and potassium.

The best and most commonly available water-soluble fertilizers are 10-52-17, 8-32-16, 12-24-12, 15-30-15, and 13-26-13. Use any of them at the rate of two level tablespoons per gallon of water. Apply one cup of this solution around the roots of your plant after you place it in the hole.

### Step 5: Side-dress with nitrogen

The major portion of the nitrogen your plants use comes from three sources: (1) the breakdown of organic matter, (2) the yearly maintenance application of fertilizer and (3) the nitrogen side-dressings. Leafy vegetables need earlier side-dressings of high nitrogen than fruiting vegetables. Many vegetable crops benefit from additional nitrogen after they have made considerable growth, started to flower, or set their first fruits. Too much nitrogen before this time will delay maturity and reduce flowering and yields.

Until the plant starts fruiting or makes considerable growth, the first two sources of nitrogen supply enough. But afterward, the demand of the plant for nitrogen often exceeds that supplied by the first two sources and a nitrogen side-dressing is needed. Because vegetable crops vary so greatly in amounts and times of application of nitrogen side-dressings, Table 2 was developed for handy reference.

Unlike vegetable crops, many modern flowering annuals have been developed to flower early and are less influenced by high nitrogen levels early in the season. Cool-season annuals, such as pansies, that are set out early in the season when soils are cool will benefit from early nitrogen side-dressings. Warm-season annuals should receive a high nitrogen side-dressing four to six weeks after they have been set out and if the season is rainy or frequent irrigation is applied. For annuals that grow throughout the summer, an addi-

**Table 2. Recommended nitrogen side-dressings.**

Crop	Pounds per 100 ft row <sup>1</sup>	
	Ammonium nitrate <sup>2</sup>	Time of application (Sprinkle the nitrogen fertilizer in the row middles and water in if rain is not likely.)
Annual flowers	1	Four to six weeks after planting.
Asparagus	2	Before growth begins in spring.
Cabbage, cauliflower, broccoli	1	Three weeks after field transplanting.
Cucumber, cantaloupe	1	1. One week after blossoming begins. 2. Three weeks later.
Onions (mature)	1	One to two weeks after bulb formation starts.
Peas and beans	1	After heavy bloom and set of pods.
Peppers, eggplants	1	After first fruit sets.
Potato	1.5	After tuber formation starts.
Spinach, kale, mustard and turnip greens	1	When plants are about one-third grown.
Sweet corn	1	1. When plants are 8–10 inches tall. 2. One week after tassels appear.
Sweet potatoes, watermelons	None	Excessive amounts of nitrogen will reduce yields or lower quality, or both.
Carrots, beets, turnips, parsnips and lettuce	None	Side-dressings of nitrogen not needed if soil is fertilized well before planting.
Tomato	1	1. One to two weeks before first tomato ripens. 2. Two weeks after picking first ripe tomato. 3. One month later

<sup>1</sup> A pint of ammonium nitrate (33% N) weighs approximately one pound.

<sup>2</sup> Other forms of nitrogen such as urea (45% N), calcium nitrate (15.5% N), and ammonium sulfate (21% N) may be used on an equivalent nitrogen basis.

tional side-dressing after another four to six weeks can stimulate late-summer growth and flowering. For an organic source of nitrogen, blood meal provides about 12 percent nitrogen in a fairly quickly available form for side-dressing. Always water well directly after applying fertilizer side-dressings to plants.

## Step 6: Maintain organic matter

Just as important as the chemical aspects of garden soil are its physical properties. Two major factors contribute to physical properties of your soil, type of soil, whether sandy or clay, and organic matter. You can't alter soil type much, but you can control organic matter.

Sandy soils and most soils in the southern part of the state should contain 2 to 3 percent organic matter. Clay-type soils and soils in northern Missouri should contain 3 to 4 percent. Annual applications of organic matter are required to reach and maintain these levels.

### Use and application

For farm gardens, use animal manures and green manures; for town gardens, use peatmoss, leafmold, compost and, if available, animal manures.

Peatmoss makes an excellent source of organic material for the small garden, but it is expensive to use on large gardens. Coarse types will provide the best soil conditioning.

To make a compost pile, gather all waste mate-

rial, such as grass clippings, leaves, and plant refuse, and place in layers 6 to 8 inches deep. The pile can be as long as desired but should not be more than 5 feet wide and 5 feet high. Add a little soil and a handful of fertilizer to each layer as you build it up. Keep the pile moist. It will be ready in 6 months to a year. See MU publication G 6956, *Making and Using Compost*, for specifics.

Animal manures are excellent. They should be well rotted, applied in the fall and plowed under. Weed seeds are the chief objection to using animal manures.

Peatmoss, compost or animal manure should be applied to the soil surface to a depth of about 2 inches, then worked in thoroughly.

Green manures are legumes or small grain crops that are plowed under while still in the green stage. Winter green manure crops include rye, wheat, barley and winter vetch. Summer green manure crops include Sudan grass, soybeans and cowpeas.

An excellent way to handle the organic matter problem on farms is to plant half of the garden to a winter green manure crop in September or early October, then put some well-rotted animal manure on the other half, fall plow it, and plant spring vegetables in this part. The following spring, turn under the green manure crop, and plant your summer vegetables. Rotate these areas each year. After turning under a green manure crop, always wait three weeks before planting.

