



# Garden Fertilization

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The best way to determine how much lime and fertilizer your garden needs is to have your soil tested. Soil tests also help prevent overfertilization, saving you money and protecting the environment.

For instructions on how to sample soils for testing, see A2166, *Sampling Lawn and Garden Soils*.

This publication discusses how to use such soil test results and how to apply the recommended fertilizers to your garden for best flower and vegetable production.

## Using the Soil Test Report

Once your soil is tested, you will receive a soil test report. The soil test report gives the amount of soil nutrients in the soil sample submitted that are available for plants to use and shows the amount of nutrients needed for good flower and vegetable production. The soil test report also will suggest a grade of fertilizer for you to use.

Each fertilizer grade consists of three numbers, such as 10-6-4. These numbers show the percentage of nitrogen (N), phosphate ( $P_2O_5$ ), and potash ( $K_2O$ ), respectively, contained in the mixture. Thus, a 50-lb bag of 10-6-4 contains 5 lb of nitrogen ( $50 \text{ lb} \times 10\% = 5 \text{ lb}$ ), 3 lb of phosphate ( $50 \text{ lb} \times 6\% = 3 \text{ lb}$ ), and 2 lb of potash ( $50 \text{ lb} \times 4\% = 2 \text{ lb}$ ).

If you cannot buy the specific grade of fertilizer recommended on the soil test report, you may substitute fertilizers having a similar ratio of nutrients. For example, use 5-10-5 or 5-9-7 in place of 10-20-10. However, apply twice as much of these grades because these materials are only half as concentrated as 10-20-10.

Very high or excessive levels of phosphorus (P) or potassium (K) occasionally build up in garden soils, primarily because of past use of commercial fertilizer, manure, or compost. When this occurs, the fertilizer recommendations on the soil test report show that you won't need a particular nutrient, but a mixed grade of fertilizer containing all three nutrients may still be suggested.

Thus, if the phosphorus test is very high, 0 lb of phosphate/100 ft<sup>2</sup> will be recommended, but a fertilizer grade containing phosphate, such as 10-5-10, will be suggested.

A fertilizer that does not contain phosphate would be preferable, but fertilizers such as 10-0-10 or 20-0-10 are not commercially available. Instead, use a complete mixed fertilizer that contains a low percentage of the nutrient that is high in your soil. For example, with a high phosphorus test, use 10-5-10, 20-5-10, or 25-5-5. With a high potassium test, use 10-6-4, 20-10-5, or 25-5-5.

Better still, you can apply nitrogen and phosphorus or nitrogen and potassium separately, omitting the high testing nutrient. If the phosphorus test

is high, apply the recommended amount of nitrogen as ammonium nitrate (33% N) or urea (45% N), and the potash as muriate of potash (60%  $K_2O$ ) or sulfate of potash (50%  $K_2O$ ). If the potassium test is high, apply the nitrogen as above and the phosphate as ordinary superphosphate (20%  $P_2O_5$ ) or triple superphosphate (46%  $P_2O_5$ ).

To determine the amount of these materials you need, simply divide the amount of nitrogen, phosphate, or potash recommended on the soil test report by the percentage in the material being added. If the report calls for 0.3 lb of potash/100 ft<sup>2</sup>, apply 0.5 lb of muriate of potash (60%  $K_2O$ ) ( $0.3 \text{ lb} \div 60\%$ ) or 0.6 lb of sulfate of potash (50%  $K_2O$ ) ( $0.3 \text{ lb} \div 50\%$ ).

If you don't have a scale for weighing fertilizer and lime, estimate the amount to apply by using a volume measure instead of weight. Approximate equivalent volume measures are listed in the following table for some of the common fertilizer materials and lime.

For example, suppose the recommendation calls for 3 lb of ammonium nitrate (33-0-0). Since 1 lb of 33-0-0 equals 1.33 pt, it follows that 3 lb equals 1.33 times 3, which is 4 pints ( $3 \times 1.33 = 3.99$ ).

### Approximate volume measures for fertilizer

Material	Weight (lb)	Volume <sup>a</sup> (pt)
Most mixed fertilizers (10-6-4, 10-10-20, 20-10-10, etc.), Ammonium sulfate (21-0-0), Muriate of potash (0-0-60), Superphosphates (0-20-0 and 0-46-0)	1	1
Activated sewage sludge, Processed manure, Urea-formaldehyde (38-0-0), Urea (45-0-0), Ammonium nitrate (33-0-0)	1	1.33
Sulfate of potash (0-0-50), Ground (dolomitic) limestone	1	0.75

<sup>a</sup>For smaller quantities, 1 pt = 2 level cups = 32 level tablespoons = 96 level teaspoons.

## Organic Fertilizers

Many organic materials can be used to supply plant nutrients in home gardens. These materials also improve soil structure (tilth) and moisture. For a list of organic amendments and their composition, see A2305, *Organic Soil Conditioners*.

## Lime

Your soil test report will tell you if and how much lime is needed. Few urban soils in southern Wisconsin need lime because the water used in watering contains lime. A soil pH of 6.2-7.0 is ideal for most gardens. High soil pH reduces the availability of phosphorus, boron, iron, manganese, and zinc.

## Applying Commercial Fertilizers

**Before Planting.** *Broadcasting* is the most practical way to apply fertilizer and the only effective way to apply limestone. Spread the material uniformly over the soil and work it into the upper 4-6 inches.

When applying large amounts of fertilizer (more than 2 lb/100 ft<sup>2</sup>), split the application. Apply about two-thirds before spading or plowing and work the remaining one-third into the upper few inches of soil after soil preparation.

When applying smaller amounts of fertilizer (less than 2 lb/100 ft<sup>2</sup>), broadcast about three-fourths of the fertilizer after the soil has been prepared and work it lightly into the soil. Apply the rest at planting time in a band alongside the row, as discussed below.

**At Planting.** Use *band placement* to get vegetable plants off to a good start. Place fertilizer in a narrow furrow or band 2-3 inches from the seed row and 2-3 inches deep. Fertilize widely spaced plants—such as tomatoes, cucumbers, squash, and melons—by circular band placement.

In vegetable gardens needing only small amounts of fertilizer, you can apply all the fertilizer in bands. To fertilize a single row or plant, multiply the length of the row or distance between plants by the width between the rows or plants to obtain area, and then fertilize accordingly.

For transplants such as tomato and cabbage, add a small amount of soluble fertilizer to transplant water to help plant recovery and increase yield. Select soluble complete fertilizers that contain a high proportion of phosphate and follow package label directions carefully.

Most commercial fertilizers have a high soluble salt content that can damage seeds and plants. This is known as salt injury or "fertilizer burn". Thus, it is important to follow label directions on fertilizer packages and place all fertilizer bands away from seeds and roots.

**During the Growing Season.** Usually, your garden will need a mid-season application of nitrogen for normal growth—especially on sandy soils and/or during rainy years.

## Vegetables

Most vegetables need about 0.25 lb (2/3 cup) of ammonium nitrate (33-0-0), 0.20 lb (1/2 cup) of urea (45-0-0), or 0.38 lb (3/4 cup) of ammonium sulfate (21-0-0)/100 ft<sup>2</sup>. Apply in a relatively wide band at least 3-4 inches from the vegetable row. If nitrogen fertilizers are not readily available, substitute a complete fertilizer high in nitrogen, such as 20-10-10 or 25-5-5, at 0.38 lb (3/4 cup)/100 ft<sup>2</sup>. Apply additional nitrogen after the plants are half-grown (leafy crops, greens, tomatoes, sweet corn, cucumbers). Too much nitrogen will cause excessive growth but little tuber or fruit production.

## Annual Flowers

On annual flower beds, use the fertilizer grade and rate suggested on the soil test report to ensure good growth and many flowers. Spray the plants with a fine mist of water to remove fertilizer from leaves, which can cause foliage burn.

## Established Flower Plantings

Apply half the rate of recommended fertilizer to most perennial flower beds each spring when growth begins. This application will stimulate plant growth and bloom. Repeat the above treatment in late June or early July. Broadcast the fertilizer over the area, but keep the material away from bulbs, stems, and 2-4 inches from perennial crowns.

Spring-flowering bulbs—such as tulips, hyacinths, daffodils, narcissi, and crocuses—should be fertilized in spring when the plants are above ground. If foliage is pale-green and undersized after flowering, apply additional fertilizer.

Special rose fertilizers are available. Many of these are excellent but may cost more than a standard fertilizer grade which will work just as well. Apply one-third of the suggested rate and grade of fertilizer about mid-May, in mid-June before or just at flowering, and again about mid-July. Broadcast the fertilizer in a circular area about 6-8 inches from the plant crown.

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