



FERTILIZING GUIDELINES

Soil Testing

Soil tests provide the best way to determine lime and fertilizer requirements. The University of Massachusetts Soil Test Lab (<http://www.umass.edu/soiltest/>) will provide a soil test and recommendation for a small fee; the website provides information on the various fees and the procedure for taking and sending a soil sample. Until you become familiar with your soil, have it tested once a year. Your soil test will include recommendations for fertilizers such as 5-10-5 or 5-10-10, which will be expressed as pounds per specified soil area such as 100 or 1000 square feet. These three numbers refer to the percentages of the macronutrients that the fertilizers contain. 5-10-5, for example, contains the equivalent of 5% nitrogen (N), 10% phosphorus (P₂O₅, known as phosphoric acid) and 5% potassium (K₂O, known as potash). The N-P-K ratio is the analysis reduced to its simplest terms. For example, 5-10-10 has a ratio of 1-2-2.

pH

One of the most important aspects of nutrient management is maintaining proper soil pH, which is a measure of soil acidity. A soil test will also provide the pH and recommend whether or not the pH should be changed. Soil pH is measured on a scale of 0 to 14. A pH of 7.0 is neutral. A pH below 7.0 indicates acidity and a pH greater than 7.0 indicates alkalinity. Most soils in Massachusetts are naturally acid and need to be limed periodically to maintain the proper pH for optimum growth of most crops. Limestone is used to raise the pH and sulfur is used to lower the pH. Lime reacts most rapidly if it is thoroughly incorporated in fairly dry soil to achieve contact with soil particles.

Soluble Synthetic Fertilizers

Synthetic fertilizers are available in many forms such as granular, dry, liquid and controlled-release pellets. Controlled-release pellets provide nutrition for several weeks. Release of the nutrients is regulated by temperature - the warmer the temperature, the faster nutrients are released.

Fertilizer can be purchased as "single ingredient" fertilizers, such as ammonium nitrate and urea for nitrogen, triple super phosphate for phosphorus or muriate of potash for potassium. Combination fertilizers such as 10-10-10 or 5-10-10 include all three nutrients and are easiest for home gardeners to use.

ORGANIC FERTILIZATION

Organic Matter

The organic approach to fertilization involves feeding the soil, rather than just feeding the plant. Soil organic matter is an important component of soils. Dead plant tissue (leaves, stems, etc.) or insect and animal refuse is gradually decomposed by soil organisms and are sources of organic matter. Organic matter is continuously being produced by plants and animals and broken down by soil microbes that use it as a source of energy. As microbes break down organic matter, nutrients are released which are then available for plant growth. Soil microbes are most active in warm soils (over 70°F) that are moist, but well aerated, with a pH between 6 and 7. Organic matter also improves soil structure. It binds soil particles together and allows for good drainage,

aeration, moisture holding capacity and root growth. Organic matter management is an essential part of organic gardening.

Use of finished composts and rotted or composted animal manures are effective ways to add organic matter to soil. Finished compost should resemble soil and have no recognizable bits of the original ingredients. Animal manure is an excellent source of nutrients and organic matter and can be mixed with other materials for composting. Organic materials which have not broken down sufficiently (fresh manures, manures with lots of wood shaving, fresh leaf piles, etc.) should be turned into the garden in the fall or a few weeks before planting or applied only in small quantities. An alternative method is to set them aside for the season, allowing them to decompose. Fresh manures can 'burn' plants; woody materials (wood chips, sawdust, leaf piles, etc.) can cause a temporary nitrogen deficiency until they are sufficiently decomposed. Note that cat and dog waste are not recommended due to the danger of spreading disease.

The nutrient content of manures and compost varies depending on a number of factors including the source, moisture content, handling and storage. Finished compost provides some nutrient value, having an analysis of about 1-1-1 (N - P₂O₅ - K₂O

Compost and manure are sold in bulk using the measurement cubic yard. A box measuring 3' by 3' by 3' contains a cubic yard or about four wheelbarrows equals a yard. If a project calls for 3 inches of compost per square foot of surface area, then a yard of compost would cover an area of 10 feet by 10 feet.

Organic Fertilizers

Composts and manures provide some nutrient value but should be supplemented with other organic fertilizers. The following lists organic sources of fertilizer and their availability to plants.

Nitrogen: Alfalfa pellets (slow availability), dried blood (medium-rapid availability), cottonseed meal (slow-medium availability), fish emulsion (rapid availability) and soybean meal (slow-medium availability).

Phosphorus: Rock phosphate (slow availability) and bone meal (slow availability).

Potassium: Wood ash (rapid availability), alfalfa pellets (slow availability), cocoa shells (slow availability) granite dust (very slow availability) and green sand (very slow availability).

Organic sources with slow or very slow availability are not soluble or effective for short-term availability and are best used for building soil reserves over the long term.

Natural fertilizers can be purchased as "single ingredient" fertilizers such as dried blood, bone meal or green sand or complete fertilizer such as 4-6-6 or 5-3-3 with a combination of organic sources of macronutrients in one bag. There are dry forms of organic fertilizer such as dried blood and liquid forms such as seaweed and fish emulsion. Natural fertilizers release nutrients slowly and some very, very slowly over a period of time. Only a portion of the total nutrient content is immediately available for plant use. This means that in a garden with low initial fertility, more fertilizer will need to be added than is immediately required by the plants.

FERTILIZATION GUIDELINES

Natural fertilizers vary in their analysis. For this reason it is advised to followed fertilizer recommendations provided on the fertilizer bag/container by the manufacturer or provided by the soil test laboratory as a result of a soil test.

GUIDELINES FOR VEGETABLES AND FLOWERS

In a small garden, a good all-purpose ratio for vegetables is 1-2-1. To meet specific needs, the following ratios can be used:

Leafy crops 1-1-1

Tuber and root crops 1-2-2

Fruiting crops 1-2-1

Organic Fertilization - There is a continual loss of organic matter from garden soil, due to harvesting of crops and oxidation. Therefore, organic matter will need to be added to the garden every year to maintain good soil structure. Gardeners depending on natural fertilizers must add at least one pound of composted organic matter per square foot of soil every year. (1 full bushel of compost or manure will weigh about 40 lbs.)

Gardeners using natural fertilizers correctly will find that each year their soil will be noticeably improved. Regular soil tests will reflect a rise in overall fertility in the soil, and after a few years the quantity of concentrated fertilizer required annually will decrease. However, the need for organic matter will not decrease and a dependable source of organic matter is recommended.

The natural fertilizers should be worked into the top four inches of the soil each year in early spring prior to planting. If large quantities of compost or manure are difficult to obtain, try using a combination of organic and synthetic fertilizers.

Synthetic Fertilization

Prior to planting: Liquid or dry fertilizer is normally applied at the time of seeding or transplanting. Dry fertilizer is best placed 2"-3" below and 2"-3" to the side of the seed.

Or, broadcast 20 pounds of 5-10-5, 5-10-10 or 10 pounds 10-10-10 per 1000 square feet. Lime can be applied at the same time. Rake into the top few inches of soil.

Sidedress: During the growing season, apply up to 20 pounds of 5-10-10 or 5-10-5 per 1000 square feet or band 8 ounces for every 10 feet of row or use half as much 10-10-10.

Flowering Bulbs

Prior to planting: Broadcast 2 pounds 5-10-10 or 1 pound 10-10-10 per 100 square feet.

Sidedress: As plants flower, apply 2 pounds 5-10-10 or 1 pound 10-10-10 and 2 pounds of bonemeal per 100 square feet.

Perennial Flowers

Early spring: Broadcast 2 pounds 5-10-5 or 5-10-10 or 1 pound 10-10-10 per 100 square feet.

The majority of perennials are not traditionally heavy feeders. High nitrogen often causes lush foliage, fewer flowers and weak stems. If, at planting time you added organic matter and fertilizer, sufficient nutrients have been provided for the first year.

Begin a fertilizing program the second year. There are some perennials that are heavy feeders. Astilbe, mums, delphiniums and tall garden phlox all benefit from annual applications of fertilizer. If plants are not as vigorous and their foliage is light or yellow-green, applying a nitrogen-based fertilizer will be beneficial.

Groundcovers

Early spring: Broadcast 2 pounds 5-10-5 or 5-10-10 or 1 pound 10-10-10 per 100 square feet when the foliage is dry. Use a broom to shake off any fertilizer adhering to the leaves to prevent burning the foliage.

SMALL FRUITS

Strawberries

Prior to planting: Two to five bushels aged manure or compost and 2 pounds 10-10-10 or equivalent per 100 square feet.

After planting: One to two pounds 10-10-10 per 100 square feet 4-6 weeks after planting and again in late August.

Fruiting Year: Do not apply fertilizer in the spring of the fruiting year as it results in large, soft berries.

Prior to mowing the foliage at time of renovation: Four pounds 10-10-10 per 100 square feet over the rows when plants are dry. Use a broom to shake off any fertilizer adhering to the leaves to prevent burning the foliage.

Grapes

Prior to planting: Two to five bushels aged manure or compost per 100 square feet.

After planting: Synthetic fertilizers are generally not necessary the year vines have been planted. If newly planted vines are growing poorly, 4-6 ounces 5-10-10 may be applied.

Bearing vines: Apply fertilizer each year, before buds begin to swell. Double the rate listed above until plants reach maturity. Three to four pounds of 5-10-10 (or equivalent) per vine, per year, is recommended for mature vines. If there is too much vine growth, reduce the amount of nitrogen you apply the following season.

Raspberries

Prior to planting: One pound 5-10-5 or 5-10-10 or one-half pound 10-10-10 per 100 square feet.

Following years: Six to eight pounds 5-10-5 or 5-10-10 or three to four pounds 10-10-10 per 25 feet of row. Hand broadcast between rows as early as possible in spring.

Blueberries

Most garden soils must be modified before planting blueberries. Blueberries grow best in soils that are well-aerated, high in organic matter, and acidic (below pH 5.5). Before planting blueberries, a soil test is essential to determine pH and soil nutrient levels. **Never** add lime to soils where you are going to grow blueberries.

Four weeks after planting: One-half to one ounce 10-10-10 or equivalent in a band around the base of the plant.

Following years: Apply fertilizer each year when growth starts or blossoms appear. Increase rate of fertilizer by one to two ounces (10-10-10) per year until mature. Mature blueberry bushes (7 years or older) require one-half pound of 10-10-10 per year applied in April. In addition (beginning 3 years after plants are set) apply ammonium sulfate at the following rates:

Yrs. After Plants are set	Oz. Ammonium Sulfate per plant
3	1.5
4	2
5	3
6	3.5
7+	4

TREE FRUITS

The amounts suggested below apply to young trees. Ten to fifteen pounds of 5-10-5 or 5-10-10 or five to eight pounds of 10-10-10 is sufficient for mature plum, cherry, and standard and semi-dwarf apple trees. Half of those amounts is sufficient for pear and dwarf apple trees. Mature peach trees should not require more than fifteen to twenty pounds of 5-10-15 or 5-10-10 or seven to ten pounds of 10-10-10.

Pounds of Fertilizer/Year of Tree age

<u>Type of tree</u>	<u>5-10-5 or 5-10-10</u>	<u>10-10-10</u>
Plum, Cherry, Standard and Semi-dwarf Apple	1	½
Dwarf Apple, Pear	½	¼
Peach	2	1

Do not fertilize at time of planting. After growth starts the year of planting, scatter fertilizer in a circle starting near the trunk (but not touching) and extending half way to the drip line. After the first year, fertilize trees annually sometime between mid April and early May. For peaches, the fertilizer can be split into two applications, one in April and a second one in late May.

Where mulches of hay or lawn clippings are used, the amount of fertilizer may be decreased after the mulch starts to decay. Where sawdust is used for mulch, the amount of fertilizer will probably need to be doubled because soil bacteria rob nitrogen from plants to break down the sawdust.

Apple and pear trees are susceptible to boron deficiency which causes premature ripening of fruit and localized spots in the flesh of the fruit. Application of boron will prevent the occurrence of this deficiency in apple and pear trees. The rate of application per tree will vary with tree size. For standard trees, apply 4 ounces of borax (11.1 percent actual boron) or its equivalent per year; for semi-dwarf trees, apply 2 ounces annually; and for dwarf trees, apply 0.5 ounce annually. **Be sure to note the percent of actual boron in the fertilizer being used to supply this element because applying an excessive amount of boron can cause tree injury.** Boron fertilizers vary from approximately 11 to 21 percent actual boron. Apply the borax at the same time and the same way as other fertilizers used under fruit trees. Fruit trees mulched with lawn clippings and/or hay probably will not require any fertilizer except boron. CAUTIONS: Do not apply more than the suggested amounts of borax since too much boron is toxic to trees. Do not fertilize fruit trees in the fall because it may cause winter injury. If the amount of new growth on apple, pear, cherry, or plum trees exceed 2 feet, reduce or eliminate nitrogen from the fertilizer program.

ORNAMENTAL TREES AND SHRUBS

Newly planted Ornamental Trees and Shrubs. Preplant incorporation of phosphorous and potassium into soils should be based on soil test results. Incorporate so that they will be in the root zone when woody plants are planted. Any nitrogen applied as a preplant should be a slow-release or organic form.

Types of Fertilizers. High nitrogen fertilizers such as 18-6-12 or 24-6-12 are best, although garden fertilizers such as 10-10-10 will do as a substitute. Compost, well-rotted manures and cotton-seed meal are also good materials to use. The important point is to use a complete fertilizer containing nitrogen, phosphorus, and potassium. Because trees are not fertilized frequently, it is recommended that one-half to two-thirds of the nitrogen be in an organic or other slow release form.

When to Fertilize and How Often. Fertilizers are best applied in late August through September. Root absorption of nutrients is very efficient in late summer and remains so until soil temperatures approach freezing. Nitrogen that is absorbed in fall will be stored and used to support the spring flush of growth. The next best time to fertilize woody plants is early spring prior to the initiation of new growth. Generally it is safe to fertilize every 2 or 3 years.

Trees

Needle-type Evergreens: One pound 10-10-10 or equivalent per inch of trunk diameter (at 4 feet above ground). If the tree is over 6 inches in diameter, use 2 pounds per inch.

Non-Evergreen: Two pounds 10-10-10 or equivalent per inch of trunk diameter (at 4 feet over ground). If tree is over 6 inches in diameter, use 4 pounds per inch.

Flowering trees: One-half pound 10-10-10 per inch of trunk diameter (at 4 feet above ground).

Methods of Application

Surface Application: Recommended for trees with a 4-inch or less trunk diameter (at 4 feet above ground) or to trees where there are no other plants, including grass, growing under the tree. Where appropriate, spread recommended fertilizer uniformly on the surface under the branches. If grass or other plants are growing under the tree, it may be necessary to apply the fertilizer in 2 or 3 applications with thorough watering after each application.

Drill Hole Application: The drill hole method should be used where high fertilizer rates have the potential to burn turf or ground covers. Also, phosphate does not move downward in soil. Therefore, sub-surface placement of fertilizer using drill hole application is recommended. Use an auger, crowbar, or soil sampling tube to drill holes into the soil over tree roots. Holes should be 1-1 ½ inches in diameter, 8 to 12 inches deep and spaced 2 to 3 feet apart arranged in concentric circles beginning about 1/3 the distance from the trunk to the drip line and extending 1 to 3 feet beyond the drip line (spread of the branches). Distribute fertilizer uniformly among the holes using a funnel. The holes may be left open or filled with compost, peat or other organic material.

Fertilizer Spikes/Stakes: Pre-measured fertilizer spikes are placed in holes in the soil around woody plants. Wide spacing of holes and slow lateral distribution of nutrients limit the effectiveness of this technique and is not recommended.

Shrubs

Fertilizers should be broadcast on the soil surface over the roots and watered in, between mid April and mid May.

Individual Specimen Shrubs: One-half to one pound 10-10-10 or equivalent per plant.

Groups of Shrubs: Two to four pounds 10-10-10 or equivalent per 100 square feet.

Hedges: Four pounds 10-10-10 or equivalent per 100 linear feet; one-half of the amount along each side of the hedge.

Broadleaf Evergreens: Two to four pounds 10-10-10 per 100 square feet. The amount may be split into two applications, one in early spring and the second after flowering. Organic fertilizers such as cottonseed meal, which contains nitrogen in an organic form, is satisfactory for fertilizing acid loving broadleaf evergreens. Apply organic fertilizers at a rate of 4-5 pounds per 100 square feet.

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