MARYLAND COOPERATIVE EXTENSION
UNIVERSITY OF MARYLAND
COLLEGE PARK•EASTERN SHORE

HOME & GARDEN

HOME AND GARDEN INFORMATION CENTER • 12005 HOMEWOOD ROAD • ELLICOTT CITY, MD 21042 • 1-800-342-2507

**Home and Garden Mimeo #42**

# Soil Amendments and Fertilizers

## Fertilizing Guidelines Included by Plant Group

Fertilizers and soil amendments are a wide array of materials added to soils to improve plant growth. They can be organic, such as bone meal, or inorganic, such as 10-10-10 fertilizer. Some must be purchased, while others are free for the taking from your landscape. Many are dual purpose—they serve as both fertilizers and soil amendments.

**Fertilizers** are primarily valued for their ability to supply nutrients. Plants use these nutrients to make components for plant growth such as proteins and carbohydrates.

**Soil amendments** are mixed into topsoil to promote healthy plant growth in a number of ways. For example, they may moderate the pH of soil or supply nutrients.

In addition to nutrition, fertile soils must provide a conducive structure for root growth, water retention, and air exchange. **Soil conditioners**, like composted horse manure, improve **soil structure** by binding soil particles into larger aggregates. This increases the amount of pore space and enhances air exchange, water movement, and root growth.

***Feed The Soil First!***

*The surest way to improve plant growth is the regular incorporation of organic matter such as composted yard waste. Organic matter improves soil structure, slowly releases nutrients, and increases beneficial microbial activity.*

From the many "homegrown" and retail products available, the wise gardener selects those that most closely address a need while providing the best value for the money.

**Words that appear in *italics* are trade names. Listed products are only examples and are not endorsments.**
**Read All Product Label Instructions Before You Open the Bag!**
***Materials with an (*) are considered acceptable by organic gardeners.**

***Caution!!*** *Wear gloves and a dust mask when handling caustic or finely powdered materials. These include hydrated and burnt lime, perlite, vermiculite, and peat moss. Take similar precautions with bonemeal, fresh manure, and mulch.*

### FERTILIZERS

The main chemicals that must be supplied to plants are called **primary nutrients**. Those required in the greatest amounts are nitrogen (N), phosphorus (P), and potassium (K). Most retail fertilizers are labeled with a three number analysis corresponding to N, P, and K. It tells what percentage of the net weight is actually composed of these three nutrients. A fertilizer containing all three nutrients is a **balanced fertilizer.** Some common N-P-K analyses of inorganic, granular fertilizers are 10-6-4, 5-10-5, and 10-10-10. A 50-lb. bag of 10-6-4 fertilizer will contain 5 lb. of nitrogen (N), 3 lb. of phosphate ($P_2O_5$), and 2 lb. of potash ($K_2O$). (Phosphate and potash are merely the available forms of phosphorus and potassium respectively.)

Plants also require the **secondary nutrients,** calcium, magnesium, and sulfur, plus very small amounts of the **micronutrients** boron, copper, chlorine, iron, manganese, molybdenum, and zinc. These latter, plus a few others, are referred to as **trace elements**.

***Contributions of primary nutrients to plant health:***

- *Nitrogen (N)- strong leaf growth, dark green color.*
- *Phosphorous (P)- roots, early plant growth, seed formation.*
- *Potassium (K)- plant vigor, disease and stress resistance, flavor and color enhancement.*

I**norganic** or **"chemical" fertilizers** are typically less expensive (per pound of nutrient) and more readily available for plant growth than **organic fertilizers**. However, the latter have the advantage of supplying other nutrients in addition to N-P-K (releasing nutrients slowly over the growing season), and often double as soil conditioners.

Some fertilizers can be absorbed immediately upon application. These are known as **quick release** or **highly soluble fertilizers**. They are useful when rapid results are required. They come in liquid or powder form and are applied to root zones or sprayed directly on foliage.

To reduce maintenance and cut down on laborious re-applications of fertilizer, **slow release fertilizers**, such as Osmocote and sulfur-coated urea, make nutrients available in small amounts over an extended period. Fertilizer stakes or tablets placed in root zone soil are also slow release formulations. However, salt accumulation resulting in root burn, can occur immediately adjacent to these products.

Fertilizers often target specific plant needs. For instance, **starter fertilizers** specially formulated for seedlings and transplants, are high in phosphorus to foster root establishment.

## FERTILIZERS

**Alfalfa meal***: typically 3-5% organic nitrogen (3-1-2). May contain ethoxyquin, a preservative, to keep it green.

**Ammonium nitrate**: granular fertilizer with 33% N (half ammonium nitrogen and half nitrate nitrogen). Mix into soil to prevent nitrogen dissipation into air. Will absorb moisture and harden if the bag is left open. (If this happens, break up the hardened pieces with a hammer. It doesn't "go bad.") Plant "burn" may result from direct contact with roots or leaves.

**Ammonium sulfate**: a dry fertilizer which is 21% N, plus sulfur. Very acidic, especially suitable for blueberries and azaleas, which require the ammonium form of nitrogen. Mix into soil to prevent loss of nitrogen to atmosphere.

**Blood meal***: readily available nitrogen, typically 10-12%. Lasts about 2 months. May help repel deer and rabbits when top-dressed around plants.

**Bone meal***: steamed ground bone high in phosphate. Sample analysis (1-11-0) or (5-12-0). Especially good for bulbs and root crops. Contains 15-22% calcium , plus trace elements. Lasts 6 to 12 months.

**Boron***: micronutrient. Can be toxic to plants if applied in excess. Often applied by fruit growers to prevent fruit pitting and rot disorders. Deficiencies are most likely to occur on sandy soils. Incorporate 6-7 tablespoons of Borax per 1,000 sq. ft. of vegetable garden area each spring where soils are sandy.

**Chelated iron***: Chelated iron is applied to the folliage of plants suffering from iron chlorosis. Chelate means "claw" in Greek. Chelated elements are combined with compounds that hold them in solution, making them available for plant uptake through roots or leaves.

**Compost or Manure tea***: ordinarily homemade from "steeping" compost or well-aged manure in a bucket of water for 1-3 days, then straining and applying the brew to plants (5 parts water to 1 part compost by volume). Good method for applying soluble nutrients directly to foliage or roots during the early part of the growing season when nutrients from soil organic matter are not readily available.

**Foliar fertilizers** are applied directly to the upper and lower leaf surfaces. Plants take up nutrients more efficiently through leaves than through roots. Foliar feeding is recommended to aid in the root growth and establishment of seedlings and transplants.*Mix granular fertilizers into the top 4-6 inches of soil, then water the area well.*

**Corn gluten***: a natural pre-emergent herbicide. Apply in spring as a top-dressing to help control crabgrass and some weed species. It adds some organic matter and nutrients to the soil (a 10-1-1 analysis).

**Cottonseed meal***: a slow release fertilizer high in nitrogen, that also adds organic matter. Sample analyses are (6-4-1.5) and (6-2-1). Lasts 6 months to 1 year.

**Epsom salts***: magnesium sulfate, a highly soluble form of magnesium and sulfur. Can be used as a foliar spray for speedier results. Makes melons sweeter. When adding it to a planting hole you should counter-balance the magnesium by adding an equal amount of calcitic lime.

**Feathermeal***: a high nitrogen byproduct of the poultry industry. Sample analysis (12-0-0). Usually encountered as a component of an organic fertilizer mix.

***fertileGro*™***: a Maryland product made from poultry litter that is dried and pelletized. 4-3-3 general purpose organic fertilizer that can be applied with a spreader.

**Fish products***: formulations range from fish powder (usual analysis 9-1-1), emulsion, and foliar sprays, to fishmeal with a slow 6-9 month release. Contains many valuable micronutrients. May have strong fishy smell.

**Greensand***: a naturally occurring iron-potassium silicate (also called glauconite) with the ability to absorb 10 times more moisture than ordinary sand. It contains marine potash, silica, iron, magnesium, and lime, plus up to 30 other trace minerals. Dual ability to bind sandy soils and loosen clay soils. Potassium (5-7 %) released very slowly over 4 to 5 years. Slightly acidic.

**Guano***: decomposed manure, usually of bat or seabird origin, was the first commercial fertilizer sold in the U.S. Desert bat guano escapes leaching in caves, preserving its nutrients. Seabird guano recycles marine trace elements. Valued for fast release and high N analysis (10-3-1). Suggested use is as a potting soil additive.

***Holly-Tone*, *Bulb-Tone*, etc.**: mixtures of organics (animal tankage, crabmeal, kelp, and greensand) and inorganics (sulfate of potash, ammonium sulfate) that target specific plant groups. All contain 11-12 micronutrients.

*Mix granular fertilizers into the top 4-6 inches of soil, then water the area well.*

**Humates***: a mined ancient organic soil. Unlike peat, humates are thoroughly decayed or mineralized, so nutrients are available to plants. Contains up to 35% humic acids that dissolve other nutrients for plant utilization. Manures and yard waste compost also contain humic acids.

**Kelp products***: made from seaweed; contain dissolved ocean minerals. Dried kelp will usually contain 1.6 to 3.3% nitrogen, 1 to 2 % $P_2 0_5$ and 15% to 20% $K_2 0$. Also valued as a growth stimulant because of rich concentrations of trace minerals (over 60), amino acids, vitamins, and growth hormones, including cytokinins, auxins and gibberellins. Available in meal, powder, and liquid forms. Very good on seedlings and transplants.

**Manure**: (purchased) these products carry an NPK fertilizer analysis on their label and will also improve soil structure.

- **Cow or Steer (dehydrated)*—** manure exposed to 180°F, dried to 17% moisture, and ground into a fine, soil-like texture. Nutrients are more concentrated and the soluble salt level is probably higher in dehydrated manure than in locally available farm manure.
- ***Cockadoodle Doo****— (4-2-2) layer hen manure that has been dehydreated.
- **Cricket***— manure of crickets raised for bait (4-3-2). Because high salts may burn roots, add sparingly to potted plants.
- ***fertileGro*™ ***— a Maryland product made from poultry litter that is dried and pelletized. 4-3-3 general purpose organic fertilizer that can be applied with a spreader.

***Milorganite***. A composted sewer sludge that has been heat dried and therefore has a higher N-P-K (5-2-5). Labeled for use in vegetable gardens in Maryland. Anecdotal evidence suggests composted sewer sludge repels rabbits, deer, voles, and squirrels when used as a top-dressing.

***Miracid***: high-solubility fertilizer (30-10-10) with chelated iron to combat chlorosis in acid-loving plants. Over-use may drop the pH too low.

***Miracle-Gro***: highly soluble fertilizer . Dissolve in water. Used as a foliar spray or applied directly to soil. Ammonium phosphate and urea sources of N. Contains six important micronutrients.

***Osmocote***: resin coated, slow release fertilizer (up to 4 month release outdoors). Many different analyses are available. Popular in the nursery and greenhouse industries.

**Rock products**: a wide variety. Be aware that touted "immediately available" nutrients may refer to only a small percentage of the whole, while the rest will be released slowly. Not considered organic if treated with a chemical to increase nutrient solubility. A selection of those available follows:

- **Azomite or rock dust***— an aluminum silicate clay mixed with over 50 minerals, from marine deposits (2.5% potassium).
- **Black rock phosphate***— about 30% phosphate rock with calcium oxide, silicas, and trace minerals. Only 3% of phosphate immediately available. Slow release builds longer reserve than colloidal phosphate. Best in slightly acid soils.
- **Soft rock or colloidal phosphate***— phosphate clay with 18-22% phosphate, 27% calcium oxide, silicas, and 14 trace minerals. 2% phosphate immediately available, the rest slow-release over 3-5 years. Half the liming value of ground lime.
- **Superphosphate** (0-20-0) **and triple superphosphate** (0-45-0)—Phosphate rock treated with acid to make the phosphorus more soluble.

**Seaweed products:** See: "Kelp products"

***Stop Rot****: a liquid formulation of calcium carbonate ($CaCO_2$) used to prevent blossom-end rot in vegetable crops. Plants take up foliar sprays very efficiently.

## SOIL CONDITIONERS

Most garden and landscape plants perform best in soils high in organic matter (greater than 3% organic matter, by weight, in the topsoil). These soils are loose, easy to work and have a large number of earthworms. Organic matter is continuously

***Blossom-end rot*** *of tomatoes is caused by a lack of calcium in the developing fruit. Prevent it by adding a small handful of finely ground limestone to each planting hole prior to transplanting. Water plants regularly and deeply and keep them mulched. Be aware that excessive nitrogen levels block calcium uptake.*

***Sul-Po-Mag****: sulfate of potash magnesia from the mineral langbeinite, with about 22% sulfur, 22% potash and 18% magnesium oxide. Readily soluble.

**Urea**: rapid nitrogen release (46-0-0) with a high "burn potential" which should be handled and used with care. Must be mixed into the soil to prevent conversion to ammonia and subsequent escape into the air. **Sulfur-coated urea** is a slow release formulation.

**Wood ashes***: analyses run from 1 to 2% phosphorus and from 4 to 10% potassium. Hardwood ashes are 45% carbonate equivalent and are half as effective as lime for raising soil pH. Softwood ashes are less effective than hardwood. Ashes are too fine to improve soil structure. The recommended yearly application rate is 25-50 lbs./1,000 sq. ft. At higher rates, test soil pH yearly.

**Worm castings***: the rich digested "soil" produced by redworm farming. No guaranteed, listed analysis due to the great variability in feedstock, storage, and handling. Concentrated source of Ca, Mg, N, P and K, in readily available form. Used for container plants, indoors and out. Use 1 to 2 cubic feet per 100 square feet of garden area. Castings can be purchased through catalogs or produced at home in redworm bins.

**SOIL CONDITIONERS**

Most garden and landscape plants perform best in soils high in organic matter (greater than 3% organic matter, by weight, in the topsoil). These soils are loose, easy to work and have a large number of earthworms. Organic matter is continuously used up through oxidation, downward movement through the soil profile, and plant growth. It should be replenished each year in cultivated flower and vegetable beds.

***Coverage***

*3 cubic feet of organic matter will cover 36 sq. ft. to a depth of 1 inch.*

*Useful conversions:*
*7.5 gallons = 1 cu. ft.*
*1 cu. ft. = 1.25 bushels*
*27 cu. ft. = 1 cu. yd.*

**Compost (commercial or "home-grown")**: made from decayed organic materials such as straw, corn cobs, food wastes, cocoa bean hulls, poultry litter, grass clippings, leaves, manure. Composts improve soil structure and slowly release nutrients to plant roots.

**Gypsum***: calcium sulfate, a mined product also called "land plaster." Can be used on very heavy, clay soils to improve soil structure without raising soil pH. About 20-23% calcium and 15-18% sulfur, two secondary nutrients usually fairly well supplied in Maryland soils. Also recommended to tie-up excess magnesium. Will leach sodium from soils with high salt concentrations caused by de-icing materials or ocean spray.

**Humus***: the stable, end product of the composting process. It holds water and nutrients, aids soil aggregation, is a source of humic acid and chelates, and contains huge microbial populations. May be purchased.

**Humic acid***: an important component of organic matter. It's a very mild acid released in the decay process. Dissolves soil minerals, especially phosphorus, for plant use.

***LeafGro****: composted leaves and yard debris from Central Maryland. Approximate analysis, 1-.5 -1, with a pH range of 6.8-7.2. Holds 225% of its weight in water and does not repel water when dry as peat moss does. Use as a soil amendment, potting mix component, or top-dressing when seeding turf. Good peat moss substitute.

**Manure (local)***: sheep, cattle, horse and chicken manure are widely available from nearby farms. Ask for manure that has been mixed with bedding material and allowed to compost and age for at least 4-6 months. Farm manures usually contain 1% or less each of N, P, and K. Rabbit, sheep and chicken manure are higher in these nutrients. Manure mixed with urine-soaked bedding will be higher in N. Approximately 20-40% of the nitrogen is available to plants the first summer after application. Weed problems may occur when the entire compost pile does not reach sufficiently high temperatures. A heavy organic mulch will help smother weeds.

***Use Manures Wisely***

*All animal manure should be composted before it is applied to vegetable gardens. Turn composted manure into your soil; don't leave it on top of the ground. Never use pet manure in the vegetable garden.*

**Mushroom compost***: used or "spent" compost from mushroom farming. It is some combination of manures, wheat straw, corn cobs, feathermeal, peanut meal, peat moss, lime, etc. Mushroom grown in this media use only a small portion of the many nutrients. Nutrient analysis: (2.75-1.5-1.5) Can have high soluble salt levels and should be fully incorporated and watered prior to planting.

**Peat moss***: partially composted moss mined from prehistoric non-renewable bogs. Light and porous, it absorbs 10-20 times its weight in water. Its high surface tension causes it to repel water when it's dry; so do not use as mulch or top-dressing. Contains little nutrient value, but has a high nutrient-holding capacity. Acidic (as low as 3.0 pH); good for working into azalea and blueberry beds.

**Pine bark fines***: a finely shredded pine bark product that retains moisture. Sometimes a composted component of potting mediums. May be incorporated into annual and perennial beds. Very acidic, so watch soil pH levels if large quantities are used. A peat moss alternative.

**Sand***: to improve water drainage and aeration of clay soils a minimum of 50% by volume is necessary. Can worsen the situation by causing clay to "set up" like concrete. Use only coarse builder's sand, not play sand. Often impractical to use because of the large volume needed.

**Sawdust***: only well-decayed sawdust should be incorporated into the soil. Fresh sawdust can burn plant roots and "tie up" nitrogen as it decomposes. (Soil microbes that break down the high-carbon sawdust need nitrogen.) Good for mulching blueberry beds.

**Topsoil***: no state or federal standards. Quality will vary. Inspect topsoil, ask for references. Inquire where it came from and whether any testing for pH, soluble salts, heavy metals, etc. has been done. Avoid very sticky, grayish, mottled, or foul-smelling soils.

Blended **topsoil (70%) and leaf compost (30%) mixes** are excellent for an instant raised bed garden. Can be purchased by the cubic yard.

**Water-absorbing polymers**: super-absorbent polymer granules that can absorb 300-400 times their weight in water. As soil dries, stored water is released slowly back into soil. Also absorbs and releases fertilizer. The cost-effectiveness of these materials has not been demonstrated for outdoor garden use.

## GROWTH STIMULANTS

*See also:* Humus, Kelp products

**Bioactivators***: various commercial products containing one or more of the following: beneficial bacteria, growth hormones and stimulants, nutrients, and vitamins. Can be useful as a "tonic" for the lawn, seedlings, transplants and plants languishing in cool soils in the spring. These are unnecessary for backyard compost piles.

***Microp****: soil innoculant. When sprayed on the soil these nitrogen-fixing algae grow rapidly and can supply 30 to 60 lbs. of nitrogen per acre, plus producing polysaccharides (the soil aggregating compounds in humus) which combat soil compaction.

***Maxicrop****: (See Kelp products). A kelp extract, containing growth regulators, that stimulates root development and plant growth (1-0-3).

**Mycorrhizae***: Are beneficial fungi which grow symbiotically on or in roots and extend the root structure by sending out tiny filaments to forage for nutrients. Some crops, like blueberry, rely heavily on mycorrhizae for nutrient uptake.

**Nitrogen-fixing bacteria innoculant***: a powder used to coat legume (pea, bean, and clover) seed to increase the growth of nitrogen-fixing nodules on their future roots.

***Roots****: a soil and root treatment composed of peat humic substances, kelp extract, and vitamin B-1.

## pH ADJUSTORS

*See also*: Ammonium sulfate, Cottonseed meal, Gypsum, *Miracid*, Shellfish products, and Wood ashes

**Aluminum sulfate***: *not* recommended as a soil acidifier because it can cause a toxic aluminum build-up (Maryland soils have adequate aluminum levels). Iron sulfate is preferred.

**Iron sulfate***: lowers pH. Turns hydrangea flowers blue. It contains 20% iron. Use 3-4 times the recommended amount of "plain" sulfur. (In a medium texture soil, lower the pH by ½ unit by applying 12-14 lbs./1000 sq. ft. of area.) See: "*Sulfur*"

***Soil pH***

*Soil pH is a measure of the hydrogen ion concentration of soil. A pH value of 7.0 is neutral. Readings below 7.0 are acidic ("sour soil"), and those above 7.0 are alkaline ("sweet soil"). Soil nutrients are most available to plant roots and microbial activity is greatest when soil pH is in the 5.5 to 7.0 range. Plants may show symptoms of nutrient deficiency or toxicity at very high or low soil pH. For example, azaleas grown in high pH soil may have yellow leaves due to a deficiency of iron (iron chlorosis). Acid rain adds 15-25 lbs. of sulfur/ acre, so Maryland soils become acidic over time. Liming is best accomplished in the fall, because lime requires time to change pH.*

**Lime***: raises pH. There are several kinds of naturally occurring mined limestone:

- **Aragonite***- or oyster shell lime, is 96% calcium carbonate mined off the coast of Bermuda. Less quickly available than ground ag lime, but it lasts 4-5 years.
- **Agricultural limestone***- a finely granulated calcitic limestone. The finer the grind or mesh size, the more readily it will act to raise soil pH. **Powdered lime** is faster acting.
- **Hydrated lime***- calcium hydroxide, produced by adding water to burnt lime. Quick acting. Need apply only 75% of calcitic recommendation.
- **Burnt lime***- calcium oxide, very caustic. (Also known as "quick lime".) Produced by heating limestone to very high temperature. Apply only 50% of calcitic recommendation. Will burn plant roots upon direct contact.
- **Dolomitic lime***- contains calcium carbonate and magnesium carbonate. Recommended for raising pH on low magnesium soils.
- **Pelletized lime***- very similar to ground ag lime, but easier to apply.
- **Wood Ash -** See page 4 ("Available Fertilizer Products")

**Sulfur***: elemental sulfur, sold as "flowers of sulfur" or micro-fine sulfur, is used to lower soil pH. At pH above 6.0, iron sulfate lowers pH more quickly than sulfur.

## POTTING MIXES

*See also*: Peat moss

**Perlite***: a very lightweight heat-expanded volcanic mineral which provides drainage and oxygen space in soils. Does not hold nutrients or water but is especially effective for loosening heavy and clay soils. Commonly used in potting media.

**Potting soil***: varies widely. Often contains topsoil. Tends to be heavy and drain poorly. Should be mixed with peat moss and perlite before using.

**Soil-less mix***: a sterile mix of peat moss, perlite and vermiculite. Recommended for growing seedlings. Also fine for indoor and outdoor container gardening. Soil-less mixes, like *Pro-Mix, Reddi Earth,*and *Sunshine Mix,* have a small amount of added fertilizer, so they can sustain a crop of flower and vegetable seedlings for 4-6 weeks without the need for additional fertilizer. Work water into these mixes by hand, prior to use.

**Vermiculite***: mica-type mineral heated in high temperature furnaces to form sterile, expanded, fan-like particles with many air spaces which promote aeration and water movement. Absorbs and holds nutrients and water (unlike perlite). Also rich in trace elements.

## 10 Ways to Conserve Nutrients, Prevent Pollution and Preserve Soil

1. Take a soil test every 3 to 4 years. Fertilize according to soil test recommendations. Do not exceed label directions.
2. Keep fertilizers off hard surfaces. Rain water will carry fertilizer salts into storm drains and surface waters and contribute to nutrient pollution of our waterways.
3. Keep bare soil covered with a mulch or plant a cover crop or ground cover. Over time, rainfall causes bare soil to erode and become compacted. Grow ground covers in place of turf in deep shade.
4. Leave grass clippings on your lawn (grasscycling.) They are a source of nitrogen for your lawn and will not contribute to thatch build-up in fescue or bluegrass lawns.
5. Keep stored manures and compost covered to prevent leaching of nutrients.
6. Incorporate or compost plant residues. However, discard plants with serious disease problems.
7. When appropriate, substitute slow-release fertilizers for those that are highly soluble and substitute locally available organic fertilizers like farmyard manure, backyard compost and municipal leaf compost for manufactured chemical fertilizers.
8. Avoid excessive foot or equipment traffic to prevent soil compaction, especially when the soil is wet.
9. Avoid cultivating soils on steep slopes. Construct terraces where appropriate. Keep soil in raised beds framed with solid sides.
10. To melt winter ice, use calcium magnesium acetate (CMA), potassium chloride (KCl), sodium chloride (NaCl) or calcium chloride ($CaCl_2$). Do not use urea, potassium nitrate, or other chemical fertilizers containing nitrogen or phosphorous. The salts in these fertilizers may burn the foliage and roots of adjacent plants and wash into and pollute waterways.

## FERTILIZER GUIDELINES BY PLANT GROUP

Good health in plants depends on a continuous supply of available nutrients from the soil or, in the case of container plants, the growing media. Nutrient needs vary from plant to plant and the ability of the soil to supply those nutrients varies from site to site.

Take a soil test of major areas of your landscape front and back lawn, vegetable garden, large flower beds- every 3-4 years to determine nutrient levels. The basic University of Maryland soil test will measure the soil pH and levels of calcium, magnesium, phosphorous and potassium. The levels of these nutrients are often in the "excessive" range in older and well-tended landscapes. This is not a problem for plants. It simply means you don't need to add these nutrients for some time.

Most garden and landscape plants grow best in a soil pH range of 6.0-7.0. Many nutrients become either unavailable or overly-abundant outside this range. Pay close attention to your soil pH readings and be prepared to adjust them according to your soil test recommendations.

Fertilizers won't necessarily help sick plants, if the cause of poor growth is related to insect, disease or environmental problems and not to a lack of nutrients. Overuse of fertilizers can lead to weak, succulent growth, encourage insect pests and disease problems, and contribute to water pollution.

*Home gardeners tend to over-fertilize flower and vegetable beds. Plan to reduce or eliminate fertilizer applications in these areas if an inch or more of organic matter is incorporated into the soil of established beds at least once a year.*

Use the information below as a starting point for planning how to fertilize your plants. More specific information can be found in the Maryland Cooperative Extension publications listed on page 8.

**Trees**:

- Healthy, mature trees do not usually benefit from fertilization. Trees in the landscape receive nutrients from turf fertilization, grass clippings, fallen leaves and natural soil fertility.
- When required, trees are fertilized in the fall (after leaf drop) or early winter. Use 10-15 lbs. of 10-6-4 per 1,000 sq. ft. of area. Broadcast evenly over an area that extends beyond the tree's dripline (canopy).
- Tree spikes are not recommended.

**Shrubs**:

- Shrubs that are surrounded by fertilized turf receive adequate nutrients and don't require additional fertilizer. The breakdown of organic mulches also contributes nutrients.
- Where growth is lagging, top-dress shrub beds with well-decomposed compost or apply a balanced fertilizer (e.g. 5-10-5, 10-6-4) in the late fall or early spring at the rate of 1 lb. per 100 sq. ft. of area.

**Annual flowers**:

- No fertilizer may be necessary if beds are heavily amended with organic matter. However, flower size and overall production can be increased with a supplemental fertilizer applied to the foliage or soil.
- In new gardens low in organic matter, apply 2-4 lbs. of 5-10-10 per 100 sq. ft. of area. In older gardens, apply 2 lbs. of 10-6-4 per 100 sq. ft. of garden area. Incorporate fertilizer into the top 6 inches of soil in early spring before planting.

*Sweep or wash granular fertilizers off foliage to prevent leaf burn.*

**Herbaceous perennials**:

- No fertilizer may be necessary if beds are heavily amended with organic matter.
- In new gardens low in organic matter, apply 2-4 lbs. of 5-10-10 per 100 sq. ft. of area. In older gardens, apply 2 lbs. of 10-6-4 per 100 sq. ft. of garden area. Broadcast the fertilizer lightly around plants in early spring.

**Vegetables**:

- No fertilizer may be necessary if beds are heavily amended with organic matter.
- In new gardens low in organic matter, apply 2-4 lbs. of 5-10-10 per 100 sq. ft. of area. In established gardens, apply 2 lbs. of 10-6-4 per 100 sq. ft. of garden area. Fertilizer should be applied and incorporated into the top 6 inches of soil in early spring.
- Early season crops benefit from foliar or liquid fertilizers, especially starter fertilizers (high in phosphorous), kelp (seaweed products), or compost tea.
- Perennial crops, like asparagus and rhubarb, are fertilized in early spring and after harvest.

**Fruit**:

- Most fruit plants are fertilized in early spring when buds swell. June-bearing strawberries are fertilized in July after harvest.
- Peaches require annual applications of fertilizer. Apple and pear trees should not be fertilized if the trees are healthy and productive (making 18-24 inches of new shoot growth each year.)

- Blueberry plants require a soil pH in the 4.5-5.0 range and should be fertilized each spring after bloom with ammonium sulfate.

**Houseplants**:

- Fertilize with a commercial fertilizer containing micronutrients or add a small amount of well-composted, screened leaf mold or other compost each year.
- Because magnesium leaches from the soil at each watering, replace it with a solution of 1 teaspoon Epsom salts per gallon of water. Water with this solution two times each year or use the solution as a leaf spray.
- During the winter months, houseplants don't need fertilizer because reduced light and temperature result in reduced growth. Fertilizing at this time could harm some plants, unless they are actively growing.
- Monthly applications of a dilute liquid fertilizer in the summer months will keep most plants healthy.
- Excessive fertilizer results in the buildup of salts, as evidenced by a white coating on the inside of pots, leafburn, and excessive, leggy growth. Flush out excessive salts by pouring a large amount of water through the growing media.

**Herbs**:

- Apply fertilizers sparingly. Many herbs, especially the "Mediterranean" herbs, such as basil, thyme, rosemary, oregano and lavender, grow best on sunny, dry sites in light (sandy) soil. Heavy applications of fertilizers or organic matter may lower the plants' essential oil content and encourage root and stem rot diseases.

**Turf**:

- Established, cool-season grasses (bluegrass and fescues) should be fertilized in the fall with 2-3 lbs. of nitrogen/1,000 sq. ft. starting in September or October, and an additional 1/2 lb. of nitrogen/1,000 sq. ft. applied in mid-November — mid-December if the turf has poor color, density or vigor. If you select a slow release fertilizer, a single fall appliction can be made. (Ten lbs. of 10-6-4 fertilizer will supply one pound of nitrogen.) If you miss the fall application or if your turf is weak or thin, apply ½ - 1 lb. of nitrogen per 1,000 sq. ft. of area in May. Do not exceed 4 lbs. of nitrogen/1,000 sq. ft. in one year for Kentucky bluegrass and 3 lbs. of nitrogen/1,000 sq. ft. for tall fescue.
- Warm season grasses (zoysia and bermuda) are fertilized starting in mid-May — July with a maximum of 2 lbs. of nitrogen per 1,000 sq. ft. of area.

## MCE Publications containing fertilization guidelines:

- EB 125 Home Fruit Production Guide.
- EB 103 Fertilizer Facts for Home Lawns
- HG 23 Fertilizing Ornamental Trees and Shrubs.
- FS 639 Basic Principles of Soil Fertility I: Plant Nutrients.
- HG 40 Indoor Redworm Composting.
- Leaflet 245 Home Composting.
- HG 11 Soil Test Basics.
- HG 18 Lead in Garden Soils.
- FS 70 Melting Ice Safely.
- The Maryland Master Gardener Handbook

Order these from your county/city MCE office, the toll free HGIC phone number or web site listed below.

*Mention of specific commercial products and trade names does not constitute an endorsement by the University of Maryland.*

Authors: Jon Traunfeld, Regional Specialist, and Ellen Nibali, Horticulture Consultant, Home and Garden Information Center (HGIC), Maryland Cooperative Extension.
Lay-out: Robin Hessey, Administrative Assistant, HGIC.

Reviewed by: David L. Clement, Ph.D., Director and Regional Specialist and Raymond V. Bosmans, Regional Specialist, HGIC.

Oct, 1998. Revised April, 2003; May 2009

**HAVE A GARDENING QUESTION??? CALL THE HOME AND GARDEN INFORMATION CENTER AT 800-342-2507**

**www.hgic.umd.edu**