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Fertilizer Guide

HOME FRUIT, VEGETABLE, AND ORNAMENTAL GARDENS

Gardens provide excellent quality fruits and vegetables for fresh use and processing when the crops are supplied with adequate nutrients and water. Ornamental plants add to the beauty and value of a residence. This fertilizer guide aims at ensuring ample levels of all nutrients for optimum yield, quality, and esthetic value. Other important management practices include plant spacing; insect, weed, and disease control; and timely harvest.

Opinions differ concerning the merits of manures or other organic fertilizers versus "chemical" fertilizers. Excellent gardens may be grown using either method. Plants do not differentiate between nutrients from either "organic" or "chemical" fertilizers. The form absorbed by plant roots from both sources is identical. Soil bacteria and fungi must act on the organic nutrient sources to change them into a form plants can use.

Regardless of the source, an adequate supply of all nutrients is important. Considering the above factors, a judicious use of supplemental chemical fertilizers may be needed to ensure adequate plant nutrition where predominantly organic fertilizers are used.

Fertilizer Application

Soil for vegetable and ornamental gardening may suffer from a variety of problems. Topsoil may have been removed prior to construction or covered with fill material in the final grading. A 2- to 4-inch layer of topsoil may be placed over fill. This shallow layer may not support vigorous plant growth without attention. Heavy equipment used in construction compacts soil. Compacted soil slows root growth and water movement. Construction wastes are thrown from windows and subsequently buried adjacent to the house, where ornamentals are later planted. This can lead to sudden death of individual plants.

Adequate nutrient supply at the appropriate time is the goal of fertilization. Specialty fertilizer blends generally are an expensive alternative to standard blends. Application method and timing can enhance fertilizer use and plant growth. A description of application methods follows:

Broadcast

Scatter material uniformly over the soil surface. It is more readily available to the plant roots if worked into the upper 2 or 3 inches of the soil rather than left on the surface. If an application method is not mentioned in this fertilizer guide, broadcasting is implied.

Band

Place fertilizer in a trench about 3 inches deep. The corner of a hoe works well to make the trench. Sow seeds 1½ to 2 inches above and to the side of the fertilizer. The plant roots quickly absorb the nutrients placed in this manner.

Sidedress

After the plant is growing, additional fertilizer may be needed. Nitrogen is the usual sidedress element. If other nutrients have been omitted, they can be added in a sidedress application. Scatter the fertilizer material close to the growing plant. Keep fertilizer granules off leaves to prevent burning. Nitrogen is very soluble and need not be mixed with the soil. A "complete" fertilizer containing nitrogen, phosphate, and potash should be lightly scratched in, but take care to avoid damaging plant roots. Irrigation must be applied before the plant can absorb the nutrients.

Nitrogen (N)

Nitrogen usually needs to be applied each year because rain and irrigation remove most of the nitrogen not used by plants. Fertilizer materials listed in the following tables provide sufficient N for initial growth of newly planted seeds and plants. If a pale green or yellow color and a slower rate of growth is noted in vegetable gardens, sidedress ½ cup of ammonium sulfate (21-0-0) or equivalent fertilizer per 10 ft of row near the plant just before an overhead irrigation. Do not apply this extra nitrogen to peas or legumes.

Manures

Manures vary in their nitrogen content. As little as 200 lb of poultry droppings or as much as 1,500 lb of manure mixed with straw, shavings, or sawdust may be required for each 1,000 sq ft. Blood meal applied at 15 to 20 lb per 1,000 sq ft is also a good source of organic nitrogen.

Table 1. Approximate nutrient concentration of manures.

Kind of Manure	Nutrient and Water Content			
	Water	N	P_2O_5	K_2O
	---------- % ----------			
Dairy	90	0.50	0.50	1.00
Beef	80	0.65	0.45	1.00
Poultry	70	1.30	1.00	0.50
Swine	85	0.45	0.30	0.40
Sheep	70	1.00	0.35	1.00
Horse	60	0.70	0.25	0.60

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Benefit from modification of soil physical properties often is greater than benefit from nutrient content of manures. Manure can modify the tilth and water holding capacity of a garden.

All of the nutrients in manure are not completely available the first year. Approximately 75 percent of the N from poultry manure is available the first year. Only 50 percent of the N from other manures is available during this time. Table 1 gives the approximate average content of some nutrients in fresh manure.

Losses of N sometimes exceed 50 percent during manure storage or following application to the surface of the soil. N loss is least when fresh manure is spread and worked into the soil immediately.

Manures often contain weed seeds. Some of these weeds may be very difficult to control. In addition, manure that has been in contact with soil may contain symphylans. These insects can be very damaging to plant roots.

Phosphate and Potash

Phosphate is essential for vigorous early growth of seedlings. It moves slowly in the soil, and best results are obtained if phosphate is banded 2 inches below the seed at planting or tilled into the soil during spring preparation.

Potash also moves slowly in soil. Band potash with care as moderate quantities can damage seedlings. Use Table 2 or 3 to determine the type and amount of fertilizer to use based on soil test results for phosphate and potash.

If the potassium soil test value is above 600 ppm, do not apply wood ashes for 5 years. Thereafter, use 10 to 15 lb per 1,000 sq ft per year.

Many eastern and southeastern Oregon garden soils are naturally high in potassium and soil pH. The addition of ashes is not advised here. Grass clippings or compost are other sources of readily available potassium. Do not add fresh clippings from weedy lawns, Bentgrass lawns or turf with rhizomes. Weeds and unwanted grass can be introduced from this practice.

Table 2. P and K fertilizer recommendations.*

If the soil test for phosphorus (P) in ppm is:	If the soil test for potassium (K) in ppm is: 0–300	Above 300
Less than 25 [10]**	20 lb/1,000 sq ft of 15-15-15 or similar fertilizer***	20 lb/1,000 sq ft 16-20-0 fertilizer
25 to 60 [10 to 20]	15 lb/1,000 sq ft of 15-15-15 or similar fertilizer	15 lb/1,000 sq ft 16-20-0 fertilizer
Above 60 [20]	15 lb/1,000 sq ft of 15-15-15 or similar fertilizer	15 lb/1,000 sq ft ammonium sulfate (21-0-0) fertilizer
	OR	
	15 lb/1,000 sq ft of ammonium sulfate (21-0-0) +	5 lb/1,000 sq ft of muriate of potash (0-0-60)

* The content (analysis) of most fertilizers is designated with three numbers that indicate the percent nitrogen, phosphate, and potash. Examples: 5-15-10 contains 5% nitrogen, 15% phosphate, and 10% potash; 21-0-0 contains 21% nitrogen, but no phosphate or potash.

** P soil test values in brackets are for eastern Oregon.

*** Similar fertilizers include 14-14-14, 16-16-16, 18-18-18, 10-20-20, 20-10-10. Rates of application may have to be adjusted slightly where the numbers (analysis) vary significantly.

Table 3. Organic phosphate and potash fertilizers.

If the soil test for phosphorus (P) in ppm is:	If the soil test for potassium (K) in ppm is: 0–300	Above 300
Less than 25 [10]*	40 lb bonemeal or 50 lb rock phosphate + 10 to 15 lb wood ashes/1,000 sq ft	40 lb bonemeal or 50 lb rock phosphate/1,000 sq ft no wood ashes needed
25 to 60 [10 to 20]	25 lb bonemeal or 30 lb rock phosphate + 10 to 15 lb wood ashes/1,000 sq ft	25 lb bonemeal or 30 lb rock phosphate/1,000 sq ft no wood ashes needed
Above 60 [20]	10 to 15 lb wood ashes/1,000 sq ft	No wood ashes or phosphate needed

* P soil test values in brackets are for eastern Oregon.

Lime

Most garden vegetables grow best if the soil pH is between 6.0 and 7.0. If the soil pH is below 6.0, a lime application is recommended. The amount of lime required is based on the SMP lime requirement test:

If the SMP lime requirement test is:	Apply this amount of ground agricultural lime/1,000 sq ft:
5.4 or below	250 lb
5.5 to 6.0	150 to 200 lb
6.1 to 6.5	100 to 150 lb
Above 6.5	0

For acid soils low in magnesium (Mg less than 2.0 meq/100g of soil) use dolomitic lime. Magnesium can also be supplied from 5–10 lb epsom salts per 1,000 sq ft. (Epsom salts will not alter soil pH.)

Lime is usually required every 3 to 4 years. If the SMP soil test is below 5.7, apply lime for 2 consecutive years and then once each 3 to 4 years thereafter.

Potatoes are more likely to develop scab, a fungus disease, if planted in freshly limed soil. An addition of a small amount of sulfur to each hill helps reduce the incidence of scab when potatoes are planted in newly limed soil.

Sulfur (S)

Sulfur is contained in ammonium sulfate, many complete fertilizers, and fungicides. Application of 1 lb S/1,000 sq ft is recommended in western Oregon and on a trial basis in central Oregon. Most eastern Oregon soils and water contain sufficient S.

Gypsum supplies calcium and sulfur. Sulfur can also be obtained from mixed fertilizers. Gypsum can lower soil pH and improve tilth in eastern Oregon where sodium (Na) is a problem. An indication of a sodium problem is a soil pH above 8.5. Gypsum will not appreciably alter soil tilth (improve clay soils) or lower soil pH in western Oregon. The most effective way to improve soil tilth is by regular additions of composted plant material or manure.

Boron (B)

Many soils in western Oregon are deficient in boron. Several crops (cabbage, broccoli, cauliflower, caneberries, strawberries, beets, carrots, etc.) can benefit from an application of B. If the soil test for B is less than 1 ppm, apply household or agricultural grade borax (11% B) at the

rate of ½ lb per 1,000 sq ft to the areas where B requiring plants will be grown. Apply B evenly and mix thoroughly with the soil.

For uniform application of B, dissolve the fertilizer material in water and apply the solution evenly with a sprinkling can.

BE CAREFUL. Boron in excessive quantities is highly toxic to plants, especially beans in the seedling stage. One application should be sufficient for up to 3 years or until another soil test is made.

Turf

Nitrogen is the most important nutrient in most turf fertilization programs. When applied at proper rates, nitrogen stimulates growth, improves turf density, and makes the grass a darker green. By stimulating growth, nitrogen reduces the severity of diseases such as red thread and rust.

Of the commonly used turf grasses, Kentucky bluegrass and perennial ryegrass have the highest nitrogen requirements; tall fescue is intermediate; fine fescues and bentgrasses persist well at low levels of nitrogen.

For top quality lawns, plan on adding 6 lb or more of available nitrogen per 1,000 sq ft per year. Medium quality turf can be achieved with 3 to 4 lb of available nitrogen per 1,000 sq ft per year. The proper rates, frequency, and timing of nitrogen fertilizer depend on the material you use. See the end of this publication for references.

Fruit Trees

Observations of annual growth, size, and color of leaves and fruit are helpful in determining fertilizer needs. In addition, leaf analysis indicates which elements are present in adequate, deficient, or excessive amounts. Soil analysis is useful in predicting the need for lime applications.

Suspect a nutrient deficiency if the cause of poor tree performance is not primarily due to lack of pruning, poor pollination, disease, winter injury, deep cultivation, insects, physical injury, limited moisture, rodents, poor weather, or poor soil drainage.

N is probably the only nutrient needed in most home orchards. Apply according to Table 4. Apply N according to terminal growth. Young trees should grow 18 to 30 inches annually. One- and two-year-old trees can be injured if N is banded around the tree. P is necessary in Hood River area. Apply ¼ lb P_2O_5 per tree at planting.

Table 4. N fertilization of fruit trees.

Tree Age	Apples, Pears, Prunes	Peaches
	- - - - - Apply N (lb/tree) - - - - -	
1	None to ⅛	None to ½
2	¼	½
3 – 5	¼ to ⅓	½ to ¾
6 – 7	⅓ to ½	¾ to 1

Azaleas, Blueberries, and Rhododendrons

These plants grow best when soil pH is 4.5 to 4.8. If soil pH is above 5.0, fertilize with ammonium sulfate to lower soil pH. For mature bushes use ⅔ to ¾ lb ammonium sulfate per bush. For younger plants, reduce this by ½ to ⅔, depending on age. Follow P and K recommendations in Table 2 or 3. Do not use wood ashes as a potash source.

Herbaceous Ornamentals

Follow the fertilizer recommendations for P, K, and S on the previous page. The soil pH should be between 6 and 7. Work P and K into the soil prior to planting. In cool, wet spring weather, P can enhance early growth. Do not allow K fertilizers to contact plant roots. N can be supplied in multiple applications after the plants have begun to grow.

Strawberries, Caneberries, and Roses

Adequate fertilization of caneberries, roses, and strawberries can be achieved by following the recommendations for P, K, S, and B on the previous page. The soil pH should be between 6 and 7. To meet the N requirements of roses and caneberries, apply 6 to 8 lb ammonium sulfate/1,000 sq ft in late winter or early spring. Decrease subsequent N applications if cane growth is excessive. For strawberries use one-half this N rate on August 1, followed by an irrigation.

Using Wood Ashes

Wood ashes can be useful as a fertilizer and liming material in home gardens, particularly on acid soils low in potassium.

The fertilizer value of wood ash depends on the type of wood. As a general rule, hardwoods weigh more per cord, yield more ash per pound of wood, and supply higher percentages of nutrients than softwoods. The effects of these factors are illustrated in Table 5, in which Douglas-fir represents softwood and oak represents hardwood. This table assumes that the wood is well cured. (Cured wood contains 20 percent moisture.) The numbers represent averages; there may be considerable variation between species and within the wood from a single tree. Nevertheless, Table 5 indicates that hardwoods produce approximately three times as much ash and five times as many nutrients as softwoods. For woods in temperate regions, the ash content usually ranges from 0.2 to 1.0 percent, occasionally approaching 3 to 4 percent.

Table 5. Wood ash composition of hard and softwoods.

	Douglas-fir	Oak
Weight/Cord – lb	2,500	4,000
% Ash	1	2
Weight of Ash – lb/cord	25	80
Amount Ca – lb/cord	3.5	20.0
Amount K_2O – lb/cord	2.5	12.0
Amount Mg – lb/cord	0.6	2.4
Amount P_2O_5 – lb/cord	0.5	2.4

Ash from a cord of oak meets the potassium needs of a garden 60 ft by 70 ft, and ash from a cord of Douglas-fir supplies enough potassium for a garden 30 ft by 30 ft. Both types of ash contain enough calcium and magnesium to reduce soil acidity slightly.

Where soils are acid and low in potassium, ashes are beneficial to most garden plants except those that prefer acid soil. Examples of acid-loving plants are blueberries, rhododendrons, and azaleas. In the case of potatoes, wood ashes may favor the development of potato scab. Wood ashes can also be applied to flower beds, lawns, and shrubs.

One-half to one lb of ash per year is recommended for each shrub and rose bush. Lawns needing some lime and potassium can benefit from wood ashes. No matter what type of plant, fresh ashes should not be added to newly germinating seeds.

When wood is burned, plant nutrients such as nitrogen, sulfur, and to some extent phosphorus, are lost as gasses. During burning, most of the nutrient elements are converted to water soluble compounds such as oxides that are chemically suitable as fertilizer and lime.

Wood ash liming value comes from Ca, K, and Mg compounds. These components are also important plant nutrients. Calcium often makes up 25 percent of ash, rarely dropping below 12 percent. Magnesium usually makes up 3 to 6 percent of ash. Both calcium and magnesium oxides in fresh ash can react with water to produce hydroxides or with carbon dioxide to produce carbonates. Calcium and magnesium oxides, hydroxides, and carbonates are found in commercial liming materials.

Potassium is found in wood ash as potassium carbonate and potassium oxide. The potash content (K_2O) of wood ash varies from 10 to 35 percent. These compounds, like lime, have a neutralizing effect on soil acidity. The P_2O_5 (phosphorus) content in wood ash usually is less than 5 percent.

How to Apply Wood Ashes

Elements in ash are water soluble. Therefore, store ash in a dry place. Apply ashes evenly and where possible mix them into the soil. Never leave ashes on the surface in lumps or piles. If ashes are concentrated in one place, excessive salt from the ash will leach into the soil, creating a harmful environment for plants. Do not add fertilizer containing nitrogen in the form of ammonium immediately after the addition of wood ash to the soil surface, because this can result in the loss of ammonia.

Using Wood Ashes with Compost

Microorganisms breaking down compost material act best in an environment that is neither acidic or basic. Wood ashes help maintain a neutral condition. Scattering a few ashes on each layer of compost material as the pile is built up will add nutrients to the compost and create a better environment for microorganisms.

Wood Ashes as a Pest Repellent

Fresh, dry wood ash contains chemical compounds that readily absorb water. Insects therefore avoid wood ash since this material draws water from their tissue. Sprinkling ash around plants tends to decrease the activity of insects causing surface damage. Adding ashes around the base of plants also decreases snail invasions since snails avoid crawling over dry salty material. Ashes can act to deter pests only when dry. Once wet, they are ineffective. Continued addition of wood ashes for this purpose is not advisable. As indicated previously, concentrating ashes in soil may create a harmful, salty condition for plant growth.

Unsuitable Types of Ash

Other ashes besides wood ashes are sometimes added to soil. Coal ashes are not recommended because they provide little fertilizer value and may contain substances which are harmful to plants. Ashes from lead-painted or chemically treated wood should not be used either because lead and other elements may harm plants. Similarly, ashes from fireplaces or incinerators in which trash has been burned should not be used, since harmful elements may concentrate in the soil. For example, boron, one constituent of glue in cardboard boxes and paper bags, may be present in amounts that would be toxic to plants.

For More Information

Contact a Master Gardener in your county office of the OSU Extension Service.

OSU publications

These are available from Publications Orders, Agricultural Communications, Administrative Services Bldg. 422, Oregon State University, Corvallis, OR 97331-2119, phone 503/737-2513.

Cook, T.W. and J.M. Whisler. *Fertilizing Home Lawns,* EC 1278, (Oregon State University, Corvallis, reprinted 1994). 50¢

Hart, John, *Fertilizer and Lime Materials,* FG 52, (Oregon State University, Corvallis, reprinted 1992). No charge.

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Vomocil, J. and J. Hart. *Rural Domestic Water Supply,* EC 1374, (Oregon State University, Corvallis, reprinted 1992). 50¢

Other publications

Western Fertilizer Handbook, Horticulture Edition (1990) The Interstate Printers & Publishers, Inc., Danville, IL.

John Hart, Extension soil scientist, and Ray McNeilan, Extension agent Multnomah County, Oregon State University, revised this information from two publications prepared by several OSU Extension specialists and agents. This publication replaces FG 61, *Using Wood Ashes in the Home Garden,* and FG 66, *Fertilizing Home Gardens.*