



Missouri Environment & Garden

Rhubarb: The Pie Plant

by David Trinklein

Fans of the popular public radio show, *A Prairie Home Companion*, know that when life, seemingly, cannot get any worse, “one little thing can revive a guy, and that is a piece of rhubarb pie.” Whether the latter is truth or fiction, the fact is rhubarb is commonly known as the “world’s favorite pie plant”. Considered by many to be one of the joys of spring, March is an ideal month to plant rhubarb for those who might want to add this tangy vegetable to their garden.

Rhubarb (*Rheum rhabarbarum*) is a member of the Polygonaceae family, commonly known as the smartweed-buckwheat family in the United States. Its genus name (*Rheum*) is thought by some to be derived from ‘Rha’, the ancient name of the Volga River, on whose banks the plants grow. Others maintain the name stems from the Greek *rheo* which, literally interpreted, means “to flow”. The latter, undoubtedly, is an intimation to the purgative properties of the root of the plant.

Rhubarb is an herbaceous perennial thought to be native to the eastern Mediterranean region and Asia Minor. It exhibits determinate growth from short, thick rhizomes. It has large, floppy leaves that are somewhat triangular in shape. Rhubarb bears many small flowers grouped in large



compound leafy greenish-white to rose-red inflorescences. The plant is prized for its thick, crisp leaf stalks (petioles) that have a tart, sour taste.

The first recorded use of rhubarb dates back to 2700 B.C. when records show that its roots were used for medicinal purposes by the Chinese. An important drug at that time, it was used to treat malaria, constipation, “people who have delirious speech with fever” and many other ailments. The success of rhubarb as a medicine was not a placebo. It is now known that rhubarb roots contain phenolic compounds known as anthraquinones, such as emodin and rhein. The latter

give the plant its cathartic and laxative properties.

By the 1st century A.D., rhubarb was being imported into Greece and Rome where it also was used as a medicine. Discorides, a noted Roman physician, pharmacologist and botanist around the time of Nero, extolled its medicinal virtues in his hallmark publication titled *De Materia Medica* (on Medical Material).

The explorer Marco Polo is credited for introducing rhubarb to Europe in the thirteenth century. There, it became a highly valuable drug that commanded great prices, and its economic value spawned a vibrant rhubarb trade. The

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plant was so highly regarded as a drug in Europe that it commanded a price three times higher than that of opium. By the early 15th century, rhubarb trade was part of the famous Silk Road during the era of its Mongol expansion.

The earliest known report of the use of rhubarb as a food dates back to 18th century Europe where it was used as a filling for tarts and pies. Ben Franklin is credited with being one of the first people to introduce rhubarb to the New World, when he sent seeds of the plant to the American Colonies. By the early part of the 19th century it was widely grown in New England and sold in vegetable markets there.

It was only when sugar became affordable to the middle-class that rhubarb's popularity dramatically increased. Its popularity peaked just before World War II when sugar rationing made the consumption of rhubarb a bit harder to swallow.

Rhubarb is a cool-season, perennial vegetable and one of the first to be harvested in the spring. Growth normally begins when temperatures rise to the 40° F. range. Only the leaf stalks of rhubarb may be eaten safely. The leaf blades contain oxalic acid which crystallizes in the kidneys and, in extreme cases, can cause death. As mentioned above, rhubarb roots contain anthraquinones which have cathartic and laxative properties.

Like many other plants, rhubarb does not "come true" from seeds. Therefore, it is propagated via divisions from proven varieties such as 'Valentine', 'Victoria' and 'Canada Red'. Rhubarb roots establish best when the weather is cool; therefore, propagules should be purchased as soon as they become available in the spring.

Rhubarb is a full-sun plant that should receive at least six hours of direct sun each day. At our latitude, a bit of afternoon shade can help rhubarb cope with hot weather. Although it will tolerate a variety of soil types, soil with excellent drainage

and high in organic matter will tend to grow more productive plants. Rhubarb should never be planted where water stands at the base of the plant, or in soils with high clay content. The latter can be made acceptable for rhubarb production if internal drainage is improved. Ample amounts of composted manure or other forms of organic matter will improve poorly-drained soils.

Vigorous in growth habit, rhubarb is a heavy feeder and benefits from adequate amounts of fertilizer. The addition of about 2.0 to 2.5 pounds of a complete garden fertilizer (e.g. 10-10-10) per 100 square feet of garden area at the beginning of the growing season is recommended. A light side-dressing with a fertilizer high in nitrogen or the application of two to three inches of compost or manure after harvest has concluded will aid in the nutrition of rhubarb.

Plant rhubarb in a shallow trench so that each bud is about one-half inch below the surface of the soil. Since mature rhubarb plants are large, space plants two to three feet apart with in rows separated by at least the same distance. Firm the soil around the crowns and water in. Keep plants uniformly moist during establishment but avoid overwatering. It is best not to harvest rhubarb the year it is planted. Normal harvest should be possible the second year and thereafter.

Rhubarb curculio and stem borer represent the two main insect pests of the species. Both insects bore into stalks and tunnel into the crown and root system. This damage also is a pathway for entry for crown rots. Since insect damage becomes evident as plants begin to wilt, infested plants should be destroyed. Also, wild dock, a close relative of rhubarb, growing in the area should be destroyed since it can harbor these insects as well.

Harvest from healthy rhubarb plants lasts for about two month, beginning in early spring. To harvest, grasp the leaf stalk near its base and

pull it to one side while twisting the stalk. Avoid harvesting rhubarb with a knife, since the resulting wound can encourage crown rot to develop. Make certain to remove the toxic leaf blade soon after the leaf stalk is harvest. This practice will encourage the leaf stalk to remain more turgid and crisp.

Also, it is consider a good cultural practice to eliminate flower stalks as soon as they can be detected. This forces the plant to put into its leaves and roots the energy that would have been used to produce flowers and seeds.

Freshly harvested rhubarb is quite perishable and should be stored in plastic bags in a refrigerator. Rhubarb that cannot be used within five to seven days after harvest can be frozen. Cut the leaf stalks into inch-long pieces and seal them in air-tight plastic bags. Frozen rhubarb keeps for about a year.

Rhubarb Trivia:

- Rhubarb is very high in vitamin K, and contains significant amounts of vitamin C, manganese, potassium, calcium and dietary fiber.
- Generally, the deeper the red color of a rhubarb stalk, the less tart it will be.
- In 1947, rhubarb was legally classified as a fruit by the U.S. Customs court in Buffalo, N.Y even though botanically it is a vegetable.
- Lanesboro, Minnesota is the self-proclaimed rhubarb capital of the state and holds an annual rhubarb festival featuring, among other activities, a rhubarb stalk throw contest.
- Rhubarb leaves are considered to be toxic and can be used to make a natural insecticide.
- The use of the word "rhubarb" to describe a heated argument is baseball was first made in 1938 by a sportscaster who thought the argument "suggested an untidy mess, a disheveled tangle of loose ends like the fibers of stewed rhubarb."

Polyphemus and Cecropia Moths

by Michele Warmund

Now is the time to be looking for the emergence of the most common silkworm, *Antherea polyphemus* from its cocoon. This large brown moth, commonly known as the Polyphemus moth, is named after the giant in Homer's epic poem, "The Odyssey". Unlike the mythological man-eating Polyphemus, this moth never feeds as an adult and has multiple generations per year.

Polyphemus cocoons, which are about 1.5 inches-long, are found hanging from branches or on the ground beneath several trees, including oak, hickory, maple, walnut, sycamore, willow, elms, etc. An outer layer of tree leaves surrounds the cocoon, which is composed of gray silk. Inside the cocoon is the pupa. In April and May, the large moth exits the cocoon in late afternoon and mates the same day. To locate these large moths, look near lights.

Polyphemus moths have a 3.5 to 5.5 inch wingspan with distinctive markings. Each front wing has an oval spot edged in white and black. Larger spots occur within a dark region on each hindwing. Near the edge of each wing there is a black line bordered by white. Large, feathery antennae are also present on moths. Many images of Polyphemus and other silkworms can be found online.

Antherea polyphemus moths do not cause feeding damage. After mating, females lay eggs singly on the underside of tree leaves. In summer, newly-hatched Polyphemus caterpillars consume their eggshells and are found singly rather than in groups. At maturity, the bright green caterpillars are about three inches long with a brown head (**Figure 1**).



Figure 1. Polyphemus caterpillar feeding on tree leaf. (photo credit: lee jenkins)

On each caterpillar segment, six bristles are visible from yellowish-orange tubercles (small swellings). Also, a slanted yellow line occurs on nearly all body segments. Caterpillars feed on tree foliage, with older ones consuming an entire leaf before cutting the petiole, causing the leaf to drop.

Polyphemus caterpillars produce clicking sounds from their serrated mandibles (mouthparts) when gently prodded. Caterpillars commonly click 50 to 55 times, lasting over a minute when attacked by a predator. This defensive response is also commonly followed by regurgitation to ward off birds or mammals. The fluid is thought to gum up the mouthparts of the attacker or it may contain chemical compounds that make the caterpillar distasteful. Following regurgitation, caterpillars attempt to re-imagine this fluid in preparation for another attack.



Figure 2. A mature Cecropia caterpillar feeding on tree foliage. (photo credit: bruce barrett)

Another large green caterpillar, *Hyalophora cecropia*, can be found

on apple, plum, cherry, walnut, elderberry, maple, ash, willow, elm, box elder, poplar, and lilac from April to August in Missouri. (**Figure 2**) The adult is commonly known as the Cecropia moth. In contrast to *Antherea polyphemus*, Cecropia moths are dark brown with four white crescent-shaped spots near the center of the wings and two black oval-shaped spots on the tips of the forewings. It is the largest moth found in North America with a wingspan of five to seven inches. Cecropia moths produce one generation per year. Female moths produce pheromones, which are detected by the male's feathery antennae up to a one mile distance. After mating, each female may lay up to 100 eggs that hatch in 10 to 14 days, producing tiny black caterpillars that feed in groups on tree and shrub foliage during summer. As caterpillars mature, they change from black to yellow with many black bristles. By August, caterpillars are up to four inches long and are green (Figure 2). Near the head, there are four orange-red tubercles or "knobs" with black bristles. Behind these tubercles, caterpillars have paired yellow tubercles with black spines on their body segments. On the sides of their body, there are also light blue tubercles occurring on each segment. In the early fall, Cecropia caterpillars spin a three inch-long cocoon attached to a twig and overwinter as pupae.

These two species of caterpillars don't usually cause excessive damage to plants and thus, chemical control is unnecessary in most cases. With a keen eye, you can spot the various life stages of these common silk moths in your area.

Interpreting Your Soil Test Results for Lawns and Gardens

by Manjula Nathan

Soil testing is an important tool for growing healthy lawns and gardens. To get reliable results and appropriate fertilizer and lime recommendations, it is important that you submit a representative soil sample from your lawn or garden. For guidelines in taking a representative sample and submitting to the lab for testing, visit MU Soil and Plant Testing Lab's website at <http://soilplantlab.missouri.edu/soil>. Once the soil test is conducted and the results are available, the ability to interpret the results is an important consideration in correcting the deficiency or imbalance.

Example of Soil Test Report from MU Soil Testing Labs for Lawns and Garden Fertility Test: results from a sample soil test

University Extension University of Missouri Columbia	Soil Test Report For Lawns and Gardens		Serial No. H46109H-1	County Boone	Region
----- MU Laboratories----- 23 Mumford Hall Columbia, MO 65211 (573) 882-0623		P.O. Box 160 Portageville, MO (573) 379-5431	Submitted 3/2/2016	Processed 3/29/2007	
http://www.soiltest.psu.missouri.edu/					
Sample ID: Home garden 1			Lab No: C060884 8		
This report is for: Lawn Garden 1000 Univ. Ave Columbia, MO 65201					
Last Limed: unknown					
SOIL TEST RESULTS		RATING			
pHs	5.5	Very low	Low	Medium	High
Phosphorus (P)	7 lbs/a	***			
Potassium (K)	191 lbs/a	*****			
Calcium (Ca)	5253 lbs/a	*****			
Magnesium (Mg)	495 lbs/a	*****			
Organic Matter:	2.6 %	Neutr. Acidity:	2.0 meq/100 g	CEC:	16.0 meq/100g
Fertilizer & Limestone Recommendations (lbs/1000 sq ft)					
Crop 1 vegetables 2 blueberries	Nitrogen(N) 0.5 1.0	Phosphorus(P ₂ O ₅) 4.0 4.0	Potash (K ₂ O) 0.5 1.0	Zinc(Zn) Sulfur(S) 50	LIME 100 0

Comments:

- *** Fertilizer rates are given in pounds of actual nutrient per 1000 sq. ft to be applied
- *** The soil needs additional organic matter for gardens and crops other than lawns. See MU Publication G6950, "Steps in Fertilizing Garden Soil" and G6956, "Making and Using Compost".
- *** Lime takes two to three months to react with the soil. Apply lime three to six months before planting.
- *** For blueberries soil needs to be treated with 50 lbs of elemental S per 1000 sq. ft to acidify the soil. It takes 3 months for S to react with the soil and acidify the soil.
- The soil should be tested every 2 to 3 years to determine the effects of your fertilization practices and to develop a new set of fertilizer and limestone guidelines.

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Explanation of Soil Test Report Form:

“Sample ID”: This is information you provided upon submitting your sample. The fertilizer suggestions are based on this.

“Ratings” indicates how high or low your soil is considered in each category.

“pHs” is an indication of the acidity or alkalinity of soil. A pH of 7 is neutral, while values below 7.0 are acidic and values above 7 are alkaline or basic. Vegetables and flowers grow best from pHs of 6.0 to 7.0. Most lawns grow well in pHs range of 5.5 -7.0. However, acid loving plants like azaleas, rhododendrons, blueberries and raspberries prefer pH below 5.5.

“Phosphorus, potassium, calcium, and magnesium” tests results are listed in lbs/a in the next four lines. These are some major essential elements required for plant growth. However, these numbers have little meanings for home owners. The ratings, however, indicate if these nutrients are considered low or high.

“Organic Matter” is the percent of organic matter found in your sample. Soil organic matter is essential in the formation of soil structure, reducing compaction, and for retaining plant nutrients. It helps in improving the water holding capacity of the soil, aeration, and tilth. While soil organic matter levels between 2% and 3% are fine for lawns, 4% to 6% is better for vegetables and flowers.

“Neutralizable Acidity (NA)” is a measurement of reserved acidity in soil and reported in mille- equivalents per 100 grams of soil (meq/100 g soil). This number along with pHs is used in calculating the lime requirement in soil.

Cation Exchange Capacity (CEC) is the ability of the soil to withhold positively charged nutrients and is reported in meq/100 g soil. While soils with high CEC values can retain more nutrients, low CEC soils can only retain fewer nutrients.

“Fertilizer and Limestone Recommendations” indicates how much nitrogen, phosphate, and potash (potassium), Zinc, Sulfur and lime your soil needs. This is the most important part of the report for home owners. These rates are in pounds needed per 1000 square feet. Depending on the garden size specific amount of nutrient requirements needs to be calculated and fertilizers to be selected accordingly.

“Comments” The soil test reports have comments at the end of the reports with notes on soil test in general, with additional notes for specific recommendations for your soil.

View MEG Publications on the web
<http://ipm.missouri.edu/meg/>

Soil testing for healthy lawns and gardens

by Manjula Nathan

The soil test is an excellent gauge of soil fertility. It is an inexpensive way to maintain good plant health and maximum productivity without polluting the environment by over application of nutrients.

Soil fertility fluctuates throughout the growing season each year. The quantity and availability of nutrients in the soil are altered by the addition of fertilizers, manure, compost, mulch, lime or sulfur and by leaching. Furthermore, large quantities of nutrients are removed from soils as a result of plant uptake, growth and development, and by harvesting of crops. A soil test will determine the current nutrient/fertility status. It also provides the information needed to maintain optimum fertility year after year.

Some plants grow well over a wide range of soil pH, while others grow best within a narrow range of pH. Most turf grasses, flowers, ornamental shrubs, vegetables and fruits grow best in slightly acid soils (pH 6.1 to 6.9). Plants such as rhododendron, azalea, mountain laurel and blueberries require a more acidic soil to grow well. A soil test is the only precise way to determine whether the soil is acidic, neutral or alkaline.

A soil test takes the guesswork out of fertilization and is extremely cost effective. It not only eliminates the expense of unnecessary fertilizers but also eliminates overuse of fertilizers and helps to protect the environment.

When is the best time for a soil test? Soil samples can be taken in the spring or fall for established sites. For new sites, soil samples can be taken any time when the soil is workable. Most people conduct their soil tests in the spring. However, fall is a preferred time to take soil tests if one suspects a soil pH problem and wants to avoid the spring rush. Fall soil testing will allow you ample time to apply lime to raise the soil pH. Sulfur should be applied in the spring if the soil pH needs to be lowered.

How to take a soil sample? Most errors in soil testing occur when the sample is taken. Potential sources of errors include the following:

- Too few cores per sample
- Failure to properly divide the area to be sampled
- Failure to cover the whole area
- Contaminated sample

Taking a representative sample is important in soil testing. Use a trowel, spade and sampling tube/core samplers.

- For garden and lawn establishment or renovation, take a 6-7 inch sample.
- For established lawns, take a 5-6 inch sample after removing thatch.
- Sample from five or more scattered/random spots in the test area.

What soil sampling tools do I need? A soil sample is best taken with a soil probe or an auger. Samples should be collected in a clean plastic pail or box. These tools help ensure an equal amount of soil to a definite depth at the sampling site. However, a spade, knife, or trowel can also be used to take thin slices or sections of soil.

Push the tip of a spade deep into the soil and then cut a 1/2-inch to 1-inch slice of soil from the back of the hole. Be sure the slice goes 6 inches deep and is fairly even in width and thickness. Place this sample in the pail. Repeat five or six times at different spots over your garden. Thoroughly mix the soil slices in the pail. After mixing thoroughly, take out about 1-1/2 cup of soil and mail or, preferably, take it to your University Extension Center. You can also mail or deliver it to the MU Soil and Plant Testing Laboratory in Columbia or at the Delta Research Center in Portageville. It is important that you fill out the soil sample information form (Fig. 1) completely and submit it with your sample. By indicating on the form the crops you wish to grow, you can get specific recommendations. For additional information on submitting samples to the lab visit lab's website at: <http://soilplantlab.missouri.edu/soil/>

How often should I test my soil? Soil should be tested every two to three years. In sandy soils, where rainfall and irrigation rates are high, samples should be taken annually.

What tests should be run? In general a regular fertility test is sufficient. This includes measurement of pH, neutralizable acidity (NA), phosphorus, potassium, calcium, magnesium, organic matter (OM) and cation exchange capacity (CEC).

What do the test result numbers mean? Some labs report soil test values as amounts of available plant

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Soil testing for healthy lawns and gardens, continued.

Fig. 1. The Soil Sample Information for Lawn and Garden

UNIVERSITY OF MISSOURI Extension		Soil Sample Information for Lawns and Gardens		Serial No. H	H
Soil and Plant Testing Laboratory University of Missouri 101 Agriculture Hall Columbia, MO 65211-2535 (573) 882-6225 (800) 526-0100 Email: soiltest.msu@missouri.edu		Address _____		Date _____	_____
Soil and Plant Testing Laboratory P.O. Box 1100 Mississippi State, MS 39762-1100 (662) 325-5221 (800) 526-0100 Fax: (662) 325-4775 Email: soiltest.msstate@mississippi.edu		City _____ State _____ ZIP _____		Account No. Firm _____	Or address _____
		Phone _____ Fax _____		Or address _____	Or address _____
		Email _____			
		County of origin _____		<input type="checkbox"/> Bill county or <input type="checkbox"/> Bill firm	Phone _____ Fax _____
		Billing county code _____		Email _____	
Plant Code for Lawns and Gardens Options (Instructions on back of form)					
1 Impatiens 2 Annual flower gardens					
Lawns <u>Shrubbery/Tree/Perennials/Reseeds/Replants</u>					
3 Fescue, bluegrass, ryegrass (establishment) 4 Fescue, bluegrass, ryegrass (reg. maintenance) 5 Fescue, bluegrass, ryegrass (high maintenance) 6 Bermudagrass, buffalograss, zoysia (establishment) 7 Bermudagrass, buffalograss, zoysia (reg. maintenance) 8 Bermudagrass, buffalograss, zoysia (high maintenance) 9 Pecan, pecan seedlings (specify) 10 Shrubbery e.g., azaleas, hydrangeas, mockorange, kalmia, arborvitae, hibiscus, forsythia, honeysuckle, lilac, camellia, barberry 11 Trees (specify) e.g., magnolias, white pine, pin oak, tulip, magnolia, oak, sassafras, spruce, junipers, redwood 12 Fruit trees (specify)					
<u>Lawns and Garden Options</u>					
1 2 3					
Specific plant Specific plant Specific plant					
Ref Date Specific plant Ref Date Specific plant Ref Date Specific plant					
Lab No. (not used on bill) (specify date) Lab No. (specify date) Lab No. (specify date)					
Send report by: <input type="checkbox"/> Hard copy <input type="checkbox"/> Email <input type="checkbox"/> FAX					
Check (<input type="checkbox"/>) Testing Desired					
Lab (2) Lab Lab C Lab E Lab K Lab M A Lab M B Lab S					
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15					
Regular fertility test includes pH, N.A., P.K., Ca, Mg, CEC and DM					
Commodity _____					
MP0005 (Revised 02/04/04)					
University of Missouri System, Lincoln University, U.S. Department of Agriculture and local University Extension Councils comprising extension.missouri.edu institutions					
White Copy - Lab Yellow - File					

Figure 2. A soil test report from MU Soil and Plant Testing Laboratory shows the results of soil analysis and recommends fertilizer and limestone needs to improve plant health and productivity.

SOIL TEST RESULTS		RATING					
		Very low	Low	Medium	High	Very high	Excess
pHs	4.5	*****					
Phosphorus (P)	25	Ibs/a	*****				
Potassium (K)	233	Ibs/a	*****	*****			
Calcium (Ca)	1635	Ibs/a	*****	*****			
Magnesium (Mg)	246	Ibs/a	*****	*****			
Organic Matter:	23 %		Neut. Acidity:	6.0 meq		CEC:	11.4 meq

Fertilizer & Limestone Recommendations (lbs/1000 sq ft)						
Crop	Nitrogen (N):	Phosphorus(P_2O_5)	Potash (K_2O)	Zinc(Zn)	Sulfur(S)	LIME
4 fescue,blue, ryegrass(avg)	2.0	1.0	0.0			150
						0
						0

Comments: ---Some herbicide labels list restrictions based on soil pH in water. Use the estimated pH in water of 5.0 as a guide to the label. If you wish to have soil pH in water analyzed, contact your dealer or local Extension specialist listed below.
--The soil should be tested every 2 to 3 years to determine the effects of your fertilization practices and to develop a new set of fertilizer and limestone guidelines.

***For average maintenance of fescue, blue, ryegrass apply one pound of nitrogen per 1000 square feet in early September and again in early November or April-May. If available use a fertilizer containing about 1/2 of the nitrogen in slow release form. See MU Publication G6705, "Cool-Season Grasses, Lawn Maintenance Calendar".

***Do not apply more than 50 pounds of limestone per 1000 square feet in one application to lawns. A second application can be made 6 months to one year later.

nutrients, and others report extractable nutrients that will become available to the plants (Fig. 2). Fertilizer rates are given in pounds of actual nutrient (as distinct from pounds of fertilizer) to be applied per 1,000 square feet.

Apply fertilizers as recommended by soil test

All fertilizer recommendations given in a soil test report are based on the amount of nutrient (N, P₂O₅, and K₂O) to apply for a given area. Lawn and garden

recommendations are given in pounds per 1000 sq. ft. From the given recommendations it is necessary to select an appropriate fertilizer grade and determine how much of this fertilizer to apply to the garden area. Numbers on fertilizer bags indicate the exact percentages of nutrients by weight: 100 lb of 5-10-10 fertilizer contains 5 lb of nitrogen (N), 10 lb of phosphate (P_2O_5), and 10 lb of potash (K_2O). Because it is difficult to achieve the exact amount of all recommended nutrients from the garden fertilizer blends available in the market, it is important to match the nitrogen requirement.

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Example

A soil test recommendation for your vegetable garden calls for 2 lb of N/1000 sq. ft, 0 lb of P₂O₅ /1000 sq. ft and 1 lb of K₂O. The garden is 40 ft by 10 ft.

- **Step 1:** Calculate the area to be fertilized. Multiplying length by width, the area of the garden is $40 \times 10 = 400$ sq. ft.
- **Step 2:** Select the fertilizer to be used. Match the ratio of nutrients recommended to the fertilizer grades available. The N-P-K nutrient ratio based on the soil test is 2-0-1. Ideally, a fertilizer such as 10-0-5 or 20-0-10 or 30-0-15 should be selected. At the local garden store, fertilizer bags marked 20-10-10, 27-3-3 and 25-0-12 are available. The one marked 25-0-12 best matches the ratio of 2-0-1 recommended by soil test.
- **Step 3:** Determine the fertilizer amount to apply: Divide the recommended amount of nutrient by the percentage of the nutrient (on a decimal basis) in the fertilizer.
 - First calculate the fertilizer recommendation for the garden area: $2 \text{ lb of N/1000 sq. ft} \times 400 \text{ sq. ft/garden} = 0.8 \text{ lb of N per 400 sq. ft garden}$. 100 lb of the 25-0-12 garden fertilizer blend will have 25 lb of N and 12 lb of K₂O.
 - To provide 0.8 lb of N for the 400 sq. ft garden you would require: $100 \text{ lb of fertilizer blend} / 25 \text{ lb of N} \times 0.8 \text{ lb of N} = 3.2 \text{ lb of the fertilizer blend required to provide the N requirement of the garden}$. Since the fertilizer blend ratio is almost the same as the recommended ratio, it will provide the required amount of K (1.6 lb of K₂O) to the garden.

Note: The weight of 2 cups of dry fertilizer is approximately 1 pound. Therefore to meet the garden fertilizer recommendation, you will need about 6 cups of the fertilizer blend (25-0-12) material for the 400 sq. ft. area.

Never apply fertilizers directly on the plant. Ideally, you should apply it about three to four inches from the plant to let the roots absorb the nutrients.

Garden soil needs plenty of organic matter. In addition to applying commercial fertilizer, it is recommended to apply manure, compost and organic sources of fertilizers that would add considerable amount of organic matter to the soil. Calculating the fertilizer rates using organic sources is often difficult. However, some types of organic fertilizer can be purchased in bags that are labeled with their fertilizer grade. Fertilizer rates for these sources can be calculated in the same manner as for inorganic fertilizers

Recommended application rate for various granular fertilizers to apply one pound of nitrogen.

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	Application Rate		
	Per 1000 square feet	Per 10 square feet	
Source	Pounds	Cups	Tablespoons
10-10-10	10	20	4
8-8-8	12.5	25	5
12-4-8	8	16	3
16-4-8	6	12	2
20-10-10	5	10	2
12-6-6	8	16	3

APRIL GARDENING CALENDAR

Category	Week				Activity
	1	2	3	4	
Ornamentals	x	x	x	x	Study your landscape for gaps that could be nicely filled with bulbs. Mark these spots carefully and make a note to order bulbs next August.
	x	x	x	x	Enjoy, but do not disturb the many wildflowers blooming in woodlands throughout Missouri.
	x	x	x	x	When buying bedding plants, choose compact, bushy plants that have not begun to flower.
	x	x	x		When crabapples are in bloom, hardy annuals may be transplanted outdoors.
	x	x	x		Fertilize established roses once new growth is 2 inches long. Use a balanced formulation.
					Begin spraying to control black spot disease.
	x	x			Examine shrubs for winter injury. Prune all dead and weakened wood.
	x				Groundcovers can be mowed to remove winter burn and tidy plants up. Raise mowers to their highest settings. Fertilize and water to encourage rapid regrowth.
	x				Shrubs and trees best planted or transplanted in spring, rather than fall, include butterfly bush, dogwood, rose of Sharon, black gum (<i>Nyssa</i>), vitex, red bud, magnolia, tulip poplar, birch, ginkgo, hawthorn and most oaks.
	x				Winter mulches should be removed from roses. Complete pruning promptly. Remove only dead wood from climbers at this time. Cultivate lightly, working in some compost or other organic matter.
		x	x		Look for flowering dogwoods in bloom.
		x	x		Break off rims from peat pots when transplanting seedlings, otherwise they can act as a wick to draw moisture away from the roots.
		x	x		Transplant Virginia bluebells (<i>Mertensia virginica</i>) after bloom, but before the foliage disappears.
		x	x		Do not prune boxwoods before April 15.
		x	x		Evergreen and deciduous hedges may be sheared. Prune the top narrower than the base so sunlight will reach the lower limbs.
		x	x		Oaks and hickories bloom.
		x	x		If soil conditions allow, take a chance sowing peas, lettuce, spinach and radish. If the weather
Lawns		x	x		Easter lilies past blooming can be planted outdoors. Set the bulbs 2 to 3 inches deeper than they grew in the pot. Mulch well if frost occurs.
		x	x		Apply controls for holly leaf miner when the new leaves are just beginning to grow.
		x	x		Balloon flower (<i>Platycodon</i>), hardy hibiscus, gasplant (<i>Dictamnus albus</i>) and some lilies are slow starters in the spring garden. Cultivate carefully to avoid injury to these tardy growers.
			x		Prune spring flowering ornamentals after they finish blooming.
			x		Begin planting out summer bulbs such as caladiums, gladioli and acidanthera at 2 week intervals.
	x	x	x	x	Start mowing cool season grasses at recommended heights. For complete details, refer to University Extension Guide #6705, Cool Season Grasses.
Vegetables	x	x			Topdress low spots and finish overseeding thin or bare patches.
	x	x			Aerate turf if thatch is heavy or if soil is compacted.
	x	x			Apply crabgrass preventers before April 15. Do not apply to areas that will be seeded.
	x	x			Finish transplanting broccoli, Brussels sprouts, cabbage, and cauliflower plants into the garden. High phosphorous fertilizers help get transplants off to a quick start.
	x	x			Plants started indoors should be hardened off outdoors in cold frames before being transplanted into the garden.
	x	x			Start cucumber, cantaloupe, summer squash, and watermelon seeds indoors in peat pots.
	x	x			Finish sowing seeds of all cool-season vegetables not yet planted.

Gardening Calendar supplied by the staff of the William T. Kemper Center for Home Gardening located at the Missouri Botanical Garden in St. Louis, Missouri. (www.GardeningHelp.org)

APRIL GARDENING CALENDAR

Category	Week				Activity
	1	2	3	4	
Fruits	x	x			Plastic films can be used to preheat the soil where warm season vegetables are to be grown.
	x	x			Asparagus and rhubarb harvests begin.
	x	x	x		Handpick and destroy asparagus beetles.
	x	x	x		Keep your hoe sharp! Don't allow weeds to get an early start in your garden.
	x	x	x		Flower stalks should be removed from rhubarb plants, if they develop.
	x	x	x		Try an early sowing of warm-season crops such as green beans, summer squash, sweet corn, New Zealand spinach and cucumbers.
	x	x			Thin out crowded seedlings from early plantings of cool season crops such as beets, carrots, lettuce, onions and radish.
	x	x			Sow seeds of luffa and hard-shell gourds indoors in peat pots. Soak seeds overnight before planting.
	x	x			Make succession sowings of cool-season crops.
	x	x	x		Begin planting lima beans, cucumbers, melons, okra and watermelons.
	x	x	x		Begin setting out transplants of tomatoes, eggplants, peppers and sweet potatoes.
	x	x	x	x	Blemish-free fruits unmarred by insect or disease injury can rarely be produced without relying on regular applications of insecticides and fungicides For special information, consult University Extension Guide Sheet #G6010, Home Fruit Spray Schedule.
	x	x			Wooden clothespins make useful spreaders for training young fruit limbs. Place pins between the trunk and branch to force limbs outward at a 60 degree angle from the trunk.
	x	x			A white interior latex paint may be brushed on the trunks of newly planted fruit trees to prevent sunburn. This will gradually weather off in time.
	x	x			Stink bugs and tarnished plant bugs become active on peaches.
	x	x			Leaf rollers are active on apple trees. Control as needed.
	x	x			Prune peaches and nectarines now.
Miscellaneous	x				Plant bare-root or potted fruit trees as soon as the soil can be worked.
	x				Remove tree wraps from fruit trees now.
	x	x	x		Protect bees and other pollinating insects. Do not spray insecticides on fruit trees that are blooming.
	x				Destroy or prune off webs of eastern tent caterpillars. "B.t." (Dipel) is a safe biological spray.
	x	x	x		Orange, jelly-like galls on cedar trees spread rust diseases to apples, crabapples and hawthorns.
	x	x	x		Begin sprays for fire-blight susceptible apples and pears using an agricultural streptomycin.
	x				Spider mites and codling moths become active on apples.
	x	x			Termites begin swarming. Termites can be distinguished from ants by their thick waists and straight antennae. Ants have slender waists and elbowed antennae.
	x	x			Look for morel mushrooms when lilacs bloom and the forest floor turns green.
	x				Mount a rain gauge on a post near the garden to keep track of precipitation so you can tell when to water. Most gardens need about 1 inch of rain per week between April and September.
	x	x	x		Mole young are born in chambers deep underground.
	x	x	x		Honeybees are swarming. Notify a local beekeeper to find a new home for these beneficial insects.
	x				Soaker hoses and drip irrigation systems help you save water and money.
	x				Hummingbirds return from their winter home in Central America.
	x				Wasp and hornet queens begin nesting.

