

The Full Scoop about Fertilizers

An Eight-Part Series *by Nanette Londeree*

“You are what you eat,” or so the saying goes. As much as you love chocolate, think what you’d be like if that’s all you ate! Plants, like people, thrive on a well-balanced diet. Imagine you’re on a tropical island, and your kitchen (your only source of food) is stocked with a huge variety of fruits, vegetables and nuts, meat, fish, poultry and dairy, everything you’ll need to stay healthy - for a month. You’ve also got oodles of boxes of corn flakes. You can’t leave the island to get anything more food – you have to subsist only on what’s in your island kitchen. You’ll do great for that first month, but after that? Cornflakes three times a day, every day with no reprieve? While it may be enough to keep you going, it’s not likely to keep you filled with energy and healthy enough to fight off disease after a few months. Guess what? You’re roses aren’t any different. Both you and your roses need an array of nutrients to be at your best.

Growing healthy roses that produce bountiful blooms and are able to fend off disease require the basics of light, moisture, air and nutrients. You take care of the light and air when choosing an appropriate planting location, and supplement Mother Nature for needed moisture and nutrients through irrigation and fertilizing. Providing the right amount of water at the right time is essential to healthy plants; similarly, ensuring that the right nutrients are present and available to the plant when they’re needed is just as important.

We gardeners routinely describe fertilizing as “feeding” our plants, but that’s not really accurate. Plants “feed” themselves, producing their own food in the form of sugars through the process of photosynthesis. We add plant nutrients, those chemical elements necessary for plant growth, to supplement those naturally occurring in the soil. In a for-

est under natural conditions, fallen leaves and dead plants slowly decay; they continually replace nutrients taken up by living plants and provide a steady, balanced level of nutrients. That same cycle of continual replacement isn’t generally available to cultivated plants without our intervention. Even if you’re lucky enough to start with great garden soil, as your roses grow, they absorb and remove nutrients from the soil leaving it less fertile. By adding materials to the soil through fertilizing, you’re making the desired nutrients available to the plant.

So how do you decide what to feed your soil? Roses have the undeserved reputation of being demanding plants that need lots of fertilizer. That’s not necessarily the case. While it’s likely you’ll get bigger flowers and more of them by adding key nutrients, in general, they don’t need lots of supplemental nutrients to be healthy and bloom. What fertilizers you use, and when you use them depends on what do you want from your plants along with the nature of the soil and the environmental conditions they are growing in. As an example, an avid rose exhibitor is likely to have a more aggressive fertilizing program, providing greater quantities of nutrients more frequently than the gardener who’s happy with simply flower-full plants. Roses planted in a shady location grow more slowly, absorbing nutrients at a lower rate than those planted in full sun, so don’t need to be replenished frequently. A young, developing rose plant with few leaves won’t use some nutrients as quickly as a fully mature plant would, but may need others in order to develop a strong root system. Other considerations when choosing a fertilizer include the cost of the material, the ease of use, and any potential impact on it may have on the environment.

How About Coffee Grounds?

After your cup of joe in the morning, don’t toss the grounds in the garbage! They can be a beneficial addition to your garden soil. Grounds from your coffee maker are reported to be slightly to highly acidic (similar to peat moss), depending on the source of the coffee beans. They’re a low level source of nitrogen (NPK ration of 2.0-0.3-0.2) as well as a minor source of calcium and magnesium. They can lower the pH of soil, so they’re best used in the soil of acid-loving plants like rhododendrons, azaleas and blueberries.



The only fertilizer that the healthy and floriferous roses 'Gemini' and 'Ballerina' get is a mulch of composted duck manure once a year.

photos by Nanette Londeree

Back to a balanced diet. Plant nutrients can only do their job if the other basic requirements for growth are met – adequate light, air and water. Fertilizers not only won't help plants growing in water-logged or moisture-deprived soil, they can actually end up damaging plants. Over-dosing with some nutrients like nitrogen can burn tender roots and foliage and stimulate excessive new growth that actually attracts sucking insect pests like aphids. Once again, adding the right material at the right time can give you the results you desire.

There are plenty of products you can buy at your local garden center, but not all valuable fertilizers come in a bag or bottle. Ever tossed used coffee grounds around the base of a potted plant, or dug banana peels into the soil? Mixed a scoop of wood ashes in when planting a new rose? Top-dressed the soil with worm castings? All serve as fertilizer by providing nutrients to the soil as they break down, but cost little to nothing, and can provide some nutritional benefits.

In the coming months, we'll explore the world of plant nutrients, fertilizers and feeding both your soil and your roses, clarify what a fertilizer is and what it does, look at the myriad types of available fertilizers, consider the many options of how and when to fertilize, delve into amendments and additives, and identify some nutritional deficiencies that may plague your plants and options to remedy them. Next time, we'll focus on basic plant needs and growing conditions,

Now, where should I put those coffee grounds?

What Your Roses Really Need

Giving your roses a high quality environment and balanced nutrition can result in robust plants that produce lots of

healthy foliage, an abundance of blooms, and an enhanced ability to resist attack from pests and disease. It doesn't have to be a lot of hard work, complicated or involve a truckload of chemicals. Consider those old roses flourishing in cemeteries or abandoned gardens that continue to grow and bloom with no human intervention – they almost seem to thrive on neglect! Compared to those survivors, our modern roses are really pampered; in return, they provide us with gorgeous flowers for much of the year. So, what are the absolute minimum things roses need?

They're actually pretty simple – begin with a healthy specimen of a well-chosen rose variety, and plant it in a sunny location that gets at least six hours of sun a day. Locate the rose where it doesn't have to compete with other plants roots and has reasonable protection from wind and surfaces that radiate a lot of heat. Plant it in soil that has good drainage. Keep the rose watered, appropriate for weather conditions and type of soil. Deadhead spent blooms to stimulate flower production, and prune to encourage new growth and blooming. That's all you really NEED to do. To promote more vigorous growth and abundant bloom you can feed them, mulch to keep weeds down and conserve water, and protect them from pests and disease.

Fertilizing plants is desirable to provide nutrients essential for optimum growth at the time they are needed. Even if you're lucky enough to start with great garden soil, as your plants grow, they absorb nutrients and leave the soil less fertile. By fertilizing, you replenish lost nutrients and ensure that plants have what they need to flourish. If and how you fertilize your roses depends on what you want from them. If you're an active exhibitor, you're likely to have a more intensive fertilization program to pump out that Queen of Show bloom than if you're simply looking for lovely flowers to

grace your garden. No matter what you're after, providing your plants with their nutritional needs starts with the soil. What you see going on with your roses above the ground is largely determined by what goes on below your feet (the top 4 – 8 inches of soil is where plants mostly get their nutrients). No matter how much you baby your plants, if the soil isn't functional and healthy, it won't matter much. A golden rule of gardening says, "If you treat your soil well, it will treat your plants well."

Have you ever seen fluffy, chocolate brown dirt that's so light and workable, you can sink your hand into it up to your elbow? It's the stuff that gardening dreams are made of. Most likely, the native soil didn't look like that and the owner of the enviable stuff has been working at creating it for a long time. That ideal soil would be made up of 45% minerals (sand, clay, silt), 5 % organic (plant and animal) material, 25% air and 25% water. The mineral portion would be loam (20 – 30% clay, 30 – 50% silt and 30 – 50% sand). It would be crumbly, relatively dark in color, smell earthy and rich, team with microorganisms and earthworms, have plenty of nutrients and a pH between 6.5 and 7.5. How does your soil compare to this ideal? If it doesn't quite measure up, you may want to add materials to improve it. That's where amendments, conditioners, enrichments and mulches can play a role – all of them can be considered, depending on the materials used, a fertilizer.

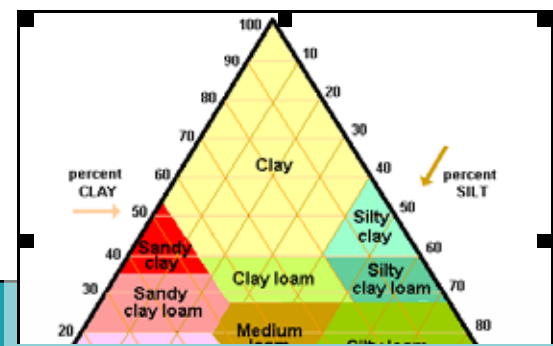
Before you start piling on soil conditioner, Epsom salts, fish emulsion or other fertilizers, it's important to understand your current soil and conditions – otherwise you may just be wasting your time and money. The main things you want to know about your soil are the texture, structure, pH and drainage. Texture is the proportion of sand, silt and clay particles that make it up. The structure relates to how the particles are held together, or clump together into crumbs or clods. The pH is how acidic or basic the soil is, and drainage – whether water drains freely from the soil, sits stubbornly in place or somewhere in between. Each of these can play a

key role in the health of the soil and its effective delivery of needed nutrients to your roses.

A simple physical test can help you figure out your soil texture, you can purchase an inexpensive pH test kit to confirm the soil's pH, and drainage is easy to evaluate – just dig a hole, fill it with water and time how long it take drain completely. Once you're equipped with this information, you'll be able to determine what you may want to change or improve in your soil, what, when and how much you'll need of the desired material to do so, and how to do it. We'll be covering those subjects and more in coming issues.

What is your soil texture?

Fill a glass container about two-thirds full of water, and add enough dry, crumbled soil to almost fill the container. Add a lid and shake vigorously for a few minutes, then set it aside for a day or two until the solids have settled out. Sand will settle to the bottom, then silt, and clay will be the top layer. Determine the approximate percentage of each major layer; find your approximate percentage on each side of the triangle below, then move towards the center of the triangle and find where the three percentages meet. That will identify your type of soil.



How About Alfalfa?

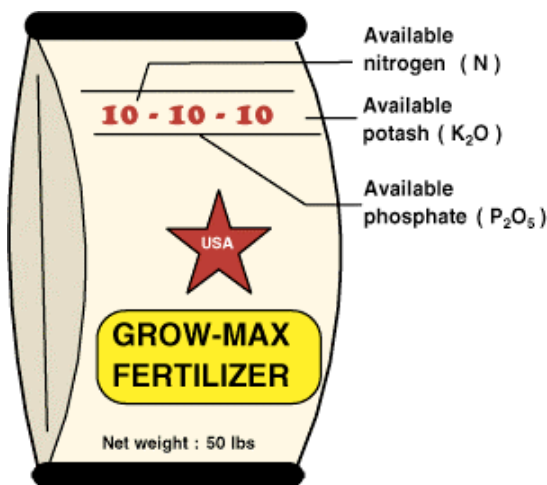
Alfalfa is not just for rabbits! In addition to the organics and minerals in alfalfa that are great for feeding the soil (NPK ratio 3-1-2), the tonic that roses really go for is triacontanol, a naturally occurring fatty alcohol produced as the alfalfa breaks down. It's a growth stimulant, so when it reaches the roses roots, it can trigger new growth at the bud union or base of the plant, in addition to increasing overall plant vigor and flower production. You can use meal or pellets. Before you purchase, confirm that the product doesn't contain any molasses, sugar or other additives. You don't need these other ingredients, and they'll cost you more.

What Are They and What Do They Do?

There's a lot of confusion about terms when it comes to fertilizers. Just stop and peruse the shelves at your local nursery or home improvement store. You'll find a mind-boggling array of things to sprinkle, spread, spray on, pour on, mix in, pound in; there's food, meal, pellets, encapsulated nutrients, and don't forget the conditioner, compost, mulches and more. Are they all fertilizers? Is a fertilizer the same thing as a nutrient? An amendment? A mulch? If not, what's the difference? And what do they do? Are there legal requirements for something to be labeled as a fertilizer? Let's find out.

Plant nutrients are the chemical elements taken in by plants that are essential for their growth and development. A fertilizer is a material added to the environment around the plant that directly impacts the plant, providing it with specific nutrients. Amendments are any materials mixed into the soil that indirectly aid plant growth by improving the condition of the soil like its structure or texture, water retention or microbial activity. Mulches are organic or inorganic materials placed on the soil surface to help prevent weed growth, conserve moisture and add organic matter to the soil as they break down.

Fertilizers are NOT plant food! Plants make their own food (sugars and carbohydrates) using water, carbon dioxide and sunlight and combine them with plant nutrients to produce the proteins, enzymes and vitamins essential to plant growth. When we fertilize, we are applying plant nutrients to supplement nutrients naturally occurring in the soil.



The law requires that manufacturers guarantee the accuracy of what is claimed on a product label - if it's on the tag, it's got to be in the bag. The term fertilizer refers to a material that guarantees the minimum percentages of primary nutrients - nitrogen, phosphate and potash, found on the container label. The product label may also identify other nutrients, like sulfur, iron and zinc if the manufacturer wants to guarantee the amount contained in the product. In some cases, a fertilizer will contain secondary nutrients or micronutrients not listed on the label because the manufacturer does not want to guarantee their exact amounts. Soil amendments make no legal claims about nutrient content or other helpful (or harmful) effects they may have on the soil and plant growth.

Plants require seventeen different chemical elements for healthy growth though most of these elements are already in the soil or the air and don't need to be added regularly. These seventeen elements are broken down into four general groups - the essential elements, the primary or macronutrients, the secondary nutrients and the micronutrients or trace elements. The elements essential to all forms of life, carbon, hydrogen and oxygen, are derived primarily from air and water. The three primary nutrients are nitrogen, phosphorus and potassium; they are the most common fertilizer ingredients. Next are the three secondary nutrients - calcium, magnesium and sulfur. The remaining eight are micronutrients - boron, chlorine, copper, iron, manganese, molybdenum, nickel and zinc. While the three essential elements are vital for life itself (no plant will grow without all of these), the remaining fourteen play varying roles in plant growth and health. The following table provides some of the key functions of each element as well as the soil pH range in which they are most readily available.

Next time we'll explore the many types, forms and formulations of fertilizers that are available, including organic vs inorganic materials.

How About Banana Peels?

If you like slow release, natural fertilizer for your roses, don't toss those banana peels away. They're rich in potassium that can be a boost to overall plant vigor and disease resistance. Chop them up and throw them in the compost bin, or bury them around the base of your plants.

Nutrient	Symbol	Function	Optimal Soil pH	Sources
Primary				
Nitrogen	N	<ul style="list-style-type: none"> ▪ Constituent of amino acids, proteins, enzymes and chlorophyll ▪ Important in photosynthesis ▪ Important for many growth and development processes 	6.0 – 8.0	Air, fertilizer
Phosphorous	P	<ul style="list-style-type: none"> ▪ Important in photosynthesis ▪ Constituent of proteins, enzyme systems ▪ Aids in proper plant maturation, ability to withstand stress ▪ Encourages blooming and root growth 	6.5 – 7.5 9.0 – 10+	Fertilizer, bone meal, superphosphate
Potassium	K	<ul style="list-style-type: none"> ▪ Improves overall vigor of the plant ▪ Helps in production of carbohydrates and provides disease resistance ▪ Helps regulate metabolic activities 	6.0 – 10+	Soil minerals, organic materials, and fertilizer
Secondary				
Calcium	Ca	<ul style="list-style-type: none"> ▪ Used by plants in cell membranes and to neutralize toxic materials ▪ Improves soil structure and helps bind organic and inorganic particles together 	6.5 – 8.5	Dolomitic lime, gypsum, superphosphate.
Magnesium	Mg	<ul style="list-style-type: none"> ▪ Necessary for the production of chlorophyll ▪ Required cofactor in many enzymatic reactions ▪ Aids movement and efficiency of phosphorus 	6.5 – 8.5	Soil minerals, organic material, fertilizers and dolomitic limestone
Sulfur	S	<ul style="list-style-type: none"> ▪ Component of many proteins 	6.0 – 10+	Soil, fertilizers
Micro				
Boron	B	<ul style="list-style-type: none"> ▪ Helps in the use of nutrients and regulates other nutrients ▪ Aids production of sugar and carbohydrates 	5.0 – 7.0	Organic matter and borax
Chlorine	Cl	<ul style="list-style-type: none"> ▪ Aids plant metabolism. 		Soil
Copper	Cu	<ul style="list-style-type: none"> ▪ Important for reproductive growth ▪ Aids in root metabolism ▪ Helps in the utilization of proteins 	5.0 – 7.0	
Iron	Fe	<ul style="list-style-type: none"> ▪ Essential for formation of chlorophyll 	4.0 – 7.0	Soil, iron sulfate, iron chelate
Manganese	Mn	<ul style="list-style-type: none"> ▪ Functions with enzyme systems involved in breakdown of carbohydrates and nitrogen metabolism 	5.0 – 7.0	Soil
Molybdenum	Mo	<ul style="list-style-type: none"> ▪ Helps in the use of nitrogen 	6.5 – 10+	Soil
Nickel	Ni	<ul style="list-style-type: none"> ▪ Important enzyme component and in nitrogen metabolism 		Soil
Zinc	Zn	<ul style="list-style-type: none"> ▪ Essential for the transformation of carbohydrates ▪ Regulates consumption of sugars ▪ Part of the enzyme systems which regulate plant growth 	5.0 – 7.0	Soil, zinc oxide, zinc sulfate, zinc chelate

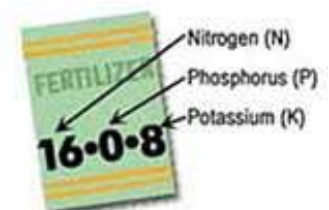
So Many Choices!!!!

If you're shopping at a nursery or home improvement center for fertilizers, you can be faced with a bewildering array of different forms and formulas. Before you pull out your wallet, have an idea of what you are trying to achieve with the product - improve the soil, correct a deficiency, or simply provide general nutrition. Do you want to add it to the soil or spray it on the plant? Does it matter if it's chemically syn-

thesized or are you sticking with organics? Getting a clear idea on what you want the fertilizer to do and how you want to use it will help make your selection easier.

What's on the label

Believe it or not, fertilizer labels are regulated and they include a lot of terminology; a fertilizer active ingredient is the specific material re-



sponsible for the intended beneficial purpose of the product while inert ingredients (often referred to as filler) are substances other than an active ingredient intentionally included in a fertilizer but have no intended nutritional value. Chemically based fertilizers are simple compounds derived from naturally occurring chemical elements; nitrogen from the atmosphere is synthesized to create ammonia and urea, while phosphate and potassium (potash) are from mined deposits. Naturally- based fertilizers are derived from organic

materials - bone meal, kelp meal, fish emulsion and manure are commonly used organic fertilizers.

A product labeled as a fertilizer guarantees the minimum percentages of the primary nutrients - nitrogen, phosphate and potash, identified on the label are present in the stated amounts in the container. In some cases, a fertilizer will contain

secondary nutrients or micronutrients not listed because the manufacturer does not want to guarantee their exact amounts. The relative amount of each macronutrient is listed as a percentage of the total on the fertilizer package label, always in the same sequence – nitrogen, phosphorus and potassium. A fertilizer that is 10-20-10 contains 10% nitrogen, 20% phosphorus and 10% potassium, or a total of 40% active food value (10+20+10), with the remaining 60% of the mixture made up of inert, inactive material that is generally of little or no practical value from the fertilizer standpoint. The ideal N-P-K proportion for roses is 1:2:1.

Chemical vs organic

There's an ongoing debate about the pros and cons of

chemical vs organic fertilizers. Does a plant know or care what the source of the elements is? Chemically based fertilizers come in a wide variety of concentrations and formulations, are generally convenient to use, readily available, provide rapid results and are the cheapest sources for the three macronutrients. On the flip side, the macronutrients can be rapidly leached during periods of heavy rain or irrigation (ending up in groundwater and runoff), chemical salts can build up in the soil following heavy applications over long periods of time and many formulations contain little or no trace elements thus requiring addition of supplemental materials.

Most of the nutrients in organic fertilizers are not water soluble and are found in low concentrations; they are broken down by soil microbes and released to the plant slowly over a period of months or even years. They can serve as both fertilizer and soil conditioner, improving soil structure and building the populations of beneficial soil organisms, and add valuable trace elements. There is a minimum loss of nutrients through leaching, and little accumulation of chemical salts so they are much less likely to burn roots than more concentrated chemicals. Organic fertilizers may contain pathogens and other disease causing organisms if not properly composted, their nutrient contents are variable and their release to available forms that the plant can use may not occur at the right plant growth stage. Also, the difficulty in obtaining some of the materials and their potentially objectionable odor may be disadvantages for this type of fertilizer.

Available Forms of Fertilizers

Once you have decided what elements you want to apply to your roses, you should consider the different forms that each may come in. Whichever material and method you use to fertilize, liquid or dry, simple or multi nutrient, chemical or organic – don't try to second guess the manufacturer - follow the directions. Too much of a good thing, even manure,



GENERAL PURPOSE	
20-10-20	
(For Continuous Liquid Feed Programs)	
Guaranteed Analysis	F1143
Total nitrogen (N)	20%
7.77% ammoniacal nitrogen	
12.23 % nitrate nitrogen	
Available phosphate (P ₂ O ₅)	10%
Soluble potash (K ₂ O)	20%
Magnesium (Mg) (Total)	0.05%
0.05% Water Soluble Magnesium (Mg)	
Boron (B)	0.0068%
Copper (Cu)	0.0036%
0.0036% Chelated Copper (Cu)	
Iron (Fe)	0.05%
0.05% Chelated Iron (Fe)	
Manganese (Mn)	0.025%
0.025% Chelated Manganese (Mn)	
Molybdenum (Mo)	0.0008%
Zinc (Zn)	0.0025%
0.0025% Chelated Zinc (Zn)	
Derived from: ammonium nitrate, potassium phosphate, potassium nitrate, magnesium sulfate, boric acid, copper EDTA, manganese EDTA, iron EDTA, zinc EDTA, sodium molybdate. Potential acidity: 487 lbs. calcium carbonate equivalent per ton.	

How About Epsom Salts?

Epsom salts (magnesium sulfate) helps produce lush new canes and rich green foliage – fact or fiction? Rosarians have been extolling its virtues for ages. It can improve the health of your roses if they are growing in soil deficient in magnesium. Roses are sensitive to salts, so the concentration of magnesium should not exceed 100 parts per million (ppm). Soils deficient in magnesium (less than 20 ppm) may exhibit leaves where the center is green and the edges yellowed. Before making your trip to the drug store, purchase a soil test kit and see if you really need to add it.

can be potentially hazardous to your plants.

Liquids or solids – liquids deliver nutrients to roots immediately and are easy to use. Solid fertilizers are sold as granules, powders or pellets; they can be broadcast, scratched or dug into the soil, or used when planting.

Simple or single nutrient fertilizers like ammonium sulfate (21-0-1), urea (46-0-0) or superphosphate (0-20-0), are relatively inexpensive and generally very concentrated; they take up little storage space, but may burn tender growth due to high concentration.

Soluble complete fertilizers like MiracleGro and RapidGro, contain macro, secondary and micronutrients and get to the roots quickly. These chemically-based products are very concentrated so a little goes a long way. You need to dilute them according to the manufacturer's instructions. Mill's Easy Feed is a unique (and potent!) blend of organic and inorganic materials; Epsom salts, chelated iron, soluble seaweed extract, fish soluble, urea and other soluble fertilizers.

Slow-release fertilizers are sold as spikes, tablets or bead-like granules that release nutrients gradually over a fairly long period, 3 – 9 months if the soil receives regular moisture. Products like Osmocote are very convenient to use as you only have to apply once in a season. They may not provide sufficient amounts of the macronutrients and require supplements, and cost more than other alternatives.

Multipurpose products feature a fertilizer and some other material with a different purpose. The most common is a combination of fertilizer and insecticide or fungicide such as Bayer Advanced™ All-in-One Systemic Rose and Flower Care. This type of product is appropriate if you need the extra ingredient every time you fertilize, otherwise it is more economical to use fertilizer alone (and gentler on the environment). Another type of multipurpose fertilizer contains other growth enhancers; Dr. Earth Rose & Flower Fertilizer is a blend of cottonseed meal, fish bone meal, fish meal, alfalfa meal, kelp meal, mined potassium sulfate, soft rock phosphate, seaweed extract and seven champion strains of beneficial soil microbes plus ecto- and endo-mycorrhizae.

Natural organic fertilizers like MaxSea, fowl manure, fish emulsion or blood meal add valuable organic matter to the garden, act slowly with less chance of burning, are beneficial to microbes though results are less dramatic.

When and How to Do It

Are you a casual rose grower or a passionate exhibitor? The answer to that question can be a help as you develop your fertilizing routine. You may want to do a simple once or twice a year addition of granular fertilizer to keep things looking good or weekly applications of a secret tonic that consistently wins you Queen of the Show. Whatever you choose to do to provide nutrients to your roses, when and how you do can have an impact on the results.

When to fertilize

Timing is everything! If you feed too early in the year, the seasonal rains may wash all your valuable nutrients away; too late in the season, the plants are starting to shut down and don't need the extras. For established plants, time your application to maximize the benefit of your fertilizer so that nutrients are available to the plant when it needs it most – during the active growing and blooming stage. It generally starts around April when the weather has warmed the soil and slows down as the soil temperature drops – late September. The frequency of application will depend on what you're after – bountiful blooms or that Queen of the Show, the quality of your soil, and the weather. If your roses are planted in healthy soil that is rich in organic materials, you generally don't need to add any fertilizers until after the first big bloom.

When planting young roses without well-developed roots, a handful of bone meal (~2.0 - 28.0 - 0.2) can aid in development of roots, while organic materials like compost that break down slowly, provide a source of nutrition that won't damage fragile root hairs.

The addition of a time-released fertilizer at planting can also provide that steady stream of nutrients throughout the growing season, for four, six or eight months depending on the formulation. For these types of fertilizer, nutrient release is dependent on the soil moisture and temperature. Wait until the plant has gone through its first bloom cycle before applying chemical fertilizers.

To protect your plants from damage, make sure to water the plants thoroughly the day before and after fertilizing. Adding fertilizers, especially inorganic ones, to a dry plant can result in leaf burn or worse. Similarly, don't fertilize on a scorchingly hot day; the plants are working hard just to stay hydrated, and the additional materials may not be of much benefit. Watering after fertilizing helps move nutrients into



the root zone. When doing a foliar application of fertilizer, do it early in the morning when the liquids will be absorbed most quickly, won't burn foliage and the leaves have time to dry completely.

How to apply fertilizer

How you apply fertilizer depends on what you are adding and when. For granular, powder or pelleted-type fertilizers, scatter them around the base of the plants and scratch lightly into the soil. Water-soluble products can be simply mixed in a watering can and applied directly to the plant, or if you're fertilizing a larger number of plants, you may want to try a delivery device – ones



that add concentrated liquid fertilizer to water at a specific rate. Called proportioners, they can be a hose-end sprayer with an adjustable dial that indicates the concentration of fertilizer you're adding per gallon of water, a siphon device or an automated metering device. The siphon is a simple device with a connector that attaches to your water faucet and hose. It has a plastic or rubber tube connected to

it; the unattached end is immersed in a container with a concentrated solution of water-soluble fertilizer. When you turn the hose on, the water pressure draws up the concentrated solution and mixes it with water to dilute the fertilizer as you apply it to your plants. The metering device functions in a similar way and can be added to your automated irrigation system to deliver a desired concentration of fertilizer



every time you water.

The fastest route for providing nutrients is through the leaves - spraying a dilute solution of fertilizer directly on the foliage. Plants can absorb nutrients eight to twenty times more efficiently through their leaf surfaces than through their roots. When using the foliar feeding approach, use a surfactant such as a mild soap (one-quarter teaspoon/gallon of spray) to ensure coverage of the leaves, otherwise the spray may bead up on the foliage. Any application system that can provide a dilute liquid to the leaves will work (watering can, hose-end or backpack sprayer, etc.). Use a fine spray and spray until the liquid drips off the leaves. Also spray on the underside of the leaves where pores are more likely to be open.



If you're growing roses in pots, use your solid or liquid fertilizer at one-half strength twice as often as roses in the ground, as watering flushes the fertilizer from the potted soil more quickly. Remember to water the rose well the day before fertilizing so there is less chance of burning the tender roots.

Finally, be gentle with your miniature roses, they can be sensitive to chemical fertilizers, so it's wise to fertilize them at half-strength.

And Then There are Amendments

Late spring and early summer may get you itching to plant new roses, spiff up your flower beds, or mix up some great soil to transplant a container rose on your patio. Unless your garden is blessed with oodles of vibrant soil just waiting to be used, you may want to give it a boost before you do any planting. You've got plenty of plain old dirt, so what do you add? Soil conditioner? A fertilizer? Gravel or sand? Will you mix it in or lay it on top? Depending on what you want the added material to do, you've got plenty of choices.

First some terminology - an amendment is any material

How About Seaweed?

Harvested from the ocean, the marine kelp 'Ascophyllum nodosum' (not the kelp that washes up onto the beach) is the most common form of seaweed available as fertilizer – it comes in liquid, powder, meal or pellet form. In addition to a little nitrogen and potassium (1.5-0.5-2.5), it adds valuable trace elements, growth hormones, and vitamins that can help improve overall plant growth and reduce plant stress from drought.

mixed into the soil that indirectly aids plant growth by improving the condition of the soil, like its structure or texture, water retention or microbial activity. To do its work, an amendment must be thoroughly mixed into the soil. The terms soil conditioner and amendment are often used interchangeably, both serving to improve the chemical, physical or biological properties of soil. Mulches are organic or inorganic materials placed on the soil surface to help prevent weed growth, conserve moisture and add organic matter to the soil as they break down. Some materials used as soil amendments can also act as a fertilizer by providing nutrients to the soil, or be applied to the soil surface as mulch.

In the process of determining what amendment to use, your first decision is what you want from the amendment - are you looking to loosen up heavy clay soil? Improve drainage? Lower soil pH? It's a good idea to do a soil test before making any significant changes. Simple test kits for soil pH and the major nutrients of nitrogen, phosphorus and potassium are available at local nurseries. Next consider how long the material will last in the soil, whether it retains water and / or improves permeability (the rate at which water moves through the soil), or if it may present any problems from excess salts, weed seeds, plant, animal or human pathogens. Finally, think about the practical aspects of the material like availability, cost and ease of handling.

Many amendments are used to change soil texture - the way a soil feels. Our ubiquitous clay soil has tiny particles that feel sticky. When wet, it will retain moisture and drain slowly, though once dried it's hard to penetrate the surface. Most often with these heavy soils, the aim is to increase permeability, improve aeration and drainage. The fastest and easiest way to do this is by adding lots of organic matter - compost, humus or tree bark (with nitrogen added) are good sources. You can also add inorganic materials like perlite or vermiculite to lighten the soil and facilitate drainage. **WARNING:** Don't use sand as an amendment for clay soils unless you want to create your own clay bricks! Any mixture less than 70% sand in 30% clay actually packs more densely than straight clay and turns the soil into concrete! If you choose to use sand, make sure it's coarse builder's sand.

Roses enjoy a soil with a pH that is slightly acid to neutral (6.5 - 7.0); pH affects availability of nutrients to plants (especially iron) and the activity of soil microorganisms. If you want to raise your soil pH, incorporate materials with calcium and magnesium carbonates - dolomitic or calcitic lime, into the soil. If you're after lowering pH, consider peat moss or coffee grounds. Watch out for unwanted salts, weed seeds and pathogens when selecting your amendments.

Wood ashes and fresh manures may contain an over-abundance of soluble salts that can change soil structure and damage roots. Fresh manures, or composted manures that have not reached an adequate temperature, may be riddled with weed seeds or carry potential pathogens.



Many amendments are readily available at little to no cost - you can make your own compost and earthworm castings and harvest wood ashes from your fireplace or wood-burning stove. Collect your coffee grounds after your morning cup of joe or hit up the myriad coffee houses that give spent grounds away for free. Other materials may cost you, especially if you purchase in small quantities (all that



packaging is expensive!). Some local landscape supply places allow you to bring your own container and shovel to fill

Material	Organic / Inorganic	Description	Decomposition Rate	Permeability	Water Retention
Cocoa bean hulls	Organic	Dark color absorbs heat; light chocolate smell may pose a slight hazard to dogs if ingested.	Moderate to slow	Medium	Medium
Coffee grounds	Organic	Coffee grounds are acidic; use to lower soil pH, or combine with more alkaline materials like wood ashes or limestone.	Moderate	Medium	Medium to high
Compost	Organic	Decomposed organic matter derived from vegetative sources; nutrient value varies depending on materials that are composted. Adds macro and micronutrients and builds the soil.	Moderate (about six months)	Low to medium	Medium to high
Earth worm castings	Organic	Superb soil conditioner with no risk of burning plants; very high in organic matter; has a neutral pH and contains trace elements, enzymes and beneficial microorganisms.	Moderate	High	Medium to high
Grass clippings	Organic	Contains about 4 percent nitrogen, 0.5 - 1 percent phosphorus, 2 - 3 percent potassium, and smaller amounts of other essential plant nutrients	Rapid (days to weeks)	Medium	Medium
Gypsum	Inorganic	33% calcium oxide; increases soil permeability, lightens heavy alkaline soils; flushes salts from soils.	Very slow	High	Low
Humus	Organic	The more or less stable fraction of the soil that persists as organic matter after the major portion of plant or animal tissues (residues) have decomposed.	Slow	High	Medium to high
Lime or Limestone	Inorganic	Generic term for a wide range of agricultural materials containing calcium and magnesium in forms that are capable of reducing soil acidity. Provides large quantities of secondary nutrients.	Very slow	High	Low
Manure	Organic	Waste material from animals including horse, cow, pig, chicken, turkey and sheep. Fresh material contains the highest amount of salts that can burn tender roots; Should be composted first to reduce chance of burning. Provides macro and micronutrients and conditions the soil.	Rapid (days to weeks)	Medium	Medium
Peat moss (fibrous sphagnum)	Organic	Harvested and dried peat moss plants; holds up to seven times its weight in water. Supplies organic matter and acidifies soil. Mix well into soil as it can repel water if allowed to dry out.	Slow (possibly years)	Low to medium	High
Perlite	Inorganic	A naturally occurring volcanic glass that, after heating, expands to produce a light material with an extremely large surface area that holds moisture and nutrients and makes them available to plant roots.	Very slow	High	Medium
Sawdust	Organic	High in carbon; compost first or mix with nitrogen fertilizer before using.	Slow (unless well weathered)	Medium	Medium
Vermiculite	Inorganic	Naturally mined ore which when heated, expands to many times its original volume creating a light fluffy material. Absorbs many times its weight in water. Good conditioner for heavy soils.	Very slow	High	High
Wood bark	Organic	High in carbon and can deplete nitrogen from soil; use products that have added nitrogen or mix with nitrogen fertilizer before using.	Moderate	High	Low to medium

up large bags of compost making it much more economical; and if you've got a lot of soil to amend, you can purchase it by the truckload. Nurseries, garden centers and home improvement stores carry easy to handle packaged materials – from quart-sized to large compression packed bags (they can be heavy!) They're also most likely to have the less common amendments like lime, peat moss, perlite and vermiculite. But buyer beware! There are no regulations about the quality of the product, salt content or other beneficial or harmful qualities of bagged products.

How much of the amendment you add will vary depending on the condition of the soil you're working with, what you're adding and what you want it to do to the soil. Over-amending can be a problem if you're trying to fix a soil problem by adding large quantities of amendment in a single season, and result in soil that is high salts or ammonia that burns roots and leaves, low nitrogen levels from the tie-up of nitrogen due to a carbon to nitrogen ratio imbalance or retaining too much water.

Now that you're filled with possibilities of what you can add to create that vibrant soil, the table below with common amendments and their key attributes may help you select a material that will meet your soil needs.

Too Little or Too Much

You're giving your roses all the right things but they're still not blooming like you'd hoped; the new foliage is a weird color green, and some of the lower leaves have fallen off. You don't have to be Miss Marple to know something is amiss and certainly not typical for a healthy rose. Before you start piling on soil conditioner, Epsom salts, fish emulsion or other fertilizers, figure out what may be causing those unusual effects. Many different plant problems produce similar symptoms – and giving too much of a good thing might actually damage your plants.

In general, healthy soil with excellent drainage contains most of the nutrients your plants need to grow and thrive. Maintaining a balanced nutrient level in the soil – not too little or too much, is important for growing vigorous plants. Deficiencies of an individual nutrient can result when there is an inadequate amount of a specific nutrient in the soil or it is unavailable to the plant (most commonly due to incorrect

soil pH or being tied up with other nutrients). Typical symptoms of nutrient deficiencies are reduced shoot growth and leaf size, leaf chlorosis (yellowing of leaf tissue due to a lack of chlorophyll), necrosis (death of plant tissue) and die-back.

A helpful diagnostic tool to help you determine what nutrient may be deficient is where the symptoms occur – on the older leaves or newer growth. Some nutrients can move easily through the plant (they're mobile) while others cannot. If only the lower leaves are affected, then a mobile nutrient is the likely culprit. Conversely, if it's the upper leaves showing the deficiency, the plant is likely deficient in an immobile nutrient, one that cannot move from older to newer leaves. The most common deficiencies in roses are nitrogen and iron. Nitrogen, along with phosphorus and potassium, can readily move through a plant while iron is immobile and cannot get to the newer growth. The table below identifies nutrients mobility and where you would most likely observe symptoms.

In addition to problems associated with the lack of a nutrient, you can also observe symptoms if you've got too much of one. Nutrient toxicity, the accumulation of soluble salts in the soil, is not uncommon in the rose garden. The salts, generally chlorides, sulfates and nitrates, are prevalent in most water sources, fertilizers, manures and Epsom salts (magnesium sulfate). If they're not leached (removed) from the soil, they can accumulate and interfere with water availability in the root zone, causing damage to foliage - marginal browning of leaves beginning at the tip and proceeding to the base of the leaf along the edge of the leaf; it can also retard overall plant growth. Drip irrigation can exacerbate the problem since water may be delivered to only a portion of the roots, allowing the soil to dry



Nitrogen Deficiency



Phosphorous Deficiency



Potassium Deficiency



Calcium Deficiency



Magnesium Deficiency



Iron Deficiency



Manganese Deficiency



out in spots concentrate salts that are present.

Roses are sensitive to salts but not all produce negative effects on the plant. They will tolerate relatively large amounts of sulfates while chlorides are especially injurious, especially as soil becomes drier. The treatment for correction of high salt accumulation is to remove them by flushing with water.

To prevent accumulation of soluble salts, moderate the use of salt-containing materials and irrigate your plants thoroughly before and after fertilizing.

the basics of light, moisture, air, balanced nutrition — having the right nutrients present and available to the plant when needed. Here is a summary of the many aspects of plant nutrition and “feeding” roses that we have covered in the past months:

What a fertilizer is and what it does:

Plant nutrients are the chemical elements taken in by plants that are essential for their growth and development. A fertilizer is a material added to the environment around the plant that directly impacts the plant, providing it with specific nutrients. Fertilizers are not plant food! Plants make their own food (sugars and carbohydrates) using water, carbon dioxide and sunlight. These are combined with

plant nutrients to produce the proteins, enzymes and vitamins essential to plant growth. When we fertilize, we are applying plant nutrients to supplement the nutrients naturally occurring in the soil.

The 17 different chemical elements for healthy plant growth are broken down into four general groups. The essential elements — carbon, hydrogen and oxygen — are derived primarily from air and water. The primary or macro-nutrients — nitrogen, phosphorus and potassium, are the most common fertilizer ingredients. Secondary nutrients along with micro-nutrients or trace elements — calcium, magnesium, sulfur, boron, chlorine, copper, iron, manganese, molybdenum, nickel and zinc — play varying roles in plant growth and health.

Element (Symbol)	Mobility in Plant	Nutrient Deficiency		Nutrient Toxicity	
		Old Leaves	New Leaves	Old Leaves	New Leaves
Nitrogen (N)	Mobile	✓			✓
Phosphorous (P)	Mobile	✓			✓
Potassium (K)	Mobile	✓			✓
Calcium (Ca)	Immobile		✓		
Magnesium (Mg)	Mobile	✓			
Sulfur (S)	Immobile			✓	
Boron (B)	Immobile		✓	✓	
Chlorine (Cl)	Mobile				
Copper (Cu)	Immobile				
Iron (Fe)	Immobile		✓		
Manganese (Mn)	Immobile		✓	✓	
Molybdenum (Mo)	Mobile				
Zinc (Zn)	Immobile		✓	✓	

Illustrations of nutrient deficient symptoms from the American Rose Society Consulting Rosarian Manual, 2001.

Wrapping It Up

We kicked off this series with the idea that “You are what you eat,” and that the saying could also apply to our roses. Growing healthy roses which produce bountiful blooms that are able to fend off disease requires — in addition to

Types of available fertilizers:

Fertilizers contain an active ingredient — the specific material responsible for the intended beneficial purpose of the product. They can also include inert ingredients (often referred to as filler) — substances other than an active ingredient intentionally included in a fertilizer but have no intended nutritional value. Chemically based fertilizers are simple compounds derived from naturally occurring chemical elements; while naturally-based fertilizers are derived from organic materials — bone meal, kelp meal, fish emul-

sion and manure are commonly used organic fertilizers.

Many varied forms and formulations are available, liquids or solids, simple or single nutrient fertilizers, soluble complete fertilizers, slow-release fertilizers and multi-purpose products that feature a fertilizer and additional materials that serve a different purpose (like a fungicide or insecticide).

How and when to fertilize:

How you apply fertilizer depends on what you are adding and when. Granular, powder or pellet type fertilizers are generally scattered around the base of the plants and lightly scratched into the soil. Water-soluble products can be simply mixed with water and applied directly to the soil or sprayed directly on the foliage.



Don't waste your time, energy and money by fertilizing at the wrong time. Too early in the year and all your valuable nutrients may be washed away by seasonal rains; too late in the season the plants are starting to shut down and don't need the extras. For established plants, time your application to maximize the benefit of your fertilizer so that nutrients are available to the plant when it needs it most — during the active growing and blooming stage. The frequency of application will depend on what you are after — bountiful blooms or that Queen — the quality of your soil and the weather. If your roses are planted in healthy soil

that is rich in organic materials, you generally don't need to add any fertilizers until after the first big bloom.

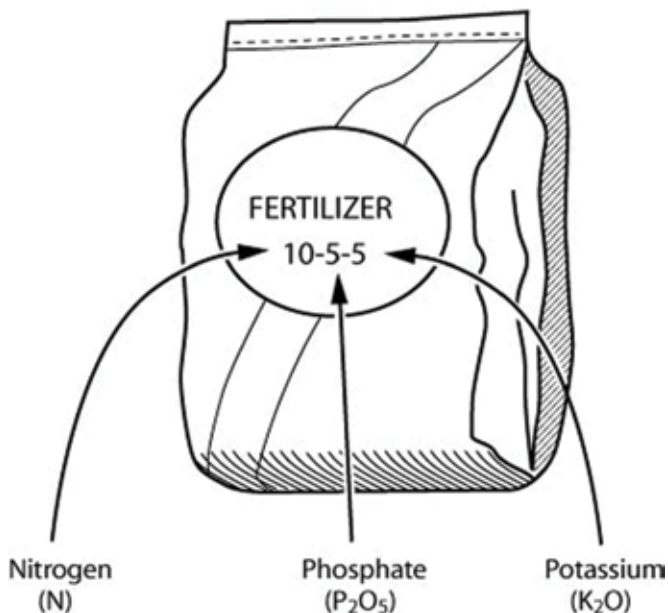
Amendments and additives:

An amendment is any material mixed into the soil that indirectly aids plant growth by improving the condition of the soil, like its structure or texture, water retention or microbial activity. The terms soil conditioner and amendment are often used interchangeably, both serving to improve the chemical, physical or biological properties of soil. Mulches are organic or inorganic materials placed on the soil surface to help prevent weed growth, conserve moisture and add organic matter to the soil as they break down. Some materials used as soil amendments can also act as a fertilizer by providing nutrients to the soil or be applied to the soil surface as mulch.

When selecting an amendment, consider what you want the amendment to do, how long the material will last in the soil, whether it retains water and/or improves permeability (the rate at which water moves through the soil) or if it may present any problems from excess salts, weed seeds, plant, animal or human pathogens. Also think about the practical aspects of the material like availability, cost and ease of handling.

How much of the amendment you add will vary depending on the condition of the soil you are working with, what you are adding and what you want it to do to the soil. Over-amending can be a problem if you are trying to fix a soil problem by adding large quantities of amendment in

FERTILIZER



a single season. This can result in soil that is high in salts or ammonia which burns roots and leaves. It can also cause low nitrogen levels from the tie-up of nitrogen due to a carbon to nitrogen ratio imbalance or retaining too much water.

Nutritional deficiencies:

Deficiencies of an individual nutrient can result when there is an inadequate amount of a specific nutrient in the soil or it is unavailable to the plant (most commonly due to incorrect soil pH or being tied up with other nutrients). Typical symptoms of nutrient deficiencies are reduced shoot growth and leaf size, leaf chlorosis (yellowing of leaf tissue due to a lack of chlorophyll), necrosis (death of plant tissue) and die-back.

Some nutrients can move easily through the plant (they're mobile) while others cannot. If only the lower leaves of the plant are affected, then a mobile nutrient is the likely culprit. Conversely, if it's the upper leaves showing the deficiency, the plant is likely deficient in an immobile nutrient, one that cannot move from older to newer leaves. The most common deficiencies in roses are nitrogen and iron. Nitrogen, along with phosphorus and potassium, can readily move through a plant while iron is immobile and cannot get to the newer growth.

Nutrient toxicity — the accumulation of soluble salts in the soil — is not uncommon in the rose garden due to its prevalent in most water sources, fertilizers, manures and Epsom salts (magnesium sulfate). They cause damage to foliage — marginal browning of leaves beginning at the tip and proceeding to the base of the leaf along the edge of the leaf — and can also retard overall plant growth.

Here's to a balanced diet and good nutrition — for you and your roses!

