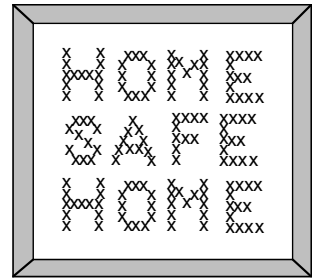


Alternatives

A Washington Toxics Coalition Fact Sheet



Choosing Fertilizers for the Lawn and Garden

by Philip Dickey



A fertilizer is a material designed to supply nutrients to plants. The most important nutrients, those that plants need in the largest amounts, are the macronutrients nitrogen (N), phosphorus (P), and potassium (K). The percentages of each of these nutrients are indicated in large numbers on a fertilizer package. Thus, a fertilizer labeled 21-3-5 contains 21% nitrogen, 3% phosphorus, and 5% potassium.

Plants also need secondary minerals like sulfur, calcium, and magnesium in smaller amounts. In addition, plants need much smaller amounts of a host of micronutrients, including things like boron, copper, and molybdenum. These are normally supplied by soil minerals, but in some cases may need supplementation.

Fertilizers are needed when soils fail to supply enough nutrients to grow the plants you want to grow. Although fertilizers are important, they are no substitute for good soil. Soil hosts a complex ecosystem that both nourishes plants and helps protect them from diseases. So, let's try to think of fertilizers as nutrient supplements rather than a sort of intravenous injection we provide while the soil simply holds the plants upright.

Types of Fertilizers

All-purpose fertilizers are designed for a wide range of uses. All of these fertilizers are "complete" in the sense that they are designed to supply N, P, and K, although they may not provide all necessary micronutrients. If you look on a store shelf, you will find many specific fertilizers, such as lawn fertilizers, vegetable fertilizers, bulb fertilizers, indoor plant fertilizers, and fertilizers designed for particular kinds of plants, such as tomatoes, trees, or roses. In reality, however, an all-purpose fertilizer will work on roses or tomatoes.

Some other types of soil amendments supply important nutrients (as well as other benefits), but for most purposes are not complete fertilizers. They include compost, steer manure, bone and seed meals, kelp meal, dolomite lime, and rock phosphate. Compost and manure add humus that increase the soil's water retention and stock of microorganisms, while supplying most essential nutrients. They may be adequate for growing many kinds of plants, but heavy feeders will need supplemental nutrients that can be supplied by additional amendments or a complete fertilizer.

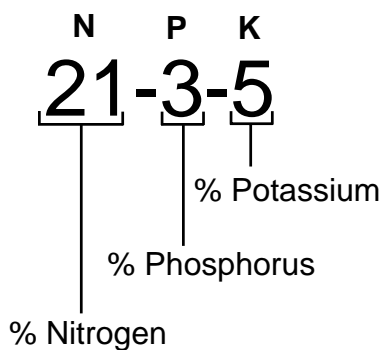
Another way to supply plant nutrients is to recycle plant material back into the soil. In the garden, this can be done by growing green manures, crops planted during fallow periods that are later plowed under, or by composting. Some green manures take nitrogen from the air and "fix" it so that it is usable as plant food. In the lawn, leaving the clippings when mowing returns nitrogen to the soil and reduces fertilizer needs by up to 30%.

When needed, choose a fertilizer labeled for your purpose or mix your own from individual soil amendments as described below. As we will see, however, there are big differences between various brands of lawn fertilizers or all purpose fertilizers.

Synthetic vs "Organic"

Fertilizers are termed "organic" when they are made from naturally occurring materials such as bone meal, blood meal, fish or kelp, or manure. Synthetic fertilizers, on the other hand, require fossil fuels to become usable nutrients. Granted, crude oil is natural, but there is a lot of processing between the oil well and the fertilizer bag. In some

What the Numbers Mean



The three numbers on a bag or box of fertilizer give the percentages of nitrogen, phosphorus, and potassium in the product.

cases, the actual chemical compounds found in synthetic and organic fertilizers may be the same, just made in a different way. For example, urea is a naturally occurring component of animal and human wastes, but it can be manufactured more efficiently than it can be extracted from natural sources.

The choice between organic and synthetic is a philosophical one for many gardeners: organic fertilizers are simply less processed. Organic fertilizers tend to release their nutrients slowly, at a speed that plants can use them, thus minimizing the chances that chemicals may run off and pollute water. They require soil organisms to transform their nutrients into usable form, a process that helps these beneficial creatures flourish, creating a healthy soil ecosystem. Organic fertilizers usually have lower levels of macronutrients than synthetic fertilizers do. To get the same amount of nitrogen in the soil, then, you may need to use more fertilizer. When you add in the slower release of organic nitrogen, especially when temperatures are low, you can see why organic fertilizers don't provide much of a jump-start. Their effect is more long-lasting and steady.

Toxicity of Home Fertilizers

Based on their nutrient compounds alone, the toxicity of most home fertilizers should be moderate to very low, according to Gosselin's *Clinical Toxicology of Commercial Products*. However, contaminants in some fertilizers may pose a greater risk. Serious concerns have been raised about hazardous waste in fertilizers. See the box at the right for more information.

Some fertilizers have a label warning that says "may be harmful if swallowed," while others do not. If properly labeled, products with the warning should be more toxic than those without it, but I am not convinced that many fertilizer makers know what the toxicity of their products is. In any case, ingestion of fertilizers should be avoided but probably wouldn't be life-threatening in most cases.

Many fertilizers are mild eye or skin irritants, and those in powdered form may be respiratory irritants. It would be wise to wear a dust mask when mixing dry fertilizer ingredients such as bone meal or lime. Concerns have been expressed about the safety of bone meal or blood meal made from cows, especially now that the so-called "mad cow disease" has been diagnosed in U.S. cattle. The risk is unknown but possible. You can wear a dust mask or avoid using these materials. Bone meal made from fish bones is available as an alternative.

Nutrient Types

Space does not permit a full discussion of all of the nutrients in fertilizer, so I will concentrate just on nitrogen, which probably comes in the widest variety of forms.

Most fertilizer product labels will tell you the sources of the nitrogen and other primary nutrients, as well as the solubility. Nitrogen in home fertilizers is most likely to come from nitrate, urea, ammonium, and various organic compounds. Here, the term organic is used in its strictly scientific sense, meaning compounds containing carbon.

Nitrate is the most readily usable form of nitrogen. It is highly soluble in water and plants can use it directly, either through the leaves or the roots, without any need for soil organisms, so nitrate promotes rapid growth. The downside is that nitrate is easily washed from the soil to become a water pollutant. Nitrate contamination in groundwater is a serious problem, especially in agricultural areas. Nitrate is not the most appropriate ingredient in garden fertilizers and is usually only found in some liquid products.

Urea is a highly soluble and concentrated form of nitrogen, but it must undergo three stages of microbial breakdown before plants can use it. Some urea in a fertilizer is fine, but I would avoid too much of it because it is very quickly released. Urea is often coated with sulfur to make it less soluble. The sulfur dissolves away slowly, controlling the release of urea. Sulfur-coated urea is a perfectly acceptable way to get slow release nitrogen, though it isn't an "organic" fertilizer.

Ammoniacal nitrogen is also highly soluble. It is broken down by soil bacteria to

Toxic Waste in Fertilizer

In July 1997 a *Seattle Times* investigative series called "Fear in the Fields: How hazardous wastes become fertilizer" revealed that toxic wastes from steel mills, paper mills, and other major polluting industries are turned into fertilizer. No thorough study has ever been done to determine whether adding wastes to fertilizer could be a safe method of disposal. From the limited testing the Washington State Department of Ecology has done on fertilizer products, we know that they often contain the highly toxic heavy metals lead, cadmium, and arsenic, as well as dioxins.

Fertilizers are not regularly tested for metals or other non-nutritive contents, and you will not find any disclosure of metals other than nutrients on labels. Testing done by the *Seattle Times* found very high levels of lead and arsenic in some products. Although the lowest levels of metals were found in soluble, liquid fertilizers, these products may not be the best choice for most gardening needs. The *Times* testing also found high levels of cadmium in some phosphate fertilizers. Significant amounts of cadmium found in some phosphate mines contaminate phosphate fertilizer made from those mines.

Until metals and other toxic chemical levels are fully disclosed on fertilizer labels, it will be extremely difficult for consumers to compare products on the shelf and purchase the ones with the lowest contaminant levels. Your best bet may be to use organic fertilizers that you mix up yourself. The Washington State Department of Agriculture has a fertilizer database on its Web site where you can obtain metals information for fertilizer products: <http://agr.wa.gov/PestFert/Fertilizers/ProductDatabase.htm>

Making Your Own All-Purpose Organic Fertilizer

The cheapest way to buy a complete organic fertilizer is to mix it up yourself from individual components, preferably purchased in bulk if you have access to them. I like the recipe from the Territorial Seed Company, which I have used with success for many years. Here's the formula:

- 4 parts seedmeal or fishmeal
- 1 part agricultural lime or dolomite
- 1 part rock phosphate or 1/2 part bonemeal
- 1/2 part kelpmeal

Proportions are by volume, so they correspond to "number of scoops" of each ingredient. You might want to wear a dust mask while mixing this up. It's very dusty. Be sure to keep the mixture dry after mixing.

How Much Fertilizer?

To apply 1 pound of nitrogen per 1000 square feet, using a 9-2-3 fertilizer:

Hint: this fertilizer contains 9% (or .09) nitrogen.

Divide:

1 pound nitrogen by
.09 pounds N per pound fertilizer

= 11 pounds of fertilizer per
1000 square feet

form nitrate, but it can also be utilized directly to a certain extent. Again, I would avoid fertilizers with too much of this ingredient.

Finally, we come to the various organic forms of nitrogen. Many of these are insoluble, but a few, such as those in some fish and kelp meals, are soluble. Organic nitrogen requires soil microbes to release its nutrients, but some organic nitrogen is highly soluble.

Availability/Mobility

The availability of nutrients to plants depends on their chemical form. Generally, soluble forms are more readily available than insoluble forms. Solubility also has a lot to do with whether or not the nutrients can run off or leach. Although it is possible to use highly soluble fertilizers without polluting water resources, more care must be taken with these materials because they provide less margin for error. I would suggest avoiding highly soluble fertilizers, especially for lawns and gardens. They are fine for houseplants, and they can be used judiciously for outdoor potted plants and as starter fertilizers to establish recently transplanted perennials.

Solubility information can be found on the labels of fertilizer products. More information on the solubility of specific fertilizer products is available in our book *Grow Smart, Grow Safe* available by mail order from our website www.watoxics.org.

As a good rule of thumb, I would suggest selecting fertilizers with at least 50% slow release, or water-insoluble nutrients. Some kelp and fish fertilizers are highly soluble. These are essentially quick-release, "organic" fertilizers. They are very effective, but like other highly soluble fertilizers, need to be used with care.

Fertilizer/Pesticide Mixtures

There are many products on the market that combine fertilizers with pesticides. Weed and feed lawn fertilizers are probably the best known example. They combine Trimec™ (a mixture of 2,4-D, MCP, and dicamba) or a similar herbicide with lawn fertilizer, usually high nitrogen in quick release form, though not always. There are also fertilizers mixed with insecticides or fungicides for roses.

Avoid using these pesticide-fertilizer mixtures. They result in the indiscriminant and often unnecessary application of pesticides. Since pesticide is applied every time you fertilize, these products encourage you to just apply the chemicals as prevention rather than properly monitoring to determine if any pesticide is necessary. It's a little like painting your entire car every time you wash it, just to get rid of any possible scratches. Better to use washing as an opportunity to look for blemishes, then apply a little touch-up paint when necessary. Or live with a few dings and get a life.

How Much Fertilizer to Use

You don't get cabbages the size of basketballs by over-fertilizing. (I don't know why you would want them, anyway.) Too much fertilizer can burn your plants, increase the chances of aphid damage or diseases, and lead to water pollution. Use the guidelines on the package or consult your local cooperative extension office. More is not better.

Sometimes fertilizer rates are specified in terms of pounds of nitrogen per square foot. The amount of fertilizer you apply will depend on how much nitrogen is in the particular product you are using. Let's say that you want to apply 1 pound of nitrogen per 1000 square feet (a typical application of lawn fertilizer). If you are using a 9-2-3 analysis fertilizer, then you know that the product contains 9% nitrogen (or about 1/10) by weight. So you can guess that the weight of fertilizer you need will be about 10 times as much as the specified nitrogen. The exact amount (11 pounds) is found by dividing the required 1 pound of nitrogen by the exact .09 fraction of nitrogen in the product. It's always a good idea to make a rough estimate of what the answer should be just to avoid applying 10,000 pounds instead of 10 pounds due to a mathematical error. It could be embarrassing when the dump truck drives up.

When to Fertilize

With highly soluble fertilizers, go for small, frequent feedings over the growing season to avoid applying more fertilizer than the plants can use. As a rule of thumb, use only half the label-suggested amount if you intend to apply frequently.

With organic fertilizers, you generally need to fertilize more when the plants are actively growing, less or not at all during the dormant season. Spring or early summer is generally the best time to apply organic fertilizers (or any fertilizers, for that matter). Too much fertilizer late in the growing season means that there will be unused nutrients available to leach from the soil. An exception is lawns, which have a long growing season and need fertilizer in the fall.

Your plants will tell you if they need fertilizer. But rather than waiting for a poor crop and trying to correct it, get a soil test before you plant, especially in a new garden. That way you avoid the guesswork. In addition to nutrient levels, a soil test will tell you about other important soil qualities such as pH. Contact a local laboratory or get a list of labs from your cooperative extension office.

Reducing Fertilizer Use

Fertilizers are important, but you don't need to have boxes and jars of them for every kind of plant in your garden. If you use compost, composted manure, and mulches regularly, you won't need as much fertilizer because these organic materials supply nutrients as they break down. Plus, you'll be recycling a waste product.

Compost can be worked into the soil or placed on top as a mulch. Adding compost to your garden every year will build the soil gradually. Finely screened compost can also be broadcast over lawns to increase soil fertility. Good quality compost can be purchased, but it's more fun to make it yourself.

Manure is also an excellent source of both nutrients and organic matter. If possible, use fully composted manure; it's less likely to pollute because it isn't as soluble as raw manure. It also smells better. An inch of steer manure worked into the soil several weeks before planting in the spring will help garden vegetable yields. Chicken manure is much more concentrated and should be mixed into the soil in small amounts.

Mulches are materials like leaves, straw, or bark that are placed on top of the soil to hold water in. As they break down, mulches supply some nutrients and organic matter. Be careful using wood chips or bark. They make an excellent mulch, but if mixed into the soil they deplete nitrogen as they break down, robbing your plants of nutrients. Add new layers of mulch from time to time as the mulch decomposes. ■

Disposal of Fertilizers

The recommended disposal for most fertilizers is to use them up or give them to someone who can. Fertilizer/pesticide mixtures such as weed and feed are considered pesticides and disposal in the trash may not be legal. If you have any question about how or where to dispose of a product, contact your local household hazardous waste agency. In the Seattle/King County area, call the Hazards Line at 206-296-4692.

What Mulch to Use

Plant	Best Mulches	Thickness
Annuals or herbaceous perennials	compost, dry grass clippings, leaves, sawdust	1-2 inches
Shrubs and trees	coarse wood chips or bark	2-4 inches

Summary

- ❖ Use compost, manure, and mulches to build soil.
- ❖ Select plants that are well adapted to your climate.
- ❖ If you are starting a new garden, test the soil to see what nutrients are needed.
- ❖ As much as possible, select slow-release fertilizers.
- ❖ Fertilize when plants need nutrients rather than during dormant periods.
- ❖ Never exceed application rates on the product label.
- ❖ Store all fertilizers out of reach of children.

The Washington Toxics Coalition is a non-profit organization dedicated to protecting public health and the environment by preventing pollution. Please write or phone for information: WTC, 4649 Sunnyside Ave N, Suite 540, Seattle, WA 98103. Phone: 206-632-1545. Visit our Internet Web site at www.watoxics.org.

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