



Colorado MASTER GARDENER

Organic Fertilizers

no. 7.733

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*Putting Knowledge to Work*

Terms

By legal definition, the term **fertilizer** refers to a soil amendment that guarantees the minimum percentages of nutrients (at least the minimum percentage of nitrogen, phosphate and potash).

An **organic fertilizer** refers to a soil amendment derived from natural sources that guarantees, at least, the minimum percentages of nitrogen, phosphate, and potash. Examples include plant and animal by-products, rock powders, seaweed, inoculants, and conditioners. These are often available at garden centers and through horticultural supply companies.

These should not be confused with substances approved for use with the USDA National Organic Program (NOP). The USDA NOP, with its "USDA Organic" label, allows for the use of only certain substances. The Organic Materials Review Institute (OMRI www.omri.org) approves brand name products made with ingredients from the "National List" for use with the NOP (see www.ams.usda.gov/nop and click "NOP Regulations" and then "National List Information"). Many of the organic fertilizers listed here will meet NOP standards (based on the National List). Growers participating in the NOP should consult with their certifier to ensure compliance for organic certification.

The term **soil amendment** refers to any material mixed into a soil. A **mulch** refers to a material placed on the soil surface. By legal definition, soil amendments make no legal claims about nutrient content or other helpful (or harmful) affects it will have on the soil and plant growth. In Colorado, the term **compost** is also unregulated, and could refer to any soil amendment regardless of active microorganism activity.

Many gardeners apply organic soil amendments, such as compost or manure, which most often do not meet the legal requirements as a fertilizer but add small amounts of nutrients.

Organic products require the activity of soil microorganisms before nutrients are available for plant uptake. This period is known as the **release time**. Microorganism activity is dependant on soil temperatures greater than 50 degrees F in the presence of sufficient soil moisture. Dry and/or cold soil conditions will delay the release of nutrients from these organic sources. This period refers to how long these products are available if applied to the soil. Use this information to time the application of the product.

Application refers to different products being applied in various ways. Some may be tilled in (worked into the soil with a machine or hand tool), others may be applied as a foliar spray (mixed with a surfactant and sprayed in a fine mist on the leaf surface while temperatures are below 80 degrees F), and some may be injected into a drip or overhead irrigation system (fertigation with a siphon mixer). Application rates in this fact sheet are generalized and based on

See soil and fertility resources at www.ext.colostate.edu/pubs/crops/pubcrop.html# for information on how to take a soil sample, interpret soil test results, guidelines for fertilizing vegetables, and best management practices for N and P fertilization.

some manufacturers' recommendations. Over or under fertilization may occur using these recommendations.

Plant By-Products

Alfalfa Meal or Pellets

Alfalfa meal or pellets are often used as animal feed. They are used to increase organic matter in the soil but do offer nutrients and a high availability of trace minerals. They contain triacontanol, a natural fatty-acid growth stimulant.

Table 1. Alfalfa meal or pellets.

| | |
|----------------------|--|
| Typical NPK analysis | 2-1-2 |
| Release time | 1-4 months |
| Pros | Available at feed stores |
| Cons | May contain seeds |
| Application | Till in 2-5 pounds per 100 square feet |

Corn Gluten Meal

Corn gluten meal materials have a high percentage of nitrogen. It carries a warning to allow 1 to 4 months of decomposition in the soil prior to seeding because its allelopathic properties inhibit the germination of seeds. However, there is no danger to established or transplanted plants. This product is also marketed as a pre-emergent weed control for annual grasses in bluegrass lawns.

Table 2. Corn gluten meal.

| | |
|----------------------|---|
| Typical NPK analysis | 9-0-0 |
| Release time | 1-4 months |
| Pros | Very high nitrogen |
| Cons | Germination inhibitor, some is GMO |
| Application | Till in 20-40 pounds per 1000 square feet |

Cottonseed Meal

Cottonseed meal is a rich source of nitrogen. Buyers should be aware that many pesticides are applied to cotton crops and residues tend to remain in the seeds. Pesticide-free cottonseed meal is available.

Table 3. Cottonseed meal.

| | |
|----------------------|---------------------------------------|
| Typical NPK analysis | 6-0.4-1.5 |
| Release time | 1-4 months |
| Pros | High nitrogen |
| Cons | Pesticide residues, most is GMO |
| Application | Till in 10 pounds per 100 square feet |

Soybean Meal

Used primarily as an animal feed product. Available bagged at many feed stores.

Table 4. Soybean meal. Used primarily as an animal feed product.

| | |
|----------------------|---|
| Typical NPK analysis | 7.2.1 |
| Release time | 1-4 months |
| Pros | High nitrogen, available bagged at many feed stores |
| Cons | almost half of the conventionally grown soy is GMO |
| Application | 8 pounds per 100 square feet |

Animal By-Products

Bat Guano – High N

Bat guano (feces) harvested from caves is powdered. It can be applied directly to the soil or made into a tea and applied as a foliar spray or injected into an irrigation system.

Table 5. Bat guano – high N.

| | |
|----------------------|---|
| Typical NPK analysis | 10-3-1 |
| Release time | 4+ months |
| Pros | Stimulates soil microbes |
| Cons | Cost |
| Application | Till in 5 pounds per 100 square feet or as a tea at 3 teaspoons per gallon of water |

Bat Guano – High P

See above. The difference is that it is processed for high phosphorus content.

Table 6. Bat guano – high P.

| | |
|----------------------|---|
| Typical NPK analysis | 3-10-1 |
| Release time | 4+ months |
| Pros | Stimulates soil microbes |
| Cons | Cost |
| Application | Till in 5 pounds per 100 square feet or as tea at 3 teaspoons per gallon of water |

Blood Meal

Blood meal, made from dried slaughterhouse waste, is one of the highest non-synthetic sources of nitrogen. If over-applied it can burn plants with excessive ammonia.

Table 7. Blood meal.

| | |
|----------------------|--|
| Typical NPK analysis | 12-0-0 |
| Release time | 1-4 months |
| Pros | Available at feed stores |
| Cons | Can burn. Expensive at garden centers |
| Application | Till in 5 to 10 pounds per 100 square feet |

Bone Meal

A well-known source of phosphorus, bone meal is steam processed and widely available at feed stores and in garden centers. If purchased at feed stores, P is expressed on the label as elemental phosphorus and is 2.3 times higher than numbers shown on garden center labels for phosphate (i.e., 12 percent phosphate is the same as 27 percent phosphorus). However, recent research has shown that P from bone meal is only available to plants in soils that have a pH below 7.0.

Table 8. Bone meal.

| | |
|----------------------|---|
| Typical NPK analysis | 3-15-0 |
| Release time | 1-4 months |
| Pros | Highly plant available form of phosphorus |
| Cons | Cost |
| Application | Till in 10 pounds per 100 square feet |

Feather Meal

Sourced from poultry slaughter, feather meal has fairly high nitrogen levels but is slow to release the N.

Table 9. Feather meal.

| | |
|----------------------|---|
| Typical NPK analysis | N varies 7-12 percent on process |
| Release time | 4+ months |
| Pros | Long term fertilizer |
| Cons | Cost versus speed of N release |
| Application | Till in 2.5 to 5 pounds per 100 square feet |

Fish Emulsion

Infamous for its foul smell, emulsions are soluble, liquid fertilizers that have been heat and acid processed from fish waste.

Table 10. Fish emulsion.

| | |
|----------------------|---------------------------------------|
| Typical NPK analysis | 5-2-2 |
| Release time | 1-4 months |
| Pros | Adds needed micronutrients |
| Cons | Some have foul smell |
| Application | Mix 6 tablespoons per gallon of water |

Enzymatically Digested Hydrolyzed Liquid Fish

Enzymatically digested hydrolyzed liquid fish may be using enzymes to digest the nutrients from fish wastes instead of using heat and acids. This retains more of the proteins, enzymes, vitamins and micronutrients than emulsions.

Table 11. Enzymatically digested hydrolyzed liquid fish.

| | |
|----------------------|---------------------------------------|
| Typical NPK analysis | 4-2-2 |
| Release time | 1-4 months |
| Pros | More nutrients than emulsions |
| Cons | More expensive than emulsions |
| Application | Mix 5 tablespoons per gallon of water |

Fish Meal

Fish meal is ground and heat dried fish waste.

Table 12. Fish meal.

| | |
|----------------------|---|
| Typical NPK analysis | 10-6-2 |
| Release time | 1-4 months |
| Pros | N and P source |
| Cons | Heat processed |
| Application | Till in 5-10 pounds per 100 square feet |

Fish Powder

Fish powder is dried with heat and turned into water-soluble powder. It is a high source of nitrogen. Many can be mixed into solution and injected into an irrigation system.

Table 13. Fish powder.

| | |
|----------------------|---|
| Typical NPK analysis | 12-0.25-1 |
| Release time | Immediate to 1 month |
| Pros | Adds micro-nutrients |
| Cons | Heat processed |
| Application | Till in 1-2 oz. Per 100 square feet OR Mix at 1 tablespoon per gallon of water |

Compost, Manure and Biosolids Based Products

For information on biosolids, worm casting, manure, and compost, refer to the following fact sheets:

7.741, *Organic Soil Amendments*;

7.742, *Using Manure in the Home Garden*; and

7.743, *Using Compost in the Home Garden*.

Rock Powders

Those that are relevant for use in Colorado soils supply phosphorus. Those that serve as a potassium source (greensand, feldspar, potassium sulfate, biotite, etc.) are not necessary as Colorado soils are naturally high in potassium. Similarly, it is not necessary to add calcium (gypsum, lime, etc.) due to naturally high calcium levels in Colorado soils and arid conditions.

If you annually apply manure and/or compost to your garden to add nitrogen, you should have sufficient levels of phosphorus in your soil. If you apply manure or compost to your garden based on P needs, you might have an excess N supply. Excess N can lead to poor flower/fruit development and increases water pollution potential from N leaching from the soil.

Generally plant or animal sources are the best value for phosphorus in the home garden. Recent CSU research concluded that no rock P (regardless of mesh size) is available for plant use unless the soil pH is below 7.0

Colloidal Phosphate (Soft Rock Phosphate)

This product is made by surrounding clay particles with natural phosphate. Total phosphate is about 20 percent while available phosphate is about 2 to 3 percent. This is why you can apply large amounts of colloidal phosphate, as it will release slowly over the years (usually more available the second year than the first). For home gardeners the cost/return is adequate to apply colloidal phosphate at rates to supply phosphorus for this season's crops. This product does add micronutrients to the soil.

Micronized (passing through 1000 mesh screen [1000 wires per square inch]) sources may be more available than regular soft rock grinds in soils with a pH below 7.0.

Seaweed

Kelp is the most common form and is valued not for its macronutrient (N, P, and K) contributions but for micronutrients, trace minerals, amino acids and vitamins plus growth hormones that stimulate plant cell division.

Kelp is often mixed with fish products to enhance growth.

Three processes are available: extracts (as kelp meal or powder); cold-processed (usually liquid); and enzymatically digested (liquid). Ranked in quality of content and plant availability they are (highest to lowest); 1) enzymatically digested; 2) cold-processed; and 3) extracts.

Kelp Meal

Kelp meal, a product of the ocean, is used primarily as a trace mineral source. It is often combined with fish meal to add N-P-K value.

Table 14. Kelp meal.

| | |
|----------------------|-------------------------------------|
| Typical NPK analysis | negligible |
| Release time | 4+ months |
| Pros | Adds micronutrients |
| Cons | Insignificant NPK value |
| Application | Till in 1 pound per 100 square feet |

Kelp Powder

Kelp powder is similar to kelp meal but ground fine enough to put into solution and applied as a foliar spray or injected into an irrigation system.

Table 15. Kelp powder.

| | |
|----------------------|-------------------------------------|
| Typical NPK analysis | 1-0-4 |
| Release time | Immediate-1 month |
| Pros | Adds micronutrients |
| Cons | Insignificant NPK value |
| Application | Mix ¼ to ½ teaspoon/gallon of water |

Liquid Kelp

Usually cold processed, liquid kelp will have higher levels of growth hormones than extracts. Some may also be enzymatically digested, making the growth hormones even more available to the plants.

Table 16. Liquid kelp.

| | |
|----------------------|---|
| Typical NPK analysis | negligible |
| Release time | Immediate-1 month |
| Pros | Adds micronutrients plus helps plant with stress |
| Cons | Insignificant NPK value |
| Application | Mix 1-2 TBS/gal of water for foliar or mix at ¼ - 1¼ tsp/gal/100 ft ² and inject |

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