


# Natural (Organic) Fertilization for Turf

Natural and organic soil amendments long have been used to improve soil structure and fertility. Organic fertilizers are any fertilizers containing carbon, and can be classified as synthetic organic or natural organic. Synthetic fertilizers are fertilizers produced from one or more synthetic materials and do not contain any animal or plant byproducts, or manures. Natural fertilizers are fertilizers derived from plant or animal products. Both synthetic and natural organic fertilizers can be slow-release fertilizers, which are fertilizer products that release nutrients slower than a soluble product due to biodegradation, limited solubility and hydrolysis, or chemical and biochemical means.

## Natural (Organic) Fertilizers

Increased environmental concerns surrounding soluble nitrogen sources have forced many to reconsider natural (organic) fertilizers. Natural (organic) fertilizers, as well as slow-release synthetic sources, release small amounts of nitrogen over long periods. University research from across the country has concluded that when applied correctly, natural (organic) and slow-release products will reduce environmental impact. Several natural (organic) fertilizers are available today, most of which are plant and animal byproducts, rock powders, inoculants, and conditioners. These products often are sold at garden centers and through horticultural supply companies (see Table 1). In general, more product will need to be applied when using natural (organic) fertilizers compared to synthetic fertilizers due to the low nitrogen content. However, it still is important to apply the same amount of pound of nitrogen per 1000 square feet regardless of which type of fertilizer is used. See "More Information" for fertilizer recommendations.

## Nitrogen Sources

**Activated sewage sludge – Milorganite® 6-4-0, EC Grow e-Corganite™ 4-3-0**

This fertilizer is one of the early modern organic fertilizer sources, and today is still a popular choice. In 1921, Milwaukee created a centralized wastewater treatment facility at its nearby industrialized peninsula called Jones Island. The new sewage treatment procedure created a solid byproduct. University of Wisconsin research found the solid byproduct was composed of approximately 17% soluble nitrogen. The rest of the nitrogen is released slowly over time (approximately 20% over six months). The primary nutrients in sewage sludge are 4–7% nitrogen (N), 1–4% phosphoric acid ($P_{2O5}$) and less than one-half percent of potassium oxide ($K_{2O}$). In 1925, Milorganite® (MIL-waukee-ORGAnic-NITrogEn) became the first commercial product released. Other biosolid fertilizer products have been developed since then, such as EC Grow® e-Corganite™.

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**Table 1. Organic Fertilizer Options***

| Example Product | Analysis (N-P-K) | Trade Name (examples) |
|---|---|---|
| **Fertilizer Sources** | | |
| Activated sewage sludge | 5-2-0 | Milorganite® |
| Composted poultry manure | 5-2-4<br>5-4-5<br>5-3-2 | Sustane®<br>EarthWorks™ Replenish,<br>Richlawn Organic |
| Iron sucrate | micronutrient | SuGrow® Granular |
| **Example Product** | **Analysis (N-P-K)** | **Trade Name (examples)** |
| **Meals and Extracts** | | |
| Hydrolyzed poultry feathers meal | 10-0-6<br>11-2-2<br>10-2-8 | Ringer Lawn Restore®<br>Scotts® Natural Lawn Food,<br>Nature Safe® All Season Fertilizer |
| Corn gluten meal | 8-2-4<br>9-0-0 | Gardens Alive!® Original WOW!<br>Espoma® Organic Weed Preventer |
| Soybean Meal | 7-1-2<br>10-0-1 | The Andersons® innova®,<br>PurelyOrganic™ – Plant Based<br>Lawn Food |
| Bone meal | 4-12-0 | Espoma® Organic Bone Meal |
| Blood meal | 12-0-0 | Whitney Farms® Natural Blood Meal |

N=Nitrogen, P=Phosporus, K=Potassium, Fe=Iron

*Additional products are available in different formulations for all these product groups.

The two distinct advantages of using activated sewage sludge materials are the reduced risk of burning turfgrass, even with over-application, and the production of a dark green dense turf without causing excessive top growth. The recommended application rates for Milorganite® are 12.8 pounds of product per 1,000 square feet and 14.4 pounds of product per 1,000 square feet for e-Corganite™. Prior to the 1980s, people were concerned about non-nutrient metals in Milorganite®. However, lab procedures changed and lowered the risk so that most commercially available sewage sludge now has very low heavy metal concentrations and does not pose known environmental threats. The U.S. Department of Agriculture prohibits use of these products in certified organic operations.

### Composted poultry manure – Sustane® 5-2-4, EarthWorks™ Replenish 5-4-5, Richlawn Organic 5-3-2

In 1988, Sustane® and EarthWorks™ developed composted poultry manure for commercial use. Since then, Richlawn Organic has been produced as a professional turf product. The composted poultry litter is concentrated in a nutrient-dense organic-based form that gives it a very low potential for burning leaves and salt buildup. All of the product supply is a similar range of nutrient of 5% N, 2 to 4% $P_{2O5}$, and 2 to 5% $K_{2O}$. Sustane® and EarthWorks™ Replenish are sold at two different grades, which are fine-grade and medium/standard-grade. Sustane® contains 80% slow-release nitrogen (SRN), also known as water-insoluble nitrogen (WIN). EarthWorks™ Replenish and Richlawn also are slow-release products that provide 54% SRN/WIN and 92% SRN/WIN, respectively. Both products also market several natural base products fortified in analysis by inorganic nutrient sources. These products have higher soluble fractions, allowing lower application rates.

### Iron sucrate–SuGrow® Granular

Iron sucrate is a patented process that reactivates iron oxide with molasses at elevated temperatures and high pH. As a result, the partially reacted product is iron (Fe) and a polysaccharide. Research at the University of Florida has seen a positive color response on Centipedegrass (Eremochloa orphoroides) in high pH situations, while no differences were seen in acidic soils

with a pH near 5.0 (Sartain, 1996). One advantage to using iron sucrate is that it has limited water solubility, and therefore is less prone to staining in comparison to iron oxide products.

## Meals and Extracts

A number of plant products are available for nutrient sources. The most well-known products are listed below. However, the retail marketplace for organic fertilizers is rapidly changing and new products featuring a combination of meals, seeds, and extracts continue to become available. A majority of these are derived from high-nitrogen leguminous plants and seeds. Corn gluten meal, soybean and cottonseed meals, seaweed extracts, crab meal, feather meal, and others fall into this category.

### Hydrolyzed poultry feather meal – Safer® Brand Ringer Lawn Restore® 10-0-6, Scotts® Natural Lawn Food 11-2-2, Nature Safe® All Season Fertilizer 10-2-8

These products contain a variety of different meals including blood meal, bone meal, meat meal, and soybean meal. As a general rule, these are not used as an inorganic fertilizer source of nitrogen because feathers do not degrade easily. However, by treating the feathers with acid, the resistant nature of the feathers is destroyed and the hydrolyzed material can be used as a fertilizer. Generally, hydrolyzed poultry feather products are expensive because these are a combination of several organic products. These products have little to no phosphorus. These products generally offer about six to eight weeks of fertilization during the growing season.

### Corn gluten meal–Gardens Alive!® WOW!® Supreme 8-2-4, Espoma® Organic Weed Preventer 9-0-0

Corn gluten meal products offer a unique blend of a high percentage of nitrogen as well as a preemergence weed control for annual grasses. Nick Christians, professor of horticulture at Iowa State University, developed corn gluten meal. The material is generally about 8 to 10% nitrogen by weight. The nitrogen will release slowly over a three to four month period after application. The recommended rate is about 10 to 20 pounds of product per 1,000 square feet in the spring and fall. Recently, some products have substituted corn gluten feed and distiller grains for corn gluten meal. These products are not corn gluten meal, which is 60% protein material from wet milling, and will not perform the same. More information can be found on the Iowa State University Department of Horticulture site.(hort.iastate.edu/horticulture-research/corn-gluten-meal-research)

### Soybean meal–The Andersons® innova® 7-1-2, PurelyOrganic™ - Plant Based Lawn Food 10-0-2

Natural plant based products offer some benefits compared to other natural products such as no unpleasant smells and harsh chemicals. Additionally, there are no re-entry restrictions after fertilizer applications. PurelyOrganic™ and The Andersons® innova® are slow-release products containing 29% SRN/WIN and 86% SRN/WIN, respectively. PurelyOrganic™ also is phosphate free, so it meets any environmental regulations limiting phosphorus usage. PurelyOrganic™ also makes combination products that include weed and feed, crabgrass defender, and grub and feed.

### Bone meal – Espoma® Organic Bone Meal 4-12-0

Bone meal is produced by treating ground bone with acid. The end product is one of the highest phosphorus containing organic sources. The expense of bone meal has limited its use in turf. Bone meal usually takes about two to four months to release the nitrogen and phosphorus. Research at Colorado State University suggests that bone meal is only available to plants in soils that have a pH below 7.0 (Card et. al., 2014).

### Blood meal – Whitney Farms® Natural Blood Meal 12-0-0

Blood meal has one of the highest nitrogen concentrations of any organic fertilizer source. It is rapidly available for plant uptake because of its high solubility. Blood meal is commonly used in other organic mixtures to give a quick plant response. The biggest drawback to blood meal products is that a large portion is composed of readily available nitrogen, causing potential burning of plant tissue and loss to the environment. The products also are high in cost. As a result, blood meal products have not been extensively used in turf fertilization.

### Seaweed extracts

Another product that has received attention is seaweed extract or kelp. The advantage in using seaweed extracts or kelp products is the addition of several micronutrients. The biggest drawback with kelp products is that these provide only small quantities of nitrogen, phosphorus, and potassium. In addition to these listed products, there are several others such as composted manures and tankages (animal residues from slaughterhouses), composted chicken manure sold as Red Rooster Chicken Litter®, GreenEdge® products, garbage composts, humates, such as naturally occurring carbon, and iron humates

## Soil Release

The release of nutrients from natural (organic) fertilizers is largely dependent on microbial degradation. Anything that influences the rate of microbial action will influence the rate of nitrogen release (also known as mineralization) from these products. Six factors influence the microbial release of nitrogen from natural (organic) fertilizers:

### Carbon-to-nitrogen (C:N) ratio

Generally speaking, if the C:N ratio of organic material is <20/1, nitrogen will be released to the plant. If the C:N ratio of the organic fertilizer is >30/1, nitrogen is tied up by the microbes (immobilization). Microbes rely on nitrogen in the soil to form proteins. When the soil has limited nitrogen, microbes also will be deficient in nitrogen, causing slow decomposition and poor microbial growth.

### Initial structural composition of the product

If the initial structure of the organic material is high in lignin or other difficult-to-decompose organic materials, then mineralization will be slow. Lignin is a complex organic polymer deposited in the cell walls of many plants, making these rigid and woody. Products such as chicken manure release nutrients quickly, because these contain uric and amino acids, which degrade easily. In contrast, horse manure high in lignin will be broken down slowly because microbes have difficulty degrading lignin.

### Temperature

Temperature has a significant influence on the rate of release of nitrogen from organic materials. Organic products are broken down at a faster rate during the warm summer months because the optimal soil temperature for microbial degradation occurs between 86°F and 95°F. When soil temperatures drop to under 86°F, mineralization begins to slow, and nearly stops once it reaches 41°F. As a result, temperature plays an important role in protecting the environment because during the winter there is minimal plant growth and little to no nutrients are released into the soil.

### pH

The optimal pH for microbial degradation ranges from 6.5–8.0. Microbes tend to grow best in high pH or alkaline soils. As a general rule, microbes are less robust in acidic conditions lower than a pH of 4.5. Optimizing pH with an application of sulfur (reduces pH) or lime (increases pH) will improve the rate of mineralization.

### Moisture

Moisture is essential for the survival of microbes; however, if the moisture level is too high, aeration will be limited and microbial activity will be inhibited. Microbes are the most active when moisture levels are near field capacity. If the moisture level is near air dry, the microbial activity decreases. If the moisture level is near saturation, soil organic nitrogen mineralization is slowed, but not stopped.

### Aeration

Finally, aeration is essential for all aerobic micro-organisms and most microbes involved in nitrogen mineralization are aerobic. Mineralization still proceeds under anaerobic conditions, but at a reduced rate. Most aerobic microorganisms prefer soils with about 20% oxygen. Their activity declines as the oxygen level declines, and more or less stops when the soil oxygen level drops below 2%.

In conclusion, the rate release of nutrients from organic fertilizers is dependent on several factors. In most cases, providing a beneficial environment for plant growth provides a good environment for microbial degradation.

## More Information

The following publications are available at county extension offices and the Iowa State University Extension Store (store.extension.iastate.edu):

- PM 930: Weed Control in Home Lawns
  store.extension.iastate.edu/Product/PM930
- PM 1057: Lawn Fertilization
  store.extension.iastate.edu/Product/4378
- PM 1447D: Responsible Phosphorus Management Practices for Lawns
  store.extension.iastate.edu/Product/4883
- HORT 3093: Turfgrass Management Calendar: Kentucky Bluegrass Lawns
  store.extension.iastate.edu/Product/4383
- PM 1072: Establishing a Lawn from Seed
  store.extension.iastate.edu/Product/4396
- HORT 3021: Fall Tips to Ensure a Healthy Green Yard in the Spring
  store.extension.iastate.edu/Product/14284)
- HORT 3023: Selecting a Grass Species for Iowa Lawns
  (https://store.extension.iastate.edu/product/5083)

## References


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Christians, N., A. Patton, and Q. Law. 2017. "Fundamentals of Turfgrass Management", 5th ed., Wiley, Hoboken, NJ.

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