

Organic vs. Synthetic Fertilizers

Understanding the Differences and
Choosing the Right Nutrient Strategy



Organic vs. Synthetic Fertilizers



ORGANIC OR SYNTHETIC.
UNDERSTAND THE DIFFERENCE.



NUTRIENT SOURCE
Natural and
manufactured
inputs supply
essential plant
nutrients



RELEASE SPEED
Availability can
differ based on
form and soil
conditions



SOIL IMPACT
Organic inputs can
support soil biology
and structure



BEST FIT
Choose the
product that
matches crop
needs and
application goals

Fertilizer provides plants with nutrients needed for growth, but not all fertilizers supply those nutrients in the same way.

Two broad categories are commonly discussed: **organic fertilizers** and **synthetic fertilizers**.

Both can provide essential plant nutrients. The important differences involve where those nutrients come from, how quickly they become available, how they interact with the soil, and how they fit within a grower's overall nutrient management program.

Understanding those differences can help growers, gardeners, landscapers, retailers, and agricultural professionals make better-informed fertilizer decisions.

What Is an Organic Fertilizer?

Organic fertilizers are derived primarily from naturally occurring plant, animal, or mineral materials.

Common organic nutrient sources can include:

- Fish-based materials
- Plant meals
- Animal-derived meals
- Compost and composted materials
- Kelp and other marine materials
- Naturally occurring mineral sources

Depending on the material, an organic fertilizer may supply nitrogen, phosphorus, potassium, secondary nutrients, micronutrients, carbon compounds, and other components.

An important characteristic of many organic fertilizers is that some of their nutrients are not immediately available to plants.

Organic nitrogen, for example, generally must be converted by soil microorganisms into plant-available forms such as ammonium and nitrate. This biological conversion process is known as **mineralization**. (OSU Extension Service)

As a result, an organic fertilizer can function as more than simply a direct nutrient source. Organic materials may also contribute carbon and organic matter that support biological processes within the soil. (University of Minnesota Extension)

What Is a Synthetic Fertilizer?

Synthetic fertilizers, often referred to as conventional or inorganic fertilizers, are manufactured or processed to supply nutrients in highly available and generally predictable forms.

They commonly provide nutrients such as nitrogen, phosphorus, and potassium in concentrated formulations.

Because many of the nutrients are already present in plant-available or readily soluble forms, synthetic fertilizers can produce a relatively rapid nutrient response.

This can be useful when a crop requires a specific nutrient at a particular stage of development or when a deficiency needs to be corrected promptly.

Synthetic fertilizers also tend to offer precise nutrient concentrations, making application rates relatively straightforward to calculate.

The tradeoff is that supplying nutrients and building soil organic matter are two different objectives. A fertilizer can provide nitrogen, phosphorus, or potassium without contributing significant organic material to the soil.

Can Plants Tell the Difference?

This is one of the most important points when comparing organic and synthetic fertilizers.

Plants absorb nutrients in specific chemical forms.

For example, plant roots absorb nitrogen primarily as nitrate and ammonium. Once an organic nitrogen source has been mineralized into these plant-available forms, the plant does not distinguish that nitrogen based on whether it originally came from an organic or synthetic fertilizer.

OSU Extension summarizes the principle simply: plants require nutrients in available forms regardless of their original source. (OSU Extension Service)

The difference, therefore, is not that plants recognize an "organic" nutrient.

The difference is **how the nutrient becomes available and what else occurs within the soil as part of that process.**

Nutrient Release Can Be Very Different

One of the most significant differences between organic and synthetic fertilizers is nutrient availability over time.

Many synthetic fertilizers contain nutrients that dissolve relatively quickly in soil water. This can make nutrients available soon after application.

Many organic fertilizers rely more heavily on biological activity.

Soil microorganisms break down organic materials and convert nutrients into forms that plants can absorb. The speed of that process can be influenced by:

- Soil temperature
- Soil moisture
- Oxygen availability
- Microbial activity
- The type of organic material
- Particle size and formulation
- Existing soil conditions

University of Minnesota Extension notes that microbial conversion of organic nitrogen varies with environmental conditions, including moisture and temperature. (University of Minnesota Extension)

This means nutrient release from an organic fertilizer may be less immediate and sometimes less predictable than nutrient release from a highly soluble synthetic fertilizer.

That is not necessarily a disadvantage.

It simply means the fertilizer program should be matched to the crop, soil, environment, and timing of nutrient demand.

Organic Fertilizers and Soil Organic Matter

One of the major reasons growers incorporate organic nutrient sources into fertility programs is their potential contribution to the soil system itself.

Organic materials can supply carbon that supports soil microorganisms and contributes to soil organic matter.

Soil organic matter is associated with important soil functions, including:

- Nutrient cycling
- Water-holding capacity

- Soil aggregation and structure
- Biological activity
- Nutrient retention
- Air and water movement through the soil

University of Minnesota Extension notes that organic materials can feed soil microorganisms, increase soil organic matter, and improve overall soil health. (University of Minnesota Extension)

Oregon State University Extension also describes biologically active organic matter as an important contributor of plant-available nitrogen, phosphorus, sulfur, and some micronutrients within cropping systems. (OSU Extension Service)

This is an important distinction.

A fertility program can be designed simply to supply nutrients to the current crop, or it can also consider the long-term condition and biological activity of the soil.

For many growers, both objectives matter.

Faster Is Not Automatically Better

The rapid availability associated with many synthetic fertilizers can be valuable.

It can also require careful management.

If more nutrients are supplied than plants can use, those nutrients do not simply disappear. Depending on the nutrient, soil, weather, and management practices, excess nutrients may move through the soil, accumulate, or leave the field through runoff or other pathways.

The same principle applies to organic fertilizers.

Organic does not mean that overapplication is harmless.

Organic nutrient sources can also contribute excessive nitrogen, phosphorus, salts, or other materials when they are applied at rates greater than the crop or soil requires.

University of Minnesota Extension cautions that fertilizer overapplication can contribute to nutrient accumulation, salinity, and pH problems. (University of Minnesota Extension)

The appropriate question is therefore not simply:

Is this fertilizer organic or synthetic?

A better question is:

Is this the right nutrient source, applied at the right rate and at the right time for this crop and soil?

Comparing Organic and Synthetic Fertilizers

The two fertilizer categories have different characteristics.

Organic Fertilizers

Organic fertilizers commonly:

- Originate from plant, animal, marine, or naturally occurring mineral sources
- Depend partly on biological processes for nutrient release
- Can contribute organic matter and carbon to the soil
- Can support soil microbial activity
- May contain nutrients beyond the primary NPK analysis
- Often release some nutrients more gradually
- Can have nutrient availability influenced by temperature, moisture, and soil biology

Synthetic Fertilizers

Synthetic fertilizers commonly:

- Contain manufactured, refined, or highly processed nutrient sources
- Provide nutrients in readily available forms
- Can produce a rapid nutrient response
- Often contain relatively concentrated nutrient analyses
- Allow precise nutrient quantities to be applied
- Generally contribute little organic matter
- Require careful application to avoid supplying nutrients beyond crop demand

Neither list automatically makes one fertilizer appropriate for every situation.

The correct choice depends on the objective.

What About Environmental Impact?

Fertilizer management has environmental consequences regardless of the source.

Nitrogen that is not captured by plants can potentially move below the root zone or be lost through other pathways. Phosphorus transported from fields or landscapes can contribute to water-quality problems.

Organic nutrient sources are not exempt from these processes.

For example, once organic nitrogen has been mineralized into nitrate, that nitrate behaves according to the same soil and water processes as nitrate originating from other fertilizer sources.

This is why responsible fertility programs consider:

- Soil testing
- Crop nutrient requirements
- Application timing
- Application rate
- Irrigation
- Weather
- Soil characteristics
- Nutrient availability

The goal should be to place nutrients where crops can use them while minimizing unnecessary losses.

Organic Fertilizer and Certified Organic Production

The word **organic** also has a regulatory meaning in agricultural production.

Under USDA National Organic Program requirements, materials used in certified organic crop production must comply with specific standards.

The general rule is that nonsynthetic substances are allowed unless specifically prohibited, while synthetic substances are prohibited unless specifically allowed on the USDA National List of Allowed and Prohibited Substances. (USDA Agricultural Marketing Service)

This distinction is important because:

Natural does not automatically mean permitted in certified organic production, and synthetic does not automatically mean prohibited.

Certain synthetic substances are specifically allowed, while certain natural substances are prohibited.

Growers participating in certified organic production should therefore verify that fertilizer and soil-amendment products are appropriate for their individual organic system plan and certifier requirements.

Is Organic Fertilizer Always Slow Release?

Not necessarily.

"Organic fertilizer" describes the source and nature of the material, not one universal release rate.

Different organic fertilizer ingredients behave differently.

Some organic materials mineralize relatively rapidly under favorable conditions, while others release nutrients more gradually.

Liquid and dry formulations can also differ considerably in nutrient availability.

This is why two organic fertilizers with similar NPK analyses may perform differently after application.

The fertilizer's **formulation, raw materials, application method, soil conditions, and growing environment** all matter.

Can Organic and Synthetic Fertilizers Be Used Together?

In conventional agricultural and landscape systems, they can.

Some growers use an integrated approach in which organic materials contribute to long-term soil management while more immediately available fertilizers are used to address specific crop nutrient requirements.

Whether that approach is appropriate depends on the production system and the grower's objectives.

For certified organic operations, however, every material used must comply with the applicable organic production requirements.

The important concept is that nutrient management does not have to be viewed as an either-or decision unless the production standard requires it.

The objective is to develop a fertility program that supplies the crop while supporting the condition of the growing system over time.

Soil Testing Still Comes First

Whether a grower chooses organic fertilizer, synthetic fertilizer, or a combination of nutrient sources, soil testing remains one of the most useful tools for making fertilizer decisions.

A fertilizer label tells you what nutrients are contained in the product.

A soil test helps determine what may already be present in the soil.

Without that information, it is easy to apply nutrients that are not needed while overlooking nutrients or soil conditions that actually require attention.

Fertilizer selection should consider:

- The crop being grown
- Existing soil fertility
- Soil pH
- Organic matter
- Nutrient deficiencies
- Stage of crop development
- Expected nutrient demand
- Application method
- Irrigation practices
- Environmental conditions
- Production requirements

The most effective fertilizer is not simply the product with the highest analysis or the fastest response.

It is the product that fits the nutrient requirements of the crop and the management objectives of the grower.

The Bottom Line

Organic and synthetic fertilizers can both supply essential plant nutrients, but they do so differently.

Synthetic fertilizers generally provide concentrated nutrients in readily available forms and can deliver a rapid, predictable nutrient response.

Organic fertilizers can provide essential nutrients while also contributing organic materials that participate in soil biological processes and nutrient cycling. Because many organic nutrients depend on microbial activity before becoming plant available, their release can be influenced by soil and environmental conditions.

Neither fertilizer category eliminates the need for responsible nutrient management.

Remember:

Plants need nutrients in forms they can absorb.

Soils are living systems in which nutrient cycling, organic matter, water, air, microorganisms, and chemistry all interact.

The right fertilizer program considers both the immediate needs of the crop and the condition of the growing environment over time.

Understanding those differences makes it easier to select fertilizer based on what the crop and soil actually need rather than simply choosing between the words "organic" and "synthetic."

Disclaimer: This material is provided for general educational purposes only. Growing conditions, soil characteristics, crop requirements, application rates, and regulatory requirements vary. Always follow product label directions as well as all governmental and safety regulations or recommendations, and consult appropriate agronomic, regulatory, or crop-management professionals when making site-specific fertilizer or soil-management decisions.

To learn more about BWF Banducci's liquid and dry organic fertilizer products, visit
BWFBanducci.com.

