



Organic matter does more than build up soil

Soil organic matter is a sign of soil health, but it is also an important nutrient reservoir that can cut fertilizer costs.

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Soil organic matter is widely recognized for improving water infiltration and increasing water-holding capacity. It also plays a role in enhancing soil structure, reducing erosion, and supporting microbial activity. As a result, many producers view soil organic matter primarily as an indicator of soil health. Yet one of its most crucial functions often receives less attention: its role as a reservoir of plant nutrients, particularly nitrogen.

Unlike commercial fertilizer, soil organic matter does not arrive in a truck, carry a price tag, or appear as a line item in a nutrient management plan. Nevertheless, it contains substantial amounts of nitrogen accumulated through years of crop residue

decomposition, manure applications, cover crops, and biological activity. As soil microorganisms break down organic matter, a portion of this nitrogen is released in plant-available forms through mineralization.

For many farms, this natural process represents one of the largest and least appreciated sources of crop nitrogen. But its contribution varies with soil temperature, moisture, texture, and management history.

Because of this uncertainty, nutrient management plans often focus on fertilizer nitrogen, manure nitrogen, and residual soil nitrate, while giving less consideration to the nitrogen supplied by soil organic matter. Recent research published in the *Soil Science Society of*

America Journal by University of California Davis' Suzette Santiago and colleagues evaluated nitrogen mineralization under field conditions across commercial agricultural soils. They also provided new insight into the contribution of soil organic matter to crop nitrogen supply.

Their findings reinforce an important concept for nutrient management: Soil organic matter is not simply a soil health indicator. It is also an active contributor to crop nitrogen supply.

How much nitrogen is supplied?

The California study evaluated 24 commercial agricultural fields over multiple growing seasons. Researchers monitored nitrogen mineralization under

field conditions and compared soils with various levels of organic matter.

Researchers found that soils with greater organic matter content consistently released more nitrogen throughout the growing season. Low-organic matter soils mineralized 0.84 pounds of nitrogen per acre per day, whereas soils with higher organic matter content released 2.51 pounds per acre per day. Over a typical 120-day growing season, these rates would be equivalent to 100 to 250 pounds of nitrogen per acre, depending on soil characteristics and environmental conditions.

While these values should not be interpreted as direct fertilizer replacement recommendations, they demonstrate that soil organic matter can supply meaningful quantities of nitrogen. As such, they deserve consideration when developing nutrient management plans.

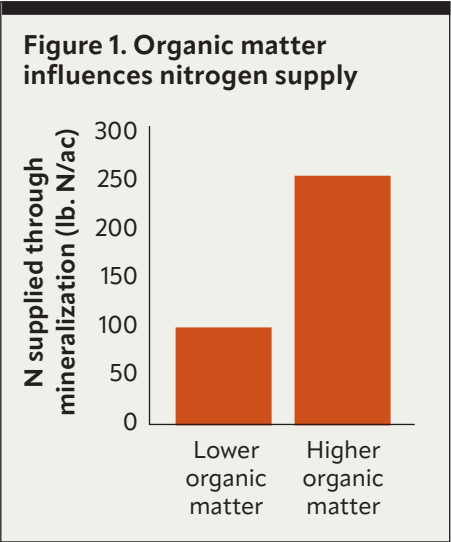
Perhaps most importantly, the study highlighted substantial variability among fields. Temperature, moisture, texture, drainage, microbial activity, and management history all influenced mineralization rates, illustrating why fixed estimates of nitrogen release per percentage point of organic matter should be viewed with caution. Although such rules of thumb can provide a useful starting point, two fields with identical organic matter levels may contribute quite different amounts of crop-available nitrogen during a growing season.

Building future nitrogen supply

One of the most valuable aspects of soil organic matter is that it reflects the cumulative result of years of management decisions. Crop residues, manure applications, cover crops, reduced tillage, and diverse crop rotations all contribute organic materials that eventually become part of the soil organic matter pool. Over time, these practices boost the amount of nitrogen stored within the soil and potentially available for future crops. Research shows

that soils receiving greater organic inputs developed larger pools of mineralizable nitrogen and supplied more nitrogen to crops than conventionally managed systems.

Viewed from this perspective, investments in soil health become investments in future nutrient supply. Building soil organic matter is a gradual process that



often requires years of consistent management, but the benefits can persist long after the original organic inputs have been applied. As organic matter accumulates, so does the soil's capacity to store and release nitrogen, improving nutrient cycling and supporting crop production over time.

Cutting input costs

The economic implications are difficult to ignore. At current fertilizer prices, every pound of nitrogen supplied by soil organic matter represents a pound that may not need to be purchased from commercial sources. Even modest reductions in fertilizer requirements can translate into meaningful savings when multiplied across hundreds or thousands of acres.

While actual nitrogen contributions

vary widely among soils, even modest increases in mineralization can have measurable economic value. Consider a field where improved soil management raises nitrogen mineralization by only 30 to 40 pounds per acre annually. At nitrogen prices ranging from \$0.50 to \$0.70 per pound, that contribution could represent \$15 to \$28 per acre each year. Across 500 acres, the value approaches \$7,500 to \$14,000 annually.

The economic value may be even greater when secondary benefits are considered. Improved soil structure, enhanced water infiltration, greater water-holding capacity, and improved tolerance for traffic can all contribute to more consistent crop performance and reduced production risk. Unlike commercial fertilizer, these benefits often persist and accumulate over time.

Giving credit where due

The findings from recent field research reinforce an important principle for nutrient management. Soil organic matter should not be viewed solely as a soil health indicator or environmental objective. It is also an important source of plant-available nitrogen that contributes to crop production every year.

Just as producers credit manure nutrients when developing fertilizer recommendations, they should recognize that soil organic matter participates in supplying crop nitrogen. While estimating that contribution remains challenging, ignoring it entirely can lead to unnecessary fertilizer applications and reduced nutrient-use efficiency.

The goal is not to eliminate fertilizer applications or rely exclusively on mineralized nitrogen, but rather to acknowledge the role of the soil itself in nutrient cycling and incorporate that contribution into management decisions whenever possible. Long before the fertilizer spreader enters the field, soil organic matter is already at work. The more effectively farms build and manage this resource, the greater its contribution to crop productivity, nutrient-use efficiency, and long-term profitability. ■

Additional N supplied (lb./acre)	N value at \$0.50/lb.	N value at \$0.70/lb.
20	\$10	\$14
40	\$20	\$28
60	\$30	\$42
80	\$40	\$56



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