



Enlightened Soil Corp

En-Soil Algae

The Natural Path to Enhanced Soil Fertility

A Brief Report: Detrimental Effects of Synthetic-Chemical, NPK Fertilizer

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NPK provides nitrogen, phosphorous, and potassium in a form that can be directly absorbed by plant roots, thus bypassing natural processes that rely on the interaction of plants and the soil microbial system. It has a place in history, since NPK helped fuel the Green Revolution. Before that, there was speculation that there would be widespread famine with population growth.

But there are negative consequences after six decades of chemical-dependent agriculture.

Consider these effects of synthetic chemical fertilizers (NPK)

1. NPK does not promote the growth or activity of soil microbes. This is the same as saying it doesn't improve fertility, since fertility = microbial bulk and activity. Fertility of midwestern farm soil has declined with extended use.
2. NPK is inefficient. Only about one-third of the nitrogen applied as NPK is used by plants.
3. NPK produces environmental toxins. Unused nitrates in soil dissolve in water and reach ground water or adjacent lakes, streams or ponds. Some is converted to NO_3^- which is toxic in ground and surface water. As much as 5% is converted to N_2O , a greenhouse gas 300-times more potent than CO_2 . Nitrogen fertilizer is also associated with water deoxygenation, leading to fish kills.
4. The excess NPK that is dissolved in water washes into surface water causing wild algae bloom (algae is a plant so it responds to fertilizer). However, don't confuse the wild algae bloom with En-Soil Algae. Paradoxically, replacing NPK with En-Soil Algae is a solution to algae bloom (See our Iron Horse Farm Case Study in Appendix 5).
5. NPK is inefficient and energy intensive. Manufacture, transport and application of NPK produces the equivalent of 5% of the natural gas produced in the US.

6. The application of nitrogen fertilizers has actually depleted soil organic nitrogen and organic carbon, apparently by accelerating the decomposition of crop residues and soil organic matter.
7. In addition to releasing greenhouse gases, NPK does not promote carbon sequestration, e.g. the transfer of atmospheric CO₂ to organic carbon that is sequestered in soil or by growing plants. A mature tree contains tons of carbon that originated in the atmosphere. Expanding coverage of the planet with plants is not only a natural way to reduce greenhouse gases, it also is considered to have the greatest potential effect, measured as the volume of CO₂ that can be removed. NPK has no role in this process; with extended use it has been found to reduce soil organic carbon. Live algae as a bio-stimulant; on the other hand, has been found to boost levels of soil organic matter and organic carbon.

References:

Mulvaney, RL, Khan SA, Ellsworth TR. "Synthetic nitrogen fertilizers deplete soil nitrogen: a global dilemma for sustainable cereal production." J Environ Quality (2009) 38:2295-2314. <https://doi.org/10.2134/jeq2008.0527>

Khan SA, Mulvaney RL, Ellsworth TR, Boast CW. "The myth of nitrogen fertilization for soil carbon sequestration." J Environ Qual (2007) 36:1821-32. DOI: [10.2134/jeq2007.0099](https://doi.org/10.2134/jeq2007.0099)

These two papers from the University of Illinois show that soil content of nitrogen and organic carbon declines with prolonged use of NPK. Organic matter measured with routine soil testing is roughly equivalent to organic carbon. Thus, with extended use, NPK causes a decline in fertility.