

Three Fixes for Depleted Soils

Soil is much more than an anchor for roots. Crops have been bred to grow bigger and faster, but at the expense of soil integrity. Depleted soils occur for various reasons: deforestation, industrial use, mining without reclamation, urbanization, incorrect cultivation and adverse events.

“Ever since humans developed agriculture, we’ve been transforming the planet and throwing the soil’s nutrient cycle out of balance. Because the changes happen slowly, often taking two to three generations to be noticed, people are not cognizant of the geological transformation taking place.” Ronald Amundson, Professor of Environmental Science, Policy and Management, University of California, Berkeley

The side-effects of depleted soil are the root cause of land lost to drought, aridity, contamination, erosion, flooding and runoff. Today, nearly half of the world’s arable land is affected by these conditions. To compound the problem, the continual use of land further injures its ability to regenerate and produce nutritious crops.

Crops grown in soil that has become depleted have little to no nutritive content. Consumers remain largely

unaware of this, but not for long. The Agricultural Marketing Service arm of the USDA will be expanding its testing of brix to all produce in the coming decade.

Brix is the amount of sucrose in the plant. Higher brix means healthier, more flavorful, more nutritious crops with much longer shelf life. Brix used to be something that only grape growers monitored because of its importance to winemaking; then apple and orange growers got in on it. But better brix is only one reason to fix depleted soil.

Like the human body, the land possesses an inherent ability to revive when relieved of toxins, nourished and allowed to rest.

What’s Missing

The elements needed for fixing depleted soil are divided into macro- and micro-nutrients:

- The macro-nutrients are Nitrogen (N), Phosphorus (P), Potassium (K),

Calcium (Ca), Sulfur (S), Magnesium (Mg), Carbon (C), Oxygen (O) Hydrogen (H)

- The micro-nutrients (or trace minerals) are Iron (Fe), Boron (B), Chlorine (Cl), Manganese (Mn), Zinc (Zn), Copper (Cu), Molybdenum (Mo), Nickel (Ni)

N-P-K

Nutrients normally replenish themselves over time through the natural cycle of plant growth (germination, decomposition, seeping, uptake, etc.) but this becomes impossible when soil is used continuously and cultivation is forced by man-made substances. Even though synthetics are designed to add the key macro-nutrients needed for plant growth with precision (Nitrogen, Phosphorus and Potassium), these substances have yet to replicate the cumulative and lasting mineral-rich result of natural decomposition.

Elemental N₂ or diatomic nitrogen is an essential component of all



living tissue. Nitrogen is of concern to agriculture as a building block for proteins and amino acids, but it is also a potential water pollutant.

A non-metal, Phosphorus (P) is an essential nutrient present in all DNA molecules. Crops need it for flowering and reproduction, as well as energy exchange. However, decades of research into nutrient management, has revealed that long-term use becomes counter-productive.

Potassium (K) helps increase crop yields, enhance high-starch grains and protein content. It may also help improve crops' immunity to weather stress, diseases and nematodes.

Organic Matter

Organic matter got phased out by constituents produced in labs and largely lost to the agricultural practices that followed. Organic matter doesn't work as dramatically or fast as man-made substances, but it works deeper. It revitalizes soil, the foundation of the biological processes necessary to long-term successful farming.

Organic matter builds soil by improving:

- resistance to erosion
- soil structure
- water-holding capacity
- nutrient uptake
- brix content after harvest

The use of organic matter creates a closed-loop system in which nutrients are put back into the soil and delivered to the crops.

Manures

While many types of organic matter are available, one in particular is garnering attention: manure. Manure contains plant nutrients, soluble and insoluble organic compounds and beneficial microorganisms.

- A cow creates about 65 pounds of manure a day containing a 3-2-1 ratio of NPK.

- A thousand-pound horse generates about 20 pounds of manure per day, at approximately 1-.3-1.5 NPK.
- A chicken produces about 50 pounds (dry weight) of manure per year at 1.2-.5-.8 NPK.

Manure supplies plants instantly with nitrogen, phosphorus, potassium and other nutrients by warming the soil, which speeds up decomposition, and lowers the soil's acidity level, or pH. The addition of hay or other feed also increases its nutrient content.

Aged manure is often preferable to fresh, and dried manure is another form coming into use. The processing of manure into a dry, granular product offers many benefits to producer and soil such as:

- Custom blends for specific needs
- Ease of storage
- Precision application
- Subsidizing fertilizer requirements
- Creating income to offset waste management costs
- Decreasing runoff by improving soil structure

Manure provides the organic matter soils need while reducing the burden of on-site waste management.

Minerals

A mere 92 natural elements make up the universe, and only four of these are organic and come from the atmosphere. The remaining 88 are mineral or inorganic and come from the ground or rock. Rocks, from which soils are made, are almost entirely made up of inorganic elements and oxides combined with the mineral elements.

Plants take up extra minerals not necessary for their own growth and reproduction, but which we require and could not otherwise get.

When minerals are not replaced, soil lacks the building blocks of farming

(continued on next page)

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and eventually reaches a point where it cannot produce a healthy crop. But long before this, the nutritive content of the crop has disappeared. Starved for minerals, crops grown in depleted soil are little more than empty calories, mostly carbohydrates, squeezed from the Carbon, Hydrogen and Oxygen they manage to suck out of the air and water.

Another fix for this is to supply minerals from an organic source. Limestone, for example is abundant in every state. Other trace minerals like Selenium or Boron occur in few places, but are worth transporting.

A Note on Boron

Boron is one of the rarest elements,

but absolutely essential for calcium metabolism. An oft-heard phrase in agriculture is “Calcium is the truck, but boron is the driver”. This refers to the concept that calcium is the transporter of nutrients into and out of the cells, but it can’t do its job unless boron is present.

Boron is easily leached out of soils, so higher rainfall areas are often deficient. Today, essentially everything east of the Mississippi River, as well as the Pacific Northwest as far south as the San Francisco Bay and as far east as central Montana are boron-deficient.

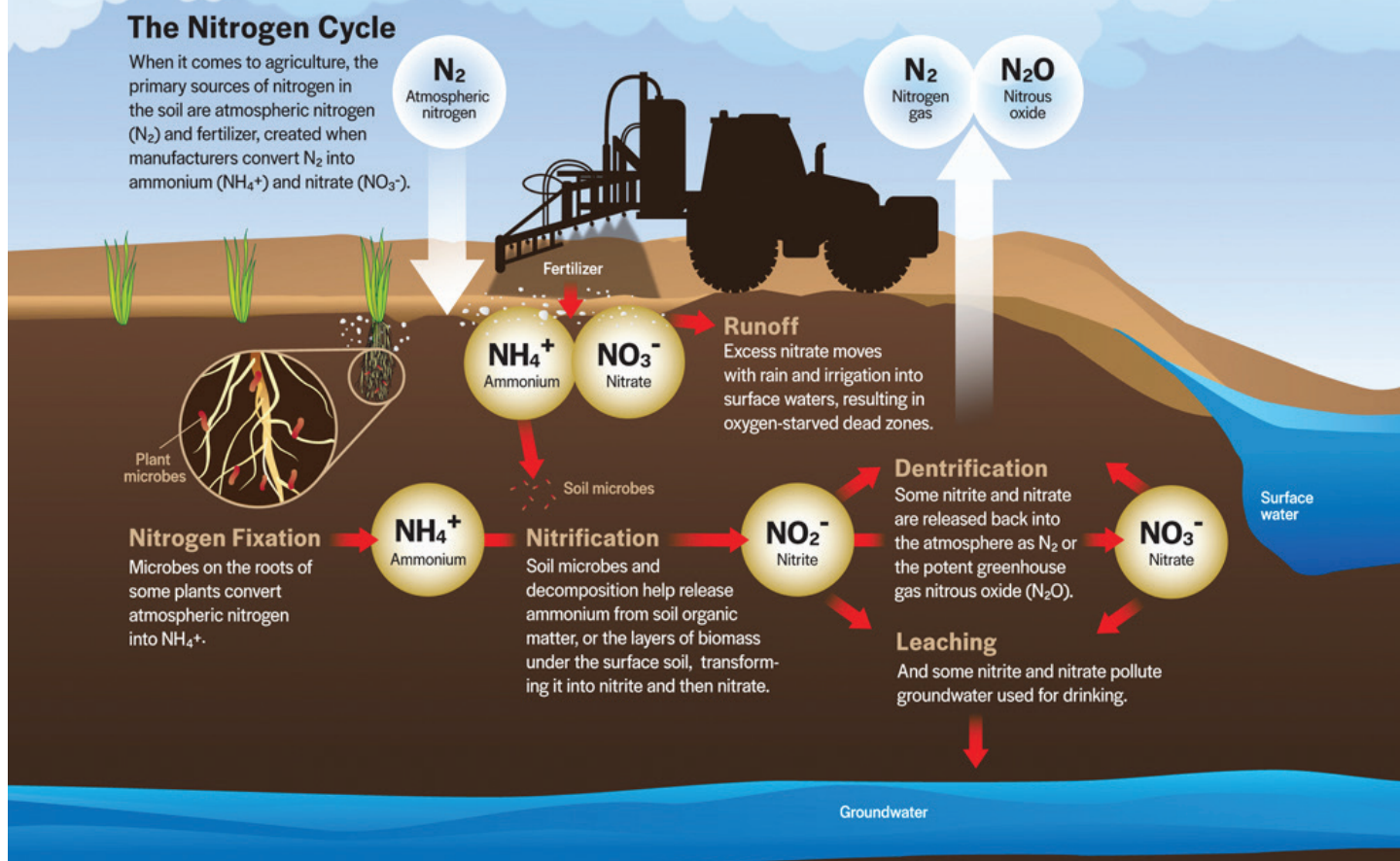
A wonderful thing about a balanced, mineralized soil is that everything else becomes easier. The soil pH self-

adjusts to its optimum, plant disease and insect problems largely disappear, water retention, drainage, soil texture and rate of decay of organic matter all become self-regulating. The grower knows that the nutrients are in the crop because the nutrients are available in the soil. Michael Astera, Agricola

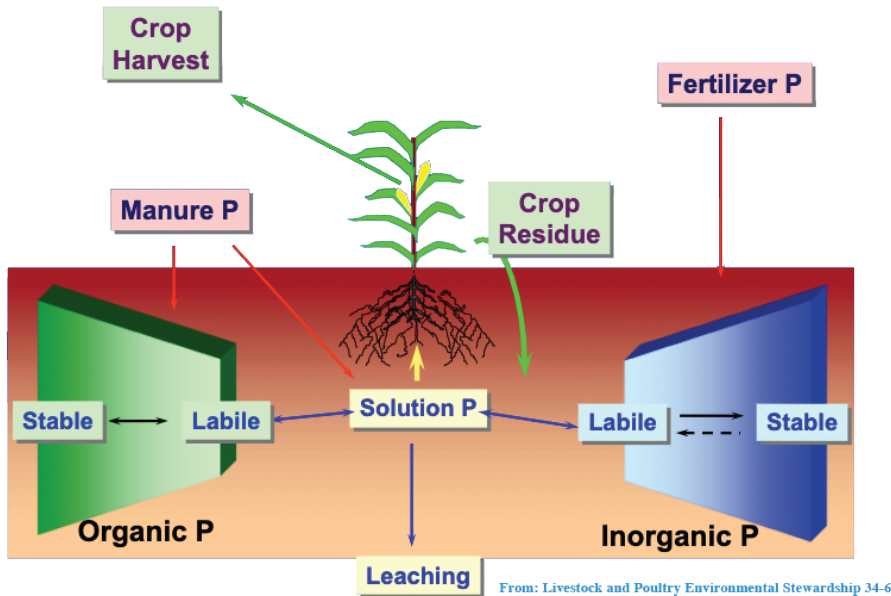
Composts

Composting is the art and science of managing the decomposition of various substances (manures, crop residues, feed wastes, grass clippings, hay, leaves, sawdust, kitchen wastes) to produce a uniform and usable final product. Called black gold by some, this breakdown reduces bulk, stabilizes soluble nutrients and supports the formation of humus.

“...when summer ends, annual crops like corn and soybeans die. Winter rain and snowmelt seep downward towards the water table, carrying any nitrate that was left in the root zone through subsurface layers to groundwater.” Ken Staver, University of Maryland



The Phosphorus Cycle



The micro-organisms that power the process require only moisture and oxygen and create temperatures of 110-160°F.

Composts are superb soil amendments. Composting farm wastes and selling farm residues have been accepted practices for thousands of years.

The advantages of this form of building soil are many:

- Composting is safe for locations near watersheds that supply drinking water. Many parasites (Giardia lamblia, Cryptosporidium parvum) that cause illness but are not eliminated by chlorination are killed by simple composting.
- Compost is 30–60% less bulky than the original materials.
- It is easier and more pleasant to handle than the original materials.
- Many weed seeds and agricultural pathogens are killed by the heat in the compost pile.
- Unpleasant odors are eliminated.
- Composting discourages flies.
- Composting reduces the decline in nitrogen availability that commonly

occurs when un-aged or non-decomposed organic matter, like manure or straw, are added directly to soil.

Composting endures because it works.

The reason of our thus treating composts of various soils and substances, is not only to dulcify, sweeten and free them from the noxious qualities they otherwise retain... apter to engender vermin, weeds and fungous . . . than to produce wholesome plants, fruits and roots, fit for the table. J Evelyn, 17th Century



- J.E. Holloway

Sources:

- Conserve Energy Future
- Cornell Waste Management Institute
- Farmers Weekly
- FEECO
- Sustainable Agriculture Research and Education
- The Ideal Soil
- USDA

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