What's Wrong with the N-P-K Approach to Farming?

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Does it make sense to use high levels of only highly concentrated water-soluble nutrients? The N-P-K-pH chemical approach to farming is both incomplete and wasteful.

Nitrogen

Managing nitrogen should not be just mathematical. Crop rotation, the nitrogen source used, and when and where the nitrogen is applied all have a bearing on how much nitrogen we need, as does soil air, soil life, organic matter, and the presence and balance of other elements (such as sulfur and calcium).

Biological farmers do not want to use any more nitrogen than absolutely necessary, not only because of cost and possible environmental pollution, but also because excess nitrogen suppresses long-term stable biological processes in the soil.

Research from the University of Minnesota has found that corn yields are highest when legumes are added to the rotation (O'Leary, Rehm, and Schmitt, 2008). By including soybeans, alfalfa, or other nitrogen-fixing plants, it is possible to grow your own plant-available nitrogen and reduce fertilizer requirements. Now consider how conventional thinking advocates applying more nitrogen to increase yield. Is yield always increasing as much as the nitrogen applied? Are your added fertilizer dollars getting you results? If not, what happens to the extra nitrogen you apply? Does it benefit the soil, the environment — or your water? What are the overall costs?

Two very real examples of the costs of applying more fertilizer than plants can use are the water quality issues in Iowa and the "dead zone" in the Gulf of Mexico (NOAA, 2014). In Iowa, drinking and surface waters are being polluted with nitrates from heavily fertilized agriculture fields (Herring, 2013). Nitrate levels are so high that the city of Des Moines operates the largest nitrate removal drinking water system in the country. The runoff nutrients are so great in the tributaries feeding the Mississippi River that a dead zone, or hypoxic zone (an area depleted of oxygen), exists at the northern edge of the Gulf of Mexico (NOAA, 2014).

Nitrates that have run off from farm fields are carried down the Mississippi River to the Gulf of Mexico, where they feed algae blooms. When the algae decomposes, it uses up all the deep-water oxygen, which then kills a lot of the plants and animals living in gulf waters. All that runoff begs the question: Did the farmers really *need* all that nitrogen they applied? Their crops certainly didn't use the nitrogen that ran off their fields.

Phosphorus

Only a small amount of the total fertilizer phosphorus is available to the growing crop because most of it changes back into the insoluble rock phosphate form. However, research has shown that phosphorus

availability increases where there are high levels of soil organic carbon and phosphatases (Oberson et al., 1992). Soil phosphatases are enzymes that catalyze processes that make phosphorus available for plant uptake (Nannipieri et al., 2011).

Having higher levels of available soil phosphorus can help to increase plant health and feed quality. These higher levels can be reached by using a combination of naturally mined rock phosphate, some high-quality manufactured phosphorus, green manure crops, livestock manure, and biological activity.

Potassium

The most common commercial source of potassium is muriate of potash, also called potassium chloride, a strong salt containing 47 percent chloride. Research has found that chloride causes calcium to leach out of the root zone and inhibits soil microbial nitrification and root nodulation (Khan, Mulvaney, and Ellsworth, 2013). While chloride is in the upper layers of soil, high levels of it can also kill beneficial soil life and injure roots.

Conventional specialists often recommend potassium applications at rates that are far too high, leading to soil imbalance and lower quality crops, in part due to the excess chloride and high solubility of the K source. Although conventional wisdom (and the fertilizer industry) links high potassium levels to big piles of crops (yield), plants are good at tapping into soil potassium reserves, and we can often obtain higher yields along with better quality by instead applying more calcium and less potassium.

Examining the N-P-K approach

Synthetic N-P-K fertilizers have few or no secondary and trace elements, yet all 20 elements are necessary for plant growth, not just the "big three" — N, P, and K. Continued use of N-P-K alone can result in calcium, sulfur, magnesium, and trace element deficiencies.

Does the N-P-K farming approach seem to be balanced with nature? Does it seem to be beneficial for soil life and crop health? How would your livestock perform if you only fed them carbohydrates and ignored protein, fats and minerals? It's the same thing. Look around: the soil gets harder and erodes, water quality deteriorates, animal and human health problems increase, pests and weeds proliferate, and more fertilizers, chemicals, and biotechnology are continually needed.

In addition to the environmental problems of the N-P-K approach, research shows that yields are no longer responding to applying more nutrients, and in some cases yields are declining (Ciampitti and Vyn, 2014). It's all related to how we treat "Mother Nature's" soil. Balance is the key, just as it is with livestock and human nutrition. We need a farming method that produces "quality" — healthy, mineralized, balanced crops.

My introduction to biological farming came from teaching and working as a consultant. After growing up on a dairy farm, I spent eight years in college studying agriculture and earned a master's degree in dairy nutrition. Then I taught agriculture for five years before finally returning to farming and working with farmers as a soils and nutrition consultant. That's when I came to the conclusion that *management*, *balance*, and *efficiency* are what make farming profitable. Over the ensuing years, I have continued to learn from my own farm, from other farms, and from the many farmers I have talked to across the U.S. and around the world. …

Biological farming will improve your farm. Don't just accept the farm situation the way it is. It can change and become profitable. Many farmers are doing it right now. There are many books and printed materials that provide useful information. Visit the farms, read the books, and check it out for yourself.

Biological farming is a program, not just adding a single product and hoping for a miracle. It takes time to change things, and there is no one single way to do anything. But there are techniques that make sense. To be successful in the long run, you must use an approach that has you working with and properly utilizing nature's biological systems.

When the original edition of this book came out more than 15 years ago, not many people involved in agriculture were focusing on soil biology. We called our approach "biological farming" to change that view (and we also named our company Midwestern BioAg). If you farmed by taking measures to care for the soil biology, not only in balance but also in abundance, your farm would really improve.

Back in the nineties, "biotechnology" — or plant manipulation—was just starting to appear on the farm scene. It has now taken over conventional agriculture, but it hasn't solved the problems it promised. I don't believe you can manipulate plants to fix today's problems. Maybe the attempt had to be made and fail before we could develop the right attitude: "Let's fix the problem, not dodge it." We have the know-how, we have the products, and we have the successful farmers who have already made it a reality. The farmers with the most resilience to deal with bad years weatherwise, prevent most disease and insect problems, and have the highest yield with reduced cost and increased profits, are what we call "Biological Farmers."

It's never too late to start.

The book, The Biological Farmer, Second Edition, by Gary Zimmer with Leilani Zimmer Durand, is a practical, how-to guide on biological farming. In this greatly expanded, revised edition of a modern farming classic, Gary Zimmer draws on a lifetime of farming experience and adds in the latest science and experience on modern issues facing farmers including the impact of GMOs, herbicide-resistant weeds, and more.