

## Answers for the Challenges in Farming Today

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Thank you for joining us for our 2013 winter meeting, we look forward to a day of sharing the beauty of farming and the opportunities in food and agriculture today.

**Why are you farming?** Let's face it, we know you are not in farming purely for the money, otherwise you would be doing something else a long time ago. There are more than economic reasons you are farming. Are you farming because you value your connection to life, the land, creation? You are farming because you have a passion and connection with nature, you enjoy each new dawn, sprouting seeds, the joy of a baby animal, the bursting of buds in the spring. You enjoy farming because farming is a celebration of life. A celebration of life, communion, and food.

With the agriculture practices in common use today, we have largely divorced ourselves from this connection with the land and creation. We have chosen to adopt a warfare mentality in which we are continually striving against natural processes, fighting with diseases and insects. In this battle against nature, we use a search and destroy mindset in which we seek to identify a pest and erase it from the map. If the pest resists being erased we simply use a bigger bomb. This fighting stance against nature is directly opposite the reason you have chosen to farm in the first place! There can be no partnership with nature as long as we seek to continually oppose natural processes.

Farming and the art and science of producing food is changing very quickly. Consumers are learning about the dangers of pesticides on their food and are demanding higher quality. In regions where harmful pest control products have been heavily used for some time, they are proving to no longer be effective, soils are crashing, and people are anxiously seeking alternatives as they witness the damage to soils, crops, livestock, and people resulting from the continued use of pesticides.

I am here today because I share your passion for farming and I want to make a difference in agriculture. I have personal experience in many different types of agriculture. I grew up on a fruit and vegetable farm where we used pesticides for disease and insect control for many years. Pesticides failed us. We needed to seek alternatives solutions. We were seeking information why our crops were failing, and what we could do to reverse the trend. Today, I am looking forward to sharing some of the things we have been able to learn on our farm, and the successes we have experienced.

### **Achieving higher yields**

Genetic potential: We routinely harvest only 15-25% of our crops genetic potential. We can harvest a great deal more by reducing stress on plants than we can by using pesticides, which increase plant stress."

Healthy crops (resistant to pests) express more of their genetic potential, and can easily produce yields several times regional averages. The genetic potential is determined before the seed is ever planted. The environment that seed is placed in determines how well it will perform. Environment determines genetic expression, and healthy mosquitos do not carry malaria.

Plant stress is the reason we lose yield. Lack of sunshine, air, water, and mineral nutrition all result in heavy yield losses. The most common source of plant stress is inadequate mineral nutrition, resulting in inability to cope with other sources of stress.

Corn has the genetic potential to yield 1100 bushel per acre, maybe it is planted in cold wet soil, now the yield has been reduced to 800 bu., perhaps fertilizer is not placed properly, now the yield is reduced to 650 bu. And so through the growing season until the final harvest is only a fraction of what we started with. We cannot increase yields, we can only keep those yields from being lost!

CPI, a Critical Point of Influence is a point at which a plant is in a critical part of its reproduction cycle, and is very vulnerable to any nutritional shortages. We can greatly reduce stress and yield loss by paying providing adequate nutrition at CPIs. The CPIs of a corn plant: 9-12 days after germination corn determines the numbers of ears it could set, 14-21 days, it determines how many rows per cob, 42-49 days, it determines how many kernels per row. Notice the biggest yield differential is earliest in the plants life.

Four primary CPIs are at planting, building frame, filling fruit, and finishing fruit. At each stage the plant has very large and very different nutritional requirements.

## **Achieving real plant health**

“Insects are natures garbage collectors and diseases are her cleanup crew.” – William Albrecht

Truly healthy plants have a functional immune system and are completely resistant to pest attack.

The foundation of plant health is having a robust photosynthesis system operating at top efficiency.

There are four main groups of plant compounds built from photosynthesis, carbohydrates, proteins, fats and oils, and PSMs (plant secondary metabolites, essential oils). These compounds are all built using the glucose produced during photosynthesis as the foundational building block. To build all of these long chain compounds beginning with this short chain sugar called glucose, plant use enzymes, which work as the N wrenches to tighten all the nuts, and make sure all the joints are solid. These enzymes need trace mineral keys to work as enzyme cofactors. Without the trace mineral enzyme cofactors, the enzymes are not able to do their job and the plant accumulates high levels of soluble compounds, becoming an attraction to disease and insect pests.

The process of digestion is exactly the reverse of building these compounds. Enzymes are used to breakdown the compounds that have been built. Insects and fungal and bacterial diseases have simple digestive systems which lack the enzymes needed to breakdown the complete compounds produced by healthy plants.

As soil and plant health begins to improve and regenerate, plants experience four different stages of plant health. In the first level they begin photosynthesizing properly, at which point they become resistant to the 'soil borne' fungal pathogens. In the second level they begin forming complete proteins, achieving resistance to insects with simple digestive systems. These first two levels can be achieved fairly quickly using a systems based approach to complete plant nutrition. In the third level, plants are photosynthesizing so efficiently they accumulate a surplus of energy and begin storing it as fats and oils. They now become resistant to the air borne pathogens, which cannot penetrate the waxy leaf surface. At level four these oils are used as the building blocks to build plant protectants the plant builds to protect itself from UV radiation, overgrazing, and pest attack.

Thinking in systems, everything is connected to everything else.

The soil plant system; there is a symbiotic relationship between soils and plants, soil biology digests and provides the nutrients needed by the plant exactly as the microbes in the rumen of a cow.

Plants in return release root exudates to food the soil microbial community. As much as 70% of a plants total sugar production can be sent out through the plants root system.

There are essentially two different models of plant nutrition. The 'normal' model in use today expects that plants absorb their nutrition as simple ions from the soil solution. This is basically 'glorified hydroponics' in which the soil is perceived as nothing more than to provide a base for the plant. This is artificial.

The second model indicates that plants absorb their nutrition as microbial metabolites, or the by products of microbial digestion. This is real world agriculture. This is the only way we can achieve plant health to level three. Without a good soil digestive system plants expend a great deal of energy 'digesting' or metabolizing nutrients. With a good soil digestive system that is already done for them, and they have much more energy to channel in other directions.

If we rely on soluble nutrients in the soil solution as the source of nutrients for our plants, the nutrient availability will fail us in mid summer. Quite frequently plants nutritional requirements begin to peak as soil levels begin to quickly decline. If we use beneficial products which enhance microbial activity and build good levels of organic matter, nutrient reserves will be released to provide all of a growing crops nutritional requirements throughout the growing season.

There are two different types of soil digestive processes, when we have bacterially dominated communities digesting high nitrogen cover crops or root exudates, this digestive process, termed mineralization, releases nutrition for the crops.

When we have fungal dominated communities digesting high carbon, low nitrogen crop residues and cover crops, the process is termed humification, and nutrients are complexed in stable humic substances.

In soils using the model of simple ions for plant nutrition, frequently the nutritional requirements of the plant peak when soil is under the most stress. Dry weather, reactive fertilizers, and unhealthy soils combine to complex nutrients and prevent plant absorption. Healthy soils with an active digestive system will prevent this from happening, and ensure the plants nutritional requirements are always met.

Plant CPIs are often related to the hormonal cycle and the point at which plants are determining their reproductive potential. There are five different groups of hormones, but we will focus on the two main players. Cytokinins are produced in growing root tips. Auxins are produced in growing shoot tips. The two balance each other out. In order for plants to reach and maintain optimum health, root systems must always be the dominant part of the plant. If there is inadequate nutrition during fruit filling, root systems will go into decline, resulting in rapid shoot growth and loss of reproductive potential.

For plants to reach their top level of performance we need both biology and good mineral nutrition.