The Living Soil

FACT SHEET

Today's crop production is becoming more of a science than an art as producers get caught up in the growing stresses we collectively put on agricultural systems. Across the country nutrient management legislation is becoming increasingly stringent in response to mounting environmental concerns. At the same time we are demanding greater production and higher quality from our nation's growers. All of this forces' today's agronomist to look deeper into the science and biology of crop production.

How a plant grows, and the symbiosis plants have with living soil is not well understood, but is an area of intense interest today. Not only do the fungi and bacteria promote the absorption and uptake of nutrients from the soil, these organisms also play a role in the health and vitality of plants. As an example, researchers have shown that the diffusion of Phosphorus (P) in sterile soils is very slow and the uptake by roots is either lacking or negligible compared to the uptake of P in the presence of bacteria.

Research findings such as this demonstrate that we can no longer look solely at plant nutrition as the assimilation of inorganic compounds. We must realize that plants also assimilate various organic-carbonaceous and nitrogenous compounds that are required for growth. The micro-flora of the root zone is of great importance in plant nutrition. Growing near or on roots, microorganisms, together with plants, create a special symbiotic zone called the rhizosphere. Soil within the rhizosphere differs in its physical, chemical and biological properties from soil outside this root/microbial zone.

Substances excreted by root system are utilized by microorganisms as nutrient sources and a great number of microbes concentrate around the roots, growing, multiplying and excreting their metabolites, many of which are, in turn, assimilated by plant roots. The whole root system during the life of plants, as well as after their death, exerts an immense influence on the growth and development of microorganisms.

A healthy plant will excrete compounds such as amino acids, carbohydrates, sugars, etc. that nourish specific organisms that help plants absorb inorganic nutrients and other vital organic compounds that support the plant. An unhealthy plant living in poor fertility will change the compounds given off by the root that can stimulate the growth of pathogens that attack the root system.

The biologically active substances of the soil not only enhance growth and increase the yield of plants but also confer on the plant better nutritional qualities. Plants, which obtain vitamins and other organic compounds from the soil in adequate amounts, yield crops of higher quality and their seeds are of a higher vitality. Plants can grow in a sterile mineral media and yield seed, however these plants may eventually loose their vitality and succumb to disease.

A healthy soil with the proper fertility balance will not only produce larger, higher quality crops, but often will also have lower weed, disease and insect pressure than nearby "less healthy" soils. Also, a healthy soil will more consistently support crops in seasons of extremes, such as drought, while poor quality soils will struggle year by year.

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Fact Sheet No. 511
Revised 11/2013

Root growth is very much influenced by soil health. The largest volume of producing roots will be in the top 15-20 cm when fertility is balanced. However in growing environments where plants push roots to depths in search of moisture the soil health at these depths plays a major role in the overall productivity and the volume of roots produced. If your production system is in a drought prone region attention to soil health (biology and fertility balance) needs to be recognized. Stratification of fertility and/or poor aeration will reduce root growth and the development of an efficient root system.

In the future, understanding soil variability and the interactions between soil nutrient balance and soil life will be a focus of research. How we impact soil health needs to be understood and not neglected. Researchers today have recognized this relationship to nutrient levels in soils and the impact of plant nutrition on plant health.

One interaction of current research interest has identified a link between glyphosate use and Mn reducing organisms in the soil. Increased use of glyphosate has been shown to be toxic to the Mn reducing organisms that are required to make Mn more available to plants. As a consequence, there has been a huge increase in the visual diagnosis of Mn deficiency in systems that are heavy users of glyphosate.

Attention to plant nutrition, and the interaction between mineral nutrition and crop disease, has identified that minerals, such as Mn, have a direct relationship to certain plant diseases. Research has shown that soils with poor Mn availability have a greater incidence of several plant diseases including take all root rot in cereals, rhyzoctonia in several vegetable crops and scab in potato, just to name a few.

Agronomists that look deeper into the science and biology of crop production will help growers to connect the diagnostic dots and respond appropriately. As such, systems that rely on glyphosate are going to be more prone to Mn deficiency and crop disease. Strategies that pay better attention to Mn fertility options (products, rates, application timing and methods), differences in crop/cultivar Mn sensitivity combined with the judicious use of glyphosate will optimize crop production by minimizing Mn issues.

For now, as agronomist and growers, in order to better understand and enhance future crop production, we must begin to seriously consider soil health, especially the rhizosphere and how our management affects both. Bottom line, a healthy living soil grows healthy and profitable crops more consistently over a wider range of growing conditions. It is our job to make crop production decisions that favor a living healthy soil.