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## INTERNATIONAL YEAR OF SOILS: MODIFYING SOIL TO IMPROVE CROP PRODUCTIVITY

**The essential link between productive soil and humans has been clear since the beginning of agriculture.** However, our food crops come from only a sliver of the world's land area (12%). There is room for limited expansion of crop production in some countries, but much of the earth is covered by urban settlements, forests, and environmentally protected areas that are not appropriate for agricultural expansion. Proper stewardship of our current agricultural land is vital to long-term food sustainability.

The earliest recorded agriculture describes attempts to improve soil properties and crop productivity through application of manures, ash, minerals, and other amendments. Our understanding of the scientific principles underlying plant growth has greatly improved, but the fundamental effort to eliminate soil constraints to food production remains the same after thousands of years.

**Soil physical properties have a major impact on root growth and development.** Compacted soils have reduced water-holding capacity and can form a brick-like barrier that roots cannot penetrate. Soil crusts prevent rainfall from entering the soil and crusty soils are prone to excessive water runoff. Coarse-textured and low-organic matter soils generally retain less plant-available water, and crops growing in these soils may be more susceptible to drought stress.

**Soil chemical properties often are a key factor in determining crop productivity.** There are very few soils in the world that contain all of the essential plant nutrients in the proper concentration. The modern fertilizer industry helps farmers to identify and eliminate any limiting nutritional factors. Addition of plant nutrients prevents the depletion and degradation of agricultural land that occurs when crops are repeatedly harvested without replacing the nutrients back into the soil.

**Many soil chemical properties can limit plant growth if left unmanaged.** Soil acidity is one of the largest global constraints to plant growth. Although soil acidity is relatively simple to remedy, it remains untreated in vast areas of the world. Other soil chemical issues that hinder plant growth include excessive salinity, and pollution from poor municipal and industrial waste management.

**The importance of biological activity in supporting crop productivity is too often overlooked.** Soil microorganisms are responsible for regulating the availability of many of the essential plant nutrients. Nitrogen fixation by bacteria living within the roots of some plants provides vital support to important cropping systems and rotations. The contribution of mycorrhizal fungi to root health is clear, but not fully understood. Similarly, the intricate exchange of chemical signals between plant roots and soil microbes plays an important role in supporting plant growth.

**We are fortunate to live in an age** when we understand these soil factors that limit plant growth and have the ability to manage them. Nutrient limitations can be eliminated through proper fertilization. Soil acidity or alkalinity is easily modified through use of appropriate amendments. Converting to no-tillage practices, or sub-soil tillage can often help improve soil physical properties. Conservation of soil organic matter and crop rotation may improve soil biological activity.

Soil stewardship is fundamental to modern agriculture. Every farming decision should be one that maintains or improves essential soil resources.

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