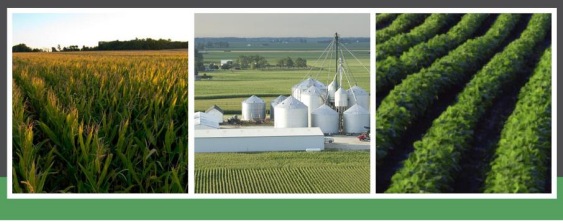

Agronomic Spotlight

Impact of Cover Crops on Soil Health and Productivity

- **Introducing cover crops into the rotation between corn and soybeans can improve soil tilth, health, and productivity.**
- **Cover crops can reduce soil loss from erosion and runoff; loss of soil also equates to a loss of soil nutrients.**
- **Cover crops can improve the availability of nutrients via a reduction in soil loss and leaching, by supporting the growth of beneficial microbes in the soil, and in some cases, through nitrogen fixation.**

IMPACT ON SOIL PHYSICAL STRUCTURE

The soil's physical structure dictates its ability to hold water and nutrients and promote crop growth. For optimal crop growth conditions, soils should have adequate aeration and water-holding capacity, drain well, resist crusting, and quickly take in water. Organic matter is an important component in soil as it provides nutrients to the crop and helps hold soil particles together. Using cover crops between cash crops can maintain or improve the soil's physical structure and productivity.

REDUCTION OF SOIL AND NUTRIENT LOSSES

Erosion and runoff prevention. Soil that is moved off site by wind and water erosion is often topsoil that contains organic matter and nutrients. When soil loss occurs, nutrients and water often need to be replaced at an expense to the grower. The impacts of wind and water erosion are significantly greater when vegetative or residue cover is lacking and soil is fully exposed to these forces. Cover crops and crop residue can slow or stop runoff and erosion.

- The canopy of cover crops shields the soil and reduces the impact of rainfall, which can break up soil particles.
- Cover crop residue increases the amount of organic matter near the soil surface, which helps to further stabilize soil particles, making them less likely to break apart upon impact.
- Cover crop roots anchor the soil.
- Cover crops reduce the speed of water flow over the soil surface.

Nutrient retention. Cover crops take up or sequester excess nitrate-nitrogen (N) and reduce leaching into groundwater. Some deep-rooted cover crops can also pull nutrients from deeper in the soil profile and release them back into the soil nearer the soil surface as the cover crop residue degrades, making them more available to subsequent cash crops.

Figure 1. Radish roots can grow to three feet into the soil profile and is considered an excellent N scavenger. Austrian winter peas are great N providers with 90 to 150 lb of N/acre contributed by their growth.

Figure 2. Field planted with oilseed radish and annual ryegrass cover crop in the fall.

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IMPROVEMENT OF SOIL PRODUCTIVITY

Nitrogen fixation. Legume cover crops can fix and release N for a cash crop to recapture in the spring. Cover crop seed cost and ability to supply N should be compared to fertilizer costs. The Midwest Cover Crop Council (MCCC) website can help select cover crops and estimate how much N is returned. The Cover Crop Decision Tool from MCCC can be found at http://mccc.msu.edu/covercroptool/covercroptool.php.

Impact on soil stability and structure. Subsoil compaction can be broken up or 'bio-drilled' by deep-rooted cover crops, such as oilseed radish or annual ryegrass, leaving the soil structure intact. Additionally, early spring growth of cover crops can help utilize excess moisture and stabilize the seed bed. This improved stability can allow machinery to pass over cover-cropped fields sooner compared to tilled fields. Termination of spring cover crop growth should be timed early enough to preserve adequate water for the cash crop. Because tillage destroys soil structure, herbicides, mowing, or another method besides tillage should be used to terminate cover crops.

Restoration. Cover crops can be used to gradually restore soils that are high in salts. As soil water evaporates, it pulls the salts from deeper in the soil profile up to the surface. The use of salt-tolerant cover crops helps reduce soil water evaporation between the cash crops, thereby helping to alleviate salinity problems.

Improved nutrient availability. When used long term, cover crops provide a food source for beneficial soil organisms, and in turn, soil organisms help with soil nutrient supply and plant uptake. Fallow soils lack root growth and cannot support the mycorrhizal fungi that help plants aquire nutrients. Cover crops can favor the growth of mycorrhizal fungi and other beneficial organisms and increase phosphorus availability within the soil. Legume cover crops, in particular, increase mycorrhizal fungi populations and can promote symbiotic relationships with subsequent crops.[2]

The cover crop survey report from the Sustainable Agriculture Research and Extension (SARE) program, Conservation Technology Information Center (CTIC), and American Seed Trade Association (ASTA) contains valuable statistics about the adoption and value of cover crops across the U.S. To access the latest version of this report, visit www.ctic.org/Cover%20Crops/

Sources

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[2] Sustainable agriculture research and education. 2012. Managing cover crops profitably (3rd edition).

[3] Sullivan, P. 1999. Sustainable soil management, soil system guide. Appropriate Technology Transfer for Rural Areas. www.soilandhealth.org

[4] Physical aspects of crop productivity (Chapter 2). Sustainable dryland cropping in relation to soil productivity. Natural Resources Management and Environment Department.

[5] Grant, C., Bittman, S., Montreal, M., Plenchette, C., and Morel, C. 2005. Soil and fertilizer phosphorus: effects on plant P supply and mycorrhizal development. Canadian Journal of Plant Science. Vol. 85:3-14.

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology Development & Agronomy by Monsanto.

Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.