Biological Farmers are Seeing the Benefits of Soluble Carbon
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Soluble carbon provides the energy/food for microorganisms. For years we have shared our observations of superior looking crops in fields that can "digest" last year's residue by July 1st. The reason for those superior crops? We have cycled much of the residue into **soluble carbon**!

Soluble carbon enters the soil in three ways: (1) plant decomposition, (2) root exudation, and (3) soil amendments. Soluble carbon is utilized by soil microbes and contributes to the accumulation of soil organic matter through humification.

Soil organic carbon exists in many forms, but can be split into 3 main groups: insoluble, biomass, and soluble carbon.

- **Insoluble soil carbon** makes up over 90% of total carbon in the soil. Things that fall in this first category would be cellulose and lignin (primary component of plant cell walls), chitin (primary component of fungal cell walls and soil animal exoskeletons), and decomposed material in the form of soil humus.
- **Biomass carbon** is made up of soil microbes and animals…basically all living organisms in the soil except plants. The biomass carbon pool only represents 1-2% of the total carbon in the soil, but is a driving force in the soil carbon cycle.
- **Soluble carbon** provides an immediate substrate/food source for many soil microbes and is produced by plant roots as root exudates, and by the

enzymatic decomposition of insoluble and biomass carbon. Soluble carbon is used rapidly, so concentrations in the soil are usually quite low (<1% of soil carbon). Soluble carbon is a very active and useful form of carbon, especially for soil microbes.

Carbon availability is much higher in the rhizosphere than in bulk soil. The concentration of soluble carbon decreases as you move away from the roots. Plant roots release all kinds of exudates and compounds (many of which are high in soluble carbon) that are appealing to bacteria and fungi in the soil. Besides root exudates, many carbon-rich compounds such as root hairs, fine roots, border cells, and mucilage are released into the rhizosphere during plant growth.

Soluble carbon is not available to soil microbes year-round. In agricultural soils, there are pulses of carbon that enter the soil via root exudates and other organic materials, following seasonal growth patterns of plants and decomposition of plant residues. Innovative farmers can utilize cover crops to increase the frequency and duration of these carbon pulses into the soil. The longer you have plants growing in your soil, the more exudates and carbon you have entering your soil. Efficient decomposition of crop residues is also an important consideration. All of this carbon improves your soil and supports populations of beneficial soil microbes.

There are many benefits of having plentiful soluble carbon in your soil. Nitrogen-fixation is an energy intensive process and N-fixing bacteria are able to do their job better if there is plenty of food (soluble carbon) available. Soluble carbon availability is also an important factor for the survival of introduced microbes (such as those in **Myco Seed Treat™**, **SP-1™**, and **Residuce™**) because it helps them get established and proliferate on your farm.

By utilizing cover crops, efficiently decomposing crop residues, rotating crops, and practicing wise tillage, you can increase rates of soluble carbon in your soil and, in turn, boost the numbers of beneficial microbes on your farm.