Indirect Effects of Cover Crops on Dry Bean Yield

Cover crops are grown on over 1.8 million hectares of grain and oilseed production in the U.S. with mixed influence on cash crop yields. Previous research has focused on understanding the complexities of cover crop integration in cropping systems and the influence on yield. However, little has focused on organic dry bean systems.

In a paper recently published in *Agronomy Journal*, researchers utilized a large data set (23 site-years) and a statistical technique relatively new to agricultural studies, structural equation modeling, to begin to understand the network of variables most influential in a cover crop’s impact on dry bean population and yield.

The initial model (41 pathways) explored the various direct and indirect relationships between cover crop quantity and quality measurements, soil properties, and dry bean population and yield. Our refined model suggests cover crop C/N ratio and the time from cover crop incorporation to dry bean planting were indirectly linked to yield through soil N availability at the time of dry bean planting and/or dry bean population.

The results suggest that cover crop management is important. Planting time and method, as well as termination timing influence biomass quantity and quality, which in turn influences how nutrient availability synchronizes with crop demand. Structural equation modeling may be a powerful tool for applying continued systems approach methods to understand agricultural production.


An Update of Cosmic-Ray Neutron Research Conducted within Environmental Science

Soil moisture plays an important role in the hydrological processes near the ground surface, and is therefore a key variable for hydrological and land surface models used for water resource management and weather/climate predictions. Common soil moisture methods provide estimates at a spatial scale of either centimeters (soil water sensors) or kilometers (remote sensing products), and up- and downscaling techniques are applied when field scale soil moisture is required. The cosmic-ray neutron method is a novel method, which can provide estimates of soil moisture representing a spatial scale of hectometers in horizontal direction and decimeters over depth. This represents a scale appropriate for many hydrological purposes.

A recent article in *Vadose Zone Journal* discusses the status and perspectives of the cosmic-ray neutron method. The authors describe the ability of the method to provide accurate soil moisture estimates at a wide range of land covers and soil types, as well as its value for field- and regional-scale hydrological modeling, data assimilation, water balance studies, precision agriculture, and calibration/validation of satellite products. The cosmic-ray neutron method is challenged by the influence on the neutron signal of vegetation, canopy interception, and snow. Identifying the signal of these can be used to improve the soil moisture method as well as extend the application to, e.g., biomass estimation.