

Where is your soil water? Crop yield has the answer

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Crop yield is highly dependent on soil plant-available water, the portion of soil water that can be taken up by plant roots. Quantitative determination of the maximum amount of plant-available water in soil using traditional methods on soil samples remains challenging, especially at the scale of an entire field.

However, a map of plant-available water capacity for a field would be instrumental in yield potential assessment and site-specific soil and water management, making the search for improved methods of soil plantavailable water quantification an important step towards improved crop productivity and management.

One of the alternative methods designed to rapidly and economically estimate plant-available water capacity for a field is the Simple Inverse Yield Model (SIYM). The SIYM first simulates crop yield using a waterbudgeting algorithm and growing season weather conditions such as radiation, temperature, and rainfall. As such, yield values can be simulated for a range of levels of soil plant-available water. In the following model step, plant-available water values can subsequently be obtained by matching measured crop yield with the closest simulated yield on a yield map.

A group of researchers at the University of Missouri and the USDA-ARS (Cropping Systems and Water Quality Research Unit) investigated the applicability and performance of the SIYM for poorly-drained claypan soils in Central Missouri, and compared them to well-drained



soils where the model was first developed and tested. For the study, a total of nine corn yield maps were generated using data collected from two fields in Central Missouri during 1993 to 2005. Soil samples were taken to determine plant-available water capacity using traditional laboratory methods. This research was published in the May-June issue of *Agronomy Journal*.

Results showed that measured plant-available water capacity correlated with corn yield better in dry years than in normal or wet years. Agreement between measured plant-available water and SIYM estimates was weaker in the claypan soils than well-drained soils, especially at locations where the claypan layer was shallow or exposed at the surface. At these locations, plants cannot utilize all the plant-available water in the soil, due to slow water transport in clay-rich soils. As a result, yields simulated by SIYM tended to be higher than measured yields, and thus SIYM-estimated plant available water capacity tended to be lower than measured plant-available water capacity.

The lead author, Pingping Jiang, stated "Compared to the measured plantavailable water using traditional methods, the SIYM estimates may be more useful in assessing soil productivity and making site-specific management decisions. SIYM is based on actual yield measurements, and less strongly on conventional soil measurement techniques, which do not take crop-soil-water interactions into account."

Source: Soil Science Society of America

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