

# Soil Water during the Drought of 2012 as Affected by Rye Cover Crops in Fields in Iowa and Indiana

Aaron L. Daigh<sup>1</sup>, Matthew Helmers<sup>1</sup>, Eileen Kladvik<sup>2</sup>, Xiaobo Zhou<sup>1</sup>, Ryan Goeken<sup>1</sup>, Jason Cavadini<sup>2</sup>, Daniel Barker<sup>1</sup>, and John Sawyer<sup>1</sup>

Iowa State University<sup>1</sup>, Purdue University<sup>2</sup>

## INTRODUCTION

The unprecedented drought of 2012 allows for an unique opportunity to evaluate the effects of cover crop on soil moisture under relatively extreme conditions.

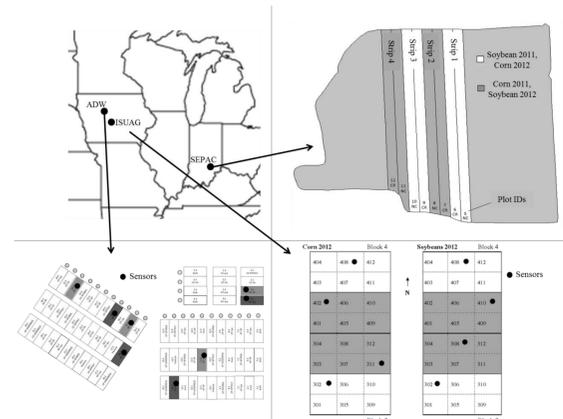
### Objective:

Quantify potential differences in soil moisture due to the presence of a rye cover crop in a corn-soybean rotation at various locations in the Midwestern USA during the drought year of 2012.

## MATERIALS & METHODS

Soil volumetric water content ( $\theta$ ) and soil water storage (SWS) was monitored at two sites in Iowa (ISUAG and ADW) and one in Indiana (SEPAC).

- Sensors: Decagon 5TE and 5TM
- Daily measurements of soil  $\theta$  at:
  - Sensor depths: 10, 20, 40, and 60 cm
  - SWS estimated to 80 cm
- Crops evaluated:
  - (S) Soybeans grown in 2012
  - (rS) Soybeans grown in 2012 following rye
  - (C) Corn grown in 2012
  - (rC) Corn grown in 2012 following rye
- Time periods:
  - Period 1 – Rye actively growing in spring of 2012
  - Period 2 – Post rye termination / production crop germination
- Statistics:
  - Repeated Measures Analysis of Variance (RPM-ANOVA) with a first-order autoregressive moving average [ARMA (1,1)] covariance structure



## RESULTS & DISCUSSION

At all sites, the observed monthly cumulative precipitation was generally similar to the 30-year monthly mean during the beginning portion of observation Period 1, but then diverged into drought conditions toward the later portion of observation Period 1 and all of Period 2

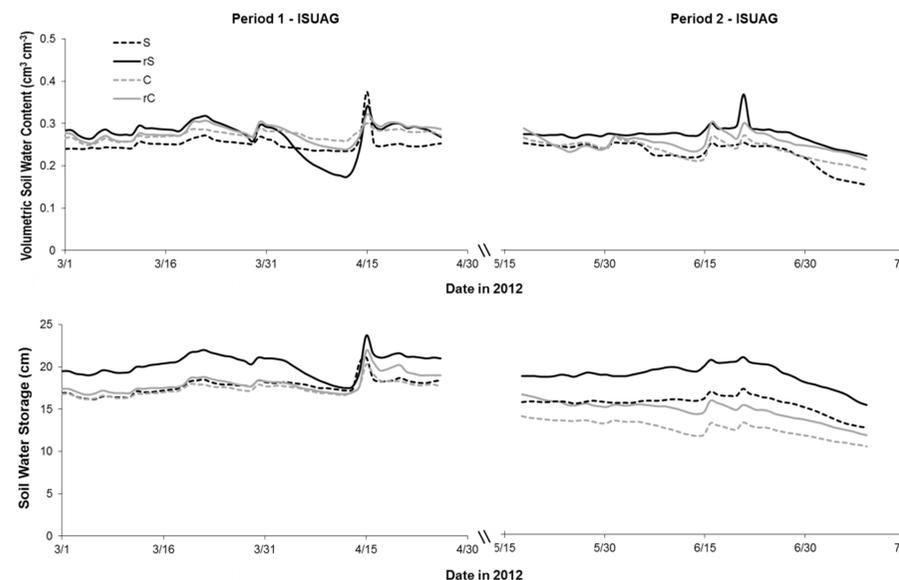
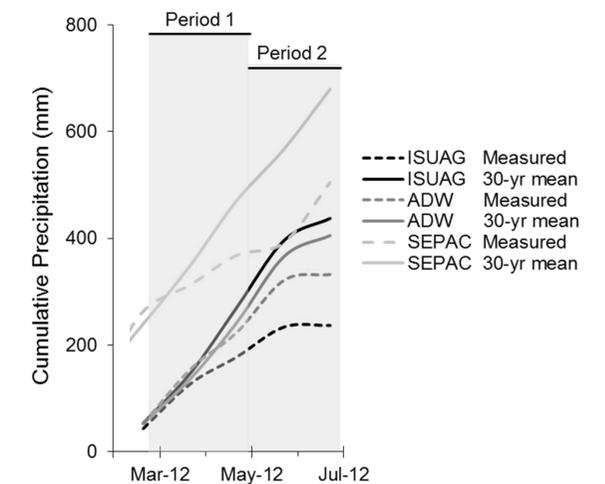


Figure) Example of soil  $\theta$  at 10 cm depth and SWS at the ISUAG site.

Soil water was significantly affected by rye cover crops at the ISUAG site in Iowa. In contrast, soil water was not affected by rye cover crops at the ADW site in Iowa and at the SEPAC site in Indiana.

Soil water at the ISUAG site was greatest following termination of the rye cover crop and when rye biomass production was greatest.

After rye termination at ISUAG, soil  $\theta$  was on average 0.041 and 0.033  $\text{cm}^3 \text{cm}^{-3}$  greater at the 10 and 20 cm depths, respectively, and SWS was on average 2.7 cm greater in crops with a rye cover crop than without a rye cover crop.

## CONCLUSION

Incorporation of a rye cover crop into a corn-soybean rotation during an unprecedented drought as the 2012 drought did not have a detrimental impact of lowering soil water conditions. Instead, a rye cover crop had either no impact on soil water conservation when rye biomass production was relatively low or significantly increased soil water conservation during the period when production crops are most sensitive to water-limited stresses.

The greatest differences in soil water was observed for soybeans grown in 2012 at ISUAG (i.e., rye/production crop planted into the previous years corn stubble).