

Impact of Soil Erosion and Climate on Crop Yield

Scott R. Lee and Richard M. Cruse
Iowa State University

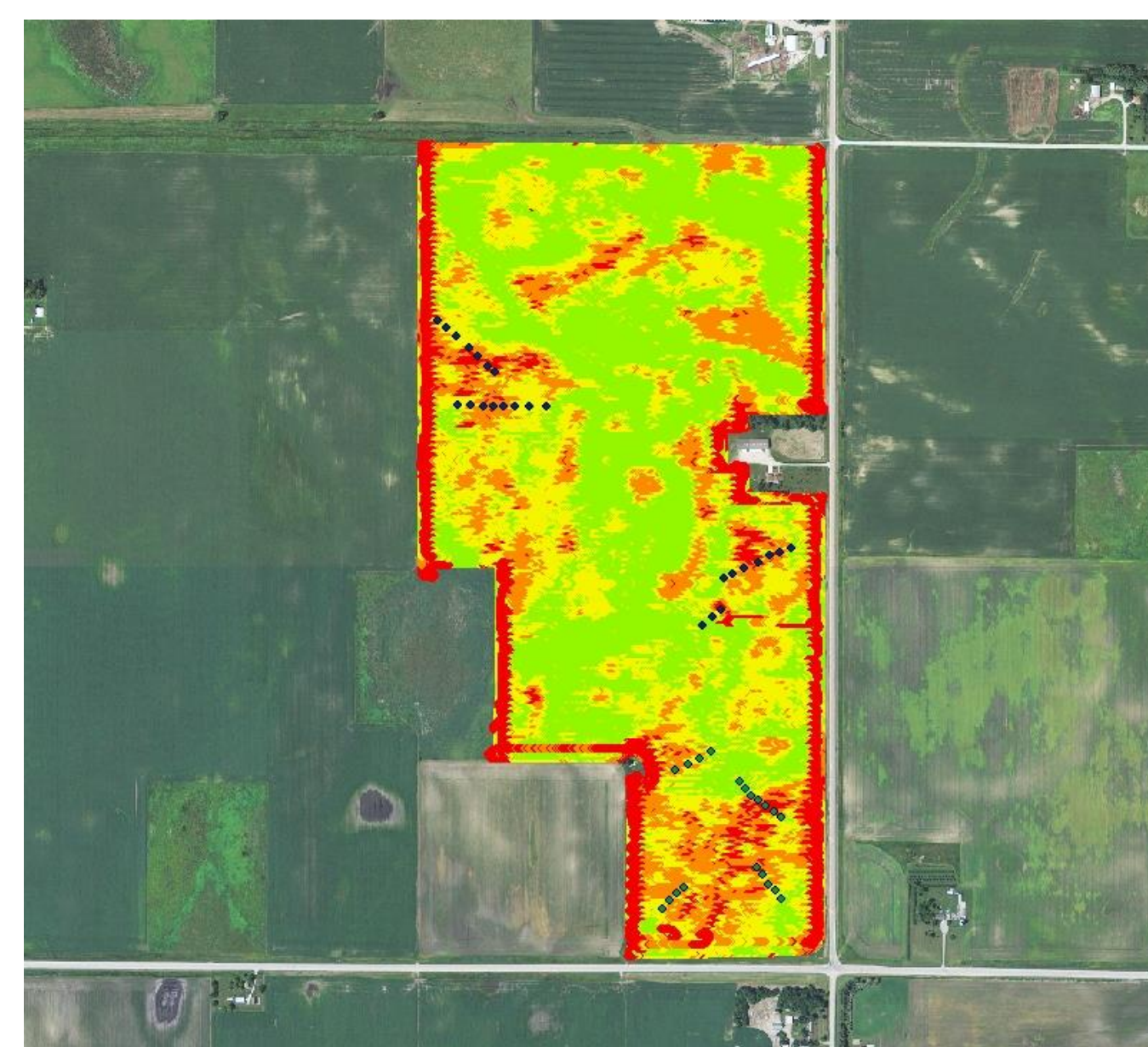
INTRODUCTION

Topsoil depth (TSD) plays a considerable role in soil productivity, and its loss is an irreversible impact of soil erosion. Crop roots and nutrients are concentrated in this layer, and it is critical for nutrient retention and water holding capacity. Climatic factors such as precipitation and temperature further complicate the relationship between soil erosion and crop productivity. Our objective is to determine the impacts of soil erosion and rainfall variation on crop yield in corn and soybean systems.

Fig. 1 – Aerial Imagery w/
Farm Sample Points



Fig. 2 – Sample Points w/
2012 Corn Yield

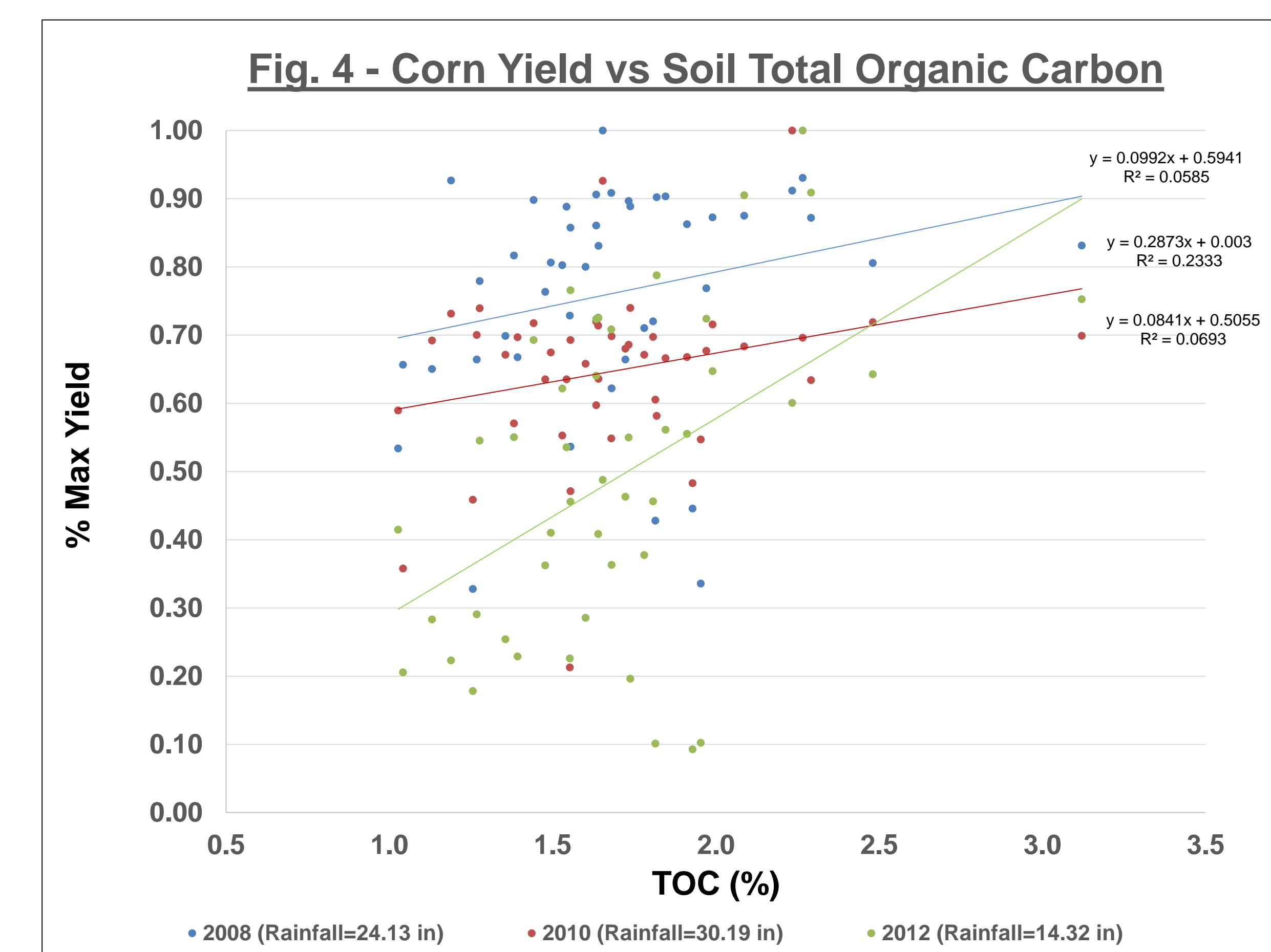
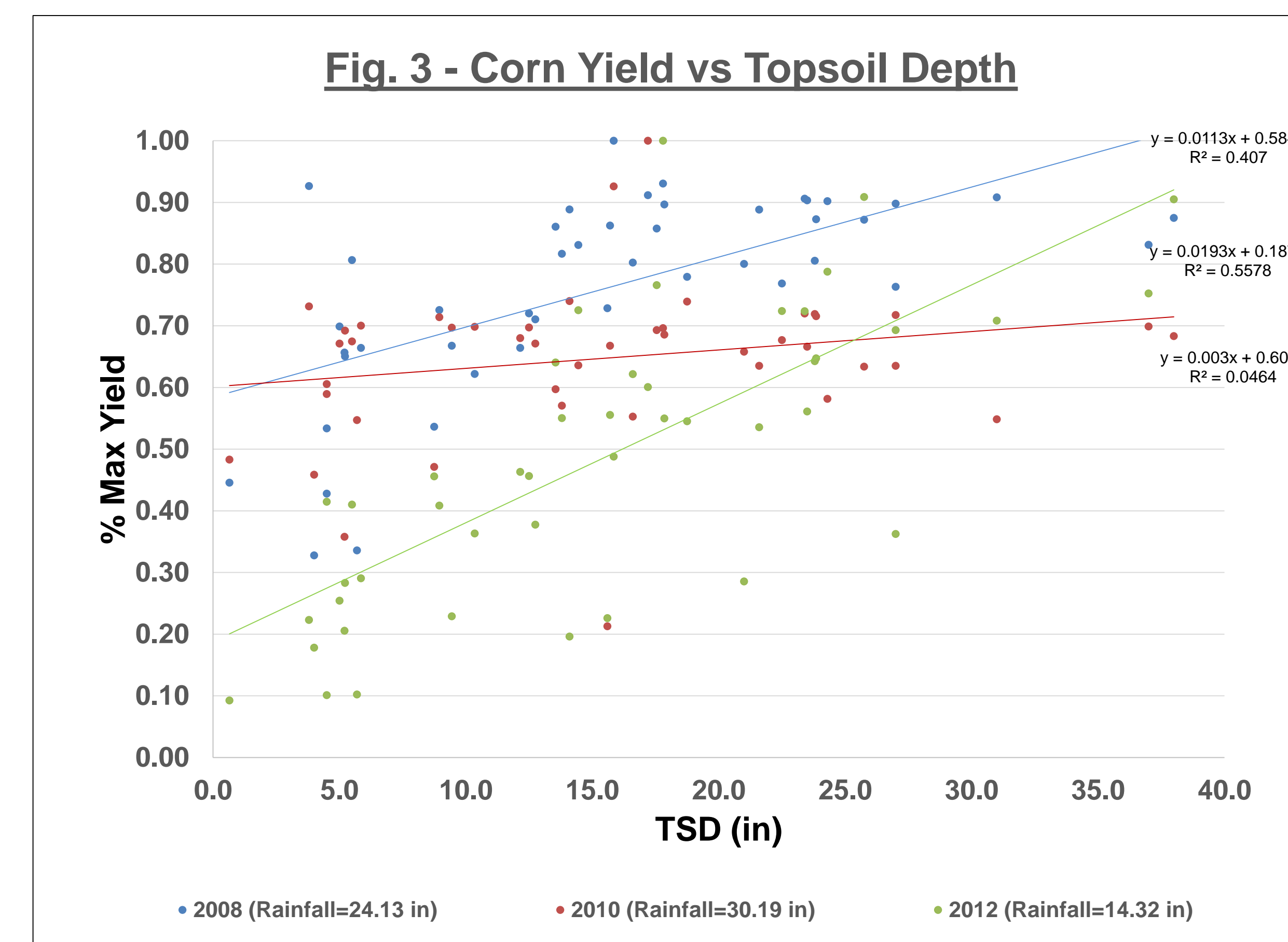


METHODS

Soil cores were taken to a depth of 40 cm at seven farm sites in Iowa. Figures 1 and 2 display a site located on the Des Moines Lobe in north-central Iowa. Geo-referenced measurements included topsoil depth (A1 and A2 horizons), Total organic carbon (0-10 cm), soil color, and landscape position. Field data were collected in 2013 and 2014 and paired with yield data from 2008 through 2013. Corn yield data from 2008, 2010 and 2012 are presented for one of the farm sites.

RESULTS

Analysis targeted relationships between crop yield versus TSD and crop yield versus total organic carbon (TOC). The annual variation of yield and growing season rainfall for the Des Moines Lobe site are presented in Figures 3-4. Yield is calculated as a percentage of maximum yield sampled (0-100%).



DISCUSSION

Corn yield is plotted (Fig 3-4) as a function of topsoil depth and total organic carbon for the years of 2008, 2010 and 2012 with growing season (Apr-Aug) rainfall totals of 24.1, 30.2 and 14.3 inches, respectively. Preliminary results for the Des Moines Lobe site indicate the following:

- Greater yield potential at thicker TSD's and higher TOC's
- Annual variation in yield response due to rainfall amounts
- Largest yield response to both TSD and TOC occurs in the driest year - 2012.
- Little to no significant yield response to TSD occurs during the wettest year - 2010.

CONCLUSIONS

Preliminary results for the Des Moines Lobe site indicate yield sensitivity and lost production due to thinning TSD's and lost TOC likely associated with soil erosion. This yield sensitivity appears to increase during drier years as thinner top soils typically have lower water retention capacity. Minimal yield response during the wettest year may indicate the potential to avoid yield reductions on thinner soils when rainfall is adequate. These preliminary results were not typical for all seven sites. Of the sites sampled, five showed similar yield response while two sites did not indicate a response. Additional analysis of the seven sites is on-going.

PARTNERS

Iowa Soybean Association
Leopold Center for Sustainable Agriculture