

Comparison of Measured and Modeled Effects of Residue Removal On Soil Organic Carbon



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Background

Soil organic carbon (SOC) is an important soil property strongly influenced by management. Changes in SOC are difficult to detect through direct sampling. Models have the potential to predict management induced changes in SOC but require long-term data sets for validation. CQESTR is a process based model that uses weather, management, and crop data to estimate changes in SOC. The objective of this study was to compare CQESTR estimated changes in SOC to measured changes in two residue removal studies in eastern Nebraska.

Methods & Materials

Results from two residue removal studies were used to validate CQESTR. The rainfed site was no-tillage continuous corn with two N-rates (120 and 180 kg N/ha) and two residue removal treatments (0 and 50%). Changes in SOC from 1998 to 2007 reported by Follett et al. (2012 BioEnergy Res. 5:866) were used for validation. The irrigated continuous corn site had tillage (disk tillage vs. no-tillage), and residue removal (0, 35, and 70%) treatments. Changes in SOC from 2001 to 2011 reported by Schmer et al. (2014. Soil Sci. Soc. Amer. J. doi:10.2136/sssaj2014.04.0166) were used for validation. Model output was validated by regressing estimated SOC and measured SOC and decomposing the mean squared deviation (MSD) into squared bias, non-unity slope, and lack of correlation components (Gauch et al., 2003. Agron J. 95:1442).

Results

- Treatment effects based on CQESTR estimated changes in SOC were similar to published results based on measured SOC at both sites (data not shown).
- After 10 years CQESTR estimated SOC agreed well with measured SOC at both sites (Fig. 1).
- Lack of correlation attributed to 66% of the MSD at the rainfed site with squared bias accounting for the remainder (Fig. 2).
- Lack of correlation attributed to over 95% of the MSD at the irrigated site with non-unity slope accounting for the remainder (Fig. 2).

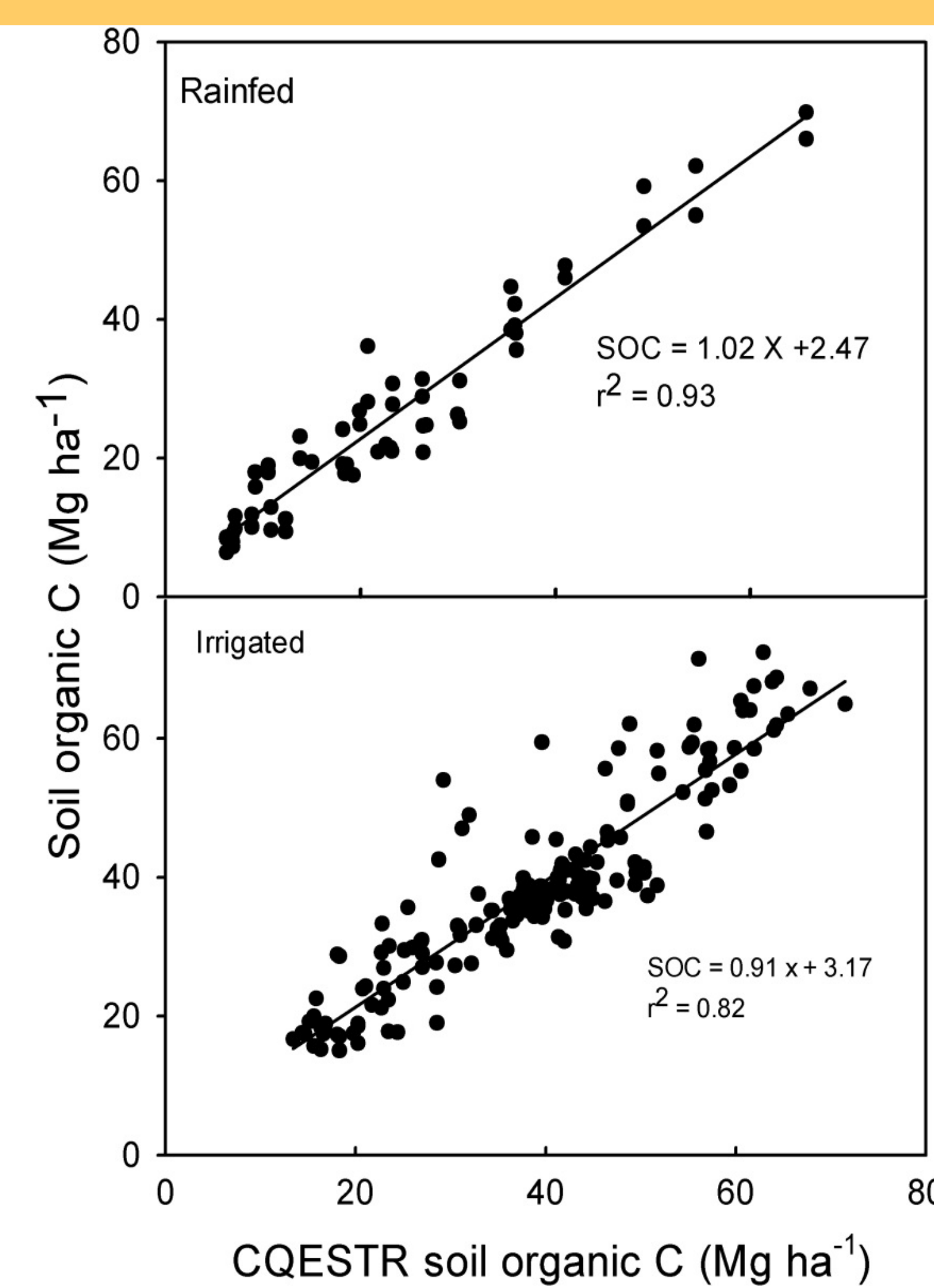


Fig. 1.

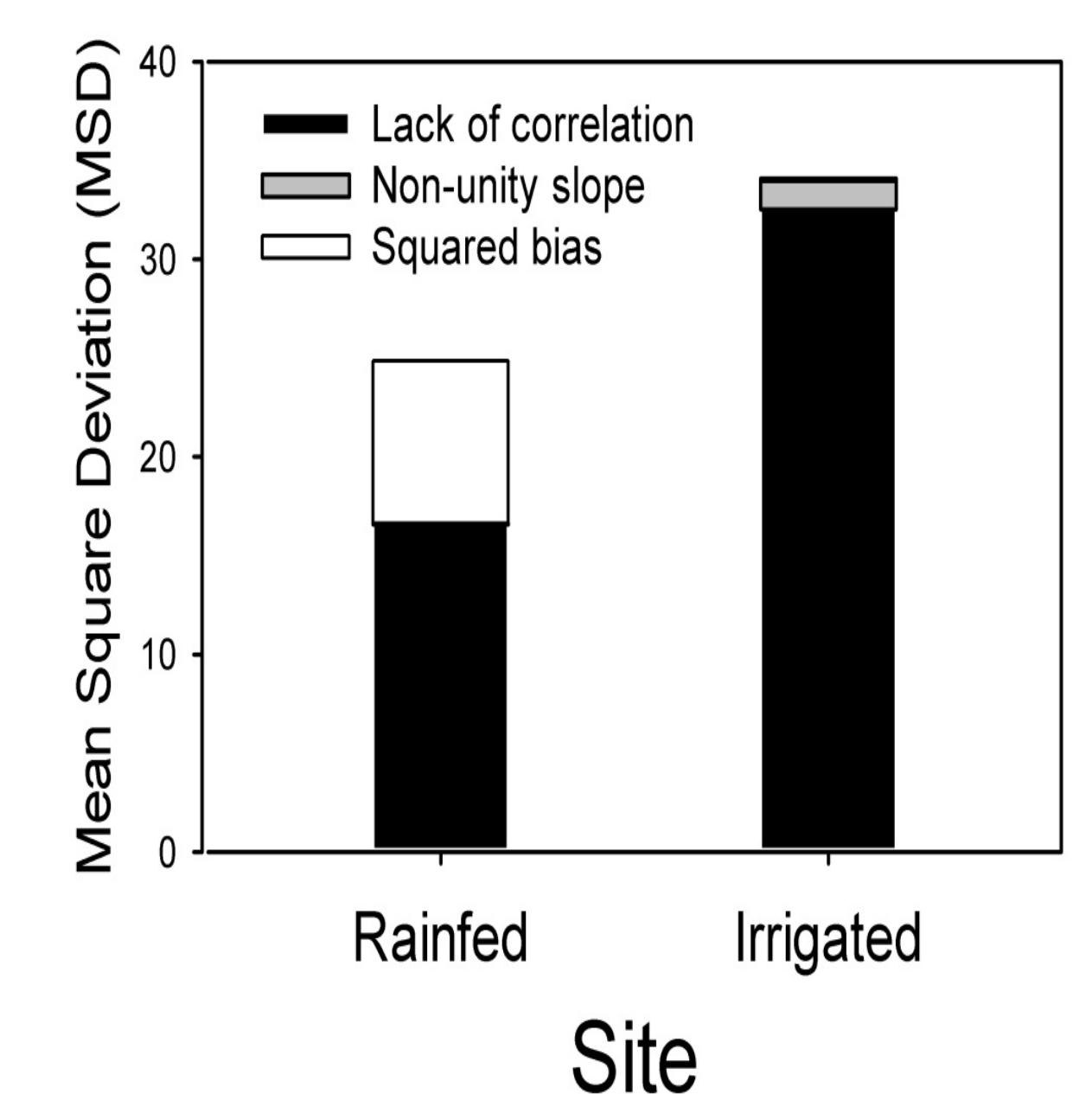


Fig. 2

Conclusion

CQESTR predicted management effects on SOC at these two sites that agreed well with previously published results. This model appears well suited for estimating the amount of residue needed to maintain or improve SOC content.