AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Corn Residue Harvest and Inefficient Groundwater Extraction

Juan Sesmero and Aaron Cook

Selected Paper prepared for presentation at the Agricultural & Applied Economics Association's 2012 AAEA Annual Meeting, Seattle, Washington, August 12-14, 2012

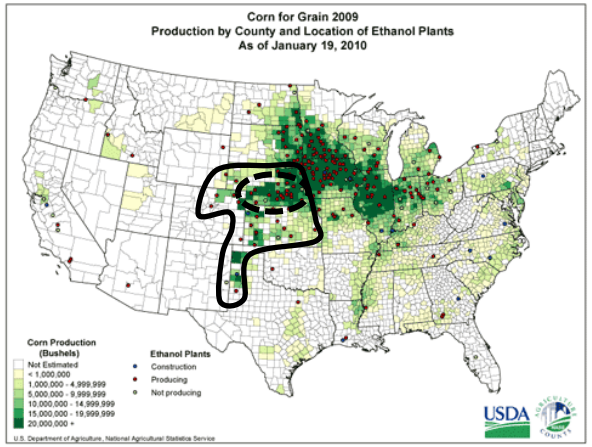
Copyright 2012 by authors. All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Corn Residue Harvest and Inefficient Groundwater Extraction

Juan Sesmero and Aaron Cook

Motivation

- Corn residue promising feedstock to meet RFS cellulosic requirement.
- Irrigated corn belt candidate area: high yields/continuous corn
- Removal of stover decreases soil moisture (e.g. Doran et al., 1984; Power et al., 1998) which reduces yield unless more irrigation is applied.
- Concern about pressure on groundwater.



Theory

- Inefficient over-extraction occur in common access resources.
- Welfare losses due to over-extraction can be empirically negligible depending on aquifer properties (Gisser-Sanchez)
- Welfare losses of over-extraction (if any) should be included in "social costs" of stover-based energy.

Research question

- What are the likely welfare losses associated with groundwater over-extraction caused by corn residue harvesting?

Model

- Farmer maximizes present value of future stream of profits subject to soil water dynamics and groundwater stock dynamics.

$$\underset{(h_t,w_t)}{Max}\int_0^{\infty} e^{-rt}\left(g_t p_y + \left[g_t h_t\left(p_h - c_h^b\right) - c_h^a\right] - \left(c_0 + c_1 H\right)w_t\right)$$

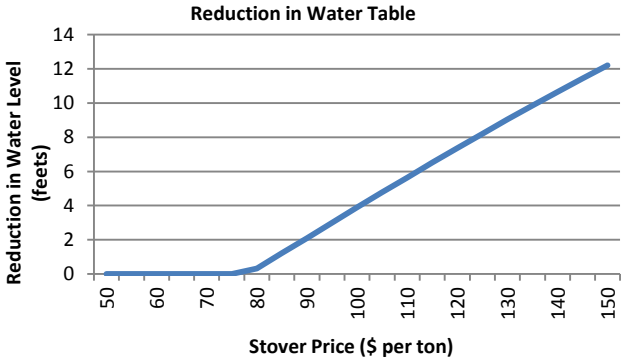
$$\dot{I}_t = I_o + dg_t\left(1 - h_t\right) - I_t$$

$$\dot{H}_t = \frac{1}{AS}\left[R + \left(\gamma - 1\right)\left(w_t + \sum_{j \neq i} w_j\left(H\right)\right)\right]$$

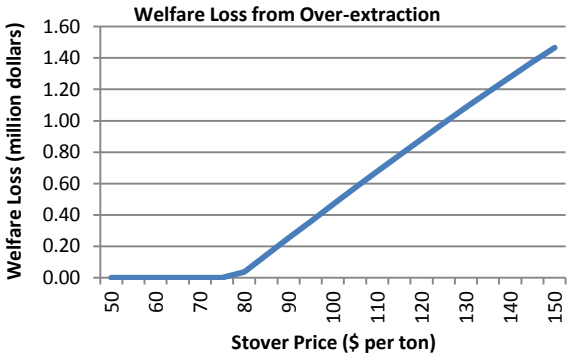
h_t : stover harvest rate
g_t : yield
p_y : net revenue/bu corn
$p_h - c_h^b$: net revenue/ton stover
H : water level
w_t : irrigation rate

- **Feedback Nash Equilibrium (FE) in linear strategies** compared to **efficient** solution.
- Model calibrated with observed data and results of agronomic experiments.

Preliminary Results (mean)



Preliminary Results (mean)



Conclusions

- Results suggest welfare losses of over-extraction may not be negligible in western Nebraska, Kansas, and Texas
- Under western NE conditions the FE supplies 112MGY at $100 per dry ton. Efficient solution only for 2.56MGY. The efficiency loss associated with market supply is 600 million dollars

Data Sources

- USDA – NASS
- Doran et al., 1984; Power et al., 1998

Authors Information

[1] Agricultural Economics, Purdue University. Phone: 765-494-7545. Email: jsesmero@purdue.edu
[2] Agricultural Economics, Purdue University. Email: cook94@purdue.edu