Contributed papers from the 4th Drainage Water Management Field Day
23 August 2011, Lamberton, Minnesota

4th Drainage Water Management Field Day

University of Minnesota
Southwest Research & Outreach Center
Lamberton, Minnesota
23 August, 2011

Edited by
Jeffrey S. Strock
University of Minnesota – Southwest Research & Outreach Center, Lamberton Minnesota

FORWARD

Agriculture and especially crop and livestock producers are faced with many challenges. There is increasing pressure to develop technologies and strategies that contribute solutions to food and energy security and climate change and environmental quality concerns. These requirements are in addition to the usual challenges of weather, pests and uncertain markets. Simply put, we will need to grow more, in a better way, and on less land without harming the environment. Intensifying cropping systems and adapting farming practices to increase productivity, mainly through more intensive residue and nutrient management, drainage, and irrigation can result in increased production but can also result in impaired water quality and loss of biological diversity. Coupled with our growing food, feed, fiber, and fuel production demands, changes in agriculture or policy will alter farming practices and science and technology will play an increasingly important role in shaping the future of agriculture.

Drainage Water Management practices are a set of agronomic, engineering, and ecological strategies that provide opportunities for targeting specific management practices at in-field, edge-of-field, or in-stream locations with the goal of improving water quality. Some practices like controlled drainage also offer the potential for yield benefits. The goal of Drainage Water Management is to design drainage systems that provide the benefits of drainage while minimizing negative impacts on the environment. To be effective, Drainage Water Management strategies must account for the many aspects of today's farming systems. One practice alone does not constitute Drainage Water Management nor does one strategy fit all systems. With all practices, their applicability and performance depends upon the context in which they are to be implemented.

The Drainage Water Management Field Day is an event to bring producers, researchers, contractors, State and Federal agency staff, policy makers, and conservation groups together around a common issue: ***agricultural drainage for productivity and environmental benefit.*** The over arching objectives of the 4th Drainage Water Management Field Day are to (1) provide a forum for researchers to share the results of on-going research with stakeholders, (2) provide an opportunity for stakeholders to participate in educational activities, and (3) provide stakeholders an opportunity to provide input into efforts addressing soil, water, and nutrient management issues.

The 4th Drainage Water Management Field Day was designed to highlight major areas within Drainage Water Management that show promise from the standpoint of water quality protection, emphasizing the array of options available to producers. The proceedings from the Field Day include six papers which discuss research projects conducted by scientists from the University of Minnesota, the Minnesota Pollution Control Agency, and South Dakota State University.

Jeffrey S. Strock, University of Minnesota – Southwest Research and Outreach Center
Organizer and Coordinator of the 4th Drainage Water Management Field Day

ACKNOWLEDGMENTS

There are many people, too numerous to mention individually, that were instrumental in helping organize, coordinate, and execute this 4th Drainage Water Management Field Day. The first and most important thank you is extended to the many participants of the 4th Drainage Water Management Field Day. A second expression of gratitude goes to the presenters who helped make this program successful by sharing the results of their research and contributing to this proceedings document. Finally, a heartfelt thank you goes the staff at the Southwest Research and Outreach Center, especially Molly Werner and Barb Lenning, for their help to coordinate the overall logistics, tours, publicity, and this proceedings document.

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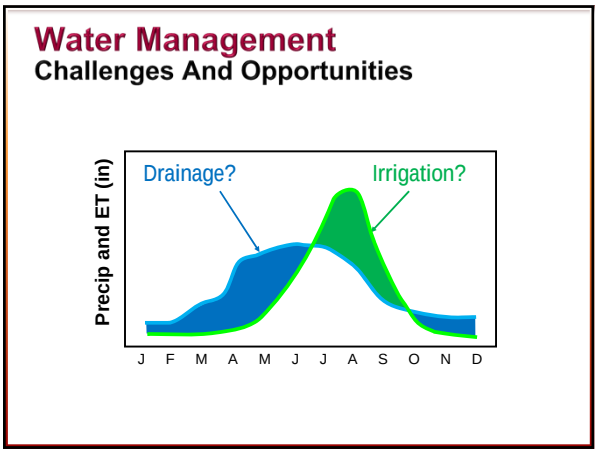

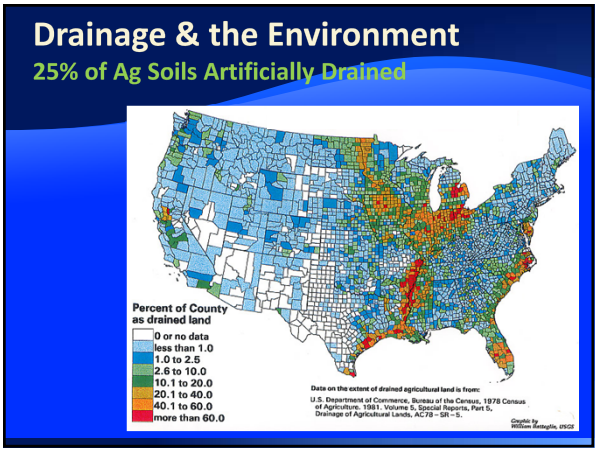

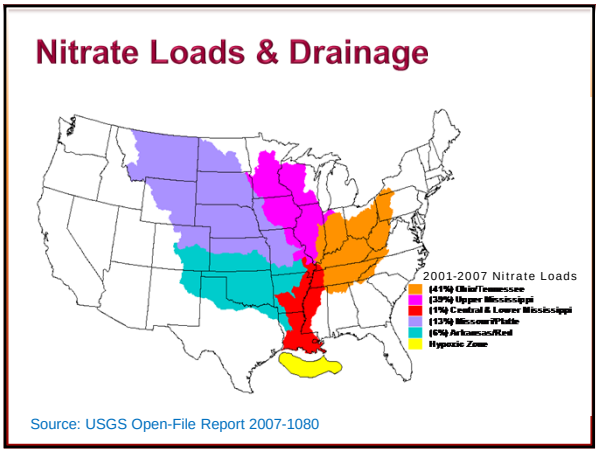

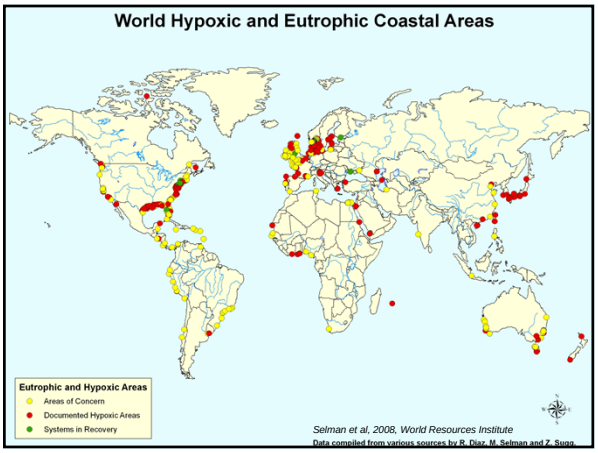

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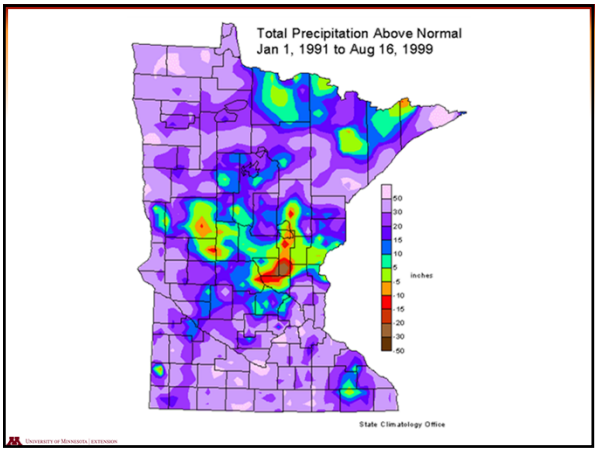
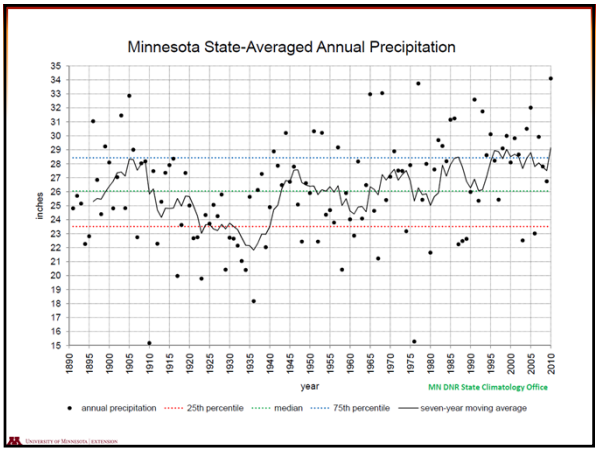
Agricultural Drainage Continues





Conservation Drainage Practices

- Managed (controlled) drainage
- Improved design of drainage systems
- Treatment of drainage outflows
- Ecologically designed ditches
- Scavenger crops

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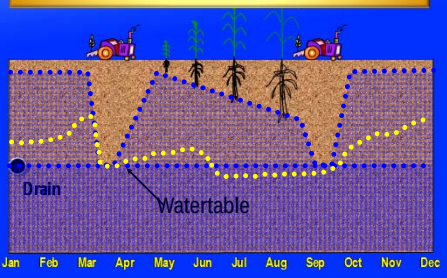
Environment

Production

Goals of Managed Drainage

Controlled Drainage - Production

- **Yesterday:** Dispose of excess water
- **Today & Tomorrow:** Manage soil water



What is Controlled Drainage?

Conventional Drainage Mode

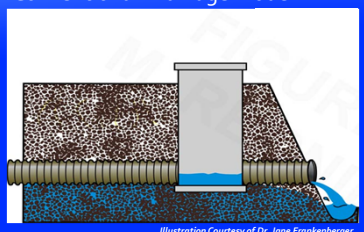


Illustration Courtesy of Dr. Jane Frankenberger Purdue Extension

What is CD?

Winter Conservation Mode

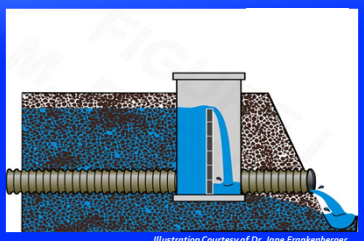
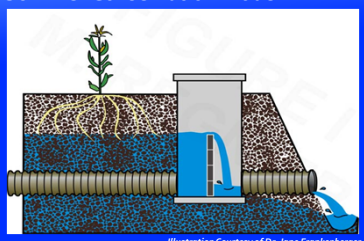


Illustration Courtesy of Dr. Jane Frankenberger Purdue Extension

What is CD?

Summer Conservation Mode



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Examples of CD . . .

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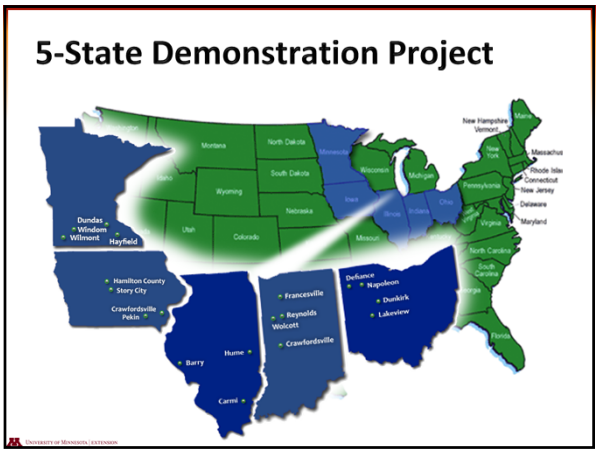
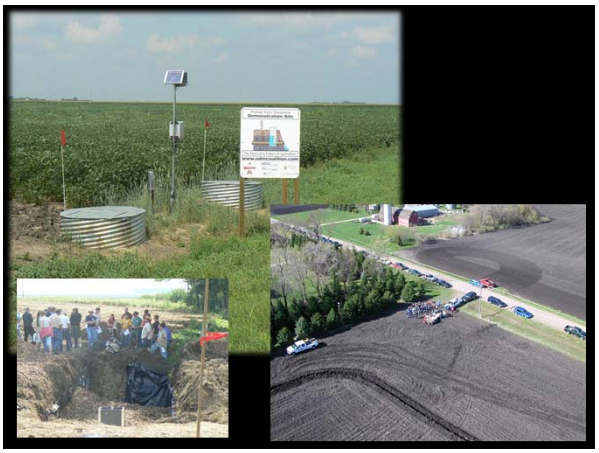
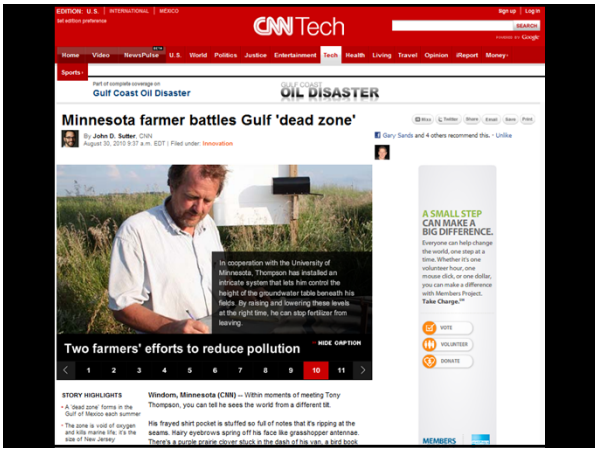
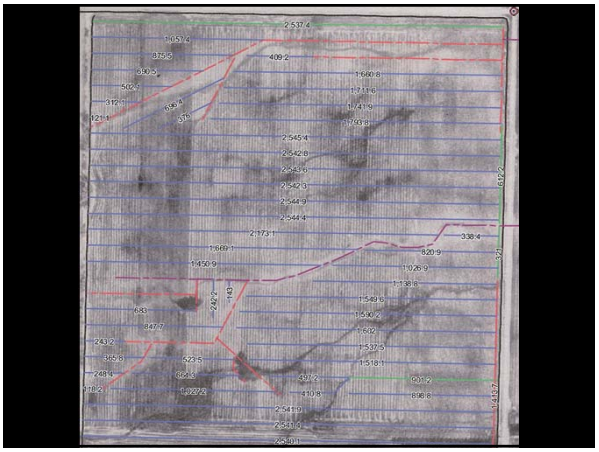
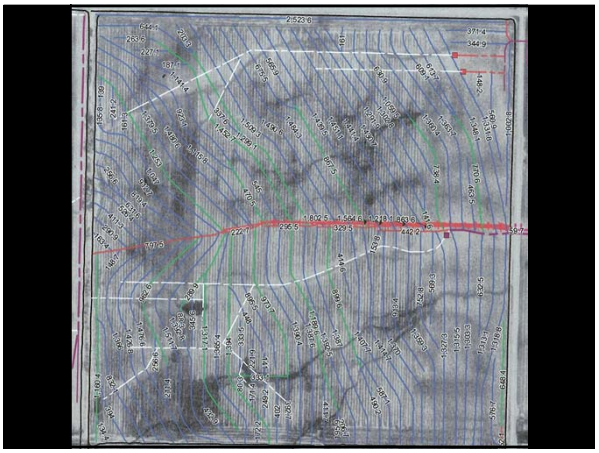
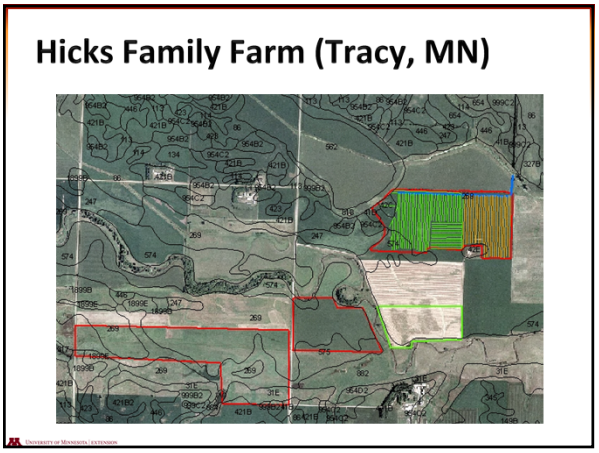




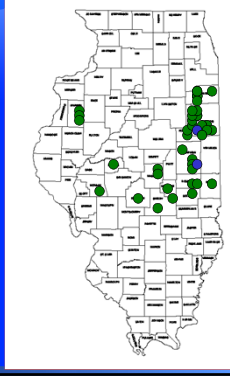








Illinois Program



Conservation Drainage Practices

- Managed drainage
- Improved design of drainage systems
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- Ecologically designed ditches
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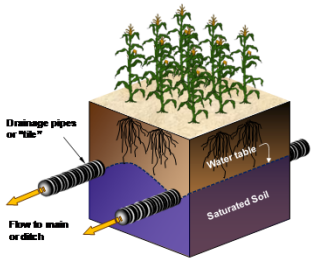
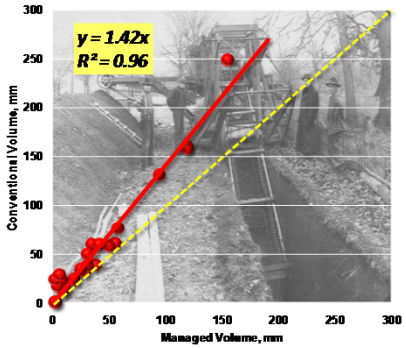
Improved Drainage Design:
Shallow & Lower Intensity Drainage



Are These Practices Effective?

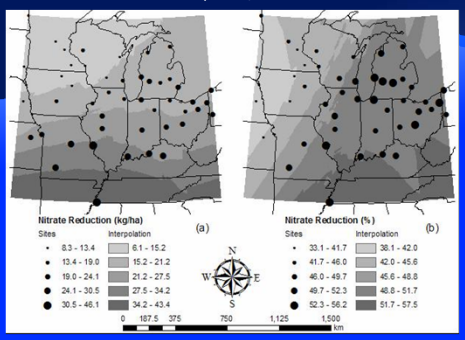
Controlled Drainage-Global Review



Annual loads

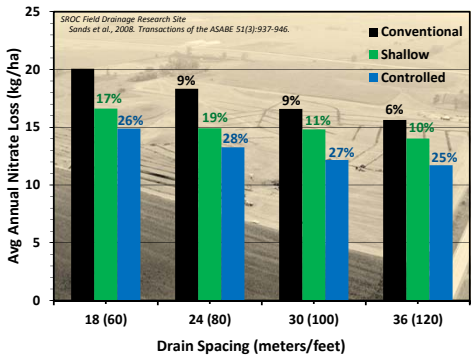
	2006	2007	2008-W (controlled)	2008-E (conv)
Precipitation (inches)	24	24	20	
Drainage (inches)	5.8	2.0	1.5	4.5
TN (lbs/A)	41	3.8	4.4	16.9
NO_3-N (lbs/A)	43	3.6	4.3	16.7
NO_3-N FWMC (mg/L)	10.6	9.96	12.7	10.8

Thorp et al., 2008



Simulated conventional drainage and CD at each site and computed change in nitrate loss.

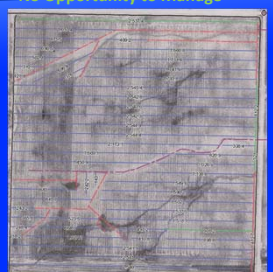
Simulated Reduction in Nitrate Loss for a Webster Soil



Luo et al., 2009. Agricultural Water Management 297:389-398.

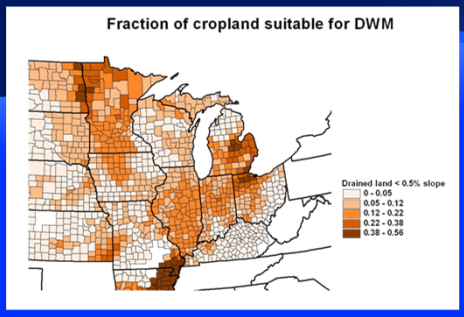
CD Design is Crucial

No Opportunity to Manage



DWM Capability

Courtesy of Dan Jaynes, USDA-ARS, Ames, IA



Computed fraction of cropland that is probably drained and suitable for DWM (slopes < 0.5%) using 1992 National Land Cover Data and STATSGO soils data.

How Flat is Flat Enough?

Image courtesy of Agri Drain Corp.

Topo Considerations

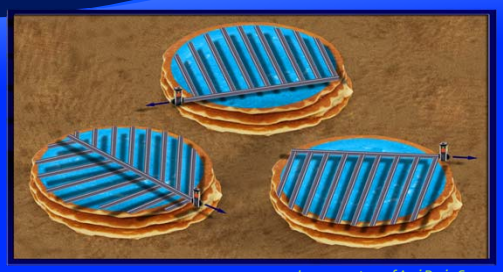


Image courtesy of Agri Drain Corp.

Trad Design on Sloping Field

Image courtesy of Agri Drain Corp.

CD Design on Sloping Field

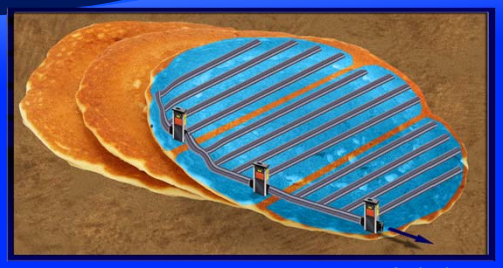


Image courtesy of Agri Drain Corp.

Multiple Water Control Zones

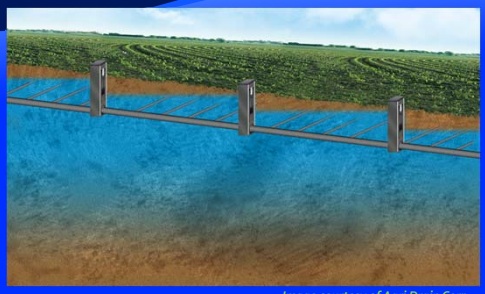
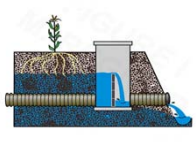
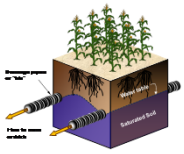


Image courtesy of Agri Drain Corp.

Design With a DWM Practice in Mind!

Every field drained without a DWM practice is an opportunity lost….perhaps forever





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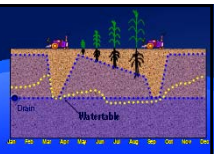
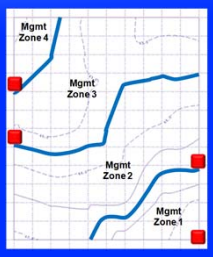
Managing the System
Controlled Drainage

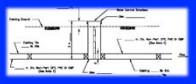


- Method 1: Off-season only
  - Conventional drainage during growing season
  - Shallow WT depth during fall & winter
- Method 2: Constant growing season
  - Constant depth setting for entire growing season
- Method 3: Variable growing season
  - Vary WT depth as plants grow
  - Shallower early, deeper, later

NRCS Practices:
554 (DWM Plan) & 587 (Control Structure)

- TSP's are now being trained to develop DWM plans





Another Twist: Subirrigation

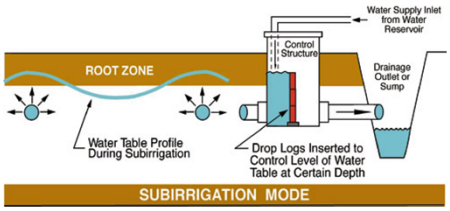
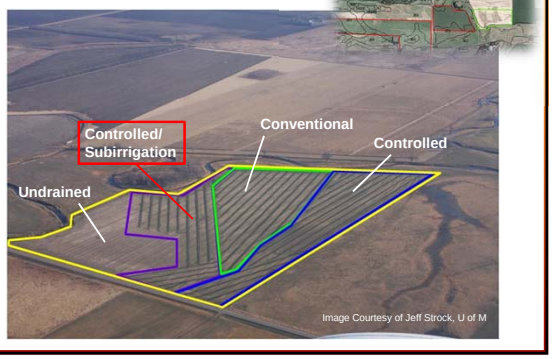


Image Courtesy Dr. Larry Brown, Ohio State University

Subirrigation Project



Subirrigation Setup w Solar Pump

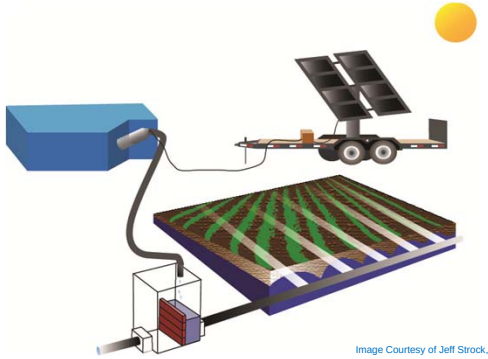


Image Courtesy of Jeff Strock, U of M

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