Economic Benefits of Tile Drainage, Conservation Drainage, Sub-irrigation

Paul Sweeney
Director of Conservation Planning
Ecosystem Services Exchange
www.ecoexch.com
How much water is available in a given year dictates the success or failure of the year’s grain production.

Soil Moisture
Rain
Irrigation
Economics of Tile Drainage

- Conventional Tile Drainage System = $800 to $1000/ac.
- Drainage Water Mgt. System = $1040 to $1240/ac
- New Sub-irrigation System Scenario = $1,800 to $2,200/ac.
- Retro fit Existing System for Sub-irrigation = ~$970* + $1,000

*Split lines in half and add water control structures

Estimates based on local costs in the Midwest
Water Quality Practices

"Valuing Conservation"

Conventional Drainage
Improving Agricultural Production
Causes of Crop Loss Iowa

Corn

- Drought: 40%
- Excess Moisture: 27%
- Flood: 12%
- Frost: 4%
- Hail: 2%
- Insects: 2%
- Plant Disease: 2%
- Wind: 2%
- Other: 6%

Soybeans

- Drought: 28%
- Excess Moisture: 27%
- Flood: 29%
- Frost: 5%
- Hail: 2%
- Insects: 2%
- Plant Disease: 6%
- Wind: 2%
- Other: 4%

Data courtesy of Chad Hart, Managing Risk in Agriculture, Iowa State University, June 2013

27% Corn Losses
27% Soybean Losses
Due to wet conditions
Corn Yield Increase on Heavy Soils in Ohio

Table 1. Corn Yields with Various Drainage Systems on Toledo Silty Clay Soil in North Central Ohio, 13 Years of Record.

<table>
<thead>
<tr>
<th>Crop</th>
<th>None</th>
<th>Surface only</th>
<th>Tile only</th>
<th>Surface and tile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>60</td>
<td>92</td>
<td>116</td>
<td>121</td>
</tr>
</tbody>
</table>

29 bushel yield increase at $3.50 a bushel = $101.50 per acre
- An 8 to 10 year ROI
- No tax depreciation or tax write-off
- No land value increase included (25%)
Yield response to Tile Drainage

Table 1. Crop yield response to subsurface drainage for various regions (bu/acre increase).

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>10 - 45</td>
<td>20 - 30</td>
<td>26</td>
</tr>
<tr>
<td>Soybeans</td>
<td>4 - 15</td>
<td>7 - 14</td>
<td>7</td>
</tr>
</tbody>
</table>

“Planning an agricultural subsurface drainage system” - Jerry Wright and Gary Sands
Yield response to Tile Drainage

ESE staff usually uses a 25% increase in corn yields and 10% in Soybean yields

Continuous Corn – 240 bushels X 25% = 60 bu X $3.50 = $210/ac (4 to 5 yr. ROI)

Soybeans – 65 bushels X 10% = 6.5 bu X $10 = $65/ac

Corn/Soybean rotation - $137.50/ac (6 to 8 yr. ROI)
Drainage Water Management
What is Drainage Water Management (DWM)?

DWM is the process of managing the timing and amount of water discharges from agricultural drainage systems. The DWM plan provides the target water table level settings needed at specific dates or seasons. Season long control is the goal.

See Dr. Norman Fausey, ARS Scientist, handout on managing DWM
The Golden Rule of Drainage Water Mgt.:

Only release the amount of water necessary to ensure you have proper conditions for field operations and to provide an aerated crop root zone.

Any drainage in excess of this rule likely carries away nutrients and water that is no longer available for crop uptake.  

Dr. Wayne Skaggs - NCSU
Yield Increases

Percent Increase in Soybean Yield Due to DWM in North Carolina

<table>
<thead>
<tr>
<th>Year</th>
<th>Yield Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>20.4</td>
</tr>
<tr>
<td>1992</td>
<td>6.0</td>
</tr>
<tr>
<td>1994</td>
<td>13.4</td>
</tr>
<tr>
<td>1998</td>
<td>12.6</td>
</tr>
<tr>
<td>2008</td>
<td>6.8</td>
</tr>
<tr>
<td>2009</td>
<td>2.2</td>
</tr>
<tr>
<td>AVG</td>
<td>10.2*</td>
</tr>
</tbody>
</table>

Dr. Wayne Skaggs - NCSU
Yield Increases

Percent Increase in Corn Yield Due to DWM in North Carolina

Year 1991 1993 2007 2008 2009 2010 2011 Avg
Yield 6.1 21.1 11.7 4.9 3.9 22.9 6.9 11.1

Dr. Wayne Skaggs - NCSU
Drainage Water Mgt. Design

50 foot spacing w/structures Cost $1,030/acre.

$224/acre more than a conventional system

200 bu/ac X 10% Corn @ $3.50/bu = $70/acre/yr

3 yr. + ROI

Environmental Benefits
Federal Funding Sources

USDA NRCS – Environmental Quality Incentives Program (EQIP)

Financial Assistance to install conservation practices

- Drainage Water Mgt. (554) - $5.26/ac.
- Structure for Water Control (587) - $983.89 ea.
- Subsurface Drain, Secondary Main (606) - $3.83/ft.

Substantial decrease in total cost of Cons. Drainage system
Sub-irrigation
Improving Agricultural Production
Causes of Crop Loss Iowa

Data courtesy of Chad Hart, Managing Risk in Agriculture, Iowa State University, June 2013

67% Corn Losses
55% Soybean Losses
Too Wet or Too Dry
So think about the year you had just the **right amount** of rain, at just the **right time**, and you raised the best crop your farm has ever produced. **Your highest yields ever!**

That’s what you get with **sub-irrigation every year**

Charlie Schafer – President AgriDrain
How does sub-irrigation tie into tile drainage and Conservation Drainage?

It is taking a tile drainage system; increasing the intensity of the drainage system by narrowing the tile spacing and adding a water source so there is never a shortage of water in the subsurface soil profile.

It drains the soil profile when there’s too much water; manages the water that is available (cons drainage); and adds water when needed to protect the crop yield.
What does it look like?

Only need to split the tile spacing and add water supply above the last structure for water control.
Water Distribution System

Well, Pump, Supply Line and Manifold
On-farm benefits: Yield impact from sub-irrigation

12 year study
35% Yield Increase
Over 100% yield boost in dry years

Sub-irrigation Yields
Conventional Tile Drainage Yields
Dry summers

Fulton County, Ohio research site

Tables 1, 2, 3. Shows number of years until return on investment for corn and soybeans on both new and retrofit systems figuring different price scenarios and average yield increases.

<table>
<thead>
<tr>
<th>Grain Prices ($/bu.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year</td>
</tr>
<tr>
<td>2012</td>
</tr>
<tr>
<td>2013</td>
</tr>
<tr>
<td>2014</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years for Return on Investment for Average Corn Yield Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (per bu.)</td>
</tr>
<tr>
<td>Retrofit</td>
</tr>
<tr>
<td>New</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Years for Return on Investment for Average Soybean Yield Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price (per bu.)</td>
</tr>
<tr>
<td>Retrofit</td>
</tr>
<tr>
<td>New</td>
</tr>
</tbody>
</table>

Source: Moe Russell Consulting
Can Sub-irrigation part of a conservation system?

- Sub-irrigation uses approx. 50% less water than a center pivot
- Sub-irrigation uses 1/3 to 1/2 of the power to supply the water to the system
- Reduces producer risks
- Increases farm income
How much water is available in a given year dictates the success or failure of the year’s grain production.

Soil Moisture – Controlled by Drainage and Irrigation
Rain – Drained when needed
Irrigation – Provides water when there is no rain
Thank You

Paul Sweeney
Director of Conservation Planning
Ecosystem Services Exchange
www.ecoexch.com