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Agronomic and Water Management Considerations of Tiling

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STUDENT FOCUSED • LAND GRANT • RESEARCH UNIVERSITY

Farmland Drainage Needs

Spring or Summer in Minnesota and North Dakota

Source: Ryan Miller U of M Extension.

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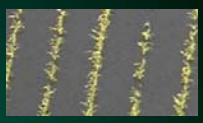
Impact of water logged conditions on yield of corn



- Yield reductions are significant even after 2 days
- Crop may look like it recovered and still have a yield reduction

Days Water Logged	Percent Yield Reduction
0	0%
2	-25%
5	-45%
8	-80%

Date of Planting	Percent Yield Reduction
By 5/1	0%
5/2-5/10	-7%
5/11-5/25	-13%
5/26-6/1	-24%

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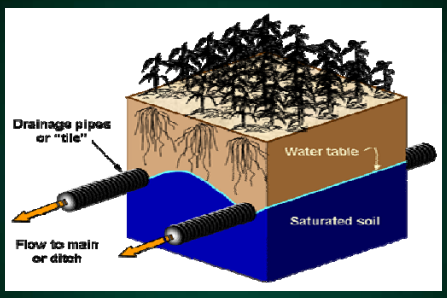

Source: G. Sands

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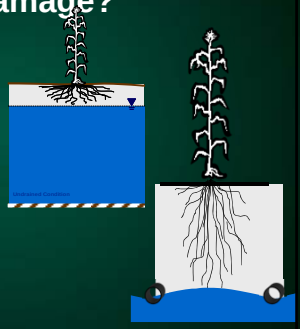
Why do water logged conditions after planting cause crop damage?

- Under water-logged conditions, the availability of oxygen is decreased
- When roots are subjected to low oxygen conditions, changes occur in the plant that generally decreases yield
- Root growth is restricted
- De-nitrification increases



Source Gary Sands

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Sub-surface water pumping unit

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Surface drainage and ditching

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Drainage Effects on Corn Yields – Ohio, 13 Year Study

Treatment	Bu/A	C.V.%
Undrained	60	46
Surface	92	33

(Source: G.O. Schwab, 1984)

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Drainage Effects on Corn Yields – Ohio, 13 Year Study

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Drainage Effects on Corn Yields – Ohio, 13 Year Study

Treatment	Bu/A	C.V.%
Undrained	60	46
Surface	92	33
Subsurface	116	18
Combination	121	17

(Source: G.O. Schwab, 1984)

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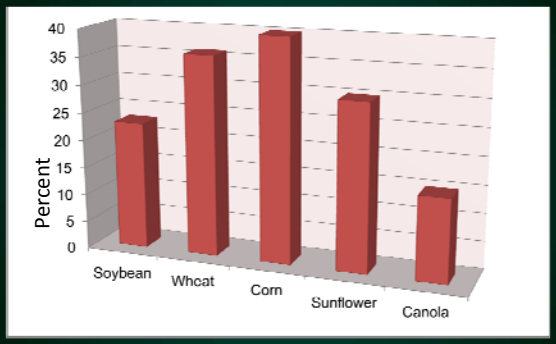
Crop Yield Increase Tiled vs Untiled in %



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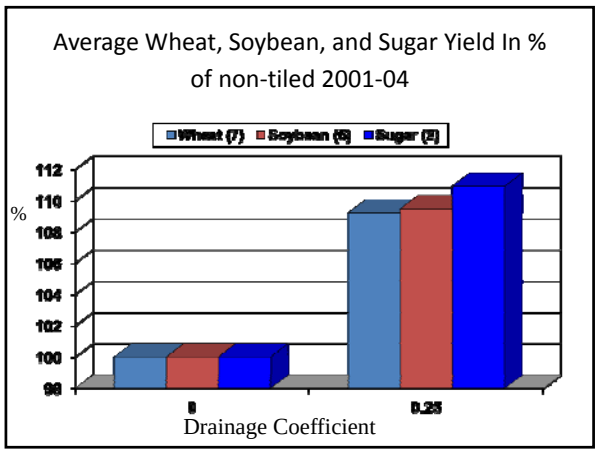
Pro Drainage Farm Drainage Contractors, Ontario
www.drainage.org/factsheets/fs11.htm



Salts in ND

- Salts found in North Dakota soils are of three types: sulfates (SO_4); carbonates (CO_3); and chlorides (Cl).
- Most saline soils in North Dakota are composed of sulfate salts
- However, the northern Red River Valley has extensive areas of saline soils that have high amounts of chloride salts.

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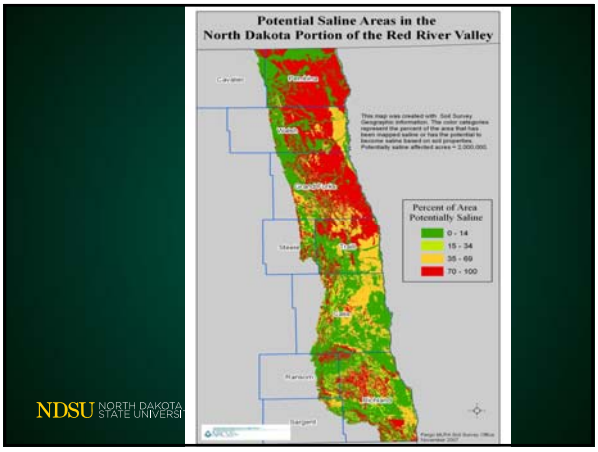

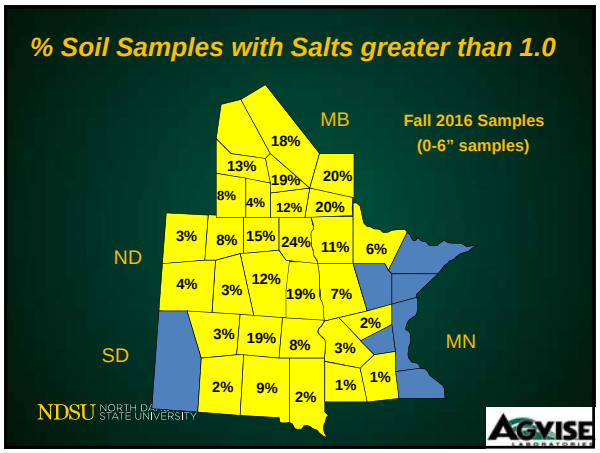
% Soil Samples with Salts greater than 1.0
MB
Fall 2016 Samples
(0-6" samples)
ND
SD
MN
18%
13%
19%
20%
8%
4%
12%
20%
3%
8%
15%
24%
11%
6%
4%
3%
12%
19%
7%
2%
3%
19%
8%
3%
1%
2%
9%
2%
1%
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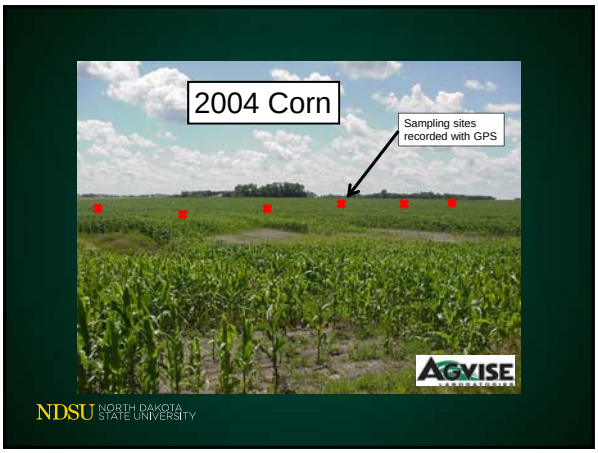
2004 Corn
Sampling sites recorded with GPS
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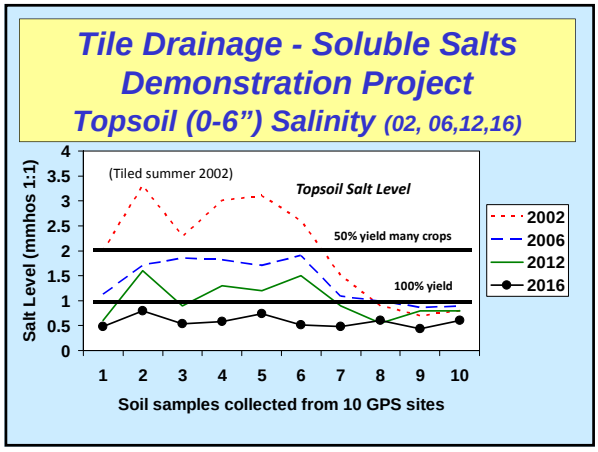
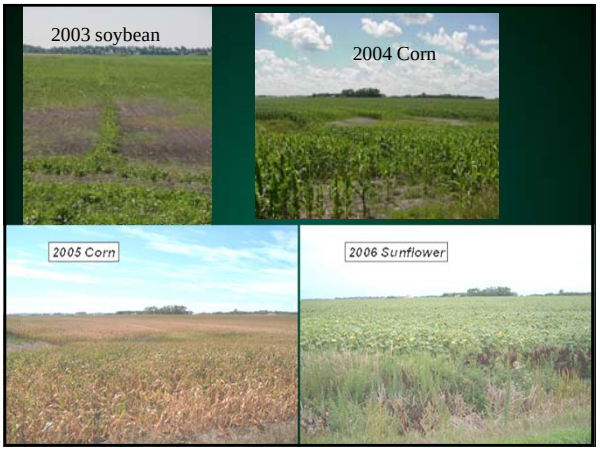
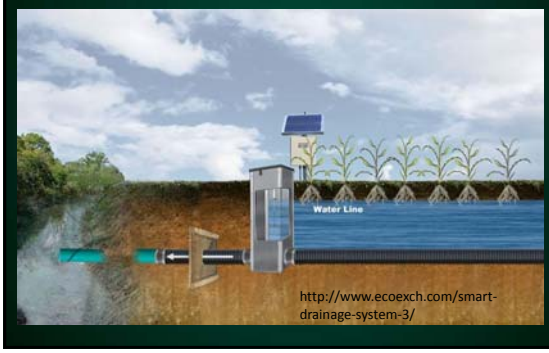

Tile Drainage - Soluble Salts Demonstration Project
Topsoil (0-6") Salinity (02, 06,12,16)
(Tiled summer 2002)
Topsoil Salt Level
50% yield many crops
100% yield
2002
2006
2012
2016
Salt Level (mmhos 1:1)
0
0.5
1
1.5
2
2.5
3
3.5
4
1 2 3 4 5 6 7 8 9 10
Soil samples collected from 10 GPS sites


2003 soybean
2004 Corn
2005 Corn
2006 Sunflower

Soybean Intensive Management Study, Fargo, 2011

Water Control Stucture



http://www.ecoexch.com/smart-drainage-system-3/

Water Control Structure Installation

SEE THE DIFFERENCE

- Plant Date: June 7, 2011
- Photo June 27, 2011 Previous weeks rainfall recorded: 2.54”

Unit 3

Unit 5

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THE BIG QUESTION: YIELD

- Soybean yield (bu/a) Significantly Different

Mean	
46.8 bu/a	Drained
40.2 bu/a	Not Drained

6.6 bu/ac advantage = 16.6 % advantage

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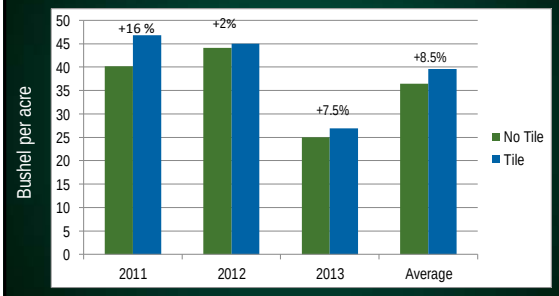
Soybean yield in bu/a NW 22 raised bed study 2011-2013



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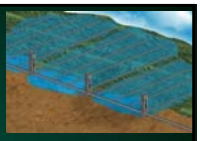
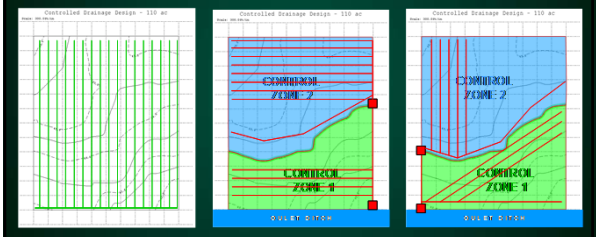
Designing by "Zones"





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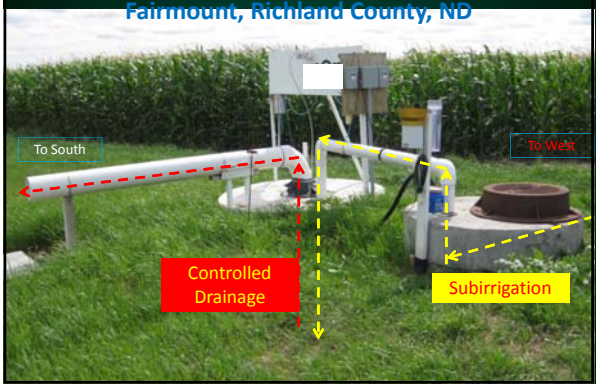
Controlled Drainage and Subirrigation at Fairmount, Richland County, ND



Machinery use on Tiled ground

Chisel Plow / disking etc 5% (??) More efficient

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Machinery

Unloading on the go vs unloading a the end of the field. Few percent more efficient

Advantages

- Higher yields resulting from subsurface drainage will increase a producer's APH, providing benefit in future years

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External Benefits $

- N retained per rainfall event
- Value added by increased organic matter
- Less blowing soil
- Reduced cleaning of ditches
- More efficient use of equipment for seed bed prep, seeding, harvesting

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External Benefits $

- Timely application of herbicides, fungicides, etc
- Better crop quality
- Harvest efficiency
- Less “hassle”
- Less compaction
- Can sleep at night

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Summary

- Ag fields in RRV should be at field capacity in the fall not saturated.
- There needs to be a good ditch system with control structures to release the water or keep the water.

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Summary

- Dikes around fields is an option.
- Control structures / pumps can be included to “manage” the water. Only remove water not needed for crop production (recycle water in the summer).

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