Subsurface Drains: Principals and Practice

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Overview

- ✓ **Reasons to tile.**
- ✓ **Drainable water.**
- ✓ **Tile drain history.**

Overview

- ✓ **Benefits and risks of tile drainage.**
- ✓ **Locating tile lines in the field.**
- ✓ **Regulatory considerations.**

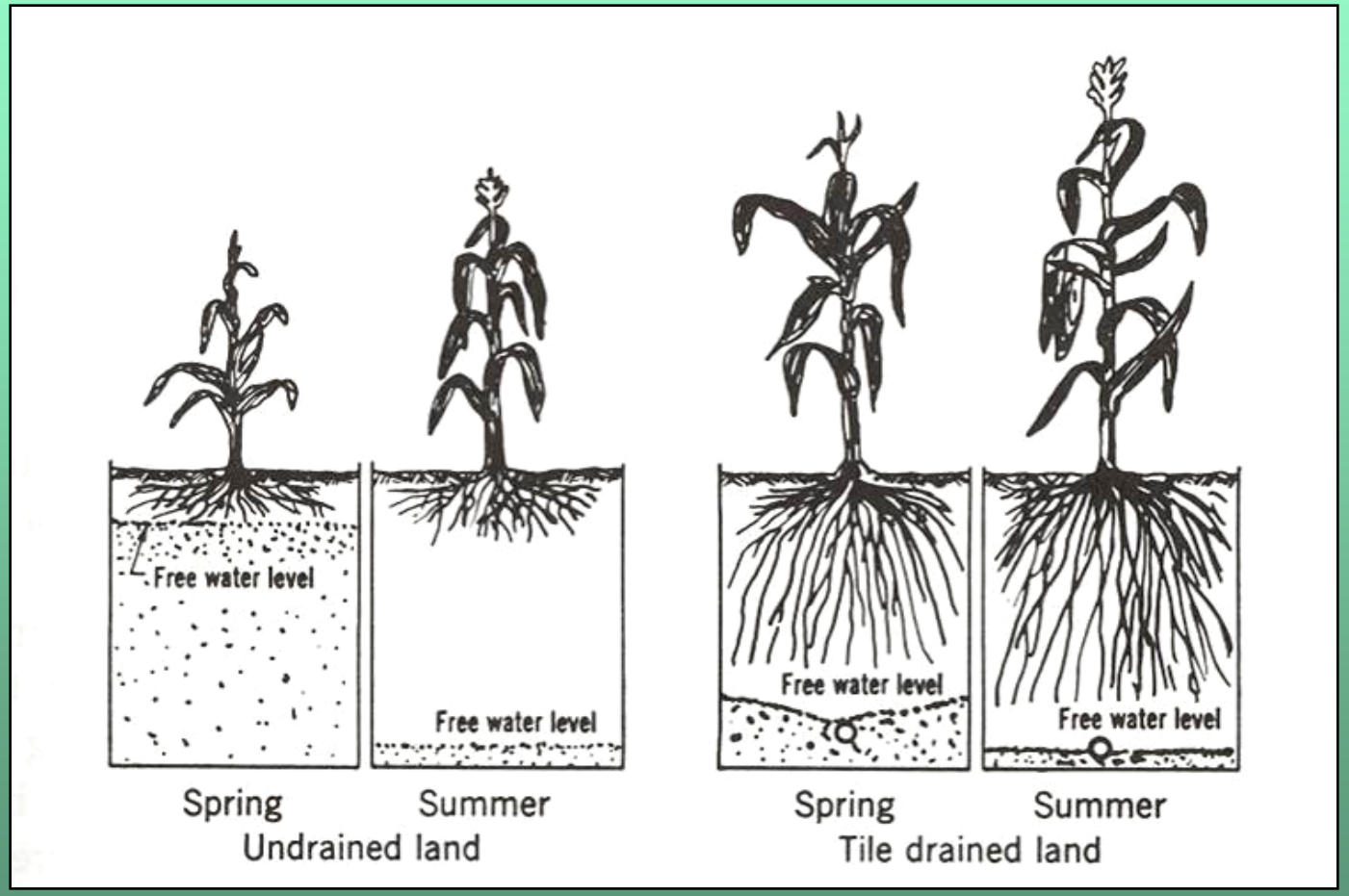
Why Tile ?

- ✓ **Maintain a proper water table level for healthiest plant growth.**
- ✓ **Keep soil voids free of excess water, which permits air flow and allows soil biological processes to occur.**

Why Tile ?

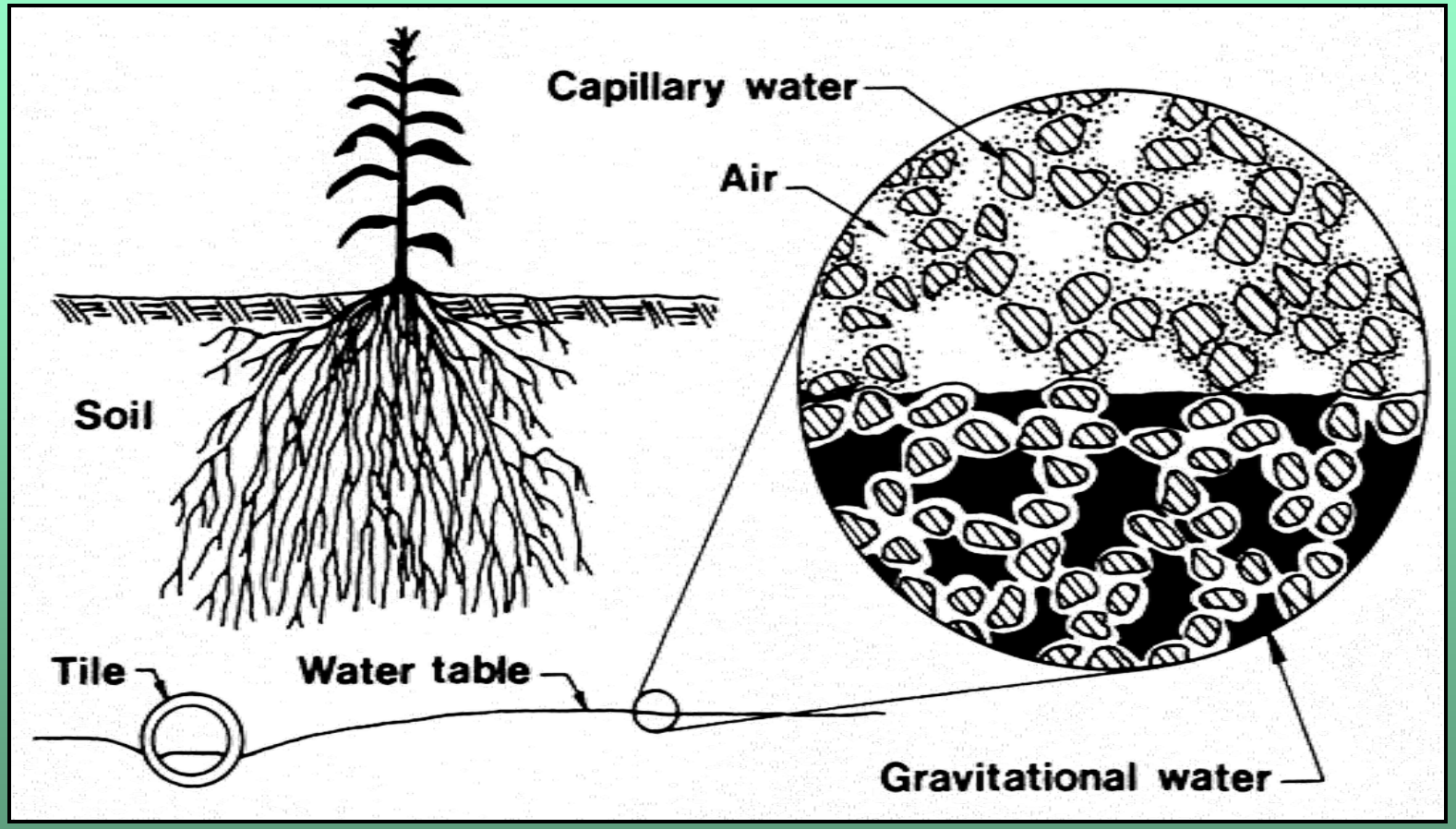
- ✓ **Reduce nitrogen losses from the soil root zone.**
- ✓ **Minimize inefficient equipment operation caused by wet areas.**

Why Tile ?



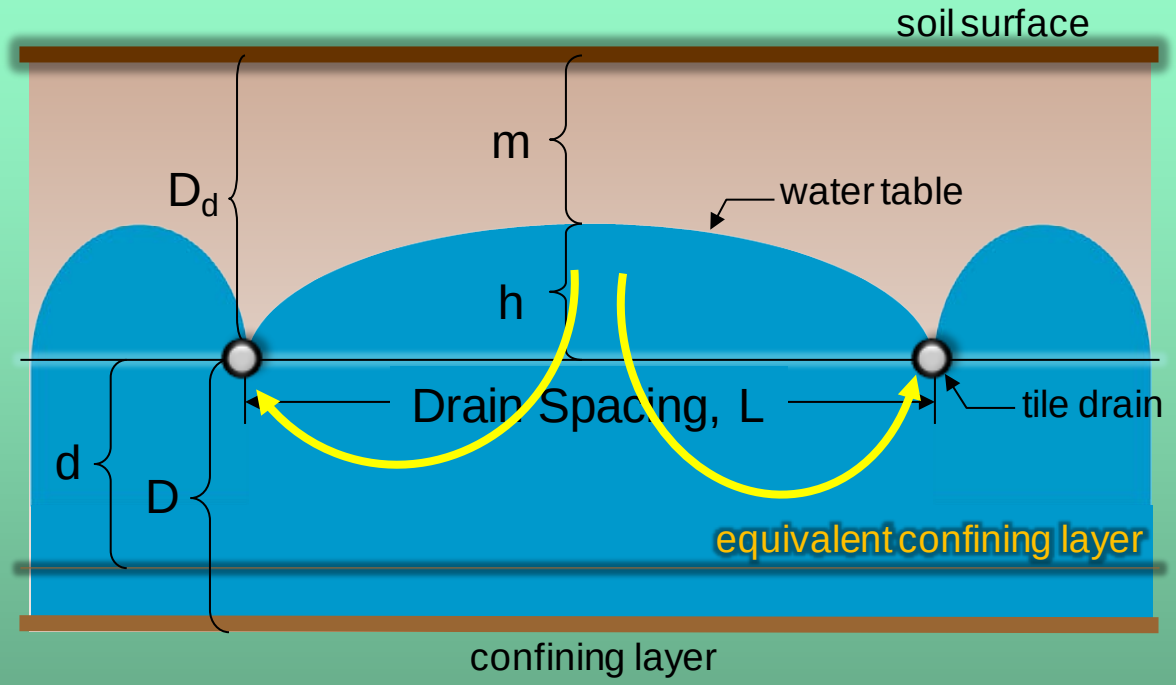
Improve root development

What Water is Drainable ?



Gravitational water =
volume between saturation and field capacity

Flow Into Drains



Factors impacting drainage rate

- **Tile depth and spacing**
- **Soil permeability**
- **Confining layer depth**
- **Tile line slope and pipe diameter**
- **Adequate outlet**

Image from Gary Sands – U of MN

Drain Construction Then and Now

In 1914 skilled tile layers were paid $2 a day.
The grade was set using a level and grade hubs

Drain construction then and now

Ditches were 3 to 5 feet deep and about 300 feet long. Due to the labor- intensive nature of the work, only 7 to 15 acres of tile were laid per year, taking 7 years to complete the 80 acre project.

Drain construction then and now

Construction materials then and now

Drain construction then and now

Drain construction then and now

Benefits of Subsurface Drainage

- ✓ **Increase crop yields and field trafficability.**
- ✓ **Greater soil water storage capacity.**
- ✓ **Conserve topsoil by reducing runoff.**
- ✓ **Soil temperature increases more quickly.**

Dry soil is warmer than wet soil. It takes 5 times as much heat to raise an equal volume of water 1 as it does to raise an equal volume of soil 1 .

Environmental Risks of Tiles

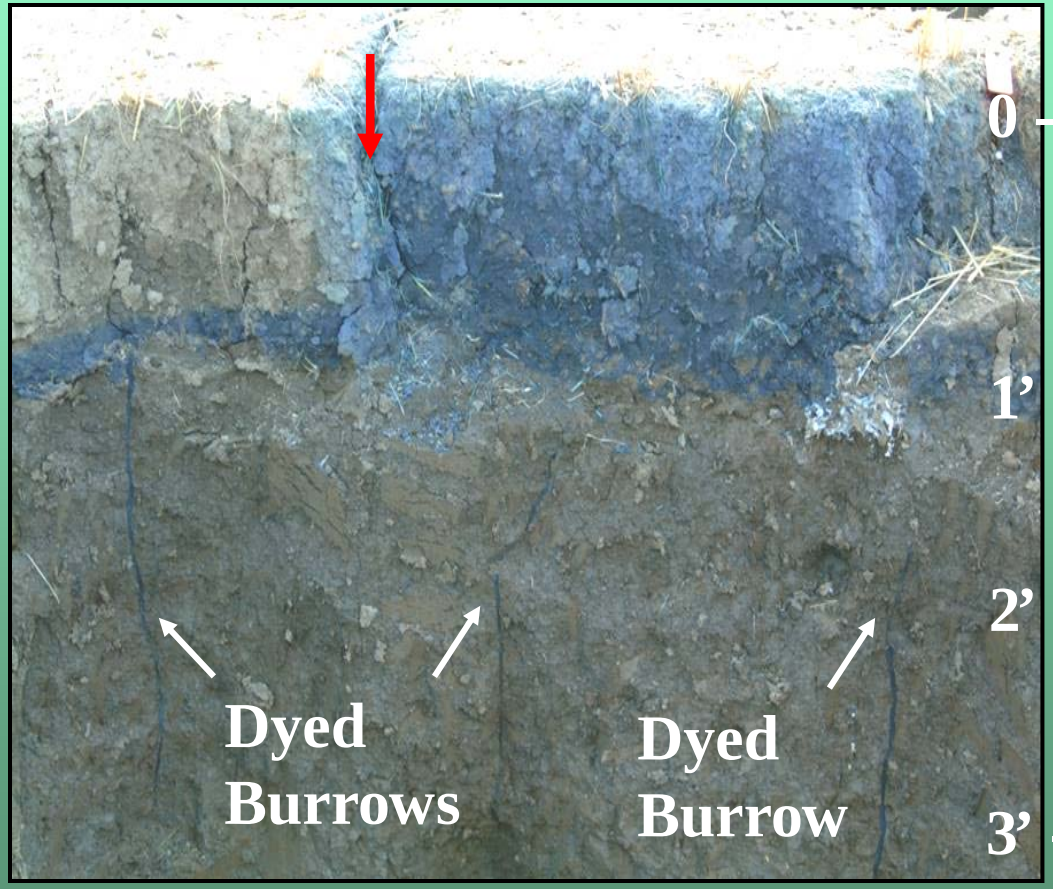
- ✓ **Increased export of nutrients (Ammonium, NO_3 and soluble P) and pesticides (Atrazine).**
- ✓ **Surface inlets act direct conduits to receiving waters.**
- ✓ **Macropores (roots and earth worm holes) are natural direct conduits.**
- ✓ **Drainage of wetlands is prohibited.**

Environmental Risks of Tiles

- Macropores -

Preferential flow through:

- Earthworm burrows
- Root holes
- Shrinkage cracks
- Structural porosity



Control Measure

- Manure in tiles -

- ✓ **Manure consistency:**
  - **0 - 2% solids: high risk**
  - **2 - 5% solids: moderate risk**
  - **> 5% solids: low risk**
- ✓ **Plugs or shut-offs.**
- ✓ **Modify tillage / manure incorporation.**
- ✓ **Precision farming (avoid tiles).**

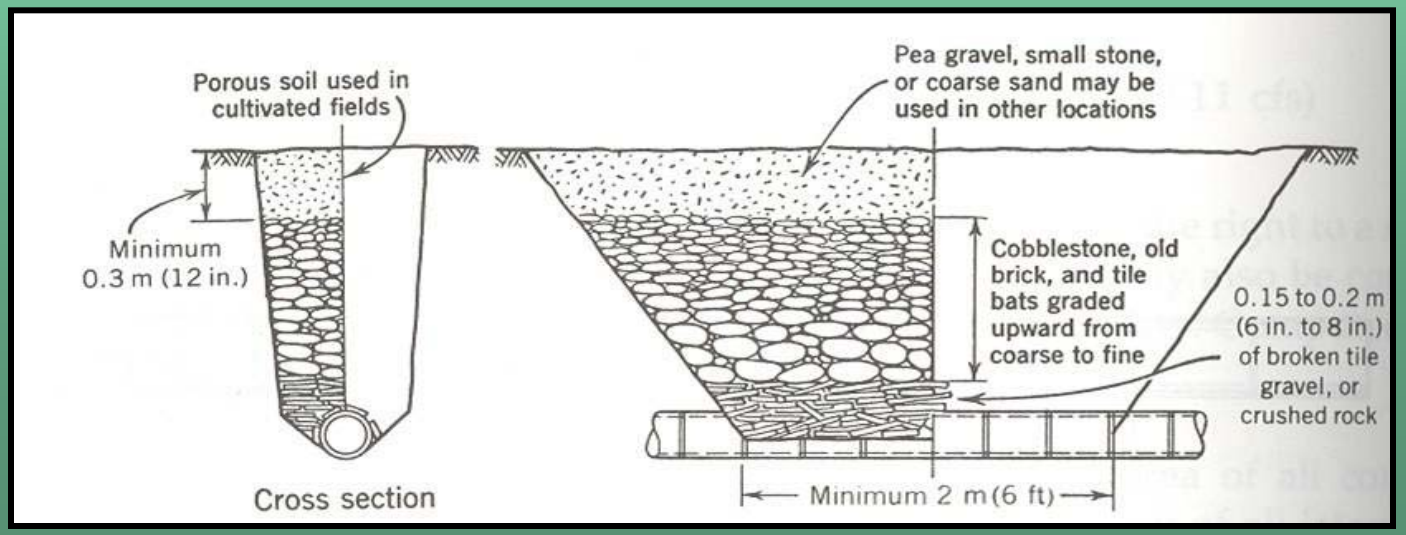
Environmental Risks of Tiles

- Surface Inlets -

Control Measures

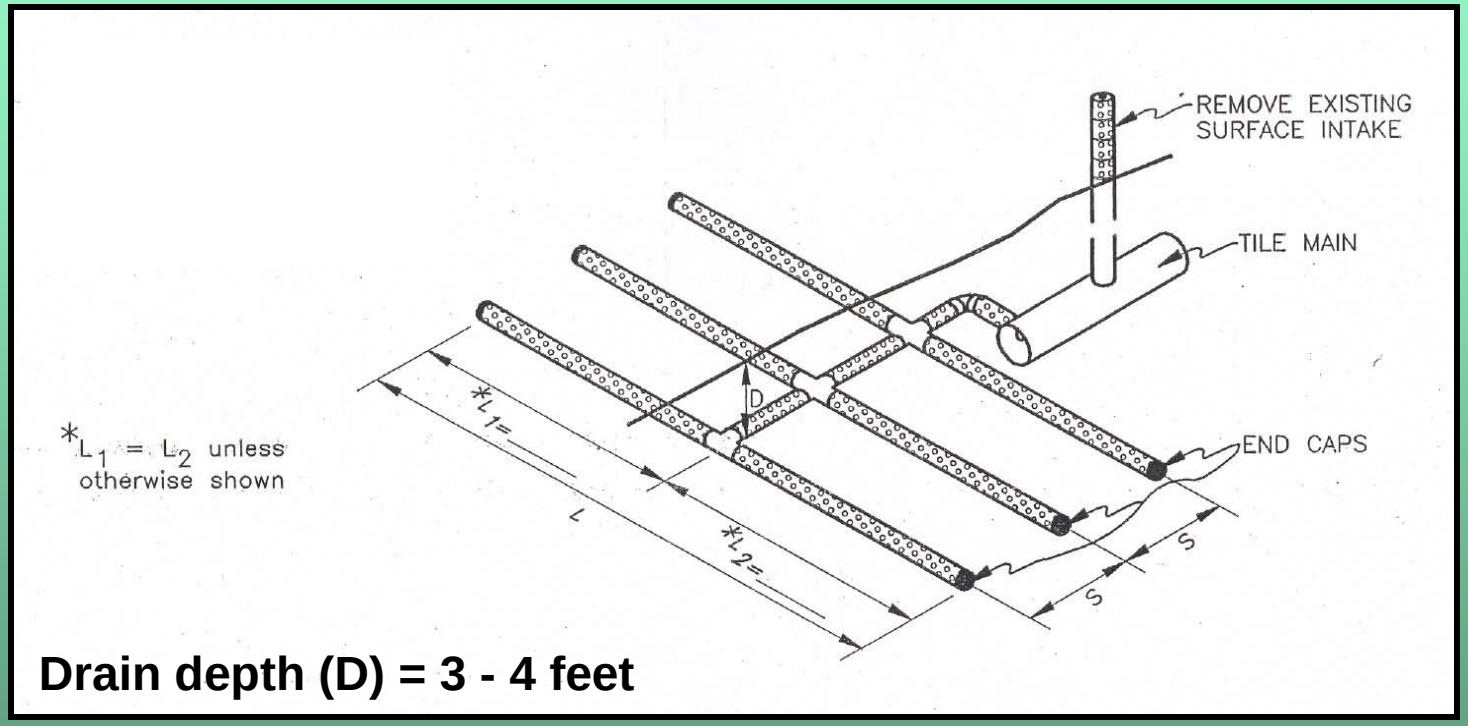
- Blind Inlet (French Drain) -

- ✓ **Can be used when water quantity to remove is small or sediment load is high**
- ✓ **Do not function satisfactorily for more than a few years**
- ✓ **They are expensive to construct, but do not interfere with farming operations**



Control Measures

- Surface inlet replacement -



Drain depth (D) = 3 - 4 feet

efotg.nrcs.usda.gov/references/public/IA/Interim980apr08.pdf

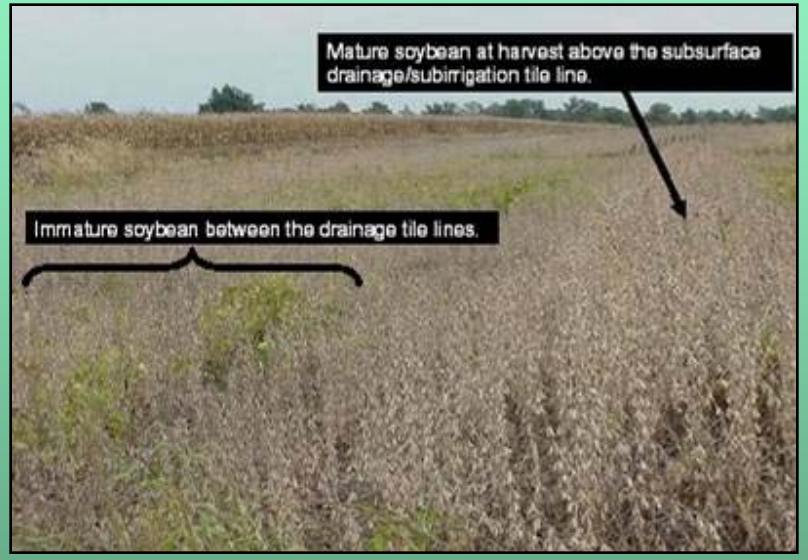
Field Locating Tile

- Air Photos -

Electronic soil survey map from Outagamie Co., WI

Field Locating Tile

- Crop Health -



Regular patterns in crop stand health and yields can indicate tile line location.

Yield monitors make this very evident !

Field Locating Tile

- Crop Growth Patterns -

Hay field in Brown County at the end of September.

Regulatory Issues

- Triggers for Swamp Buster -

Ineligible for USDA program benefits if:

- Plant a commodity crop on wetlands converted between December 23, 1985 and November 28, 1990; or
- Convert wetlands after November 28, 1990

WDNR, the Corps of Engineers, the county and the local drainage board may also have regulatory authority.

Check with your local NRCS field office to be sure !

Questions ?