Agricultural Drainage Fact Sheet

South Dakota
Cooperative Extension Service
SDSU

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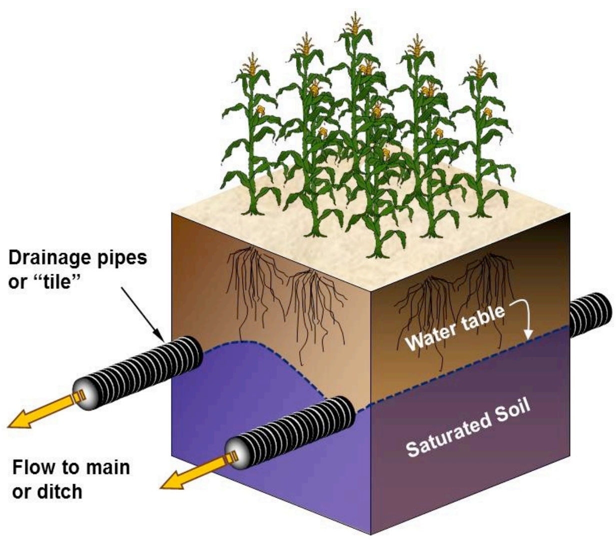

Graphic courtesy of Gary Sands, University of Minnesota

Drainage Benefits

- Proper soil drainage improves agricultural production by:
  - Allowing for more timely planting, harvesting, and tillage operations
  - Minimizing crop stress due to excess water and high water tables
- Proper drainage also minimizes soil compaction and buildup of salts
- Typical yield increases in the Midwest from subsurface drainage improvements are 10–30 bu/ac for corn and 5–10 bu/ac for soybeans
- Well drained soils have less year-to-year yield variability
- Proper drainage enhances the ability to incorporate other conservation practices such as conservation tillage

Drainage Impacts

Hydrologic Impacts

- Surface and subsurface drainage have very different hydrologic impacts
- Surface drainage speeds water away from the landscape and increases peak flows
- Subsurface drainage promotes greater infiltration, which generally reduces surface runoff and peak flows when compared to surface drainage
- Subsurface drainage typically increases baseflow (low flows) and may increase total water yield (surface runoff plus drain flow) somewhat (5–10%)
- The hydrologic impacts of local, field-scale effects are dampened at larger scales (watershed level)

Water Quality Impacts

- The water quality impacts of drainage are related to the hydrologic impacts
- Surface drainage, by enhancing surface runoff, tends to increase losses of sediment and phosphorous
- Subsurface drainage reduces pollutants associated with surface runoff but often increases losses of dissolved pollutants such as nitrate-nitrogen
- Nitrate is both a human health concern (drinking water) and a cause of surface water impairments
- Nutrient enrichment of surface water bodies can lead to algal blooms and fish kills from hypoxic (low oxygen) or "dead" zones
- Excess nutrients from agricultural land in the Mississippi River Basin, particularly from more heavily drained states in the Midwest, are a leading contributor to the hypoxic zone in the Gulf of Mexico (Fig. 1)

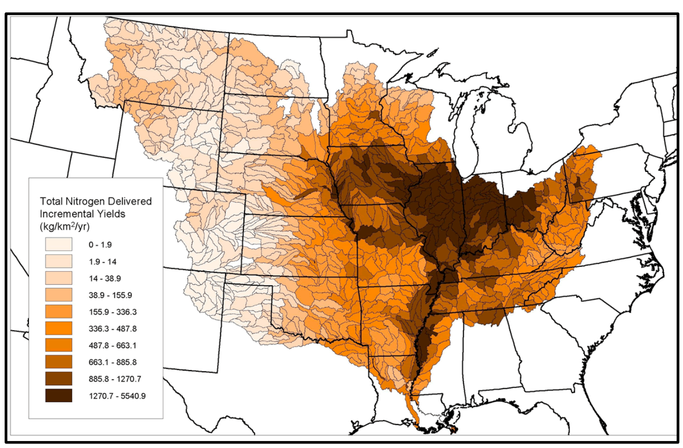

Figure 1. Total nitrogen yields for HUC8 watersheds in the Mississippi/Atchafalaya River Basin (Source: USGS)

Photo by USDA-NRCS

Drainage Background

- Agricultural drainage includes both surface (ditches and waterways) and subsurface (tile) drainage
- Glacial processes in upper Midwest created an abundance of highly productive but poorly drained soils
- Earliest drainage activities in the upper Midwest addressed agriculture, transportation infrastructure, and human health needs
- Approximately 25% of arable land in the U.S. has some form of surface and/or subsurface drainage improvement
- Increased precipitation in SD in recent years (Fig. 2), particularly in the fall, has led to spring planting and fall harvest issues and reduced yields because of excess water for many producers
- Excess water issues combined with higher commodity and land prices have led to increased interest in drainage
- Farmers in SD are permitted to drain their lands as long as they comply with county drainage regulations and federal wetland regulations
- Design of new drainage systems should consider both agricultural production and environmental goals. This is an area of active research.

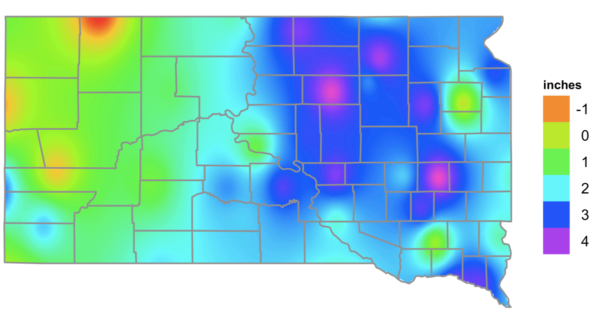

Figure 2. Increase in mean annual precipitation (in inches) for the period of 1991–2008 as compared to 1961–1990.

Conservation Drainage

Conservation drainage is a set of practices designed to provide the benefits of drainage while minimizing negative environmental impacts. Conservation drainage practices include:

- Nutrient best management practices
- Drainage water management (controlled drainage) (Fig. 3)
- Denitrifying (woodchip) bioreactors (Fig. 4)
- Shallow drainage
- Reduced drainage intensity
- Treatment wetlands and saturated buffers
- Winter cover crops
- Including perennials in the crop rotation
- Sediment trapping for surface inlets
- Improved side inlets to prevent ditch erosion
- Two-stage ditches

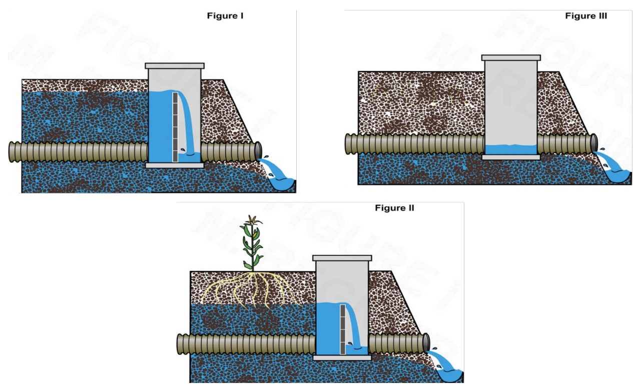

Figure 3. Drainage water management uses water control structures to manage the water table. Flow and nitrate reductions of 10 to 50% may be possible. Illustrations by Jane Frankenberger, Purdue Extension.

Figure 4. Denitrifying (woodchip) bioreactors intercept and treat drainage water to reduce nitrate levels of water leaving drained fields. Photo: USDA-NRCS.