Why Drain?

- Problem:
  - Poorly drained, waterlogged soils.
- Purpose:
  - Remove excess water from the root zone of growing plants.

Waterlogged Soils

- Gas exchange occurs slowly and only near the soil surface.
- Within the soil profile, oxygen may be absent and carbon dioxide may accumulate.
- Nitrification is prevented.
- Plant, especially fungal/root diseases may become prevalent.
- Plants may suffer from water stress if grown in waterlogged soils when then root zone water table recedes.
- Soils more susceptible to compaction.
- Greater heat capacity so they are slower to warm.
- Heat loss by evaporation is greater.
- Germination and early plant growth delayed.
- High evaporation rates can lead to salt accumulation near the soil surface.
Potential Benefits of Drainage

- Reduced soil erosion
- Early seeding date and more flexibility;
- Better seed germination and establishment;
- Better plant growth, health, and yield;
- Reduced salinity under irrigation.

Potential Drawbacks of Drainage

- Nutrients
  - Nitrogen
  - Phosphorus
- Sediments
- Some pesticides
- Fecal coliform
- Changes in hydrologic response

Census of Agriculture Map of Drainage
Plant Available Water

Field Drainage System

- Main types of common systems
  1) Surface drainage
  2) Subsurface drainage
  3) Managed drainage (aka Controlled drainage)

- Gravitational water is of interest. The volume of this water, the hydraulic characteristics of the soil in question, and the wet-condition-tolerance and value of the crop being grown dictate the drainage system design and its feasibility.

Surface Drainage

- Surface drainage is the removal of water that collects on the land surface.
- A surface drainage system consists of shallow ditches and may include land smoothing and land grading.
Subsurface Drainage

• Removes only gravitational water.
• Capacity to remove water (aka drainage coefficient) is expressed as depth/day (e.g. 3/8 in/day).
• System design dictated by crop, soil, location and topography.
• Can be used to manage root zone water level down or up (e.g. controlled/managed drainage).
• Changes hydrologic response of field.

Subsurface Drainage Designs

• The major considerations in sub-surface drainage design include:
  – Drainage coefficient;
  – Drain depth and spacing;
  – Drain diameters and gradient.
Subsurface Drainage

• Water is carried into the outlet by main drains, which receive water from the laterals.
• The system will function only as well as its outlet.
• Four basic patterns are used in the design of subsurface drainage systems.

For more information

• http://www.extension.umn.edu/agriculture/water/
• https://engineering.purdue.edu/SafeWater/Drainage/
• http://agwatermgmt.ae.iastate.edu/
• http://ohioline.osu.edu/b871/index.html

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