TKP3501
Agricultural Mechanization

Topic 6f: Crop Irrigation
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What is crop irrigation?

- Irrigation – artificial application of water to the soil for the purpose of supplying the moisture essential for plant growth
- Vital role in biomass or yield production
- Nature irrigation- drainage either surface or subsurface water supply in a given area
Why need an irrigation for crop?

Corn fields in a Midwest state, USA
Calculation of water requirement

- The net irrigation requirement (NIR) is the amount of water which is not effectively provided by the rainfall;
  
  » \( \text{NIR} = \text{ET} - \text{eRAIN} \)

  Where;
  
  \( \text{ET} \) = evapotranspiration and
  
  \( \text{eRAIN} \) = effective rainfall
The gross irrigation requirement (IRR) is the amount that must be pumped.

IRR is greater than NIR by a factor which depends on the irrigation efficiency (EFF).

» IRR = NIR / EFF
Methods in estimating water requirement

- Historical observations (e.g. rainfall pattern, soil data)
- Numerical models (e.g. SWAT model)
Historical observations

- To estimate future used for a crop water requirement at a specific location, a long term record has been kept for irrigation water requirement
- Estimate the long term averages and extreme values
- Possible problems;
  - Required at least 20 years dataset for long term prediction
  - Used only in a specific location, and cannot be generalized to other areas
Numerical models

- Two numerical methods;
  - Agriculture Field Scale-Numerical Simulation Model (AFSIRS)
    - A computer generated model based on daily water budget of the crop root zone
  - Statistical method (e.g., SCS)
    - A statistical regression method that allows monthly crop irrigation requirements to be estimated based on three factors below;
      - Monthly crop evapotranspiration (ET)
      - Monthly rainfall
      - Soil-water holding characteristics
Irrigation technique

- Surface irrigation
  - Furrow
  - Contour flooding
- Subsurface irrigation
- Overhead irrigation
  - Sprinkler
  - Drip irrigation
- Basin and check irrigation
Surface Irrigation

- Totally depends on the water source - good if abundance!
- Example – Siphon method
- Two methods;
  » Furrow and flooding
Furrow

Flooding
Subsurface Irrigation
Overhead Sprinkler

- Spraying pattern- cross sectional pattern
- Spray water into the air above the crop and around the crop area in broadcast pattern
- Water being pumped and under pressure, to deliver the right operating pressured required by the sprinkler system
- Non-uniform water distribution
- The amount of water is the highest close to the nozzle post
- Overlap should be about 65% to get the uniformity.
Question/ Review

- What is the best method in reducing the water usage in irrigation for row crop production?
Thank you

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