IRRIGATION

Learning Objectives

The learner will:

- Understand reasons for irrigation
- Learn to recognize the effects of water stress
- Learn methods of determining the proper frequency of irrigation
- Examine various system designs and delivery methods and investigate specific advantages and disadvantages.

Why irrigate?

- Maintain and moderate best temperature for plant life
- Gives structure and support to plant – water molecules in tissue
- Unlocks biological and chemical processes in the soil that support plant growth
- Plants use water to form oxygen and carbohydrates
- Irrigation protects crops from frost

Effects of water stress

- Water stressed plants have lower immunity to pests and disease
- Decreased yield. Plants are particularly sensitive at these stages
  - Flowering stage
  - Fruit/yield set
  - Seedling
  - Fruit ripening

Terms and Definitions

- *GPM (gallons per minute)* – A measurement of flow (volume of water at given source in one minute)

- *PSI (pounds per square inch)* – A measurement of water pressure (the force that water exerts on a given area)

  - (e.g. Water coming out of a pipe can be expressed both in terms of rate of flow and the force applied to that flow, as in 35 GPM @ 50 PSI.)

- *Velocity* - Rate at which water moves through a closed system. As velocity increases, pressure decreases. Velocity should be 5ft/sec or less. (Use table to determine.)

- *Evaporation* – Loss of water from soil to atmosphere

- *Transpiration* – Loss of water from plant to atmosphere

- *Evapotranspiration (ET)* – Evaporation plus transpiration
- *Evapotranspiration rate (ETo)* – Measurement of ET in inches/day
- *Hygroscopic Water* – Water held too tightly in soil to be available to plants
- *Capillary Water* – Water that is held in pore spaces of soil; available to plants
- *Gravitational Water* – Water draining from soil; not available to plants
- *Capillary Action* – Movement of water in soil from wet to dry areas
- *Percolation* - Movement of gravitational water down through soil
- *Permanent Wilting Point* – Boundary between capillary water and hygroscopic water. Plant begins to sustain damage and will die if water is not applied.
- *Field Capacity* – Boundary between gravitational water and capillary water (upper limit for soil moisture available to plant)
- *Available Water* – Amount of water available to plants

Frequency of Irrigation

Soil Test Method

- Manual test – Soil is felt and observed at the root zone of the plant. Water is applied when soil is at 50%-75% (depends on crop specifics). Charts are available as a guide to this method, but judgment is largely based on site-specific experience.
- Mechanical test – Tensiometer

Soil Budget Method

- Calculate site ETo
  - Get from local extension office
  - Measure time for one inch of water to evaporate from a pan.
- Replace water as it evaporates from field capacity using measured amounts from an irrigation system.
- Example/Exercise: *If local ETo is .4in/day, how much water needs to be applied in a week?*
  - Formula is PR= (96.3xGPM)/(SxL)
  - PR= precipitation rate measured in in/hr
  - 96.3= constant
  - GPM= gallon per minute water flow in measured area
  - S= in-line spacing of sprinklers or emitters in feet
  - L= lateral spacing of sprinklers or emitters in feet

Factors Affecting Irrigation Frequency

Climate

- As temperature increases, ETo increases
- As wind increases, ETo increases
- As humidity increases, ETo decreases
- As precipitation increases, ETo decreases

Soil Type (see charts)

- Coarse – sand – drains quickly, increase frequency of irrigation
- Medium – loam – drains moderately
- Fine – clay – drains slowly, decrease frequency of irrigation

Slope (see charts)

- The steeper the slope, the less water the soil can absorb before run-off.

Crop Specifics

- Water loving or drought tolerant
- Germinating direct seeded crops
- Dry down during ripening
- Perennials

Irrigation Systems

Design Considerations

- Determine Source
  - Pond or other open source (gravity feed or pump)
  - Well

- Determine GPM and PSI at delivery point
  - Flow test with bucket and stopwatch
  - PSI test with gauge
  - Determine pipe size using tables
  - Determine delivery method based on GPM, PSI, and field requirements

Drip or Micro

- For row crops, typically T-tape coming from 1/2”-1” manifold, with filters and pressure regulators.

Advantages

- *Good for limited water source*
- *Efficient direct delivery of water to root zone*

Disadvantages

- *Maintenance on filters*
- *Limited life*

Overhead Sprinkler

- Buried PVC – must be designed correctly and buried deep enough to avoid cultivation
- Aluminum Hand Line – 20'-30' pieces are moved as needed. Have impact heads. Connect to fittings at top of field or row.

Advantages

- *More ambient cooling*
- *Longer life*

Disadvantages

- *Less efficient*
- *Can promote mold/disease*
- *Takes higher flow*

Flood

- Sheet of water over established vegetation. Best for pasture or cover crop.

Assessment/Review

- What are the symptoms and effects of water stress in plants?
- What are some factors affecting irrigation frequency?
- Name several types of irrigation systems and discuss advantages and disadvantages of each.