Measuring/estimating soil water status and evapotranspiration (ET) for irrigation scheduling

Why measure soil water status?

- Water conservation
- Irrigation scheduling
  - When to irrigate?
  - How much water to apply?
  - How to apply (irrigation system selection and design)?
- Reduce runoff
- Reduce chemical leaching to other water bodies
- Optimize crop yield

Does this influence overall plant growth?

Note the response in chlorophyll content
Criteria for sensor selection?

- Soil type
- Cost
- Accuracy and reliability
- Crop
- Response time
- Complexity (preparation, installation, service, use)
- Durability

Soil Properties: Texture

Soil Texture: The relative proportions of sand, silt, and clay particles in a mass of soil (material less than 2mm in size).

- Very Coarse Sand = 2 to 1 mm
- Very Fine Sand = 0.1 to 0.5 mm
- Silt = 0.05 to 0.002 mm
- Clay = < 0.002 mm

Effect of Texture on Fertility of the Soil

- Large surface area of clay makes it the storehouse of plant nutrients.
- Soils with more clay will have more nutrients than sandy soils.
Physical Properties as Affected by Soil Texture

- Porosity – Relative Pore Volume in Soil
- Infiltration – Downward movement of water
- Water Holding Capacity
  - Permanent Wilting Point
  - Field Capacity
  - Available Water

Soil Texture Classes

- Sand – Sand imparts a gritty feel to soil due to the shape of the individual particles.
- Silt – When moist, silt has a floury feel and does not ribbon when pressed between the thumb and forefinger due to the shape of the individual particles.

Overall Results

- Nodule counts were not reduced due to Roundup
- Leaf “greenness” was reduced
- Yield was not affected by Roundup
- Protein content in seed may be altered

Soil Texture Classes

- Clay – Moist clay is sticky and will ribbon readily when pressed between the thumb and forefinger. When placed between the teeth clay has a smooth slick feeling.
Soil pH and herbicide effectiveness and carryover

Bioavailability and activity of atrazine increases when soil pH > 7.
Atrazine half-life decreases dramatically as pH increases from 6.8 to 8.0.
Sulfonylureas (SU; Exceed) carryover is much more if pH > 7.2.

How common are acid and alkaline soils in Nebraska?

| Percent of Samples by pH Range for Zip Code Areas |
|---------------------------------|----------------|----------------|
|                                 | 68000-68099   | 68300-68399    | 68700-68799    |
| pH <= 5.3                       | 7.2%          | 10.3%          | 17.7%          |
| 5.3 < pH <= 6.2                 | 59.2%         | 61.8%          | 34.5%          |
| 6.2 < pH <= 7.2                 | 20.4%         | 26.3%          | 25.0%          |
| 7.2 < pH <= 7.8                 | 7.1%          | 1.5%           | 16.7%          |
| 7.8 < pH                        | 6.0%          | 0.1%           | 5.7%           |
| Total                           | 100.0%        | 100.0%         | 100.0%         |

Timing of Weed Control & Weed Size

Weed Size and CPWC

- If weeds emerge before crop or are taller than crop control them 4-5 days (1-2 crop leaf) before CPWC
- If weeds emerge 5-10 days after crop, wait 5-10 days (2-3) crop leaves to start control

Timing of Weed Control and Weed Size

Larger weeds need higher herbicide rates

Example: Glyphosate Rates
- Lower rate 16-24 oz (annual grass 3-8” tall, broadleaf < 4”)
- Full rate – 32 oz grass > 8”, and broadleaf 4-10”
- High rate – 40-64 oz (smartweed, morningglory, weeds > 12”)
Herbicide Combinations

- What do you expect to gain?
  1. Broader Spectrum
  2. Synergism

- What do you stand to lose?
  1. Antagonism
  2. Crop Injury

Herbicide Additives

- Gain?
- Improved Performance
- Loss?
- Potential Crop Injury

Soybean Yields Decrease with Stand Reduction, NE 2003