Indirect Determination of Leaf Area Index to Calculate Evapotranspiration: Sustainable Agriculture Research and Education (SARE)

Soybean Forage

Figure 2. Organic soybean 6/20, 7/12, 7/25, 8/25, 9/12, 9/25/17. Note that data from 9/25/17 was not included on poster.

**Materials and Methods**

- **Organic agriculture**
  - composted manure
  - long-term rotations
  - perennials
  - improve soil quality
- **Long-term rotations / perennials**
  - longer growing season
  - longer season water use
  - longer season nutrient use
  - improve soil quality
- **Evapotranspiration measure challenge**
  - need low-cost leaf area index
  - varied crops
  - incomplete canopy
  - dry soil
- **Goals**
  - determine LAI from ground cover + plant height
  - use LAI with climate data to determine ET
  - compare ET for different rotations

**Soils**
- Clarion: Fine-loamy, mixed, superactive, mesic Typic Hapludoll
- Webster: Fine-silty, mixed, superactive, mesic Typic Endoaquoll
- Canisteo: Fine-silty, mixed, superactive, calcareous mesic Typic Endoaquoll
- Harps: Fine-loamy, mixed, superactive, mesic Typic Calciaquoll

**Rotations (Cambardella et al., 2015) [Supplement 1, 2]**
- conventional corn (Zea mays L.) - soybean (Glycine max [L.] Merr.)
- 4-year organic: oat (Avena sativa L.) + 1st year alfalfa (Medicago sativa L.), 2nd-year alfalfa, corn, soybean
- mixed forage

**Soil measurements**
- Monitoring wells for water table depth
- Neutron probe for soil water content
- Surface soil samples for soil water content
- Soil characterization (soil from neutron probe installation)

**Crop measurements (periodic)**
- Picture from camera on pole ~6.5 m above ground (Fig. 1)
- Plant height

**Picture processing (SamplePoint, Booth et al., 2006)**
- Ground cover green crop
- Total green cover
- Non-green cover
- Soil cover
- Crop and total green LAI from cover + plant height (Supplement 3)
- Compare LAI with LAI-2000
- Interpolate measurement dates

**Steps: calculate evapotranspiration (ET) [Supplement 4]**
- Weather station: air temperature, net radiation, barometric pressure
- Potential ET (Priestly-Taylor)
- Adjust for less than full canopy and for surface soil wetness
- For crop + weed
- Actual ET: Adjust for root zone soil water
- Crop ET: adjust for green crop cover

**Data Summary**
- LAI-2000 excessive range of data (Figure 3)
- Dry early 2016 and most 2017 (Supplement 5, Tables 1, 2)
- Forage and 4-year rotation use more water in spring and fall (Tables 1, 2, 3)
- Corn - soybean often use more water July + August (Tables 1, 2, 3)

**References**