# Crop Evapotranspiration of Corn, Soybean, and Sorghum under Dryland Conditions as Quantified Using Soil Water Balance

**Jenny Rees**
**Extension Educator, Clay County**
**University of Nebraska-Lincoln Extension**

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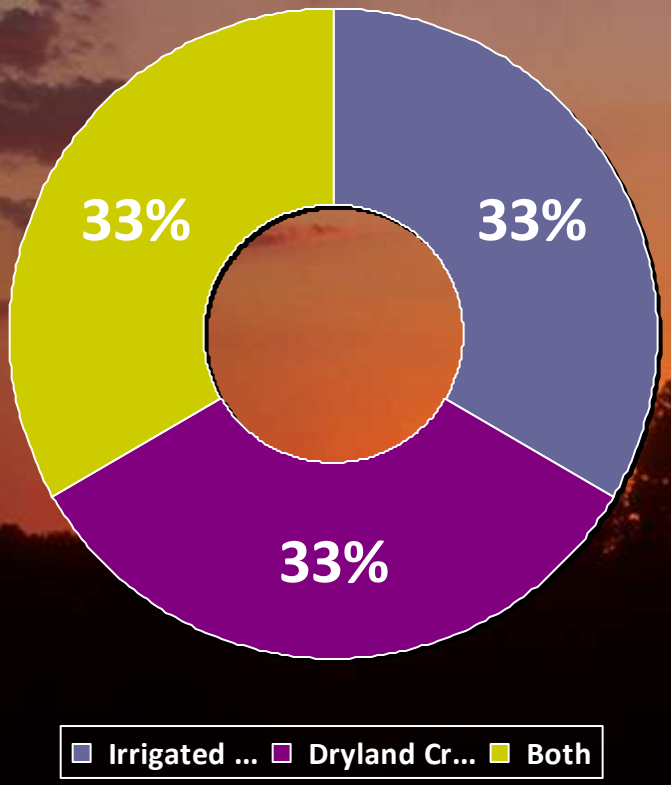
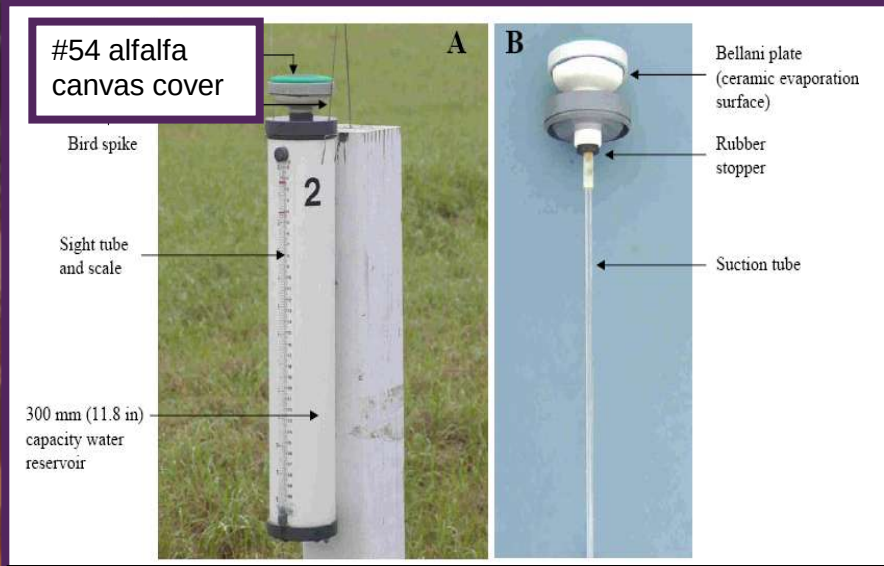
# Do you have:

1. Irrigated Crops
2. Dryland Crops
3. Both

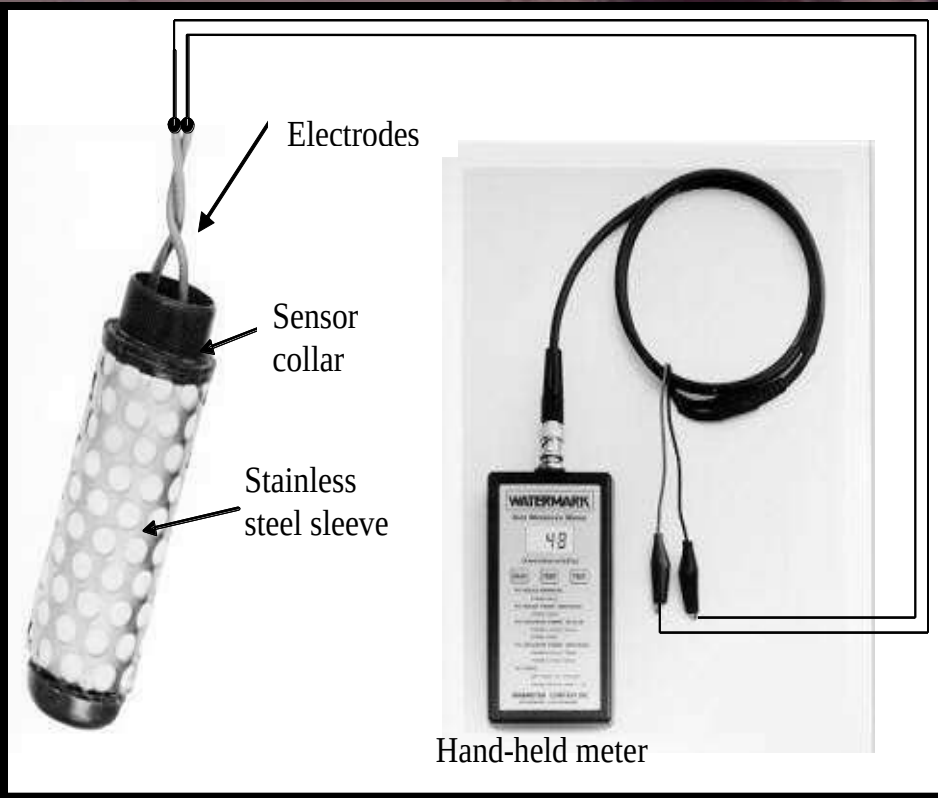


# Proposal/Objectives:

- Compare water use of 3 crops in 2 dryland fields.
- Utilize tools such as ET gage and Watermark sensors.
- Summer field day.
- Present research findings.




# Know how. Know **now.**

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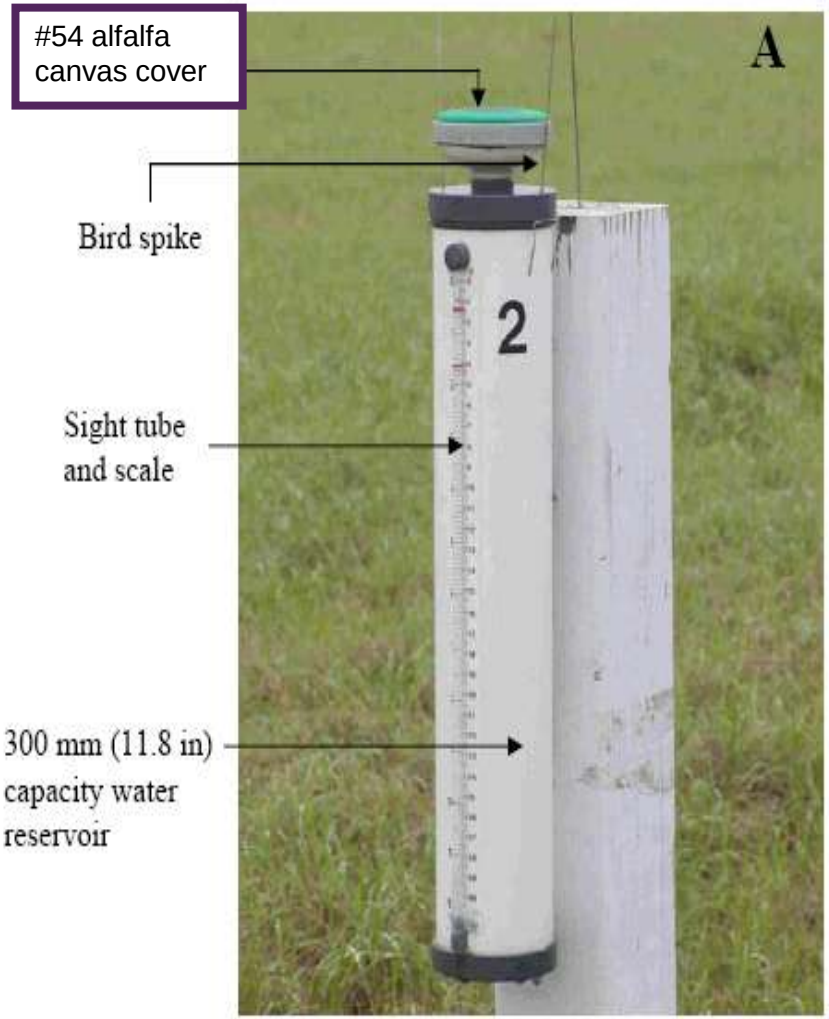


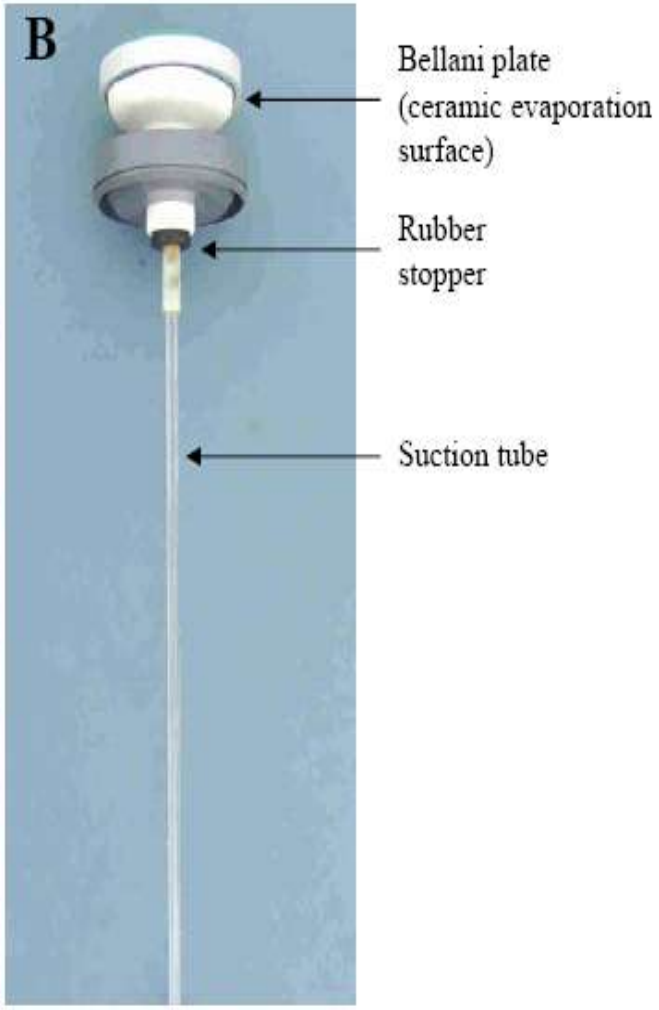

# Field Experimental Design

- Datalogger (8 soil sensors/datalogger
- 4 sensors/crop
- Soil matric potential measured every ft. up to 4 ft.
- Matric potential converted to soil water in inch/ft using soil water retention curve.

| Crop | Replication |
|---|---|
| Sorghum | 1 |
| Corn | |
| Soybeans | |
| Corn | 2 |
| Soybeans | |
| Sorghum | |
| Soybeans | 3 |
| Corn | |
| Sorghum | |

# Field Pics

**John in field**

University of Nebraska Lincoln EXTENSION

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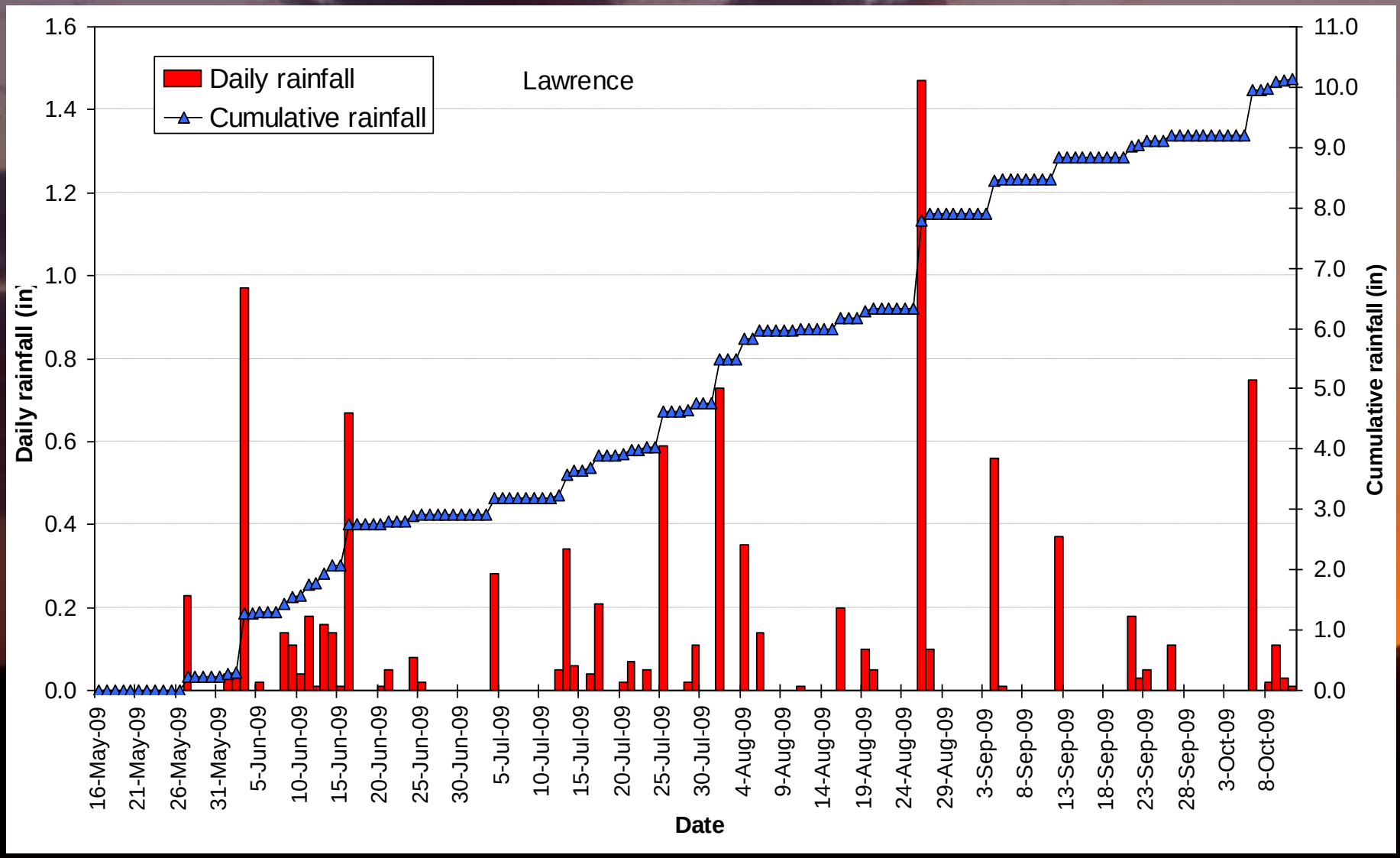
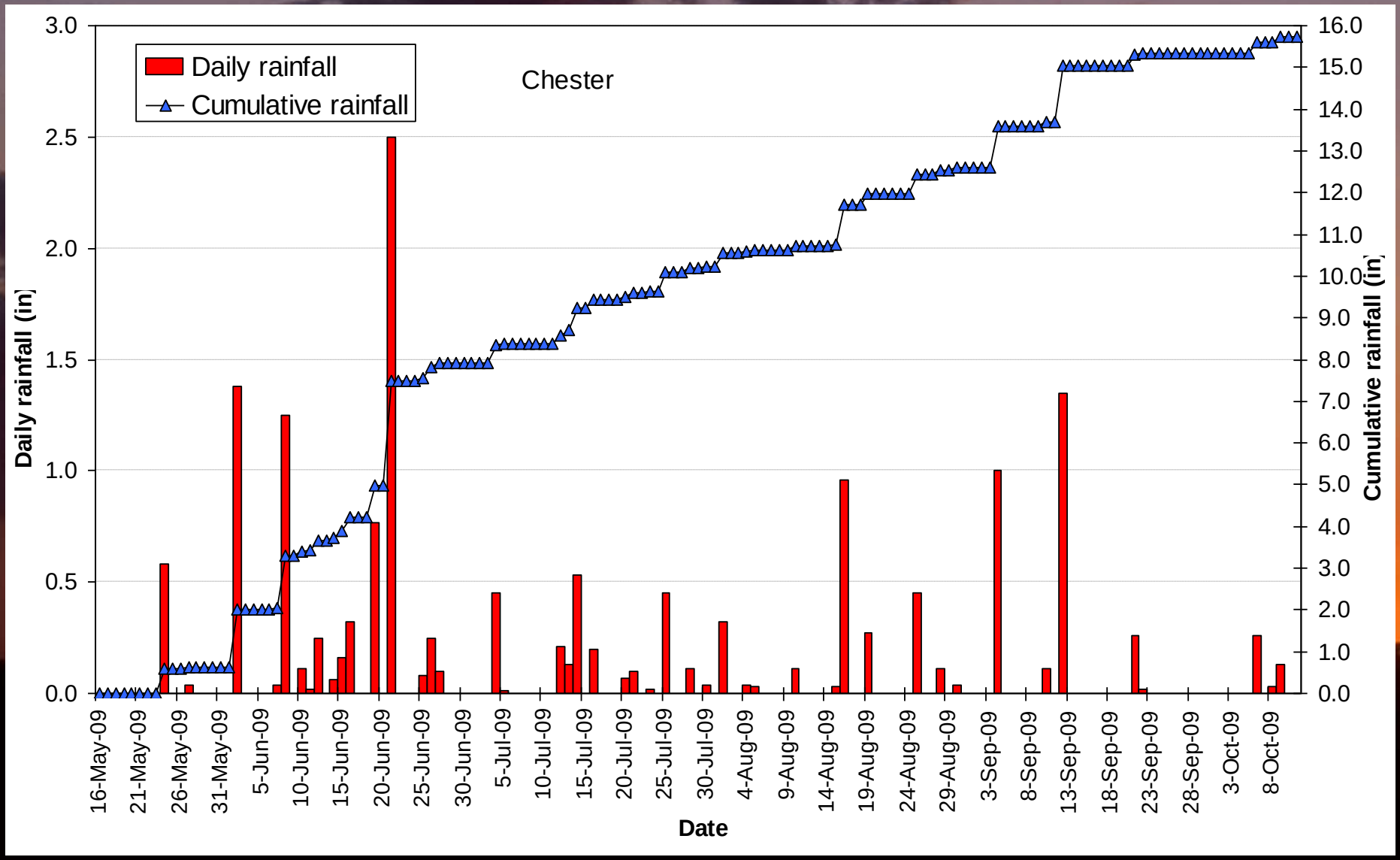
# Management Practices

| Parameter | LAWRENCE | | | CHESTER | | |
|---|---|---|---|---|---|---|
| | Corn | Soybean | Sorghum | Corn | Soybean | Sorghum |
| Planting date | May 7 | May 8 | May 19 | May 7 | May 7 | May 26 |
| Emergence date | May 16 | May 16 | May 23 | May 16 | May 16 | June 6 |
| Maturity day/group | 113-day | 2.6 | - | 113-day | 3.4 | - |
| "*Full*" maturity date | Oct 5 | Sept 15 | Oct 6 | Oct 10 | Sept 15 | Oct 6 |
| Planting population (ppa) | 20,000 | 135,000 | 65,000 | 20,000 | 135,000 | 65,000 |
| Hybrid/variety | 33T57 | 92M61 | 85Y40 | 33T57 | 92M61 | 85Y40 |
| Row spacing/planted rows | 30"/12 | 30"/12 r | 30"/12 r | 30"/16 r | 30"/16 r | 30"/16 r |

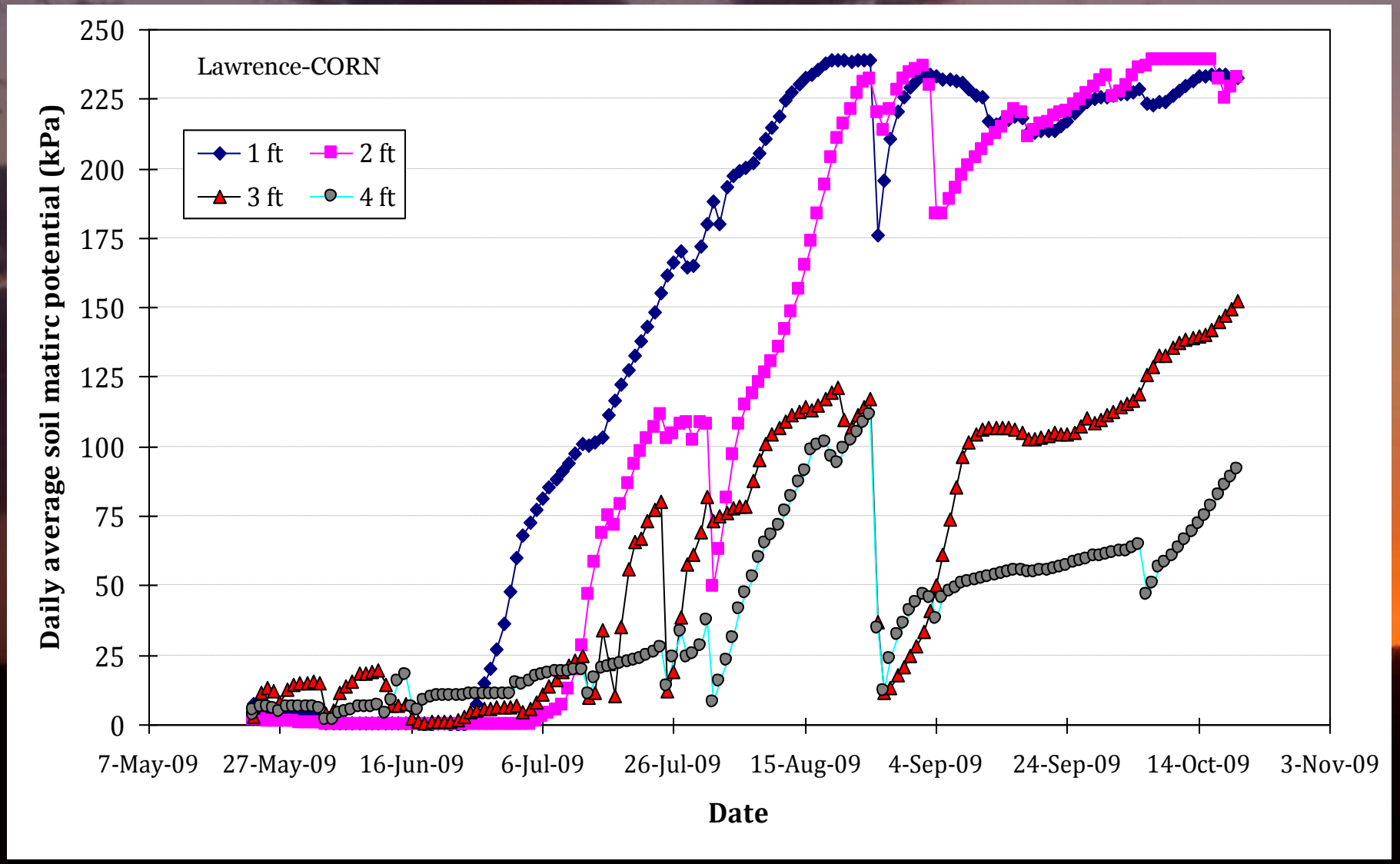
# *Rainfall - Lawrence*



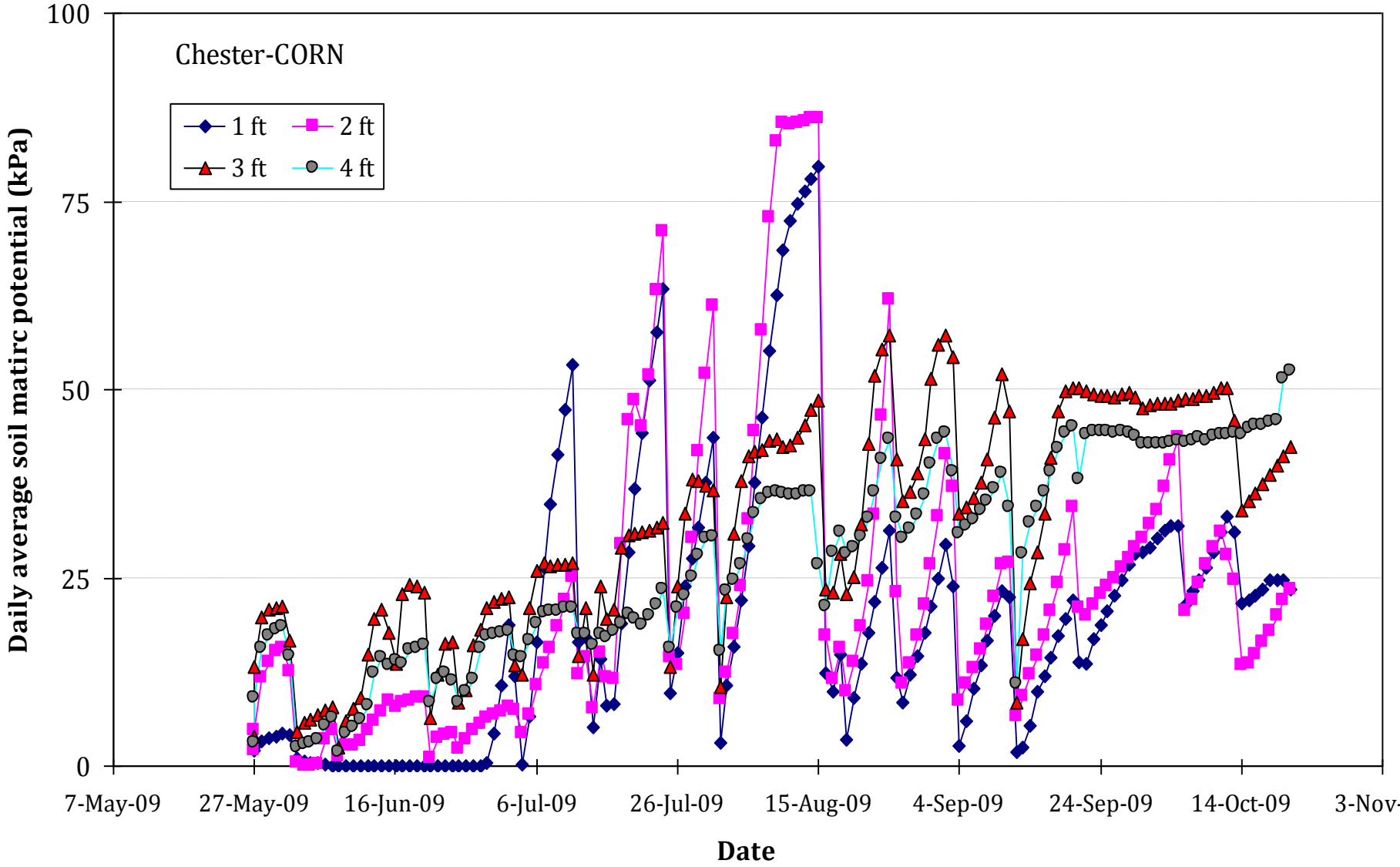
# *Rainfall - Chester*



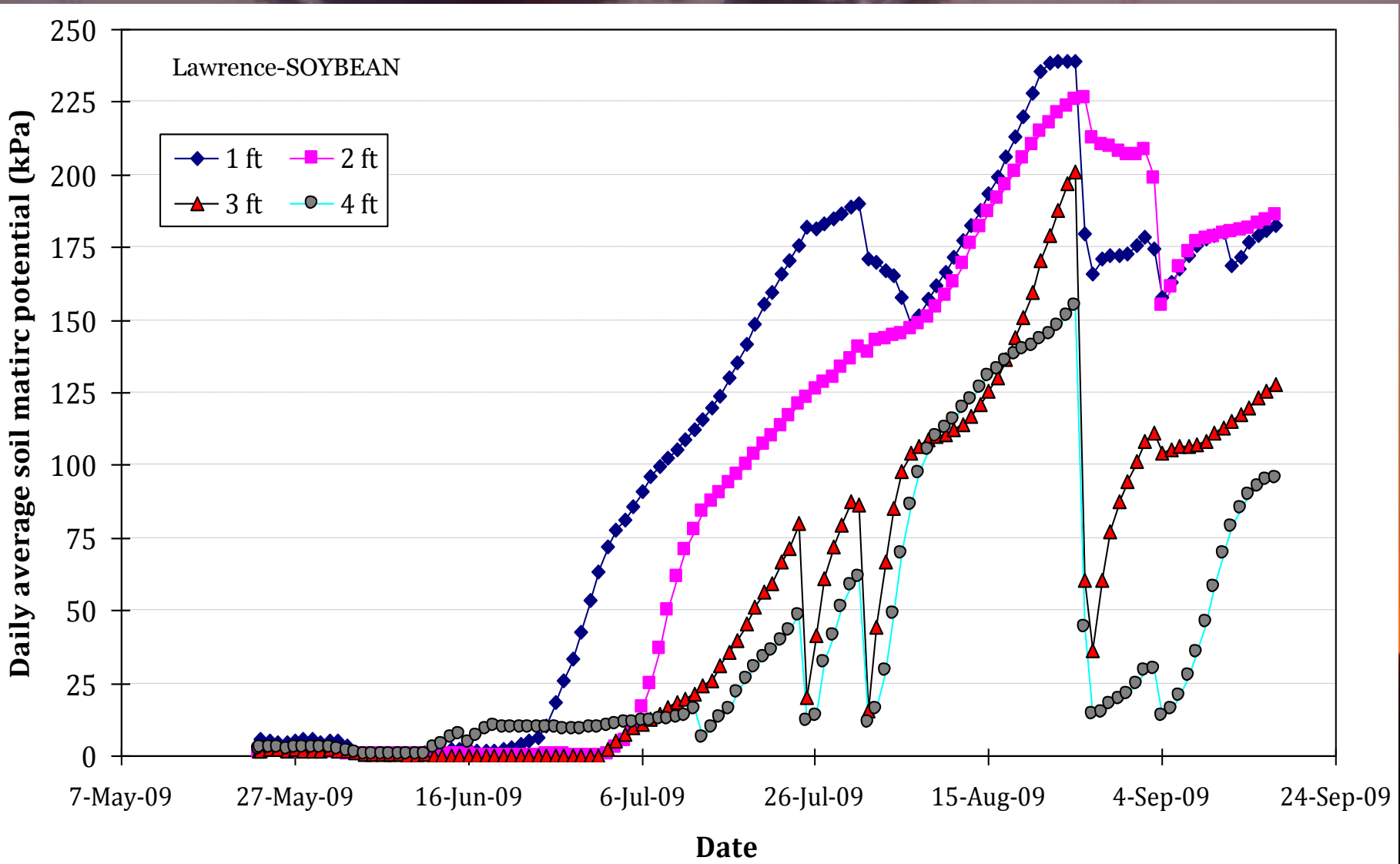
# *Distribution of daily average soil matric potential Lawrence - CORN*



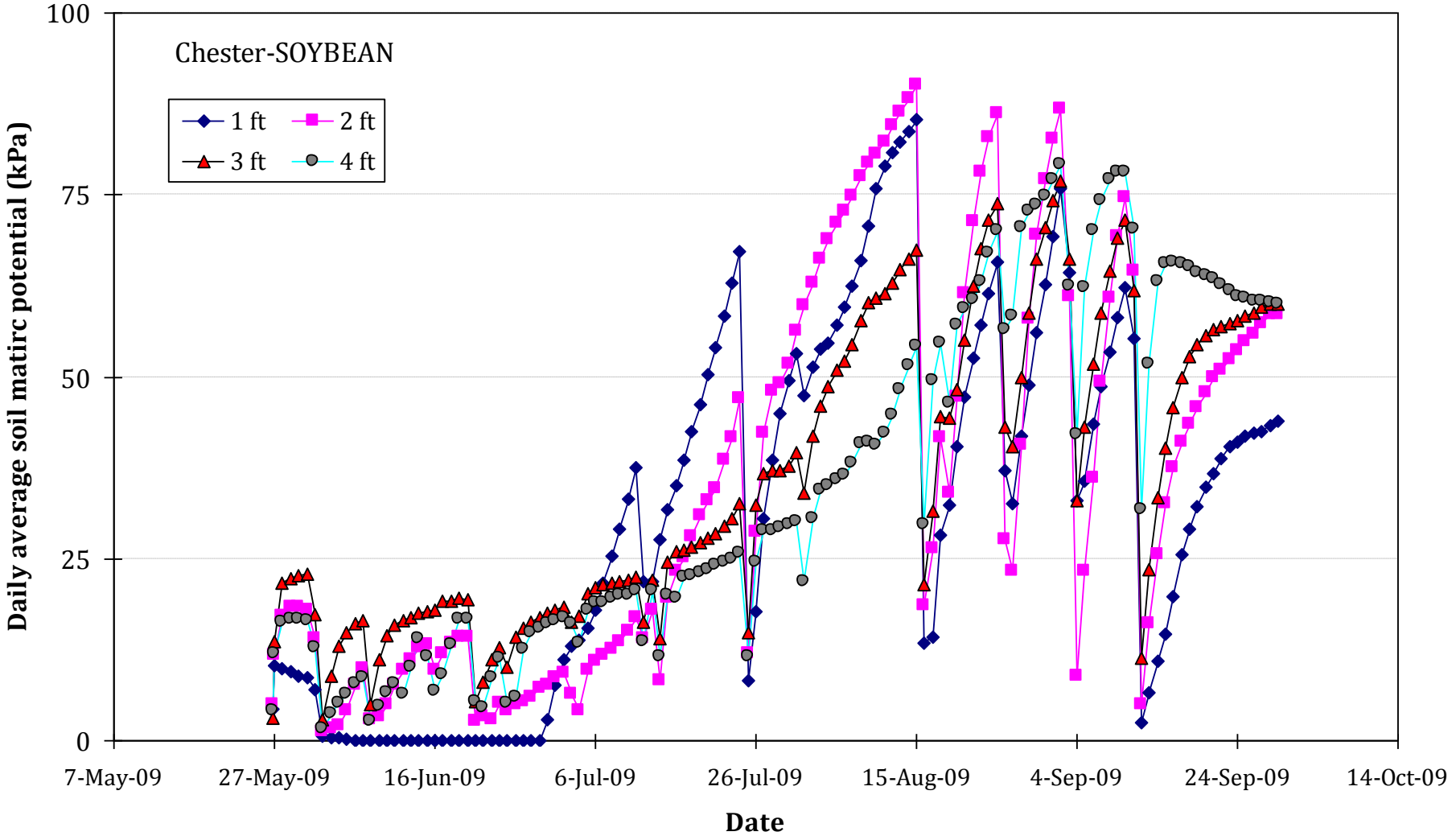
# *Distribution of daily average soil matric potential Chester - CORN*



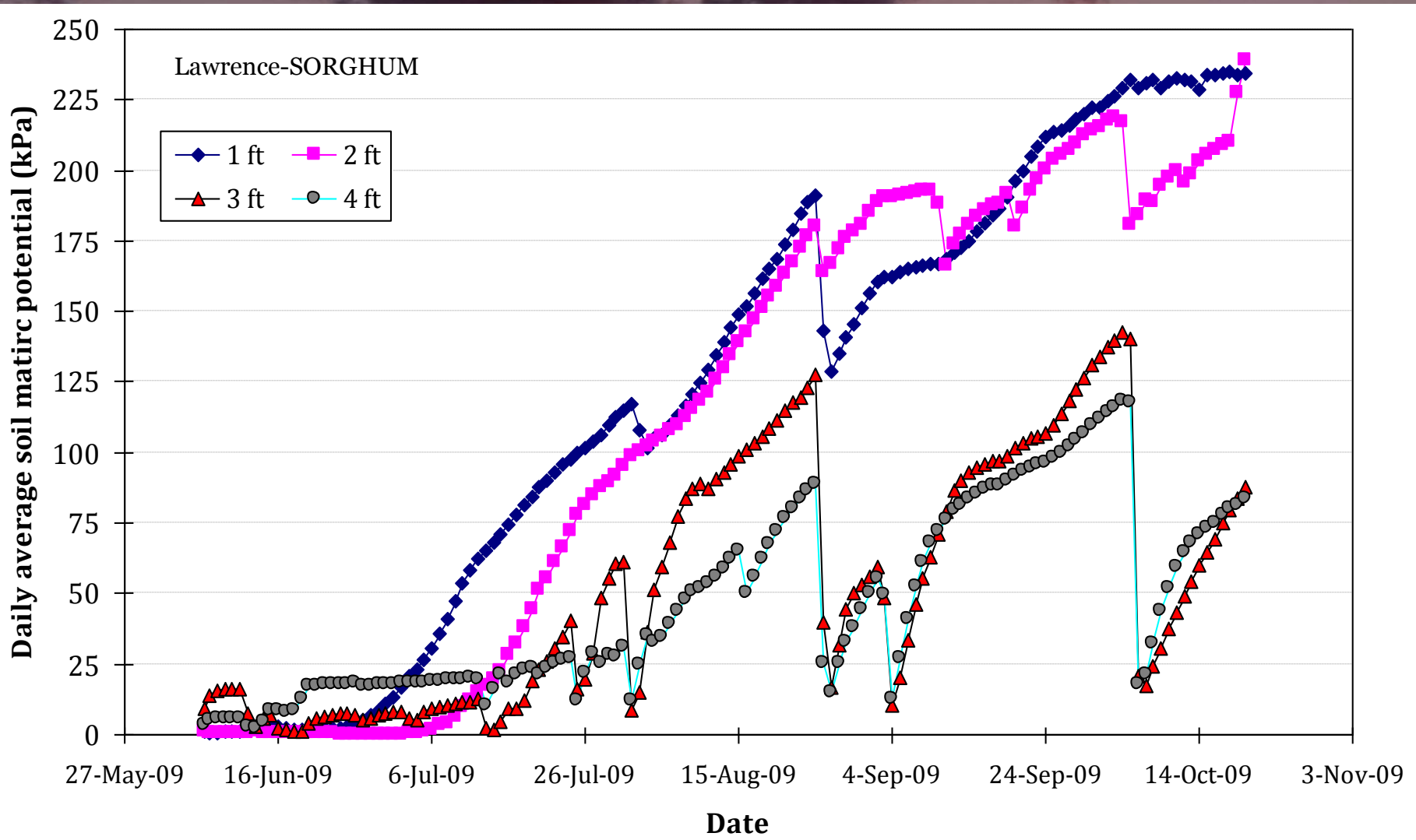
# *Distribution of daily average soil matric potential Lawrence-Soybean*



# *Distribution of daily average soil matric potential Chester- SOYBEAN*



# *Distribution of daily average soil matric potential Lawrence - SORGHUM*



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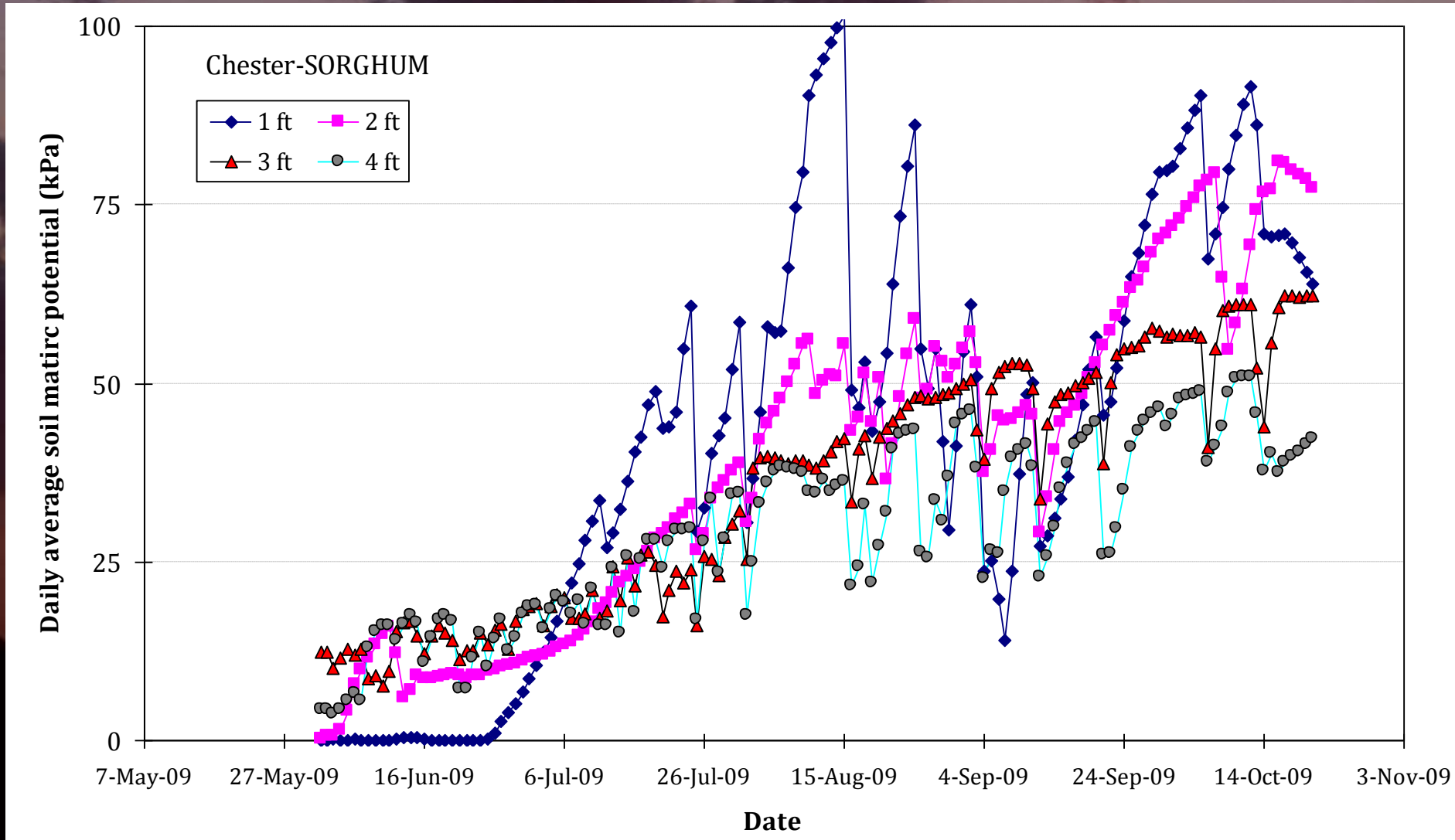
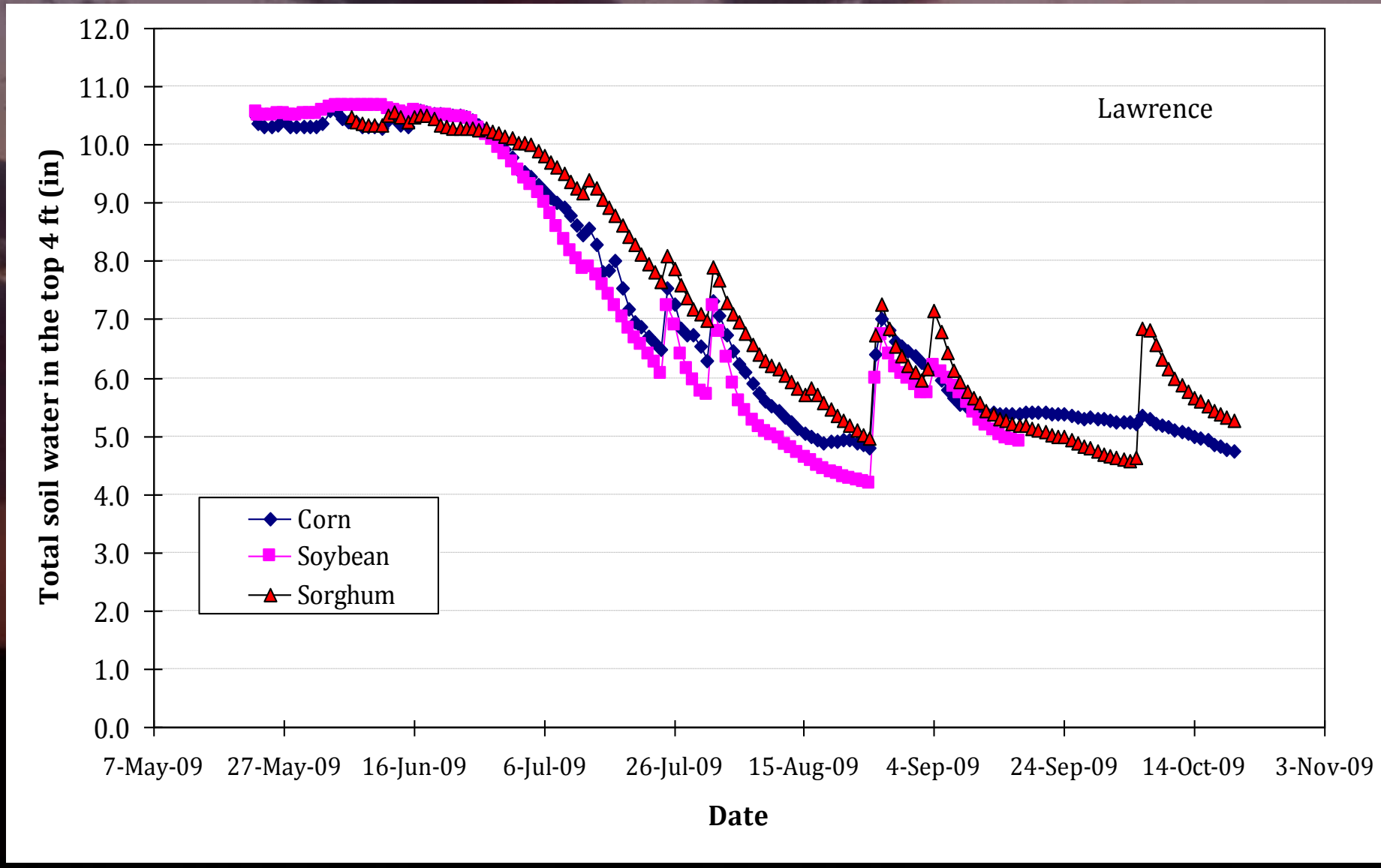


# *Trend of daily total soil water in the top 4 ft - Lawrence*



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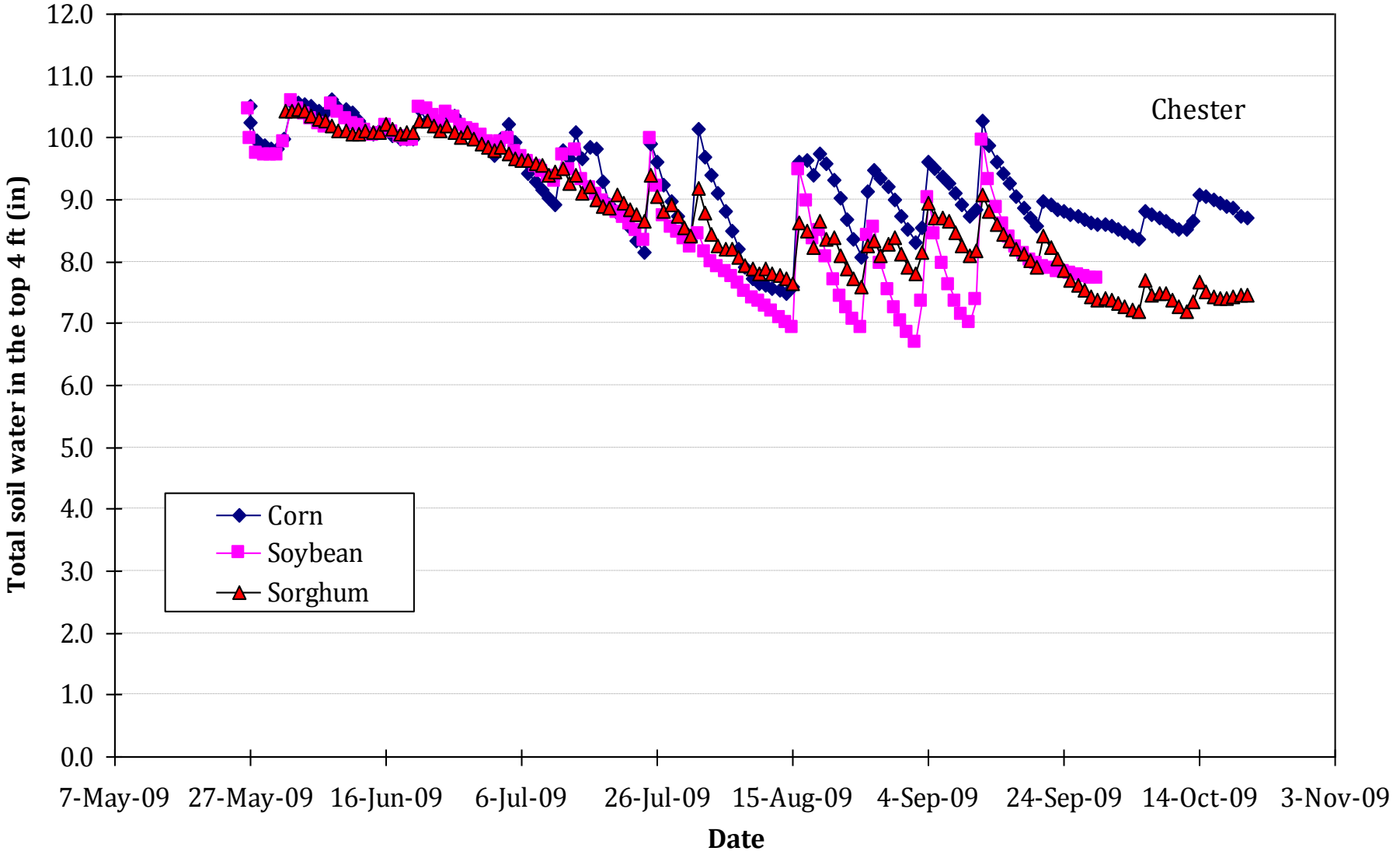


# *Calculation of Crop Evapotranspiration*

- General soil water balance equation was used to quantify crop evapotranspiration as a function of water input and output to and from the field:

$$ET_c = (TSWi - TSWe) + rainfall - RO - DP$$

where:

$ET_c$ = crop evapotranspiration (in)
**TSWi** = initial available soil water at the beginning of season (in)
**TSWe** = available soil water at the full maturity (in)
RO = Runoff (assumed zero)
DP = Deep percolation (assumed zero)

# *Crop Evapotranspiration for Each Site*

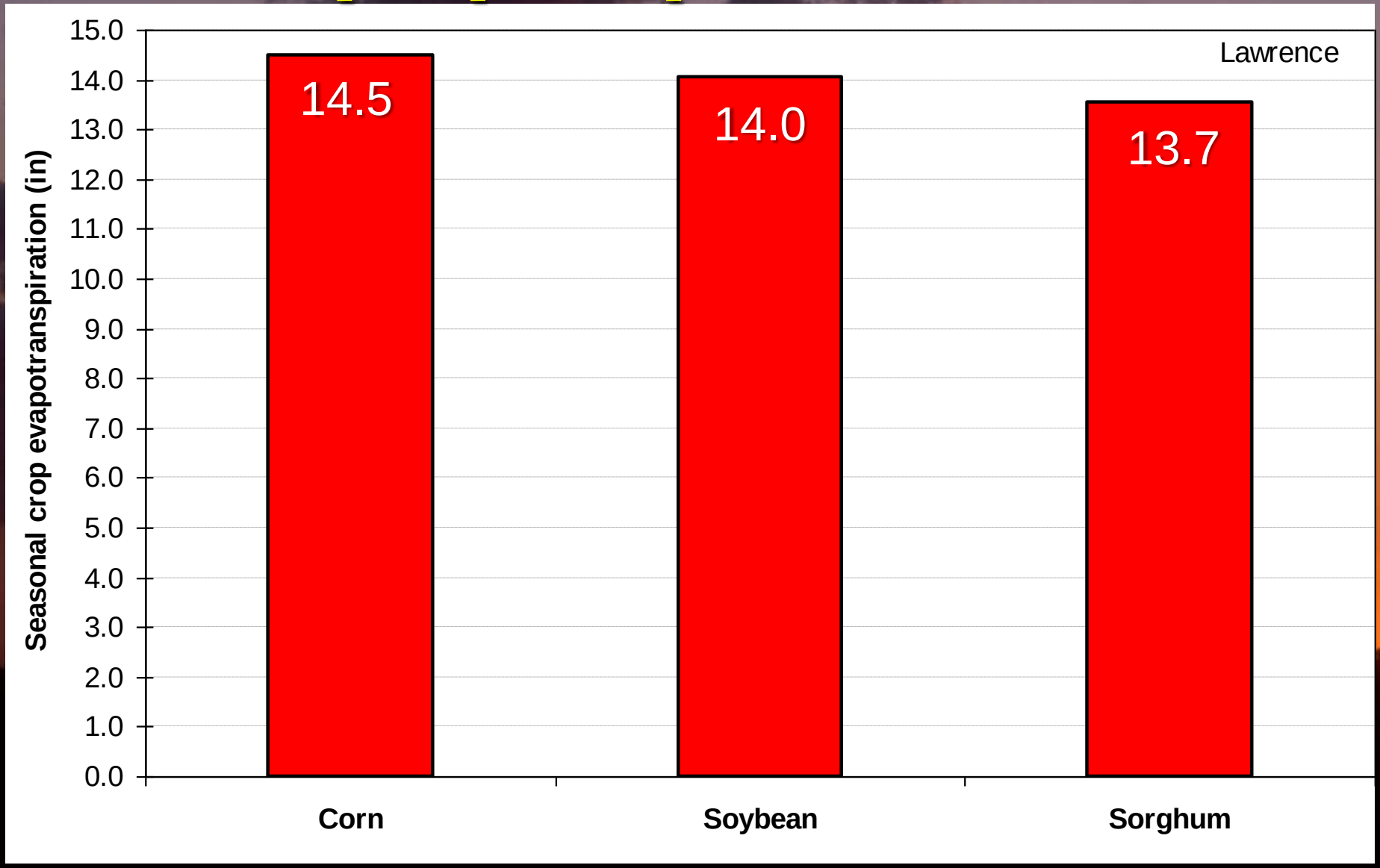
## Lawrence

| Crop | Rainfall (in) | TSWi (in) | TSWe (in) | ETc (in) |
|---|---|---|---|---|
| Corn | 9.21 | 10.5 | 5.2 | 14.51 |
| Soybean | 8.84 | 10.6 | 5.4 | 14.04 |
| Sorghum | 9.96 | 10.4 | 6.8 | 13.56 |

## Chester

| Crop | Rainfall (in) | TSWi (in) | TSWe (in) | ETc (in) |
|---|---|---|---|---|
| Corn | 15.75 | 10.5 | 8.4 | 17.85 |
| Soybean | 15.05 | 10.4 | 8.6 | 16.85 |
| Sorghum | 13.59 | 10.3 | 7.7 | 16.19 |

# *Crop evapotranspiration - Lawrence*



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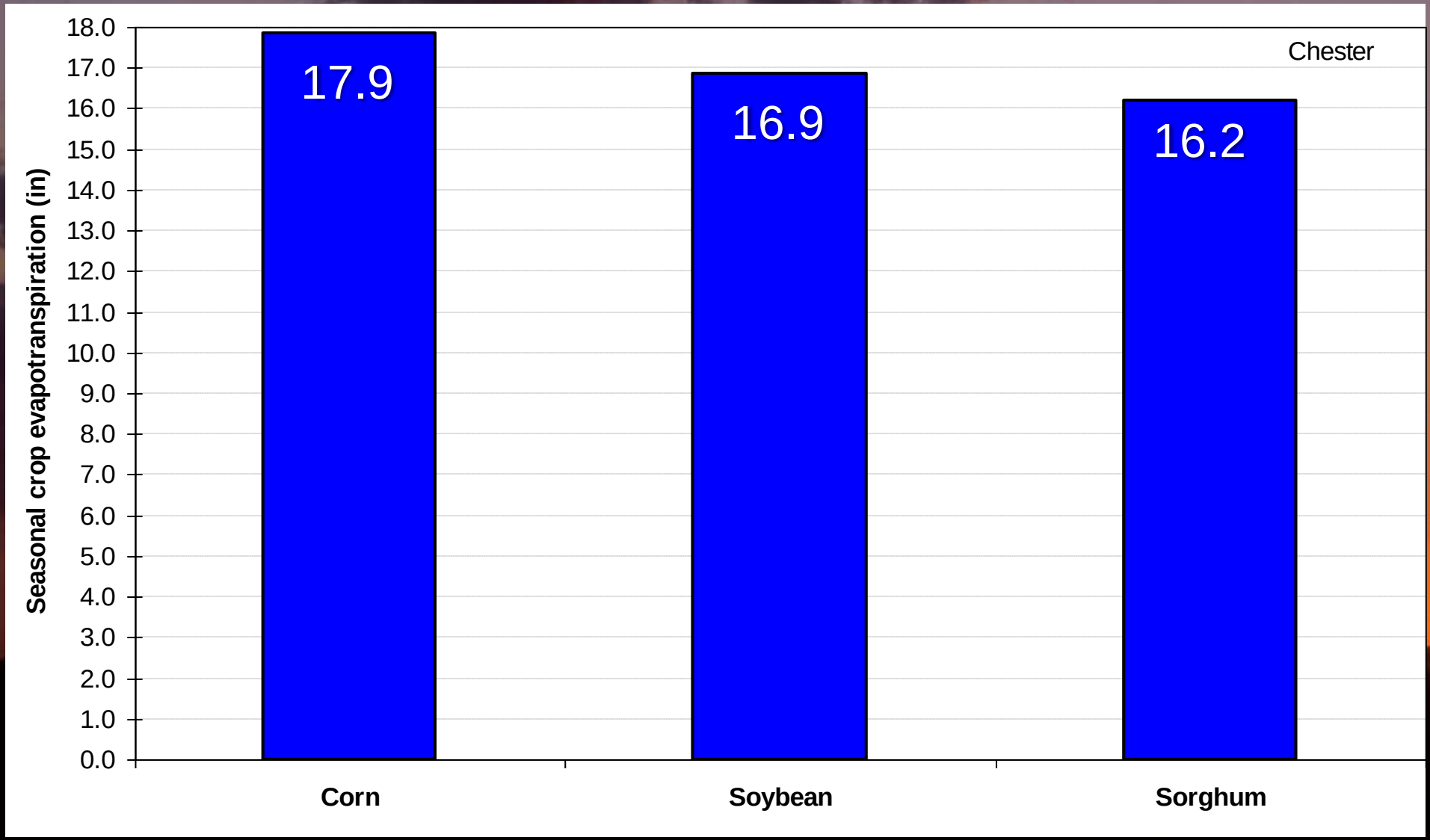
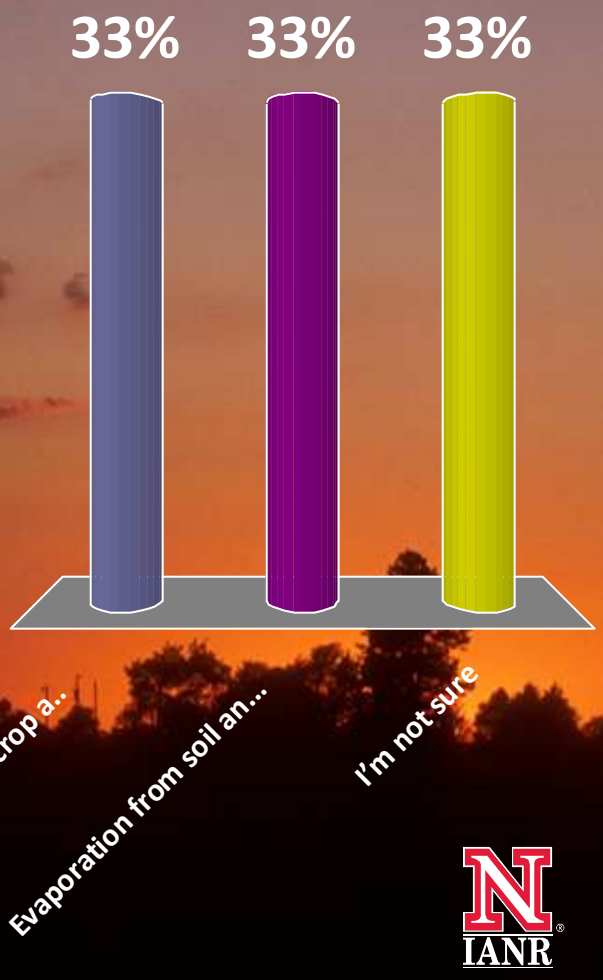


# Yield Data

| Location | Corn | Sorghum | Soybeans |
|---|---|---|---|
| Lawrence | 97.5 bu/A | 77.4 bu/A | 33.4 bu/A |
| Chester | 113.1 bu/A | 98.7 bu/A | 33.3 bu/A |

# Evapotranspiration means:

1. Evaporation from crop and transpiration from soil
2. Evaporation from soil and transpiration from crop
3. I'm not sure



# Are you interested in participating in NAWMDN (irrigation scheduling)?

33% 1. Yes

33% 2. No

33% 3. Already am involved

# This study found greatest ET use in which crops?

| | |
|---|---|
| 25% | **1.** Corn > Soybean > Sorghum |
| 25% | **2.** Sorghum > Soybean > Corn |
| 25% | **3.** Soybean > Corn > Sorghum |
| 25% | **4.** Soybean > Sorghum > Corn |

# Thank You!

- John Dolnicek and James Vorderstrasse
- Nebraska Grain Sorghum Board
- Little Blue NRD-Daryl Andersen
- Dr. Suat Irmak-UNL Extension Irrigation Specialist
- Dr. Charlie Wortmann-UNL Extension Soils Specialist
- Dr. Mark Bernards-UNL Extension Weed Scientist
- Lowell Sandell-UNL Extension Weed Scientist

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