Agriculture and Natural Resources

Corn Irrigation Water Management Using ET and Soil Moisture Sensors
Texas AgriLife Extension Service
Colorado County, 2011
Cooperators: Mahalitc Brothers Farms, Fitz Leopold

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Summary

Colorado County, located in the Coastal Bend Region of Texas, is comprised of about 32% cropland with rice and corn being the primary produced grains. Much of the cropland is irrigable, with surface-furrow irrigation commonly used. Crop yields were widely reduced in recent years due to inadequate irrigations and insufficient rainfall. Growers are beginning to adopt center pivot irrigation which required different water management practices than surface irrigation.

Two on-farm irrigation water management of corn demonstrations were conducted in Colorado County in 2011 with:

- center pivot irrigation
- surface-furrow irrigation

On each field, one station of soil moisture sensors (Irrometer, WaterMark Sensor) was installed, with sensors placed at 1-ft, 2-ft and 3-ft. The cooperators regularly read the sensors and transmitted the data along with irrigation and rainfall data to Extension Ag Engineering in College Station. The data was graphed and displayed on the TexasET Network Website (http://TexasET.tamu.edu). The information was used along with real-time ET (evapotranspiration) data in order to determine the timing and amount of irrigations.

Objective

The goal was to demonstrate how to use soil moisture and ET data for determining timing, amounts, and need for irrigation.

Materials and Methods

With assistance from Extension Ag Engineering, the two cooperators installed soil moisture sensors (Irrometer, WaterMark Sensors) at one location in each of their fields. Sensors were placed at depths of 1-ft, 2-ft and 3-ft. They regularly read the sensors using a hand-held meter, and sent the readings along with rainfall and irrigation amounts to College Station using email and/or cell phone texts. Extension Ag Engineering then graphed the data and posted the graphs on the TexasET Network Website (http://TexasET.tamu.edu). These graphs were continuously updated during the growing season and used to make irrigation decisions.

Grower	Mahalitc Brothers Farms	Fitz Leopold
Field Size	190 Acres	20 Acres
Planting Date	March 12, 2011	March 11, 2011
Sensor Install Date	March 28, 2011	May 7, 2011
Maturity Date	June 15, 2011	June 26, 2011
Harvest Date	July 26, 2011	July 15, 2011
Total Rainfall	2.5 inches	2.0 inches
Total Irrigation	7.0 inches	8.3 inches
Soil Type	Norwood Loam & Mohat Loam	Laewest Clay
Irrigation System	Center Pivot	Surface/Furrow with Gated Pipe
# of Irrigations	6	2

*Table does not reflect any pre-plant irrigation or rainfall

Crop water requirements (ETc) was calculated using potential evapotranspiration (ETo) taken from the TexasET Network Website (http://TexasET.tamu.edu) for the Ft Bend weather station. Crop water requirements were calculated using the following crop coefficients (Kc):

Growth Stage	Crop Coefficient (%)
Seed	0
Emergence	0.35
2 Leaf	0.45
4 Leaf	0.70
6 Leaf	0.85
10 Leaf	1.00
12 Leaf	1.15
14 Leaf	1.20
Tassel	1.25
Silk-Blister-Milk	1.30
Dough	1.20
Dent	1.00
½ Maturity	0.90
Black Layer	0.70
Harvest	0

Results and Discussion

Soil moisture graphs are shown below which also give irrigation and rainfall events, and are used to track soil moisture levels and how they respond to irrigation and rainfall events, root growth and crop water demand. The standard recommendations based on soil type are to keep soil moisture above about 40-60 cbars for loams, and about 80 cbars for clays. However, soil properties vary significantly,

and trial and error or detailed laboratory analysis of soil samples is needed to determine the actual soil moisture levels to use to trigger irrigation. Based on an analysis of the soil moisture charts below and the yield obtained, it appears that the standard recommendations for moisture levels in these two soils are too low.

Cooperator 1: Mahalitc Brothers Farms

Yield: 111 bu/ac

Total Crop Evapotranspiration: 27.37 inches

Lighter loam soils, like in this field, require more frequent irrigations than heavier soils due to differences in soil water holding capacity. The chart for the Mahalitc farm indicates:

- significant mid-season water stress occurred
- irrigation may have been terminated too early, thereby contributing to lower yields than were possible
- the amount of water put out at each irrigation was insufficient to keep up with crop water demand.

Cooperator 2: Fitz Leopold

Yield: 111 bu/ac

Total Crop Evapotranspiration: 26.28 inches

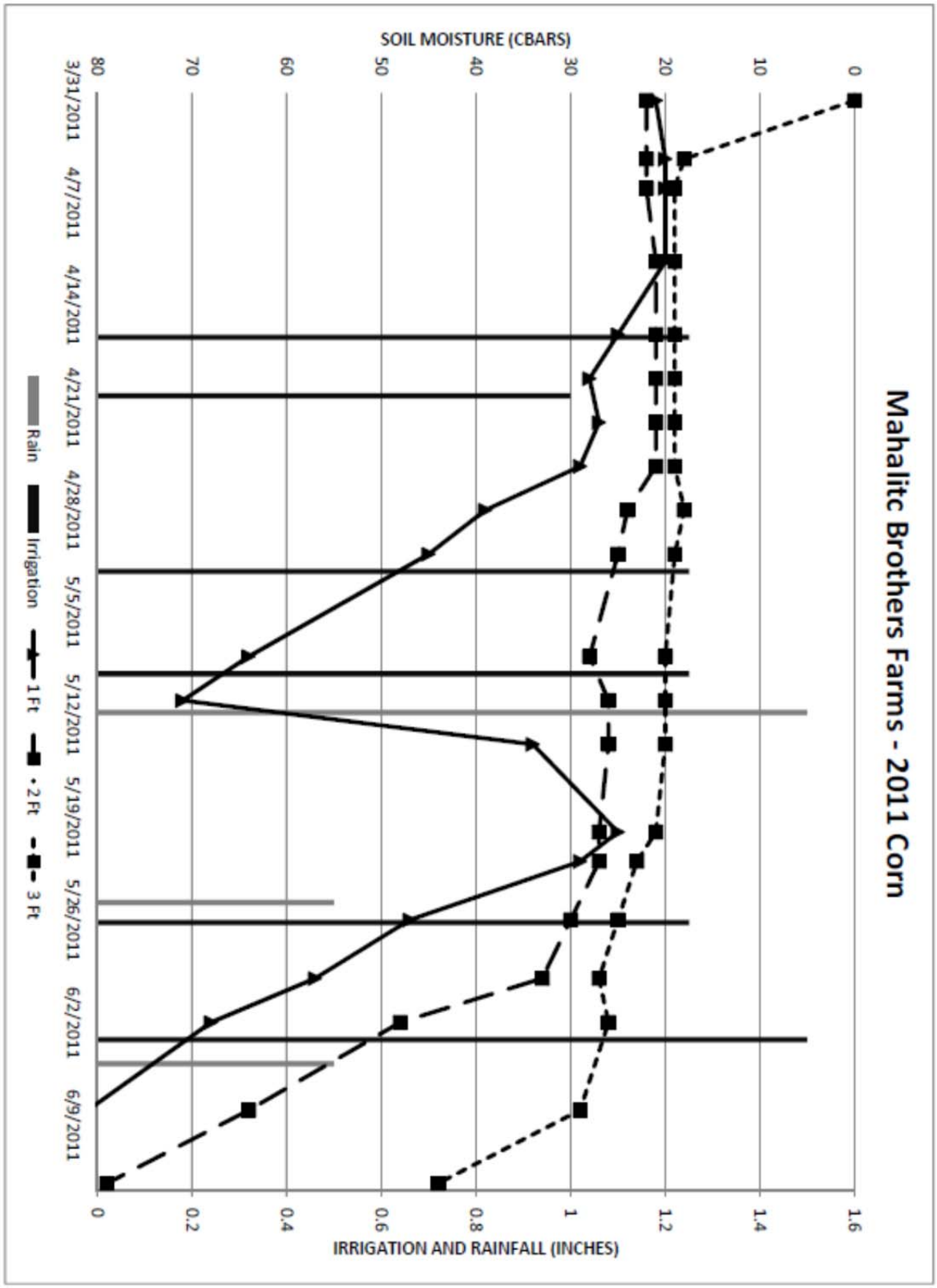
The soil moisture chart for Leopold is show below. In general, heavier soils allow less frequent irrigations than lighter soils. The chart indicates that there may have been some early season and late season water stress. Based upon the yield obtained, it appears that soil moisture levels, particularly at one and two feet need to be kept higher in order to achieve higher yields

Conclusions

The use of soil moisture sensors continues to be a valuable decision making tool. Due to a historic record drought throughout the State as well as Colorado County, less than 3 inches of rainfall occurred between the planting and harvest date compared to over 14 inches received in 2010. The widespread failure of dryland corn in 2011 shows the value of irrigation in dry years. As a result of this second year demonstration, the skill levels of the cooperators in use of soil moisture sensors for irrigation water management increased significantly, and their need for assistance from Extension decreased compared to the previous year. Both cooperators have indicated their intent to keep monitoring soil moisture as a part of their irrigation management plans.

Acknowledgements

We would like to acknowledge Colorado County Extension Agent, Kara Matheney for her assistance in working with the growers to collect data during the course of the demonstration.



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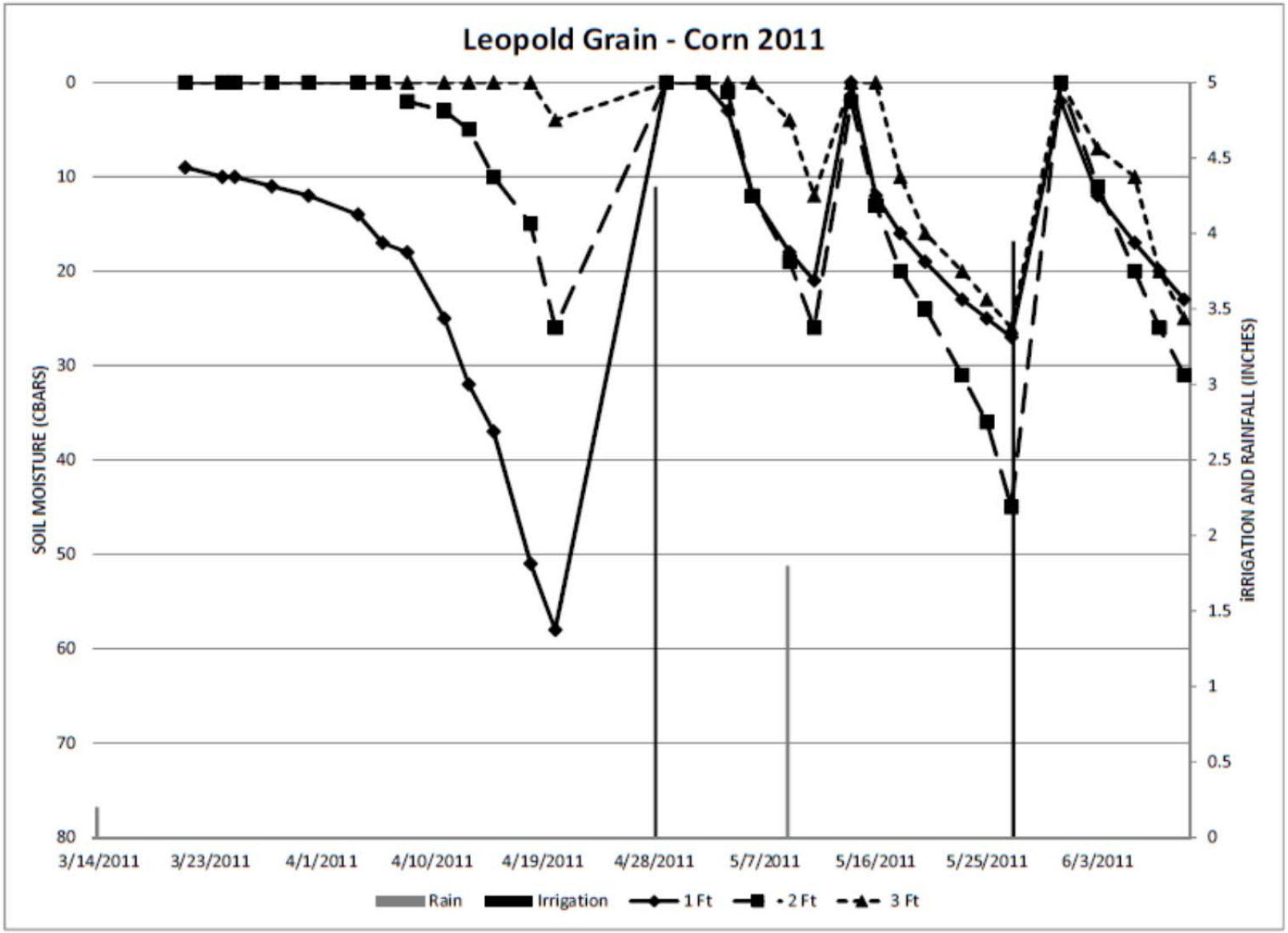
Leopold Grain - Corn 2011
SOIL MOISTURE (CBARS)
IRRIGATION AND RAINFALL (INCHES)
0
10
20
30
40
50
60
70
80
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
3/14/2011
3/23/2011
4/1/2011
4/10/2011
4/19/2011
4/28/2011
5/7/2011
5/16/2011
5/25/2011
6/3/2011
Rain
Irrigation
1 Ft
2 Ft
3 Ft