



Vineyard Irrigation Water Management with Soil Moisture Sensors
Texas AgriLife Extension Service
Burleson County
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Summary

Growth in the Texas Winegrape market has resulted in an increasing number of vineyards being established around the state. An estimated 3000 acres of bearing acreage currently exist in the state. An on-farm irrigation water management demonstration was conducted in Burleson County for 2011 on a recently established vineyard. Soil moisture sensors were installed in three (3) fields of 4-year old, 3-year old and 2-year old vines. The soil moisture data is used here to evaluate the effectiveness of the irrigation schedule used, which consisted of a fixed irrigation amount with frequency determined by plant inspection.

The results indicate that a more flexible irrigation schedule with larger irrigation volumes was needed to meet crop water requirements and to prevent stress during critical growth stages. The data also indicates that water requirements are different depending on the age of the vines and the season of the year.

Objective

The goal of the demonstration was to demonstrate how to use soil moisture sensors (WaterMark) as a tool for determining the timing and amount of irrigation needed.

Materials and Methods

The cooperator installed soil moisture sensors (Irrrometer, WaterMark Sensors) in fields comprised of 4-year old, 3-year old and 2-year old vines. One set of sensors was installed in each field at depths of 1-ft, 2-ft and 3-ft. The grower took occasional readings of the sensors using a hand-held meter and emailed them to Extension Ag Engineering, along with irrigation and rainfall data. The data was graphed and posted continuously throughout the growing season on the TexasET Network Website (<http://TexasET.tamu.edu>). Additional graphs were produced which compare applied water to estimated crop water requirements (ETc).

ETc was calculated using the ETo (potential evapotranspiration) from the TAMU Golf Course weather station along with a crop coefficient of $K_c = 0.8$. The irrigation schedule was the same for all fields. Typically, each irrigation event was for one hour and put out 0.15 inches. Irrigation volumes was not measured but estimated using the drip emitter flow rate (3 gallons per hour), runtime and wetted area. The wetted diameter was determined by visual inspection during irrigation events.

Mound Prairie Vineyard 2011 Irrigation Demonstration Results			
	Station 1	Station 2	Station 3
Grape Variety	Black Spanish (Lenoir)	Blanc du Bois	Blanc du Bois
Number of Vines	150	500	750
Vine Age (Years)	4	3	2
Estimated Yield	400-500 lbs.	NA*	NA*
Soil Type	Robco Loamy Fine Sand		
Irrigation Method	Drip, 3 GPH Emitters		

The frequency of irrigation was adjusted by the grower during the course of the year based on visual inspection of the plants and the current fruit growth stage.

A total of 18 soil moisture readings were taken in 2011. Normal recommendations are to check soil moisture levels on at least a weekly basis. Rodents appear to have damaged the soil moisture sensor installed at 3-ft in Station 1 (4-Year Old Vines). The 1-ft readings from Station 2 (3-Year Old Vines) was faulty and are not included in this analysis.

Results and Discussion

The weekly irrigation volumes during the growing season are shown below. Also, 2011 was a drought year. From January 11 to November 27, 2011, only 15 inches of rainfall occurred which is about 37% of normal, thus requiring a continuous need to irrigation. An irrigation controller failure resulted in no irrigation for 8 days in June.

Seasonal Irrigation Frequency			
Date	Frequency	Runtime/Day	Estimated. Irrigation/ Week
March 1-June 10	3 Days/Week	1 Hour	0.45 inches
June 11-June 19	No Irrigation*	No Irrigation*	0*
June 20-November 5	6 Days/Week	1 Hour	0.9 inches
November 6-December	3 Days/Week	1 Hour	0.45 inches

*Controller Error Resulted in No Irrigation

Graph #1 shows the cumulative irrigation and rainfall compared to estimated crop water requirements (ETc). Also shown on Graph #1 are the nine (9) rainfall events that occurred in 2011. Irrigations and rainfall exceeded ETc during the first half of the year, but was insufficient to meet water requirements during the second half of the year. Most crops, including grapes, have the highest water requirement during the summer months, typically June through August. For grapes, this is the time when fruit growth is at its greatest.

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Results by Field

Station 1

There was plenty of moisture at 1-ft throughout the growing season, with minor decrease in soil moisture during the peak growth stage. However, crop stress is evident by the changes at the 2-ft depth during July-August, which show rapid decline in soil moisture beginning early July and a reading below 80 cbars for 60 days. These readings also indicate that the 4-year old vines had significant root mass at two feet, and that irrigation amounts and frequency were inadequate to meet ETC.

Station 2

There were problems with the data from 1-ft depth, and this data is not included in this analysis. Drastic depletion of moisture at 2-ft indicates early season water stress in the 3-year old vines. Soil moisture levels improved somewhat by June, but irrigation amounts and frequency appear to be inadequate to meet plant water requirements. The data also shows that the vines extracted water from the 3-ft depth.

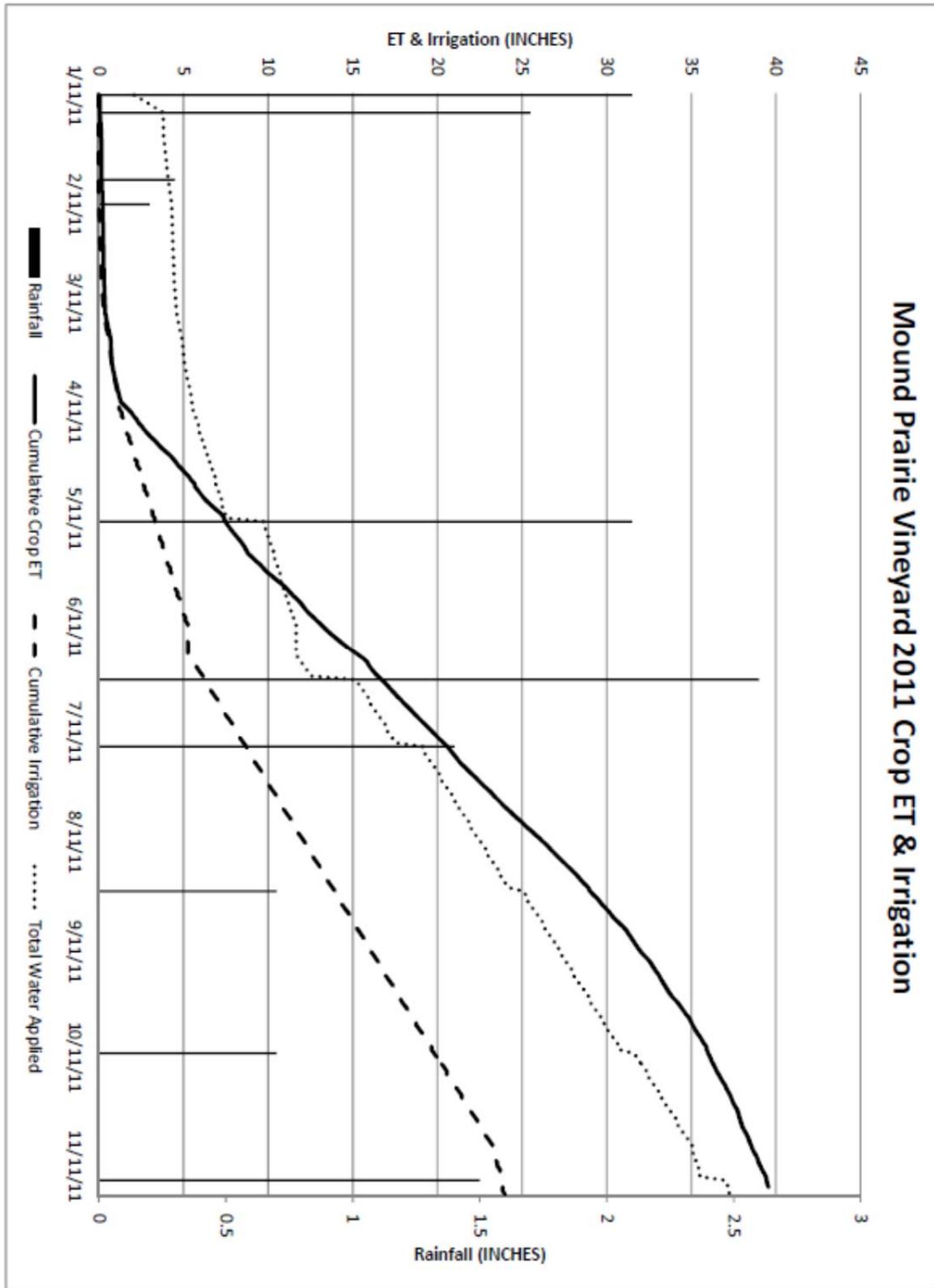
Station 3

Station 3 contained the youngest vines in the vineyard (2-year old). Sensor readings showed a high fluctuation in soil moisture at all three depths, especially during July and August. This data indicated that irrigation volumes were inadequate, as soil moisture fell below a reading of 80 cbars at least three times. Depletion of moisture at 3-ft profile continued into the fall, likely also resulting in late season water stress.

Conclusions

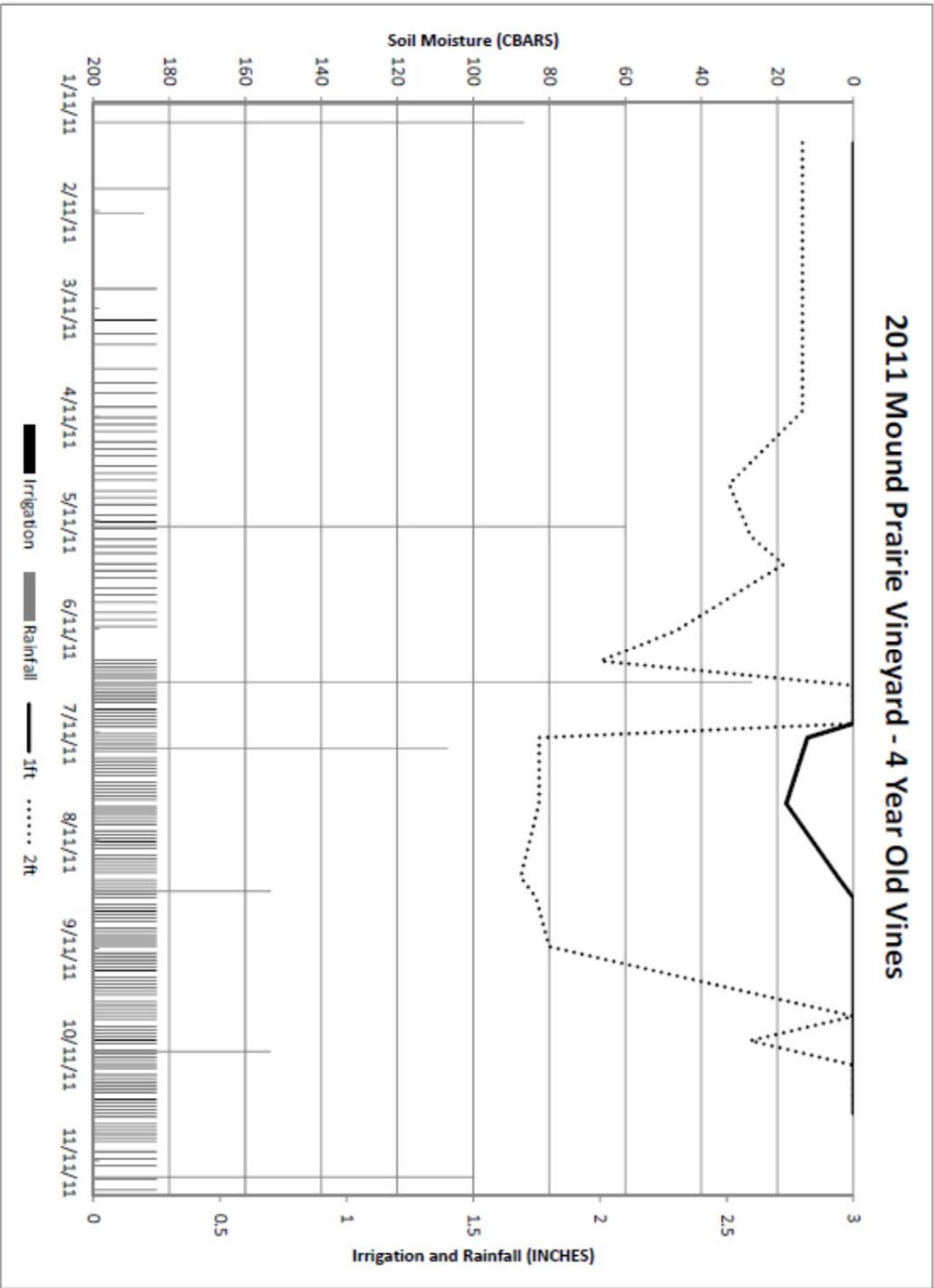
It appears that irrigation amounts and frequency was inadequate which resulted in plant stress occurring in all three fields at various times during the growing season. Although all three fields had identical irrigation schedules, soil moisture data indicates that water demand varies depending upon the age of the vines. The four year old vines appear to require more water from June to September, 3-year old vines from January to June, and 2-year old vines from June to November. Continued and more frequent readings of soil moisture are needed to accurately determine the actual water demand of vineyards throughout the year.

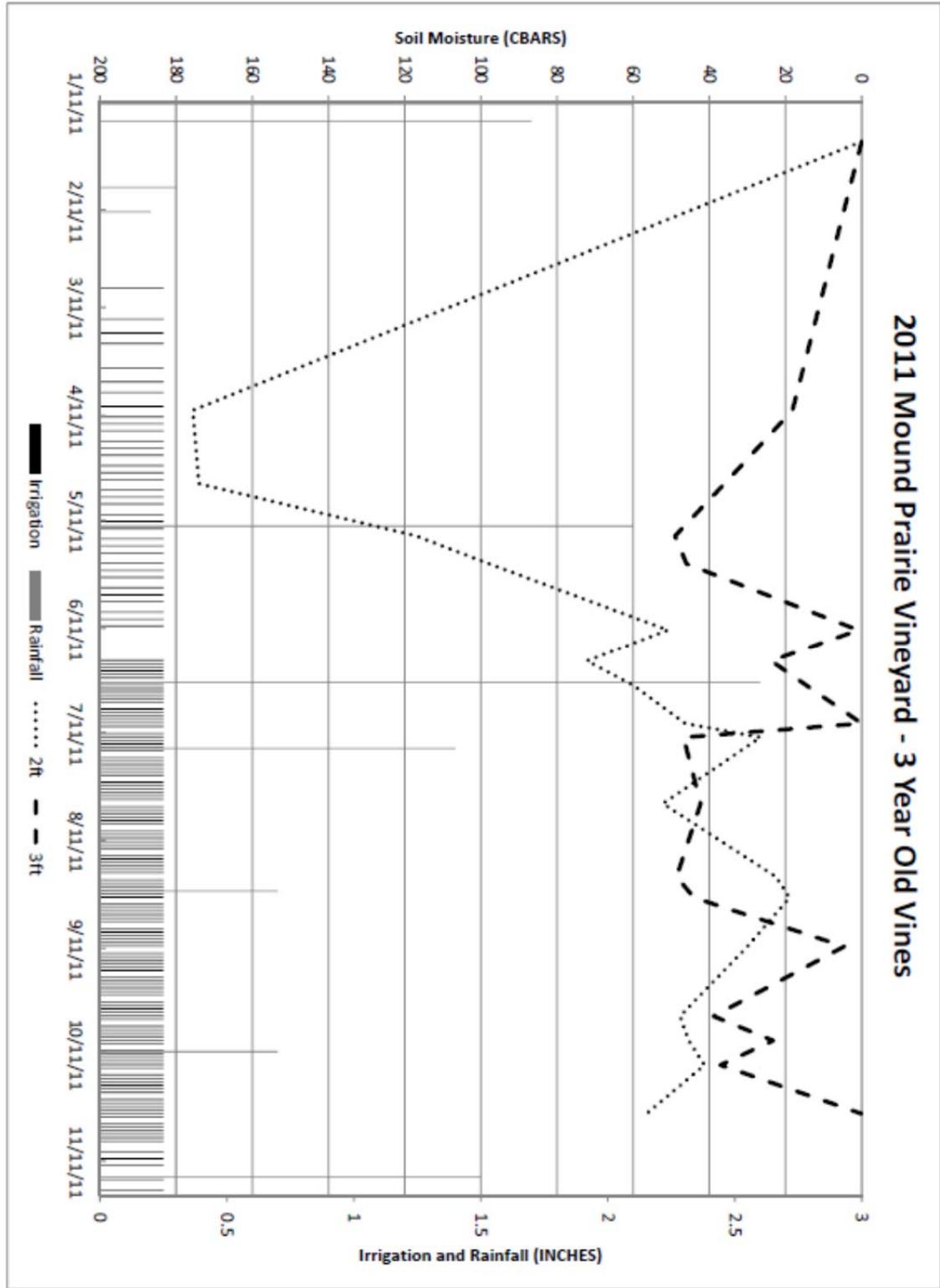
Mound Prairie Vineyard 2011 Crop ET & Irrigation



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2011 Mound Prairie Vineyard - 4 Year Old Vines





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Mound Prairie Vineyard - 2 Year Old Vines

