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Soil water potential as related to the Crop Water Stress Index of irrigated cotton

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SOIL WATER POTENTIAL AS RELATED TO THE CROP WATER STRESS INDEX OF IRRIGATED COTTON

by

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APPROVAL BY THESIS DIRECTOR

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ABSTRACT

The application of the crop water stress index (CWSI) method to irrigation scheduling is enhanced by knowledge of the relationship between CWSI and soil water potential (SWP) and how this relationship is affected by soil texture.

A study using the same cultivar of cotton on three different soils was conducted in southern Arizona over a single growing season. Detailed data were collected of CWSI and soil moisture content for several treatments that scheduled irrigations at threshold CWSI values.

CWSI was correlated with soil water potential values calculated from pressure plate determined moisture release curves. Spatial variability of soil characteristics necessitated use of average rather than plot specific moisture release curves. Analysis showed a linear CWSI-SWP relationship that varied greatly with soil depth and study site. The study concluded that soil profile average SWP alone does not normalize the CWSI between sites with different soil textures.

Chapter 1

INTRODUCTION

1.1 Scope and Purpose

Cotton remains the largest agricultural crop in Arizona, accounting for 43 percent of the cultivated acreage in the state. It is also the single largest user of water, using 45 percent of the total irrigation water applied (Arizona Agricultural Statistics Service, 1985). Arizona also contains one of the fastest growing urban centers in the country which is competing directly for the state's limited water resources. As this competition for water continues between the agricultural sector and the perhaps more politically favored urban population, irrigators are more and more pressed to increase the efficiency of their water use.

Farmers that rely strictly on experience and visual observations of the crop for scheduling irrigation typically over-irrigate or irrigate too late, after water stress damage to the potential yield has already occurred. The integration of more objective or more discerning measurements into the irrigators management of irrigation, or irrigation scheduling, can greatly increase the yield and/or reduce the necessary amount of irrigation water.

1.1.1 Irrigation scheduling. The variety of techniques employed for scheduling irrigations fall into several categories according to the measurements or models on which they are based. These groupings

(Stegman, 1983) are those methods employing, or combining: soil based measurements, plant based measurements, evaporation devices, or a computed water balance. Among those utilizing a measurement of the growing plant is the crop water stress index. The crop water stress index uses measurement of the temperature of the crop canopy and measurements or estimates of environmental parameters to estimate the moisture status of the plant. These parameters include net radiation, air temperature and humidity, and wind speed.

1.1.2 **The crop water stress index.** The crop water stress index (CWSI) has received much attention due to its potential for providing irrigation scheduling information from remotely sensed crop temperatures. The original formulation by Idso et al. (1981) of the empirical CWSI was followed by a "theoretical" CWSI proposed by Jackson et al. (1981). The empirical form of the CWSI was used for this study.

The empirical CWSI uses measurement of the difference in temperature between the crop canopy and the air, and the vapor pressure deficit (VPD) of the air to arrive at an index of crop stress. The theoretical CWSI requires measurements of net radiation and wind speed to perhaps better estimate the plant stress. This advantage may, however, be largely negated by increased errors in measurement of the extra parameters. The CWSI is defined so that a non-stressed plant has a CWSI of zero and the CWSI of a fully stressed crop is one.

The convenience to the irrigator of the CWSI method for scheduling irrigation and it's potential for application to automation of scheduling irrigation has engendered interest by researchers,

manufacturers of infrared thermometers (IRT), and automation equipment, irrigation scheduling services and to some degree farmers themselves. Initial studies have illustrated the validity of the method for some crops and current research is mainly one of refining the method and its application to commercial agriculture.

The soil water holding capacity is directly affected by soil texture. Consequently, soil texture is important to the irrigator and to the design of irrigation systems, as it directly affects the depth and frequency of irrigation. However, the effects of soil texture on CWSI measurements are currently unclear.

The use of soil water potential, which is a measure of the energy required to remove soil water, rather than soil water content in a sense "normalizes" soil moisture status for soil texture. A number of researchers have related CWSI to soil moisture content or available water (Geiser et al., 1982; Jackson et al., 1981; Nakayama and Bucks,1983; Shih et al., 1986). A few (Zeywar, 1988) have related it to soil water potential.

Further research into the field verification and application of the CWSI requires knowledge of the sensitivity and response of the CWSI to soil parameters. The IRT, by taking the temperatures of many plants, integrates the value over the area of the field scanned. Soils information obtained by most techniques, whether it be moisture status or soil texture, is a point measurement and is inconvenient and more expensive to obtain. In order to verify the CWSI model on a field scale in terms of moisture extraction, soil moisture measurements are

likely to be a bottleneck. Recommendations on the frequency, depths, and type of soil monitoring that correlate with the CWSI would be of benefit to the researcher.

Of concern to the irrigator is the level of CWSI at which to irrigate. This may vary with the particular strategy of irrigation scheduling, as it can be optimized to maximize yield per unit area, maximize yield per unit of water applied, or maximize net profit. To carry out these optimizations requires ability to predict yield as a function of the average CWSI experienced by the crop.

1.2 Objectives

The purpose of this study was to explore the sensitivity of the crop water stress index to soil texture. More specifically stated, the objectives are to:

1. Determine if a relationship exists between the CWSI at irrigation and soil water potential across varying soil textures.
2. Determine the effect of soil water potential by depth on the CWSI. Which depth, if any, has the dominant influence on CWSI.

Chapter 2

PREVIOUS RESEARCH

2.0.1 Transpiration. The primary purpose of most leaves is the absorption and conversion of light energy into chemical energy by photosynthesis. The biochemical processes of the plant require that it absorb much more water than is strictly required for its metabolism. This extra water is passed back to the atmosphere as transpiration, the diffusion of water vapor from the humid intercellular air within the leaf through the stomata to the relatively dry air outside the leaf. By virtue of their function, photosynthesis, the typical leaf is designed to absorb solar radiation. Photosynthesis, however, uses only a small fraction of the incident solar radiation resulting in heating of the leaf.

Transpiration is the dominant and all important process in the plant water relations with the soil and the atmosphere. It is a result of the energy gradient that moves moisture into, through, and out of the plant. Although recognizably important, the benefit of transpiration has been debated by researchers alternately arguing that it is necessary for cooling, nutrient circulation, and mineral absorption. Hatfield (1987) suggests that regulation of transpiration is to maintain optimum temperatures for metabolic activity. Kramer (1983) characterizes it as simply an unavoidable evil; "unavoidable because of leaf structure and evil because it often produces water

deficits and injury by dehydration." In any case, evapotranspiration has a cooling effect on the leaf.

2.1 History of leaf- and canopy-air temperature measurements.

Leaf temperatures have been measured by researchers since the middle part of the last century. Ehlers (1915) cites several earlier researchers who used mercury bulb thermometers to measure leaf temperature up to 10 degrees centigrade warmer than the air temperature. Ehlers (1915) himself found similar temperature differences on conifers.

Beginning with research cited by Ehlers (1915) where leaf temperatures were measured with mercury bulb thermometers, a variety of methods have been used to measure leaf temperatures. They were measured most often above air temperature but frequently enough below air temperature to stimulate a lively controversy over the true state of leaf and air temperatures in growing plants. Calculations by Curtis (1938) showing that impossibly high ET rate would be necessary to cool leaves below ambient air temperature only fueled the debate.

With the maturing of leaf energy transfer theories and thermocouple technology in the 1960's researchers began to consistently measure leaf temperatures below ambient air temperatures and to correlate leaf temperatures with environmental parameters, mainly leaf water status and the vapor pressure deficit. The earlier air-leaf temperature results are now attributed to crudeness in measuring techniques, measurement of only upper sunlit leaves in the plant canopy

or measurement on single potted plants which are not representative of a canopy. Many of the earlier measurements were also done in greenhouses or other very humid environments where the leaf temperatures are indeed higher than air temperature due to special circumstances of the energy balance in a humid environment.

The problem of getting representative canopy temperatures resulted in the bulk of the early work in this field being done on single leaves. The development of portable infra-red equipment in the early 1960's allowed researchers to investigate the difference between individual leaves and the canopy as a whole.

2.1.1 **Infra-red thermometry.** The infrared thermometer (IRT) estimates the average surface temperature of all objects in its view by measuring the apparent blackbody radiation R and relating it to the surface temperature θ_s by the Stefan-Boltzmann law,

$$R = \varepsilon\rho\theta_s^4$$

where ε is the emissivity of the surface and ρ is the Stefan-Boltzmann constant (5.674×10^{-8} W m^{-2} K^{-4}) and R is in units of W/m^2. Various research has described the factors such as background and reflected radiation, the emissivity of plant surfaces, ambient air temperature effects on the circuitry of the IRT, and management of reference blackbody sources on IR thermometry as applied to crop temperature. The emissivity of plant surfaces has been shown to be between 0.95 and 1.00 for virtually all plants (Gates, 1964b, Idso et al.,1969, Fuchs and Tanner, 1966, and Blad and Rosenberg, 1976).

Successful use of IR thermometry requires frequent calibration checks, averaging of the temperature values measured from several different view angles to minimize the effects of row direction and sun orientation, and view angles that do not include the soil surface, any buildings, background sky or mountains in the field of view of the IRT.

With the development of infrared techniques for measuring surface temperatures the specifics of the energy balance of the leaf began to be explained. Gates (1964a) measured the Bowen ratio (the ratio of sensible to latent heat exchange) of various leaves and found that it varies with position in the canopy. Weigand and Namken (1966) concluded that the interpretation of leaf temperatures required knowledge of plant turgidity and solar radiation. Idso and Baker (1967) explained that although radiation was the dominant mode of energy transfer for individual leaves, transpiration was the dominant factor in determining the canopy temperature as a whole. Clark and Hiler (1973), working with peas found that plant water potential was more sensitive to the water status of the plant than leaf diffusion resistance and leaf-air temperature differences. They suggested that direct measurement of the plant water status rather than that of the soil be used for irrigation scheduling.

2.1.2 Leaf-air temperature measurements for irrigation scheduling. Using fine wire thermocouples on cotton leaves, Ehrler (1973) looked at the possibility of using leaf-air temperature differences to schedule irrigations. He concluded that leaf-air

temperature difference (ΔT) alone was not adequate for scheduling irrigations and that other parameters would have to be known to relate ΔT to the plant water status. These other parameters were vapor pressure, solar radiation, and the particular plant species. He also recognized the considerable problem of getting temperatures representative of the average canopy temperature with a point measurement as with thermocouples. Blad et al. (1982) further documented the variability in leaf temperatures by finding greatly varying leaf temperatures on adjacent plants.

Several proposals were made for the use of canopy-air temperature measurement for scheduling irrigations.

2.1.3 Canopy temperature variability method. Aston and Van Bavel (1972) attempted to correlate canopy temperature with soil water depletion and found large temperature variation within the field which they attributed to differential drying due to inherent non-homogeneity of the soil. Blad et al. (1981) and Clawson and Blad (1982) tested the concept, termed the canopy temperature variability (CTV), by irrigating when the standard deviation of midday canopy temperatures within the plot reached a specific value.

2.1.4 Stress degree day method. The stress degree day (SDD) concept was developed by Idso et al. (1977) and Jackson et al. (1977). They reasoned that the SDD, defined as the difference between the canopy temperature and the air temperature, would increase with increasing plant stress. The cumulative seasonal SDD was used by several researchers to successfully predict yield of several different

crops. Idso et al. (1977) applied the SDD concept to scheduling irrigation by zeroing the cumulative SDD after an irrigation and then irrigating again when the cumulative SDD reached a particular value.

2.1.5 Temperature stress day method. Heermann and Duke (1978) used the average temperature difference between treatment plots and adjacent well-watered areas to schedule irrigation. They concluded that an average temperature difference of 1.5 degrees centigrade correlated significantly with yield reduction. Clawson and Blad (1982) and Gardner et al. (1981) used a similar well-watered reference plot to define the temperature stress day (TSD). They considered this TSD and the CTV method to successfully integrate the environmental effect on evapotranspiration.

2.1.6 Other methods. Hiler and Clark (1971) defined the stress-day-index which was used by Hiler et al. (1974) for timing irrigations. More recently, Geiser et al. (1982) and Slack et al. (1981) combined canopy-air temperature difference with net radiation, vapor pressure, and soil moisture to schedule irrigations. They demonstrated a water saving with no yield reduction over other methods of scheduling.

2.1.7 Crop water stress index. Building on the success of the stress-degree-day method for predicting water stress and crop yield, Idso et al. (1981) recognized, from energy balance considerations, the influence of environmental factors such as air vapor pressure, net radiation, and wind speed on the stress-degree-day parameter. They observed that under daytime non-water-stressed conditions a variety of crops exhibited a linear relationship between the foliage-air

temperature difference and the air vapor pressure deficit. Over a wide range of vapor pressure deficits they were able to describe crop specific linear "non-stressed" or lower baselines. Using a non theoretical argument to "explain" the apparent vapor pressure gradient at zero vapor pressure deficit, they postulated an upper baseline that represents the maximum canopy-air temperature difference. These empirical data led them to describe the crop water stress index requiring only measurement of the canopy-air temperature difference and the air vapor pressure deficit.

2.2 The Crop Water Stress Index

The crop water stress index quantifies plant water stress by considering the ratio of actual evapotranspiration to potential evapotranspiration as manifested by the evaporative cooling of the plant canopy relative to air temperature. The canopy air temperature difference may be related to the level of plant stress by two different methods. An "empirical" CWSI, while perhaps more suspect in its development, requires fewer inputs. The "theoretical" CWSI possibly better describes plant stress but requires additional parameters which are more difficult to measure or estimate.

2.2.1 Empirical approach. Idso et al. (1981) proposed a crop water stress index based on upper and lower limits to the canopy-air temperature difference and the VPD. A horizontal upper baseline forms the maximum value of the canopy temperature minus the air temperature (Figure 1). This is considered to occur under no transpiration, or

maximum stress. The lower limit of the canopy air temperature difference, known as the non-stressed baseline, occurs under maximum evapotranspiration and maximum cooling. This is assumed to represent zero stress and occurs at potential evapotranspiration. The canopy-air temperature difference for any VPD condition will fall within the envelope enclosed by the upper and lower baselines in Figure 1. The crop water stress index then for a point is defined as the ratio of its distance from the lower baseline to the total distance between the two baselines at a specific VPD. Therefore, the CWSI ranges from zero for a non-stressed plant to 1 for a fully stressed plant. For the point P, the CWSI is equal to the ratio of the lengths c/(c+d).

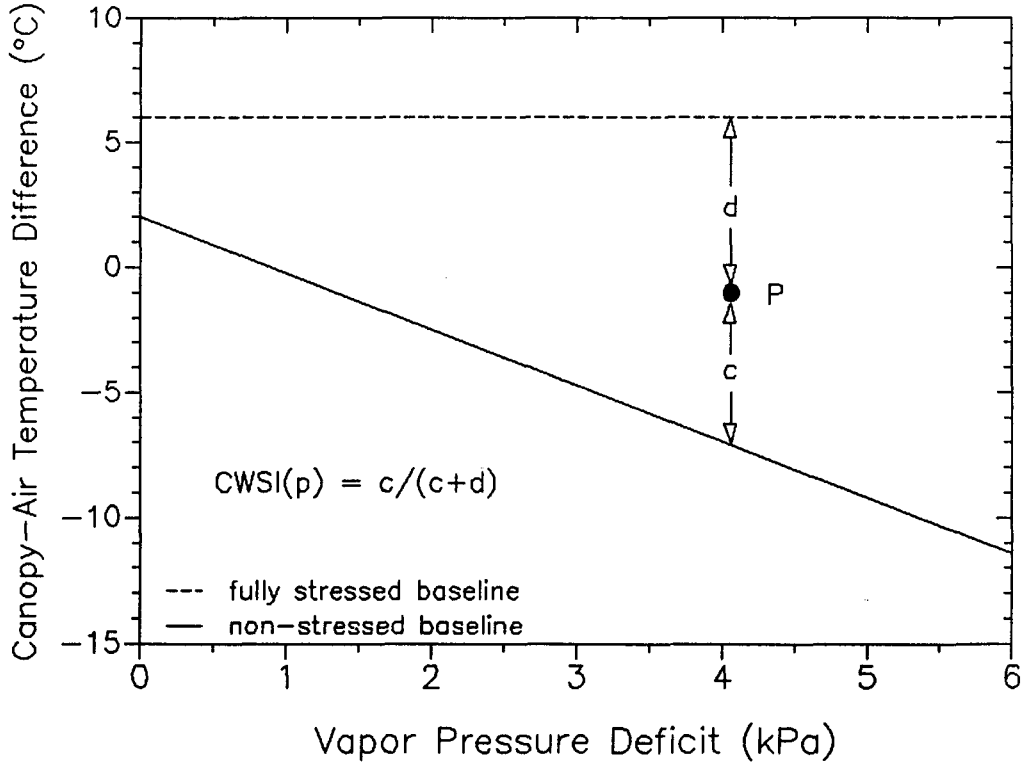

Figure 1 Graphical representation of the CWSI baselines and calculation of the empirical CWSI.

The lower baseline is an empirically observed crop specific linear relationship. The upper baseline is a temperature and radiation dependent construct developed from the derived "intersection" of the two baselines. The empirical CWSI is calculated by

$$CWSI = \frac{(T_c - T_a) - [a_0 + a_1(e_0 - e_a)]}{a_1[(e_0 - e_0^*) - (e_0 - e_a)]} \qquad [1.1]$$

where T_c = radiant canopy temperature (°C)
T_a = ambient air temperature 1.5m above canopy (°C)
a_0, a_1 = crop specific coefficients for intercept and slope of non-water stressed baseline
e_a = actual vapor pressure (kPa)
e_0 = saturation vapor pressure (kPa)
e_0^* = saturation vapor pressure at Ta + a_0 (kPa)

The empirical method CWSI assumes nearly constant maximum net radiation and so is valid only for full sunlight. Consequently measurements must be taken near midday and not under cloudy conditions.

2.2.2 **Theoretical approach.** Jackson et al. (1981) presented a theoretical justification of the crop water stress index. The theoretical CWSI takes into account the environmental factors of net radiation and aerodynamic resistance of the crop. Although it has been shown to better model plant stress the additional parameters required have proved to be problematic to measure or estimate.

2.3 Crop stress

Although leaf temperature measurements have been proposed for measuring stress due to toxics, nutrient deficiency, disease, and heat,

of primary concern to the irrigator is water stress. As defined by Kramer (1983) water stress refers to "situations in which plant water potential and turgor are reduced enough to interfere with normal functioning of the plant". The effects of water stress include decreases in plant water potential and transpiration, loss of turgor or wilting, cessation of plant cell enlargement, disruption of metabolic processes, and death.

2.3.1 **Plant water potential as a measure of crop stress.** On the basis of plant physiology Kramer (1983) makes a strong case for the use of plant water potential as the best measure of plant stress. Jackson (1982) concludes however, that "a quantitative measure of plant water stress under field conditions has not been achieved", primarily because of the variability of point measurements. He suggests that for "early" stages of stress, canopy temperature is a better measurement of stress.

2.4 CWSI and soil moisture

2.4.1 **CWSI-Leaf water potential.** Howell et al. (1983), Idso et al. (1982), and Reginato (1983) have all demonstrated clear inversely related linear relationships between CWSI and leaf water potential (LWP), an accepted measure of plant water stress.

2.4.2 **Leaf water potential-soil moisture status.** The relationship between leaf water potential (LWP) and soil water potential (SWP) is complex. The mass flow of water movement can be described by the general transport equation

$$\text{Flux} = -K * \text{driving force} \qquad 1.2$$

where K is a proportionality factor. For the case of water movement

$$\text{Water flux} = \Delta\psi \; / \; r \qquad 1.3$$

where $\Delta\psi$ is the difference in water potential, and r is the resistance to flow. The flow between soil and leaf can then be modeled after Kaufmann (1976) and Kaufmann and Hall (1974) as

$$\text{flux} = (\psi_{\text{leaf}} - \psi_{\text{soil}})/(r_{\text{soil to leaf}}) \qquad 1.4a$$

or

$$\psi_{\text{leaf}} = \psi_{\text{soil}} - \text{flux} * (r_{\text{soil to leaf}}) \qquad 1.4b$$

where ψ is potential. These illustrate the dependence of LWP on rate of transpiration, soil water potential, and the resistances to flow of liquid in the plant. The resistances include stomatal, cuticular, leaf mesophyl, and xylem resistances as well as the root and soil resistances to flow. These resistances and the capacitive effect of moisture storage in the tissues vary with many environmental factors including wind speed, temperature, plant species, stage of growth, water content, soil texture, and solute concentrations. For a discussion of plant resistances and environmental influences see Chapter 7: Water movement in the soil-plant-atmosphere continuum (Kramer,1983). Many partial and integrated models have been developed to model the water status of the plant. There is a consensus (Shawcroft et al., 1974; Slack et al., 1977; Stockle and Campbell, 1985; Kramer,1983) that much more information is necessary before simulation models will be "useful in managing crop water problems".

In lieu of an accurate descriptive model for the flow of water in plants, the coupling of the CWSI to soil moisture status must be done by empirical correlations. There is the possibility that the influence of certain factors are dominant within the typical ranges of soil texture, soil moisture, solar radiation, and air temperature encountered in irrigated situations and that a useful relationship may be found.

2.4.3 **Salinity effects on CWSI.** There has been some research suggesting that the CWSI is sensitive to soil water salinity. Rhoades et al. (1981) caution that under arid or semi-arid conditions irrigation scheduling must consider soil salinity. Howell et al. (1984) irrigated cotton on high water holding capacity soils with water of different salinities in an attempt to define the relationship between canopy temperature measurements and both the soil salinity (osmotic potential) induced stress and water deficit (matric potential) stress. They report that the CWSI was "sensitive to osmotic potential stress in the absence of matric potential stress." This suggests that the CWSI responds to total SWP which is generally taken as the sum of the osmotic and matric components. Current plant-soil-water relations theory for most plants accepts the idea that plant growth is a function of total potential rather than its components. The CWSI would be more suited to irrigation scheduling if it could be related to total soil water potential rather than to soil moisture content which may differ significantly depending on the levels of soil-water salinity.

Most researchers who have related CWSI or canopy-air temperature difference measurements to soil moisture status have used soil water

content rather than SWP (Jalali-Farahani, 1987, Scherer, 1986; Slack et al.,1981). Soil water potential is easily related to soil water content through a soil moisture release curve. Unfortunately, soil moisture release information is much more difficult and tedious to develop than simple soil moisture content. Note that hysterisis effects are generally ignored in the use of moisture release curves. Idso and Ehrler (1976) and Brady et al. (1975), however, found that canopy air temperature measurements worked well for predicting soil moisture only on a drying soil.

2.4.4 **Recovery periods.** A number of researchers (Hsiao, 1973; Ehrler,1973 and Idso and Ehrler ,1976) have noted periods of up to 6 days after irrigation for the CWSI value to recover to realistic values. This recovery period has been observed to depend primarily on the severity of stress but also varies with plant species, age, and irrigation history. Reasons put forward by Jackson (1982) for the existence of recovery periods are rehydration of plant tissues and growth of new root hairs. Measurements by Garrot and Husman (1989) suggest that the recovery periods measured by Jackson and other researchers are, except for cases of severe stress, an artifact of the technique used for measuring VPD. After an irrigation or rain the plant, especially if it is a short crop such as turf grass, is actually growing within the moist boundary layer of the evaporating moisture from the soil surface. Measurement of the VPD at the typically used 1 meter above the canopy is therefore nonrepresentative and erroneously indicates delayed recovery of the CWSI.

Jackson (1981) concludes that "there is not a unique relationship between plant temperatures and soil moisture" and that estimates of soil moisture cannot be obtained from plant temperatures alone. His evidence for this is the mere existence of recovery periods as well as the observation from studies by Jackson (1981) that even upon recovery by the plant, the CWSI does not return to the same value upon subsequent irrigations. He speculates that this is due to the changes in root volume with time and the changing location of extracable water. That rooting volume and root distribution is dependent on irrigation method, irrigation history and plant nutrition makes the relationship even more complex.

2.5 CWSI for scheduling cotton irrigations

The CWSI has proved to be most accurately determined under conditions of low humidity and no clouds such as exist in the southwest where cotton is of major economic importance. Consequently, cotton has been fairly widely used in CWSI studies.

2.5.1 Non-stressed baselines. Various baselines have been reported for non-water-stressed cotton. These have been developed by using measurements taken the day after an irrigation with the assumption that the crop is then fully "non stressed" or else by taking "diurnal" measurements over a single or several days. (Note that Howell et al. (1984) and Reginato (1983) observed recovery times on cotton for the CWSI following irrigations of up to 5 days.)

Studies by Howell et al. (1984) at three different sites on canopies with a leaf area index of greater than 0.80 lead them to conclude that non-stressed baselines do not vary seasonally, with row spacing or plant density and can be considered applicable to large regions of roughly similar climatic conditions. Fangmeier and Garrot (1988), on extensive work with cotton, have observed changes in the non-stressed baseline with early developement of the crop canopy.

The non-stressed baseline reported by Idso et al. (1982) and Reginato (1983) for cultivar Deltapine 70 at Phoenix, AZ and used in this study is

$$Tc - Ta = 2.0 - 2.24\ VPD$$

where Tc and Ta are temperatures (°C) of the canopy and of the air and VPD is the vapor pressure deficit (kPa).

2.5.2 Yield vs. CWSI relationships. Although relatively few studies have actually scheduled irrigations on the basis of the CWSI there have been several recommendations for irrigating cotton. The yield-seasonal average CWSI relationship appears to be linear within currently researched limits. Reginato (1983) and Howell et al. (1984) considered the period between cotton flower bud squares and first boll split and 50% boll split, respectively. Both report linear relationships for several varieties of cotton. Fangmeier et al. (1988) found on trickle irrigated cotton that yield decreased linearly with increasing seasonal average CWSI from CWSI = 0.13 to CWSI = 0.4.

Optimum or maximum CWSI values at which to initiate irrigation may be of more practical use to irrigators. Reginato (1983), irrigating

cotton at CWSI values between 0.2 and 0.3 found that this resulted in a seasonal average of 0.15. Upon examining leaf water potentials in cotton Howell et al. (1984) strongly recommended that CWSI not exceed 0.7. With the use of reflected IR of selected wave bands Jackson and Pinter (1981) determined that senescence began to offset green growth in wheat when CWSI reached 0.3 and net growth ceased at 0.5. Jackson (1982) appears to generalize this to a recommendation for irrigation within that range.

Chapter 3

EXPERIMENTAL PROCEDURE

Cotton (*Gossypium hirsutum L.* cv. Deltapine 90) was grown at three sites in southeastern Arizona during the summer months of 1987. Except for irrigation treatments of various levels the crop was grown using standard farm practices. The sites were located at the University of Arizona's Campus Agriculture Center (CAC), the Maricopa Agriculture Center (MAC), and the Marana Agriculture Center (MRN) and represented three different soil textures, respectively, a fine sandy loam, a loam, and a clay loam. Table 1 summarizes general soil characteristics for the three soil textures.

Table 1 Summary of general soil characteristics for the three soil textures.

Site Location	CAC	MAC	MRN
USDA textural class	very fine sandy loam	loam	clay loam
% sand	60[1]	59[2]	39[3]
% silt	31[1]	22[2]	35[3]
% clay	9[1]	19[2]	27[3]
bulk density			
.15 m	1.30	1.49	1.50
.45 m	1.42	1.57	1.50
.75 m	1.39	1.44	1.39

Textural data from previous research on coincident or adjacent sites by [1]Killen (1988) .1 m depth, [2]El-Haris (1987) .5 m depth, [3]Coelho (1974) .3 and .6 m depths.

The three sites share a warm dry climate with average daily maximum temperatures ranging from 35°C to 40°C. Daytime relative humidities from 8 to 20 percent during the summer months. Average solar radiation is 21 to 28 MJ/m^2. Near each site (10 to 1200 m) is a weather station of the Arizona Meteorological Network (AZMET) that records daily and hourly information on maximum, minimum, and average air temperatures, relative humidity, soil temperature, maximum and average wind speed, solar radiation, and precipitation.

3.1 Campus Agricultural Center Site Description

Located at N. Campbell Avenue and E. Roger Road (32°16'49"N, 111°58'18"W) in Tucson, the Campus Agricultural Center (CAC) is at an elevation of 713 meters. The experiment site was located immediately south of the irrigation laboratory building in the field designated K.

3.1.1 Soils. The soil is a Gila loam classified as coarse loamy, mixed (calcareous), thermic Typic Torrifluvents (Post et al.,1986). Particle size analyses place it as a very fine sandy loam by the USDA textural classification chart.

3.1.2 Experimental layout. The study area consisted of 20 individual plots as shown in Figure 2. The plots were 15.25 meters long with eight north-south oriented rows on a one meter (40 inch) spacing. Between each plot was a two row unplanted buffer which provided access and prevented irrigation water runoff between plots. The treatments were randomized within the block and are shown in Figure 2 for each plot. The neutron probe access tubes were inserted

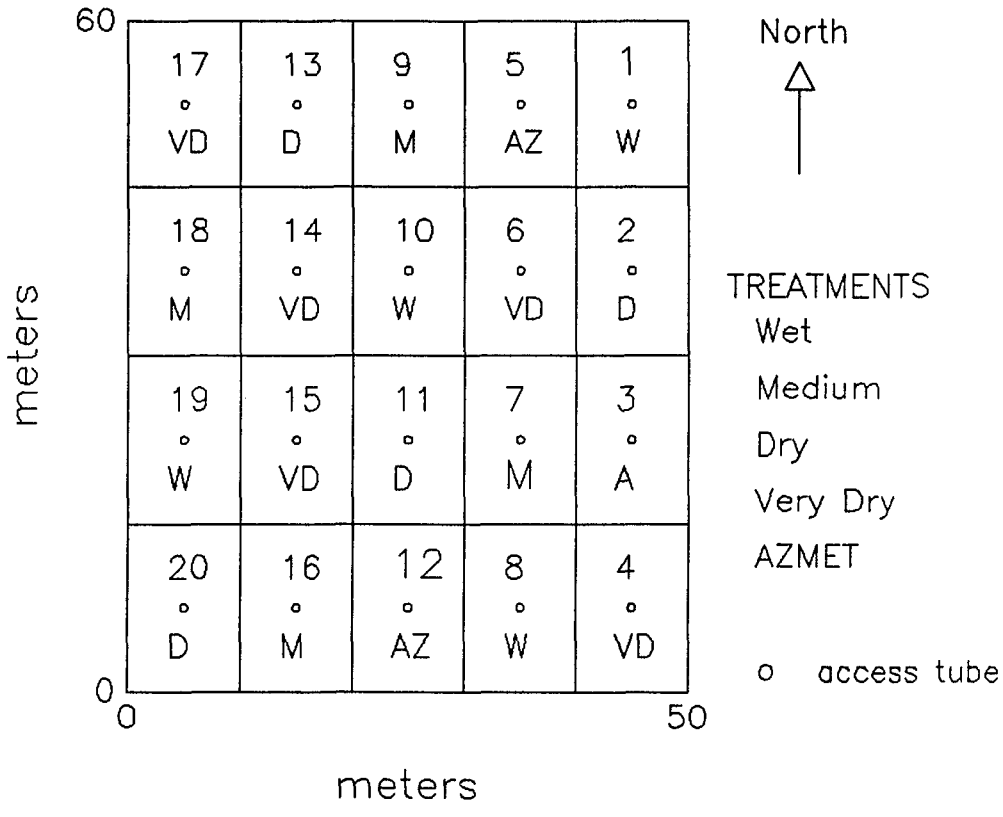

Figure 2 Plot layout and treatments at Campus Agriculture Center.

in a row near the center of each plot.

3.1.3 Irrigation method. The CAC site was irrigated by a subsurface drip system. Chapin Twin Wall IV hose with outlets every 0.23 m was installed under every row about 0.2 meters below the surface.

Although water was applied at CAC with a drip system the low volume high frequency applications of the typical drip system which confine the crops roots to well defined and restricted wetted regions were not used. Applications were single events of sufficient time (10 to 20 hours) to replace the measured soil water deficit. The long application times ponded water on the soil surface and effectively

caused a furrow-type surface irrigation. It is assumed that this technique avoided the uneven root distributions associated with the point source of a drip system. For example, Zeywar (1988) investigated the correlation of CWSI with measured SWP at various positions transverse to a drip line. He found much poorer correlations with greater distance from the drip line source and attributes the effect to the decreasing root density.

3.2 Maricopa Agriculture Center Site Description

Located 6 kilometers east of Maricopa on Smith Road (33°04'07"N 111°58'18") the Maricopa Agriculture Center (MAC) is at an elevation of 415 meters. The experiment was sited in the field designated as F-10.

3.2.1 Soils. The soil is classified in the fine-loamy, mixed, hyperthermic Typic Natragids family. This soil exhibits some gravel and caliche deposits below 0.5 meters. There is a layer of higher soil bulk density typical of compaction layers, at roughly 0.4 m at this site.

3.2.2 Experimental layout. The area consisted of a field 125 meters wide and 245 meters long. The crop rows were spaced one meter (40 inches) apart and ran east-west. Each replicate plot consisted of an eight row wide strip running the length of the field as in Figure 3. Between each plot was a two meter wide buffer and dike. The four randomized treatments are indicated on the plot layout (Table 1). Neutron probe access tubes were installed to 1.2 meters in the center of each plot on a transect across the field in a north-south direction.

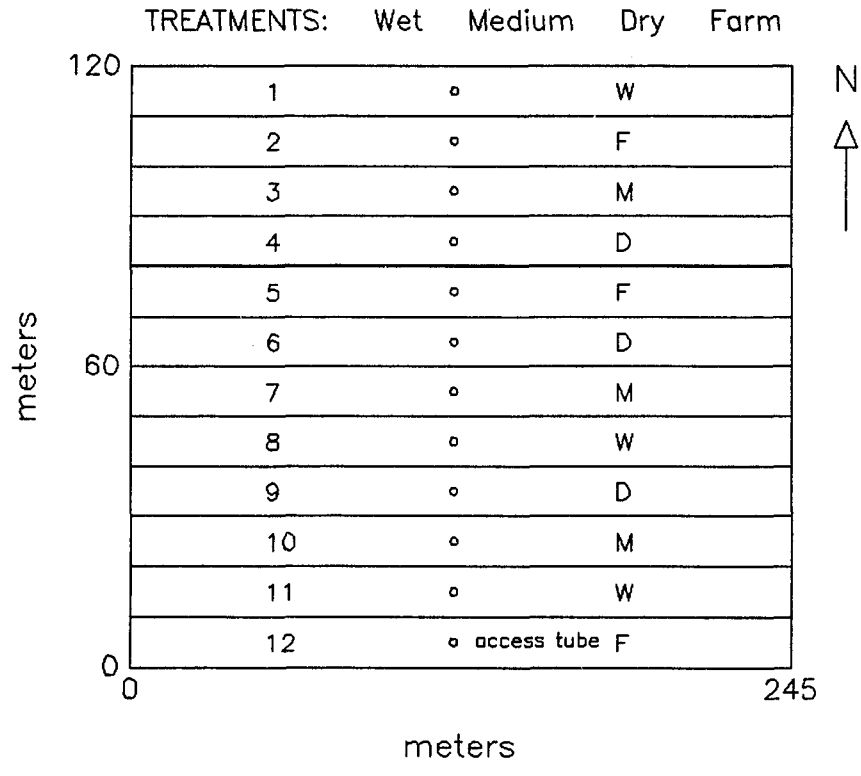

Figure 3 Plot layout and treatments at Maricopa Agriculture Center.

3.2.3 Irrigation method. Irrigation of the cotton crop was by furrows on a field that had been laser levelled to a slope of 0.0255 percent. Previous experience on these nearly level fields (MAC and MRN) had shown that the standard practice of low application with one syphon per furrow from the supply canal and long set times of 12 hours or more produced very nonuniform applications. A high inflow method employing several syphons per furrow and set times of an hour and half produced much better uniformity of application.

3.3 Marana Agricultural Center Site Description

The Marana site is located northwest of Tucson 1.6 km west of I-10 at Sanders Road (32°27'40"N 111°14'00"W) at an elevation of 625 meters. The study used the field designated E-2.

3.3.1 **Soils.** The soil is of the Pima clay loam series, classified as fine-silty, mixed (calcareous), thermic Typic Torrifluvents. This clay loam is the heaviest of the three soils studies.

3.3.2 **Experimental layout.** Field E-2 was divided into 12 plots running the length of the 182 meter long field (Figure 4). Plot width was eight 1-meter rows plus a 2-row buffer with dike. Row orientation was north-south. Neutron probe access tubes were placed in a center row in the center of the plot.

3.3.3 **Irrigation method.** The study site field had been previously laser levelled to a slope of 0.02 percent with a furrow length of 180 meters in length. As at the Maricopa site, irrigation was by high flow rate and short set times.

3.4 Crop management

Except for the various levels of irrigation treatments, management of the crop was done using standard farm practices. The fields were pre-irrigated, planted, and then irrigated as needed with adequate water to assure a good stand. The crop at CAC was hoed by hand for weeds and at MAC and MRN spraying for weeds and insects were carried out as

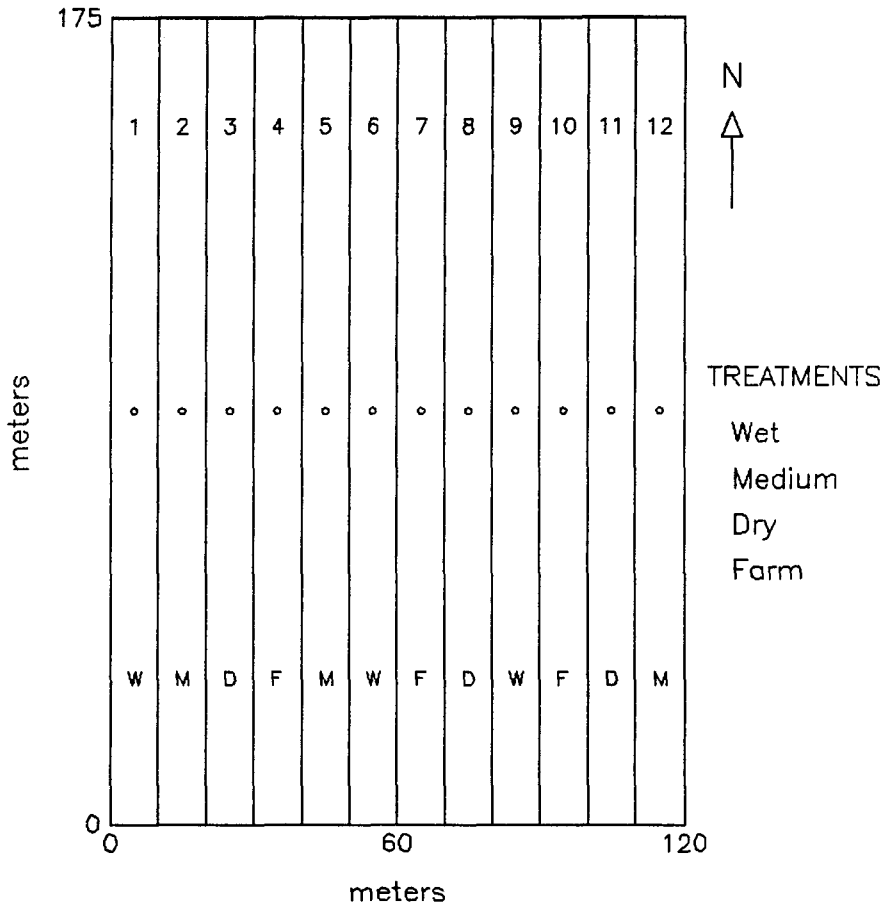

Figure 4 Plot layout and treatments at MRN.

needed. The irrigation treatments were begun when the crop canopy had developed enough to give realistic temperatures measurements by the IRT. Several different non-stressed baselines were used during the early stages of the crop canopy development to get realistic CWSI measurements. Treatments ceased when the average CWSI values for the treatment indicated by ceasing to recover after irrigations that

senescence had begun. Table 2 lists dates of major crop management activities.

3.5 Irrigation treatments

For each soil type a range of CWSI values at which the crop would be irrigated was selected to bracket the anticipated optimum CWSI value of 0.3. Wet, medium, and dry treatments were selected with the medium treatment near CWSI of 0.3. Refer to Table 3 for listing of the CWSI scheduling criteria.

An additional "treatment" at the MAC and MRN sites was actually a monitor of the CWSI value at which typical irrigation practice by the

Table 2 Dates of planting, initiation and cessation of treatments, defoliation, and harvest.

Site	Tmt	Planted	Begin Treatment	End Treatment	Defol-iated	1st/2nd Pick
CAC	Wet	127	169	240		
	Medium	127	169	240		
	Dry	127	169	240		
	Very Dry	127	169	243		
	AZ	127	169	240		
MAC	Wet	115	173	243	275	285/337
	Medium	115	173	243	275	285/337
	Dry	115	173	225	275	285/337
	Farm op.	115	173	253	275	285/337
MRN	Wet	107	161	243	279	293/324
	Medium	107	161	243	279	293/324
	Dry	107	161	251	279	293/324
	Farm op.	107	161	238	279	293/324

farm managers took place. At MAC and MRN these "treatments", indicated by F in the plot layouts, tables, and appendices, were irrigated when the farm operator chose, on the basis of personal experience, to do so. At CAC a fourth very dry treatment was scheduled for irrigation when CWSI values reached 0.45. For a fifth treatment at CAC, irrigation was scheduled when CWSI reached 0.23 and the amount of water to apply was determined by summing the AZMET system's estimate of reference crop evapotranspiration (ET_o) and the application of an appropriate crop coefficient curve.

Table 3 lists the design CWSI scheduling criteria as well as the actual measured average values of CWSI at irrigation. The season average of all CWSI values measures for each treatment is also listed for comparison. Upon reaching the scheduling criteria the plots were irrigated to replace the moisture deficit in the top meter of soil profile as determined from the neutron probe readings.

3.6 Data Collection

Measurements of CWSI and soil moisture content were obtained approximately three times a week during the course of the irrigation treatments. At CAC, which is closer and easier to monitor, measurements were done more frequently when events such as impending irrigation warranted. At CAC irrigations may be considered to have occurred closer to the time as stipulated by the established scheduling criteria. The travel distances involved and the necessity of dealing with a third

Table 3 CWSI values used for irrigation scheduling and actual average seasonal CWSI values at irrigation.

Site	Tmt	Scheduling Criteria CWSI	Measured CWSI Value Avg. at Irrig.	Season Average	Std dev	No of Irrig.
CAC	Wet	.10	.156	.041	.067	8
	Medium	.23	.348	.113	.173	5
	Dry	.30	.401	.132	.175	5
	Very Dry	.45	.616	.221	.188	4
	AZ	.23	.359	.143	.096	5
MAC	Wet	.10	.179	.130	.76	8
	Medium	.25	.242	.155	.08	7
	Dry	.40	.527	.255	.11	4
	Farm op.		.302	.207	.16	5
MRN	Wet	.10	.185	.098	.10	8
	Medium	.25	.269	.162	.05	7
	Dry	.40	.445	.197	.04	5
	Farm op.		.163	.078	.11	5

party to carry out irrigations resulted in fewer CWSI and neutron probe reading at irrigation and less accurately timed irrigation in response to the scheduling criteria.

3.6.1 CWSI parameters. Crop canopy temperatures were measured with an Everest Interscience Model 110 hand held infrared thermometer. Canopy temperatures of each plot were taken from two opposing directions and averaged to get a temperature for the plot. At CAC readings were taken from east and west. AT MAC and MRN measurements were taken standing at the ends of the field and pointing the IRT at each plot from an oblique angle to avoid getting ground surface measurements. Wet- and dry-bulb air temperatures were measured with a Model 566 Bendix aspirated type psychrometer held 1 meter above the crop canopy.

Measurements were taken in the middle of the day and only under cloudless conditions. Measurements were made at roughly 1100, 1200, and 1330 hours at CAC, MRN, and MAC respectively by the same equipment and operator. An attempt was made to take measurements and calculate the CWSI three days a week. Where possible, measurements of CWSI (and moisture content) were taken on the day of but prior to irrigations. The CWSI value for each plot was calculated by the empirical method of Idso et al. (1981). Field measurements were entered by hand into a computer which used a special program to calculate the empirical CWSI.

3.6.2 Soil Moisture Content. Soil moisture contents for three depths (.15 m, .45 m, and .75 meters from the surface) were obtained for each plot. Readings were taken with a (Campbell Pacific Model 503 DR) neutron soil moisture probe and converted to volumetric moisture content by calibration curves. The calibration curves were based on probe readings and gravimetric soil samples taken at the beginning of the season at four depths .15, .45, .76, and 1.02 meters from the surface. For each site a single calibration curve using an average site bulk density was developed to convert count ratios directly into "inches per foot" for convenience in calculating depths of irrigation water to apply.

3.6.3 Crop yield. Yields were determined by machine picking the central four rows of each plot. The weight of lint cotton was used as the yield indicator.

3.6.4 Soil samples for bulk density and moisture release curves. After harvest, undisturbed soil samples for three depths in each plot

were taken for later laboratory determinations of bulk density and soil moisture release curves. A pit was dug in the center of each plot and soil samples were obtained by sampling into the vertical side of the pit with a thin wall type soil core sampler. The samples were taken as close as possible to the neutron access tube at .15, .45, and .76 meter depths. At MAC and MRN a single sample was taken at each depth while at CAC a second set was taken. The 29.5 mm high, 53.8 mm inside diameter cores were trimmed and placed in metal soil cans.

3.7 Laboratory determination of moisture release data.

Pressure plate extractions to determine moisture release curves were carried out using 5 bar and 15 bar (Soil Moisture Equipment Cat. no. 1600 and 1500) pressure chambers pressurized by bottled nitrogen gas. The 5 bar chambers allowed the stacking of three pressure plates. The 15 bar chambers did not hold multiple plates and were used only for the 1500 kPa determinations. In spite of the quicker equilibrations expected from using pressure plate cells rated at 1 and 3 bars, to avoid shifting samples from plate to plate 15 bar pressure plate cells were used for all pressures.

3.7.1 Sample preparation. The intact soil cores were removed from the soil cans, trimmed to the exact length of the brass core ring if necessary, and placed on 15 bar ceramic plates that had been wetted for a minimum of 4 hours. Most samples had dried out and required some prewetting with a wash bottle to enable intact transfer to the pressure plate cells.

The samples were placed ten or twelve to a plate and allowed to wet from the bottom in shallow tubs of deionized water. In order to ensure good contact with the plate a slight downward pressure was exerted on the still dry soil surface as the sample began to saturate. Poor physical contact, if not hydraulic contact, with the plate was sometimes later evident upon sampling.

3.7.2 **Pressure plate extractions.** Extractions were done at gauge pressures of 30, 100, 250, 500 and 1500 kPa. Except for the 1500 kPa runs, 3 plates with individual outflows were run at a time. Excess water was allowed to stand in the bottom of the chambers to preclude desiccation of the sample surfaces during the relatively long equilibration times. Outflow from the cells was directed to individual burets the ends of which were covered with parafilm to minimize evaporation. Equilibrium was detected by monitoring and recording at least twice daily the outflow water level in the buret. Extensive laboratory work performed by Musil and Levitt (1988) indicated that repeatable results were obtainable only by waiting a further 48 hours after cessation of outflow before removing the pressure and sampling. This procedure was followed.

3.7.3 **Subsampling.** Upon removal from the pressure chamber each ring was immediately covered with a plastic disk to minimize evaporation during the lengthy sampling process. A 5 to 10 gram sample of uniform depth was scraped from each ring and placed in a small covered can. The undisturbed core samples were taken horizontally and with the CAC samples there was often noticeable difference in texture from one side

of the sample to the other in what would have been horizontal strata in the field.

3.7.4 Evaporation from the subsamples. The sampling procedure took roughly 20 to 40 minutes per plate of 12 samples depending on the difficulty in handling the soil, which varied greatly with soil texture, moisture content, and height of the sample in the ring. The small sample size and low ambient humidity suggested the possibility of errors in moisture content calculations due to evaporation.

A small test was run to gauge the efficacy of the plastic covers in reducing evaporation. A set of twelve (100 kPa run) samples was subsampled three times, once very quickly with very small samples immediately upon removal from the chamber, a second time in the normal covered-core sampling procedure, and a third time in a normal procedure with the sample cores uncovered. Although the exposed sampling resulted in a lower average calculated moisture content, a t-test showed no significant difference between the means.

3.7.5 Drying and weighing. The samples were dried in an oven at 105 degrees celsius for a minimum of 24 hours, cooled in a desiccator, and weighed for calculation of moisture content. All weighing of "subsamples" and tare weights were done using a digital electronic balance with a precision of 0.0005 grams. The larger soil remainders and brass core sample ring tares were weighed using Mettler K7 analytical balance.

3.8 Bulk density

Bulk densities for each sample were calculated by summing the weights of all subsamples plus the remainder portion and dividing by the volume of the sampling core ring.

Chapter 4

RESULTS, ANALYSIS AND DISCUSSION

Table 4 lists the average bulk densities for each site determined for the overall field at each depth as well as an average bulk density for the soil profile to 0.9 meter. Appendix A lists the complete set of measured bulk densities. There was close agreement between the two replications of the CAC soil. As expected, the MAC site had the highest bulk density, however, MRN did not have the lowest bulk density as expected because of its finer texture.

The results of the pressure plate extractions for each sample are

Table 4 Average bulk densities determined from undisturbed sample cores at three sites..

Site	Depth .15 m	Depth .45 m	Depth .76 m	Average
CAC	1.39	1.42	1.30	1.37
s[1]	.06	.06	.06	.08
MAC	1.49	1.57	1.44	1.50
s	.07	.09	.09	.10
MRN	1.50	1.50	1.39	1.46
s	.08	.07	.08	.09
Rep 1				
CAC1	1.38	1.42	1.29	1.36
s	.07	.06	.06	.07
Rep 2				
CAC2	1.39	1.41	1.32	1.38
s	.07	.06	.06	.07

[1]standard deviation

shown in Appendix A and summarized by site, depth and treatment in Tables 5-7. There was some variability from plot to plot on the relative moisture contents held at a given soil water potential with depth. However, the results of averaging the four replications in each treatment yield much more consistent water retention curves.

For the MAC soil (Table 6), the moisture content at the 1500 kPa extraction turned out to be in most cases virtually identical to the 500 kPa value, and on the MRN (Table 7) soil there was actually a slightly

Table 5 Average bulk density and soil moisture release results by depth and by treatment at CAC.

Site	Tmt	Depth cm	Bulk Density	Percent Moisture (volume basis) 30kPa	100kPa	250kPa	500kPa	1500kPa
Overall field average								
CAC1			1.369	18.91	14.77	12.59	11.44	10.74
s*			.08	3.5	3.2	2.8	2.7	2.5
Field-depth average								
CAC		15	1.386	19.64	15.84	13.77	12.66	12.05
s			.07	1.5	.9	.9	.9	1.1
CAC		46	1.417	18.04	14.00	11.85	10.74	9.94
s			.06	4.2	3.7	3.0	2.8	2.6
CAC		76	1.304	19.06	14.47	12.16	10.94	10.23
s			.06	4.0	3.9	3.4	3.2	2.8
Average by treatment								
CAC	W		1.349	19.93	16.22	13.97	12.74	12.40
s			.09	3.5	3.4	3.2	3.2	3.1
CAC	VD		1.370	19.38	14.72	12.49	11.37	10.74
s			.08	3.0	2.9	2.3	2.3	2.2
CAC	M		1.369	18.35	14.33	12.40	11.27	10.76
s			.08	3.2	3.0	2.8	2.6	2.2
CAC	D		1.382	18.77	14.59	12.17	10.98	10.01
s			.07	4.3	3.7	3.1	2.7	2.1
CAC	AZ		1.377	18.13	13.98	11.94	10.85	9.78
s			.07	3.3	2.9	2.4	2.2	2.0

*standard deviation

higher moisture content at the 1500 kPa tension than at 500 kPa tension. General moisture release information for soils of these textures and other moisture release studies (Morin, 1977; Coelho, 1974; El-haris, 1987; Killen, 1988) performed on soils very near the sites of this study consistently show larger decreases in moisture content between 500 and 1500 kPa tension. Speculation on the cause of the seemingly erroneously "high" 1500 kPa values center on gradual clogging of the ceramic plates or poor hydraulic contact with the ceramic plates. Both of these would tend to slow down the extraction rate and perhaps cause premature

Table 6 Average bulk density and soil moisture release results by depth and by treatment at MAC.

Site	Tmt	Depth cm	Bulk Density	Percent Moisture (volume basis) 30kPa	100kPa	250kPa	500kPa	1500kPa
Average for whole field								
MAC			1.497	22.31	18.99	16.45	15.35	15.34
s*			.10	3.6	3.1	2.6	2.3	2.3
Average by depth								
MAC		15	1.49	22.00	18.84	16.57	15.58	15.54
s			.07	.9	.9	1.0	.7	.8
MAC		46	1.57	21.46	18.54	16.39	15.62	15.48
s			.09	1.8	1.7	1.7	1.8	1.8
MAC		76	1.44	23.46	19.60	16.38	14.87	14.99
s			.09	5.8	5.0	4.1	3.5	3.5
Average by treatment all plots all depths								
MAC	W		1.49	23.11	19.67	17.01	15.81	15.94
s			.08	3.5	3.0	2.7	2.5	2.5
MAC	M		1.51	22.34	19.05	16.63	15.51	15.35
s			.13	3.6	3.2	2.7	2.5	2.7
MAC	F		1.53	22.31	18.80	16.34	15.24	15.11
s			.08	4.7	4.0	3.3	3.0	3.0
MAC	D		1.47	21.47	18.44	15.81	14.86	14.96
s			.09	4.5	3.8	3.2	2.8	2.7

*standard deviation

detection of equilibrium.

There is the possibility that the 500 kPa values are low instead. Qualitative examination of the plotted data suggest that this error would require a much sharper, and perhaps less physically likely, "bend" in the curve. In any case, analysis of the data was carried out with all the data as originally determined.

4.1 Development of moisture release curves

Integral to the aims of the study was the question of which depth

Table 7 Average bulk density and soil moisture release results by depth and by treatment at MRN.

Site	Tmt	Depth cm	Bulk Density	Percent Moisture (volume basis) 30kPa	100kPa	250kPa	500kPa	1500kPa
Overall field average								
MRN			1.464	28.85	25.64	22.84	21.07	21.28
s*			.09	3.2	3.2	3.1	3.1	3.4
Field-depth average								
MRN		15	1.50	30.21	27.01	23.97	22.31	22.39
s			.08	2.4	2.2	2.1	2.0	2.5
MRN		46	1.50	30.47	27.44	24.81	23.09	23.52
s			.07	3.1	3.1	2.9	2.8	3.0
MRN		76	1.39	25.88	22.46	19.73	17.80	17.92
s			.08	1.3	1.3	1.2	1.1	1.5
Treatment average								
MRN	W		1.45	28.89	25.78	23.15	21.62	21.71
s			.07	2.9	3.1	3.2	2.9	3.4
MRN	M		1.50	28.73	26.03	23.09	21.28	21.66
s			.10	4.3	4.8	4.6	4.5	4.8
MRN	D		1.47	29.22	26.04	23.25	21.39	21.48
s			.09	1.4	1.1	1.0	1.0	1.4
MRN	F		1.43	28.57	24.69	21.87	19.99	20.26
s			.12	3.5	3.0	2.8	3.2	3.4

*standard deviation

or combination of depths would correlate best with the CWSI. For this purpose several subset 'averages' of the moisture release data were generated. Considering the 5 data points of moisture content vs. tension to be a 'curve', some definitions of the terms used for these 'average' moisture release curves are in order.

Field Average Curves

Overall field average moisture release curve refers to a curve developed by averaging the individual sample moisture content values for all plots and all depths at one site. There is one overall field average curve for each of the sites.

Field-depth average moisture release curves represent an average of all results at a given depth. This results in one curve for each depth at each site.

Treatment curves.

Treatment average moisture release curves are averages of all three depths and all four replications in each treatment at each site. There are four of these at MAC and MRN and five at CAC.

Treatment-depth average curves represent averages of all four replications of one treatment at one depth. There are 12 of these for MAC and MRN and 15 for CAC.

Specific curves

Plot average curves represent the average soil profile (to 0.9 meter) at a single plot so there is one per plot.

Specific-depth curves are curves developed from the moisture retention from one (two replications in the case of CAC) soil sample taken at a given depth.

In all cases the average curves are not an average of the coefficients found from the regression but a separate curve regressed to the average of the moisture retention values of the samples making up the particular 'average'.

4.1.1 Moisture release curve models. The five moisture contents obtained from the pressure plate apparatus describe a tabular moisture release curve. For interpolation and extrapolation of the values for given observed moisture contents a continuous function model for the moisture release curve was sought.

Bruce and Luxmoore (1986) list a series of proposed models describing the relationship between moisture content (θ) and soil water matric potential (ψ). From among those three were compared by fitting them to the pressure plate data. Van Genuchten (1980) presented a function that was recommended by Nielsen et. al. (1986) as having physically realistic shape and curvatures at high potential. The Van Genuchten model is

$$\theta = \theta_r + \frac{\theta_s - \theta_r}{[1-(\alpha\psi)^n]^m}$$

where θ_r is residual moisture content and θ_s is the moisture content at zero potential and α, m, and n are empirical constants with a simplifying assumption that m = 1 - 1/n.

From observations on a variety of porous media Brooks and Corey (1964) proposed the equation

$$(\theta-\theta_r)/(\theta_s-\theta_r) = (\psi_b/\psi)^\lambda$$

where θ_r and θ_s are residual and saturation moisture contents, ψ_b is the bubbling pressure and λ is a constant also known as the pore size distribution index.

If the residual moisture content θ_r is taken to be zero one gets

the power law form proposed by Campbell (1974)

$$\psi = \psi_b(\theta/\theta_s)^{-b}$$

where b is a constant. Rearranging, one can represent this in the following power law form with constants A and b.

$$\psi = A\theta^{-b}$$

Each of the three models was fit to the data from each soil type, the Van Genuchten model by a nonlinear regression computer program and the Brooks and Corey and Campbell models by logarithmically transforming the data and performing simple linear regressions.

The Van Genuchten and the Brooks and Corey models require estimation of the residual and saturation moisture contents and bubbling pressure. Representative values for saturation moisture content were taken from previous research (Killen, 1988; Coelho, 1974; El-Haris, 1987) on the soils at the same general locations as in this study. The residual moisture content was approximated by using air-dry moisture contents.

The relative performance of the models was virtually identical for all sets of data. The model comparison on overall field average moisture release data from the MAC soil is shown in Figure 5. The Brooks and Corey model overestimated the moisture content at potentials greater than about 250 kPa and more greatly underestimated the observed values at lower soil water potentials. The Van Genuchten and Campbell models were virtually identical. At very high s the choice of θ_s values affected the Van Genuchten curve but only very slightly. The nonlinear regression program for determining the parameters was, however, very

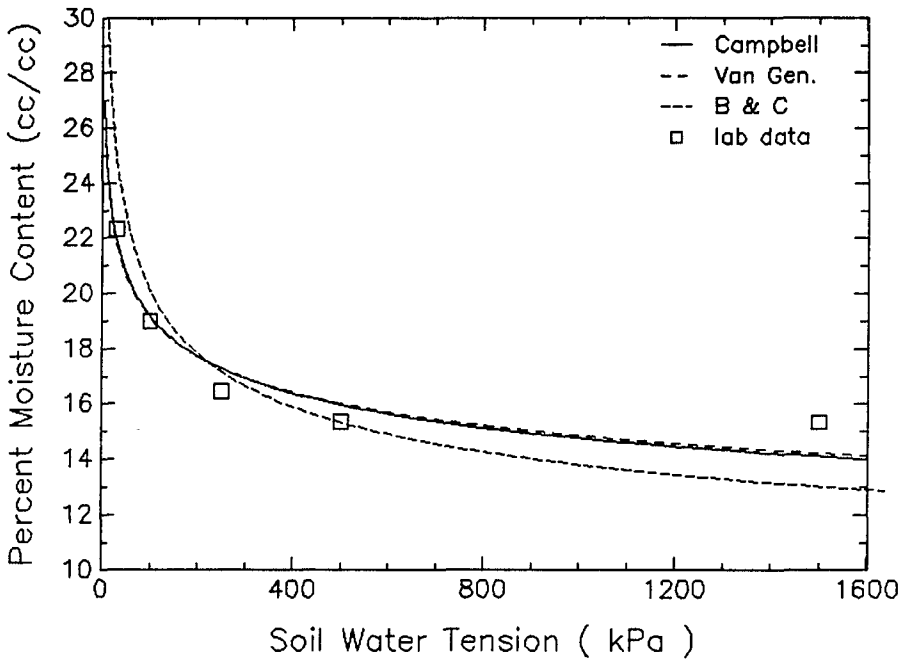

Figure 5 Regression fit comparison of Campbell, Van Genuchten (θs=43.5%,θ=1.5%), and Brooks and Corey (θs=43.5%,θr=5.5,Pb=2kPa) to MAC moisture release data.

sensitive to the input value of the saturation moisture content giving wildly varying magnitudes for the estimated parameters α and n. The Campbell model was selected for use as being as good as and less problematic than Van Genuchten's. Figure 6 shows the Campbell model applied to the overall field average moisture release data for the three sites.

4.2 Application of Campbell model to moisture release data

The conversion of the measured soil moisture contents to soil moisture potential values on an areal and depth basis is not straight forward. The nonlinearity of the relationship between the two variables

means that, depending on which end of the curve is being considered, very small variations in one variable mean very large variations in the other. The specific plot-depth moisture release curves were developed from 65 cc soil samples while the neutron probe measurements get the average moisture content of a roughly 5 liter volume.

Occasionally, a measured moisture content was not well represented by its associated specific plot depth moisture release curve. This caused the calculated soil water potential to have an unrealistically large value. Under dry conditions SWP values calculated from the specific plot-depth curves exceeded -6 MPa with several values in the -60 MPa range. Clearly, the specific plot-depth curves do not adequately reflect the moisture retention with soil tension, at least for purposes of predicting the SWP at drier moisture contents. The approach taken by this study to alleviate this problem was to average the measured moisture contents and the moisture retention data among the four replications in each treatment. Also, the overall field average moisture release curve was used for converting treatment average measured moisture contents to potential values. An additional technique, especially in layered soils, would be to use depth specific calibration curves for the neutron probe to convert measured moisture contents to potentials.

4.3 Correlation of CWSI with soil parameters

The season long moisture content and CWSI data for each site were entered into a spreadsheet database (QUATTRO) to ease the data

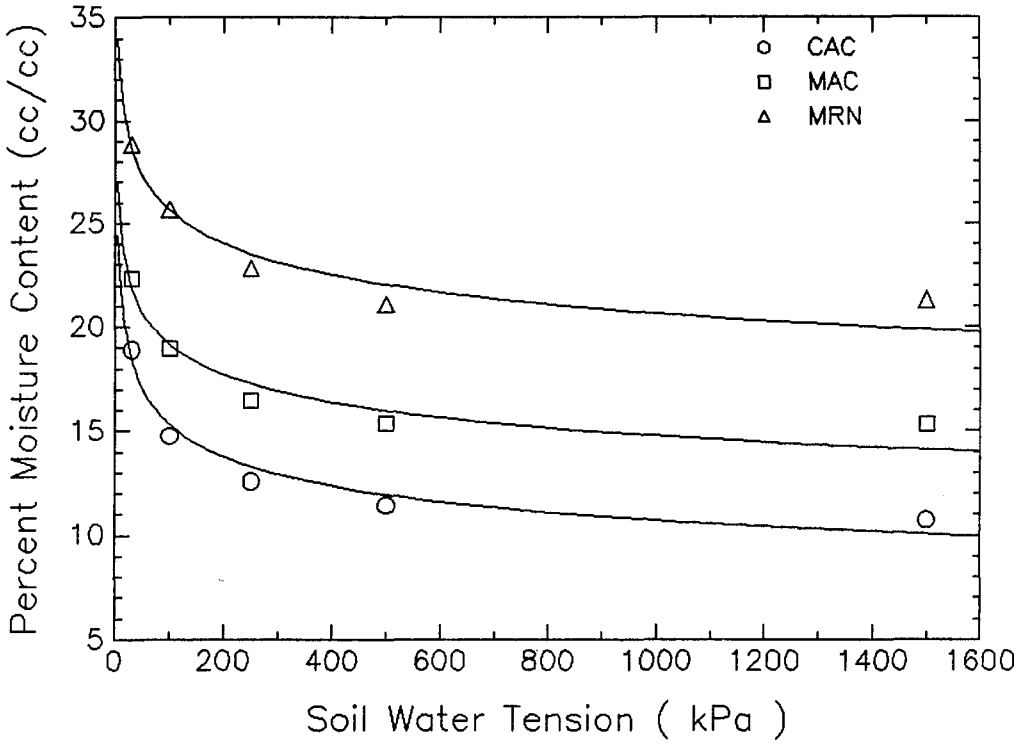

Figure 6 Overall field average moisture release curves with fitted Campbell model at three sites.

manipulation and analysis. Appendix D is an abridged form of this raw database listing only the days on which both CWSI and soil moisture measurements were available.

For each day, plot, depth, and treatment average, the soil water potential values for each depth and for the whole profile were determined for the measured moisture contents. This was done using both the treatment specific and the overall field average moisture release curves. This resulted in two soil water potential values for each moisture content value, one calculated by the moisture release curve most specific to it (labelled "Plot specific mrel" in Appendix D), and

one value calculated by using the overall field average curve (labelled "Field average mrel curve" in Appendix D).

On the day of an irrigation there were several cases in which CWSI measurements were made but soil moisture content readings were not. In this case, if there were soil moisture contents available for the previous day, a 'substitution' of the CWSI value was made back to the previous day to go with the soil moisture information. These cases are indicated by a lower case i in the 'Irrigation' column in Appendix D. If there was no soil moisture information one day prior to the day of an irrigation the data for that day was not used in further analysis.

Simple two-variable correlations of CWSI with soil moisture content, and calculated SWP were performed using the statistics computer program COSTAT (B. Simons, CoHort Software Inc). Appendix B lists the two-variable correlations of CWSI with moisture content (MC), soil tension as calculated by plot-depth moisture release curves (sp), and overall field average moisture release curve (fa), each at depth one (.15m), depth two (.46m), depth three (.76m) and average depth designated as MC1, MC2, MC3, MC123, sp1, sp2, sp3, sp123, fa1, fa2, and fa123.

4.3.1 CWSI vs. soil moisture content. The CWSI followed the expected trend with respect to soil moisture content, decreasing with increasing moisture content. The relationship appears to be nonlinear. The plots of CWSI vs. soil moisture content for each of three depths at CAC, MAC, and MRN are shown in Figure 7, Figure 8, and Figure 9 respectively. The plots show a marked increase in scatter in the

shallowest depth (.15 m). Except for the middle depth at MRN the apparent trend is an improving correlation with depth. The best correlation of CWSI and soil moisture content is with the average soil profile values.

In a comparison of CWSI vs. average soil profile moisture content for the different soils, Figure 10 shows a shift with the soil type from the lightest to heaviest (tightest) soil.

4.3.2 **CWSI vs. soil water potential.** Figures 11, 12, and 13 show treatment average CWSI vs. soil water potential with respect to depth for the three soils. The shallowest depth exhibits a very flat slope and a wide range of SWP values. At CAC and MAC the bottom two depths are consistent in having much steeper slopes and slightly better grouped sets of data.

The MRN plots (Figure 13) seem anomalous in that the most scatter is at the bottom depth. The center depth shows a tighter grouping of the data and a slighly steeper slope than the others. A partial explanation for the depth related patterns of scatter and to some degree the varying slopes is the fact that a single profile average bulk density was used to convert neutron probe readings to moisture contents. This means that where bulk densities differ from the profile average the moisture contents are all shifted by the amount of the error in bulk density. This shift may drasticaly affect the end results because of the highly nonlinear moisture release curve.

All the plots show linear relationships between CWSI and SWP. The degree of correlation follows roughly the same trend as moisture content

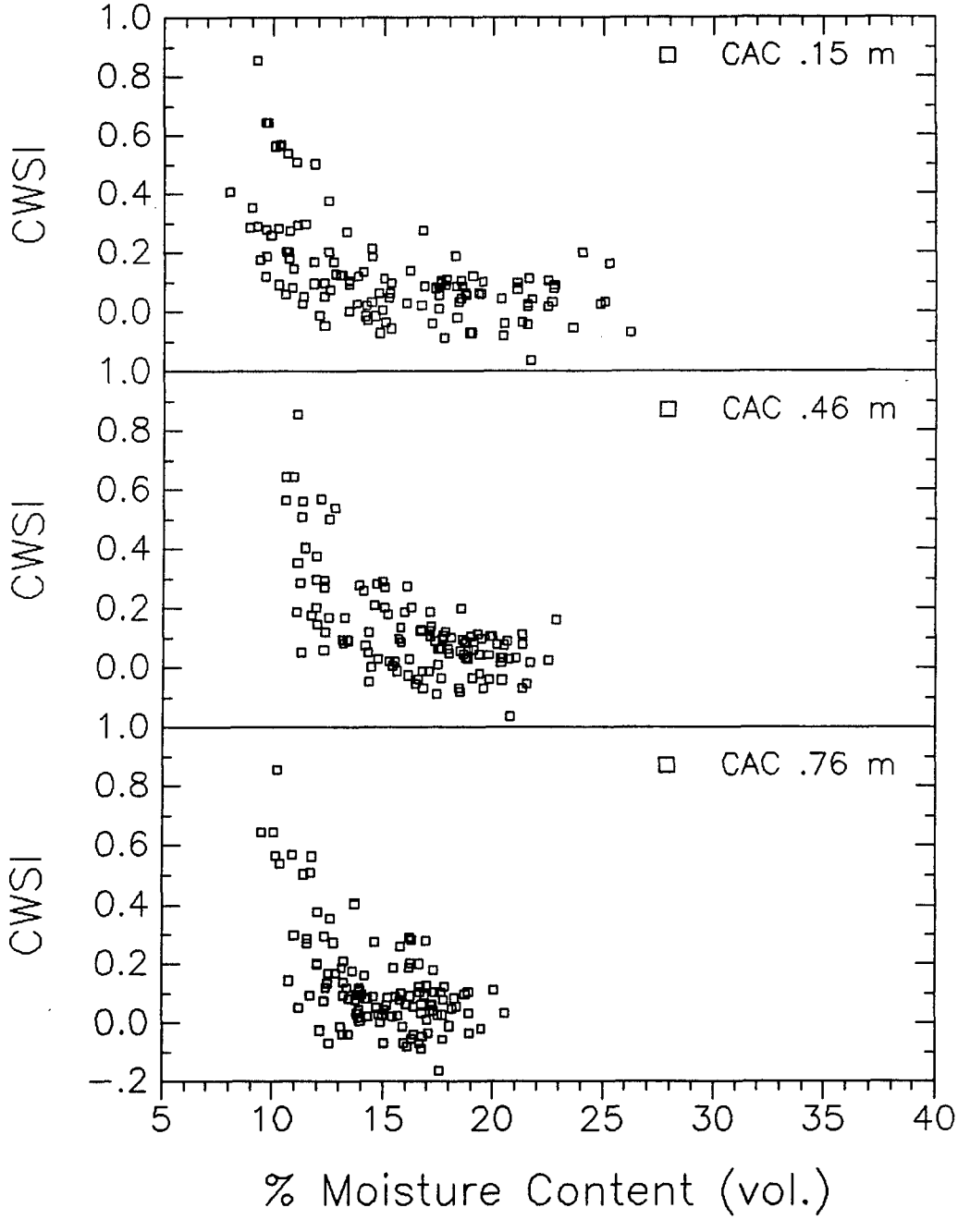

Figure 7 Treatment average CWSI vs. percent moisture content measured at three depths at CAC.

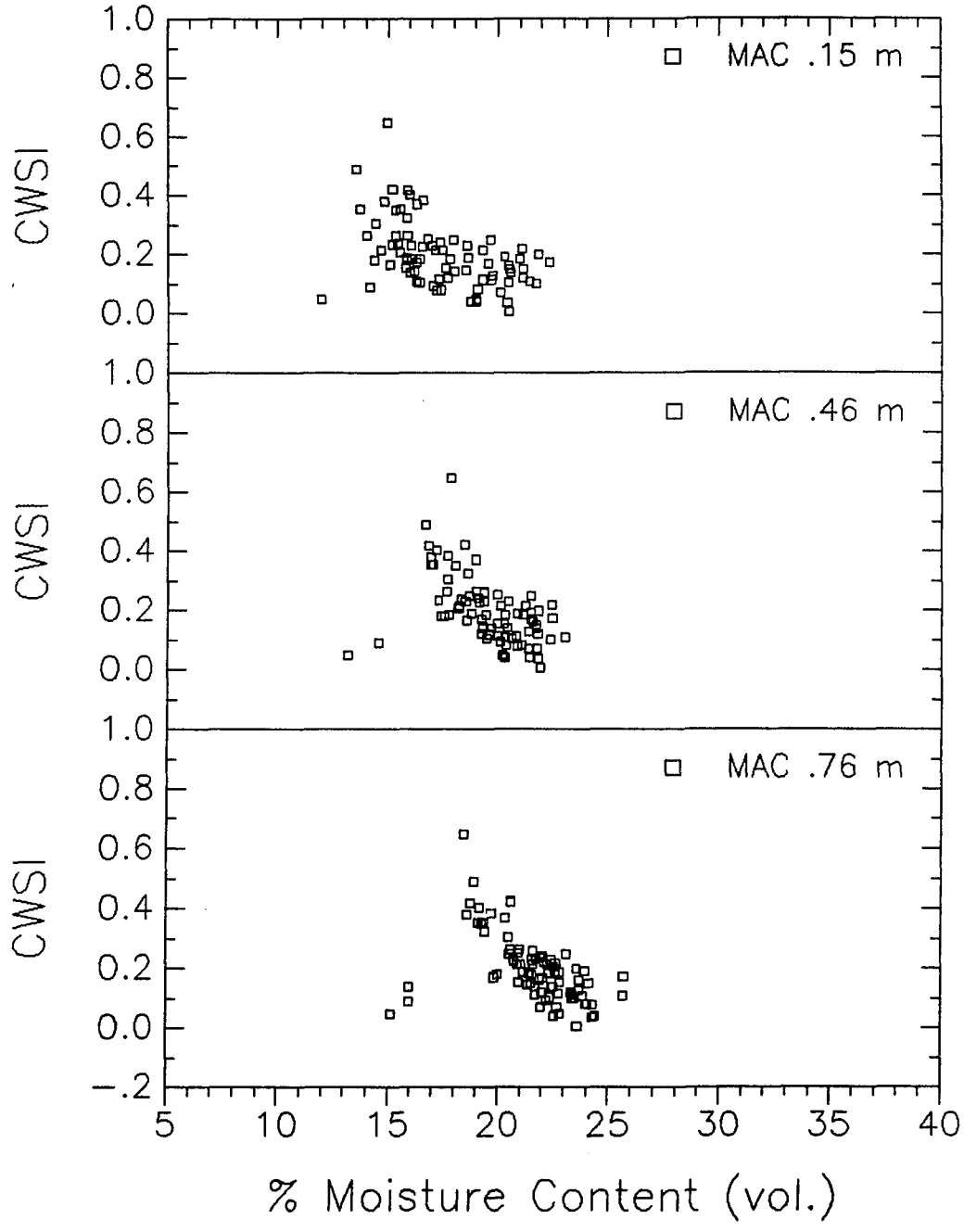

Figure 8 Treatment average CWSI vs. soil moisture content at three depths at MAC.

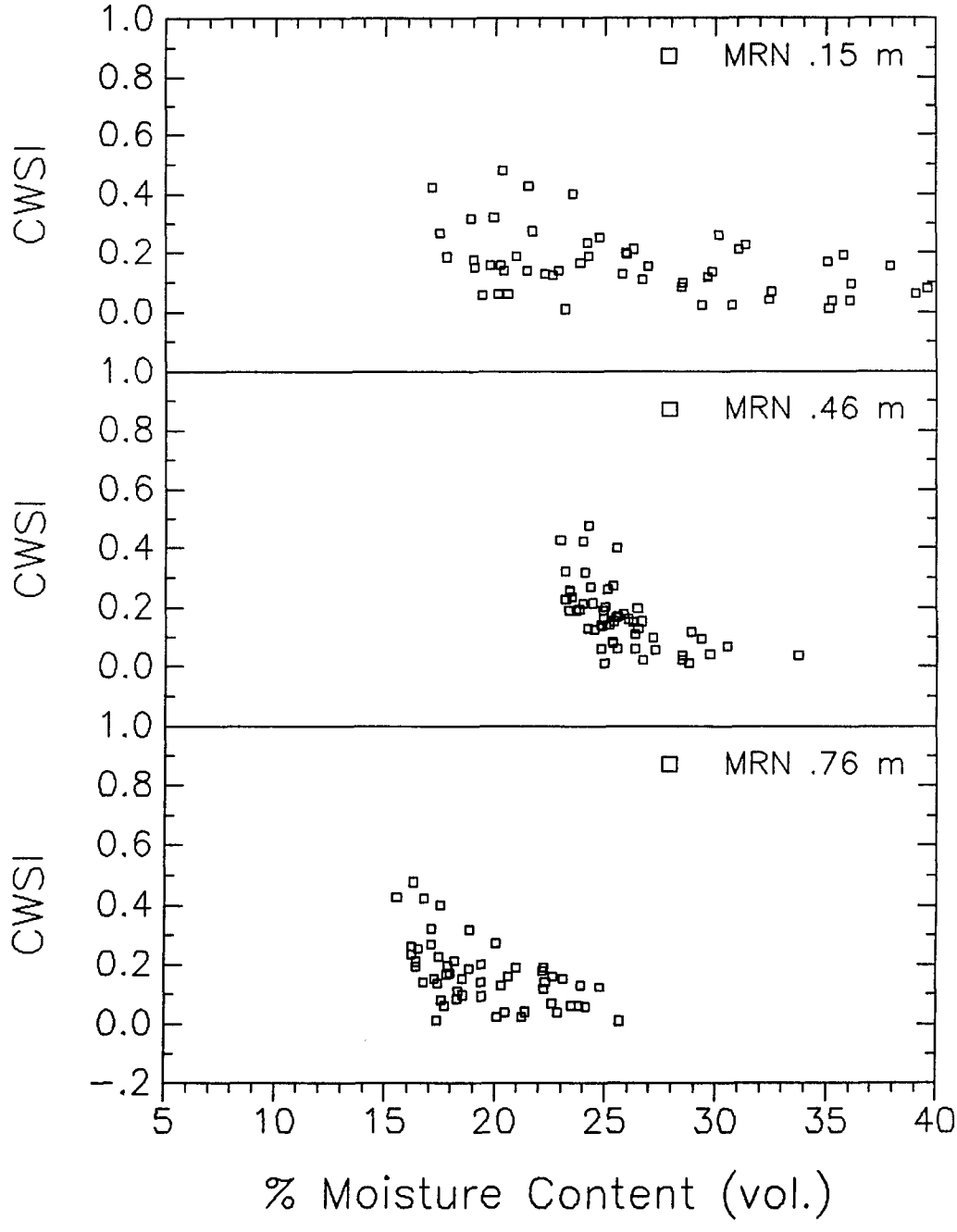

Figure 9 Treatment average CWSI vs. soil moisture content at three depths at MRN.

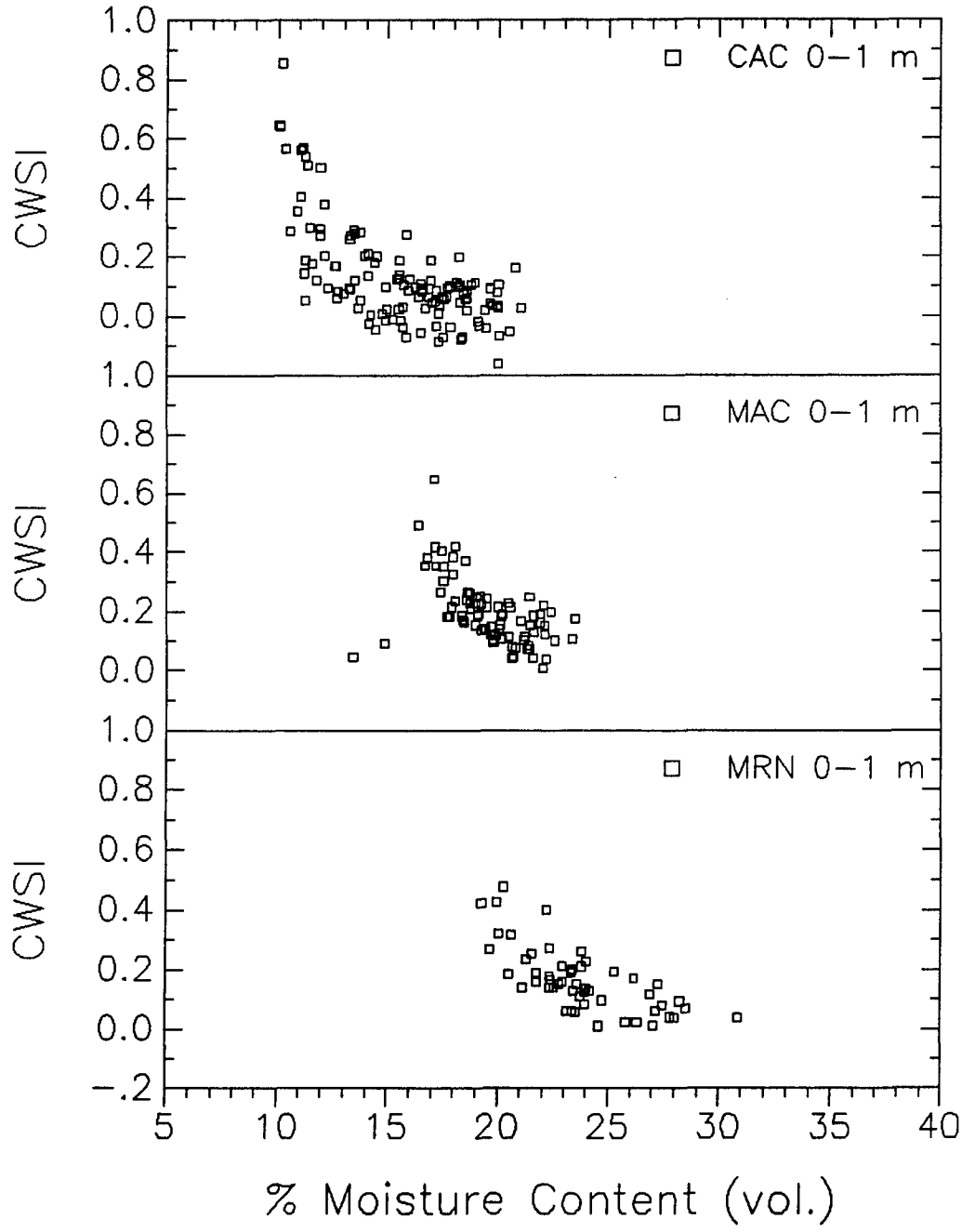

Figure 10 Treatment average CWSI vs. average soil profile moisture content at CAC, MAC, and MRN.

in that correlation improves with depth and the "best" correlation is usually with the soil profile average values. These are marked "sp123" and "fal23" in the tables in appendix B.

Comparison of the CWSI vs. average profile soil water potential on different soils (Figure 14) shows relatively good correlations between the parameters. This comparison was expected to "normalize" the CWSI--soil moisture status for soil texture. The intercepts and the slopes of the regression lines shown in Figure 14 were tested using the student T test at $\alpha = .05$ for significant difference. On a pooled data basis as well as paired comparisons the regressions lines proved to be significantly different from each other. When intercepts and slopes where compared individually, the intercepts at MAC and MRN was the only pair that were not significantly different.

Contrary to expectations, the soil water potentials determined using field average (overall field average and field-depth average) moisture release curves show a higher correlation with CWSI than those found using the treatment average moisture release curves. The latter use soils information--bulk density and the texture dependent moisture retention--which is physically "closer in the field" or more specific to the corresponding CWSI measurements. The variability in soil moisture characteristics within the plots in which the CWSI measurements are taken (canopy temperature) appears to be sufficiently large that four replications as in this study are simply not enough to correlate better than field average parameters. With this in mind, all further analyses were performed using data based on the field average curves.

The slope in the surface zone is quite flat whereas the deeper depths have steeper but roughly similar slopes. This apparent difference of CWSI-SWP behaviour with soil texture is counter to results of work by Scherer (1986). He looked at the response (as measured by canopy-air temperature differences) of soybeans to soil moisture status (percent of available water) and found no significant difference with soil texture. Reasons for the discrepancy might include the differences in rooting depth or pattern of water extraction.

The different slopes on these lines may be the result of several things which will only be speculated upon here. Consider that at the point in the plant's stem where roots begin to branch off there is at any given time (and its associated CWSI value) a specific water potential value. At the same time there would appear to be different values of SWP at the root-soil interface in the different zones. One might hypothesize varying applied tensions by the different roots due perhaps to different solute concentrations within the plant or flow resistances within the root system.

A better explanation of the varying slopes may lie in the components of the soil water potential. A plant responds to matric and osmotic potential in the soil. The moisture contents as measured by the neutron probe are converted to potentials via the pressure plate extraction data which measures matric potential only. Under high osmotic potentials then the plant may be applying equal values of total potential throughout the soil profile but the potential in saline zones are indicated as very high because the moisture release curve is a

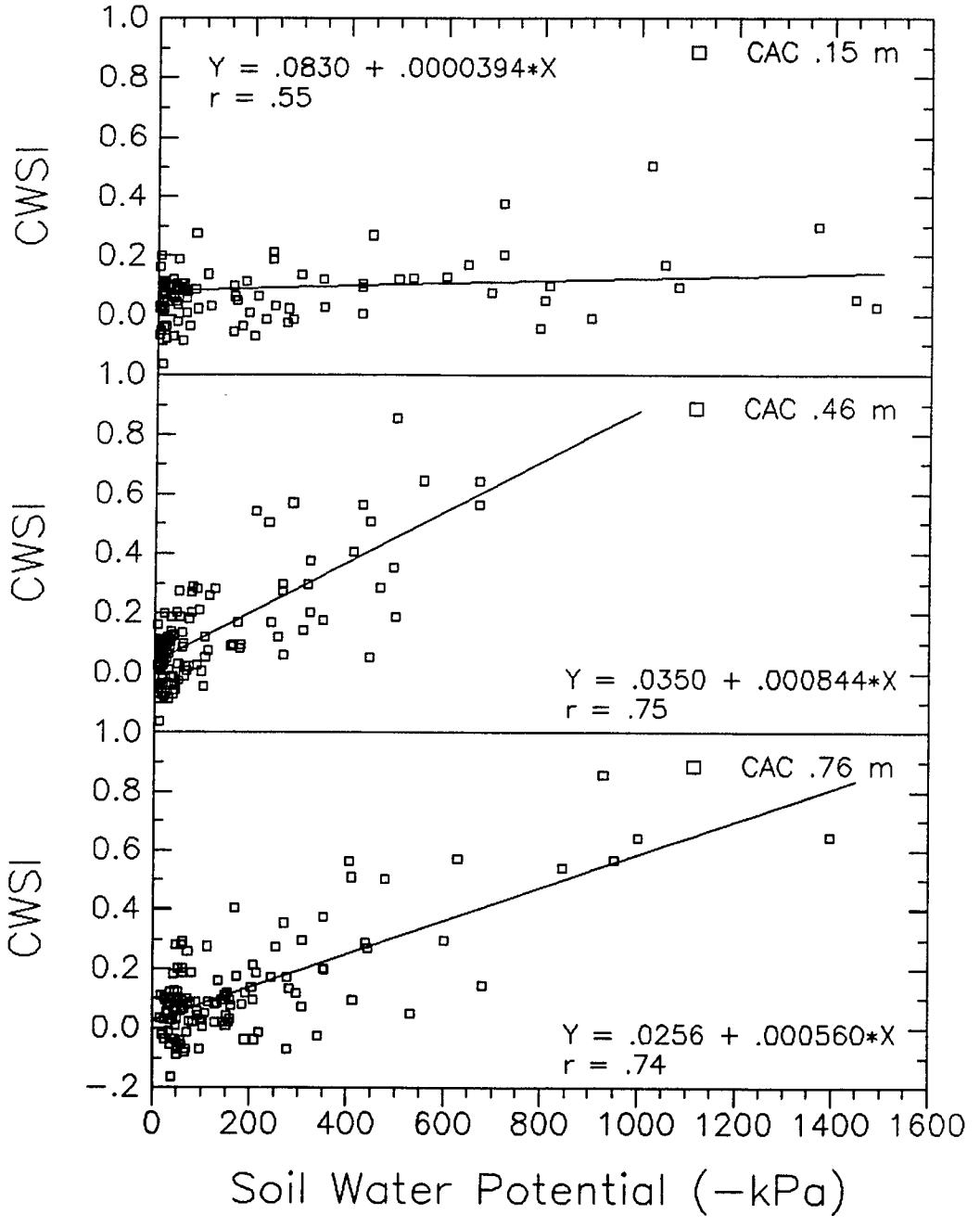

Figure 11 Treatment average CWSI vs. soil water potential measured at three depths at CAC.

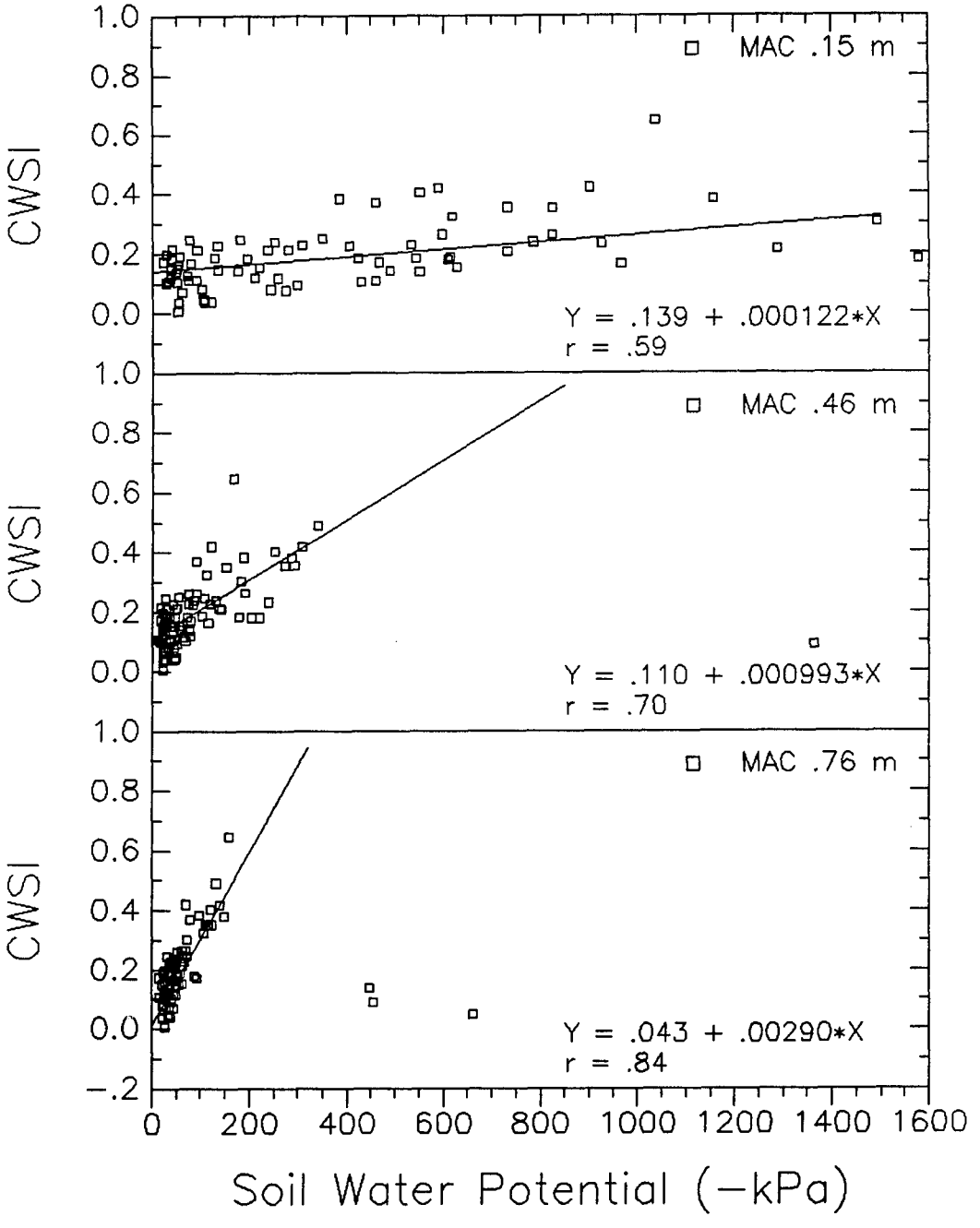

Figure 12 Treatment average CWSI vs. soil water potential at three depths at MAC.

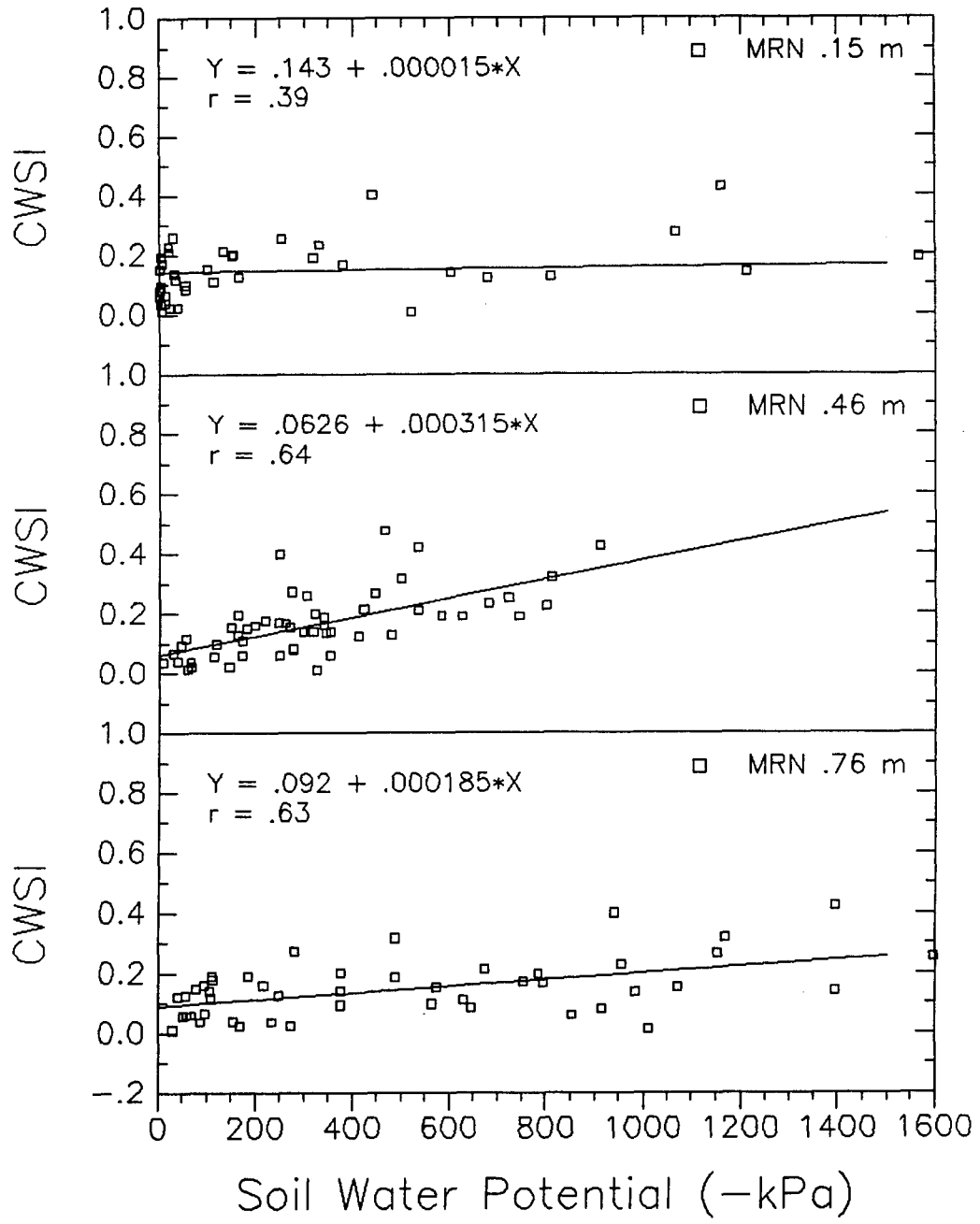

Figure 13 Treatment average CWSI vs. soil water potential content at three depths at MRN.

reflection of only the matric potential. This hypothesis may be weakly supported by the salinities of the irrigation water used in this study. MAC, with the steepest slope had the most saline irrigation water at 600 ppm. CAC and MRN, with much flatter and rather similar slopes, had very similar irrigation water salinities of 300 ppm and 350 ppm.

Varying root density might also produce the unequal slopes on the regression lines. If the plant is extracting water, the soil moisture regime immediately surrounding the roots is not in equilibrium. The resistance to flow in the soil results in a gradient in the SWP away from the root surface. The average soil moisture and the average SWP will then be higher where the roots are further apart even though the potential at the root-soil interface may be identical. The unsaturated hydraulic conductivity of the soil, which varies with soil texture, would affect this by varying the slope of the soil water potential gradients.

Thus the steep slopes at specific depths in Figures 11-15 might be explained by low root densities due to the factors, such as compaction, fertility, and water holding capacity, that influence rooting pattern. The plant experiences the large tensions at the root surface but the moisture content-soil moisture release technique used in this study would measure the average SWP which would be smaller.

Notice that the slopes of the regression lines between sites are rather similar at the shallowest depth. If all these site follow typical rooting patterns, the shallowest depth is the most densely rooted. If root density is the major factor affecting the slope of the

CWSI-SWP relationship then the surface at all three sites may be the one with the most similar conditions. However, there were significantly poorer correlations of CWSI with soil moisture parameters in this shallowest depth.

4.3.3 CWSI vs. soil water potential at irrigation. The data presented in Figure 14 are all the CWSI and soil moisture measurements taken throughout the season. Figure 15 shows the subset of that data which is just the measurements taken at irrigation. The slopes in Figure 15 appear to be slightly steeper; otherwise the relationships are very similar.

4.3.4 Season average CWSI at irrigation vs. soil water potential. The seasonal average CWSI at irrigation correlates very well with SWP (Figure 16). Because they are averages of the same set of data, they agree very closely with the plots of Figure 14 and 15 to the extent that the relative slopes when compared across soil types is preserved.

4.4 Yield results

The lint cotton yield of each treatment as well as the associated season average CWSI value and the average CWSI value at irrigation are listed in Table 8. The lint cotton yield versus season average CWSI at irrigation is plotted in Figure 14 for each site. For MAC and MRN the yield generally decreases with increasing CWSI values and the relationship could be construed to be linear. However, the MRN data does hint at a maximum at CWSI=.2 and the CAC data plateaus between CWSI values of 0.2 and 0.4 with a slight decrease at SWP smaller than 0.3.

Table 8. Yield results for CAC, MAC, and MRN in 1987.

Site	Tmt	Yield Lint Cotton kg/ha	Measured CWSI Value Avg. at Irrig.	Season Average	Std dev
CAC	Wet	1667	.156	.041	.067
	Medium	1705	.348	.113	.173
	Dry	1717	.401	.132	.175
	Very Dry	1407	.616	.221	.188
	AZ	1718	.359	.143	.096
MAC	Wet	1995	.179	.130	.76
	Medium	1712	.242	.155	.08
	Dry	1208	.527	.255	.11
	Farm op.	1401	.302	.207	.16
MRN	Wet	1726	.185	.098	.10
	Medium	1632	.269	.162	.05
	Dry	1252	.445	.197	.04
	Farm op.	1720	.163	.078	.11

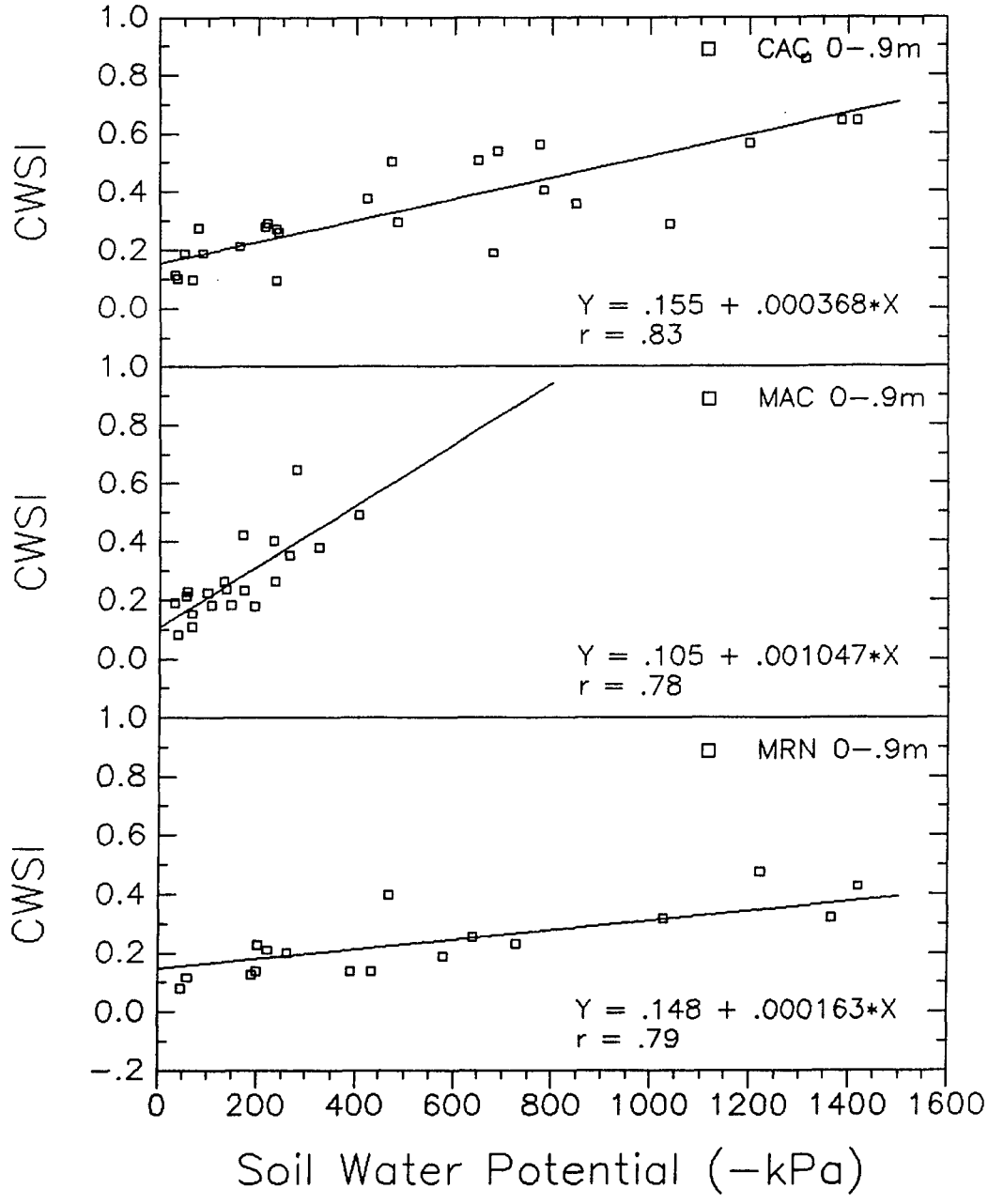

Figure 15 Treatment average CWSI at irrigation vs. average profile soil water potential measured at CAC, MAC, and MRN.

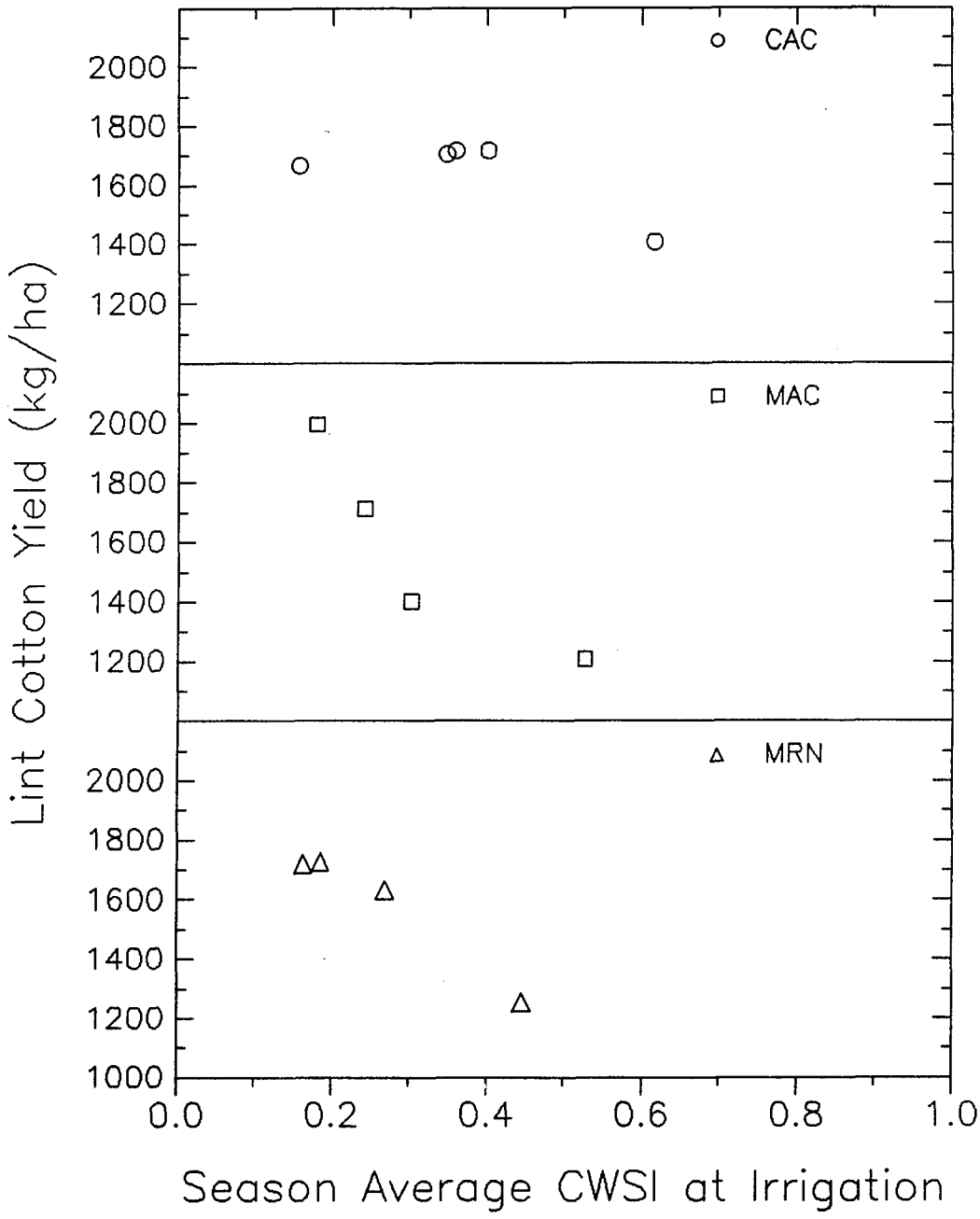

Figure 16 Lint cotton yield vs. season average CWSI at irrigation by treatment.

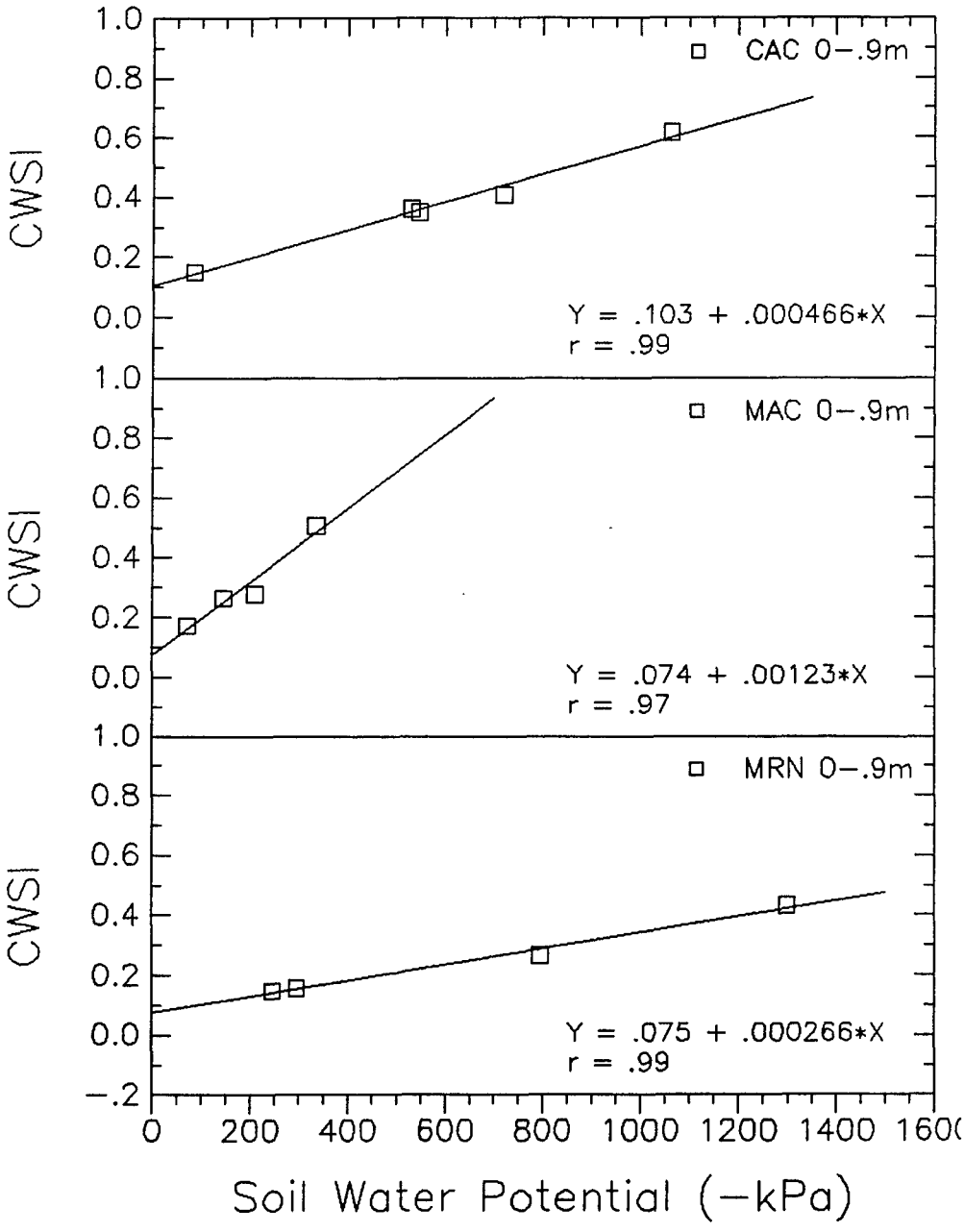

Figure 17 Seasonal average treatment average CWSI vs. soil water potential at CAC, MAC, and MRN.

Chapter 5

SUMMARY AND CONCLUSIONS

The objectives of this study were to determine if there is a definable relationship between CWSI at irrigation and soil water potential that normalizes the effect of soil texture. In exploring this the study addressed first the basic question of a relationship between CWSI and soil water potential. Irrigated cotton was grown at three sites in southern Arizona having different soil textures. Soil moisture content and CWSI readings were taken at each site during the 1987 growing season. Moisture release curves were developed from soil samples and grouped/averaged to obtain overall field average curves and more specific treatment average curves. These curves were used to get soil water potential values from the neutron probe measured moisture contents.

The CWSI was correlated with soil moisture content and with the soil water potential at various depths and averages. The CWSI-soil moisture content relationship appeared to be non-linear. All CWSI-SWP relationships appeared to be linear. The degree of correlation between the CWSI and various groupings of SWP was good with R^2 ranging from 0.4 to 0.8.

The CWSI correlated best with SWP values derived from the overall field average moisture release curve and most poorly with SWP's derived from plot and depth specific curves. Correlations were generally better at the 0.45 and 0.76 meter depths.

Linear regressions of CWSI with SWP all had slightly positive y-axis intercepts. The slopes of the CWSI-SWP relationships, however, were not consistent. They varied widely with depth at two of the sites and did not change consistently with depth or bulk density.

The regression lines (slopes and intercepts) for the overall field average case at each site appear much different and were statistically shown to be significantly different. Thus the expected normalizing effect for texture of using soil water potential rather than soil moisture content for relating CWSI to soil moisture status did not occur. It is possible that the effect did occur but that some other soil based factor such as salinity was large enough to obcure the fact from this study. The CWSI-SWP relationship at a site is virtually the same whether it is determined by all CWSI/SWP measurements or just those at irrigation since it is the drier values that most influence the curve.

Further research on some of the questions raised by this study might benefit from the following observations.

1. The variability of soil moisture release characteristics was such that 4 replications (8 at CAC) were still not enough to provide better correlations than the gross field average value for both moisture release curves and bulk density.

2. The neutron probe calibration should be done for each depth. Depth specific bulk densities should be used if the gravimetric to volumetric conversion of moisture contents is included in the calibration.

3. In order to explain the depth related factors that affect the CWSI it will probably be necessary to obtain depth related measurements of soil salinity, rooting pattern, and soil textural analysis.

APPENDIX A

BULK DENSITIES, MOISTURE CONTENT DATA, AND CAMPBELL MODEL PARAMETERS FOR MOISTURE RELEASE CURVES FOR CAC, MAC, AND MRN

Table A.1 Bulk density, moisture release curve, and Campbell model parameters for CAC

Site	Smple #	Tmt	Plot #	Dpth m	BD g/cc	Percent Moisture (volume basis) 30 kPa %	100 kPa %	250 kPa %	500 kPa %	1500 kPa %	Campbell model psi = $a\theta^{-b}$ a	-b	r^2
Overall field average													
CAC	avg	avg	avg	1.37	18.91	14.77	12.59	11.44	10.74		4.0286E+09	-6.4366	.95
	std dev			.08	3.5	3.2	2.8	2.7	2.5				
Field average by depth													
CAC	avg	avg	15	1.39	19.64	15.84	13.77	12.66	12.05		8.9930E+10	-7.3980	.95
	std dev			.07	1.5	.9	.9	.9	1.1				
CAC	avg	avg	45	1.42	18.04	14.00	11.85	10.74	9.94		1.3988E+09	-6.1730	.96
	std dev			.06	4.2	3.7	3.1	2.8	2.6				
CAC	avg	avg	76	1.30	19.06	14.47	12.16	10.94	10.23		7.2749E+08	-5.8410	.95
	std dev			.06	4.0	3.9	3.4	3.2	2.8				
Averages by treatment													
CAC	W	avg	15	1.39	19.12	15.84	13.82	12.84	12.40		7.5653E+11	-8.1807	.94
CAC	W	avg	45	1.40	19.32	15.86	13.47	12.18	11.86		3.7627E+10	-7.1213	.94
CAC	W	avg	76	1.26	21.35	16.97	14.61	13.21	12.95		4.0434E+10	-6.9304	.92
CAC	W	avg	avg	1.35	19.93	16.22	13.97	12.74	12.40		9.4421E+10	-7.3673	.93
CAC	VD	avg	15	1.41	20.07	15.72	13.64	12.48	12.21		3.0119E+10	-6.9876	.91
CAC	VD	avg	45	1.40	19.81	14.91	12.50	11.40	10.51		7.7108E+08	-5.7896	.95
CAC	VD	avg	76	1.31	18.27	13.54	11.35	10.25	9.51		2.6521E+08	-5.5852	.95
CAC	VD	avg	avg	1.37	19.38	14.72	12.49	11.37	10.74		1.7140E+09	-6.1037	.94
CAC	M	avg	15	1.38	19.77	15.96	14.04	12.85	12.40		2.0199E+11	-7.6555	.94
CAC	M	avg	45	1.44	16.67	12.93	11.19	10.18	9.48		2.3505E+09	-6.5411	.95
CAC	M	avg	76	1.28	18.61	14.10	11.97	10.77	10.39		1.1465E+09	-6.0490	.93
CAC	M	avg	avg	1.37	18.35	14.33	12.40	11.27	10.76		7.6367E+09	-6.7296	.94
CAC	D	avg	15	1.37	19.20	15.60	13.43	12.26	11.50		3.7635E+10	-7.1478	.96
CAC	D	avg	45	1.43	18.34	14.29	11.89	10.80	9.59		5.8676E+08	-5.8256	.98
CAC	D	avg	76	1.35	18.76	13.89	11.18	9.88	8.95		5.3665E+07	-4.9711	.96
CAC	D	avg	avg	1.38	18.77	14.59	12.17	10.98	10.01		8.2768E+08	-5.9021	.97
CAC	AZ	avg	15	1.39	20.02	16.08	13.92	12.84	11.73		3.6655E+10	-7.0455	.97
CAC	AZ	avg	45	1.42	16.07	12.03	10.20	9.14	8.24		1.4733E+08	-5.6247	.97
CAC	AZ	avg	76	1.32	18.30	13.83	11.70	10.58	9.35		3.6020E+08	-5.6765	.98
CAC	AZ	avg	avg	1.38	18.13	13.98	11.94	10.85	9.78		1.2199E+09	-6.1165	.97

Table A.1 (continued)

Site	Smple #	Tmt	Plot #	Dpth cm	BD g/cc	30 kPa	100 kPa	250 kPa	500 kPa	1500 kPa	Campbell model psy = $a\theta^{-b}$ a	-b	r^2
						Percent moisture content (vol. basis)							
Average by plot													
CAC		W	1	avg	1.37	19.15	13.71	11.75	10.46	10.43	3.0637E+08	-5.5512	.88
CAC		D	2	avg	1.43	19.34	14.61	12.30	11.37	10.91	1.7767E+09	-6.1226	.92
CAC		AZ	3	avg	1.37	16.16	12.34	10.82	9.75	9.55	2.3878E+09	-6.6263	.91
CAC		VD	4	avg	1.37	19.71	14.55	12.50	11.41	10.65	1.0625E+09	-5.9194	.93
CAC		AZ	5	avg	1.36	20.93	15.93	13.54	12.59	10.62	1.0540E+09	-5.7719	.98
CAC		VD	6	avg	1.39	18.79	14.10	12.08	11.08	9.65	5.6480E+08	-5.7844	.97
CAC		M	7	avg	1.35	18.06	13.43	11.67	10.98	9.71	1.2416E+09	-6.1536	.95
CAC		W	8	avg	1.31	21.16	18.92	16.68	15.48	14.47	2.0631E+14	-9.6882	.98
CAC		M	9	avg	1.36	20.20	15.79	13.56	12.55	11.98	1.9644E+10	-6.8321	.93
CAC		W	10	avg	1.37	18.11	14.71	12.81	12.09	11.83	3.3635E+11	-8.0663	.90
CAC		D	11	avg	1.36	16.09	12.21	10.24	9.42	8.37	2.3522E+08	-5.7892	.97
CAC		AZ	12	avg	1.40	19.54	15.56	13.24	12.09	10.40	2.4039E+09	-6.1626	.99
CAC		D	13	avg	1.34	23.53	18.66	15.26	13.61	11.49	6.3369E+08	-5.3588	1.00
CAC		AZ	14	avg	1.38	15.90	12.09	10.17	8.98	8.53	2.0514E+08	-5.7602	.95
CAC		VD	15	avg	1.33	18.50	13.81	11.60	10.43	10.29	5.5782E+08	-5.8128	.90
CAC		M	16	avg	1.37	18.33	15.05	13.13	11.52	11.38	3.7666E+10	-7.2456	.94
CAC		VD	17	avg	1.39	20.53	16.44	13.81	12.58	12.39	1.7805E+10	-6.7397	.92
CAC		M	18	avg	1.39	16.80	13.05	11.23	10.02	9.97	2.3857E+09	-6.5178	.91
CAC		W	19	avg	1.35	21.32	17.55	14.63	12.94	12.88	1.8966E+10	-6.6506	.92
CAC		D	20	avg	1.39	16.11	12.89	10.87	9.52	9.29	1.1224E+09	-6.3203	.94
Average of the two sets of samples taken													
CAC		W	1	15	1.43	21.12	16.61	14.37	12.83	13.07	2.7546E+10	-6.8247	.88
CAC		W	1	46	1.38	18.22	12.61	10.67	9.60	9.36	7.3400E+07	-5.1616	.89
CAC		W	1	76	1.30	18.11	11.92	10.20	8.95	8.85	2.0751E+07	-4.7381	.87
CAC		D	2	15	1.51	20.74	16.88	14.74	13.63	13.27	5.1504E+11	-7.8408	.93
CAC		D	2	46	1.39	16.06	11.78	9.84	9.24	8.86	2.4245E+08	-5.8216	.90
CAC		D	2	76	1.39	21.23	15.17	12.31	11.25	10.59	1.3438E+08	-5.0916	.92
CAC		AZ	3	15	1.50	21.04	17.32	15.06	13.46	13.44	2.5048E+11	-7.5442	.92
CAC		AZ	3	46	1.35	14.44	10.51	9.21	8.25	7.94	1.7168E+08	-5.9300	.91
CAC		AZ	3	76	1.27	13.00	9.18	8.17	7.55	7.28	1.0333E+08	-5.9884	.88
CAC		VD	4	15	1.46	21.09	16.28	14.34	13.04	13.15	4.6181E+10	-7.0146	.88
CAC		VD	4	46	1.39	17.34	12.02	10.21	9.52	8.29	5.1904E+07	-5.1340	.94
CAC		VD	4	76	1.27	20.71	15.36	12.93	11.67	10.53	4.5729E+08	-5.5317	.96
CAC		AZ	5	15	1.36	20.33	15.90	13.92	13.07	11.63	2.4690E+10	-6.8912	.97
CAC		AZ	5	46	1.43	21.09	15.30	12.91	11.58	9.84	1.3366E+08	-5.0874	.98
CAC		AZ	5	76	1.28	21.35	16.60	13.77	13.12	10.37	5.6845E+08	-5.5001	.99
CAC		VD	6	15	1.41	20.04	15.57	13.11	12.23	11.12	4.0629E+09	-6.3172	.96
CAC		VD	6	46	1.35	19.13	14.15	12.19	11.02	9.41	2.6895E+08	-5.4931	.98
CAC		VD	6	76	1.40	17.20	12.57	10.93	9.98	8.41	1.4689E+08	-5.4902	.98
CAC		M	7	15	1.38	20.92	16.28	14.43	13.57	11.79	2.6538E+10	-6.8471	.98
CAC		M	7	46	1.41	17.47	12.59	10.91	9.97	8.36	1.0042E+08	-5.3305	.98
CAC		M	7	76	1.27	15.79	11.43	9.67	9.40	8.97	3.7767E+08	-6.0255	.86
CAC		W	8	15	1.36	17.84	15.94	13.68	12.77	12.28	1.3291E+13	-9.3103	.95
CAC		W	8	46	1.35	20.43	18.49	16.03	14.23	13.25	2.1952E+12	-8.2472	.98
CAC		W	8	76	1.23	25.21	22.32	20.32	19.44	17.88	1.6935E+17	-11.2732	.99
CAC		M	9	15	1.41	20.24	17.08	15.01	13.99	13.62	9.0807E+12	-8.8472	.93
CAC		M	9	46	1.38	21.44	16.91	14.58	13.87	13.15	1.2558E+11	-7.3100	.92
CAC		M	9	76	1.28	18.91	13.37	11.11	9.79	9.17	5.3862E+07	-4.9813	.94
CAC		W	10	15	1.35	19.01	15.50	13.79	13.48	12.14	2.0389E+12	-8.5522	.95
CAC		W	10	46	1.43	18.06	15.21	13.25	12.61	12.02	2.9449E+12	-8.8117	.94
CAC		W	10	76	1.32	17.25	13.44	11.38	10.17	11.33	1.7733E+09	-6.2912	.75
CAC		D	11	15	1.34	18.38	14.80	12.82	11.80	10.44	1.0788E+10	-6.8196	.99
CAC		D	11	46	1.41	14.07	10.23	8.47	8.05	6.79	2.8483E+07	-5.2919	.96
CAC		D	11	76	1.34	15.83	11.60	9.45	8.42	7.88	3.6723E+07	-5.1518	.94
CAC		AZ	12	15	1.37	20.09	16.33	14.11	13.24	11.41	2.7495E+10	-6.9207	.99
CAC		AZ	12	46	1.44	16.20	12.92	10.90	9.77	8.52	4.4297E+08	-5.9641	.99
CAC		AZ	12	76	1.38	22.32	17.44	14.72	13.26	11.28	1.2922E+09	-5.6979	.99
CAC		D	13	15	1.26	19.22	15.48	13.19	12.04	10.71	6.1292E+09	-6.5192	.99
CAC		D	13	46	1.44	29.48	23.52	19.27	17.13	14.28	1.9355E+09	-5.3243	1.00
CAC		D	13	76	1.33	21.89	16.98	13.30	11.65	9.47	4.0180E+07	-4.5791	1.00
CAC		AZ	14	15	1.33	18.62	14.76	12.60	11.59	10.44	5.0448E+09	-6.5391	.98
CAC		AZ	14	46	1.45	12.56	9.40	7.76	6.97	6.66	3.1942E+07	-5.5672	.93
CAC		AZ	14	76	1.36	16.52	12.10	10.14	8.39	8.48	3.6709E+07	-5.0543	.91
CAC		VD	15	15	1.39	19.16	15.07	13.25	12.06	11.98	4.8817E+10	-7.2599	.90
CAC		VD	15	46	1.33	19.29	13.77	11.05	9.72	9.49	4.0642E+07	-4.8401	.91

Table A.1 (continued)

Site	Smple #	Tmt	Plot #	Dpth cm	BD g/cc	30 kPa	100 kPa	250 kPa	500 kPa	1500 kPa	Campbell model psy = $a\theta^{-b}$ a	-b	r^2
						Percent moisture content (vol. basis)							
CAC		VD	15	76	1.28	17.03	12.58	10.49	9.49	9.39	2.3618E+08	-5.6799	.89
CAC		M	16	15	1.36	18.07	14.50	12.84	11.44	11.61	6.4730E+10	-7.4873	.89
CAC		M	16	46	1.47	12.20	9.91	8.87	7.72	7.56	2.6249E+09	-7.3694	.94
CAC		M	16	76	1.29	24.72	20.73	17.67	15.41	14.97	1.3280E+11	-6.9409	.95
CAC		VD	17	15	1.36	19.97	15.95	13.85	12.59	12.60	7.2015E+10	-7.2778	.90
CAC		VD	17	46	1.52	23.47	19.70	16.54	15.32	14.86	5.8364E+11	-7.5439	.93
CAC		VD	17	76	1.28	18.15	13.66	11.03	9.84	9.71	1.6192E+08	-5.4080	.91
CAC		M	18	15	1.39	19.84	15.99	13.89	12.41	12.58	6.3530E+10	-7.2405	.90
CAC		M	18	46	1.50	15.56	12.31	10.38	9.16	8.86	7.1556E+08	-6.2448	.94
CAC		M	18	76	1.29	15.01	10.86	9.43	8.49	8.46	1.8816E+08	-5.8737	.88
CAC		W	19	15	1.41	18.52	15.33	13.45	12.28	12.10	4.8075E+11	-8.1095	.93
CAC		W	19	46	1.43	20.58	17.11	13.92	12.27	12.82	8.5207E+09	-6.4383	.87
CAC		W	19	76	1.20	24.85	20.21	16.52	14.27	13.73	4.4288E+09	-5.8732	.95
CAC		D	20	15	1.36	18.47	15.24	12.97	11.59	11.59	3.2820E+10	-7.1754	.92
CAC		D	20	46	1.50	13.77	11.63	10.00	8.77	8.42	4.6618E+09	-7.2130	.96
CAC		D	20	76	1.33	16.10	11.80	9.64	8.21	7.86	2.2571E+07	-4.9320	.94
CAC1 = first replication, CAC2 = second replication, CAC = average of CAC1 and CAC2													
Raw data sets 1 & 2													
CAC2	27	W	1	15	1.37	20.34	15.54	13.23	11.27	11.78	1.1232E+09	-5.8332	.88
CAC1	222	W	1	15	1.49	21.90	17.68	15.52	14.40	14.37	1.1022E+12	-7.9515	.89
CAC1	52	D	2	15	1.53	21.59	17.49	15.40	14.41	13.56	8.3477E+11	-7.9032	.95
CAC2	28	D	2	15	1.48	19.89	16.27	14.08	12.84	12.98	2.4400E+11	-7.6841	.89
CAC2	34	AZ	3	15	1.54	21.79	17.31	14.73	13.60	13.58	6.2670E+10	-7.0260	.89
CAC1	250	AZ	3	15	1.45	20.29	17.34	15.40	13.31	13.31	8.3401E+11	-7.9998	.93
CAC1	253	VD	4	15	1.44	21.13	16.03	14.17	12.86	12.95	2.2903E+10	-6.7848	.87
CAC2	20	VD	4	15	1.48	21.05	16.54	14.52	13.22	13.34	9.5424E+10	-7.2519	.88
CAC1	265	AZ	5	15	1.41	21.12	16.58	14.14	13.45	11.20	4.6152E+09	-6.2269	.99
CAC2	42	AZ	5	15	1.31	19.55	15.22	13.69	12.69	12.07	1.2137E+11	-7.5358	.93
CAC1	262	VD	6	15	1.46	20.76	15.88	12.73	12.06	10.43	4.1587E+08	-5.4775	.97
CAC2	39	VD	6	15	1.36	19.32	15.25	13.49	12.40	11.82	7.0957E+10	-7.3726	.94
CAC2	33	M	7	15	1.34	20.01	16.07	14.17	13.04	12.08	1.1154E+11	-7.4261	.97
CAC2	259	M	7	15	1.43	21.83	16.50	14.69	14.10	11.51	6.1498E+09	-6.2682	.97
CAC1	256	W	8	15	1.36	14.70	16.32	13.44	12.78	11.96	7.4650E+13	-10.1210	.68
CAC2	25	W	8	15	1.37	20.99	15.56	13.93	12.77	12.60	1.5470E+10	-6.6837	.87
CAC2	45	M	9	15	1.37	19.33	16.36	14.36	12.78	13.49	1.2647E+12	-8.2729	.84
CAC1	268	M	9	15	1.45	21.16	17.80	15.65	15.20	13.75	1.4811E+13	-8.8829	.97
CAC2	48	W	10	15	1.43	20.59	16.34	14.35	13.48	13.57	4.3208E+11	-7.8081	.86
CAC1	272	W	10	15	1.27	17.44	14.65	13.23		10.70	7.1483E+02	-0.5530	.19
CAC2	226	D	11	15	1.33	17.25	14.37	12.04	11.36	10.83	5.6859E+10	-7.5518	.94
CAC1	275	D	11	15	1.35	19.51	15.23	13.60	12.25	10.04	1.6470E+09	-6.0273	.99
CAC2	229	AZ	12	15	1.32	19.15	15.98	13.20	12.42	11.84	5.3355E+10	-7.2543	.94
CAC1	278	AZ	12	15	1.42	21.02	16.67	15.01	14.06	10.97	5.2484E+09	-6.2359	.98
CAC2	207	D	13	15	1.25	18.92	15.28	12.96	11.88	11.20	1.6362E+10	-6.9009	.95
CAC1	281	D	13	15	1.27	19.53	15.67	13.43	12.19	10.22	1.8999E+09	-6.0678	1.00
CAC1	284	AZ	14	15	1.33	19.61	14.78	12.71	11.37	9.52	2.7595E+08	-5.4374	.99
CAC2	210	AZ	14	15	1.33	17.63	14.73	12.49	11.81	11.37	2.0372E+11	-7.9441	.93
CAC1	289	VD	15	15	1.38	19.35	15.26	13.55	12.30	11.94	6.8517E+10	-7.3545	.93
CAC2	213	VD	15	15	1.40	18.98	14.88	12.95	11.83	12.02	3.1032E+10	-7.1217	.87
CAC2	201	M	16	15	1.37	18.15	14.90	12.48	11.44	11.67	2.9711E+10	-7.1840	.88
CAC1	292	M	16	15	1.34	18.00	14.10	13.21	11.45	11.54	9.7064E+10	-7.6482	.89
CAC1	304	VD	17	15	1.39	20.45	16.33	14.58	13.13	12.98	2.3928E+11	-7.6268	.92
CAC2	219	VD	17	15	1.33	19.50	15.57	13.12	12.04	12.22	2.0231E+10	-6.8973	.88
CAC2	216	M	18	15	1.38	20.16	15.91	13.49	12.34	12.55	1.8842E+10	-6.8015	.87
CAC1	301	M	18	15	1.40	19.52	16.07	14.28	12.49	12.60	2.0796E+11	-7.6674	.91
CAC1	295	W	19	15	1.43	18.81	15.37	13.85	12.34	12.04	3.6227E+11	-7.9736	.94
CAC2	232	W	19	15	1.39	18.23	15.28	13.05	12.21	12.15	5.1304E+11	-8.1647	.90
CAC2	204	D	20	15	1.37	18.86	15.62	12.80	11.88	11.89	2.4290E+10	-7.0160	.89
CAC1	297	D	20	15	1.35	18.08	14.86	13.13	11.29	11.29	3.3896E+10	-7.2350	.93
CAC1	223	W	1	46	1.37	18.55	13.16	11.09	9.95	9.93	1.4475E+08	-5.3533	.88
CAC2	51	W	1	46	1.39	17.89	12.05	10.26	9.24	8.80	3.6586E+07	-4.9603	.90
CAC1	54	D	2	46	1.40	16.54	12.14	9.96	9.66	8.97	2.4495E+08	-5.7634	.90
CAC2	29	D	2	46	1.39	15.59	11.41	9.72	8.82	8.75	2.1772E+08	-5.8419	.88
CAC1	251	AZ	3	46	1.36	14.44	10.67	9.35	8.43	7.75	2.0259E+08	-5.9885	.95
CAC2	37	AZ	3	46	1.35	14.44	10.34	9.08	8.07	8.13	1.2242E+08	-5.7963	.87
CAC2	22	VD	4	46	1.39	16.46	11.56	9.85	8.70	8.31	4.8662E+07	-5.1996	.92
CAC1	254	VD	4	46	1.38	18.22	12.48	10.57	10.34	8.26	4.1141E+07	-4.9547	.95
CAC2	43	AZ	5	46	1.42	21.18	15.73	13.64	11.89	11.15	8.9386E+08	-5.7103	.95
CAC1	266	AZ	5	46	1.45	21.01	14.87	12.19	11.27	8.53	1.9227E+07	-4.4341	.99
CAC1	263	VD	6	46	1.33	19.81	14.57	12.09	11.34	8.88	7.1027E+07	-4.9601	.99
CAC2	40	VD	6	46	1.37	18.45	13.74	12.29	10.69	9.93	9.7329E+08	-6.0135	.95

Table A.1 (continued)

Site	Smple #	Tmt	Plot #	Dpth cm	BD g/cc	30 kPa	100 kPa	250 kPa	500 kPa	1500 kPa	Campbell model psy = $a\theta^{-b}$ a	-b	r^2
						Percent moisture content (vol. basis)							
CAC1	260	M	7	46	1.45	19.15	13.32	11.29	10.65	7.72	1.3641E+07	-4.4517	.98
CAC2	35	M	7	46	1.36	15.79	11.87	10.54	9.29	9.00	9.1526E+08	-6.3352	.92
CAC2	31	W	8	46	1.38	21.12	19.40	18.46	15.61	15.07	7.6021E+14	-10.0248	.93
CAC1	257	W	8	46	1.31	19.74	17.59	13.61	12.85	11.42	7.6824E+09	-6.4505	.96
CAC2	46	M	9	46	1.39	21.23	17.10	14.95	13.61	13.41	2.2998E+11	-7.5150	.92
CAC1	269	M	9	46	1.38	21.64	16.72	14.20	14.14	12.90	5.0908E+10	-6.9967	.91
CAC2	49	W	10	46	1.46	17.60	14.77	13.58	12.80	12.61	2.3517E+14	-10.4427	.91
CAC1	273	W	10	46	1.40	18.52	15.65	12.92	12.42	11.44	8.4517E+10	-7.4899	.95
CAC2	227	D	11	46	1.40	11.79	9.03	7.79	7.18	7.02	3.1734E+08	-6.6559	.90
CAC1	276	D	11	46	1.41	16.34	11.43	9.14	8.91	6.56	5.1552E+06	-4.3631	.97
CAC1	279	AZ	12	46	1.41	15.12	11.53	10.10	8.70	6.94	2.9928E+07	-5.0989	1.00
CAC2	230	AZ	12	46	1.46	17.28	14.32	11.69	10.84	10.10	4.7824E+09	-6.6624	.96
CAC2	208	D	13	46	1.48	25.20	20.52	16.88	15.47	15.13	5.6796E+10	-6.6594	.92
CAC1	282	D	13	46	1.41	33.76	26.51	21.65	18.80	13.43	1.1732E+08	-4.2748	.99
CAC1	285	AZ	14	46	1.44	13.13	9.25	7.40	6.48	5.88	3.0624E+06	-4.5603	.95
CAC2	211	AZ	14	46	1.46	11.99	9.56	8.12	7.46	7.45	8.8527E+08	-6.9981	.90
CAC1	290	VD	15	46	1.31	18.99	13.03	10.83	9.63	9.29	3.8721E+07	-4.8683	.90
CAC2	214	VD	15	46	1.36	19.60	14.51	11.27	9.82	9.68	3.9534E+07	-4.7838	.91
CAC1	293	M	16	46	1.42	12.60	10.07	9.43	7.86	7.60	1.7721E+09	-7.1057	.95
CAC2	202	M	16	46	1.53	11.80	9.75	8.32	7.57	7.51	2.7295E+09	-7.4813	.92
CAC2	220	VD	17	46	1.51	22.57	19.27	16.14	15.23	15.23	3.1867E+12	-8.1728	.89
CAC1	305	VD	17	46	1.54	24.38	20.12	16.94	15.42	14.50	1.1377E+11	-6.9440	.96
CAC1	302	M	18	46	1.45	14.71	11.20	9.59	8.24	7.82	1.1880E+08	-5.7167	.95
CAC2	217	M	18	46	1.55	16.42	13.43	11.18	10.09	9.90	4.1496E+09	-6.7407	.93
CAC1	296	W	19	46	1.43	20.71	17.52	13.47	11.31	11.48	3.5555E+08	-5.3437	.91
CAC2	233	W	19	46	1.42	20.46	16.70	14.37	13.23	14.16	2.7977E+11	-7.6266	.79
CAC1	298	D	20	46	1.48	14.65	12.35	10.74	9.05	8.47	1.4549E+09	-6.5849	.97
CAC2	205	D	20	46	1.51	12.88	10.91	9.26	8.50	8.38	1.4809E+10	-7.8726	.93
CAC2	53	W	1	76	1.32	18.29	12.04	10.33	9.39	9.09	3.3442E+07	-4.8925	.87
CAC1	224	W	1	76	1.28	17.92	11.81	10.06	8.52	8.61	1.2488E+07	-4.5688	.88
CAC2	30	D	2	76	1.41	23.89	16.71	12.97	11.28	10.49	2.3399E+07	-4.3363	.94
CAC1	225	D	2	76	1.38	18.57	13.63	11.65	11.23	10.68	1.9766E+09	-6.2590	.88
CAC1	252	AZ	3	76	1.29	12.83	8.89	8.05	7.45	7.03	7.5093E+07	-5.9008	.88
CAC2	38	AZ	3	76	1.25	13.17	9.48	8.29	7.66	7.53	1.3517E+08	-6.0528	.87
CAC1	255	VD	4	76	1.26	22.44	16.65	14.53	12.97	11.47	1.2861E+09	-5.7211	.97
CAC2	24	VD	4	76	1.29	18.98	14.07	11.33	10.37	9.59	1.3434E+08	-5.2738	.94
CAC1	267	AZ	5	76	1.25	26.19	21.75	17.95	17.49	12.35	9.9885E+08	-5.2406	.96
CAC2	44	AZ	5	76	1.31	16.51	11.45	9.60	8.75	8.38	4.1934E+07	-5.1445	.90
CAC2	41	VD	6	76	1.42	16.43	12.18	10.85	10.07	9.35	1.9759E+09	-6.5397	.93
CAC1	264	VD	6	76	1.38	17.98	12.96	11.02	9.90	7.46	1.5071E+07	-4.5739	.99
CAC1	261	M	7	76	1.24	15.97	12.43	10.24	9.92	9.06	1.2327E+09	-6.4058	.93
CAC2	36	M	7	76	1.29	15.60	10.42	9.09	8.88	8.88	6.9957E+07	-5.4224	.76
CAC1	258	W	8	76	1.35	24.68	21.01	18.01	16.99	15.20	2.3456E+12	-7.8499	.99
CAC2	32	W	8	76	1.12	25.74	23.63	22.64	21.88	20.55	2.4106E+26	-17.6918	.99
CAC2	47	M	9	76	1.29	19.76	14.20	11.56	10.23	9.68	6.8581E+07	-4.9811	.93
CAC1	270	M	9	76	1.27	18.05	12.54	10.65	9.35	8.66	4.0824E+07	-4.9722	.94
CAC1	274	W	10	76	1.27	16.75	13.13	10.75	8.99		2.0174E+03	-1.1031	.70
CAC2	50	W	10	76	1.37	17.75	13.75	12.00	11.35	11.33	3.2092E+10	-7.3138	.86
CAC1	277	D	11	76	1.33	14.23	10.08	8.15	7.11	6.22	4.3640E+06	-4.5505	.97
CAC2	228	D	11	76	1.35	17.42	13.13	10.74	9.73	9.54	2.5840E+08	-5.6569	.91
CAC1	280	AZ	12	76	1.42	23.10	18.16	15.98	14.15	11.00	6.9458E+08	-5.3932	.99
CAC2	231	AZ	12	76	1.34	21.54	16.72	13.47	12.37	11.57	1.1170E+09	-5.7334	.94
CAC1	283	D	13	76	1.33	25.75	20.52	15.52	13.26	9.54	1.0353E+07	-3.8773	.99
CAC2	209	D	13	76	1.32	18.03	13.44	11.09	10.04	9.41	2.1104E+08	-5.5271	.94
CAC1	287	AZ	14	76	1.41	13.69	9.97	9.24	7.08	7.20	2.4995E+07	-5.2492	.90
CAC2	212	AZ	14	76	1.30	19.34	14.23	11.03	9.70	9.76	3.9301E+07	-4.8038	.89
CAC1	291	VD	15	76	1.31	15.21	11.00	9.21	8.17	8.03	5.3501E+07	-5.3727	.90
CAC2	215	VD	15	76	1.26	18.85	14.16	11.77	10.82	10.76	9.0381E+08	-5.9375	.88
CAC2	203	M	16	76	1.27	25.36	21.08	17.20	15.43	15.58	5.6620E+10	-6.6220	.90
CAC1	294	M	16	76	1.32	24.07	20.38	18.14	15.38	14.36	1.7559E+11	-7.0661	.98
CAC2	221	VD	17	76	1.30	17.72	13.27	10.34	9.37	9.44	6.7976E+07	-5.1407	.88
CAC1	306	VD	17	76	1.27	18.57	14.06	11.73	10.31	9.98	3.6094E+08	-5.6446	.93
CAC1	303	M	18	76	1.29	16.19	11.05	9.53	8.03	7.78	1.5618E+07	-4.8174	.92
CAC2	218	M	18	76	1.29	13.84	10.67	9.34	8.95	9.14	6.3573E+09	-7.3759	.80
CAC1	300	W	19	76	1.24	21.38	17.38	14.20	11.90	11.65	8.6921E+08	-5.6182	.94
CAC2	234	W	19	76	1.17	28.32	23.04	18.85	16.65	15.82	1.7659E+10	-6.0646	.96
CAC1	299	D	20	76	1.34	16.36	11.82	9.71	8.02	7.62	1.2037E+07	-4.6742	.95
CAC2	206	D	20	76	1.31	15.84	11.79	9.57	8.39	8.09	4.3912E+07	-5.2051	.93

Table A.2 Bulk density, moisture release curve, and Campbell model parameters for MAC

Site	Smple #	Tmt	Plot #	Dpth cm	BD g/cc	Percent Moisture (volume basis) 30 kPa %	100 kPa %	250 kPa %	500 kPa %	1500 kPa %	Campbell model psy = $a\theta^{-b}$ a	-b	r^2
Average for whole field													
MAC	avg	avg	avg	1.50		22.31	18.99	16.45	15.35	15.34	2.0425E+13	-8.8174	.90
	std	dev		.1		3.6	3.1	2.6	2.3	2.3			
Average by depth													
MAC	avg	avg	15	1.49		22.00	18.84	16.57	15.58	15.54	1.7684E+14	-9.5628	.90
	std	dev	15	.07		.92	.88	.96	.73	.75			
MAC	avg	avg	46	1.57		21.46	18.54	16.39	15.62	15.48	1.1454E+15	-10.2528	.90
	std	dev	46	.09		1.8	1.7	1.7	1.8	1.8			
MAC	avg	avg	76	1.44		23.46	19.60	16.38	14.87	14.99	2.3566E+11	-7.2471	.90
	std	dev	76	.09		5.8	5.0	4.1	3.5	3.5			
Average by treatment all plots all depths													
MAC		W	avg	avg	1.49	23.11	19.67	17.01	15.81	15.94	2.0915E+13	-8.7212	.89
MAC		M	avg	avg	1.51	22.34	19.05	16.63	15.51	15.35	3.7818E+13	-9.0155	.92
MAC		D	avg	avg	1.47	21.47	18.44	15.81	14.86	14.96	1.7602E+13	-8.8681	.88
MAC		F	avg	avg	1.53	22.31	18.80	16.34	15.24	15.11	1.1797E+13	-8.6494	.91
Average by plot all depths													
MAC		W	1	avg	1.41	23.66	19.79	16.99	15.58	15.69	2.4048E+12	-7.9753	.90
MAC		W	8	avg	1.46	22.42	19.01	16.56	15.38	15.54	2.2593E+13	-8.8357	.89
MAC		W	11	avg	1.60	23.24	20.22	17.47	16.46	16.59	2.3172E+14	-9.4598	.88
MAC		M	3	avg	1.40	22.85	20.20	17.98	16.58	16.12	1.4623E+15	-10.0967	.96
MAC		M	7	avg	1.56	21.11	17.42	15.24	14.32	14.63	5.3496E+12	-8.5493	.85
MAC		M	10	avg	1.55	23.07	19.54	16.68	15.64	15.29	5.4709E+12	-8.3039	.92
MAC		F	2	avg	1.48	25.70	21.79	19.22	17.49	17.48	5.4726E+13	-8.7366	.92
MAC		F	5	avg	1.50	23.48	19.83	17.33	16.35	16.33	7.1665E+13	-9.0832	.89
MAC		F	12	avg	1.60	17.73	14.77	12.47	11.88	11.51	2.0522E+11	-7.9310	.92
MAC		D	4	avg	1.41	23.08	20.35	17.30	16.21	16.48	8.9595E+13	-9.1552	.87
MAC		D	6	avg	1.52	17.76	14.94	13.27	12.65	12.75	3.1660E+13	-9.6884	.86
MAC		D	9	avg	1.47	23.57	20.02	16.85	15.71	15.64	2.6172E+12	-8.0021	.90
Average by treatment and depth all plots													
MAC		W	avg	15	1.49	21.46	18.73	16.65	15.72	15.69	3.3682E+15	-10.5968	.90
MAC		W	avg	46	1.61	22.37	19.45	17.05	16.19	16.33	1.2619E+15	-10.1316	.88
MAC		W	avg	76	1.38	25.50	20.84	17.31	15.52	15.79	7.7014E+10	-6.7187	.89
MAC		M	avg	15	1.54	22.49	19.18	16.89	15.96	15.63	1.6911E+14	-9.4881	.92
MAC		M	avg	46	1.53	21.70	18.51	16.56	15.78	15.29	8.3532E+14	-10.1302	.93
MAC		M	avg	76	1.45	22.84	19.48	16.46	14.80	15.13	7.7326E+11	-7.6742	.89
MAC		D	avg	15	1.42	21.21	17.94	15.40	14.54	14.77	8.4028E+12	-8.6679	.86
MAC		D	avg	46	1.57	21.30	18.64	16.87	16.11	15.91	9.3017E+16	-11.7232	.91
MAC		D	avg	76	1.41	21.90	18.72	15.15	13.91	14.20	1.0347E+11	-7.1153	.88
MAC		F	avg	15	1.50	22.82	19.50	17.34	16.09	16.08	2.5817E+14	-9.5719	.91
MAC		F	avg	46	1.58	20.48	17.54	15.09	14.39	14.40	2.6348E+13	-9.1487	.88
MAC		F	avg	76	1.51	23.61	19.35	16.59	15.24	14.84	4.9868E+11	-7.4973	.93
Individual lab-determined moisture release curves													
MAC	109	W	1	15	1.48	22.47	19.30	17.29	15.92	16.11	5.0676E+14	-9.8308	.90
MAC	112	F	2	15	1.49	23.45	20.47	18.42	16.25	16.74	1.9670E+14	-9.3586	.89
MAC	115	M	3	15	1.41	22.65	19.33	17.29	15.92	15.63	1.5056E+14	-9.4248	.94
MAC	118	D	4	15	1.40	21.91	19.16	16.56	15.58	16.04	2.1226E+14	-9.5974	.85
MAC	121	F	5	15	1.46	22.37	18.65	16.80	15.81	15.73	2.1173E+14	-9.5940	.89
MAC	124	D	6	15	1.48	21.70	17.89	14.92	14.24	14.54	4.0832E+11	-7.6174	.84
MAC	71	M	7	15	1.60	22.14	18.81	16.75	15.82	16.02	5.0256E+14	-9.8848	.87
MAC	68	W	8	15	1.50	21.23	18.37	16.13	15.66	15.57	1.9819E+15	-10.4654	.87
MAC	64	D	9	15	1.38	20.02	16.77	14.71	13.82	13.73	9.5935E+12	-8.9021	.90
MAC	61	M	10	15	1.62	22.68	19.40	16.63	16.15	15.23	3.8310E+13	-8.9788	.94
MAC	58	W	11	15	1.49	20.67	18.53	16.53	15.59	15.40	3.7837E+16	-11.5082	.93
MAC	55	F	12	15	1.55	22.66	19.39	16.79	16.22	15.79	1.6204E+14	-9.4478	.91
MAC	110	W	1	46	1.48	23.83	19.95	17.31	16.33	16.42	2.4149E+13	-8.6959	.88
MAC	113	F	2	46	1.50	23.18	19.99	17.71	16.69	16.97	1.7561E+15	-10.1275	.87
MAC	116	M	3	46	1.41	21.17	18.99	17.60	17.40	15.89	4.9243E+19	-13.7824	.98
MAC	119	D	4	46	1.51	23.19	20.43	18.21	17.06	17.13	1.5699E+16	-10.8144	.90
MAC	122	F	5	46	1.57	20.61	18.20	15.77	15.51	15.79	5.6642E+15	-10.8778	.81
MAC	125	D	6	46	1.58	19.71	17.57	16.68	15.86	15.61	1.8695E+21	-15.3702	.93
MAC	72	M	7	46	1.63	23.05	18.81	16.71	15.68	15.88	1.5037E+13	-8.6528	.86

Table A.2 (continued)

Site	Smple #	Tmt	Plot #	Dpth cm	BD g/cc	30 kPa	100 kPa	250 kPa	500 kPa	1500 kPa	Campbell model psy = $a\theta^{-b}$ a	-b	r^2
						Percent moisture content (vol. basis)							
MAC	69	W	8	46	1.57	19.88	17.09	15.37	14.32	14.59	6.3800E+14	-10.3145	.87
MAC	65	D	9	46	1.61	21.01	17.93	15.72	15.42	14.98	5.0897E+14	-10.0687	.90
MAC	62	M	10	46	1.55	20.87	17.72	15.36	14.25	14.10	6.2494E+12	-8.6225	.92
MAC	59	W	11	46	1.78	23.39	21.31	18.48	17.92	18.00	2.8210E+17	-11.6642	.86
MAC	56	F	12	46	1.66	17.66	14.44	11.79	10.97	10.43	5.0781E+09	-6.6425	.94
MAC	111	W	1	76	1.29	24.68	20.12	16.36	14.51	14.54	1.2677E+10	-6.2184	.91
MAC	114	F	2	76	1.46	30.48	24.91	21.54	19.54	18.74	2.0679E+12	-7.3521	.95
MAC	117	M	3	76	1.39	24.73	22.30	19.06	16.42	16.85	4.7597E+12	-7.9892	.90
MAC	120	D	4	76	1.31	24.13	21.46	17.12	15.99	16.27	9.0398E+11	-7.5483	.86
MAC	123	F	5	76	1.47	27.46	22.65	19.41	17.72	17.48	1.9116E+12	-7.5547	.92
MAC	126	D	6	76	1.50	11.88	9.35	8.21	7.86	8.12	6.0561E+09	-7.7988	.79
MAC	92	M	7	76	1.46	18.13	14.64	12.27	11.45	11.98	2.6068E+10	-7.1378	.82
MAC	70	W	8	76	1.31	26.15	21.57	18.19	16.16	16.46	2.1793E+11	-6.9829	.90
MAC	67	D	9	76	1.42	29.69	25.34	20.12	17.88	18.21	7.9726E+10	-6.3885	.89
MAC	63	M	10	76	1.50	25.66	21.49	18.04	16.52	16.56	9.2966E+11	-7.4737	.90
MAC	60	W	11	76	1.52	25.66	20.82	17.39	15.88	16.37	1.5930E+11	-6.9343	.86
MAC	57	F	12	76	1.60	12.88	10.49	8.82	8.46	8.32	6.6250E+09	-7.5881	.88

Table A.3 Bulk density, moisture release curve, and Campbell model parameters for MRN

Site	Smple #	Tmt	Plot #	Dpth cm	BD g/cc	Percent Moisture (volume basis) 30kPa %	100kPa %	250kPa %	500kPa %	1500kPa %	Campbell model psy = $a\theta^{-b}$ a	-b	r^2
Overall field average													
MRN		avg	avg	avg	1.46	28.85	25.64	22.84	21.07	21.28	9.5811E+16	-10.6344	.90
		std	dev		.09	3.2	3.2	3.1	3.1	3.4			
Averaged over field by depths													
MRN		avg	avg	15	1.50	30.21	27.01	23.97	22.31	22.39	3.8753E+17	-10.8999	.91
		std	dev		.084	2.4	2.2	2.1	2.0	2.5			
MRN		avg	avg	46	1.50	30.47	27.44	24.81	23.09	23.52	2.9901E+19	-12.1428	.89
		std	dev		.073	3.1	3.1	2.9	2.8	3.0			
MRN		avg	avg	76	1.39	25.88	22.46	19.73	17.80	17.92	1.3157E+14	-8.9659	.92
		std	dev		.080	1.3	1.3	1.2	1.1	1.5			
Average by treatment all plots all depths													
MRN		W	avg	avg	1.45	28.89	25.78	23.15	21.62	21.71	1.6388E+18	-11.4823	.91
MRN		M	avg	avg	1.50	28.73	26.03	23.09	21.28	21.66	3.9579E+17	-11.0475	.89
MRN		D	avg	avg	1.47	29.22	26.04	23.25	21.39	21.48	1.3197E+17	-10.6879	.92
MRN		F	avg	avg	1.43	28.57	24.69	21.87	19.99	20.26	1.5409E+15	-9.4456	.90
Average by treatment and depth													
MRN		W	avg	15	1.46	30.06	26.98	23.87	22.35	22.17	4.7237E+17	-10.9742	.92
MRN		W	avg	46	1.48	31.01	28.29	26.04	24.02	24.58	2.2812E+21	-13.3298	.88
MRN		W	avg	76	1.40	25.61	22.07	19.54	18.50	18.38	4.1707E+15	-10.0919	.90
MRN		M	avg	15	1.57	31.15	28.09	25.02	23.25	23.43	2.2839E+18	-11.3111	.91
MRN		M	avg	46	1.56	31.31	29.23	26.28	24.57	25.22	5.2111E+21	-13.4995	.86
MRN		M	avg	76	1.38	23.72	20.78	17.99	16.01	16.32	1.5091E+13	-8.5065	.90
MRN		D	avg	15	1.51	30.19	26.78	23.77	22.09	22.25	1.5312E+17	-10.6340	.90
MRN		D	avg	46	1.48	29.26	26.33	23.69	21.97	22.25	3.9079E+18	-11.6842	.90
MRN		D	avg	76	1.43	28.20	25.02	22.27	20.11	19.94	4.5488E+15	-9.7858	.94
MRN		F	avg	15	1.46	29.45	26.19	23.24	21.57	21.71	1.3024E+17	-10.6623	.91
MRN		F	avg	46	1.48	30.29	25.92	23.24	21.81	22.03	3.3943E+16	-10.2125	.88
MRN		F	avg	76	1.36	25.99	21.97	19.12	16.58	17.04	1.5840E+12	-7.5895	.90
Average by plot all depths													
MRN		W	1	avg	1.44	29.70	26.86	24.44	23.22	23.86	2.5396E+21	-13.5461	.84
MRN		W	6	avg	1.48	28.14	25.06	22.41	20.84	20.97	3.4591E+17	-11.1041	.91
MRN		W	9	avg	1.42	28.84	25.43	22.60	20.80	20.31	9.8491E+15	-9.9656	.95
MRN		M	2	avg	1.45	28.56	26.30	23.35	21.62	22.29	5.3466E+18	-11.8219	.86
MRN		M	5	avg	1.49	30.68	28.01	25.00	22.65	23.24	7.2214E+17	-10.9936	.88
MRN		M	12	avg	1.57	26.95	23.78	20.93	19.56	19.44	1.1825E+16	-10.2292	.92
MRN		D	3	avg	1.42	28.74	25.95	23.32	21.45	22.39	2.1573E+18	-11.5461	.84
MRN		D	8	avg	1.51	30.09	26.34	23.36	21.16	21.29	3.5739E+15	-9.5381	.92
MRN		D	11	avg	1.49	28.83	25.84	23.07	21.56	20.75	2.1857E+17	-10.8846	.97
MRN		F	4	avg	1.49	29.72	25.80	23.08	21.66	22.57	1.0539E+17	-10.5754	.82
MRN		F	7	avg	1.38	29.00	24.61	21.47	19.16	19.32	2.2318E+13	-8.1427	.91
MRN		F	10	avg	1.43	27.00	23.67	21.05	19.13	18.89	1.6309E+15	-9.6179	.94
Laboratory determined raw data													
MRN	1	W	1	15	1.43	30.51	27.82	24.70	23.40	23.83	5.3067E+19	-12.2918	.87
MRN	2	W	1	46	1.50	31.20	28.81	26.50	24.79	25.74	2.7239E+23	-14.6797	.83
MRN	3	W	1	76	1.37	27.39	23.95	22.10	21.47	22.00	3.4152E+20	-13.3002	.78
MRN	4	M	2	15	1.54	31.70	29.13	26.29	24.71	25.21	2.8451E+21	-13.3044	.87
MRN	5	M	2	46	1.47	31.35	29.69	26.63	25.32	26.30	5.2076E+23	-14.8017	.79
MRN	6	M	2	76	1.35	22.62	20.09	17.13	14.82	15.37	1.4506E+12	-7.8505	.88
MRN	7	D	3	15	1.38	30.15	26.79	23.75	22.11	22.55	2.2885E+17	-10.7507	.88
MRN	8	D	3	46	1.40	29.58	27.11	24.83	22.76	24.17	3.0961E+20	-12.8846	.78
MRN	9	D	3	76	1.48	26.48	23.94	21.37	19.49	20.46	1.3564E+17	-10.9787	.83
MRN	10	F	4	15	1.40	29.35	26.32	23.45	21.79	22.51	9.0245E+17	-11.2293	.85
MRN	11	F	4	46	1.64	36.52	30.46	27.33	25.96	27.24	2.5927E+16	-9.5902	.77
MRN	12	F	4	76	1.44	23.31	20.62	18.46	17.25	17.97	5.0233E+16	-11.1436	.83
MRN	13	M	5	15	1.54	30.70	28.05	25.05	23.13	23.38	6.8746E+18	-11.6650	.90
MRN	14	M	5	46	1.59	32.04	28.86	26.14	23.47	24.09	8.2167E+17	-10.9061	.89
MRN	15	M	5	76	1.33	29.30	27.12	23.81	21.35	22.24	5.7079E+16	-10.3589	.85
MRN	16	W	6	15	1.44	30.22	26.77	23.55	21.77	21.40	1.3674E+16	-9.9200	.94
MRN	17	W	6	46	1.53	31.17	27.88	25.51	23.59	24.42	6.6895E+19	-12.2958	.85
MRN	18	W	6	76	1.47	23.03	20.53	18.18	17.16	17.08	3.4817E+16	-11.0852	.91
MRN	21	F	7	15	1.56	31.90	28.30	25.09	23.11	23.49	1.2204E+17	-10.3926	.89

Table A.3 (continued)

Site	Smple #	Tmt	Plot #	Dpth cm	BD g/cc	30 kPa	100 kPa	250 kPa	500 kPa	1500 kPa	Campbell model psy = $a\theta^{-b}$ a	-b	r^2
						Percent moisture content (vol. basis)							
MRN	26	F	7	46	1.34	27.44	23.45	20.70	19.17	18.82	4.3075E+14	-9.1926	.93
MRN	93	F	7	76	1.25	27.66	22.07	18.63	15.20	15.64	4.9497E+09	-5.7094	.91
MRN	94	D	8	15	1.54	30.85	27.40	24.09	22.15	22.63	2.9486E+16	-10.0727	.88
MRN	95	D	8	46	1.49	28.55	24.94	22.52	20.71	20.71	5.1344E+16	-10.5012	.92
MRN	96	D	8	76	1.49	30.87	26.68	23.47	20.61	20.55	6.1170E+13	-8.2718	.93
MRN	97	W	9	15	1.52	29.44	26.37	23.34	21.88	21.29	1.7718E+17	-10.7548	.95
MRN	98	W	9	46	1.41	30.68	28.19	26.11	23.67	23.57	2.8548E+20	-12.7498	.94
MRN	99	W	9	76	1.34	26.41	21.74	18.34	16.86	16.06	3.8348E+11	-7.1524	.95
MRN	100	F	10	15	1.41	27.09	23.94	21.17	19.80	19.13	1.0866E+16	-10.1888	.96
MRN	101	F	10	46	1.46	26.90	23.85	21.69	20.32	20.02	1.8225E+18	-11.7805	.94
MRN	102	F	10	76	1.40	27.00	23.21	20.28	17.29	17.51	1.9985E+12	-7.5554	.92
MRN	103	D	11	15	1.61	29.58	26.15	23.48	22.00	21.57	4.5554E+17	-11.0364	.94
MRN	104	D	11	46	1.55	29.66	26.92	23.73	22.42	21.87	1.1180E+18	-11.2647	.94
MRN	105	D	11	76	1.32	27.25	24.44	21.99	20.25	18.82	1.0023E+16	-10.1169	.99
MRN	106	M	12	15	1.63	31.06	27.08	23.72	21.91	21.71	3.1605E+15	-9.4235	.93
MRN	107	M	12	46	1.61	30.53	29.14	26.06	24.93	25.26	1.6987E+24	-15.2702	.86
MRN	108	M	12	76	1.47	19.25	15.11	13.02	11.86	11.35	1.1834E+10	-6.7657	.94

APPENDIX B

CORRELATION OF TREATMENT AVERAGE CWSI WITH SOIL MOISTURE PARAMETERS AT CAC, MAC, AND MRN

Table B.1 Correlation of treatment average CWSI with soil moisture content at CAC.

X Variable	Y Variable	Corr (r) / S.E. of r	Slope (b) / S.E. of b	Y Int (a) / P	n-2
MC1	CWSI	-0.555304801	-0.0210978296	0.4568580129	118
		0.0765593034	2.908736E-03	4.629896E-11 ***	
MC2	CWSI	-0.6443651719	-0.0344634647	0.6951894787	118
		0.0703979924	3.765192E-03	2.07847E-15 ***	
MC3	CWSI	-0.576409029	-0.0405006641	0.7331218608	118
		0.0752257975	5.285647E-03	5.619173E-12 ***	
MC123	CWSI	-0.6731170567	-0.0389807025	0.7381216514	118
		0.0680788029	3.942551E-03	-4.94825E-17 ***	
sp1	CWSI	0.5210963756	3.264641E-05	0.0909985134	118
		0.078570845	4.922421E-06	1.04911E-09 ***	
sp2	CWSI	0.5785246433	6.578517E-04	0.0603047273	118
		0.0750880408	8.538408E-05	4.510448E-12 ***	
sp3	CWSI	0.7266969055	7.399115E-04	9.80113E-03	118
		0.0632396309	6.438961E-05	-6.094809E-17 ***	
sp123	CWSI	0.8047852125	5.330178E-04	0.0279115442	118
		0.0546421922	3.61901E-05	3.032811E-17 ***	
fa1	CWSI	0.5501249675	3.935837E-05	0.0829892531	118
		0.0768755609	5.500017E-06	7.597946E-11 ***	
fa2	CWSI	0.7502918579	8.443097E-04	0.0349893786	118
		0.0608598089	6.848605E-05	-7.878392E-17 ***	
fa3	CWSI	0.7407728691	5.597086E-04	0.0255505726	118
		0.0618401134	4.672478E-05	-9.789541E-19 ***	
fa123	CWSI	0.8129814171	4.600327E-04	0.0305440572	118
		0.0536041055	3.033235E-05	1.570292E-17 ***	

Table B.2 Correlation of treatment average CWSI with soil moisture content at MAC.

X Variable	Y Variable	Corr (r)	Slope (b)	Y Int (a)	n-2
		S.E. of r	S.E. of b	P	
MC1	CWSI	-0.559411212	-0.0273431124	0.6753696633	71
		0.0983711781	4.808224E-03	2.679898E-07	***
MC2	CWSI	-0.6473892663	-0.045239441	1.0881065044	71
		0.0904516942	6.320747E-03	6.039169E-10	***
MC3	CWSI	-0.6686897027	-0.0431693264	1.137728186	71
		0.0882421509	5.696744E-03	1.011941E-10	***
MC123	CWSI	-0.691738273	-0.0462147471	1.1064182776	71
		0.0857032352	5.725798E-03	1.233242E-11	***
sp1	CWSI	0.4412857868	1.07088E-04	0.1487780957	71
		0.1064978248	2.584411E-05	9.311884E-05	***
sp2	CWSI	0.6504865348	9.538038E-04	0.1126952928	71
		0.0901381778	1.32169E-04	4.698564E-10	***
sp3	CWSI	0.1557214951	2.412961E-04	0.1802787328	71
		0.1172304109	1.816528E-04	0.1883208605	ns
sp123	CWSI	0.7099961542	1.217241E-03	0.073525353	71
		0.0835738234	1.432817E-04	2.01613E-12	***
fa1	CWSI	0.5865664414	1.22326E-04	0.1385394819	71
		0.0961175784	2.004492E-05	4.948075E-08	***
fa2	CWSI	0.680023226	9.961233E-04	0.1078834127	71
		0.0870137121	1.274609E-04	3.681194E-11	***
fa3	CWSI	0.4084818828	8.244059E-04	0.1460633715	71
		0.1083254455	2.186245E-04	3.3362E-04	***
fa123	CWSI	0.7830611347	1.098771E-03	0.0795842741	71
		0.073811261	1.0357E-04	2.860455E-16	***

Table B.3 Correlation of treatment average CWSI with soil moisture content at MRN.

X Variable	Y Variable	Corr (r) S.E. of r	Slope (b) S.E. of b	Y Int (a) P	n-2
MC1	CWSI	-0.44697723	-7.727491E-03	0.3673360846	51
		0.1252614016	2.165561E-03	7.927935E-04	***
MC2	CWSI	-0.5941752714	-0.0309997913	0.961259922	51
		0.1126295112	5.876198E-03	2.725696E-06	***
MC3	CWSI	-0.5524470936	-0.0224832398	0.6042688144	51
		0.1167200613	4.75022E-03	1.795394E-05	***
MC123	CWSI	-0.7145289576	-0.0301517819	0.882623502	51
		0.0979644162	4.133915E-03	1.870643E-09	***
sp1	CWSI	0.4034549102	1.635852E-05	0.1399012092	51
		0.1281255615	5.194992E-06	2.738846E-03	**
sp2	CWSI	0.361302431	8.295033E-05	0.1300593892	51
		0.1305689325	2.997693E-05	7.859475E-03	**
sp3	CWSI	0.6100249396	3.224911E-05	0.1247750321	51
		0.1109557033	5.865699E-06	1.240076E-06	***
sp123	CWSI	0.7436869486	1.495365E-04	0.0970034117	51
		0.0936126481	1.882311E-05	1.775583E-10	***
fa1	CWSI	0.3923973369	1.508976E-05	0.1425953499	51
		0.1287971753	4.952936E-06	3.659398E-03	**
fa2	CWSI	0.6431100155	3.153795E-04	0.0626177606	51
		0.1072297797	5.258521E-05	2.06973E-07	***
fa3	CWSI	0.6307022402	1.085167E-04	0.0920658328	51
		0.1086652247	1.86966E-05	4.151539E-07	***
fa123	CWSI	0.750517916	1.805222E-04	0.0912604954	51
		0.0925375237	2.225806E-05	9.767231E-11	***

APPENDIX C

CORRELATION OF TREATMENT AVERAGE CWSI AT IRRIGATION

VS SOIL MOISTURE PARAMETERS AT CAC, MAC, AND MRN

Table C.1 Correlation of treatment average CWSI at irrigation with soil moisture parameters at CAC.

X Variable	Y Variable	Corr (r)	Slope (b)	Y Int (a)	n-2
		S.E. of r	S.E. of b	P	
MC1	CWSI	-0.4941644755	-0.0326124601	0.7314604466	24
		0.1774590881	0.0117114397	0.0102888098	*
MC2	CWSI	-0.7169816605	-0.054745286	1.0869776738	24
		0.1422933148	0.0108648361	3.768095E-05	***
MC3	CWSI	-0.8014973601	-0.0559566889	1.1070999709	24
		0.1220658944	8.522053E-03	8.616459E-07	***
MC123	CWSI	-0.7597017796	-0.0610855504	1.1378433136	24
		0.1327361427	0.0106729516	6.751707E-06	***
sp1	CWSI	0.2782096959	1.105039E-05	0.3108196969	24
		0.1960653978	7.78765E-06	0.168766877	ns
sp2	CWSI	0.4747790776	4.307823E-04	0.2432533263	24
		0.1796506827	1.630028E-04	0.0142522153	*
sp3	CWSI	0.8481496503	6.653805E-04	0.1513783455	24
		0.1081361354	8.483371E-05	4.470627E-08	***
sp123	CWSI	0.8047789933	4.213863E-04	0.152976945	24
		0.121162902	6.344151E-05	7.183824E-07	***
fa1	CWSI	0.2760986943	1.342972E-05	0.303361527	24
		0.1961896947	9.542868E-06	0.1721568162	ns
fa2	CWSI	0.7282894945	6.693748E-04	0.1695941422	24
		0.1398800695	1.285645E-04	2.465509E-05	***
fa3	CWSI	0.8442075207	4.542532E-04	0.184896277	24
		0.1094139049	5.88737E-05	5.951526E-08	***
fa123	CWSI	0.8314976127	3.677283E-04	0.1546865587	24
		0.1133967445	5.01495E-05	1.42304E-07	***

Table C.2 Correlation of treatment average CWSI at irrigation with soil moisture parameters at MAC.

X Variable	Y Variable	Corr (r)	Slope (b)	Y Int (a)	n-2
		S.E. of r	S.E. of b	P	
MC1	CWSI	-0.5236630504	-0.0395612843	0.9131642509	18
		0.2008007594	0.0151699379	0.0178021043	*
MC2	CWSI	-0.6093642786	-0.0570031393	1.3350075705	18
		0.186886058	0.0174823047	4.342596E-03	**
MC3	CWSI	-0.8681039838	-0.0688378725	1.7372992373	18
		0.1169984505	9.277603E-03	7.039485E-07	***
MC123	CWSI	-0.7155259264	-0.0629800973	1.4507078514	18
		0.1646583413	0.0144931133	3.897355E-04	***
sp1	CWSI	0.201505077	4.4621E-05	0.2373403938	18
		0.2308674107	5.112295E-05	0.3942573474	ns
sp2	CWSI	0.5992548937	7.921065E-04	0.1549415353	18
		0.188693398	2.494185E-04	5.233335E-03	**
sp3	CWSI	0.7183835467	3.748018E-03	0.0216946133	18
		0.1639656264	8.554568E-04	3.600504E-04	***
sp123	CWSI	0.7036429819	1.310358E-03	0.0686566211	18
		0.1674791121	3.118876E-04	5.365742E-04	***
fa1	CWSI	0.5081960946	1.048191E-04	0.1911928279	18
		0.202996542	4.186951E-05	0.022147584	*
fa2	CWSI	0.5977661561	8.406256E-04	0.1499035005	18
		0.1889555537	2.657241E-04	5.376386E-03	**
fa3	CWSI	0.8924434568	2.876312E-03	0.0756231468	18
		0.106339257	3.427275E-04	1.230929E-07	***
fa123	CWSI	0.779019604	1.046633E-03	0.1046143663	18
		0.1477852151	1.985533E-04	5.180503E-05	***

Table C.3 Correlation of treatment average CWSI at irrigation with soil moisture parameters at MRN.

X Variable	Y Variable	Corr (r)	Slope (b)	Y Int (a)	n-2
		S.E. of r	S.E. of b	P	
MC1	CWSI	-0.5148329492	-0.0141580574	0.5967959002	14
		0.2291205289	6.301327E-03	0.04128705	*
MC2	CWSI	-0.4411640587	-0.0341301965	1.0967258327	14
		0.2398473135	0.0185555368	0.0871635689	ns
MC3	CWSI	-0.7200296266	-0.0381185878	0.9607997313	14
		0.1854641546	9.818529E-03	1.658518E-03	**
MC123	CWSI	-0.7502041324	-0.0444032557	1.2448735243	14
		0.1767148146	0.0104594373	8.155749E-04	***
sp1	CWSI	0.4639643536	1.584074E-05	0.2294405115	14
		0.2367544054	8.083302E-06	0.0702501827	ns
sp2	CWSI	-0.0184392304	-3.333284E-06	0.2651612115	14
		0.2672158029	4.830495E-05	0.9459615488	ns
sp3	CWSI	0.7901397118	3.205722E-05	0.2025794342	14
		0.163811572	6.646095E-06	2.703828E-04	***
sp123	CWSI	0.7883130441	1.349008E-04	0.1542118553	14
		0.164438991	2.813978E-05	2.857939E-04	***
fa1	CWSI	0.4670285751	1.553173E-05	0.2326726645	14
		0.2363236748	7.859293E-06	0.0681743504	ns
fa2	CWSI	0.3886487014	1.807971E-04	0.170367271	14
		0.2462507704	1.145544E-04	0.1368272367	ns
fa3	CWSI	0.6797053413	9.993947E-05	0.1615799128	14
		0.1960321856	2.88233E-05	3.772509E-03	**
fa123	CWSI	0.7862572252	1.627354E-04	0.1477221581	14
		0.165140541	3.417993E-05	3.040005E-04	***

APPENDIX D

CWSI AND SOIL MOISTURE CONTENT MEASUREMENTS

FOR CAC, MAC, AND MRN

Table D.1 CWSI, soil moisture content, and calculated soil water potentials for CAC.

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
Wet treatment																
173	22-Jun		W	avg 0.105	17.58	19.85	18.92	18.78	49	22	57	39	55	14	25	25
175	24-Jun		W	avg 0.033	14.40	18.73	18.98	17.36	253	33	56	70	243	20	25	42
177	26-Jun	I	W	avg 0.098	12.23	17.69	18.77	16.23	982	49	60	114	812	28	27	65
180	29-Jun		W	avg 0.035	18.40	21.02	20.60	20.01	34	14	32	24	40	10	15	17
182	01-Jul	i	W	avg 0.112	14.98	19.29	20.08	18.11	185	28	38	51	183	16	18	32
187	06-Jul		W	avg -0.020	18.31	19.38	19.48	19.06	35	26	47	35	41	16	21	23
189	08-Jul		W	avg -0.035	15.04	17.83	18.98	17.21	177	50	58	74	175	28	25	45
191	10-Jul		W	avg -0.010	12.06	15.58	18.04	15.23	1076	121	79	183	898	61	33	98
194	13-Jul	I	W	avg 0.092	10.23	13.35	16.27	13.28	4146	363	163	500	3042	158	61	237
198	17-Jul		W	avg -0.163	21.69	20.77	17.56	20.01	9	16	96	24	12	10	39	17
201	20-Jul		W	avg 0.010	17.46	17.48	17.00	17.31	52	53	120	71	58	30	47	43
203	22-Jul	I	W	avg 0.188	14.44	15.94	16.23	15.53	247	103	166	158	236	53	62	87
208	27-Jul		W	avg 0.028	21.52	20.73	17.71	19.99	9	16	90	25	12	10	37	17
210	29-Jul		W	avg 0.060	19.40	19.08	17.23	18.57	22	29	109	42	27	17	44	27
212	31-Jul		W	avg -0.087	17.73	17.42	16.77	17.31	46	55	132	71	52	31	51	43
215	03-Aug		W	avg 0.022	14.19	15.23	15.44	14.95	285	142	234	209	270	70	83	111
219	07-Aug		W	avg 0.033	25.06	20.42	13.81	19.76	3	16	506	27	4	11	159	18
224	12-Aug		W	avg -0.080	20.42	18.48	16.08	18.33	15	36	176	47	18	21	65	30
226	14-Aug	I	W	avg 0.188	18.23	17.13	15.50	16.95	37	62	228	83	42	34	81	49
229	17-Aug		W	avg -0.040	21.52	20.40	18.42	19.44	9	18	153	30	12	12	58	20
231	19-Aug	I	W	avg 0.100	19.48	18.10	15.87	17.82	21	42	193	57	26	24	71	36
233	21-Aug		W	avg -0.053	23.60	21.56	16.31	20.49	4	12	160	21	6	8	60	15
240	28-Aug	I	W	avg 0.275	16.75	16.04	14.65	15.81	73	98	337	139	79	51	113	77
243	31-Aug		W	avg 0.090	22.73	20.65	15.58	19.65	6	16	219	28	8	11	79	19
Medium treatment																
173	22-Jun		M	avg 0.085	18.29	19.08	18.27	18.55	46	30	24	31	41	17	31	28
175	24-Jun		M	avg 0.050	15.19	18.00	18.19	17.13	167	42	24	51	163	25	32	46
177	26-Jun		M	avg 0.123	13.06	17.10	17.83	16.00	479	56	27	77	498	34	36	72
180	29-Jun		M	avg 0.182	10.65	15.17	17.33	14.38	2001	112	32	147	2264	72	42	142
182	01-Jul	i	M	avg 0.260	9.67	13.87	16.98	13.50	3928	189	36	216	4622	125	48	213
187	06-Jul		M	avg 0.057	18.73	18.50	18.38	18.53	39	36	23	31	35	21	30	28
189	08-Jul		M	avg -0.055	15.27	16.46	17.71	16.48	161	70	28	64	157	43	37	59
191	10-Jul		M	avg -0.045	12.27	14.33	16.79	14.47	742	156	38	142	791	102	51	137
194	13-Jul		M	avg 0.060	10.54	12.27	15.17	12.66	2144	383	67	320	2435	266	92	323
198	17-Jul	I	M	avg 0.188	9.65	11.08	13.13	11.28	3987	690	151	646	4696	498	214	677
201	20-Jul		M	avg 0.033	22.63	20.33	16.79	19.92	10	21	38	20	9	12	51	17
203	22-Jul		M	avg 0.065	19.31	17.50	16.13	17.65	31	49	48	42	28	30	64	38
208	27-Jul		M	avg 0.095	13.35	13.10	13.21	13.22	411	262	146	245	423	177	207	244
210	29-Jul		M	avg 0.170	12.63	12.48	12.56	12.56	608	347	193	337	641	239	277	341
212	31-Jul		M	avg 0.053	11.31	11.29	11.23	11.28	1309	620	361	648	1444	444	533	680
215	03-Aug	I	M	avg 0.565	10.25	10.56	10.17	10.33	2608	912	628	1110	2998	670	953	1199
219	07-Aug		M	avg -0.035	21.31	19.06	17.08	19.15	16	30	35	26	13	18	46	22
224	12-Aug		M	avg 0.022	16.69	15.48	14.31	15.49	87	100	93	93	81	63	129	88
226	14-Aug	I	M	avg 0.212	14.44	14.58	13.21	14.08	238	141	146	168	238	91	207	163
229	17-Aug		M	avg 0.043	21.75	19.79	17.33	19.63	14	24	32	22	11	14	42	19
231	19-Aug		M	avg 0.065	18.71	17.63	16.06	17.47	39	47	49	45	35	28	66	41
233	21-Aug		M	avg 0.030	16.00	16.15	14.85	15.67	116	78	78	87	111	49	104	82
240	28-Aug	I	M	avg 0.503	11.85	12.52	11.44	11.94	944	341	326	458	1022	234	479	471
243	31-Aug		M	avg 0.105	22.44	19.98	17.65	20.02	11	23	29	20	9	13	38	17
Dry treatment																
173	22-Jun		D	avg 0.080	17.31	20.15	17.77	18.41	53	15	33	28	62	12	37	29
175	24-Jun		D	avg 0.028	13.73	18.85	17.54	16.71	276	22	35	50	345	19	39	54
177	26-Jun		D	avg 0.105	13.35	17.10	16.69	15.72	339	38	45	72	423	34	53	80
180	29-Jun		D	avg 0.202	10.65	16.27	16.65	14.52	1712	51	46	115	2264	47	53	134
182	01-Jul	i	D	avg 0.290	9.23	14.94	16.21	13.46	4751	85	52	180	6511	79	62	218
187	06-Jul		D	avg 0.058	17.48	18.85	16.40	17.57	50	22	49	37	58	19	58	39
189	08-Jul		D	avg -0.013	14.13	16.77	15.88	15.59	227	43	58	75	279	39	71	85
191	10-Jul		D	avg 0.028	11.27	14.71	14.98	13.65	1139	93	77	165	1484	87	99	199
194	13-Jul		D	avg 0.120	9.62	12.35	13.38	11.78	3519	256	135	393	4772	255	192	512
198	17-Jul	I	D	avg 0.287	8.88	11.21	11.60	10.56	6285	451	274	751	8697	464	440	1036
201	20-Jul		D	avg 0.020	22.44	21.69	14.02	19.38	8	10	107	21	9	8	146	21
203	22-Jul		D	avg 0.085	18.56	18.77	14.25	17.19	32	22	99	42	37	19	133	45
208	27-Jul		D	avg 0.075	12.50	14.15	12.33	12.99	543	116	202	221	690	110	308	273
210	29-Jul		D	avg 0.095	11.77	13.29	11.73	12.26	835	167	260	311	1077	162	413	396
212	31-Jul		D	avg 0.145	10.88	12.00	10.77	11.22	1470	303	397	527	1934	305	680	705
215	03-Aug	I	D	avg 0.645	9.77	10.90	9.52	10.06	3161	532	732	1000	4270	553	1398	1416
219	07-Aug		D	avg -0.037	20.50	19.81	13.17	17.83	16	16	146	34	18	14	210	36
224	12-Aug		D	avg -0.025	14.21	16.10	12.13	14.15	217	55	220	134	268	50	340	158

Table D.1 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
226	14-Aug	I D	avg	0.270	13.27	15.04	11.58	13.30	354	81	276	193	443	76	445	235
229	17-Aug	D	avg	0.077	21.06	20.48	13.79	18.44	13	13	116	28	15	11	160	29
231	19-Aug	D	avg	0.083	17.48	18.67	13.48	16.54	49	23	130	53	58	20	183	58
233	21-Aug	D	avg	-0.013	14.58	17.08	13.06	14.90	182	39	152	98	223	34	220	113
240	28-Aug	I D	avg	0.540	10.63	12.77	10.38	11.26	1736	211	478	516	2297	208	846	688
243	31-Aug	D	avg	0.112	21.58	21.33	13.94	18.95	11	11	110	24	12	9	151	24
Very Dry treatment																
173	22-Jun	DV	avg	0.105	18.48	18.98	17.38	18.28	41	10	36	25	38	18	42	30
175	24-Jun	DV	avg	0.063	15.25	17.94	17.29	16.83	177	15	37	43	159	25	43	52
177	26-Jun	DV	avg	0.128	12.75	16.73	17.04	15.51	695	23	41	74	596	39	47	88
180	29-Jun	DV	avg	0.282	10.21	14.69	16.29	13.73	3813	55	53	169	3088	88	61	192
187	06-Jul	I DV	avg	0.405	7.98	11.44	13.69	11.03	25144	281	153	734	19108	410	168	782
189	08-Jul	DV	avg	0.025	24.85	22.50	15.71	21.02	4	3	67	10	4	6	75	12
191	10-Jul	DV	avg	-0.070	18.88	19.58	16.67	18.38	35	8	47	24	33	15	53	29
194	13-Jul	DV	avg	-0.070	14.77	16.79	15.94	15.83	225	23	61	65	201	38	69	77
198	17-Jul	DV	avg	0.052	12.25	14.27	14.75	13.76	944	66	98	166	801	105	108	189
201	20-Jul	DV	avg	0.273	10.73	12.29	12.75	11.92	2605	175	236	436	2137	263	254	475
203	22-Jul	I DV	avg	0.563	10.04	11.35	11.77	11.06	4326	295	382	725	3488	429	405	773
208	27-Jul	DV	avg	0.088	21.08	19.44	14.08	18.19	15	9	129	25	15	16	142	31
210	29-Jul	DV	avg	0.120	19.02	17.83	13.90	16.92	33	15	140	41	31	26	154	50
212	31-Jul	DV	avg	-0.037	17.17	16.54	13.40	15.70	71	25	175	68	66	42	190	81
215	03-Aug	DV	avg	0.120	13.75	14.31	12.42	13.49	390	65	277	190	341	103	296	214
219	07-Aug	DV	avg	0.297	11.40	11.94	11.00	11.44	1642	212	575	574	1368	315	601	619
224	12-Aug	I DV	avg	0.643	9.65	10.56	10.08	10.10	5885	473	974	1334	4696	670	1000	1385
226	14-Aug	DV	avg	0.162	25.23	22.87	14.19	20.76	4	3	123	10	4	6	136	13
229	17-Aug	DV	avg	0.045	18.48	18.63	13.92	17.01	41	12	139	40	38	20	152	48
231	19-Aug	DV	avg	0.138	16.17	17.15	13.23	15.51	113	20	188	74	103	34	205	87
233	21-Aug	DV	avg	0.135	14.02	15.77	12.52	14.10	336	34	263	141	295	56	282	161
240	28-Aug	DV	avg	0.570	10.33	12.15	10.92	11.13	3474	180	603	692	2822	283	629	739
243	31-Aug	I DV	avg	0.855	9.25	11.08	10.21	10.18	8111	345	904	1262	6403	498	930	1314
AZMET treatment																
173	22-Jun	AZ	avg	0.095	17.60	18.58	16.90	17.69	61	11	39	28	55	20	49	37
175	24-Jun	AZ	avg	0.065	14.71	17.60	16.78	16.37	218	15	40	46	207	29	51	62
177	26-Jun	AZ	avg	0.125	12.96	16.69	16.69	15.44	532	20	41	65	529	40	53	90
180	29-Jun	AZ	avg	0.203	10.58	15.02	16.27	13.96	2214	35	48	121	2365	76	61	172
182	01-Jul	i AZ	avg	0.260	9.88	14.08	15.81	13.26	3607	51	56	166	3947	113	72	240
187	06-Jul	AZ	avg	0.087	16.81	15.77	15.25	15.94	85	27	69	54	77	56	89	73
189	08-Jul	AZ	avg	0.005	13.35	14.44	14.90	14.23	430	44	79	108	423	97	102	152
191	10-Jul	AZ	avg	0.082	10.81	13.13	14.31	12.75	1904	76	99	211	2018	175	129	309
194	13-Jul	AZ	avg	0.177	9.35	11.75	13.63	11.58	5283	141	131	381	5894	347	172	575
198	17-Jul	I AZ	avg	0.355	9.00	11.10	12.60	10.90	6934	194	204	550	7842	492	271	845
201	20-Jul	AZ	avg	0.020	21.56	20.35	13.85	18.59	15	6	119	21	12	12	156	27
203	22-Jul	AZ	avg	0.107	17.83	17.73	13.92	16.49	56	14	116	44	50	27	152	59
208	27-Jul	AZ	avg	0.170	11.81	13.19	12.83	12.61	1021	74	184	226	1049	170	244	331
210	29-Jul	I AZ	avg	0.295	11.06	12.29	12.33	11.90	1620	110	231	323	1704	263	308	482
212	31-Jul	AZ	avg	-0.068	26.23	21.35	12.56	20.05	4	5	208	13	3	9	277	17
215	03-Aug	AZ	avg	-0.070	19.00	18.44	15.06	17.50	36	11	74	30	31	22	96	40
219	07-Aug	AZ	avg	0.008	14.90	15.40	13.94	14.74	199	31	115	87	189	65	151	121
224	12-Aug	AZ	avg	0.203	12.44	11.92	12.06	12.14	710	130	262	285	716	318	351	423
225	13-Aug	I AZ	avg	0.377	12.44	11.92	12.06	12.14	710	130	262	285	716	318	351	423
226	14-Aug	AZ	avg	0.200	24.04	18.52	12.04	18.20	7	11	264	24	5	21	354	31
229	17-Aug	AZ	avg	0.045	20.33	19.35	15.10	18.26	22	9	73	23	19	16	94	31
231	19-Aug	AZ	avg	0.090	17.77	17.33	14.58	16.56	57	16	89	43	51	31	116	57
233	21-Aug	AZ	avg	0.098	15.27	15.67	13.81	14.92	167	28	121	81	157	59	159	112
240	28-Aug	I AZ	avg	0.508	11.04	11.29	11.75	11.36	1642	177	304	427	1728	444	409	648
243	31-Aug	AZ	avg	0.080	22.71	21.35	15.79	19.95	10	5	57	14	8	9	73	17
Individual plots																
173	22-Jun	W	19	0.05	16.83	22.67	21.83	20.44	55	16	60	36	76	6	11	15
175	24-Jun	W	19	-0.08	13.92	21.17	21.67	18.92	256	25	63	61	312	9	11	24
177	26-Jun	I W	19	0.08	11.25	20.08	21.50	17.61	1437	35	66	98	1505	13	12	39
180	29-Jun	W	19	0.12	17.17	21.92	22.08	20.39	47	20	57	37	66	7	10	15
182	01-Jul	i W	19	0.16	13.67	20.33	21.75	18.58	297	32	62	89	357	12	11	27
187	06-Jul	W	19	0.00	16.92	20.17	21.00	19.36	53	34	76	52	74	12	14	21
189	08-Jul	W	19	-0.10	13.42	18.25	20.33	17.33	345	65	92	109	409	23	17	43
191	10-Jul	W	19	0.11	10.67	15.92	19.08	15.22	2214	156	133	259	2231	53	24	99
194	13-Jul	I W	19	0.18	9.50	12.50	15.83	12.61	5663	738	399	906	5257	237	72	331
198	17-Jul	W	19	-0.21	20.58	20.00	16.08	18.89	11	36	364	62	17	13	65	25
201	20-Jul	W	19	0.03	15.33	15.92	15.50	15.58	117	156	452	222	152	53	81	85
203	22-Jul	I W	19	0.24	12.42	14.08	14.17	13.56	646	343	767	561	725	113	137	208
208	27-Jul	W	19	-0.02	20.42	19.83	14.50	18.25	11	38	669	78	18	14	120	31
210	29-Jul	W	19	-0.10	17.92	17.67	14.33	16.64	33	80	716	143	48	28	128	56
212	31-Jul	W	19	-0.11	15.58	15.67	13.83	15.03	102	173	882	282	135	59	158	107

Table D.1 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
215	03-Aug	W	10	0.10	11.75	13.25	12.83	12.61	1010	507	1370	906	1091	165	244	331
219	07-Aug	W	10	0.04	24.08	19.67	11.25	18.33	3	40	2969	75	5	14	527	30
224	12-Aug	W	10	0.00	19.67	18.00	14.08	17.25	16	71	794	113	24	25	142	44
226	14-Aug I	W	10	0.14	17.33	16.92	13.83	16.03	43	105	882	184	61	37	158	71
229	17-Aug	W	10	-0.06	20.25	20.42	14.83	18.50	12	31	585	71	19	11	105	28
231	19-Aug I	W	10	0.11	17.83	17.92	14.67	16.81	34	73	625	134	50	28	112	52
233	21-Aug	W	10	-0.08	23.17	21.92	15.17	20.08	4	20	514	41	7	7	92	17
240	28-Aug I	W	10	0.25	14.92	16.58	14.42	15.31	146	120	692	250	187	41	124	95
243	31-Aug	W	10	0.17	21.58	20.67	14.83	19.03	7	29	585	59	12	11	105	23
173	22-Jun	W	10	0.19	16.50	17.83	17.58	17.31	79	28	28	35	89	26	39	43
175	24-Jun	W	10	0.04	13.92	16.83	17.58	16.11	339	46	28	62	312	38	39	68
177	26-Jun I	W	10	0.13	12.08	15.92	17.50	15.17	1133	76	27	100	887	53	40	101
180	29-Jun	W	10	-0.04	16.42	18.50	19.00	17.97	82	20	18	26	92	21	25	34
182	01-Jul i	W	10	0.06	13.25	17.17	18.67	16.36	515	39	18	54	448	33	27	62
187	06-Jul	W	10	-0.02	17.92	18.17	18.67	18.25	39	24	18	23	48	24	27	31
189	08-Jul	W	10	-0.06	14.83	16.50	18.17	16.50	196	55	21	51	195	43	32	59
191	10-Jul	W	10	0.05	12.17	14.75	17.67	14.86	1068	148	25	118	843	85	38	115
194	13-Jul I	W	10	0.11	10.33	13.00	16.75	13.36	4319	450	35	279	2822	186	52	228
198	17-Jul	W	10	-0.15	21.58	19.25	18.25	19.69	8	14	21	12	12	16	31	19
201	20-Jul	W	10	0.07	16.92	16.58	17.42	16.97	64	53	28	40	74	41	41	49
203	22-Jul I	W	10	0.20	14.17	15.25	16.83	15.42	291	110	34	88	273	69	50	91
208	27-Jul	W	10	-0.03	21.08	18.67	17.33	19.03	10	19	28	16	14	20	42	23
210	29-Jul	W	10	0.08	18.67	17.08	16.67	17.47	27	41	36	32	36	34	53	41
212	31-Jul	W	10	-0.19	17.33	15.67	16.00	16.33	52	87	47	55	61	59	67	63
215	03-Aug	W	10	-0.11	13.67	13.83	14.83	14.11	395	260	76	180	357	127	105	161
219	07-Aug	W	10	-0.06	25.17	21.25	12.75	19.72	2	6	197	12	4	9	254	19
224	12-Aug	W	10	-0.12	20.08	17.17	15.83	17.69	15	39	50	29	21	33	72	37
226	14-Aug I	W	10	0.14	17.67	16.00	14.83	16.17	44	72	76	60	53	52	105	67
229	17-Aug	W	10	0.00	21.42	19.00	17.00	19.14	8	16	32	15	13	18	47	23
231	19-Aug I	W	10	0.06	19.17	17.00	15.83	17.33	22	42	50	34	29	35	72	43
233	21-Aug	W	10	-0.11	23.67	20.42	17.92	20.67	4	8	23	8	6	11	35	14
240	28-Aug I	W	10	0.18	17.58	18.00	14.92	16.17	48	72	73	60	55	52	101	67
243	31-Aug	W	10	0.09	23.08	19.42	17.08	19.86	4	13	31	11	7	15	46	18
173	22-Jun	W	8	0.12	16.83	21.42	20.50	19.58	51	23	276	63	76	9	16	19
175	24-Jun	W	8	0.06	13.50	20.42	20.58	18.17	398	34	264	130	391	11	15	32
177	26-Jun I	W	8	0.06	11.42	19.25	20.50	17.06	1895	56	276	240	1350	16	16	47
180	29-Jun	W	8	0.02	17.42	22.00	21.25	20.22	37	19	184	46	59	7	13	16
182	01-Jul i	W	8	0.11	14.00	20.17	20.92	18.36	284	38	220	117	298	12	14	30
187	06-Jul	W	8	-0.02	18.08	22.08	21.83	20.67	26	18	136	37	45	7	11	14
189	08-Jul	W	8	0.04	15.33	20.42	21.83	19.19	122	34	136	76	152	11	11	22
191	10-Jul	W	8	-0.08	11.58	18.00	21.58	17.06	1656	98	155	240	1212	25	12	47
194	13-Jul I	W	8	0.02	9.08	15.75	20.92	15.25	15924	293	220	709	7325	57	14	97
198	17-Jul	W	8	-0.10	20.58	22.83	21.83	21.75	8	14	136	23	17	6	11	10
201	20-Jul	W	8	-0.02	17.25	19.83	21.58	19.56	41	44	155	64	64	14	12	20
203	22-Jul I	W	8	0.21	13.50	18.75	21.33	17.86	398	70	176	153	391	19	13	35
208	27-Jul	W	8	0.05	21.50	24.33	25.08	23.64	5	8	28	10	12	4	5	6
210	29-Jul	W	8	0.20	19.83	23.25	24.58	22.56	11	12	36	16	23	5	5	8
212	31-Jul	W	8	-0.05	18.00	21.92	24.42	21.44	27	19	38	26	46	7	6	11
215	03-Aug	W	8	-0.02	14.75	20.25	23.08	19.36	174	37	72	70	203	12	8	21
219	07-Aug	W	8	-0.04	25.00	23.92	22.08	23.67	1	9	119	10	4	4	10	6
224	12-Aug	W	8	-0.12	18.92	20.25	21.75	20.31	17	37	142	44	32	12	11	15
226	14-Aug I	W	8	0.29	16.83	19.33	21.25	19.14	51	54	184	78	76	16	13	23
231	19-Aug I	W	8	0.09	18.08	19.50	20.33	19.31	26	50	303	72	45	15	17	21
233	21-Aug	W	8	0.05	21.67	21.58	20.42	21.22	5	22	289	29	12	8	16	12
240	28-Aug I	W	8	0.38	14.08	16.42	18.58	16.36	268	208	835	359	286	44	28	62
243	31-Aug	W	8	-0.05	21.67	20.67	18.67	20.33	5	31	794	44	12	11	27	15
173	22-Jun	W	1	0.06	20.17	17.50	15.75	17.81	34	28	44	35	20	30	74	36
175	24-Jun	W	1	0.11	16.25	16.50	16.00	16.25	150	38	41	58	99	43	67	65
177	26-Jun I	W	1	0.12	14.17	15.50	15.58	15.08	383	53	46	88	273	63	79	105
180	29-Jun	W	1	0.04	22.58	21.67	20.08	21.44	16	9	14	12	9	8	18	11
182	01-Jul i	W	1	0.12	18.92	19.50	19.00	19.14	53	16	18	23	32	15	25	23
187	06-Jul	W	1	-0.04	20.33	17.08	16.42	17.94	33	32	36	34	19	34	58	34
189	08-Jul	W	1	-0.02	16.58	15.33	15.50	15.81	131	56	48	68	85	67	81	77
191	10-Jul	W	1	-0.12	13.83	13.67	13.83	13.78	450	101	82	145	326	137	158	187
194	13-Jul I	W	1	0.06	12.00	12.17	11.58	11.92	1188	184	189	325	934	280	445	477
198	17-Jul	W	1	-0.19	24.00	21.00	14.08	19.69	10	11	75	20	6	10	142	19
201	20-Jul	W	1	-0.04	20.33	17.58	13.50	17.14	33	27	92	43	19	29	182	46
203	22-Jul I	W	1	0.10	17.67	15.67	12.58	15.31	85	50	128	81	53	59	274	95
208	27-Jul	W	1	0.11	23.08	20.08	13.92	19.03	14	14	79	24	7	13	152	23
210	29-Jul	W	1	0.06	21.17	18.33	13.33	17.61	25	22	97	37	14	22	195	39
215	03-Aug	W	1	0.12	16.58	13.58	11.00	13.72	131	104	241	149	85	142	601	192
219	07-Aug	W	1	0.19	26.00	16.83	9.17	17.33	6	34	573	41	3	38	1744	43
224	12-Aug	W	1	-0.08	23.00	18.50	12.67	18.06	14	21	124	32	8	21	264	33
226	14-Aug I	W	1	0.18	21.08	16.25	12.08	16.47	25	41	155	54	14	47	347	59
229	17-Aug	W	1	-0.10	24.17	20.75	13.00	19.31	10	12	109	22	5	10	227	21

Table D.1 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
215	03-Aug	W	19	0.10	11.75	13.25	12.83	12.61	1010	507	1370	906	1091	165	244	331
219	07-Aug	W	19	0.04	24.08	19.67	11.25	18.33	3	40	2969	75	5	14	527	30
224	12-Aug	W	19	0.00	19.67	18.00	14.08	17.25	18	71	794	113	24	25	142	44
226	14-Aug I	W	19	0.14	17.33	16.92	13.83	16.03	43	105	882	184	61	37	158	71
229	17-Aug	W	19	-0.06	20.25	20.42	14.83	18.50	12	31	585	71	19	11	105	28
231	19-Aug I	W	19	0.11	17.83	17.92	14.67	16.81	34	73	625	134	50	28	112	52
233	21-Aug	W	19	-0.08	23.17	21.92	15.17	20.08	4	20	514	41	7	7	92	17
240	28-Aug I	W	19	0.25	14.92	16.58	14.42	15.31	146	120	692	250	187	41	124	95
243	31-Aug	W	19	0.17	21.58	20.67	14.83	19.03	7	29	585	59	12	11	105	23
173	22-Jun	W	10	0.19	16.50	17.83	17.58	17.31	79	28	26	35	89	26	39	43
175	24-Jun	W	10	0.04	13.92	16.83	17.58	16.11	339	46	26	62	312	38	39	68
177	26-Jun I	W	10	0.13	12.08	15.92	17.50	15.17	1133	76	27	100	887	53	40	101
180	29-Jun	W	10	-0.04	16.42	18.50	19.00	17.97	82	20	16	26	92	21	25	34
182	01-Jul i	W	10	0.06	13.25	17.17	18.67	16.36	515	39	18	54	448	33	27	62
187	06-Jul	W	10	-0.02	17.92	18.17	18.67	18.25	39	24	18	23	48	24	27	31
189	08-Jul	W	10	-0.06	14.83	16.50	18.17	16.50	196	55	21	51	195	43	32	59
191	10-Jul	W	10	0.05	12.17	14.75	17.67	14.86	1068	148	25	118	843	85	38	115
194	13-Jul I	W	10	0.11	10.33	13.00	16.75	13.36	4319	450	35	279	2822	186	52	228
198	17-Jul	W	10	-0.15	21.58	19.25	18.25	19.69	8	14	21	12	12	16	31	19
201	20-Jul	W	10	0.07	16.92	16.58	17.42	16.97	64	53	28	40	74	41	41	49
203	22-Jul I	W	10	0.20	14.17	15.25	16.83	15.42	291	110	34	88	273	69	50	91
208	27-Jul	W	10	-0.03	21.08	18.67	17.33	19.03	10	19	28	16	14	20	42	23
210	29-Jul	W	10	0.08	18.67	17.08	16.67	17.47	27	41	36	32	36	34	53	41
212	31-Jul	W	10	-0.19	17.33	15.67	16.00	16.33	52	87	47	55	61	59	67	63
215	03-Aug	W	10	-0.11	13.67	13.83	14.83	14.11	395	260	76	180	357	127	105	161
219	07-Aug	W	10	-0.06	25.17	21.25	12.75	19.72	2	6	197	12	4	9	254	19
224	12-Aug	W	10	-0.12	20.08	17.17	15.83	17.69	15	39	50	29	21	33	72	37
226	14-Aug I	W	10	0.14	17.67	16.00	14.83	16.17	44	72	76	60	53	52	105	67
229	17-Aug	W	10	0.00	21.42	19.00	17.00	19.14	8	16	32	15	13	18	47	23
231	19-Aug I	W	10	0.06	19.17	17.00	15.83	17.33	22	42	50	34	29	35	72	43
233	21-Aug	W	10	-0.11	23.67	20.42	17.92	20.67	4	8	23	8	6	11	35	14
240	28-Aug I	W	10	0.18	17.58	16.00	14.92	16.17	46	72	73	60	55	52	101	67
243	31-Aug	W	10	0.09	23.08	19.42	17.08	19.86	4	13	31	11	7	16	46	18
173	22-Jun	W	8	0.12	16.83	21.42	20.50	19.58	51	23	276	63	76	9	16	19
175	24-Jun	W	8	0.06	13.50	20.42	20.58	18.17	398	34	264	130	391	11	15	32
177	26-Jun I	W	8	0.06	11.42	19.25	20.50	17.06	1895	56	276	240	1350	16	16	47
180	29-Jun	W	8	0.02	17.42	22.00	21.25	20.22	37	19	184	46	59	7	13	16
182	01-Jul i	W	8	0.11	14.00	20.17	20.92	18.36	284	38	220	117	298	12	14	30
187	06-Jul	W	8	-0.02	18.08	22.08	21.83	20.67	26	18	136	37	45	7	11	14
189	08-Jul	W	8	0.04	15.33	20.42	21.83	19.19	122	34	136	76	152	11	11	22
191	10-Jul	W	8	-0.08	11.58	18.00	21.58	17.06	1656	98	155	240	1212	25	12	47
194	13-Jul I	W	8	0.02	9.08	15.75	20.92	15.25	15924	293	220	709	7325	57	14	97
198	17-Jul	W	8	-0.10	20.58	22.83	21.83	21.75	8	14	136	23	17	6	11	10
201	20-Jul	W	8	-0.02	17.25	19.83	21.58	19.56	41	44	155	64	64	14	12	20
203	22-Jul I	W	8	0.21	13.50	18.75	21.33	17.86	398	70	176	153	391	19	13	35
208	27-Jul	W	8	0.05	21.50	24.33	25.08	23.64	5	8	28	10	12	4	5	6
210	29-Jul	W	8	0.20	19.83	23.25	24.58	22.56	11	12	36	16	23	5	5	8
212	31-Jul	W	8	-0.05	18.00	21.92	24.42	21.44	27	19	38	26	46	7	6	11
215	03-Aug	W	8	-0.02	14.75	20.25	23.08	19.36	174	37	72	70	203	12	8	21
219	07-Aug	W	8	-0.04	25.00	23.92	22.08	23.67	1	9	119	10	4	4	10	6
224	12-Aug	W	8	-0.12	18.92	20.25	21.75	20.31	17	37	142	44	32	12	11	15
226	14-Aug I	W	8	0.29	16.83	19.33	21.25	19.14	51	54	184	79	76	16	13	23
231	19-Aug I	W	8	0.09	18.08	19.50	20.33	19.31	26	50	303	72	45	15	17	21
233	21-Aug	W	8	0.05	21.67	21.58	20.42	21.22	5	22	289	29	12	8	16	12
240	28-Aug I	W	8	0.38	14.08	16.42	18.58	16.36	268	208	835	359	286	44	28	62
243	31-Aug	W	8	-0.05	21.67	20.67	18.67	20.33	5	31	794	44	12	11	27	15
173	22-Jun	W	1	0.06	20.17	17.50	15.75	17.81	34	28	44	35	20	30	74	36
175	24-Jun	W	1	0.11	16.25	16.50	16.00	16.25	150	38	41	58	99	43	67	65
177	26-Jun I	W	1	0.12	14.17	15.50	15.58	15.08	383	53	46	88	273	63	79	105
180	29-Jun	W	1	0.04	22.58	21.67	20.08	21.44	16	9	14	12	9	8	18	11
182	01-Jul i	W	1	0.12	18.92	19.50	19.00	19.14	53	16	18	23	32	15	25	23
187	06-Jul	W	1	-0.04	20.33	17.08	16.42	17.94	33	32	36	34	19	34	58	34
189	08-Jul	W	1	-0.02	16.58	15.33	15.50	15.81	131	56	48	68	85	67	81	77
191	10-Jul	W	1	-0.12	13.83	13.67	13.83	13.78	450	101	82	145	326	137	158	187
194	13-Jul I	W	1	0.06	12.00	12.17	11.58	11.92	1188	184	189	325	934	280	445	477
198	17-Jul	W	1	-0.19	24.00	21.00	14.08	19.69	10	11	75	20	6	10	142	19
201	20-Jul	W	1	-0.04	20.33	17.58	13.50	17.14	33	27	92	43	19	29	182	46
203	22-Jul I	W	1	0.10	17.67	15.67	12.58	15.31	85	50	128	81	53	59	274	95
208	27-Jul	W	1	0.11	23.08	20.08	13.92	19.03	14	14	79	24	7	13	152	23
210	29-Jul	W	1	0.08	21.17	18.33	13.33	17.61	25	22	97	37	14	22	195	39
215	03-Aug	W	1	0.12	16.58	13.58	11.00	13.72	131	104	241	149	85	142	601	192
219	07-Aug	W	1	0.19	26.00	16.83	9.17	17.33	6	34	573	41	3	38	1744	43
224	12-Aug	W	1	-0.08	23.00	18.50	12.67	18.06	14	21	124	32	8	21	264	33
226	14-Aug I	W	1	0.18	21.08	16.25	12.08	16.47	25	41	155	54	14	47	347	59
229	17-Aug	W	1	-0.10	24.17	20.75	13.00	19.31	10	12	109	22	5	10	227	21

Table D.1 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
231	19-Aug I	W	1	0.14	22.83	18.00	12.67	17.83	15	24	124	35	8	25	264	36
233	21-Aug	W	1	-0.07	25.92	22.33	11.75	20.00	6	8	177	18	3	7	409	17
240	28-Aug I	W	1	0.29	20.42	15.17	10.67	15.42	32	59	279	76	18	72	720	91
243	31-Aug	W	1	0.15	24.58	21.83	11.75	19.39	9	9	177	22	5	8	409	21
173	22-Jun	M	18	0.07	17.92	18.00	16.17	17.36	54	10	15	20	48	25	63	42
177	26-Jun	M	18	0.28	12.42	15.83	15.83	14.69	762	23	17	59	725	55	72	124
180	29-Jun	M	18	0.26	10.42	14.08	15.58	13.36	2717	48	19	110	2659	113	79	228
182	01-Jul i	M	18	0.42	9.33	13.33	15.25	12.64	6018	68	21	157	5992	159	89	326
187	06-Jul	M	18	0.05	18.42	18.42	16.50	18.11	30	9	13	15	27	22	56	32
189	08-Jul	M	18	-0.02	15.67	16.67	16.00	16.11	142	17	16	32	130	40	67	68
191	10-Jul	M	18	0.02	12.92	14.25	14.92	14.03	572	45	24	80	542	108	101	167
194	13-Jul	M	18	0.10	10.83	12.42	13.00	12.08	2046	105	54	211	1989	247	227	436
198	17-Jul I	M	18	0.15	10.08	11.08	10.83	10.67	3439	214	157	476	3383	498	657	973
201	20-Jul	M	18	0.04	23.92	21.08	14.67	19.89	7	4	27	8	6	9	112	18
203	22-Jul	M	18	0.03	20.25	18.33	14.08	17.56	22	9	34	18	19	22	142	39
208	27-Jul	M	18	0.08	14.42	13.75	10.92	13.03	258	56	150	129	240	132	628	269
210	29-Jul	M	18	0.10	13.17	12.42	10.17	11.92	498	105	228	231	470	247	953	477
212	31-Jul	M	18	0.07	12.50	11.67	8.50	10.89	728	156	654	416	690	363	2711	852
215	03-Aug I	M	18	0.69	10.92	10.75	8.42	10.03	1935	259	693	711	1880	601	2871	1448
219	07-Aug	M	18	0.02	22.25	19.25	14.83	18.78	11	7	25	12	10	16	105	26
224	12-Aug	M	18	0.08	17.25	15.33	11.75	14.78	70	28	98	57	64	67	409	119
226	14-Aug I	M	18	0.24	14.92	14.75	10.75	13.47	202	36	165	104	187	85	688	216
229	17-Aug	M	18	0.11	22.58	20.08	16.00	19.56	10	5	16	9	9	13	67	20
231	19-Aug	M	18	0.05	19.00	18.00	14.33	17.11	35	10	30	22	31	25	128	46
233	21-Aug	M	18	-0.01	15.83	16.42	13.00	15.08	131	18	54	50	120	44	227	105
240	28-Aug I	M	18	0.46	11.83	12.83	9.83	11.50	1079	86	278	291	1035	201	1157	600
243	31-Aug	M	18	0.10	23.50	20.42	16.33	20.08	8	5	14	8	6	11	60	17
173	22-Jun	M	16	0.09	18.17	16.67	20.33	18.39	24	3	110	26	43	40	17	29
175	24-Jun	M	16	0.08	15.33	15.75	20.50	17.19	86	4	104	42	152	57	16	45
177	26-Jun	M	16	0.08	13.25	14.75	19.92	15.97	256	6	127	72	448	85	19	72
180	29-Jun	M	16	0.29	10.33	13.25	19.58	14.39	1649	14	143	153	2822	165	21	142
182	01-Jul i	M	16	0.27	9.33	11.80	18.42	13.52	3533	33	152	241	5992	338	22	212
187	06-Jul	M	16	0.06	18.50	16.92	22.33	19.25	21	2	58	19	38	37	10	22
189	08-Jul	M	16	-0.06	14.83	15.25	21.58	17.22	110	5	73	42	195	69	12	45
191	10-Jul	M	16	-0.10	11.50	13.08	20.50	15.03	740	15	104	112	1279	179	16	107
194	13-Jul	M	16	0.13	10.25	10.92	19.08	13.42	1752	59	172	254	2996	547	24	222
198	17-Jul I	M	16	0.22	9.33	9.75	17.08	12.06	3533	135	370	552	5992	1098	46	443
201	20-Jul	M	16	0.05	21.33	17.83	22.42	20.53	7	2	56	12	13	26	9	14
203	22-Jul	M	16	0.11	18.17	15.42	21.08	18.22	24	5	86	28	43	65	13	31
208	27-Jul	M	16	0.07	12.83	11.50	17.08	13.81	326	40	370	207	568	396	46	185
210	29-Jul	M	16	0.13	11.67	10.75	15.83	12.75	665	66	627	368	1150	601	72	309
212	31-Jul	M	16	0.06	11.17	10.17	14.33	11.89	923	99	1251	611	1590	848	128	484
215	03-Aug I	M	16	0.43	10.33	9.58	12.00	10.64	1649	153	4293	1366	2822	1221	362	989
219	07-Aug	M	16	-0.07	20.42	16.58	21.33	19.44	10	3	79	17	18	41	13	20
224	12-Aug	M	16	-0.03	16.25	13.42	17.92	15.86	56	13	266	76	99	153	35	76
226	14-Aug I	M	16	0.25	14.33	12.83	16.17	14.44	142	18	542	149	251	201	63	138
229	17-Aug	M	16	0.10	21.42	17.42	21.42	20.08	7	2	77	14	13	31	12	17
233	21-Aug	M	16	0.04	16.67	14.00	17.50	16.06	46	9	313	69	82	118	40	70
240	28-Aug I	M	16	0.59	12.92	11.33	13.00	12.42	310	45	2463	446	542	434	227	366
243	31-Aug	M	16	0.05	22.08	17.25	21.00	20.11	6	2	88	14	10	32	14	16
173	22-Jun	M	9	0.13	18.33	21.92	18.42	19.56	61	20	27	30	41	7	30	20
175	24-Jun	M	9	0.10	14.42	20.33	18.25	17.67	507	34	28	59	240	12	31	38
177	26-Jun	M	9	0.06	12.17	19.33	17.92	16.47	2277	50	31	96	843	16	35	59
180	29-Jun	M	9	0.06	9.92	16.83	17.08	14.61	13901	137	39	217	3826	38	46	128
182	01-Jul i	M	9	0.19	9.33	15.33	16.58	13.75	23768	270	45	328	5992	67	55	190
187	06-Jul	M	9	0.06	18.67	20.67	17.75	19.03	52	31	32	36	36	11	37	23
189	08-Jul	M	9	-0.08	15.08	18.17	16.92	16.72	340	78	41	86	172	24	49	54
191	10-Jul	M	9	-0.03	12.08	15.83	15.67	14.53	2420	214	60	225	887	55	76	133
194	13-Jul	M	9	-0.06	11.08	13.75	13.58	12.81	5196	600	122	534	1680	132	175	300
198	17-Jul I	M	9	0.05	9.92	12.58	11.25	11.25	13901	1147	313	1293	3826	227	527	691
201	20-Jul	M	9	0.03	23.08	22.50	14.42	20.00	8	16	91	25	7	6	124	17
203	22-Jul	M	9	0.03	20.08	19.08	14.08	17.75	27	55	102	57	21	17	142	37
208	27-Jul	M	9	0.09	13.67	14.33	11.50	13.17	814	443	280	441	357	102	464	251
210	29-Jul	M	9	0.16	14.42	15.00	11.67	13.69	507	317	261	337	240	77	426	195
212	31-Jul	M	9	0.06	11.67	12.67	10.17	11.50	3301	1093	518	1113	1150	218	953	600
215	03-Aug I	M	9	0.29	11.00	12.08	9.33	10.81	5555	1542	793	1703	1777	292	1570	895
219	07-Aug	M	9	-0.06	22.08	21.42	15.92	19.81	12	24	56	27	10	9	69	18
224	12-Aug	M	9	0.02	17.58	17.58	13.33	16.17	88	99	134	109	55	29	195	67
226	14-Aug I	M	9	0.23	15.25	16.50	12.33	14.69	309	158	198	208	159	43	308	124
229	17-Aug	M	9	-0.04	22.08	22.25	15.83	20.06	12	18	57	25	10	7	72	17
231	19-Aug	M	9	0.13	19.17	20.08	15.00	18.08	41	38	75	51	29	13	98	33
233	21-Aug	M	9	0.11	16.75	18.83	14.42	16.67	135	60	91	88	79	19	124	55
240	28-Aug I	M	9	0.56	12.50	15.17	12.00	13.22	1793	293	227	429	690	72	362	244
243	31-Aug	M	9	0.24	22.42	22.08	17.17	20.56	10	19	38	21	9	7	45	14

Table D.1 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
173	22-Jun	M	7	0.05	18.75	19.75	18.17	18.89	51	12	10	17	34	14	32	25
175	24-Jun	M	7	0.02	16.50	18.92	17.75	17.72	122	16	11	26	89	18	37	37
177	26-Jun	M	7	0.07	14.42	18.50	17.67	16.86	308	18	12	35	240	21	38	51
180	29-Jun	M	7	0.12	11.92	16.50	17.08	15.17	1136	33	14	67	983	43	46	101
182	01-Jul I	M	7	0.24	10.67	15.00	16.67	14.11	2426	54	16	105	2231	77	53	161
187	06-Jul	M	7	0.06	18.33	18.00	16.92	17.75	59	20	15	26	41	25	49	37
189	08-Jul	M	7	-0.06	15.50	15.75	16.33	15.86	188	42	19	51	141	57	80	76
191	10-Jul	M	7	-0.07	12.58	14.17	16.08	14.28	783	73	20	97	657	108	65	149
194	13-Jul	M	7	0.07	10.00	12.00	15.00	12.33	3774	178	31	240	3597	305	98	382
198	17-Jul I	M	7	0.33	9.25	10.92	13.33	11.17	6437	294	63	442	6403	547	195	725
201	20-Jul	M	7	0.01	22.17	19.92	15.67	19.25	16	12	24	15	10	13	76	22
203	22-Jul	M	7	0.09	18.75	17.17	15.25	17.06	51	26	28	33	34	33	89	47
208	27-Jul	M	7	0.14	12.50	12.83	13.33	12.89	819	124	63	183	690	201	195	288
210	29-Jul	M	7	0.29	11.25	11.75	12.58	11.86	1685	199	89	305	1505	347	274	491
212	31-Jul	M	7	0.02	9.92	10.67	11.92	10.83	3997	333	124	533	3826	631	377	881
215	03-Aug I	M	7	0.85	8.75	9.83	10.92	9.83	9417	513	210	967	9659	1042	629	1642
219	07-Aug	M	7	-0.03	20.50	19.00	16.25	18.58	28	15	19	19	18	18	62	27
224	12-Aug	M	7	0.02	15.67	15.58	14.25	15.17	175	44	42	67	130	61	133	101
226	14-Aug I	M	7	0.13	13.25	14.25	13.58	13.69	550	71	56	126	448	106	175	195
231	19-Aug	M	7	0.08	17.92	17.00	15.33	16.75	70	28	27	36	48	35	86	53
233	21-Aug	M	7	-0.02	14.75	15.33	14.50	14.86	264	48	38	76	203	67	120	115
240	28-Aug I	M	7	0.40	10.17	10.75	10.92	10.61	3370	319	210	605	3183	601	629	1006
243	31-Aug	M	7	0.03	21.75	20.17	16.08	19.33	18	11	20	15	11	12	65	21
173	22-Jun	D	20	0.10	18.58	19.58	18.00	18.72	26	2	15	10	37	15	34	26
175	24-Jun	D	20	-0.02	14.58	17.33	17.58	16.50	148	5	16	23	221	31	39	59
177	26-Jun	D	20	0.12	12.58	16.00	17.17	15.25	421	10	18	37	657	52	45	97
180	29-Jun	D	20	0.12	15.42	15.33	17.08	15.94	98	13	19	28	146	67	46	73
182	01-Jul I	D	20	0.27	11.67	14.17	16.75	14.19	725	23	21	59	1150	108	52	155
187	06-Jul	D	20	0.09	17.00	16.58	16.83	16.81	49	7	20	20	71	41	50	52
189	08-Jul	D	20	0.05	13.42	14.67	16.42	14.83	266	18	23	44	409	88	58	116
191	10-Jul	D	20	0.23	11.00	12.75	15.33	13.03	1106	49	32	101	1777	210	86	269
194	13-Jul	D	20	0.35	9.58	11.25	13.00	11.28	2974	122	72	251	4928	454	227	680
198	17-Jul I	D	20	0.41	9.17	10.42	11.25	10.28	4092	213	148	451	6846	730	527	1236
201	20-Jul	D	20	0.02	23.67	21.25	15.50	20.14	5	1	30	6	6	9	81	16
203	22-Jul	D	20	0.08	19.08	18.17	15.50	17.58	21	4	30	15	30	24	81	39
208	27-Jul	D	20	0.04	13.08	13.50	12.67	13.08	319	33	82	98	493	147	264	261
210	29-Jul	D	20	0.03	12.92	13.42	12.42	12.92	349	34	91	106	542	153	296	284
212	31-Jul	D	20	0.18	11.08	11.67	10.58	11.11	1048	94	200	276	1680	363	753	748
215	03-Aug I	D	20	0.63	10.33	10.67	9.25	10.08	1732	179	388	509	2822	631	1654	1397
219	07-Aug	D	20	-0.06	21.25	19.17	14.58	18.33	10	3	41	12	14	17	116	30
224	12-Aug	D	20	0.02	15.67	14.92	12.25	14.28	87	16	97	57	130	80	321	149
226	14-Aug I	D	20	0.30	13.83	14.50	11.50	13.28	214	20	132	89	326	95	464	238
229	17-Aug	D	20	0.15	21.33	19.75	15.33	18.81	10	2	32	10	13	14	86	25
231	19-Aug	D	20	0.11	17.75	17.42	14.42	16.53	36	5	43	22	52	31	124	58
233	21-Aug	D	20	-0.06	15.08	16.00	13.75	14.94	115	10	55	42	172	52	163	111
240	28-Aug I	D	20	0.62	10.83	12.08	10.58	11.17	1234	73	200	267	1989	292	753	725
243	31-Aug	D	20	0.10	21.00	21.08	15.83	19.31	11	1	27	8	15	9	72	21
173	22-Jun	D	13	0.05	15.92	25.33	17.33	19.53	90	65	85	77	116	3	42	20
175	24-Jun	D	13	0.02	13.00	24.17	17.08	18.08	335	84	91	116	516	4	46	33
177	26-Jun	D	13	0.12	10.58	23.17	16.83	16.86	1281	105	98	169	2365	5	50	51
180	29-Jun	D	13	0.24	8.50	21.00	15.83	15.11	5350	177	129	304	11969	10	72	103
182	01-Jul I	D	13	0.37	7.92	18.92	15.25	14.03	8504	308	153	452	20253	18	89	167
187	06-Jul	D	13	0.08	15.50	22.75	14.67	17.64	107	115	183	133	141	6	112	38
189	08-Jul	D	13	-0.07	12.75	20.17	14.08	15.67	380	219	221	250	596	12	142	82
191	10-Jul	D	13	0.03	9.58	17.58	13.25	13.47	2447	454	292	562	4928	29	203	216
194	13-Jul	D	13	0.15	8.33	14.67	12.08	11.69	6087	1194	445	1199	13858	88	347	538
198	17-Jul I	D	13	0.34	7.50	13.25	10.83	10.53	12097	2050	734	2108	30213	165	657	1059
201	20-Jul	D	13	0.08	21.00	24.92	11.42	19.11	15	71	577	86	15	3	484	23
203	22-Jul	D	13	0.09	16.50	22.00	11.75	16.75	71	138	506	175	89	7	409	53
208	27-Jul	D	13	0.05	9.58	16.00	11.17	12.25	2447	751	639	935	4928	52	551	399
210	29-Jul	D	13	0.21	9.25	14.75	10.67	11.56	3083	1158	788	1278	6403	85	720	581
212	31-Jul	D	13	0.49	8.67	13.83	10.33	10.94	4713	1630	911	1710	10367	127	866	825
215	03-Aug I	D	13	0.95	7.83	12.75	9.67	10.08	9111	2516	1237	2653	21902	210	1279	1397
219	07-Aug	D	13	-0.03	18.92	23.08	10.67	17.56	29	107	788	136	32	5	720	39
224	12-Aug	D	13	0.02	8.08	19.83	11.08	13.00	7424	239	661	680	17360	14	575	272
226	14-Aug I	D	13	0.36	11.00	18.50	11.08	13.53	998	347	661	549	1777	21	575	211
229	17-Aug	D	13	0.14	19.50	24.25	12.00	18.58	24	82	460	100	26	4	362	27
231	19-Aug	D	13	0.11	15.50	22.83	12.00	16.78	107	113	460	173	141	6	362	53
233	21-Aug	D	13	0.08	12.33	21.67	12.08	15.36	473	150	445	278	762	8	347	93
240	28-Aug I	D	13	0.53	9.08	16.50	10.83	12.14	3471	638	734	982	7325	43	657	423
243	31-Aug	D	13	0.15	20.50	24.42	11.50	18.81	17	79	558	84	18	4	464	25
173	22-Jun	D	11	0.10	17.00	18.92	18.17	18.03	44	5	12	13	71	18	32	33
175	24-Jun	D	11	0.06	13.17	17.83	18.00	16.33	250	7	13	22	470	26	34	63
177	26-Jun	D	11	0.05	10.33	16.83	17.67	14.94	1307	9	14	37	2822	38	38	111

Table D.1 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
180	29-Jun	D	11	0.21	8.17	15.50	17.08	13.58	6504	14	16	65	16091	63	46	205
182	01-Jul i	D	11	0.23	7.58	14.42	16.92	12.97	10781	21	17	85	27842	98	48	276
187	06-Jul	D	11	0.06	16.58	18.58	18.25	17.81	52	5	12	14	85	20	31	36
189	08-Jul	D	11	-0.01	13.00	16.75	17.67	15.81	273	9	14	27	516	39	38	77
191	10-Jul	D	11	-0.06	10.25	15.25	16.83	14.11	1381	16	18	52	2996	69	50	161
194	13-Jul	D	11	-0.05	8.83	12.67	15.58	12.36	3808	42	26	112	9005	218	79	377
198	17-Jul I	D	11	0.14	8.25	11.08	13.67	11.00	6069	84	52	220	14927	498	169	798
201	20-Jul	D	11	-0.02	20.42	19.08	16.83	18.78	13	5	18	10	18	17	50	26
203	22-Jul	D	11	0.10	17.08	16.83	16.33	16.75	42	9	21	19	68	38	60	53
208	27-Jul	D	11	0.08	11.92	13.42	13.33	12.89	494	31	59	88	983	153	195	288
210	29-Jul	D	11	0.07	10.92	12.50	12.58	12.00	899	45	79	133	1880	237	274	456
212	31-Jul	D	11	-0.05	10.75	11.42	11.50	11.22	998	72	126	196	2106	415	464	702
215	03-Aug I	D	11	0.37	9.25	10.17	9.83	9.75	2781	133	282	443	6403	848	1157	1735
219	07-Aug	D	11	-0.06	19.00	17.25	14.17	16.81	21	8	43	19	31	32	137	52
224	12-Aug	D	11	-0.05	14.17	14.08	12.25	13.50	152	24	91	67	273	113	321	214
226	14-Aug I	D	11	0.24	12.00	13.08	11.58	12.22	471	35	121	120	934	179	445	405
229	17-Aug	D	11	0.03	20.00	18.25	15.08	17.78	14	6	31	14	21	23	95	36
231	19-Aug	D	11	0.06	16.17	16.75	14.50	15.81	62	9	38	27	103	39	120	77
233	21-Aug	D	11	0.00	13.50	15.08	13.67	14.08	211	17	52	53	391	74	169	163
240	28-Aug I	D	11	0.49	10.25	11.25	10.25	10.58	1381	78	228	275	2996	454	908	1023
243	31-Aug	D	11	0.10	20.58	18.50	15.75	18.28	12	6	25	12	17	21	74	30
173	22-Jun	D	2	0.07	17.75	16.75	17.58	17.36	83	18	61	46	52	39	39	42
175	24-Jun	D	2	0.05	14.17	16.08	17.50	15.92	484	23	63	78	273	50	40	74
177	26-Jun	D	2	0.13	19.92	12.42	15.08	15.81	33	104	134	81	22	247	95	77
180	29-Jun	D	2	0.24	10.50	13.25	16.58	13.44	5069	71	83	219	2507	165	55	219
182	01-Jul i	D	2	0.29	9.75	12.25	15.92	12.64	9082	112	102	319	4338	268	69	326
187	06-Jul	D	2	0.00	20.75	17.50	15.83	18.03	24	14	105	36	16	30	72	33
189	08-Jul	D	2	-0.02	17.33	15.50	15.33	16.06	100	29	123	74	61	63	86	70
191	10-Jul	D	2	-0 09	14.25	13.25	14.50	14.00	462	71	164	171	262	165	120	169
194	13-Jul	D	2	0.03	11.75	10.83	12.83	11.81	2098	229	306	485	1091	573	244	506
198	17-Jul I	D	2	0.26	10.58	10.08	10.67	10.44	4764	348	784	1027	2365	892	720	1114
203	22-Jul	D	2	0.07	21.58	18.08	13.42	17.69	18	12	244	41	12	24	188	37
208	27-Jul	D	2	0.13	15.42	13.67	12.17	13.75	249	59	401	191	146	137	334	190
210	29-Jul	D	2	0.07	14.00	12.50	11.25	12.58	531	100	598	328	298	237	527	336
212	31-Jul	D	2	-0.04	13.00	11.08	10.67	11.58	950	201	784	545	516	498	720	572
215	03-Aug I	D	2	0.63	11.67	10.00	9.33	10.33	2219	366	1548	1096	1150	939	1570	1194
219	07-Aug	D	2	0.00	22.83	19.75	13.25	18.61	11	7	260	30	8	14	203	27
224	12-Aug	D	2	-0.09	18.92	15.58	12.92	15.81	50	28	296	81	32	61	235	77
226	14-Aug I	D	2	0.18	16.25	14.08	12.17	14.17	165	50	401	159	99	113	334	157
229	17-Aug	D	2	-0.01	23.42	19.67	12.75	18.61	9	7	316	30	7	14	254	27
231	19-Aug	D	2	0.05	20.50	17.67	13.00	17.06	27	13	286	51	18	28	227	47
233	21-Aug	D	2	-0.07	17.33	15.58	12.75	15.22	100	28	316	102	61	61	254	99
240	28-Aug I	D	2	0.52	12.33	11.25	9.83	11.14	1435	184	1186	692	762	454	1157	736
243	31-Aug	D	2	0.10	24.25	21.33	12.67	19.42	7	4	327	23	5	9	264	21
173	22-Jun	DV	17	0.03	16.50	20.58	14.25	17.11	99	72	93	87	89	11	133	46
175	24-Jun	DV	17	0.00	12.58	19.25	14.33	15.39	713	119	90	177	657	16	128	92
177	26-Jun	DV	17	0.17	10.00	17.83	14.08	13.97	3799	212	99	340	3597	26	142	171
180	29-Jun	DV	17	0.44	8.00	15.92	13.25	12.39	19273	501	138	765	18743	53	203	371
187	06-Jul I	DV	17	0.58	6.50	13.50	10.50	10.17	87343	1734	486	2900	87091	147	789	1325
189	08-Jul	DV	17	-0.02	23.75	25.83	11.00	20.19	7	13	378	28	6	3	601	16
191	10-Jul	DV	17	0.03	17.50	22.33	12.00	17.28	65	39	236	81	57	7	362	44
194	13-Jul	DV	17	-0.06	12.42	18.92	11.92	14.42	786	136	245	275	725	18	377	140
198	17-Jul	DV	17	0.21	9.83	15.58	11.17	12.19	4293	587	348	851	4073	61	551	411
201	20-Jul	DV	17	0.63	8.58	13.83	10.25	10.89	11548	1443	554	1826	11136	127	908	852
203	22-Jul I	DV	17	0.83	8.25	12.92	9.75	10.31	15406	2420	726	2647	14927	193	1216	1214
208	27-Jul	DV	17	0.12	20.58	22.92	11.75	18.42	20	32	265	53	17	6	409	29
210	29-Jul	DV	17	0.11	17.92	21.08	11.75	16.92	55	60	265	94	48	9	409	50
212	31-Jul	DV	17	-0.03	15.75	19.42	11.58	15.58	139	112	286	163	125	16	445	85
215	03-Aug	DV	17	0.20	11.75	16.50	11.00	13.08	1175	382	378	530	1091	43	601	261
219	07-Aug	DV	17	0.58	9.92	13.67	9.92	11.17	4037	1581	662	1541	3826	137	1102	725
224	12-Aug I	DV	17	1.03	7.08	12.25	9.33	9.56	46730	3609	919	4404	46115	268	1570	1975
226	14-Aug	DV	17	0.18	24.92	25.92	10.08	20.31	5	13	605	27	4	3	1000	15
229	17-Aug	DV	17	0.10	17.67	21.50	11.50	16.89	60	52	297	95	53	8	464	51
231	19-Aug	DV	17	0.31	14.67	19.42	11.33	15.14	234	112	322	198	212	16	505	102
233	21-Aug	DV	17	0.25	12.33	17.67	10.83	13.61	826	228	410	406	762	28	657	203
240	28-Aug	DV	17	0.70	8.58	13.58	9.75	10.64	11548	1655	726	2136	11136	142	1216	989
243	31-Aug I	DV	17	0.96	7.92	12.25	9.08	9.75	20799	3609	1064	3845	20253	268	1840	1735
173	22-Jun	DV	15	0.10	18.25	19.83	18.75	18.94	34	21	14	21	42	14	27	24
175	24-Jun	DV	15	0.03	15.58	18.83	18.67	17.69	107	27	14	31	135	19	27	37
177	26-Jun	DV	15	0.09	13.67	18.00	18.25	16.64	278	34	16	45	357	25	31	56
180	29-Jun	DV	15	0.20	10.83	16.42	17.17	14.81	1501	53	23	88	1989	44	45	118
187	06-Jul I	DV	15	0.28	8.25	11.17	13.50	10.97	10845	344	90	501	14927	475	182	811
189	08-Jul	DV	15	0.00	23.00	21.83	18.00	20.94	6	13	18	12	8	8	34	13
191	10-Jul	DV	15	-0.05	17.92	18.67	17.33	17.97	39	29	22	28	48	20	42	34

Table D.1 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
194	13-Jul	DV	15	-0.12	14.67	15.67	15.33	15.22	166	67	44	75	212	59	86	99
198	17-Jul	DV	15	0.02	12.42	13.33	13.33	13.03	557	146	96	185	725	159	195	269
201	20-Jul	DV	15	0.14	10.75	11.17	10.25	10.72	1587	344	429	572	2106	475	908	941
203	22-Jul I	DV	15	0.43	10.58	9.92	9.33	9.94	1778	612	730	887	2365	989	1570	1528
208	27-Jul	DV	15	0.02	20.33	18.08	15.00	17.81	16	33	49	30	19	24	98	36
210	29-Jul	DV	15	-0.01	18.25	16.75	14.00	16.33	34	48	73	50	42	39	147	63
212	31-Jul	DV	15	-0.08	16.42	15.17	12.83	14.81	73	78	120	88	92	72	244	118
215	03-Aug	DV	15	0.01	14.17	13.00	11.00	12.72	214	165	287	212	273	186	601	313
219	07-Aug	DV	15	0.10	11.42	10.67	9.33	10.47	1026	430	730	657	1350	631	1570	1095
224	12-Aug I	DV	15	0.57	10.08	9.33	8.58	9.33	2527	820	1175	1282	3383	1438	2561	2298
226	14-Aug	DV	15	0.12	24.33	22.75	18.33	21.81	4	11	16	9	5	6	30	10
229	17-Aug	DV	15	0.08	17.33	17.50	16.00	16.94	49	39	34	40	61	30	67	49
231	19-Aug	DV	15	0.10	14.75	16.33	14.58	15.22	160	55	58	75	203	45	116	99
233	21-Aug	DV	15	0.08	13.17	14.83	13.50	13.83	364	87	90	130	470	82	182	183
240	28-Aug	DV	15	0.62	10.17	10.92	10.58	10.56	2380	384	358	627	3183	547	753	1041
243	31-Aug I	DV	15	0.86	9.08	9.92	9.67	9.56	5393	612	598	1118	7325	989	1279	1975
173	22-Jun	DV	6	0.13	20.33	18.08	16.67	18.36	22	33	29	28	19	24	53	30
175	24-Jun	DV	6	0.10	17.67	16.83	16.50	17.00	54	49	30	43	53	38	56	48
177	26-Jun	DV	6	0.06	14.75	15.25	16.50	15.50	168	85	30	74	203	69	56	88
180	29-Jun	DV	6	0.17	11.67	12.67	15.83	13.39	739	236	38	172	1150	218	72	225
187	06-Jul I	DV	6	0.41	9.00	10.25	12.83	10.69	3808	754	121	629	7842	806	244	957
189	08-Jul	DV	6	-0.02	28.08	25.00	16.33	23.14	3	6	32	7	2	3	60	7
191	10-Jul	DV	6	-0.17	20.83	20.33	19.08	20.08	19	18	14	16	16	12	24	17
194	13-Jul	DV	6	-0.08	16.58	17.58	18.25	17.47	80	39	17	37	85	29	31	41
198	17-Jul	DV	6	-0.11	14.25	15.08	16.58	15.31	209	90	30	79	262	74	55	95
201	20-Jul	DV	6	0.01	12.92	12.67	13.75	13.11	389	236	83	194	542	218	163	258
203	22-Jul I	DV	6	0.39	11.75	11.50	12.00	11.75	707	401	175	365	1091	396	362	522
208	27-Jul	DV	6	0.07	22.00	18.83	13.75	18.19	13	27	83	29	11	19	163	31
210	29-Jul	DV	6	0.21	20.42	16.83	14.00	17.08	22	49	75	42	18	38	147	47
212	31-Jul	DV	6	-0.08	18.58	16.08	13.25	15.97	39	64	101	62	37	50	203	72
215	03-Aug	DV	6	0.09	15.00	13.83	12.00	13.61	151	145	175	156	178	127	362	203
219	07-Aug	DV	6	0.07	12.83	11.42	10.83	11.69	405	417	306	375	568	415	657	538
224	12-Aug I	DV	6	0.32	11.08	10.17	9.92	10.39	1022	789	497	744	1680	848	1102	1153
226	14-Aug	DV	6	0.12	25.92	23.83	16.17	21.97	5	7	34	10	3	4	63	9
229	17-Aug	DV	6	-0.03	19.33	18.17	14.83	17.44	30	33	55	37	27	24	105	41
231	19-Aug	DV	6	0.04	17.50	16.58	13.67	15.92	57	54	86	63	57	41	169	74
233	21-Aug	DV	6	0.04	15.17	15.58	12.50	14.42	141	76	140	112	165	61	285	140
240	28-Aug	DV	6	0.42	11.58	12.17	10.83	11.53	773	294	306	408	1212	280	657	590
243	31-Aug I	DV	6	0.71	10.42	11.33	10.00	10.58	1512	434	475	668	2659	434	1049	1023
173	22-Jun	DV	4	0.16	18.83	17.42	19.83	18.69	53	22	30	32	33	31	19	26
175	24-Jun	DV	4	0.12	15.17	16.83	19.67	17.22	240	26	32	51	165	38	20	45
177	26-Jun	DV	4	0.19	12.58	15.83	19.33	15.92	891	36	35	82	657	55	22	74
180	29-Jun	DV	4	0.32	10.33	13.75	18.92	14.33	3548	74	40	152	2822	132	25	145
187	06-Jul I	DV	4	0.35	8.17	10.83	17.92	12.31	18485	253	53	375	16091	573	35	388
189	08-Jul	DV	4	0.14	24.58	17.33	17.50	19.81	8	23	61	22	5	31	40	18
191	10-Jul	DV	4	-0.09	19.25	17.00	18.25	18.17	45	25	48	37	28	35	31	32
194	13-Jul	DV	4	-0.04	15.42	15.00	18.25	16.22	214	48	48	73	146	77	31	65
198	17-Jul	DV	4	0.09	12.50	13.08	17.92	14.50	933	96	53	142	690	179	35	135
201	20-Jul	DV	4	0.31	10.67	11.50	16.75	12.97	2840	186	77	274	2231	396	52	276
203	22-Jul I	DV	4	0.60	9.58	11.08	16.00	12.22	6019	225	100	390	4928	498	67	405
208	27-Jul	DV	4	0.18	21.33	17.92	15.83	18.36	22	19	106	35	13	26	72	30
210	29-Jul	DV	4	0.17	19.50	16.67	15.83	17.33	41	28	106	49	26	40	72	43
212	31-Jul	DV	4	0.04	17.92	15.50	15.92	16.44	75	40	103	67	48	63	69	60
215	03-Aug	DV	4	0.18	14.08	13.92	15.67	14.56	404	70	112	139	286	122	76	132
219	07-Aug	DV	4	0.44	11.42	12.00	13.92	12.44	1763	150	216	350	1350	305	152	361
224	12-Aug I	DV	4	0.65	10.33	10.50	12.50	11.11	3548	297	391	686	2822	695	285	748
226	14-Aug	DV	4	0.23	25.75	19.00	12.17	18.97	6	14	454	29	3	18	334	24
229	17-Aug	DV	4	0.03	19.58	17.33	13.33	16.75	40	23	274	60	25	31	195	53
231	19-Aug	DV	4	0.10	17.75	16.25	13.33	15.78	80	32	274	86	52	47	195	78
233	21-Aug	DV	4	0.17	15.42	15.00	13.25	14.56	214	48	283	139	146	77	203	132
240	28-Aug	DV	4	0.54	11.00	11.92	12.50	11.81	2288	155	391	479	1777	318	285	506
243	31-Aug I	DV	4	0.89	9.58	10.83	12.08	10.83	6019	253	472	796	4928	573	347	881
173	22-Jun	AZ	14	0.04	17.17	16.75	16.67	16.86	43	5	25	18	66	39	53	51
175	24-Jun	AZ	14	0.01	13.50	15.42	16.58	15.17	205	8	25	32	391	65	55	101
177	26-Jun	AZ	14	0.15	11.17	14.08	16.58	13.94	709	13	25	52	1590	113	55	173
180	29-Jun	AZ	14	0.29	8.92	12.50	16.17	12.53	3086	25	29	97	8401	237	63	346
182	01-Jul i	AZ	14	0.29	8.67	11.58	16.08	12.11	3717	38	29	118	10367	379	65	430
187	06-Jul	AZ	14	0.14	15.50	13.75	15.50	14.92	83	15	35	36	141	132	81	112
189	08-Jul	AZ	14	0.02	11.75	12.17	15.42	13.11	508	28	36	75	1091	280	84	258
191	10-Jul	AZ	14	0.15	9.50	10.75	14.83	11.69	2039	58	44	145	5257	601	105	538
194	13-Jul	AZ	14	0.18	8.67	9.58	13.83	10.69	3717	110	63	242	10367	1221	158	957
198	17-Jul I	AZ	14	0.30	8.67	9.08	11.83	9.86	3717	148	138	386	10367	1700	392	1613
201	20-Jul	AZ	14	0.07	20.83	18.00	13.92	17.58	12	3	61	14	16	25	152	39
203	22-Jul	AZ	14	0.08	16.67	15.17	13.83	15.22	52	9	63	32	82	72	158	99

Table D.1 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
208	27-Jul	AZ	14	0.12	11.00	10.92	11.00	10.97	782	53	200	209	1777	547	601	811
210	29-Jul I	AZ	14	0.18	10.42	10.08	9.92	10.14	1116	83	338	329	2659	892	1102	1349
212	31-Jul	AZ	14	-0.08	26.50	22.00	10.25	19.58	2	1	286	7	3	7	908	19
215	03-Aug	AZ	14	-0.02	17.58	15.42	14.42	15.81	36	8	51	26	55	65	124	77
219	07-Aug	AZ	14	-0.01	13.75	13.00	11.83	12.86	182	20	138	84	341	166	392	292
224	12-Aug	AZ	14	0.40	11.75	8.00	7.67	9.14	508	300	1241	599	1091	3724	4953	2632
225	13-Aug I	AZ	14	0.57	11.75	8.00	7.67	9.14	508	300	1241	599	1091	3724	4953	2632
226	14-Aug	AZ	14	0.15	23.42	18.58	9.17	17.06	6	3	503	16	7	20	1744	47
229	17-Aug	AZ	14	0.11	18.67	16.50	13.92	16.36	25	5	61	21	38	43	152	62
231	19-Aug	AZ	14	0.09	15.92	14.67	12.75	14.44	70	10	95	43	116	88	254	138
233	21-Aug	AZ	14	0.14	13.42	13.00	11.58	12.67	213	20	154	91	409	186	445	322
240	28-Aug I	AZ	14	0.68	9.92	9.33	9.08	9.44	1540	127	527	495	3826	1438	1840	2130
243	31-Aug	AZ	14	0.14	21.33	18.33	14.17	17.94	10	3	56	12	13	22	137	34
173	22-Jun	AZ	12	0.14	19.75	22.83	21.33	21.31	30	3	35	16	23	6	13	11
175	24-Jun	AZ	12	0.08	17.92	21.83	21.17	20.31	58	5	36	21	48	8	13	15
177	26-Jun	AZ	12	0.10	16.75	20.92	21.17	19.61	93	6	36	26	79	10	13	18
180	29-Jun	AZ	12	0.23	13.83	19.08	20.92	17.94	349	10	39	45	326	17	14	34
182	01-Jul i	AZ	12	0.12	12.83	17.83	20.50	17.06	587	15	43	62	568	26	16	47
187	06-Jul	AZ	12	0.02	18.75	20.33	21.17	20.08	43	7	36	22	34	12	13	17
189	08-Jul	AZ	12	-0.02	15.75	18.92	20.67	18.44	142	11	41	38	125	18	15	29
191	10-Jul	AZ	12	0.07	12.92	17.17	20.75	16.94	561	19	40	64	542	33	15	49
194	13-Jul	AZ	12	0.10	10.58	15.25	20.75	15.53	2229	39	40	110	2365	69	15	87
198	17-Jul I	AZ	12	0.33	10.08	14.25	20.17	14.83	3116	58	48	146	3383	106	17	116
201	20-Jul	AZ	12	0.03	22.17	22.33	21.08	21.86	13	4	37	13	10	7	13	10
203	22-Jul	AZ	12	0.10	18.58	20.33	20.83	19.92	45	7	40	24	37	12	14	17
208	27-Jul	AZ	12	0.12	13.08	15.75	20.58	16.47	514	32	42	76	493	57	15	59
210	29-Jul I	AZ	12	0.15	12.33	14.75	20.33	15.81	773	47	45	98	762	85	17	77
212	31-Jul	AZ	12	-0.11	27.50	24.92	21.00	24.47	3	2	38	7	2	3	14	5
215	03-Aug	AZ	12	-0.17	20.00	20.83	21.67	20.83	27	6	32	18	21	10	11	13
219	07-Aug	AZ	12	-0.10	16.33	17.75	21.00	18.36	111	16	38	39	95	27	14	30
224	12-Aug	AZ	12	0.10	13.33	14.75	20.25	16.11	451	47	47	87	428	85	17	68
225	13-Aug I	AZ	12	0.20	13.33	14.75	20.25	16.11	451	47	47	87	428	85	17	68
226	14-Aug	AZ	12	0.21	25.08	22.75	19.42	22.42	6	4	59	11	4	6	22	8
229	17-Aug	AZ	12	0.05	21.17	21.33	21.00	21.17	18	5	38	16	14	9	14	12
231	19-Aug	AZ	12	0.02	18.83	19.17	20.58	19.53	41	10	42	27	33	17	15	20
233	21-Aug	AZ	12	0.03	16.58	17.67	20.17	18.14	100	16	48	42	85	28	17	32
240	28-Aug I	AZ	12	0.32	12.75	12.83	17.92	14.50	614	109	93	167	596	201	35	135
243	31-Aug	AZ	12	-0.04	23.67	23.33	21.25	22.75	8	3	35	10	6	5	13	7
173	22-Jun	AZ	5	0.13	15.33	19.92	16.08	17.11	167	33	132	80	152	13	65	46
175	24-Jun	AZ	5	0.06	13.08	19.08	15.92	16.03	498	41	139	117	493	17	69	71
177	26-Jun	AZ	5	0.12	11.58	18.50	15.83	15.31	1152	48	144	153	1212	21	72	95
180	29-Jun	AZ	5	0.09	9.58	16.75	15.50	13.94	4253	79	161	262	4928	39	81	173
182	01-Jul i	AZ	5	0.22	8.67	15.83	4.83	13.11	8503	106	205	373	10367	55	105	258
187	06-Jul	AZ	5	0.10	15.33	16.58	14.00	15.31	167	83	282	153	152	41	147	95
189	08-Jul	AZ	5	-0.03	12.25	15.17	13.75	13.72	783	131	312	287	801	72	163	192
191	10-Jul	AZ	5	0.03	9.83	14.08	12.50	12.14	3561	191	527	582	4073	113	285	423
194	13-Jul	AZ	5	0.07	8.83	12.75	11.42	11.00	7457	318	867	1028	9005	210	484	798
198	17-Jul I	AZ	5	0.21	8.58	11.92	10.50	10.33	9088	448	1374	1475	11136	318	789	1194
201	20-Jul	AZ	5	-0.06	21.25	21.50	11.50	18.08	18	22	833	58	14	8	464	33
203	22-Jul	AZ	5	0.11	17.00	18.83	11.67	15.83	82	44	770	126	71	18	426	77
208	27-Jul	AZ	5	0.13	11.25	14.42	10.75	12.14	1409	170	1207	582	1505	98	688	423
210	29-Jul I	AZ	5	0.30	10.75	13.67	10.33	11.58	1927	223	1501	763	2106	137	866	572
212	31-Jul	AZ	5	-0.02	25.75	23.08	10.33	19.72	5	15	1501	35	3	5	866	19
215	03-Aug	AZ	5	-0.13	18.58	19.67	13.00	17.08	44	35	424	81	37	14	227	47
219	07-Aug	AZ	5	0.03	14.50	16.67	12.25	14.47	245	81	589	211	230	40	321	137
224	12-Aug	AZ	5	0.13	12.17	14.00	11.08	12.42	821	197	1021	511	843	118	575	366
225	13-Aug I	AZ	5	0.33	12.17	14.00	11.08	12.42	821	197	1021	511	843	118	575	366
226	14-Aug	AZ	5	0.18	23.58	20.83	10.75	18.39	9	26	1207	53	6	10	688	29
229	17-Aug	AZ	5	0.03	20.33	21.08	15.00	18.81	24	25	193	47	19	8	98	25
231	19-Aug	AZ	5	0.14	17.75	19.33	14.58	17.22	61	38	226	77	52	16	116	45
233	21-Aug	AZ	5	0.11	15.42	17.92	13.50	15.61	161	56	345	136	146	26	182	84
240	28-Aug I	AZ	5	0.53	10.67	13.17	11.67	11.83	2033	270	770	675	2231	172	426	499
243	31-Aug	AZ	5	0.06	23.17	23.25	17.33	21.25	10	15	87	23	7	5	42	12
173	22-Jun	AZ	3	0.07	18.17	14.83	13.50	15.50	78	19	18	31	43	82	182	88
175	24-Jun	AZ	3	0.11	14.33	14.08	13.50	13.97	473	26	18	62	251	113	182	171
177	26-Jun	AZ	3	0.13	12.33	13.25	13.17	12.92	1470	38	20	104	762	165	210	284
180	29-Jun	AZ	3	0.20	10.00	11.75	12.50	11.42	7154	78	28	235	3597	347	285	628
182	01-Jul i	AZ	3	0.41	9.33	11.08	11.83	10.75	12040	110	39	350	5992	498	392	925
187	06-Jul	AZ	3	0.09	17.67	12.42	10.33	13.47	98	56	87	78	53	247	866	216
189	08-Jul	AZ	3	0.05	13.67	11.50	9.75	11.64	676	88	123	207	357	396	1216	555
191	10-Jul	AZ	3	0.08	11.00	10.50	9.17	10.22	3486	151	179	488	1777	695	1744	1280
194	13-Jul	AZ	3	0.36	9.33	9.42	8.50	9.08	12040	288	281	1068	5992	1361	2711	2737
198	17-Jul I	AZ	3	0.58	8.67	9.17	7.92	8.58	21058	338	430	1554	10367	1607	4106	3940
201	20-Jul	AZ	3	0.04	22.00	19.58	8.92	16.83	19	4	211	18	11	15	2050	52
203	22-Jul	AZ	3	0.14	19.08	16.58	9.33	15.00	55	10	160	38	30	41	1570	108

Table D.1 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
208	27-Jul	AZ	3	0.31	11.92	11.67	9.00	10.86	1906	81	199	327	983	363	1941	866
210	29-Jul I	AZ	3	0.55	10.75	10.67	8.75	10.06	4146	138	236	544	2106	631	2289	1422
212	31-Jul	AZ	3	-0.06	25.17	15.42	8.67	16.42	7	15	250	21	4	65	2420	61
215	03-Aug	AZ	3	0.04	19.83	17.83	11.17	16.28	41	7	55	22	23	26	551	64
219	07-Aug	AZ	3	0.11	15.00	14.17	10.67	13.28	336	26	72	86	179	109	720	238
224	12-Aug	AZ	3	0.18	12.50	10.92	9.25	10.89	1329	120	169	321	690	547	1654	852
225	13-Aug I	AZ	3	0.41	12.50	10.92	9.25	10.89	1329	120	169	321	690	547	1654	852
226	14-Aug	AZ	3	0.26	24.08	11.92	8.83	14.94	9	71	223	39	5	318	2165	111
229	17-Aug	AZ	3	-0.01	21.17	18.50	10.50	16.72	25	5	79	19	14	21	789	54
231	19-Aug	AZ	3	0.11	18.58	16.17	10.42	15.06	67	12	83	38	37	48	827	106
233	21-Aug	AZ	3	0.11	15.67	14.08	10.00	13.25	242	26	106	87	130	113	1049	241
240	28-Aug I	AZ	3	0.50	10.83	9.83	8.33	9.67	3911	223	316	707	1989	1042	3043	1834
243	31-Aug	AZ	3	0.16	22.67	20.50	10.42	17.86	15	3	83	12	8	11	827	35

Table D.2 CWSI, soil moisture content, and calculated soil water potentials for MAC.

Day	Date	Irr Tmt	Plot #		CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
Wet treatment																	
173	22-Jun	I	W	avg	0.082	19.03	21.03	23.97	21.34	93	50	41	53	103	31	24	39
175	24-Jun		W	avg	0.107	21.42	23.00	25.67	23.36	27	20	26	24	33	13	14	18
177	26-Jun		W	avg	-0.047	19.58	22.08	24.78	22.15	69	30	33	39	78	19	19	28
180	29-Jun		W	avg	0.077	17.17	20.86	24.28	20.77	278	54	38	68	276	34	22	49
182	01-Jul	I	W	avg	0.107	16.28	20.28	23.83	20.13	488	72	43	89	459	46	25	65
187	06-Jul		W	avg	0.040	18.72	21.42	24.42	21.52	111	42	37	50	120	26	21	36
189	08-Jul		W	avg	0.080	17.39	20.33	24.06	20.59	242	70	40	73	244	44	23	53
191	10-Jul		W	avg	0.103	16.39	19.47	23.36	19.74	454	109	49	106	430	69	28	77
194	13-Jul	I	W	avg	0.237	15.39	18.31	21.97	18.56	885	204	74	181	785	130	44	134
198	17-Jul		W	avg	0.037	20.36	21.81	24.28	22.15	46	35	38	39	54	22	22	28
203	22-Jul		W	avg	0.117	17.28	19.58	22.75	19.87	259	103	59	100	259	65	35	73
205	24-Jul	I	W	avg	0.223	16.50	19.11	22.11	19.24	423	132	71	132	403	84	42	97
208	27-Jul		W	avg	0.160	20.42	21.53	23.69	21.88	44	39	45	43	53	25	26	31
215	03-Aug	I	W	avg	0.213	19.25	20.08	22.25	20.53	83	80	68	75	92	50	41	55
219	07-Aug		W	avg	0.150	20.47	21.69	24.11	22.09	43	36	40	40	51	23	23	29
224	12-Aug	i	W	avg	0.153	17.58	19.92	22.81	20.10	215	87	58	90	219	55	34	66
229	17-Aug		W	avg	0.137	20.53	21.69	15.97	19.40	42	36	633	123	50	23	448	90
232	20-Aug		W	avg	0.113	19.28	20.81	23.36	21.15	81	56	49	58	91	35	28	42
240	28-Aug		W	avg	0.120	17.67	19.19	22.00	19.62	205	126	74	111	210	80	44	82
243	31-Aug		W	avg	0.190	20.25	21.44	23.94	21.88	48	41	42	43	57	26	24	31
251	08-Sep		W	avg	0.127	19.72	21.33	23.67	21.57	64	43	45	49	73	27	26	35
Medium treatment																	
173	22-Jun		M	avg	0.153	15.75	20.25	20.94	18.98	738	49	56	113	628	46	63	109
175	24-Jun		M	avg	0.187	15.78	18.75	22.79	19.11	720	106	29	106	613	102	34	103
177	26-Jun		M	avg	0.207	15.50	18.17	22.58	18.75	859	148	32	126	732	141	36	122
180	29-Jun	I	M	avg	0.233	15.13	17.25	21.75	18.04	1084	247	42	179	926	239	48	171
182	01-Jul		M	avg	0.090	14.11	14.56	15.94	14.87	2094	1381	456	1020	1797	1363	454	940
187	06-Jul		M	avg	0.047	11.94	13.14	15.14	13.41	10184	3897	679	2595	8849	3896	661	2344
189	08-Jul		M	avg	0.137	15.97	19.25	22.53	19.25	646	81	32	100	550	78	37	97
191	10-Jul		M	avg	0.163	15.06	18.53	21.89	18.49	1133	120	40	143	967	115	46	138
194	13-Jul	I	M	avg	0.263	14.00	17.64	20.61	17.42	2257	197	64	245	1938	190	71	233
198	17-Jul		M	avg	0.007	20.42	21.89	23.61	21.97	63	22	22	30	53	21	26	30
203	22-Jul		M	avg	0.093	17.03	20.06	22.22	19.77	352	54	36	78	298	51	41	76
205	24-Jul		M	avg	0.227	16.03	19.31	21.56	18.96	625	79	45	114	532	75	51	110
208	27-Jul	I	M	avg	0.420	15.17	18.44	20.58	18.06	1056	125	64	177	902	120	71	169
215	03-Aug		M	avg	0.070	20.08	21.36	22.69	21.38	74	28	30	39	62	27	35	38
219	07-Aug	I	M	avg	0.263	15.83	18.97	21.00	18.60	702	94	55	136	598	90	62	131
224	12-Aug		M	avg	0.100	21.72	22.36	23.47	22.52	35	18	23	24	29	17	28	24
229	17-Aug		M	avg	0.183	17.81	20.28	22.31	20.13	231	48	35	67	194	46	40	65
232	20-Aug	I	M	avg	0.183	16.42	19.39	21.44	19.08	498	76	47	108	423	72	53	104
240	28-Aug		M	avg	0.120	21.11	21.78	23.33	22.07	46	23	25	29	38	22	29	29
243	31-Aug		M	avg	0.227	18.53	20.44	22.44	20.47	158	44	33	57	133	42	38	56
251	08-Sep		M	avg	0.247	19.61	21.44	23.14	21.40	92	27	26	38	77	26	31	38
Dry treatment																	
173	22-Jun		D	avg	0.140	16.17	20.39	21.69	19.42	281	42	32	66	490	43	49	89
175	24-Jun		D	avg	0.213	17.14	21.19	21.61	19.98	169	26	33	51	280	29	50	69
177	26-Jun		D	avg	0.260	15.31	19.33	21.58	18.74	451	77	33	91	826	74	51	122
180	29-Jun		D	avg	0.213	14.61	18.19	20.89	17.90	675	158	42	137	1288	138	64	183
182	01-Jul		D	avg	0.303	14.39	17.69	20.50	17.53	771	219	48	164	1492	184	73	221
187	06-Jul		D	avg	0.353	13.67	17.03	19.36	16.69	1204	343	72	255	2441	273	111	341
189	08-Jul	I	D	avg	0.490	13.53	16.67	18.92	16.37	1315	441	85	301	2691	340	131	403
191	10-Jul		D	avg	-0.030	22.69	23.44	23.36	23.17	15	8	19	14	19	10	28	19
194	13-Jul		D	avg	0.070	20.06	21.75	21.94	21.25	43	19	30	30	62	22	45	40
198	17-Jul		D	avg	0.187	18.61	20.83	21.17	20.20	83	32	38	47	127	35	58	63
203	22-Jul		D	avg	0.170	16.25	19.19	19.83	18.43	268	84	61	106	466	80	93	142
205	24-Jul		D	avg	0.323	15.78	18.58	19.44	17.94	347	123	70	134	618	111	108	180
208	27-Jul	I	D	avg	0.647	14.94	17.86	18.44	17.08	555	196	102	207	1038	167	158	277
215	03-Aug		D	avg	0.150	21.08	21.72	21.50	21.44	28	20	34	28	39	22	52	37
219	07-Aug		D	avg	0.250	16.75	19.94	20.92	19.20	206	54	42	73	349	54	63	99
224	12-Aug	i	D	avg	0.380	14.78	16.94	18.61	16.78	611	363	96	242	1156	287	148	324
229	17-Aug		D	avg	0.217	21.03	22.42	22.64	22.03	29	14	24	22	40	16	36	29
232	20-Aug		D	avg	0.167	19.53	21.44	22.03	21.00	55	23	29	33	80	26	44	45
240	28-Aug		D	avg	0.213	17.44	20.08	21.03	19.51	145	50	40	64	237	51	61	86
243	31-Aug		D	avg	0.370	16.28	18.97	20.31	18.52	265	97	51	101	459	90	79	136
251	08-Sep		D	avg	0.350	15.31	18.03	19.25	17.53	451	176	75	164	826	152	116	221

Farm

Table D.2 (continued)

Day	Date	Irr Tmt	Plot #		CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
173	22-Jun	I	F	avg	0.180	14.31	17.53	21.56	17.80	2248	110	50	181	1577	203	51	193
175	24-Jun		F	avg	0.173	22.33	22.44	25.69	23.49	32	11	13	16	22	16	14	17
177	26-Jun		F	avg	-0.003	21.64	21.17	23.61	22.14	43	20	25	27	30	29	26	28
180	29-Jun		F	avg	0.047	18.97	20.17	22.83	20.66	151	31	33	50	106	48	34	52
182	01-Jul		F	avg	0.140	18.00	19.67	22.47	20.05	249	38	37	65	175	62	38	68
187	06-Jul	I	F	avg	0.183	16.00	17.75	21.39	18.38	769	98	53	137	541	178	54	145
189	08-Jul		F	avg	0.147	18.50	19.28	21.36	19.71	192	46	54	75	135	76	55	78
191	10-Jul		F	avg	-0.043	20.92	21.39	23.42	21.91	59	18	27	30	42	26	28	31
194	13-Jul		F	avg	0.040	18.94	20.28	22.56	20.59	153	29	36	51	107	46	37	53
198	17-Jul		F	avg	0.240	17.33	19.06	22.03	19.47	358	51	43	83	251	86	44	87
203	22-Jul		F	avg	0.180	15.81	17.39	19.97	17.72	865	119	89	187	608	220	89	200
205	24-Jul	I	F	avg	0.353	15.50	16.92	19.11	17.18	1043	153	123	246	732	292	122	264
208	27-Jul		F	avg	0.197	21.81	21.81	23.56	22.39	40	15	26	25	28	22	27	25
215	03-Aug		F	avg	0.103	20.44	20.56	22.36	21.13	74	25	38	41	52	39	39	42
219	07-Aug		F	avg	0.227	16.97	18.47	20.72	18.72	437	68	67	117	308	118	68	123
224	12-Aug	i	F	avg	0.403	15.97	17.17	19.14	17.43	782	133	122	217	550	251	121	232
229	17-Aug		F	avg	0.183	20.94	21.11	22.61	21.56	58	20	35	34	41	30	36	36
232	20-Aug		F	avg	0.113	19.67	20.00	21.69	20.45	107	33	48	54	75	52	49	57
240	28-Aug		F	avg	0.247	17.94	18.84	20.56	19.05	257	63	72	101	181	108	72	106
243	31-Aug		F	avg	0.383	16.58	17.67	19.69	17.98	546	103	99	165	384	187	98	176
251	08-Sep		F	avg	0.417	15.86	16.83	18.75	17.15	836	160	142	249	588	307	140	268
173	22-Jun	I	W	1	0.11	20.00	20.75	24.00	21.58	82	85	33	55	64	36	23	35
175	24-Jun		W	1	0.04	22.17	23.17	26.17	23.83	30	33	19	25	24	12	13	15
177	26-Jun		W	1	0.02	20.50	22.25	24.83	22.53	64	46	27	39	51	18	18	24
180	29-Jun		W	1	0.08	18.75	21.17	24.50	21.47	155	72	29	57	119	29	20	37
182	01-Jul	I	W	1	0.18	17.50	20.75	23.92	20.72	305	85	34	76	229	36	24	50
187	06-Jul		W	1	0.00	20.08	21.67	24.75	22.17	79	58	27	45	62	23	19	28
189	08-Jul		W	1	0.06	18.92	21.00	24.25	21.39	142	77	31	59	109	32	22	38
191	10-Jul		W	1	0.12	17.83	20.42	23.33	20.53	254	98	39	82	192	42	29	55
194	13-Jul	I	W	1	0.20	16.83	19.50	21.75	19.36	447	146	61	131	333	68	48	92
198	17-Jul		W	1	-0.01	21.17	22.42	24.67	22.75	47	44	28	36	37	16	19	22
203	22-Jul		W	1	0.10	18.50	20.33	22.92	20.58	177	102	44	80	135	44	33	53
205	24-Jul	I	W	1	0.23	17.50	19.75	22.00	19.75	305	131	57	112	229	60	44	77
208	27-Jul		W	1	0.15	20.92	21.50	23.33	21.92	53	63	39	49	42	25	28	31
215	03-Aug	I	W	1	0.22	19.67	19.42	22.33	20.47	97	152	52	84	75	71	39	56
219	07-Aug		W	1	0.17	21.42	22.33	24.75	22.83	42	45	27	35	33	17	19	21
224	12-Aug		W	1	0.14	19.83	20.67	23.00	21.17	89	88	43	64	69	37	32	42
232	20-Aug		W	1	0.00	20.67	21.67	23.58	21.97	60	58	37	48	47	23	27	30
240	28-Aug		W	1	0.08	19.25	20.17	22.25	20.56	120	109	53	81	92	48	41	54
243	31-Aug		W	1	0.11	21.42	21.83	24.42	22.56	42	55	30	39	33	21	21	24
251	08-Sep		W	1	0.04	21.33	21.92	23.67	22.31	44	53	36	42	35	21	26	26
173	22-Jun	I	F	2	0.09	14.33	19.58	24.33	19.42	2965	145	133	305	1548	65	21	89
175	24-Jun		F	2	0.13	23.50	24.50	27.08	25.03	29	15	61	33	14	7	10	10
177	26-Jun		F	2	0.03	24.17	23.00	26.00	24.39	22	28	82	42	10	13	13	12
180	29-Jun		F	2	0.04	19.58	21.92	25.25	22.25	160	46	101	93	78	21	16	27
182	01-Jul		F	2	0.19	18.67	21.50	25.08	21.75	250	56	106	113	124	25	17	33
187	06-Jul	I	F	2	0.19	16.33	19.58	23.92	19.94	873	145	151	241	444	65	24	71
189	08-Jul		F	2	0.12	18.25	21.67	24.25	21.39	309	52	136	131	154	23	22	38
191	10-Jul		F	2	-0.07	21.67	23.42	25.67	23.58	62	24	90	56	30	10	14	16
194	13-Jul		F	2	0.02	19.58	22.00	24.92	22.17	160	45	112	96	78	20	18	28
198	17-Jul		F	2	0.20	17.83	20.83	24.42	21.03	384	77	130	152	192	35	21	44
203	22-Jul		F	2	0.16	15.83	19.00	21.75	18.86	1168	197	304	393	598	89	48	116
205	24-Jul	I	F	2	0.36	15.75	18.25	20.83	18.28	1227	296	417	517	628	134	65	152
208	27-Jul		F	2	0.18	21.83	23.08	25.58	23.50	58	27	92	58	28	12	15	17
215	03-Aug		F	2	0.03	21.00	23.17	23.92	22.69	83	26	151	78	40	12	24	23
219	07-Aug		F	2	0.21	17.00	19.83	22.42	19.75	601	127	243	263	303	57	38	77
224	12-Aug	i	F	2	0.44	15.83	18.42	20.42	18.22	1168	270	483	531	598	122	76	157
229	17-Aug		F	2	0.18	21.50	23.00	24.50	23.00	67	28	127	69	32	13	20	20
232	20-Aug		F	2	0.05	19.83	21.92	23.25	21.67	142	46	186	117	69	21	29	34
240	28-Aug		F	2	0.21	17.58	19.92	21.67	19.72	438	122	312	266	219	55	49	78
243	31-Aug		F	2	0.35	15.92	18.50	20.42	18.28	1112	258	483	517	568	117	76	152
251	08-Sep		F	2	0.30	14.58	17.50	19.25	17.11	2522	453	745	919	1312	206	116	273
173	22-Jun		M	3	0.16	14.92	20.00	24.42	19.78	1306	58	39	120	1057	52	21	76
175	24-Jun		M	3	0.16	14.42	19.42	24.25	19.36	1801	87	41	148	1464	71	22	92
177	26-Jun		M	3	0.22	14.08	18.83	24.00	18.97	2246	132	45	182	1831	97	23	110
180	29-Jun	I	M	3	0.23	13.75	18.08	23.08	18.31	2815	231	61	261	2303	147	31	150
182	01-Jul		M	3	0.13	20.75	22.92	25.25	22.97	58	9	30	26	45	13	16	20
187	06-Jul		M	3	0.02	16.75	20.67	23.75	20.39	438	37	49	86	349	37	25	58
189	08-Jul		M	3	0.16	15.67	19.58	23.42	19.56	823	77	54	134	661	65	28	84
191	10-Jul		M	3	0.19	14.83	19.08	22.42	18.78	1377	110	77	202	1115	85	38	120
194	13-Jul	I	M	3	0.35	13.92	18.50	20.50	17.64	2513	169	158	380	2052	117	73	209
198	17-Jul		M	3	0.03	20.83	22.08	24.33	22.42	56	15	40	34	43	19	21	25

Table D.2 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
203	22-Jul	M	3	0.09	17.08	20.50	22.67	20.08	364	41	71	103	289	41	35	66
205	24-Jul	M	3	0.23	15.92	19.83	21.58	19.11	709	65	104	169	568	57	51	103
208	27-Jul	I M	3	0.44	14.92	18.75	20.58	18.08	1308	140	153	298	1057	102	71	188
215	03-Aug	M	3	-0.02	21.08	21.67	23.17	21.97	50	19	59	41	39	23	30	30
219	07-Aug	I M	3	0.23	16.08	20.08	21.83	19.33	642	54	95	151	514	50	47	93
224	12-Aug	M	3	0.15	22.17	22.75	24.58	23.17	31	10	37	24	24	14	20	19
229	17-Aug	M	3	0.20	17.50	20.92	23.33	20.58	290	31	56	80	229	33	29	53
232	20-Aug	I M	3	0.17	16.17	19.75	22.25	19.39	612	69	82	146	490	60	41	91
240	28-Aug	M	3	0.12	21.67	22.17	24.17	22.67	39	14	42	30	30	18	22	23
243	31-Aug	M	3	0.20	18.33	20.50	23.00	20.61	187	41	63	79	147	41	32	53
251	08-Sep	M	3	0.16	19.50	21.58	23.92	21.67	105	20	46	48	82	24	24	34
173	22-Jun	D	4	0.12	16.67	21.67	24.00	20.78	398	56	35	78	366	23	23	49
175	24-Jun	D	4	0.21	20.67	24.33	24.00	23.00	51	16	35	31	47	7	23	20
177	26-Jun	D	4	0.35	15.92	20.25	24.58	20.25	620	117	29	98	568	46	20	62
180	29-Jun	D	4	0.17	15.00	19.42	23.92	19.44	1095	184	35	142	1002	71	24	88
182	01-Jul	D	4	0.20	14.92	19.08	23.58	19.19	1155	222	39	160	1057	85	27	99
187	06-Jul	D	4	0.34	14.25	18.67	22.67	18.53	1792	282	53	221	1637	106	35	135
189	08-Jul	I D	4	0.45	14.00	18.58	22.00	18.19	2123	296	67	261	1938	111	44	159
191	10-Jul	D	4	-0.04	22.67	24.00	24.50	23.72	21	19	30	23	19	8	20	15
194	13-Jul	D	4	0.09	20.33	22.75	24.17	22.42	59	33	33	39	55	14	22	25
198	17-Jul	D	4	0.25	18.67	21.75	23.50	21.31	134	54	40	62	124	22	27	39
203	22-Jul	D	4	0.16	16.50	20.17	22.50	19.72	439	122	56	125	403	48	37	78
205	24-Jul	D	4	0.38	16.08	19.67	22.17	19.31	561	160	63	152	514	62	42	94
208	27-Jul	I D	4	0.67	15.17	18.92	21.08	18.39	985	244	92	237	902	93	60	145
215	03-Aug	D	4	0.11	21.33	23.75	23.33	22.81	37	21	43	33	35	9	29	22
219	07-Aug	D	4	0.25	17.00	20.58	23.42	20.33	328	98	42	84	303	39	28	60
224	12-Aug	i D	4	0.42	13.08	14.25	18.17	15.17	4067	5225	282	1384	3704	1695	176	790
229	17-Aug	D	4	0.22	21.67	23.42	24.67	23.25	32	24	28	28	30	10	19	18
232	20-Aug	D	4	0.15	20.08	22.42	24.17	22.22	67	39	33	42	62	16	22	27
240	28-Aug	D	4	0.16	18.33	21.00	23.25	20.86	160	79	44	75	147	32	29	48
243	31-Aug	D	4	0.32	16.75	19.67	22.58	19.67	380	160	55	128	349	62	36	80
251	08-Sep	D	4	0.21	15.42	18.50	20.83	18.25	842	311	100	254	771	117	65	155
173	22-Jun	I F	5	0.21	13.83	17.17	23.58	18.19	2397	210	82	258	2174	251	27	159
175	24-Jun	F	5	0.13	21.92	23.00	29.25	24.72	29	9	16	16	27	13	6	11
177	26-Jun	F	5	-0.08	20.33	21.92	25.50	22.58	60	15	45	36	55	21	15	24
180	29-Jun	F	5	0.04	18.58	20.58	25.00	21.39	141	29	53	59	129	39	17	38
182	01-Jul	F	5	0.17	17.67	20.17	24.58	20.81	229	36	60	76	210	48	20	49
187	06-Jul	I F	5	0.15	15.58	17.83	23.83	19.08	765	139	75	167	696	170	25	104
189	08-Jul	F	5	0.16	20.50	20.92	25.92	21.78	55	24	73	50	51	33	24	33
191	10-Jul	F	5	-0.04	20.75	21.92	24.83	22.50	49	15	55	37	45	21	18	24
194	13-Jul	F	5	0.00	18.83	21.00	24.67	21.50	124	23	58	57	114	32	19	36
198	17-Jul	F	5	0.23	17.00	19.50	24.25	20.25	332	53	66	97	303	68	22	62
203	22-Jul	F	5	0.17	15.58	17.58	22.67	18.61	765	182	110	210	696	196	35	130
205	24-Jul	I F	5	0.36	15.08	17.17	21.67	17.97	1045	210	155	288	950	251	49	177
208	27-Jul	F	5	0.17	22.67	23.33	25.33	23.78	21	7	48	23	19	11	16	15
215	03-Aug	F	5	0.08	20.67	22.42	24.08	22.39	51	12	70	39	47	16	23	25
219	07-Aug	F	5	0.14	16.67	19.42	23.42	19.83	401	55	86	118	366	71	28	74
224	12-Aug	i F	5	0.39	15.58	17.75	22.00	18.44	765	145	138	228	696	178	44	141
229	17-Aug	F	5	0.18	20.67	21.58	24.83	22.36	51	17	55	40	47	24	18	26
232	20-Aug	F	5	0.04	19.42	20.33	24.25	21.33	93	33	66	61	85	44	22	39
240	28-Aug	F	5	0.18	17.50	19.08	23.25	19.94	251	66	91	112	229	85	29	71
243	31-Aug	F	5	0.30	15.83	17.92	22.25	18.67	656	132	127	204	598	162	41	127
251	08-Sep	F	5	0.40	15.50	16.92	21.17	17.86	805	246	185	305	732	292	58	187
173	22-Jun	D	6	0.17	15.33	17.17	16.25	16.25	380	197	2	59	812	251	386	430
175	24-Jun	D	6	0.23	15.00	17.25	16.33	16.19	449	183	2	61	1002	239	381	443
177	26-Jun	D	6	0.19	14.50	16.33	15.67	15.50	581	423	3	93	1386	418	515	652
180	29-Jun	D	6	0.27	13.92	15.33	14.67	14.64	795	1117	5	162	2052	800	831	1080
182	01-Jul	D	6	0.42	13.67	15.17	14.08	14.31	912	1322	7	202	2441	894	1116	1323
187	06-Jul	D	6	0.42	12.92	14.50	13.08	13.50	1402	2638	12	354	4187	1418	1903	2206
189	08-Jul	I D	6	0.54	13.08	14.08	13.00	13.39	1272	4129	12	384	3704	1912	1993	2372
191	10-Jul	D	6	-0.03	22.25	21.25	20.33	21.28	22	7	0	4	23	28	78	40
194	13-Jul	D	6	0.04	19.42	19.33	17.17	18.64	63	32	1	16	85	74	266	128
198	17-Jul	D	6	0.16	17.92	18.17	15.92	17.33	116	82	3	31	183	141	460	243
203	22-Jul	D	6	0.15	16.17	17.17	14.67	16.00	254	197	5	68	490	251	831	493
205	24-Jul	D	6	0.27	15.83	16.75	14.25	15.61	297	287	6	87	598	323	1025	613
208	27-Jul	I D	6	0.68	14.75	16.17	13.58	14.83	510	495	9	142	1177	465	1450	961
215	03-Aug	D	6	0.21	20.17	16.83	17.33	18.11	47	266	1	21	59	307	248	165
219	07-Aug	D	6	0.23	16.33	17.42	15.67	16.47	235	158	3	52	444	217	515	382
224	12-Aug	i D	6	0.42	15.58	16.58	14.75	15.64	336	335	5	85	696	358	798	603
229	17-Aug	D	6	0.22	20.67	19.58	18.25	19.50	39	26	1	10	47	65	171	86
232	20-Aug	D	6	0.15	19.08	18.58	17.00	18.22	72	58	2	19	100	111	285	157
240	28-Aug	D	6	0.20	16.33	17.33	15.67	16.44	235	170	3	52	444	227	515	387

Table D.2 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
243	31-Aug	D	6	0.34	15.67	16.33	14.75	15.58	322	423	5	88	661	418	798	622
251	08-Sep	D	6	0.27	15.08	15.58	13.75	14.81	430	871	8	145	950	677	1327	977
173	22-Jun	M	7	0.13	17.58	24.92	21.67	21.39	248	12	8	23	219	6	49	38
175	24-Jun	M	7	0.22	17.17	18.08	21.33	18.86	314	199	9	67	276	147	55	116
177	26-Jun	M	7	0.16	16.92	17.50	21.17	18.53	363	264	9	78	317	206	58	135
180	29-Jun I	M	7	0.14	16.50	16.42	20.42	17.78	464	459	12	110	403	397	76	192
182	01-Jul	M	7	0.05	21.58	20.75	22.58	21.64	33	60	6	21	31	36	36	34
187	06-Jul	M	7	0.03	19.08	18.75	21.67	19.83	110	145	8	43	100	102	49	74
189	08-Jul	M	7	0.07	14.58	17.83	20.25	17.56	1573	224	12	123	1312	170	80	216
191	10-Jul	M	7	0.12	13.83	17.25	19.67	16.92	2651	299	15	169	2174	239	99	302
194	13-Jul I	M	7	0.25	13.08	16.33	18.25	15.89	4599	479	28	288	3704	418	171	524
198	17-Jul	M	7	-0.02	19.08	20.33	22.08	20.50	110	72	7	33	100	44	43	55
203	22-Jul	M	7	0.08	15.67	18.58	20.67	18.31	775	157	11	86	661	111	88	150
205	24-Jul	M	7	0.22	14.83	17.83	19.92	17.53	1330	224	14	125	1115	170	91	221
208	27-Jul I	M	7	0.39	14.17	17.08	18.67	16.64	2095	325	22	194	1731	264	145	349
215	03-Aug	M	7	0.13	19.50	19.08	21.67	20.08	89	125	8	39	82	85	49	66
219	07-Aug I	M	7	0.19	15.17	17.75	19.75	17.56	1067	233	15	123	902	178	96	218
224	12-Aug	M	7	0.07	20.50	20.83	22.42	21.25	54	58	6	24	51	35	38	40
229	17-Aug	M	7	0.17	16.58	18.75	20.58	18.64	442	145	11	74	384	102	71	128
232	20-Aug I	M	7	0.17	15.58	17.92	19.58	17.69	817	215	16	115	696	162	102	203
240	28-Aug	M	7	0.10	20.08	20.17	21.67	20.64	67	77	8	31	62	48	49	52
243	31-Aug	M	7	0.18	17.75	18.92	20.42	19.03	225	135	12	62	200	93	76	107
251	08-Sep	M	7	0.12	18.42	19.50	21.42	19.78	157	103	8	44	141	68	53	76
173	22-Jun I	W	8	0.09	17.67	21.92	24.92	21.50	176	9	39	38	210	21	18	36
175	24-Jun	W	8	0.18	21.25	23.58	26.33	23.72	25	4	26	16	36	10	12	15
177	26-Jun	W	8	-0.06	18.92	22.67	25.75	22.44	86	7	31	26	109	15	14	25
180	29-Jun	W	8	0.07	15.75	21.08	25.08	20.64	585	14	37	55	628	31	17	52
182	01-Jul I	W	8	0.10	14.92	20.50	24.75	20.06	1033	19	40	70	1057	41	19	67
187	06-Jul	W	8	0.06	17.75	22.00	25.25	21.67	167	9	35	36	200	20	16	34
189	08-Jul	W	8	0.10	16.08	20.58	24.92	20.53	470	18	39	57	514	39	18	55
191	10-Jul	W	8	0.09	15.08	19.50	24.50	19.69	920	32	43	83	950	68	20	79
194	13-Jul I	W	8	0.23	14.00	18.33	22.83	18.39	2006	60	71	152	1938	128	34	145
198	17-Jul	W	8	0.04	20.00	22.17	24.75	22.31	48	8	40	28	64	18	19	26
203	22-Jul	W	8	0.13	16.25	19.67	23.25	19.72	422	29	63	82	466	62	29	78
205	24-Jul I	W	8	0.22	15.33	19.08	22.42	18.94	774	39	81	117	812	85	38	111
208	27-Jul	W	8	0.19	20.42	22.33	24.42	22.39	39	8	44	27	53	17	21	25
215	03-Aug I	W	8	0.20	18.67	21.00	22.50	20.72	99	15	79	53	124	32	37	50
219	07-Aug	W	8	0.13	20.25	22.17	24.83	22.42	42	8	40	26	57	18	18	25
224	12-Aug i	W	8	0.10	17.08	20.67	23.75	20.50	250	17	54	58	289	37	25	55
229	17-Aug	W	8	0.15	20.25	22.33	24.83	22.47	42	8	40	26	57	17	18	25
232	20-Aug	W	8	0.17	18.50	21.33	24.17	21.33	109	12	48	41	135	27	22	39
240	28-Aug	W	8	0.11	16.33	19.50	22.58	19.47	400	32	77	91	444	68	36	87
243	31-Aug	W	8	0.19	19.50	22.00	24.58	22.03	63	9	42	31	82	20	20	29
251	08-Sep	W	8	0.10	18.17	21.75	24.58	21.50	131	10	42	38	160	22	20	36
173	22-Jun	D	9	0.13	16.50	22.33	24.83	21.22	139	13	98	63	403	17	18	41
175	24-Jun	D	9	0.20	15.75	22.00	24.50	20.75	211	15	106	76	628	20	20	50
177	26-Jun	D	9	0.24	15.50	21.42	24.50	20.47	243	20	106	84	732	26	20	56
180	29-Jun	D	9	0.20	14.92	19.83	24.08	19.61	342	44	119	119	1057	57	23	82
182	01-Jul	D	9	0.29	14.58	18.83	23.83	19.08	418	74	127	148	1312	97	25	104
187	06-Jul	D	9	0.30	13.83	17.92	22.33	18.03	669	122	192	233	2174	162	39	172
189	08-Jul I	D	9	0.48	13.50	17.33	21.75	17.53	831	171	228	292	2745	227	48	221
191	10-Jul	D	9	-0.02	23.17	25.08	25.25	24.50	7	4	88	20	16	5	16	12
194	13-Jul	D	9	0.08	20.42	23.17	24.50	22.69	21	9	106	37	53	12	20	23
198	17-Jul	D	9	0.15	19.25	22.58	24.08	21.97	35	12	119	48	92	15	23	30
203	22-Jul	D	9	0.20	16.08	20.25	22.33	19.56	175	36	192	122	514	46	39	84
205	24-Jul	D	9	0.32	15.42	19.33	21.92	18.89	255	57	217	161	771	74	45	114
208	27-Jul I	D	9	0.59	14.92	18.50	20.67	18.03	342	89	316	233	1057	117	69	172
215	03-Aug	D	9	0.13	21.75	24.58	23.83	23.39	12	5	127	29	29	6	25	17
219	07-Aug	D	9	0.27	16.92	21.83	23.67	20.81	112	17	133	74	317	21	26	49
224	12-Aug i	D	9	0.29	15.67	20.00	22.92	19.53	221	40	163	123	661	52	33	85
229	17-Aug	D	9	0.21	20.75	24.25	25.00	23.33	18	6	94	30	45	7	17	18
232	20-Aug	D	9	0.20	18.42	23.33	24.92	22.56	33	9	96	39	85	11	18	24
240	28-Aug	D	9	0.28	17.67	21.83	24.17	21.22	76	17	116	63	210	21	22	41
243	31-Aug	D	9	0.45	16.42	20.92	23.58	20.31	146	26	136	90	423	33	27	60
251	08-Sep	D	9	0.57	15.42	20.00	23.17	19.53	255	40	152	123	771	52	30	85
189	08-Jul	M	10	0.18	17.67	20.33	23.92	20.64	243	33	46	66	210	44	24	52
191	10-Jul	M	10	0.18	16.50	19.25	23.58	19.78	449	53	51	94	403	78	27	76
194	13-Jul I	M	10	0.19	15.00	18.08	23.08	18.72	1055	90	60	149	1002	147	31	123
198	17-Jul	M	10	0.01	21.33	23.25	24.42	23.00	45	10	40	27	35	11	21	20
203	22-Jul	M	10	0.11	18.33	21.08	23.33	20.92	174	24	56	59	147	31	29	46
205	24-Jul	M	10	0.23	17.33	20.25	23.17	20.25	288	34	59	78	251	46	30	62

Table D.2 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
208	27-Jul	I M	10	0.43	16.42	19.50	22.50	19.47	469	47	73	107	423	68	37	87
215	03-Aug	M	10	0.10	19.67	23.33	23.25	22.08	93	10	57	38	75	11	29	29
219	07-Aug	I M	10	0.37	16.25	19.08	21.42	18.92	514	57	105	137	466	85	53	113
224	12-Aug	M	10	0.08	22.50	23.50	23.42	23.14	28	9	54	26	21	10	28	19
229	17-Aug	M	10	0.18	19.33	21.17	23.00	21.17	108	23	62	54	89	29	32	42
232	20-Aug	I M	10	0.21	17.50	20.50	22.50	20.17	264	31	73	80	229	41	37	64
240	28-Aug	M	10	0.14	21.58	23.00	24.17	22.92	40	11	43	28	31	13	22	21
243	31-Aug	M	10	0.30	19.50	21.92	23.92	21.78	100	17	46	42	82	21	24	33
251	08-Sep	M	10	0.46	20.92	23.25	24.08	22.75	53	10	44	29	42	11	23	22
173	22-Jun	I W	11	0.06	19.42	20.42	23.00	20.94	57	148	57	74	85	42	32	46
175	24-Jun	W	11	0.10	20.83	22.25	24.50	22.53	25	54	37	37	43	18	20	24
177	26-Jun	W	11	-0.10	19.33	21.33	23.75	21.47	60	89	46	58	89	27	25	37
180	29-Jun	W	11	0.08	17.00	20.33	23.25	20.19	262	155	53	104	303	44	29	63
182	01-Jul	I W	11	0.04	16.42	19.58	22.83	19.61	391	241	60	137	423	65	34	82
187	06-Jul	W	11	0.06	18.33	20.58	23.25	20.72	110	135	53	82	147	39	28	50
189	08-Jul	W	11	0.08	17.17	19.42	23.00	19.86	234	266	57	122	276	71	32	73
191	10-Jul	W	11	0.10	16.25	18.50	22.25	19.00	440	468	72	185	466	117	41	108
194	13-Jul	I W	11	0.28	15.33	17.08	21.33	17.92	858	1184	97	323	812	264	55	182
198	17-Jul	W	11	0.08	19.92	20.83	23.42	21.39	42	117	51	60	67	35	28	38
203	22-Jul	W	11	0.12	17.08	18.75	22.08	19.31	247	400	76	159	289	102	43	94
205	24-Jul	I W	11	0.22	16.67	18.50	21.92	19.03	328	468	80	183	366	117	45	107
208	27-Jul	W	11	0.14	19.92	20.75	23.33	21.33	42	123	52	82	67	36	29	39
215	03-Aug	I W	11	0.22	19.42	19.83	21.92	20.39	57	208	80	95	85	57	45	58
219	07-Aug	W	11	0.15	19.75	20.58	22.75	21.03	47	135	62	71	72	39	35	44
224	12-Aug	i W	11	0.22	15.83	18.42	21.67	18.64	593	493	87	222	598	122	49	128
229	17-Aug	W	11	0.13	19.75	20.50	23.08	21.11	47	141	56	68	72	41	31	43
232	20-Aug	W	11	0.17	18.67	19.42	22.33	20.14	89	266	70	107	124	71	39	65
240	28-Aug	W	11	0.17	17.42	17.92	21.17	18.83	198	680	102	202	240	162	58	117
243	31-Aug	W	11	0.27	19.83	20.50	22.83	21.06	44	141	60	70	69	41	34	44
251	08-Sep	W	11	0.24	19.67	20.33	22.75	20.92	49	155	62	75	75	44	35	46
173	22-Jun	I F	12	0.24	14.75	15.83	16.75	15.78	1469	55	3	65	1177	575	318	558
175	24-Jun	F	12	0.26	21.58	19.83	20.75	20.72	40	12	1	7	31	57	67	50
177	26-Jun	F	12	0.04	20.42	18.58	19.33	19.44	68	19	1	12	53	111	112	88
180	29-Jun	F	12	0.06	18.75	18.00	18.25	18.33	152	23	2	20	119	154	171	148
182	01-Jul	F	12	0.06	17.67	17.33	17.75	17.58	267	30	2	27	210	227	209	215
187	06-Jul	I F	12	0.21	16.08	15.83	16.42	16.11	649	55	4	55	514	575	367	464
189	08-Jul	F	12	0.16	16.75	15.25	15.92	15.97	442	70	5	59	349	845	460	501
191	10-Jul	F	12	-0.02	20.33	18.83	19.75	19.64	71	17	1	11	55	97	96	81
194	13-Jul	F	12	0.10	18.42	17.83	18.08	18.11	180	25	2	22	141	170	182	165
198	17-Jul	F	12	0.29	17.17	16.83	17.42	17.14	350	38	3	34	276	307	239	269
203	22-Jul	F	12	0.21	16.00	15.58	15.50	15.69	681	61	6	67	541	677	557	584
205	24-Jul	I F	12	0.34	15.67	15.33	14.83	15.28	831	68	9	83	661	800	766	741
208	27-Jul	F	12	0.24	20.92	19.00	19.75	19.89	54	16	1	10	42	89	96	72
215	03-Aug	F	12	0.20	19.67	16.17	19.08	18.31	97	48	1	20	75	465	123	150
219	07-Aug	F	12	0.33	17.25	16.17	16.33	16.58	335	48	4	44	263	465	381	360
224	12-Aug	i F	12	0.38	16.50	15.33	15.00	15.61	509	68	8	70	403	800	706	613
229	17-Aug	F	12	0.19	20.67	18.75	18.50	19.31	61	18	2	13	47	102	155	94
232	20-Aug	F	12	0.25	19.75	17.75	17.58	18.36	93	26	2	19	72	178	223	146
240	28-Aug	F	12	0.35	18.75	18.92	16.75	17.47	152	35	3	29	119	292	318	227
243	31-Aug	F	12	0.50	18.00	16.58	16.42	17.00	224	40	4	36	175	358	367	289
251	08-Sep	F	12	0.55	17.50	16.08	15.83	16.47	292	49	5	46	229	490	477	382

Table D.3 CWSI, soil moisture content, and calculated soil water potentials for MRN.

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
Wet treatment																
173	22-Jun		W avg	0.060	20.53	25.50	23.47	23.17	1872	407	61	349	1923	249	68	293
175	24-Jun	I	W avg	0.140	20.33	25.00	22.31	22.55	2079	530	103	477	2133	317	107	391
177	26-Jun		W avg	0.037	36.06	33.69	22.63	30.86	4	10	81	13	4	8	87	14
180	29-Jun		W avg	0.067	32.50	30.47	22.58	28.52	12	38	91	32	13	29	96	32
182	01-Jul	I	W avg	0.117	29.61	28.63	22.25	26.90	34	78	105	63	35	56	109	60
187	06-Jul		W avg	0.040	32.39	29.67	21.39	27.81	13	54	157	43	13	40	158	42
189	08-Jul		W avg	0.023	29.36	28.42	21.19	26.32	37	96	172	80	39	67	169	75
191	10-Jul	I	W avg	0.127	25.72	26.42	20.31	24.15	158	254	265	217	164	162	248	189
203	22-Jul	I	W avg	0.140	22.83	24.78	19.39	22.33	582	596	423	531	603	353	376	433
205	24-Jul		W avg	0.153	37.89	25.33	18.50	27.24	2	444	679	54	2	270	573	52
217	05-Aug		W avg	0.060	39.06	24.78	17.69	27.18	2	596	1085	56	2	353	854	54
219	07-Aug		W avg	0.170	35.03	25.53	17.94	26.17	5	401	924	86	6	246	753	80
224	12-Aug	i	W avg	0.137	29.81	24.83	17.42	24.02	31	579	1249	231	33	344	984	200
243	31-Aug	I	W avg	0.227	31.33	23.17	17.47	23.99	18	1462	1210	234	18	799	956	202
Medium treatment																
173	22-Jun		M avg	0.060	20.11	26.31	23.81	23.41	4125	352	29	295	2404	171	60	263
175	24-Jun		M avg	0.160	20.22	26.00	22.64	22.95	3875	413	45	366	2264	197	94	323
177	26-Jun		M avg	0.160	19.75	24.86	20.61	21.74	5063	755	100	667	2929	339	217	576
180	29-Jun	I	M avg	0.317	18.88	24.08	18.83	20.59	8523	1160	216	1214	4839	499	488	1025
182	01-Jul		M avg	0.093	36.08	29.28	19.39	28.25	6	83	188	37	4	47	376	36
187	06-Jul		M avg	0.097	28.50	27.11	18.53	24.71	80	235	248	162	54	118	565	147
189	08-Jul		M avg	0.110	26.64	26.31	18.31	23.75	172	352	274	251	112	171	630	225
191	10-Jul		M avg	0.167	23.83	25.42	17.83	22.36	604	561	343	489	378	259	796	427
198	17-Jul	I	M avg	0.320	19.92	23.14	17.08	20.05	4604	1991	494	1634	2673	811	1170	1365
205	24-Jul	I	M avg	0.253	24.72	23.36	16.50	21.53	399	1750	664	743	253	722	1597	639
217	05-Aug	I	M avg	0.233	24.14	23.47	16.19	21.27	523	1641	778	850	328	681	1889	727
219	07-Aug		M avg	0.193	35.72	23.78	16.39	25.30	6	1378	703	125	5	582	1697	115
243	31-Aug	I	M avg	0.210	31.03	23.94	16.39	23.79	31	1254	703	247	21	535	1697	221
Dry treatment																
173	22-Jun		D avg	0.057	19.39	27.19	24.11	23.56	3113	68	135	284	3582	114	53	244
175	24-Jun		D avg	0.150	19.03	26.19	23.08	22.77	3802	105	207	411	4397	180	79	352
177	26-Jun		D avg	0.177	19.00	25.78	22.19	22.32	3862	127	305	507	4467	218	112	435
180	29-Jun		D avg	0.273	21.67	25.31	20.03	22.33	955	157	832	505	1067	273	281	433
182	01-Jul		D avg	0.187	17.78	24.86	18.83	20.49	7831	193	1519	1267	9221	339	488	1081
187	06-Jul		D avg	0.267	17.47	24.31	17.11	19.63	9417	252	3884	2004	11139	446	1153	1707
189	08-Jul	I	D avg	0.423	17.08	23.94	16.75	19.26	11963	300	4785	2457	14236	535	1398	2090
191	10-Jul		D avg	0.013	35.11	28.72	17.36	27.06	6	36	3370	65	6	59	1012	56
198	17-Jul		D avg	0.153	26.92	26.61	17.25	23.59	95	87	3588	281	100	148	1072	241
203	22-Jul		D avg	0.140	21.42	25.14	16.75	21.10	1081	170	4785	925	1211	296	1396	791
205	24-Jul	I	D avg	0.477	20.31	24.22	16.25	20.26	1905	262	6437	1430	2165	465	1832	1220
217	05-Aug		D avg	0.197	25.94	26.42	17.86	23.41	141	95	2552	305	150	162	785	263
219	07-Aug	I	D avg	0.400	23.50	25.50	17.50	22.17	403	144	3117	547	440	249	942	469
243	31-Aug		D avg	0.260	30.11	25.08	16.19	23.80	29	174	6657	256	30	304	1889	220
251	08-Sep	I	D avg	0.427	21.50	22.92	15.50	19.97	1037	501	10222	1666	1161	911	2798	1420
Farm																
173	22-Jun		F avg	0.010	23.14	24.94	25.61	24.56	370	184	32	114	521	326	31	157
175	24-Jun		F avg	0.123	22.58	24.47	24.78	23.94	479	223	42	145	679	411	42	206
177	26-Jun		F avg	0.127	22.22	24.17	23.89	23.43	569	254	55	178	810	478	58	260
180	29-Jun		F avg	0.190	24.22	23.64	22.22	23.36	227	318	95	183	317	625	111	268
182	01-Jul	I	F avg	0.190	20.92	23.31	20.97	21.73	1084	368	148	362	1567	743	186	579
187	06-Jul		F avg	0.037	35.22	28.44	20.44	28.04	4	48	179	33	5	66	234	39
191	10-Jul		F avg	0.023	30.72	26.67	20.08	25.82	18	93	205	71	24	145	274	92
205	24-Jul	I	F avg	0.200	25.89	24.97	19.39	23.42	112	182	268	179	153	321	376	261
217	05-Aug		F avg	0.083	28.42	25.28	18.25	23.98	41	160	424	143	56	277	647	203
219	07-Aug		F avg	0.213	26.25	24.42	18.17	22.94	96	229	439	216	132	422	674	325
224	12-Aug	i	F avg	0.080	39.58	25.28	17.56	27.47	1	160	569	40	1	277	916	48
173	22-Jun		W 1	0.04	21.83	27.83	22.75	24.14	1839	170	306	472	982	86	90	189
175	24-Jun	I	W 1	0.21	21.50	27.83	21.67	23.67	2222	170	585	617	1161	86	139	234
177	26-Jun		W 1	0.04	36.58	34.92	21.83	31.11	3	6	528	15	4	5	130	13
180	29-Jun		W 1	0.11	33.08	32.17	21.83	29.03	11	20	528	39	11	15	130	27
182	01-Jul	I	W 1	0.12	30.08	30.92	22.42	27.81	36	36	372	70	30	24	102	42
189	08-Jul		W 1	0.05	30.00	30.58	21.83	27.47	37	43	528	82	31	27	130	48
191	10-Jul	I	W 1	0.21	27.08	28.92	21.25	25.75	130	97	757	197	94	54	165	95
203	22-Jul	I	W 1	0.13	25.75	28.67	22.33	25.58	242	110	391	215	163	60	106	102
205	24-Jul		W 1	0.14	40.50	28.67	20.83	30.00	1	110	986	25	1	60	197	19

Table D.3 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
217	05-Aug	W	1	0.04	40.92	28.67	20.25	29.94	1	110	1438	25	1	60	255	19
219	07-Aug	W	1	0.22	36.92	26.83	20.83	26.86	3	101	986	42	3	56	197	28
224	12-Aug i	W	1	0.05	32.08	28.58	20.75	27.14	16	115	1040	97	15	62	205	54
243	31-Aug I	W	1	0.19	33.67	27.25	20.67	27.19	9	231	1097	94	9	111	212	53
173	22-Jun	M	2	0.05	22.50	29.17	22.67	24.78	2912	108	33	177	707	49	93	143
175	24-Jun	M	2	0.15	22.33	28.17	21.25	23.92	3214	181	55	269	767	74	165	209
177	26-Jun	M	2	0.12	22.08	28.00	19.67	23.25	3734	198	101	375	867	80	331	282
180	29-Jun I	M	2	0.30	21.08	27.00	18.17	22.08	6916	339	189	690	1437	124	674	488
182	01-Jul	M	2	0.08	35.25	28.50	18.83	27.53	7	152	142	51	5	65	488	47
187	06-Jul	M	2	0.05	29.58	28.58	18.67	25.61	76	146	152	120	36	62	528	101
189	08-Jul	M	2	0.13	28.42	28.25	18.33	25.00	130	173	176	159	56	72	621	130
191	10-Jul	M	2	0.24	26.08	27.58	18.17	23.94	408	247	189	285	141	98	674	206
198	17-Jul I	M	2	0.42	23.17	26.42	17.50	22.36	1974	468	253	595	515	162	942	427
203	22-Jul	M	2	0.00	29.17	26.92	17.25	24.44	92	355	283	208	42	129	1072	166
205	24-Jul I	M	2	0.25	26.25	26.17	16.83	23.08	374	539	343	409	132	182	1335	305
217	05-Aug I	M	2	0.29	26.50	26.17	16.67	23.11	330	539	371	403	119	182	1460	301
219	07-Aug	M	2	0.26	35.67	26.50	16.83	26.33	6	447	343	86	5	156	1335	75
243	31-Aug I	M	2	0.21	33.00	26.17	16.50	25.22	18	539	401	143	11	182	1597	119
173	22-Jun	D	3	0.08	19.00	30.33	21.67	23.67	4093	25	293	294	4467	30	139	234
175	24-Jun	D	3	0.25	18.42	28.67	20.75	22.61	5724	52	471	498	6275	60	205	379
177	26-Jun	D	3	0.20	18.75	28.08	20.17	22.33	4720	67	645	574	5161	77	264	433
180	29-Jun	D	3	0.35	27.83	27.92	18.92	24.89	68	73	1301	164	70	83	469	137
182	01-Jul	D	3	0.28	17.08	27.33	19.08	21.17	12840	95	1182	1066	14236	107	433	785
187	06-Jul	D	3	0.25	17.33	27.08	18.58	21.00	10983	107	1562	1168	12151	120	550	833
189	08-Jul I	D	3	0.44	17.00	26.67	18.50	20.72	13533	131	1862	1362	15015	145	573	959
191	10-Jul	D	3	0.05	36.67	35.67	20.17	30.83	3	3	645	14	3	4	264	14
198	17-Jul	D	3	0.24	29.42	32.25	20.25	27.31	37	11	616	56	36	14	255	51
203	22-Jul	D	3	0.19	24.33	30.33	19.42	24.69	286	25	977	180	301	30	371	149
205	24-Jul I	D	3	0.52	23.25	29.92	20.00	24.39	467	30	706	208	495	36	285	170
217	05-Aug	D	3	0.24	30.67	33.42	24.83	29.64	24	7	66	22	24	9	41	21
219	07-Aug I	D	3	0.44	27.67	32.50	23.75	27.97	72	10	107	43	74	13	61	39
243	31-Aug	D	3	0.27	33.33	33.50	20.67	29.17	10	7	493	26	10	9	212	25
251	08-Sep I	D	3	0.40	22.33	28.33	19.58	23.42	720	60	890	332	767	69	344	261
173	22-Jun	F	4	0.04	26.42	25.17	18.92	23.50	97	954	297	334	123	292	469	252
175	24-Jun	F	4	0.14	26.42	24.42	18.25	23.03	97	1275	443	413	123	422	647	312
177	26-Jun	F	4	0.15	25.67	24.58	18.00	22.75	135	1105	516	470	168	389	732	355
180	29-Jun	F	4	0.29	24.83	24.00	17.58	22.14	195	1504	670	627	241	520	903	475
182	01-Jul I	F	4	0.26	24.25	24.00	17.25	21.83	255	1504	829	726	313	520	1072	550
187	06-Jul	F	4	0.05	36.25	26.67	17.17	26.69	3	548	875	87	4	145	1120	65
191	10-Jul	F	4	0.04	33.25	25.75	17.08	25.36	7	766	924	149	10	221	1170	112
205	24-Jul I	F	4	0.19	30.00	25.75	18.17	24.64	23	766	466	202	31	221	674	152
217	05-Aug	F	4	0.10	32.50	25.75	16.67	24.97	10	766	1217	175	13	221	1460	132
219	07-Aug	F	4	0.29	31.00	25.17	17.00	24.39	18	934	978	225	22	292	1222	170
224	12-Aug i	F	4	0.08	39.17	25.50	16.00	26.89	1	841	1918	80	2	249	2105	80
173	22-Jun	M	5	0.11	19.25	24.67	25.00	22.97	7152	540	189	784	3874	373	38	321
175	24-Jun	M	5	0.21	20.08	25.17	23.92	23.06	4362	434	298	753	2441	292	57	308
177	26-Jun	M	5	0.18	18.92	22.75	20.92	20.86	8768	1304	1196	2261	4686	998	190	893
180	29-Jun I	M	5	0.41	17.83	21.92	20.33	20.03	17445	1959	1603	3540	8913	1567	245	1378
182	01-Jul	M	5	0.12	38.25	31.33	22.25	30.61	2	40	630	33	2	20	109	15
187	06-Jul	M	5	0.07	29.00	27.83	21.17	26.00	60	145	1057	201	44	86	171	86
189	08-Jul	M	5	0.07	27.00	26.67	20.83	24.83	138	231	1246	333	97	145	197	140
191	10-Jul	M	5	0.16	23.25	25.33	20.67	23.08	791	404	1354	743	495	270	212	305
198	17-Jul I	M	5	0.21	18.50	22.42	20.17	20.36	11369	1532	1745	2953	5974	1191	264	1156
205	24-Jul I	M	5	0.25	24.17	22.92	19.25	22.11	504	1204	2826	1193	325	911	401	481
217	05-Aug I	M	5	0.22	23.25	23.08	19.00	21.78	791	1113	3236	1409	495	835	451	566
219	07-Aug	M	5	0.21	36.83	23.67	19.08	26.53	4	848	3092	161	3	616	433	69
243	31-Aug I	M	5	0.20	31.58	24.17	19.33	25.03	22	675	2702	305	18	478	386	129
173	22-Jun	W	6	0.14	21.33	24.25	23.42	23.00	894	630	23	262	1264	459	69	316
175	24-Jun I	W	6	0.11	21.33	23.75	22.17	22.42	894	814	42	348	1264	591	113	416
177	26-Jun	W	6	0.04	36.50	32.08	23.17	30.58	4	20	26	11	4	15	76	15
180	29-Jun	W	6	0.01	33.25	29.33	23.17	28.58	11	61	26	23	10	45	76	31
182	01-Jul I	W	6	0.10	30.50	27.92	22.58	27.00	26	112	34	44	26	83	96	58
187	06-Jul	W	6	0.09	33.08	28.83	22.00	27.97	12	75	46	30	11	56	121	39
191	10-Jul I	W	6	0.09	26.83	25.83	20.50	24.39	92	289	100	137	104	213	228	170
203	22-Jul I	W	6	0.15	23.33	22.92	18.00	21.42	368	1263	424	578	476	911	732	676
205	24-Jul	W	6	0.16	37.50	25.17	17.67	26.78	3	399	521	48	3	292	866	63
217	05-Aug	W	6	0.08	38.83	24.25	16.92	26.67	2	630	843	51	2	459	1277	66
219	07-Aug	W	6	0.15	35.17	25.58	17.25	26.00	6	326	879	67	5	239	1072	86
224	12-Aug i	W	6	0.16	31.33	24.25	17.17	24.25	20	630	716	146	19	459	1120	180
243	31-Aug I	W	6	0.26	31.00	21.75	16.42	23.06	22	2401	1175	255	22	1719	1671	308

Table D.3 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
173	22-Jun	F	7	0.01	23.75	25.92	32.75	27.47	616	44	11	43	392	205	3	48
175	24-Jun	F	7	0.12	22.75	25.67	32.00	26.81	984	48	13	52	627	230	4	62
177	26-Jun	F	7	0.11	22.58	24.75	30.83	26.06	1040	67	18	66	679	358	6	84
180	29-Jun	F	7	0.12	21.75	24.50	28.25	24.83	1538	73	26	98	1024	405	13	140
182	01-Jul	I F	7	0.20	21.33	24.00	25.92	23.75	1880	88	42	140	1264	520	28	225
187	06-Jul	F	7	0.06	36.33	28.08	24.92	29.78	7	21	53	22	4	77	40	20
191	10-Jul	F	7	0.00	31.92	27.42	24.25	27.86	29	26	61	38	16	103	51	41
205	24-Jul	I F	7	0.17	25.92	25.17	20.83	23.97	249	57	146	130	152	292	197	204
217	05-Aug	F	7	0.05	27.58	24.58	19.17	23.78	130	71	235	139	77	389	417	222
219	07-Aug	F	7	0.18	25.25	24.00	19.00	22.75	326	88	248	199	201	520	451	355
224	12-Aug	i F	7	0.10	39.75	23.75	18.17	27.22	3	97	320	46	1	591	674	53
173	22-Jun	D	8	0.04	22.50	26.50	28.33	25.78	707	58	59	124	707	156	13	94
175	24-Jun	D	8	0.14	22.17	25.67	27.08	24.97	822	81	86	168	832	230	19	132
177	26-Jun	D	8	0.18	22.08	25.25	26.08	24.47	854	97	118	203	867	281	26	164
180	29-Jun	D	8	0.28	21.42	24.83	22.83	23.03	1162	115	354	363	1211	344	87	312
182	01-Jul	D	8	0.09	20.50	24.42	21.25	22.06	1806	137	641	548	1951	422	165	494
187	06-Jul	D	8	0.23	20.25	23.17	19.08	20.83	2043	239	1561	943	2231	799	433	906
189	08-Jul	I D	8	0.39	19.42	23.33	18.50	20.42	3120	221	2017	1144	3526	732	573	1123
198	17-Jul	D	8	0.07	27.33	24.58	18.42	23.44	100	128	2094	306	85	389	596	258
203	22-Jul	D	8	0.10	22.50	23.92	18.33	21.58	707	171	2174	673	707	543	621	622
205	24-Jul	I D	8	0.42	21.33	22.08	16.92	20.11	1209	395	4229	1321	1264	1429	1277	1319
217	05-Aug	D	8	0.13	25.08	22.58	16.83	21.50	237	312	4405	699	216	1089	1335	648
219	07-Aug	I D	8	0.40	23.17	21.83	16.83	20.61	527	445	4405	1045	515	1641	1335	1016
243	31-Aug	D	8	0.24	30.42	21.25	16.00	22.56	34	591	6704	442	26	2280	2105	389
251	08-Sep	I D	8	0.51	23.42	20.67	15.58	19.89	473	792	8340	1466	458	3196	2666	1484
175	24-Jun	I W	9	0.10	18.17	23.42	23.08	21.56	5072	987	68	506	7283	701	79	631
177	26-Jun	W	9	0.03	35.08	34.08	23.50	30.89	4	8	60	14	6	7	67	14
180	29-Jun	W	9	0.08	31.17	29.92	22.75	27.94	15	43	76	38	20	36	90	40
182	01-Jul	I W	9	0.13	28.25	27.67	21.75	25.89	44	118	104	81	59	93	134	90
187	06-Jul	W	9	0.04	30.50	28.67	20.42	26.53	19	75	164	64	26	60	237	69
189	08-Jul	W	9	0.06	27.17	27.08	20.33	24.86	67	155	169	122	91	120	245	138
191	10-Jul	I W	9	0.08	23.25	24.50	19.17	22.31	357	555	257	360	495	405	417	438
203	22-Jul	I W	9	0.14	19.42	22.75	17.83	20.00	2479	1427	431	1066	3526	996	796	1399
205	24-Jul	W	9	0.16	35.67	22.17	17.00	24.94	4	1987	607	118	5	1365	1222	133
217	05-Aug	W	9	0.06	37.42	21.42	15.92	24.92	2	3082	972	119	3	2073	2206	135
219	07-Aug	W	9	0.14	33.00	22.17	15.75	23.64	8	1987	1048	202	11	1365	2424	236
224	12-Aug	i W	9	0.20	26.00	21.67	14.33	20.67	107	2658	2056	769	146	1801	5643	987
243	31-Aug	I W	9	0.23	29.33	20.50	15.33	21.72	29	5383	1269	468	39	3527	3082	581
175	24-Jun	F	10	0.11	18.58	23.33	24.08	22.00	1274	140	73	200	5688	732	54	508
177	26-Jun	F	10	0.12	18.42	23.17	22.83	21.47	1397	152	109	253	6275	799	87	657
180	29-Jun	F	10	0.16	26.08	22.42	20.83	23.11	40	224	217	125	141	1191	197	301
182	01-Jul	I F	10	0.11	17.17	21.92	19.75	19.61	2858	292	325	604	13501	1567	319	1724
187	06-Jul	F	10	0.00	33.08	30.58	19.25	27.64	4	6	395	22	11	27	401	45
191	10-Jul	F	10	0.03	27.00	26.83	18.92	24.25	28	27	450	78	97	134	469	180
205	24-Jul	I F	10	0.24	21.75	24.00	19.17	21.64	256	100	408	235	1024	520	417	605
217	05-Aug	F	10	0.10	25.17	25.50	18.92	23.19	58	49	450	120	209	249	469	289
219	07-Aug	F	10	0.17	22.50	24.08	18.50	21.69	182	96	533	229	707	499	573	589
224	12-Aug	i F	10	0.06	39.83	26.58	18.50	28.31	1	30	533	18	1	150	573	35
173	22-Jun	D	11	0.05	16.67	24.75	22.33	21.25	14916	224	226	779	18633	358	106	734
175	24-Jun	D	11	0.06	16.50	24.25	21.42	20.72	16666	282	345	1025	20790	459	154	959
177	26-Jun	D	11	0.15	16.17	24.00	20.33	20.17	20876	317	583	1378	25970	520	245	1281
180	29-Jun	D	11	0.19	15.75	23.17	18.33	19.08	27849	472	1663	2513	34520	799	621	2304
182	01-Jul	D	11	0.19	15.75	22.83	18.17	18.25	27849	555	5936	4085	34520	953	1918	3704
187	06-Jul	D	11	0.32	14.83	22.67	13.67	17.06	53978	603	32478	8535	66363	1041	8649	7608
189	08-Jul	I D	11	0.44	14.83	21.83	13.25	16.64	53978	920	44425	11172	66363	1641	11416	9897
191	10-Jul	D	11	0.00	33.33	23.25	13.42	23.33	7	453	39148	282	10	765	10206	272
198	17-Jul	D	11	0.15	24.00	23.00	13.08	20.03	267	512	50495	1485	350	872	12788	1378
203	22-Jul	D	11	0.13	17.42	21.17	12.50	17.03	9177	1304	80102	8688	11532	2391	19249	7741
205	24-Jul	I D	11	0.49	16.33	20.67	11.83	16.28	18642	1707	139463	14186	23223	3196	31465	12499
217	05-Aug	D	11	0.22	22.08	23.25	11.92	19.08	668	453	129905	2513	867	765	29546	2304
219	07-Aug	I D	11	0.36	19.67	22.17	11.92	17.92	2401	775	129905	4993	3067	1365	29546	4506
243	31-Aug	D	11	0.27	26.58	20.50	11.92	19.67	86	1870	129905	1811	115	3527	29546	1673
251	08-Sep	I D	11	0.37	18.75	19.75	11.33	16.61	4066	2846	215846	11377	5161	5545	46337	10075
173	22-Jun	M	12	0.02	18.58	25.08	23.75	22.47	3469	727	6	176	5688	304	61	405
175	24-Jun	M	12	0.12	18.25	24.67	22.75	21.89	4114	938	8	231	6929	373	90	536
177	26-Jun	M	12	0.18	18.25	23.83	21.25	21.11	4114	1586	12	334	6929	566	165	787
180	29-Jun	I M	12	0.24	17.67	23.33	18.00	19.67	5588	2192	38	690	9873	732	732	1673
182	01-Jul	M	12	0.08	34.75	28.00	17.08	26.61	10	135	54	31	6	80	1170	67
187	06-Jul	M	12	0.17	26.92	24.92	15.75	22.53	106	804	94	172	100	330	2424	395

Table D.3 (continued)

Day	Date	Irr Tmt	Plot #	CWSI	Vol. Moisture Content (%) 15cm	46cm	76cm	avg	Plot specific mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg	Field avg mrel curves Soil Water Potential (kPa) 15cm	46cm	76cm	avg
189	08-Jul	M	12	0.13	24.50	24.00	15.75	21.42	256	1426	94	289	280	520	2424	676
191	10-Jul	M	12	0.10	22.17	23.33	14.67	20.06	659	2192	152	585	832	732	4592	1358
198	17-Jul	I M	12	0.33	18.08	20.58	13.58	17.42	4486	14877	256	2392	7658	3357	9136	6089
205	24-Jul	I M	12	0.26	23.75	21.00	13.42	19.39	344	10955	278	798	392	2632	10206	1946
217	05-Aug	I M	12	0.19	22.67	21.17	12.92	18.92	534	9710	359	1027	653	2391	14346	2529
219	07-Aug	M	12	0.11	34.67	21.17	13.25	23.03	10	9710	302	137	6	2391	11416	312
243	31-Aug	I M	12	0.22	26.50	21.50	13.33	21.11	62	7648	290	334	54	1878	10792	787

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