IRROMETER®

Management — IRROMETER instruments and WATERMARK sensors measure soil moisture status in centibars (cb) or kilopascals (kPa) of soil water tension. This value represents the energy a plant's root system uses to draw water from the soil. The key element in proper soil moisture measurement is the operator. Taking the time to interpret your sensor readings will give you a vivid picture of what is happening with the soil moisture in the root system of your crop. Usually 2-3 readings between irrigations are sufficient. Charting your readings will show exactly how quickly (or slowly) your soil moisture is being depleted. Automatic data collection equipment, such as the WATERMARK Monitor, can also provide a graphical display of the data.

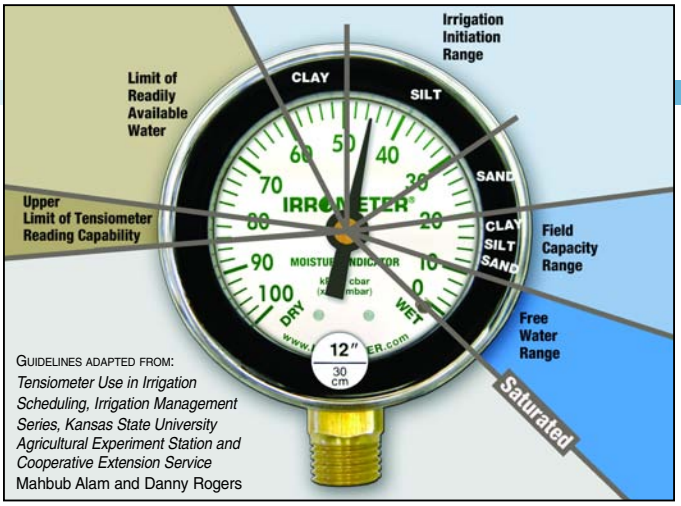
Use the following readings as a general guideline:

- 0-10 cb (kPa) = Saturated soil
- 10-30 cb (kPa) = Soil is adequately wet (except coarse sands, which are beginning to lose water)
- 30-60 cb (kPa) = Usual range for irrigation (most soils)
- 60-100 cb (kPa)* = Usual range for irrigation in heavy clay
- 100-200 cb (kPa)* = Soil is becoming dangerously dry for maximum production. Proceed with caution!

**IRROMETER instrument limitation is approximately 85 cb (kPa), WATERMARK sensors read up to 200 cb (kPa).*

Your own situation may be unique because of differences in crops, soils and climate.

Perhaps the most important soil moisture reading is the difference between today's reading and that of 3-5 days ago. That is to say, how quickly is the reading going up? A slow increase means the soil is drying out slowly. But a big jump means the soil is losing water very rapidly. A faster rate or increase means the crop is beginning to work harder to extract water from the soil and may start to stress. By analyzing such trends in the readings, you will determine **WHEN** to irrigate. Displaying the readings on a graph makes it easier to see the trends, thereby making interpretation simpler.

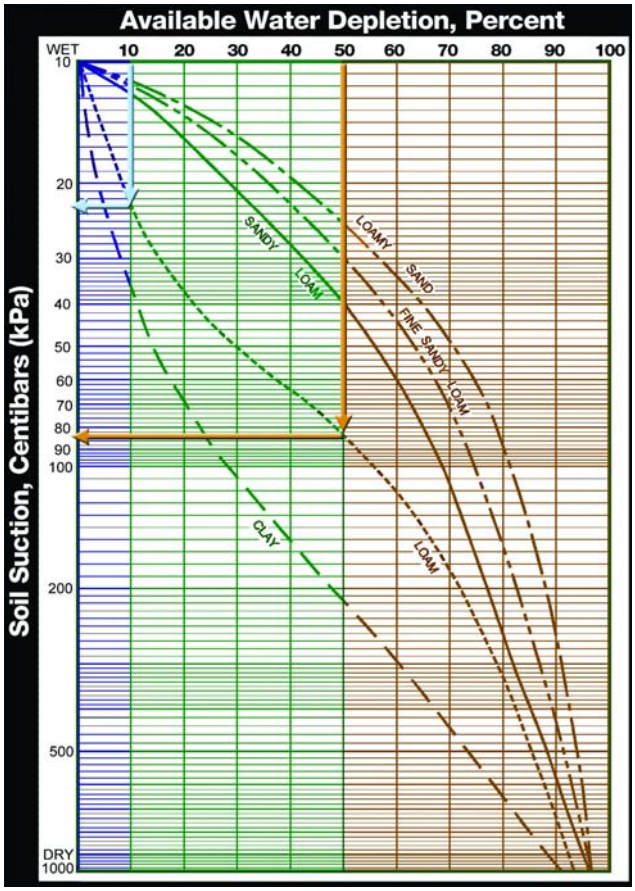


GUIDELINES ADAPTED FROM:
Tensiometer Use in Irrigation Scheduling, Irrigation Management Series, Kansas State University Agricultural Experiment Station and Cooperative Extension Service
Mahbub Alam and Danny Rogers

By using sensors at two or more depths in the root system, you can determine **HOW MUCH** water to apply. If the shallow sensor shows a rapidly increasing reading, but the deep sensor shows adequate moisture, you can run a short irrigation cycle as you only need to replenish the shallow root profile. If the deep sensor also shows a dry condition, then a longer irrigation cycle is needed to fully re-wet the entire root zone. The readings you take after an irrigation or rainfall event will show you exactly how effective that water application was.

Your own experience and management will soon point you in the proper direction. You will be practicing "irrigation to need" with the positive results that come from any good management program.

WATERMARK



Moisture Thresholds — This graph is provided to ***assist you in creating*** reference points for your own site and application. These identify the "boundaries" within which you want to manage moisture availability for your crop. How wet and how dry the soil should be depends on soil type, crop, the plant's stage of development and cultural practices for managing the field. The chart is offered as a reference guide to assist you in selecting appropriate threshold levels. There is no substitute for experience and agronomic knowledge to provide the best recommendations. Please consult a crop consultant, farm adviser, NRCS agent or extension agent for more specific advice on proper soil moisture management. A list of crop consultants that specialize in irrigation management can be found on our website at:

http://www.IRROMETER.com/consults.html

– First, select the soil type(s) that most closely resembles that in your field.

– Then, draw a vertical line from 10% available water depletion (represented by the blue/green boundary) down to the curve for your soil type and then horizontally over to the left axis labeled soil suction to obtain the reference WET value. This will determine the lower (wetter) threshold value.

– Use this centibar / kPa value as the wet threshold. For example, for a loam soil, this value would be 23 (as indicated by the blue arrow).

– Next, draw a vertical line from 50% available water depletion (represented by the green/brown boundary) down to the curve for your soil type and then horizontally over to the left axis labeled soil suction to obtain the reference DRY value. This will determine the higher (drier) threshold value.

– Use this centibar / kPa value as the dry threshold. For example, for a loam soil, this value would be 84 (as indicated by the brown arrow).

GRAPH ADAPTED FROM:
Agronomy No. 11, figure 30-2
Irrigation of Agricultural Lands
American Society of Agronomy
R.M. Hagan, H.R. Haise, T.W. Edminster, editors.

IRROMETER®

WATERMARK

Suggested placement depths for IRROMETER and WATERMARK SENSORS

The following are suggested placement depths for various crops based on deep, well drained soils. In lighter or shallow soils, place instrument accordingly or set them at an angle. With drip or trickle irrigation 12" and 24" depths are recommended, with an added 36" instrument for deeply rooted crops.

CROP	SHALLOW INSTRUMENT (INCHES)	DEEP INSTRUMENT (INCHES)	FOR EXTRA DEPTH, SET AT (INCHES)
ALFALFA	18-24	36-48	60-70
ALMONDS	24	48	72
APPLES	20	40	60
APRICOTS	24	48	72
ARTICHOKES	18	36	
ASPARAGUS	18-24	36-48	
AVOCADOS	12	24	36
BANANAS	12	24	
BARLEY	18	36	
BEANS (bush)	10		18
BEANS (Lima)	18	36	
BEANS (Pole)	18	36	
BEETS (sugar)	18	36	
BEETS (table)	12-18	24-36	
BLUEBERRIES	12	24	
BROCCOLI	12	20	
CABBAGE	12	20	
CANAIGRE	18	36	48
CANTALOUPE	18	36	
CARNATIONS	4-6		
CARROTS	12	24	
CAULIFLOWER	12	24	
CELERY	10	20	
CHARD	12	24	
CHERRIES	24	48	
CHRISTMAS TREE	12	24	
CITRUS: Orange, Lemon, Grapefruit	18	36	
COFFEE	18-24	36-48	
CORN (sweet)	12	30	
CORN (field)	18	36	
COTTON	18	36	48
CRANBERRIES	18	36	
CUCUMBERS	18	36	
DATE PALM	24	48	60
EGGPLANT	12	24	
FIGS	18	36	
GARLIC	12	24	
GRAIN and FLAX	18	36	
GRAPES	24	48	60
HOPS	24	48	60
JOJOBA	18	36	
KIWI	18	36	48
LADINO CLOVER	10	20	
LETTUCE	12		
MACADAMIAS	12	24	36
MAIZE	18	36	

CROP	SHALLOW INSTRUMENT (INCHES)	DEEP INSTRUMENT (INCHES)	FOR EXTRA DEPTH, SET AT (INCHES)
MELONS	18	36	
MILO	24	48	
MINT	12	24	
MONTEREY PINES, FIRS	12	24	
MUMS	4-6		
MUSTARD	18	36	
NECTARINES	18	36	
OATS	18	36	
OKRA	18	36	
OLIVES	24	48	60
ONIONS	12		
PAPAYA	12	24	
PARSNIPS	18	36	
PEACHES	18	36	60
PEANUTS	12	24	
PEARS	18	36	48
PEAS	18	36	
PECANS	18	36	48
PEPPERS	15	30	
PERMANENT PASTURES	8-15		24-30
PERSIMMONS	18	36	
PINEAPPLE	15	30	
PISTACHIO NUTS	24	48	60
POMEGRANATES	18	36	
POTATOES (Irish)	8-10	18	
POTATOES (sweet)	18	36	
PLUMS	24	48	72
PRUNES	24	48	72
PUMPKIN	18	36	48
RADISHES	12		
RASPBERRIES	18	36	
SORGHUM	18	36	
SOY BEANS	18	36	60
SPINACH	12	24	
SQUASH (Summer)	15	30	
STRAWBERRIES	6	12	
SUDAN GRASS	18-24	36-48	
SUGAR CANE	18	36	
SUNFLOWERS	24	48	60
TEA	12	24	
TOBACCO	8-15	30	
TOMATOES	18	36	
TURNIPS	18	36	
WALNUTS	24	48	72
WATERMELON	18	36	48
WHEAT, HAY	18	36	

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THE IRROMETER COMPANY, INC.

1425 Palmyrita Ave., Riverside, CA 92507

(951) 682-9505 PHONE

(951) 682-9501 FAX

www.IRROMETER.com

sales@IRROMETER.com

Irrigation ASSOCIATION™

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