i-Linc Technologies, Inc.

Soil Moisture Meter Information

HOW DOES A MOISTURE SENSOR WORK?

Measuring soil moisture for growing purposes is typically done in one of two ways:

- Volumetric measurement, the percentage of water in a given amount of soil.
- Tensiometric measurement, the physical force actually holding water in the soil, measured in Centibars (or kPa) of soil water tension.

Our soil moisture measurement is based on the tensiometric method, because of the fact that the amount of water is not as important as how difficult it is for the plant to extract it from the soil.

Soil water tension (or matric potential) has to be overcome for the plant to move water in to its root system. Different soil types will have different tensions even at the same volumetric measurement, making volumetric information relative to local conditions and often requiring site calibration for reading equipment. Because we use soil water tension, there is no site calibration required when using our sensors.

THE MOISTURE SENSOR

The moisture sensor is a calibrated, indirect method of measuring soil water tension. These "Granular Matrix Sensors" electronically read the amount of moisture absorbed through a special "granular matrix", or mix of precisely composed materials. This special mix buffers the sensor against the effects of different salinities and ensures a much longer life than traditional "gypsum blocks". The readings are calibrated to reflect the same values that would be generated by a tensiometer. These sensors are maintenance free and can be left in the ground permanently, with an expected life of 5+ years. Our moisture sensors require very little power to read and integrate perfectly with electronic systems for data logging or telemetry.

UNDERSTANDING SENSOR DATA

Management - 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. A graphical display of your readings shows exactly how quickly (or slowly) your soil moisture is being depleted.

Use the following readings as a general guideline:

- **0-10 Centibars** = Saturated soil
- **10-30 Centibars** = Soil is adequately wet *(except coarse sands, which are beginning to lose water)*

- **30-60 Centibars** = Usual range for irrigation (most soils)
- **60-100 Centibars** = Usual range for irrigation in heavy clay
- **100-200 Centibars** = Soil is becoming dangerously dry for maximum production. Proceed with caution!

Perhaps the most important soil moisture reading is the difference between today's reading and that of 3 to 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. By analyzing such trends in the readings, you will determine WHEN to irrigate. A graph of readings over time makes it easier to see the trends, thereby making interpretation simpler. Your own situation may be unique because of differences in crop, soils and climate.

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 achieve the positive results that come from any good management program.

Thresholds – Thresholds are reference lines that you specify 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 plants stage of development and cultural practices for managing the field. The following chart is offered as a reference guide to assist you in selecting appropriate threshold levels.

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 line.

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 line.

For example, for a loam soil, this value would be 84 (as indicated by the brown arrow). 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 in your area.

Suggested placement depths for Sensors - 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	
BEANS (sugar)	18	36	
BEANS (table)	12-18	24-36	
BLUEBERRIES	12	24	
BROCCOLI	12	20	
CABBAGE	12	20	
CANAIGRE	18	36	48
CANTALOUPE	18	36	
CARNATIONS	12	(placed 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	12	(placed 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
WATERMALON	18	36	48
WHEAT-HAY	18	36	