

Irrigation Pointers for Raised Beds in High Tunnels



Raised Beds

- Warm quicker
- Better Drained



Why Manage Irrigation?

- Maximize return on investment
 - High tunnel structure
 - Transplants/seed
 - Irrigation equipment
- Minimize crop loss
 - Biotic disease
 - Abiotic disease
- Improve crop quality
 - Firmness
 - Flavor

Types of Irrigation

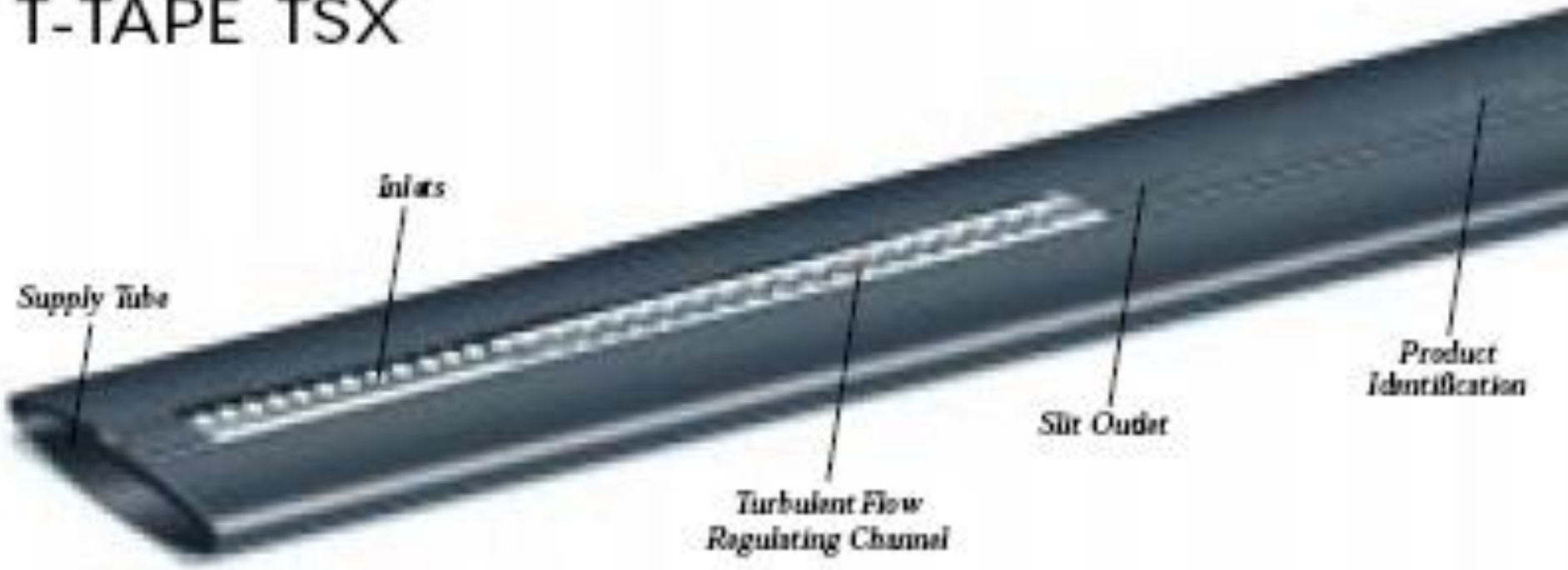
- Overhead
- Surface
- Micro-Irrigation
- Subsurface

Micro-Irrigation

- Point Source
 - Micro-Sprinklers etc.
- Line Source
 - T-Tape etc.



T-TAPE TSX



T-TAPE PRODUCT IDENTIFICATION



Outlet Spacing

4, 6, 8, 12, 16, 18 & 24 inch spacing available for most T-TAPE TSX wall thicknesses.

Contact your T-TAPE dealer for a complete product listing.

Flow Rates

Various flow rates available to meet specific application needs.

Common Flow Rates

| | | |
|------|-------|--------------|
| .170 | | .gpm/100 Ft. |
| .220 | | .gpm/100 Ft. |
| .280 | | .gpm/100 Ft. |
| .340 | | .gpm/100 Ft. |
| .450 | | .gpm/100 Ft. |
| .670 | | .gpm/100 Ft. |

Role of water in plants

- Cell processes
- Cooling
- Carry nutrients
- Turgor pressure
- Photosynthesis

Advantages of Drip

- Improved crop yield and quality
- Better management of applied crop protection materials
- Crop protection savings due to reduced run-off
- Fertilizer can be delivered directly to the plant's root zone
- Water savings
- Less evaporation
- Uniform watering
- Energy savings
- Decreased disease and weed pressure

Disadvantages

- High management requirement. A delay in operation decision may result in irreversible damage to crop.
- May be easily damaged by rodents, insects and workers.



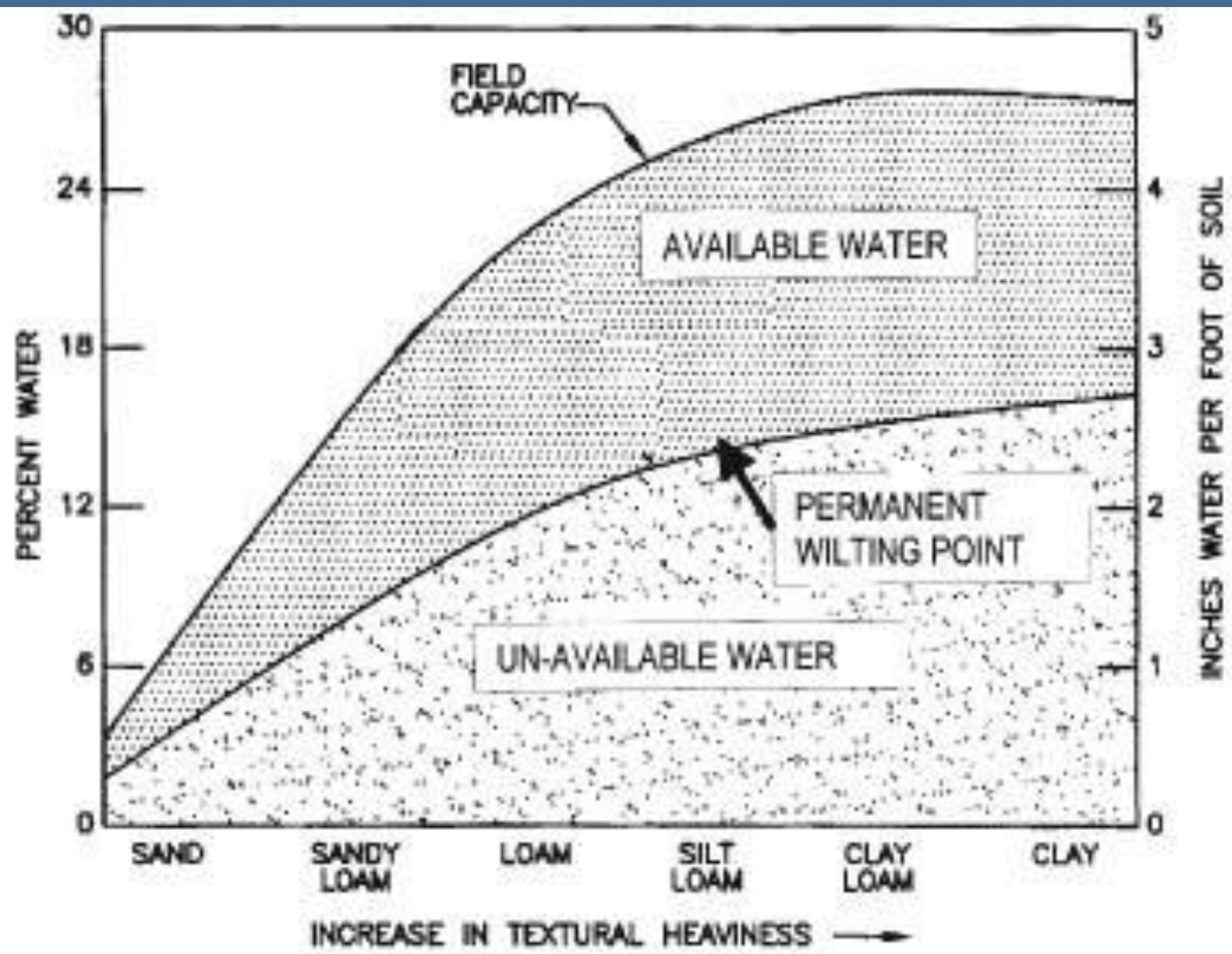
Saturation



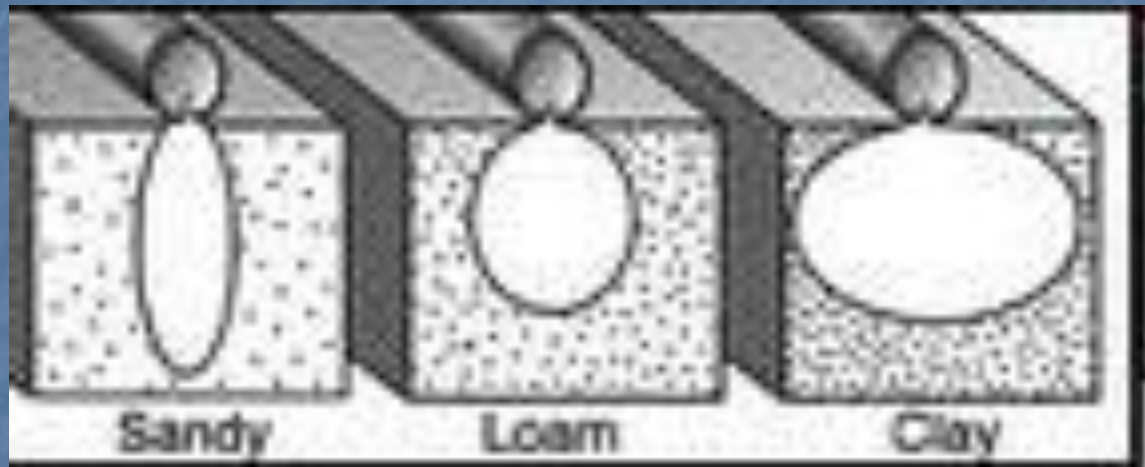
Field Capacity



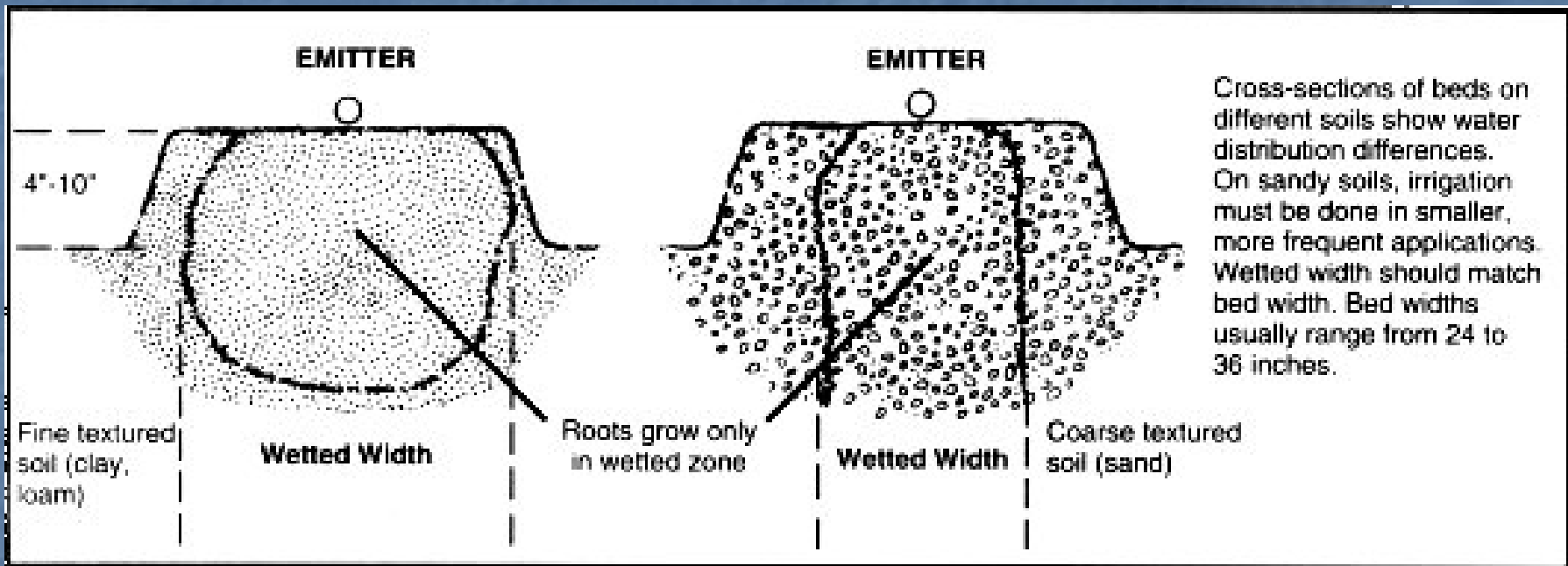
Wilting Point



Soil type wetting patterns

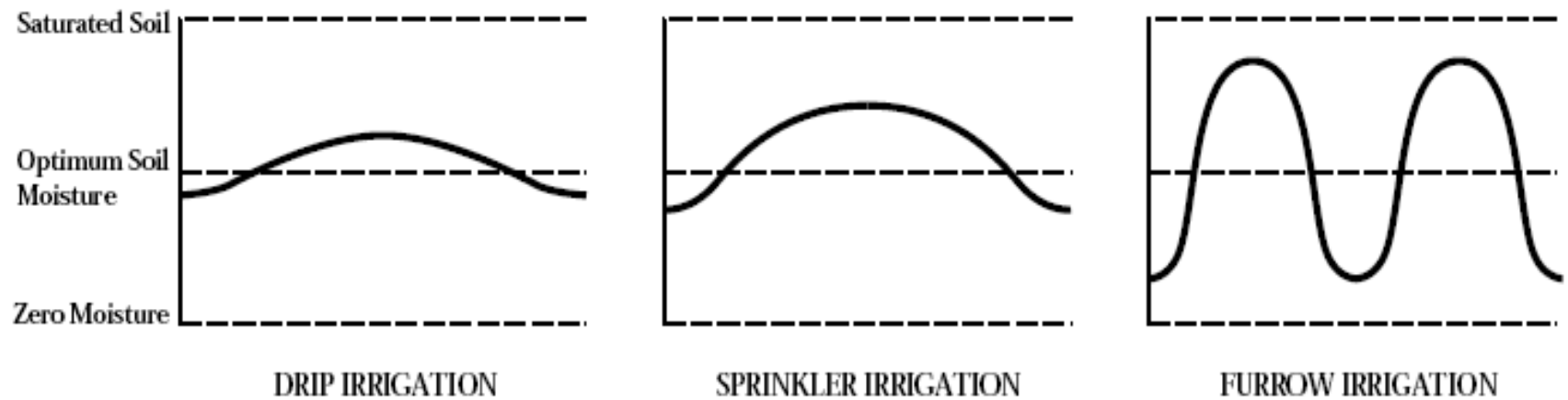






Monitor soil moisture

FIGURE 1: RELATIVE MOISTURE VARIATION



Factors that influence soil moisture

- Sun
- Wind
- Rain
- Temp
- Relative humidity
- Crop removal

Soil Moisture Techniques

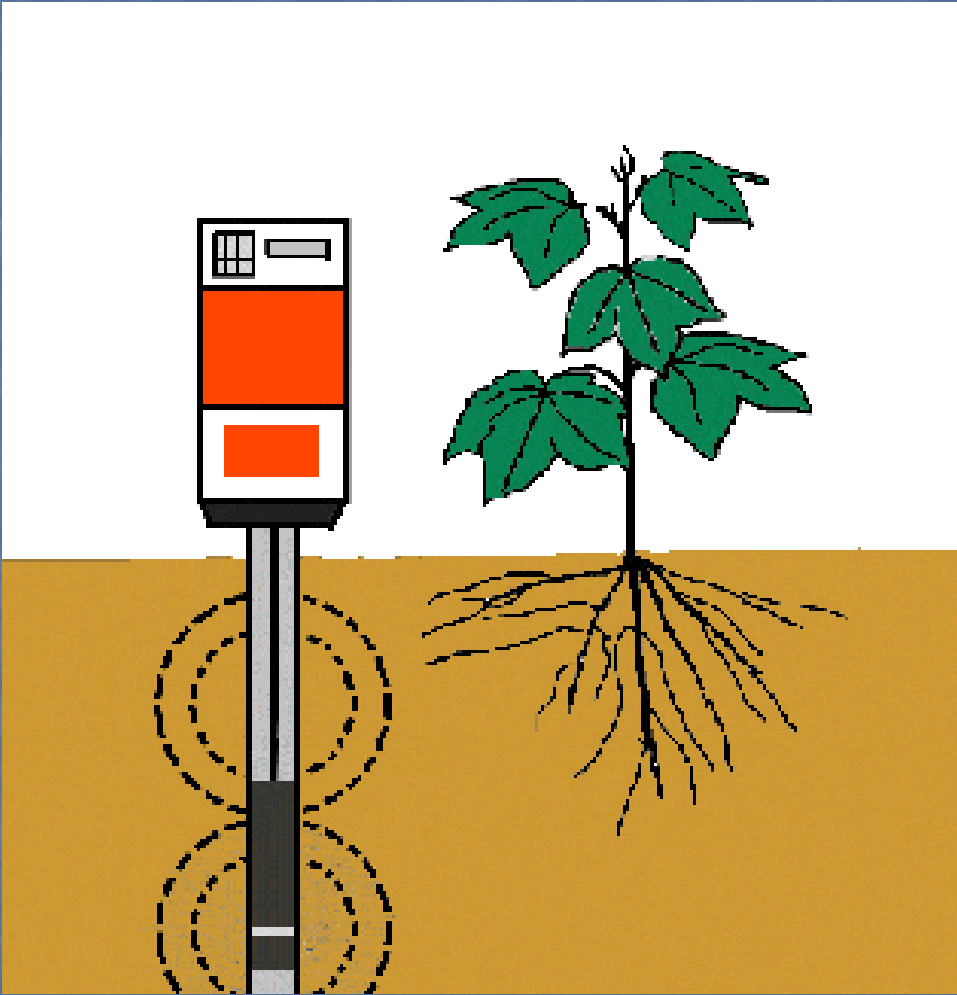
- The "Feel Method"
- Neutron Probe
- Electrical Resistance
- Soil Tension
- New Technology
- Plant Indicators
- Computerized Irrigation Scheduling

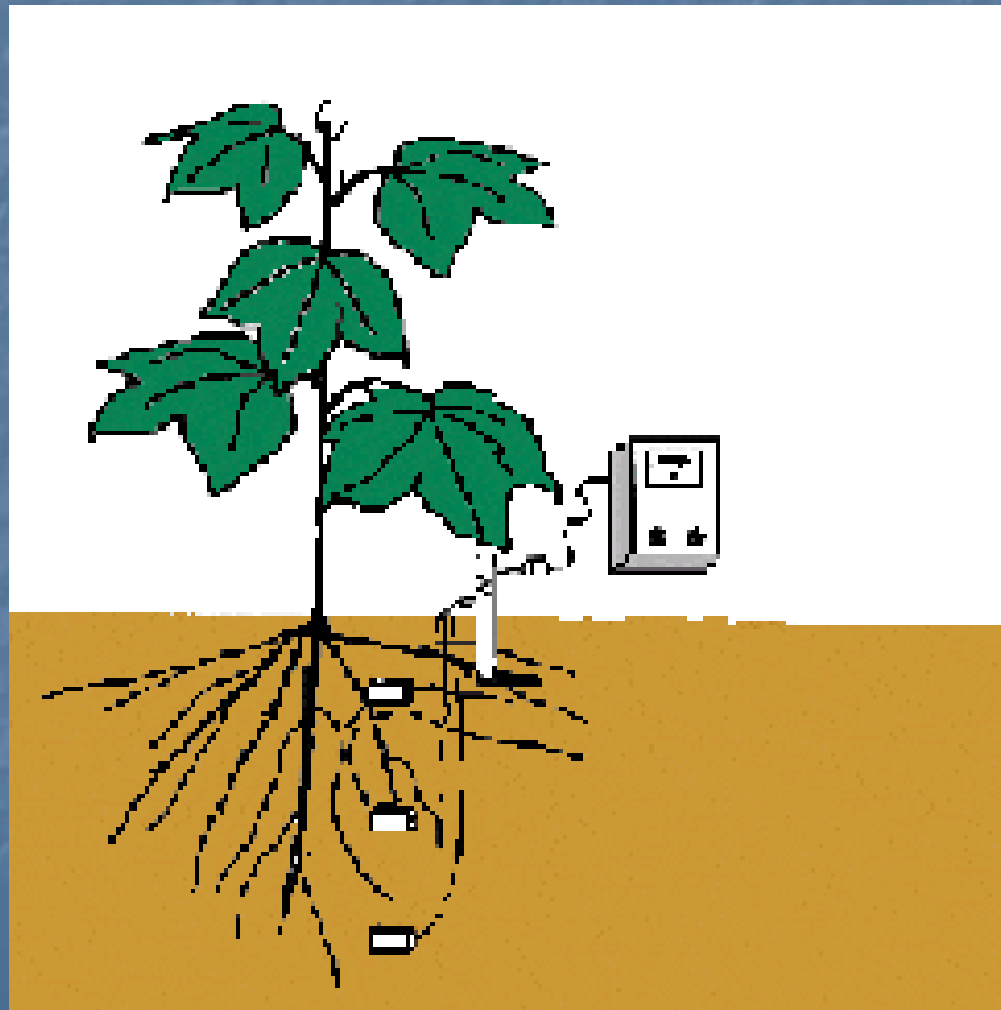
Feel



Table 3. Guide for Judging Soil Water Deficit Based on Soil Feel and Appearance for Several Soil Textures

| Soil Texture Classification | | | | |
|-----------------------------|--|--|--|--|
| Moisture deficiency in./ft. | Coarse (loamy sand) | Sandy (sandy loam) | Medium (loam) | Fine (clay loam) |
| | (field capacity) | (field capacity) | (field capacity) | (field capacity) |
| 0.0 | Leaves wet outline on hand when squeezed. | Appears very dark, leaves wet outline on hand, makes a short ribbon. | Appears very dark, leaves wet outline on hand, will ribbon out about one inch. | Appears very dark, leaves slight moisture on hand when squeezed, Will ribbon out about two inches. |
| 0.2 | Appears moist, makes a weak ball. | Quite dark color, makes a hard ball. | Dark color, forms a plastic ball, slicks when rubbed. | Dark color will feel slick and ribbons easily. |
| 0.4 | Appears slightly moist, sticks together slightly | Fairly dark color, makes a good ball. | Quite dark, forms a hard ball. | Quite dark, will make thick ribbon, may slick when rubbed. |
| 0.6 | Dry, loose, flows through fingers. | Slightly dark color makes a weak ball | Fairly dark, forms a good ball. | Fairly dark, makes a good ball. |
| 0.8 | (wilting point) | Lightly colored by moisture, will not ball. | Slightly dark, forms weak ball. | Will ball, small clods will flatten out rather than crumble. |
| 1.0 | | Very slight color due to moisture. | Lightly colored, small clods crumble fairly easily. | Slightly dark, clods crumble. |
| 1.2 | | (wilting point) | Slight color due to moisture, small clods are hard | Some darkness due to unavailable moisture, clods are hard, cracked. |
| 1.4 | | | (wilting point) | (wilting point) |
| 1.6 | | | | |
| 1.8 | | | | |
| 2.0 | | | | |







HERMETICALLY SEALED GAUGE

Accuracy and long gauge life are insured by a hermetically sealed neoprene cover with a molded-in diaphragm which keeps out dirt and moisture and compensates for variations in temperature and barometric pressure.
(Pat. 2773388)
(Pat. 3394594)

AIR-FREE GAUGE

The water seal prevents air from entering gauge, as gauge and chamber remain full regardless of water level in instrument.

THE IRROMETER BODY

is constructed of tough durable plastic impervious to attack by soil chemicals or electrolysis.

The IRROMETER is available in standard lengths of 6, 12, 18, 24, 36, 48 & 60 inches.

CLOSURE

Large cap for easy operation and better control. Cap removed when filling reservoir. Submerged valve gives a positive leakproof seal. Servicing is instantaneous—a twist of the wrist.

RESERVOIR

Holds a reserve supply of fluid sufficient for several irrigation cycles under average operating conditions. Unscrewing cap part way releases air and fills tube. (This is to replace fluid lost by action of drying soil.)
(Pat. 2878671)

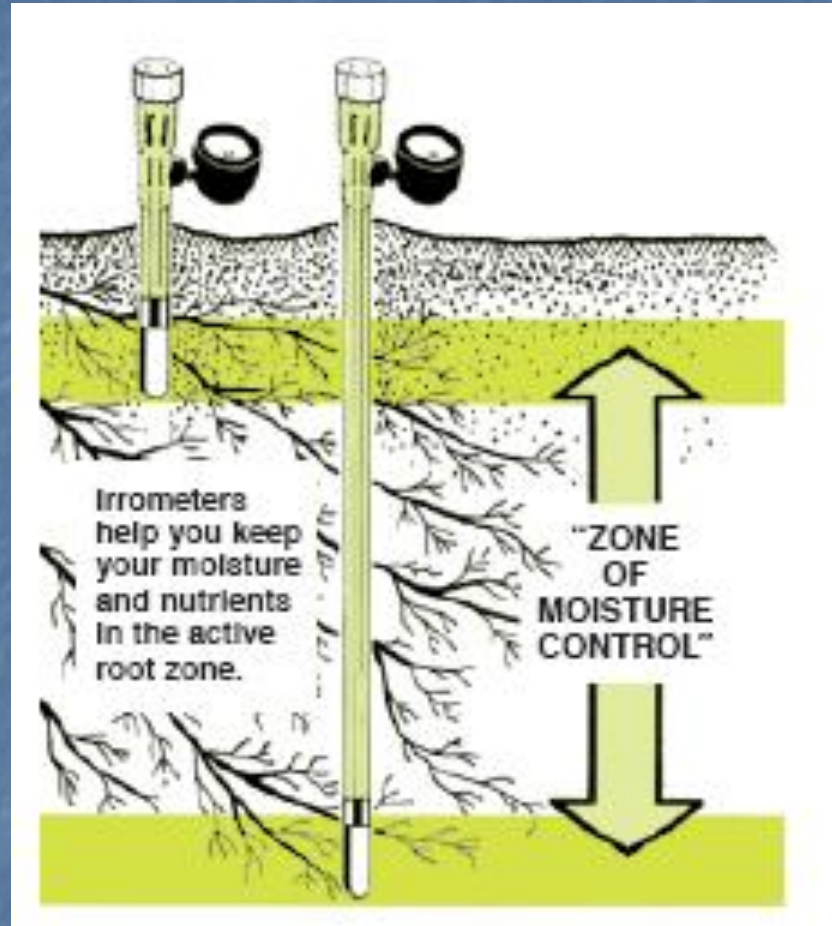
ALL SOLVENT WELDED JOINTS ARE PERMANENTLY LEAKPROOF

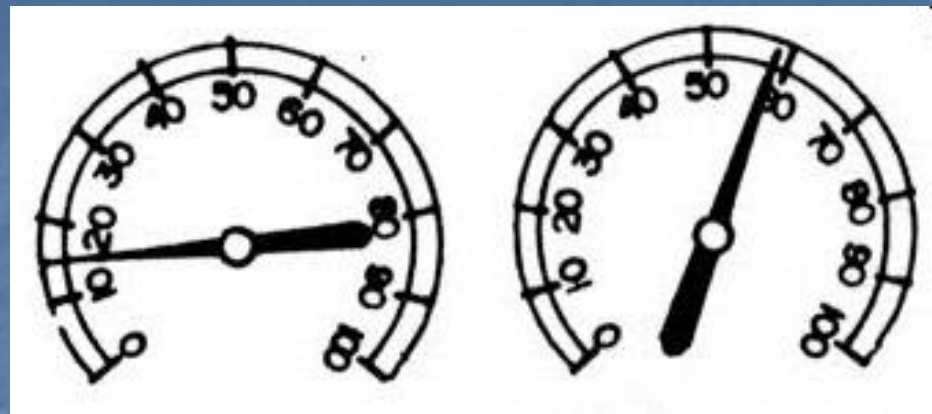
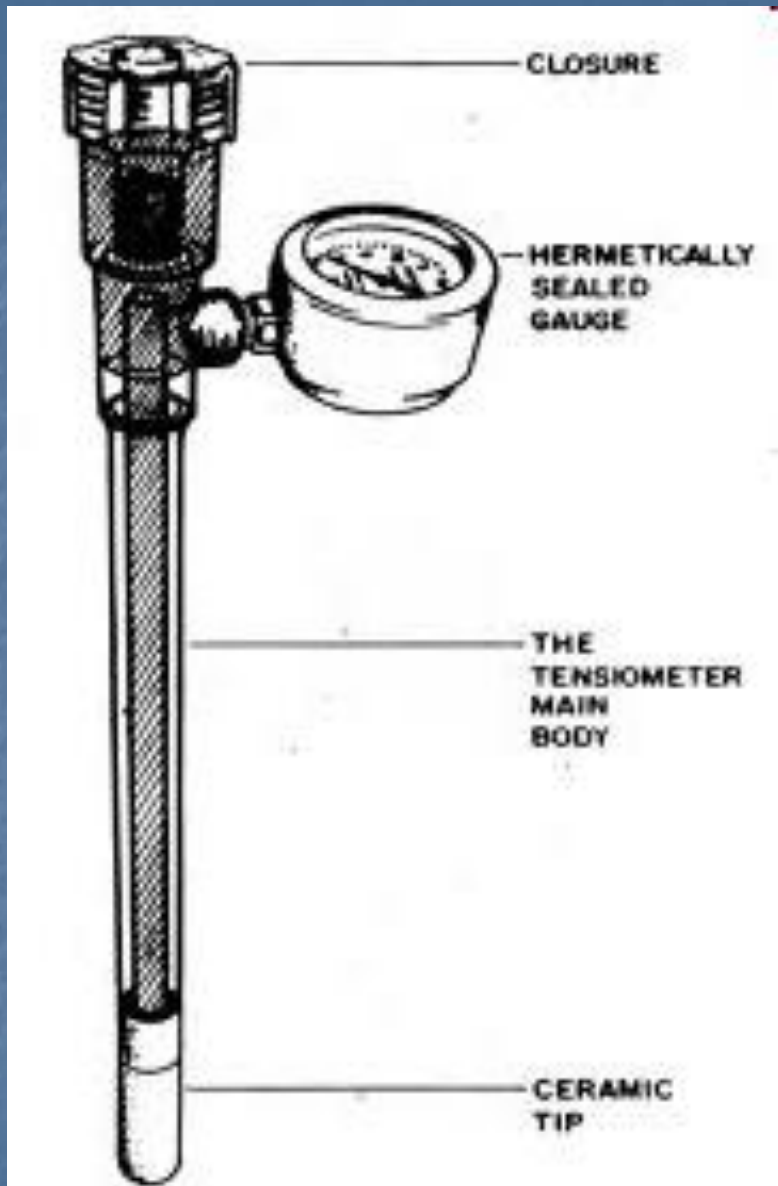
CERAMIC TIP

Has many times the strength of conventional tips. It is more porous to give quick response to variations in soil moisture.

MODEL "SR" (not pictured)

Threaded tip connection make tip replacement easy. Uses o-ring seal.





| 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 | 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 |
| Egg Plant | 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 |
| Watermelon | 18 | 36 | 48 |
| Wheat-Hay | 18 | 36 | |

Table 2. Soil Water Deficit Estimates for Different Soil Textures and Selected Tensions

| Soil Texture | Soil Tension in Centibars | | | | | | |
|--------------|--|-----|-----|-----|-----|-----|-------|
| | 10 | 30 | 50 | 70 | 100 | 200 | 1500* |
| | Soil Water Deficit - Inches Per Foot of Soil | | | | | | |
| Coarse sands | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.6 | 0.7 |
| Fine sands | 0 | 0.3 | 0.4 | 0.6 | 0.7 | 0.9 | 1.1 |
| Loamy sands | 0 | 0.4 | 0.5 | 0.8 | 0.9 | 1.1 | 1.4 |
| Sandy loam | 0 | 0.5 | 0.7 | 0.9 | 1.0 | 1.3 | 1.7 |
| Loam | 0 | 0.2 | 0.5 | 0.8 | 1.0 | 1.6 | 2.4 |

*1500 cbs refers to the permanent wilting point and the soil deficit value is equal to the soil's total available water capacity







04/09/2004



Water quality

- pH
- Hardness
- Iron
- Suspended materials

Success

- Determine number of lines per bed and spacing and flow rate
- Zone as appropriate
- Fertigate in timely fashion with correct materials
- Know your water quality
- Automation?????
- Mechanical monitoring of soil moisture levels