A rechargeable, porous, permeable limestone aquifer.
- Primary source of water for over 1.7 M people of San Antonio-Austin corridor.
- Major use from agriculture and light industry.

**Water Discharge from the Edwards Aquifer in 2001**

- Springs: 63%
- Domestic & Livestock: 20%
- Municipal & Military: 17%
- Industrial: 3%
- Irrigation: 2%

**Irrigation System Design**

- Crop
  - Area
- Soil
  - Type
  - Water holding capacity
  - Depth
- Water Requirements
  - Daily vs. seasonal
- Water Supply
  - Location
  - Pumping capacity
  - Elevation
  - Quality
  - Water rights
- Energy Source
Irrigation Systems

- Drip
- LEPA - Bubble
- Furrow
- LEPA with drag sock and furrow dikes
- High pressure with drops

Irrigation Efficiencies

- Surface: 50-80%
- Sprinklers: 55-75%
- Center Pivot: 55-75%
- LEPA:
  - Bubble mode: 95-98%
  - Spray mode: 80-85%
- Drip: 80-95%
Precision Sub-Surface Drip Irrigation System

Water requirement - Frequency irrigation
- Available soil moisture
- Soil type (sandy vs. clay)
- Rate of water use
  - Plant age
  - Rooting depth (shallow vs. deep-rooted)
  - Crop canopy
- Climate
  - Rainfall
  - Temperature
  - Humidity
  - Radiation
  - Wind

PET Network – When and How Much
Provides regional data to guide irrigation decision making
Definitions

- **Crop Evapotranspiration (ETc)**
  The amount of water used by a crop in a specific time period by a particular crop, consisting of water evaporation from the soil and water transpiring from the plant.

  \[ \text{ETc} = \text{ETo} \times \text{Kc} \]

  \[ \text{ETo} = \text{reference evapotranspiration} \]
  \[ \text{Kc} = \text{crop coefficient} \]

Irrigation Requirement (IR)

\[ \text{IR} = (\text{ETc} \times \text{Kc}) - \text{ER} \]

\[ \text{ETc} = \text{ETo} \times \text{Kc} \]

- ETo = reference evapotranspiration
- Kc = crop coefficient (watermelon with mulch)
  - Planting-vesting: 0.2-0.4
  - Vining-fruit set: 0.5-0.6
  - Fruit set to harvest: 0.6-0.8
- ER = effective rainfall
  (-50% due to mulch)

Lysimeter experiments in spinach

- Fall - Winter
  2002-03 and 2003-04
- Variety: **DMC 16**
- Seasonal Water Use:
  5.4" – 2002/03
  6.0" – 2003/04
Crop Coefficients (Kc) for Spinach for South Texas

<table>
<thead>
<tr>
<th>Growth Stage</th>
<th>Crop Coefficient</th>
<th>FAO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2002</td>
<td>2003</td>
</tr>
<tr>
<td>Emergence</td>
<td>0.35</td>
<td>0.35</td>
</tr>
<tr>
<td>2 - 3 leaves</td>
<td>0.55</td>
<td>0.50</td>
</tr>
<tr>
<td>4 - 6 leaves</td>
<td>0.70</td>
<td>0.70</td>
</tr>
<tr>
<td>7 - 9 leaves</td>
<td>0.80</td>
<td>0.85</td>
</tr>
<tr>
<td>10 - 12 leaves</td>
<td>0.90</td>
<td>0.90</td>
</tr>
<tr>
<td>13 - 15 leaves</td>
<td>0.95</td>
<td>1.00</td>
</tr>
<tr>
<td>16 - 18 leaves</td>
<td>1.00</td>
<td>1.05</td>
</tr>
<tr>
<td>19 - harvest</td>
<td>1.05</td>
<td>1.05</td>
</tr>
</tbody>
</table>

Crop Coefficients (Kc) for Spinach for FAO

<table>
<thead>
<tr>
<th>Growth Stage</th>
<th>Crop Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>ini</td>
<td>0.70</td>
</tr>
<tr>
<td>mid</td>
<td>1.00</td>
</tr>
<tr>
<td>end</td>
<td>0.95</td>
</tr>
</tbody>
</table>

Water Demands of Vegetables

- Critical periods of development (Table 22)
  - Root, fruit, bulb, tuber
- Daily-seasonal water consumption (Tables 22-23)
- Peak water use (Table 25)
  - Cool humid to dry: 0.10-0.20 inches/day
  - Warm humid to dry: 0.15-0.25 inches/day
  - Hot humid to dry: 0.20-0.45 inches/day

Monitoring soil moisture

- Tensiometer
  - 15 and 30 cm depth
  - Tension: -25 cb (kPa)
  - Saturation: 0 cb
  - Field Capacity: 10 cb
  - Irrigation range: 20-25 cb
  - Dry: 30-50 cb
  - Top accuracy: 80 cb
(values depend on soil type)
Capacitance swipe-go™

- Up to 100 cm
- Soil water content (mm)

SDI – Summer/Fall 2002

Monitoring soil moisture

Water content for 100 % PET (FAO)

- 10 cm depth
- 20 cm depth
- 30 cm depth
- 40 cm depth

Time

Saturation Values

SDI – Summer/Fall 2002

Monitoring soil moisture

Water content for 100 % PET (FAO)

- 10 cm depth
- 20 cm depth
- 30 cm depth
- 40 cm depth

Time

Saturation Values
Minor control for salinity problems
- Frequent irrigation
- Selection of salt-tolerant crops
- Leaching
- Bed forming (peak beds)
- Seed placement

Major control for salinity problems
- Changing irrigation method
- Changing water supply
- Artificial drainage
Definitions

- **Irrigation efficiency**
  A measure of the amount of irrigation water beneficially used (to replenish soil moisture) divided by the amount of water applied.

- **Allowable soil water depletion**
  The maximum amount of water that can be depleted from the soil in a particular crop without reducing yield.

- **Deficit irrigation**
  The crop receives less water than the required for maximum ET. The yield will generally be limited by the lower water of the soil, depending on the crop tolerance to drought conditions.

Definitions

- **Available water capacity (AWC)**
  The percent volume of soil occupied by water that is available to the plant.

- **Permanent wilting point (PWP)**
  The percentage of volume of the soil occupied by water that is unavailable to the plant. The plant wilts and will not recover.

- **Moisture tension**
  The tension (negative pressure) under which water is held in soils. It is related to moisture content. High moisture content corresponds to low tension; low moisture content with high tension. Measured in bars, Pascals, or kPa (cbar).

Definitions

- **Leaching**
  Applying irrigation water in excess of the soil moisture depletion level to remove salts from the root zone.

- **Surface runoff**
  The amount of water flowing off the lower end of the field.