Limiting Factor for Crop Production

- Water
- Temperature
- Light
- Nutrition
- Markets
- Labor

Yield Profitability

Water

- Quantity
- Quality
  - salinity

Water quality

<table>
<thead>
<tr>
<th>Classes of Water</th>
<th>Concentration, total dissolved solids</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1, Excellent</td>
<td>Electrical conductivity umhos* 250</td>
<td>Sodium% 175</td>
</tr>
<tr>
<td>Class 2, Good</td>
<td>Gravimetric ppm 250-750 175-525</td>
<td>40-40</td>
</tr>
<tr>
<td>Class 3, Permissible</td>
<td>Electrical conductivity umhos* 750-2000</td>
<td>Sodium% 525-1400</td>
</tr>
<tr>
<td>Class 4, Doubtful</td>
<td>Gravimetric ppm 2000-3000 1400-2100</td>
<td>60-60</td>
</tr>
<tr>
<td>Class 5, Unsuitable</td>
<td>Electrical conductivity umhos* 3000+</td>
<td>Sodium% 2100+</td>
</tr>
</tbody>
</table>

Concentration

- Concentration, total dissolved solids
- Electrical conductivity umhos*
- Gravimetric ppm
- Sodium%
- Chlorides (Cl) meq/L
- Sulfates (SO4) meq/L

Classes of Water

- Class 1, Excellent
- Class 2, Good
- Class 3, Permissible
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Concentration
Site selection

- Topography
- Soil Type
- Water source & quality

Land preparation

- Deep plowing
- Disking
- Bedding
- Pre-plant fertilization
- Pre-plant irrigation
- Rolling cultivator
- Pre-emergence herbicide

'Warming'

East-west running beds
South slopes

Crop Establishment

- Direct Seeding
- Transplants
  - Bare-root
  - Containerized
- Vegetative propagation
Seed Vigor Definition (AOSA rev. 2002)

- Seed vigor comprises those seed properties which determine the potential for rapid, uniform emergence, and development of normal seedlings under a wide range of field conditions (AOSA 1980, McDonald 1980).

‘High vs. Low seed vigor lots’
High = seed with good performance
Low = seed with poor performance

Factors affecting seed vigor
- Genetic constitution
- Environment and nutrition of the mother plant
- Stage of maturity at harvest
- Seed size or weight
- Mechanical integrity
- Deterioration and aging
- Pathogens
Seed enhancement products

- Coated seeds
  - Layers of clay, sand, etc
  - Splitting materials (to moisture)
- Pelleted seeds
  - Fungicides, insecticides
- Primed seeds

Seed Priming

Primed seeds germinate faster and seedling emergence is synchronized.

Primed seeds germinate faster and seedling emergence is synchronized.

Liquid Priming

Liquid Priming

Spinach seed

Spinach seed
Containerized Transplants

**Advantages**
- Less seed cost
- Uniformity
- Stress tolerance
- Better weed control
- Lower inputs (e.g., irrigation)
- Increase # rotations
- Better land use (shorter cycles)
- Earliness (flowering)
- Higher yields
- Less production risk

**Disadvantages**
- Higher initial cost / plant
- Transplanting equipment
  - Small cell size
- Operational speed
- Personnel training

DS watermelons

TR + SDI watermelons
DS ‘Long Cayenne’ Pepper

TR ‘Jalapeno’ Pepper

‘Good’ Transplant Quality

- ‘Sticky’
- Well developed root system
- Increased stem diameter
- Uniform height (5-6 inches)
- Green or minimal chlorosis
- Presence of cotyledons
- Pest-free
- Acclimated to stress

‘Speedling’ polystyrene flats

Vacuum-formed inserts
(128, 200 and 242 cell trays)
Stages of transplant development

- Stage 1: From seeding to germination
- Stage 2: From germination to cotyledon expansion
- Stage 3: From expansion to true leaves
- Stage 4: From true leaves to hardening

Environmental and cultural factors at each developmental stage

<table>
<thead>
<tr>
<th>Factors</th>
<th>Stage 1</th>
<th>Stage 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Moisture</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Light</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Nutrition</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>
Moisture levels at each growth stage

Water availability

Time

1 2 3 4 Stages

(Skye & Koranski, 1997)

**Goal:** To increase plant compactness, to reduce transplant shock and increase field survival.

**Techniques**

- Reduction in watering (Thomas, 1993)
- Low temperatures (Heins et al. 1995)
- Mechanical stress (Latimer, 1991)
- Subirrigation (Leskovar, 1994)
- Reduction in fertilizer (Aloni et al., 1991)
- PNC (Dufault, 1996)
- DIF or pulse-DIF (Jensen, 1994)
- ABA (Leskovar, 1992)

**Transplant ‘Shock’**

Transpiration > Water uptake

- Wilted
- Chlorotic
- Burned
- Abscised
- Detopped

**Effects of Stress on Growth**

Stress

Growth

Establishment Vegetative Reproductive Maturity
Windbreaks

- Species
  - Rye, Wheat
  - Sorghum

- Distance
  - 5-7 x plant height
  - If 5 feet? No. beds?

Crop Training - Staking

Sep. 17, 60 DAT

- Drip Mulch

Furrow

Effect of plastic mulch color on aphids population and viruses incidence in watermelons