Chap 12. Plant Propagation

I. Three Methods of Plant Propagation

a. Sexual Propagation (Seed Propagation)
b. Asexual Propagation (Vegetative Propagation)
c. Micropropagation (Tissue Culture)

II. Sexual Propagation

1. Seed production

Mostly in Western States

- California, Oregon, Washington, Idaho
- Low humidity (less fungal, bacterial diseases)
- Mild temperature (good for flowering, seed set)
- Even distribution of rainfall throughout year
- Isolated from major production areas

Hybrid Seed Production

- Use of male sterility (US production)
- Hand pollination (Developing countries)

Labor Intensive Operation

- Pollination
- Harvesting, cleaning, and handling

A Commercial Flower Seed Company
Goldsmith Seed

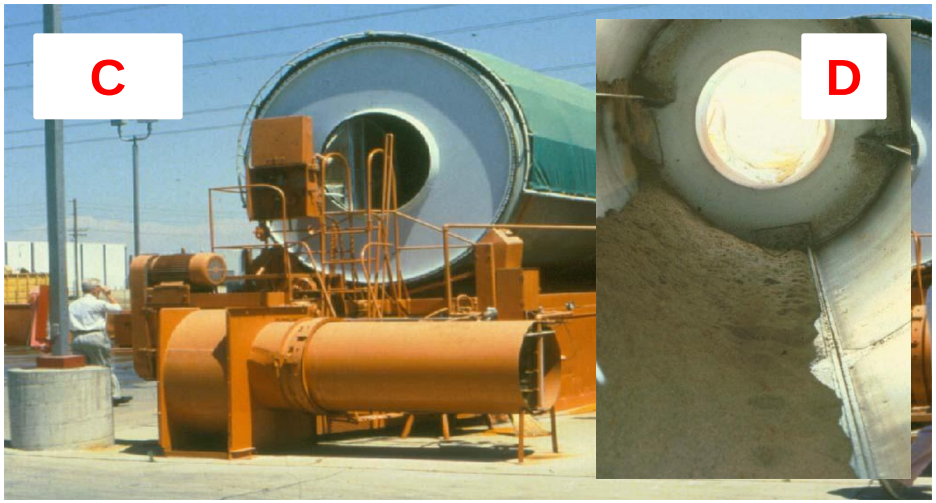
Flower Seed Production in Western States
Flower Seed Farms

Field Drying of Seeds

Vegetable Cultivar Development and Trials

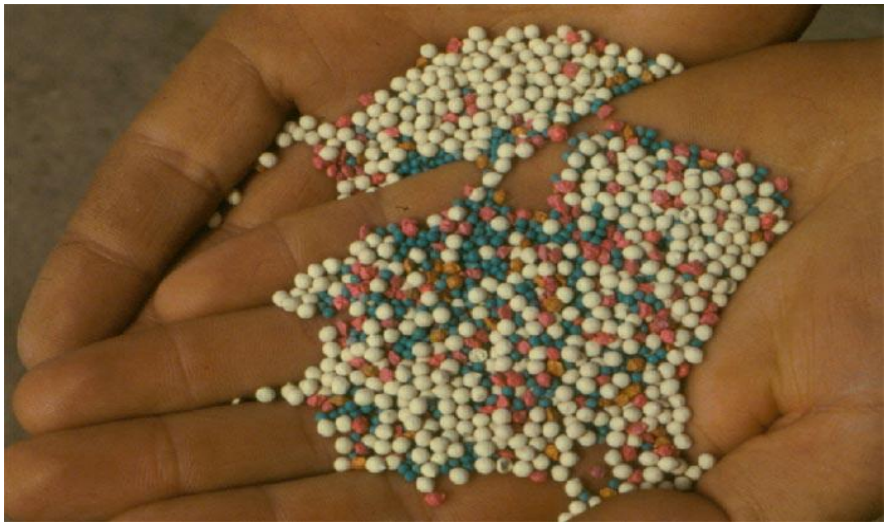
A – Field testing of vegetable breeding lines in Santa Paula, California
B – Yield trial of tomato cultivars in California

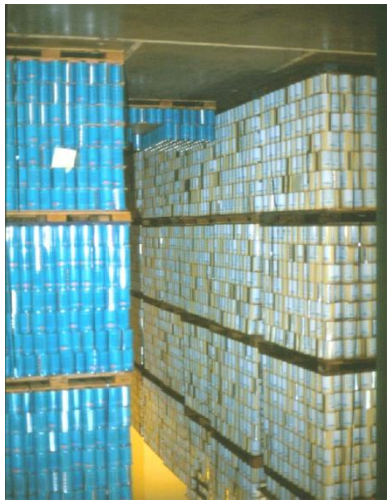
Extraction and Cleaning of Tomato Seeds



Fermented fruits are used to extract and clean seeds by gravity flow in water (A, B), cleaned seeds are dried by rotating grain drying drums (D)

Seed Grading, Packaging, Storage





2. Seed Storage

- **Optimum condition for seed storage**
  - Low temperature (0-32 ^{o}F)
  - Low humidity (less than 10% RH)
- **Practical storage conditions**
  - 32-50 ^{o}F, 50-65% RH
- **Seed longevity varies by species**
  - Most annual flowers last 1-2 years
  - Woody plants 5-20 years
  - Lotus seed known to last over 1000 years
  - Permanent storage at cryogenic temperature(-196 ^{o}C)

Lotus (*Nerumbo nucifera*)

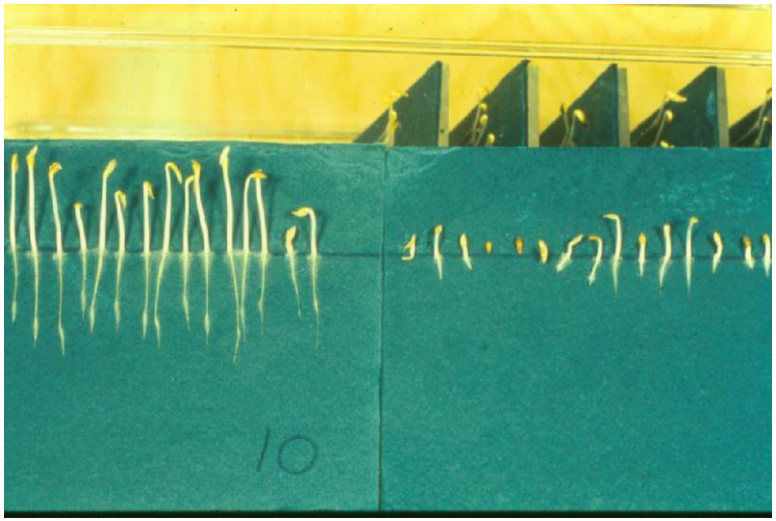
Seeds stuck in mud for over 1000 years germinated well

3. Seed Germination

- **Seed Germination Test**
  - **Seed viability**
  - **Determined by percent germination (100 seed lots)**
  - **Tetrazolium (TTC) test to find tissue viability**
- **Enhancement of % Germination**
  - **Seed quality and storage conditions**
  - **Seed priming to enhance germination vigor and uniformity**

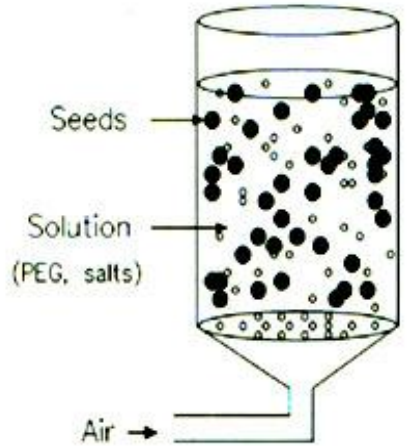
Seed Storage

National Germplasm Storage Lab, Fort Collins, CO

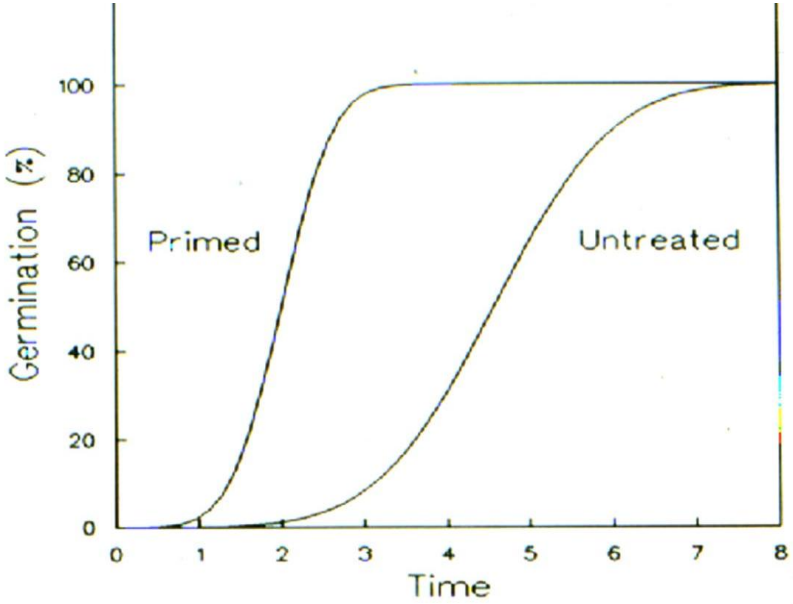


Seed Priming

- **A process of prehydrating and redrying seeds to enhance their subsequent germination performance**
- **Used for flower and vegetable seeds for uniform and vigorous germination**



Us e of osmotic solution



Germination of Primed Seeds

Irregularities in seed germination, poor quality seeds

Uniformity in the germination of primed seeds

Breaking Seed Dormancy

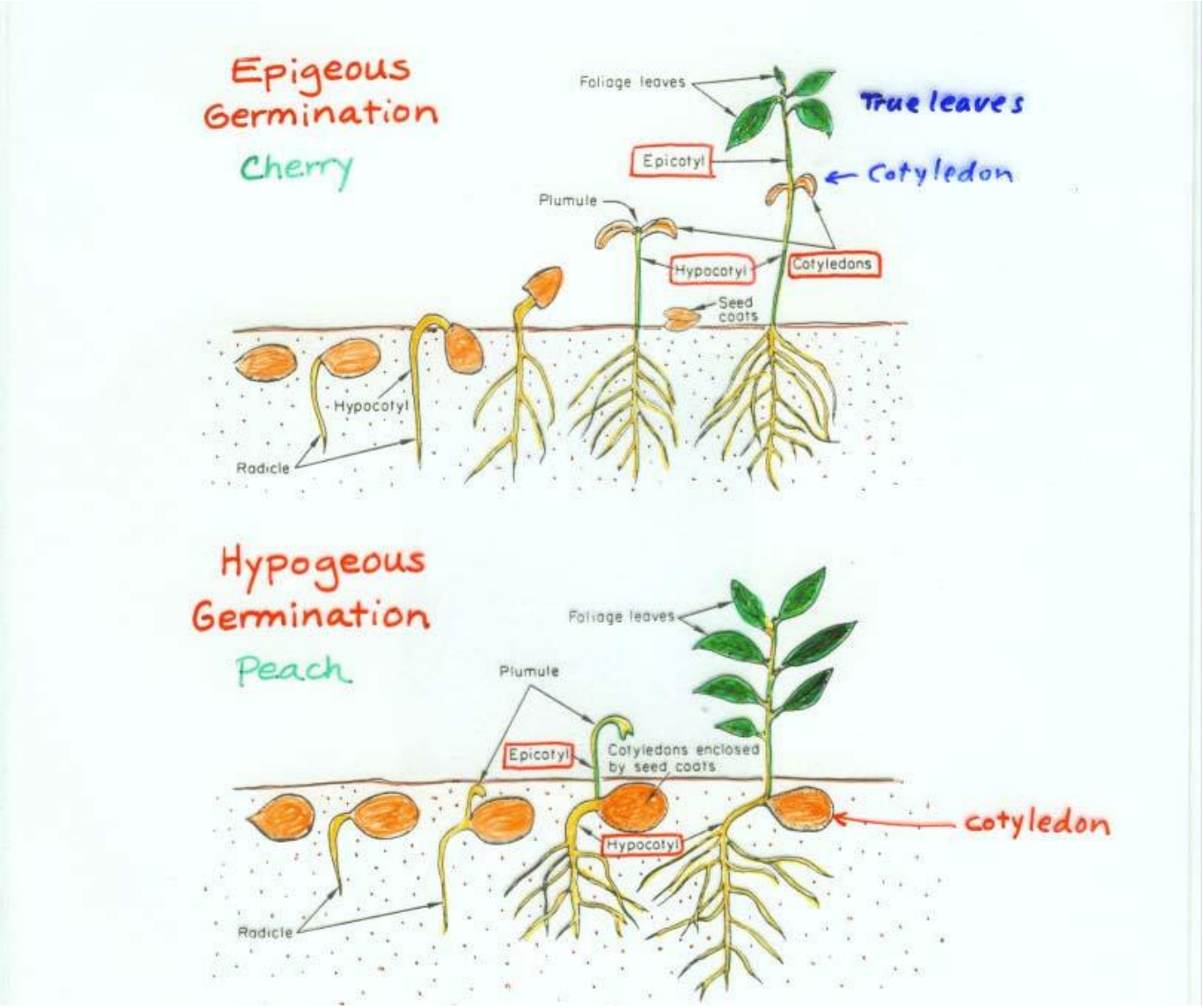
- **Scarification**
  - Overcomes physical seed dormancy
    (Seed coat is impermeable to water)
  - Three methods
    - Mechanical abrasion
    - Hot water (170-212 ºF)
    - Acid treatment (concentrated sulfuric acid)

    (Seed coat is impermeable to water)
- **Stratification**
  - Overcomes physiological seed dormancy
    - (Embryo dormancy, internal dormancy)
  - Moistened, cold storage
    - Storage at 32 ºF for 1-9 months)
  - Some species may require warm stratification
    - *Viburnum*, Redbud

Two Different Types of Germination

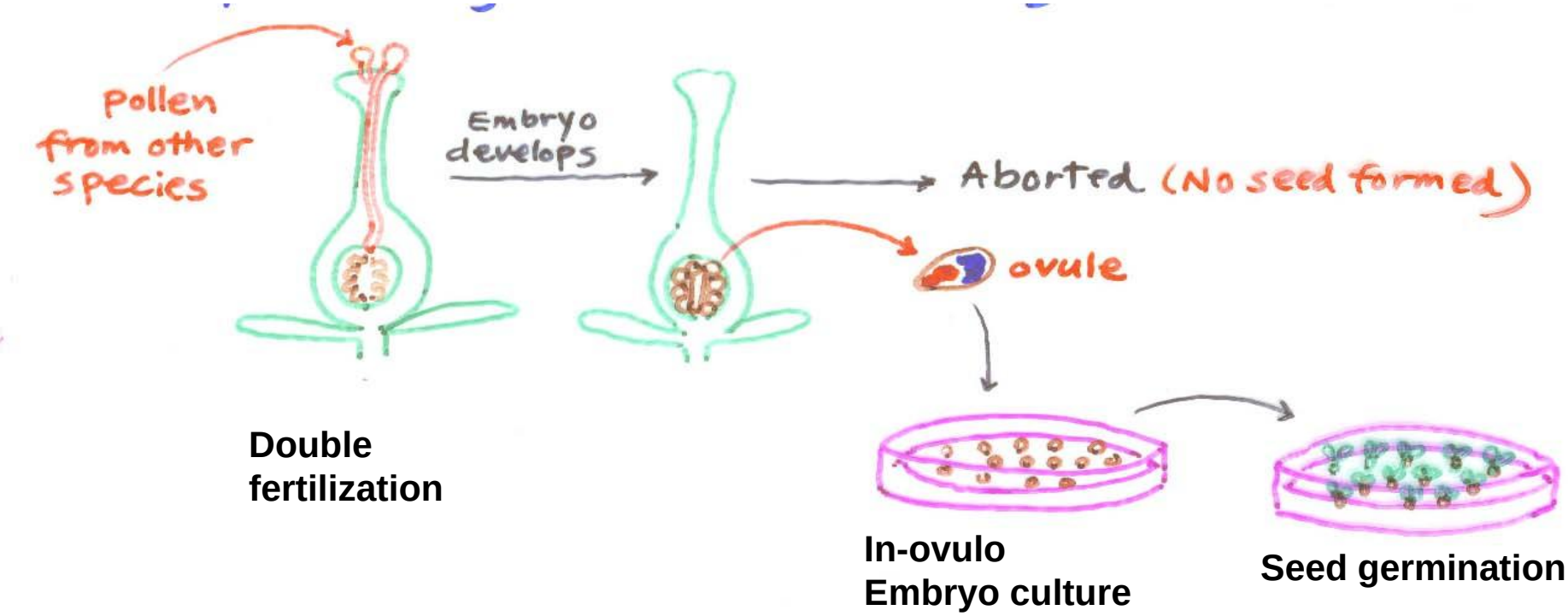
- **Epigeous Germination**
  - Cotyledons are exposed above ground
  - Epicotyl and hypocotyls are also visible
  - Cherry, soybean, radish
- **Hypogeous Germination**
  - Cotyledons are buried in the ground
  - Only epicotyl are visible
  - Peach, pea, apricot

Germination of Angiosperm Seeds



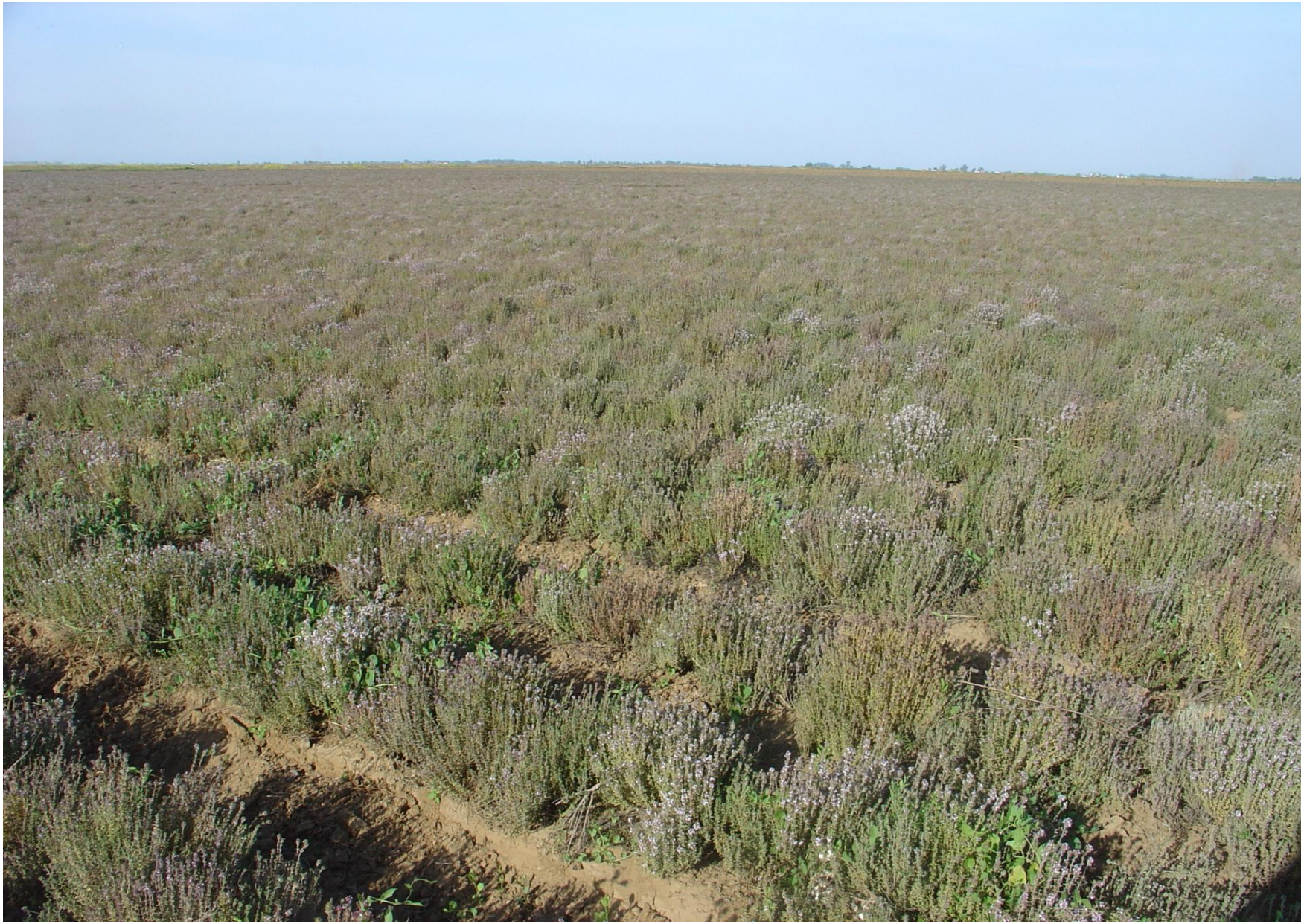
Embryo Culture

- **Immature zygotic embryos are excised and cultured in vitro to obtain viable seeds**
- **Used in abortive inter-specific crosses (i.e., potato)**
- **Used for embryos lacking endosperm (i.e., orchids)**



Production of Vegetable Seeds, Maxwell, California

Onion Seed Production, Maxwell, CA

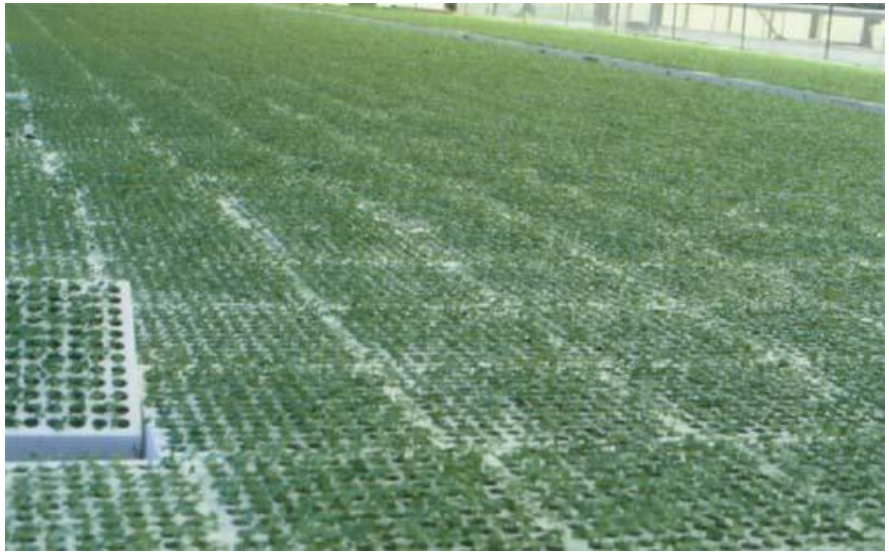


Production Herb Seeds, Maxwell, CA

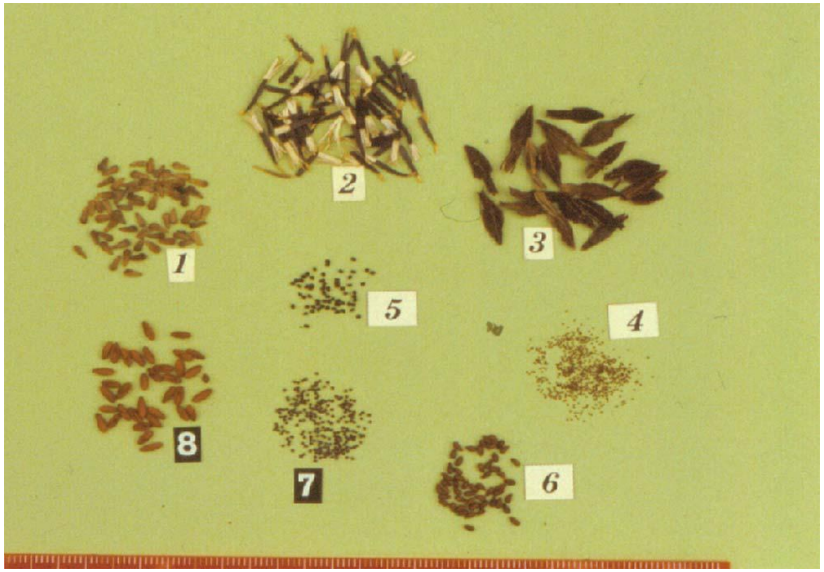
4. Field Establishment

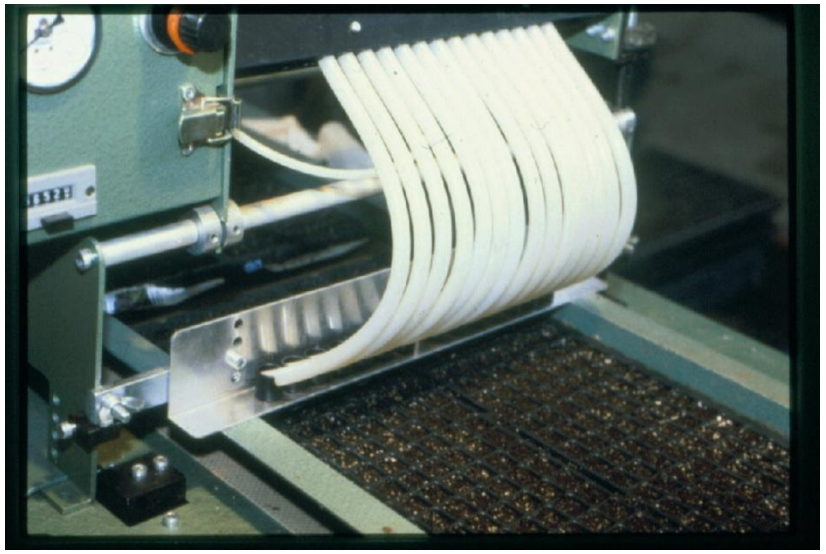
- **Direct Seeding**
  - Use of pelletized seeds
  - Mechanical planting
- **Transplanting**
  - Mechanical transplanting
    - Use of fluid drilling
    - Plug-grown seedlings
  - High value vegetable crops
    - Lettuce, cabbage, celery (i.e., California, Arizona)

Field Production of Vegetables, California

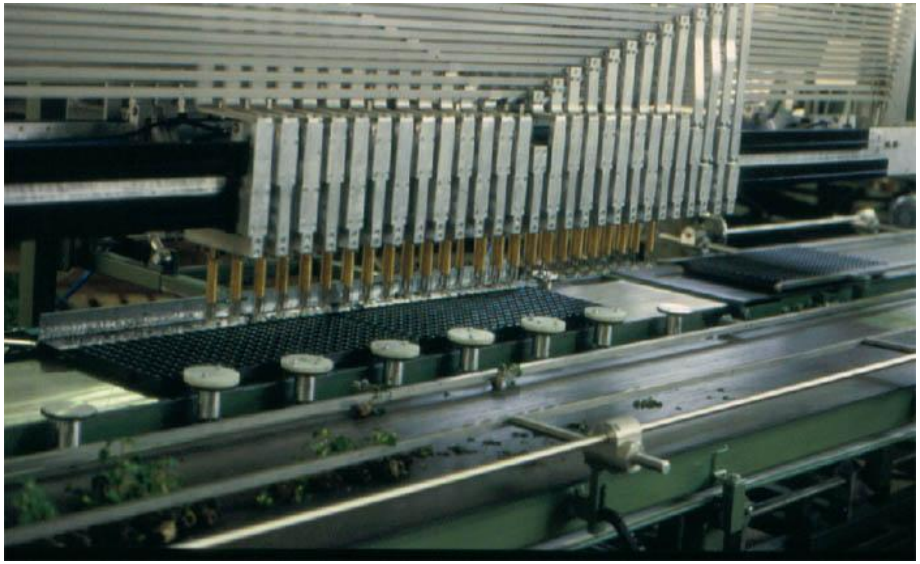


Seedling Production in Greenhouse





Plugs to Cell Packs



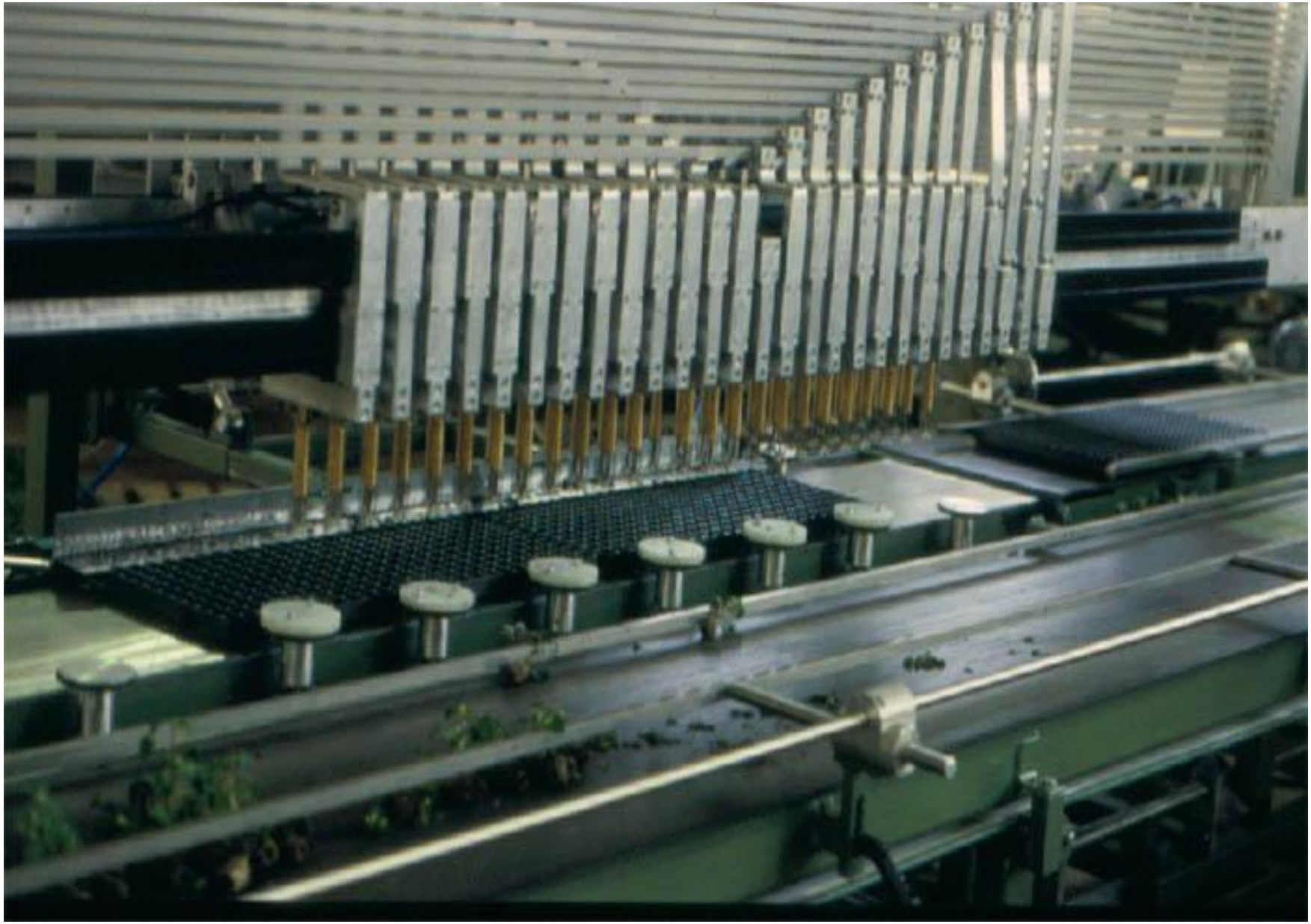
Bedding Plant Plug Culture, Small Growers

Seedling Plug Transplanter, Small Growers

Bedding Seed Planting, Bergen's Greenhouse, MN

Bedding Plant Plug Culture

Stage 4 plugs



Bedding plant plug transplanter

Culture of bedding plant cell packs

Flood irrigation

Floor Irrigated Greenhouse

Flood irrigation

Bedding Plant Cell Packs

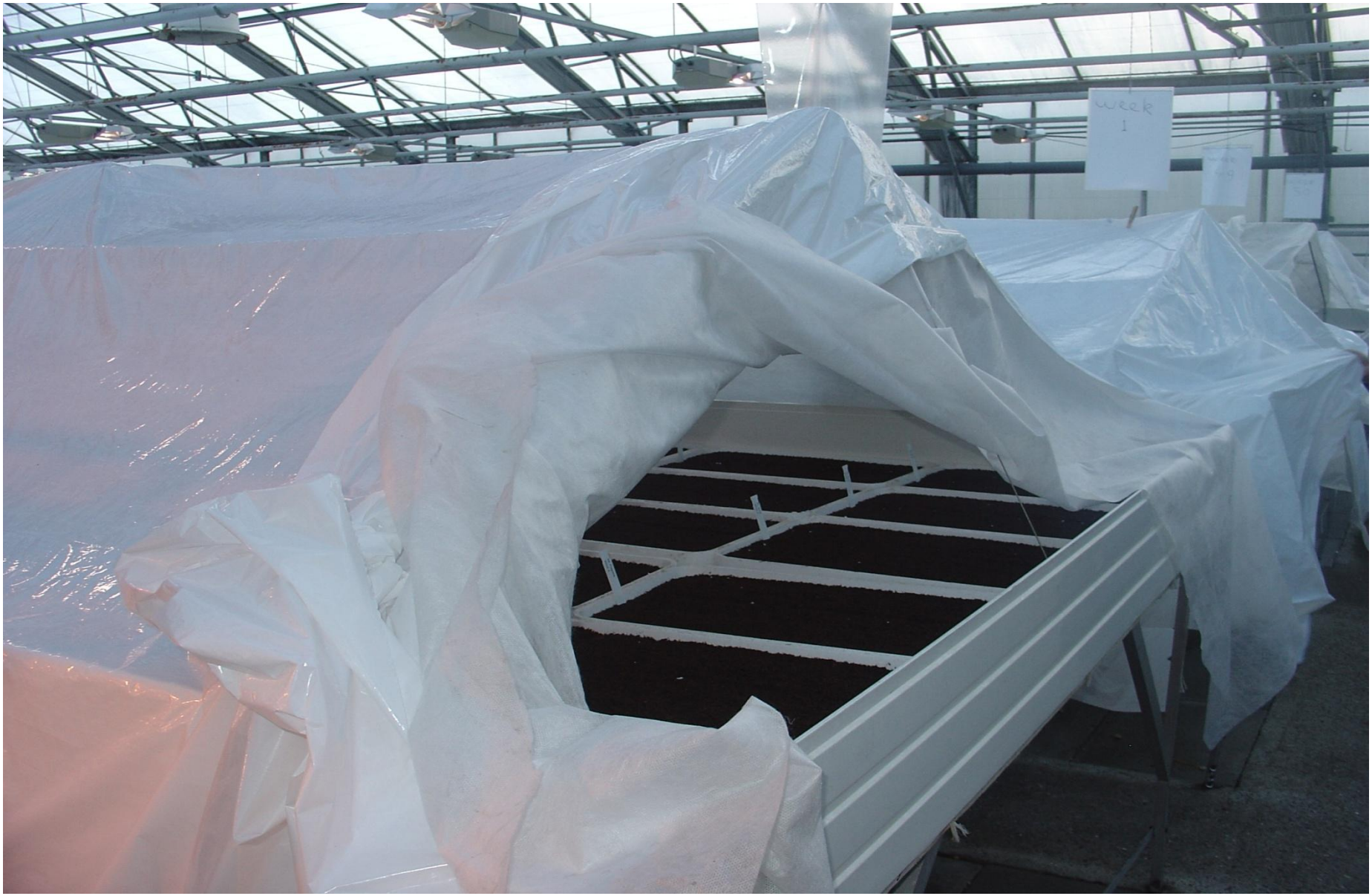
Containerized Bedding Plants Ready to Be Marketed

Bergen's Greenhouse, Forest Lakes, MN

Gerten's Greenhouse, MN

PLEASE CHECK WITH
CASHIER BEFORE
LOADING BAG GOODS.

Use of Spores in Fern Propagation – Staghorn Fern



Spore germination under high temperature and humidity

Production of ornamental ferns from spore culture

Close-up of fern seedlings grown from spores

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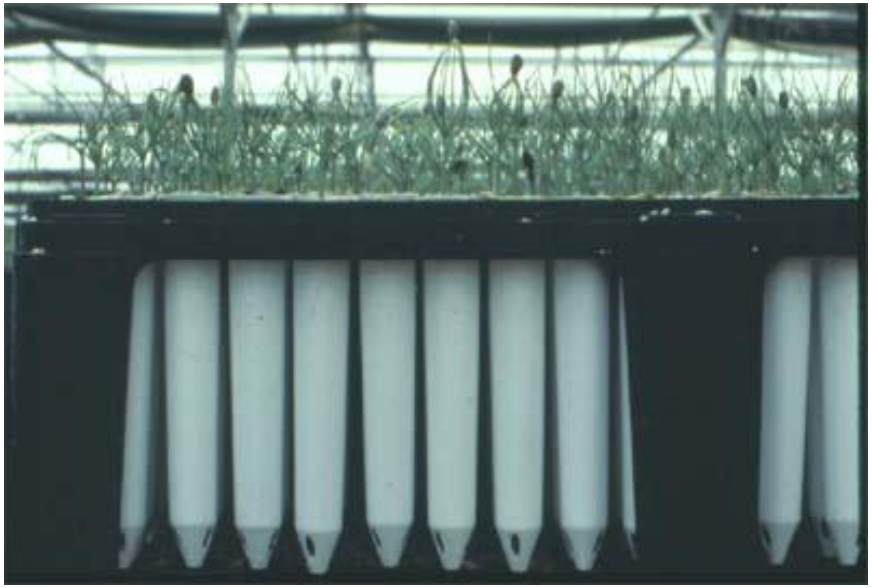
Alocacia

Seed Propagation for Trees