

Vegetable Transplant Production

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Why Transplant ?

1. High seed cost (seedless watermelons)
2. Earliness (tomato, pepper, other warm season crops)
3. Uniform stand and harvest
4. Reduces amount of time the plant is in the field
5. Eliminates the need for thinning

Why Not Transplant ?

1. Not cost effective (lettuce)
2. Some crops not adapted (sweet corn, some cucurbits).
 - Roots are destroyed by the process and roots do not regenerate easily
 - Not efficient in water uptake

Success =

- Temperature control
 - 80F for rapid, uniform germination
 - grow out @ 75F day/65F night
- Water
 - harden off by withholding
- Nutrition
 - do not cut back

Keys to Success

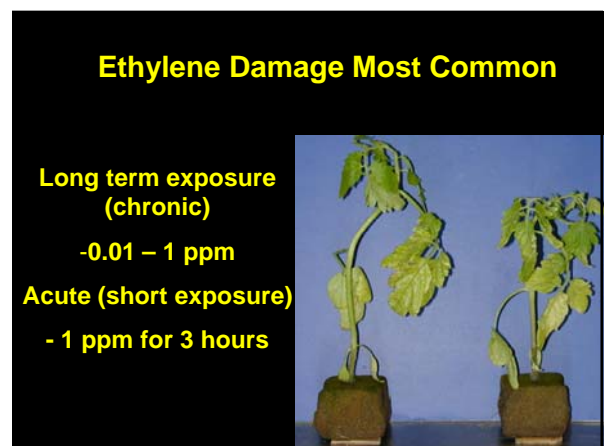
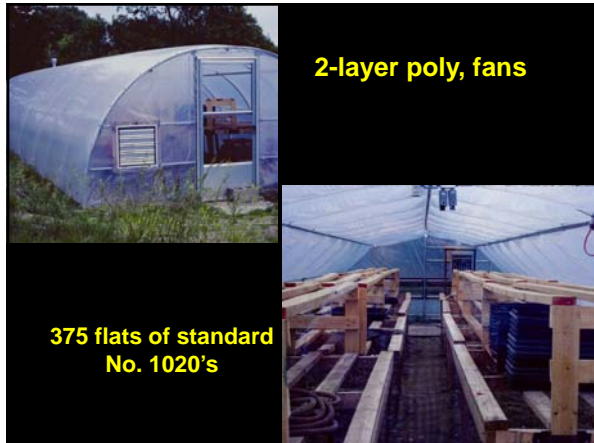
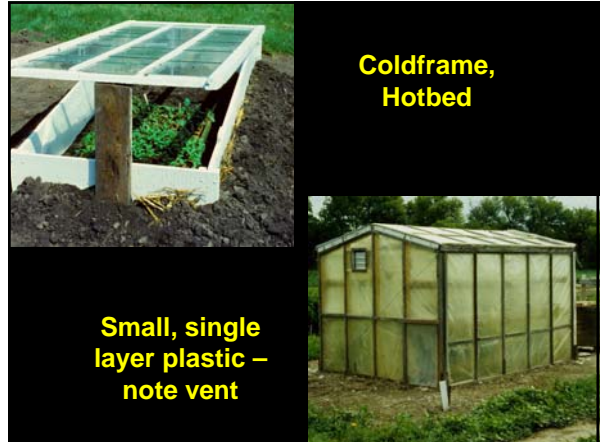
1. Start with excellent seed
 - high germination %
 - excellent vigor
2. Practice good greenhouse sanitation
 - bacteria and fungi can survive in plant debris for years
 - clean flats, benches, pipes, tools with a 1% solution of bleach

Keys to Success (cont.)

3. Water
 - test for: pH, alkalinity, Ec (salts)
 - use 68F water for young seedlings
4. Understand how the fertilizer injector works – know dilution of stock
5. Watch for pests
 - rodents
 - thrips, whitefly, mites

Growing Structures

- Coldframes, hotbeds
- Small greenhouse – 1 layer poly
- Greenhouse – 2 layer poly
- Wagons



Symptoms

- yellowing of lower leaves
- leaves drooping
- flowers drop off



Bedding plants hit by frost



Cold Injury (prior to flower appearance)



Common Problems

- High temperature
 - Over water
 - Low light
- = spindly, soft transplant resulting in field death



Crowding – 1/2 inch

High light
vs
Low light



Common Problems (cont.)

- Low germination temperature, < 70F
- Sow to early in spring
- Excess fertility (soluble salts)
- P deficiency
- Poorly drained media (using soil)



California Wonder Hot – Jalapeno

Need heating pad for hot peppers, eggplant

Pepper Transplants



Too large, flat bound

K deficiency



Nutrition Example Weekly Feed

Tomato 200N – 30P – 250K

Muskmelon 250N – 25P – 250K

Artificial media assumed

A good fertilizer analysis = Poinsettia mix

17 – 5 – 19 (Johnsons Whsle)

25 – 5 – 15 (Peters or Jacks)

Growing Conditions

Crop	Temperature, F			Time, wks	Plts/sq.ft
	Germ.	Day	Night		
Broccoli, caul.	70-85	65-70	60	5-6	48
Cucurbits	85-95	70-75	65	3	24
Pepper	70-85	70-75	60	5-7	36
Tomato	70-85	75	60	4-6	24
Eggplant	75-85	70-85	65	5-7	36

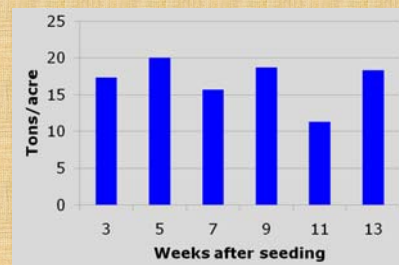
Does Transplant Age Make a Difference ?

Answer = Yes. Exception = watermelons

- tomatoes, peppers = 4-5 week old out performed 6-8 week old plants in earliness, yield, and fruit size

- Cabbage = highly variable depending on variety

Transplant Age - Watermelon



Florida, 1993 data, 2-inch cell size, Crimson Sweet(Varina)

Leave the Cotyledons Intact

No. Cotyledons Removed	Tomato Delay in Cluster Appearance		
	1st	2nd	3rd
1	4	4	3
1.5	7	6	5
2	10	11	8

Plant Physiol. 48: 482-489. 1973.

Ideal Transplant



Stocky – as tall as wide



Mixes and Containers

- Jiffy pots, jiffy 7's are not used commercially
- Cell trays - specific sizes for specific purposes and crops
- Artificial mixes = 100%. Soil introduces pathogens and weed seed

Prepare your own mix?



Problems if you use soil as a portion of the mix



Herbicide carryover

Soil pathogens



Hardening Off

Why? To reduce transplanting shock or stress

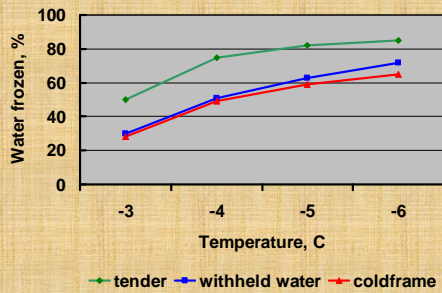
How? Reduce optimum growing conditions

Options

- Reduce temperature
- Increase ventilation
- Withhold water
- Reduce fertilizer application

Above only if not in plasticulture system

The most practical, without injurious consequences, is to withhold water.



Cabbage leaves. Rosa, Missouri Res. Bul. 48, 1921.

Plugs ? (cells > 128)

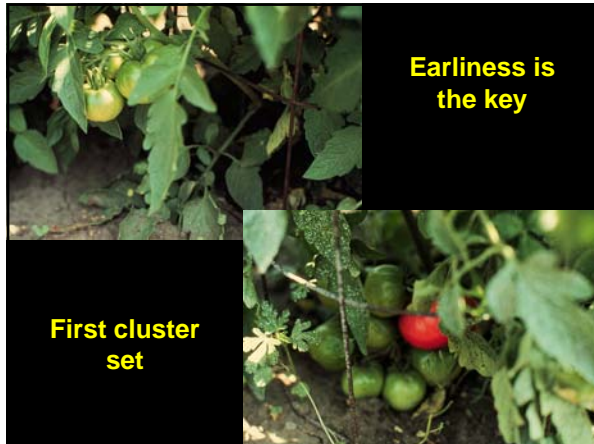
- Root volume is too small to practically withhold fertilizer and water
- Poor plugs =
 - tall, spindly
 - thin stems
 - very sensitive to transplant shock
- Bring in cooler night air - use fans
- Move out into full sunlight

Success in the Field

1. Use young, vigorous plants
 - minimize root breakage
 - keep seed leaves sound
 - do not over-harden
2. Transplant under favorable conditions
 - cloudy, high RH days
 - wind at low mph
3. Immediate watering

4. Use a 'starter fertilizer' solution
 - contains high P fertilizer
 - may not be needed if transplant late spring into high fertility soil





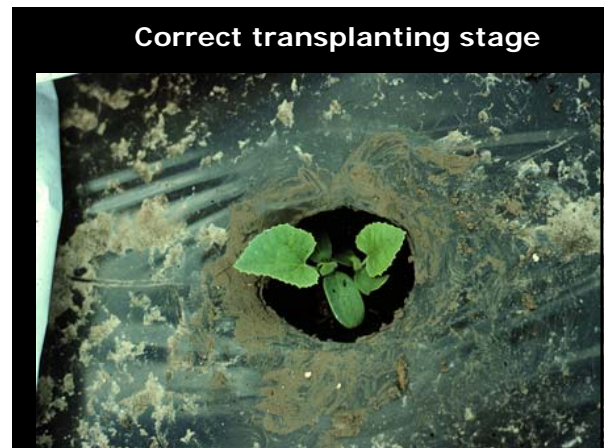
Ease of Transplanting

Easy = cole crops, tomato. Efficient in water absorption and form new roots rapidly

Moderate = celery, eggplant, onion, pepper. Do not absorb water as efficiency, but quickly form new roots

Hard (special care and containers) = cucurbits, sweet corn.

- Roots are easily injured during transplanting. Develops 'suberin' a compound that prevents root initiation.
- Cannot be held, plant becomes too large during transplant development.



Cell Size Muskmelon

Size	Early No./acre
Jiffy 7	217
2 ¼ peat pot	223
3 peat pot	207

Central Iowa, 1979 Burpee hybrid
(Naeve data)



Is Depth of Planting Important?

- Plant deep to avoid wind breakage?
 - Tomatoes will generate roots along the stem, but not peppers
 - Smother growing point results in growth distortion – corn, lettuce
- Head lettuce – deep planting results in a long skinny head. Height does not vary, but width varies greatly. Leaf pressure on the growing point causes change.

	width, inches
Shallow	4.88
Medium	4.65
Deep	3.69

Stem Scalded from Black Plastic



For Further Information

In-depth California guide can be found at:

<http://anrcatalog.ucdavis.edu/pdf/8013.pdf>

Midwest veg production guides:

<http://ohioline.osu.edu/b672/pdf/Transplants.pdf>

<http://www.btny.purdue.edu/pubs/ID/ID-56/>

Height Control

Brushing

- linear response to daily number of events
- up to 20X daily effective in reducing tomato plant size. Fans as effective.

DIF = day – night temperature difference

- keep seedlings cooler during day than night
- impractical in most greenhouses. But, 2 hours at dawn as effective as entire time period.
- not used much – vegetable transplants have shown delays in flowering once transplanted.

DIF Procedure

Day temperature – night temperature = DIF

DIF **negative** = DT < NT

DIF **positive** = DT > NT

Objective is DIF negative – cool days and warm nights (cell elongation and plant height is least)

Need very good greenhouse controls

DIF Pointers

- Never water late afternoon or at night
- Raise greenhouse temp 2 hours prior to dawn
- Vent at dawn to have cooler temperature post-dawn than pre-dawn

Cole crops, tomatoes = -6 DIF
(48-55 day/55-58 night)

Peppers, eggplant = -4 DIF
(65 day/68-70 night)