

# Vegetable Transplant Production in Greenhouses

Krishna Nemali, Ph.D.

Asst. Professor, Controlled Environment Agriculture

(765) 494-8179, [knemali@purdue.edu](mailto:knemali@purdue.edu)

Purdue University



# Acknowledgements

Some of the material presented here was obtained from the following. I thank them for their courtesy and support.

## ***Commercial Transplant Production in Florida***

*Gene McAvoy and Monica Ozores-Hampton*

## ***Vegetable Transplant Production***

*Dan Drost, Extension Vegetable Specialist*

## ***Commercial Production of Vegetable Transplants***

*W. Terry Kelley, Extension Horticulturist, George E. Boyhan, Extension Horticulturist, Darbie M. Granberry (retired), Extension Horticulturist, Stormy Sparks, Extension Entomologist, David Langston, Extension Plant Pathologist, Stanley Culpepper, Extension Weed Scientist, Paul E. Sumner, Extension Engineer, Greg Fonsah, Extension Economist*

## ***Growing Vegetable Transplants***

*By Lewis W. Jett, WVU Extension Service commercial horticulture specialist*

# Outline

- Containers and media
- Seeding and scheduling
- Growth systems, irrigation and fertilizer
- Growth control
- Hardening

# Advantages of greenhouse transplants

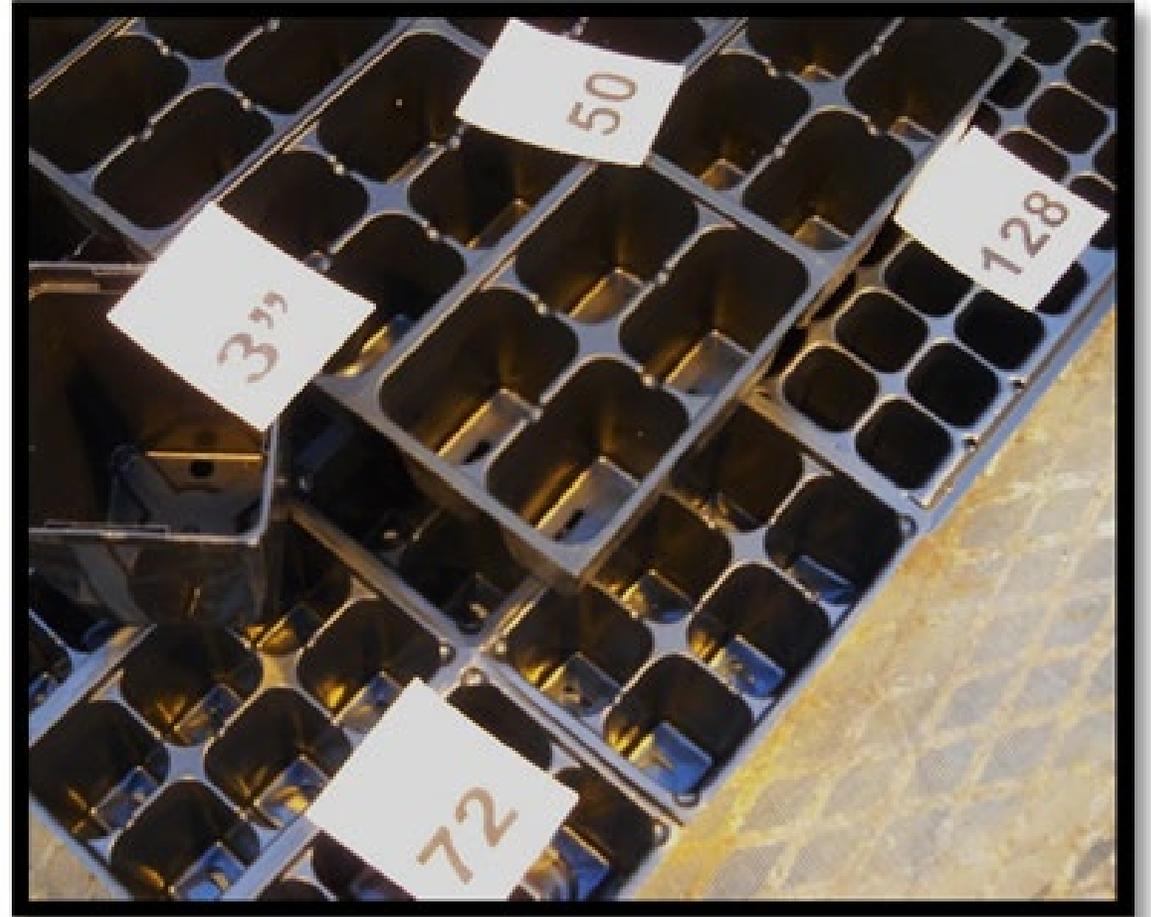
- Transplants can be produced earlier
- Transplants are uniform and stocky
- Growth can be controlled easily
- Protection from harsh environment
- Less shock at transplanting due to root ball



# Containers for transplants



Polystyrene tray



Plastic tray

# Containers for transplants

- Cell shape has no relation to crop growth whereas volume or height can affect growth
- 1-inch cells: cabbage, cauliflower, kale, broccoli and lettuce
- 2-inch cells: tomato, pepper, water melon, musk melon, cucumber
- Inserts available for older polystyrene trays that have cracks
- More water available to plants in plastic trays than polystyrene trays, this results in increased transplant growth under plastic trays
- Sanitize trays with chlorine bleach when reusing; properly aerate after sanitization

# Media for transplants



Peat  
(organic, ~70%)

Moisture/nutrients



Vermiculite  
(inorganic, ~20%)

Moisture/nutrients



Perlite  
(inorganic, ~10%)

Drainage

**+ Wetting agent**

# Media for transplants

- Avoid using field soil due to poor drainage, weeds and pest infestation
- Usually commercial mixes are more uniform than custom mixes
- Media should be fine, avoid media for bedding plants or large containers
- If using compost, ensure that it is pasteurized, decomposed properly and you are aware of nutrient status
- Organic producers: ATTRA publications on *Potting Mixes for Certified Organic Production* and *Plug and Transplant Production for Organic Systems*.



Mechanical tray filling equipment

# Seeding transplants

- Buy high quality seeds with high germination rates
- Moisten media before dribbling
- Apply a layer of vermiculite at the top of tray after seeding
- Pelleted seeds are better
- Water seeds with warm water (70 F) after seeding if possible



# Temperature is key for germination (along with water)

<b>Crop</b>	<b>Germination Temp (F)</b>
Asparagus	75-85
Brassica Crops (broccoli, cabbage, kale)	70-80
Cucurbits (cucumber, melons, squash)	75-95
Greens (chard, lettuce, spinach)	60-70
Bulb Crops (leeks, onions)	65-80
Solanaceous Crops (eggplant, pepper, tomato)	75-85

# Accelerate seed germination



Heat mats



Cold frames

# Scheduling transplant production

<b>Crop</b>	<b>Weeks from Seed to Transplant in Field</b>
<b>Cabbage</b>	4 to 6
<b>Cauliflower</b>	4 to 6
<b>Broccoli</b>	4 to 6
<b>Lettuce</b>	3 to 4
<b>Eggplant</b>	6 to 8
<b>Peppers</b>	6 to 8
<b>Tomatoes</b>	5 to 8
<b>Squash/ Pumpkin</b>	2 to 3
<b>Cucumber</b>	3
<b>Watermelon</b>	3 to 4
<b>Melons</b>	2 to 3
<b>Onions</b>	10 to 12

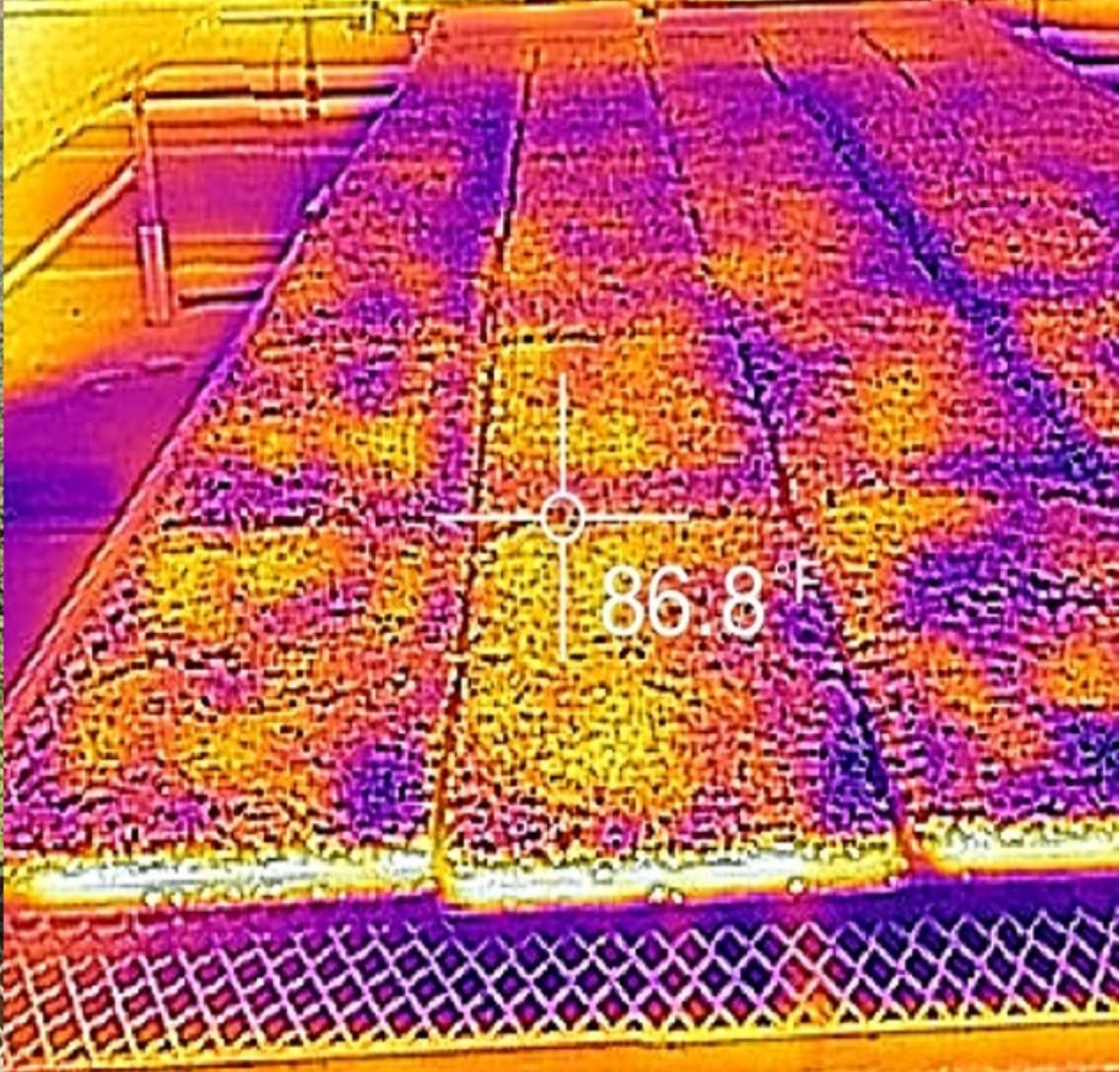
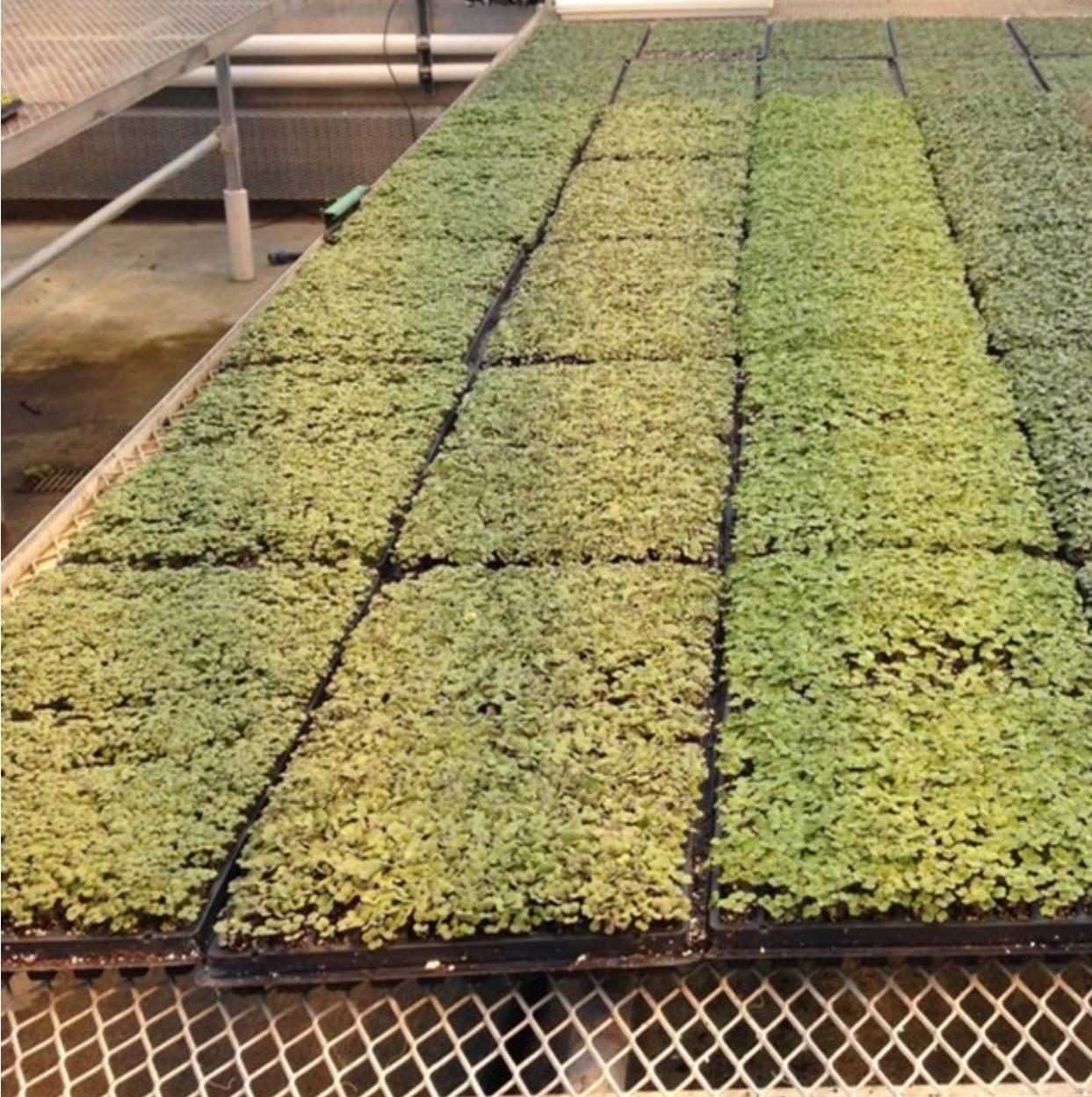
# Growing systems (based on irrigation)



Rail/bench system



Float system

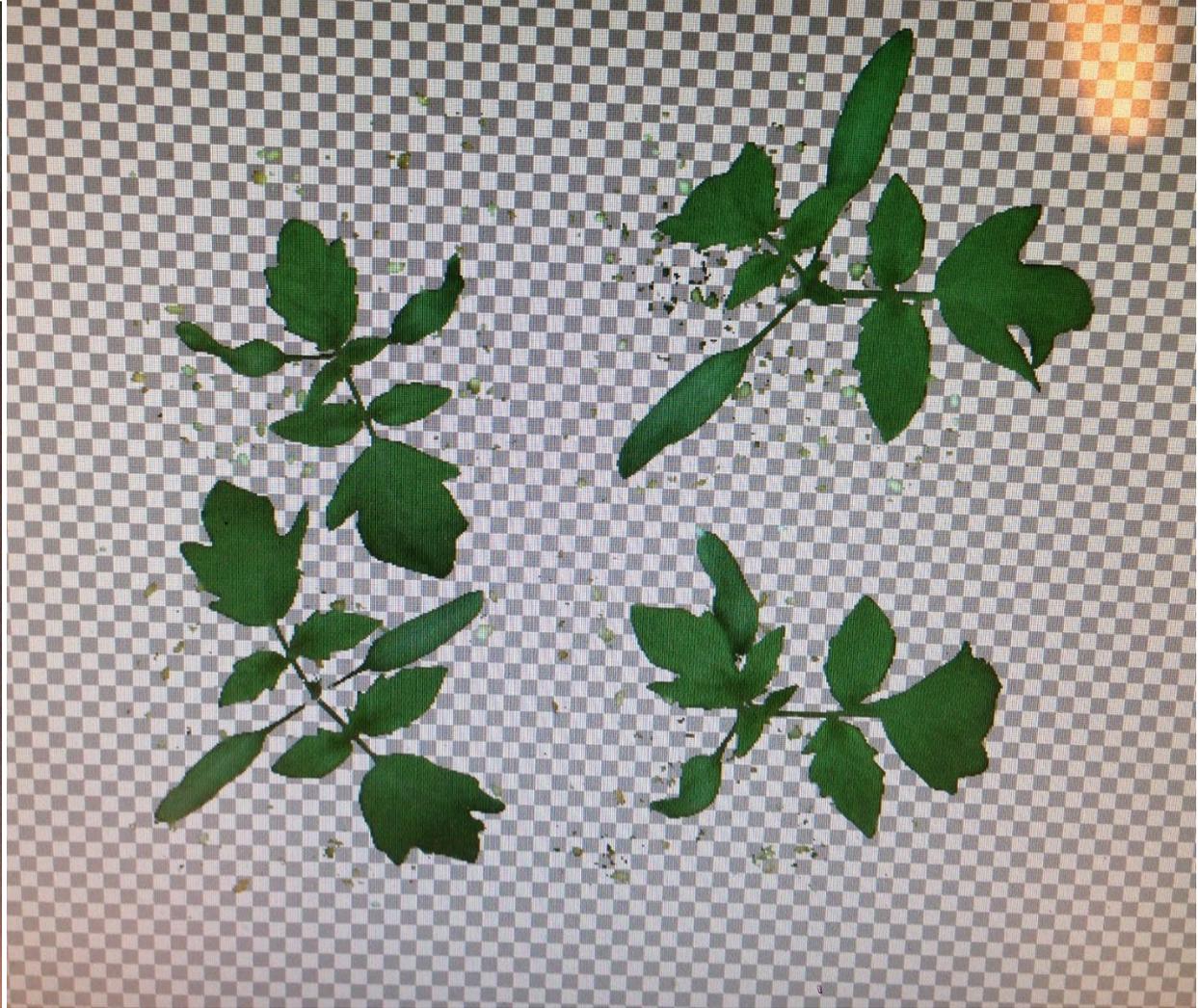


Thermal imaging: a new and affordable tool to growers

# General fertilizer guidelines

- Check if the media contains starter charge; if yes, delay fertilization for a couple of weeks
- Apply fertilizer solution until it drains out
- Apply a balanced fertilizer solution with an EC of  $\sim 1.5$  mS/cm
- In terms of N, apply at 50-100 ppm depending on the crop.
- Solanaceous and cole crops get more N while cucurbits get less N
- Fertilizer rates are usually 30-50% lower under subirrigation. Why?
- Managing media pH is crucial to avoid nutrient deficiency/toxicity symptoms. Best pH is  $\sim 6$ .

# Supplying fertilizers based on crop growth rate



# Transplant Growth Control

- Goal is to produce sturdy and stocky plants not big plants
- Elongated transplants are susceptible for stresses after transplanting in the field
- Plant growth regulators, except for sumagic, are not allowed
- Supplemental light, lowering fertilizer and mild drought can aid in reducing seedling elongation



# Growth control using negative DIF

- DIF stands for difference in night and day temperature
- Negative DIF indicates that night temperature is greater than day temperature (ex: night 60, day 55 F)
- Negative DIF for 2-3 h during the morning can reduce plant height
- This is possible during cooler months by allowing outside air in the greenhouse

# Mechanical Stress for growth control

Using mechanical stress  
(ex: brushing plants gently),  
we can control plant  
height, improve plant  
strength, stress tolerance,  
insect resistance

Crop and cultivar	Stem length (cm)	
	Untreated	Brushed
Tomato		
Sunny	20.4	9.6*
Celebrity	19.0	9.5*
Eggplant		
Black Beauty	14.6	9.2*
Ping Tung Long	9.4	6.2*
Cucumber		
Suyo Long	23.0	16.0*
Sweet Success	26.6	20.5*
Squash		
Dixie	9.6	8.0*
All Seasons	7.0	6.0*
Cream of the Crop	7.3	5.5*
Broccoli		
Early Dawn	8.0	6.9*
Green Duke	7.8	7.3*
Symphony	6.4	6.2
Premium Crop	5.6	5.8
Green Comet	4.9	4.8
Cabbage		
Conquest	5.6	5.0*
A&C #5	4.3	4.0
Rio Verde	4.1	4.1
Gourmet	4.9	4.9
Market Prize	4.3	3.9*

\*Significantly different from respective untreated control;  $P < 0.05$ .

(Latimer, 1998)

# Hardening transplants

- Hardening store carbohydrates in stems and develop waxy coatings on leaves
- Goal of hardening is to reduce growth so reserves are stored in plants
- Ventilation by cool air, exposure to sun light, mild drought or lowering fertilizer can harden transplants
- Harden transplants a week prior to moving to field

