

# So, You Want to Grow Greenhouse Tomatoes?

Missouri Tomato Conference, KCMO

MAY 19, 2022

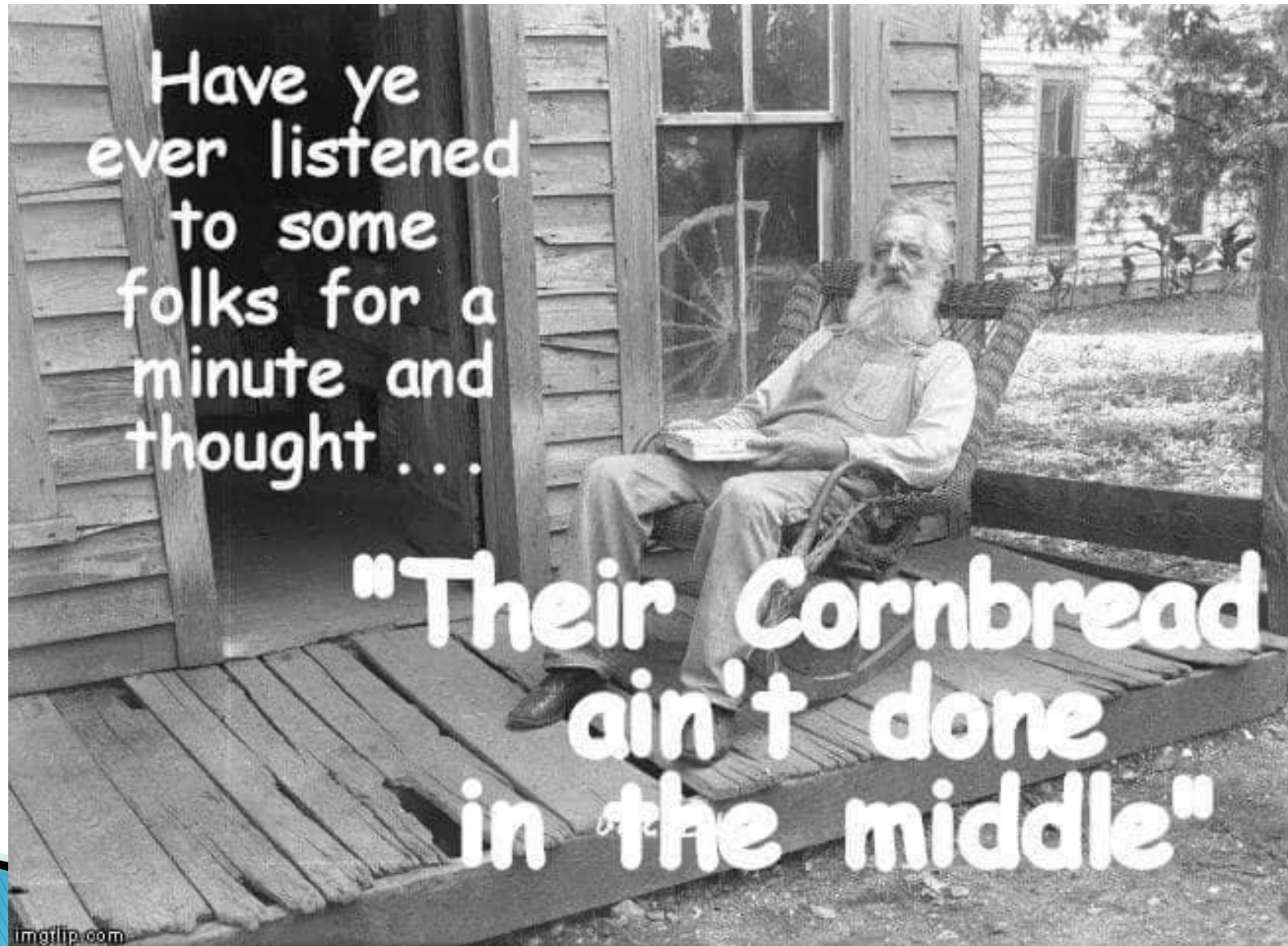
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Professor & Vegetable Specialist







# I've See It All ...



# Greenhouses are for Environmental Modification

- Modify
  - temperature
  - light
  - insects, diseases, and weeds
  - air pollutants
  - water
- Allow crop production at a time when it would otherwise be impossible.



# Greenhouse Tomatoes

## Higher Quality & Value

- locally grown
- vine ripened
- not breakers or gassed
- uniform size & shape
- good red color
- good flavor

**higher quality --→ higher value**







Looks easy,  
lot to learn!



# U.S. Food Crops Grown Under Protection

Year	Number of Operations	Sales in U.S. Dollars (millions)
1998	1015	\$223
2009	1476	\$553
2014	2521	\$797

# Production acres greenhouse vegetables

	Canada	USA	Mexico
Tomato	432	408	1,951
Cucumber	282	105	330
Pepper	296	61	550
Total	1,010	574	<b>2,831</b>



# U.S. Food Crops Grown Under Protection

Crop	Production (tons)	Hydroponic production (tons)	Value (\$million)
Total	260,966	165,557	796
Cucumbers	36,310	33,101	78
Herbs (cut fresh)	17,761	3,811	71
Lettuce	10,965	7,719	56
Peppers	3,851		6
Strawberries	353		1
<b>Tomatoes</b>	<b>96,265</b>	<b>82,797</b>	<b>401</b>
Other	95,461	36,791	184

# Growers



- ▶ Growers have a lot to learn before getting into the hydroponic tomato business.
- ▶ But that is just the beginning.
- ▶ *continue learning every year.*







Small, family-run  
business

Huge, multi-acre range

**Same Concepts**



# Grow, then Sell Tomatoes

- ▶ Don't even think about growing greenhouse tomatoes unless you have a market to sell them.
- ▶ Investigate the market in your area first
- ▶ Wholesale?
- ▶ Retail?
- ▶ Small grower?
- ▶ **Sell locally.**
- ▶ Have alternative buyers.





# Get Educated



- ▶ Extension publications
- ▶ Books
- ▶ Newsletters
- ▶ Visit growers
- ▶ Internet
- ▶ Facebook page
- ▶ Grower conferences



# The Greenhouse Structure

- See vendor list in Greenhouse Tomato Handbook
- Determine size
- Site location
- Sales on site?
- Plan for drainage
  - 1–2% slope





# Learn The Language

- ▶ See the Greenhouse Tomato Growers' Glossary
- ▶ Learn the terminology
- ▶ Feel free to suggest words to add if you find other terms you don't know

Cluster?

Peduncle?

EC?

PPM?

Calyx?

Internode?

IPM?

Truss?

## Greenhouse Tomato Growers' Glossary

Producing greenhouse tomatoes, like many endeavors, has its own world of terminology. But because of the integration of many different fields—horticulture, botany, plant physiology, plant pathology, entomology, and others—there are more terms in this field than perhaps any other agricultural pursuit. Also, greenhouse tomato production is rooted in European and Asian countries and was well established in Holland, England, and Japan, before being transported to Canada and eventually to the United States. So, some words have a more international base.

For all of these reasons, this Greenhouse Tomato Growers' Glossary was assembled to help growers with learning the language of hydroponics and greenhouse tomato production. For more specific information, refer to other publications of the Mississippi State University Extension Service. All of these publications are online at <http://msucares.com>, or you may get copies from your county Mississippi State University Extension Service office:

Greenhouse Tomato Handbook, MSU Extension Publication 1828

Budget for Greenhouse Tomatoes, MSU Extension Publication 2257

Environmental Control for Greenhouse Tomatoes, MSU Extension Publication 1879

Greenhouse Tomatoes: Pest Management in Mississippi, MSU Extension Publication 1861

Starting Vegetable Transplants, MSU Extension Publication 1995

Fertigation: The Basics of Injecting Fertilizer for Field-Grown Tomatoes, MSU Extension Publication 2037

A Spreadsheet Approach to Fertilization Management For Greenhouse Tomatoes, MAFES Bulletin 1003

### Helpful Terms To Know

**abiotic disease:** plant disease caused by factors other than living organisms, such as drought, nutritional deficiencies, pH problems, pesticide burn, and air pollution.

**bacterium:** microscopic, one-celled organisms reproducing by fission, lacking chlorophyll, and causing disease in tomato, such as bacterial canker, bacterial wilt, bacterial stem rot, pith necrosis, and bacterial soft rot.

**biological control:** using one or more living organisms to help control a pest or limit its population.

**blade:** the extended flat part of a leaf, not including the petiole.

**blossom-end rot:** a sunken, leathery brown or black spot on the bottom or near the bottom of a tomato fruit; not from a disease; usually from lack of water or not enough calcium in the fruit.

**bullish:** a plant with thick, leathery, dark-green leaves, little or no fruit, and very vegetative; may be caused by overfertilization with nitrogen or genetic off-type.

**calyx:** the green pointed structures beneath flower petals and at the top of the fruit; composed of individual sepals.



# Start Small

- ▶ Start with 1 or 2 bays
  - Not 6
  - Not 12
  - Not 5 acres

“Well you said  
start small...”





# Who will do all the work?

- ▶ Labor – yes there is work to do
- ▶ Average 20 hours per week per bay over the life of the crop
  - Do it all by yourself?
  - Family labor?
  - Hire part-time labor?
  - Hire full-time labor?
- ▶ Be sure labor is available when you need it.



# Temperature Control

- Heaters (64°F min)
- Fans (keep it under 90°F)
- Vents
- HAF
- Shade Materials?
- Pad & Fan system?
- Fogging?





# How Many Plants?

- ▶ Plant Population
- ▶ **5 square feet per plant**
  - Length X width / 5 = number of plants
  - 24 X 96 → 460 plants      30 X 96 → 576 plants
- ▶ 3 or 4 plants for 2 cubic foot lay-flat bag
- ▶ 2 plants per 5 or 7 ½ gallon upright bag
- ▶ 14 inches between stems in the row

Notice the "V-formation"







# Variety

- ▶ Choose a good variety.
- ▶ Pick a **greenhouse** variety.
- ▶ Look for
  - Good yield
  - Size 8–10 oz
  - Red color
  - Excellent disease resistance
  - Free of disorders



# For Greenhouse Production

In most cases ....

- Red
- Indeterminate
- Beefsteak type
- Roma, cherry, grape - *if good market exists.*
- Greenhouse variety – not field or home garden type which are not well adapted to greenhouse conditions.
- *Can deviate from this based on market demands.*





# Greenhouse Tomato Varieties

- Big Dena (Syngenta)
- Trust (De Ruiter / Seminis / Monsanto) – being phased out!
- Geronimo (De Ruiter / Seminis / Monsanto)
- Torero (De Ruiter / Seminis / Monsanto)
- Rebelski (De Ruiter / Seminis / Monsanto)
- Touché (Paramount Seeds)
- Foronti (De Ruiter / Seminis / Monsanto)
- Tanager (Yuksel Seeds)
- Frederik (new – Paramount Seeds)
- ~~Blitz, Quest, Matrix, Clarence, Ambiance, Tresco, Match, Heritage, Starbuck~~
- Cluster types – ~~Success, Tradiro~~
  - Komeett (new – Paramount Seeds)
  - Endeavour (new – Rijk Zwann)
  - Orangaro (new – Paramount Seeds)









# Choose a good growing medium

- ▶ Pine bark (**composted** fines)
- ▶ Perlite
- ▶ Coconut coir
- ▶ Rockwool
- ▶ Peat-lite mixes
- ▶ Soil
- ▶ Sand (no!)



# Have the right tools

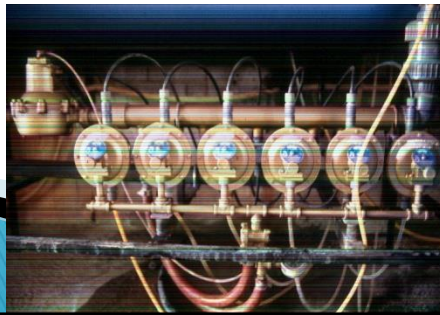
- ▶ Pollinator or bumblebee hive
  - (Class A, B, or C depends on greenhouse size)
- ▶ pH meter
- ▶ EC meter
- ▶ High/low thermometer





# Design A Good Irrigation System

- ▶ Not as simple as it sounds
- ▶ Get help from an irrigation engineer
- ▶ Choose proper emitters
- ▶ Use filters
- ▶ Plan for fertigation
  - Bulk tank
  - Injector



# Fertility & Nutrition

- ▶ Use a greenhouse hydroponic tomato fertilizer
- ▶ Use correct pH (5.6–5.8)
- ▶ Get regular tissue analysis

GUYAN													
Grower:  J. P. L. BARKINS 1044 BARKINS LN CRYSTAL SPRINGS, MS 39059													
Date:  MARCH 7, 1976													
PLANT ANALYSIS REPORT													
MISSISSIPPI COOPERATIVE EXTENSION SERVICE Mississippi State University and U.S. Department of Agriculture Cooperating													
Soil Testing and Plant Analysis Laboratory R-6, Box 8446 7/6/70 Mississippi State, Mississippi 39762													
			Percentage Expressed on a Dry Weight Basis						Parts Per Million Expressed on a Dry Weight Basis				
Lab #	Sample Number	Crop	N Nitrogen	P Phosphorus	K Potassium	Ca Calcium	Mg Magnesium	S Sulfur	Fe Iron	Mn Manganese	Zn Zinc	Cu Copper	B Boron
215	1	FOURTEEN	5.79	0.58	3.86	7.67	0.93		107	153	33	9	
216	11	"	4.43	0.77	3.45	2.07	1.18		92	71	21	8	
SUFFICIENCY LEVELS:			3.5-5.0	0.5-1.0	3.5-5.0	1.5-4.0	0.5-1.0		50-100	50-500	20-100	1-20	
Comments:													
K. Crowe													
Lander, Extension Agency Coordinator MISSISSIPPI COOPERATIVE EXTENSION SERVICE													
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Form 592 (10-9-63)													





# Tissue Analysis

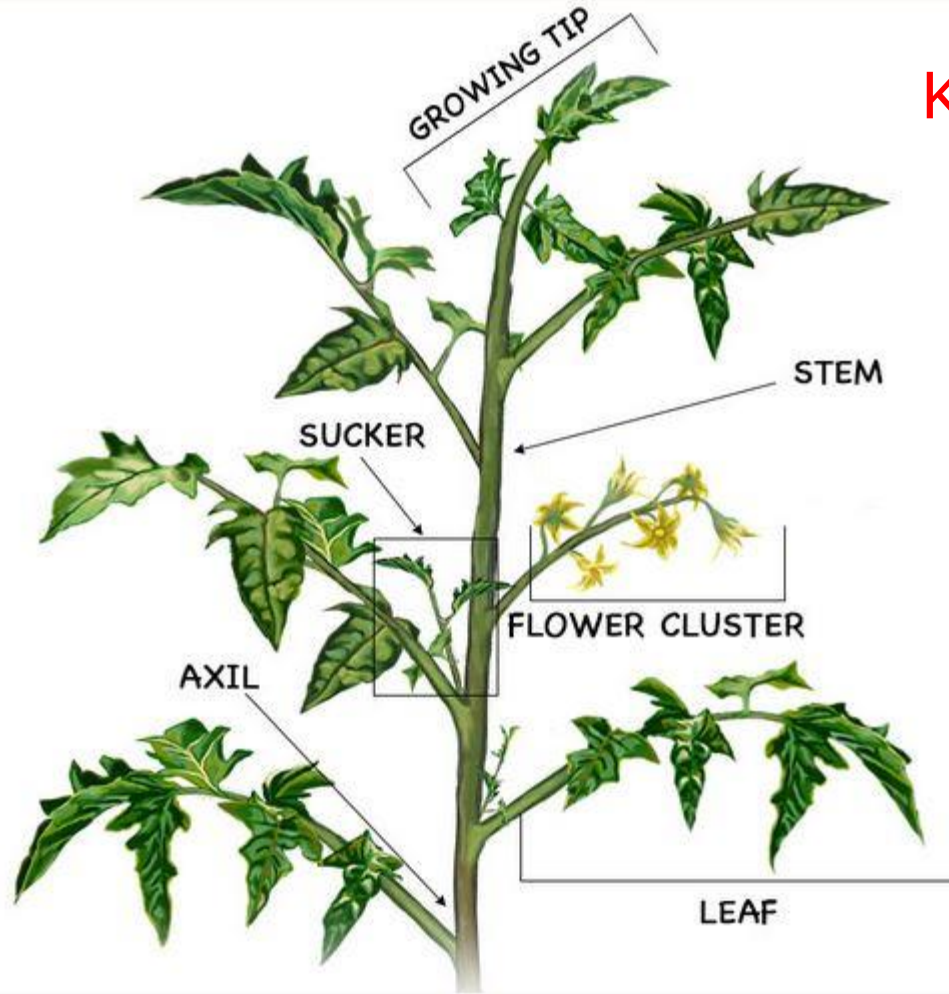
## How to Take Sample

- ▶ Snap off 10 to 12 leaves total
- ▶ Not more than 1 per plant
- ▶ Randomly selected from throughout greenhouse
- ▶ Choose leaf just above golf ball sized fruit
- ▶ Send to laboratory for analysis



# Suckering Your Tomatoes

Know Your Tomato Anatomy!





# What Makes Good Tomato Flavor?

- ▶ Correct fertility
  - Not too weak
  - Increasing EC improves flavor
- ▶ Correct pH
  - Lower pH (more acid) improves flavor
- ▶ Maturity – vine-ripened
- ▶ Lots of sun
  - Plants turn sunlight into sugar
  - More sun → more sugar → more flavor



# Have A Support System\*

- ▶ Wire Height
  - Average – 7 feet high
  - Higher for the taller grower
  - Lower for the shorter grower
- ▶ Be sure it has good support
  - 600 plants with fruit load can weigh 3 to 4 tons!
- ▶ 3 feet apart in V-formation over row
- ▶ Tie strings to wire above and clip to base of plant



*\*note: this does not refer to group therapy,  
but that may be useful as well*



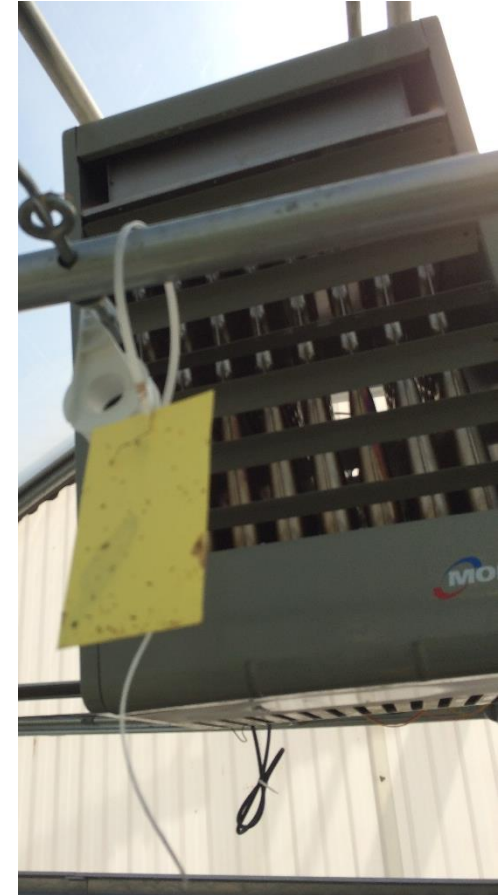
# Tomato Pruning & Training for the greenhouse

- Train to 1 main stem!
- Remove suckers once/week
- Tie top of string to horizontal wires overhead
- Tie or clip bottom of string to base of plant
- Attach under a leaf, NOT under flower cluster or fruit which can cause damage.
- Once per week, either add plant clip OR twist string around stem, *always in the same direction.*



# Maintain Your Equipment

- ▶ Heaters
  - Should be ready in **advance** of need
- ▶ Fans
- ▶ Vents
- ▶ Emitters
- ▶ Injectors
- ▶ Pumps





# Be A Worrier!

- ▶ Check your work.
- ▶ Use pH and EC meter to check nutrient solution daily and after mixing.
- ▶ Use a gallon jug at 1 emitter to check volume per day.
- ▶ Walk the greenhouse every day.
  - Look for wilting plants.
  - Look for critters.



# Use Diagnostics Resources When Needed

- ▶ Local County Agent or Area Horticulture Agent
- ▶ Extension Vegetable Specialist
- ▶ Digital diagnostics (pictures)
- ▶ Diagnostics laboratory (samples)
- ▶ Friends in the business





# You Are Not ONLY A Grower

You Are Also A...

- ▶ Seller
- ▶ Marketer
- ▶ Promoter
- ▶ Industry Representative



# Know Your Product – What's So Good About It?

- ▶ Vine-ripened
- ▶ Good red color
- ▶ Great flavor
- ▶ Locally grown
- ▶ Not breakers or gassed
- ▶ Uniform size and shape
- ▶ Nutrition & health benefits
  - vitamins, **lycopene**
- ▶ Excellent quality



**higher quality --→ higher  
value**



# Sell Quality



- ▶ Grade your fruit well.
- ▶ Do not sell cull or #2 and #1 fruit to same buyer.
- ▶ Build your reputation for high quality.
- ▶ Keep your customers happy.
- ▶ Aim for repeat business!
- ▶ Develop a brand name customers associate with high quality.
- ▶ Logo!

# Know When to Harvest

- ▶ Red – same day retail
- ▶ Light red – retail and close wholesale
- ▶ Pink – wholesale close and mid range
- ▶ Turning – wholesale long range
- ▶ Breaker – never
- ▶ Green – NEVER EVER
  - Well, except for fried green tomatoes

**Red Ripe**



**Light Red**



**Green**



**Breaker**



**Turning**



**Pink**





# Use Stickers for Promotion

Cost per sticker

For round 3/4 inch label...



- ▶ 0.2 cents per sticker (i.e. 5 for a penny; including the plate charge)



# Publication Resources

- ▶ **Greenhouse Tomato Handbook**
- ▶ Tomato Troubles: Common Problems with Tomatoes Greenhouse Tomato Growers' Glossary
- ▶ Environmental Control for Greenhouse Tomatoes
- ▶ Greenhouse Tomatoes – Pest Management in Mississippi
- ▶ Budget For Greenhouse Tomatoes

*All are on the web site*





# Greenhouse Tomato Handbook



# Greenhouse Tomato Handbook

**Also available in Spanish**

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# Internet Resources

## ▶ Greenhouse Tomato FAQ

<http://extension.msstate.edu/crops/commercial-horticulture/greenhouse-tomatoes>





Thanks for coming.

Questions?

