Organic Seedling Production and Greenhouse Efficiencies for Small Farms

Ecofarm Conference

January 25, 2020

Seedling Production:

- To grow or not to grow your own:
- Elements you can and need to influence-to optimize seedling development
- How greenhouse infrastructure enhances environmental conditions
- System Efficiencies to improve outcomes and reduce labor

Buying in seedlings versus growing your own Pros and Cons:

Buying In

Advantages:

- Does not require you to build and manage GH infrastructure
- Does not require any specific seedling growing skills and knowledge
- Can schedule crop maturity precisely to meet production schedules
- Cost per seedling can be very low when buying in large quantities

Disadvantages:

- Costs per seedling can be very high at lower volumes
- Most nurseries have large minimum order thresholds
- Many nurseries do not want to supply high crop diversity
- “Lead Time” from ordering to ready seedlings can be much longer than…
- Some nurseries wont allow you to supply seed

Buying In

Additionally, plants are occasionally damaged in transport but more typically you will receive very high quality, uniform transplants when you buy in seedlings from a skilled growing operation

Growing your own

Advantages:

Allows precise control of timing and varieties, quantities
Daily ability to see plants, adjust schedules, manage accordingly
Potential “slow season” work to help retain highly skilled staff

Disadvantages:

Requires GH infrastructure
Requires specialized skills/knowledge
Requires time/labor to make mixes, fill containers, sow seeds,
Water, manage GH conditions-temperature, air circulation...

Key environmental conditions influencing seedling germination and development:

- **Temperature**
- **Air Circulation**
- **Soil Moisture**
- **Light**

Seedling Life Stages and Environmental Management

- Pre-germination and Emergence
- Emergence and Development of True Leaves
- Development of Leaf Canopy and Root System
- Seedling Maturation and Hardening Off
- Qualities of Mature Transplants
- Holding Strategies and When to Cut Loose

Greenhouse structures create the ability to manage environmental conditions to optimize germination and development

Passive and Active Environmental Controls

Temperature: *Passive*: sunlight, capturing of solar radiation for heating and air circulation through venting for cooling

***Active*:** mechanical devices for heating and cooling

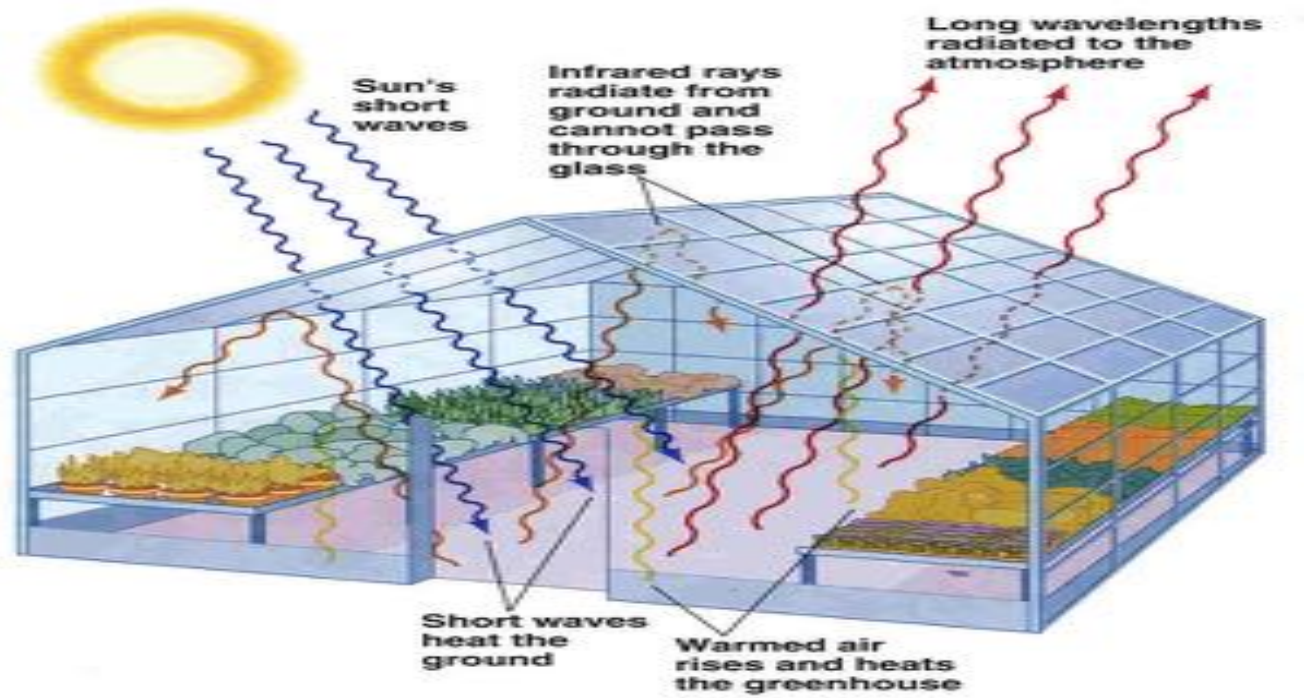
Air Circulation: *Passive*: through venting to promote rapid air exchange

***Active*:** HAF and exhaust fans to facilitate additional movement

Water: hand and automated delivery methods

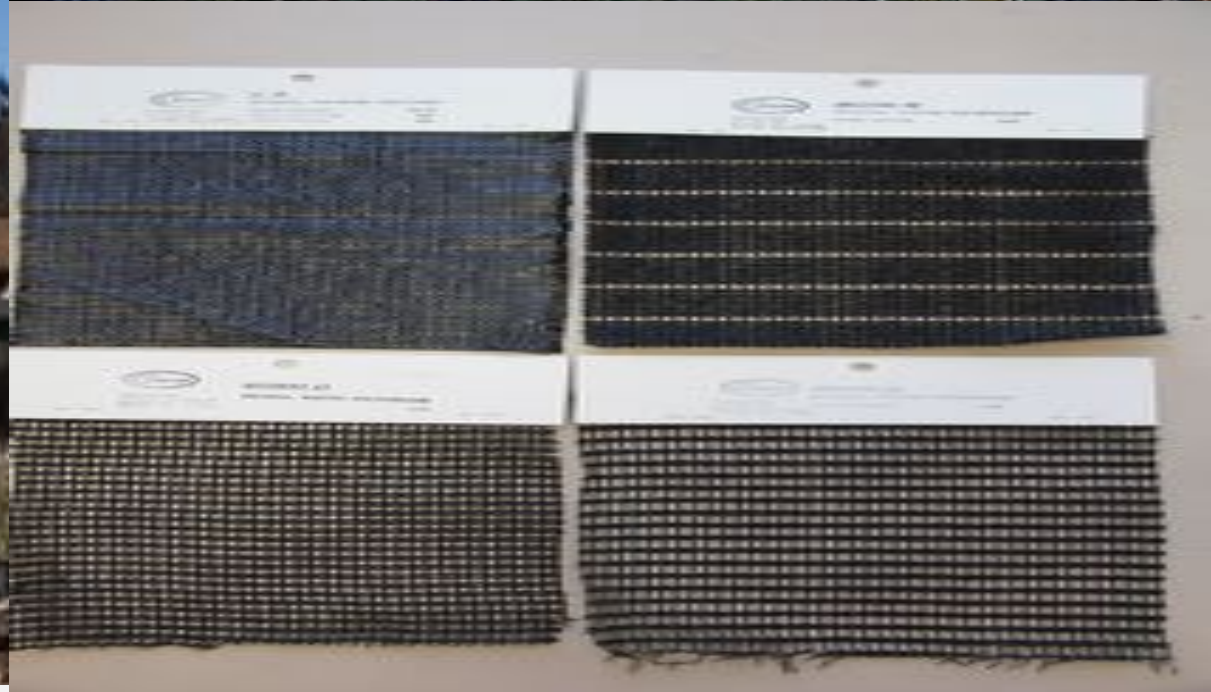
Light: *Passive*: infiltration sunlight through roof/wall glazing

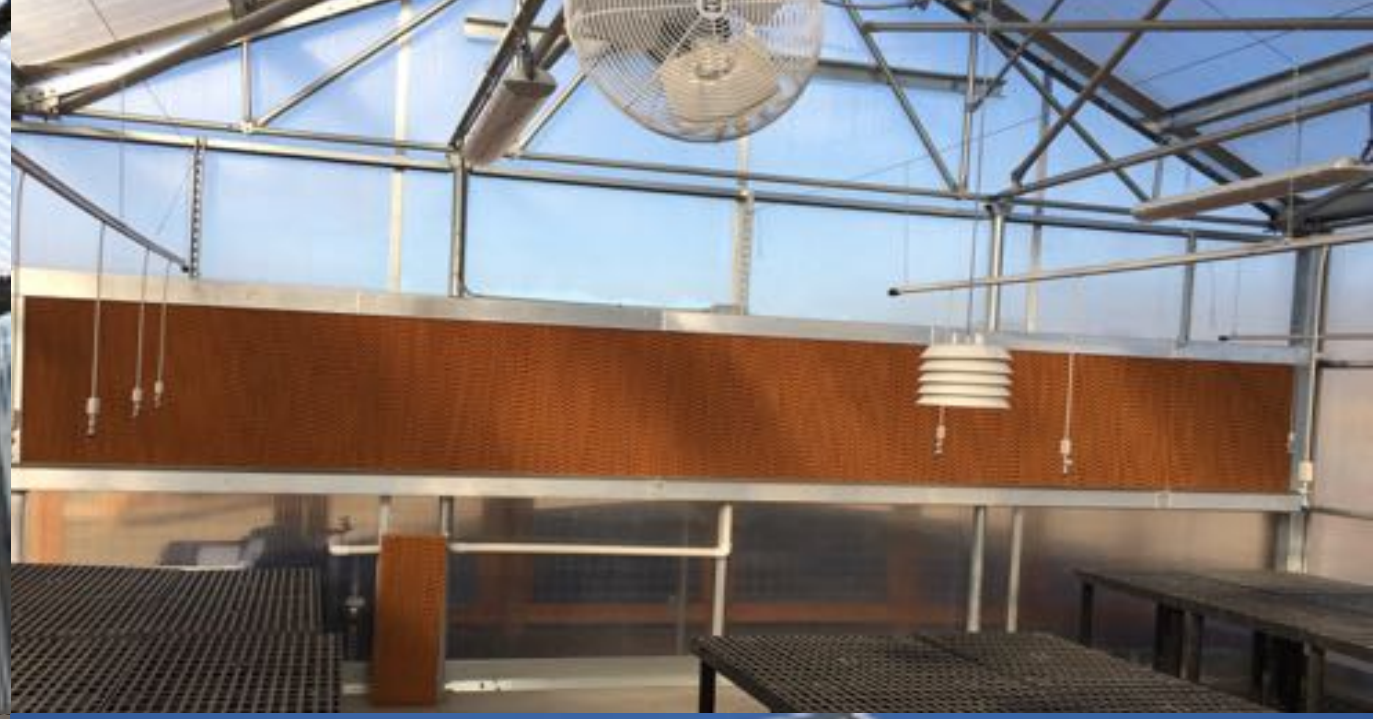
Active: supplemental lighting, LED, metal halide, et al



Passive Design: Heating, Cooling, Air Circulation

Passive Design: Cooling





Active Infrastructure: Heating, Cooling & Air Circulation

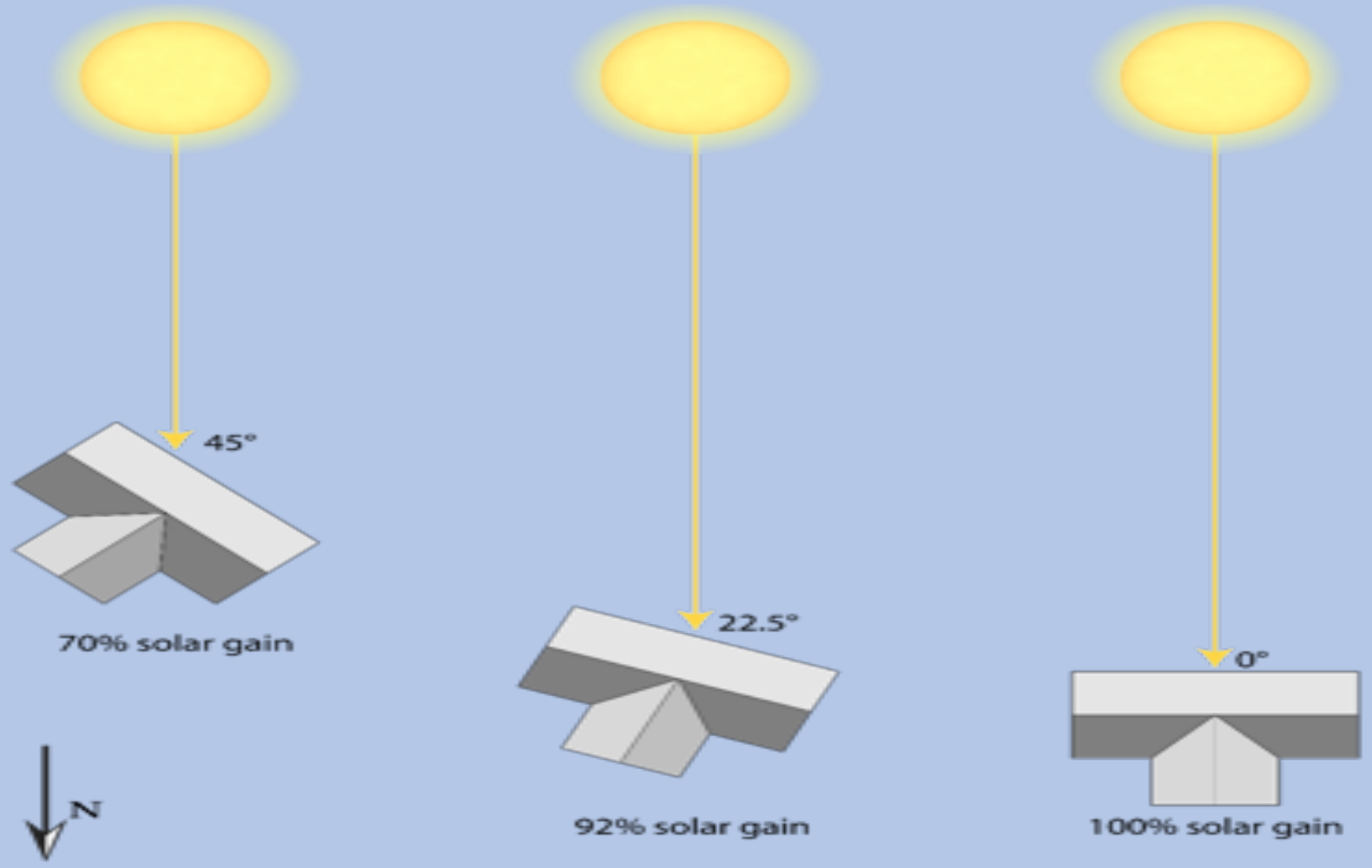
Active Heating:

Microclimatic control through Bottom Heat

Location Considerations and Optimal Greenhouse Siting:

- to optimize & conserve energy flow
- to make the most of natural lighting

Greenhouse Alignment and Solar Gain



Growing your own: focus on Crop Quality

Crop Quality:

- Create capacity to manage environmental conditions optimally
- Soil mix quality and provision for fertility
- Irrigation: timeliness, proper volume and uniformity
- Knowledge of seedling maturity
- Timely plant outs: crop planning, field preparation and ability to prioritize most sensitive crops
- Have the capacity to hold and maintain seedling health
- Pest and disease prevention, monitoring, and intervention

System Efficiencies:

- Workspace design, movement & handling of materials
- Soils: making your own or buying in
- Container choicesSowing methods: vacuum seeders
- Germination chambers
- Optimizing use of bench space
- Irrigation delivery: tools and automation
- Supplemental Fertility: role and modes of delivery

Making Soil Mixes in House:

Advantages:

- Control of inputs, structure, texture
- Can choose more sustainable options
- Can optimize qualites based on crop
- Control of batch size
- Can optimize moisture levels for sowing

Disadvantages

- Must stockpile numerous raw ingredients
- Need to know basic chemistry to balance pH, nutrient levels
- Process can be imprecise without background knowledge, testing and or trial & error
- Huge time and labor inputs required to assemble and mix

Buying in Soil Mixes

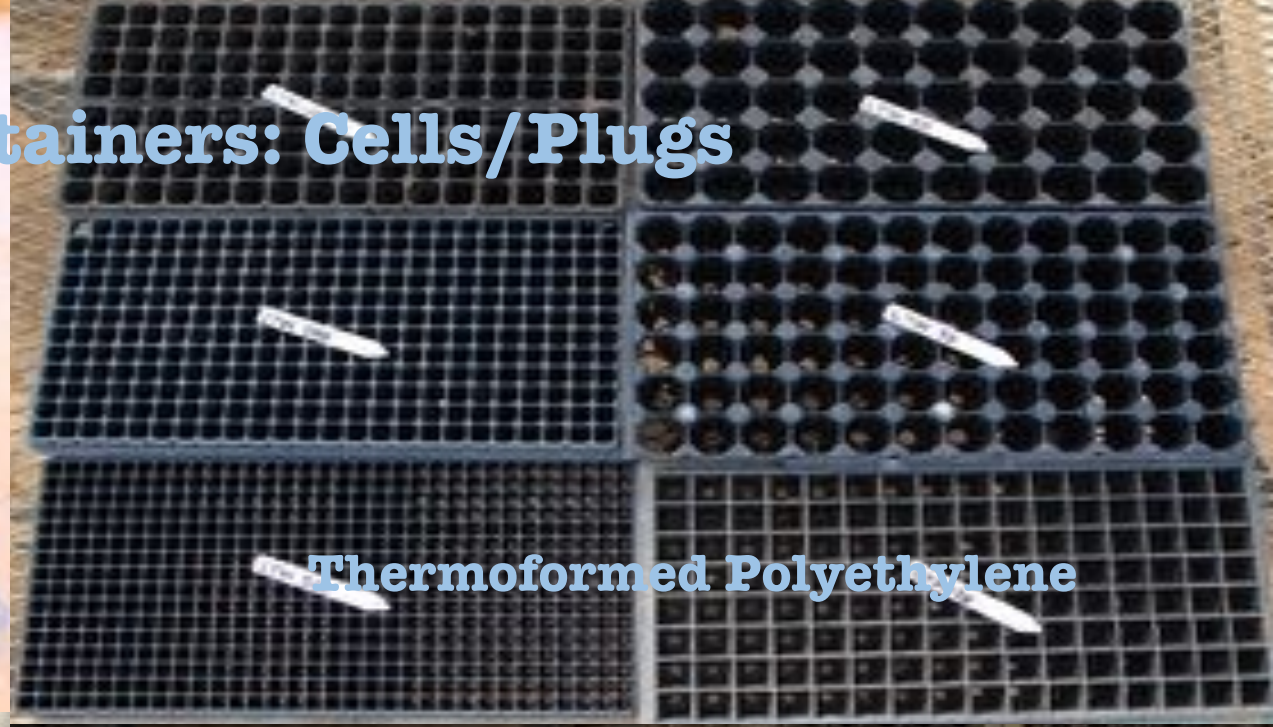
Advantages:

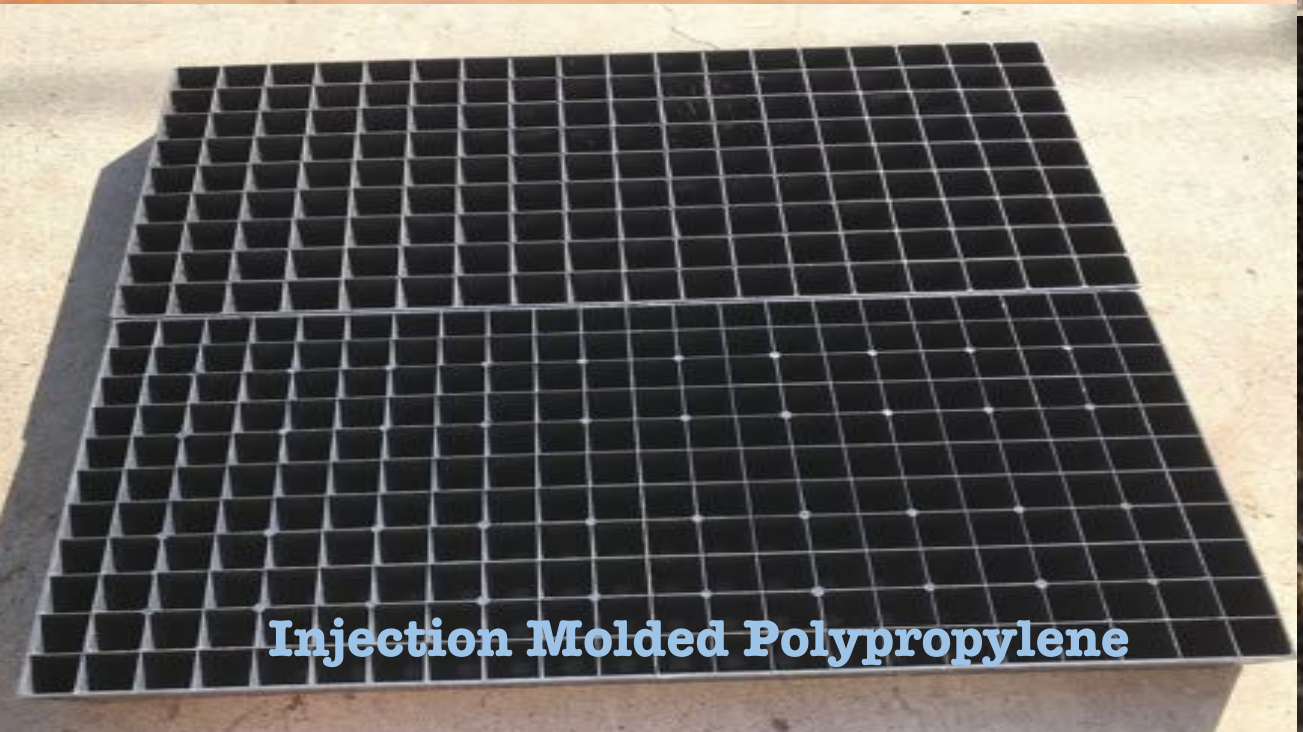
- Possible to purchase high quality mixes with optimal texture, pH, nutrients
- Less materials to stockpile
- Huge time and labor savings
- Cost can be very low
- ”Loose fill” totes much easier to handle

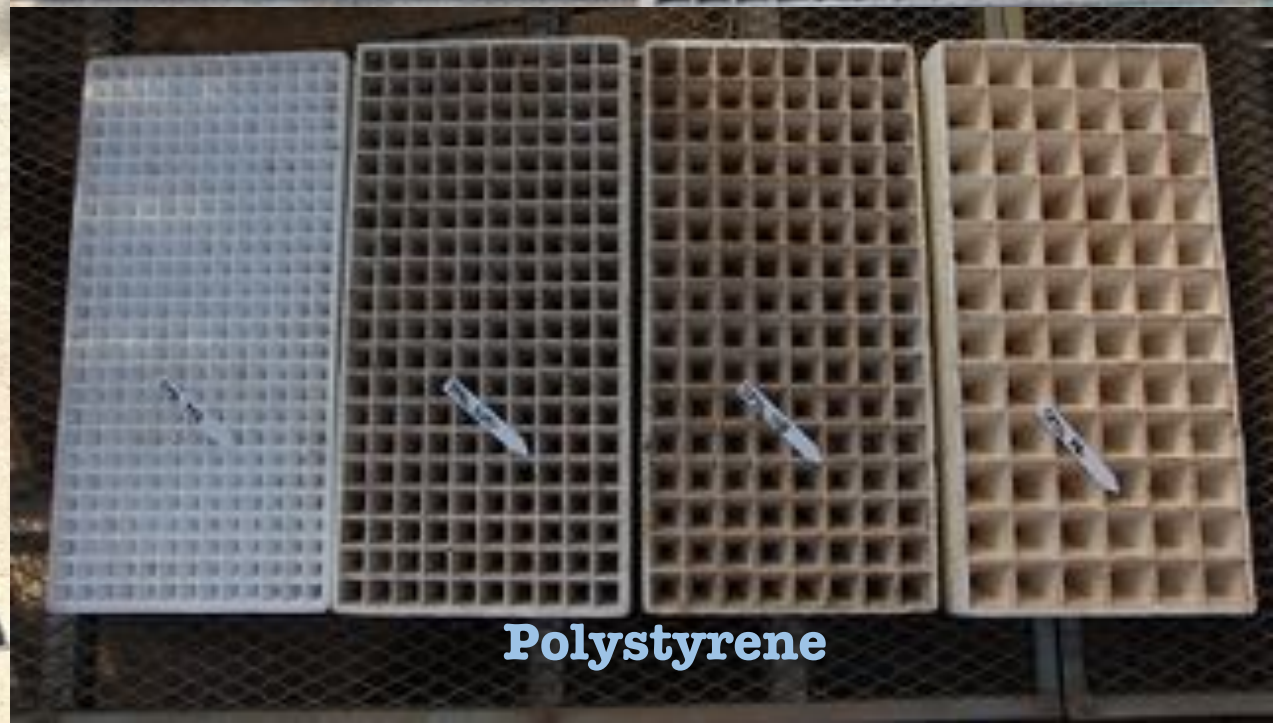
Disadvantages:

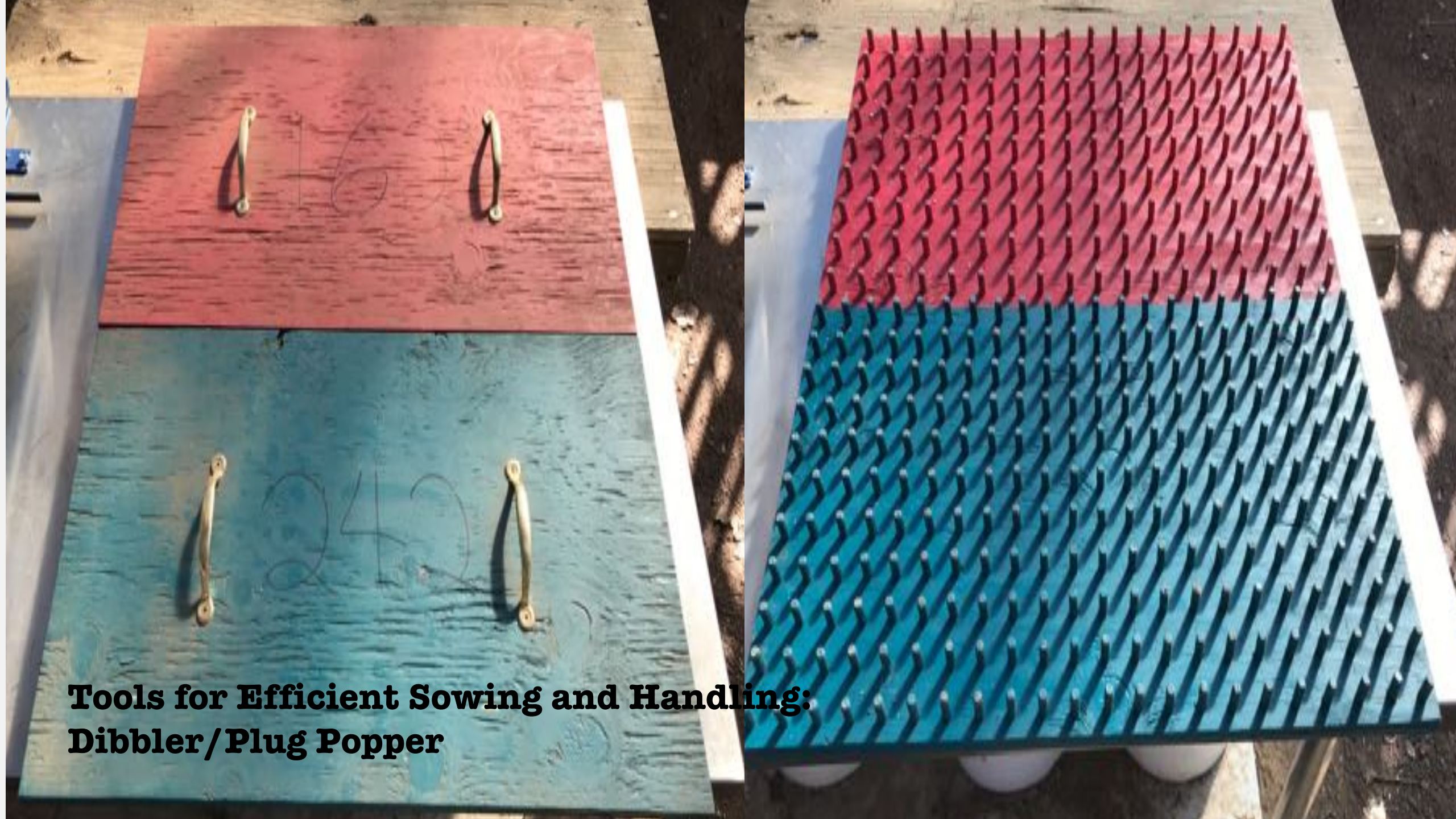
- Some mixes lack any fertility inputs
- Typically composed of non sustainable ingredients
- Large totes require forklift to move
- Compressed bales difficult to handle
- May dry in storage, become hydrophobic
- Cost can be very high

Propagation Containers: Cells/Plugs









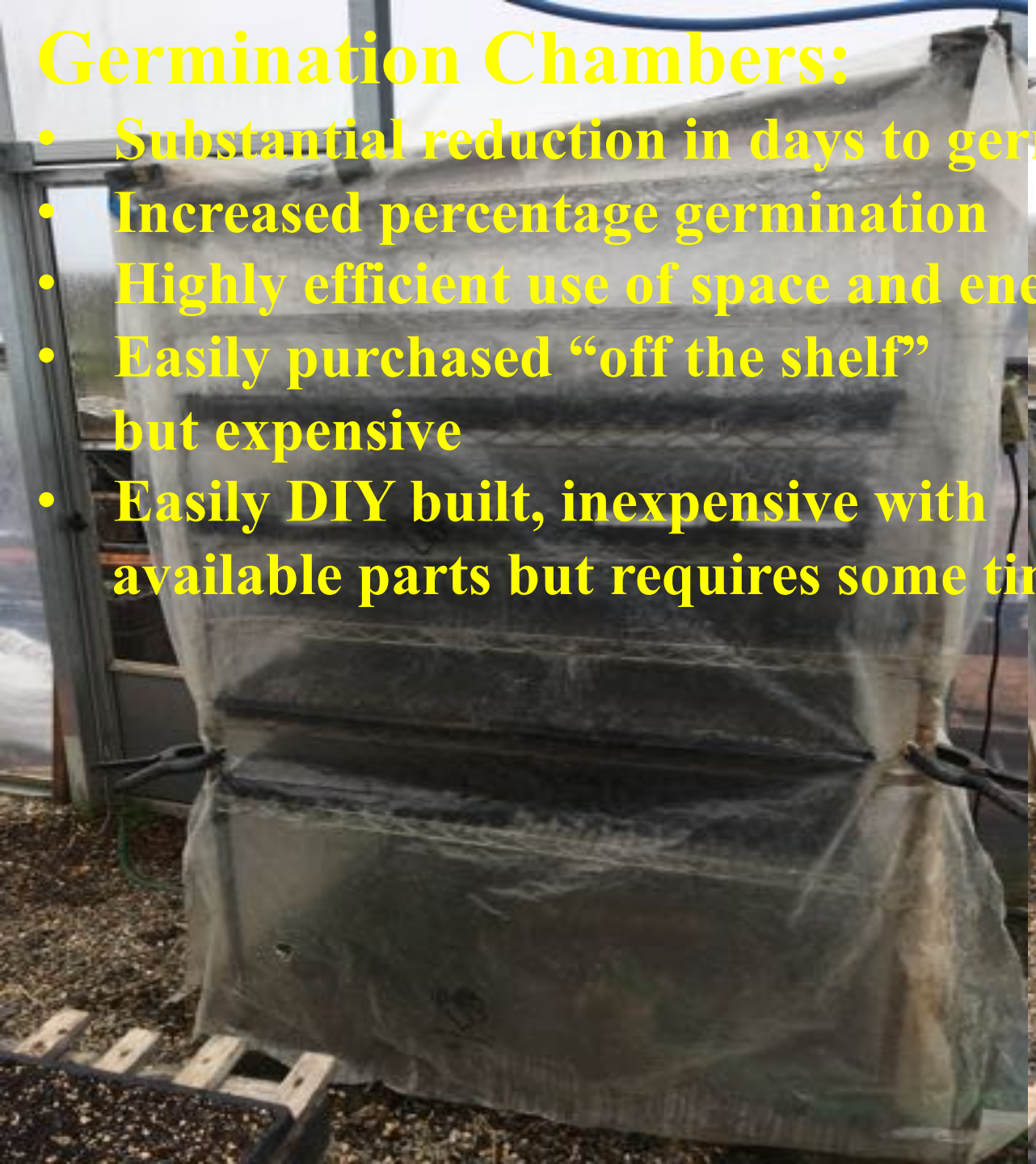
Tools for Efficient Sowing and Handling:
Dibbler/Plug Popper

Tools for Efficient Sowing:
Stationary Vacuum Seeder


Tools for Efficient Sowing:
DIY Vacuum Seeder-a short video

Germination Chambers:

- Substantial reduction in days to germination& time in greenhouse
- Increased percentage germination
- Highly efficient use of space and energy
- Easily purchased “off the shelf” but expensive
- Easily DIY built, inexpensive with available parts but requires some tinkering



Caveats:

- You must be on top of timing…
- Steep initial learning curve to harness the benefits

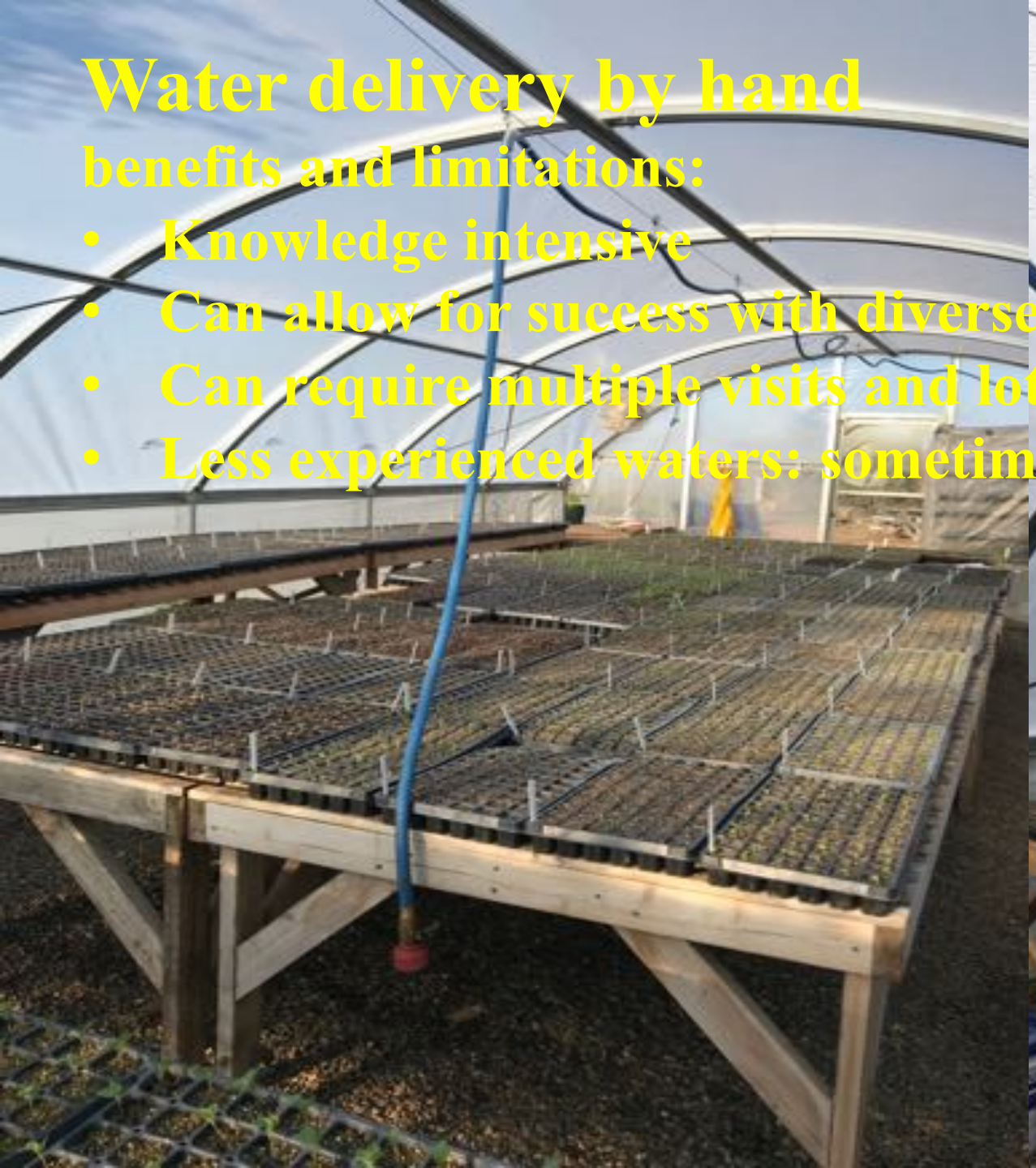
Bench Space, Container Footprint, Cell Size, and Blocking: the challenges of inconsistency

Bench Space, Container Footprint, Cell Size, and Blocking: the benefits of consistency and uniformity

Water delivery by hand

benefits and limitations:

- Knowledge intensive
- Can allow for success with diverse crops
- Can require multiple visits and lots of time to deliver needed water
- Less experienced waters: sometimes too much or too little



Automated Water Delivery

benefits and limitations:

- Upfront capital investment
- Success dependent on consistencies
- Steep initial learning curve
- Blocking critical to success
- Necessity of programing based on weather patterns, anticipated conditions
- Immense time and labor savings
- Improved crop quality

Supplemental Fertility:

- **Reasons to use:**
  - Soil media lacks provision for fertility\
  - To accelerate growth to meet target dates
  - To support crops when “holding” is necessary

Materials:

- Soluable NPK and micronutrients

Modes of delivery

- By hand via dilution in watering can (smallest scale)
- By hand via Injector
- By overhead system via injector

Greenhouse and Propagation Resources

Print Resources:

Beytes, Chris (ed.). 2011 Ball Red Book, Volume 1: Greenhouses and Equipment, 18th Edition. Greensboro Books

Styer, Roger, and David Koranski. 1997 Plug and Transplant Production. Ball Publishing

Web Resources:

Appropriate Technology Transfer for Rural Areas: trove of free PDFs on soil media, greenhouse management, pest and disease management,and much more

www.attra.org

UCSC Center for Agroecology and Sustainable Farm Systems,
Teaching Organic Farming and Gardening, Unit 1.3 Progagation, Grennhouse Management
https://casfs.ucsc.edu/about/publications/Teaching-Organic-Farming/part-1.html

Please attend our upcoming:

Organic Seedling Production Field Day

March 25, 2020 at the
UCSC Farm Greenhouses

And be on the lookout for our free:

Seedling Grower Guide

Available in English and Español
in print and online June of 2020

Thank You

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