

What's New in Substrates, Peat and Alternative Amendments

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Today's Discussion and Journey ☺

- Trends and Future Projections
- Innovations in the Industry
- Challenges for Growing Media
- Traditional and Alternative Components
- Research Areas



Horizon Surfing



Growing Media Demand

Future Demand for Growing Media

Table 4. Total estimated market in 2050 based on the expected market increase (Table 2) and a more realistic estimate of the potentially available materials (Table 3).

	2017 (Mm ³ year ⁻¹)	2050 (Mm ³ year ⁻¹)	Increase (%)
Peat	40	80	200
Coir	11	46	418
Wood fiber	3	30	1000
Bark	2	10	500
Compost	1	5	500
Perlite	1.5	10	667
Stone wool	0.9	4	433
Soils/tuffs	8	33	413
New		65	
Total	67	283	

What's Driving the Demand?



Trend Setters and Market Drivers



“New Crops” Grown in Soilless Systems

➤ Leafy Greens & Herbs



“New Crops” Grown in Soilless Systems

➤ Veggies



“New Crops” Grown in Soilless Systems

➤ Soft Fruit - Strawberries



“New Crops” Grown in Soilless Systems

➤ Soft Fruit - Blueberries



“New Crops” Grown in Soilless Systems

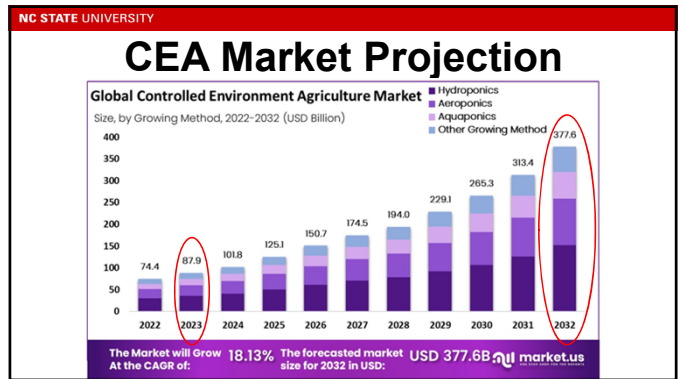
• Soft Fruit - Raspberries



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"New Crops" Grown in Soilless Systems

➤ Cannabis



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Is CEA the Gateway "Trend"?

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Looking Back to See Forward....

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Innovations In/Across Horticultural Industry

Advances in horticultural soilless culture
Edited by Professor Norman S. Grala, University of Bonn, Germany

burleigh.dobbs

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AI and Robotics in Hort/AG

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Product Innovations – Containers/Growing



Biosbased Growing Containers

A viable alternative for growers and consumers.

HC Leader in Horticultural Containers





Grow Organiks
CORK POT

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Innovations/Changes – Perlite Free



Annuals
19'98



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Young Plant Product Developments

- Stabilized plugs (biopolymers, synthetic, organic, etc.)





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Stratified Substrates

10.21273/HORTSCI17019-22

Stratified Substrates Can Reduce Peat Use and Improve Root Productivity in Container Crop Production

Job S. Fields and Kristopher S. Critchlow
Hammond Research Station, Louisiana State University Agricultural Center, 21549 Old Covington Highway, Hammond, LA 70403, USA

Keywords: bark, horticulture, growing media, Petunia, RhizaVision, soilless culture

Abstract: Peat use in horticulture continues to be scrutinized as consumers are becoming increasingly aware of the environmental sustainability concerns associated with peat. Thus, the horticultural industry in diverse to search for peat alternatives. Substrate stratification (i.e., vertical layering of unique media atop another in a singular container) has been studied in nursery substrates and has demonstrated improved resource efficiency with regard to water and fertilizer inputs. However, minimal research has evaluated using the concept of stratified substrates as an attempt to reduce peat inputs in greenhouse production. Hence, the objective of this study was to identify if stratifying costly horticulture media atop of low-cost pine bark can reduce peat use, reduce, and cost within the horticulture industry. A horticulture crop, *Petunia hybrid* 'Supernova Honey', was grown in two distinct substrate treatments: 1) nonstratified (commercial peat-based horticulture substrate) and 2) stratified peat-based substrate layered atop aged pine bark (1:1 by volume) under two different irrigation schedules. Crop growth was evaluated, including growth indices, shoot physiological responses, and root growth measurements. Substrate hydraulic properties such as matrix potential and volumetric water content were monitored over time. The results demonstrated that a petunia crop can be produced in stratified substrate systems and yield similarly sized and quality crops as traditionally grown plants. Furthermore, the stratified substrate-produced crop had improved root productivity, yet less bloom, when compared with nonstratified-grown crops.



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Stratified Substrates



0% 25% 50% 75% 100%

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Stratified Substrates



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Sustainability Efforts

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Warm Fuzzy Feelings

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Initiatives to Counter Peat Debate

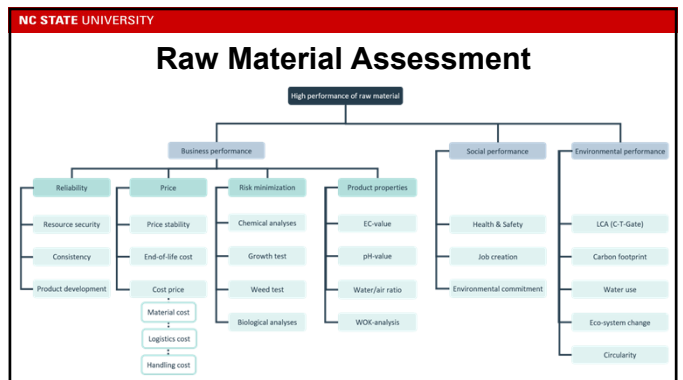
- Environmental Sustainability
 - Carbon footprint, release, sequestration of substrate components
 - Processing inputs required for manufacturing
 - Freight and Transportation Distances
- Substrate Industry Sustainability Efforts
 - OMRI – Listed Production
 - Responsibly Produced Peat (RPP)
 - Responsibly Managed Peatlands Certification

****All growing media components have some degree of environmental impact****

Veriflora Certified
All of our Conestoga (Sphagnum) Peat products are Veriflora Certified. A portion of each purchase goes to bog restoration.

OMRI LISTED For Organic Use • OMRI.org

responsibly produced peat



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Challenges Facing the Growing Media Industry

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Challenges Facing the Growing Media Industry

- Due to on-going and future imposed, proposed, or perceived restrictions on peat extraction and use in horticulture, a global campaign to extend peat supplies and identify extenders and alternatives is underway.

Why Gardeners Should Stop Using Peat, and What to Use Instead
Finding a substitute for peat in a little like making your first cake without gluten. Here's what the experts advise.

LET'S BAN PEAT!

RTIC

NEWS: SPORTS ENTERTAINMENT BUSINESS LIFESTYLE
CURRENT PHASES OF PEAT RESTRICTION
Horticulture at 'critical stage' over peat shortages

By Margaret Beach
Feb 2, 2022

➤ Current Demand AND Supply Chain is fueling the debate and concern.

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Peat Stats

cspma.org

Globally:

- 3% landmass
- 30% carbon sequestration
- Hort. usage: 0.05%

Canada:

- 16% landmass
- 27% of global peatland
- Hort. usage: 0.03%

Global distribution of peatlands

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Peat Stats

PEATLAND USES IN CANADA

• Virgin peatlands	81 %
• Agriculture	15 %
• Urban development	0.8 %
• Reservoirs	0.8 %
• Miscellaneous development	0.7 %
• Ports	0.3 %
• Forestry	0.02 %
• Peat moss harvesting	0.03 %

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Canadian Sphagnum Peat Moss Association
Association canadienne de la tourbe de sphagnum
Canadian Peat: Ideal For Growing, Fair Generations to Come.

2023 CSPMA Report

FOR IMMEDIATE RELEASE
2023 Canadian Harvest of Horticultural Peat Moss as of August 31

Summary:

- Poor weather conditions yielded extraction levels below target... by 45+%

OTTAWA, Ontario, Canada, September 13, 2023 – The Canadian Sphagnum Peat Moss Association (CSPMA), whose members represent close to 90 per cent of North America's horticultural peat extraction, is reporting its annual level of harvest for the 2023 season. The annual survey of members was conducted on the status of their 2023 Actual Harvest as a percentage of their 2023 Expected Harvest as of August 31 (harvest will continue in some regions, weather dependent). The harvest overall varied regionally, but well known significantly poor weather conditions across North America meant that harvest, unfortunately, was well below expected levels. However, with appropriate planning and carry over from 2022, the industry is confident that the needs of the market will be filled.

Regional Results:
In Western Canada (Manitoba (MB), Saskatchewan (SK) and Alberta (AB)), all regions were below the targeted volumes (75% in MB, 68% in SK, 48% in AB). In some cases, record breaking rain, and the impacts of Canadian forest fires significantly delayed the harvest season, a situation that extended through much of the summer. As we approach the end of summer, we see more favorable conditions, but these are likely insufficient to enable target volumes to be reached.
In New Brunswick (NB), both North and South regions saw the worst historic conditions for harvest and results were significantly below expectations (40% in NB North, 30% in NB South). Varied weather patterns combined with frequent open fall through the early and mid summer months constrained harvest throughout the Maritimes, including Prince-Edward-Island, Nova Scotia, and Newfoundland and Labrador. The harvest on Quebec's South Shore (72%) and North Shore (50%) were also below expectations. Similar summer storms, particularly on the North Shore, did not permit either region to achieve its targeted volumes. Similar weather patterns affected the Ontario (78%) harvest.

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Other New or Ongoing Challenges

- Geopolitical crises – pending and yet unknown
- Increasingly volatile global weather patterns affecting peat extraction
- Spread of misinformation and use of "cherry picked" data to drive

- Discovery of "Issues and Threats" of peat alternatives
- Decisions of the/some Big Box Stores.....

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Two Main Issues.....

1. Demand for Growing Media

2. Peat Supply and/or Reduction


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Coconut Products

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Coconut Products

- Coconut Materials and Products
 - Global use of coir is second to peat in volume and will only continue to increase
 - Coir suppliers are being innovative with new product offerings
 - Strong reliance and reputation among many growers (and specific crops)





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Bark Products


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Building Bark

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Engineered Barks



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Engineered Barks



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Biochar Products


Biochar & Carbonization
Beneficially impact 12 of the 17 UN SDGs



Biochar's debut at the United Nations
fingerlakesbiochar.com • 2 min read

USDA Forest Service
Black to the Future: Biochar and Forests


Biochar at a glance
Critical benefits such as soil remediation and reducing wildfire risk.



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Biochar

- Biochar Materials and Products
 - Noun or Verb?
 - A lot of research interest in the past 10-12 years
 - Charring of organic materials offer “new uses”
 - Some successful (impactful) use of charred materials in soilless crop production



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Some Other Organic Feedstocks


- Miscanthus and Bamboo
- Cotton and Corn Stalks
- Dairy Manure/Fiber
- Palm Oil Fiber
- Water Hyacinth
- Seaweed/kelp
- Hemp Biomass
- Reed Grass
- Figue
- Jute (Burlap)
- Anaerobic Digestates



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Wood Substrates


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Wood Products as Substrates

- Most researched alternative in the past 20 years
 - Holds the most potential
 - Proximity
 - Malleable
 - Economical




	2017 (Mm ³ year ⁻¹)	2050 (Mm ³ year ⁻¹)	Increase (%)
Peat	40	80	200
Coir	11	46	418
Wood fiber	3	30	1000

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History of Wood Substrates

- Alain Courtabessis “invents” Hortifibre (circa 1979-1980)
- Original product was disc refined but switched to extruder
- Patented the process in 1981 (sold it; now expired)
- Since 1980.....A LOT HAS HAPPENED!



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North America Wood Fiber

Evaluation of Pine Bark, Pine Bark With Wood, and Pine Tree Chips as Components of a Container Plant Growing Media¹
 A.J. Lakso, Jr.¹ and V.E. Nash²
 South Mississippi Branch Experiment Station
 Mississippi State University
 Piquetteville, MS 39070 1986

HostScience 40(5):1513-1515, 2005.

Chipped Pine Logs: A Potential Substrate for Greenhouse and Nursery Crops
 Robert D. Wright and Jake F. Browder
 Department of Horticulture, Virginia Tech, Blacksburg, VA 24061 2005

WholeTree Substrates Derived from Three Species of Pine in Production of Annual Vinca
 Glenn B. Fain^{1,2}, Charles H. Gilliam^{3,4}, Jeff L. Sibley^{3,4}, and Cheryl R. Boyer^{2,5} 2008



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1) Processing Techniques


- Engineered Wood Fiber
 - Differing processing methods:
 - Extruded
 - Disc Refined
 - Hammer Milled



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Wood Toxicity Based on Manufacture Method

→ Extruder → Disc Refiner → Hammer Mill



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Wood Toxicity Based on Manufacture Method

→ Extruder → Disc Refiner → Hammer Mill



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Hammer-milled

- Traditional machinery used for processing materials
- Variables influencing end-product type and consistency:
 - Moisture, wood chip size, screen size, rpm's,
- Cannot make true "fiber" but can make many sizes
- No heat generated in this process- chemicals!**

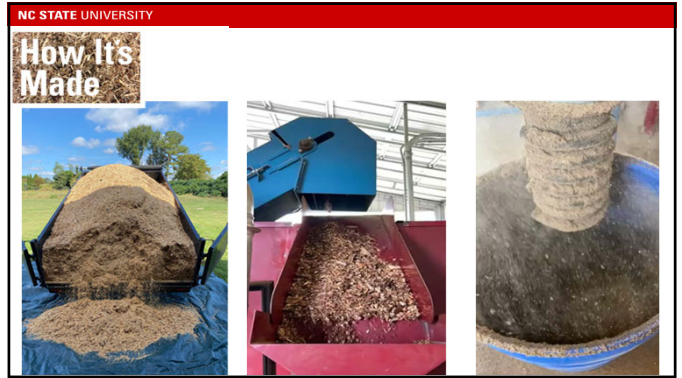


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Welcome to S.P.A.R.C.!

Substrate Processing And Research Center





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Aging Wood Materials

Comparison of Aged and Fresh *WholeTree* as a Substrate Component for Production of Greenhouse-Grown Annuals¹

Whitney G. Gasker¹, Chae B. Park¹, Donald J. Eaker¹, Charles H. Gilliam², and Jeff L. Hildey¹
¹North Carolina State University, Department of Horticulture,
Raleigh, NC 27697

Assessing Phytotoxicity in Fresh and Aged Whole Pine Tree Substrates²

Anthony L. Wiltcher
USDA-ARS Southern Horticultural Laboratory, Poplarville, Mississippi 39470
University of Southern Mississippi, Department of Biological Sciences, Hattiesburg,
Mississippi 39409
Email: anthony.wiltcher@ars.usda.gov

What happens during aging?

- Volatilization
- Solubilization/Leaching
- Microbial degradation

Home-Grown Media
Young's Plant Farm Produces Its Own Sustainable Substrate






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Metrolina Greenhouses, Huntersville, NC

- 230 acres
- 5-6 million cubic feet of substrate annually



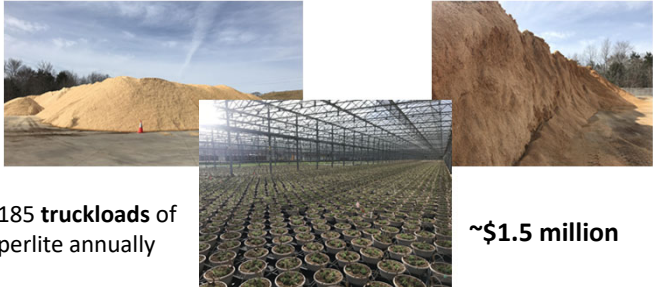
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Metrolina Greenhouses



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Stopped Using Perlite in 2017



185 truckloads of perlite annually

~\$1.5 million

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Metrolina Aging Piles of Sawdust



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Wood Fiber Production

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Many Refining Options.....

CLEXTRAL

Extrusion
Expertise
Excellence

Wood fiber plants for substrates

The best technology to produce wood fiber for substrates

PROMEKO

BIOEXTRUDER

the wood fiber company

PREMIER TECH

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Newes

P.R. Russell

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Expanding the Species and Feedstock Options.....Nationally.

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Greenville, California

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Fire Prevention Thinning

● Non-Thinned

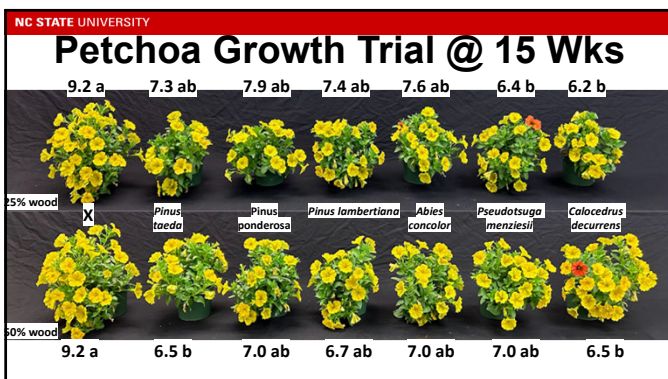
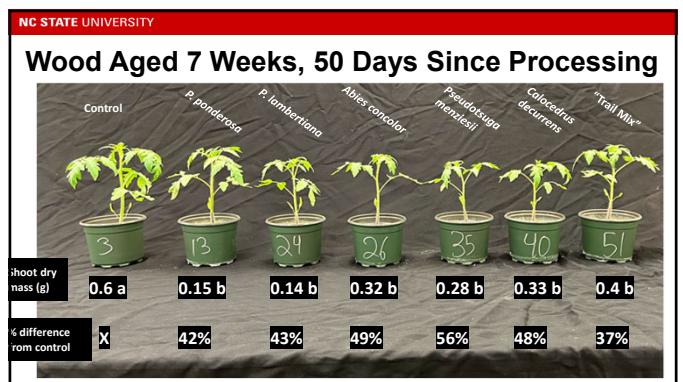
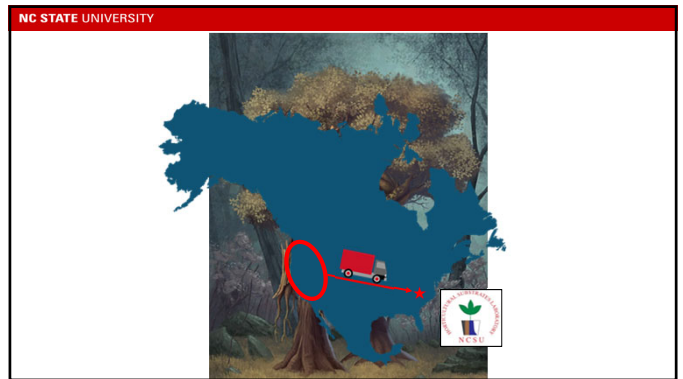
● Thinned

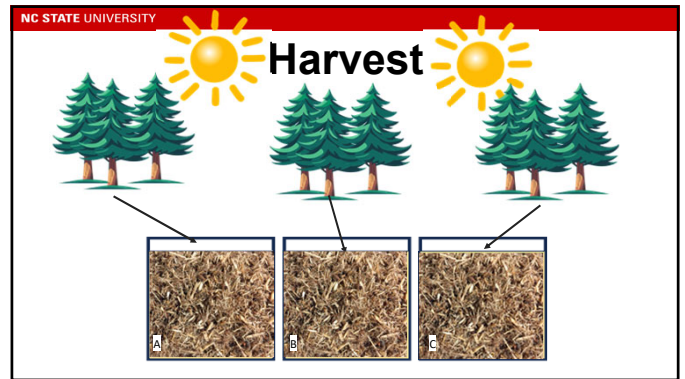
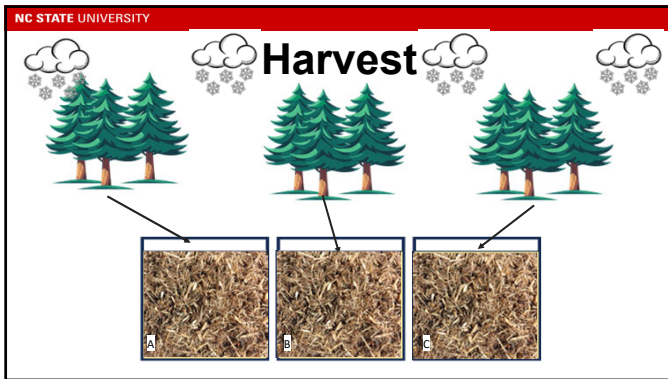
● ~20 tons of biomass per acre.....

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Western Wood (Fiber)

- A partnership to expand efforts of understanding species (valorization) to utilize for wood fiber production from forest thinnings on West Coast.





Some Known Advantages (Pros) of Wood Substrates

Summary of Potentials/Advantages

- Wood is a blank canvas.....
- Abundant & Regional (depends on location)
- Physically stable
- Excellent rooting
- Good storage properties (when dry)
- Offered in various forms to fit specific needs
- Can be economical
- Production not reliant on weather

Summary of Concerns/Issues

- Science can't keep up with demand
- Some use of bad wood sources
- Green wood toxicity
- Nutrient tie-up and fertility
- Changes to pH Management
- Changes to irrigation management
- Many unknowns remain

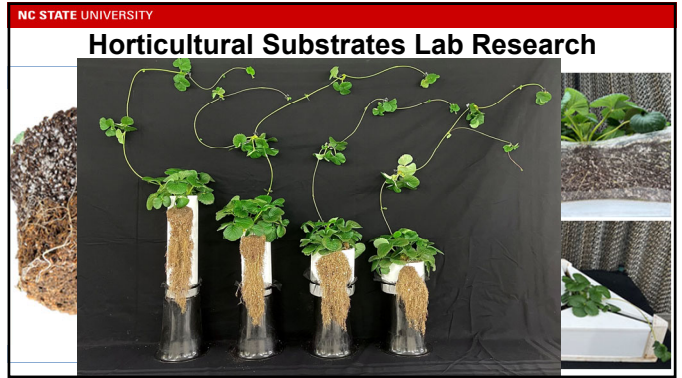
Other Substrate Research Areas



Beyond Soil: Advancing Strawberry Cultivation Through Soilless Substrate Systems

Brandan Shur
2022 - 2024

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Horticultural Substrates Lab Research



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Horticultural Substrates Lab Research

- Substrate Components
 - Alternative substrates (wood products)



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Week 6



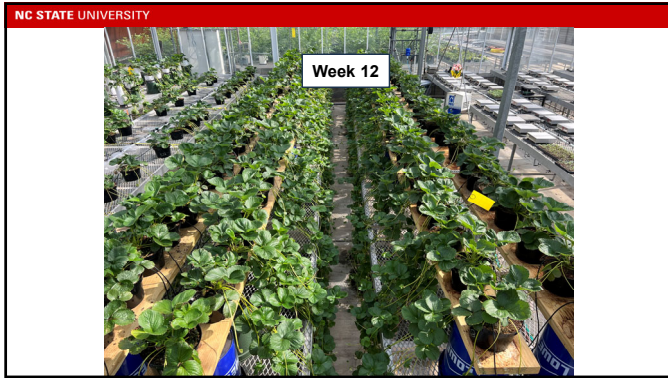
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Week 8



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Week 10



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Horticultural Substrates Lab Research

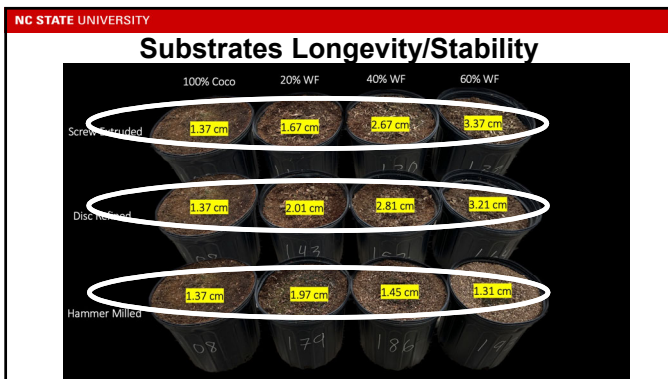
- Container Modeling
 - Predicting the air-water relationships in different container geometries

	Strawberry Pots	Strawberry Trough	Strawberry Bag	
Air	???	???	???	???
Water	???	???	???	???
Porosity	???	???	???	???

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Horticultural Substrates Lab Research

- Blueberries: substrate volume, porosity, composition, root growth, stratification, etc..



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Summary Points

Growing Media – Past, Present and Future

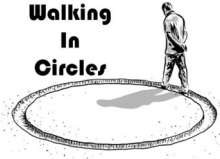
How to deal with **changes** in the growing media market!

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A Few Takeaways....

- ❖ Our industry is on the FOREFRONT of global change
- ❖ "Substrate Security" is Food/Health/National Security!
- ❖ Global trends based on perceptions, social media, political platforms, etc. ARE helping to steer the future of our industry
- ❖ We must remain both **PROACTIVE** and **REACTIVE**

**Walking
In
Circles**



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THANK YOU!

