

How Can The Greenhouse Industry Benefit From Changing The Materials Used For Making Growing Containers?

Jessica Weller

HORT 4092, Spring 2024

Faculty adviser: Professor Stevie Famulari

Bachelor of Science in Horticulture

University of Cincinnati College of Design, Architecture, Art, and Planning

School of Planning: Horticulture

Abstract

The overuse of plastic containers in greenhouse and nursery production surpasses the amount being recycled. A solution to this issue involves a shift in the materials used for making containers. Specifically, containers employed for plant growth are largely single-use due to the higher costs associated with reusing them in production. Due to chemicals used during the growing process recycling containers is challenging. Transitioning to eco-friendly alternatives holds the promise of positively impacting the environment and curbing plastic waste generated in growing containerized plants. This research delves into the types of plastics currently utilized, their purposes, and the recycling processes involved. This is compared to new eco-friendly container options, analyzing their advantages and disadvantages. The significance of this study lies in the exploration of potential materials for manufacturing containers in greenhouse and nursery production. The result of this paper finds alternatives to plastic, fostering sustainability and reducing reliance on plastic for containers, thereby contributing to a more sustainable industry.

Inventory & Analysis

- 1 cubic foot bag Berns Potting Soil
The Berns potting soil is used for its consistency and quality of materials used in its formulation
- GooingTop LED Grow Light
6000K Full Spectrum Clip Plant Growing Lamp with White and Red LEDs.
- 8- EcoGrown Standard Round Pot, size 5 inches
Will be used as a test for different materials. Made from recycled newspaper and a plant- based binding agent.
- 8- 3" biodegradable Seed Starting JIFFY-POT
Will be used as a test for different materials. Made from harvested peat.
- 8- Jiffy Seed Starting Expanding Peat Pellets
Will be used as a test for different materials. Made from peat with netting derived from cornstarch.
- 3" plastic pots
Will be used as a constant in the experiment to replicate what is currently being used.
- 2- pot holding trays
The trays hold the containers in place and to keep things organized.
- 1- small watertight tray
This tray holds the peat pellets.
- Tomato, Roma VF seeds, *Solanum lycopersicum* "Roma"
Seeds that I planned on growing this year.
- Basil, Everleaf emerald Towers seeds, *Ocimum basilicum* "Everleaf Emerald Towers"
Seeds that I planned on growing this year.
- Plant tags
These keep track of what is planted in each row.

Major Project Elements

Containers

The focus for this project is looking into different types of materials that can be used for making bio-containers.

Storing

It is important to know how to store the bio-containers properly to extend their longevity.

Consumer appeal

For bio-containers to become more common in greenhouse production consumers need to like them for them to sell and make a profit.

Recycling

Where recycling takes place and how long is the process.

Literature review

The issue with plastic containers

- Leaks chemicals
- Pollutes the water
- Overfilling landfills
- Large carbon footprint

Compatibly in greenhouse production

Compostable containers are more compatible for greenhouse production

- Rigid
- Has stronger wet and dry strength
- Already used by some companies (Groovy Plant Ranch)
- Improvement in plant growth
- Best used in annual production

Greenhouses can benefit by aligning the industry with environmentally friendly practices, reduce their environmental impact, and open new marketing opportunities, such as environmentally conscious consumers and areas for growth.

Solution

Greenhouses can benefit in many ways by aligning the industry with environmentally friendly practices, reduce their environmental impact and it opens new marketing opportunities and growth.

Switching to bio-containers will lessen the environmental impact by the greenhouse industry. By reducing plastic use for growing containers the 4 billion containers made in one year will be significantly lessened which in turn will reduce the amount of single use containers going to the landfills. It will also be helping the environment by not adding more items that can leach chemicals into our environment.

Consumers are becoming more environmentally conscious and are more concerned about environmental issues such as plastic pollution and waste management. Offering products grown in eco-friendly containers can be a selling point for many consumers because:

- Reduce waste sent to landfills
- Do not leach harmful chemicals
- Reduces their environmental footprint
- Can use in their compost

Future

Bio-containers are the future of the greenhouse industry. As more companies start to transition they will over time become cheaper and turn into the new "normal" for annual production.

As time goes on the use of these containers will be much easier as companies share what works best for them and what does not work.

Promoting better and safer alternatives



(Weller, J. 2024)

Case Study 1

"Physical Properties of Biocontainers for Greenhouse Crop Production" by Michael R Evans, Matt Taylor, and Jeff Kuehuy

Used 10 different types of containers in the experiment

(4-inch plastic, 5-inch plastic, OP47, fertil, cowpot, coconut fiber, peat, rice hull, paper, rice straw)

Evaluated for dry and wet vertical, lateral, and punch strength, assessed water usage and loss, looked algae and fungi growth, and observed decomposition based on original dry weight.

Case Study 2

"Golf Balls That Are Safer For The Environment"

Biodegradable golf balls are a thing. Peta Case. (2020). Biodegradable Golf Canada Inc. (2022). Causeartist. (2023). Dekate, N., Navarette, D., & Gardon, R., Golf balls as pollution. Oregon Courses, Jarzecki, K., Zhao, B., Nakamura, K., & Wu, P. (2018)

The problem with golf balls

- Crafted from a diverse range of materials, including rubbers, resins, plastics, and metals
- When golf balls are lost or end up in bodies of water retrieving them can be challenging



(Causeartist, 2023)

Biodegradable golf balls

- Created from biopolymers, natural rubber, and other organic substances, chosen to have a balance between durability, performance, and biodegradability (Causeartist, 2023)
- Keeping the high-quality and performance standards
- American company, Biodegradable Golf Balls, makes their golf balls from compressed cornstarch with a polyvinyl alcohol (PVA) coating, offering an 80% performance rate.
- Specifically tailored for players near bodies of water and are not intended for professional green use (Biodegradable Golf Canada Inc., 2020).

Case Study 3

"Evaluating Biodegradable containers as Alternatives to Plastic Pots" by Renee L. Conneway

Used 9 different types of containers in his experiment (coir, manure, wood fiber, peat, slot rice hull, PLA bioplastic, PHA bioplastic, solid rice hull, and straw)

Evaluated the potential use of bio-pots for greenhouse production by looking at

- Plant growth
- Watering frequency
- Container strength
- Substrate
- Algal growth

Evaluated the performance of biodegradable pots in a landscape setting by looking at

- Plant performance
- Pot performance



(Weller, March 6, 2024)

PLASTIC

CONTAINERS

AVERAGE NUMBER OF CONTAINERS USED IN THE BUSY SEASONS

SMALL GREENHOUSES

~200,000

MEDIUM GREENHOUSES

~1,000,000

WHOLESALE GREENHOUSES

~6,000,000

CONTAINER CROP INDUSTRY

~4 BILLION per year (sizes ranging from 3.25" and larger)



(Florabally, 2021)

Plastic Pollution

- Only around 8.5% of plastic containers are being recycled in the U.S.
- Most plastic containers end up in landfills or fresh water and oceans
- Takes hundreds to thousands of years to completely decompose
- Releases chemicals into their surroundings
- 4 billion containers produced in one year adds up

Issues Regarding Recycling

- Containers need to be clean and sorted
- Have to meet weight and/or quantity
- Cost of labor and cleaning chemicals

TYPES OF ALTERNATIVE POTS			
Type	Description	Benefits	Constraints
Plantable • Can be planted directly into the soil. Designed to stay intact during short-term production; within 3-12 months can be planted directly into soil.	• Mostly made from peat, cow manure, rice hulls, wood pulp, coconut coir, paper and/or hemp.	• Allows roots to grow through the walls of the pot as it decomposes in the landscape. • No need to remove a container • Cleanup and disposal costs are drastically reduced • Rate of decomposition is influenced by weather, soil type and irrigation.	• Appearance • Durability • Degradation is possible during production process • Large nursery production containers
Compostable • Pots designed for the plants to be removed when planted.	• Made from rice hulls, recycled paper, cardboard, poultry feathers, bamboo or other natural fiber waste products.	• Some types (such as molded fiber and rice hull containers) are available in size for production of larger nursery crops.	• They are either backyard compostable or industrial compostable (composting that involves heating it to a high enough temperature that allows microbes to break it down.)

(Association of Professional Landscape Designers, 2020)

Benefits

- Significant reduction in single use growing containers
- Environmentally friendly
- Does not leave behind harmful chemicals
- Promotes better and safer alternatives



(Weller, March 6, 2024)

