e-GRO Alert

W. Garrett Owen[1]
owen.367@osu.edu

Volume 14 Number 8 February 2025

Avoid Holding Rooted Cuttings and Plugs Too Long

Holding rooted cuttings and plugs too long in propagation trays can lead to plant stretch, uneven growth, premature flowering, nutritional disorders, and increased pest and disease risks.

In greenhouse production, rooted cuttings (liners) and seedlings (plugs) are the foundation of high-quality crops (Fig. 1). However, holding them too long in liner or plug trays can lead to significant challenges that compromise plant quality and increase production costs. This alert highlights the risks associated with prolonged holding and provides actionable strategies for growers to mitigate these issues and maintain crop quality.

© W. Garrett Owen

Figure 1. Example of a high-quality rooted 'Calliope® Medium Dark Red GL' geranium liner. Photo by: W. Garrett Owen, OSU.

The Risks of Holding Liners and Plugs Too Long

Holding rooted cuttings and plugs too long in liner or plug trays can significantly impact plant quality (Fig. 2). Overcrowding in trays leads to competition for light, causing plants to stretch with elongated stems (Fig. 3). Stretched plants are more fragile during transplanting, making them prone to damage and resulting in uneven growth in finished containers. For example, Figure 4 demonstrates the impact of holding coleus liners too long; within a row, plants in the middle of the tray are taller due to shading from adjacent plants, while plants along the edges of the tray are shorter because of less competition for light. This uneven growth complicates transplanting efficiency.

[1] Assistant Professor and Extension Specialist, The Ohio State University

Overcrowded and stretched young plants with dense foliage can create microclimates within trays. High humidity and limited airflow are favorable for pathogen infection (Fig. 5). Extended holding also stresses young plants and triggers premature flowering. Premature flowering is problematic as it diverts energy away from vegetative growth and limits the plant's ability to establish after transplanting; additionally, flower buds and flowers can be points of pathogen infection. Stressed plants are also more susceptible to pest infestations such as aphids, mites, or thrips.

Nutritional disorders associated with substrate pH or fertility can also develop during prolonged holding of rooted cuttings (Fig. 6) and plugs. These disorders often develop because of the limited substrate holding capacity within the cell, causing plants to exhaust the limited nutrients available in the propagation substrate. Symptoms such as chlorosis (yellowing), interveinal chlorosis, or stunted growth may develop and can be difficult to correct once the plants are transplanted into their final containers.

Mitigating Problems Associated with Extended Holding

1. Proper Planning

Proper planning is essential to avoid issues caused by holding rooted cuttings and plugs too long. Growers should carefully schedule propagation and transplanting timelines to minimize the time young plants spend in trays. Growers should coordinate space availability in the greenhouse to ensure that rooted cuttings and plugs can be moved out of propagation areas without delay. If young plants are received from propagators, then coordinate labor to inspect and space to quarantine plants as needed. Furthermore,

Figure 2. Holding rooted cuttings and plugs too long in liner or plug trays can significantly impact plant quality. Photo by: W. Garrett Owen, OSU.

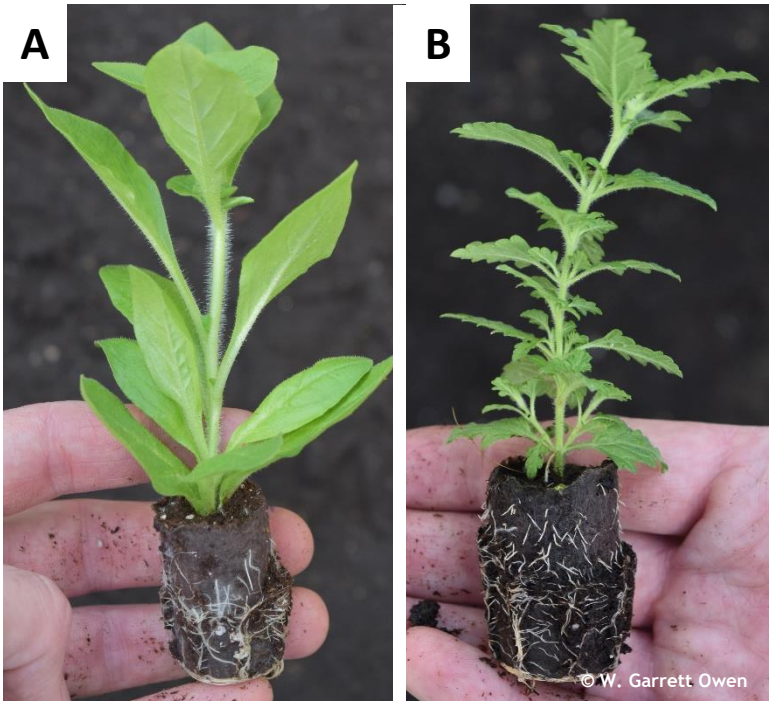

Figure 3. Petunia (A) and verbena (B) liners were held too long and became overcrowded in the liner tray leading to competition for light, causing plants to stretch.
Photos by: W. Garrett Owen, OSU.

105-cell Liner Tray

Transverse Cross Section

Tray edge | Tray center | Tray edge

Longitudinal Cross Section

Tray edge | Tray center | Tray edge

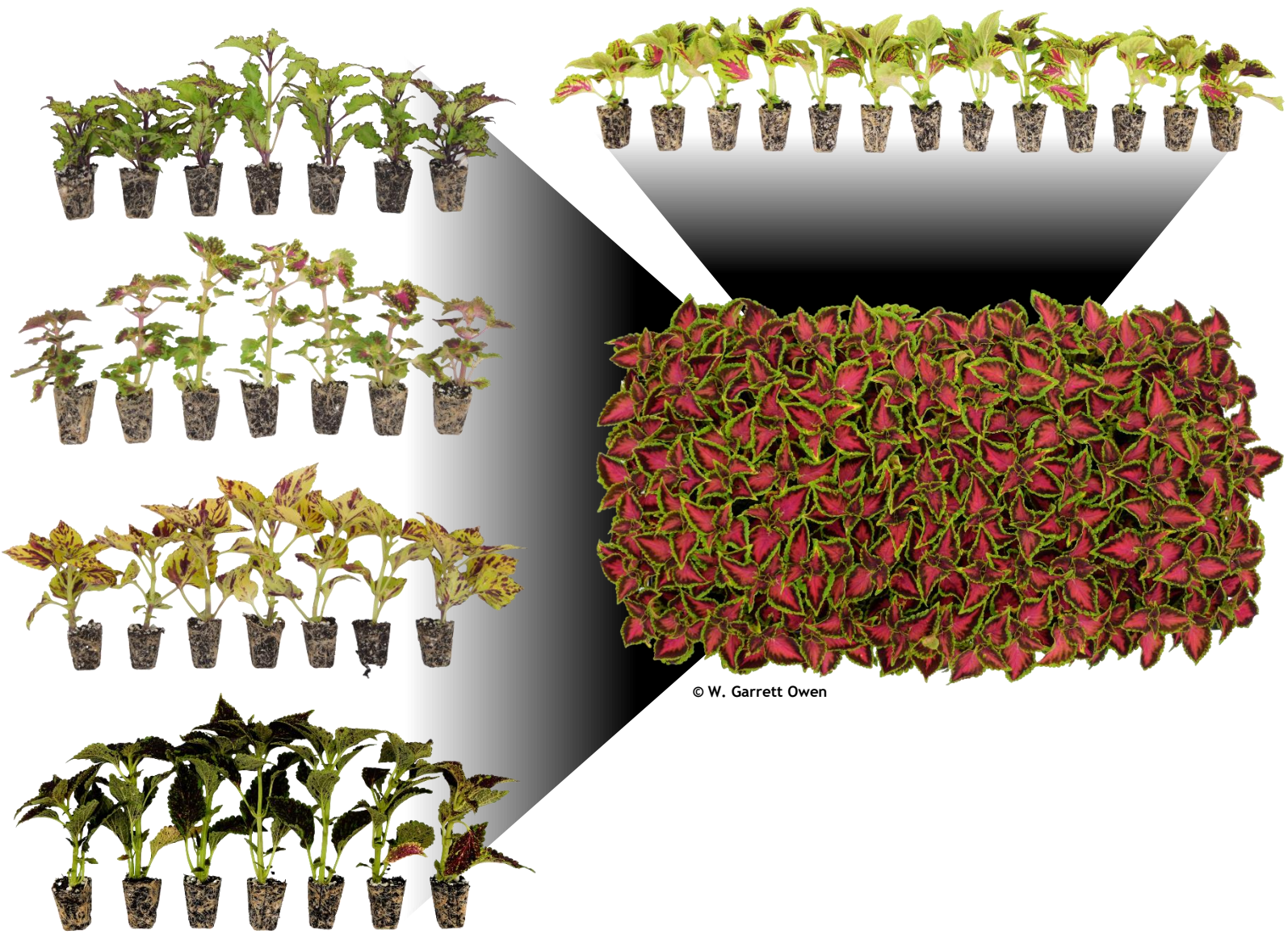

Figure 4. Holding rooted coleus cuttings too long in liner trays causes overcrowding and plants to stretch. Within a row, plants in the middle of the tray are taller due to shading from adjacent plants, while plants along the edges of the tray are shorter because of less competition for light. This uneven growth complicates transplanting. Photos by: W. Garrett Owen, OSU.

ensure adequate labor is available or scheduled to transplant young plants into their final containers.

While proper planning and labor coordination are crucial, there may be instances where liners and plugs need to be held. This may be a result of inclement weather conditions, delayed deliveries of supplies or hard goods, equipment failure requiring repairs, or the young plants requiring extra time to root or grow before transplanting.

2. Transplant Promptly

The most effective way to avoid problems associated with prolonged holding is to transplant rooted cuttings or plugs into their final containers as soon as possible (Fig. 7). Prompt transplanting ensures that plants have sufficient space, light, and nutrients to grow uniformly. Delayed transplanting increases the risk of stretch, making it more difficult for plants to recover once moved into their finishing environment. For information on proper transplanting techniques, refer to e-GRO Alert 14.03: Best Practices for Transplanting Plugs and Liners for Spring Production.

3. Environmental Management

Managing the greenhouse environmental conditions is critical for preventing stretch during extended holding periods. Providing adequate spacing between trays reduces shading among plants and limits elongation caused by competition for light. Maintaining proper photoperiods also helps mitigate premature flowering or tuber formation in certain crops like petunia or dahlias.

Managing greenhouse air temperature is a powerful strategy for controlling stem elongation. Growers can employ two effective techniques: DIF (temperature differential) and DROP. The difference (DIF) between day and night temperatures can significantly influence plant growth. A positive (+) DIF, where day temperatures exceed night temperatures, promotes stem elongation. Conversely, a negative (-) DIF, with warmer nights than days, inhibits stem elongation. As the DIF becomes more positive, plants tend to grow taller, while a smaller or negative DIF results in shorter, more compact plants.

Figure 5. Overcrowded and stretched young plants with dense foliage can create humid microclimates within trays which are favorable for pathogen infection. Photo by: W. Garrett Owen, OSU.

Figure 6. Scaevola liners held too long developed interveinal chlorosis (yellowing) because of high substrate pH induced iron deficiency. Photo by: W. Garrett Owen, OSU.

Figure 7. A zinnia plug promptly transplanted into the final container. Photo by: W. Garrett Owen, OSU.

An alternative to DIF is the DROP technique. This method involves lowering the greenhouse temperature by 5˚F-10˚F for 2 to 3 hours starting at sunrise. DROP can be as effective as a negative DIF in controlling plant height and is often easier to implement in some greenhouse environments.

Both DIF and DROP allow growers to effectively manage plant height without relying solely on plant growth regulators (PGRs). While implementing these temperature manipulation strategies requires careful environmental control, they can significantly improve plant quality and reduce the need for other height management interventions. By incorporating these techniques into their growing practices, greenhouse growers can achieve more compact, high-quality plants.

4. Irrigation and Nutrient Strategies

Irrigation and nutrient strategies can also help control growth. Implementing mild water stress can limit stretch, but care must be taken to add water before plants start to wilt. Growers should also avoid over-fertilizing during holding periods because excessive nitrogen can promote stretch. Limiting phosphorus supply to young plants can reduce stretch.

5. Plant Growth Regulator Applications

Plant growth regulators are valuable tools for managing stem elongation during extended holding periods. When applied correctly, PGRs can effectively control stem elongation of young plants. Common PGRs for controlling stem elongation in young plants include ancymidol, daminozide, paclobutrazol, uniconazole, or a tank mix of chlormequat chloride + daminozide. Additionally, ethephon can be used to abort premature flowering while promoting lateral branching.

Figure 8. Plant growth regulator applications, such as liner dips, are effective for controlling liner growth, especially when plants need to be held in the greenhouse for extended periods before transplanting. Photo by: W. Garrett Owen, OSU.

Figure 9. Removing the apical meristem or a “soft” pinch can manage stretch and premature flowering in rooted cuttings or plugs. Photo by: W. Garrett Owen, OSU.

Figure 10. Cutting back, which involves removing one-half or more of a plant to reduce its size, can be considered as a last resort when other control methods are ineffective, though it is generally not recommended. Photo by: W. Garrett Owen, OSU.

Before using PGRs to mitigate stem elongation, growers need to consider the chemical, application method, and rate. Different crops may require specific approaches; for instance, annual bedding plants often respond well to daminozide or paclobutrazol sprays, while herbaceous perennials may be more responsive to uniconazole sprays. Therefore, growers must consider the crop and chemical intended to be used.

Application methods vary, with foliar sprays being the most common, but substrate drenches, liner dips (Fig. 8), and sprenches are also effective for certain situations. When applying PGRs, it's crucial to do so preventatively if transplanting delays are anticipated. Before applying PGRs, ensure young plants are well-watered and not stressed, as this will help reduce the likelihood of phytotoxicity.

Growers should always follow PGR label instructions for rates, application methods, and crop-specific recommendations. Keep detailed records of PGR applications, including rates, dates, and crop responses, to refine your strategies over time. Remember that PGRs are just one tool in managing plant growth; they should be integrated with proper environmental control, nutrition management, and cultural practices for optimal results. By carefully incorporating PGRs into their production plan and considering factors such as cultivar vigor, fertility levels, and growing conditions, you can effectively manage liner and plug growth during extended holding periods and maintain high-quality young plants.

6. Pinching

As an alternative to PGR application, pinching can manage stretch and premature flowering in rooted cuttings or plugs held too long (Fig. 9). Removing the shoot tip encourages branching while delaying flowering, allowing the young plant to redirect energy toward vegetative growth. Pinching should be performed carefully to avoid damaging young plants or their root systems during handling. Additionally, removing the shoot tip leaves an open wound, which can be an entry point for disease infection.

7. Cutting Back

When other control methods are not effective, cutting back can be considered a last resort. This process involves removing one-half or more of a plant to reduce its size; however, this technique is often not recommended (Fig. 10). Young plant response to cutting back can be variable due to recovery time, and this technique increases the production time required to produce a marketable crop.

Prolonged holding of rooted cuttings and plugs can compromise crop quality, leading to stretch, uneven growth, premature flowering, nutritional disorders, and heightened susceptibility to pests and diseases. To mitigate these risks and maintain the quality of liners and plugs during unavoidable holding periods, growers should prioritize thorough planning and prompt transplanting. When those aren't enough, growers need to implement strategies that manage the environment, deploy timely PGR applications, or utilize pinching techniques. By proactively addressing these challenges, greenhouse growers can ensure they are using high-quality young plants to produce of marketable, high-quality crops.

e-GRO Alert

www.e-gro.org

CONTRIBUTORS

Dr. Nora Catlin
Floriculture Specialist
Cornell Cooperative Extension
Suffolk County
nora.catlin@cornell.edu

Dr. Chris Currey
Assistant Professor of Floriculture
Iowa State University
ccurrey@iastate.edu

Dr. Ryan Dickson
Greenhouse Horticulture and
Controlled-Environment Agriculture
University of Arkansas
ryand@uark.edu

Dan Gilrein
Entomology Specialist
Cornell Cooperative Extension
Suffolk County
dog1@cornell.edu

Dr. Chieri Kubota
Controlled Environments Agriculture
The Ohio State University
kubota.10@osu.edu

Heidi Lindberg
Floriculture Extension Educator
Michigan State University
wolleage@anr.msu.edu

Dr. Roberto Lopez
Floriculture Extension & Research
Michigan State University
rglopez@msu.edu

Dr. Neil Mattson
Greenhouse Research & Extension
Cornell University
neil.mattson@cornell.edu

Dr. W. Garrett Owen
Sustainable Greenhouse & Nursery
Systems Extension & Research
The Ohio State University
owen.367@osu.edu

Dr. Rosa E. Raudales
Greenhouse Extension Specialist
University of Connecticut
rosa.raudales@uconn.edu

Dr. Alicia Rihn
Agricultural & Resource Economics
University of Tennessee-Knoxville
arihn@utk.edu

Dr. Debalina Saha
Horticulture Weed Science
Michigan State University
sahadeb2@msu.edu

Dr. Beth Scheckelhoff
Extension Educator - GreenhouseSystems
The Ohio State University
scheckelhoff.11@osu.edu

Dr. Ariana Torres-Bravo
Horticulture/ Ag. Economics
Purdue University
torres2@purdue.edu

Dr. Brian Whipker
Floriculture Extension & Research
NC State University
bwhipker@ncsu.edu

Dr. Jean Williams-Woodward
Extension Plant Pathologist
University of Wyoming
jwilwood@uwyo.edu

Cooperating Universities

Cornell CALS College of Agriculture and Life Sciences

Cornell Cooperative Extension Suffolk County

UTIA Institute of Agriculture The University of Tennessee

Iowa State University

University of Wyoming

UConn

UofA Division of Agriculture Research & Extension University of Arkansas System

Michigan State University

NC State University

Purdue University

The Ohio State University

In cooperation with our local and state greenhouse organizations

Maumee Valley Growers — Choose the Very Best.

Metropolitan Detroit Flower Growers Association — Metro Detroit Flower Growers Association

NC Flower Power

Western Michigan Greenhouse Association

Connecticut Greenhouse Growers Association

Indiana Flower Growers Association

LIFGA

Cincinnati Flower Growers Association

Michigan Greenhouse Growers Council

NYSFI New York State Flower Industries, Inc.