Biochar in Peat Mixes: Safe for Growth Regulator Use

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Why This Matters:

- Peat shortages and rising costs are driving growers to explore alternative aggregates such as biochar. At the same time, plant growth regulators like paclobutrazol are essential for controlling plant size and quality in greenhouse crops.
- The existing concern has been whether biochar, known for its high adsorption capacity, reduces the effectiveness of these chemicals.
- This research directly tested that question. Biochar, up to 30% in volume, can replace perlite in peat mixes without reducing paclobutrazol efficacy.
- Growers can confidently substitute biochar without increasing paclobutrazol rates. This study posits that using biochar will reduce the amount of limestone needed, lowering input costs.

Background & Research Insights:

- The study investigated whether incorporating biochar into peat substrates would interfere with Paclobutrazol drenches used to control plant height. Researchers conducted two greenhouse experiments at NC State University: one with poinsettia and another with pansy and begonia.
- Paclobutrazol effectively reduced plant height, diameter, and dry weight in all crops, regardless of substrate type.
- Biochar (coarse or extra-coarse) did not differ from perlite in terms of plant growth regulator (PGR) activity.
- Up to 30% biochar substitution in peat-based mixes did not compromise plant quality.
- These results suggest that biochar can be a sustainable aggregate option without disrupting PGR-based growth control.

Materials & Inputs Needed:

- The ratios tested were 85:15 and 70:30 for peat to aggregate (by volume).
- Biochar types: coarse (<6 mm) and extra-coarse (>6 mm, fines removed).
- Base mix: Canadian sphagnum peat moss.
- Additives: AquaGro 2000 G wetting agent, dolomitic limestone (adjusted to pH 6.0), starter fertilizer (15N-2.2P-12.6K), and water-soluble fertigation (Ultrasol).

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- Crops studied: Poinsettia ('Princettia Red' and 'Princettia White'), pansy ('Matrix Blue Blotch'), and begonia ('Big Red Bronze Leaf').
- Paclobutrazol treatments: 0-4 mg·L^{-1} (Expt. 1) and 0-100 µg·L

Step-by-Step Guidelines:

1. Prepare Substrate Mixes:
    - Combine Canadian sphagnum peat moss with either perlite or biochar. Use 15% or 30% aggregate by volume.
    - Ensure biochar is coarse or extra-coarse grade with fines removed to avoid excess surface area that could increase chemical adsorption.
2. Adjust Substrate Chemistry:
    - Incorporate dolomitic limestone to balance pH to around 6.0. Note that biochar's naturally higher pH may reduce the amount of lime required, offering cost savings.
    - Add a wetting agent and starter fertilizer as standard practice.
3. Plant Establishment:
    - Transplant plugs or cuttings into the prepared mixes. For poinsettias, use 1.4 L pots; for pansy and begonia, 0.67 L pots are sufficient.
    - Maintain greenhouse temperatures of approximately 23°C day/17°C night with supplemental lighting as needed.
4. Fertilization & Irrigation:
    - Use water-soluble fertilizer solutions to provide balanced nutrition. For continuous systems, maintain a ~10% leaching fraction during fertigation to prevent salt buildup.
    - Monitor EC and pH periodically to ensure substrate stability.
5. Apply Paclobutrazol Drenches:
    - Apply a single drench (poinsettia) or continuous low-dose applications (pansy and begonia). Rates between 0.5-4 mg·L^{-1} (poinsettia) and 6.25-100 µg·L^{-1} (pansy/begonia) provided effective growth control.
    - No adjustments are needed when biochar is present at ≤30%.
6. Monitor Growth Response:
    - Track plant height, diameter, and bract/flower development. Expect similar responses to perlite-based mixes.
    - If growth appears more vigorous than expected, reassess substrate composition or adjust paclobutrazol rates slightly.

Tips & Pitfalls:

- Biochar rates above 30% were not tested; higher incorporation may reduce PGR effectiveness.
- Particle size matters. Very fine biochar could increase surface area for adsorption, potentially altering chemical performance.

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- Watch for unexpected growth. If plants are taller than anticipated, it may signal reduced paclobutrazol efficacy. Adjust by lowering biochar levels or modestly increasing PGR rate.
- Feedstock differences. This study used wood-derived biochar; other sources may behave differently.

Expected Outcomes:

Growers incorporating biochar at up to 30% volume into peat mixes can expect outcomes comparable to traditional peat-perlite substrates.

- Effective plant size control with standard paclobutrazol drench rates.
- No reduction in bract size (poinsettias) or shoot dry weight (pansy/begonia).
- Stable substrate pH with potentially reduced lime input needs.
- Sustainable alternative to perlite without compromising crop quality

Additional Resources:

Veazie, P., Jeong, K. Y., Jackson, B., Suchoff, D., & Whipker, B. E. (2024). Peat substrates amended with wood-based biochar do not influence the efficacy of paclobutrazol drenches. *HortScience, 59*(2), 248–254. https://doi.org/10.21273/HORTSCI17621-23

Visuals and Graphics:

Experiment	Plant Species / Cultivar	Substrate Treatments	Paclobutrazol Application	Key Result
Expt. 1	Poinsettia (‘Princettia red and white)	Peat-based substrate amended with coarse biochar (<6 mm) at 15% and 30%; perlite-amended substrate at same rates	Single drench at 0, 0.5, 1.0, 2.0, and 4.0 $mg \cdot L^{-1}$	Paclobutrazol efficacy was not affected by substrate type or amendment rate
Expt. 2	Pansy and Begonia	Peat-based substrate amended with coarse (<6 mm) or extra-coarse (>6 mm) biochar at 15% and 30%; perlite-amended substrate at same rates	Continuous drenches at irrigation: 0, 6.25, 12.5, 25.0, 50, and 100 $\mu g \cdot L^{-1}$	Paclobutrazol efficacy remained consistent across all substrate types and particle sizes

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