

Can leaf mold substitute for peat moss in seed starting media for organic transplant production?

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INTRODUCTION

- Peatlands store 30% of the world's terrestrial carbon, equivalent to 75% of all carbon in the atmosphere.
- Draining peatlands for mining changes vegetation cover, erodes biodiversity, lowers water quality, increases the frequency of fires, and causes land subsidence. Mining and use of peat releases sequestered carbon into the atmosphere, contributing to climate change.
- Most mined peat is used for agriculture. It is often the largest component of horticultural potting mixes and seed starting media. Peat use is increasing.
- High-quality, low-cost alternatives to peat are needed for more sustainable containerized growing media.
- Leaf mold is a low-cost, locally available, and renewable alternative substrate with similar physical properties to peat. Used alone or in combination with other materials, leaf mold could serve as a renewable alternative to peat in seed starting media.

METHODS

This experiment was conducted in the passive solar geodesic dome on KPU's Research and Teaching Farm on the Garden City Lands, in Richmond, BC.



Figure 4. Study location, the geodesic dome on KPU's Research Farm and Teaching Farm on the Garden City Lands.

Experimental design: Completely randomized full factorial design with two replicates and 36 treatments, consisting of 72 475 cm³ cells.

Each treatment consisted of a growing medium, a loosening agent, and a crop. All possible combinations of six growing media, two loosening agents, and three crops were tested:

1. Growing medium
 - Peat (Sun Gro Black Gold, Agawam MA)
 - Leaf mold (homemade, Richmond BC)
 - Compost (Hop, Vancouver BC)
 - Leaf mold/Compost (1:1)
 - Peat/Compost (1:1)
 - Peat/Leaf mold (1:1)
2. Loosening agent
 - Sand (Lawnboy Enterprises, Vancouver BC)
 - Vermiculite
3. Crop
 - Kale (cv. Lacinato, West Coast Seeds, Vancouver BC)
 - Lettuce (cv. Aerostar, West Coast Seeds, Vancouver BC)
 - Zinnia (cv. Giant Blue Point, West Coast Seeds, Vancouver BC)

Table 1. Nutrient amendments added to leaf mold and peat before blending media.

Ingredient	Amount (g/L)
Lime	2.8
Blood meal	2.5
Kelp meal	7.5
Bone meal	3.9
Guano	1.9
Total	18.5

A germination test was performed with radish seeds to verify compost maturity before starting the experiment.

Leaf mold and peat were pre-mixed with nutrient amendments to achieve an equivalent comparison between treatments and ensure that any differences were not simply due to pH or nutrient deficiency (Table 1).

Kale (Lacinato), lettuce (Aerostar), and zinnia (Giant Blue Point) were seeded in 18-cell flats on June 21. Leaf area was estimated weekly by randomly selecting and measuring the length and width of four leaves from each plant. The mean of the estimated leaf area values were recorded and compared.

Kale and zinnia were harvested on July 29, 2019. Plants were oven-dried at 60 °C in an air-forced oven for 72 hours. Dry weights were recorded and root:shoot ratios were calculated.

No data were collected from lettuce plants as they failed to germinate. Thus, the experiment was analyzed with 24 treatment combinations.

All data were tested for normality using the Shapiro-Wilk Test. Dried biomass and root:shoot ratio data were analyzed by ANOVA. Leaf area data were analyzed using a Linear Mixed Model test with week, medium, and loosener as fixed effects and crop as a random effect. All analyses were conducted using the jamovi (v. 1.0.8.0) interface for R statistical software. Tukey's Honestly Significant Difference test and the Bonferroni test were used to compare differences between treatments ($\alpha = 0.05$).

RESULTS

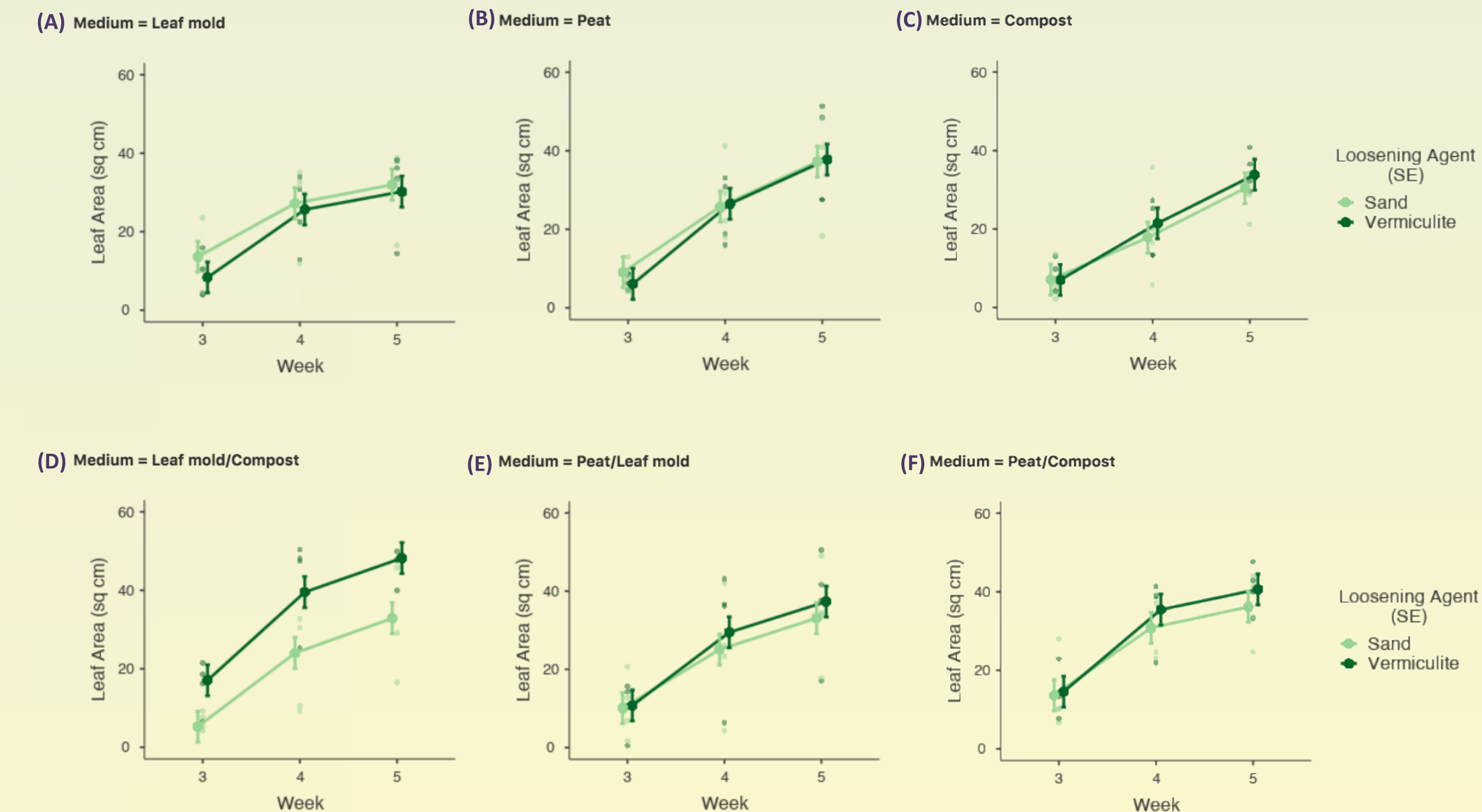


Figure 5. Leaf area growth over time in growing media with two different loosening agents.

Leaf area was greater in leaf mold/compost (Fig. 5D) and peat/compost (Fig. 5F) blends than in pure compost (Fig. 5C). An interaction was observed between growing medium and loosening agent. The leaf mold/compost blend with vermiculite produced greater leaf area than the same blend with sand (Fig. 5D), pure leaf mold with vermiculite (Fig. 5A), or pure compost with either loosening agent (Fig. 5C).

Table 2. Results for the ANOVA test on the effect of crop, loosening agent, soil medium, and their interactions, on root:shoot ratios ($p > 0.05$).

	Sum of Squares	df	Mean Square	F	p
Crop	0.0760	1	0.0760	3.846	0.060
Medium	0.1355	5	0.0271	1.372	0.264
Loosening Agent	0.0450	1	0.0450	2.278	0.142
Crop * Medium	0.1106	5	0.0221	1.119	0.372
Crop * Loosening Agent	0.0130	1	0.0130	0.658	0.424
Medium * Loosening Agent	0.1327	5	0.0265	1.343	0.274
Residuals	0.5731	29	0.0198		

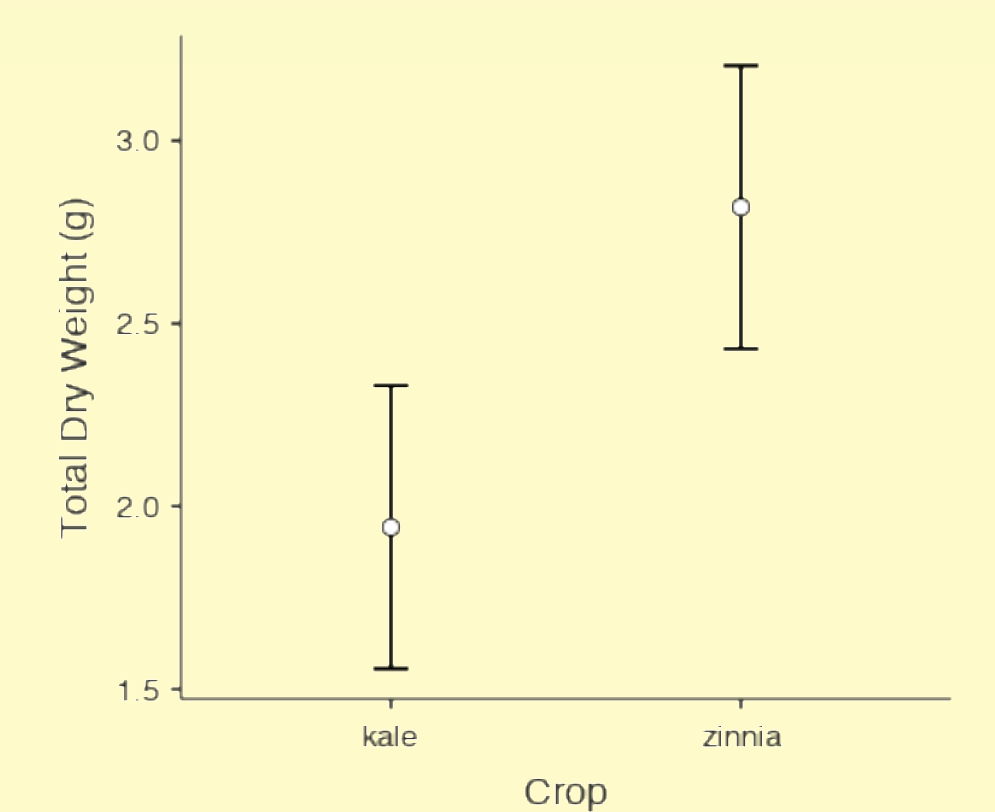


Figure 6. Total dry weight (g) of plant biomass for kale and zinnia.

Medium had no significant effect on root:shoot ratios. Total dry weight only differed by crop, not by medium. Total dry weight for zinnias was significantly higher than the total dry weight for kale at the end of the experiment.

CONCLUSION

- Total dry weight (biomass) was not affected by soil media.
- Root:shoot ratio was not affected by soil media.
- Maximum leaf growth occurred with an equal mix of leaf mold and compost media with vermiculite as the loosening agent.
- Leaf mold on its own cannot replace peat as a substrate, but, in combination with compost, it can substitute for peat in seed starting media for vegetable and flower production. This combination can reduce our dependence on peat for transplant production and provide a locally-available, renewable, and low-cost alternative to peat for small-scale farmers and gardeners.
- Further experiments should investigate different ratios of compost, loosening agents, and amendments combined with leaf mold on a wider selection of crops to determine optimal mixes for transplant growth.

ACKNOWLEDGMENTS

Thanks to Mike Bomford and Rebecca Harbut for their guidance and expertise throughout this project. Thanks to Andy Smith and the KPU farm crew for technical assistance and watering the transplants. Thanks to my partner, Dylan, for building a compost sifter and for helping me to clean and measure the plant biomass samples.

OBJECTIVE

To assess the suitability of leaf mold as an alternative to peat in growing media for organic transplant production.



Figure 1. Completely randomized design of 36 soil mix treatments in four 18-cell trays.



Figure 2. Kale (*Brassica oleracea*) and zinnia (*Zinnia elegans*) seedlings after five weeks.



Figure 3. Fresh roots vs. dried roots of zinnia (*Z. elegans*).