



Alternatives to traditional peat moss starter mixes

IN A NUTSHELL

Hans was interested in finding a starter mix that can produce healthy and vigorous seedlings without the use of peat moss.

- Both biochar and coco coir mixes performed comparatively well to ProMix BX by Hans' observation
- Hans prefers the potential of biochar mixes over coco coir, given that biochar can be locally sourced or produced
- More on-farm trials are needed to assess the viability of alternative starter mixes
- More research is needed into the life cycle assessment of both peat moss and biochar

FARMER-RESEARCHERS

Hans Ning, Paper Kite Farm

FUNDING

Brian and Joannah Lawson Family Foundation

The Arrell Family Foundation

MOTIVATION

Hans was interested in finding alternatives to sphagnum peat moss, as it's a resource that is known to store enormous amounts of carbon that is released when it is harvested.

As potential replacements for peat moss, he wanted to look at both biochar and coco coir mixed with top soil and composted cow manure at a ratio of 1:1:1, and compare them against a standard peat moss potting mix called ProMix BX.

METHODS

For his side-by-side screening trials, Hans planted a single variety of tomatoes and bok choy into the three treatments listed below. He purchased the ProMix BX, coco coir, and composted cow manure from a local supplier. Hans made the biochar from brush he had around the farm, which included mostly eastern red cedar, prickly ash, and invasive mulberry, and charged the biochar with worm castings. The two other treatments received a similar amount of worm castings to account for this nutrient inoculation in the biochar treatment.



Three seed trays each with a different starter mix planted with tomatoes on March 23, 2022

VARIETIES

Tomato: Purple Bumblebee

Bok Choy: Ching Chiang

TREATMENTS

1. Promix BX (control)
2. Coco coir (1 part coco coir, 1 part screened top soil, 1 part composted cow manure)
3. Biochar (1 part biochar, 1 part screened top soil, 1 part composted cow manure)

TOMATO COMPARISON - ONE REPLICATE SET FOR EACH STARTER MIX

Hans filled three 1020 trays with one of the three starter mixes. He sowed 50 seeds of Purple Bumblebee into each tray. Hans put thermostats in his germination area to regulate germination temperature and rotated the trays daily to ensure similar conditions.

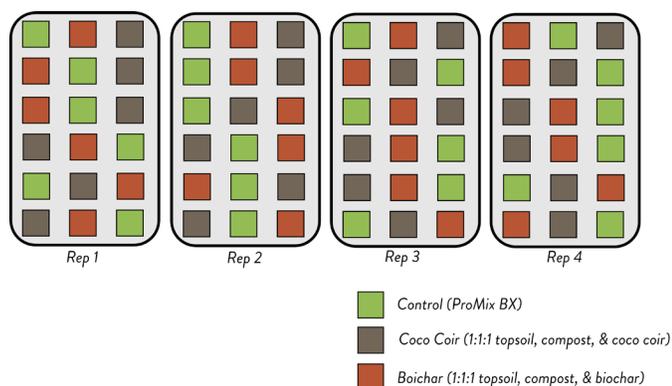


Figure 1. The layout for the potted up tomato plants.

After 14 days Hans took germination counts for each of the treatments. After 6 weeks he potted up 24 of the most vigorous tomato seedlings from each treatment into individual 4" pots with the same stater mix that the seedlings were germinated in. He then randomized the potted plants, as seen in **Figure 1**, and placed them in the unheated greenhouse when weather permitted.

4" POT LAYOUT FOR TOMATOES

Two weeks after he potted up the seedlings and one week after he transplanted them in the field, Hans recorded seedling vigour ratings for each plant.

BOK CHOY COMPARISON - ONE REPLICATE SET FOR EACH TREATMENT MIX

Hans used three 72-cell trays for the bok choy and filled each tray with one of the three treatment starter mixes. He sowed one bok choy seed into each cell.

After 14 days Hans took germination counts for each of the trays.

Two weeks after Hans assessed the seedlings germination, he recorded seedling vigour ratings for each treatment. Due to poor germination, Hans determined that the bok choy seedlings weren't viable enough to transplant.

DATA ANALYSIS

This comparison is set-up as a screening trial with no replicate data for starter mixes. As such, we can't assign probability to any differences Hans observed. Rather, Hans used this comparison to identify major differences among starter mixes, to determine if the treatments have the potential for a fully replicated trial in the future.

FINDINGS

GERMINATION

Hans observed that germination for tomatoes in all three treatments was similar and acceptable. Tomatoes in the ProMix performed the best with 88% germination and tomatoes in both the coco coir and biochar stater mixes performed well, with 80% germination (**Table 1**).

The germination for bok choy in all three treatments was consistently poor. Bok choy in the ProMix performed best with 63% germination, and bok choy in the coco coir mix performed worst at 37% germination (**Table 1**).

SEEDLING VIGOUR

Hans observed no noticeable effect of starter mixes on vigour of the tomato seedlings, as seen in **Table 2**. He made the following observations about each of the three starter mixes.

PROMIX BX

"Needed noticeably more watering than the other two treatments. At the time of potting up, the seedlings were all visually strong. The roots of this treatment were noticeably more robust." Hans wonders if water intake was higher due to the presence of mycorrhizal fungi?



Tomato seedlings on May 4, 2022 before pot up



Sample of tomato seedlings and root balls from each of the three start mixes

Table 1. Percent germination of tomatoes and bok choy for each of the three starter mixes

VARIETY	TOMATO GERMINATION	BOK CHOY GERMINATION
Promix BX	88%	63%
Coco coir mix	80%	34%
Biochar mix	80%	57%

Table 2. Seedling vigour rating of tomatoes and bok choy for each of the three starter mixes

VARIETY	TOMATO GERMINATION	BOK CHOY GERMINATION
Promix BX	4	3
Coco coir mix	3	1
Biochar mix	5	2

Table 3. Transplant vigour rating of tomatoes for each of the three starter mixes

VARIETY	TRANSPLANT VIGOUR RATING
Promix BX	5
Coco coir mix	5
Biochar mix	5

COCO COIR

“Due to the use of topsoil, weed seeds were present in this potting mix. Tomato seedlings may have been mistakenly pinched off during weeding, which could have affected germination counts. At the time of potting up, seedlings were noticeably smaller compared to ProMix and biochar mixes and roots were also noticeably the smallest.”

BIOCHAR

“This treatment also suffered from weeds, so we likely pinched some tomato plants that we mistook for weeds. This treatment needed noticeably less water than the other two mixes, and also developed the most algae on its surface. At the time of potting up, they were clearly the largest plants with the largest leaves. The roots were more fine and slightly smaller than the ProMix roots, but had more roots than the coco coir treatment.”

Following his observations of germination, Hans rated bok choy seedling vigour average for the ProMix treatment, low for the biochar treatment, and very low for the coco coir treatment (**Table 2**).

TRANSPLANT VIGOUR

Hans observed that transplanted tomato plants from all of the treatments survived transplanting without shock. There was no visual difference between starter mixes post transplant in the field (**Table 3**).

Hans was unable to take a transplant vigour rating for bok choy as the germination for all treatments were poor and not worth transplanting into the field.

CONTENT AND CAVEATS

Due to difficulty with sanitation, it was hard to control the quality of the mixes and keep them disease- and weed-free.

NEXT STEPS

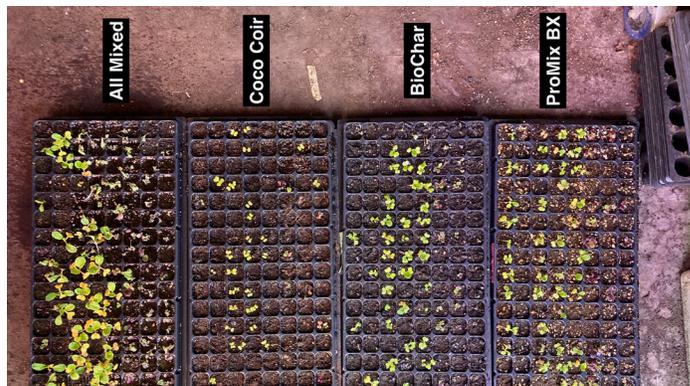
Hans plans to conduct side-by-side comparisons of peat-based mixes and biochar mixes. He thinks another interesting trial would be using biochar for soil block mixes. While biochar can be airy, it also can be compacted under pressure when wet.



Tomato seedlings by starter mix at transplant on June 9, 2022



Comparison of tomato plants by starter mix at transplant on June 9, 2022. “Coir” refers to Coco Coir.



Seedling trays of bok choy by starter mix

TAKE HOME MESSAGE

Both biochar and coco coir performed well when compared to ProMix BX, and Hans thinks biochar mixes hold more promise because they can be locally sourced or produced.

Although biochar appears to be a promising starter mix on Hans’ farm, it isn’t currently practical with their production system. More work is needed to refine and improve biochar production and mixing for it to be a viable option in terms of quantity, consistency, and sterility.

Although no concrete decisions can be made from the observation presented, this comparison was an important first attempt to find a substitute for peat-based starter mixes for ecological farmers in Ontario. Continued research into peat moss alternatives like biochar that can add carbon, keep nutrients, and help reduce inputs to the soil are important lines of inquiry for ecological farmers.