EFAO 2022: Research Protocol

Alternatives to traditional peat-moss starter mixes

Farmer-researcher: Hans Ning, Paper Kite Farm- EAST

Project type: Research trial

Research priorities: Soil health

EFAO Contact: Dillon Muldoon

Objective

Hans would like to know whether or not biochar is a suitable alternative to sphagnum peat moss as part of a potting mix to start vegetable seedlings.

Background

Hans is interested in finding a more sustainable alternative to sphagnum peat moss, as it's a non-renewable resource that sequesters many times more carbon than an equivalently sized rainforest. He wants to look at both biochar and coco coir mixed with mushroom compost at a ratio of 1:1 as a possible replacement for a peat moss based potting mix like ProMix BX.

References

1. For the Love of Peat- 99% Invisible (podcast): https://99percentinvisible.org/episode/for-the-love-of-peat/

Experimental Design

Varieties

Tomato:	Purple Bumblebee	50 cell
Bok Choy:	Ching Chiang	72 cell
Chard:	Fordhook Giant	72 cell

Treatments

1. ProMix BX (control)
2. Coco coir (1:1 mix of mushroom compost and coco coir)

3. Biochar (1:1 mix of mushroom compost and biochar)

The ProMix BX, coco coir, and mushroom compost will be purchased from a supplier. The biochar will be made from brush Hans has around the farm. The biochar will comprise mostly eastern red cedar, prickly ash, and invasive mulberry and will be charged with worm castings.

Updated treatments

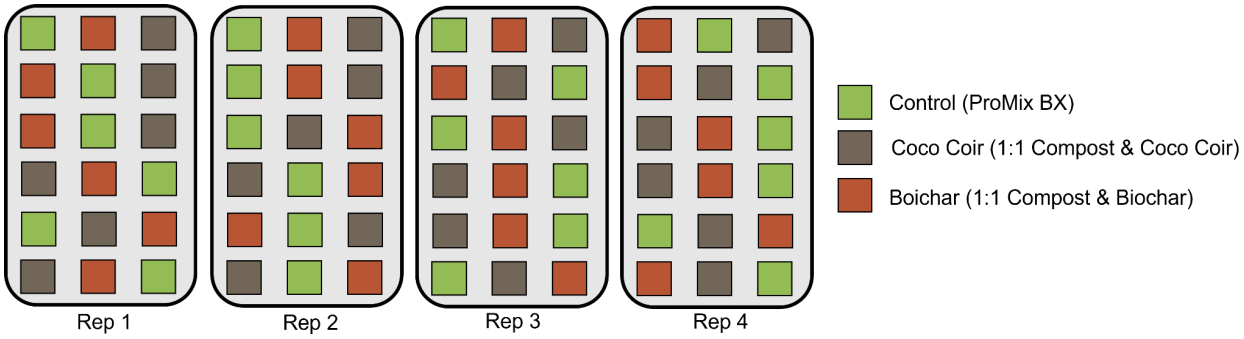
1. Promix BX (control)
2. Coco coir (1 part coco coir, 1 part screened top soil, 1 part composted cow manure)
3. Biochar (3 parts biochar, 3 parts screened top soil, 3 parts composed cow manure, and 0.5 parts worm casting (just to charge the biochar)

Tomato Trial (RCBD)

Hans will use three 1020 trays for germinating tomatoes, each tray will be filled with one of the three treatment starter mixes. Into each tray he will sow 50 seeds of the tomato crop being trialled. Hans will rotate the trays everyday to ensure similar conditions. (Although I have put thermostats in two areas to make sure that the conditions are similar for all trays, I will rotate them everyday anyways to promote more fair comparisons.)

After 14 days he will take germination counts for each of the trays and note them on the data sheets provided. After 4 to 6 weeks Hans will re-pot 24 of the most vigourous and best looking tomato seedlings from each treatment into individual 4" pots with the same statermix that the seedlings were grown in. These re-potted plants will then be arranged into 4 randomised complete blocks, as seen in the diagram below and placed in the unheated greenhouse when weather permits.

4" Pot Layout for Tomatoes



Two weeks after the seedlings are re-potted into the above layout, Hans will record seedling vigour ratings for each plant on the data sheet provided (also see **Measurements** below) One week after being transplanted into the garden beds Hans will take transplant vigour ratings for each plant on the data sheets provided.

Bok Choy and Chard Trial (side-by-side)

For bok choy and chard Hans will use three 72-cell trays for each crop and assess them in a side by side trial. For both crops Hans will fill each single tray with one of the three treatment stater mixes. Into each of the 72-cells in each of the three trays per crop he will sow 1 seed of the bok choy or chard crop being trialled.

After 14 days he will take germination counts for each of the trays and note them on the data sheets provided. These trays of bok choy and chard will not be re-potted into a randomized complete block design like the tomatoes above, but will be assessed in a side-by-side trial. These trays will be placed in the unheated greenhouse when weather permits.

Two weeks after the seedlings are assessed for germination, Hans will record seedling vigour ratings for each plant on the data sheet provided (also see **Measurements** below) One week after being transplanted into the garden beds Hans will take transplant vigour ratings for each plant on the data sheets provided.

Statistical model

This trial will be a randomized and replicated complete block design for tomatoes and a side-by-side for bok choy and chard in an unheated greenhouse. We will use an ANOVA (or other appropriate statistical methodology) to determine the significance of each measurement across treatments.

Measurements

Quantitative and Qualitative

Crop management records

The following information will be collected on this sheet once per planting:

    - Seeding date
    - Transplant date
    - Fertilizer applications (rates, amounts, and date)
    - Irrigation
    - Other products or notes
- DOC LINK

Germination

The following information will be collected on this sheet once a year:

- Germination rates will be taken once at 14 days post seeding
    - Total number of seeds sown
    - Total number of seeds that germinated after 14 days
    - Germination notes (how did you seed your cells, place, other information)
- DOC LINK

Seedling vigour

The following information will be collected on this sheet:

- **Seedling vigour** (seedling size, health, and growth rate)
    - Around 2 weeks after re-potting seedlings
    - Rating scale from very poor (1) to very high (5) [1=very low (Weak and slow-growing plants); 2=low (Below average vigour); 3=moderate (Acceptable growth and some resilience to stress); 4=high (Strong growth); and 5=very high (Exceptional growth and resilience to stress)]
- Hans will make note of anything else he sees which might be of interest (damage, disease, pest, etc.)
- Tomato (one sheet per replicate): DOC LINK
- Chard/ Bok Choy: DOC LINK

Transplant vigour

The following information will be collected on this sheet:

- **Transplant vigour** (transplant size, health, and growth rate)
    - Transplant vigour will be taken once, one week after the time of transplant into garden beds
    - Rating scale from very poor (1) to very high (5) [1=very low (Weak and slow-growing plants); 2=low (Below average vigour); 3=moderate (Acceptable

growth and some resilience to stress); 4=high (Strong growth); and 5=very high (Exceptional growth and resilience to stress)]

- Hans will make note of anything else he sees which might be of interest (damage, disease, pest, etc.)
- Tomato (one sheet per replicate): DOC LINK
- Chard/ Bok Choy: DOC LINK

Photos

Please take photos of the following times/items:

- Farmer-researches with FLRP sign
- Germination for all crops
- Seedling growth (1, 2, 3,& 4 weeks after re-potting) for tomatoes
- Seedling growth for chard and bok choy
- Transplanting time for all crops

Research Plan

Please note that if data is submitted after the submission deadline, EFAO staff cannot guarantee that your data will be analyzed and written up before the Research Symposium and/or the next growing season.

Time	Task	Methods & Measurements or Action Item
Tomatoes		
March 23	Seeding	Sow 50 seeds into each of the three treatments in 1020 trays
14 days after seeding (April 6, 2022)	Germination Observation	Note the total number of germinated seeded out of the 50 planted for each treatment on the data sheet
April 18	Re-pot to 4inch	Re-pot seedling into 4” pots with the same starter mix that was in the germination trays
3 weeks after repotting	Seedling vigour rating observation	Rate each plant on a scale from 1-5 and make any other notes or observations of interest
May 16	Pre-Transplant	Before transplanting each plant into garden beds

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One week post transplant	Transplant vigour rating observation	Rate each plant before transplant on a scale from 1-5 and make any other notes or observations of interest
Chard		
June 13	Seeding	Sow 72 seeds into each of the three treatments in 72 cell trays
14 days after seeding	Germination Observation	Note the total number of germinated seeded out of the 72 planted for each treatment on the data sheet
3 weeks after germination observation	Seedling vigour rating observation	Rate each plant on a scale from 1-5 and make any other notes or observations of interest
July 11	Pre-Transplant	Before transplanting each plant into garden beds
One week post transplant	Transplant vigour rating observation	Rate each plant before transplant on a scale from 1-5 and make any other notes or observations of interest
Bok Choy		
May 9	Seeding	Sow 36 seeds into each of the three treatments in 1020 trays
14 days after seeding	Germination Observation	Note the total number of germinated seeded out of the 36 planted for each treatment on the data sheet
3 weeks after repotting		Rate each plant on a scale from 1-5 and make any other notes or observations of interest
May 23	Transplant	Before transplanting each plant into garden beds
One week post transplant		Rate each plant before transplant on a scale from 1-5 and make any other notes or observations of interest
December 31, 2022	Farmer-fee and	Submit invoices at this site:

	research expense invoice with receipts for expenses	https://efao.ca/data/
January/February 2023	Finalize and publish research report	Work with EFAO staff to review polished research report for publication.

Staff check-ins

Dillon will check in with Hauns on seeding, gemination observations, seedling observations and transplant observations for all crops throughout the trial through email.

Materials

Please list all materials, supplies and equipment that will be reimbursed for this project. If possible, please also indicate a short-list of any in-kind materials, supplies and equipment that you will use.

Material	Unit	Quantity Required	Total Cost*	Note
Compost				Pro-rated
Seed				
Standard Starter Mix Promix				
Plant markers or pots				
Coco Coir				
Total			~$500	

Farmer-fee

A $500 farmer-fee can be collected for the 2022 season after all data and photos have been submitted to the EFAO research staff.

Invoices for Farmer-Fees & Reimbursements

Research expenses

- Submit an **invoice along with copies of receipts** for all qualified expenses using form found at **https://efao.ca/data/**
- **Deadline**: December 31, 2022

Farmer-fee

- Submit an **invoice** for your farmer-fee using form found at **https://efao.ca/data/**
- **Deadline**: December 31, 2022

Memorandum of Understanding

Please fill out the MOU at https://airtable.com/shrlAcZ7bowmTQwvd

EFAO Account Information

As a farmer-researcher, you must maintain current membership with EFAO throughout the duration of your trial.
We use your mailing address to deliver cheques, farmer-led research signs and any trial supplies.
To check the status of your membership, log in here: https://efao.z2systems.com/np/clients/efao/login.jsp or contact Martina, martina@efao.ca.

Farmer-fees and Reimbursements

I agree with the following:

- The deadline for reimbursements and farmer-fees is December 31, 2022.
- To receive reimbursement for qualified research expenses, I will submit an invoice and copies of receipts at the form found at https://efao.ca/data/.
- To receive my farmer-fee, I will submit an invoice to https://efao.ca/data/ after I have submitted the final data and photos.

Photo Use

We like to share snippets and stories of farmer-led research through EFAO's print publication, e-newsletter and social media accounts, using photos and updates that you send us. We will credit you when we use any photos.

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Choices (Select all that apply on the MOU):

- EFAO has my permission to share photos in EFAO's print publications
- EFAO has my permission to share photos in EFAO's e-newsletters
- EFAO has my permission to share photos in EFAO's social media
- I do not want my photos share in these ways
- Other

Farmer-Led Research Agreement

I agree with the following:

- I will complete my trial to the best of my ability following the written protocol.
- If circumstances change and I am unable to conduct my trial, I will notify EFAO staff as soon as possible.
- I will keep in contact with EFAO staff with updates and questions, or to make changes to my protocol .
- I will submit data to the EFAO by the date specified in the written protocol.
- I acknowledge that if I submit data after the submission deadline outlined in the written protocol, EFAO staff cannot guarantee that my data will be analyzed and written up before the Research Symposium and/or the next growing season.
- I will work with EFAO staff to interpret data and write the research report.
- I will take photos of my project throughout the season(s).

Program Participation

There are several farmer-led research events held throughout the year including webinars, field days, and the Research Symposium. The Research Symposium is held in conjunction with the annual EFAO Conference at the end of November/early December.

When and where possible I will:

- Attend farmer-led research events, including webinars and field days
- Attend and present my research findings at the Research Symposium
- I will complete the feedback survey related to the program

Data Use

You own all data generated on your farm as part of your farmer-led research trial with EFAO. You can notify EFAO at any time to remove EFAO's privileges to use and share your data, photos and farm information. To opt out of sharing your data, please contact Sarah Larsen via email (sarah@efao.ca) or mobile (226-582-0626).

I agree with the following:

- By participating in the EFAO's FLRP, I agree to share with the EFAO the data collected as part of my trial, along with photos of the project and any farm information (e.g. soil type, previous farm practices, and soil tests) that I deem relevant.
- By sharing my data, photos, and farm information with EFAO, I agree that EFAO can use this information in research reports, posters, and summaries of my trial (e.g. summaries on the EAFO blog and in EFAO's print publication).
- I understand that I can notify EFAO at any time to remove EFAO's privileges to use and share my data, photos, and farm information.

Signature

Please fill out the MOU at https://airtable.com/shrlAcZ7bowmTQwvd