EFAO 2022: Research Protocol

Red Pepper Variety Trial

Farmer-researchers:

Name	Farm	Region	Field
Mike Smith	Guelph Centre for Urban Organic Farming (GCUOF)	WEST	Field
Will Makxam	Rivers Edge	WEST	Field
Anne Dockendorff	Silver Rapids Farm	NORTH	Field
Matthew Brearley	Castlegarth Farm	EAST	Field
Karlo Bobinac	Jones Family Greens	WEST	Field
Angie Koch and Nikola Barsoum	CASPP Demonstration Gardens at Fertile Ground	WEST	Field

Project type: Variety trial

Research priorities: Seed selection, production, & breeding, Weed control

EFAO Contact: Rebecca Ivanoff, rebecca@efao.ca, (519) 760-2971

Objective

Farmers would like to identify the most productive and best tasting varieties of sweet red pepper grown in-field across different farms in Ontario during the 2022 season.

Background

High yielding, early maturing, flavourful, blocky, red peppers, have been identified as something desired by ecological vegetable farmers (5). To complement Mike's question on pepper yields between the hoophouse and the fields, six farmers will perform the variety trial just in the field. The pepper varieties chosen include three commonly grown hybrid varieties, as well as an older open-pollinated variety that was bred for the northeast United States, and two new varieties. These new varieties include a farmer-bred variety that was supported by the EFAO's Farmer-Led Research Program, as well as one that was bred at Cornell University from the same parental varieties.

References

1. 2018 Canadian Vegetable Breeding Priorities Report, http://www.seedsecurity.ca/images/survey-report/2018-Survey-Report-Canadian-Organic-and-Ecological-Plant-Breeding-Priorities.pdf

Experimental Design

Varieties

The 2022 pepper variety trial includes six varieties, all of which will be transplanted in the field within 2 replicates for each planting.

Code	Variety	DTM	Type	Source	Certification	Intellectual Property[1]
PV1	King Arthur F1 (check)	59 green; 79 red ripe	F1	Johnny's Selected Seed	Untreated	No
PV2	Renegade Red	62-75 days	OP	Hawthorn	Organic	OSSI pledged[2]
PV3	Yankee Bell	60 green; 80 red ripe	OP	Annapolis Seeds	Organic	No
PV4	Ace F1	50 green; 70 red ripe	F1	Johnny's Selected Seed	Untreated	No
PV5	Sprinter F1	60 green; 80 red ripe	F1	Johnny's Selected Seed	Organic	No
PV6	Crimson Carillon	58-67 green; 72-80 red	OP	Fruition	Organic	No

1. No Plant Breeders Rights Granted in Canada, see https://inspection.canada.ca/plant-varieties/plant-breeders-rights/varieties/eng/1300463863953/1300463978655
2. Open Source Seed Initiative, https://osseeds.org/

Planting and Cultivation Recommendations

The trial should be grown as you would normally grow peppers in the field, including bed and row spacing. The table below provides suggestions based on recommended cultivation practices for peppers. Use the suggestions if they make sense for your farm.

Plot size per variety	10 plants per variety section, 2 replications = 20 plants total for each variety
Row and bed spacing	In-row: 18”; between row: 30”-36”
Seeding date	6-8 weeks before last frost mid-March
Transplanting dates	Transplant after the last frost mid-May to early June
Days to harvest	57-80 days from transplant
Harvesting	Harvest ripe red peppers twice a week as you normally would and take all fruit for the last harvest before the frost

Each farmer should receive approximately 25 seeds of each variety for each planting. We suggest that you plant 25 seeds of each variety. The goal is to get at least 20 seedlings of each variety so that you can plant 10 per plot.

Field Layout

The trial arrangement is flexible as long as you plant at least 2 replicated blocks of each of the 3-6 varieties you chose, with each variety plot having *at least* 10 plants of the variety.

Please observe these best practices as best you can and record what you do:

- For each planting in this trial, create two replicate blocks of your trial space by dividing the space in half (see layout below)
- Plots may be distributed in multiple side-by-side beds or planted in one bed (see examples below)
    - In each half, plant the varieties in a random order, either by drawing variety names out of a hat, etc. or randomly choosing the flat to transplant next.
    - Each of the 2 replicate blocks should have a plot of 10 plants for each variety; the order of the planting will be different in each replicated block.
- Avoid the edge of the field and the end of the bed when finding a place for the trial.
- Avoid areas with known soil, shade or irrigation differences that would affect some plots more than others. That is, try to plant your trial in a homogenous area in your field.
- If possible, plant the trial in a spot where it has the same crop on either side of it.

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- Use stakes to label the plots AND draw a field map showing the order and location of varieties. This serves as a backup in case the stakes get lost! Please snap a photo of the layout and send it to Rebecca, which is a third back-up!

Examples of field layout:

Example 1: Layout with 2 replicate blocks of 6 varieties (at least 10 plants/variety) down a single row. Note: each variety is randomly assigned to a plot in each replicate block.

Replicate block A						Replicate block B					
V5 10 plants min	V2 10 plants min	V3 10 plants min	V4 10 plants min	V6 10 plants min	V1 10 plants min	V4 10 plants min	V3 10 plants min	V1 10 plants min	V5 10 plants min	V2 10 plants min	V6 10 plants min

Bed length →

Example 2: Layout with 2 replicate blocks of 6 varieties (10 plants/variety) planted across multiple rows. Note: each variety is randomly assigned to a plot in each replicate block. This layout can also be used within one bed, with rows of peppers on each side of the bed.

Replicate block A		Replicate block B	
V5 - 10 plants min	V3 - 10 plants min	V6 - 10 plants min	V1 - 10 plants min
V1 - 10 plants min	V6 - 10 plants min	V4 - 10 plants min	V2 - 10 plants min
V2 - 10 plants min	V4 - 10 plants min	V2 - 10 plants min	V5 - 10 plants min

Bed length →

Statistical model

This trial will be a randomized and replicated trial over multiple farms. We will use an ANOVA (or other appropriate statistical methodology) to determine the significance of each measurement across the farmer participants.

Measurements

Quantitative and Qualitative

Crop management records

- The following information will be collected on this sheet once per year:
    - Seeding date
    - Transplant date
    - In-row spacing
    - Between-row spacing
    - Configuration (number of rows/beds)
    - Fertilizer applications (rates, amounts, and date)
    - Weed control
    - Irrigation
    - Mulch
    - Other products or notes

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)

Early season vigour

The following information will be collected on this sheet **once in the season**:

- Early season vigour looks at seedling size, health, and growth rate
- Early season vigour will be taken once around 1 month after transplant
    - Rating scale from very poor (1) to very high (5) [1=very low (0-20%); 2=low (20-40%); 3=moderate (40-60%); 4=high (60-80%); and 5=very high (80-100%)]

Disease and pest resistance observations

The following information will be collected on this sheet **throughout the season:**

- Growers will make notes of any disease or pest issues that occur on peppers varieties throughout the year (weekly scouting)
- Observations of particular pest or disease, future action threshold

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Information from OMAFRA on common pests and disease can be found here:

- Common insect pests:
    - http://www.omafra.gov.on.ca/IPM/english/peppers/insects/index.html
- Common disease and disorders:
    - http://www.omafra.gov.on.ca/IPM/english/peppers/diseases-and-disorders/index.html

Yield (One sheet harvest-week [harvest twice a week?])

The following information will be collected on this sheet **at every harvest throughout the harvest window/period:**

- Marketable *Red* Peppers
    - weight of marketable harvest (lbs/g)
    - number of marketable fruits
- Non-marketable Red Peppers
    - weight of non-marketable harvest (lbs/g)
    - number of non-marketable fruits

Final Harvest Data Sheet Yield (Once per year [Final before frost harvest])

The following information will be collected on this sheet **once for the last harvest before final frost:**

- Marketable (**Red**)
    - weight of marketable harvest (lbs/g)
    - number of marketable fruits
- Marketable (**Green**)
    - weight of marketable harvest (lbs/g)
    - number of marketable fruits
- Non-marketable (**All other fruits**)
    - weight of non-marketable harvest (lbs/g)
    - number of non-marketable fruits

Flavour

The following information will be collected on this sheet **once in the season at peak maturity**:

- **If possible taste one red pepper from all the replicates, if not taste one red pepper from each variety between both replicates.**
- Notes on Flavour (sweet, bitter?)

- Flavour and texture will be taken once a year in the middle of harvest season
    - Rating scale from very poor (1) to very excellent (5) [1=very poor (0-20%); 2=poor(20-40%); 3=moderate (40-60%); 4=excellent (60-80%); and 5=very excellent (80-100%)]

Overall performance

The following information will be collected on this sheet **once at the end of the season**:

- Farmers will rate their impression of the overall performance of each variety

Photos

Please take photos of the following times/items:

- Farmer-researches with FLRP sign
- Germination
- Transplanting into the field (during and finished)
- Flowering/ flowers
- Younger peppers vs older peppers
- Worst of the maretable harvest, best of the unmarketable
- Harvest actions shot
- Other

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
Mid March	Seeding	In cell trays
MidMay to Early June	Transplant	
Late June	Early season vigour observation	3 weeks post transplant take early season vigour rating observations
August - October	Harvest	Twice per week harvest ripe red peppers
October 15	Submit data and photos	Submit data and photos to EFAO research staff by October 15

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December 31, 2022	Farmer-fee and research expense invoice with receipts for expenses	Submit invoices at this site: 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

Rebecca will check (group emails at seeding, transplant, and harvest.
Rebecca will text Mike for reminders, and for longer updates will 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
Seed				Rebecca will purchase and send you seed
Postage				To mail seeds to farms.
Soil, trays, amendments, bins, scales, etc			In-kind by Farmers	
Total				

Farmer-fee

Farmer-fee will be in-kind from the GCUOF; all other farmer-researchers receive $50 per variety (two replicates/variety) to a maximum of $300. They can submit invoices to the EFAO after they have submitted their data and photos to 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.

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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.

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

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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