EFAO 2022: Research Protocol

Red Pepper Variety Trial

Farmer-researchers:

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

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.
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References


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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Variety</th>
<th>DTM</th>
<th>Type</th>
<th>Source</th>
<th>Certification</th>
<th>Intellectual Property¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV1</td>
<td>King Arthur</td>
<td>59 green; 79 red</td>
<td>F1</td>
<td>Johnny’s Selected Seed</td>
<td>Untreated</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>F1 (check)</td>
<td>ripe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV2</td>
<td>Renegade Red</td>
<td>62-75 days</td>
<td>OP</td>
<td>Hawthorn</td>
<td>Organic</td>
<td>OSSI pledged²</td>
</tr>
<tr>
<td>PV3</td>
<td>Yankee Bell</td>
<td>60 green; 80 red</td>
<td>OP</td>
<td>Annapolis Seeds</td>
<td>Organic</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ripe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV4</td>
<td>Ace F1</td>
<td>50 green; 70 red</td>
<td>F1</td>
<td>Johnny’s Selected Seed</td>
<td>Untreated</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ripe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV5</td>
<td>Sprinter F1</td>
<td>60 green; 80 red</td>
<td>F1</td>
<td>Johnny’s Selected Seed</td>
<td>Organic</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ripe</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PV6</td>
<td>Crimson</td>
<td>58-67 green;</td>
<td>OP</td>
<td>Fruition</td>
<td>Organic</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Carillon</td>
<td>72-80 red</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹. No Plant Breeders Rights Granted in Canada, see https://inspection.canada.ca/plant-varieties/plant-breeders-rights/varieties/eng/1300463863953/130046386397655
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.
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<table>
<thead>
<tr>
<th>Plot size per variety</th>
<th>10 plants per variety section, 2 replications = 20 plants total for each variety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Row and bed spacing</td>
<td>In-row: 18”; between row: 30”-36”</td>
</tr>
<tr>
<td>Seeding date</td>
<td>6-8 weeks before last frost mid-March</td>
</tr>
<tr>
<td>Transplanting dates</td>
<td>Transplant after the last frost mid-May to early June</td>
</tr>
<tr>
<td>Days to harvest</td>
<td>57-80 days from transplant</td>
</tr>
<tr>
<td>Harvesting</td>
<td>Harvest ripe red peppers twice a week as you normally would and take all fruit for the last harvest before the frost</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Replicate block A</th>
<th>Replicate block B</th>
</tr>
</thead>
<tbody>
<tr>
<td>V5 10 plants min</td>
<td>V4 10 plants min</td>
</tr>
<tr>
<td>V2 10 plants min</td>
<td>V3 10 plants min</td>
</tr>
<tr>
<td>V3 10 plants min</td>
<td>V1 10 plants min</td>
</tr>
<tr>
<td>V4 10 plants min</td>
<td>V5 10 plants min</td>
</tr>
<tr>
<td>V6 10 plants min</td>
<td>V2 10 plants min</td>
</tr>
<tr>
<td>V1 10 plants min</td>
<td>V6 10 plants min</td>
</tr>
</tbody>
</table>

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.

<table>
<thead>
<tr>
<th>Replicate block A</th>
<th>Replicate block B</th>
</tr>
</thead>
<tbody>
<tr>
<td>V5 - 10 plants min</td>
<td>V6 - 10 plants min</td>
</tr>
<tr>
<td>V1 - 10 plants min</td>
<td>V4 - 10 plants min</td>
</tr>
<tr>
<td>V2 - 10 plants min</td>
<td>V2 - 10 plants min</td>
</tr>
<tr>
<td>V3 - 10 plants min</td>
<td>V5 - 10 plants min</td>
</tr>
</tbody>
</table>

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.
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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 \textit{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 \textit{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 \textit{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:
- Common disease and disorders:

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?)
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- 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 marketable 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.

<table>
<thead>
<tr>
<th>Time</th>
<th>Task</th>
<th>Methods &amp; Measurements or Action Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid March</td>
<td>Seeding</td>
<td>In cell trays</td>
</tr>
<tr>
<td>Mid May to Early June</td>
<td>Transplant</td>
<td></td>
</tr>
<tr>
<td>Late June</td>
<td>Early season vigour observation</td>
<td>3 weeks post transplant take early season vigour rating observations</td>
</tr>
<tr>
<td>August - October</td>
<td>Harvest</td>
<td>Twice per week harvest ripe red peppers</td>
</tr>
<tr>
<td>October 15</td>
<td>Submit data and photos</td>
<td>Submit data and photos to EFAO research staff by October 15</td>
</tr>
</tbody>
</table>
**EFAO 2022: Research Protocol**

<table>
<thead>
<tr>
<th>December 31, 2022</th>
<th>Farmer-fee and research expense invoice with receipts for expenses</th>
<th>Submit invoices at this site: <a href="https://efao.ca/data/">https://efao.ca/data/</a></th>
</tr>
</thead>
<tbody>
<tr>
<td>January/February 2023</td>
<td>Finalize and publish research report</td>
<td>Work with EFAO staff to review polished research report for publication.</td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Material</th>
<th>Unit</th>
<th>Quantity Required</th>
<th>Total Cost*</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed</td>
<td></td>
<td></td>
<td></td>
<td>Rebecca will purchase and send you seed</td>
</tr>
<tr>
<td>Postage</td>
<td></td>
<td></td>
<td></td>
<td>To mail seeds to farms.</td>
</tr>
<tr>
<td>Soil, trays, amendments, bins, scales, etc</td>
<td></td>
<td></td>
<td>In-kind by Farmers</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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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](https://airtable.com/shrlAcZ7bowmTQwvd)