

Participatory Vegetable Breeding for Organic Systems in the Upper Midwest

Poster Presented by: Michael Lordon, Organic Seed Alliance

Dr. Julie Dawson, Dr. Rue Genger, Thomas Hickey, Marissa Nix, Steffen Mirsky (University of Wisconsin-Madison), Dr. Jared Zystro, Dr. Micaela Colley, Dr. Cathleen McCluskey (Organic Seed Alliance), Dr. Nicolas Enjalbert (SeedLinked), Alice Formiga (eOrganic), Erica Kempter (Nature and Nurture Seeds), Keith Mueller (KC Tomato)

Context

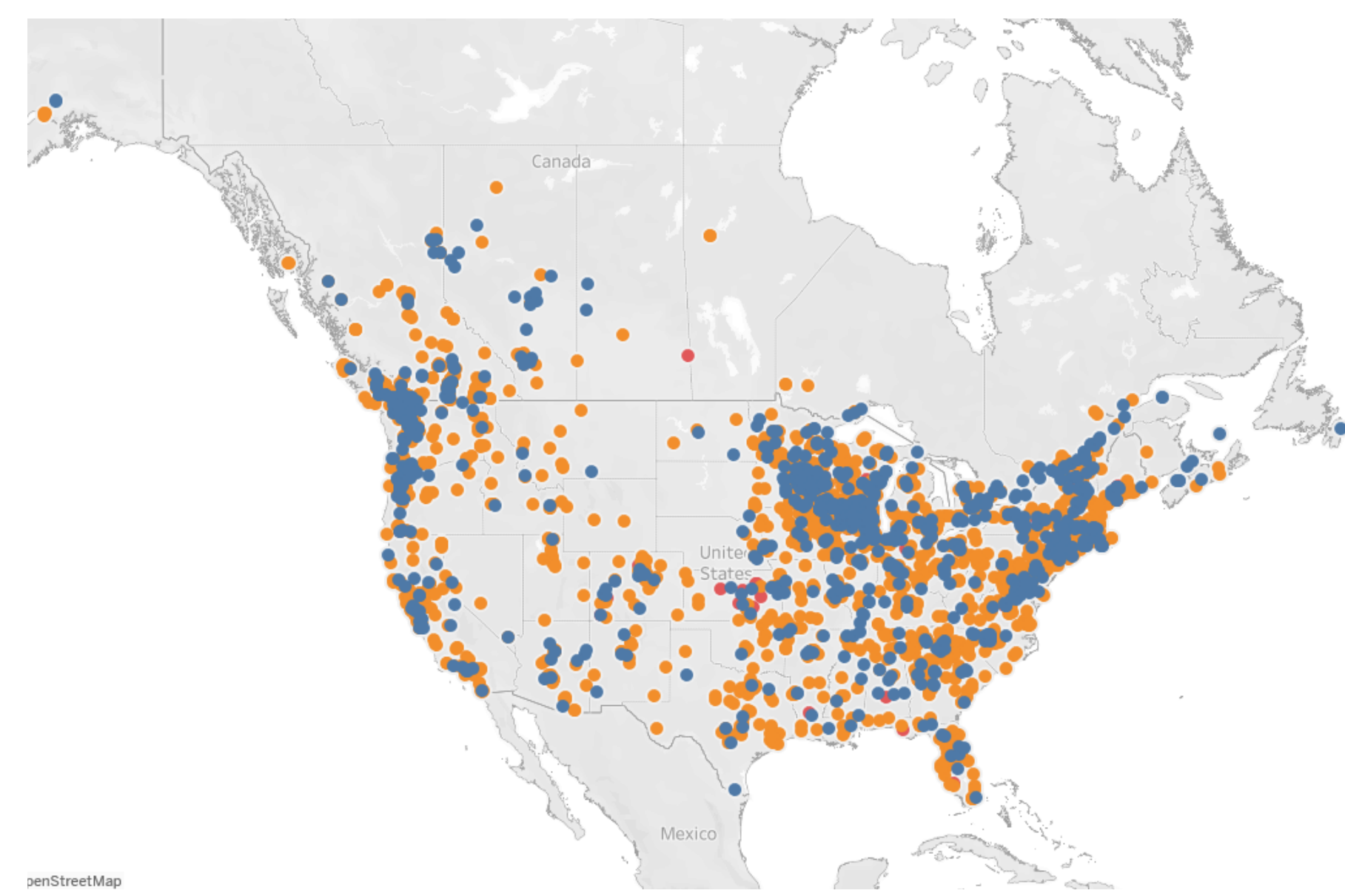
Varieties bred for organic systems work better for organic farmers. In particular, as weather patterns become more erratic, it is critical that we develop methods for variety development that can lead to resilient cultivars over heterogeneous environmental conditions. In the Upper Midwest, we are seeing more significant large rainfall events and more severe temperature swings, causing many varieties to show weaknesses that were not apparent with more stable weather patterns. The best strategy for dealing with this type of unpredictability is to test varieties over a wider range of environmental conditions, both within and across years. This is difficult for many breeding programs to accomplish, whether they are in the public sector, private sector or independent.

There is a critical need to build capacity for farmers, plant breeders and organic seed companies to work together to ensure that farmers' evolving needs and unique knowledge drive the development of the crop varieties available to them.

This project aims to build collaborative plant breeding capacity among Upper Midwest farmers, independent plant-breeders, regional organic seed companies, and organic certifiers. It has improved SeedLinked functionality for farmers, breeders, and organic certifiers to effectively collect, share, and analyze data to support decentralized collaborative breeding. We are developing models for independent breeders, public sector programs and organic seed companies to work together to develop and commercialize varieties that respond to regional organic farmers' needs in regions and crops without large-scale organic breeding programs.

Platform development

SeedLinked tools created for independent plant breeders



- Early generation testing
- Family-based tracking
- Ranking methods for unbalanced designs
- Advanced testing
- Documentation for release
- Organic seed search

Collaborative Breeding Case Studies

Participatory trial methodology and tools to provide independent breeders access to data and testing networks

Independent breeders and small regional seed companies are an under-appreciated sector of the organic seed industry but are critical to producing varieties that are regionally adapted and suited to organic systems. Because of the lack of investment in plant breeding in general, and for organic systems in particular, there are many crops for which there are no public or private sector breeding programs in the Upper Midwest. This points to a need for new models to develop varieties for organic farmers. Expecting full time organic vegetable farmers to all become farmer-breeders and develop their own varieties for crops where they have inadequate variety choices is unrealistic. Small seed companies may provide the means to bridge this gap, and will be most effective when they are able to collaborate with networks of farmers interested in evaluating early generation crosses on their farms, and with public sector researchers and breeders that can give them access to more advanced techniques and resources. They may also find it advantageous to work with larger scale organic seed companies that have access to larger seed markets and tools for managing the logistics of larger volume seed production and sales. We have three case studies of independent breeding projects.

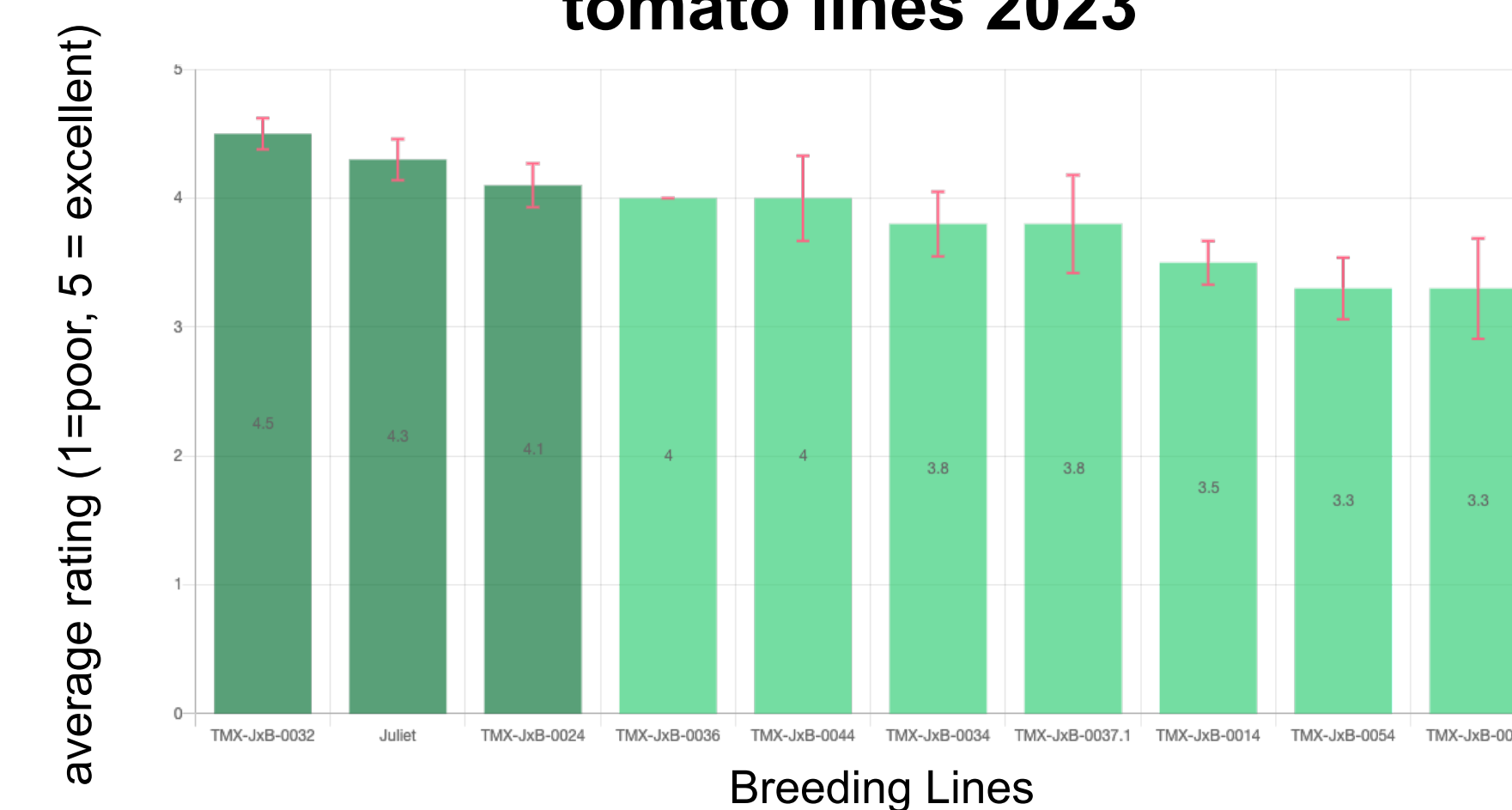
Nature & Nurture Seeds: Independent breeder & seed company, can commercialize varieties directly

Saladette tomato

- Juliet x Blush
- Goals: OP
 - Appearance of Juliet
 - Flavor of Blush
 - Early maturity
 - Field production
 - Good disease tolerance
- 17 participants selected from F3 families in 2022
- Seeds (F4) of selected F3 plants grown/selfed in greenhouse over winter to distribute F5 seeds to participants
- F5 families sent to 45 participants in 2023



Overall Performance Ranking for JxB F5 tomato lines 2023



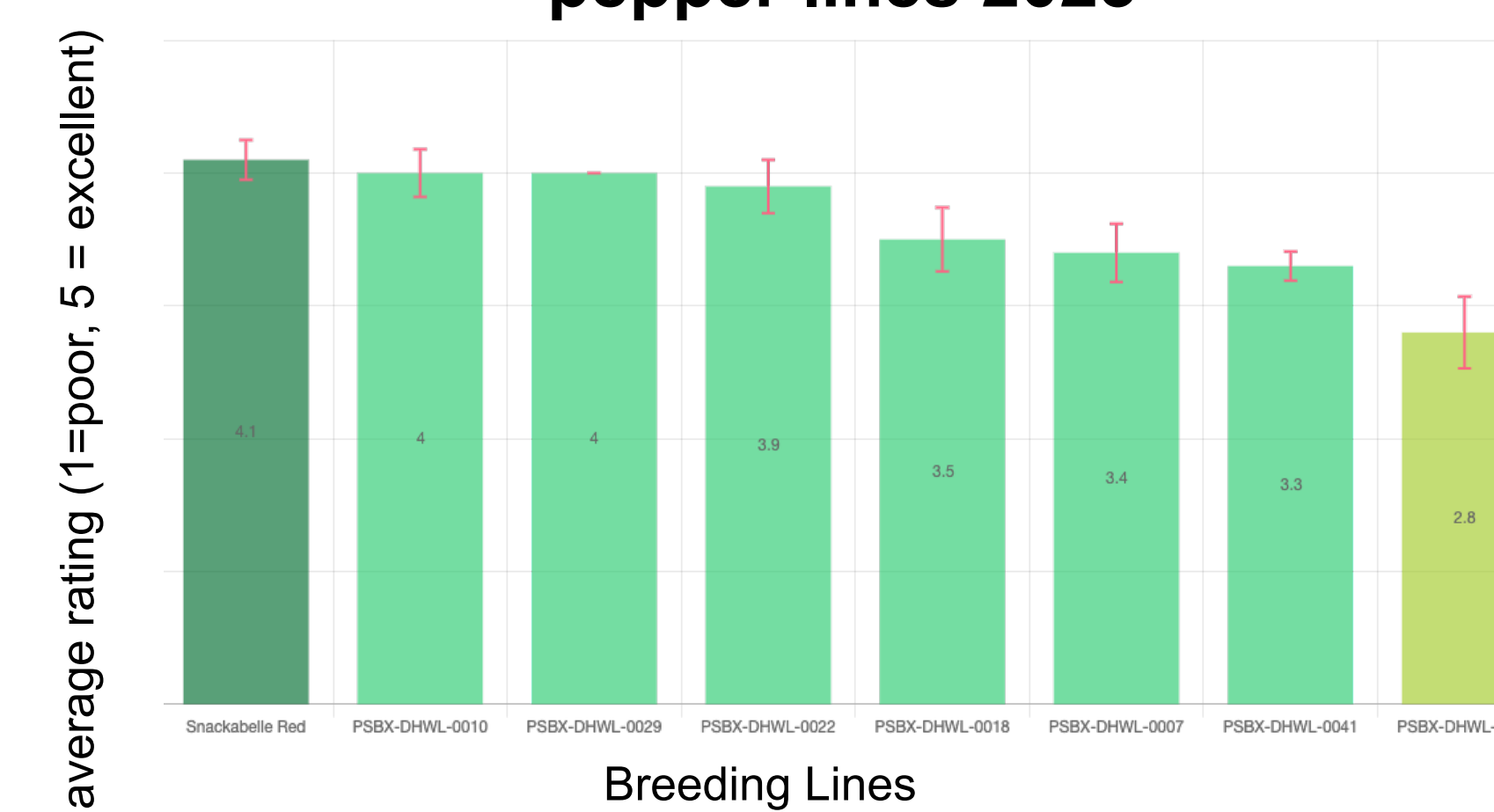
Organic Seed Alliance: Non profit organization with breeding projects in partnership with university breeders

Small bell pepper variety

- Doe Hill X WI Lakes
- Goals: OP
 - Size of WI Lakes
 - Flavor of Doe Hill
 - Early maturity
- 8 participants selected individual plants in 2022
- Seeds of selected plants grown/selfed in greenhouse over winter
- Seed sent to 43 participants in 2023 for trials



Overall Performance Ranking for DHxWL pepper lines 2023



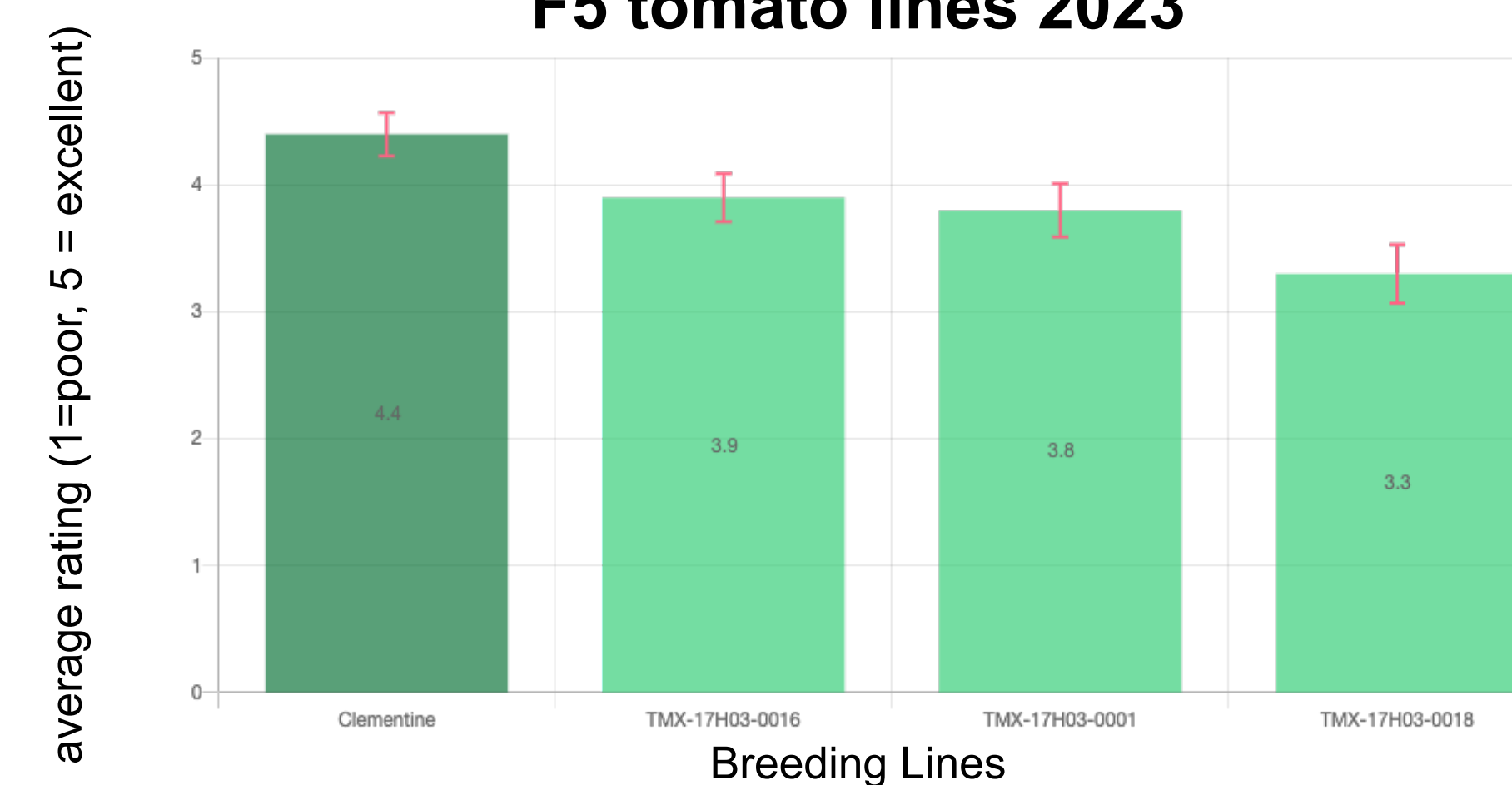
KC Tomato: Independent breeder interested in licensing varieties to seed companies

Cocktail tomato

- 17H03 Cross of two breeding lines (16H11 x SGLL 9-5-3)
- Goals: OP
 - Flavor intensity
 - Larger cocktail size
 - Early maturity
 - High tunnel production
 - Unique carotenoid content (delta)
- 16 participants selected from F3 families in 2022
- Seeds of selected plants grown/selfed in greenhouse over winter
- F5 families sent to 31 participants in 2023

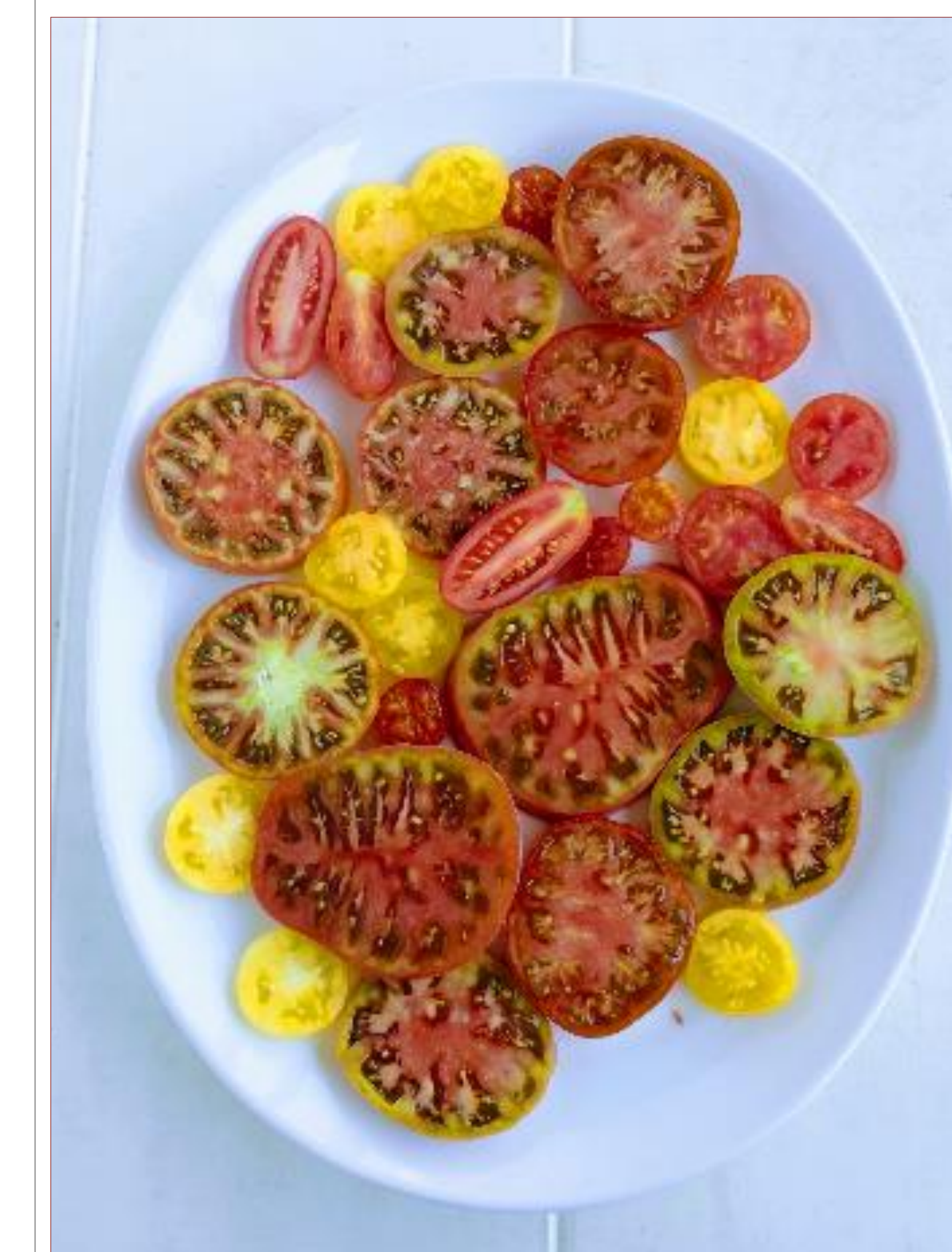


Overall Performance Ranking for 17H03 F5 tomato lines 2023

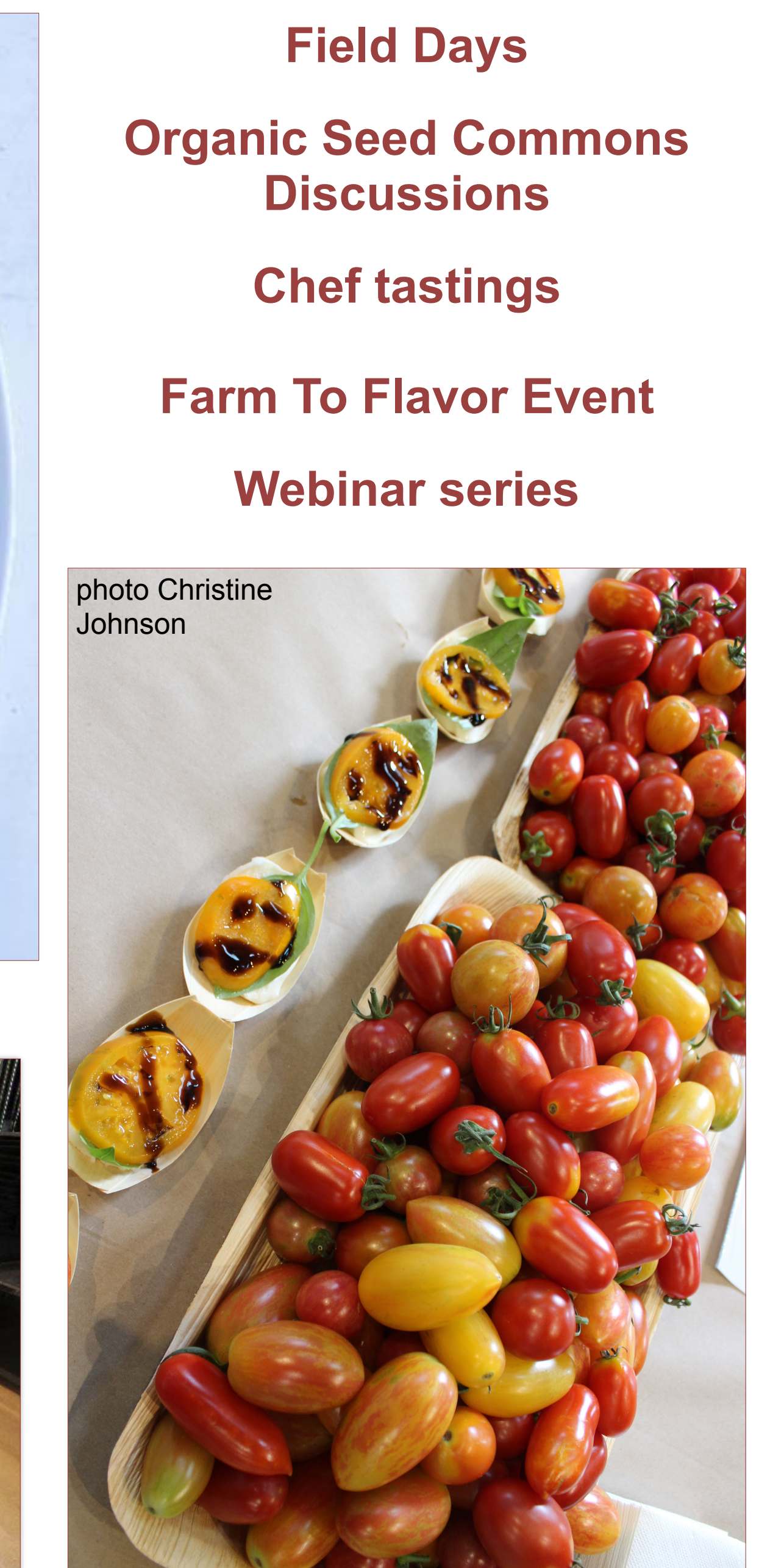
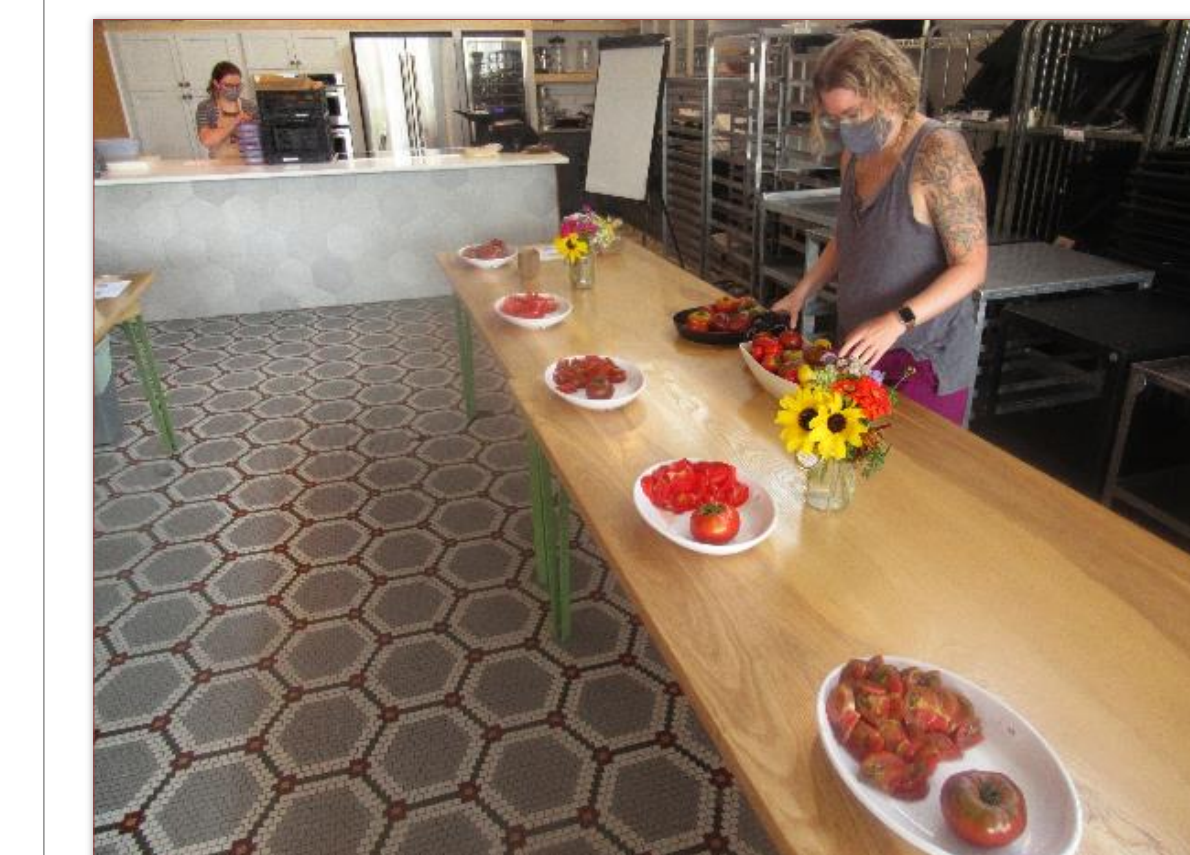


Outreach

Building a community of practice



photos Ambar Carvalho



- Field Days
- Organic Seed Commons Discussions
- Chef tastings
- Farm To Flavor Event
- Webinar series



Future Directions

- Release of varieties for the Upper Midwest under the Open Source Seed Initiative
- Improving modeling of GxE in participatory trials
- Building support networks for successful commercialization of varieties developed through collaborative breeding networks

