

Currently, it is not a high priority for most seed companies to engage with or consider the unique needs and preferences of organic farmers and their fresh market customers (i.e. chefs, farmers' market consumers, CSA members, retailers and wholesalers) during the plant breeding process. Organic farmers need varieties adapted to local conditions and organic production methods. Additionally, their fresh market customers demand vegetables of superior flavor, texture, cooking quality and nutritional value and have an appreciation for uniqueness, quality and novelty. Incorporating chefs, farmers and other end users into the plant breeding process gives breeders deeper insight into preferred traits while also increasing awareness and understanding of organic plant breeding to a broader audience. The objective of this work is to bring together plant breeders, seed growers, fresh market farmers, chefs, produce buyers and other discriminating consumers to discuss and identify preferences in cultivars and breeding lines for fresh market vegetables. Two case studies are presented.

1 - Variety Sensory Evaluation: The Northern Organic Vegetable Improvement Collaborative (NOVIC) is an OREI-funded collaborative project among Oregon State University, University of Wisconsin, Cornell University, Organic Seed Alliance, USDA-ARS and over 30 organic farmers in Oregon, Washington, Wisconsin and New York. The original NOVIC was funded 2009-2013; NOVIC II is currently funded 2014-2018. NOVIC conducts extensive variety and breeding line trials of vegetable crops with the goal of finding those well adapted to organic farming systems. One goal for the Oregon group was to find an early Italian sweet pepper that performed well on organic farms and had superior flavor to replace the standard hybrid 'Gypsy'. Twenty-five farmers and chefs convened to evaluate commercially available cultivars.

2 - Variety Showcase Event: A Culinary Breeding Network event with a goal to provide a venue for conversation among diverse participants through (1) tasting commercially available cultivars of the same species side by side; (2) providing feedback on breeding populations and (3) exchanging ideas and perspectives with one another. Participants included 125 farmers, seed growers, plant breeders, chefs, produce buyers and food/farming journalists. In 2012, the Culinary Breeding Network was formed with a mission to bridge the gap between breeders and eaters to improve agricultural and culinary quality in the Northwest. Through this initiative, events are organized to increase communication and collaboration between plant breeders, farmers and chefs in order to develop varieties desirable to all parties.

Materials and Methods

1 - Variety Sensory Evaluation: In October 2010 and 2011, in conjunction with a NOVIC sweet pepper trial, a sensory evaluation of nine commercially available cultivars was conducted. Individuals evaluated overall appearance, color, flavor, sweetness, texture and overall liking of raw, sautéed and roasted preparations for each entry. A representative fruit for each variety was displayed raw (whole and halved). Pepper samples for tasting were displayed on plain white dinner plates and labeled with a random, numeric code (Fig. 1). Raw samples were cut evenly into 1/8" strips. Sautéed samples were cut in the same manner then sautéed in a stainless steel pan over medium-high heat with a blended oil (70% canola/30% olive oil) for 5 minutes and sprinkled with sea salt after removed from heat. One tablespoon oil and ½ teaspoon salt for every one cup of peppers. Roasted peppers were roasted whole at 215°C for 30 minutes, then peeled, seeded and cut into 1/2" pieces. Evaluators using a 1-9 Hedonic scale (1=Dislike extremely; 9=Like extremely). A comment box was included for additional remarks. Individuals recruited for the evaluations were collaborating farmers and Portland restaurant chefs who frequently bought produce from local farmers' markets.

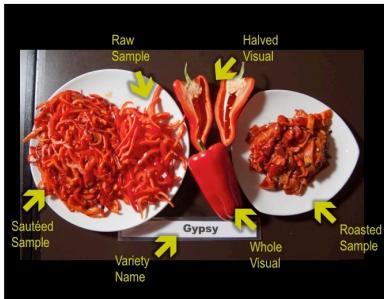


Fig. 1. Example of a pepper sample display. During evaluations a numeric code is used rather than the cultivar name.



Fig. 2. Pepper evaluators preferred the appearance of fruits with rounded shoulders like those of 'Stocky Red Roaster' (L)

2 - Variety Showcase Event: In September 2014, twelve stations were set up for tasting vegetable species with one cultivar featured in a dish created by a collaborating chef. There were two types of stations - Variety Tasting and Breeding Population. - each with a chef and breeder representative (Fig 4). In all cases, the highlighted cultivar had been bred or maintained by a public or independent plant breeder (i.e. Frank Morton, Wild Garden Seed; Jim Myers, Oregon State University; Michael Mazourek, Cornell University; Irwin Goldman, University of Wisconsin; Andrew Still and Sarah Kleeger, Adaptive Seeds; Brian Campbell and Crystine Goldstein, Uprising Seeds; Anthony and Carol Boutard, Ayers Creek Farm; and Micaela Colley and Laurie McKenzie, Organic Seed Alliance). Variety Tasting stations included side by side tastings of multiple varieties of the same vegetable. Simple ballots were used to identify favorites. These tables included Beet (Fig. 6), Cilantro, Thai Basil, Leaf Celery and Onion. Breeding Population stations illustrated the myriad of traits within a population. The breeder was present to discuss their process and goals and engage with tasters to gain insight on preferences. These tables included Tomato (Fig. 5), Mild Habanero Pepper (Fig. 3) and Carrot.



Fig. 3. Variation in phenotypes among mild habanero breeding lines



Fig. 4. Chef Jason French (L) and breeder Frank Morton (R) with 'Stocky Red Roaster' featured at the sweet pepper table



Fig. 5. Farmer and seed grower Scott Chichester ponders OSU breeder Jim Myers' 'Indigo' tomato breeding populations



Fig. 6. The beet variety tasting at the Variety Showcase event. Beets were evaluated both raw and roasted.

Species	Commercially Available Cultivars	Breeding Lines
Beet	6*	
Cilantro	6	
Thai Basil	7	
Leaf Celery	6	
Onion	8	
Tomato	3	5
Mild Habanero	2	3
Carrot		5

Fig. 7. Number of cultivars and breeding lines evaluated at the Variety Showcase event.

*Three of the beet cultivars were new releases to seed companies but not yet available for purchase.

Results and Summary

1 - Variety Sensory Evaluation: 'Gatherer's Gold', 'Joelene's Rustic Italian' and 'Stocky Red Roaster' were preferred to 'Gypsy' for overall liking. These three open-pollinated varieties also outperformed the standard hybrid in the field which had become increasingly difficult to secure a quality seed source. Agronomically, 'Gypsy' was a top performer due to high yield in number of fruits and very low culs due to an above average plant architecture and leaf canopy preventing sun scald on fruits. Comments included on evaluation ballots indicated that evaluators preferred the appearance of 'Stocky Red Roaster' with its rounded shoulders for easier processing in the kitchen (Fig. 2). The 'Stocky Red Roaster' pepper bred by collaborating breeder Frank Morton of Wild Garden Seed was highly ranked by farmers and chefs for appearance and flavor. In conjunction with its outstanding field performance, seed sales for this previously little known sweet roasting pepper have increased 400% for the independent organic seed company and is now offered by several national seed companies.

2 - Variety Showcase Event: Results from this event included a significant increase in communication between plant breeders and end users. Plant breeders increased awareness of consumer preferences and needs which can serve to guide their breeding process. Chefs and farmers became aware of varieties and breeding projects they might not have previously known about (Fig. 7). Participants were also able to share their input with breeders that can address their needs through their work. A significant amount of press resulted which can be found on the Culinary Breeding Network website - www.culinarybreedingnetwork.com

In addition to a high degree of discrimination in flavors, chefs may identify cultivars and imagine novel applications outside the culinary norm; they can also facilitate in creating consumer demand for a specific cultivar. Engaging with chefs and produce buyers through qualitative sensory evaluations like the Variety Showcase to assess cultivars and breeding populations sets this work apart from standard quantitative sensory panels. Creating a venue to facilitate an interactive exchange of specific needs has resulted in a greater understanding of what consumers are looking for in fresh market produce for breeders and, for all other participants, a greater understanding of the important role breeders play in the food we eat.