

Identifying Profitable Vegetable and Small Fruit Varieties for Maine Farmers: 2015

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Program Justification and Objectives:

Maine has a large and diverse group of vegetable and berry growers that farm in excess of 11,000 acres and are responsible for over 20 million dollars in annual gross revenue. These farmers face considerable challenges to economically viable and sustainable crop production, including our short growing season, very cold winters and limited land and labor resources. Maine vegetable and berry growers are also confronted with a relatively small and rapidly declining number of suitable plant varieties developed for short, cool growing seasons. Surveys in 1999 (Handley) and 2001, 2007 (Hutton) indicated that the members of the Maine Vegetable and Small Fruit Growers Association rank varietal evaluation as one of their highest research priorities. In the research priority request submitted by the Association to the Agricultural Council of Maine, variety testing was ranked as the number one priority (Seaman, 2012)

Over the past three decades, the number of vegetable seed companies, nurseries and Land Grant Universities with active research and breeding programs has declined significantly. For economic reasons, the focus of remaining breeding programs is varietal development for the primary vegetable and berry production areas of the world. Unfortunately, Maine and other regions in northern latitudes are not part of these major production areas. Additionally, there is a rapid turnover in commercial vegetable varieties. Seminis, the largest vegetable seed company in the world, has a stated goal of 20% new product per year, or an average variety life expectancy of 5 years (Rucker per. communication). Consequently, the selection of varieties available to Maine growers is shrinking, and as new varieties become available they will not necessarily be well adapted to our northern environment. Identification of varieties that are both locally adapted and have acceptable horticultural qualities is becoming increasingly challenging. As a result, extensive testing of new varieties is essential before Maine farmers can be assured a reasonable chance of economic success with these crops in the future.

Maine vegetable and berry growers are consulted through discussions and formal surveys during annual meetings to determine priorities for the vegetable and berry species to be included in upcoming variety trials. Strawberries, sweet corn and pumpkins are always high priority crops due to their high value, customer popularity and rapidly changing variety selection. Other crops that are routinely requested include hoop house tomatoes, salad greens and raspberries. Recently, as winter markets have increased, there is tremendous interest in off-season production and variety recommendations for crops suited for this type of market, e.g. carrots, onions, cole crops, winter squash.

Evaluation of each crop should be conducted over a minimum of three growing seasons. While most entries will be included in each year of a trial, some varieties may be dropped based on poor performance or availability, and some may be added as new varieties become available.

Overall objectives:

1. New vegetable and berry varieties of various species will be rigorously evaluated in replicated trials at Highmoor Farm to determine:
 - a. Suitability for Maine climate (plant establishment, days to maturity, cold tolerance)
 - b. Potential commercial value (yield, quality, unique characteristics)
 - c. Pest tolerance (insect, disease resistance)
2. Trial results and subsequent variety recommendations will be shared with Maine farmers, agricultural educators, seed suppliers and nurseries to:
 - a. Improve Maine farmers decision making process for variety selection
 - b. Improve variety recommendations coming from agricultural educators, consultants, seed companies and nurseries.

- c. Enhance the availability of suitable varieties from seed companies and nurseries serving Maine farmers.

Objectives for the 2015-2019 trials:

- 2015** Bell pepper, sweet corn, butternut squash, and determinate hoop house tomato. Establish a new strawberry planting.
- 2016** Bell pepper, cabbage, table beet, sweet corn, butternut squash, determinate hoop house tomato and strawberry evaluation.
- 2017** Cabbage, table beet, sweet corn, green bean, determinate hoop house tomato and strawberry evaluation.
- 2018** Cabbage, table beet, sweet corn, green bean. Establish a new strawberry planting.
- 2019** Cabbage, table beet, sweet corn, and green bean.

Study Plan/Design and Activities 2015:

Butternut Squash:

Objective: Determine the relative performance of fourteen cultivars of butternut squash including days to maturity, fruit weight, quality storability and severity of insect and disease injury.

Butternut squash are commonly found growing on most Maine vegetable farms and is a staple for CSA's and farm market sales particularly for winter markets. Plots of 10 plants will be established in four replicated complete blocks. Growth rate, marketability, weight, insect and disease severity will be scored for each plot. At maturity, fruit will be harvested, counted and weighted. Harvested fruit will be stored and evaluated for storability by removing fruit from storage at specific intervals and evaluating for weight loss and fruit quality.

- The trial will require approximately 1.0 acres (\$1,400).
- Anticipated Completion Lettuce Evaluation: April 30, 2018

Bell Pepper Evaluation

Objective: Determine the relative yield, maturity and quality of 21 bell pepper cultivars.

Bell peppers are an important crop to direct market farmers (farm stand, farmer's market, CSA) and regional wholesale growers. The product requirements for these two markets can be quite different. Direct market peppers can have greater variation in fruit shape and size, while wholesale markets demand uniform, blocky, 3 to 4 lobe peppers. The widely fluctuating temperatures occurring in Maine during the growing season can negatively impact fruit set of bell pepper making it difficult to produce economically viable yields (Hutton, M.G. and D.T. Handley. 2006). Several new cultivars have been introduced since our last evaluation of the crop. Transplants will be grown in the greenhouse and then transplanted to the field. The experiment will be planted in four randomized complete blocks using plots of 16 pepper plants arranged in double rows of plastic mulched beds.

- The trial will require approximately 0.5 acres (\$700).
- Anticipated Completion of Pepper Evaluation: April 30, 2016

Sweet Corn Evaluation

Objective: Determine the relative performance of 18 SH₂ type corn cultivars, including germination, maturity date, harvest ease, ear characteristics (color, uniformity, row number, kernel size), and stalk characteristics (height, lodging).

Sweet corn is grown on approximately 2,000 acres in the state of Maine and comprises approximately half of the acreage planted to retail vegetable production. In the last ten years development of synergistic and augmented sweet corn genetics has greatly increased the number of many new sweet corn varieties available. Most of these new varieties have not been extensively trialed under Maine growing conditions, where cold soil temperatures can significantly affect seed germination and early plant growth. Plant stand establishment, yield and ear quality

characteristics of these new varieties need to be evaluated under Maine growing conditions. Approximately 18 super sweet and augmented super sweet corn varieties will be evaluated in replicated randomized complete blocks.

- This trial will require approximately 1 acre of land (\$1,400).
- Anticipated Completion Date: Continuous

Short-Day Strawberry Evaluation

Objective: Determine relative performance of 24 June-bearing strawberry varieties, including plant characteristics (vigor, hardiness, and disease tolerance), fruit characteristics (size, shape, color, firmness, and flavor) and yield, over three harvest seasons (2016, 2017, and 2018).

Strawberries are an important high value retail crop for many diversified farmers, with approximately 1000 acres harvested in Maine each season. A variety trial of new selections and established varieties will be established at Highmoor in 2015 under a conventional matted row system with 24 varieties in 20 foot long plots arranged in a randomized complete block plan with four replications. 2016 will be the first harvest year of the trial. Plots will be renovated following harvest in anticipation of two more harvest seasons.

- The trial will require approximately 0.5 acre of land (\$700).
- Anticipated Completion Date: April 30, 2019

Expected Outcomes and Impact Assessment

Data from these trials will establish a resource of scientifically-based, reliable information regarding variety performance under Maine growing conditions upon which farmers can base variety purchasing decisions. Improved variety decisions will lead to improved crop success, including higher yields, improved crop quality, reduced pest pressure, and/or expanded market opportunities. Specifically, varieties with proven local adaptation will be recommended in updated grower resources, including the New England Vegetable Management Guide, the Maine Vegetable Variety Recommendations Fact Sheet, and Extension vegetable growing web resources. Growers will also be informed of new variety recommendations through numerous presentations at meetings (see below), and through consultations. We expect that growers will use the trial results as a primary source of information when making variety purchasing decisions; that recommended varieties will be trialed by growers as a result; and, ultimately adopted to improve crop production and quality standards statewide. We expect this information to reach over 200 growers annually, and if only 25% initially adopt new variety recommendations, over 2500 acres of vegetable production could be influenced in a single year.

Grower surveys will be carried out annually at both the Maine Vegetable and Fruit School (approximately 190 farmers attend) and Maine Ag Trades Show (approximately 85 attendees) to determine levels of adoption of recommended varieties and sources of information farmers are using to make variety decisions economic impact of variety recommendations. Historically, attendance at these meetings provides an acceptable sample size and cross section of the industry, including small, mid-size and large business operators. We are in the process of developing online surveys for webpage visitors and blog followers to expand the reach of our assessments, and plan to initiate their use in 2013. Data from these sources combined with updated agricultural census data, and input from industry leaders (Maine Vegetable & Small Fruit Growers Association, Maine Organic Farmers and Gardeners, Maine Department of Agriculture) will provide the basis for assessing impacts on an industry level for the state, anticipated for 2015.

Outreach and Publication Plan

Data resulting from these trials will be statistically analyzed, interpreted and summarized for distribution to growers, Extension educators, consultants, seed companies and nurseries. We anticipate presentation of the data to growers at meetings including the Maine Vegetable and Small Fruit Growers Association Meeting (Jan. 2015), the Maine Vegetable and Fruit School (March 2015), the New England Vegetable and Berry Growers Winter Meeting (Feb. 2015) and the New England Vegetable and Berry Conference (December 2015). The results will also be presented in the statewide Extension Vegetable Newsletter, and the Maine Vegetable and Small Fruit Growers Association Newsletter. Reports and data from previous trials are currently posted on our Extension web page,

(<https://extension.umaine.edu/highmoor/research/>) and we will expand and enhance these presentations to increase their use by growers. The page will allow visitors to view results by crop and chronologically. Growers will be notified of additions to the trial information and variety recommendations on the page through our blog. We anticipate trial results and recommendations will be shared with regional horticultural educators and researchers through poster and oral presentations at regional and national meetings of the American Society for Horticultural Science, leading to publications in *HortTechnology*. The results of the vegetable variety trials also provide the basis for making appropriate variety recommendations in the *New England Vegetable Management Guide*, a regional publication of cooperating state Extension specialists distributed to more than 1500 vegetable growers throughout New England. Growers and Master Gardeners will be provided with opportunities to view the trials first-hand and discuss the varieties during summer field days and twilight meetings.

Budget Justification

Funds from the Maine Agricultural Center are needed to offset MAFES service fees and support temporary labor to establish and maintain the trial plots during the growing season and to help with data collection.

Hatch funds will be used to pay for soil testing and growing media and replacement hand tools.

Gifts from The Maine Vegetable and Small Fruit Growers Association (MVSFGA), The New England Vegetable and Berry Growers Association (NEVBG) will be used to support travel to regional and national meetings to present findings of this research.

The following seed companies: Seedway (Elizabethtown, PA), Siegers Seed Co (Holland, MI), Rupps (Wauseon, OH), Stokes (Buffalo, NY), Harris (Rochester, NY), and Johnny's Selected Seeds (Albion, ME) will provide support through donations of seed and some supplies.

It is anticipated that Cooperative Extension will meet the costs of printing, copying and mailing reports, newsletters and surveys associated with this study, as the distribution of information will be managed through established Extension channels.

2015 Progress Report

Original project objectives that were met and significant findings:

Sweet Corn:

Of the 20 varieties of supersweet cultivars evaluated in 2015, the best performing for growth habit and ear quality this year, listed in order of maturity (earliest to latest) were: Anthem, Superb, CSABF 12-551, Mirai 315, EX 08767143, Snack Pack, Aces, and Obsession. The corn was seeded on 10 June. Harvest began 1 September with the earliest varieties. The latest variety was harvested on 10 September. With the exception of BC0805 (which was abandoned due to very poor stand), All cultivars performed well and recovered from a severe hailstorm that struck with the plants were at pre-tassel.



Butternut Squash:

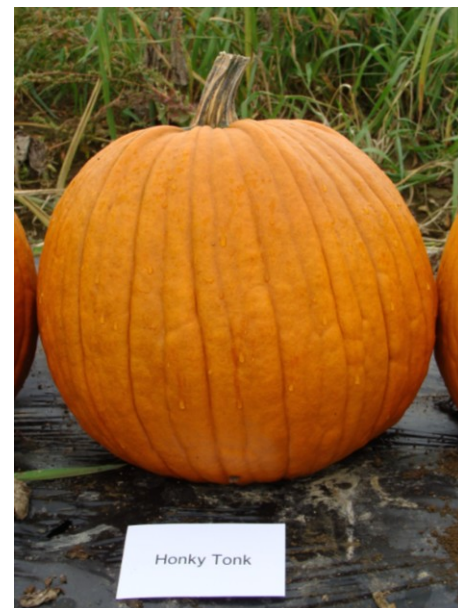
Sixteen varieties of butternut squash were evaluated in 2015. Plants were started in the greenhouse on 2 June and transplanted to the field on 17 June. Harvest began 25 September. Based on the results of this trial, Avalon showed the best overall performance and large fruit size, similar to 2014, although fruit size among all varieties was much smaller this year, due to poorer growing conditions, a severe hailstorm that damaged the plants, and an herbicide failure. Of the medium-sized varieties, Victory and RB4757A performed well and had good fruit characteristics. Of the small-sized varieties, Betternut 401, Waltham and Metro all had good yield and fruit characteristics.

Pumpkins:

Twenty varieties of Jack-o-Lantern pumpkins were evaluated in 2015. The plots were direct-seeded through black plastic mulch on 15 June. While hail damaged a significant portion of the early fruit set, late fruit set was strong and, combined with a late fall, allowed a good crop to be harvested. Conestoga Special produced the largest fruit of the trial, with good shape, color and ribbing, but a low fruit count. Early King was another good performing variety in the largest fruit class. In the medium-sized fruit class, Phatso III, Hannibal and Cargo had good yields and high marks in most fruit quality characteristics. In the smaller-size fruit class, Honky Tonk produced high numbers of very good quality fruit. Gold Challenger and Orange Rave also performed well in this class.

Strawberries:

Twenty-five varieties of June-bearing strawberries were established on raised, drip –irrigated beds. Each treatment/variety is replicated 4 times in 20-foot long plots. The beds were mulched for winter protection in late December and will be harvested in June-July of 2016 to determine yield and fruit quality performance. We anticipate renovating the beds for a second harvest season in 2017.



Butterhead Lettuce Trial:

The field fertilized with 500 pounds 15-15-15 prior to making beds. Beds were 32 inches wide and 62 inches on center and covered with white mulch film. Lettuce was transplanted three rows on the bed with plants spaced 12 inches on center. Plots consisted of four plants and there were three replications. Single plants were measured and rated for: body, sweetness, bitterness and bottom rot at maturity. Traits were rated on a 1 (less) to 5 (more) scale. Harmony produced the largest butterhead though not significantly larger than the ten other varieties. Nancy, Rhapsody and Adriana had the sweetest taste and Edox and Alkindus were the most bitter. Buttercrunch and Rhapsody were rated worst for bottom rot susceptibility.



Carrot Trial:

Carrots were direct seeded into a field using a single row Jang seeder. Rows are 23 inches on center and each plot was eight feet long with two rows. The field was irrigated using overhead irrigation to establish the crop. Weeds were controlled through hand weeding. In late August, plant stands were thinned to approximately 20 plants per foot. Bunches of 12 representative roots from each plot were weighed and photographed. The remaining roots from each plot were topped, counted and weighed. All roots from each plot were placed into perforated plastic bags and placed into cold storage. Through the winter and spring samples will be taken and measured for brix and flavor. All varieties grown produce roots of acceptable quality and flavor. There were however, significant differences in uniformity of plant stand. Nantindo, Goldfinger Honeysnax, Nutri-red, Purple 68, and Snowman each had poor stands.

Original project objectives not met:

Bell Pepper:

The bell pepper trial was planted but was abandoned after a severe hailstorm in July destroyed many of the plants.

Butternut Squash:

We had intended to carry out storage trials with selected butternut varieties, but postponed this work until 2016, due to the relatively poor overall quality of the fruit this year.

Educational material, publications, and programs:

Reports were sent to industry partners.

The results of the lettuce, carrot, butternut squash, sweet corn, and pumpkin trials were reported at the Annual Meeting of the Maine Vegetable & Small Fruit Growers Association at the Maine Agricultural Trades Show in Augusta on January 15, 2016. In addition to an illustrated talk, participants were given handouts with the results for later reference.

The forthcoming edition (2015-2016) of the New England Vegetable Management Guide is extensively revised in regards to vegetable variety recommendations. Much of the new information was directly adapted from the results of recent vegetable trials at Highmoor Farm, including sweet corn.

Research reports are being added to the Highmoor Farm web site,
<https://extension.umaine.edu/highmoor/research/>

Evaluation of project impacts:

Eighty percent of the attendees completing our survey at the annual meeting of the Maine Vegetable and Small Fruit Growers Association indicated the variety trials conducted at Highmoor farm to be important or highly important. A phone survey of 20 growers indicated information provided from the Highmoor farm vegetable cultivar trials is being used to make decisions on which cultivars to plant and estimated the economic value of good variety selection to be between \$400 to \$600 per crop. Of the growers consulted, the economic benefit ranged from \$500 to \$2500 per farm.