OREGON PROCESSED VEGETABLE COMMISSION

RESEARCH REPORTS 2022-2023

1. PROJECT YEAR: *2022*

Project Title: Broccoli Breeding and Evaluation

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Total project request:
2022: **$7,395**

Other funding sources: None

2. EXECUTIVE SUMMARY (ABSTRACT):

Oregon has the climate and infrastructure to produce high quality broccoli for processing. The main constraints are high labor costs and buffering against environmental perturbations. We have been breeding broccoli to be better adapted to mechanical harvest as well as selecting for traits that improve processing quality. The objectives of this project are to breed high yielding broccoli cultivars with excellent processing quality and field productivity that includes exserted, large and firm heads with reduced leaves about the head. Processing traits include segmented heads with uniformly colored, small florets with fine beads and short pedicles. In 2022, funding was reduced and the yield and quality evaluation trial, along with processing samples at the OSU Pilot Plant were eliminated. We grew only the breeding nursery for generation advance and seed maintenance. Our breeding nursery consisted of 19 advanced inbred lines, 12 F_1 hybrids, 30 lines in early generations of inbreeding and 14 cytoplasmic male sterile (CMS) lines at various stages of backcrossing.

3. FULL REPORT

3.a. BACKGROUND

Oregon has a climate favorable for summer production of broccoli with relatively mild temperatures and a long growing season. The challenges facing broccoli growers are the cost of production and buffering against climate perturbations. The challenges facing processors are finding cultivars with the desired quality and ease of processing characteristics along with productivity. Mechanization has reduced labor costs in many crops, but Cole crop harvest remains relatively non-mechanized. Large labor crews are typically needed to harvest broccoli and cost and access to labor are the two main problems for broccoli harvest – cost in terms of wages to workers and access in that other crops such as blueberries need labor for harvest at the same time as broccoli. The industry is progressing towards mechanization but problems remain in developing systems that achieve efficiency in the field and deliver quality product to the processing plant. One difficult aspect of mechanical harvest in particular appears to be the removal of leaves from around the head.

The three pieces that have to be joined to achieve efficient mechanization are the production system, the harvest equipment, and the plant genetics. Our program focuses on the plant genetics. The OSU broccoli breeding program has worked for over 25 years to develop cultivars that have architectural traits that make the cultivar more amenable to machine harvest. In 2017, we released 'Cascadia' F_1 broccoli to the industry, which had superior harvest and processing traits, but was ultimately rejected because head size and yields were not on par with commercial cultivars being used at the time.

The two key factors for developing cultivars suitable to machine harvest are uniform heading and appropriate plant architecture. Most commercially available broccoli hybrids are high yielding but have short plants with heavy and poorly exserted heads. Short plants have high fiber in the portion of the stem subtending the head that must be used to achieve a normal-length cut. The lack of height as well as the high fiber makes them a challenge for machine harvest.

In the processing plant, traits that would increase the efficiency of the process include reducing leaves around the head and minimizing large floret size. Historically, leaves around the head have been removed by the harvester when harvested by hand. Leaf removal by machine has proved more difficult with the result that heads coming into the plant carry too much vegetative matter, resulting in the rejection of lots. Florets larger than 2½ inches have to be recut, which decreases processing efficiency; plants with small florets would be preferred over those with high yields but large florets. Emphasis for most commercial hybrids has been on large, dense heads on short-stature plants. As a result, these have many large leaves around the head, and achieve high head weight by producing larger florets. These are traits that are amenable to breeding and our exserted head materials already have fewer leaves and smaller florets with the main challenge with these hybrids being achieving high levels of productivity in this architectural package. Other quality traits needed in a processing broccoli include florets and stems that are uniformly dark green in color and shape; and beads that are small and retained during the blast freezing process.

On the horizon is the need to develop more heat tolerant broccoli cultivars as temperatures increase and we have more extreme weather events during the growing season. Inbred lines from the Oregon State University breeding program have the genetic potential to create hybrids with greatly improved head exsertion and segmentation, better color, and low fiber. The OSU hybrids are suitable for machine harvest, and some inbreds possess disease resistance to downy mildew and tolerance to head rot. Since the release of Cascadia, we have been selecting for higher and stable yields in our materials.

To bring OSU hybrids into commercial production, cytoplasmic male sterility needs to be backcrossed into inbreds used as the female in crosses. There is also a need to derive new inbreds with improved abiotic and biotic stress resistance.

3.b OBJECTIVES

1. Breed broccoli cultivars with excellent processing quality and field productivity.
    a. Bring in new genetics from non-cytoplasmic male sterile commercial hybrids to broaden the genetic base in order to increase yields and stability.
    b. Select for field traits that includes exserted heads with reduced leaves about the head on lodging resistant plants. Hybrids should be high yielding, have solid stems with large and heavy heads with shallow branches.
    c. Processing traits include segmented heads that produce uniformly colored florets that are dark green in color with fine beads and short pedicles. Florets should be <2½" in size.
2. Develop seed production systems using cytoplasmic male sterility (CMS) to produce field scale quantities of F_1 hybrid seed.

3.c. SIGNIFICANT FINDINGS

- An observation trial consisting of 75 inbreds, early generation lines, commercial and experimental F_1 hybrids and cytoplasmic male sterile backcrosses was grown in the field.
- OSU experimental lines had better exsertion, segmentation and reduced leafage around heads, as well as improved processing traits such as dark green stems and florets.
- Cuttings from 88 single plant selections and 19 mass selections were taken for propagation in the winter greenhouse.

3.d. METHODS

We continued to derive new inbreds and use these on a small scale to produce F_1 hybrid seed for replicated yield trials. Inbreds saved from the 2021 fall trials were grown from cuttings in the greenhouse. During the winter of 2022, these were bud-pollinated to perpetuate the line, and crossed to other inbred lines to produce seeds for field evaluation of combining ability for F_1 hybrid production. Crossing efforts focused on obtaining enough seed for maintenance and generation advance. New inbreds obtained from selections of a random-mated mass selected population originally developed under organic production systems, where cuttings have been brought into the greenhouse for self-pollination. Approximately five or more generations of selfing are required to develop homozygous inbreds.

Inbreds and experimental hybrids were grown in the 2022 main fall planting in the field in a single replicate observation trial (Tables 1 & 2). Commercial hybrids were also grown for comparison to experimental materials. Plots were evaluated for days to maturity, head exsertion, shape and segmentation, branching depth, bead size and color, head diameter, firmness and uniformity. An overall rating was also assigned to each accession.

Backcrossing of selected hybrids to place the nuclear genome in the Ogura cytoplasmic male sterile (CMS) background continued. We crossed to develop CMS forms of S454, S462, S463, S471, S473 and S475.

3.e. RESULTS & DISCUSSION

Greenhouse inbred and hybrid seed production: Cuttings were taken from inbreds and breeding lines grown in the field in 2021 to establish material for crossing and hybrid seed production in the greenhouse during the winter of 2021-2022. Sixty-two selections were taken for rooting with most of these surviving to be potted for crossing. These were bud pollinated by hand to self the inbreds and produce seed for the 2022 growing season. Most lines are highly inbred but a few are still segregating and showing significant variation in the field. The process was repeated at the end of the 2022 growing season where cuttings of 88 single plant selections and 19 mass selections were collected and brought into the greenhouse for rooting in November.

Observation Trials: The observation trial included 19 highly inbred lines, 12 F_1 hybrids, 30 lines still undergoing inbreeding and selection, and 14 cytoplasmic male sterility (CMS) lines at various stages of backcrossing to selected inbreds (Table 1). Growth in the field was uneven with some plots showing various degrees of stunting. Data was not recorded on these plots. We paid particular attention to head size, branch depth and head firmness in making selections Thirteen accessions received overall ratings of 7 or above (Table 2).

4. BUDGET DETAILS

Breeding (Myers)	
Salaries and benefits	
Faculty Research Assistant, field, 0.06 FTE	$2,183
OPE @ 75.4%	$1,638
Wages and benefits	
Student Wages ($13.50/hr, 15 hr/wk, 8 wks	$1,620
OPE @ 10%	$162
Supplies	$300
Land use and greenhouse rental	$1,492
Total	$7,395

BUDGET NARRATIVE

Salary and OPE is requested for a full-time faculty research assistant who will commit approximately 6% FTE to broccoli breeding. OPE for FRA is 75.4%. The remainder of salary will come from other sources. $1,620 is requested for a summer undergraduate student to assist in plot maintenance and harvest operations. Undergraduate student OPE is 10%. Funds for services and supplies includes $300 for field and greenhouse supplies ((fertilizer, pots, labels, stakes, tags, crossing supplies, envelopes, paper bags, etc.). Facilities user charges include land use rental (0.5 acre at $1,460 per acre = $730), and greenhouse rental ($1.61*700 sq. ft. = $1,127).

Table 1. Broccoli germplasm in the OSU broccoli breeding program in 2022.

Accession	Prev. no.	Pedigree
	Inbreds	
S446	91-203-2-3-2-1	S352/S240-11-8
S466	11-1-1-1-2	S446/S460
S454	91-232-4-1-2-1	S233/Emerald City
S462	04-4-2-2-1	S411/S446/S454/S387
S463	04-5-2-2-1	S454/S446/USVL 089
S465	04-5-2-2-3	S454/S446/USVL 089
S469	11-2-1-1-1	S454/RS2
S471	09-1-1-3-1-2-2	OSU OP Selection
S473	09-1-3-1-1-1-1	OSU OP Selection
S475	09-1-1-3-1-1-2	OSU OP Selection
S475-1G (glossy)	09-1-1-3-1-1-2	OSU OP Selection
S479	(S446/S457)-1-1-2-3	S446/S457
S481	(S463/S446)-1-1-1-1	S454/RS2
S482	(S454/RS2)-2-1-1-2-6-1	S454/RS2
S483	(S454/S445)-1-1-1-2-1	S454/S445
S486	(S458A/S446)-1-3-1-2-2	S458A/S446
S487	(S458A/S446)-1-3-1-2-3	S458A/S446
S488	(S458A/S446)-1-3-1-2-4	S458A/S446
20-233-1-1-1	(S463/S473)-1-1-1	S463/S473
20-233-1-2-1	(S463/S473)-1-2-1	S463/S473
20-234-1-1-2	(S475/S463)-1-1-2	S475/S463
20-234-1-1-4	(S475/S463)-1-1-4	S475/S463
20-234-1-1-5	(S475/S463)-1-1-5	S475/S463
20-234-1-1-6	(S475/S463)-1-1-6	S475/S463
20-234-1-1-7	(S475/S463)-1-1-7	S475/S463
20-234-2-1-1	(S475/S463)-2-1-1	S475/S463
20-234-3-1-1	(S475/S463)-3-1-1	S475/S463
21-235-1-2	(S471/S483)-1-2	S471/S483
21-235-1-4	(S471/S483)-1-4	S471/S483
21-236-1-1	(S471/S486)-1-1	S471/S486
21-237-1-1	(S471/S490)-1-1	S471/S490
21-238-1-1	(S471/S492)-1-1	S471/S492
21-239-1-1	(S473/S463)-1-1	S473/S463
21-240-1-1	(S475/S486)-1-1	S475/S486
21-239-2	(S473/S463)-2	S473/S463
21-241-1	S475-1Glossy/S471-1	S475-1Glossy/S471
21-241-2	S475-1Glossy/S471-2	S475-1Glossy/S471
21-241-3	S475-1Glossy/S471-3	S475-1Glossy/S471
OSU OP-1		OSU OP Selection
OSU OP-2		OSU OP Selection
OSU OP-3		OSU OP Selection
OSU OP-5		OSU OP Selection
OSU OP-6		OSU OP Selection
OSU OP-7		OSU OP Selection

Accession	Prev. no.	Pedigree
OSU OP-8		OSU OP Selection
OSU OP-9		OSU OP Selection
OSU OP-10		OSU OP Selection
OSU OP-11		OSU OP Selection
New crosses		
22-242		S471/S463
22-243		S475/S463
22-244		S475/S481
22-245		S475/S487
22-246		S475/S488
22-247		S479/S481
22-248		S479/S486
22-249		S479/S488
22-250		EP/S471
22-251		EP/S475
22-252		EP/S481
22-253		EP/S483
CMS lines		
(A463/S463)		(A411*3-1/S463)-2//S463
O446		O446*O446(?)
O446*2-1/S462-1/S454		O446*2-1/S462-1//S454
O454-1*3		(O446*3/S446)-1/S454*3
O454-2*3		(O446*3/S446)-2/S454*3
O463-1*3		(O446*3/S446)-2//S463*3
O463-4*4		(O446*3/S446)-4//S463*4
O473-1*3		(O446*3/S446)-1//S473*3
O473-2*3		(O446*3/S446)-2//S473*3
O473-3*3		(O446*3/S446)-3//S473*3
OS473-1*3-2/S471		[(O446*3/S446)-1//S473*3]-2///S471
O473-1*2/475		(O446*3/S446)-1//S473*2///S475
O473-4*2/475		(O446*3/S446)-4//S473*2///S475
OS473-1*3-2/S471		[(O446*3/S446)-1//S473*3]-2///S471
OS473-1*3-2/S471		[(O446*3/S446)-1//S473*3]-2///S471

Table 2. Observation data for OSU experimental broccoli inbreds and hybrids grown at the OSU Vegetable Research Farm near Corvallis OR in 2022[z].

Entry	Date	Days to harvest maturity	No. plants	Head Exsertion[y]	Head shape[x]	Head Segmentation[w]	Branch depth[v]	Bead size[u]	Stem Color[t]	Head Diameter (cm)	Head Firmness[s]	Plot Uniformity[r]	Overall[r]	Notes
Commercial cultivars														
Emerald Pride	24-Sep	53	10	5	5	3	7	5	3	12	7	7	5	
Covina	8-Oct	67	3	3	6	3	1	3	3	15	9	9	3	
Emerald Jewel	8-Oct	67	5	3	5	1	1	3	3	15	8	7	3	
Green Magic	1-Oct	60	14	5	6	1	5	5	5	10	7	3	3	
Emerald Star	8-Oct	67	8	3	6	3	3	3	5	20	9	7	5	
OSU Inbreds														
S446	15-Oct	74	8											Quite variable – latter 1/3 stunted
S466	23-Oct	82	6											Stunted, no obs data recorded
S454	23-Oct	82	12											Stunted, no obs data recorded
S462	15-Oct	74	10											Stunted, no obs data recorded
S463	23-Oct	82	6											Stunted, no obs data recorded
S465	23-Oct	82	8											Stunted, no obs data recorded
S469	23-Oct	82	5											Stunted, no obs data recorded
S471	23-Oct	82	11											Stunted, no obs data recorded
S473	23-Oct	82	11											Stunted, no obs data recorded
S475	23-Oct	82	14											Stunted, no obs data recorded
S479	23-Oct	82	13											Stunted, no obs data recorded
S481	8-Oct	67	12											Stunted, no obs data recorded
S482	15-Oct	74	9											Stunted, no obs data recorded
S483	15-Oct	74	13											Stunted, no obs data recorded
S486	8-Oct	67	13	9	4	7	9	3	7	12	7	7	7	
S487	8-Oct	67	5	7	7	5	7	1	9	8	8	7	7	

Entry	Date	Days to harvest maturity	No. plants	Head Exsertion[y]	Head shape[x]	Head Segmentation[w]	Branch depth[v]	Bead size[u]	Stem Color[t]	Head Diameter (cm)	Head Firmness[s]	Plot Uniformity[r]	Overall[r]	Notes
S488	8-Oct	67	15	9	6	7	7	3	7	10	7	7	6	
F1 hybrids														
S471/S463	8-Oct	67	49	8	6	7	3	3	6	18	7	7	9	
EP/S483	8-Oct	67	48	6	3	5	5	5	5	12	7	5	7	
S475/S463	8-Oct	67	41	7	3	5	5	5	7	10	9	7	7	
S475/S481	8-Oct	67	45	7	4	8	5	3	7	15	9	3	7	Some leafy heads.
S475/S487	8-Oct	67	45	7	4	8	7	1	7	10	9	3	5	Somewhat stunted.
S475/S488	8-Oct	67	44	7	4	5	3	3	7	12	9	1	5	Most of plot stunted.
S479/S481	15-Oct	74	45	6	4	7	9	1	7	12	9	1	3	Selected plant vigorous among mostly stunted, button heads.
S479/S488	23-Oct	82	45											Leaners, discard.
EP/S471	8-Oct	67	51	4	6	3	4	4	4	10	7	1	5	
EP/S475	8-Oct	67	36											Stunted, no obs data recorded
EP/S475	8-Oct	67	36	5	3	5	6	3	5	15	7	1	6	
EP/S481	8-Oct	67	67	6	4	7	9	3	3	20	5	1	5	Quite variable & latter 1/3 of row stunted
EP/S481	8-Oct	67	32	7	4	3	7	7	5	25	7	7	9	Robust.
EP/S483	8-Oct	67	30	7	4	5	7	5	5	12	5	3	5	
Glossy experimental lines														
S475-1Glossy/S471	15-Oct	74	30											8 glossy plants.
S475-1Glossy/S471	23-Oct	82	25											All glossy.
Early generation inbreds														
OSU OP-1	15-Oct	74	45	6	7	1	4	4	5	10	5	1	1	Small heads, smooth dome.
OSU OP-2	6-Oct	65	22	7	5	3	5	6	5	12	5	3	5	
OSU OP-3	8-Oct	67	43	5	4	1	5	5	4	12	7	1	6	Some w/ few head leaves, last 2/3s of plot stunted.

Entry	Date	Days to harvest maturity	No. plants	Head Exsertion[y]	Head shape[x]	Head Segmentation[w]	Branch depth[v]	Bead size[u]	Stem Color[t]	Head Diameter (cm)	Head Firmness[s]	Plot Uniformity[r]	Overall[r]	Notes
OSU OP-5	3-Oct	62	41	6	5	1	5	8	7	8	4	1	4	Stunted & mostly button heads.
OSU OP-6			36											Late, stunted, heavy aphids.
OSU OP-7	24-Sep	53	39	7	5	5	3	3	5	15	7	7		
OSU OP-8	1-Oct	60	49	7	5	9	3	3	7	20	7	1	7	Highly segmented very loose heads but shallow branching, some wilty heads but no club root.
OSU OP-9	8-Oct	67	37	9	7	5	5	5	5	8	7	5		
OSU OP-10	24-Sep	53	45	9	4	9	9	5	5	10	4	1	7	
OSU OP-11	20-Sep	49	49	6	5	3	7	5	5	12	5	5	7	Early, vigorous.
(S473/S463)-2	15-Oct	74	31										1	Irregular heads.
(S471/S483)-1-2	8-Oct	67	29	6	6	7	7	5	9	12	7	5	5	
(S471/S483)-1-4	8-Oct	67	29	7	7	6	7	7	7	12	8	5	5	
(S471/S486)-1-1	8-Oct	67	24	7	4	9	5	5	7	15	9	5	7	
(S471/S490)-1-1	8-Oct	67	15	7	5	7	5	3	5	20	7	7	5	
(S471/S490)-1-1	8-Oct	67	12											Stunted, no obs data recorded
(S471/S492)-1-1	23-Oct	82	29											Stunted, no obs data recorded
(S473/S463)-1-1	15-Oct	74	13	6	4	5	7	1	3	15	9	5	3	Small florets.
(S475/S486)-1-1	23-Oct	82	29											Stunted, no obs data recorded
(S463/S473)-1-1-1	8-Oct	67	26	6	4	5	5	4	5	12	7	3	1	Many blind.
(S463/S473)-1-2-1	8-Oct	67	27	6	5	7	5	5	5	15	5	3	5	
(S475/S463)-1-1-2	8-Oct	67	31	7	4	5	3	1	5	12	3	5	3	Shallow branching but soft heads & many leaners & blind plants.
(S475/S463)-1-1-4	8-Oct	67	33	5	5	5	6	2	5	12	9	5	5	Many irregular heads but firm.
(S475/S463)-1-1-5	8-Oct	67	29	5	4	3	2	3	5	15	9	7	7	Shallow branching.
(S475/S463)-1-1-6	15-Oct	74	30											Stunted, no obs data recorded
(S475/S463)-1-1-7	8-Oct	67	30	5	4	4	3	1	5	15	9	5	7	

Entry	Date	Days to harvest maturity	No. plants	Head Exsertion[y]	Head shape[x]	Head Segmentation[w]	Branch depth[v]	Bead size[u]	Stem Color[t]	Head Diameter (cm)	Head Firmness[s]	Plot Uniformity[r]	Overall[r]	Notes
(S475/S463)-3-1-1	8-Oct	67	19	7	3	7	7	1	5	20	9	7	5	Loose leafy heads.
Cytoplasmic male sterile inbreds														
(A463/S463)	23-Oct	82	14											Stunted, no obs data recorded
O446*2-1/S462-1/S454	8-Oct	67	16	7	6	7	5	3	7	10	8	7	7	
O454-2*3	15-Oct	74	13											Stunted, no obs data recorded
O463-4*4	8-Oct	67	13	6	5	3	4	5	7	15	7	7	7	
O473-1*3	1-Oct	60	13	9	1	9	9	3	7	20	3	7	1	Severe leaf spot.
O473-2*3	24-Sep	53	23	9	3	9	9	3	9	15	5	7	3	
O473-3*3	8-Oct	67	14	9	3	9	9	3	9	15	5	7	3	
OS473-1*3-2/S471	8-Oct	67	6	6	5	6	5	3	9	12	7	7	7	
O473-1*2/475	23-Oct	82	11											Stunted, no obs data recorded
O473-4*2/475	15-Oct	74	8											Stunted, no obs data recorded
OS473-1*3-2/S471	23-Oct	82	8											Stunted, no obs data recorded

[z]Trial was transplanted on Aug. 2 into variable length plots with rows spaces 30 in. apart. Plant spacing within row was 1 ft. [y]Scale of 1 - 9 where 1 is least and 9 is most head exsertion above canopy. [x]Scale of 1 - 9 where 1 is concave head, 5 is a flat head and 9 is an extreme domed head. [w]Scale of 1 - 9 where 1 is smooth dome, 5 is segmented but touching florets and 9 is separated florets. [v]Branching depth on a 1 - 9 scale where less depth is preferred. [u]Scale of 1 - 9 where 1 is coarse, 5 is medium and 9 is very fine bead size. [t]Scale of 1 - 9 where 1 is lighter and 9 is very dark green. [s]Scale of 1 - 9 where 1 is soft and 9 is very firm head. [r]Scale of 1 - 9 where 1 is least and 9 is best.

Project Title: Green Bean Breeding and Evaluation -2022

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Funding request for 2022-2023

$31,070 breeding
$9,442 processing
$40,511 total

Contributions from the OSU breeding program
$21,433

1. EXECUTIVE SUMMARY (ABSTRACT): Oregon is a major producer of processed green beans, and cultivars are needed that are adapted to western Oregon. The types that have traditionally been used are the bush blue lake (BBL) green beans with high yields and excellent processing quality. On the other hand, they need improvement in plant architecture, and disease resistance (especially to white mold and root rots). Further complicating the breeding process, BBL types are genetically isolated from other green beans which means that it is difficult to introgress traits from other types of green beans. The primary objective of the OSU green bean breeding program is to develop high yielding and high quality BBL green beans with high levels of white mold resistance. In 2022, a yield and processing trial of 31 OSU experimental advanced lines and five check cultivars was conducted. Most experimental lines had been tested in prior years but 12 were being evaluated for the first time. These also had been tested for white mold resistance in 2021 using the straw test. A second trial with 19 entries from commercial seed companies in addition to three checks and six OSU experimental lines were also grown and evaluated. Several commercial entries had BBL quality and high yields. OSU7318 performed well in a challenging year and we are moving forward with plans for release.

2. FULL REPORT

2.a. BACKGROUND Green beans grown for processing in the Willamette Valley contribute significantly to the Oregon state economy each year ($20.2 million in 2021). The industry produces a high-quality product with the unique flavor, color, and appearance based on the Bush Blue Lake (BBL) class of green beans. From genetic studies we have conducted, Blue Lake green beans form a distinct gene pool compared to other snap beans. Furthermore, the growing environment in Western Oregon is unlike any other green bean production area in the United States, and the OSU BBL cultivars have been bred for this environment for more than half a century. Developing productive varieties that are adapted to Western Oregon requires a dedicated breeding effort. BBL green beans have higher yield potential than those bred for the Midwestern U.S. A factor contributing to BBL pod quality is that these types typically

have very low fiber pods. A tradeoff of the higher yields is that BBL beans allocate fewer resources to vegetative growth, which can compromise plant architecture and lead to lodging when pod loads are heavy. Lodging and low fiber content contributes to susceptibility to white and gray mold by BBL types.

White mold disease caused by *Sclerotinia sclerotiorum* is a pathogen of more than 400 species of plants including snap bean. Not only does it have the potential to cause heavy yield loss, but it can adversely affect pod quality and cause rejection of whole lots at the processing plant if moldy pods in the lot exceeds 3%. The growing environment in western Oregon is favorable to disease development, especially during cooler and moist conditions that may occur anytime during the growing season. The disease is mainly controlled by fungicide application, which requires precise timing and can be expensive especially if two sprays are used. Biological control also has potential but is expensive has not been implemented on a wide scale. If genetic variation exists, resistance is usually the most efficient means of achieving control of any disease, as the costs associated with control of that disease are internalized in the cost of the seed. White mold disease resistance is no exception to this principle.

While the main focus of the program is on improving white mold resistance of the BBL types, other traits including yield, maturity, growth habit, pod size, shape and color, and processing characteristics need to be maintained or improved.

2.b OBJECTIVES

1. Breed improved Bush Blue Lake green bean varieties with:
    a. White mold resistance
    b. Improved plant architecture
    c. High economic yield
    d. Improved pod quality (including straightness, color, smoothness, texture, flavor and quality retention, and delayed seed size development)
    e. Tolerance to abiotic stresses

2.c. SIGNIFICANT FINDINGS

- A yield trial of 31 OSU experimental lines and five checks continued evaluation of 19 lines that had previously shown high yields and good quality in addition to 12 lines being tested for the first time.
- A trial with 19 commercial entries, three checks and six OSU experimental lines was also evaluated for yield, quality and pods were frozen for processing evaluation. One commercial entry was a wax bean, another was a Romano type with the remainder being green beans of different types.
- Production environment was challenging this year, especially for the commercial trial which had combined challenges of uneven stand establishment and high temperatures during pod development. While grand mean for the OSU trial was 9 T/A, that of the commercial trial was only 4.6 T/A.
- OSU7318 continues to have high yields and good quality. In the first trial, it yielded 8.6 T/A and was not significantly different from OR 5630. In the commercial trial, its yields at 5.7 T/A, were higher than the trial average and significantly better than OR5630 at 3.6 T/A. I plan to move forward with release.
- OSU7066 performed similarly to OR 5630 and has partial white mold resistance and remains under consideration.

- Another advanced line with good white mold resistance (OSU7199) did not perform well under heat stress and has been dropped from consideration for release but is being used in crosses because of its relatively high levels of white mold resistance.

2.d. METHODS

Varietal Development: The program continued with crosses among elite lines and the best white mold resistant lines. Pedigree and single seed descent breeding methods were used to advance and select early generation materials. While the emphasis was on breeding for white mold resistance, we also continued to incorporate improved plant architecture and conduct yield and processing trials of the best lines. Thirty-one advanced lines were included in this trial along with five check cultivars (Table 1-6). The yield and quality trial consisted of three reps arranged in a randomized complete block design and planted into 18 ft. single row plots with 30" row spacing. The trial was planted June 1. Five-foot sections of each plot were harvested up to three times to obtain data on graded yield and raw product evaluation. Lines were also evaluated for growth habit and graded samples were evaluated for pod smoothness, straightness, seed to pod ratio, and color. Those that met expectations in the raw product evaluation were frozen for evaluation of the processed product.

We also conducted a second trial of commercial snap bean lines and cultivars (Tables 7-12). Note that this trial is supported entirely by fees from seed companies, but we report results here because of the potential interest in cultivars developed by industry. The trial was planted June 15 in a similar manner to the first trial, except six reps were planted, of which four were harvested for evaluation. Otherwise the harvest and evaluation procedures were the same.

A sample display was conducted Oct. 31 at the OSU Pilot Plant where panelists evaluated snap bean samples for quality attributes. Data collected from panelists is shown in Tables 6 & 12. We also displayed samples on Nov. 16 at the Pacific Northwest Vegetable Association meeting in Kennewick, WA where growers, processors and seed companies were able to view samples.

Advanced Lines: Seed increase, rogueing, and sub-line maintenance of the historical releases continued.

2.e. RESULTS & DISCUSSION

Varietal Development: In 2022, we grew 524 plots in the early generation nursery. Plots consisted of populations and lines at various stages of inbreeding. The majority of these were advanced lines, the remainder being populations at various stages of advance.

Yield Trials: For the first trial (Table 1), most experimental entries fell into the 5 to 6 (full) sieve classes (50-60% 1-4 sieve) with two lines judged to be 4 sieve (whole) beans (Table 4). Maturities ranges from 61 to 70 days (Table 4), reflecting an early June planting date and warm temperatures. In general, this trial suffered little heat damage. OR5630 was relatively high yielding with 9.1 T/A (10.3 T/A adjusted). No experimental lines had significantly higher yields. Our 4-sieve check, Sahara, had a yield of 7.9 T/A which was significantly lower than OSU5630. We calculated pod filling efficiency (PFE), which is yield divided by days to harvest and gives an estimate of rate of gain in yield per day. PFE showed a positive correlation with yield but higher PFE was achieved when higher yields were achieved in fewer days.

Several of the experimental lines in the trial for the first time exhibited a pod cross-sectional shape that was heart or oval pods and some were discarded at this stage. Pod color in general matched OR5630 (Tables 4 & 6). Seed development by sieve size and harvest date is shown in table 5. Most lines showed typical BBL full seed development by the time of harvest. Quality and flavor data from the sample display is shown in table 6. This was a non-blind evaluation so there may be some bias to evaluations as shown by the high score for OSU5630 checks. Among experimental lines, OSU7318 continued to receive relatively high ratings.

Commercial Green Bean Trial: This trial had 19 commercial entries, three check cultivars and six OSU experimental full sieve types (Table 7). Most commercial lines submitted for trial were 5- or full-sieve, but the other ranged from extra fine (2 sieve) types to whole bean (3 & 4 sieve) types. One entry was a wax bean and one a Romano while the remainder were green beans. Yields were considerably lower (0.9-8.4 T/A) in this trial (Table 8) due to a combination of uneven germination and emergence and high temperatures at flowering. OR 5630 yielded only 3.7 T/A with the six lines that had significantly higher T/A being those that matured early. Sahara with its built-in heat tolerance did relatively well at 5.6 T/A (Table 8). Among the earliest and highest yielding commercial lines were the RR lines from Pure Line Seeds. Raw product quality for most was acceptable although several had pod color too light to blend with BBL types (Table 10). Seed size development notes during successive harvests are in table 11 and processed product evaluation is shown in table 12. .

White Mold Research: A long term project has been the development of a MAGIC (multi-parent advanced generation inter-cross) population based on an 8 way cross of the most resistant snap bean lines we have identified through GWAS (genome wide association mapping). In the winter of 2022, 622 lines were produced in the final 8-way cross. These were selfed and the progeny planted in the field and grown to produce 1055 lines. These undergoing another generation of advance in the winter 2022-2023 greenhouse. These will be grown in the field in 2023 to produce families for white mold screening.

We also submitted three advanced lines (OSU7066, OSU7199 and OSU7318) to straw tests in the National Sclerotinia Nursery. The first two advanced lines showed moderate levels of resistance in the Oregon tests while OSU7318 was susceptible. In field trials, OSU7318 has shown reduced levels of disease, which we can attribute to avoidance rather than physiological resistance.

Advanced lines for release: Table 13 summarizes three years of yield data along with disease reaction for 11 advanced lines that show the most promise for release. These have all been shown to have acceptable quality. OSU7318 is a consistently high yielding line with excellent quality. OSU7199 has a high average yield, but performance has been variable across years. It does, however, have very good white mold resistance. We will not advance OSU7199 further for release but will use it as a parent in crosses to pyramid white mold resistance. Another line of interest is OSU7066 with relative high yield and very good white mold reaction. We are currently scaling up production of OSU7318 and OSU7055 as well as other lines for evaluation by seed companies and possibly release.

Requested Budget ***1) Breeding (Myers)***		
Salaries and benefits		
Faculty Research Assistant	$17,462	
OPE @ 75.4%	$13,107	
Wages and benefits		
Student Wages	$0	
OPE @10%	$0	
Supplies	$500	
Travel	$0	
Land and greenhouse rental	$0	
Total (breeding)	**$31,070**	
2) Processing Evaluation (Wiegand)		

Salaries and benefits	
Faculty Research Assistant	$3,339
OPE @ 61.59%	$2,057
Wages and benefits	
Student wages	$2,496
OPE @ 10%	$250
Supplies	$1,300
Total (processing)	**$9,442**
Grand Total	**$40,511**

BUDGET NARRATIVE

Request to OPVC:
Budget Justification: Salary and OPE is requested for a full-time faculty research assistant who will commit 40% FTE to green bean breeding. OPE is 75.4%. A Food Science and Technology faculty research assistant will commit approximately 0.05 FTE to processing of entries from green bean trials; the remainder of salary to come from other sources. Undergraduate student wages of $2,496 are requested for the processing program with 10% OPE. $500 is requested for materials and supplies for field work (includes stakes, tags, envelopes, paper bags, etc.).

Contributions of the OSU breeding program

Student Wages	$10,260
OPE @ 10%	$1,026
Supplies	$500
Travel	$93
Land and greenhouse rental	$9,554
Total	$21,433

Contributions of the Vegetable Breeding Program:
Undergraduate student wages of $10,260 are estimated for the breeding program with 10% OPE. An additional $500 is required to cover greenhouse materials and supplies expenses (fertilizer, pots, labels, stakes, tags, crossing supplies). To cover transport of samples from the farm to campus for processing, $93 is estimated. Land use rental at the OSU Vegetable Research Farm consists of five acres at $1,460 per acre and greenhouse rental of 1,400 ft^2 at $1.61 per square foot.

Table 1. Experimental green bean lines and check cultivars grown in a yield and processing evaluation trial at the OSU Vegetable Research Farm in 2022.

No.	Entry	Pedigree	Predominant sieve size
1	Cornell501	(WM check)	5
2	NY6020-4	(WM check)	5
3	OSU5630	(check)	5-6
4	Banga	(check)	2
5	Sahara	(check)	4
6	OSU7048	Banga/5600	2-3
7	OSU7066	5630/Cornell 501	6
8	OSU7069	5630/Cornell 501	6
9	OSU7072	5630/Cornell 501	4
10	OSU7074	5630/Cornell 501	4
11	OSU7099	6443/Cornell 501	6
12	OSU7184	6443/6772	6
13	OSU7185	6443/6772	5
14	OSU7187	6443/6772	6
15	OSU7199	6792/6443	6
16	OSU7208	6792/6443	6
17	OSU7261	ID Refugee/6443	5
18	OSU7262	ID Refugee/6443	4
19	OSU7263	ID Refugee/6443	5
20	OSU7273	5630/6771	6
21	OSU7280	5630/6771	5
22	OSU7281	5630/6771	6
23	OSU7285	5630/6771	5
24	OSU7290	5630/6771	6
25	OSU7304	5630/6771	4
26	OSU7305	5630/6771	5
27	OSU7306	5630/6771	5-6
28	OSU7307	5630/6771	6
29	OSU7316	5630/6771	5
30	OSU7318	5630/6771	5
31	OSU7377	B8571/5-07	4
32	OSU7430	B8579/5-19	4
33	OSU7481	B8595/5-13	5
34	OSU7491	B8601/5-20	5
35	OSU7503	B8604/5-30	6
36	OSU7534	B8608/5-28	6

Table 2. Yield and yield parameters for OSU experimental green bean lines grown in a trial planted June 1 at the OSU Vegetable Research Farm in 2022.[z]

Entry	Plants/A	Harvest DAP	T/A	T/A (adj)[y]	Pod fill eff[x]
Banga	193,600	63	6.4	6.4	205
OSU5630	176,821	63	9.1	10.3	289
Sahara	187,792	65	7.9	7.9	243
OSU7048	160,043	63	5.5	5.5	173
OSU7066	170,691	61	8.1	8.5	267
OSU7069	149,072	63	7.7	8.6	245
OSU7072	178,435	65	7.7	11.2	236
OSU7074	179,080	64	7.7	8.9	240
OSU7099	179,403	62	7.0	7.3	227
OSU7184	149,717		discard		
OSU7185	163,269	68	5.9	5.3	174
OSU7187	154,557	68	4.8	4.5	140
OSU7199	146,491	68	8.4	7.3	248
OSU7208	179,080	65	6.0	5.5	184
OSU7261	152,299	64	6.8	8.3	212
OSU7262	132,293	63	6.2	9.1	197
OSU7263	158,752		discard		
OSU7273	183,597	63	9.5	12.7	302
OSU7280	161,656	63	7.1	9.8	227
OSU7281	162,624	62	6.3	7.2	204
OSU7285	162,947	63	7.8	10.4	249
OSU7290	161,979	63	9.8	12.1	310
OSU7304	185,211	61	8.6	12.1	282
OSU7305	193,600	63	9.0	12.0	286
OSU7306	191,987	64	9.3	10.2	290
OSU7307	179,725	63	9.9	12.0	315
OSU7316	181,984	63	8.9	11.7	284
OSU7318	158,429	65	8.6	11.1	264
OSU7377	138,101	64	7.4	10.3	232
OSU7430	183,920		discard		
OSU7481	185,856		discard		
OSU7491	140,037		discard		
OSU7503	125,517	68	6.7	8.0	196
OSU7534	171,336		discard		
LSD 0.05	28,059		2.0	2.4	63

[z]Mean of 3 replications; subplots of 5' were harvested from 18' plots in rows 30 in. apart. [y]Tons/Acre adjusted to 50% 1-4 sieve for full and 5 sieve beans; yields for smaller sieve lines were not adjusted. [x]Pod filling efficiency (lb/A/day). DAP = days after planting.

Table 3. Sieve size categories for OSU experimental green bean lines grown in a trial planted June 1 at the OSU Vegetable Research Farm in 2022.[z]

		Harvest	Sieve category (T/A)								Sieve category (%)[y]						
Entry	**Proc**	**DAP**	**1**	**2**	**3**	**4**	**5**	**6**	**1-4**	**total**	**% 1-4**	**1.0**	**2.0**	**3.0**	**4.0**	**5.0**	**6.0**
OSU5630		62	0.3	0.3	1.0	3.0	1.0		4.7	5.7	82.4	5.3	6.1	17.6	53.4	17.6	
OSU5630	x	63	0.2	0.3	0.7	2.9	2.4	0.0	4.1	6.4	62.8	2.7	4.1	10.8	45.3	36.5	0.7
OSU5630		65	0.2	0.3	0.7	3.2	2.3		4.3	6.6	65.6	2.6	4.6	9.9	48.3	34.4	
Sahara		63	0.1	0.2	1.2	3.7	0.1		5.3	5.4	97.6	2.4	3.2	22.6	69.4	2.4	
Sahara	x	65	0.2	0.2	0.7	4.1	0.3		5.2	5.5	95.2	3.2	3.2	13.5	75.4	4.8	
Banga		58	0.2	0.3					0.6	0.6	100.0	30.8	61.5	7.7			
Banga	x	63	0.4	3.4	0.7				4.5	4.5	100.0	9.6	74.0	16.3			
OSU7048		61	0.6	1.8	0.4				2.9	2.9	100.0	21.2	63.6	13.6	1.5		
OSU7048	x	63	0.5	2.2	1.0	0.1			3.8	3.8	100.0	13.6	56.8	27.3	2.3		
OSU7066	x	61	0.3	0.3	0.8	2.0	2.7	0.2	3.4	6.3	54.2	4.2	4.9	12.5	32.6	42.4	3.5
OSU7066		63	0.3	0.3	0.6	2.0	3.6	0.6	3.1	7.3	42.9	3.6	3.6	8.3	27.4	48.8	8.3
OSU7069		62	0.3	0.5	0.7	1.7	1.6	0.1	3.3	5.0	65.8	7.0	9.6	14.0	35.1	31.6	2.6
OSU7069	x	63	0.3	0.3	0.6	2.1	2.0	0.1	3.4	5.5	61.4	6.3	5.5	11.0	38.6	37.0	1.6
OSU7072	x	65	0.2	0.3	1.4	3.3	0.2		5.3	5.5	96.0	3.2	6.3	26.2	60.3	4.0	
OSU7074		62	0.3	0.4	0.8	2.4	0.4		3.9	4.3	90.9	6.1	9.1	19.2	56.6	9.1	
OSU7074	x	64	0.1	0.2	0.6	2.7	1.9		3.6	5.5	65.9	2.4	4.0	10.3	49.2	34.1	
OSU7089	discard	63	0.2	0.4	1.4	2.8	0.1		4.8	4.9	97.3	3.5	8.8	28.3	56.6	2.7	
OSU7099	x	62	0.3	0.3	0.8	1.5	2.1	0.3	2.9	5.3	54.5	5.0	6.6	14.9	28.1	39.7	5.8
OSU7184	discard	58	0.2	0.2	0.7	1.8	0.4		2.9	3.3	88.0	5.3	6.7	20.0	56.0	12.0	
OSU7185		65	0.1	0.3	0.6	1.1	1.2	0.3	2.1	3.6	59.8	3.7	8.5	15.9	31.7	32.9	7.3
OSU7185	x	68	0.2	0.2	0.3	1.0	2.0	0.6	1.7	4.3	38.8	4.1	4.1	7.1	23.5	46.9	14.3
OSU7187		65	0.1	0.3	0.5	0.9	0.6	0.0	1.8	2.4	73.2	5.4	10.7	21.4	35.7	25.0	1.8
OSU7187	x	68	0.1	0.2	0.3	0.9	1.5	0.5	1.6	3.5	44.4	3.7	4.9	9.9	25.9	42.0	13.6
OSU7199	x	68	0.2	0.3	0.5	1.3	2.8	1.0	2.2	6.1	36.7	2.9	4.3	8.6	20.9	46.0	17.3
OSU7199		70	0.2	0.2	0.3	0.9	2.7	3.7	1.6	7.9	19.8	2.2	2.2	4.4	11.0	34.1	46.2
OSU7208	x	65	0.1	0.3	0.3	1.0	2.1	0.3	1.7	4.2	41.7	2.1	6.3	8.3	25.0	50.0	8.3
OSU7261	x	64	0.1	0.3	0.8	2.4	1.3	0.0	3.6	4.9	72.6	2.7	5.3	15.9	48.7	26.5	0.9
OSU7262		61	0.3	0.4	1.1	1.0	0.1		2.8	2.9	97.0	10.4	14.9	38.8	32.8	3.0	

OSU7262	x	63	0.3	0.4	1.6	2.0	0.2		4.3	4.5		96.1	5.8	9.7	35.0	45.6	3.9	
OSU7263		62	0.2	0.3	0.7	2.0	0.4		3.3	3.7		89.3	4.8	9.5	19.0	56.0	10.7	
OSU7273		61	0.3	0.5	1.1	3.0	0.7		5.0	5.7		87.7	5.4	9.2	20.0	53.1	12.3	
OSU7273	x	63	0.3	0.3	1.0	4.0	1.1		5.6	6.7		83.8	4.5	3.9	15.6	59.7	16.2	
OSU7280	x	63	0.2	0.3	0.9	3.3	0.7		4.6	5.3		87.6	3.3	5.0	16.5	62.8	12.4	
OSU7281	x	62	0.3	0.3	0.6	2.0	1.3	0.6	3.2	5.1		63.2	6.8	6.0	11.1	39.3	25.6	11.1
OSU7285	x	63	0.3	0.3	0.7	3.0	1.0		4.4	5.4		82.3	5.6	6.5	13.7	56.5	17.7	
OSU7290		61	0.3	0.3	1.1	3.2	0.7	0.2	5.0	6.0		83.9	5.1	5.8	19.0	54.0	12.4	3.6
OSU7290	x	63	0.3	0.3	0.7	3.8	1.8		5.2	7.0		74.4	4.4	4.4	10.6	55.0	25.6	
OSU7304	x	61	0.3	0.5	1.4	3.5	0.6		5.6	6.2		90.2	4.2	8.4	21.7	55.9	9.8	
OSU7305		62	0.3	0.3	1.0	3.0	1.0		4.6	5.6		82.8	5.5	5.5	18.8	53.1	17.2	
OSU7305	x	63	0.2	0.2	0.9	4.0	1.1		5.4	6.4		83.1	3.4	3.4	14.2	62.2	16.9	
OSU7306		62	0.3	0.4	1.1	3.5	0.7		5.4	6.1		88.6	5.7	7.1	17.9	57.9	11.4	
OSU7306	x	64	0.2	0.3	0.6	3.0	2.8		4.1	6.8		59.2	3.2	4.5	8.3	43.3	40.8	
OSU7307	x	63	0.2	0.3	0.7	3.7	2.0		4.9	6.9		71.1	3.1	5.0	9.4	53.5	28.9	
OSU7316		61	0.3	0.4	1.3	3.0	0.3		5.1	5.4		93.6	5.6	8.0	24.0	56.0	6.4	
OSU7316	x	63	0.2	0.4	1.0	3.6	1.3		5.2	6.5		80.5	3.4	6.7	14.8	55.7	19.5	
OSU7318		63	0.3	0.3	1.0	3.0	0.8		4.7	5.5		85.8	6.3	6.3	18.1	55.1	14.2	
OSU7318	x	65	0.2	0.3	1.0	3.2	1.3		4.8	6.1		79.1	3.6	5.8	16.5	53.2	20.9	
OSU7318		68	0.2	0.3	1.1	3.3	1.1	0.0	4.8	6.0		80.4	2.9	4.3	18.1	55.1	18.8	0.7
OSU7377		62	0.2	0.3	0.9	1.5	0.1		2.9	3.0		95.7	5.8	11.6	29.0	49.3	4.3	
OSU7377	x	64	0.1	0.3	0.8	3.4	0.6		4.6	5.2		88.3	2.5	5.0	15.0	65.8	11.7	
OSU7430	discard	62	0.2	0.2	0.7	1.8	0.5		2.9	3.4		85.7	5.2	5.2	20.8	54.5	14.3	
OSU7430	discard	64	0.0	0.1	0.4	2.4	1.0		2.9	3.8		75.0	1.1	2.3	10.2	61.4	25.0	
OSU7491	discard	64	0.1	0.1	0.4	1.9	0.6		2.6	3.2		80.8	2.7	4.1	13.7	60.3	19.2	
OSU7503		65	0.1	0.3	0.7	1.3	0.4		2.4	2.9		84.8	4.5	9.1	25.8	45.5	15.2	
OSU7503	x	68	0.1	0.2	0.6	2.5	1.4		3.4	4.8		70.3	1.8	3.6	12.6	52.3	28.8	
OSU7525	discard	68	0.3	0.3	0.8	2.8	1.1		4.1	5.2		79.2	5.0	5.0	15.0	54.2	20.8	
OSU7534	discard	65	0.2	0.3	0.7	2.4	1.6		3.6	5.2		69.7	4.2	5.9	14.3	45.4	30.3	
[z]Mean of 3 replications; subplots of 5' were harvested from 18' plots in rows 30 in. apart. [y]Percent calculated as % of total of 1-6 sieve beans. Proc = date sent for processing; DAP = days after planting.																		

Table 4. Pod quality parameters, flavor and notes on green bean lines and cultivars grown in a trial planted June 1 at the OSU Vegetable Research Farm in 2022.

Entry	Harvest (DAP)	Main sieve size	Length (cm)	Straightness[z]	Cross-section shape[y]	Smoothness[z]	Color[x]	Sweetness	Astringency	Perfuminess	Notes[w]
OSU5630	62	5-6	18	6	r	8	6	6	3	5	
OSU5630	63										Dropped 20% overnight w/ irrigation; a few flats in 5 sv.
OSU5630	65										Dev seed w/o sizing up - grade didn't change, quality still good.
Sahara	63	4	13	7	r	7	7	3	7	5	
Sahara	65										Uniform dk grn color, pods vary in length w/in sv.
Banga	63	2	11	7	r	7	4	3	7	5	Tough skin, sl curved pods, mixed seed dev in 2 sv.
OSU7048	61	2-3	12	7	o-h-r	5	6	3	3	2	Fiberous, coarse.
OSU7048	63										Seg fiber, 4 sv light & curved; 4 sv may be off type.
OSU7066	61	6	17.5	5	cb	4	5	6	3	4	Umami flavor?
OSU7066	63										Still good quality, mixed seed dev in 4 sv.
OSU7069	62	6	14.5	7	r-cb	8	7	7	3	5	Umami like cukes?
OSU7069	63	5									Nice appearance, uniform dk green pods.
OSU7072	65	4	12	9	h-r	9	6	1	7	1	Short straight smooth pods, hard picking in the field but productive.
OSU7074	62	4	13	8	hr	8	7	8	3	6	coarse
OSU7074	64	4-5									Short pods but otherwise, good quality.
OSU7089	63	4-5	13	3	h-o	7	3	5	5	3	Discard-heart pods at best, curved & too light.
OSU7099	62	6	17.5	7	hr	8	6	7	2	7	Tough skin.
OSU7184	58	6	14.5	5	o	5	3	7	7	1	Too light & oval - do not send.

Entry	Harvest (DAP)	Main sieve size	Length (cm)	Straightness[z]	Cross-section shape[y]	Smoothness[z]	Color[x]	Sweetness	Astringency	Perfuminess	Notes[w]
OSU7185	65	6	15	7	r	7	6	3	7	1	Long pods & much battering in grader.
OSU7185	68										Seedy but not pithy, many plants had only immature pods suggesting uneven germ.
OSU7187	65	6	15	5	r	5	8	3	7	1	P & S Mon; low yield but v dk green pods, some blanking
OSU7187	68										Still good quality
OSU7199	68	6	15	5	r	5	7	9	7	1	Nice looking pods on tall robust upr plant.
OSU7199	70										Still decent quality even though grading very low.
OSU7208	65	6	15	5	r	5	6	5	7	1	RC, generally good quality, mixed seed dev 5 sv.
OSU7261	64	4-5	12	7	cb	7	6	7	7	1	Short pods but otherwise, good quality; usable 2 sv.
OSU7262	61	4	13.5	6	r	3	5	3	3	2	Fibrous.
OSU7262	63										Seg length, type is short.
OSU7263	62	5	15	5	hr	6	4	6	2	3	Some stringy, mixed w/ wax, discard?
OSU7273	61	6	16.5	6	hr	5	7	4	3	4	Tender.
OSU7273	63	5									Seg flat/strings, heart tendency but otherwise nice quality.
OSU7280	63	5	14	7	r	3	6	5	7	3	Good quality except bumpy.
OSU7281	62	6	14.5	5	cb	4	7	4	3	7	Spicy, crunchy.
OSU7285	63	5	13	5	h-r	7	4	3	9	1	3rd rep much lower yielding than others, marginal quality.
OSU7290	61	4-5	15	7	r	4	6	6	2	2	One stringy, tough skin.
OSU7290	63										Long pods, good quality, mixed seed dev in 4 & 5 sv.
OSU7304	61	4	14	8	r	7	6	4	5	6	Coarse, fibrous.
OSU7305	62	5	15	6	r	5	5	5	2	3	Coarse.
OSU7305	63	4-5									Rogue for ovals.
OSU7306	62	5	15.5	6	r	5	6	6	3	4	Sweet, coarse, ovals.
OSU7306	64										8, 11 & 7 oval plants in 1-3 reps, a tendency towards strings esp. in ovals.
OSU7307	63	5	14	5	h-r	7	5	5	7	1	striped flat podded outcross mix

Entry	Harvest (DAP)	Main sieve size	Length (cm)	Straightness[z]	Cross-section shape[y]	Smoothness[z]	Color[x]	Sweetness	Astringency	Perfuminess	Notes[w]
OSU7316	61	5	15	6	r	5	7	5	6	5	Crunchy, hint of umami.
OSU7316	63										Oval mix, nice bean.
OSU7318	63	5	14	7	r-cb	5	6	7	7	1	Nice quality but getting seedy without sizing up.
OSU7318	65										Not much change in 2nd pick. Fairly seedy but overall quality is good.
OSU7318	68										Becoming seedy and pithy in all sv sizes.
OSU7377	62	4	13	7	hr	7	7	5	3	4	Sweet, coarse.
OSU7377	64										Nice bean but short pods, mixed seed dev in 5 sv - may be a larger sv mix.
OSU7430	62	4	11.5	6	o-r	4	5	6	3	5	some very stringy, discard?
OSU7430	64	5									High proportion of strings - discard.
OSU7491	64	5	15	3	o-h	9	6	3	7	3	Soapy flavor, long slender curved high fiber pods. Seg strings - discard - may also have hard seed problem -1 plot w/ 10 flowering plants but no pods.
OSU7503	65	5	12	7	r	7	5	7	7	1	Short podded 4-5 sv, v str & uniform.
OSU7503	68										Becoming pithy in 6 sv & some 5 sv pods.
OSU7525	68	5	13	8	h	9	6	5	7	1	Becoming pithy in 5 sv, somewhat fibrous & heart shaped pods with oval tendency.
OSU7534	65	5	14.5	3	r	7	4	7	9	1	Seg wax, curved pods - too light - discard.

[z]Scale of 1 - 9 where 1 is least or worst and 9 is most or best. [y]Scores based on a 1 - 9 scale with 9 darkest. Standard BBL color is rated as 5. [x]r = round, cb = creaseback, h = heart and o =oval. [w]Abbreviations: sv = sieve, dev = development, RC = reverse curve, v = very, sl = slight, grn = green, upr = upright.

Table 5. Seed development in different sieve sizes on day of harvest for experimental and check snap bean lines grown in a trial planted June 1 at the OSU Vegetable Research Farm in 2022.

		Sieve size[z]					
Entry	Harvest (DAP)	6	5	4	3	2	1
OSU5630	62		7	5	1		
OSU5630	63	7	7	5	3		
OSU5630	65		9	8	7		
Sahara	63		5	5	3		
Sahara	65		5	5	3		
Banga	63				7	5	1
OSU7048	61				5	3	1
OSU7048	63			5	7	7	3
OSU7066	61	7	5	3	1		
OSU7066	63	7	7	5	3		
OSU7069	62	8	5	3	3	1	
OSU7069	63	9	7	7	3		
OSU7072	65		7	5	3		
OSU7074	62	7	5	3	1		
OSU7074	64		7	6	3		
OSU7089	63		8	7	5		
OSU7099	62	7	5	3	1		
OSU7184	58						
OSU7185	65	5	4	3	2		
OSU7185	68	9	9	5	3		
OSU7187	65	5	3	2	1		
OSU7187	68	7	7	5	3		
OSU7199	68	8	7	4	2		
OSU7199	70	9	7	5	3		
OSU7208	65	7	5	3	2		
OSU7261	64	6	6	3	2		
OSU7262	61			5	3	1	
OSU7262	63		5	7	3		
OSU7263	62	7	7	5	3		
OSU7273	61		5	3	1		
OSU7273	63		7	7	3		
OSU7280	63		7	7	5		
OSU7281	62	f	5	5	1		
OSU7285	63		8	6	4		
OSU7290	61	7	5	3	1		
OSU7290	63		7	5	3		
OSU7304	61	7	7	5	3	1	
OSU7305	62	9	7	5	3		
OSU7305	63		9	5	3		
OSU7306	62		7	5	3		
OSU7306	64		7	5	3		
OSU7307	63		7	5	3		

		Sieve size[z]					
Entry	Harvest (DAP)	6	5	4	3	2	1
OSU7316	61		7	5	3	1	
OSU7316	63		8	7	3		
OSU7318	63		7	5	3		
OSU7318	65	9	8	7	5		
OSU7318	68	9	9	9	7		
OSU7377	62		7	5	3	1	
OSU7377	64		7	3	1		
OSU7430	62		7	5	3		
OSU7430	64						
OSU7491	64		9	3	2		
OSU7503	65		5	4	3	2	
OSU7503	68	7	7	5	3		
OSU7525	68		8	7	3		
OSU7534	65		4	2	1		

[z]Scale of 1 - 9 for seed development where 1 = none, 3 = beginning, 5 = moderate, 7 = becoming seedy & 9 = very seedy.

Table 6. Average scores for processed (frozen samples) of the OSU green bean breeding lines evaluated in a sample display, October 31, 2022 at the OSU Pilot Plant. Scored on a scale of 1 - 5 where 5 is best. N is number of evaluators. Comments from individuals separated by (;).

	Average Score						% Count (Overall)					
Entry	Color	Fla-vor	Sweet-ness	Tough-ness	Over-all	N	% 1 (Worst)	% 2	% 3	% 4	% 5 (Best)	Comments
OSU5630	4.0	3.9	3.3	2.9	3.7	15	0.0	13.3	26.7	40.0	20.0	Somewhat tough; Mild
Banga	3.5	2.3	1.8	3.2	2.3	15	13.3	53.3	26.7	6.7	0.0	Slightly bitter; Fine
Sahara	3.9	2.9	2.9	2.9	3.2	15	6.7	26.7	20.0	33.3	13.3	Green and grassy. Matcha flavor?
OSU7048	3.6	2.6	2.1	2.6	2.9	14	0.0	42.9	35.7	7.1	14.3	Good beany flavor but not sweet; Mushy
OSU7066	3.9	3.5	3.5	2.7	3.9	14	0.0	0.0	35.7	35.7	28.6	
OSU7069	3.9	2.9	2.6	3.3	3.2	14	7.1	14.3	42.9	21.4	14.3	Slightly bitter; Chewy
OSU7072	3.9	2.0	2.4	3.1	2.2	14	21.4	42.9	28.6	7.1	0.0	Off flavor; High linalool, high fiber bumpy; Segregating for stringiness; Has a rose flavor; Tough
OSU7074	3.8	2.9	2.6	2.9	3.1	14	7.1	21.4	42.9	14.3	14.3	Moderate linalool
OSU7099	4.0	3.2	3.1	2.8	3.4	14	14.3	0.0	21.4	57.1	7.1	Unique floral taste; Buttery flavor; Fresh favor
OSU7185	3.9	3.7	3.9	2.8	3.8	14	0.0	0.0	28.6	64.3	7.1	High linalool, very sweet; Mochi flavor
OSU7187	3.9	3.4	3.9	2.8	3.6	14	0.0	7.1	21.4	71.4	0.0	Tough. Distinct flavor
OSU7199	3.8	3.3	3.4	2.7	3.5	14	7.1	14.3	21.4	35.7	21.4	Chewy but not tough skin; Dirty water flavor
OSU7208	4.1	2.7	2.6	3.1	2.9	14	7.1	28.6	28.6	35.7	0.0	Tough skin, but very sweet;
OSU7261	3.8	2.5	2.6	2.8	2.7	13	15.4	23.1	38.5	23.1	0.0	Sweet, distinct and weird flavor
OSU7262	3.8	3.1	2.6	3.0	3.1	13	0.0	23.1	53.8	15.4	7.7	Long fibers
OSU7273	3.9	3.3	2.9	3.0	3.4	14	0.0	0.0	57.1	42.9	0.0	Floral taste; Sushi forward flavor
OSU7280	2.9	1.2	2.1	3.3	1.7	13	53.8	23.1	23.1	0.0	0.0	Inconsistent color. Very interesting flavor, very distinct; Off flavor, very stringy; Irregular color, heavy grass flavor; Cardboard; Green Squash flavor

	Average Score						% Count (Overall)					
Entry	Color	Fla-vor	Sweet-ness	Tough-ness	Over-all	N	% 1 (Worst)	% 2	% 3	% 4	% 5 (Best)	Comments
OSU7281	3.8	3.1	3.3	3.0	3.5	13	0.0	0.0	53.8	46.2	0.0	Green taste
OSU7285	3.2	3.0	2.7	3.0	2.9	13	15.4	0.0	61.5	23.1	0.0	Very tough; Thoroughly fine and aver-age
OSU7290	3.9	3.3	2.8	2.8	3.3	13	7.7	15.4	30.8	30.8	15.4	Pretty good! Want it crisper
OSU7304	4.1	3.3	2.8	3.0	3.3	13	0.0	23.1	30.8	38.5	7.7	
OSU7305	3.6	2.8	2.6	3.3	2.8	13	15.4	15.4	46.2	23.1	0.0	
OSU7306	3.5	3.0	2.5	3.1	2.9	13	7.7	23.1	46.2	15.4	7.7	Variable color 3 sv; Oh no, they're all the same now
OSU7307	3.6	2.8	2.5	3.0	3.0	13	15.4	15.4	30.8	30.8	7.7	Fine
OSU7316	3.8	3.3	2.8	2.9	3.3	12	0.0	25.0	33.3	33.3	8.3	
OSU7318	4.0	3.6	3.3	3.0	3.5	14	0.0	14.3	35.7	35.7	14.3	Very tasty; Bumpy 3 sv, otherwise very nice bean
OSU7377	3.3	3.0	2.8	2.3	2.8	12	16.7	16.7	41.7	25.0	0.0	
OSU7503	3.1	3.8	4.1	2.6	3.8	12	0.0	8.3	16.7	66.7	8.3	

Table 7. Commercial snap bean lines and checks grown in a yield trial at the OSU Vegetable Research Farm in 2022.

No.	Entry	Source	Predominant sieve size
1	OR5630	OSU/check	5-6
2	Sahara	HM/check	4
3	Crockett	HM/check	3
4	BSC897	Brotherton	3-4
5	Dinasty	Brotherton	3-4
6	Hudson	Brotherton	5
7	BEX069	Brotherton	4-5
8	World Cup	Brotherton	5
9	BEX175	Brotherton	Romano
10	Bruce	Pureline	4-5
11	RR2006	Pureline	5
12	RR2015	Pureline	5
13	RR3006	Pureline	5
14	RR3009	Pureline	6
15	RR3011	Pureline	4-5
16	GVSB 17	Seneca	5
17	GVSB 59	Seneca	5
18	GVSWB 1	Seneca	4 (wax)
19	SB4829	Syngenta	4-5
20	SB4735	Syngenta	4
21	Black Diamond	Syngenta	4-5
22	Tibesti	Syngenta	2
23	OSU7066	OSU	6
24	OSU7199	OSU	6+
25	OSU7318	OSU	5
26	C87	OSU	6
27	C103	OSU	6
28	C134	OSU	6

Table 8. Yield and maturity of commercial green bean lines in a yield trial planted June 15 at the OSU Vegetable Research Farm, Corvallis, 2022[z].

		1st harvest			2nd harvest			3rd harvest			Sent for processing		
Entry	**Stand (no./A)**	**Days to harvest**	**T/A**		**Days to harvest**	**T/A**		**Days to harvest**	**T/A**		**Days to harvest**	**T/A**	**T/A (adj)[y]**
OSU5630	149,846	61	3.5		63	3.7		65	5.1		63	3.7	3.9
OSU7066	124,582	62	2.0		64	3.9					64	3.9	2.6
OSU7199	114,563	68	0.9								68	0.9	0.5
OSU7318	143,138	61	3.5		64	5.7		66	5.4		64	5.7	5.7
BEX069	136,778	57	4.4		59	5.1		61	5.7		59	5.1	5.1
BEX175	152,460	63	5.2		66	8.4		68	9.0		66	8.4	8.4
Black Diamond	148,801	61	2.8		63	3.0					63	3.0	3.0
Bruce	152,460	61	5.4		63	6.9					63	6.9	6.9
BSC897	157,513	61	3.0		64	5.0		66	5.4		64	5.0	5.0
C103	139,218	61	4.1		62	4.3		64	5.0		62	4.3	4.0
C134	125,279	62	2.7		63	2.9					63	2.9	2.9
C87	124,582	61	4.0		63	4.6					63	4.6	4.3
Crockett	123,275	63	1.5		65	2.1		68	2.2		65	2.1	2.1
Dinasty	138,956	62	2.0		64	2.4		66	2.5		64	2.4	2.4
GVSB17	173,804	58	4.2		61	5.9		63	6.7		61	5.9	5.6
GVSB59	145,926	61	2.3		64	5.3					64	5.3	4.6
GVSWB1	157,513	62	2.2		65	2.1		68	4.0		65	2.1	2.1
Hudson	141,396	61	2.9		64	5.1					64	5.1	4.6
RR2006	133,119	56	4.2		58	6.8		61	6.2		58	6.8	6.7
RR2015	150,543	61	5.6		64	7.1					64	7.1	6.2
RR3006	131,377	58	1.9		61	2.9		63	4.6		61	2.9	3.6
RR3009	115,870	62	4.4		64	6.6					64	6.6	5.8
RR3011	110,468	59	2.4		62	5.8		64	8.3		62	5.8	5.8
Sahara	145,055	61	5.1		64	5.6		66	5.6		64	5.6	5.6
SB4735	147,930	63	1.1		65	1.8		68	3.2		68	3.2	3.2
SB4829	151,850	58	5.0		61	7.1		63	6.6		61	7.1	7.1
Tibesti	150,282	61	1.4		64	2.0		66	2.3		64	2.0	2.0
World Cup	137,214	61	2.4		64	3.4					64	3.4	3.1
LSD 0.05	25,445		1.8			2.4			2.7			2.4	2.3

[z]Mean of 4 replications; subplots of 5' were harvested from 18' plots in rows 30 in. apart. [y]Tons/Acre adjusted to 50% 1-4 sieve for full and 5 sieve beans; yields for smaller sieve lines were not adjusted.

Table 9. Grades of commercial green bean lines in a yield trial planted June 15 OSU Vegetable Research Farm, Corvallis, 2022.[z]

		Harvest	Sieve size									Sieve size						
Entry	**Proc**	**DAP**	**1**	**2**	**3**	**4**	**5**	**6**	**1-4**	**total**		**1-4**	**1**	**2**	**3**	**4**	**5**	**6**
			T/A									**%**						
OR5630		61	0.2	0.4	0.8	1.0	0.9	0.1	2.4	3.4		70.1	5.2	11.7	23.4	29.9	27.3	2.6
OR5630	x	63	0.1	0.2	0.3	1.2	1.3	0.1	1.9	3.3		56.6	3.9	5.3	10.5	36.8	39.5	3.9
OR5630		65	0.2	0.1	0.3	0.7	2.6	0.9	1.2	4.7		25.9	3.7	1.9	5.6	14.8	54.6	19.4
OSU7066		62	0.1	0.1	0.2	0.5	0.6	0.3	0.9	1.8		47.6	4.8	4.8	9.5	28.6	33.3	19.0
OSU7066	x	64	0.1	0.1	0.1	0.3	1.3	1.7	0.6	3.6		17.1	3.7	2.4	2.4	8.5	36.6	46.3
OSU7199	x	68	0.1	0.0	0.0	0.1	0.1	0.3	0.3	0.7		39.4	18.2	6.1	3.0	12.1	12.1	48.5
OSU7318		61	0.4	0.5	0.9	1.1	0.3	0.0	2.9	3.2		89.2	13.5	14.9	27.0	33.8	10.8	0.0
OSU7318	x	64	0.3	0.2	0.4	1.7	2.5	0.2	2.6	5.3		49.6	5.8	4.1	8.3	31.4	47.1	3.3
OSU7318		66	0.1	0.1	0.3	1.2	2.8	0.7	1.7	5.2		32.8	2.5	2.5	5.0	22.7	53.8	13.4
BEX069		57	0.3	0.5	1.0	2.0	0.2	0.0	3.9	4.1		95.7	8.5	12.8	25.5	48.9	4.3	0.0
BEX069	x	59	0.3	0.3	0.8	2.5	1.0	0.0	4.0	4.9		80.5	5.3	7.1	16.8	51.3	19.5	0.0
BEX069		61	0.2	0.2	0.8	3.2	1.0	0.0	4.4	5.4		80.6	3.2	3.2	14.5	59.7	19.4	0.0
BEX175	x	66	(Romano - not graded)															
Black Diamond		61	0.1	0.1	0.7	1.5	0.1	0.0	2.4	2.5		94.7	3.5	5.3	26.3	59.6	5.3	0.0
Black Diamond	x	63	0.1	0.2	0.6	1.7	0.2	0.0	2.6	2.7		93.7	4.8	6.3	20.6	61.9	6.3	0.0
Bruce		61	0.3	0.6	1.6	2.2	0.3	0.0	4.7	5.1		93.2	6.8	12.0	31.6	42.7	6.8	0.0
Bruce	x	63	0.3	0.4	1.0	3.9	0.9	0.0	5.7	6.5		86.7	4.7	6.0	16.0	60.0	13.3	0.0
BSC897		61	0.3	0.7	1.1	0.6	0.0	0.0	2.7	2.7		100.0	11.5	24.6	41.0	23.0	0.0	0.0
BSC897	x	64	0.1	0.4	1.5	2.4	0.3	0.0	4.4	4.7		94.4	2.8	8.4	32.7	50.5	5.6	0.0
BSC897		66	0.1	0.3	1.3	3.1	0.5	0.0	4.8	5.3		90.9	2.5	5.8	24.0	58.7	9.1	0.0
C103		61	0.2	0.1	0.3	1.2	1.5	0.3	1.9	3.7		50.6	4.7	3.5	9.4	32.9	41.2	8.2
C103	x	62	0.2	0.1	0.3	1.2	1.9	0.4	1.7	4.1		43.0	4.3	2.2	7.5	29.0	46.2	10.8
C103		64	0.2	0.0	0.1	0.5	2.4	1.4	0.8	4.6		18.1	3.8	1.0	1.9	11.4	52.4	29.5
C134		62	0.1	0.0	0.2	1.0	0.8	0.1	1.4	2.4		61.1	5.6	1.9	9.3	44.4	33.3	5.6
C134	x	63	0.2	0.0	0.1	0.9	1.1	0.2	1.3	2.6		49.2	8.5	1.7	5.1	33.9	42.4	8.5

		Harvest	Sieve size									Sieve size						
Entry	**Proc**	**DAP**	**1**	**2**	**3**	**4**	**5**	**6**	**1-4**	**total**		**1-4**	**1**	**2**	**3**	**4**	**5**	**6**
C87		61	0.6	0.2	0.6	1.1	1.1	0.2	2.4	3.8		64.4	14.9	4.6	14.9	29.9	29.9	5.7
C87	x	63	0.5	0.1	0.2	1.1	2.0	0.5	1.9	4.4		44.0	12.0	3.0	4.0	25.0	45.0	11.0
Crockett		63	0.1	0.2	0.7	0.3	0.0	0.0	1.3	1.3		100.0	6.9	13.8	51.7	27.6	0.0	0.0
Crockett	x	65	0.2	0.1	0.4	1.0	0.1	0.0	1.8	1.9		95.5	11.4	6.8	22.7	54.5	4.5	0.0
Crockett		68	0.4	0.2	0.3	0.8	0.2	0.0	1.7	1.9		90.7	23.3	11.6	14.0	41.9	9.3	0.0
Dinasty		62	0.3	0.3	0.8	0.4	0.0	0.0	1.8	1.8		100.0	14.6	19.5	43.9	22.0	0.0	0.0
Dinasty	x	64	0.2	0.1	0.7	1.1	0.1	0.0	2.0	2.1		95.9	8.2	4.1	30.6	53.1	4.1	0.0
Dinasty		66	0.3	0.0	0.4	1.2	0.1	0.0	1.9	2.0		93.6	12.8	2.1	21.3	57.4	6.4	0.0
GVSB 17		58	0.2	0.4	0.7	1.7	1.0	0.0	3.0	4.0		76.1	5.4	9.8	18.5	42.4	23.9	0.0
GVSB 17	x	61	0.1	0.2	0.4	1.8	2.7	0.4	2.5	5.6		44.2	2.3	3.1	7.0	31.8	48.1	7.8
GVSB 17		63	0.2	0.1	0.3	2.1	3.5	0.3	2.7	6.5		40.7	2.7	1.3	4.7	32.0	54.0	5.3
GVSB 59		61	0.3	0.5	0.7	0.6	0.2	0.0	2.0	2.2		92.0	12.0	24.0	30.0	26.0	8.0	0.0
GVSB 59	x	64	0.4	0.1	0.2	1.0	2.5	0.7	1.8	5.0		36.5	8.7	2.6	4.3	20.9	49.6	13.9
GVSWB 1		62	0.2	0.3	0.7	0.7	0.1	0.0	1.8	1.9		95.5	9.1	18.2	34.1	34.1	4.5	0.0
GVSWB 1	x	65	0.1	0.1	0.2	0.8	0.5	0.0	1.2	1.7		69.2	5.1	5.1	12.8	46.2	30.8	0.0
GVSWB 1		68	0.4	0.3	0.4	1.0	1.4	0.1	2.1	3.5		59.3	11.1	9.9	11.1	27.2	38.3	2.5
Hudson		61	0.2	0.4	0.7	1.1	0.2	0.0	2.4	2.6		90.0	8.3	15.0	25.0	41.7	8.3	1.7
Hudson	x	64	0.2	0.2	0.3	1.2	2.1	0.7	1.9	4.7		40.4	4.6	3.7	7.3	24.8	44.0	15.6
RR2006		56	0.3	0.3	0.7	1.4	1.0	0.1	2.8	3.9		71.9	9.0	7.9	19.1	36.0	25.8	2.2
RR2006	x	58	0.3	0.2	0.4	1.5	2.5	0.1	2.5	5.1		48.7	6.8	4.3	8.5	29.1	48.7	2.6
RR2006		61	0.3	0.2	0.3	1.4	3.1	0.8	2.1	6.0		35.5	5.1	2.9	5.1	22.5	51.4	13.0
RR2015		61	0.3	0.6	1.2	2.4	0.9	0.0	4.4	5.3		83.5	5.0	10.7	22.3	45.5	16.5	0.0
RR2015	x	64	0.1	0.1	0.4	1.9	3.7	0.6	2.5	6.8		36.9	1.9	1.9	5.7	27.4	54.1	8.9
RR3006		58	0.4	0.3	0.4	0.5	0.1	0.0	1.7	1.8		92.9	23.8	19.0	23.8	26.2	7.1	0.0
RR3006	x	61	0.2	0.3	0.5	0.9	0.6	0.0	1.8	2.4		75.0	7.1	12.5	19.6	35.7	23.2	1.8
RR3006		63	0.2	0.1	0.4	1.8	1.5	0.2	2.6	4.3		60.2	4.1	3.1	10.2	42.9	34.7	5.1
RR3009		62	0.2	0.3	0.7	1.7	1.0	0.1	2.9	4.0		72.5	4.4	7.7	18.7	41.8	25.3	2.2
RR3009	x	64	0.1	0.2	0.3	1.7	3.1	0.8	2.4	6.3		37.5	1.4	2.8	5.6	27.8	50.0	12.5

		Harvest	Sieve size									Sieve size						
Entry	**Proc**	**DAP**	**1**	**2**	**3**	**4**	**5**	**6**	**1-4**	**total**		**1-4**	**1**	**2**	**3**	**4**	**5**	**6**
RR3011		59	0.3	0.6	0.6	0.5	0.2	0.0	2.0	2.3		88.7	15.1	24.5	26.4	22.6	9.4	1.9
RR3011	x	62	0.3	0.5	1.1	2.2	1.3	0.2	4.2	5.7		73.8	5.4	9.2	20.0	39.2	23.1	3.1
RR3011		64	0.2	0.3	0.7	2.4	3.5	0.8	3.5	7.8		44.7	2.2	3.4	8.9	30.2	44.7	10.6
Sahara		61	0.3	0.8	1.7	1.5	0.1	0.0	4.4	4.6		97.1	7.6	18.1	38.1	33.3	2.9	0.0
Sahara	x	64	0.1	0.2	0.9	3.4	0.7	0.0	4.7	5.3		87.7	2.5	4.1	16.4	64.8	12.3	0.0
Sahara		66	0.1	0.1	0.3	3.0	1.8	0.0	3.6	5.4		66.1	1.6	2.4	5.6	56.5	33.9	0.0
SB4735		63	0.1	0.0	0.2	0.4	0.1	0.0	0.7	0.8		89.5	15.8	5.3	21.1	47.4	10.5	0.0
SB4735	x	65	0.2	0.2	0.2	0.7	0.3	0.0	1.2	1.5		82.4	14.7	11.8	11.8	44.1	17.6	0.0
SB4735	x	68	0.3	0.5	0.5	0.9	0.5	0.0	2.3	2.7		82.5	12.7	17.5	19.0	33.3	17.5	0.0
SB4829		58	0.3	0.6	1.2	2.3	0.2	0.0	4.4	4.6		96.2	7.5	13.2	25.5	50.0	3.8	0.0
SB4829	x	61	0.3	0.3	1.2	3.2	1.5	0.0	5.1	6.7		77.1	5.2	5.2	18.3	48.4	22.9	0.0
SB4829		63	0.2	0.2	0.7	3.5	1.7	0.0	4.5	6.2		72.0	2.8	2.8	10.5	55.9	28.0	0.0
Tibesti		61	0.5	0.6	0.1	0.0	0.0	0.0	1.3	1.3		100.0	41.4	48.3	10.3	0.0	0.0	0.0
Tibesti	x	64	0.2	0.7	1.0	0.2	0.0	0.0	2.0	2.0		100.0	8.9	33.3	48.9	8.9	0.0	0.0
Tibesti		66	0.0	0.3	1.2	0.4	0.0	0.0	2.0	2.0		100.0	2.1	17.0	59.6	21.3	0.0	0.0
World Cup		61	0.2	0.3	0.7	0.8	0.3	0.0	2.0	2.3		86.8	7.5	15.1	28.3	35.8	13.2	0.0
World Cup	x	64	0.1	0.1	0.3	0.8	1.4	0.3	1.2	2.9		41.8	3.0	3.0	9.0	26.9	49.3	9.0
C45		65	0.1	0.0	0.0	0.1	0.1	0.1	0.3	0.5		50.0	16.7	8.3	8.3	16.7	25.0	25.0
C76		63	0.0	0.1	0.1	0.2	0.3	0.0	0.4	0.7		59.6	0.6	9.3	18.6	31.1	37.3	3.1

[z]Percent calculated as % of total of 1-6 sieve beans. “X” in Proc column indicates harvest that was sent for processing. DAP = days after planting.

Table 10. Notes on a commercial green bean yield trial planted Jun 15 at the OSU Vegetable Research Farm, Corvallis, 2022. See Table 3 for an explanation of pod cross section shape[z].

			Pod						Flavor			
Entry	DAP	Sieve size	Length (cm)	Straightness	Cross-sectional shape[y]	Smoothness	Color[x]		Sweetness	Astringency	Perfuminess	Notes[w]
OR5630	61	5	14	5	r	7	5		9	7	1	Severe split set w/ some plants w/ no pods & others with a good cluster. Many polywogs & more curved than usual. Mixed seed dev in 6 sv; 1 fiberless flat.
OR5630	63											Seg ovals. Mixed seed dev in 3 sv. Many polywogs in 3 & 4 sv.
OR5630	65											Oval mix.
OSU7066	62	6	16	4	cb	5	5		7	7		Severe split - some very mature pods & lots of flowers & not much in between. Potential to set very large pods. CB may be too extreme for accurate grading. Good quality bean.
OSU7066	64											Very few new pods - severely distorts grade. 1 sv mostly parthenocarpic, 2 sv mix of parthenocarpic & polywogs. Odd seed dev in 5 & 6 sv suggests mix of sv types.
OSU7066												
OSU7199	68	6+	16	5	r-cb	5	5		5	7	1	A few plants have a few very mature pods but many flowers. Probably would have a good set in another couple weeks. Does not appear that heat has been knocking off blossoms.
OSU7199												
OSU7199												
OSU7318	61	5	14.5	5	r	7	6		9	7	1	Split set but not as severe as 5630. Pods shorter than usual & many polywogs.

			Pod						Flavor			
Entry	DAP	Sieve size	Length (cm)	Straightness	Cross-sectional shape[y]	Smoothness	Color[x]		Sweetness	Astringency	Perfuminess	Notes[w]
OSU7318	64											Dropped 39% in 3 days. Not as flashy as some in this trial. 1 sv about half parthenocarpic pods. Mixed seed dev in 5 sv.
OSU7318	66											Still has good quality but becoming CB & not grading accurately.
BEX069	57	4-5	13	7	r-cb	7	4		8	5	3	Spent blossoms clinging to pods in field provide site for WM infection
BEX069	59											Mixed seed dev in 5 sv
BEX069	61											
BEX175	63	Romano	15	5	f	3	4		7	3	9	Narrower pod width than traditional romanos. 10 seed length: 7.7 cm.
BEX175	66											Seed ln: 9.7 cm. Has a tattered leaf syndrome possibly from the heat desiccating developing leaves. Pods tend to break at neck, sometimes leaving some yield behind - particularly the case w/ polywogs.
BEX175	68											Still good quality; 10 seed ln: 9.9 cm.
Black Diamond	61	4-5	14.5	9	r	9	9		7	5	1	Very dk shiny (ace) bean, tough pods; generally keeps its length w/ few polywogs in the heat but low yields. 2 & 3 sv the junkiest.
Black Diamond	63											A bit past prime - some pods in 4 & 5 sv becoming pithy but it's not particularly seedy. Not enough 2s or 5s to send.
Black Diamond												
Bruce	61	4-5	13	9	h	9	5		7	7	1	Long str pods, very few polywogs or blanks & decent yields.
Bruce	63											Best performer in trial & rivals Sahara in heat tolerance. Becoming pithy in 5 sv.

			Pod						Flavor			
Entry	DAP	Sieve size	Length (cm)	Straightness	Cross-sectional shape[y]	Smoothness	Color[x]		Sweetness	Astringency	Perfuminess	Notes[w]
Bruce												
BSC897	61	3-4	11.5	5	h-o	7	4		9	7	5	Many ovals in this line esp. 2 & 3 sv. Pods keeping their length but many polywogs & low yield due to heat. Ovals w/ partial string.
BSC897	64											Strong oval tendency with flats, primarily coming out in the 4 sv. Essentially no change in seed dev.
BSC897	66											Many ovals & flats. Mixed seed dev in all svs, does not grade accurately.
C103	61	6	13	3	cb	5	1		7	7		Parthenocarpic 1 sv. Severe split with polywogs & short pods all sieve sizes. Mixed seed dev in 4 & 5 sv.
C103	62											1 oval plant
C103	64											
C134	62	6	14	5	h-r	7	3		5	5	1	Junky 3 sv w/ many polywogs.
C134	63											3 sv essentially all polywogs.
C134												
C87	61	6	13	5	cb	5	3		7	9	3	Color mix - smaller sv med green with larger sv light green pods. Med green has better pod quality, light green has many polywogs and short pods. Seed evaluation in light green variant. Many 1 sv pods are parthenocarpic.
C87	63											Previous color mix from unknown wrong picking. Picked correct plot today. This line produces large crop of par-thenocarpic pods which inflates 1 sv yield.
C87												
Crockett	63	3	12.5	7	r	9	7		5	7	5	Somewhat tough. Very low yield due to heat but few polywogs. Becoming a bit pithy in 4 sv. ace pods.
Crockett	65											
Crockett	68											Becoming pithy in 4 & 5 sv.

			Pod						Flavor			
Entry	DAP	Sieve size	Length (cm)	Straightness	Cross-sectional shape[y]	Smoothness	Color[x]		Sweetness	Astringency	Perfuminess	Notes[w]
Dinasty	62	3-4	12.5	9	r	9	4		7	5	7	Tough skin. Mainly affected by heat w/ low yields. ace.
Dinasty	64											Very low yield.
Dinasty	66											Many parthenocarpic pods. Mixed seed dev in 3 sv.
GVSB 17	58	5	12	3	r-cb	7	3		7	3	3	Split set w/ a few very mature pods & rest developing. Many polywogs esp. in 2 & 3 sv, mixed seed dev in 5 sv.
GVSB 17	61											3 sv looking less damaged by heat than higher sieves (long str pods vs curved & polywogs). Very little seed dev for grading so low.
GVSB 17	63											1s & 2s mostly parthenocarpic. Becoming pithy in 5 & 6 sv.
GVSB 59	61	5	10	3	cb	7	4		1	5	1	Very short junky pods; mostly polywogs; slightly better in 2 & 3 sv.
GVSB 59	64											Dropped 55% in 3 days. Very little seed dev. 1 sv mainly parthenocarpic pods.
GVSB 59												
GVSWB 1	62	4	14	7	r	7	1		9	7	3	Split set w/ many polywogs in 2 & 3 sv. Good wax bean color but mixed light green/wax in 2 sv.
GVSWB 1	65											1 green podded plant.
GVSWB 1	68											
Hudson	61	5	15	7	r	5	5		3	5	1	Pod quality is pretty good but yield is very low. Wide range in pod sv sizes. Ovals particularly in 3 & 4 sv
Hudson	64											Dropped 50% over 3 days. Not particularly seedy.
Hudson												
RR2006	56	5	13.5	7	cb	8	5		7	5	1	Many spent blossoms w/ pods; many polywogs & short pods in 3 & 4 sv. Split set but not as severe as others.
RR2006	58											Many polywogs esp. in 3 & 4 sv; little seed dev.
RR2006	61											

			Pod						Flavor			
Entry	DAP	Sieve size	Length (cm)	Straightness	Cross-sectional shape[y]	Smoothness	Color[x]		Sweetness	Astringency	Perfuminess	Notes[w]
RR2015	61	5	14	5	r-cb	7	4		7	5	9	Pods have decent quality although yields low.
RR2015	64											Dropped 46% in 3 days. Mixed seed dev in all sv sizes but not particularly seedy.
RR2015												
RR3006	58	5	14.5	5	r	7	5		7	7	1	Bad split set makes judging when to pick difficult, BBL flavor.
RR3006	61											Very similar to 5630. Severe split - low yield & misshapen pods.
RR3006	63											Decent yield in this picking but becoming pithy in 5 & 6 sv.
RR3009	62	6	13.5	5	cb	5	5		7	7	1	Polywogs in 3 & 4 sv, some split set but mainly reduced yield. Good quality.
RR3009	64											1 oval, fibrous roots. Dropped 35% in 2 days.
RR3009												
RR3011	59											Bad split set; some plants only in flower, others with 6 sv pods; won't be able to get accurate yields in this trial.
RR3011	62											Not a heavy nodulator. Becoming seedy but still good quality.
RR3011	64											Becoming pithy in 6 sv.
Sahara	61	4	12	5	r	9	5		3	5	3	This line is holding the yields under heat stress but has more polywogs & shorter than normal pods. ace pods.
Sahara	64											More curved pods than normal. Little seed dev but mixed in all sv sizes. Only dropped 10% over 3 days
Sahara	66											
SB4735	63	4	13.5	9	r	9	7		5	7	3	Very poor yield & many polywogs (mainly 3 sv) due to heat. Otherwise, an attractive bean. Somewhat tough & becoming pithy in 5 sv. ace pods

			Pod						Flavor			
Entry	DAP	Sieve size	Length (cm)	Straightness	Cross-sectional shape[y]	Smoothness	Color[x]		Sweetness	Astringency	Perfuminess	Notes[w]
SB4735	65											Mixed seed dev in 4 sv. Quality in 5 sv ok.
SB4735	68											Becoming pithy around seed in 5 sv.
SB4829	58	4-5	12.4	7	r-cb	9	7		7	7	3	Holds up well under heat w/ few polywogs & no split. 1 & 2s usable. ace pods
SB4829	61											This bean has held up really well in the heat.
SB4829	63											Polywogs in 3 sv & smaller but 4 & 5 sv good quality, & overall good yields Becoming pithy in 4 & 5 sv.
Tibesti	61	2	12	7	r	7	6		7	5	9	Long slender attractive bean. Pod quality generally good but some blanking in 3 sv.
Tibesti	64											Little seed dev.
Tibesti	66											Becoming pithy in 4 sv. Variable seed dev in all sv sizes.
World Cup	61	5	14	7	r	9	4		1	5	1	Very bad split set w/ many plants only flowering now. Low yields and some polywogs.
World Cup	64											Dropped 45% in 3 days. Mixed seed dev in 5 & 6 sv.
World Cup												
C45	65	6	13	3	h	3	3		5	5	1	Many polywogs in all sv sizes, although 3 & 4 sv are better. Dark green interior gel contrasts with lighter skin color.
C76	63	5	12	5	r	4	4		9	7	3	Affected by heat - low yield & polywogs in 3 & 4 sv. Not quite yet prime.

[z]Scale of 1 - 9 where 1 is least or worst and 9 is most or best. [y]r = round, cb = creaseback, h = heart and o =oval. [x]Scores based on a 1 - 9 scale with 9 darkest. Standard BBL color is rated as 5. [w]Abbreviations: sv = sieve, dev = development, RC = reverse curve, v = very, sl = slight, grn = green, upr = upright.

Table 11. Seed development of lines in snap bean yield trial planted June 15 and grown at the Vegetable Research Farm in 2022. Red highlighting indicates high values of the scale while blue indicates low values[z].

		Seed development in sieve size:					
Entry	**DAP**	**6**	**5**	**4**	**3**	**2**	**1**
OR5630	61	6	5	5	3		
OR5630	63	9	7	5	4		
OR5630	65	8	7	5	3		
OSU7066	62	6	5	3	2		
OSU7066	64	7	9	4	5		
OSU7199	68	7	5	3	2		
OSU7318	61	5	4	2	1		
OSU7318	64	7	6	6	3		
OSU7318	66	9	7	5	3		
BEX069	57		3	2	1	1	
BEX069	59		5	3	1		
BEX069	61		7	3	2		
Black Diamond	61		6	4	2		
Black Diamond	63		7	5	3		
Bruce	61		5	5	3	1	
Bruce	63	9	7	6	3	2	
BSC897	61		5	3	2	1	
BSC897	64		5	3	2		
BSC897	66		9	7	5		
C103	61	7	5	3	2	1	
C103	62	8	6	5	3		
C103	64	9	8	7	4		
C134	62	7	5	3	2		
C134	63	9	9	6	3		
C87	61	5	4	3	2	1	
C87	63	7	7	5	3		
Crockett	63			3	1	1	
Crockett	65		4	3	3		
Crockett	68		5	3	3		
Dinasty	62						
Dinasty	64		5	4	3		
Dinasty	66		7	5	3		
GVSB 17	58		5	3	1	1	
GVSB 17	61	5	5	3	1		
GVSB 17	63	9	9	8	5	3	
GVSB 59	61	5	3	2	1	1	
GVSB 59	64	5	5	3	2		

		Seed development in sieve size:					
Entry	**DAP**	**6**	**5**	**4**	**3**	**2**	**1**
GVSWB 1	62		3	2	1	1	
GVSWB 1	65		5	4	3		
GVSWB 1	68	9	9	7	3		
Hudson	61	3	3	2	1	1	
Hudson	64	5	5	3	2		
RR2006	56	5	5	3	1		
RR2006	58	5	4	3	1		
RR2006	61	7	5	3	1		
RR2015	61		3	2	2		
RR2015	64	6	6	4	2		
RR3006	58						
RR3006	61	4	3	3	1		
RR3006	63	7	7	6	3		
RR3009	62	7	5	3	1		
RR3009	64	9	7	5	2		
RR3011	59	6	5	3	2	1	
RR3011	62	7	5	3	1		
RR3011	64	9	8	5	3		
Sahara	61		4	2	2	1	
Sahara	64		5	4	3		
Sahara	66	5	4	3	2		
SB4735	63		5	4	2		
SB4735	65		7	4	1		
SB4735	68		7	5	3		
SB4829	58		4	2	2	1	
SB4829	61		6	5	3		
SB4829	63			7	6	3	
Tibesti	61				2	1	1
Tibesti	64			3	2	1	1
Tibesti	66			5	3	3	
World Cup	61		3	3	1		
World Cup	64	7	6	5	2		
C45	65	7	6	4	2		
C76	63	5	5	4	3		

[z]Scale of 1-9 where 1 = no development, 3 = seed development beginning, 5 = moderate seed development, 7 = seedy appearance, 9 = very seedy appearance.

Table 12. Average scores for processed (frozen samples) of the OSU green bean commercial trial evaluated in a sample display, October 31, 2022 at the OSU Pilot Plant. Scores based on a scale of 1 - 5 (5 best), N is number of individuals rating samples. Comments separated by (;) are from different individuals.

	Average Score						% Count (Overall)					
Line	Color	Flavor	Sweetness	Toughness	Overall	N	% 1 (Worst)	% 2	% 3	% 4	% 5 (Best)	Comments
5630	4.2	3.8	3.5	2.6	3.8	13	0.0	0.0	23.1	69.2	7.7	
Sahara	4.2	3.1	2.8	3.3	3.4	13	0.0	7.7	53.8	30.8	7.7	
7066	3.6	3.5	2.9	3.1	3.5	13	0.0	7.7	46.2	38.5	7.7	
Crockett	4.2	3.3	2.6	2.8	3.4	13	0.0	23.1	23.1	46.2	7.7	Intense flavor up front ; Large pods, tough skin
7199	2.7	2.8	2.3	3.3	2.8	12	8.3	16.7	66.7	8.3	0.0	
7318	4.5	3.5	2.8	3.0	3.7	12	0.0	0.0	41.7	50.0	8.3	Bland taste; Only 6 sv so may not be comparable
SB4735	4.3	2.6	2.3	3.2	3.0	12	8.3	16.7	50.0	16.7	8.3	Bland tasting; Slight bitter
SB4829	4.3	3.5	3.1	2.7	3.5	11	0.0	9.1	27.3	63.6	0.0	Soapy flavor; Very bland taste
Black Diamond	4.0	3.1	2.9	3.2	3.1	12	16.7	16.7	16.7	41.7	8.3	
Tibesti	4.1	3.3	2.8	3.2	3.4	12	0.0	16.7	41.7	25.0	16.7	Not appetizing; Very tough and bland; Very dk green but poor quality
BSC897	2.8	3.2	2.3	3.4	3.0	12	8.3	16.7	41.7	33.3	0.0	
Dinasty	3.1	3.7	3.0	3.1	3.6	12	0.0	16.7	16.7	58.3	8.3	
BEX069	3.1	3.2	2.8	2.8	3.0	12	8.3	25.0	41.7	8.3	16.7	
Hudson	3.6	3.4	3.1	3.4	3.4	12	8.3	8.3	25.0	50.0	8.3	Too light
World Cup	3.9	2.8	2.8	3.5	3.0	12	0.0	33.3	33.3	33.3	0.0	
BEX175	2.6	2.8	2.6	3.1	2.5	11	9.1	45.5	27.3	18.2	0.0	
RR2006	3.8	2.1	2.6	2.8	2.2	12	33.3	41.7	8.3	8.3	8.3	Tough for a romano
Bruce	4.5	3.8	4.3	3.6	3.8	12	0.0	0.0	50.0	25.0	25.0	Strange off squashy flavor
RR2015	3.3	3.1	2.8	3.2	3.0	12	8.3	16.7	50.0	16.7	8.3	Sweet but tough
RR3006	3.8	2.8	2.6	3.3	2.5	12	16.7	41.7	25.0	8.3	8.3	
RR3009	3.8	3.2	2.5	2.8	2.8	12	8.3	16.7	58.3	16.7	0.0	Slight off flavor; Very tough
RR3011	3.9	3.8	3.0	3.2	3.4	12	0.0	33.3	8.3	41.7	16.7	
GVSB 17	3.0	3.3	3.1	2.8	3.2	12	0.0	25.0	41.7	25.0	8.3	

	Average Score						% Count (Overall)					
Line	Color	Flavor	Sweetness	Toughness	Overall	N	% 1 (Worst)	% 2	% 3	% 4	% 5 (Best)	Comments
GVSB 59	3.0	2.8	2.6	2.9	2.8	12	8.3	33.3	33.3	16.7	8.3	Strong perfume (linalool) flavor
GVSWB 1	3.5	2.8	2.4	3.0	3.1	12	0.0	25.0	50.0	16.7	8.3	Too light but otherwise good
C87	3.6	3.7	3.7	3.8	3.4	12	0.0	16.7	33.3	41.7	8.3	Wax
C103	2.0	2.6	2.8	3.2	2.3	12	25.0	41.7	8.3	25.0	0.0	Not a processing bean but tender skin & firm interior
C134	2.8	3.3	3.3	3.4	3.2	12	8.3	16.7	25.0	50.0	0.0	Slight off flavor; Lightest bean in trial

Table 13. Field productivity and disease resistance parameters for advanced green bean lines grown at the OSU Vegetable Research Farm in 2020 - 2022.

Entry	Mean (2020-2022)					White mold
	Days to harvest	Ton/A	Adjusted T/A[z]	PFE[y] (lb/A/da)	% 1-4	Severity score[x]
OSU5630 (ck)	69.7	10.8	11.8	311	57.2	8.2
Sahara (ck)	70.0	8.7	8.7	249	90.8	
OSU7290	72.0	11.9	11.3	329	51.6	6.2
OSU7273	70.3	11.6	12.3	328	63.7	7.0
OSU7305	70.3	11.0	12.0	310	67.9	6.6
OSU7318	71.3	11.2	12.3	314	58.5	7.6
OSU7306	70.0	10.2	11.1	291	63.1	6.3
OSU7199	75.0	10.1	8.4	270	38.6	4.4
OSU7066	69.0	8.9	9.5	258	50.9	4.8
OSU7281	70.0	9.3	8.5	263	46.3	6.4
OSU7261	72.3	9.4	9.1	259	52.6	6.0
OSU7208	73.7	8.0	7.6	216	47.9	6.3
OSU7069	69.7	8.6	8.3	249	57.2	6.3
LSD 0.05						1.1

[z]Mean adjusted to 50% 1-4 for full sieve beans; T/A not adjusted for whole beans. [y]PFE = pod filling efficiency or rate of pod fill per day. [x]Straw test white mold disease severity score conducted in the 2021 greenhouse, scale of 1 - 9 with 1 = resistant. Cornell 501 had a DS or 5.6 and NY6020-4 was 3.8.

Research/Extension Progress Report for 2020-2021 Funded Projects Progress Report for the Agricultural Research Foundation Oregon Processed Vegetable Commission

Title
Creating an Oregon Green Bean Awareness Campaign

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Funding History
$24,657 (for 2022-23)

Abstract
The overall objective of the "Creating an Oregon Green Bean Awareness Campaign" project is to educate regional consumers, culinary professionals, retailers and distributors about the history and sensory quality of Oregon green beans and their value and use as a local frozen vegetable. This project will describe the unique historical and cultural story of green beans in Oregon; promote the culinarily attributes of frozen Blue Lake green beans through professionally developed cooking tips and recipes; and execute an Oregon Green Bean campaign to engage consumers, culinary professionals, retailers and distributors through various communication channels. The impacts will include increased knowledge on how to use frozen green beans and interest in home cooking with frozen green beans, as well as increased awareness of the history and culinary value of green beans in Oregon.

Key Words
Green beans, Oregon, Agriculture, History, Willamette Valley, frozen, vegetables, local

Objectives
Objective 1: Describe the story, history and culinary value of Oregon green beans
Objective 2: Describe the unique culinarily attributes of frozen Blue Lake green beans
Objective 3: Develop cooking tips and recipes for frozen Blue Lake green beans
Objective 4: Create an Oregon Green Bean campaign to engage consumers, culinary professionals, retailers and distributors with green bean history, types, recipes and cooking tips through various communication channels

Procedures
Objective 1: Describe the story, history and culinary value of Oregon green beans. The historical story of green beans as Oregon's state vegetable will be written into a promotion and marketing piece. A basis for this story will be Dr. Jim Baggett's History of the Blue Lake Bean Industry. This 1500-word story will be developed by author and journalist Margarett Waterbury who has experience writing articles and essays on Oregon agriculture, e.g. Fibrevolution: Bringing flax back to Oregon. This piece will be published to

Medium, sent to journalists (i.e. Capital Press, Portland Monthly) and food-focused podcasts, as well as shared with businesses that may be interested in also sharing this story (i.e. Burgerville, Food Co-ops).

Objective 2: Describe the unique culinarily attributes of frozen Blue Lake green beans
Building off of Myers' previous work, superior tasting varieties will be selected to develop flavor/culinary descriptions by CBN collaborating chef Tim Wastell. Myers has identified best tasting varieties in four different green bean types including Romano, Blue Lake, Midwest and Extra Fines. Myers will identify three varieties in each of the four types to grow, harvest and freeze in the 2021 growing season. These 12 varieties will be provided to chef Tim Wastell to use for creating a culinary description for the Blue Lake bean, including notes on flavor, texture and best culinary usage. The purpose of Tim receiving all four bean types is to best describe how Blue Lake beans are unique in comparison to other types. An example of these culinary descriptions can be found here.

Objective 3: Develop cooking tips and recipes for frozen Blue Lake green beans
CBN collaborating chef Tim Wastell of Antica Terra and cooking advocate Jim Dixon of Wellspent Market will create cooking tips and recipes. Three recipes will be developed. Professional photographer Shawn Linehan will use photos of the executed dishes and create double sided recipe cards with tips on one side and a recipe on the other, incorporating bean and dish photos. Examples of these recipe cards and photos are here.

Objective 4: Create an Oregon Green Bean campaign to engage consumers, culinary professionals, retailers and distributors with green bean history, types, recipes and cooking tips through various communication channels

- *Poster:* A poster created to create an identify for and celebrate the Oregon Green Bean awareness campaign designed by Victory Gardens of Tomorrow. Printed posters will be distributed at in-person events and shared on CBN social media.
- *Social Media*: The Oregon Green Bean story, types, recipes and cooking tips will be shared through the CBN Instagram account (>21k) and distributed in a CBN newsletter (>2k). A social media campaign will be created to highlight Oregon chefs posting videos of themselves using frozen green beans in home-cooked meals. We will create and promote a #hashtag to facilitate promotion and make the campaign searchable.
- *Sagra*: A week-long virtual Oregon Green Bean Sagra will be presented through the CBN YouTube site.
- *Green Bean Zine*. A zine will be published and aimed at consumers to share the Oregon Green Bean story, flavor descriptions of types, recipes and cooking tips. Custom illustrations will be created for the zine and can be used in other marketing materials as well. Selman and Stone have experience in creating zines and found them to be popular with consumers. Example: Garlic Types and Market Niches (https://www.eatwintervegetables.com/garlic-zine).

Accomplishments
Objective 1: *Describe the story, history and culinary value of Oregon green beans.*
Journalist Margarett Waterbury has completed a draft article of the historical story of green beans in Oregon which has been reviewed and edited by Jim Myers. It is ready for submission to the OPVC for review before publishing to Medium, sending to various media outlets and using the content in the "Oregon Green Bean Zine".

Waterbury also wrote an additional piece on the origins, domestication and breeding of beans. This has also been edited by Myers and will be used in the "Oregon Green Bean Zine".

Heather Arndt Anderson is a Portland-based culinary historian and ecologist who writes the OPB Superabundant weekly newsletter where she shares the most captivating food stories from around the Northwest. Anderson will include her own article on Oregon Green Beans in a February Superabundant newsletter as well as link to the Waterbury article. Anderson's email is handerson@opb.org if the OPVC would like to speak with her directly on her piece.

Work remaining on Objective 1: Submit draft articles to the OPVC for review before publishing to Medium, sending to various media outlets and using the content in the "Oregon Green Bean Zine".

Objective 2: *Describe the unique culinarily attributes of frozen Blue Lake green beans*
Breeder Myers provided different green bean types to chef Tim Wastell to use for creating a culinary description for the Blue Lake bean, including notes on flavor, texture and best culinary usage as well as to best describe how Blue Lake beans are unique in comparison to other types.

Work remaining on Objective 2: Wastell will submit his write up by Jan 10. This will be used in the "Oregon Green Bean Zine".

Objective 3: *Develop cooking tips and recipes for frozen Blue Lake green beans*
Cooking advocate Jim Dixon, Oregon-native and owner of Wellspent Market has created two simple and tasty recipes using frozen Blue Lake beans from Myers' program. The Green Beans Agrodolce was included in the Willamette Week "What we are cooking this week" column and provided some history of beans in Oregon for the article. https://www.wweek.com/food/2023/01/03/what-were-cooking-this-week-green-beans-agrodolce/

Work remaining on Objective 3: Wastell will submit his recipe and general frozen bean cooking tips by Jan 10. Professional photographer Shawn Linehan will create double sided recipe cards.

Objective 4: *Create an Oregon Green Bean campaign to engage consumers, culinary professionals, retailers and distributors with green bean history, types, recipes and cooking tips through various communication channels*

- *Poster*. Artist Joe of Victory Gardens of Tomorrow has been commissioned to create a poster for the Oregon Green Bean awareness campaign.
- *Green Bean Zine*. Custom illustrations have been created. Layout contractor has been identified and will start the work in mid-January.

Work remaining on this Objective:

- *Social Media*. The Oregon Green Bean story, types, recipes and cooking tips will be shared through the CBN Instagram account (>25k) and distributed in a CBN newsletter (>3k). A social media campaign will be created to highlight Oregon chefs posting videos of themselves using frozen green beans in home-cooked meals. We will create and promote a #hashtag to facilitate promotion and make the campaign searchable. This will occur in January and February 2023.
- *Sagra*. A week-long virtual Oregon Green Bean Sagra will be presented through the CBN YouTube site. This will occur in February 2023.
- *Green Bean Zine*. A zine will be published and aimed at consumers to share the Oregon Green Bean story, flavor descriptions of types, recipes and cooking tips. This will occur in January and February 2023.

Impacts
Increased interest in home cooking with frozen green beans.

Increased knowledge on how to use frozen green beans.
Increased awareness of the history and culinary value of green beans in Oregon.

Relation to Other Research

This extension effort compliments the breeding work of Jim Myers.