  

Oregon Processed Vegetable Commission Proposals 2022 - 2023

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Proposals

PROPOSAL TO THE OREGON PROCESSED VEGETABLE COMMISSION (2022)

1. OPVC PROPOSAL COVER PAGE (1 page)

PROJECT TITLE: Broccoli Breeding and Evaluation

PROPOSED PROJECT DURATION: 1 year (renewed yearly)

Personnel & Cooperators:
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BUDGET TOTALS
TOTAL BUDGET REQUEST (all years):

	Full budget	Reduced budget
Year 1:	$8,524 (breeding)	$7,395
	$6,613 (processing)	0
	$15,137 (total)	$7,395

2. PROPOSAL NARRATIVE (maximum 5 pages)

JUSTIFICATION and LITERATURE REVIEW

Oregon has had a favorable climate for summer production of broccoli with mild temperatures and a long growing season. The long-term trends are towards warmer summers with more extremes in weather. This presents challenges to broccoli growers that affects the cost of production and whether broccoli will remain profitable. 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 aspect of mechanical harvest in particular appears to be the removal of leaves from around the head.

The three pillars that are needed 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 20 years to develop cultivars that have architectural traits that make the cultivar more amenable to machine harvest.

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 human harvester. 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.

Another issue facing broccoli growers in Oregon is that of climate change. Historically, the Willamette Valley of Oregon has been a good environment for broccoli production, with cool days and nights. In recent years, summer temperatures have been warmer but there have been more extreme daytime high temperatures as well. In the past two years, we and others conducted heat tolerance trials of commercial hybrids and a few experimental inbreds to identify materials that showed stable performance across the season.

Disease resistances that are desirable include bacterial head rot, downy mildew, and club root resistances. 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 some of the already discussed disease resistance characteristics. Traits that need improvement in OSU materials are elimination of hollow stems and heavier heads with shallow branching without increasing floret size.

Many OSU hybrids are high quality and have shown stable, high yields over several years, but to bring these 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 disease resistance.

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.

PROCEDURES

We understand that OPVC funds may be limited this year. As such we indicate below which activities we would curtail if funds were reduced. We also present two versions of a budget: a full version, and one supporting only core activities.

<u>This activity is considered to be essential and will be conducted regardless of the budgeted amount.</u> We will identify non-CMS hybrids by examination at flowering, and will use those without IP constraints for crossing to OSU inbreds. The goal will be to broaden the genetic base of the OSU breeding program, and facilitate breeding higher yielding broccoli hybrids with desired architectural and processing quality traits. We will continue to derive new inbreds and use these on a small scale to produce F_1 hybrid seed for replicated yield trials. Inbreds lines saved from the 2021 fall trials will be grown from cuttings in the greenhouse. During the winter of 2022, these will be bud-pollinated to perpetuate the line, and crossed to other inbred lines to evaluate combining ability for F_1 hybrid production. Crossing efforts will focus on obtaining enough seed for replicated field trials of new hybrid combinations. Our breeding cycle is set up for fall production in the field, but where sufficient seed is available, we will trial hybrids in the spring as well. New inbreds will be obtained from selections of a random-mated mass selected population originally developed under organic production systems, where cuttings will be brought into the greenhouse for self-pollination. Approximately five or more generations of selfing are required to develop homozygous inbreds.

<u>This activity is considered to be essential and will be conducted regardless of the budgeted amount.</u> Inbreds and experimental hybrids and commercial hybrids will be grown in the 2022 main fall planting in the field in a single replicate observation trial, and hybrids alone in a replicated yield and quality evaluation trial. Plots will be evaluated for head size, shape, and exsertion, segmentation, floret texture and color, maturity and disease resistance.

This activity would be curtailed if budget is reduced. A replicated yield trial will be conducted in the fall. Up to 10 of the most promising OSU experimental hybrids and two to four check varieties will be planted. The other will consist of commercial hybrids selected chosen because of reported heat tolerance and/or have desirable mechanical harvest traits. Hybrids will be transplanted in one row plots 30 feet in length and replicated four times. In addition to observation data, yield data will be obtained. Entries in the yield trials will be taken to the OSU pilot processing plant for blanching and freezing. Frozen material will be evaluated at the OSU winter cutting and will be displayed at the PNVA meetings in Kennewick, WA in November.

This activity would be curtailed if budget is reduced. Abiotic (heat) stress tolerance will be evaluated by planting sequential replicates at one week intervals across the growing season, with planting timed to span the period of greatest heat during the summer. OSU inbreds and hybrids with sufficient seed will be grown along with a selection of commercial cultivars that performed well in prior heat trials, as well as hybrids that have not been previously tested. Plots will consist of 10 plants per line per planting date and plants will be evaluated at harvest maturity for head quality.

This activity is considered to be essential and will be conducted regardless of the budgeted amount. Backcrossing of selected hybrids to place the nuclear genome in the Ogura cytoplasmic male sterile (CMS) background will continue. We will continue developing CMS forms of S454, S463, S471, S473 and S475. Seed production of selected hybrid combinations using a fertile inbred as a male and a CMS inbred as a female will be evaluated in the field using isolation plots.

ANTICIPATED BENEFITS/EXPECTED OUTCOMES/INFORMATION TRANSFER

The long-term benefits of the breeding program are hybrids with higher and stable yields, adapted to mechanization, with improved quality traits and abiotic tolerance. In the short term, we would generate new knowledge about the genetic control of yield, quality and abiotic stress traits.

PROJECT TIMELINE:

Quarter 1	Quarter 2	Quarter 3	Quarter 4
Crossing & selfing in the greenhouse,	Packet & prepare for 2022 field season; start transplants for a late June planting.	Maintain plots, conduct evaluations & harvest yield trials and perform quality evaluations; samples taken to Pilot plant for processing and freezing.	Take cuttings from field and root in the greenhouse; compile data and produce reports; conduct sample display of frozen materials.

Requested Budget- Full budget option

1) Breeding (Myers)	
Salaries and benefits	
Faculty Research Assistant, field, 0.06 FTE	$2,619
OPE @ 75.4%	$1,966
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	$1,857
Total	**$8,524**
2) Processing (Wiegand)	
Salaries and benefits	
Faculty Research Assistant	$3,339
OPE @ 61.59%	$2,057
Wages and benefits	
Student Wages	$936
OPE @ 10%	$94
Supplies	$187
Total	**$6,613**
Grand Total (full budget)	**$15,137**

Requested Budget-Reduced budget option

1) 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**
2) Processing (Wiegand)	
Salaries and benefits	
Faculty Research Assistant	$0
OPE @ 61.59%	$0
Wages and benefits	$0
Student Wages	$0
OPE @ 10%	$0
Supplies	$0
Total	**$0**
Grand Total (reduced budget)	**$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. For the Food Science & Technology faculty research assistant, approximately 5% FTE will be required to process broccoli samples; the remainder of salary to come from other sources. $1,620 is requested for a summer undergraduate student to assist in plot maintenance and harvest operations. The FST FRA will also supervise an undergraduate student in broccoli processing. 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).

If budgets are reduced, yield and processing quality trial will be eliminated and no processing will be carried out.

<u>PROPOSAL TO THE OREGON PROCESSED VEGETABLE COMMISSION (2022)</u>

1. OPVC PROPOSAL COVER PAGE (1 page)

PROJECT TITLE: Green Bean Breeding and Evaluation

PROPOSED PROJECT DURATION: 1 year (renewed yearly)

Personnel & Cooperators:
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Funding request for 2022-2023

	Full budget option	Reduced budget option
Year 1:	$31,070 breeding	$15,785
	$9,442 processing	0
	$40,511 total	**$15,785**

Contributions from the OSU breeding program
Year 1: **$21,433**

2. PROPOSAL NARRATIVE (maximum 5 pages)

JUSTIFICATION and LITERATURE REVIEW

Green beans grown for processing in the Willamette Valley contribute significantly to the Oregon state economy each year ($26.2 million in 2019). 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. Based on 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 (WM) 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 partial resistance is known, there are challenges to successful deployment. First, the genetic factors conditioning resistance generally have small individual effect and are strongly influenced by the environment (in this respect, white mold resistance shows many similarities to the genetic control of yield). A number of resistance factors are known but these are in different varieties, many of which are not snap beans. Our work supported by the USDA National Sclerotinia Initiative involving meta-QTL analysis revealed that there are 17 factors contributing to resistance distributed throughout the bean genome. More recently, we conducted a genome wide association study (GWAS) and identified 39 regions of the bean genome that harbor resistance. None of these have major effect, but in combination, can contribute significantly to declines in disease. Dealing with so many different regions that need to be combined into a single background presents significant challenges for plant breeders. Our approach in progress is to develop a large population from multi-way crosses among eight parents with the highest genomic estimated breeding values previously identified in our GWAS work. A technique called genomic selection can then be applied to select lines that have accumulated white mold resistance factors. Another complexity is that in addition to physiological resistance, avoidance traits such as maturity, growth habit, lodging, flower number and retention, and canopy porosity influence the overall level of resistance. This past year, we screened nearly a thousand experimental snap bean lines for WM resistance, and used that information to only keep those with resistance levels equivalent to or better than our resistant check cultivars. With funds from the Specialty Crop Block Grant program, we are also developing DNA-based single nucleotide polymorphism (SNP) “fingerprints” for each of these lines that will allow us to associate the resistance we observed in the field or greenhouse with places in the genome that can be used as a basis for genotypic selection.

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. Abiotic stress tolerance generally and heat tolerance in particular is a trait that may be important going into the future as the climate warms and we see more extreme weather events, like the heat dome of 2021.

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

PROCEDURES

We understand that OPVC funds may be limited this year. As such we indicate below which activities we would curtail if funds were reduced. We also present two versions of a budget: a full version, and one supporting only core activities.

Breeding for White Mold Resistance: <u>This activity is considered to be essential and will be conducted regardless of the budgeted amount.</u> Because of the overriding need for white mold resistant snap bean cultivars, breeding for white mold resistance continues to be the primary objective of the breeding program. In 2022, we will again screen our thousand or so breeding lines for reaction to white mold using the straw test in the greenhouse. We will conduct a field white mold evaluation trial but due to field constraints, this will be more limited in the number of lines we can screen. this will be The field trial will consist of 20-foot plots replicated three times grown in a field at the Vegetable Research Farm that has a history of white mold infection. The field will be managed to achieve high levels of white mold infection.

We will also use the SNP genotypic data we receive to identify lines for favorable alleles for white mold resistance. This will be done using previous information that identified where these regions lie in the genome. Lines that show an accumulation of favorable alleles will be screened to verify that genetic associations translate into resistance in the field. A long-term strategy of the program is to create a MAGIC (Multiparent advanced generation intercross) population to develop a breeding population with high levels of white mold resistance. The parents were identified by our evaluations of the 376 accession Snap Bean Association Panel (SnAP). The population is based on combining eight white mold resistant parents by making four two-way crosses, following with two four-way crosses, and finally a single eight-way cross. At each step the number of individuals crossed increases with the goal of obtaining around 1,000 unique lines by the third round of crossing. These lines are selfed for another three generations to develop homozygous inbred lines. These can be genotyped with molecular markers and phenotyped for disease resistance for molecular mapping studies. The population can also be used to extract elite white mold resistant snap bean lines.

Varietal Development:

This activity is considered to be essential and will be conducted regardless of the budgeted amount. We will continue our traditional program with crosses among elite lines and the best white mold resistant lines. Pedigree and single seed descent breeding methods will be used to advance and select early generation materials. While the emphasis will be on breeding for white mold resistance, we also need to continue to incorporate improved plant architecture and conduct yield and processing trials of the best lines.

Yield and processing quality trials:

This activity would be curtailed if budget is reduced. Preliminary yield trials of about 30 advanced lines will be planted between May 10 and July 5. Plots will consist of a single 20-foot row from which 5-foot sections will be harvested for graded yield and raw product evaluation. Lines will be evaluated for growth habit, yield and graded samples will be evaluated for pod smoothness, straightness, seed to pod ratio, and color. Those that meet expectations in the raw product evaluation will be frozen for evaluation of the processed product. User panels will evaluate quality of samples. Frozen material will be evaluated at the OSU winter cutting and will be displayed at the PNVA meetings in Kennewick, WA in November. Where the opportunity presents in the preliminary yield trials, we will evaluate for white mold resistance and/or heat tolerance.

Advanced Lines: This activity is considered to be essential and will be conducted regardless of the budgeted amount. Seed increase, roguing, and sub-line maintenance of the historical releases will continue.

ANTICIPATED BENEFITS/EXPECTED OUTCOMES/INFORMATION TRANSFER:
The long-term benefits of the breeding program are cultivars with higher and stable yields, improved quality and durable disease resistance. In the short term, we would generate new knowledge about the genetics of disease resistance and other snap bean traits.

PROJECT TIMELINE:

Quarter 1	Quarter 2	Quarter 3	Quarter 4
Crossing in the greenhouse; finish cleaning seed & packet & prepare for 2022 field season.	Plant bean trials and nurseries beginning May 1 – July 1. Maintain plots.	Maintain plots, conduct evaluations & harvest yield trials and perform quality evaluations. Samples taken to Pilot plant for processing and freezing.	Harvest dry seed, dry and thresh. Compile data and produce reports. Conduct sample display of frozen materials.

Requested Budget - Full option *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 (full)	**$40,511**

Requested Budget - Reduced option *1) Breeding (Myers)*	
Salaries and benefits	
Faculty Research Assistant	$8,731
OPE @ 75.4%	$6,554
Wages and benefits	
Student Wages	$0
OPE @10%	$0
Supplies	$500
Travel	$0
Land and greenhouse rental	$0
Total (breeding)	**$15,785**
2) Processing Evaluation (Wiegand)	
Salaries and benefits	
Faculty Research Assistant	$0
OPE @ 61.59%	$0
Wages and benefits	
Student wages	$0
OPE @ 10%	$0
Supplies	$0
Total (processing)	**$0**
Grand Total (reduced)	**$15,785**

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.).

Under the reduced budget option, the breeding program FRA would be reduced to 0.2 FTE and the processing budget would be eliminated.

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. In the event of budget reduction, Land rental costs would be reduced to three acres @ $1460 = $4,380 (total Land and greenhouse rental: $6,634 and total contribution of $18,513).

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PROPOSAL

TITLE: Creating an Oregon Green Bean awareness campaign

YEAR INITIATED: n/a **CURRENT YEAR:** 2022-23 **TERMINATING YEAR** 2023-24.

PERSONNEL & COOPERATORS:

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FUNDING REQUEST FOR 2022-23: $24,657

JUSTIFICATION:

Millennials and Gen Zs are eating more vegetables, leading to a predicted 10 percent increase in fresh vegetable consumption over the next few years. Frozen vegetable consumption has been in decline, but because Millennials and Gen Zs are also eating more frozen vegetables, consumption of frozen vegetables is forecast to increase by 3 percent in the next few years (NPD Group). The interest by young consumers in vegetables, as well as their interest in eating foods that are both healthy and come with a story, are drivers of this project.

Oregon green beans are nutritious, delicious and have a great story, especially for young regional eaters. The Oregon processing industry has built its reputation on the blue lake green bean. First brought to the Willamette Valley as a pole bean more than a century ago, it was soon established as the major processing bean. Many an Oregonian as high schoolers have spent their summers picking pole beans in the first half of the 20th century. The pole bean was replaced by the bush blue lake green bean through the breeding efforts of Tex Frazier in the 1950s to early 70s and remains the primary type with the cultivar OSU5630 now grown on the majority of acreage in the valley.

Relative to other types of green beans, blue lake types are higher yielding, have excellent culinary quality and processing characteristics, and retain quality after processing. They have among the lowest fiber pods of any type of green bean and have a highly preferred flavor profile that it shares with many of the old-time pole beans such as ‘McCaslan’ or ‘Kentucky Wonder’. The pods will retain texture and color even when left for hours under the heat lamp of a buffet line. They are flavorful and versatile, easy to prepare and flexible in accommodating different cuisines. As new users search for frozen vegetables to eat, it is time to tell the story of the blue lake green bean and promote its use and consumption to ensure that it is part of the increase in frozen food consumption.

HYPOTHESIS & OBJECTIVES:

Overall objective: 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. In other words "Make Oregon green beans hip!"

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:

In 2011, Selman created the Culinary Breeding Network (CBN) with a mission to build communities of plant breeders, seed growers, farmers, produce buyers, chefs and other stakeholders to improve quality in vegetables, fruits and grains. Some CBN activities include 1) working with culinary professionals to identify best quality varieties, their usage and recipe development; 2) developing marketing campaigns, i.e. website creation, content development, branding, artwork/design, photography and video production (see www.eatwintervegetables.com); 3) organizing public outreach events, both in-person and virtual, i.e. Sagra and Variety Showcase; 4) marketing through social media, i.e. CBN Instagram with >21,000 followers with a national and international reach.

In a November 2020 survey sent to 75 direct-market farmers working with CBN, 45% of respondents identified CBN's most valuable impact in the food system as creating a "buzz" in the community around specific vegetables and/or varieties. Additionally, 82% have started growing a variety due to CBN promotion, showing a strong track-record of effective stakeholder engagement and success in responding to their needs. When asked where CBN should expand or increase efforts for the future, farmers responded with 56% marketing and promotion of specific varieties.

<u>Objective 1: Describe the story, history and culinary value of Oregon green beans</u>
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).

<u>Objective 2: Describe the unique culinarily attributes of frozen Blue Lake green beans</u>
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; culinary educator Katherine Deumling of Cook What What You Have; and cooking advocate Jim Dixon of Real Good Food will create cooking tips and recipes. Three recipes will be developed, including one recipe from each of culinary professional. Professional photographer Shawn Linehan will take 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. In Italy, a Sagra is a festival to increase awareness of locally grown foods and create excitement and interest around regionally-grown vegetables. Selman and Stone have successfully been introducing these festivals here in Oregon. In 2019, the Winter Vegetables Sagra (SCBP funded) occurred in partnership with the Friends of Family Farmers annual Fill Your Pantry sale. The event attracted over 1,000 attendees and included 31 farmer vendors. In 2020, due to Covid restrictions, Selman and Stone organized an online Sagra which took the form of nine weeks of virtual programming starting in December 2020 which will run through March 2021. The Sagra features TED-style talks, interactive Q&A sessions, cooking demos, and virtual field tours with content focused on nine winter vegetables: Celeriac, Radicchio, Brussels Sprouts, Cabbage, Cauliflower, Collards, Winter Squash, Garlic and Purple Sprouting Broccoli. Presentations explore plant histories, origins and domestication; medicinal, nutritional and culinary elements of species; farm visits; cooking demonstrations; art and folklore. This virtual event had >900 pre-registrations. Presentations which are watched, recorded and archived on the new (created in November 2020 for this purpose) Culinary Breeding Network YouTube channel with >850 subscribers and have had >12,000 views. The Sagra was featured in Capital Press. Viewers have been a mixture of farmers, consumers and chefs and many have requested continuing this virtual content even after Covid restrictions.

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).

ANTICIPATED BENEFITS/EXPECTED OUTCOMES/INFORMATION TRANSFER:
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.

PROJECT TIMELINE:
Timeline: May 1, 2022-April 30, 2023

May 2022 - Myers plants selected high-quality 12 green bean varieties (four types) at OSU
June 2022 - Poster design created
June 2022 - Waterbury begins research on Oregon green bean history and conducts interviews
June 2022 - Zine planning begins in order to determine illustrations needed
July 2022 - Myers plants harvests / Wiegand freezes them
August 2022 - Wastell receives frozen beans for creating flavor/culinary descriptions
Aug-Sept 2022 - Wastell, Dixon and Duemling develop recipes and cooking tips
Sept-Oct 2022 - Linehan photographs recipes and creates recipe cards
Dec 2022 - Zine completion and week-long Sagra
Jan - Feb 2023 - Social media campaign with chef videos

LITERATURE REVIEW:
Myers and colleagues (Wallace et al., 2018) conducted a diversity study of snap beans using a panel of 200 snap and dry bean cultivars, heirlooms and landraces. They found that snap beans could be arranged into eight distinct groups that parallel dry bean centers of domestication and races. Of these eight groups, four are known mainly as older heirloom beans and are rarely grown commercially today. The other four groups include the blue lake green beans and other heirloom pole beans, the Midwestern green beans typified by ‘Tendercrop’, the flat podded Romano beans and the extra fine European types. Each has their own set of culinary characteristics.

A graduate student of Myers, Lyle Wallace, (2018) examined flavor volatiles in green beans. He found that three compounds are the primary determinants of flavor in green beans. These are 1-octen-3-ol, 3-hexen-1-ol and linalool. The two former compounds contribute the “beany” flavor while the latter produces a floral aroma. Blue lake and European extra fine types tend to be high in 1-octen-3-ol and 3-hexen-1-ol, but low in linalool. Midwestern green beans have just the opposite volatile profile whereas Romano beans tend to be high in all three compounds. Additional volatiles may influence flavor as well, but their effects do not seem to be as important as the octen-hexen-linalool trio. Different flavors, combined with differences in pod color, texture and fiber may make certain types of snap beans better suited to certain dishes, and understanding these specificities will help in promoting the blue lake type.

REFERENCES:

Baggett, James R. and William Lucas. 2005. A story of the Blue Lake pole bean industry in Western Oregon. Oregon State University Valley Library Special Collections and Archives, History of the Pacific Northwest Collection (HD9235.B42 U63 2005).

Drucker, A et al, 2020. Garlic Types and Market Niches. Available at https://www.eatwintervegetables.com/garlic-zine).

NPD Group. Guess who is eating their vegetables now? Younger consumers drive growth of fresh and frozen vegetable consumption. Available at https://www.npd.com/wps/portal/npd/us/news/press-releases/2016/guess-whos-eating-their-vegetables-now-younger-consumers-drive-growth-of-fresh-and-frozen-vegetable-consumption-boomers-not-so-much/

Wallace, L., H. Arkwazee, K. Vining and J.R. Myers. 2018. Genetic diversity within snap beans and their relation to dry beans. Genes 9(587); doi:10.3390/genes9120587. http://www.mdpi.com/2073-4425/9/12/587/htm.

Wallace, Lyle T. 2018. Sensory Analysis and Genetic Mapping of Green Bean Flavor. Ph.D. dissertation, Oregon State University.

2022-23 BUDGET: $24,045

	OPVC
Salaries: Faculty	$7,572
Graduate student	
Other students	
Other labor	
Employee Benefits (OPE): Faculty	$4,685
Graduate student	
Other students	
Other labor	
Equipment	
Travel: Domestic (in state)	
Domestic (out of state)	
Foreign (conferences, etc.)	
Operating Expenses [1]	$12,400
Other Expenses [2]	
Total	$24,657

[1] Otherwise known as "Goods and Services" or "Supplies and Materials."
[2] Capital outlays, or other needs. Please detail in footnote.

Please note that no indirect cost or graduate student tuition is allowed

BUDGET JUSTIFICATION:
Lane Selman, Professor of Practice: The equivalent of 0.10 FTE (base salary is $75,720) = **$7,572**. OPE benefits calculated at 61.87%. Total OPE=**$4,685**

Written story of Oregon Green Bean. Contractor Margarett Waterbury. 1500 words. **$1500**

Culinary descriptions. Contractor chef Tim Wastell. **$500**

Recipe creation. Contractors chef Tim Wastell and culinary educator/advocates Katherine Deumling and Jim Dixon. $450/recipe x 3 recipes = **$1350**

Recipe cards w/photos. Contractor Shawn Linehan. One day of shooting and one day of editing to create 3 recipe cards and 15-20 bean and dish photos = **$2000**. Cost for chef = $850 for the day of shooting = **$850**

Sagra. $250 stipend/speaker x 5 speakers = **$1000**

Social Media campaign. $250 video/chef x 6 chefs = **$1500**

Campaign Poster. Contractor Victory Gardens of Tomorrow (creation) = **$1000**. Printing 100 prints x $3/print = **$300**

Green Bean Zine. Contractor Shawn Linehan (layout/design) = **$1000** and Contractor Fiona Murray (illustrations) = **$1000**. Printing 100 zines x $4/zine = **$400**

ANTICIPATED REQUESTS IN COMING YEARS (if applicable): n/a

OTHER SUPPORT OF PROJECT: n/a