OPVC CONTINUING PROJECT REPORT: *2015* **PROJECT YEAR**:

1. OPVC REPORT COVER PAGE (maximum 2 pages)

OPVC Project Number:

Project Title: Green Bean Breeding and Evaluation 2015

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2. EXECUTIVE SUMMARY (ABSTRACT): Oregon is the second largest 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, excellent processing quality. On the other hand, then need improvement in plant architecture, disease resistance (especially to white mold), and are genetically isolated from other 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 2015, a yield and processing trial of 18 advanced lines was conducted. An additional commercial trial with 27 entries was also grown and evaluated. Seven advanced lines are undergoing intense scrutiny for release as the first partially white mold resistant lines commercially available.

3. FULL REPORT (no maximum)

3.a. BACKGROUND Green beans grown for canning and freezing in the Willamette Valley contribute about $23 million to the Oregon state economy each year. 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. The growing environment in Western Oregon is different from any other green bean production area in the United States. Developing productive varieties that are adapted to this area requires the attention of a substantial breeding effort in Western Oregon.

BBL green beans have rather unique characteristics compared to Midwestern green beans. Foremost, they have almost double the yield potential because they put more of their photosynthate into reproductive development and less into vegetative growth. The tradeoff is that BBL plant architecture is not as robust as that of many Midwestern types. BBL green beans have a unique flavor profile, being higher in sugars and the "beany" flavor components, and lower in the "floral" flavors that are more typical of Midwestern beans. BBL and Midwestern green beans have different co-adapted complexes of genes for snap bean traits such that the two groups are somewhat genetically isolated. This creates challenges in introgressing desirable genes from Midwestern types into a BBL background.

Most important at present is the development of BBL varieties with upright plant architecture and resistance to white and gray mold. Other needs include resistance to the root rot complex, improved seed quality, and tolerance to abiotic stresses including heat and moisture stress. The material developed by the OSU breeding program over the past five decades provides an excellent base population for continued improvement. While small acreages of other market types (European extra fine, wax and romano beans) are grown, the OSU breeding program will focus predominantly on full sieve green beans.

Breeding programs typically take about 10 years to develop a new variety. Winter nurseries and off-season greenhouse production can increase the number of generations per year and shorten the breeding cycle. New technologies, such as marker-assisted selection to introgress specific traits can also shorten the breeding process.

3.b OBJECTIVES

- Breed improved Bush Blue Lake green bean varieties with:
    - White and gray mold resistance
    - Improved plant architecture
    - High economic yield
    - Improved pod quality (including straightness, color, smoothness, texture, flavor and quality retention, and delayed seed size development)
    - Tolerance to abiotic stresses
- Improve seed quality of materials in the breeding program to provide greater resistance to mechanical injury and low germination issues.

3.c. SIGNIFICANT FINDINGS Seven advanced green bean lines that combine productivity, quality, and white mold resistance were trialed again in 2015 and continue to appear promising. Seed of these lines is being fast-tracked for increase and more substantial evaluations for eventual release.

3.d. METHODS

Varietal Development: The program will continue 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. Green beans are a self-pollinated crop and cultivars are purelines that developed through a minimum of six generations of self-pollination with selection. To initiate the process, selected lines are crossed in the greenhouse during the winter and the F_1s are grown in the field to produce large F_2 populations (target of 250 seeds per cross). F_3s are then grown in the greenhouse or an off season winter nursery using a technique such as single seed descent (one seed is taken from each plant in the population and bulked). Selection is generally not conducted in the off season environment. The F_4 is produced in the field in Oregon where selection for pod traits (length, cross-section, color, sieve size, smoothness, and straightness) and plant architecture is conducted. Similar selection is conducted in the F_5 and selected plants are harvested as single plants (all the seed from one plant is composited). In the F_6 and beyond, the populations are maintained as a collection of selected families (advanced lines). At this generation, there is sufficient seed for testing in various yield and disease trials.

Variety Trials: Two types of trials are conducted: experimental materials trials where OSU advanced lines are evaluated and a commercial trial where lines submitted by commercial breeders are evaluated. The commercial green bean trial is predominantly supported by plot fees, but data are reported here because of their potential interest to growers and processors. Advanced lines are planted in plots consisting of a single 20-foot row from which 5-foot sections harvested one time (experimental materials trial), or three times, two – three days apart (commercial trial). Lines are evaluated for growth habit, pod characteristics and T/A yield. Where the opportunity presents (disease is present), we will evaluate disease resistance. Graded samples are evaluated for pod smoothness, straightness, flavor, and color. These samples are frozen for later evaluation of the processed product. The commercial trial is open to all types of snap beans, but with an emphasis on entries comparable to blue lake beans. Samples from optimum harvest dates will be processed as above.

Advanced Lines: A breeding nursery consisting of lines at all stages of development are grown. Historic lines and those actively used commerce are evaluated each year and rogued for off types. Promising advanced lines undergo seed increase, rogueing, and initiation of sub-lines for varietal maintenance. Seed quality of OSU advanced lines will be quantified using germination damage tests that are standard in the industry. In short, seeds are dropped onto a steel plate, and then subjected to cold (10°C) germination tests.

The most promising lines near release are provided to seed companies for evaluation and increase. As these lines are increased, they will be tested in small-scale on-farm acreages.

Breeding for White Mold Resistance: Because of the urgent need for white mold resistant snap bean varieties, breeding for white mold resistance is the primary objective of the breeding program for the near future. Material with potential resistance is at various stages of development in the breeding program. Currently, the program is evaluating advanced lines developed using the NY6020 source of resistance. Additional lines in earlier generations with other sources of resistance are being advanced and selected for plant type and disease resistance.

Screening for resistance is laborious and restricted to advanced generations. This is because resistance is a quantitative trait and requires evaluation of replicated plant samples to obtain useful data. Two types of tests are used: the greenhouse based straw test where a plug of agar containing actively growing

white mold mycelia is placed on a decapitated stem of a plant, and field trials where replicated plots are grown in a field with high risk of disease development with management to encourage disease. The white mold effort is supported in part by grants from the National Sclerotinia Initiative.

3.e. RESULTS & DISCUSSION

Overview of Project and Varietal Development: After a reduction in the size of the green bean breeding program due to budget cuts (2013) and to the observation of bacterial brown spot (*Pseudomonas syringae* pv. *syringae*) in experimental lines (2013 and 2014), the program increased in size in 2015. No brown spot was observed this past year indicating that environmental conditions were not favorable to development of disease symptoms, and/or we had managed to eliminate the disease from our experimental lines. In 2014, the bean breeding nursery was reduced to 207 lines, in 2015, the number rebounded to 1,048. This is important because plant breeding is a numbers game, and the smaller the program is, the less likely one will find the very best new recombinants.

In 2015, we conducted two yield and quality evaluation trials. It should be noted that the evaluation of commercial entries was funded entirely by fees from industry. Seventy-six advanced lines with putative white mold resistance were screened in the field. Stock seed increase and rogueing was conducted for four released cultivars and various advanced lines. There are a number of advanced selections that carry the NY6020 source of white mold resistance that are in or nearing field testing and processing phase of evaluation. The early generation nursery matured during high temperature conditions in August and most lines exhibited an extreme split set. The replicated yield trials generally escaped the heat and showed little or no split set.

Yield Trials: The experimental materials green bean yield and quality evaluation trial had 17 advanced experimental lines and six check cultivars (table 1, fig. 1). Three of the checks were commercial bush blue lake cultivars (OR 91G, OR 54, and OSU 5630), one was Sahara as a small sieve check, and two were checks with partial white mold resistance (Cornell 501 and NY 6020-5). All lines had been tested the previous two to three years, and were retained because they had the best combination of yield and white mold resistance. Most lines were classed as five or full sieve with percent 1-4 sieve ranging from 50-75%. The trial was planted on June 19 and was harvested 61 – 68 days later. Plots were harvested once at optimal maturity (although in some cases a second harvest was conducted if initial harvest was too young.

OR 54 was the highest yielding check with a yield of 12.1 T/A at 69% 1-4 sieve (which is equivalent to 14.6 T/A when adjusted to 50% 1-4 sieve). OR 91G showed similar high yield but OSU5630 was somewhat lower. Surprisingly, Cornell 501 had over 10 T/A yields at 54% 1-4 sieve. Normally, Cornell 501 (a white mold resistant check) has yields more similar to NY6020-5 (which was 4.8 T/A at 30% 1-4 sieve). Seven lines (6980, 6986, 6992, 6993, 7013, 7022, 7023, and 7025) had adjusted T/A yields that were not significantly different from OSU 5630. Two advanced lines of interest, 6771 and 6774, had yields of 10.3 T/A 8.5 T/A (adjusted), and 7.8 T/A and 9.2 T/A (adjusted), respectively. 6771 was harvested on the late side at 32% 1-4 sieve while 6774 was harvested at 68% 1-4 sieve. Data on pod traits and notes from raw product evaluation are shown on table 2. Most lines exhibited good pod quality although some had pod color that might be too light upon processing. Flavor characteristics for most fit a BBL profile (Table 2).

Commercial Green Bean Trial: This trial was planted on June 29 and harvested 58 – 61 days later. The trial included seven five - full sieve green beans, and 15 two to four-five sieve green beans. Two full sieve and one 4 sieve check cultivars and two OSU experimental lines were included (tables 3 – 5, and

figs. 2 -3). Yields of the check cultivars OR 91G and OSU 5630 at 10.1 and 9.2 T/A were somewhat lower than previous years, and the checks were outperformed by BSC11B525 and Huntington among the larger sieve beans. Highest among the commercial experimentals (although not significantly different from the checks) were SB4680, and SB4682. In general, the positive correlation between yield and sieve size was once again observed.

Processing and Quality Evaluation of Experimental Green Beans: Experimental lines from the preliminary trial were sent to the OSU Pilot Plant for processing, along with 91G, OR54, and OSU 5630. In the Commercial Trial, all commercial lines along with OSU experimentals were processed and frozen along with the checks 91G, and OSU 5630.

Processed and frozen samples were evaluated by researchers 30 December, 2015. The commercial lines and some experimentals were then displayed in a cutting at the North West Food Processors Association Meetings in Portland in January, 2016. Data from the processed evaluations are being analyzed and will be reported at a later date. Though the data from the research evaluation does show how the new lines are doing and which crosses are the most promising, the low number of evaluators does not lead to statistically significant analyses of the results.

Advanced lines considered for release: 6771 and 6774 have now been trialed for five years (Table 6). When compared to OR 91G, yields of 6771 and 6774 have been 80 and 86%, respectively of the check in seven to nine environments. These are yields achieved without significant white mold pressure. Overall, it appears that 6771 and 6774 are more sensitive to environmental perturbations, which reduces yield in particular trials, so that their long term yield potential appears to be 80 – 90% of the traditional BBL cultivars.

Several other advanced lines appear promising and appear to be clusters of sister lines (6980, 6986, 6992, 6993, 7013, 7022, 7023, and 7025) reported earlier as combining good yields with white mold resistance. In particular, 7025 is of interest and appears to have good quality and acceptable quality as well (although in 2015 it exhibited an oval off type that needs to be eliminated).

4. BUDGET DETAILS

1) Breeding (Myers)	
Salaries and benefits	
Faculty Research Assistant	14,106
OPE @ 70%	9,874
Wages and benefits	
Student Wages	0
OPE @ 8%	0
Supplies	500
Travel	0
Land and greenhouse rental	0
Total	$24,480
2) Processing Evaluation (Yorgey)	
Salaries and benefits	
Senior Faculty Research Assistant	2,610
OPE @ 60%	1,566
Wages and benefits	
Student wages	1,300
OPE (@ 8%	104
Supplies	1,344
Total	$6,925
Grand Total	**$31,405**

Budget Justification: Salary and OPE is requested for a full time faculty research assistant who will commit 37% FTE to green bean breeding. A senior faculty research assistant will commit approximately 0.1 FTE to processing of entries from green bean trials; the remainder of salary to come from other sources. Undergraduate student wages of $1,300 are requested for the processing program with 8% OPE. OPE for the FRA is 70% and that of the SFRA is 60%. $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	7,220
OPE @ 8%	577.6
Supplies	500
Travel	92
Land and greenhouse rental	9,586
Total	17,975

Undergraduate student wages of $7,220 are estimated for the breeding program with 8% OPE. An additional $500 is required to cover field and greenhouse materials and supplies expenses (fertilizer, pots, labels, stakes, tags, crossing supplies). To cover transport of samples from the farm to campus for processing, $92 is estimated Land use rental at the OSU Vegetable Research Farm consists of five acres at $1,259 per acre and greenhouse rental of 2,123 ft^2 at $1.55 per square foot.

Table 1. Performance of preliminary green bean lines, Jun 19 planting, Corvallis, 2015.[z]

Line	Days to Harvest	Est. Sieve Size	Stand	Percent Sieve Size[y]						%1-4 Sieve	Av Tons/Acre	Av Adj Tons/Acre[x]
				1.0	2.0	3.0	4.0	5.0	6.0			
91G	61	6	198	4.5	6.8	14.0	34.1	37.5	3.0	59.5	12.1	13.3
OR54	63	6	198	5.6	9.4	18.4	35.2	28.1	3.4	68.5	12.3	14.6
Cornell 501	68	5	180	2.7	2.7	8.0	41.2	43.4	2.2	54.4	10.3	10.8
NY6020-5	63	6	182	2.9	4.8	6.7	15.2	51.4	19.0	29.5	4.8	3.8
Sahara	61	4	196	6.8	14.1	45.8	33.3	0.0	0.0	100.0	8.9	8.9
5630	63	6	163	4.7	5.9	14.4	36.4	35.6	3.0	61.4	10.8	12.1
6770	63	6+	168	3.5	6.1	7.4	13.0	28.3	41.7	30.0	10.7	8.5
6771	63	6	200	0.9	2.6	5.7	23.0	60.4	7.4	32.2	10.3	8.5
6772	61	5	199	4.2	6.8	12.7	50.4	25.4	0.4	74.2	10.8	13.4
6774	63	6	189	5.1	10.2	19.3	33.5	27.8	4.0	68.2	7.8	9.2
6779	63	6	195	1.9	5.3	12.9	34.0	42.6	3.3	54.1	9.8	10.2
6792	68	6	200	1.9	1.5	3.8	16.2	67.3	9.2	23.5	12.2	9.0
6835	63	6+	193	3.2	3.2	6.9	24.3	54.7	7.7	37.7	11.5	10.1
6900	61	5	195	6.5	9.8	16.3	43.1	23.5	0.7	75.8	7.1	8.9
6980	67	5	186	3.6	6.8	14.9	38.7	32.9	3.2	64.0	10.2	11.6
6986	68	6	182	5.3	6.7	13.8	32.9	36.9	4.4	58.7	9.9	10.8
6992	66	5	192	2.2	3.6	11.1	46.7	35.6	0.9	63.6	10.3	11.7
6993	66	5	200	2.2	5.2	16.1	40.4	33.9	2.2	63.9	10.4	11.8
6996	66	6	200	2.0	3.5	7.5	25.2	51.6	10.2	38.2	11.6	10.3
7013	67	5	200	2.7	5.8	16.1	43.8	31.3	0.4	68.3	10.0	11.9
7022	66	5	199	3.3	5.6	17.7	49.8	23.7	0.0	76.3	10.1	12.8
7023	67	5	193	2.9	3.7	12.8	44.6	36.0	0.0	64.0	11.0	12.5
7025	66	5	200	3.6	6.3	17.9	47.8	24.6	0.0	75.4	10.1	12.6
LSD 0.05			17								1.5	1.7

[z]Mean of 4 replications; subplots of 5' were harvested from 18' plots in rows 30" apart.
[y]Percent calculated as % of total of 1-6 sieve beans.
[x]Tons/Acre adjusted to 50% 1-4 sieve for full and 5 sieve beans; yields for smaller sieve lines were not adjusted.

Table 2. Notes on preliminary green bean lines, June 19 planting, OSU Vegetable Research Farm, Corvallis, 2015.

Entry	Pod Length (cm)	Pod Straight-ness[z]	Pod Cross Section[y]	Pod Smooth-ness[z]	Pod Color[x]	Flavor[z]			Notes[w]
						Sweet-ness	Astrin-gency	Perfumi-ness	
91G	17	4	r	5	5	9	7	1	
OR54	16	7	r	5	5	7	7	1	A number of flats in this lot.
Cornell 501	14	7	r	5	4	3	5	3	Oval mix in 3 sv.
NY6020-5	13	7	r	5	3	3	5	5	
Sahara	13	8	r	7	6	5	7	3	
5630	15	4	r	5	5	8	7	1	
6770	23	3	cb	3	5	7	7	1	Extremely long and large sieve bean - probably too long for processing. Nice appearance but much battering in the grader.
6771	13	6	r-cb	7	5	7	7	3	
6772	13.5	8	r-h	5	4	7	7	1	
6774	16	5	r	5	6	7	5	1	
6779	14	5	r	4	6	8	5	1	Nice looking bean although somewhat bumpy in higher sieves.
6792	16	7	r	7	5	5	7	1	Some ovals. Based on sieve size, this line should have been harvested earlier, but based on seed development, this line is still prime.
6835	17	8	r	7	5	7	7	1	Long very straight attractive bean.
6900	14	6	r	6	5	7	8	1	
6980	13	7	r	7	5	7	7	1	Short but nice green bean.
6986	15	5	r	5	5	5	7	1	This line seems to have a higher proportion that abscise at the neck rather than pedicle.
6992	15	6	h-r	7	5	7	7	1	Straight in smaller sieves, some curving in larger sieves. Overall a nice bean but need to select against heart shape.
6993	14	7	r	5	6	5	7	1	Round seeded. Very attractive line but pods on the short side.
6996	16	5	h-r	7	5	7	7	1	Nice looking bean and even at this stage of maturity, still very good quality.

Table 2. (Continued)

Entry	Pod Length (cm)	Pod Straight-ness[z]	Pod Cross Section[y]	Pod Smooth-ness[z]	Pod Color[x]	Flavor[z]			Notes[w]
						Sweet-ness	Astrin-gency	Perfumi-ness	
7013	15	4	r	7	4	7	7	1	May be some for strings (or carryover from previous plot).
7022	15	3	h	5	4	5	5	3	Heart and curved pods probably too light.
7023	13	3	r	4	4	5	7	1	Curly pods esp. smaller sieves.
7025	14	5	h-o mix	7	5	5	7	1	Mix of oval and heart shape.

[z]Scale of 1 - 9 where 1 is least or worst and 9 is most or best. [y]Cross section: r = round, h = heart, cb = crease-back. [y]Scores based on a 1 - 9 scale with 9 darkest. Standard BBL color is rated as 5. [w]RC: reverse curve; sv: sieve.

Table 3. Performance of commercial green bean varieties, June 29 planting, OSU Vegetable Research Farm, Corvallis, 2015.

Variety	Source	AV Stand	Sieve size	Days	Percent Sieve Size[z]						Tons/Acre Sieve Size							
					1	2	3	4	5	6	1-4	1.0	2.0	3.0	4.0	5.0	6.0	Graded Total[y]
91G	OSU (ck)	180	6	59	4.2	5.2	14.7	41.9	33.0	1.0	66.0	0.3	0.4	1.2	3.5	2.7	0.1	8.3
91G*					2.5	4.0	8.9	34.2	48.0	2.5	49.5	0.2	0.3	0.8	3.0	4.2	0.2	8.8
91G					2.7	3.6	6.7	24.1	52.7	10.3	37.1	0.3	0.3	0.7	2.3	5.1	1.0	9.7
5630	OSU (ck)	167	6	59	5.0	5.6	16.8	44.7	27.4	0.6	72.1	0.4	0.4	1.3	3.5	2.1	0.0	7.8
5630*					5.9	6.9	13.3	40.4	31.4	2.1	66.5	0.5	0.6	1.1	3.3	2.6	0.2	8.2
5630					2.5	3.8	7.6	29.0	50.0	7.1	42.9	0.3	0.4	0.8	3.0	5.2	0.7	10.4
6771	OSU	180	5-6	60	3.6	6.4	16.4	52.9	20.7	0.0	79.3	0.2	0.4	1.0	3.2	1.3	0.0	6.1
6771*					1.1	2.1	4.8	30.3	57.4	4.3	38.3	0.1	0.2	0.4	2.5	4.7	0.3	8.2
6774*	OSU	175	6	60	4.9	7.7	9.9	30.3	39.4	7.7	52.8	0.3	0.5	0.6	1.9	2.4	0.5	6.2
6774					1.9	2.9	4.3	11.5	39.2	40.2	20.6	0.2	0.3	0.4	1.0	3.6	3.7	9.1
Sahara					4.5	8.0	34.1	50.0	3.4	0.0	96.6	0.3	0.6	2.6	3.8	0.3	0.0	7.7
Sahara	HM	180	4	59	3.2	4.2	24.2	61.6	6.8	0.0	93.2	0.3	0.3	2.0	5.1	0.6	0.0	8.3
Sahara					2.3	2.7	11.3	68.0	15.8	0.0	84.2	0.2	0.3	1.1	6.6	1.5	0.0	9.7
CR-1220	Crites	170	6	60	2.7	4.7	12.0	40.7	35.3	4.7	60.0	0.2	0.3	0.8	2.7	2.3	0.3	6.5
CR-1220*					1.9	2.4	5.3	21.3	53.1	15.9	30.9	0.2	0.2	0.5	1.9	4.8	1.4	9.0
CR-1427	Crites	180	3	61	9.3	32.1	55.6	3.1	0.0	0.0	100.0	0.7	2.3	3.9	0.2	0.0	0.0	7.0
CR-1427					7.6	19.2	61.6	11.6	0.0	0.0	100.0	0.6	1.4	4.6	0.9	0.0	0.0	7.5
CR-1427*					3.4	13.2	63.7	19.6	0.0	0.0	100.0	0.3	1.2	5.7	1.7	0.0	0.0	8.9
CR-1428	Crites	178	5	60	3.2	4.7	11.6	35.3	40.0	5.3	54.7	0.3	0.4	1.0	2.9	3.3	0.4	8.3
CR-1428*					3.3	4.3	9.0	27.0	47.9	8.5	43.6	0.3	0.4	0.8	2.5	4.4	0.8	9.2
CR-1428					1.9	3.0	5.6	13.1	40.7	35.8	23.5	0.2	0.3	0.7	1.5	4.7	4.2	11.7
CR-1430	Crites	174	4-5	60	3.5	5.3	12.9	57.6	20.6	0.0	79.4	0.3	0.4	1.0	4.3	1.5	0.0	7.4
CR-1430*					5.0	6.7	11.1	49.4	27.8	0.0	72.2	0.4	0.5	0.9	3.9	2.2	0.0	7.8
CR-1430					1.6	3.5	8.6	29.7	54.7	2.0	43.4	0.2	0.4	1.0	3.3	6.1	0.2	11.1
CR-1433	Crites	180	5	59	3.5	4.1	14.1	44.7	33.5	0.0	66.5	0.3	0.3	1.0	3.3	2.5	0.0	7.4
CR-1433*					2.7	2.1	7.4	35.6	49.5	2.7	47.9	0.2	0.2	0.6	2.9	4.0	0.2	8.2
CR-1433					2.8	2.8	6.1	23.5	58.2	6.6	35.2	0.3	0.3	0.6	2.2	5.4	0.6	9.3
F26	Pureline	154	6	59	11.1	11.1	15.4	24.8	29.1	8.5	62.4	0.6	0.6	0.8	1.3	1.5	0.4	5.1
F26	NOT SENT				5.3	8.7	11.3	22.0	36.0	16.7	47.3	0.3	0.6	0.7	1.4	2.3	1.1	6.5

Table 3. (Continued).

Variety	Source	AV Stand	Sieve size	Days	Percent Sieve Size[z]						Tons/Acre Sieve Size							
					1	2	3	4	5	6	1-4	1.0	2.0	3.0	4.0	5.0	6.0	Graded Total[y]
F26					4.4	5.5	8.8	15.4	35.2	30.8	34.1	0.3	0.4	0.7	1.2	2.8	2.4	7.9
PLS 2219	Pureline	180	4	60	15.3	17.6	25.9	36.5	4.7	0.0	95.3	0.6	0.7	1.0	1.3	0.2	0.0	3.7
PLS 2219*					11.5	14.2	22.3	45.3	6.8	0.0	93.2	0.7	0.9	1.4	2.9	0.4	0.0	6.4
PLS 2219					6.8	10.0	20.5	50.5	12.1	0.0	87.9	0.6	0.8	1.7	4.2	1.0	0.0	8.3
PLS 2196	Pureline	180	4	60	6.4	7.8	21.3	51.8	12.8	0.0	87.2	0.4	0.5	1.3	3.2	0.8	0.0	6.1
PLS 2196*					4.3	4.3	10.3	42.2	37.3	1.6	61.1	0.3	0.3	0.8	3.4	3.0	0.1	8.0
PLS 2196					2.7	3.6	7.2	23.3	57.8	5.4	36.8	0.3	0.3	0.7	2.3	5.6	0.5	9.7
PLS 4921	Pureline	180	3	61	9.3	22.9	52.5	15.3	0.0	0.0	100.0	0.5	1.2	2.7	0.8	0.0	0.0	5.1
PLS 4921*					5.6	13.7	49.7	31.1	0.0	0.0	100.0	0.4	1.0	3.5	2.2	0.0	0.0	7.0
PLS 4921					5.3	15.8	50.0	28.9	0.0	0.0	100.0	0.4	1.3	4.1	2.4	0.0	0.0	8.3
PLS 5060	Pureline	170	4	59	6.4	12.1	34.0	44.0	3.5	0.0	96.5	0.4	0.7	2.1	2.7	0.2	0.0	6.1
PLS 5060	NOT SENT				4.7	10.7	27.3	53.3	4.0	0.0	96.0	0.3	0.7	1.8	3.5	0.3	0.0	6.5
PLS 5060					3.7	5.3	18.9	51.1	21.1	0.0	78.9	0.3	0.4	1.6	4.2	1.7	0.0	8.3
PLS 7396	Pureline	180	3	60	22.1	41.9	32.6	3.5	0.0	0.0	100.0	0.8	1.6	1.2	0.1	0.0	0.0	3.7
PLS 7396*					11.3	30.1	51.1	7.5	0.0	0.0	100.0	0.7	1.7	3.0	0.4	0.0	0.0	5.8
PLS 7396					10.6	22.4	49.1	18.0	0.0	0.0	100.0	0.7	1.6	3.4	1.3	0.0	0.0	7.0
BSC11B525	Brotherton	180	5	58	4.4	5.3	16.2	54.8	18.9	0.4	80.7	0.4	0.5	1.6	5.4	1.9	0.0	9.9
BSC11B525*					3.1	3.5	12.4	54.4	26.5	0.0	73.5	0.3	0.3	1.2	5.4	2.6	0.0	9.8
BSC11B525					1.6	2.8	7.2	42.4	44.0	2.0	54.0	0.2	0.3	0.8	4.6	4.8	0.2	10.9
BSC12B522	Brotherton	180	4	61	6.3	12.7	36.1	43.0	1.9	0.0	98.1	0.4	0.9	2.5	3.0	0.1	0.0	6.9
BSC12B522*					5.1	8.6	25.7	56.0	4.6	0.0	95.4	0.4	0.7	2.0	4.3	0.3	0.0	7.6
BSC12B522					4.6	6.9	19.9	53.7	14.8	0.0	85.2	0.4	0.7	1.9	5.0	1.4	0.0	9.4
BSC14B415*	Brotherton	170	6	60	8.1	9.2	13.3	20.2	31.2	17.9	50.9	0.6	0.7	1.0	1.5	2.3	1.3	7.5
BSC14B415					3.9	5.2	6.1	12.2	27.9	44.5	27.5	0.4	0.5	0.6	1.2	2.8	4.4	10.0
DW630	Brotherton	180	3	60	16.6	57.9	25.5	0.0	0.0	0.0	100.0	1.0	3.7	1.6	0.0	0.0	0.0	6.3
DW630*					9.9	50.9	38.6	0.6	0.0	0.0	100.0	0.7	3.8	2.9	0.0	0.0	0.0	7.4
DW630					4.5	25.1	65.0	5.4	0.0	0.0	100.0	0.4	2.4	6.3	0.5	0.0	0.0	9.7
HS931	Brotherton	180	3	60	15.7	24.7	49.4	10.1	0.0	0.0	100.0	0.6	1.0	1.9	0.4	0.0	0.0	3.9
HS931*					11.1	26.2	46.8	15.9	0.0	0.0	100.0	0.6	1.4	2.6	0.9	0.0	0.0	5.5

Table 3. (Continued).

Variety	Source	AV Stand	Sieve size	Days	Percent Sieve Size[z]						Tons/Acre Sieve Size							
					1	2	3	4	5	6	1-4	1.0	2.0	3.0	4.0	5.0	6.0	Graded Total[y]
HS931					3.8	20.1	51.6	24.5	0.0	0.0	100.0	0.3	1.4	3.6	1.7	0.0	0.0	6.9
DX170	Brotherton	163	2	60	40.6	59.4	0.0	0.0	0.0	0.0	100.0	1.9	2.7	0.0	0.0	0.0	0.0	4.6
DX170*					24.0	76.0	0.0	0.0	0.0	0.0	100.0	1.3	4.1	0.0	0.0	0.0	0.0	5.4
DX170					15.9	82.9	1.2	0.0	0.0	0.0	100.0	1.1	5.9	0.1	0.0	0.0	0.0	7.1
Ambition	Syngenta	180	4	59	7.2	16.3	41.2	34.6	0.7	0.0	99.3	0.5	1.1	2.7	2.3	0.0	0.0	6.7
Ambition*					4.7	8.1	32.6	52.9	1.7	0.0	98.3	0.3	0.6	2.4	4.0	0.1	0.0	7.5
Ambition					3.9	5.2	12.2	65.7	13.0	0.0	87.0	0.4	0.5	1.2	6.6	1.3	0.0	10.0
Huntington	Syngenta	176	6	60	4.4	8.0	16.7	44.6	25.9	0.4	73.7	0.5	0.9	1.8	4.9	2.8	0.0	10.9
Huntington*					3.4	4.9	8.2	29.9	50.0	3.7	46.3	0.4	0.6	1.0	3.5	5.8	0.4	11.7
Pismo	Syngenta	155	4-5	60	7.1	10.4	23.0	48.1	11.5	0.0	88.5	0.6	0.8	1.8	3.8	0.9	0.0	8.0
Pismo*					4.3	6.4	11.8	38.5	38.0	1.1	61.0	0.3	0.5	1.0	3.1	3.1	0.1	8.1
Pismo					3.0	3.4	6.4	15.0	57.5	14.7	27.8	0.3	0.4	0.7	1.7	6.7	1.7	11.6
SB4680	Syngenta	180	4-5	60	5.8	7.1	19.6	56.0	11.6	0.0	88.4	0.6	0.7	1.9	5.5	1.1	0.0	9.8
SB4680*					3.4	4.7	9.4	54.5	27.9	0.0	72.1	0.3	0.5	1.0	5.5	2.8	0.0	10.1
SB4680					2.2	2.2	5.5	32.2	56.4	1.5	42.1	0.3	0.3	0.7	3.8	6.7	0.2	11.9
SB4682	Syngenta	180	4-5	60	3.1	8.3	27.5	59.1	2.1	0.0	97.9	0.3	0.7	2.3	5.0	0.2	0.0	8.4
SB4682*					3.1	6.7	26.9	60.5	2.7	0.0	97.3	0.3	0.7	2.6	5.9	0.3	0.0	9.7
SB4682					2.5	4.1	13.1	64.3	16.0	0.0	84.0	0.3	0.4	1.4	6.8	1.7	0.0	10.6

[z]Percent calculated as % of total of 1-6 sieve beans. [y]Total tons/acre of the graded beans, including sieve sizes 1-6.
*Harvested for processing

Table 4. Statistical comparison of yields of commercial green bean lines, Corvallis, 2015[z].

Cultivar	Sieve size	T/A Unadjusted	T/A Adjusted[y]
91G	6	9.3	9.2
5630	6	8.7	10.1
6771	5-6	6.5	5.7
6774	6	6.4	6.6
Sahara	4	8.6	8.6
CR-1220	6	9.2	7.5
CR-1427	3	9.4	9.4
CR-1428	5	9.8	9.1
CR-1430	4-5	8.4	8.4
CR-1433	5	8.5	8.3
F26	6	7.2	7.0
PLS 2219	4	6.8	6.8
PLS 2196	4	8.3	8.3
PLS 4921	3	7.3	7.3
PLS 5060	4	7.4	7.4
PLS 7396	3	6.1	6.1
BSC11B525	5	10.1	12.5
BSC12B522	4	7.6	7.6
BSC14B415	6	7.7	7.8
DW630	3	7.8	7.8
HS931	3	5.7	5.7
DX170	2	5.7	5.7
Ambition	4	7.8	7.8
Huntington	6	12.5	11.7
Pismo	4-5	8.6	8.6
SB4680	4-5	10.5	10.5
SB4682	4-5	10.0	10.0
LSD 0.05		1.6	1.6

[z]Based on one selected harvest for each variety (marked with * on Table 3), which was usually the harvest closest to optimal based on that variety's intended use (50% 1-4 sieve for full sieve). Yields are field yields of 1-6 sieve beans. [y]Full sieve beans were adjusted to 50% 1-4 sieve; all others were unadjusted.

Table 5. Notes on June 24 commercial bean trial, OSU Vegetable Research Farm, Corvallis, Oregon, 2015.

Line	Pod Length (cm)	Pod Straight-ness[z]	Pod Cross Section[y]	Pod Smooth-ness[z]	Flavor[z]				Notes[w]
					Pod Color[x]	Sweet-ness	Astrin-gency	Perfumi-ness	
91G	18	5	R	5	5	5	7	1	
5630	17	5	R	7	5	7	7	1	Many ovals in this seed lot.
6771	13	8	R	4	5	7	9	1	
6774	16	5	R	1	7	8	7	1	Very bumpy in this trial.
Sahara	14	7	R	9	6	5	7	1	Curved in 5 sv.
CR-1220	15	7	R-CB	7	5	1	7	1	
CR-1427	12	9	R	9	5	7	7	1	
CR-1428	16	5	CB	5	4-5	5	9	1	Line shows strong crease back. Seems to be 2 color variations one a good match to 91G the other lighter. Little seed development in any sieve size.
CR-1430	13	8		r	4	3	7	1	
CR-1433	14	5	R-CB	7	4	7	7	1	
F26	18	3	R-H	5	5	5	7	3	Long somewhat curvy bean - low fiber but has immature white seed.
PLS 2219	13.5	5	O	7	5	7	7	1	
PLS 2196	13	8	O-R	9	5	5	7	1	Tends to curl in higher sieve sizes (5 & 6).
PLS 4921	13.5	9	R-H	9	4	5	7	1	
PLS 5060	13	3	0	7	5	7	7	1	Does not size accurately because of pod cross section shape.
PLS 7396	14	9	H	7	5	1	3	3	Long slender 3 sv bean.
BSC11B525	15	5	R	9	5	7	5	1	Attractive bean.
BSC12B522	17	5	O-H	7	3	5	9	3	Long slender shiny pods.
BSC14B415	14	5	R-CB	5	5	7	7	1	Very broad sieve size distribution. High percentage break at neck, not pedicle.
DW630	12	9	R	7	wax	5	7	1	Attractive small sieve wax bean.
HS931	13	7	R	9	4	5	7	1	Shiny pods and Yellow green color.

Table 5. (Continued).

Line	Pod Length (cm)	Pod Straight-ness[z]	Pod Cross Section[y]	Pod Smooth-ness[z]	Flavor[z]				Notes[w]
					Pod Color[x]	Sweet-ness	Astrin-gency	Perfumi-ness	
DX170	12	9	R	9	5	3	9	1	
Ambition	15	8	R	9	7	3	5	1	Slightly tough, but very nice looking bean.
Huntington	15	7	R-CB	7	4	7	7	1	
Pismo	14	7	R	7	4	7	7	1	
SB4680	15	7	H	9	6	1	7	1	Trace of WM in this line.
SB4682	14	6	R-CB	7	4	5	7	1	

[z]Scale of 1 - 9 where 1 is least or worst and 9 is most or best. [y]Cross section: R = round, H = heart, CB = crease-back, O = oval.
[x]Scores based on a 1 - 9 scale with 9 darkest. Standard BBL color is rated as 5. [w]sv: sieve.

Table 6. Average adjusted T/A for elite green bean lines and checks from 2011 to 2015 grown at the Vegetable Research Farm.

	2011	2012		2013		2014		2015		Average relative to OR91G
	YT1	YT1	Comm	YT1	Comm	YT1	Comm	YT1	Comm	
Entry		adjusted T/A								%
OSU 5630	13.9	13.6	10.1	11.4	13.0	10.9	9.9	13.3	9.2	111
91G	13.4	12.3	8.3	10.7	13.1	7.2	12.4	9.7	10.1	100
6771	9.6	11.1		10.5		8.5	7.2	6.3	5.7	80
6774	11.9		7.0	9.9	9.6	9.7	6.9	9.2	6.6	86
LSD 0.05	2.5	1.8	1.8	1.9	1.9	2.6	1.4	1.6	1.6	

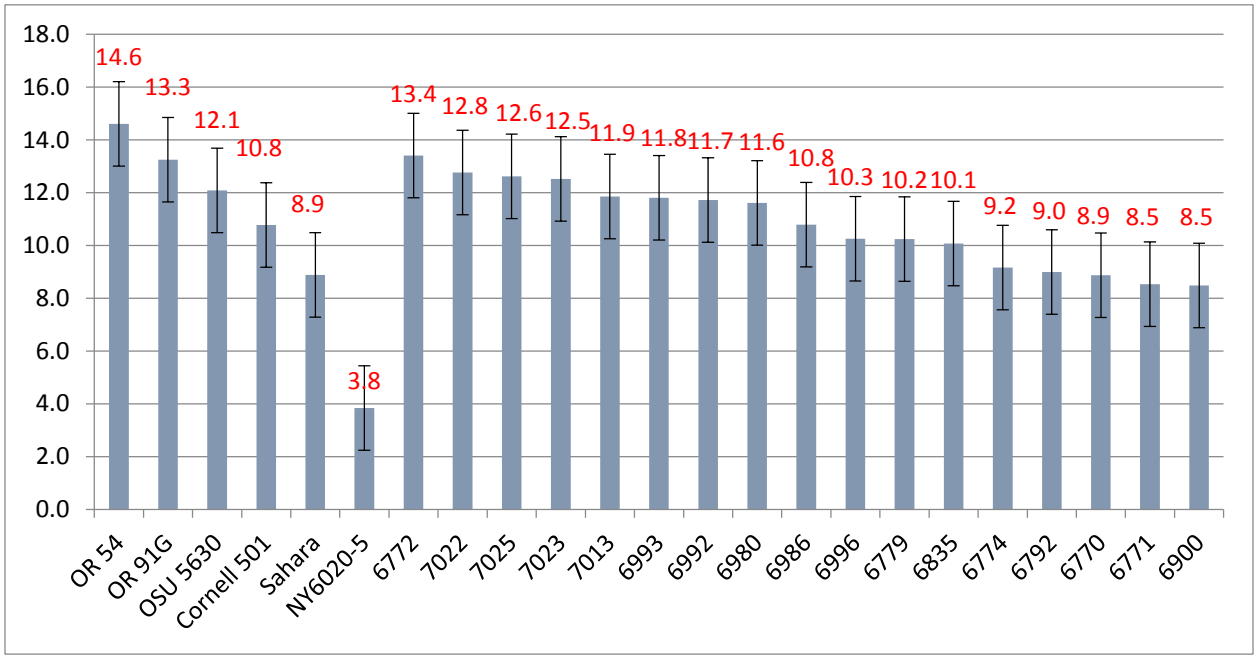

Figure 1. Average adjusted T/A of experimental and check green bean lines grown in a yield trial at the OSU Vegetable Research Farm in 2015.

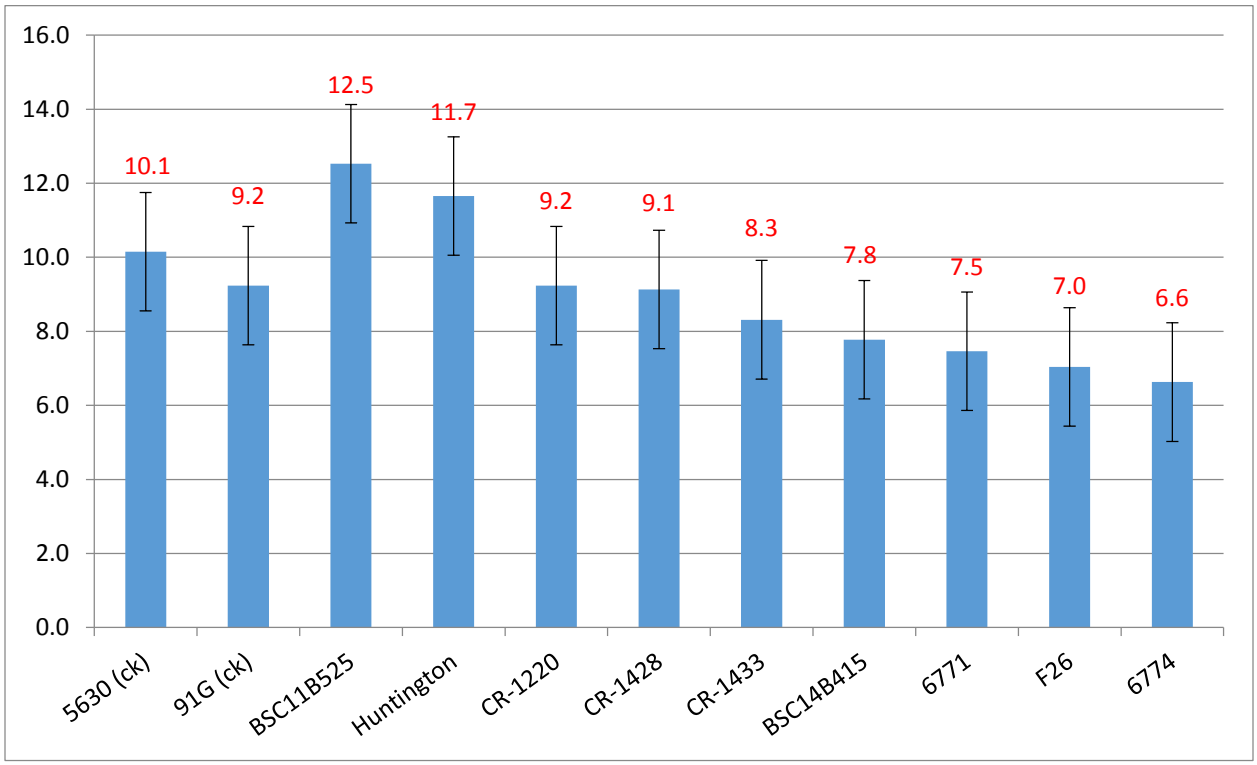

Figure 2. Adjusted T/A yield for five – full sieve green bean lines grown in a yield trial at the OSU Vegetable Research Farm in 2014.

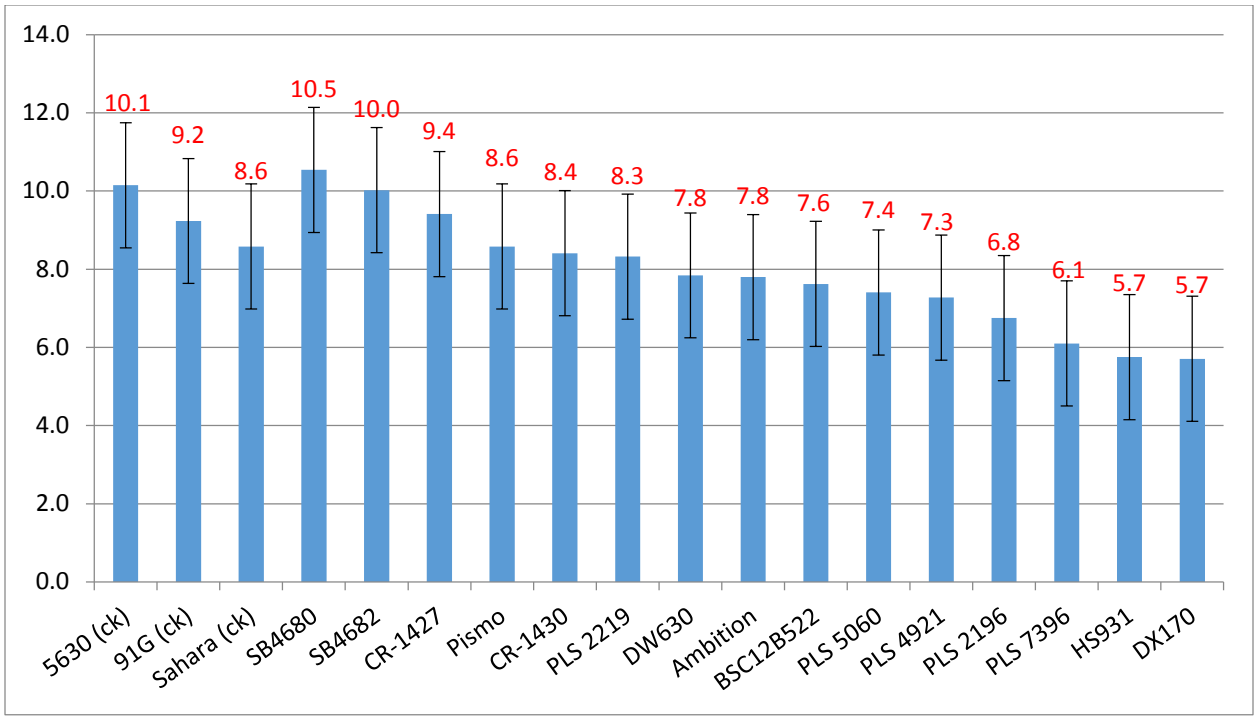

Figure 3. T/A yield for two to four/five sieve green bean lines grown in a yield trial at the OSU Vegetable Research Farm in 2015.