Report to the Oregon Processed Vegetable Commission
2009–2010

1. Title: Green Bean Breeding and Evaluation

2. Project Leaders: James R. Myers, Horticulture

3. Cooperator: Brian Yorgey, Food Science and Technology

4. Project Status: Terminating 30 June, 2010

5. Project Funding:

$40,516	breeding
$11,234	processing
$51,750	total

Breeding funds were used for a major portion of the support of a vegetable breeding technician, student labor, supplies, winter nursery, and research farm expenses. Processing funds were used for processing samples of experimental beans, laboratory analysis, and for student labor.

6. Breed improved Bush Blue Lake green bean varieties with:
    a. White and gray 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

    Improve seed quality of materials in the breeding program to provide greater resistance to mechanical injury and low germination issues.

7. Report of Progress:

Varietal Development: In 2009-10, the focus remains on developing white mold resistant bush blue lake (BBL) green beans. Approximately 2,500 breeding lines and populations at various stages of advance were grown in the field for evaluation and selection. Changes in our breeding activities from previous years included reducing the number of yield nurseries, and not conducting a root rot trial this year. In addition, our entire white mold testing ground was devoted to evaluating two backcross-inbred interspecific populations developed by crossing to scarlet runner bean. This project is part of a Master' thesis (Shawna Zimmerman) and will be reported separately. We did select heavily within crosses to the NY6020 source of resistance for good plant type along with field resistance to white mold, with about 150 single plant selections made. We have recently obtained outside support for a study of root rot resistance to begin next year, and in preparation, we increased two populations based on the cross OSU5446/RR 6950. We conducted one yield trial of OSU lines and one of mostly private company cultivars. We re-

duced the number of entries in the OSU line yield trial, but increased the number of reps to three, leaving about the same number of plots harvested. Of the lines evaluated, OSU 6604 - 6607 were derived from crosses of OSU BBL lines to SB4247 (these have a similar pedigree to OSU 6599 - 6602 evaluated last year). OSU 6616 - 6658 are mostly crosses to OSU 6002, a persistent color BBL type that was considered for release but ultimately dropped from the program. OSU 6667 - 6671 are crosses to OSU 6185, a Minuette/OSU 5163 derived line with very nice growth habit and pod quality. The lines in the yield trial with designations such as C^U, DJV, GRI are seed coat color isolines. They are backcross lines in a OR 91G background that incorporate, the cartridge buff (c^u) seed color gene (C^U), a triple recessive that lacks seed hilum ring (*d*), reduced seed color (*j*), and brown seed (*v*) (DJV; the overall effect being a slight rusetting on the seed), and a version of the white seed gene (p^{gri}) that allows a small amount of pigment to form (GRI). The rationale for creating these seed coat color combinations is to determine if it is possible to allow an attenuated amount of color in the seeds, which would avoid the germination and emergence problems associated with white seed, but would not interfere with quality of the canned product. These lines were grown in the yield trial and processed so that we could evaluate their effect on color of the processed product.

Processing evaluation will be done in January, 2010. A report from Brian Yorgey on processing characteristics will be forthcoming during 2010.

Yield Trials: The trial of OSU lines was planted June 11. It contained 50 full sieve breeding lines, three small sieve lines, and five checks (Tables 1 and 2). We have given full sieve size lines priority in our program and have not made as many crosses to small sieve types in recent years; consequently, we are not publishing a small sieve table. Growing conditions were good until late July when extreme heat (102, 105, 105°F, July 28 - 30) caused severe split set. The OSU trial lines were at 48 – 51 days after planting with harvest occurring 6 – 11 days after heat period. Six lines and the checks OR 54 and OSU 5630 had significantly higher yields than OR 91G. OSU 6443 had the second highest adjusted T/A after OSU 6439, but these lines were not significantly different from 12 other lines including OSU 5630, OSU 5669, and OR 54). Savannah (four sieve check from Harris Moran) was one of lowest yielding lines in the trial, mainly because of its sensitivity to heat stress. Among OSU small sieve lines, OSU 6631 had significantly higher yields, but OSU 6670 and DJV2-2 did not. Over past four years (text table, left), OSU 6443 has consistently ranked among the

Four year average for selected OSU full sieve lines and checks

	Adjusted T/A				
Line	2006[z]	2007[z]	2008[z]	2009[y]	Overall AV
OR 91G	12.1	8.7	9.5	7.7	9.6
OR 54	10.7	11.0	11.4	10.6	10.9
5630	12.8	11.9	11.4	10.9	11.8
5669	10.4	10.6	9.7	9.9	10.2
6174	7.3	8.0	10.3	3.6	7.6
6189	9.4	9.9	9.4	7.4	9.1
6439	12.5	10.5	10.7	11.7	11.3
6440	11.8	10.9	12.0	10.2	11.3
6443	12.3	12.2	13.4	11.4	12.4
6456	9.2	9.9	11.6	10.6	10.3
6471	9.7	13.1	13.4	7.3	11.1
6479	12.5	12.1	11.2	10.6	11.7
6493	9.2	12.2	12.4	5.2	10.1
6494	10.0	13.3	12.5	6.4	10.8
LSD 0.05	3.1	2.5	3.1	2.1	1.5

[z]Average of 2 trials per year, 2 reps per trial.
[y]Average of 3 reps; 1 trial only planted this year.

highest yielding lines. It was not significantly different from OSU 5630 and five breeding lines.

Table 3 shows flowering duration, which we evaluated as a way to study indeterminacy of BBL lines. As might be expected, the highest yielding lines had the longest flowering duration times. However, additional factors may be involved since some cultivars that do not have a reputation of indeterminacy had long flowering duration periods. For example, OSU 6443 and OSU 5630 had the longest flowering period, though not significantly different from OR 54, OSU 5669 and six others. Only four lines (DJV1-1, OSU 6542, OSU 6479, and OSU 6512) had a significantly shorter duration than OR 91G. Twenty-five lines were not significantly different from OR 91G and 43 had a significantly shorter duration compared to OR 54. Because its flowering duration pattern is similar to OR 54, OSU 6443 should be evaluated carefully for this trait.

Indio Winter Nursery: We again advanced materials in a winter nursery in Indio, CA with 43 checks and advanced lines, and 31 single pod descent populations (table 4). The nursery was planted Jan. 26, with notes recorded and harvest happening on May 9. Heat tolerance was evaluated, and in general, the nursery is useful for eliminating the least heat tolerant materials. B8110, 8116, and B8122 single pod descent populations are crosses to OSU 6002 (to evaluate persistent color), and B8313-8340 are crosses to white mold resistant lines derived from the interspecific backcross inbred population OR 91G/PI255956.

Germination trial: We conducted a preliminary study on germination of persistent color (*pc*) types. These have excellent pod quality with uniform color in both the exterior and interior, but we have observed that germination and emergence is much worse in these types compared to normal white-seeded green beans. We selected a set of lines that representing both *pc* and normal types (table 5). The Plant Introduction (PI) lines are 'Flageolet Vert' landrace materials from France that are related to the original source of *pc* that was introduced into green beans. In our trial, 'Tempest' was one of the early commercially acceptable *pc* green beans. One pair of lines (Ulysses and Spartacus) represents a near-isogenic set for *pc*. There were difficulties distinguishing *pc* from non *pc* types based on cotyledon color (*pc* cotyledons are white, unlike the green cotyledons of normal beans) in this trial. It is unclear whether genetic or mechanical mixes were present, or whether environmental conditions affect expression of the trait. In general, the green bean *pc* types had lower germination compared normal green bean types. Unexpectedly, the three Flageolet Vert lines ranked fairly high for germination (but the phenotype was unclear with these lines). Two OSU lines (OSU 6530 and OSU 6515) had worst germination, with OSU 6515 being significantly worse than anything else in the trial. OSU 6530 was not significantly different from three *pc* lines and one non *pc* type. This study is being conducted in conjunction with efforts to clone and map the gene responsible for the *pc* trait (data not reported here). It appears that there is variation for germination within lines with the *pc* trait and selection for improved germination should be possible.

Commercial Green Bean Trial: This trial was planted on June 24 and harvested during August 21 – 25. The high heat period of July 28 – 30 happened at the beginning of flowering for this trial. Fourteen entries from four seed companies and three checks and four OSU experimental lines were grown (tables 6 - 8). Similar to last year, Huntington

had the highest adjusted T/A, although it was not significantly different from four other entries, including OSU 5630. Huntington also appeared to have good heat tolerance as exhibited by a lack of split set. The extra fine beans in the trial (Redon, BSC 8609, Selecta) were generally lower yielding and were all statistically equivalent. Of the intermediate (4 - 5) sieve lines, BSC 8577 had best yield (although not significantly different from Inspiration, and Bullion) but has an oval tendency and tough skin.

Summary:

Approximately 2,500 lines were advanced in the green bean early generation nursery. Because of moderate white mold pressure in this nursery, we were able to select among lines with the NY 6020 source of resistance. Lines were advanced and data was obtained on heat tolerance from a winter nursery grown at Indio, CA. A germination trial of persistent color vs. normal green beans documented the reduced germination effect that has been empirically observed in past trials. Variation exists among different sources of *pc*, suggesting that it will be possible to select for better germination in this background. One yield trial of OSU breeding lines and a commercial yield trial were grown. The advanced line OSU 6443, while not the top yielder this year, continues to show consistently high yields and should be evaluated for release. No root rot trials were conducted this year, but two populations of a cross between resistant and susceptible parents was increased in anticipation of a major trialing effort in 2010. The white mold nursery was devoted to evaluation of two backcross-inbred populations for a separate project on breeding for resistance.

Table 1. Performance of preliminary green bean lines, June 11 planting, Corvallis, 2009.[z]

Line	Days to Harvest	Est. Sieve Size	Stand	Percent Sieve Size[y] 1	2	3	4	5	6	%1-4 Sieve	Av Tons/ Acre	Av Adj Tons/ Acre[x]
Savannah	63	4	150	10.2	14.3	14.3	44.9	16.3	0.0	83.7	3.5	3.5
91G	57	full	150	3.6	4.5	11.7	43.2	34.2	2.7	63.1	6.8	7.7
OR 54	61	full	150	2.0	4.0	12.6	45.7	33.8	2.0	64.2	9.3	10.6
5630	62	full	150	4.8	3.6	11.4	38.3	40.7	1.2	58.1	10.1	10.9
5669	60	full	150	2.7	4.1	11.5	41.2	36.5	4.1	59.5	9.0	9.9
6174	62	5	150	10.3	6.9	3.4	29.3	39.7	10.3	50.0	3.6	3.6
6189	58	full	150	5.6	4.8	11.3	26.6	41.9	9.7	48.4	7.6	7.4
6348	57	5	150	3.9	7.1	17.3	47.2	22.8	1.6	75.6	7.3	9.1
6438	60	full	150	3.4	4.0	12.1	43.0	34.9	2.7	62.4	9.2	10.3
6439	60	full	150	3.1	6.2	16.8	42.9	28.0	3.1	68.9	9.9	11.7
6440	60	5	150	2.1	5.7	13.5	47.5	30.5	0.7	68.8	8.6	10.2
6443	60	full	150	3.2	5.8	14.8	47.1	26.5	2.6	71.0	9.5	11.4
6456	60	full	150	6.2	6.8	13.0	43.2	28.8	2.1	69.2	8.9	10.6
6471	61	full	150	4.6	2.8	8.3	42.6	40.7	0.9	58.3	6.7	7.3
6479	61	full	150	4.1	4.1	7.6	37.4	43.9	2.9	53.2	10.3	10.6
6493	61	full	150	7.3	2.4	6.1	36.6	45.1	2.4	52.4	5.1	5.2
6494	62	full	150	5.4	4.5	5.4	23.2	56.3	5.4	38.4	7.3	6.4
6512	60	full	150	4.1	4.1	8.1	31.7	46.3	5.7	48.0	7.4	7.2
6515	60	5	150	1.4	5.6	18.3	43.7	28.2	2.8	69.0	4.4	5.2
6530	60	5	150	2.6	5.3	14.9	47.4	26.3	3.5	70.2	6.7	6.7
6535	60	full	146	3.4	3.4	12.4	37.1	38.2	5.6	56.2	5.6	6.0
6537	60	full	150	1.8	0.9	4.4	27.2	50.0	15.8	34.2	6.8	5.7
6542	61	5	147	7.5	3.2	11.8	40.9	33.3	3.2	63.4	5.8	6.6
6553	62	5	150	1.9	3.2	10.4	42.9	36.4	5.2	58.4	9.6	10.3
6576	61	full	150	5.3	1.8	5.3	21.1	47.4	19.3	33.3	3.8	3.1
6594	62	5	150	8.9	5.4	8.9	33.9	41.1	1.8	57.1	3.7	4.0
6600	58	full	150	2.2	3.7	11.9	38.1	35.1	9.0	56.0	8.2	8.7
6602	62	full	150	2.6	3.4	7.7	31.6	51.3	3.4	45.3	7.0	6.6
6604	60	full	150	1.7	3.4	10.2	37.9	42.9	4.0	53.1	10.8	11.2
6606	60	full	150	1.1	2.2	11.0	38.5	40.7	6.6	52.7	5.6	5.8
6607	57	full	148	2.3	5.3	11.5	38.2	38.9	3.8	57.3	8.0	8.6
6616	60	full	150	2.8	4.7	9.3	34.6	43.9	4.7	51.4	6.7	6.8
6618	58	full	150	7.6	7.6	13.3	31.4	35.2	4.8	60.0	6.3	7.0
6619	58	full	150	2.6	5.1	12.8	34.2	41.9	3.4	54.7	7.1	7.4
6620	57	full	150	4.0	7.1	13.1	38.4	36.4	1.0	62.6	6.3	7.1
6630	56	5	148	2.4	15.7	7.2	33.7	38.6	2.4	59.0	5.1	5.6
6631	57	4-5	150	3.7	8.3	21.1	46.8	20.2	0.0	79.8	6.5	6.5
6640	62	full	150	9.0	4.5	4.5	21.3	53.9	6.7	39.3	5.3	4.7
6641	63	full	150	11.8	17.1	15.8	28.9	17.1	9.2	73.7	4.4	5.5
6643	63	full	150	12.6	11.6	14.7	20.0	25.3	15.8	58.9	5.6	6.1
6644	63	5	150	12.3	13.6	14.8	29.6	23.5	6.2	70.4	5.0	6.1
6655	60	full	150	3.1	6.3	17.0	40.9	29.6	3.1	67.3	9.5	11.1

Table 1. Performance of preliminary green bean lines, June 11 planting, Corvallis, 2009 (cont.)[z]

Line	Days to Harvest	Est. Sieve Size	Stand	Percent Sieve Size[y] 1	2	3	4	5	6	%1-4 Sieve	Av Tons/Acre	Av Adj Tons/Acre[x]
6658	61	full	150	2.3	3.4	10.2	31.8	38.6	13.6	47.7	5.4	5.3
6667	58	full	150	1.8	1.8	9.1	30.9	45.5	10.9	43.6	3.4	3.2
6670	57	4-5	136	3.6	3.6	16.1	46.4	30.4	0.0	69.6	3.6	3.6
6671	57	full	150	3.5	5.9	10.6	32.9	40.0	7.1	52.9	5.2	5.3
C^U 1-1	60	full	150	2.6	3.4	10.3	31.0	43.1	9.5	47.4	7.1	6.9
DJV 1-1	60	full	150	2.7	2.7	6.4	30.0	50.0	8.2	41.8	7.0	6.5
DJV 2-1	61	5	150	8.1	8.1	10.1	45.5	27.3	1.0	71.7	6.3	7.7
DJV 2-2	60	4	149	8.0	5.3	12.0	52.0	22.7	0.0	77.3	4.9	4.9
GRI 1-1	58	full	150	1.6	3.1	6.3	26.6	49.2	13.3	37.5	7.8	6.9
GRI 1-2	57	full	150	2.9	3.7	10.3	27.2	44.9	11.0	44.1	8.2	7.7
WMG811	62	full	150	4.6	4.6	4.6	23.1	50.8	12.3	36.9	6.0[w]	5.2[w]
WMG826	60	full	150	1.3	3.8	10.3	37.2	41.0	6.4	52.6	7.0[w]	7.2[w]
WMG836	58	full	150	3.2	6.5	9.7	37.1	35.5	8.1	56.5	5.9[w]	6.3[w]
WMG861	61	full	150	3.5	1.8	5.3	22.8	42.1	24.6	33.3	5.7[w]	4.8[w]
WMG897	62	full	150	12.5	6.3	6.3	31.3	34.4	9.4	56.3	3.3[w]	3.5[w]
WMG903	62	full	150	1.7	5.0	6.7	33.3	40.0	13.3	46.7	5.4[w]	5.2[w]
LSD 0.05[w]			3.3								2.5	2.7

[z]Mean of 3 replications (with the exception of the WMG lines which had 2 replications each); subplots of 5' were harvested from 20' 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

[w]Reported LSD applies to all entries except the WMG lines (these had only 2 reps each); LSD for comparison of WMG lines only is 1.7 for Av tons/acre and 1.6 for av adj. tons/acre.

Table 2. Notes on preliminary green bean lines, June 11 planting, Corvallis, 2009.[z]

Line	Pod Length (cm)	Pod Straight-ness[y]	Pod Cross Section[x]	Pod Smooth-ness[w]	Pod Color[v]	Flavor Sweet-ness	Flavor Astrin-gency	Flavor Beani-ness	Flavor Perfumi-ness	Notes[u]
Savannah	11.0	7	round	7	7	5	7	3	5	Badly stressed by heat; split set
91G	15.0	4	round	3	5	8	3	5	1	Much blanking from heat
OR 54	15.0	5	round	6	5	7	3	5	1	Not much heat stress evident
5630	14.5	5	round	5	5	7	5	5	1	
5669	13.5	5	round	5	5	7	5	7	1	
6174	14.5	3	round	5	7	7	5	5	3	Mod to high level of blanking; bad split set
6189	14.5	7	round	7	6	5	7	5	1	Much battering in the grader; seed dev only beginning in all sieve sizes. This line has held up well in the heat and stress of this trial.
6348	12.5	7	round to cb	5	6	7	5	5	1	Appears to be a mix (different seed sizes, $ strings, variable pod length)
6438	14.5	5	round	7	5	7	5	7	1	Some blanking
6439	14.5	7	round	7	5	7	3	7	1	Excellent flavor; attractive pod color and appearance
6440	13.5	7	round to cb	7	5	7	3	9	1	Attractive pods
6443	14.5	7	round	7	5	7	5	5	1	Attractive bean and has held up well in heat
6456	14.0	8	round	7	5	7	5	7	1	Very similar to 6443
6471	13.0	7	round	7	5	7	7	5	1	Some blanking; nice looking bean
6479	14.5	6	round	7	5	5	5	7	1	Little evidence of heat stress; excellent yield
6493	13.0	5	round	7	5	7	3	7	1	Lots of blanking and polywogs; bad split set
6494	14.0	7	round	7	5	7	7	5	1	Good quality pods with little blanking
6512	14.5	6	round	7	5	7	3	5	7	Some blanking; pc type

Table 2. Notes on preliminary full sieve green bean lines, June 11 planting, Corvallis, 2009 (cont).[z]

Line	Pod Length (cm)	Pod Straight-ness[y]	Pod Cross Section[x]	Pod Smooth-ness[w]	Pod Color[v]	Flavor Sweet-ness	Flavor Astrin-gency	Flavor Beani-ness	Flavor Perfumi-ness	Notes[u]
6515	14.0	4	round to cb	7	7	7	7	5	1	Pc type with nice color; much blanking
6530	12.5	4	round	7	5	7	5	7	1	Pc type; some blanking
6535	13.0	5	round	7	6	7	3	5	1	Pc type; attractive with excellent dark green interior color; some blanking.
6537	14.0	5	round	7	6	5	5	3	1	Pc type; moderate blanking.
6542	13.5	7	round to cb	7	7	7	5	5	1	Attractive bean; pc type; split set
6553	14.5	8	round to cb	9	5	7	3	7	1	Very attractive pods; pc type
6576	11.0	7	round	7	7	7	5	7	1	Pc type with short pods; some blank-ing; low yield
6600	14.5	6	round	5	5	7	5	3	1	Tall plants
6602	12.5	7	round	7	5	7	1	7	7	Curved pods; some blanking.
6604	14.0	7	round to cb	7	5	7	7	5	1	Strong cb tendency
6606	14.0	5	round	7	4	7	7	5	1	Excellent flavor; moderate amount of blanking
6607	14.0	7	round	9	6	9	5	3	1	Very nice appearance with little heat stress
6616	14.0	3	round	7	6	7	5	7	1	Excellent flavor; attractive pods but curved
6618	15.5	5	round	7	7	7	7	3	1	Attractive pod with dark green interior
6619	16.0	3	round	7	7	3	7	7	1	Long slender s-curved pods
6620	14.5	5	round	7	5	7	3	3	1	Pc type
6630	11.0	5	heart	3	5	7	3	3	1	
6631	13.0	3	round	5	4	8	3	1	1	Pc type; many polywogs and blanks

Table 2. Notes on preliminary full sieve green bean lines, June 11 planting, Corvallis, 2009 (cont).[z]

Line	Pod Length (cm)	Pod Straight-ness[y]	Pod Cross Section[x]	Pod Smooth-ness[w]	Pod Color[v]	Flavor Sweet-ness	Flavor Astrin-gency	Flavor Beani-ness	Flavor Perfumi-ness	Notes[u]
6640	15.0	3	round	7	9	7	5	5	1	Long slender dark green; very attrac-tive; split set; very sweet for such a dark green color
6641	14.0	5	round	7	7	7	7	3	1	Pc type; similar to 6643 but not as dark; split set
6643	19.0	5	round	7	9	7	3	5	1	Long slender attractive pods; pc type with very dark green pods; bad split set
6644	12.5	5	round	3	7	7	7	3	1	Pc type; short pods; split set; dark green color
6655	13.0	5	round	7	7	7	7	3	1	Very attractive bean; some blanking
6658	13.0	5	round	7	5	9	5	7	1	Pc type; intense sweetness; some blanking
6667	14.0	5	round	7	5	3	3	7	1	Very low yields; probably split set
6670	11.0	7	heart	3	5	7	7	5	1	Some blanking; pc type
6671	14.0	7	round	8	9	7	5	7	1	Attractive shiny dark green smooth pods
C^U 1-1	13.5	4	round	5	5	7	5	5	1	Some blanking; some pods with purple blush
DJV 1-1	12.0	3	oval	1	5	7	3	5	1	Short, extremely bumpy oval pods; some with purple blush
DJV 2-1	12.0	3	oval	4	3	7	5	5	1	
DJV 2-2	11.0	7	oval	7	3	5	7	5	1	
GRI 1-1	14.0	6	round to cb	7	7	5	5	7	1	Pods similar to 91G; purple sutures; sometimes purple blush on pods
GRI 1-2	14.0	4	round	3	5	3	5	3	1	
WMG811	13.0	3	round	3	5	7	5	3	1	Many blanks and polywogs; bad split set
WMG826	14.4	5	round	5	5	8	5	3	5	Mix of nice and junky pods

Table 2. Notes on preliminary full sieve green bean lines, June 11 planting, Corvallis, 2009 (cont).[z]

Line	Pod Length (cm)	Pod Straight-ness[y]	Pod Cross Section[x]	Pod Smooth-ness[w]	Pod Color[v]	Flavor Sweet-ness	Flavor Astrin-gency	Flavor Beani-ness	Flavor Perfumi-ness	Notes[u]
WMG836	14.5	4	round	6	5	5	5	7	1	Can produce nice pods, but many blanks, short pods and polywogs in this trial
WMG861	13.0	3	round	3	5	1	1	5	1	Moderate blanking
WMG897	12.5	3	round	3	5	5	5	3	5	Short pods; many curved; $ strings and ovals; split set
WMG903	14.0	5	round	5	5	7	5	7	1	Some blanking; variable length; attrac-tive pods

[z]Trial was subjected to extreme heat at flowering.
[y]Scores based on a 1-9 scale with 9 straightest
[x]Cross section: cb = crease-back
[w]Scores based on a 1-9 scale with 9 smoothest
[v]Scores based on a 1-9 scale with 9 darkest
[u]pc = persistent chlorophyll; cb = crease-back.

Table 3. OSU snap bean flowering duration, Corvallis, Oregon, 2009[z]

Entry	Begin Flowering[y]	End Flowering[x]	Flowering Duration[y]	Notes
Savannah	44.0	63	19.0	Stunted plants
91G	35.7	57	21.3	
OR 54	37.3	61	23.7	Significantly more indeterminate than 91G
5630	37.7	62	24.3	Significantly more indeterminate than 91G
5669	37.3	60	23.0	
6174	43.0	62	19.0	Stunted plants
6189	39.7	58	18.3	
6348	35.0	57	22.0	
6438	37.0	60	23.0	
6439	37.0	60	23.0	
6440	36.3	60	23.7	Significantly more indeterminate than 91G
6443	35.7	60	24.3	Significantly more indeterminate than 91G
6456	38.3	60	21.7	
6471	42.0	61	19.0	
6479	42.0	61	19.0	
6493	42.0	61	19.0	
6494	42.3	62	19.7	
6512	41.0	60	19.0	
6515	39.7	60	20.3	
6530	42.7	60	17.3	
6535	42.3	60	17.7	
6537	40.3	60	19.7	
6542	42.0	61	19.0	
6553	40.0	62	22.0	
6576	42.0	61	19.0	
6594	43.0	62	19.0	
6600	37.7	58	20.3	
6602	41.7	62	20.3	
6604	37.0	60	23.0	
6606	40.0	60	20.0	
6607	36.3	57	20.7	
6616	38.0	60	22.0	
6618	38.3	58	19.7	
6619	37.0	58	21.0	
6620	40.0	57	17.0	
6630	36.0	56	20.0	
6631	38.3	57	18.7	
6640	42.0	62	20.0	
6641	45.7	63	17.3	
6643	45.0	63	18.0	Tails
6644	44.0	63	19.0	
6655	41.0	60	19.0	
6658	42.7	61	18.3	

Table 3. OSU snap bean flowering duration, Corvallis, Oregon, 2009 (cont)[z]

Entry	Begin Flowering[y]	End Flowering[x]	Flowering Duration[y]	Notes
6667	41.3	58	16.7	
6670	40.3	57	16.7	
6671	41.3	57	15.7	
C^U 1-1	40.3	60	19.7	Mix of white and purple flowers
DJV 1-1	40.7	60	19.3	Purple flowers
DJV 2-1	43.0	61	18.0	Purple flowers
DJV 2-2	41.0	60	19.0	Purple flowers
GRI 1-1	37.0	58	21.0	
GRI 1-2	36.0	57	21.0	
WMG811	42.0	62	20.0	
WMG826	36.3	60	23.7	Significantly more indeterminate than 91G
WMG836	38.0	58	20.0	
WMG861	40.3	61	20.7	
WMG897	41.7	62	20.3	
WMG903	38.3	62	23.7	Significantly more indeterminate than 91G
LSD 0.05	1.9		1.9	

[z]Planted June 11. This trial experienced extreme heat (100F+) when most lines were at full flowering.
[y]Number of days from planting.
[x]Number of days from planting; date used was harvest date.

Table 4. OSU snap bean notes, Indio, California, 2009[z]

Entry	Heat Tole-rance[y]	Yield[x]	Notes[w]
OR 54	5	5	
OR 91G	4	4	
OSU 5630	4	6	Split-set, blanks
OSU 5635	3	4	Polywogs, split-set, blanks
6436	4	5	Polywogs
6438	3	4	Split-set, late
6439	5	5	
6440	4	3	Polywogs
6441	3	4	Polywogs
6442	2	2	Split-set, late
6443	3	5	Blanks
6445	4	4	Split-set
6447	5	6	
6449	2	2	Extreme split-set
6452	1	2	Foliage completely gone
6453	4	5	
6454	5	5	
6455	5	5	
6456	6	7	Looks good
6463	3	4	Late
6467	4	3	
6469	6	6	Looks good
6471	5	5	Low incidence of split-set
6474	5	4	Floppy plants
6475	3	4	Split-set, polywogs
6477	4	4	Slightly late
6478	4	4	Split-set
6479	4	6	
6480	3	3	Hooked pods, split-set, polywogs
6481	3	4	Hooked pods, split-set, polywogs
6484	4	4	Floppy plants
6485	5	4	
6487	3	3	Floppy, $ pod fiber, split-set
6489	4	5	Polywogs
6490	5	5	
6493	5	6	
6494	4	5	Split-set
6495	4	7	Polywogs, blanks, good yield
6496	3	3	Split-set, late
6497	2	3	Extreme split-set, polywogs
6500	1	2	Low stand, poor quality
6501	5	5	
6502	5	5	
B8110 F2 ('03)	4	4	$ maturity
B8116 F2 ('03)	4	4	$ maturity
B8122 F2 ('03)	4	3	$ maturity, poor stand

Table 4. OSU snap bean notes, Indio, California, 2009 (cont.)[z]

Entry	Heat Tole-rance[y]	Yield[x]	Notes[w]
B8313	3	3	Polywogs, split-set
B8314	2	4	Late
B8315	4	5	
B8316	4	5	
B8317	5	6	
B8318	4	4	Floppy plants
B8319	3	3	
B8320	3	3	Split-set
B8321	5	5	Compact plants
B8322	3	3	Split-set, low yield
B8323	3	4	Lots of polywogs
B8324	5	5	
B8325	3	3	Split-set, low yield
B8326	2	4	
B8327	4	4	Compact plants
B8328	4	3	Low yield
B8329	3	4	Late
B8330	4	4	Split-set
B8331	5	6	
B8332	3	4	Split-set
B8333	5	5	
B8334	4	5	
B8335	2	3	$ maturity or extreme split-set
B8336	3	4	Some pod fiber
B8337	3	3	Split-set
B8338	5	4	
B8339	3	5	Split-set
B8340	5	4	

[z]Planted January 26 . Notes taken May 9.
[y]Scores based on 1-9 scale with 9 = tolerant.
[x]Scores based on 1-9 scale with 9 = high.

Table 5. Green Bean Germination Trial, Corvallis, Oregon, 2009[z]

Entry	% Germination							Mean Comparison[y]	Type[x]	Notes
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Mean			
PI264240	90	100	100	96	98	88	95.3	a	Pc/pc (?)	
5630	98	96	96	94	98	84	94.3	a	Pc	
PI518183	88	96	98	90	98	94	94.0	a	Pc/pc (?)	
91G	96	92	92	96	100	86	93.7	a	Pc	
Limelight	94	94	98	84	96	90	92.7	ab	Pc	
PI508042	88	94	94	92	88	94	91.7	ab	Pc/pc (?)	Slow uneven germination
Ulysses	74	90	98	94	94	98	91.3	abc	Pc	
5996	74	96	98	90	92	94	90.7	abc	Pc	
RS080-1395	86	96	96	72	76	72	83.0	bcd	Pc	
Pix	72	80	90	84	90	70	81.0	cd	pc	Slow uneven germination; 1 albino
Tempest	72	88	90	70	80	78	79.7	d	pc	Slow uneven germination
6530	68	82	84	96	90	54	79.0	d	pc	
Spartacus	48	100	88	98	74	66	79.0	d	pc	Slow to germinate
6515	32	56	36	82	66	42	52.3	e	pc	
LSD 0.05							10.5			

[z]Planted June 24; notes taken July 7.

[y]Means with the same letter are not significantly different.

[x]Pc refers to normal chlorophyll types (green cotyledons at emergence); pc to persistent chlorophyll types (white cotyledons at emergence); PC/pc (?) indicates a mix of cotyledon types (these may or may not be phenotypic and/or genetic mixes).

Table 6. Performance of commercial green bean varieties, June 24 planting, Corvallis, 2009.

Variety	Source	AV Stand	Intended Use	Days	Percent Sieve Size[z]							Tons/Acre Sieve Size						Graded Total[y]
					1	2	3	4	5	6	1-4	1	2	3	4	5	6	
91G	OSU	150	full sieve	58	13.0	5.1	8.7	22.5	37.7	13.0	49.3	0.78	0.30	0.52	1.35	2.26	0.78	6.00*
				60	10.5	3.9	7.2	18.3	37.9	22.2	39.9	0.70	0.26	0.48	1.22	2.52	1.48	6.66
				61	8.7	3.4	4.9	12.6	36.9	33.5	29.6	0.78	0.30	0.44	1.13	3.31	3.00	8.96
OR 54	OSU	150	full sieve	60	5.4	7.2	12.0	31.1	32.9	11.4	55.7	0.39	0.52	0.87	2.26	2.39	0.83	7.26*
				61	3.9	4.9	9.9	26.6	40.9	13.8	45.3	0.35	0.44	0.87	2.35	3.61	1.22	8.83
				62	4.0	4.0	7.0	20.9	38.3	25.9	35.8	0.35	0.35	0.61	1.83	3.35	2.26	8.74
5630	OSU	150	full sieve	58	6.1	6.1	11.6	40.9	31.7	3.7	64.6	0.44	0.44	0.83	2.91	2.26	0.26	7.13
				60	5.4	4.8	7.5	29.6	47.8	4.8	47.3	0.44	0.39	0.61	2.39	3.87	0.39	8.09*
				61	4.3	3.4	5.8	24.6	54.1	7.7	38.2	0.39	0.30	0.52	2.22	4.87	0.70	9.00
6443	OSU	150	full sieve	60	4.7	5.3	11.8	29.4	37.1	11.8	51.2	0.35	0.39	0.87	2.18	2.74	0.87	7.40*
				61	3.2	4.8	10.6	30.9	36.7	13.8	49.5	0.26	0.39	0.87	2.52	3.00	1.13	8.18
				63	4.3	3.3	5.2	20.5	46.2	20.5	33.3	0.39	0.30	0.48	1.87	4.22	1.87	9.14
6501	OSU	150	full sieve	61	5.7	6.3	15.2	42.4	29.1	1.3	69.6	0.39	0.44	1.04	2.91	2.00	0.09	6.87
				63	7.0	4.3	7.6	26.5	48.1	6.5	45.4	0.57	0.35	0.61	2.13	3.87	0.52	8.05*
				65	8.4	6.5	5.6	17.7	44.7	17.2	38.1	0.78	0.61	0.52	1.65	4.18	1.61	9.35
6530	OSU	150	full sieve	61	11.7	8.6	9.4	32.0	35.2	3.1	61.7	0.65	0.48	0.52	1.78	1.96	0.17	5.57
				63	6.1	6.6	11.0	22.7	44.8	8.8	46.4	0.48	0.52	0.87	1.78	3.52	0.70	7.87*
				65	4.9	4.0	7.1	18.3	49.1	16.5	34.4	0.48	0.39	0.70	1.78	4.79	1.61	9.74
6602	OSU	150	full sieve	62	4.1	6.2	15.1	39.0	31.5	4.1	64.4	0.26	0.39	0.96	2.48	2.00	0.26	6.35
				64	3.5	2.9	8.7	32.0	47.1	5.8	47.1	0.26	0.22	0.65	2.39	3.52	0.44	7.48*
				65	5.9	4.1	5.9	24.9	50.9	8.3	40.8	0.44	0.30	0.44	1.83	3.74	0.61	7.35
Huntington	Syngenta	126	full sieve	61	8.2	11.5	15.3	28.4	32.8	3.8	63.4	0.65	0.91	1.22	2.26	2.61	0.30	7.96
				62	5.6	8.5	12.7	30.5	37.1	5.6	57.3	0.52	0.78	1.17	2.83	3.44	0.52	9.27*
				64	6.5	6.0	8.5	21.9	45.3	11.9	42.8	0.57	0.52	0.74	1.91	3.96	1.04	8.74
SB 4359	Syngenta	150	full sieve	56	5.0	5.0	14.2	46.1	29.8	0.0	70.2	0.30	0.30	0.87	2.83	1.83	0.00	6.13
				58	4.0	5.7	7.5	29.9	50.0	2.9	47.1	0.30	0.44	0.57	2.26	3.78	0.22	7.57*
				60	2.4	3.0	7.2	23.5	54.2	9.6	36.1	0.17	0.22	0.52	1.70	3.92	0.70	7.22
Spartacus	Seminis	149	full sieve	57	9.2	10.2	17.3	34.7	25.5	3.1	71.4	0.39	0.44	0.74	1.48	1.09	0.13	4.26
				60	3.5	4.1	6.4	23.8	49.4	12.8	37.8	0.26	0.30	0.48	1.78	3.70	0.96	7.48*
				62	3.0	2.5	4.1	15.7	52.3	22.3	25.4	0.26	0.22	0.35	1.35	4.48	1.91	8.57

Table 6. Performance of commercial green bean varieties, June 24 planting, Corvallis, 2009 (cont.).

Variety	Source	AV Stand	Intended Use	Days	Percent Sieve Size[z]							Tons/Acre Sieve Size						Graded Total[y]
					1	2	3	4	5	6	1-4	1	2	3	4	5	6	
BSC 847	Brotherton	115	full sieve	58	4.3	5.3	10.2	40.1	36.9	3.2	59.9	0.35	0.44	0.83	3.26	3.00	0.26	8.13
				60	3.6	4.1	7.1	38.8	42.3	4.1	53.6	0.30	0.35	0.61	3.31	3.61	0.35	8.53*
				62	2.7	2.7	6.3	27.9	51.8	8.6	39.6	0.26	0.26	0.61	2.70	5.00	0.83	9.66
BSC 8729	Brotherton	150	full sieve	63	20.3	14.9	23.0	31.1	9.5	1.4	89.2	0.65	0.48	0.74	1.00	0.30	0.04	3.22
				65	15.5	12.4	19.6	39.2	12.4	1.0	86.6	0.65	0.52	0.83	1.65	0.52	0.04	4.22
				68	8.4	8.4	13.9	30.7	31.9	6.6	61.4	0.61	0.61	1.00	2.22	2.31	0.48	7.22*
Inspiration	Syngenta	150	4-5 sieve	60	18.0	19.0	24.0	34.0	5.0	0.0	95.0	0.78	0.83	1.04	1.48	0.22	0.00	4.35
				62	13.2	16.7	21.9	36.8	11.4	0.0	88.6	0.65	0.83	1.09	1.83	0.57	0.00	4.96
				64	7.3	11.6	20.7	39.0	21.3	0.0	78.7	0.52	0.83	1.48	2.78	1.52	0.00	7.13*
BSC 8699	Brotherton	134	4-5 sieve	61	23.6	7.3	10.9	36.4	21.8	0.0	78.2	0.57	0.17	0.26	0.87	0.52	0.00	2.39
				63	14.1	10.9	7.6	30.4	34.8	2.2	63.0	0.57	0.44	0.30	1.22	1.39	0.09	4.00*
				65	8.3	12.8	18.0	27.8	30.8	2.3	66.9	0.48	0.74	1.04	1.61	1.78	0.13	5.79
BB 2175	Pureline	142	4-5 sieve	61	18.2	6.1	12.1	36.4	27.3	0.0	72.7	0.26	0.09	0.17	0.52	0.39	0.00	1.44
				63	28.9	13.2	10.5	26.3	21.1	0.0	78.9	0.48	0.22	0.17	0.44	0.35	0.00	1.65
				65	17.3	22.7	13.3	21.3	22.7	2.7	74.7	0.57	0.74	0.44	0.70	0.74	0.09	3.26*
Bullion	Seminis	150	4 sieve	63	7.1	10.6	20.6	41.8	19.1	0.7	80.1	0.44	0.65	1.26	2.57	1.17	0.04	6.13
				64	5.9	7.2	17.6	43.8	24.8	0.7	74.5	0.39	0.48	1.17	2.91	1.65	0.04	6.66*
				65	4.5	5.0	15.6	44.1	29.1	1.7	69.3	0.35	0.39	1.22	3.44	2.26	0.13	7.79
BSC 8577	Brotherton	147	4 sieve	57	9.7	20.4	34.5	33.6	1.8	0.0	98.2	0.48	1.00	1.70	1.65	0.09	0.00	4.92
				60	4.3	7.4	19.7	60.1	8.5	0.0	91.5	0.35	0.61	1.61	4.92	0.70	0.00	8.18*
				62	5.4	6.4	14.9	51.5	21.8	0.0	78.2	0.48	0.57	1.31	4.52	1.91	0.00	8.79
Ferrari	Pureline	150	3-4 sieve	61	24.4	14.6	31.7	29.3	0.0	0.0	100.0	0.44	0.26	0.57	0.52	0.00	0.00	1.78
				63	24.6	14.5	24.6	36.2	0.0	0.0	100.0	0.74	0.44	0.74	1.09	0.00	0.00	3.00*
				65	21.6	28.4	22.5	27.5	0.0	0.0	100.0	0.96	1.26	1.00	1.22	0.00	0.00	4.44
BSC 8609	Brotherton	149	2-3 sieve	58	16.2	54.4	29.4	0.0	0.0	0.0	100.0	0.48	1.61	0.87	0.00	0.00	0.00	2.96
				60	15.1	41.1	42.5	1.4	0.0	0.0	100.0	0.48	1.31	1.35	0.04	0.00	0.00	3.18*
				62	15.5	29.8	52.4	2.4	0.0	0.0	100.0	0.57	1.09	1.91	0.09	0.00	0.00	3.65
Redon	Syngenta	149	2 sieve	61	36.2	63.8	0.0	0.0	0.0	0.0	100.0	1.09	1.91	0.00	0.00	0.00	0.00	3.00
				63	34.1	62.4	3.5	0.0	0.0	0.0	100.0	1.26	2.31	0.13	0.00	0.00	0.00	3.70*
				65	30.7	62.2	7.1	0.0	0.0	0.0	100.0	1.70	3.44	0.39	0.00	0.00	0.00	5.52

Table 6. Performance of commercial green bean varieties, June 24 planting, Corvallis, 2009 (cont.).

Variety	Source	AV Stand	Intended Use	Days	Percent Sieve Size[z]							Tons/Acre Sieve Size						Graded Total[y]
					1	2	3	4	5	6	1-4	1	2	3	4	5	6	
Selecta	Seminis	150	2 sieve	58	27.0	73.0	0.0	0.0	0.0	0.0	100.0	0.87	2.35	0.00	0.00	0.00	0.00	3.22
				60	24.5	75.5	0.0	0.0	0.0	0.0	100.0	1.04	3.22	0.00	0.00	0.00	0.00	4.26*
				62	19.2	80.0	0.8	0.0	0.0	0.0	100.0	1.00	4.18	0.04	0.00	0.00	0.00	5.22

[z]Percent calculated as % of total of 1-6 sieve beans.
[y]Total tons/acre of the graded beans, including sieve sizes 1-6. Values will be lower than those reported in Table 6 because some beans are lost in the grading process. Analysis of variance (Table 6) was calculated using the harvest marked with *.

Table 7. Statistical comparison of yields of commercial green bean lines, Corvallis, 2009[z].

Line	Intended Use	T/A Unadjusted		T/A Adjusted[y]	
		Mean	Mean Comparison [x]	Mean	Mean Comparison [x]
91G	full sieve	6.3	de	6.2	de
OR 54	full sieve	7.4	bcd	7.8	bcd
5630	full sieve	8.6	abc	8.4	abc
6443	full sieve	7.9	abcd	8.0	bcd
6501	full sieve	8.5	abc	8.1	bcd
6530	full sieve	8.2	abc	7.9	bcd
6602	full sieve	8.0	abcd	7.8	bcd
Huntington	full sieve	9.5	a	10.1	a
SB 4359	full sieve	8.0	abcd	7.7	bcd
Spartacus	full sieve	7.8	abcd	6.9	cd
BSC 847	full sieve	8.9	ab	9.2	ab
BSC 8729	full sieve	7.9	abcd	8.7	abc
Inspiration	4-5 sieve	7.5	bcd	7.5	bcd
BSC 8699	4-5 sieve	4.6	ef	4.6	ef
BB 2175	4-5 sieve	3.6	f	3.6	f
Bullion	4 sieve	7.0	cd	7.0	cd
BSC 8577	4 sieve	8.7	abc	8.7	abc
Ferrari	3-4 sieve	3.3	f	3.3	f
BSC 8609	2-3 sieve	3.4	f	3.4	f
Redon	2 sieve	4.0	f	4.0	f
Selecta	2 sieve	4.5	ef	4.5	ef
LSD 0.05		1.9		1.9	

[z]Based on one selected harvest for each variety (marked with * on Table 5), 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.

[x]Means with the same letter are not significantly different.

Table 8. Notes on June 24 commercial bean trial, Corvallis, Oregon, 2009.

Line	Pod Length (cm)	Pod Straight-ness[z]	Pod Cross Section	Pod Smooth-ness[y]	Pod Color[x]	Flavor[w]				Notes[v]
						Sweet-ness	Astrin-gency	Beani-ness	Perfumi-ness	
91G	15.0	3	round	4	5	7	5	5	1	Split set and variable yield across field; some blanking.
OR 54	15.0	5	round	6	5	5	7	7	1	Not as junky as 91G
5630	16.0	4	round	5	5	8	5	3	1	Not as badly split as 91G and not as much blanking.
6443	16.0	5	round	5	5	7	7	7	1	Not as junky or as badly split as 91G.
6501	15.0	6	round	5	5	3	3	7	1	Affected by heat - split set, some blanking.
6530	15.5	7	round	7	5	7	7	5	1	Significantly straighter than BBL varieties; severe interlocular cavitation in some pods.
6602	15.5	7	round	6	5	5	5	5	1	Straight, attractive pods; many pollywogs in 4 sv.
Huntington	15.0	7	round	6	5	7	5	3	1	Better than many varieties in the trial for heat tolerance; little evidence of a split set.
SB 4359	14.5	8	round	7	7	5	1	3	1	Attractive straight smooth bean; color appears to match 91G.
Spartacus	14.0	6	round	7	7	7	1	3	1	Some blanking and pollywogs from heat; holds very well--still in prime condition at 38% 1-4 sv.
BSC 847	18.0	3	round	7	5	7	5	3	1	Very long slender pods.
BSC 8729	19.5	3	round	5	4	7	3	7	3	Extremely long pods with slight reverse curve; very late and extremely affected by the heat with a few very large pods and many more in smaller sieve sizes.
Inspiration	15.5	8	round	8	6	7	7	5	1	Tough skin; slender, smooth, straight, attractive pods.

Table 8. Notes on June 24 commercial bean trial, Corvallis, Oregon, 2009 (cont.).

Line	Pod Length (cm)	Pod Straight-ness[z]	Pod Cross Section	Pod Smooth-ness[y]	Pod Color[x]	Flavor[w]				Notes[v]
						Sweet-ness	Astrin-gency	Beani-ness	Perfumi-ness	
BSC 8699	14.0	7	round	7	4	7	7	7	1	Slightly tough skin; bad split but little blanking; holds well--quality still very good at 63% 1-4 sv.
BB 2175	14.5	7	round	7	3	1	3	5	1	Severely affected by heat--badly split with many blanks and pol-lywogs.
Bullion	14.0	9	round	8	6	7	5	1	1	Attractive pods; moderate amount of blanking from heat.
BSC 8577	13.0	6	round & oval mix	7	5	7	5	5	1	Tough skin; oval tendency.
Ferrari	13.5	9	round	8	4	7	1	1	1	Very straight and smooth; shiny; tough skin; severely affected by heat--split set with many blanks and pollywogs in smaller sieve sizes.
BSC 8609	11.0	8	round to oval	9	5	5	3	5	1	Oval tendency
Redon	14.0	7	round	7	4	7	7	7	1	Tough skin.
Selecta	12.5	8	round	8	5	3	5	3	1	Tough skin; attractive pods; some blanking and pollywogs from heat, but pod length very uniform.

[z]Scores based on a 1-9 scale with 9 straightest
[y]Scores based on a 1-9 scale with 9 smoothest
[x]Scores based on a 1-9 scale with 9 darkest
[w]Scores based on a 1-9 scale with 9 strongest
[v]Notes taken on prime harvest date; sv = sieve; BBL = bush blue lake; pc = persistent color; OT = off-type.

Figure 1. Commercial Bean Adjusted T/A 2009 - Full Sieve Varieties

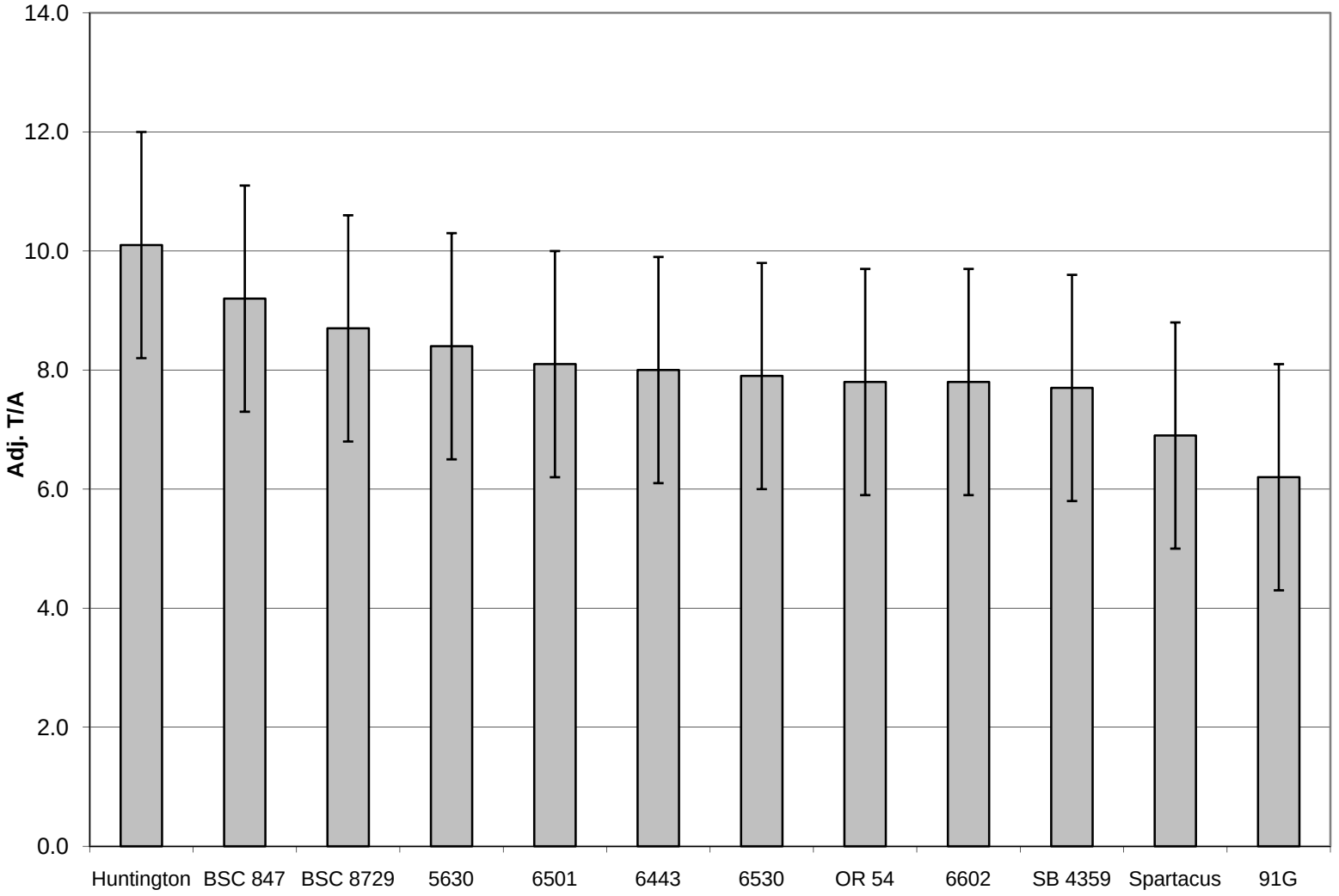

Figure 2. Commercial Bean T/A 2009 - Small Sieve Varieties