Report to the Oregon Processed Vegetable Commission
2013–2014

1. Title: Green Bean Breeding and Evaluation

2. Project Leaders: James R. Myers, Horticulture

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4. Project Status: Terminating 30 June, 2014

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.

5. Objective:

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

6. Report of Progress:

Overview of Project and Varietal Development: Funding for 2013-14 was reduced substantially which resulted in a scaling back of the objectives. We conducted two yield and quality evaluation trials. However, the evaluation of commercial entries was funded entirely by fees from industry. We also grew out approximately 1300 breeding lines and populations at various stages of generation advance in an observation and selection nursery. One-hundred seventy-five advanced lines harvested in the field in 2011 were subjected to a drop test to determine resistance to mechanical and imbibitional injury prior to planting in 2013, with approximately 20 lines discarded for poor performance. Interestingly, several different types of germination curves were observed and further work is needed to determine which are the most desirable in terms of high levels of germination and emergence. Sixty advanced lines with putative white mold resistance were screened in the field. Stock seed increase and roguing 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 first of these was grown in preliminary trials in 2011 and approximately 1/3 of these with new additions were grown in the preliminary yield and quality trials conducted this year.

Yield Trials: The preliminary green bean yield and quality evaluation trial had 51 advanced experimental lines and five check cultivars (table 1). Three of the checks were commercial bush blue lake

cultivars and two were checks with partial white mold resistance. Seventeen lines were new this year; the remainder had been tested for one or two years previously. Eighteen lines were classed as four sieves and had from 75 – 90% 1-4 sieve pods at maturity. Another 20 lines were classed as 5 sieve with percent 1-4 sieve ranging from 60-75%. The remainder was classified as full sieve, where the target maturity was 50 – 60% 1-4 sieve. The trial was planted on June5 and was harvested 60 – 70 days later. The trial was replicated three times with plots 20 feet in length. Five foot subplots were harvested up to three times on successive days. In general, we attempted to harvest the plots just once, but would harvest additional times if line did not appear to be at optimal maturity.

Thirteen lines had adjusted T/A yields that were not significantly different from OSU 5630. Highest yielding was 6975 (a 5 sieve line). Two lines of interest in this group are 6771 and 6774, both of which are high yielding and have relative good levels of white mold resistance. Both lines have been tested for three years now. Among four sieve experimental lines five were not significantly different for unadjusted T/A from OSU 5630. These included 6806, 6973, 6992, 7017, and7038.

Commercial Green Bean Trial: This trial was planted on June 21 and 27 (Seminis material was planted along with a second set of checks one week after the main planting). The trial included seven five - full sieve green beans, and 12 3-4 or 4-5 sieve green beans, plus two full sieve and one 4 sieve check cultivars (tables 3 – 5, and figures 1 & 2). Three of the seven full sieve entries were experimental lines from the OSU program. BSC 890 had yields similar to OR 91G and OSU 5630 while the OSU experimental lines with yields of about 9 T/A were significantly lower than the checks.

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.

Frozen samples were evaluated by researchers October 1 2013. The commercial lines were then displayed in a cutting at the Bean Improvement Cooperative meetings in Portland at the end of October where commercial bean breeders and public breeders from all over the world viewed the material. The best of the OSU preliminary lines along with all the samples from the Commercial Trial will be displayed to the industry at the Northwest Food Processors Association meeting on January 13, 2014.

Data from the evaluations is currently 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.

White Mold Resistance Breeding: Conditions were very favorable for white mold during the latter part of the season, and disease symptoms were severe in the white mold nursery. Disease incidence and severity were evaluated, and we also calculated a disease index based on the geometric mean of incidence and severity to provide a single value to rate disease (table 6). The lines were then ranked by disease index (smaller numbers indicate higher levels of resistance). Three of four check lines with partial resistance to white mold had the lowest disease index scores while susceptible checks ranked had the highest scores. Among the most resistant experimental lines, six had disease index scores that were not significantly different from the partially resistant checks. Those lines tested previously in 2012 also had low scores (figure 3). Also apparent in figure 3 is that a number of that showed apparent resistance in 2012 were susceptible in 2013 (those in the lower right hand corner of

the graph). When a subset of lines including resistant and susceptible checks and most promising experimentals is graphed (figure 4), a relatively strong relationship between years is revealed. Apparently, lines vary for stability of response to disease in different environments. Figure 5 reveals that a weak but significant negative association between yield and disease symptoms is found as has been observed in previous years. In general, those lines with the lowest disease index are the lowest yielding (figure 5). There are some lines such as 6771 and 6774 that have yields similar to OR 91G but have significantly better white mold resistance. These lines were three days earlier than 91G and OSU 5630 in the preliminary trial in 2013. In the past three years, these lines have performed consistently in terms of yield and disease. They may be more sensitive to environmental stress as evidenced by the performance of 6774 in the commercial trial (tables 3 – 5). Of the two lines, 6774 appears to have better color than 6771. Two lines (6743 and 6792) that had been flagged in 2012 as having good disease resistance and yield did not perform as well this year.

Disease parameters and certain avoidance traits were correlated (table 7). In particular, lodging was positively correlated with disease traits as was number of sclerotia. Estimated yield was only negatively correlated with disease severity. Number of sclerotia was also positively correlated with lodging and negatively correlated with estimated yield.

An interesting relationship was observed between number of sclerotia and disease severity (figure 6). Number of sclerotia appears to be fairly level below 70% disease severity, and then climbs exponentially. A second order polynomial regression equation had a good fit with an r^2 of 0.92. It appears that the two traits in tandem can be used to differentiate among lines with moderate levels of resistance with those having less than 150 sclerotia per square meter and disease severities less than 70% being lines for positive selection.

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Summary:

Among entries in trials that combine moderate levels of white mold resistance with yield and quality traits are 6771 and 6774. These lines have been tested for three years and the data appears sufficient to propose these for release.

Table 1. Performance of preliminary green bean lines, June 5 planting, OSU Vegetable Research Farm, Corvallis, 2013.[z]

				Percent Sieve Size[y]							
Entry	Days to Harvest	Est. Sieve Size	Stand	1.0-2.0	3.0	4.0	5.0	6.0	%1-4 Sieve	Av Tons/ A	Av Adj Tons/ A[x]
91G	61	6	150	9.4	15.4	43.6	28.2	3.4	68.5	9.0	10.7
5630	61	6	150	10.6	16.5	42.4	24.7	5.9	69.4	9.5	11.4
OR54	65	6	150	16.1	18.4	44.3	20.7	0.6	45.3	11.8	11.3
NY6020-5	64	6	150	10.3	10.3	7.2	37.1	35.1	27.8	3.7	2.8
Cornell 501	63	5	150	9.9	15.4	51.6	23.1	0.0	76.9	5.6	7.2
6777	63	4	150	8.9	19.4	68.5	3.2	0.0	96.8	7.5	
6806	64	4	150	7.3	12.4	69.3	10.9	0.0	89.1	8.4	
6893	63	4	150	15.1	15.1	40.7	26.7	2.3	70.9	5.6	
6898	61	4	143	13.6	26.2	54.4	5.8	0.0	94.2	6.7	
6905	65	4	150	12.7	25.5	52.7	9.1	0.0	90.9	6.8	
6973	65	4	150	4.2	9.6	54.5	31.1	0.6	68.3	9.9	
6980	61	4	150	22.5	21.6	34.3	20.6	1.0	78.4	6.0	
6986	65	4	150	23.9	22.8	34.8	18.5	0.0	81.5	5.6	
6988	65	4	150	47.0	21.2	25.8	6.1	0.0	93.9	4.2	
6992	64	4	150	12.7	19.0	61.1	7.1	0.0	92.9	7.8	
6993	64	4	150	16.8	23.9	43.4	15.9	0.0	84.1	7.0	
6999	61	4	150	18.6	27.9	44.2	9.3	0.0	90.7	5.6	
7017	62	4	150	16.9	26.1	46.5	10.6	0.0	89.4	8.8	
7018	61	4	150	27.4	30.5	33.7	8.4	0.0	91.6	5.9	
7022	61	4	150	17.6	33.3	42.2	6.9	0.0	93.1	6.4	
7023	63	4	150	12.0	20.5	51.3	16.2	0.0	83.8	7.0	
7038	63	4	150	8.9	16.6	48.5	13.0	13.0	74.0	8.9	
7042	64	4	113	30.9	27.2	30.9	11.1	0.0	88.9	5.0	
6768	68	5	150	7.8	11.3	36.5	35.7	8.7	55.7	6.7	7.1
6772	62	5	150	6.5	6.0	44.0	42.9	0.6	56.5	10.5	11.1
6779	63	5	150	5.6	6.3	38.9	44.4	4.8	50.8	7.8	7.9
6792	64	5	150	3.1	9.9	36.6	42.7	7.6	49.6	8.0	7.9
6847	62	5	150	16.3	18.4	32.7	22.4	10.2	67.3	5.6	6.6
6849	58	5	150	4.3	7.1	47.1	37.1	4.3	58.6	8.4	9.0
6886	63	5	150	11.5	11.5	29.8	40.4	6.7	52.9	6.3	6.9
6900	61	5	150	6.9	4.1	20.0	62.8	6.2	31.0	9.1	8.3
6909	62	5	150	4.1	8.3	33.1	49.6	5.0	45.5	7.7	7.4
6925	62	5	150	18.5	11.3	18.5	32.3	19.4	48.4	7.8	7.7
6975	63	5	150	10.9	20.5	46.8	20.5	1.3	78.2	9.6	12.4
6996	63	5	150	9.6	13.2	47.1	30.1	0.0	69.9	8.4	9.0
7005	64	5	150	8.8	17.0	42.1	32.1	0.0	67.9	9.9	10.7
7007	61	5	150	30.1	28.0	28.0	14.0	0.0	86.0	5.2	7.0

Table 1. (continued)

Entry	Days to Harvest	Est. Sieve Size	Stand	Percent Sieve Size[y] 1.0-2.0	3.0	4.0	5.0	6.0	%1-4 Sieve	Av Tons/ A	Av Adj Tons/ A[x]
7009	63	5	150	12.9	15.1	30.9	35.3	5.8	59.0	8.7	9.4
7012	62	5	150	6.7	11.6	36.6	39.6	5.5	54.9	9.8	10.3
7014	65	5	150	18.1	18.1	34.1	27.5	2.2	70.3	8.4	10.1
7025	65	5	150	6.5	11.5	44.6	37.4	0.0	62.6	8.7	9.7
7037	64	5	150	5.4	7.2	31.3	50.0	6.0	44.0	9.5	8.8
7043	65	5	148	12.1	13.6	28.6	42.9	2.9	54.3	8.4	8.7
6443	63	6	150	10.1	13	34.3	37.9	4.7	61.5	10.2	11.0
6743	65	6	150	28.8	15.4	17.3	25.0	13.5	61.4	3.5	4.0
6770	62	6	150	25.7	18.6	25.7	21.2	8.8	69.9	6.6	7.9
6771	58	6	150	6.1	6.8	50.3	36.7	0.0	63.3	9.2	10.5
6773	63	6	150	10.9	16.8	41.2	27.7	3.4	68.9	7.7	9.2
6774	58	6	150	8.6	12.6	37.1	33.8	7.9	58.3	9.2	9.9
6785	63	6	150	5.2	10.4	37.5	36.5	10.4	53.1	5.4	5.6
6835	62	6	150	14.5	14.5	37.9	33.1	0.0	66.9	7.7	9.0
6866	63	6	150	4.0	6.1	26.3	50.5	13.1	36.4	6.5	5.6
6937	63	6	150	20.5	18.2	43.2	18.2	0.0	81.8	5.7	7.6
6978	63	6	150	29.3	29.3	34.3	7.1	0.0	92.9	6.2	8.8
7013	63	6	150	11.5	19.6	38.5	28.4	2.0	69.6	9.3	9.9
7044	65	6	150	7.8	13.0	38.3	37.4	3.5	59.1	7.1	8.9
LSD 0.05										1.9	1.9

[z]Mean of 3 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 4 sieve lines were not adjusted.

Table 2. Notes on preliminary green bean lines, June 5 planting, OSU Vegetable Research Farm, Corvallis, 2013.

Entry	Pod Cross Section[z]	Pod Color[y]	Notes	Entry	Pod Cross Section[z]	Pod Color[y]	Notes
91G	r	5		6978	r	6	
OR54	r	5		6980	r-h	6	
5630	r	5		6980	r-cb	6	
Cornell 501	h	6		6986	h	6	
NY6020-5	r-cb	4		6988	r	4	
6743	r-cb	5	Split set	6988	r-h	4	
6768	h-cb	6		6988	h-cb	4	
6770	r	5	Battered in grader	6992	r-h	5	Sl. variable color, straight pods
6771	h-r	5		6993	h	7	Low yield due to bad split set
6772	r-h	5		6996	r-h	6	
6773	r	4		6999	h	4	
6774	r	8		7005	h-cb	5	
6777	r	6		7007	h	4	
6779	r	5		7009	r	5	
6785	h-cb	5		7012	h-cb	3	
6792	r-h	4		7013	h	4	
6806	r	4	Productive	7013	h	4	
6835	r	6		7013	h	4	
6847	r	4		7014	h	5	
6849	h-cb	4		7014	h	3	
6866	h-cb	6		7017	r-cb	4	
6886	r-h	5		7018	h-cb	5	
6893	r	6		7022	h-cb	4	
6893	r	6	Bumpy pods Aug. 6	7023	h-cb	5	
6898	r	4		7025	h-cb	4	
6900	r	6		7025	h-cb	5	
6905	r	5	Variable sizes	7037	h-cb	4	
6909	r	6		7038	cb	3	
6925	h	7		7042	h-r	6	
6937	h	7		7043	h	5	
6973	r	7		7044	h	5	
6975	cb-r	6	Variable shapes				

[z]Cross section: r = round, h = heart, cb = crease-back. [y]Scores based on a 1-9 scale with 9 darkest.

Table 3. Performance of commercial green bean varieties, June 21 & 27 planting, OSU Vegetable Research Farm, Corvallis, 2013.

					Percent Sieve Size[z]							Tons/Acre Sieve Size						
Variety	Source	AV Stand	Sieve size	Days	1	2	3	4	5	6	1-4	1	2	3	4	5	6	Graded Total[y]
5630	OSU (ck)	150	6	59	6.9	7.4	23.1	45.8	16.2	0.5	83.3	0.7	0.7	2.2	4.3	1.5	0.0	9.4
5630				61	5.7	6.1	12.6	44.3	31.3	0.0	68.7	0.6	0.6	1.3	4.4	3.1	0.0	10.0*
5630				63	4.9	3.4	7.9	32.2	50.2	1.5	48.3	0.6	0.4	0.9	3.7	5.8	0.2	11.6
91G	OSU (ck)	150	6	59	5.2	6.0	12.9	40.3	33.9	1.6	64.5	0.6	0.7	1.4	4.4	3.7	0.2	10.8*
Sahara	Harris Moran (ck)	150	4	61	9.6	17.7	42.4	29.8	0.5	0.0	99.5	0.8	1.5	3.7	2.6	0.0	0.0	8.6
Sahara				63	4.5	9.0	28.1	55.2	3.2	0.0	96.8	0.4	0.9	2.7	5.3	0.3	0.0	9.6*
Sahara				66	3.4	5.6	18.5	65.7	6.9	0.0	93.1	0.3	0.6	1.9	6.7	0.7	0.0	10.1
6743	OSU	150	6	63	9.0	9.5	13.8	23.8	30.7	13.2	56.1	0.7	0.8	1.1	2.0	2.5	1.1	8.2*
6743				66	5.8	6.7	8.7	19.7	33.2	26.0	40.9	0.5	0.6	0.8	1.8	3.0	2.3	9.0
6774	OSU		6	60	14.1	14.7	25.6	33.3	12.2	0.0	87.8	1.0	1.0	1.7	2.3	0.8	0.0	6.8
6774				63	5.7	6.2	11.4	24.6	37.4	14.7	47.9	0.5	0.6	1.0	2.3	3.4	1.3	9.2*
6774				66	4.3	3.5	5.4	12.5	42.0	32.3	26.8	0.5	0.4	0.6	1.4	4.7	3.6	11.2
6792	OSU	150	4	62	8.7	11.3	19.3	34.0	26.7	0.0	73.3	0.6	0.7	1.3	2.2	1.7	0.0	6.5
6792				64	4.0	6.4	16.2	35.3	36.4	1.7	61.8	0.3	0.5	1.2	2.7	2.7	0.1	7.5*
6792				66	2.6	3.5	8.3	30.4	49.6	5.7	44.8	0.3	0.3	0.8	3.0	5.0	0.6	10.0
BSC 11B511	Bro-therton		3-4	61	25.9	27.6	37.9	8.6	0.0	0.0	100.0	1.3	1.4	1.9	0.4	0.0	0.0	5.0
BSC 11B511				63	16.0	24.1	39.5	20.4	0.0	0.0	100.0	1.1	1.7	2.8	1.4	0.0	0.0	7.0*
BSC 11B511				64	15.2	22.8	39.8	22.2	0.0	0.0	100.0	1.1	1.7	3.0	1.7	0.0	0.0	7.4
BSC 11B515	Bro-therton	150	4-5	63	5.0	10.0	35.4	48.8	0.8	0.0	99.2	0.6	1.1	4.0	5.5	0.1	0.0	11.3*
BSC 11B515				66	3.7	7.1	27.5	58.7	3.0	0.0	97.0	0.4	0.8	3.2	6.9	0.3	0.0	11.7
BSC 831	Bro-therton	150	3-4	59	14.1	23.7	43.6	17.9	0.6	0.0	99.4	1.0	1.6	3.0	1.2	0.0	0.0	6.8
BSC 831				61	9.0	15.6	40.7	34.2	0.5	0.0	99.5	0.8	1.3	3.5	3.0	0.0	0.0	8.7*
BSC 831				63	3.9	8.3	26.1	58.3	3.5	0.0	96.5	0.4	0.8	2.6	5.8	0.3	0.0	10.0
BSC 890	Bro-therton	145	5-6	63	9.8	18.1	35.8	34.3	2.0	0.0	98.0	0.9	1.6	3.2	3.0	0.2	0.0	8.9
BSC 890				66	5.8	8.7	29.8	50.8	5.0	0.0	95.0	0.6	0.9	3.1	5.4	0.5	0.0	10.5*

Table 3. (continued).

					Percent Sieve Size[z]							Tons/Acre Sieve Size						
Variety	Source	AV Stand	Sieve size	Days	1	2	3	4	5	6	1-4	1	2	3	4	5	6	Graded Total[y]
BSC B525	Bro-therton	150	4-5	61	18.9	36.4	39.2	5.6	0.0	0.0	100.0	1.2	2.3	2.4	0.3	0.0	0.0	6.2
BSC B525				63	6.9	25.4	48.6	19.1	0.0	0.0	100.0	0.5	1.9	3.7	1.4	0.0	0.0	7.5*
Dinasty	Bro-therton	137	3-4	61	14.8	26.0	49.1	10.1	0.0	0.0	100.0	1.1	1.9	3.6	0.7	0.0	0.0	7.4
Dinasty				63	6.5	15.0	47.2	30.8	0.5	0.0	99.5	0.6	1.4	4.4	2.9	0.0	0.0	9.3*
Dinasty				66	5.1	10.2	40.8	42.7	1.2	0.0	98.8	0.6	1.1	4.5	4.7	0.1	0.0	11.1
GB 210	Pure Line	150	3-4	60	19.3	32.1	42.1	6.4	0.0	0.0	100.0	1.2	2.0	2.6	0.4	0.0	0.0	6.1
GB 210				62	17.8	27.4	42.7	12.1	0.0	0.0	100.0	1.2	1.9	2.9	0.8	0.0	0.0	6.8*
GB 210				64	8.3	18.8	49.1	23.9	0.0	0.0	100.0	0.8	1.8	4.7	2.3	0.0	0.0	9.5
GB 50	Pure Line	150	4-5	59	10.7	9.6	16.9	47.8	15.2	0.0	84.8	0.8	0.7	1.3	3.7	1.2	0.0	7.7*
GB 50				61	7.5	7.5	12.6	45.2	27.1	0.0	72.9	0.7	0.7	1.1	3.9	2.3	0.0	8.7
GB 50				63	4.8	5.2	8.9	30.2	48.4	2.4	49.2	0.5	0.6	1.0	3.3	5.2	0.3	10.8
SB 4556	Syngen-ta	150	4-5	60	11.3	13.9	26.1	39.1	9.6	0.0	90.4	1.1	1.4	2.6	3.9	1.0	0.0	10.0
SB 4556				62	9.0	9.4	14.6	33.9	33.0	0.0	67.0	0.9	1.0	1.5	3.4	3.3	0.0	10.1*
SB 4556				64	5.8	5.8	7.7	24.8	51.4	4.5	44.1	0.8	0.8	1.0	3.3	7.0	0.6	13.5
SB 4566	Syngen-ta	150	4-5	59	12.9	15.2	29.8	39.3	2.8	0.0	97.2	1.0	1.2	2.3	3.0	0.2	0.0	7.7
SB 4566				60	10.6	11.6	28.8	46.0	3.0	0.0	97.0	0.9	1.0	2.5	4.0	0.3	0.0	8.6*
SB 4566				63	4.5	7.4	18.5	51.9	17.7	0.0	82.3	0.5	0.8	2.0	5.5	1.9	0.0	10.6
SB 4598	Syngen-ta	150	5	60	6.7	7.2	17.2	57.9	11.0	0.0	89.0	0.6	0.7	1.6	5.3	1.0	0.0	9.1
SB 4598				62	3.0	4.5	10.9	53.2	28.4	0.0	71.6	0.3	0.4	1.0	4.7	2.5	0.0	8.7*
SB 4598				64	2.4	4.7	7.1	38.7	46.6	0.4	53.0	0.3	0.5	0.8	4.3	5.1	0.0	11.0
SB 4599	Syngen-ta	150	4	59	10.7	15.4	40.2	33.1	0.6	0.0	99.4	0.8	1.1	3.0	2.4	0.0	0.0	7.4*
SB 4599				61	10.8	12.7	33.1	42.8	0.6	0.0	99.4	0.8	0.9	2.4	3.1	0.0	0.0	7.2
SB 4599				63	7.8	9.5	24.1	52.6	6.0	0.0	94.0	0.8	1.0	2.4	5.3	0.6	0.0	10.1
SB 4603	Syngen-ta	150	4	59	7.0	6.6	16.2	50.7	19.7	0.0	80.3	0.7	0.7	1.6	5.0	2.0	0.0	10.0*
SB 4603				61	4.0	5.3	12.4	47.1	29.8	1.3	68.9	0.4	0.5	1.2	4.6	2.9	0.1	9.8
SB 4603				63	2.4	3.3	7.2	34.0	49.3	3.8	46.9	0.2	0.3	0.7	3.1	4.5	0.3	9.1

Table 3. (continued).

					Percent Sieve Size[z]							Tons/Acre Sieve Size						
Variety	Source	AV Stand	Sieve size	Days	1	2	3	4	5	6	1-4	1	2	3	4	5	6	Graded Total[y]
SB 4616	**Syngen-ta**	150	4	59	5.6	6.5	16.7	52.8	18.5	0.0	81.5	0.5	0.6	1.6	5.0	1.7	0.0	9.4
SB 4616				60	4.6	5.9	13.2	55.7	20.5	0.0	79.5	0.4	0.6	1.3	5.3	2.0	0.0	9.5*
SB 4616				62	5.3	3.7	8.1	36.2	45.5	1.2	53.3	0.6	0.4	0.9	3.9	4.9	0.1	10.7
5630[x]	OSU (ck)	145	6	62	5.6	9.5	22.5	44.2	18.2	0.0	81.8	0.6	1.0	2.3	4.4	1.8	0.0	10.0
5630				64	7.3	6.6	15.1	42.1	27.4	1.5	71.0	0.8	0.7	1.7	4.7	3.1	0.2	11.3*
5630				68	3.0	3.7	6.1	27.6	54.9	4.7	40.4	0.4	0.5	0.8	3.6	7.1	0.6	12.9
91G	OSU (ck)	142	6	62	11.7	13.1	20.4	33.5	20.4	1.0	78.6	1.0	1.2	1.8	3.0	1.8	0.1	9.0
91G				64	6.8	6.4	11.3	31.3	40.0	4.2	55.8	0.8	0.7	1.3	3.6	4.6	0.5	11.5*
BA1001	Seminis	130	5	62	8.8	11.6	23.2	43.1	13.3	0.0	86.7	0.7	0.9	1.8	3.4	1.0	0.0	7.9
BA1001				64	5.0	6.4	14.9	46.0	27.2	0.5	72.3	0.4	0.6	1.3	4.0	2.4	0.0	8.8*
SV 1007GG	Seminis	128	4	64	7.3	10.2	35.1	45.3	2.0	0.0	98.0	0.8	1.1	3.7	4.8	0.2	0.0	10.7
SV 1007GG				68	3.1	5.0	17.4	64.9	9.7	0.0	90.3	0.3	0.6	2.0	7.3	1.1	0.0	11.3*
SV 1098 GV	Seminis	147	6	62	2.6	3.5	8.4	31.7	48.5	5.3	46.3	0.3	0.3	0.8	3.1	4.8	0.5	9.8*
SV 1098 GV				64	4.0	3.5	7.9	20.3	53.0	11.4	35.6	0.3	0.3	0.7	1.8	4.7	1.0	8.8

[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 *. [x]Seminis lines and check planted one week later than rest of trial.

Table 4. Statistical comparison of yields of commercial green bean lines, Corvallis, 2013[z].

Cultivar	Sieve size	T/A Unadjusted	T/A Adjusted[y]
5630	6	10.9	13.0
6743	6	8.8	9.3
6774	6	9.8	9.6
6792	6	8.1	9.1
91G	6	11.5	13.1
BSC 11B511	3-4	8.0	8.0
BSC 11B515	4-5	11.7	11.7
BSC 831	3-4	9.0	9.0
BSC 890	5	11.2	11.2
BSC B525	4-5	7.9	7.9
Dinasty	3-4	9.7	9.7
GB 210	3-4	7.1	7.1
GB 50	4-5	8.3	8.3
SB 4556	4-5	10.7	10.7
SB 4566	4-5	9.1	9.1
SB 4598	5	9.6	9.6
SB 4599	4	7.9	7.9
SB 4603	4	10.5	10.5
SB 4616	4	9.8	9.8
Sahara	4	10.1	10.1
LSD 0.05		1.6	1.9
5630[x]	6	11.8	14.3
91G	6	12.2	13.0
SV1007GG	4	11.8	11.8
BA1001	5	9.6	9.6
SV1098GV	6	10.9	10.5
LSD 0.05		1.3	1.4

[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. [x]Semins cultivars and associated checks were planted one week later than other lines so comparisons should be made only within the group.

Table 5. Notes on June 21, 27 commercial bean trial, OSU Vegetable Research Farm, Corvallis, Oregon, 2013.

Line	Pod Length (cm)	Pod Straightness[z]	Pod Cross Section[y]	Pod Smoothness[x]	Pod Color[w]	Flavor[v]			Notes[u]
						Sweetness	Astringency	Perfuminess	
91G (ck)	15.0	5	r	5	5	7	7	1	Moderately seedy 5 & 6 sv, 3 & 4 sv beginning
5630 (ck)	16.0	4	h-r	5	5	5	9	1	Very seedy 6 sv, seedy 5 sv, mixed in 4 sv.
6743	18.0	5	r	5	5	7	7	1	Segregating oval, lots of battering in the grader. Moderately seedy 6 sv, beginning in 4 & 5 sv.
6774	13.5	5	r	5	6	5	7	1	Looks like spit set in field but don't see it in the grades. - holds very well.
6792	15.5	7	r	6	5	5	8	1	No white mold found in the field. Nice looking bean. Seedy 6 sv, moderately seedy 5 sv, beginning in 4 sv, 3 sv ok.
BSC 11B511	13.5	8	r	9	6	3	3	1	Mixed seed dev in 3 & 4 sv.
BSC 11B515	14.5	7	r	7	6	5	7	3	Seedy 5 sv, moderately seedy 4 sv.
BSC 831	14.0	9	r	9	6	5	6	1	Moderately seedy 4 & 5 sv.
BSC 890	15.5	7	r	7	6	5	7	1	Seedy 5 sv, mixed in 4 sv, beginning in 3 sv.
BSC B525	12.0	7	h-o	8	5	5	7	5	Moderately seedy 4 sv, mixed in 3 sv.
Dinasty	13.5	7	r	8	5	7	7	3	Moderately seedy 4 & 5 sv, mixed in 3 sv.
GB 210	14.0	7	r	7	5	5	9	1	Moderately seedy 4 sv.
GB 50	14.0	7	h-r	9	8	5	3	7	Moderately seedy 5 sv, beginning in 4 sv.
Sahara	14.0	8	r	8	6	3	5	1	Moderately seedy 4 & 5 sv, mixed in 3 sv.

Table 5. (continued).

Line	Pod Length (cm)	Pod Straightness[z]	Pod Cross Section[y]	Pod Smoothness[x]	Pod Color[w]	Flavor[v]			Notes[u]
						Sweetness	Astringency	Perfuminess	
SB 4556	12.0	4	r	8	4	7	5	1	Moderate seed dev in 5 sv, beginning in 4 sv.
SB 4566	14.0	7	h-r	7	7	7	5	5	Seedy 5 sv, mixed in 4 sv, beginning in 3 sv.
SB 4598	14.0	7	r-cb	6	5	3	7	3	Moderate seed dev in 5 sv, beginning in 4 sv.
SB 4599	14.0	8	h-o	9	5	3	3	7	Tough & fibrous - moderately seedy 4 & 5 sv.
SB 4603	15.0	7	r	7	4	5	1	7	Medium seed in 5 sv. Too light to blend with BBL types.
SB 4616	15.0	7	r	7	4	3	5	5	Moderately seedy 5 sv, mixed in 4 sv, beginning in 3 sv.
BA1001	15.0	7	r-cb	8	5	3	5	1	Med seed dev in 5 & 6 sv, beginning in 4 sv, 3 sv Ok.
SV 1007GG	16.0	8	h-r	9	8	3	3	1	Moderately seedy in 5 sv, mixed in 3 & 4 sv.
SV 1098 GV	15.0	6	r	9	7	5	5	1	Moderately seedy in 5 & 6 sv, beginning in 3 & 4 sv.

[z]Scores based on a 1-9 scale with 9 straightest. [y]Cross section: r = round, h = heart, o = oval, cb = crease-back. [x]Scores based on a 1-9 scale with 9 smoothest. [w]Scores based on a 1-9 scale with 9 darkest. [v]Scores based on a 1-9 scale with 9 strongest. [u]Notes taken on prime harvest date; sv = sieve; BBL = bush blue lake.

Table 6. Results for white mold screening nursery for advanced green bean breeding lines grown at the OSU Vegetable Farm in Corvallis in 2013.

Entry	Incidence (%)	Severity (%)	Disease Index[z]	Lodging[y]	Est. Yield[y]	Sclerotia (no. m^{-2})
G122 (ck)	87	26	47	2.0	1.3	54
6229 (ck)	85	29	50	2.7	2.3	64
6993	87	30	50	1.7	2.0	60
NY6020 (ck)	87	33	53	2.7	1.0	91
6777	89	33	54	2.7	2.3	74
6792	94	39	60	2.0	2.3	67
6986	90	40	60	2.0	1.3	67
6992	90	41	60	2.7	2.0	77
6893	96	40	62	2.0	1.3	54
7025	95	46	66	2.7	2.3	64
6779	96	46	66	2.3	1.7	57
6980	87	54	68	2.3	1.3	124
7022	96	50	69	2.7	1.7	84
6886	98	51	70	2.7	1.3	74
6771	100	52	71	2.3	2.3	84
6900	100	52	72	2.7	1.7	87
6999	97	54	72	3.0	1.7	91
6770	100	56	74	2.7	1.7	81
6937	100	56	74	3.0	2.0	91
6774	97	58	75	3.0	1.7	94
7023	100	59	77	3.0	2.3	87
6235 (ck)	100	63	79	3.0	1.7	131
6743	100	63	79	3.0	2.0	131
6996	100	63	79	3.0	2.7	114
7038	100	63	79	2.3	2.7	104
7043	100	63	79	3.0	2.3	124
6988	97	68	81	3.0	1.0	128
6230	100	67	81	3.0	1.7	141
6768	100	67	81	3.0	2.3	141
6835	100	67	81	3.0	2.3	84
6847	100	67	81	3.0	1.7	131
7005	100	67	81	3.0	2.0	134
7042	100	67	81	2.7	2.7	107
6973	100	70	84	3.0	2.3	168
6785	100	70	84	2.7	1.7	148
6905	100	70	84	3.0	1.7	138

Table 6. (continued).

Entry	Incidence (%)	Severity (%)	Disease Index[z]	Lodging[y]	Est. Yield[y]	Sclerotia (no. m^{-2})
7009	100	70	84	3.0	1.3	111
7037	100	70	84	3.0	1.7	121
6978	100	74	86	3.0	2.3	154
6866	100	74	86	2.7	1.3	188
7018	100	74	86	3.0	2.0	151
7044	100	74	86	3.0	2.0	188
6806	100	78	88	2.7	1.7	171
6849	100	78	88	3.0	1.0	272
6925	100	78	88	3.0	2.0	188
6975	100	78	88	3.0	2.3	178
7007	100	78	88	1.7	1.3	144
6772	100	78	88	3.0	2.0	222
6909	100	78	88	3.0	1.3	171
6773	100	81	90	2.0	1.7	225
6898	100	81	90	3.0	1.3	198
7014	100	81	90	3.0	1.3	272
5402(ck 2)	100	81	90	3.0	1.3	201
6443	100	85	92	3.0	2.0	255
5402(ck 1)	100	85	92	3.0	1.7	248
7017	100	89	94	3.0	1.0	319
5613	100	89	94	3.0	1.3	299
5630(ck 2)	100	93	96	3.0	1.0	302
91G (ck)	100	93	96	3.0	1.7	319
5630(ck 1)	100	96	98	3.0	1.3	379
LSD 0.05	8	17	14	0.5	1.1	98

[z]Disease index is the geometric mean of percent incidence and severity; [y]Scale of 1 to 3 where 1 = upright for lodging and low for yield and 3 = prostrate for lodging and high for yield; [x]Number of sclerotia found in two 248 cm^2 circles from below each plot, averaged over reps.

Table 7. Pearson multiple correlations among white mold disease resistance and avoidance traits in advanced green bean breeding lines segregating for resistance grown at the OSU Vegetable Research Farm, Corvallis OR in 2013 (see table 6 for explanation of traits). Top number for each comparison is correlation coefficient (r, which varies from -1 to 1) and bottom number is probability of > |r| under H_0: Rho=0. Highlighted comparisons are statistically different from r = 0 at the 0.05 probability level.

	Severity (%)	Disease Index	Lodging	Est. Yield	No. Sclerotia
Incidence (%)	0.69	0.80	0.39	0.04	0.34
	<.0001	<.0001	<.0001	0.5728	<.0001
Severity (%)	1.00	0.99	0.46	-0.17	0.80
		<.0001	<.0001	0.0204	<.0001
Disease Index		1.00	0.48	-0.13	0.73
			<.0001	0.0758	<.0001
Lodging			1.00	0.00	0.33
				0.996	<.0001
Est. Yield				1.00	-0.21
					0.0056

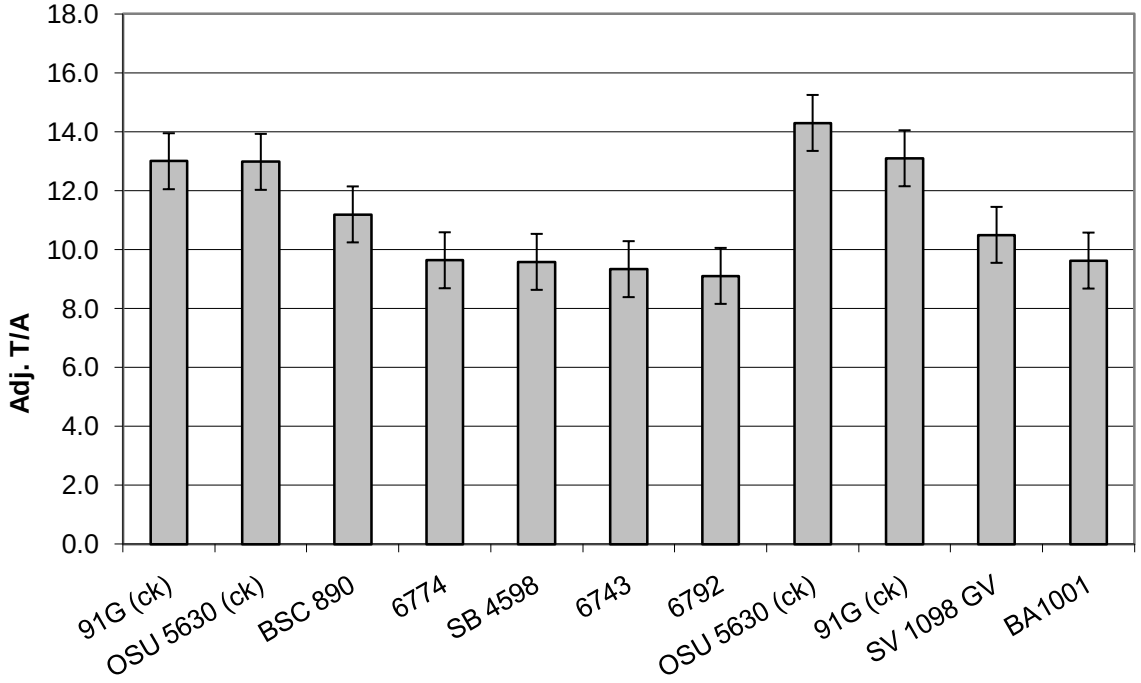

Figure 1. T/A for green bean cultivars grown in the commercial trial at the OSU Vegetable Research Farm, Corvallis, OR in 2013 - Full sieve cultivars.

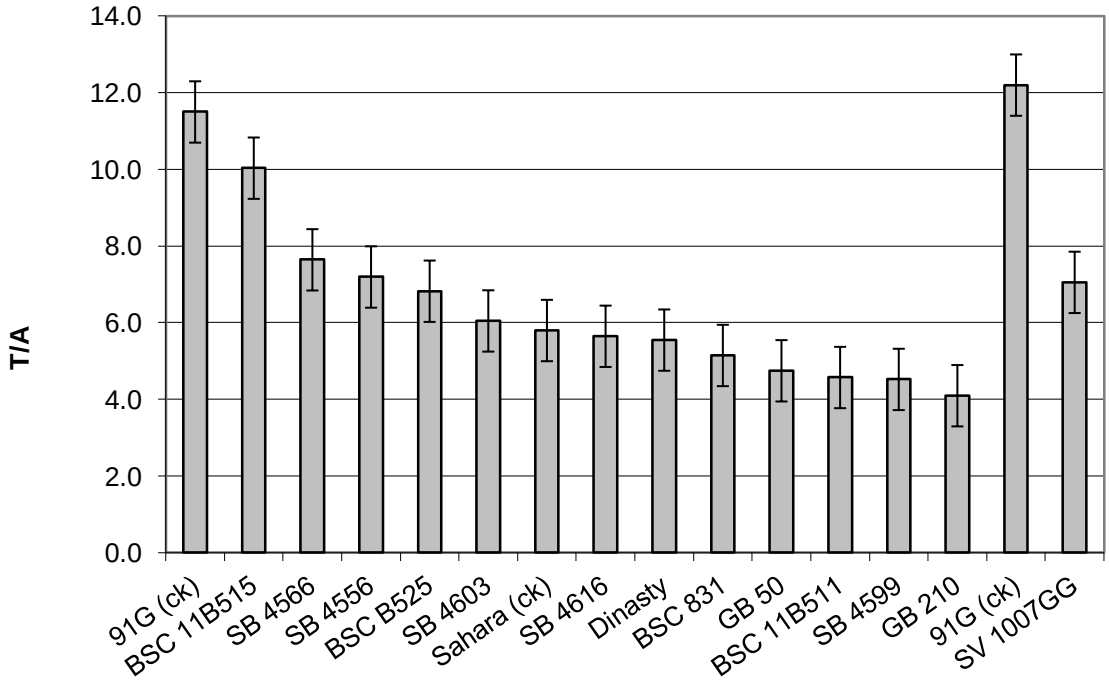

Figure 2. T/A for green bean cultivars grown in the commercial trial at the OSU Vegetable Research Farm, Corvallis, OR in 2013 - Small sieve cultivars.

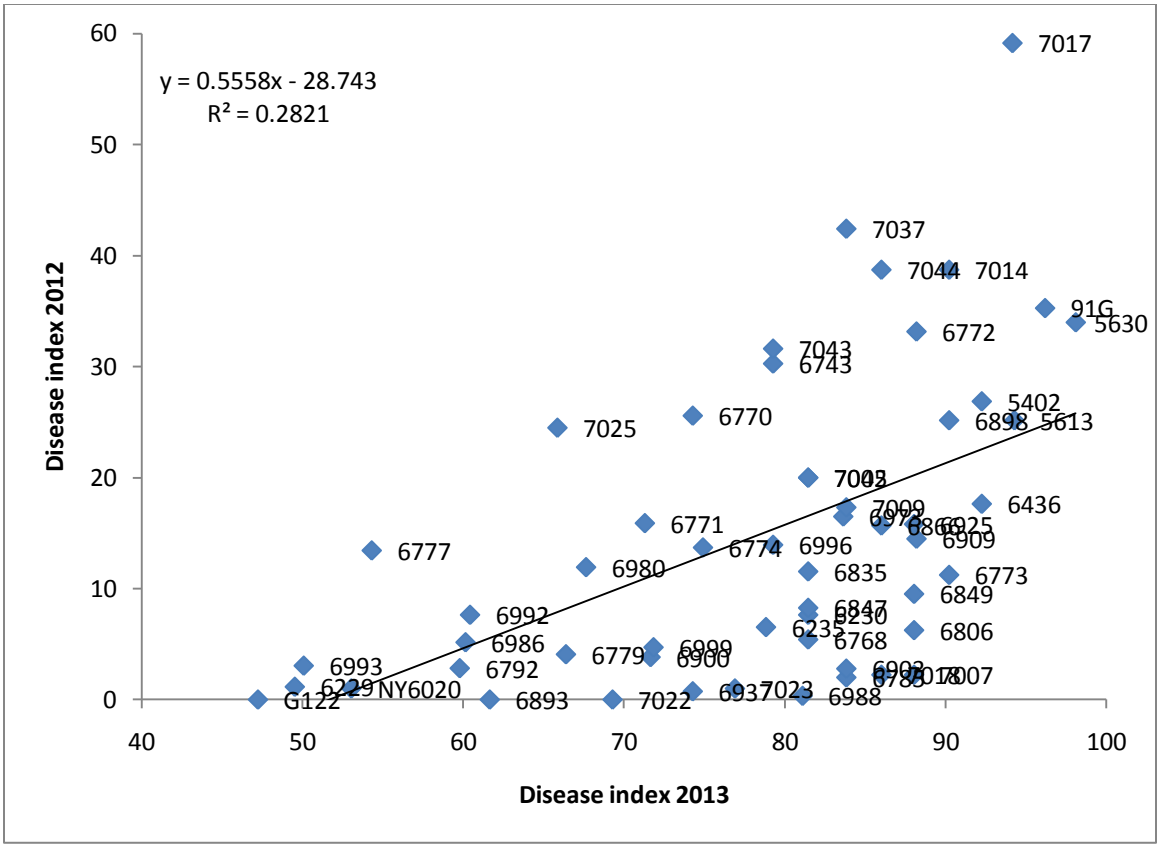

Figure 3. Disease index from 2013 vs. 2012 for green bean breeding lines and checks grown in white mold screening nurseries at the OSU Vegetable Research Farm, Corvallis, OR.

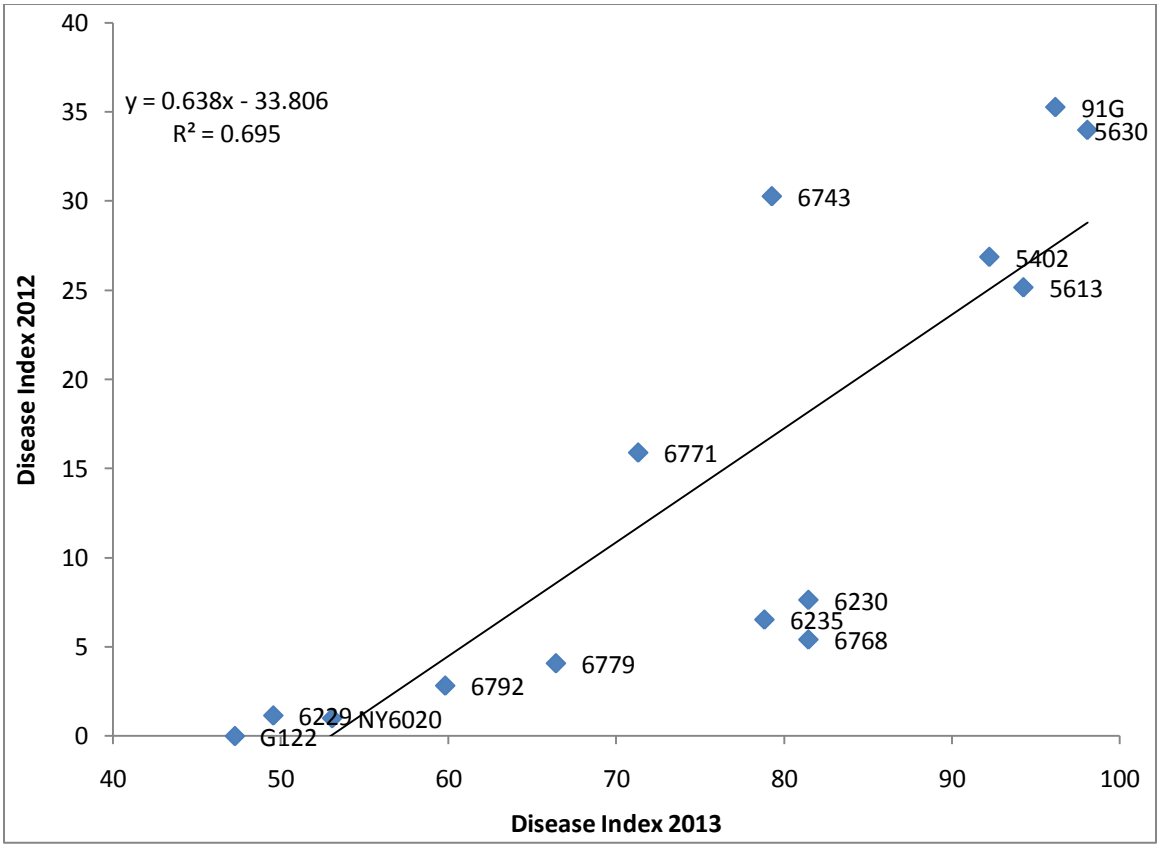

Figure 4. Disease index from 2013 vs. 2012 for a subset of green bean breeding lines and checks grown in white mold screening nurseries at the OSU Vegetable Research Farm, Corvallis, OR.

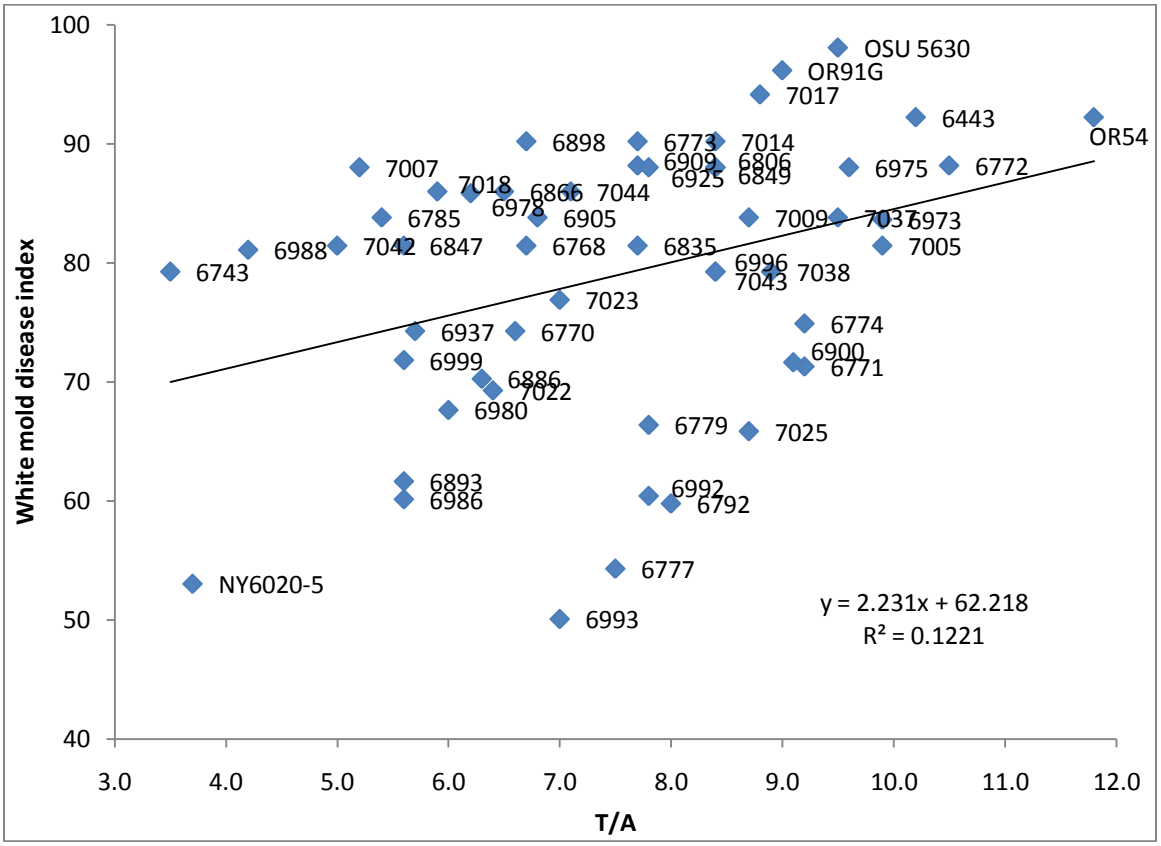

Figure 5. Disease index vs. tons per acre yield for green bean breeding lines and checks grown at the OSU Vegetable Research Farm, Corvallis, OR in 2013.

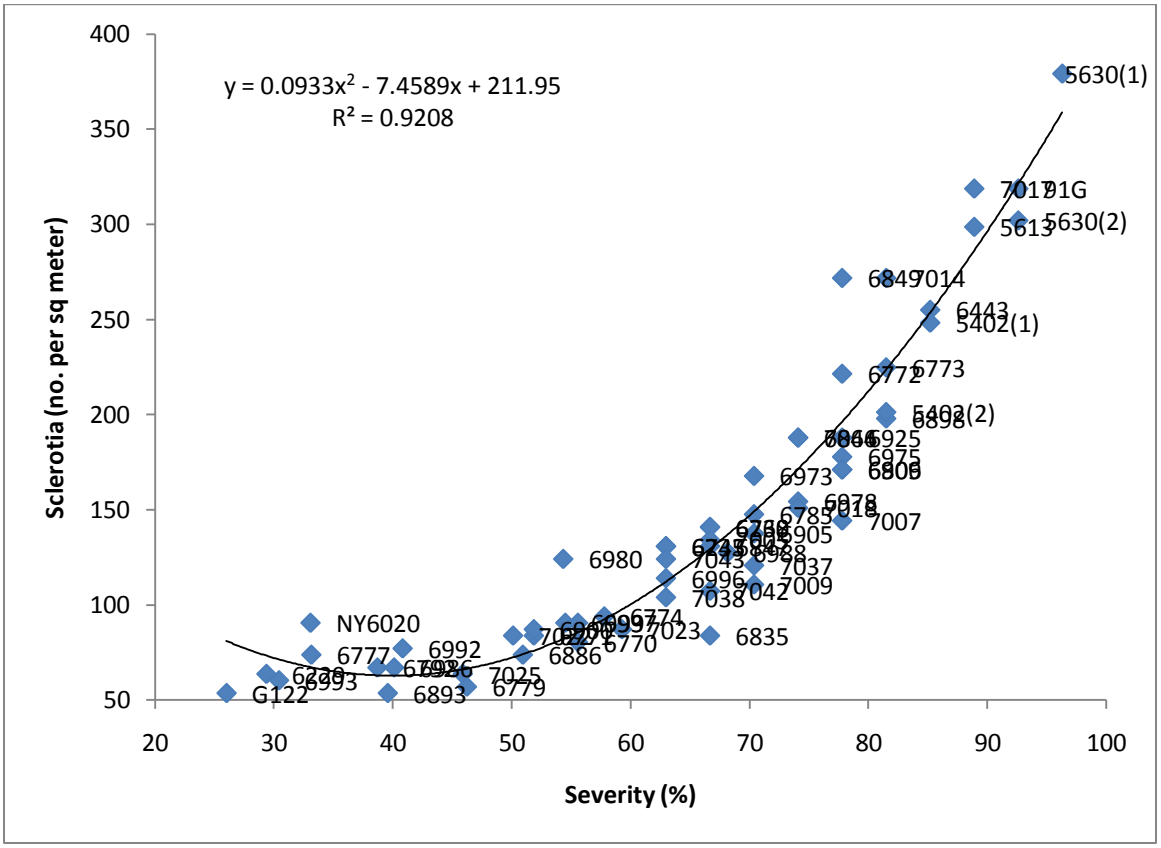

Figure 6. Disease severity vs. number of sclerotia found beneath the canopy of green bean breeding lines and checks grown in white mold screening nurseries at the OSU Vegetable Research Farm, Corvallis, OR in 2013.