

Report to the Oregon Processed Vegetable Commission
1989

1. Title: Green bean breeding and evaluation
2. Project Leaders: J. R. Baggett, Horticulture
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3. Project Status: Continuing, indefinite
4. Project Funding for Reporting Period:

Breeding: \$39,000

Processing Evaluation: \$11,450

Funds allotted to breeding were used for research farm assessments, supplies and labor for planting, plot maintenance, harvest, crosses, seed production and cleaning. Funds allotted to evaluation were used for processing labor and packaging, analytical work, conducting panel evaluations, and analysis of results.

5. Objectives: Breed bush green beans for the western Oregon processing industry with:
 - a) Improved potential for high yields at favorable sieve sizes and dependability
 - b) Improved straightness, texture, and other quality factors
 - c) Develop easy picking and small pod strains of Blue Lake type
 - d) Resistance to white mold and root rot

6. Report of Progress:

- a) A major effort in 1989 was the evaluation and comparison of a group of breeding lines for which yield and processing trials began in 1988. These were the OSU lines numbering from 5402 to 5422 which came from crosses of OSU 5078 and 5079 with a number of older OSU lines, including 5052, 5169, 5207, 5191, and Oregon 91G. The crosses were made to combine the high yield potential and upright habit of 5078 and 5079 with better pod quality, especially better smoothness, but also better color and less fiber. The best of these new lines appear to have some of the desired improvements. Several were included in yield trials in 1988, and 13 were included in 1989 replicated trials. Because of seed short-ages, only 5402, 5411, and 5417 were in all six of the 1989 trials, with all of the lines included only in trials 2 and 4. Table 1 shows results of trials 1, 3, 5, and 6, while trials 2 and 4 are reported in Table 2. Based on preliminary examination of the plots and comparisons in our seed increase-observation plots, 5406 and 5422 were not harvested in the trials and 5411 and 5412 were not harvested in trial 4.

Observations in the various plots and a field day at which processor field representatives examined harvested pods resulted in the choosing

of the most promising lines. These were 5402 and 5403, sister lines from 5078 x 5052, and 5421 from 5079 x 5207. Lines of secondary interest are 5404, 5416, and 5420. The best lines appear to consistently have smoother pods than Oregon 91G, equal color, and better length in the smaller sieve pods.

Yields in 1989 trials, while requiring repetition for several years before reliable conclusions can be made, indicated a potential for higher yields than Oregon 91G (Tables 1, 2, and 3). Data from panel quality evaluations are not available at this writing.

Commercial seed increases of 5402 were started in 1989 with the production of 17 lbs. in Idaho and a similar amount in California. Seed increases at Corvallis in 1989 were adequate to permit the initiation of commercial increases of 5403 and 5421 in 1990. An additional supply, possibly 50 lbs., of 5402 was produced at Corvallis and may be included in 1990 increases in Idaho.

- b) Older breeding lines which have been in a seed increase program, 5163 and 5256, were included in all six yield trials in 1989 and were continued in commercial seed increases. Adjusted yields of 5163 usually exceeded those of Oregon 91G, while yields of 5256 were close to those of Oregon 91G (Tables 1, 2, and 3). Both of these lines are considered to be smaller sieve than Oregon 91G and often require harvest at 60% 1-4 sieve or over for good quality, getting seedy in 5-sieve pods if harvested later (depending on environmental conditions). While processors have been interested in these lines, there has been no immediate interest in growing them in competition with Oregon 91G.

- c) Yield trials included three Romano type beans, Roma II, Roma 350, and Primo. Yield comparisons are difficult because there is no precise grading system and because Primo is slightly more plump than the Roma lines.

Roma 350 and Roma II were very similar, except that Roma 350 may have been slightly longer and darker or richer green in color. Primo has darker color, a thicker, more fleshy pod, and is several days earlier but may yield a little less on the average (Tables 1 and 2).

- d) Selection continued in small sieve and easy picking lines. Elimination for strings, fiber, and poor color has been heavy in the small sieve material, but a number of lines have been continued. New crosses involving some newly acquired small sieve varieties (i.e. Faria, Masai) as parents were in the F_1 or F_2 stage in 1989. Some of the easy picking selections have excellent plant habit and long straight pods, but most have immature white seeds which are less desirable than immature green seeds. Lines in these groups will be ready for plot trials about 1991.
- e) Sublines of Oregon 91G were examined for off-types and a number of the best lines were continued. New single plant selections were made in Oregon 91G, and each of the priority new lines (5256, 5163, 5402, 5043, etc.) to establish populations initially free from flat pod and other rogues. It is our intention to compare these populations annually, during the period the lines are being tested for potential release, to determine if there are genetic differences in susceptibility to the mutations that result in flat pods.

Observations of the flat pod type which occurs at the base of the plant late in the plant's life, indicate that it is not heritable in most cases. Distinct heritable types which are semi-sterile have been confirmed in OSU 5206. Since it does not appear that this type of mutant is a significant problem in commercial seed production and processing, it may not be studied further.

- f) Root rot and white mold plots were effective in evaluating breeding lines in 1989 (Tables 4 and 5). Generally, all acceptable Blue Lake types beans are highly susceptible to both diseases when compared under high levels of infection. Some of the new 5400 series of lines are more susceptible to white mold and root rot than Oregon 91G. Some new lines from white mold resistant crosses have approximate Blue Lake type and noticeably less susceptibility. However, the additional cycles of breeding needed to achieve competitive type and yield will likely result in loss of most of the observed resistance. New breeding lines are being obtained from the Geneva, New York Experiment Station to make additional crosses.

7. Summary:

1989 breeding line evaluations emphasized a new series of lines from crosses of OSU 5078 and 5079 x older OSU lines. These lines are potentially high yielding and several (OSU 5402, 5403, and 5421) have excellent pod smoothness and straightness surpassing Oregon 91G in 1989 trials. OSU 5402, 5403, and 5421 will be commercially increased in 1990. In the case of 5402, this will be a second year of increase and will result in several hundred lbs. of seed. Older breeding lines OSU 5163 and 5256 were increased further in 1989. OSU 5163 exceeded Oregon 91G, and OSU 5256 approximately equalled Oregon 91G in 1989 yield trials. Selection in newer material of small sieve and easy picking type continued. Root rot and white mold tests indicated most new breeding lines are equal to Oregon 91G in susceptibility to both diseases.

8. Signatures:

Submitted by:

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Table 1. Yields of selected OSU bean lines on four planting dates, Corvallis, Oregon, 1989¹

Line	Av. Stand	Harvest 1			Harvest 2			Harvest 3			Harvest 4			Harvest 5			Avg. ² Adj. T/A	LSD ³ Adj. T/A	
		Days	%	Tons Adj.	Days	%	Tons Adj.	Days	%	Tons Adj.	Days	%	Tons Adj.	Days	%	Tons Adj.			
91G	150	76	71	8.2	9.9	78	41	9.1	8.2*	79	37	10.7	9.7	80	33	11.6	9.6	9.3	1.4
5163	150	76	76	7.0	8.3	78	61	9.2	9.7	79	52	9.5	9.2*	80	42	9.7	8.6	9.1	
5256	150	78	69	8.5	9.6	79	57	7.9	8.1	80	57	8.6	8.7*	82	48	9.5	8.9	8.8	
5402	150	78	74	8.5	10.5	79	62	8.6	9.6	80	54	9.4	9.8	81	53	10.6	10.9*	10.0	
5411	150	75	63	8.1	9.1*	78	28	9.6	7.5	79	21	11.1	7.9					8.2	
5417	147	76	86	7.0	9.5	78	66	8.4	9.8	80	52	10.3	10.5*	82	43	11.5	10.7	9.9	
Roma 350	146	78	79	5.4		80	76	6.6*		82	91	9.6						7.2	
Roma II	148	78	71	8.3		80	66	8.7		82	50	9.1*						8.7	
Primo	146	74	86	5.4		76	76	6.6		78	47	7.6*						6.5	
Hystyle	150	74	58	4.9	5.0*	76	49	5.7	5.3	78	30	7.4	5.7	80	28	8.6	6.5	5.3	
91G	150	71	52	10.4	10.6*	73	42	11.1	10.2	75	25	10.6	8.0					9.6	1.9
5163	148	71	70	9.2	10.5	73	61	9.7	10.2*	75	45	10.6	9.6					10.1	
5256	150	71	76	8.4	10.0	73	67	9.1	10.1	75	53	8.6	8.4*					9.5	
5402	150	73	68	11.6	13.7	75	41	11.6	10.6*	77	35	11.1	9.4					11.2	
5411	149	70	66	9.0	10.4	73	37	5.9	5.1*									7.8	
5417	130	73	50	9.3	9.3*	75	34	11.0	9.2	77	33	12.1	10.0					9.5	
Roma 350	144	68	85	8.2		70	77	7.9		73	73	9.3*						8.5	
Roma II	140	68	84	8.7		70	78	8.1		73	62	9.4*						8.7	
Primo	142	68	73	7.3		70	62	7.3		73	55	8.4*						7.7	
Hystyle	150	68	74	8.0	9.4	70	54	7.8	7.7*	73	47	8.4	7.8	75	31	10.0	7.7	8.3	
91G	150	66	44	12.1	11.4*	68	29	11.9	9.4	70	20	12.0	8.4					9.7	1.4
5163	150	66	60	11.4	11.9*	68	34	12.9	10.4	70	28	12.7	9.5					10.6	
5256	150	66	76	10.3	12.3	67	63	10.7	11.7*	69	42	11.6	10.4	71	33	12.4	9.9	11.5	
5402	150	66	75	11.2	14.0	67	57	11.3	12.1*	69	38	11.6	10.2	71	30	13.1	10.5	12.1	
5411	150	66	41	12.8	11.6*	68	22	13.7	9.8	70	15	15.8	10.2					10.5	
5417	132	67	48	10.9	10.7*	69	32	13.0	10.7	71	25	14.1	10.6					10.7	
Roma 350	144	66	81	9.6		68	71	8.0		70	60	10.6*						9.4	
Roma II	150	66	78	10.3		68	56	10.4*		70	43	10.5						10.4	
Primo	136	66	46	11.1*		68	27	13.3		70	22	13.3						12.6	
Hystyle	150	66	36	9.8	8.0*	68	24	11.9	8.6	70	17	12.3	8.1					8.2	
91G	150	66	65	9.2	10.6	69	54	10.3	10.7*									10.6	1.8
5163	150	67	67	9.8	10.8	69	58	9.9	10.1*									10.4	
5256	150	67	80	9.3	11.4	69	74	8.8	10.3*									10.8	
5402	150	69	67	10.3	12.0	71	55	11.1	11.6*									11.8	
5417	130	67	73	9.8	12.0	69	56	8.8	9.4*									10.7	
Roma 350	142	66	85	8.5		69	84	8.7*										8.6	
Roma II	150	66	82	8.6		69	84	9.5*										9.1	
Primo	132	66	74	7.3		69	62	8.6*										8.0	
Hystyle	148	66	61	8.1	8.6*	69	43	9.6	8.6									8.6	

¹ Means of 4 replications; subplots of 5' were harvested from double 20' plots on each harvest date; rows 36" apart; days = days from planting; % = percent 1-4 sieve grades; tons = tons/acre; adj. = tons/acre adjusted to 50% 1-4 sieve, except 5163, 5256, and Hystyle, which were 55% 1-4 sieve. For Roma II, Roma 350, and Primo, yields shown as average adjusted yields were actually not adjusted.

² Average adjusted yields based on the first 3 harvests in the May 1, May 26, and June 16 plantings; for the first two harvests of the June 26 planting.

³ Analysis of variance calculated using the harvest closest to 50% 1-4 sieve (55% for 5163, 5256, and Hystyle), marked *.

Table 2. Green bean yields, May 12 and June 6 plantings, Corvallis, Oregon, 1989¹.

May 12 Planting														
Line	Av. Stand	Harvest 1				Harvest 2				Harvest 3				Avg. ² Adj. T/A
		Days	%	Tons	Adj.	Days	%	Tons	Adj.	Days	%	Tons	Adj.	
91G	150	73	46	8.4	8.1*	74	44	8.0	7.5	76	28	9.8	7.6	7.7
5073	150	70	71	7.1	8.6	71	66	7.5	8.7	73	41	7.9	7.2*	8.2
5090B	150	74	38	7.1	6.3*	76	22	10.1	7.2					6.8
5163	150	73	69	7.8	8.7	74	59	7.5	7.8*	76	38	9.0	7.6	8.0
5256	150	73	69	6.2	7.0	74	62	6.4	6.8*	76	34	7.3	5.9	6.6
5386	127	73	42	6.8	6.3*	75	28	8.6	6.7	76	31	8.7	7.0	6.7
5394	150	73	47	7.3	7.1*	75	29	8.8	7.0	76	20	10.3	7.2	7.1
5402	150	73	69	6.8	8.1	74	57	6.9	7.3*	76	29	9.5	7.5	7.6
5403	149	73	56	6.9	7.3*	75	33	9.0	7.4	76	31	9.7	7.9	7.5
5404	150	73	60	8.1	8.9	74	46	8.6	8.2*	76	30	9.9	7.9	8.3
5405	143	73	54	8.0	8.3*	75	44	8.9	8.3	77	23	9.6	7.0	7.9
5408	150	73	62	8.6	9.6	74	53	9.2	9.4*	76	38	9.5	8.3	9.1
5411	150	73	45	9.0	8.5*	75	27	9.0	7.0	77	17	10.1	6.8	7.4
5412	144	73	56	7.0	7.5*	75	30	9.0	7.2	77	20	9.0	6.3	7.0
5416	150	74	87	8.7	11.9	76	46	7.2	6.9*	77	38	8.7	7.7	8.8
5417	125	74	54	6.7	6.9*	76	29	8.8	6.9	77	23	9.1	6.6	6.8
5420	144	73	64	7.9	9.1	74	57	8.1	8.6*	76	35	9.1	7.7	8.5
5421	119	73	60	7.4	8.1	74	55	6.7	7.1*	76	28	9.9	7.7	8.4
Roma 350	145	74	81	6.8		76	70	8.2		77	69	8.0*		7.7
Roma II	127	74	85	5.6		76	77	7.0		77	67	6.6*		6.4
Primo	144	73	59	6.2*		76	39	7.1		77	34	8.8		7.4
Hystyle	150	70	72	5.5	6.3	71	67	5.0	5.6	73	46	6.1	5.6*	5.8

Table 2. Green bean yields, May 12 and June 6 plantings, Corvallis, Oregon, 1989¹ (cont.).

June 6 Planting														
Line	Av. Stand	Harvest 1				Harvest 2				Harvest 3				Avg. ² Adj. T/A
		Days	%	Tons	Adj.	Days	%	Tons	Adj.	Days	%	Tons	Adj.	
91G	150	65	65	4.7	5.5	67	48	7.9	7.7*	69	42	8.8	8.1	6.6
5073	150	65	53	7.4	7.7	67	47	9.0	8.7*					8.2
5090B	150	66	55	8.2	8.6*	69	35	9.5	8.1					8.4
5163	150	65	65	7.9	8.7	67	54	7.9	7.9*	69	49	8.0	8.6	8.3
5256	149	65	76	5.4	6.5	67	63	6.9	7.4	69	59	7.0	7.3*	7.0
5386	150	65	53	10.1	10.4	67	49	9.0	8.9*					9.6
5394	148	65	73	6.1	7.4	67	57	7.0	7.5*					7.4
5402	150	67	75	6.2	7.8	69	73	8.7	10.7	71	50	10.2	10.2*	9.2
5403	146	67	67	8.5	10.0	69	56	10.0	10.6*	71	44	11.2	10.6	10.3
5404	150	65	71	7.2	8.7	67	54	9.0	9.3*	69	42	9.6	8.9	9.0
5405	150	65	63	7.1	8.0	67	50	8.8	8.8*	69	34	10.3	8.7	8.4
5408	150	65	58	7.7	8.3	67	43	9.6	8.9*					8.6
5411														
5412														
5416	150	67	68	7.1	8.4	69	63	7.5	8.5	71	48	9.5	9.3*	8.4
5417	131	66	66	7.5	8.7	69	45	9.3	8.6*					8.6
5420	149	65	62	7.3	8.1	67	51	8.2	8.2*	69	34	7.2	6.0	8.2
5421	138	65	71	7.1	8.6	67	58	7.9	8.6	69	48	11.1	10.9*	8.6
Roma 350	148	65	84	5.7		67	78	7.2		69	74	7.8*		6.4
Roma II	148	65	90	6.5		67	84	6.3		69	71	7.9*		6.4
Primo	131	65	70	6.3		67	55	8.3*						7.3
Hystyle	148	64	59	5.2	4.6*	66	43	6.9	6.1					6.0

¹Mean of 4 replications; subplots of 5' were harvested from 20' plots on each harvest date; rows 36" apart, days = days from planting; % = percent 1-4 sieve grades; tons = tons/acre; adj. = tons/acre adjusted to 50% 1-4 sieve, except 5163, 5256, and Hystyle, which were adjusted to 55% 1-4 sieve. Analysis of variance calculated using the harvest closest to 50% 1-4 sieve for each line (55% for 5163, 5256, and Hystyle), marked with *. LSD at 5% significance = 1.2 tons/acre for May 12 planting date and 1.5 tons/acre for June 6 planting date.

²Average adjusted yields shown for Roma 350, Roma II, and Primo are actually average yields. Yields were not adjusted for these varieties.

Table 3. Summary of average yields of selected Oregon State University bean lines, 1984-1989.

Line	Adjusted ¹ Tons/Acre											1989 5-12 & 6-6	1984- ² 1989	1984- ³ 1989	
	1984 AV	1985 AV	1986 AV	1987 AV	1988 AV	1989 Planting Date									1989 AV
						5-1	5-12	5-26	6-6	6-16	6-26				
Oregon 91G	8.1	7.6	9.9	10.0	7.2	9.3	7.7	9.6	6.6	9.7	10.6	8.9	7.2	8.6	8.3
5073	9.2	8.9	11.8	10.3	7.5	---	8.2	---	8.2	---	---	---	8.2	---	9.3
5090	8.4	6.4	10.4	9.4	6.6	---	6.8	---	8.4	---	---	---	7.6	---	8.1
5163	9.2	6.4	11.5	10.8	7.2	9.1	8.0	10.1	8.3	10.6	10.4	9.4	8.2	9.1	8.9
5256	9.1	6.8	10.5	9.3	6.4	8.8	6.6	9.5	7.0	11.5	10.8	9.0	6.8	8.5	8.2
5402	---	---	---	---	---	10.0	7.6	11.2	9.2	12.1	11.8	10.3	8.4	---	---
5403	---	---	---	---	---	---	7.5	---	10.3	---	---	---	8.9	---	---
5411	---	---	---	---	---	8.2	7.4	7.8	---	10.5	---	---	---	---	---
5421	---	---	---	---	---	---	8.4	---	8.6	---	---	---	8.5	---	---
Hystyle	---	---	---	---	6.1	5.3	5.8	8.3	6.0	8.2	8.6	7.0	5.9	---	---

¹Adjusted to 50% 1-4 sieve except that in 1986-1989 5256, 5163, and Hystyle were adjusted to 55% 1-4 sieve.

²Includes only the 5-12 and 6-6 trials in 1989.

³Includes all 1989 trials.