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OSU bean program focuses on Blue Lake bush types

The bean breeding program at Oregon State University continues, the principal objective being improved varieties of bush green beans of the Blue Lake type. Although many improvements in plant type and pod quality have been made since the change from pole to bush varieties began about 20 years ago, increased costs of production and processing, and strong competition from other regions make improvements in yield and pod type as important as ever.

In the University breeding program we have concentrated our efforts on the development of bush varieties of the Blue Lake type. Blue Lake color, flavor, and texture have generally been

achieved in varieties such as 'Oregon 58' and 'Oregon 1604' and yield has generally equaled or surpassed that of varieties from other sources. In growth habit, OSU material has been improved considerably over the earlier bush Blue Lake introduction, but is still inferior to many commercial varieties, especially those considered to be non-Blue Lake in Oregon, such as 'Gallatin 50'. Blue Lake bush types tend to have crooked and bumpy pods with a tendency for blanking, and some become too large.

Characteristics currently stressed in the selection program are upright growth habit, pods which are straight, smooth, moderately long, of medium mature diameter, and with minimal side-wall fiber. Yields must approach or equal those of 'Oregon 1604'. A range of earliness is considered acceptable, but we are striving to develop some new lines as early as 'Oregon 1604' while still retaining the yield capacity. Although extremely concentrated maturity is considered undesirable by some processors because it does not permit flexibility in harvest operations, most OSU

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lines are at least moderately concentrated compared to varieties in commercial use.

Current Status of Breeding Lines

At present several breeding lines in advanced generations are considered promising. About 20 are being increased by commercial seed producers with expected seed returns varying from 200 to 10,000 lbs. The new lines came from a number of different crosses, but can be grouped to some extent with respect to origin and characteristics as described below. Yield estimates from replicated small-plot trials are shown in Table 1.

It should be recognized that the determination of potential commercial yield of a line requires several years of trial and is subject to error in small plot trials during a single year or two. For example, in 1977, root rot and symphytan problems reduced vigor in the trial. Early lines, such as 'Oregon 1604', appear to be affected more than later, more vegetative lines. Thus, the yield of some compared to 'Oregon 1604' may have been exaggerated. Indications of processing quality were obtained from panel evaluations conducted on samples uniformly processed at the Department of Food Science. Both OSU and processing industry personnel

Table 1. Yields of selected green bean breeding lines and varieties, Corvallis, OR; 1976 and 1977

Variety or OSU line no.	Parentage or source	1976		1977	
		Tons/acre	% 1-4 sieve ²	Tons/acre	% 1-4 sieve ²
Ore 1604		5.8	44	7.5	62
Ore 1604B		5.9	55	7.3	58
4091-3	B5713-1	5.9	45	7.9	62
4094-1	B5713-4	5.8	58	7.8	39
4094-3	B5713-4	6.5	53	8.1 ³	40
4117-2	B5772-2	4.8	41	5.4	50
4439-5	B5713-2	4.8	43	--	--
4755	B6519-3-2	6.2	54	8.4	56
4843	B6647-6-3-1	6.5	56	9.3	51
4846	B6647-6-3-1-1	6.7	57	7.9	53
4849-2	B6647-6-5-1	--	--	6.9	51
4852-2	B6647-8-2	--	--	8.1	62
4862	B6843-2	5.0	51	7.4	56
4883	B6849-3	--	--	7.0	43
4884	B6849-8-1	--	--	8.1	52
4886	B6849-9	--	--	9.4	52
GV50	Gallatin Valley	4.2	63	6.0	75
Galamor	" "	4.5	66	7.1	58
GP73102	Rogers Bros.	4.8	80	7.2	45
BBL73149	" "	--	--	7.1	47
BBL47	Asgrow	4.8	80	--	--
B53	"	--	--	7.9	61
NCX8013	FMC	--	--	5.3	39
E6211	Ferry Morse	--	--	8.2	78
E5200	" "	6.2	58	--	--
ISB-2	Idaho Seed Bean	4.4	55	--	--
WHP-1	" " "	--	--	8.0	40

¹ Means of 4 replications; adjusted to 50% 1-4 sieve size and adjusted for stand-by analysis of co-variance.

² Actual % 1-4 sieve size.

³ Stand very poor; yield probably overadjusted.

Table 2. Quality evaluations of selected green bean lines and varieties, 1976 and 1977.¹

Variety or OSU line Number	Canned cut, 6-sieve				Canned whole, 3-sieve								Frozen, cut, 4&5-sieve			
	Overall quality				Color				General appear.				Overall Quality			
	OSU		Industry		OSU		Industry		OSU		Industry		OSU		Industry	
	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977	1976	1977
Ore 1604	5.9	6.3	5.5	--	6.3	6.8	4.6	--	5.8	5.7	4.3	--	6.2	5.3	5.3	--
Ore 1604B	5.7	6.3	--	5.8	5.3	6.6	--	6.5	5.5	6.8	--	5.6	5.8	5.4	--	5.2
4091-3	6.0	6.3	5.7	5.9	6.4	6.8	5.6	6.7	6.7	6.1	5.4	6.3	6.4	6.2	5.8	6.2
4094-1	6.3	6.5	4.9	6.7	7.0	6.8	5.5	6.9	6.6	6.7	5.4	7.0	6.4	6.1	5.5	6.6
4094-3	6.1	6.4	5.8	7.0	6.3	7.0	6.0	7.2	6.2	7.0	5.7	7.2	6.1	6.8	5.9	6.1
4117-2	5.9	6.4	5.3	5.8	6.5	6.8	5.6	5.9	6.2	6.6	4.9	6.1	6.0	5.7	5.2	5.8
4439-5	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4755	6.3	5.3	5.5	6.7	6.8	6.8	6.2	7.1	6.1	5.9	5.9	6.6	6.7	6.3	5.7	5.4
4843	6.3	--	5.5	--	6.8	--	5.4	--	6.9	--	5.6	--	6.4	--	5.7	--
4846	6.8	5.1	5.1	5.8	6.4	6.1	4.6	6.3	6.6	6.3	5.1	6.2	6.4	5.4	5.4	6.1
4849-2	--	5.1	--	--	--	6.3	--	--	--	6.0	--	--	--	6.3	--	--
4852-2	--	5.9	--	5.9	--	6.3	--	6.1	--	6.0	--	6.1	--	6.1	--	5.5
4862	6.4	7.0	5.0	6.4	6.8	7.4	5.5	6.7	7.2	6.8	6.2	6.9	6.6	6.5	5.2	5.7
4883	--	5.9	--	6.4	--	6.8	--	7.2	--	6.8	--	7.3	--	7.0	--	6.9
4884	--	5.5	--	6.4	--	6.2	--	7.3	--	6.5	--	7.1	--	6.5	--	6.3
GV 50	6.1	5.6	4.8	--	6.8	6.0	5.2	--	6.8	6.3	5.2	--	6.7	5.4	5.2	--
Galamor	5.7	5.8	--	5.2	6.3	6.8	--	5.3	6.5	6.7	--	5.8	6.3	6.5	--	5.9
GP73102	--	5.2	--	--	--	5.8	--	--	--	5.9	--	--	--	5.7	--	--
BBL 47	6.6	--	5.0	--	6.4	--	5.2	--	6.8	--	5.0	--	6.4	--	5.4	--
B53	--	6.3	--	6.2	--	6.3	--	6.1	--	6.6	--	6.4	--	4.7	--	4.9
NCX8013	--	6.6	--	6.5	--	7.0	--	6.3	--	6.6	--	6.3	--	5.8	--	7.0
E6211	--	6.0	--	--	--	6.8	--	--	--	6.6	--	--	--	6.6	--	--

¹Samples processed in OSU Food Science pilot plant, evaluated by panels of 10-15 OSU and processing industry panels, using a scale of 1-9 where 1=poor, 9=outstanding.

participated. Table 2 shows averaged scores from 1976 and 1977 evaluations. General comments on lines or groups follow:

4091-3 - A day or two later than Ore. 1604, with a small, fairly neat plant and a concentrated crop of medium-long, straight pods. Much smoother than 1604, but with the blanking problem to a degree, this line also has darker color. Hot weather periods in 1977 indicated it will become pithy when overmature, so must be harvested on schedule. Under increase for several years, there could be as much as 10,000 lbs of seeds in Fall 1978.

4094-1 and 4094-3 - With slightly larger pods, and slightly later maturity than 4091-3, these sister lines have been rated very high in processed quality. Color and smoothness, especially in the 3-sieve vertical packs, have been outstanding. There appears to be a tendency for poor germination, although several Idaho-grown seedlots tested in 1978 germinated well.

4117-2 - This line is the earliest line under test and is one or two days earlier in maturity than 'Oregon 1604'. It does not have the yield potential of the other lines described, but general quality characteristics are fair. Seed increases were started in 1978 to permit commercial evaluation.

4439-5 - Only fair in yielding ability, this relative of 4093-4 has short, straight pods which should be highly adapted to processing plant graders and snippers. The pods are possibly too short, but seed increases are being made for commercial size trials. As much as 200 lbs of seed may be harvested in 1978.

4755 - The growth habit of this line is distinctly upright, with the long pods borne well off the ground. In July 1978, it showed a tendency for stem elongation common to many lines of Blue Lake origin, but this does not normally occur. It has yielded about the same as 'Oregon 1604', but pod straightness and smoothness are distinctly better. Two sublines are

being increased in 1978 with a possibility harvesting around 2000 lbs of each.

4843-4852 Group - Several lines in this series are being increased. They bear medium long, smooth, slender, medium dark green pods which are slow to reach sieve size 6, but may have moderate sidewall fiber when in that maturity class. The pods are borne close in the dense central area of the plant, which is very upright until the pod load becomes heavy. The suitability of this growth habit, and the acceptability of the pods for processing have not been adequately evaluated.

4862-4886 Group - This group of related lines includes six under increase in 1978. The pods of the entire group are unusually straight for bush Blue Lake material, yet this straightness does not seem to be associated with excessive pod wall fiber as is often the case. However, a few fibrous 6-sieve pods were found in the 1977 quality tests. Otherwise the quality is good, with especially good flavor in canned pods. The growth habit is somewhat open and upright and the plant has moderate vigor. Maturity is medium and yields have been fair to good. This group is considered to be potentially good with respect to processing plant efficiency because of medium length in combination with the rather consistent straightness.

Many new breeding lines are being generated from new crosses, primarily involving the above described lines as parents used in nearly all possible combinations. This approach has been used for several years because of these lines including several distinct types of plant and pods. Future breeding is likely to involve outside material to further broaden the genetic base. An additional phase of the breeding program includes a number of new crosses for root rot resistance. Existing lines from the root rot program, as well as the better horticultural lines described above, were crossed with two resistant lines released by the University of Wisconsin. The parentage of these resistant lines, Wisconsin 77 and 83,

included resistant lines developed in our program here, and sent to Wisconsin some years ago.

It is anticipated that the OSU bean breeding program will be continued at the present or an increased level of

activity, for a number of years to come.

J.R. Baggett, W.A. Frazier
Horticulture Department

G.W. Varseveld
Food Science Department

Nitrogen and phosphorus fertilizers, row spacing affect snap beans

Various rates of nitrogen and phosphorus fertilizers were tested on bush beans in 6- and 36-inch rows at the OSU Vegetable Research Farm in 1977. Nitrogen rates were approximately 0, 50, 150 and 300 pounds N per acre supplied as ammonium nitrate; phosphorus rates were 0, 50 and 150 pounds P per acre as treble superphosphate. Thus, there were 12 treatments of a 4 x 3 factorial design with four replications. Potassium sulfate was applied on all plots at a rate of 55 pounds K per acre. All of the phosphorus and potassium fertilizer, as well as 0, 50 or 100 pounds N per acre, were applied broadcast and rototilled into the soil before planting. Additional nitrogen fertilizer was broadcast and irrigated in on appropriate plots during the season. 'Oregon 1604' bush beans were planted on May 13 in 6-inch and 36-inch rows and resulted in plant populations of about 170-180,000 plants per acre and 85-95,000 plants per acre for the respective row spacings. Irrigation was by overhead sprinklers as needed at 7 to 10-day intervals. Plant and soil samples were taken on June 24, about one week before first bloom. Harvest was on July 25 and 26.

Results of fertilizer treatments at the two row spacings are summarized in Table 1. Yield increase from application of phosphorus fertilizer was significant. Phosphorus levels in soil samples (0-6 inch depth) averaged 58, 62 and 73 ppm P for the 0, 50 and 150 pounds P per acre rates, respectively. There was a general trend for an increase in yield at the 50 and 150 pound N per acre rates, then a slight decrease in yield at the 300 pound N rate, compared to the zero N rate. However, these

differences in yield were not statistically significant. The major difference in yield was due to row spacings because yield from 6-inch rows averaged about 37 percent higher than from 36-inch rows. Yield response to fertilizers was similar for both row spacings. Number of pods per plant from 10-plant samples taken from each plot at harvest was higher for plants from 36-inch rows than from 6-inch rows and usually was higher at the higher rates of nitrogen and phosphorus fertilizers, Table 1.

Average fresh weights of plants, taken about one week before bloom, were higher in 36-inch than in 6-inch rows. Addition of nitrogen and phosphorus fertilizers increased plant weights over those plants not receiving nitrogen and phosphorus.

Chemical analyses were made on leaves of plants sampled on June 24 and nitrogen, phosphorus and potassium concentrations are reported in Table 1. Addition of nitrogen fertilizer increased nitrogen concentrations in leaves of plants in 6- and 36-inch rows with slightly higher levels of nitrogen in plants from 36-inch rows. Addition of phosphorus fertilizer decreased average nitrogen concentration in leaves. Phosphorus concentrations in leaves of plants were not appreciably affected by application of phosphorus or nitrogen fertilizers. Phosphorus concentration was slightly higher in leaves of plants in 36-inch rows than in plants in 6-inch rows. Concentration of potassium in leaves of plants sampled before bloom was not consistently affected by application of nitrogen and phosphorus fertilizers. Potassium levels averaged slightly higher in leaves of plants in 36-inch rows than in 6-inch rows.

Although yield responses were obtained from broadcast application of phosphorus fertilizer in this test, band application of phosphorus is usually more efficient and economical and is recommended. Differences in phosphorus concentrations in leaves or plants from phosphorus fertilizer

applications have been most apparent early in the season than at bloom or later. Yield results confirm earlier tests showing that increases in yield of snap beans can be obtained from use of higher plant populations in closer spaced rows.

H.J. Mack
Horticulture Department

Table 1. Effects of nitrogen and phosphorus fertilizers on 'Oregon 1604' bush beans in 6- and 36-inch rows, Corvallis, 1977

	Row Spac (inches)	N fert. means (lbs. N/A)				P fert. means (lbs. P/A)		
		0	50	150	300	0	50	150
Yield (T/A)	6	10.8	11.0	11.3	11.2	10.6	11.3	11.3
	36	7.7	8.2	8.6	8.0	7.9	8.2	8.3
Sieve sizes (%) 1-4	6	43	45	46	46	45	44	46
	36	42	44	43	46	44	44	44
No. pods per plant	6	13.4	13.0	16.2	13.6	13.6	14.1	14.5
	36	18.4	22.7	20.1	19.3	18.7	20.5	21.2
Fresh wt. of plants (g)-6/24	6	13.4	14.6	15.5	14.8	12.3	14.0	17.5
	36	15.7	17.8	17.2	16.4	14.2	16.7	19.4
% N	6	4.00	4.74	5.20	5.10	4.99	4.72	4.56
	36	4.75	4.92	5.15	5.07	5.04	4.99	4.90
% P	6	.28	.29	.30	.31	.29	.30	.29
	36	.32	.33	.32	.29	.34	.30	.30
% K	6	1.59	1.75	1.88	1.35	1.82	1.68	1.68
	36	1.81	1.92	1.94	2.00	1.90	1.96	1.87

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