SOYBEAN PERFORMANCE IN OREGON IN 2000

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Introduction

Soybean is a potentially valuable new crop for Oregon. Soybean could provide a high-quality protein for animal nutrition and oil for human consumption, both of which are in short supply in the Pacific Northwest. In addition, edible or vegetable soybean production could be exported to the Orient and provide a raw material for specialized food products. Soybean is valuable as a rotation crop because of the soil-improving qualities of its residues and its N_2-fixing capability. Because of the high-value irrigated crops typically grown in the Snake River Valley, soybeans may be economically feasible only at high yields.

Soybean varieties developed for the midwestern and southern states are not necessarily well adapted to Oregon's lower night temperatures, lower relative humidity, and other climatic differences. Previous research at Ontario has shown that, compared to the commercial cultivars bred for the Midwest, plants for eastern Oregon need to have high tolerance to seed shatter and lodging, reduced plant height, increased seed set, and higher harvest index (ratio of seed to the whole plant). There is also a need to identify semi-dwarf cultivars that will grow and yield well under high seeding rates and narrow row spacing. Yields could also be increased by increasing the seeding rate from 200,000 seeds/acre to 300,000 seeds/acre if semi-dwarf lines adapted to local conditions could be identified.

M. Seddigh and G. Jolliff at Oregon State University, Corvallis, identified a soybean line that would fill pods when subjected to cool night temperatures. Those lines were crossed at Corvallis with productive lines to produce 'OR 6' and 'OR 8', among others. At this point, the development moved to Ontario, OR. The later two lines were crossed at our request for several years with early-maturing high-yielding semi-dwarf lines by R.L. Cooper (USDA, ARS, Wooster, OH) to produce semi-dwarf lines with potential adaptation to the Pacific Northwest. Selection criteria at the Malheur Experiment Station included high yield, zero lodging, zero shatter, low plant height, and maturity in the available growing season. In 1992, 241 single plants were selected from five F5 lines that were originally bred and selected for adaptation to eastern Oregon. Seed from these selections was planted and evaluated in 1993. Eighteen selections were found promising and selected for further testing in larger plots in 1994 and 1995. Starting in 1995, all lines were planted at 300,000 seeds/acre. This report summarizes work done in 2000 as part of the continuing breeding and selection program to adapt soybeans to eastern Oregon.

Methods

The 2000 line evaluation trial was conducted on Owyhee silt loam previously planted to wheat. The herbicide Dual at one lb ai/acre was broadcast preplant and incorporated with a bed harrow on May 9. Seed was planted on May 12 at 200,000 seeds/acre in rows 22 inches apart. *Rhizobium japonicum* soil-implant inoculant was applied in the seed furrow at planting. Emergence began on May 19. The crop was furrow irrigated as necessary. Eight of the single plant selections from 1992, nine cultivars, and 'OR 6' and 'OR 8' were planted in replicated plots four rows wide by 25 ft long in 2000. The experimental design was a randomized complete block with four replicates. All plots were cut to 22 ft.

Plant height and reproductive stage were measured weekly for each cultivar. Stand counts were made in 3 ft of row in each plot in 1996, 1997, 1999, and 2000. Prior to harvest, each plot was evaluated for lodging and seed shatter. Lodging was rated as the degree to which the plants were leaning over (0 = vertical, 10 = prostrate). The middle two rows in each four-row plot were harvested on September 26 using a Wintersteiger Nurserymaster small plot combine. Beans were cleaned, weighed, and oven dried to determine moisture content. Dry bean yields were corrected to 13 percent moisture. Data were analyzed by analysis of variance. Means separation was determined by the protected least significant difference (LSD) test.

Results and Discussion

Yields ranged from 37 bu/acre for 'OR-8' to 60 bu/acre for 'Korada'(Table 1). Lodging ranged from zero to two for the 1992 single plant selections and from zero to seven for the other cultivars. Of the 1992 single plant selections, 'M92-085', 'M92-213', and 'M92-330' had seed counts sufficient for the manufacturing of tofu (< 2,270 seeds/lb) in 2000 (Table 2). The cultivars 'M92-330', 'OR-8', 'Evans', and 'Sibley' had seed counts of less than 2,270 seeds/lb every year that seed counts were made. The lines 'M92-085' and 'M92-213' combine early maturity, no shatter, no lodging, seed counts and hilum color adequate for tofu (Table 3). The lines 'M92-225' and 'M92-237' made reasonable tofu in food quality tests in 1999.

In 1995 the planting rate was increased from 200,000 to 300,000 seeds/acre (Table 4). In 1999 the seeding rate was reduced to 200,000 seeds/acre. However, plant populations in 1996 and 1997 were not different from 1999 (Table 5). Plant populations were below the target of 300,000 plants/acre in 1996 and 1997 and 200,000 plants/acre in 1999 and 2000.

Table 1. Performance of soybean cultivars, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

Cultivar	Days to maturity*	Days to harvest maturity†	Lodging	Shatter	Height	Yield	Seed count	Hilum color
	days from emergence		0-10‡	percent	cm	bu/acre	seeds/lb	
M92-085	91	111	0	0	90	48.2	2,236	white
M92-213	101	111	0	0	55	44.0	2,081	tan
M92-220	101	111	1	0	100	41.4	2,461	tan
M92-225	91	111	0	0	75	49.4	2,443	white
M92-237	91	111	2	0	100	48.1	2,528	tan
M92-314	111	118	0	0	110	39.3	2,484	black
M92-330	91	111	0	0	90	52.3	2,090	black
M92-350	91	111	1	0	100	47.7	2,357	black
OR-6	91	111	2	0	90	51.1	2,316	white
OR-8	111	118	7	0	115	37.1	1,938	white
Agassiz	96	111	2	0	95	48.0	2,335	brown
Evans	101	111	7	0	115	47.5	2,180	white
Glacier	91	111	1	0	80	49.6	2,286	tan
Gnome 85	111	118	7	0	105	49.6	2,174	white
Korada	96	111	0	0	85	60.3	2,324	white
Lambert	101	111	8	0	105	57.1	2,278	brown
Lena	96	111	6	0	100	51.1	2,373	white
R0725CH	96	111	9	0	105	53.0	2,374	white
Sibley	111	118	5	0	110	40.1	1,847	white
Mean							2,269	
LSD (0.05)			2	NS		5.5	157	

*Pods yellowing, 50 percent of leaves yellow.

†Stems dry enough to be combined, 95 percent of pods brown.

‡0 = none, 10 = 100 percent lodging.

Table 2. Seed counts for soybean cultivars for 5 years, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

Cultivar	1994	1995	1996	1999	2000	average
	seeds/lb					
M92-085	2,392	2,188	2,030	2,455	2,236	2,260
M92-213	2,304	1,995	2,084	2,284	2,081	2,150
M92-217	1,976	2,033	2,000	2,149		2,040
M92-220	2,660	2,213	1,974	2,336	2,461	2,329
M92-223	2,273	2,017	1,930	2,456		2,169
M92-225	2,825	2,353	2,195	2,169	2,443	2,397
M92-237	2,449	2,142	2,049	2,547	2,528	2,343
M92-239	2,041	1,946	2,227	2,346		2,140
M92-314	2,119	2,113	1,962	2,302	2,484	2,196
M92-330	2,063	2,037	2,195	2,113	2,090	2,100
M92-350	2,580	2,219	2,168	2,218	2,357	2,308
OR-6	2,803	2,205	1,985	2,327	2,316	2,327
OR-8	2,083	2,059	2,055	2,223	1,938	2,072
Agassiz	2,372	2,166	1,984	2,230	2,335	2,217
Evans	2,232	2,152	1,972	2,187	2,180	2,145
Glacier				2,309	2,286	2,298
Gnome 85	2,463	2,167	2,040	2,003	2,174	2,169
Korada					2,324	2,324
Lambert	2,347	2,126	1,934	2,270	2,278	2,191
Lena					2,373	2,373
Minnato				3,405		3,405
Proto				2,199		2,199
R0725CH					2,374	2,374
Sibley	2,066	1,845	1,828	2,226	1,847	1,962
Vinton				1,759		1,759
Mean	2,336	2,110	2,034	2,296	2,269	2,250
LSD (0.05)		155	116	132	157	

Table 3. Maturity (days from emergence), lodging (0-10), and height (cm) of soybean lines, 1994-2000, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

Cultivar	1994			1995			1996			1997			1998			1999			2000		
	Mat	Lod	Ht	Mat	Lod	Ht	Mat	Lod	Ht	Mat	Lod	Ht	Mat	Lod	Ht	Mat	Lod	Ht	Mat	Lod	Ht
M92-085	93	2	102	106	0	95	105	6	70	100	0	80	115	0	56	107	0	76	91	0	90
M92-213	107	0	70	123	0	80	105	0	80	112	0	100	128	0	70	107	0	83	101	0	55
M92-217	107	0	68	115	0	75	105	0	86	112	0	80	137	0	55	107	0	87			
M92-220	107	4	102	123	0	80	115	2	80	112	0	85	121	0	60	107	0	85	101	1	100
M92-223	107	0	65	115	0	65	115	0	70	114	4	110	132	3	55	113	0.6	115			
M92-225	93	5	92	106	0	80	90	1	76	100	0	60	115	0	42	94	0	74	91	0	75
M92-237	100	5	106	106	0	95	90	0	88	100	0	70	115	0	49	107	0.1	104	91	2	100
M92-239	107	0	67	106	0	55	105	0	85	112	0	65	128	0	46	113	0.5	98			
M92-314	100	0	80	106	0	55	90	0	74	112	0	80	137	0	56	113	0	80	111	0	110
M92-330	100	1	101	98	2	95	90	0	74	100	0	65	115	0	46	94	0.3	85	91	0	90
M92-350	107	7	106	106	8	105	90	9	79	100	0	100	115	0	64	101	0	86	91	1	100
OR-6	100	9	107	106	2	100	98	9	97	112	3	85	115	8	60	97	0.5	105	91	2	90
OR-8	120	10	96	129	7	100	126	7	78	120	8	105	137	7	74	113	1.6	110	111	7	115
Agassiz	102	7	105	123	5	100	98	6	76	112	3	70	132	6	62	101	0.3	100	96	2	95
Evans	107	9	105	123	8	110	126	8	70	120	8	100	137	10	69	107	0.8	117	101	7	115
Glacier																101	0.8	91	91	1	80
Gnome 85	102	8	105	123	6	100	105	8	90	112	7	100	132	9	72	101	1.3	107	111	7	105
Korada																			96	0	85
Lambert	107	9	112	129	6	85	126	7	81	112	6	105	132	9	71	113	3	100	101	8	105
Lena																			96	6	100
R0725CH																			96	9	105
Sibley	114	10	110	125	8	90	126	7	75	120	9	60	137	9	42	113	3.5	110	111	5	110
Vinton																120	6	120	100	4	100
Mean	104	5	94	115	3	87	106	4	79	110	3	84	127	3	58	107	1	97	98	3	96

Table 4. Yield of soybean cultivars in 7 years; Hail depressed yields in 1998. Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

	Yield							
Cultivar	1994	1995	1996	1997	1998	1999	2000	Average 1994-2000
	bu/acre							
M92-085	63.3	48.7	41.2	50.0	29.4	48.6	48.2	47.1
M92-213	61.2	43.4	52.3	49.9	26.9	53.5	44.0	47.3
M92-217	35.7	49.3	48.8	55.2	25.3	47.7		43.7
M92-220	62.0	49.6	46.3	54.6	47.4	42.8	41.4	49.2
M92-223	45.6	55.3	34.5	45.5	20.9	39.9		40.3
M92-225	62.8	49.1	51.7	43.7	27.8	49.3	49.4	47.7
M92-237	63.1	50.6	42.1	48.5	31.9	44.8	48.1	47.0
M92-239	47.8	42.2	44.4	42.0	23.5	43.4		40.5
M92-314	63.2	48.9	57.8	49.2	28.6	47.5	39.3	47.8
M92-330	57.8	51.1	55.0	44.8	41.8	45.4	52.3	49.7
M92-350	63.6	55.2	43.0	49.9	34.9	42.4	47.7	48.1
OR-6	58.2	28.2	25.3	43.6	33.1	42.6	51.1	40.3
OR-8	66.3	34.0	22.1	34.2	13.6	40.1	37.1	35.3
Agassiz	62.4	36.3	38.6	46.0	21.7	43.9	48.0	42.4
Evans	68.6	13.2	14.2	29.9	25.0	40.0	47.5	34.1
Gnome 85	67.0	32.6	25.3	41.8	23.9	41.0	49.6	40.2
Lambert	69.6	31.7	29.4	53.6	35.2	47.5	57.1	46.3
Sibley	64.3	24.0	18.4	29.7	14.8	41.0	40.1	33.2
Average	60.1	41.3	38.4	45.1	28.1	44.5	46.7	43.3

Table 5. Plant population for soybean cultivars for 4 years, Malheur Experiment Station, Oregon State University, Ontario, OR, 1999.

Cultivar	Plant population			
	1996	1997	1999	2000
	plants/acre			
M92-085	184,533	121,664	120,780	76,230
M92-213	155,587	139,769	143,550	78,210
M92-217	72,366	153,528	92,070	
M92-220	130,259	129,630	141,570	81,180
M92-223	47,038	115,870	148,500	
M92-225	57,893	134,699	141,570	76,230
M92-237	47,038	134,699	145,530	93,060
M92-239	123,022	142,665	137,610	
M92-314	155,587	144,114	100,980	77,220
M92-330	115,786	138,320	104,940	97,020
M92-350	173,678	137,596	132,660	62,370
OR-6	188,152	133,521	153,450	81,180
OR-8	159,205	132,527	164,340	99,990
Agassiz	155,587	118,767	111,870	72,270
Evans	94,076	127,457	103,950	100,980
Glacier			179,190	73,260
Gnome 85	126,641	118,767	124,740	105,930
Lambert	249,663	137,596	188,100	110,880
Minnato			288,090	
Proto			162,360	
Sibley	115,786	131,803	99,990	98,010
Vinton			149,490	
Korada				116,820
Lena				76,230
R0725CH				87,120
Mean	130,661	132,944	142,515	87,589
LSD (0.05)		NS	22,361	25,797