

SOYBEAN PERFORMANCE IN ONTARIO IN 2001

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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 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 N₂-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, Oregon 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).

M. Seddigh and G.D. 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, Oregon. The later two lines were crossed at our request for several years with early-maturing high-yielding semi-dwarf lines by R.L. Cooper 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. A total of 18 selections were found promising and selected for further testing in larger plots in 1994 and 1995. This report summarizes work done in 2001 as part of the continuing breeding and selection program to adapt soybeans to eastern Oregon.

Methods

The trial was conducted on a silt loam previously planted to onion. Fifty lb of N, 100 lb of P, 55 lb of K, 55 lb of S, 28 lb of Mg, 1.8 lb of Zn, and 1.2 lb of Cu were broadcast in the fall of 2000. The field was then disked twice, moldboard plowed, groundhogged twice and bedded to 22-inch rows. Seed of 8 single plant selections made in 1992, 18

single plant selections made in 1999, and 7 commercial cultivars was planted on May 18 at 200,000 seeds/acre in rows 22 inches apart. Seed was treated with ApronMaxx fungicide. *Rhizobium japonicum* soil implant inoculant was applied in the seed furrow at planting. Micro-Tech herbicide at 1.5 lbs ai/ac was sprayed on May 19. Emergence started on May 24. The field was furrow irrigated as necessary. Plots were four rows wide and 22 ft long. The experimental design was a randomized complete block with four replicates.

Plant height and reproductive stage were measured weekly for each cultivar. Stand counts were made in 3 ft of the middle two rows in each plot. 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 October 4 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 test.

Results and Discussion

Yields ranged from 22 bu/acre for 'Evans' to 56 bu/acre for 'M16' and 'Korada' (Table 1). All cultivars had seed counts sufficient for the manufacturing of tofu (<2,270 seeds/lb) in 2001. All of the single plant selections made in Madras, Oregon, except 'M9' and 'M13', had lodging of 5 or more. Seven of the 1992 single plant selections had seed counts sufficient for the manufacturing of tofu (<2,270) averaged over 5 years (Table 2). The cultivars 'M92-330', 'OR-8', 'Evans', and 'Sibley' had seed counts of less than 2,270 seeds per lb every year that seed counts were made. The lines 'M92-225' and 'M92-237' made reasonable tofu in food quality tests in 1999.

Plant populations were below the target of 300,000 plants per acre in 1996 and 1997 and the target of 200,000 plants per acre in 1999, 2000, and 2001 (Table 4).

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

Cultivar	Days to maturity*	Days to harvest maturity*	Plant population plants/acre	Lodging 0-10	Shatter percent	Height cm	Yield bu/acre	Seed count seeds/lb
M92-085	104	125	77,848	3	0	90	49.8	1873
M92-213	104	125	83,280	0	0	70	28.7	1702
M92-220	119	131	77,848	2	0	83	47.2	2126
M92-225	96	119	65,175	0	0	80	42.6	2126
M92-237	104	119	71,512	5	0	90	47.8	2196
M92-314	104	125	94,142	0	0	83	42.2	2046
M92-330	104	119	89,616	1	0	90	52.2	1799
M92-350	104	125	84,185	6	0	86	46.2	2126
OR-6	104	125	84,185	9	0	71	43.6	2126
OR-8	119	131	90,521	9	0	88	24.9	1799
Evans	119	131	84,185	9	0	86	22.0	2037
Gnome 85	119	131	89,616	7	0	85	26.2	1955
Korada	104	119	89,616	4	0	92	56.0	1993
Lambert	119	131	105,005	8	0	90	38.6	2081
Sibley	104	136	91,426	8	0	91	29.3	1766
M1	104	125	85,995	5	0	90	49.8	1918
M2	104	125	126,730	5	0	97	52.1	1873
M3	104	125	96,858	4	0	81	45.9	1993
M4	104	125	102,289	5	0	88	50.3	1993
M5	104	125	95,953	6	0	85	50.3	1873
M6	96	119	92,332	5	0	80	41.8	1911
M7	104	125	124,919	7	0	81	44.7	1911
M8	96	125	113,152	7	0	81	42.7	2081
M9	104	119	66,986	3	0	86	52.0	1799
M10	104	125	85,995	6	0	87	44.0	1955
M11	104	125	81,469	6	0	94	48.3	1911
M12	104	125	93,237	5	0	82	54.6	1911
M13	104	125	107,720	3	0	88	48.7	1993
M14	104	119	86,900	5	0	87	39.3	1898
M15	104	125	107,720	7	0	90	48.0	1948
M16	104	125	119,488	4	0	93	56.4	2000
M17	104	125	86,900	6	0	89	39.9	1918
M18	104	125	124,014	6	0	80	52.7	1993
LSD (0.05)			29,955	3			8.9	127

*Days from emergence.

Cultivars M92-085 through M92-350 are from single plant selections made at the Malheur Experiment Station in 1992. Cultivars M1 through M18 are from single plant selections made from M92-330 by Peter Sexton at the Central Oregon Agricultural Research and Extension Center in Madras, Oregon in 1999.

Table 2. Seed counts for soybean cultivars for 6 years, Malheur Experiment Station, Oregon State University, Ontario, OR.

Cultivar	1994	1995	1996	1999	2000	2001	average 1994-2000
	----- seeds/lb -----						
M92-085	2392	2188	2030	2455	2236	1873	2260
M92-213	2304	1995	2084	2284	2081	1702	2150
M92-217	1976	2033	2000	2149			2040
M92-220	2660	2213	1974	2336	2461	2126	2329
M92-223	2273	2017	1930	2456			2169
M92-225	2825	2353	2195	2169	2443	2126	2397
M92-237	2449	2142	2049	2547	2528	2196	2343
M92-239	2041	1946	2227	2346			2140
M92-314	2119	2113	1962	2302	2484	2046	2196
M92-330	2063	2037	2195	2113	2090	1799	2100
M92-350	2580	2219	2168	2218	2357	2126	2308
OR-6	2803	2205	1985	2327	2316	2126	2327
OR-8	2083	2059	2055	2223	1938	1799	2072
Agassiz	2372	2166	1984	2230	2335		2217
Evans	2232	2152	1972	2187	2180	2037	2145
Glacier				2309	2286		2298
Gnome 85	2463	2167	2040	2003	2174	1955	2169
Korada					2324	1993	2324
Lambert	2347	2126	1934	2270	2278	2081	2191
Lena					2373		2373
Minnato				3405			3405
Proto				2199			2199
R0725CH					2374		2374
Sibley	2066	1845	1828	2226	1847	1766	1962
Vinton				1759			1759
Mean	2336	2110	2034	2296	2269	1983	2209
LSD(0.05)		155	116	132	157		

Table 3. Yield of soybean cultivars in 8 years. Hail depressed yields in 1998. Malheur

Experiment Station, Oregon State University, Ontario, OR.

Cultivar	Yield								Average 1994-2000
	1994	1995	1996	1997	1998	1999	2000	2001	
	----- bu/acre -----								
M92-085	63.3	48.7	41.2	50.0	29.4	48.6	48.2	49.8	47.1
M92-213	61.2	43.4	52.3	49.9	26.9	53.5	44.0	28.7	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	47.2	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	42.6	47.7
M92-237	63.1	50.6	42.1	48.5	31.9	44.8	48.1	47.8	47.0
M92-239	47.8	42.2	44.4	42.0	23.5	43.4			40.6
M92-314	63.2	48.9	57.8	49.2	28.6	47.5	39.3	42.2	47.8
M92-330	57.8	51.1	55.0	44.8	41.8	45.4	52.3	52.2	49.7
M92-350	63.6	55.2	43.0	49.9	34.9	42.4	47.7	46.2	48.1
OR-6	58.2	28.2	25.3	43.6	33.1	42.6	51.1	43.6	40.3
OR-8	66.3	34.0	22.1	34.2	13.6	40.1	37.1	24.9	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	22.0	34.1
Gnome 85	67.0	32.6	25.3	41.8	23.9	41.0	49.6	26.2	40.2
Lambert	69.6	31.7	29.4	53.6	35.2	47.5	57.1	38.6	46.3
Sibley	64.3	24.0	18.4	29.7	14.8	41.0	40.1	29.3	33.2
Average	60.1	41.3	38.4	45.1	28.1	44.5	46.7	38.7	43.5

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

Cultivar	Plant population				
	1996	1997	1999	2000	2001
	----- plants/acre -----				
M92-085	184,533	121,664	120,780	76,230	77,848
M92-213	155,587	139,769	143,550	78,210	83,280
M92-217	72,366	153,528	92,070		
M92-220	130,259	129,630	141,570	81,180	77,848
M92-223	47,038	115,870	148,500		
M92-225	57,893	134,699	141,570	76,230	65,175
M92-237	47,038	134,699	145,530	93,060	71,512
M92-239	123,022	142,665	137,610		
M92-314	155,587	144,114	100,980	77,220	94,142
M92-330	115,786	138,320	104,940	97,020	89,616
M92-350	173,678	137,596	132,660	62,370	84,185

OR-6	188,152	133,521	153,450	81,180	84,185
OR-8	159,205	132,527	164,340	99,990	90,521
Agassiz	155,587	118,767	111,870	72,270	
Evans	94,076	127,457	103,950	100,980	84,185
Glacier			179,190	73,260	
Gnome 85	126,641	118,767	124,740	105,930	89,616
Lambert	249,663	137,596	188,100	110,880	105,005
Minnato			288,090		
Proto			162,360		
Sibley	115,786	131,803	99,990	98,010	91,426
Vinton			149,490		
Korada				116,820	89,616
Lena				76,230	
R0725CH				87,120	
Mean	130,661	132,944	142,515	87,589	85,211
LSD(0.05)		NS	22,361	25,797	29,955