SOYBEAN PERFORMANCE IN ONTARIO IN 2005

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Introduction

Soybean is a potentially valuable new crop for Oregon. Soybean could provide 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 nitrogen (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, 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. This line was 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 (USDA, Agriculture Research Service, Wooster, OH) to produce semi-dwarf lines with potential adaptation to the Pacific Northwest. Selection criteria at the Malheur Experiment Station (MES) 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 5 F5 lines that were originally bred and selected for adaptation to eastern Oregon. Seed from these selections was planted and evaluated in 1993; 18 selections were found promising and selected for further testing in larger plots from 1994 through 1999. Of the 18 lines, 8 were selected for further testing. In 1999, selections from one of the advanced MES lines were made by P. Sexton at the Central Oregon Agricultural Research and Extension Center (COAREC) in Madras, Oregon. Sixteen of these selections made in Madras were chosen for further testing. In 2000, we made further selections from six of our 1992 MES lines and from OR-6.

In 2005, a new planting configuration was used; its objective was to provide a more uniform distribution of the plants over the soil surface. The more uniform plant

distribution should result in improved access to light, nutrients, and water for individual plants. This report summarizes work done in 2005 as part of our continuing breeding and selection program to adapt soybeans to eastern Oregon.

Materials and Methods

The trial was conducted on a Greenleaf silt loam (pH of 7.5 and 2.6 percent organic matter) previously planted to wheat. Two hundred lb of sulfur and 1 lb of boron were broadcast in the fall of 2004. The field was disked twice, moldboard plowed, groundhogged twice, and bedded to 30-inch rows in the spring of 2005. On May 26, Micro-Tech® herbicide was applied at 3 lb ai/acre and the field was harrowed to incorporate it.

Five commercial cultivars, 3 older lines selected at MES in 1992, 9 lines selected in 1999 at the COAREC from an advanced MES line, and 20 lines selected in 2000 at MES were planted in plots 4 rows by 25 ft. The plots were arranged in a randomized complete block design with four replicates. The seed was planted on May 27 at 200,000 seeds/acre in 3 rows on each 30-inch bed using a plot drill with disk openers. The rows were spaced 7 inches apart (Fig. 1). *Rhizobium japonicum* soil implant inoculant was applied in the seed furrow at planting. Emergence started on June 1.

The field was furrow irrigated on alternate furrows when the soil water tension at 8-inch depth reached 50-60 centibars (cb). Soil water tension was monitored by six granular matrix sensors (GMS, Watermark Soil Moisture Sensors Model 200SS, Irrometer Co., Riverside, CA) installed in the bed center at 8-inch depth. Sensors were automatically read three times a day with an AM-400 meter (Mike Hansen Co., East Wenatchee, WA).

The field was sprayed on June 8 with Poast® at 0.28 lb ai/acre and Basagran® at 0.62 lb ai/acre for weed control. For lygus bug and stinkbug control, the field was sprayed with Warrior® at 0.03 lb ai/acre and Lannate® at 0.45 lb ai/acre on July 20, and with dimethoate at 0.5 lb ai/acre on August 16. For spider mite control, the field was sprayed with Comite® at 1.6 lb ai/acre on August 20.

Plant height and reproductive stage were measured weekly for each cultivar. 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 beds in each four-bed plot were harvested on October 7 using a Wintersteiger Nurserymaster small plot combine. Beans were cleaned, weighed, and a subsample was oven dried to determine moisture content. Samples of selected cultivars were sent to Oregon State University for analysis of crude fat and crude protein. Crude fat was analyzed using ether extraction and crude protein was analyzed using a copper catalyst Kjeldahl method. Moisture at the time of analysis was determined by oven drying at 100°C for 24 hours. Dry bean yields, crude fat, and crude protein were corrected to 13 percent moisture. Variety lodging, plant population, yield,

and seed count were compared by analysis of variance. Means separation was determined by the protected least significant difference test.

Results and Discussion

Yields in 2005 ranged from 56.2 bu/acre for 'Sibley' to 76.6 bu/acre for '107' (Table 1). Several of the lines had seed counts sufficient for the manufacturing of tofu (<2,270 seeds/lb). Several lines combined high yields, little lodging, and early maturity.

Crude fat ranged from 20.49 percent for 'M92-220' to 21.77 percent for 'M92-085' (Table 2). Crude protein ranged from 34.27 percent for '106' to 36.54 percent for M92-220.

On average, yields in 2005 were the highest in the last 4 years (Table 3), possibly as a result of the modified planting configuration. The planting configuration used previously had seeds planted in single rows on 22-inch beds. In 2005 there were 3 rows on a 30-inch bed.

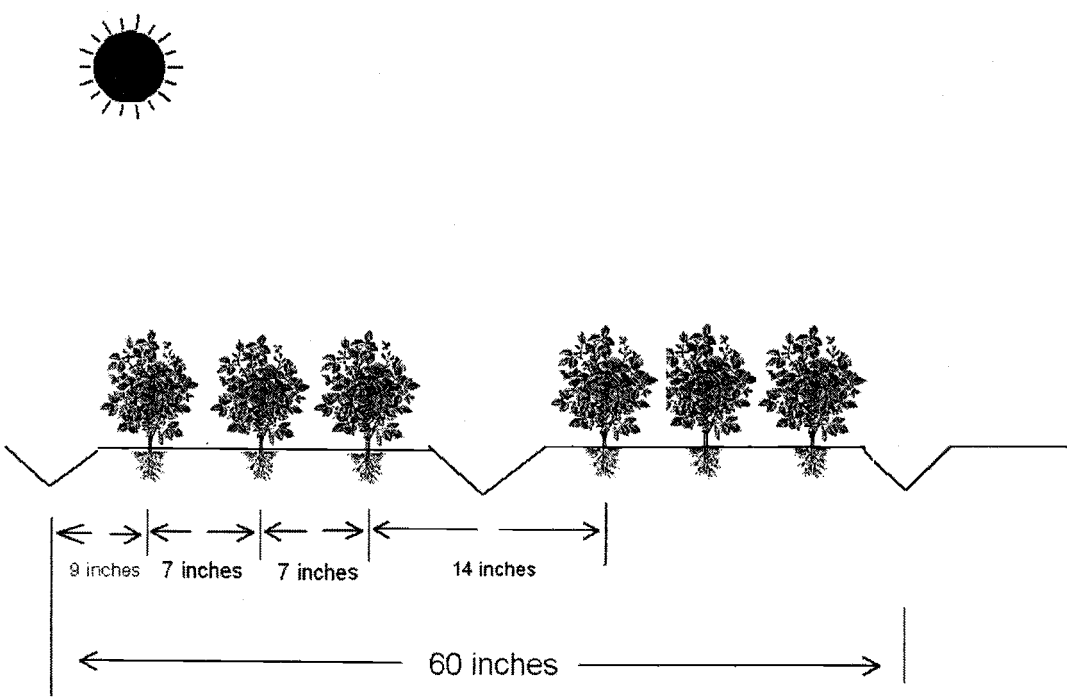

Figure 1. Soybean planting configuration used in 2005, Malheur Experiment Station, Oregon State University, Ontario, OR.

Table 1. Performance of soybean cultivars ranked by yield in 2005, Malheur Experiment Station, Oregon State University, Ontario, OR.

Cultivar	Origin	Days to maturity	Days to harvest maturity	Lodging	Height	seeds/lb	Yield
		--- days from emergence ---		0-10	cm	seeds/lb	bu/acre
107	M92-085	97	107	5.0	87	2,269	76.6
101	M92-085	97	121	6.0	105	2,295	74.4
M9	M92-330	97	121	7.5	80	2,292	73.9
M15	M92-330	97	121	4.5	100	2,220	73.8
103	M92-085	97	107	5.8	96	2,318	73.7
Lambert		107	121	9.3	79	2,304	73.3
M1	M92-330	97	121	6.0	85	2,284	73.0
M4	M92-330	97	107	4.3	86	2,349	73.0
106	M92-085	97	121	5.8	77	2,299	72.0
M92-085		97	121	5.8	81	2,255	71.8
905	OR-6	97	107	9.0	77	2,430	71.1
104	M92-085	97	121	5.3	98	2,395	70.9
909	OR-6	97	121	9.3	82	2,391	70.8
108	M92-085	97	121	4.8	86	2,379	70.5
M12	M92-330	97	121	6.8	84	2,290	70.4
608	M92-314	97	121	6.8	87	2,294	70.2
M3	M92-330	97	107	3.8	100	2,352	69.6
Evans		107	121	9.3	76	2,286	69.3
M16	M92-330	97	121	4.3	93	2,268	69.1
514	M92-237	107	121	7.3	108	2,345	68.5
312	M92-220	107	121	5.8	102	2,403	68.4
311	M92-220	107	121	7.0	104	2,409	68.1
M92-225		97	121	5.8	101	2,338	68.0
M13	M92-330	97	121	4.0	99	2,253	67.9
Korada		107	121	5.3	105	2,306	67.8
303	M92-220	97	121	7.0	110	2,480	67.7
309	M92-220	107	121	6.0	96	2,447	67.5
601	M92-314	107	121	6.5	101	2,336	65.6
Gnome 85		107	121	9.5	75	2,300	65.4
OR-6		97	121	9.5	74	2,344	65.1
511	M92-237	107	121	7.0	101	2,563	65.0
308	M92-220	107	121	5.3	99	2,396	64.5
307	M92-220	107	121	6.5	100	2,404	64.3
305	M92-220	107	121	6.0	103	2,427	64.2
M92-220		107	121	8.3	101	2,393	63.4
313	M92-220	107	121	7.5	98	2,506	62.5
M2	M92-330	107	121	6.5	74	2,296	62.0
OR-8		114	121	9.8	80	2,041	57.8
Sibley		114	121	9.8	75	1,976	56.2
LSD (0.05)				2.0		131	8.0

Table 2. Quality analysis for selected cultivars. Data was corrected to 13 percent moisture, Malheur Experiment Station, Oregon State University, Ontario, OR, 2005.

Cultivar	Crude fat	Crude protein
	%	
M92-085	21.77	36.44
M92-220	20.49	36.54
M92-225	21.19	36.50
M1	21.54	36.03
M2	21.42	35.78
M3	21.49	36.05
M4	21.14	36.26
M9	21.45	35.82
M12	21.04	35.64
M13	21.11	35.59
M15	20.67	35.68
M16	21.57	36.29
101	21.28	35.90
106	20.93	34.27
107	21.12	34.93
LSD (0.05)	0.44	0.76

Table 3. Performance of soybean varieties over years, Malheur Experiment Station, Oregon State University, Ontario, OR.

Cultivar	Yield				Average 2002-2005				
	2002	2003	2004	2005	Yield	Days to maturity	Lodging	Height	Seed count
	---------- bu/acre ----------				bu/acre		0-10	cm	seeds/lb
107	66.9	59.5	61.5	76.6	66.1	89.8	3.5	86.3	2,187
M9	66.3	55.4	68.2	73.9	66.0	91.8	5.0	87.0	2,217
M12	65.7	56.1	70.5	70.4	65.7	94.8	4.3	85.5	2,125
M15	73.8	52.4	61.8	73.9	65.5	95.0	3.6	92.0	2,204
106	72.9	55.4	60.9	72.0	65.3	91.5	3.6	83.0	2,117
104	66.3	57.5	65.8	70.9	65.1	93.0	4.1	93.0	2,228
M92-085	64.1	61.6	62.5	71.9	65.0	96.8	3.7	88.0	2,155
108	68.1	54.3	66.9	70.5	64.9	91.5	3.2	85.5	2,180
103	69.6	55.3	60.6	73.7	64.8	91.5	3.7	91.0	2,140
M1	65.7	59.7	60.3	73.0	64.7	93.0	3.8	85.3	2,239
M3	63.7	52.1	68.7	69.6	63.5	95.0	3.6	93.3	2,254
M13	70.4	53.2	61.8	67.9	63.3	93.0	3.5	91.5	2,251
M16	65.7	55.6	62.2	69.1	63.2	93.0	2.8	92.5	2,183
M4	66.1	55.3	58.1	73.0	63.1	95.0	3.1	84.3	2,236
101	68.6	49.5	59.7	74.4	63.1	93.5	4.1	90.8	2,094
312	64.7	53.1	64.7	68.4	62.7	102.5	2.3	91.3	2,428
601	68.5	54.4	61.9	65.6	62.6	101.0	2.7	91.3	2,379
303	64.2	54.7	63.0	67.7	62.4	100.3	3.8	94.3	2,469
Korada	67.2	55.2	57.7	67.8	62.0	102.8	4.4	86.3	2,384
Lambert	62.9	58.6	52.7	73.3	61.9	104.3	8.1	86.0	2,343
305	68.8	57.4	54.8	64.2	61.3	102.8	2.7	84.3	2,450
M2	65.0	57.9	60.1	62.0	61.3	99.3	4.3	84.0	2,144
608	68.2	49.5	56.4	70.2	61.1	93.0	3.8	86.8	2,161
511	67.2	53.8	58.0	65.0	61.0	101.0	3.2	88.8	2,519
309	65.3	48.4	62.8	67.5	61.0	102.8	3.1	90.5	2,501
307	69.1	54.5	55.1	64.3	60.8	101.0	2.9	89.8	2,497
514	66.4	52.5	54.9	68.6	60.6	93.8	2.5	89.5	2,284
311	60.4	51.1	59.9	68.1	59.9	102.5	2.1	87.3	2,404
313	63.6	53.8	59.5	62.5	59.8	104.3	4.5	91.0	2,460
M92-220	69.4	49.5	57.0	63.4	59.8	102.8	4.4	97.3	2,515
308	65.7	49.4	59.4	64.6	59.8	104.3	1.8	87.5	2,503
M92-225	58.9	50.1	56.5	68.0	58.4	89.8	3.7	89.8	2,292
909	53.3	53.2	53.0	70.8	57.6	91.8	7.4	87.3	2,301
Gnome 85	60.0	48.7	52.9	65.4	56.8	102.8	8.0	85.5	2,220
905	48.6	50.3	55.1	71.1	56.3	91.8	7.5	85.5	2,378
OR-6	51.5	49.6	50.1	65.1	54.1	95.0	7.9	84.8	2,328
Evans	51.3	41.0	50.9	69.3	53.1	104.3	8.8	87.8	2,232
Sibley	51.0	40.5	49.0	56.2	49.2	109.5	9.0	87.3	2,111
OR-8	45.3	39.4	44.2	57.8	46.7	106.0	8.8	84.5	2,102
Average	63.9	52.8	59.0	68.4	61.0	97.6	4.4	88.4	2,288
LSD (0.05)	10.1	10.7	8.4	8.0					