

SOYBEAN PERFORMANCE IN ONTARIO IN 2018

Clinton C. Shock, Erik B. G. Feibert, Alicia Rivera, and Kyle D. Wieland, Malheur Experiment Station, Oregon State University, Ontario, OR

Introduction

Soybean is a potentially valuable new crop for the Pacific Northwest (PNW). Soybean can provide raw materials for biodiesel, high-quality protein, and oil for human consumption, all of which are in short supply in the PNW. In addition, edible or vegetable soybean production can provide a raw material for specialized food products. Soybean is valuable as a rotation crop because of the soil-improvement effects of its residues and its nitrogen (N₂)-fixing capability. Because high-value irrigated crops are typically grown in the Snake River Valley, soybeans may be economically feasible only at high yields. The most common rotation crop in the Treasure Valley is irrigated winter wheat, so soybeans need to be competitive in value with winter wheat.

This report summarizes work done in 2018 as part of our continuing breeding and selection program to adapt soybeans to eastern Oregon and includes the added yield enhancements achieved by changing the planting configuration. Our soybean reports from the last decade are available at our station web site <<http://www.cropinfo.net>>. There is a search function on the home page that will conveniently find all of our recent reports dealing with soybeans by using the key word “soybean”.

Materials and Methods

The 2018 trial was conducted on Greenleaf silt loam soil previously planted to wheat. A soil analysis taken in the fall of 2017 showed that the top foot of soil had a pH of 7.9, 2.9% organic matter, 4 ppm nitrate, 1 ppm ammonium, 47 ppm phosphorus (P), 358 ppm potassium (K), 23 ppm sulfur (S), 2131 ppm calcium, 486 ppm magnesium (Mg), 125 ppm sodium, 4.2 ppm zinc (Zn), 3 ppm manganese (Mn), 1.8 ppm copper (Cu), 10 ppm iron, and 0.2 ppm boron (B). In the fall of 2017, the wheat stubble was shredded and the field was irrigated. The field was then disked. Based on a soil analysis, 104 lb K/acre, 53 lb of S/acre, 9 lb of Mn/acre, and 1 lb of B/acre were broadcast before plowing. After the fertilizer was spread, the field was moldboard plowed, groundhogged twice, and bedded to 30-inch rows. On May 14, Outlook[®] herbicide was applied at 18 oz (0.84 lb ai)/acre and incorporated during planting.

Fifty-five lines selected in 2009 and 2010 were evaluated. The 55 selections were planted in plots 4 rows wide by 25 ft long. The experimental design was a randomized complete block design with four replicates. The seed was planted on May 15 at 200,000 seeds/acre in 3 rows on each 30-inch bed using a plot drill with disc openers. The rows were spaced 7 inches apart. *Bradyrhizobium japonicum* inoculant (ABI Inoculant, Advanced Biological Marketing, Inc., Van Wert, OH) was applied to the seed before planting. Emergence started on May 22. The field was furrow irrigated to maintain the soil water tension below 60 cb at 8-inch depth.

Plant height in each plot was measured on July 30. Each plot was evaluated for lodging and seed shatter on October 15. 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 22-24 using a Wintersteiger Nurserymaster small-plot combine. Beans were cleaned, weighed, and a subsample was oven dried to determine moisture content. Moisture at the time of analysis was determined by oven drying at 100°C for 24 hours. Dry bean yields were corrected to 13% moisture.

Results and Discussion

Plant stands in 2018 were fair to poor. Seed were drilled into uneven beds that dried too quickly. The poor plant stands compromised productivity. Yields in 2018 averaged 55 bu/acre and ranged from 44 bu/acre for selection 20-7-09 to 68 bu/acre for selection 11-3-2010 (Table 1). Many lines had seed counts sufficient for the manufacturing of tofu (<2,270 seeds/lb). All of the soybean materials evaluated had light-colored seed coats and pale hilums. Averaged over cultivars and years, seed yields averaged 59 bu/acre and seed size averaged 2,336 seeds/lb (Table 2).

Summary

Reasonable soybean yields can be achieved in the Treasure Valley by employing varieties selected for the environment, high planting rates, modest fertilization, use of *Bradyrhizobium japonicum* inoculation, proper May planting dates, appropriate irrigation, and timely control of lygus bugs and spider mites.

Acknowledgements

This project was funded by Oregon State University, Malheur County Education Service District, and was supported by Formula Grant nos. 2018-31100-06041 and 2018-31200-06041 from the USDA National Institute of Food and Agriculture.

Table 1. Performance of soybean cultivars in 2018. Malheur Experiment Station, Oregon State University, Ontario, OR. Table 1 continues on the next page.

Selection	Cross	Interm. sel.	Yield bu/acre	Height cm	Days to maturity from emergence	Lodging 0-10	Seed size seeds/lb
8-2-10	Korada		58.8	103	113	7	2,259
11-21-09	M92-330	M1	50.8	100	113	6	2,265
11-3-10	M92-330	M1	68.0	101	113	6	2,121
12-1-10	M92-330	M2	49.7	102	106	8	2,128
12-7-10	M92-330	M2	55.4	101	106	5	2,064
14-3-10	M92-330	M4	53.0	103	106	5	2,124
14-4-10	M92-330	M4	55.9	102	106	4	2,045
14-5-10	M92-330	M4	57.2	103	106	3	2,045
14-8-10	M92-330	M4	56.3	102	106	5	2,141
15-3-10	M92-330	M9	57.7	104	106	5	2,115
16-8-10	M92-330	M12	59.4	104	106	6	2,030
16-10-10	M92-330	M12	59.2	103	106	6	2,127
17-4-10	M92-330	M13	57.5	104	106	4	2,132
17-5-10	M92-330	M13	55.4	101	106	3	1,979
17-10-10	M92-330	M13	57.9	103	106	6	2,009
18-2-10	M92-330	M15	56.6	102	113	4	2,094
18-7-10	M92-330	M15	56.8	102	106	6	1,966
18-8-10	M92-330	M15	63.7	103	106	4	1,949
19-6-10	M92-330	M16	59.4	103	106	5	1,954
19-7-10	M92-330	M16	60.6	103	106	6	2,028
19-8-10	M92-330	M16	57.2	103	106	5	1,967
19-9-10	M92-330	M16	56.6	103	113	8	2,186
19-10-10	M92-330	M16	59.2	104	106	3	2,058
20-7-09	M92-085	101	43.8	103	106	5	2,202
20-11-09	M92-085	101	49.3	104	113	5	2,217
20-11-09	M92-085	101	45.3	101	113	5	2,556
20-1-10	M92-085	101	52.6	103	106	5	2,062

Table 1. (Continued.) Performance of soybean cultivars in 2018. Malheur Experiment Station, Oregon State University, Ontario, OR.

Selection	Cross	Interm. sel.	Yield	Height	Days to maturity	Lodging	Seed size
			bu/acre	cm	from emergence	0-10	seeds/lb
20-4-10	M92-085	101	55.6	100	106	4	1,972
20-6-10	M92-085	101	58.6	103	106	5	2,152
20-7-10	M92-085	101	50.3	102	113	6	2,001
21-12-10	M92-085	103	59.4	103	113	7	2,140
23-6-10	M92-085	106	61.3	104	113	6	1,988
24-1-09	M92-085	107	58.8	99	113	2	2,425
24-2-09	M92-085	107	48.0	103	113	7	2,245
24-2-09	M92-085	107	46.9	103	113	7	2,415
24-3-10	M92-085	107	58.3	102	106	4	2,058
30-1-10	M92-220	303	48.2	99	113	5	2,357
30-3-10	M92-220	303	53.2	100	113	4	2,266
30-5-10	M92-220	303	53.0	98	113	6	2,135
31-1-10	M92-220	305	47.3	102	113	7	2,349
31-3-10	M92-220	305	51.4	103	113	6	2,345
31-5-10	M92-220	305	47.4	101	113	5	2,287
31-8-10	M92-220	305	50.6	102	118	3	2,302
32-3-10	M92-220	307	51.6	100	118	3	2,262
34-1-10	M92-220	309	51.2	100	106	6	2,138
34-11-10	M92-220	309	47.8	98	113	7	2,139
35-6-10	M92-220	311	52.1	102	113	5	2,184
36-6-10	M92-220	312	50.0	100	113	5	2,435
36-7-10	M92-220	312	52.9	104	106	4	2,225
36-10-10	M92-220	312	58.8	102	106	4	2,055
37-9-10	M92-220	313	64.9	102	106	6	2,722
40-3-10	M92-314	601	59.5	103	113	5	1,978
41-3-10	M92-314	608	60.1	103	113	6	1,973
42-8-10	OR-6	905	48.0	105	120	10	2,541
43-10-10	OR-6	909	44.7	108	120	10	2,254
Average			54.6	102	110	5.3	2,167
LSD (0.05)			8.6	4		2.4	207

Table 2. Yield and seed size for soybean cultivars from 2014 to 2018. Malheur Experiment Station, Oregon State University, Ontario, OR. Planting dates were: May 28, 2014, May 26, 2015, June 3, 2016, May 19, 2017, and May 15, 2018. Table 2 continues on next page.

Selection	Yield						Seed size					
	2014	2015	2016	2017	2018	Average	2014	2015	2016	2017	2018	Average
	----- bu/acre -----						----- seeds/lb -----					
8-2-10	63.1	61.0	53.9	57.1	58.8	58.8	2364	2138	2570	2630	2259	2392
11-21-09	70.3	73.8	46.8	61.2	50.8	60.6	2302	2245	2717	2815	2265	2509
11-3-10	64.5	73.4	56.8	64.8	68.0	65.5	2322	1945	2719	2398	2121	2336
12-1-10	62.2	64.0	49.9	58.7	49.7	56.9	2182	1964	2710	2452	2128	2287
12-7-10	71.6	66.2	41.6	59.2	55.4	58.8	1991	1837	2629	2429	2064	2190
14-3-10	64.2	68.5	40.5	64.5	53.0	57.3	2072	1936	2684	2343	2124	2232
14-4-10	71.4	75.6	45.8	60.8	55.9	61.9	2104	1971	2680	2389	2045	2238
14-5-10	66.5	70.6	47.0	63.1	57.2	60.9	2106	1943	2642	2326	2045	2213
14-8-10	71.2	73.3	51.3	63.0	56.3	63.0	2091	1883	2711	2401	2141	2245
15-3-10	67.6	73.6	48.0	64.6	57.7	62.3	2172	1952	2626	2389	2115	2251
16-8-10	72.4	73.2	53.9	63.4	59.4	64.5	2154	1869	2700	2378	2030	2226
16-10-10	66.8	70.2	42.5	59.8	59.2	59.7	2091	1917	2717	2430	2127	2284
17-4-10	70.2	71.6	51.0	63.3	57.5	62.7	2121	1941	2693	2436	2132	2264
17-5-10	68.4	69.0	46.8	61.0	55.4	60.1	2079	1919	2741	2451	1979	2234
17-10-10	62.7	72.5	45.4	61.1	57.9	59.9	2199	1942	2686	2377	2009	2243
18-2-10	65.3	71.9	44.2	61.6	56.6	59.9	2183	1942	2641	2462	2094	2265
18-7-10	67.4	68.7	46.4	56.5	56.8	59.2	2014	1894	2828	2403	1966	2221
18-8-10	70.2	64.5	46.8	61.9	63.7	61.4	2093	1911	2638	2340	1949	2186
19-6-10	67.2	70.8	42.6	67.1	59.4	60.8	2045	1944	2627	2312	1954	2176
19-7-10	61.4	69.2	46.6	66.9	60.6	60.6	2105	1953	2663	2461	2028	2242
19-8-10	75.1	65.5	44.0	65.8	57.2	61.5	1998	1961	2595	2317	1967	2168
19-9-10	65.1	67.4	55.8	65.1	56.6	62.0	2195	2055	2742	2624	2186	2360
19-10-10	63.1	62.7	54.8	61.9	59.2	60.3	2087	1872	2624	2412	2058	2211
20-7-09	61.8	66.8	42.0	58.8	43.8	54.6	2318	2225	2707	2876	2202	2466
20-11-09	68.1	65.0	44.0	60.0	49.3	57.3	2368	2368	2725	2809	2217	2497
20-11-09	64.6	67.0	46.0	59.1	45.3	56.4	2359	2187	2667	2901	2556	2534
20-1-10	60.2	72.2	45.3	58.6	52.6	57.8	2169	1978	2589	2307	2062	2221

Table 2. (Continued.) Yield and seed size for soybean cultivars from 2014 to 2018. Malheur Experiment Station, Oregon State University, Ontario, OR.

Selection	Yield						Seed size					
	2014	2015	2016	2017	2018	Average	2014	2015	2016	2017	2018	Average
	----- bu/acre -----						----- seeds/lb -----					
20-4-10	67.2	70.2	45.3	61.7	55.6	60.0	2079	1,941	2,658	2,392	1,972	2208
20-6-10	67.7	68.3	48.3	54.2	58.6	59.4	2116	1,952	2,603	2,462	2,152	2274
20-7-10	60.8	67.1	44.5	63.2	50.3	57.2	2062	1,905	2,665	2,334	2,001	2193
21-12-10	65.6	68.4	51.3	58.5	59.4	60.7	2178	2,014	2,645	2,528	2,140	2301
23-6-10	57.5	68.7	51.9	62.6	61.3	60.4	2098	1,973	2,587	2,428	1,988	2215
24-1-09	63.7	60.7	51.8	63.8	58.8	59.7	2458	2,443	2,815	2,896	2,425	2637
24-2-09	59.3	62.7	54.3	55.6	48.0	56.0	2350	2,099	2,734	2,923	2,245	2470
24-2-09	67.0	57.6	41.5	58.7	46.9	54.3	2392	2,139	2,678	2,943	2,415	2560
24-3-10	68.4	58.9	50.4	60.3	58.3	59.3	2131	1,977	2,688	2,291	2,058	2229
30-1-10	65.5	62.4	45.3	62.9	48.2	56.9	2279	2,269	2,635	2,880	2,357	2484
30-3-10	66.8	63.7	48.4	59.1	53.2	58.2	2296	2,200	2,666	2,727	2,266	2431
30-5-10	67.8	65.0	51.9	61.3	53.0	59.8	2347	2,259	2,767	2,717	2,135	2445
31-1-10	65.8	68.2	48.3	58.5	47.3	57.6	2294	2,154	2,587	2,775	2,349	2432
31-3-10	66.3	63.5	48.7	59.1	51.4	57.8	2244	2,181	2,646	2,773	2,345	2438
31-5-10	65.2	59.6	49.9	61.8	47.4	56.8	2362	2,185	2,658	2,892	2,287	2477
31-8-10	64.3	58.7	53.1	66.1	50.6	58.5	2202	2,148	2,684	2,712	2,302	2410
32-3-10	69.6	60.9	50.2	62.5	51.6	59.0	2355	2,112	2,682	2,744	2,262	2431
34-1-10	65.9	58.3	45.0	57.0	51.2	55.5	2170	2,062	2,670	2,766	2,138	2361
34-11-10	57.0	61.2	45.2	53.0	47.8	52.8	2302	2,036	2,745	2,838	2,139	2412
35-6-10	62.6	65.1	48.8	69.6	52.1	59.7	2445	2,127	2,647	2,875	2,184	2455
36-6-10	55.7	62.9	37.0	59.4	50.0	53.0	2383	2,118	2,739	2,911	2,435	2517
36-7-10	58.5	59.9	48.6	62.6	52.9	56.5	2310	2,171	2,729	2,826	2,225	2452
36-10-10	67.5	66.7	53.7	61.6	58.8	61.7	2065	1,907	2,637	2,356	2,055	2204
37-9-10	69.5	68.1	49.9	61.3	64.9	62.8	2097	1,995	2,735	2,528	2,722	2357
40-3-10	67.6	60.7	47.7	65.0	59.5	60.1	2163	1,947	2,812	2,460	1,978	2272
41-3-10	66.7	56.2	53.7	65.6	60.1	60.4	2134	1,916	2,614	2,329	1,973	2193
42-8-10	29.9	53.4	52.4	48.2	48.0	46.4	2848	2,241	2,688	2,783	2,541	2620
43-10-10	52.3	53.4	56.2	43.9	44.7	50.1	2121	1,944	2,457	2,885	2,254	2332
Average	64.8	65.8	48.2	60.8	54.6	58.8	2210	2038	2675	2579	2167	2336
LSD(0.05)	8.9	4.7	8.7	8.4	8.6	3.7	152	93	NS	170	207	80