



RESULTS OF AGRONOMIC, CROPPING SYSTEMS AND WEED SCIENCE RESEARCH CONDUCTED IN SOUTH CENTRAL MONTANA – 2018

The Annual Report of the Investigations at and Administration of the
Southern Agricultural Research Center, Huntley, Montana

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- PROJECT TITLE:** Irrigated Commercial Soybean Cultivar Performance Trial near Huntley, Montana. (Exp. 188009).
- PROJECT LEADERS:** Kenneth D. Kephart, Agronomist, SARC, Huntley
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- PROJECT PERSONNEL:** Tom A. Fischer, Research Specialist and Farm Foreman, SARC, Huntley
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- OBJECTIVES:** To provide growers in south-central Montana with a reliable, unbiased, up-to-date source of information that will permit valid comparisons among improved soybean cultivars for irrigated grain production. This information should help producers in south-central Montana select soybean cultivars best suited to this region of the state.
- METHODS:** For 2018, three private companies submitted 18 soybean cultivars for testing under flood irrigated conditions near Huntley, Montana (Table 1). A summary for a limited number of traits for all entries is provided in Table 2. All of the cultivars entered in the 2018 trial appeared to be genetically modified for herbicide tolerance. Relative maturity group (MG) ratings varied from MG 0.3 to MG 1.2, with most entries rated as mid-to-late MG 0 types. The study was planted using an alpha-lattice design with four replications. Test plots consisted of a 15-foot, 7-row plot with 7-inch row spacing. Each plot was planted with 310 seeds, equal to planting 220,000 seeds per acre. Planting depth was set at 1½ inches deep. Plot stands were determined by counting the number of established plants along 3.3 feet (1 meter) of two interior rows at approximately the 3 to 5 leaf stage of crop development. All rows of each test plot were subsequently trimmed 36 inches. All rows of each plot were harvested using an experimental-plot combine. Test weight (pounds per bushel) and percent grain moisture content were obtained for each plot using a Dickey-john GAC 2100 grain analyzer. Grain protein, oil, and fiber content were estimated by near-infrared reflectance using a Perten IM9500+ NIR spectrometer and adjusted to 100 percent dry matter content. Recorded grain yields were adjusted to 13% grain moisture content, and are reported in bushels per acre based on a 60-pound standard bushel weight.
- RESULTS and SUMMARY:** Conditions were colder than average during March and April of 2018, but rose above average for May, while precipitation was well above average throughout most of the growing season (Table 3). Record winter snowfall and the above average precipitation in the spring led to above average surface soil moisture conditions at planting, facilitating quick emergence, establishment and early growth of the soybeans. The last freezing date in the spring of 2018 (April 25th), occurred before planting on May 4th. Final crop establishment was quite variable in 2018, ranging from slightly less than 205,000 plants/acre for 'Innotech IS0638' to almost 262,000 plants/acre for 'Innotech IS0481' (Table 4).
- The frost-free period for the 2018 growing season at Huntley spanned from April 25th to September 21st, resulting in a 149-day growing season (Table 3). This interval is 24 days longer than the normally expected frost-free period at this location. Total accumulated heat units (2,138 °F, GDD₅₀) for the season were 145 °F warmer than the heat units normally expected to accumulate on average for this 149-day interval, and 6 percent above the level of heat units normally

expected to accumulate during a typical 125-day frost-free growth period. June and July growing conditions were close to normal temperatures with greater than average precipitation during crop irrigation. Lodging was evident in some entries prior to harvest in 2018 (Table 4), with 'Dyna-Gro S06XT59', 'Dyna-Gro S09RY64', and 'Innotech IS0925' demonstrating the highest degree of lodging among the 18 entries. Subsequent drying conditions were favorable for crop maturation. Harvested on October 23rd, harvest grain moisture content averaged 9.0 percent, with no evidence of any green, immature seed in any of the harvested samples.

Adjusted soybean grain yields averaged 84 bushels per acre in 2018. Yield among the 18 entries in 2018 varied from 72 bushels per acre for 'Asgrow AG03X7' to 92 bushels per acre for 'Asgrow AG09X9'. Eleven other soybean entries produced averaged grain yields from 83 to 90 bushels per acre, which were statistically equal to the yield of the highest yielding hybrid tested in 2018. Test weight averaged 58.3 lb/bu for the 18 entries, and varied from 57.8 lb/bu for 'Dyna-Gro S05XT88' and 'Rob-See-Co RS0665' to 59.1 lb/bu for Dyna-Gro S06XT59. Grain protein, oil, and fiber content averaged 34.2, 17.8, and 5.01 percent, respectively.

Table 1. Contact information for seed sources of 18 soybean entries tested at the MSU Southern Agricultural Research Center near Huntley, Montana during 2018.

Brand	Hybrids	Contact
<u>Asgrow</u>	AG03X7 AG04X9 AG05X8 AG06X7 AG06X8 AG07X9 AG09X9	Mr. David Heimkes Monsanto Company Emmett ID 83617 PH: 320-444-3186 EM:david.heimkes@monsanto.com
<u>Dyna-Gro</u>	S05XT88 S06XT59 S07RY45 S09RY64	Mr. Nathan Haynie Crop Production Services 1505 Lockwood Road Billings MT 59101 PH: 406-252-3834 EM:nathan.haynie@cpsagu.com
<u>Innotech</u>	IS0481 IS0638 IS0925 IS1052	Mr. Dan Story Rob-See-Co 707 Golf Course Road Laurel MT 59044
<u>Rob-See-Co</u>	RS0665 RS0828 RS1231	PH: 406-697-6084 EM:dstory@robseeco.com

Table 2. Summary of trait information provided for commercial soybean cultivars tested under irrigated conditions near Huntley, Montana during 2017. Sorted by brand & cultivar.

Brand & Cultivar	Maturity ¹ Group	Roundup ² Ready	Xtend ³	Flower Color	Seed			Phytophthora Resistance Gene
					Hilium Color	Pod Color	Pubescence Color	
Asgrow AG03X7	0.3	Y	Y	Purple	Purple	Brown	-	Rps1c
Asgrow AG0536	0.5	Y	N	Purple	-	-	-	-
Asgrow AG06X7	0.6	Y	Y	Purple	-	-	-	-
Asgrow AG08X8	0.8	Y	Y	Purple	-	-	-	-
Asgrow AG0934	0.9	Y	N	Purple	Brown	Brown	Light Tawny	Rps3a
Croplan R2C0600	0.6	Y	N	Purple	Brown	Tan	Light Tawny/Tawny	Rps3a
Croplan R2C0900	0.9	Y	N	Purple	Black	Brown	Light Tawny	Hrps1c
Croplan R2C0957	0.9	Y	N	Purple	Buff	Brown	Green	Rps1k, Rps3a
Dyna-Gro S05XT88	0.5	Y	Y	Purple	-	-	-	HRps3a
Dyna-Gro S07RY45	0.7	Y	N	Purple	Black	Brown	Light Tawny	HRps1c
Dyna-Gro S09RY64	0.9	Y	N	Purple	Black	Brown	Light Tawny	none
Rob-See-Co IS0824	0.8	Y	N	Purple	-	-	-	-
Rob-See-Co IS0840	0.8	Y	N	Purple	Black	Tan	Light Tawny	none
Rob-See-Co IS0925	0.9	Y	N	Purple	Brown	Tan	Light Tawny	Rps3a
Rob-See-Co IS1052	1.0	Y	N	Purple	Brown	Tan	Light Tawny	Rps1k, Rps3a
Rob-See-Co IS1168	1.1	Y	N	Purple	Black	Brown	Light Tawny	none

1/ Relative maturity value presented if known.

2/ "Roundup Ready" indicates host plant tolerance to applications of glyphosate herbicides registered for in-crop use.

3/ "Xtend" indicates host plant tolerance to application of dicamba-based herbicides registered for in-crop use.

Table 3. Summary of climatic data by months for the 2017-2018 cropping year (September-August) compared to averages for the period of record from 1911 to 2017 at the Southern Agricultural Research Center near Huntley, Montana.

	2017				2018								Year
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
<u>Precipitation (inches)</u>													<u>Total</u>
Current Year (2017-2018)	2.57	0.37	1.17	1.14	0.58	1.82	0.90	2.70	3.81	3.77	0.87	2.00	21.70
Average (1911-2016)	1.30	1.07	0.64	0.59	0.55	0.45	0.79	1.34	2.18	2.33	1.14	0.94	13.32
Difference	+1.27	-0.70	+0.53	+0.55	+0.03	+1.37	+0.11	+1.36	+1.63	+1.44	-0.27	+1.06	+8.38
<u>Mean Temperature (°F)</u>													<u>Average</u>
Current Year (2016-2017)	58.6	47.0	33.6	23.4	19.6	9.9	29.3	40.7	59.1	63.4	70.2	67.8	43.6
Average (1911-2016)	58.0	46.9	33.6	23.9	20.7	25.7	34.3	45.5	54.9	63.3	70.8	68.8	45.5
Difference	+0.6	+0.1	0.0	-0.5	-1.1	-15.8	-5.0	-4.8	+4.2	+0.1	-0.6	-1.0	-1.9

Last Killing Frost in Spring^{1/} 2018 32°F on April 25
Average (1911-2017) May 17

First Killing Frost in the Fall^{1/} 2018 30°F on September 21
Average (1911-2017) September 19

Frost-free Period 2018 149 days
Average (1911-2017) 125 days

Growing Degree Days (Base 50)^{2/} 2018 2,138 GDD (°F)
Average (1911-2017) 2,009 GDD (°F)

Growing Degree Days (Base Corn)^{2/} 2018 2,199 GDD (°F)
Average (1911-2017) 2,219 GDD (°F)

Maximum Summer Temperature 100°F on August 11, 12, and 13, 2018

Minimum Winter Temperature -29 °F on February 10 and 20, 2018

1/ 32 °F is considered a killing frost. Average last and first killing frost dates are calculated on a 50% probability of a minimum temperature occurring below the threshold temperature of 32.5 °F based on observations from 1911 to 2017.

2/ Growing degree days calculated from temperatures observed during the frost free period from April 25 through September 17, 2018, and for the same 145-day interval from the period of record of 1911 to 2017.

Table 4. Agronomic performance of 18 commercial soybean cultivars grown under irrigated conditions near Huntley, Montana during 2018. Sorted by brand & cultivar. MSU Southern Agricultural Research Center.

Brand & Cultivar	Maturity	Grain ^{1/}	Test	Grain	1,000 Seed	Grain ^{2/}	Grain ^{2/}	Oil	Grain ^{2/}	Canopy	Vine	Stand	Flower Date		
	Group	Yield	Weight	Moisture	Weight	Protein	Oil	Yield	Fiber	Height	Length			Lodging ^{3/}	Count
		-bu/a-	-lb/bu-	-%-	-g-	-%-	-%-	-lb/a-	-%-	-inches-	-inches-	- 0 to 9 -	-plants/a-		
Asgrow AG03X7	0.3	72.1	58.1	8.9	175.2	34.6	17.8	668.2	4.98	31.4	39.7	2.5	238,966	187.8	Jul 7
Asgrow AG04X9	0.4	86.3*	58.7	8.8	178.4	33.6	17.7	796.9*	5.10	34.8	44.6	3.9	250,345	188.0	Jul 7
Asgrow AG05X8	0.5	82.8	58.3	9.2	161.9	35.2	17.8	767.7*	4.89	37.1	43	2.1	241,810	188.0	Jul 7
Asgrow AG06X7	0.6	82.3	58.2	9.0	184.2	34.0	18.2	785.1*	4.99	30.4	41.5	2.7	224,741	188.5	Jul 8
Asgrow AG06X8	0.6	85.4*	58.8	8.9	193.2	34.0	17.4	776.0*	5.09	34.5	43.6	3.8	227,586	187.5	Jul 7
Asgrow AG07X9	0.7	85.8*	58.3	8.9	173.6	33.8	17.9	802.1*	5.04	35.8	41.5	3.2	213,362	186.8	Jul 6
Asgrow AG09X9	0.9	92.0**	58.3	9.0	165.7	34.1	17.8	854.1**	5.03	28.9	44.1	3.6	216,207	187.3	Jul 6
Dyna-Gro S05XT88	0.5	85.7*	57.8	9.0	175.1	33.8	18.3	820.4*	5.00	32.6	43.6	2.6	230,431	187.5	Jul 7
Dyna-Gro S06XT59	0.6	83.7*	59.1	9.0	175.7	34.2	17.7	770.8*	5.02	29.2	44.8	5.7	258,879	187.8	Jul 7
Dyna-Gro S07RY45	0.7	83.0*	58.5	8.9	169.5	34.0	18.1	785.7*	5.01	34.3	40.5	2.4	213,362	188.5	Jul 8
Dyna-Gro S09RY64	0.9	86.8*	58.4	9.0	184.4	33.7	18.2	823.0*	5.03	28.1	42.7	7.2	256,034	186.8	Jul 6
Innotech IS0481	0.4	76.1	57.9	9.1	156.5	35.2	17.8	706.2	4.90	33.5	40.2	1.6	261,724	187.3	Jul 6
Innotech IS0638	0.6	89.5*	58.0	9.0	166.3	33.9	18.1	847.8*	5.01	31.0	43.7	3.7	204,828	188.0	Jul 7
Innotech IS0925	0.9	88.9*	58.4	8.9	185.3	33.7	18.0	839.1*	5.05	32.1	43.5	5.0	219,052	187.0	Jul 6
Innotech IS1052	1.0	77.8	58.2	8.9	168.9	34.8	17.6	716.6	4.96	34.4	41.6	3.4	244,655	187.3	Jul 6
Rob-See-Co RS0665	0.6	80.7	57.8	9.0	170.7	34.0	17.6	739.8	5.07	30.7	42.5	3.7	230,431	187.0	Jul 6
Rob-See-Co RS0828	0.8	85.5*	58.2	8.9	178.8	34.2	17.9	796.3*	5.01	35.5	40.1	2.4	230,431	187.5	Jul 7
Rob-See-Co RS1231	1.2	85.6*	58.3	8.8	177.2	35.4	17.5	780.9*	4.92	31.5	43.7	3.7	244,655	189.0	Jul 8
Average		83.9	58.3	9.0	174.5	34.2	17.8	782.0	5.01	32.5	42.5	3.3	233,750	187.6	Jul 7
Prob > F		0.018	0.594	0.200	0.294	0.002	0.110	0.027	0.144	0.517	0.942	0.781	0.941	0.87	
LSD (p=0.5)		9.1	ns	ns	ns	0.9	ns	96.5	ns	ns	ns	ns	ns	ns	
CV%		7.5	1.2	1.7	9.4	1.8	2.3	8.6	1.8	16.2	10.9	20.6	0.2	0.9	
Lattice RE% ^{4/}		100	100	100	100	106	100	100	104	100	100	100	100	100	

** Indicates highest yielding cultivar within a column.

* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Unrestricted LSD.

1/ Grain yield based on a 60-pound standard bushel weight and adjusted to 13 percent grain moisture content.

2/ Percent grain protein content, oil content, fiber content, and oil yield reported on a dry matter basis.

3/ Lodging visually estimated on a score from 0 to 9 (0=none, 9=all stems flat) observed at maturity. Observations transformed by natural logarithm prior to analysis.

4/ Adjusted means provided for Lattice RE% values equal to or greater than 105%.

Planted: May 4, 2018

Harvested: October 23, 2018

Fertility: 68 lb/a residual soil NO3-N

Herbicide: AMS (2 lb/a) + Outlook (16 oz/a) + Roundup Powermax (24 oz/a) + Prowl 3.3EC (24 oz/a), pre-emergence 5/5/18

Insecticide: None

Previous Crop: Barley

Irrigation: Flood July 11, July 23, August 2

Precipitation: 11.38 inches