



RESULTS OF AGRONOMIC, CROPPING SYSTEMS AND WEED SCIENCE RESEARCH CONDUCTED IN SOUTH CENTRAL MONTANA – 2017

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. 178009).
- 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 2017, four private companies submitted 16 soybean cultivars for testing under flood irrigated conditions near Huntley, Montana (Tables 1). A summary for a limited number of traits for all entries is provided in Table 2. All of the cultivars entered in the 2017 trial appeared to be genetically modified for herbicide tolerance. Relative maturity group (MG) ratings varied from MG 0.3 to MG 1.1, 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:** Although conditions remained warmer than average during March, April and May of 2017, precipitation also was above average during those months (Table 3).. By the end of April, precipitation amounts were 4.75" above the long-term average precipitation level. Surface soil moisture conditions were above average at planting, facilitating quick emergence, establishment and early growth of the soybeans. Planted on May 10th, the germinating soybean seedlings were just below the soil surface during the last freezing date (May 20th) experienced in the spring of 2017. Final crop establishment was quite variable in 2017, ranging from slightly more than 154,000 plants/acre for 'Dyna-Gro S05XT88' to almost 219,000 plants/acre for 'Croplan R2C0957' and 'Innotech IS1168' (Table 4).
- The frost-free period for the 2017 growing season at Huntley spanned from May 20th to September 17th, resulting in a 126-day growing season (Table 3). This interval is only 1 day longer than the normally expected frost-free period at this location. Total accumulated heat units (2,185 °F, GDD₅₀) for the season were 274 °F warmer than the heat units normally expected to accumulate on average for

this 126-day interval, and 14 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 much warmer than normal with less than average precipitation during crop irrigation. Lodging was quite evident in some entries prior to harvest in 2017 (Table 4), with 'Asgrow AG06X7', 'Croplan R2C0900', and 'Dyna-Gro S09RY64' demonstrating the highest degree of lodging among the 16 entries. Subsequent drying conditions were quite favorable for crop maturation. Harvested on October 5th, harvest grain moisture content averaged 11.2 percent, with no evidence of any green, immature seed in any of the harvested samples.

Adjusted soybean grain yields averaged 76 bushels per acre in 2017. Yield among the 16 entries in 2017 varied from 65 bushels per acre for 'Asgrow AG03X7' to 86 bushels per acre for 'Innotech IS1052'. Eight other soybean entries produced averaged grain yields from 75 to 83 bushels per acre, which were statistically equal to the yield of the highest yielding hybrid tested in 2017. Test weight averaged 57.4 lb/bu for the 16 entries, and varied from 56.1 lb/bu for Asgrow AG03X7 to 58.3 lb/bu for 'Innotech IS0824'. Grain protein, oil, and fiber content averaged 32.8, 19.0, and 5.03 percent, respectively.

Table 1. Contact information for seed sources of 16 soybean entries tested at the MSU Southern Agricultural Research Center near Huntley, Montana during 2017.

Brand	Hybrids	Contact
<u>Asgrow</u>	AG03X7 AG0536 AG06X7 AG08X8 AG0934	Mr. David Heimkes Monsanto Company Emmett ID 83617 PH: 320-444-3186 EM:david.heimkes@monsanto.com
<u>Croplan</u>	R2C0600 R2C0900 R2C0957	Mr. Curt Droogsma Croplan by WinField United 406 Cherry Hills Road Billings MT 59105 PH: 406-860-1330 EM:cddroogsma@landolakes.com
<u>Dyna-Gro</u>	S05XT88 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>	IS0824 IS0840 IS0925 IS1052 IS1168	Mr. Dan Story Rob-See-Co 707 Golf Course Road Laurel MT 59044 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 2016-2017 cropping year (September-August) compared to averages for the period of record from 1911 to 2016 at the Southern Agricultural Research Center near Huntley, Montana.

	2016				2017								Year
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
<u>Precipitation (inches)</u>													<u>Total</u>
Current Year (2016-2017)	1.87	3.06	0.27	1.17	0.37	0.74	2.30	1.75	1.53	1.13	0.21	0.24	14.64
Average (1911-2016)	1.30	1.09	0.63	0.60	0.55	0.46	0.79	1.36	2.21	2.32	1.14	0.97	13.42
Difference	+0.57	+1.97	-0.36	+0.57	-0.18	+0.28	+1.51	+0.39	-0.68	-1.19	-0.93	-0.73	+1.22
<u>Mean Temperature (°F)</u>													<u>Average</u>
Current Year (2016-2017)	59.8	47.6	41.9	14.1	14.1	25.6	40.4	46.9	55.9	65.6	75.8	68.4	46.3
Average (1911-2016)	58.1	46.9	33.6	23.9	21.1	25.9	34.4	45.5	54.9	63.4	70.9	68.8	45.6
Difference	+1.7	+0.7	+8.3	-9.8	-7.0	-0.3	+6.0	+1.4	+1.0	+2.2	+4.9	-0.4	+0.73

Last Killing Frost in Spring^{1/} 2017 32° F on May 20, 2017
Average (1911-2016) May 17

First Killing Frost in the Fall^{1/} 2017 32° F on September 17, 2017
Average (1911-2016) September 19

Frost-free Period 2017 126 days
Average (1911-2016) 125 days

Growing Degree Days (Base 50)^{2/} 2017 2,185 GDD (°F)
Average (1911-2016) 1,911 GDD (°F)

Growing Degree Days (Base Corn)^{2/} 2017 2,095 GDD (°F)
Average (1911-2016) 1,982 GDD (°F)

Maximum Summer Temperature 101 °F on Jul 16, 2017

Minimum Winter Temperature -30 °F on Dec 17, 2016

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 2016.

2/ Growing degree days calculated from temperatures observed during the frost free period from May 14 through September 17, 2017, and for the same 126-day interval from the period of record of 1911 to 2016.

Table 4. Agronomic performance of 16 commercial soybean cultivars grown under irrigated conditions near Huntley, Montana during 2017. Sorted by brand & cultivar. MSU Southern Agricultural Research Center.

Brand & Cultivar	Maturity Group	Grain ^{1/} Yield -bu/a-	Test Weight -lb/bu-	Grain Moisture -%-	1,000 Seed Weight -g-	Grain ^{2/} Protein -%-	Grain ^{2/} Oil -%-	Oil Yield -lb/a-	Grain ^{2/} Fiber -%-	Canopy Height -inches-	Lodging ^{3/} - 0 to 9 -	Stand Count -plants/a-
Asgrow AG03X7	0.3	65.1	56.1	10.8	166.6	32.7	18.7	637.3	5.09	33.3	0.1	199,014
Asgrow AG0536	0.5	72.7	56.3	11.0	175.3	32.3	19.6	738.0*	5.01	39.2	1.4	213,940
Asgrow AG06X7	0.6	72.1	57.7	11.6	181.2	32.2	19.3	724.3	5.07	43.2	5.4	179,113
Asgrow AG08X8	0.8	78.0*	57.9	11.8	161.8	33.0	19.4	782.4*	4.95	37.4	2.8	208,965
Asgrow AG0934	0.9	81.3*	57.6	10.6	180.0	34.1	18.6	793.7*	4.92	36.8	1.8	189,063
Croplan R2C0600	0.6	75.2*	56.8	11.1	167.4	33.9	18.8	738.2*	4.94	38.5	1.3	208,965
Croplan R2C0900	0.9	79.9*	57.6	11.6	162.3	32.4	18.8	783.0*	5.10	40.3	5.0	213,940
Croplan R2C0957	0.9	76.2*	58.0	11.2	185.6	32.0	19.3	770.2*	5.08	40.2	2.0	218,866
Dyna-Gro S05XT88	0.5	72.5	56.2	10.9	168.9	33.4	19.2	735.1*	4.94	36.9	1.2	154,236
Dyna-Gro S07RY45	0.7	83.0*	57.3	11.0	158.9	32.2	19.1	825.8*	5.09	38.0	3.3	174,137
Dyna-Gro S09RY64	0.9	79.1*	57.8	11.1	163.9	31.9	19.0	784.7*	5.15	40.2	4.4	203,990
Innotech IS0824	0.8	75.0	58.3	11.5	205.4	33.6	17.8	697.5	5.08	38.4	2.4	174,137
Innotech IS0840	0.8	75.0	57.8	11.1	187.1	33.2	19.0	743.8*	4.99	39.6	1.5	208,965
Innotech IS0925	0.9	68.6	57.4	11.5	182.5	32.2	19.3	698.6	5.05	35.3	3.1	213,940
Innotech IS1052	1.0	85.8**	57.7	11.4	185.1	32.4	19.0	846.3**	5.07	37.5	3.8	199,014
Innotech IS1168	1.1	77.1*	58.1	11.2	187.4	33.3	18.6	747.3*	5.02	39.3	2.9	218,916
Average		76.0	57.4	11.2	176.2	32.8	19.0	752.9	5.03	38.4	2.3	199,325
Prob > F		0.050	<0.001	0.058	<0.001	<0.001	<0.001	0.116	<0.001	<0.001	<0.001	0.768
LSD (p=0.5)		10.7	0.8	0.7	8.7	0.8	0.5	112.5	0.05	2.7	0.8	77,809
CV%		9.4	0.9	3.8	3.3	1.7	1.9	10.5	0.7	4.6	1.5	27.4
Lattice RE% ^{4/}		107	110	112	106	100	102	102	100	130	108	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 10, 2017

Harvested: October 5, 2017