



RESULTS OF AGRONOMIC, CROPPING SYSTEMS AND WEED SCIENCE RESEARCH CONDUCTED IN SOUTH CENTRAL MONTANA – 2020

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. 208009).
- PROJECT LEADERS:** Kenneth D. Kephart, Agronomist, SARC, Huntley
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- PROJECT PERSONNEL:** Shane Leland, 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 2020, two private companies submitted 10 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 2020 trial appeared to be genetically modified for herbicide tolerance. Relative maturity group (MG) ratings varied from MG 0.3 to MG 1.0, 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 April of 2020, but were close to average through the rest of the spring and summer. Precipitation was below average for April and May, was well above average for June, and was below average for July and August (Table 3). Below average winter snowfall and precipitation in the spring led to drier surface soil moisture conditions at planting, delaying emergence and establishment, however above average precipitation in June facilitated the early growth of the soybeans. Planted on May 5th, the germinating soybean seedlings were just below the soil surface during the last freezing date (May 9th) experienced in the spring of 2020. Final crop establishment was quite variable in 2020, ranging from almost 168,000 plants/acre for 'Asgrow AG10X9' to almost 222,000 plants/acre for 'REA RX0411' (Table 4).
- The frost-free period for the 2020 growing season at Huntley spanned from May 10th to September 9th, resulting in a 123-day growing season (Table 3). This interval is 5 days shorter than the normally expected frost-free period at this location. Total accumulated heat units (2028 °F, GDD₅₀) for the season were 145

°F warmer than the heat units normally expected to accumulate on average for this 123-day interval, and 4 percent above the level of heat units normally expected to accumulate during a typical 128-day frost-free growth period. June growing conditions were warmer with greater than average precipitation, and July growing conditions were normal with less than average precipitation during crop irrigation. Lodging was minimal in the entries prior to harvest in 2020 (Table 4). Subsequent drying conditions were quite favorable for crop maturation. Harvested on October 8th, harvest grain moisture content averaged 6.8 percent, with no evidence of any green, immature seed in any of the harvested samples.

Adjusted soybean grain yields averaged 60.7 bushels per acre in 2020 (Table 4). Yield among the 10 entries in 2020 varied from 57.3 bushels per acre for 'Asgrow AG08X0' to 68.0 bushels per acre for 'Asgrow AG09X9'. There was no statistical difference between the yields of the entries in 2020. Test weight averaged 57.4 lb/bu for the 10 entries, and varied from 56.7 lb/bu for 'Asgrow AG09X9' to 58.2 lb/bu for 'Asgrow AG06X8'. Grain protein, oil, and fiber content averaged 34.4, 18.6, and 4.9 percent, respectively.

Table 1. Contact information for seed sources of 10 soybean entries tested at the MSU Southern Agricultural Research Center near Huntley, Montana during 2020.

Brand	Hybrids	Contact
<u>Asgrow</u>	AG05X9	Mr. David Heimkes
	AG06X8	Bayer Cropscience
	AG08X0	Emmett ID 83617
	AG09X9	PH: 320-444-3186
	AG10X9	EM: david.heimkes@bayer.com
<u>REA Hybrids</u>	RX0411	Mr. Jon Langan
	RX0520	REA Hybrids
	RX0628	Laporte, MN 56461
	RX0721	PH: 701-535-1006
	RX1030	EM: jonathan.langan@bayer.com

Table 2. Summary of trait information provided for commercial soybean cultivars tested under irrigated conditions near Huntley, Montana during 2020. Sorted by brand & cultivar.

Brand & Cultivar	Maturity ^{/1} Group	Roundup ^{/2} Ready	Xtend ^{/3}	Flower Color	Seed Hilium Color	Pod Color	Pubescence Color	Phytophthora Resistance Gene
REA/RX0411	0.4	Y	Y	Purple	Black	Brown	Light Tawny	Rps1c
REA/RX0520	0.5	Y	Y	Purple	Buff	Brown	Gray	Rps1c/Seg Rps3z
REA/RX0628	0.6	Y	Y	Purple	Black	Brown	Tan	Rps1c
REA/RX0721	0.7	Y	Y	Purple	Black	Brown	Light Tawny	Rps1c
REA/RX1030	1.0	Y	Y	Purple	Brown	Brown	Tawny	Rps3a
Asgrow/AG05X9	0.5	Y	Y	Purple	Imperfect Black	Brown	Gray	Rps1c
Asgrow/AG06X8	0.6	Y	Y	Purple	Brown	Brown	Light Tan	Rps1c
Asgrow/AG08X0	0.8	Y	Y	Purple	Black	Brown	Light Tan	Rps1c
Asgrow/AG09X9	0.9	Y	Y	Purple	Black	Brown	Light Tan	Rps1 ^k
Asgrow/AG10X9	1.0	Y	Y	Purple	Brown	Tan	Light Tan	Rps3a

^{/1} Relative maturity value presented if known.

^{/2} "Roundup Ready" indicates host plant tolerance to application 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 2019-2020 cropping year (September-August) compared to averages for the period of record from 1911 to 2019 at the Southern Agricultural Research Center near Huntley, Montana.

	2019				2020								Year
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
<u>Precipitation (inches)</u>													<u>Total</u>
Current Year (2019-2020)	3.66	1.00	0.81	0.50	0.17	0.46	0.69	0.79	1.58	4.75	0.00	0.72	15.13
Average (1911-2019)	1.33	1.10	0.63	0.61	0.55	0.48	0.80	1.38	2.23	2.31	1.13	0.97	13.52
Difference	2.33	-0.10	0.18	-0.11	-0.38	-0.02	-1.11	-0.59	-0.65	2.44	-1.13	-0.25	1.61
<u>Mean Temperature (°F)</u>													<u>Average</u>
Current Year (2019-2020)	59.8	37.2	32.2	28.3	24.6	26.8	35.8	40.3	54.9	65.3	70.4	71.4	45.58
Average (1911-2019)	58.1	46.8	33.7	23.9	21.0	25.5	34.2	45.5	54.9	63.4	70.8	68.8	45.55
Difference	1.7	-9.6	-1.5	4.4	3.6	1.3	1.6	-5.2	0.0	1.9	-0.4	2.6	0.03

Last Killing Frost in Spring^{1/} 2020 32 °F on May 9
Average (1911-2019) May 16

First Killing Frost in the Fall^{1/} 2020 31 °F on September 9
Average (1911-2019) September 21

Frost-free Period 2020 123 days
Average (1911-2019) 128 days

Growing Degree Days (Base 50)^{2/} 2020 2,028 GDD (°F)
Average (1911-2019) 1883 GDD (°F)

Growing Degree Days (Base Corn)^{2/} 2020 1,970 GDD (°F)
Average (1911-2019) 1,973 GDD (°F)

Maximum Summer Temperature 102 °F on August 18, 2020

Minimum Winter Temperature -22 °F on January 18, 2020

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 2019.

2/ Growing degree days calculated from temperatures observed during the frost free period from May 10th through September 9th, 2020, and for the same 123-day interval from the period of record of 1911 to 2019.

Table 4. Agronomic performance of 10 commercial soybean cultivars grown under irrigated conditions near Huntley, Montana during 2020. Sorted by brand & cultivar. MSU Southern Agricultural Research Center.

Brand & Cultivar	Maturity Group	Grain ^{1/} Yield	Test Weight	Grain Moisture	1,000 Seed Weight	Grain ^{2/} Protein	Grain ^{2/} Oil	Oil Yield	Grain ^{2/} Fiber	Canopy Height	Vine Length	Lodging ^{3/}	Stand Count	Flower Date	
														Julian	Calendar
		-bu/a-	-lb/bu-	-%-	-g-	-%-	-%-	-lb/a-	-%-	-inches-	-inches-	- 0 to 9 -	-plants/a-	- day -	- date -
Asgrow AG05X9	0.5	60.5	57.7	6.7	144.1	35.5	17.9	618.3	5.0	26.3	27.0	0.0	190,603	188.3	Jul 7
Asgrow AG06X8	0.6	58.9	58.2	6.8	141.0	34.4	18.9	561.3	4.8	30.2	30.9	0.6	207,672	188.3	Jul 7
Asgrow AG08X0	0.8	57.3	58.0	6.8	132.4	34.0	17.7	588.4	4.8	29.8	31.0	0.0	196,293	189.0	Jul 8
Asgrow AG09X9	0.9	68.0	56.7	6.9	156.0	36.1	17.8	666.3	4.9	32.2	33.2	0.2	182,069	190.5	Jul 10
Asgrow AG10X9	1.0	65.3	57.1	6.9	135.8	34.2	18.3	638.1	4.9	30.6	31.4	0.0	167,845	189.5	Jul 9
REA RX0411	0.4	57.5	57.3	6.8	143.1	32.3	19.6	537.7	4.8	34.6	35.8	0.2	221,897	185.0	Jul 4
REA RX0520	0.5	58.4	57.5	6.8	170.3	35.4	18.3	577.6	4.8	29.9	31.0	0.2	190,603	188.0	Jul 7
REA RX0628	0.6	57.5	57.0	6.8	127.0	33.7	19.7	532.4	5.0	28.0	28.8	0.0	199,138	187.3	Jul 6
REA RX0721	0.7	60.8	57.1	6.7	141.1	33.9	18.8	569.1	4.8	30.7	32.2	0.2	173,534	187.0	Jul 6
REA RX1030	1.0	62.3	56.9	6.8	151.0	34.6	18.7	595.4	4.9	26.7	27.8	0.0	196,293	188.3	Jul 7
Average		60.7	57.4	6.8	144.2	34.4	18.6	588.5	4.9	29.9	30.9	0.1	192,595	188.1	Jul 7
Prob > F		0.838	<0.001	0.405	<0.001	<0.001	<0.001	0.651	<0.001	<0.001	<0.001	0.390	0.559	0.007	
LSD (p=0.5)		ns	0.4	ns	6.6	0.4	0.3	ns	0.04	6.8	6.8	ns	ns	2.2	
CV%		16.5	0.4	1.6	2.6	0.7	1.1	16.6	0.5	15.2	14.6	2.7	17.5	0.8	
Lattice RE% ^{4/}		100.0	110.8	100.0	140.5	162.4	100.0	100.0	145.6	100.0	100.0	100.0	100.0	100.0	

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 5, 2020

Harvested: October 8, 2020

Fertility: 73.0 lb/a of residual soil NO₃-N

Herbicide: Satellite HydroCap 32 oz/a, Outlook 16 oz/a, Roundup Powermax 16 oz/a, Sharpen 1 oz/a May 6, 2020

Insecticide: Mustang Maxx 4 oz/a August 3, 2020

Previous Crop: Barley

Irrigation: Flood July 7, July 22, August 11, August 25

Precipitation: 10.97 inches