



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 Hybrid Grain Corn Performance Trial near Huntley, Montana.
(Exp. 171309).
- PROJECT LEADERS:** Kenneth D. Kephart, Agronomist, SARC, Huntley
Valerie Smith, Research Associate, SARC, Huntley
- PROJECT PERSONNEL:** Tom A. Fischer, Research Specialist and Farm Foreman, SARC, Huntley
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- OBJECTIVES:** To provide corn growers in south central Montana with a reliable, unbiased, up-to-date source of information that will permit valid comparisons among improved corn hybrids for irrigated grain production. This information should help corn producers in south central Montana select hybrids best suited to this region of the state.
- METHODS:** For 2017, four private companies submitted 26 corn hybrids representing five brands for testing under flood irrigated conditions near Huntley, Montana (Table 1). All of the hybrids entered in the 2017 trial appeared to be genetically modified for both insect resistance and herbicide tolerance. Relative maturity ratings varied from 85 to 99 days. The study was planted using a rectangular alpha-lattice design with three replications. Test plots consisted of a 30-foot, 4-row plot with 30-inch row spacing. Each 30-foot row was planted with 69 seeds, equal to planting 40,075 seeds per acre or about 105 percent of the target population of 38,200 plants per acre. Planting depth was set at 1½ inches deep. Plot stands were determined by counting the number of established plants along the two center rows at approximately the 4 to 5 leaf stage of crop development. All rows of each test plot were subsequently trimmed 36 inches. The center two 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. Test weight is reported for grain sampled immediately after harvest on an "as-is" moisture basis, and also for grain dried below a threshold value of 15.5 percent moisture content. Grain protein, oil, and starch 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 15.5% grain moisture content, and are reported in bushels per acre based on a 56-pound standard bushel weight.
- RESULTS and SUMMARY:** Unusually warm temperatures and above average precipitation prevailed during the preceding fall and winter months at Huntley (Table 2). Although conditions remained warmer than average during March, April and May of 2017, precipitation also was above average during those months. 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 corn. Planted on May 3rd, 2016, corn seedlings spiking at or just below the soil surface were evident in all plots prior to the last freezing date (May 20th) experienced in 2017. Final crop establishment eventually averaged 88 percent with hybrids varying from 78 to 91 percent (Table 3).
- The frost-free period for the 2017 growing season at Huntley spanned from May 20th to September 17th, resulting in a 121-day growing season (Table 2). This interval is 5 days shorter than the normally expected frost-free period at this

location. Total accumulated heat units (2,095 °F, GDD_{corn}) for the season were 184 °F warmer than the heat units normally expected to accumulate on average for this 121-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 much warmer than normal with less than average precipitation during crop irrigation. All hybrids had achieved some level of physiological maturity (*aka*, kernel black layer) by the middle of September when killing frost occurred. Later maturing hybrids all possessed black layer development for kernels at or near the base of the ears but usually lacked black layer for kernels examined at the distal end of the ears. Subsequent drying conditions were quite favorable. Harvested on October 19th, harvest grain moisture content averaged 17 percent, 9 percent drier than the similar set of plots harvested in 2016. No lodging was evident prior to harvest in 2017.

Adjusted corn grain yields averaged 225 bushels per acre in 2017. Yield among the 26 entries in 2017 varied from 262 bushels per acre for the hybrid 'Dyna-Gro D39DC43 DGVT2P' to 186 bushels per acre for the hybrid 'Dekalb DKC 35-88'. Twenty-four other hybrid corn entries produced averaged grain yields from 240.3 to 262.4 bushels per acre, which were statistically equal to the yield of the highest yielding hybrid tested in 2017. Test weight measured from grain dried below 15.5 percent moisture content averaged 58.3 lb/bu for the 26 entries, and varied from 59.8 lb/bu for 'Dekalb DKC 35-88' to 56.4 lb/bu for Dyna-Gro D39DC43. None of the 26 hybrid corn entries possessed a test weight value less than 56 lb/bu at grain moisture levels below 15.5 percent. Grain protein, oil, and starch content averaged 9.8, 3.7, and 70.9 percent, respectively.

Table 1. Contact information for seed sources of 26 hybrid corn entries tested at the MSU Southern Agricultural Research Center near Huntley, Montana during 2017.

Brand	Hybrids	Contact
<u>Croplan</u>	2692ASS3011A 3146SS/RIB 3240GT/RIB 3314VT2P/RIB X17090C/VT2P X15091A/VT2P	Mr. Curt Droogsma Croplan by WinField United 406 Cherry Hills Road Billings MT 59105 PH: 406-860-1330 EM: cddroogsma@landolakes.com
<u>DeKalb</u>	DKC 35-88 RIB DKC 36-28 RIB DKC 37-86 RIB DKC 39-27 RIB DKC 40-77 RIB DKC 41-99 RIB DKC 45-65 RIB	Mr. David Heimkes Monsanto Company Emmett ID 83617 PH: 320-444-3186 EM: david.heimkes@monsanto.com
<u>Dyna-Gro</u>	D26QH53 D27VC47 VT2P D32VC41 VT2P D33QZ23 D34VC54 VT2P D39VC43 DGVT2P	Mr. Nathan Haynie Crop Production Services 1505 Lockwood Road Billings MT 59101 PH: 406-252-3834 EM: nathan.haynie@cpsagu.com
<u>Innotech</u>	IC4016-3010 IC4173 IC4521 IC4730	Mr. Dan Story Rob-See-Co 707 Golf Course Road Laurel MT 59044
<u>Rob-See-Co</u>	RC3601 RC3834-3010 RC4343	PH: 406-697-6084 EM: dstory@robseeco.com

Table 2. 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	+0.7

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 121 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 20 through September 17, 2017, and for the same 121-day interval from the period of record of 1911 to 2016.

Table 3. Agronomic performance of 26 commercial corn hybrids grown under irrigated conditions near Huntley, Montana during 2017. Sorted by brand & hybrid. MSU

Brand & Hybrid	RM	GMO	Harvest ^{2/}			Grain ^{4/}			Grain ^{4/} Protein	Grain ^{4/} Oil	Grain ^{4/} Starch	Crop Establishment	
			Yield	Test Weight	Grain Moisture	Test Weight	Grain Protein	Grain Oil				Grain Starch	Stand
	- days -	- Y/N -	- bu/a -	- lb/bu -	- % -	- lb/bu -	- % -	- % -	- % -	- % -	- plants/a -	- % -	
Croplan 2692AS3011A	86	Y	221.6	58.4	16.3	59.7	3.7	9.4	3.7	71.3	35,924	89.6	
Croplan 3146SS/RIB	91	Y	207.2	56.8	17.0	58.8	3.8	10.2	3.8	70.5	36,354	90.7	
Croplan 3240GT/CB/LL	92	Y	217.0	57.1	16.3	58.5	3.4	9.8	3.4	71.3	36,569	91.3	
Croplan 3314VT2P/RIB	93	Y	228.6	55.0	18.9	57.4	3.8	10.0	3.8	70.7	35,708	89.1	
Croplan X17090C/VT2P	90	Y	221.8	54.1	18.7	56.5	3.7	9.9	3.7	70.7	34,203	85.3	
Croplan X515091A/VT2P	91	Y	233.8	56.6	17.0	57.5	4.1	9.8	4.1	70.4	36,354	90.7	
Dekalb DKC 35-88 RIB	85	Y	186.1	59.5	15.5	59.8	3.8	10.7	3.8	70.4	34,525	86.2	
Dekalb DKC 36-28 RIB	86	Y	200.7	56.8	16.1	58.1	4.1	9.9	4.1	70.2	36,354	90.7	
Dekalb DKC 37-86 RIB	87	Y	203.7	57.2	16.0	58.3	3.7	9.9	3.7	71.1	36,139	90.2	
Dekalb DKC 39-27 RIB	89	Y	224.5	55.5	17.0	57.2	4.0	9.7	4.0	70.6	34,740	86.7	
Dekalb DKC 40-77 RIB	90	Y	195.1	58.4	15.7	59.5	3.7	9.9	3.7	70.8	34,310	85.6	
Dekalb DKC 41-99 RIB	91	Y	233.9	56.0	16.9	58.0	3.9	10.6	3.9	70.1	36,569	91.3	
Dekalb DKC 45-65 RIB	95	Y	238.6	55.3	18.7	57.3	4.1	9.6	4.1	70.7	33,988	84.8	
Dyna-Gro D26QH53	86	Y	234.7	57.7	15.6	58.4	3.4	9.2	3.4	71.7	34,956	87.2	
Dyna-Gro D27VC47 VT2P	87	Y	199.7	57.4	17.3	59.0	3.6	10.2	3.6	70.8	35,278	88.0	
Dyna-Gro D32VC41 VT2P	92	Y	229.0	56.1	17.3	57.9	4.0	10.0	4.0	70.4	34,418	85.9	
Dyna-Gro D33QZ23	93	Y	223.3	58.7	15.8	59.6	3.5	10.1	3.5	71.1	31,299	78.1	
Dyna-Gro D34VC54 VT2P	94	Y	240.0	53.7	19.5	56.7	4.0	9.3	4.0	70.8	36,139	90.2	
Dyna-Gro D39DC43 DGVT2P	99	Y	261.9**	51.8	22.0	56.4	3.9	9.0	3.9	71.4	35,816	89.4	
Innotech IC4016-3010	90	Y	227.5	57.9	15.6	58.4	3.5	9.3	3.5	71.6	34,633	86.4	
Innotech IC4173	91	Y	213.1	57.9	16.6	58.9	3.7	9.9	3.7	70.9	35,278	88.0	
Innotech IC4521	95	Y	223.0	57.0	16.6	58.6	3.4	10.3	3.4	71.0	35,063	87.5	
Innotech IC4730	97	Y	250.8*	55.7	18.6	57.8	3.2	9.4	3.2	71.9	35,063	87.5	
Rob-See-Co RC3601	86	Y	232.1	58.2	16.9	59.8	3.7	9.8	3.7	71.1	34,848	87.0	
Rob-See-Co RC3834-3010	88	Y	237.5	58.0	15.5	58.1	3.4	9.6	3.4	71.6	33,665	84.0	
Rob-See-Co RC4343	93	Y	226.3	57.8	16.2	58.6	3.6	10.8	3.6	70.4	31,944	79.7	
Average			225.3	56.8	17.1	58.3	3.7	9.8	3.7	70.9	35,055	87.5	
Prob > F			<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	
PLSD (p=0.05)			20.2	0.9	1.1	1.0	0.2	0.6	0.2	0.6	2,224	5.6	
CV%			5.1	1.0	3.5	1.0	3.1	3.5	3.1	0.5	3.8	3.8	
Lattice RE% ^{5/}			107	100	107	100	100	106	100	112	100	100	

** Indicates highest yielding hybrid.

* Indicates hybrids yielding equal to highest yielding hybrid based on Fisher's protected LSD (p=0.05).

1/ Yields in bushels per acre are based on a 56 pound standard bushel weight for corn and adjusted to 15.5 percent moisture content. (over)

2/ Grain test weight determined on an "as-is" harvest moisture basis.

3/ Grain test weight determined for wet grain (>15.5 %) dried below the threshold of 15.5 percent moisture content.

4/ Grain protein, oil and starch content adjusted to 100 percent dry matter content.

5/ Adjusted means provided for Lattice RE% values equal to or greater than 100%.

Planted: May 3, 2017

Harvested: October 19, 2017

Previous crop: Spring Barley

Fertility: 200-0-30, PPI (plus 55.0 lb/a of residual soil NO₃-N)

Herbicide: AMS (1.5 lb/a) + Roundup PowerMax (16 oz/a) + Prowl 3.3EC (16 oz/a) + Outlook (16 oz/a) + Activator 90 (4 oz/a), pre-emergence

Irrigation: Flood, June 20, July 3, July 13, July 28, August 7, August 21, September 5.

Precipitation (planting to harvest): 5.99"