



RESULTS OF AGRONOMIC, CROPPING SYSTEMS AND WEED SCIENCE RESEARCH CONDUCTED IN SOUTH CENTRAL MONTANA – 2016

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

<u>PROJECT TITLE:</u>	Irrigated Hybrid Grain Corn Performance Trial near Huntley, Montana. (Exp. 161309).
<u>PROJECT LEADERS:</u>	Kenneth D. Kephart, Agronomist, SARC, Huntley David May, Research Associate, SARC, Huntley
<u>PROJECT PERSONNEL:</u>	Tom A. Fischer, Research Specialist and Farm Foreman, SARC, Huntley Janna Rozett, Research Assistant III, SARC, Huntley
<u>OBJECTIVES:</u>	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.
<u>METHODS:</u>	For 2016, six private companies submitted 36 corn hybrids for testing under flood irrigated conditions near Huntley, Montana (Table 1). All of the hybrids entered in the 2016 trial appeared to be genetically modified for both insect resistance and herbicide tolerance. Relative maturity ratings varied from 83 to 103 days. The study was planted using a triple 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 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 DA7200 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.
<u>RESULTS and SUMMARY:</u>	<p>Unusually warm and dry conditions prevailed during the preceding fall and winter months at Huntley (Table 2). Although conditions remained warmer than average during March, April and May of 2016, precipitation also was above average during those month. 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 14th) experienced in 2016. Final crop establishment eventually averaged 93 percent with hybrids varying from 89 to 97 percent (Table 3).</p> <p>The frost-free period for the 2016 growing season at Huntley spanned from May 14th to October 6th, resulting in a 145-day growing season (Table 2). This interval is 20 days longer than the normally expected frost-free period at this location. Total accumulated heat units (2,227 °F, GDD_{corn}) for the season were only 8 °F warmer than the heat units normally expected to accumulate on average for this</p>

145-day interval, and 8 percent above the level of heat units normally expected to accumulate during a typical 125-day frost-free growth period.

June growing conditions were much warmer than normal with less than average precipitation as crop irrigation began. Most hybrids had achieved physiological maturity (*aka*, kernel black layer) by the end of the first week of October, but unusually wet conditions in October hindered the subsequent field drying of the grain. Harvested on October 17th, 18th and 19th, harvest grain moisture content averaged 26 percent. Later maturing hybrids possessing more than 29 to 30 percent grain moisture content at harvest, 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. No lodging was evident prior to harvest in 2016.

Adjusted corn grain yields averaged 238 bushels per acre in 2016. Yield among the 36 entries in 2016 varied from 256 bushels per acre for the hybrid 'Dyna-Gro D39DC43 DGV2P' to 187 bushels per acre for the hybrid 'Channel 183-22 R'. 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 2016. Test weight measured from grain dried below 15.5 percent moisture content averaged 56.5 lb/bu for the 36 entries, and varied from 58.7 lb /bu for Channel 183-22 R to 53.5 lb/bu for "Pioneer P9789 AMXT". Approximately 65% of the entries consistently possessed test weight values equal to or heavier than 56 lb/bu at grain moisture levels below 15.5 percent.

Table 1. Contact information for seed sources of 36 hybrid corn entries tested at the MSU Southern Agricultural Research Center near Huntley, Montana during 2016.

Brand	Hybrids	Contact
<u>Channel Seed</u>	183-22 R 186-33 STXRIB 190-13 VT2PRIB 192-09 VT3PRIB 197-50 STXRIB 203-44 STXRIB	Ms. Jaymi Wegner Simplot Grower Solutions/Channel Seed 4804 Danford Drive Billings MT 59106 PH: 406-656-2804 FX: 406-656-2005 EM: jaymi.wegner@simplot.com
<u>Croplan by WinField</u>	2587VT2P 2692ASS3011A 313455/RIB 314655/RIB 3314VT2P/RIB 3499VT3P/RIB 3614VT2P/RIB 3899VT2P/RIB X16089A VT2P	Mr. Curt Droogsma Croplan by WinField 406 Cherry Hills Road Billings MT 59105 PH: 406-860-1330 EM: cddroogsma@landolakes.com
<u>DeKalb</u>	DKC36-28RIB DKC37-86RIB DKC39-27RIB DKC40-77RIB DKC41-32RIB DKC44-13RIB DKC45-65RIB	Mr. David Heimkes Monsanto Company Emmett ID 83617 PH: 320-444-3186 EM: david.heimkes@monsanto.com
<u>Dyna-Gro</u>	CX15886 3000GT D27VC47 VT2P D32VC41 VT2P 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>Golden Harvest</u>	G84J92-3011A G90E41-3110A G90Y04-3110A G95D32-3110 G96V99-3010	PH: EM:
<u>Pioneer</u>	P9188AM P9305AM P9697AM P9789AMXT	Mr. Marc Vogel North 40 Ag 2150 Road 14 South Ballentine MT 59006 PH: 406-860-2966 EM: mvogel@north40ag.com

Table 2. Summary of climatic data by months for the 2015-2016 cropping year (September-August) compared to averages for the period of record from 1911 to 2015 at the Southern Agricultural Research Center near Huntley, Montana.

	2015				2016								Year
	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	
<u>Precipitation (inches)</u>													<u>Total</u>
Current Year (2015-2016)	0.26	1.97	0.50	0.50	0.25	0.11	1.30	1.41	2.49	0.86	0.46	1.57	11.68
Average (1911-2015)	1.31	1.08	0.63	0.60	0.56	0.47	0.79	1.36	2.20	2.33	1.15	0.96	13.44
Difference	-1.05	+0.89	-0.13	-0.10	-0.31	-0.36	+0.51	+0.05	+0.29	-1.47	-0.69	+0.61	-1.76
<u>Mean Temperature (°F)</u>													<u>Average</u>
Current Year (2015-2016)	62.8	51.2	34.0	24.4	25.3	38.3	41.4	48.6	55.1	68.5	71.2	68.3	49.2
Average (1911-2015)	58.1	47.0	33.7	24.0	21.0	25.7	34.2	45.6	55.0	63.4	70.8	68.8	45.6
Difference	+4.7	+4.2	-0.3	+0.4	+4.3	+12.6	+7.2	+3.0	+0.1	+5.1	+0.4	-0.5	+3.6

Last Killing Frost in Spring^{1/} 2016 32 °F on May 14, 2016
Average (1911-2015) May 17

First Killing Frost in the Fall^{1/} 2016 30 °F on Oct 6, 2016
Average (1911-2015) September 19

Frost-free Period 2016 145 days
Average (1911-2015) 125 days

Growing Degree Days (Base 50)^{2/} 2016 2,223 GDD (°F)
Average (1911-2015) 2,009 GDD (°F)

Growing Degree Days (Base Corn)^{2/} 2016 2,227 GDD (°F)
Average (1911-2015) 2,219 GDD (°F)

Maximum Summer Temperature 99 °F on Sep 1, 2016

Minimum Winter Temperature -11 °F on Dec 26, 2015

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 2015.

2/ Growing degree days calculated from temperatures observed during the frost free period from May 14 through October 6, 2016, and for the same 145-day interval from the period of record of 1911 to 2015.

Table 3. Agronomic performance of 36 commercial corn hybrids grown under irrigated conditions near Huntley, Montana during 2016. Sorted by brand & hybrid. MSU Southern Agricultural Research Center.

Brand & Hybrid	At Harvest ^{2/}											
	RM	GMO	Grain ^{1/}	Test		Grain	Test ^{3/}	Grain ^{4/}	Grain ^{4/}	Grain ^{4/}	Crop Establishment	
			Yield	Weight	Moisture	Weight	Protein	Oil	Starch	Stand	Emergence	
	- days -	- Y/N -	- bu/a -	- lb/bu -	- % -	- lb/bu -	----- % -----	- plants/a -	- % -			
Channel 183-22 R	83	Y	187.3	55.3	20.1	58.7	11.3	3.7	70.0	38,182	95.3	
Channel 186-33 STXRIB	86	Y	210.9	52.6	22.1	57.4	10.8	3.8	70.5	38,290	95.5	
Channel 190-13 VT2PRIB	90	Y	233.4*	53.9	21.5	57.3	10.6	3.4	71.0	36,569	91.3	
Channel 192-09 VT3PRIB	92	Y	243.9*	50.9	25.2	56.4	10.5	3.4	72.0	37,644	93.9	
Channel 197-50 STXRIB	97	Y	255.8*	50.3	30.3	55.2	10.1	3.6	70.9	37,214	92.9	
Channel 203-44 STXRIB	103	Y	244.8*	50.9	32.9	54.5	9.4	4.0	71.6	37,860	94.5	
Croplan 2587VT2P	85	Y	208.4	53.7	21.9	57.9	10.6	3.4	71.0	37,429	93.4	
Croplan 2692ASS3011A	86	Y	248.3*	53.2	21.5	58.1	10.5	3.5	70.6	36,784	91.8	
Croplan 313455/RIB	91	Y	231.9	51.9	25.1	57.6	9.9	3.5	70.2	37,214	92.9	
Croplan 314655/RIB	91	Y	231.8	51.4	27.7	57.1	10.5	3.6	70.5	37,644	93.9	
Croplan 3314VT2P/RIB	93	Y	242.8*	50.1	28.1	55.6	9.8	3.6	71.3	36,569	91.3	
Croplan 3499VT3P/RIB	94	Y	238.1*	48.0	27.6	55.7	9.2	3.7	71.9	37,322	93.1	
Croplan 3614VT2P/RIB	96	Y	244.6*	50.0	28.8	55.4	10.2	3.5	71.1	38,397	95.8	
Croplan 3899VT2P/RIB	98	Y	255.7*	49.9	32.0	54.5	9.1	3.8	71.8	37,860	94.5	
Croplan X16089A VT2P	89	Y	246.2*	51.6	23.5	56.5	10.4	3.5	71.5	35,924	89.6	
Dekalb DKC36-28	86	Y	228.9	52.3	23.3	57.3	10.5	3.6	70.6	38,397	95.8	
Dekalb DKC37-86	87	Y	225.1	51.3	24.7	57.3	9.6	3.6	70.8	37,860	94.5	
Dekalb DKC39-27	89	Y	250.2*	50.3	26.1	55.9	9.7	3.6	71.3	36,676	91.5	
Dekalb DKC40-77	90	Y	234.1*	52.3	22.9	57.5	10.3	3.6	70.6	35,708	89.1	
Dekalb DKC41-32	91	Y	244.8*	50.1	29.6	55.4	10.5	3.6	71.1	37,967	94.7	
Dekalb DKC44-13	93	Y	251.3*	48.4	27.8	56.1	10.0	3.7	71.1	39,043	97.4	
Dekalb DKC45-65	95	Y	250.2*	50.1	29.4	55.5	9.3	3.7	72.1	36,999	92.3	
Dyna-Gro CX15886 3000GT	86	Y	234.9*	53.1	22.1	57.6	10.1	3.6	71.2	37,752	94.2	
Dyna-Gro D27VC47 VT2P	87	Y	235.6*	52.4	24.0	57.8	10.0	3.6	71.2	35,924	89.6	
Dyna-Gro D32VC41 VT2P	92	Y	249.4*	52.0	23.8	57.3	9.8	3.6	70.9	36,999	92.3	
Dyna-Gro D34VC54 VT2P	94	Y	256.2**	50.4	26.7	55.5	10.2	3.5	70.5	38,075	95.0	
Dyna-Gro D39DC43 DGVT2P	99	Y	251.9*	50.4	32.7	55.0	8.6	3.9	72.2	37,322	93.1	
Golden Harvest G84J92-3011A	84	Y	238.5*	52.7	21.9	58.1	10.4	3.5	70.4	36,569	91.3	
Golden Harvest G90E41-3110A	90	Y	227.9	51.6	23.0	57.5	10.5	3.4	70.8	37,107	92.6	
Golden Harvest G90Y04-3110A	90	Y	238.5*	53.1	22.1	57.1	10.2	3.2	71.8	37,752	94.2	
Golden Harvest G95D32-3110	95	Y	238.9*	52.2	28.9	56.8	9.5	3.7	71.6	35,816	89.4	
Golden Harvest G96V99-3010	96	Y	251.1*	49.4	31.3	54.0	9.4	3.6	72.2	37,214	92.9	

Table 3. Agronomic performance of 36 commercial corn hybrids grown under irrigated conditions near Huntley, Montana during 2016. Sorted by brand & hybrid. MSU Southern Agricultural Research Center.

Brand & Hybrid	RM	GMO	Grain ^{1/} Yield	At Harvest ^{2/}			Grain ^{4/} Protein	Grain ^{4/} Oil	Grain ^{4/} Starch	Crop Establishment	
				Test Weight	Grain Moisture	Test ^{3/} Weight				Stand	Emergence
	- days -	- Y/N -	- bu/a -	- lb/bu -	- % -	- lb/bu -	----- % -----	----- % -----	- plants/a -	- % -	
Pioneer P9188 AM	91	Y	231.7	53.0	23.1	57.5	9.7	3.7	71.7	37,429	93.4
Pioneer P9305 AM	93	Y	233.9*	51.6	29.5	56.2	10.4	3.5	71.8	36,354	90.7
Pioneer P9697 AM	96	Y	233.0	52.0	28.2	57.4	9.7	3.4	71.7	36,676	91.5
Pioneer P9789 AMXT	97	Y	224.4	50.0	29.0	53.5	9.7	3.4	72.9	37,322	93.1
Average			237.6	51.5	26.1	56.5	10.0	3.6	71.2	37,274	93.0
PLSD (p=0.05)			22.8	2.0	1.8	1.1	0.9	0.2	1.2	ns	ns
CV%			5.5	2.3	4.2	1.2	5.3	4.0	1.1	3.6	3.6
Lattice RE% ^{5/}			119	95	89	98	99	91	90	102	102

** Indicates highest yielding hybrid.

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

ns Indicates no statistical difference between hybrids within a column at the 0.05 probability level.

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.

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

3/ Grain test weight determined for grain 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 105%.

Planted: May 3, 2016

Harvested: October 17-19, 2016

Previous crop: Spring Barley

Fertility: 200-50-30, PPI (plus 53.7 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, Jun 20, Jun 30, Jul 12, Jul 27, Aug 9, Aug 29

Precipitation: 9.57"