



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

- PROJECT TITLE:** Dryland Hybrid Grain Corn Performance Trial near Huntley, Montana.
(Exp. 201308).
- PROJECT LEADERS:** Kenneth D. Kephart, Agronomist, 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 2020, three private companies submitted 15 corn hybrids representing three brands for testing under dryland conditions near Huntley, Montana (Table 1). Eleven of the hybrids entered in the 2020 trial were genetically modified for both insect resistance and herbicide tolerance. Relative maturity ratings varied from 79 to 95 days. The study was planted using a quadruple lattice design with four replications. Test plots consisted of a 30-foot, 4-row plot with 30-inch row spacing. Each 30-foot row was planted with 27 seeds, equal to planting 15,682 seeds per acre or about 105 percent of the target population of 14,935 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. 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:** 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 2). 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 corn. The last freezing date in the spring of 2020 occurred on May 9th. Final crop establishment eventually averaged 94 percent with hybrids varying from 87 to 102 percent (Table 3).
- 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 2). This interval is 5 days shorter than the normally expected frost-free period at this location. Total accumulated heat units (1,970 °F, GDD_{corn}) for the season were 3 °F cooler than the heat units normally expected to accumulate on average for this 123-day interval, and 4 percent below 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. All hybrids had achieved some level of physiological maturity (*aka*, kernel black layer) by early 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. The subsequent drying period was prolonged due to precipitation. Harvested on October 26th, harvest grain moisture content averaged 14 percent. Minimal lodging was evident prior to harvest in 2020.

Adjusted corn grain yields averaged 81.8 bushels per acre in 2020 (Table 3). Yields among the 15 entries in 2020 varied from 70.8 bushels per acre for the hybrid 'Dekalb DKC 31-85' to 90.8 bushels per acre for the hybrid 'Dekalb DKC 42-04'. Ten other hybrid corn entries produced averaged grain yields of 79.4 to 90.2 bushels per acre, which were statistically equal to the yield of the highest yielding hybrid tested in 2020. Test weight averaged 58.2 lb/bu for the 15 entries and varied from 56.3 lb/bu for 'Hi Fidelity Genetics HFG 0921' and 'REA Hybrids REA 3B923' to 60.3 lb/bu for 'Dekalb DKC 33-37.' None of the 15 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 10.5, 3.8, and 70.1 percent, respectively.

Table 1. Contact information for seed sources of 15 hybrid corn entries tested at the MSU Southern Agricultural Research Center near Huntley, Montana during 2020.

Brand	Hybrids	Contact
<u>DeKalb</u>	DKC 31-85 DKC 33-37 DKC 37-50 DKC 42-04 DKC 47-27	Mr. David Heimkes Bayer Cropscience Emmett ID 83617 PH: 320-444-3186 EM: david.heimkes@bayer.com
<u>Hi Fidelity Genetics</u>	HFG0851 HFG0852 HFG0921 HFG0951	Ms. Rachel Greenhut Hi Fidelity Genetics Durham, NC 27701 PH: 530-574-3135 EM: Rachel.greenhut@hifidelitygenetics.com
<u>REA Hybrids</u>	1B780 1B821 2B851 3B903 3B912 3B923	Mr. Jon Langan REA Hybrids Laporte, MN 56461 PH: 701-535-1006 EM: jonathan.langan@bayer.com

Table 2. 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 3. Agronomic performance of 15 commercial corn hybrids grown under dryland conditions near Huntley, Montana during 2020. Sorted by brand & hybrid. MSU Southern Agricultural Research Center.

Brand & Hybrid	RM	Grain ^{1/}	Test ^{2/}	Grain	Grain ^{3/}	Grain ^{3/}	Grain ^{3/}	Crop Establishment		Silking Date		Tasseling Date		Bird ^{4/}
		Yield	Weight	Moisture	Protein	Oil	Starch	Stand	Emergence	Julian	Calendar	Julian	Calendar	Damage
	- days -	- bu/a -	- lb/bu -	- % -	----- % -----			- plants/a -	- % -	- days -	- date -	- days -	- date -	- % -
Dekalb DKC 31-85	81	70.8	59.1	13.1	11.3	4.2	69.2	15,246	97.2	203.5	Jul 23	204.0	Jul 23	3.7
Dekalb DKC 33-37	83	77.2	60.3	13.3	11.4	4.1	69.2	13,592	86.7	204.2	Jul 23	203.7	Jul 23	7.5
Dekalb DKC 37-50	87	76.5	57.8	13.2	10.6	3.9	69.9	14,883	94.9	204.7	Jul 24	203.9	Jul 23	1.3
Dekalb DKC 42-04	92	90.8**	56.8	14.3	9.7	3.6	70.9	14,318	91.3	208.7	Jul 28	207.5	Jul 27	0.0
Dekalb DKC 47-27	97	79.4*	59.2	14.9	10.7	3.6	70.5	14,923	95.2	209.7	Jul 29	209.7	Jul 29	1.3
HFG 0851	85	84.5*	59.7	13.9	10.4	3.6	70.5	14,399	91.8	205.1	Jul 24	204.3	Jul 23	8.8
HFG 0852	85	72.5	56.7	13.0	10.0	3.7	70.6	14,923	95.2	206.2	Jul 25	206.5	Jul 26	1.3
HFG 0921	92	83.6*	56.3	14.3	10.4	4.0	69.8	14,762	94.1	210.7	Jul 30	210.3	Jul 29	0.0
HFG 0951	95	80.8*	57.4	15.1	10.2	3.8	70.6	13,189	84.1	209.7	Jul 29	208.7	Jul 28	6.2
REA 1B780	79	83.7*	58.2	13.3	10.3	4.2	69.7	15,327	97.7	203.7	Jul 23	203.5	Jul 23	8.8
REA 1B821	82	82.5*	60.0	14.1	10.3	4.1	70.1	14,318	91.3	205.0	Jul 24	204.5	Jul 24	2.5
REA 2B851	85	85.3*	59.6	13.8	10.3	4.0	70.3	14,238	90.8	204.2	Jul 23	203.5	Jul 23	8.8
REA 3B903	90	90.2*	58.6	13.7	10.3	3.4	70.7	14,681	93.6	207.3	Jul 26	206.3	Jul 25	5.0
REA 3B912	91	79.4*	57.6	13.7	11.3	3.3	70.1	15,649	99.8	208.3	Jul 27	207.3	Jul 26	3.7
REA 3B923	92	88.9*	56.3	13.7	10.5	3.9	69.9	16,053	102.4	209.0	Jul 28	209.0	Jul 28	0.0
Average		81.8	58.2	13.8	10.5	3.8	70.1	14,700	93.7	206.7	Jul 26	206.2	Jul 25	3.9
Prob > F		0.034	<0.001	<0.001	0.012	<0.001	<0.001	ns	ns	<0.001		<0.001		0.001
LSD (P=0.05)		11.6	0.9	0.6	0.9	0.2	0.7	---	---	1.5		1.4		2.3
CV%		9.8	1.0	2.8	5.6	2.9	0.7	8.0	8.0	0.5		0.4		21.5
Lattice RE% ^{5/}		100	128	108	100	100	100	100	100	103		101		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.

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

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

4/ Bird damage visually estimated as the percent feeding damage occurring on at least 50% of the ears.

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

Planted: April 30, 2020

Harvested: October 26, 2020

Fertility: 86.0 lb/a residual soil NO₃-N + 50 lb/a N as Urea

Herbicide: Prowl 3.3 EC 32 oz/a, Outlook 16 oz/a, Liberate 6 oz/a May 2, 2020

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

Previous Crop: Chemical fallow

Precipitation (planting to harvest): 9.66 inches