

PROJECT TITLE: Montana Specialty Mills, LLC Mustard Performance Evaluation under No-Till, Dryland, Chemical Fallow Conditions near Havre and Conrad, Montana. (Exps. 09-OC10 & 09-MU18).

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OBJECTIVES:

To provide Montana Specialty Mills with a reliable, unbiased, up-to-date source of information that will permit valid dryland seed and oil production comparisons among selected mustard varieties submitted for testing.

METHODS:

Contact information for mustard seed sources submitted for this trial is summarized in Table 1.

Northern Agricultural Research Center, Havre: In 2009, Montana Specialty Mills, LLC submitted two mustard entries for testing near Havre and Conrad, MT. The trial at Havre was seeded on April 12, under no-till, dryland, chemical fallow conditions in replicated, 22-foot, 4-row plots with 12-inch row spacing utilizing a three-point-mounted 'Hege 1000' plot drill equipped with 'John Deere Tru-Vee' disk openers. Each plot was seeded with 7.33 grams, equal to seeding 8 lbs per acre. Seeding depth was 1 inch. Percent plant stand was determined by visually estimating the amount of "open" space six-inches and larger between plants within all rows. No post-emergence herbicides were applied, and all plots were hand weeded. Flowering date was recorded as the date when 50 percent of the plants within a plot had at least one open floret. Pod shatter was determined by visual assessment prior to harvest, and was recorded as total percent in each plot. Harvest maturity date was recorded when 50 percent of the plants pods were tan and dry. Tilled 4-foot alleys were used for plot differentiation, reducing the harvested area to 4 rows wide by 18 feet long. The 72 ft² plots were direct harvested using a 'Wintersteiger Elite 1541-21' plot combine. Seed samples were cleaned in the laboratory using a 'Clipper Office Tester and Cleaner' and then weighed following cleaning to determine seed yield. Seed test weight (lb/bu) and percent grain moisture content were obtained for each plot using a 'Dickey-john GAC 2100' grain analyzer. Recorded grain yields were adjusted to eight percent grain moisture content and are reported in pounds per acre. Grain oil percentages were determined using nuclear magnetic resonance (NMR) spectroscopy and are reported on a dry matter basis. Trial management information for the trial located at NARC is listed in Table 5.

Western Triangle Agricultural Research Center, Conrad: The trial at Conrad was seeded on April 9. Available trial management information for the Conrad site is listed in Table 7.

RESULTS and SUMMARY:

Northern Agricultural Research Center, Havre: The oilseed cropping environment in 2009 at Havre was categorized as good with higher than normal precipitation. Total annual growing season precipitation (9/1/08 through 8/31/09) was 12.46 inches, 4.71 percent greater than the average for all years since 1916 (Table 2). April 1 through July 31 precipitation was 6.29 inches or 93 percent of the 94-year average. Heat units expressed as "Growing Degree Days" (GDD, base 50) from May through July were 1242, or 96 percent of the average for the last 59 years (1951-2009). The last spring frost was 27 days late with the first fall frost 8 days late, resulting in 100 frost-free days, 19 days shorter than the 94-year average. September 2008 through March 2009 precipitation was 129 percent of the long-term average. The April through June growing season saw an average daily temperature at 52.3 degrees F, 0.8 degrees below normal. July and August average temperatures were 1.1 percent lower than normal with the high for 2009 recorded on July 26 and September 4, at 98 degrees F. There were 29 days 90 degrees F or above, and no days with temperatures 100 degrees F or above. April growing conditions were wetter and cooler than normal resulting in delayed seeding and emergence of crops usually planted early. May and June were drier and cooler than normal resulting in very good oilseed production at NARC. Overall, the growing season was cooler than the 94-year average. The minimum winter temperature was -31 degrees F on December 15. Oilseed crop outlook was initially not very good with March conditions much drier than normal followed by cool, wet conditions in April, which delayed seeding and emergence. Timely rainfall during May and June, coupled with adequate fallow-stored soil moisture resulted in spring crop performance that was substantially better than anticipated.

Overall average mustard seed yield at NARC was 1885 lb/ac. 'Pacific Gold', an oriental mustard check for the trial produced 2231 lb/ac with no other entry performing statistically equal. Yellow mustards 'Andante' and 'Ida Gold' both produced over 1800 lb/ac and both entries flowered fairly early. Grain oil ranged from 27.5 to 35.0 percent.

Mustard ID, mustard type, sponsor, plant stand, grain yield, test weight, grain moisture, flowering date, plant height, maturity date, lodging rating, pod shatter and grain oil data are summarized for NARC in Table 4.

Western Triangle Agricultural Research Center, Conrad: Crop year weather data for Conrad is reported in Table 3. Overall average mustard seed yield at WTARC was 1551 lb/ac. 'Andante', a yellow mustard submitted by Montana Specialty Mills, LLC, produced 1848 lb/ac with only 'Forge' oriental mustard producing statistically less seed yield at 828 lb/ac. Seed yield of Forge is likely low due to the late flowering date of the variety. Grain oil ranged from 30.5 to 36.1 percent.

Mustard ID, mustard type, sponsor, grain yield, flowering date, plant height, lodging rating and grain oil data are summarized for WTARC in Table 6.

FUTURE PLANS:

With continued support from Montana Specialty Mills, LLC and research center personnel, evaluations will continue in 2010 at Havre, Conrad and potentially other selected sites across Montana.

**Table 1. Contact Information for Seed Sources of Two Commercial Mustard Entries Tested near Havre and Conrad, MT. 2009.
(Exps. 09-OC10 & 09-MU18)**

COMPANY	HYBRIDS TESTED	CONTACT
Montana Specialty Mills, LLC	Andante Ida Gold	Mr. Justin Hager Merchandiser 525 3rd St. NW Great Falls, MT 59403 PH: 1-800-332-2024 FX: 1-406-761-7926 EM: Justin.Hager@mtspecialtymills.com WB: www.mtspecialtymills.com

Table 2. Summary of climatic data by months for the 2008-2009 crop year (September to August) and averages for the period 1916-2009 at the Northern Agricultural Research Center, Havre, Montana.

Month Year	Sep 2008	Oct 2008	Nov 2008	Dec 2008	Jan 2009	Feb 2009	Mar 2009	Apr 2009	May 2009	Jun 2009	Jul 2009	Aug 2009	Crop Year
<u>Precipitation (inches)</u>													<u>Total</u>
Current Year	1.39	0.06	1.94	0.69	0.86	0.13	0.04	1.85	1.02	1.59	1.83	1.06	12.46
94-Year Average (1916 to 2008-09)	1.15	0.65	0.43	0.45	0.43	0.32	0.54	0.98	1.77	2.56	1.43	1.19	11.90
<u>Mean Temperature (°F)</u>													<u>Average</u>
Current Year	56.1	45.8	30.1	19.4	15.9	21.2	25.4	43.1	52.8	61.1	68.9	66.1	42.1
94-Year Average (1916 to 2008-09)	56.1	45.9	30.0	19.7	15.4	20.0	30.0	43.6	54.1	61.8	69.2	67.3	42.8

Last killing frost in spring*

2009

Ave. 1916-2009

June 10th (32°)

May 14th

First killing frost in fall*

2009

Ave. 1916-2009

September 28th (27°)

September 20th

Frost free period

2009

Ave. 1916-2009

110 days

129 days

Growing degree days (base 50)

May 1-Oct 31, 2009

Ave. 1951-2009

2384.0

2384.4

Maximum summer temperature

98° July 26th and September 4th

Minimum winter temperature

-31° December 15th

*In this summary 32° is considered a killing frost.

Table 3. Summary of climatic data by month for the '08-'09 crop year (September thru August) at the Western Triangle Agricultural Research Center, Conrad, MT.

Month	Precipitation (inches)		Mean Temperature (°F)	
	Current Year	Average (24-yr)	Current Year	Average (24-yr)
September, 2008	2.45	1.22	53.9	56.8
October, 2008	0.00	0.58	45.5	45.2
November, 2008	0.20	0.29	38.7	32.5
December, 2008	0.55	0.18	14.9	24.8
January, 2009	0.11	0.18	24.3	23.3
February, 2009	0.24	0.23	25.1	24.9
March, 2009	0.24	0.43	26.7	33.1
April, 2009	1.16	0.95	39.5	43.2
May, 2009	0.94	1.80	49.1	52.3
June, 2009	1.88	2.87	57.0	59.7
July, 2009	4.31	1.43	64.3	67.1
August, 2009	0.59	1.23	63.2	66.1
Total	12.67	--	--	--
Average	--	11.35	41.9	44.2

Last killing frost in Spring (32°F)

2009----- June 07

Average 1986-2009----- May 19

First killing frost in Fall (32°F)

2009----- September 28

Average 1986-2008----- Sept 24

Frost free period (days)

2009----- 113

Average----- 128

Maximum summer temperature----- 91.9°F (September 04, 2009)

Minimum winter temperature----- -26.3°F (December 15, 2009)

Table 4. Agronomic Performance of Condiment Mustard Entries Grown under Dryland, Fallow, No-till Conditions near Havre. Northern Agricultural Research Center. Havre, MT. 2009. (Exp. 09-OC10-OC)

ID	Mustard Type	Sponsor	Plant	Grain	Test	Grain	Flowering Date		Plant	Maturity Date		Lodging	Pod	Grain	
			Stand	Yield	Weight	Moisture	Julian	Calendar	Height	Julian	Calendar	rating	Shatter	Oil	
			%	lb/ac	lb/bu	%	day	date	inches	day	date	0-9	%	%	lb/ac
Forge	Oriental	MSU - Check	94.6	1981.6	55.7	5.9	167.8	Jun 17	52.4	207.5	Jul 27	0.0	0.0	30.9	612.5
Pacific Gold	Oriental	MSU - Check	97.6	2230.6 **	53.7	5.8	165.5	Jun 15	42.7	206.0	Jul 26	0.0	0.0	35.0	781.4
Andante	Yellow	MT Spec. Mills, LLC	95.8	1819.4	56.3	5.8	157.0	Jun 6	33.7	203.3	Jul 22	0.0	0.0	27.5	500.5
Ida Gold	Yellow	MT Spec. Mills, LLC	94.3	1820.2	56.0	5.8	156.8	Jun 6	35.2	203.5	Jul 23	0.0	0.0	27.9	508.0
Pennant	Yellow	MSU - Check	97.4	1664.2	56.0	5.8	155.5	Jun 5	31.9	203.0	Jul 22	0.0	0.0	28.6	475.3
Tilney	Yellow	MSU - Check	96.5	1794.0	56.1	5.9	159.5	Jun 9	31.4	204.0	Jul 23	0.0	0.0	27.8	499.3
Average			96.0	1885.0	55.6	5.8	160.3	Jun 9	37.9	204.5	Jul 24	0.0	0.0	29.6	562.8
LSD (p=0.05)			ns	225.24	0.22	0.67	2.14	-	3.55	0.81	-	-	-	-	-
CV%			2.43	7.93	0.26	0.76	0.88	-	6.21	0.26	-	-	-	-	-

Grain yield and percent oil is adjusted to 8 percent grain moisture content.

** Indicates highest yielding cultivar within a column.

* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

Seeding Date: April 12, 2009

Harvest Date: August 12, 2009

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Field	An-2-5	K (ppm) 0-6	277	Init PAW (in.) 0-6"	1.31	Fert. Rate (lbs/ac) P2O5	n/a
Quarter	NW	Ca (ppm) 0-6	5266	Init PAW (in.) 6-24"	4.06	Fert. Rate (lbs/ac) K2O	n/a
Section	33	Mg (ppm) 0-6	479	Init PAW (in.) 24-36"	2.42	Herbicide App. Date	none
Township	32N	Na (ppm) 0-6	25	Init PAW (in.) 36-48"	2.27	Herbicide Product	n/a
Range	15E	SaltH ₂ O (MMHOS/cm) 0-6	0.58	Init PAW (in.) 0-48"	10.07	Herbicide Rate (/ac)	n/a
Latitude	N48 29.410'	SaltH ₂ O (MMHOS/cm) 6-24	0.43	Cropping System	NT-ChmFlw	Precip (in.) Plnt'g-Harvest	6.31
Longitude	W109 47.795'	S (ppm) 0-24	7	Previous Crop	Barley	Precip (>.1) Plnt'g-Harvest	5.54
Soil Series	Hillon CL	Zn (ppm) 0-6	0.5	Planting Date	4/11	Harvest Date	8/12
pH 0-6	8.0	Fe (ppm) 0-6	10.1	Planting Depth (in.)	1.0	Rooting Depth (in.)	38"
Org.Matter (%) 0-6	1.5	Mn (ppm) 0-6	4.7	Moist Soil Depth @ Plnt'g	48+	Post PAW (in.) 0-6"	0.64
N (lbs/ac) 0-6	23	Cu (ppm) 0-6	1.4	Dry Surf Soil (in.) @ Plnt'g	0.50	Post PAW (in.) 6-24"	2.16
N (lbs/ac) 6-24	63	CEC 0-6	31.1	2" Soil Temp (°F) @ Plnt'g	60	Post PAW (in.) 24-36"	1.70
N (lbs/ac) 24-36	18	Soil Texture 0-6	n/a	4" Soil Temp (°F) @ Plnt'g	55	Post PAW (in.) 36-48"	2.22
N (lbs/ac) 36-48	16	Soil Texture 6-24	n/a	Fertilizer Formulation	none	Post PAW (in.) 0-48"	6.72
N (lbs/ac) 0-48	120	Soil Texture 24-36	n/a	Fertilizer Placement	n/a	Precip (>.1) Hvst-Post	0.36
P (ppm) Olsen 0-6	19	Soil Texture 36-48	n/a	Fert. Rate (lbs/ac) N	n/a		

Table 6. Agronomic Performance of Condiment Mustard Entries Grown under Dryland, Fallow, No-till Conditions near Conrad. Western Triangle Agricultural Research Center. Conrad, MT. 2009. (Exp. 09-MU18-OC)

ID	Mustard Type	Sponsor	Plant	Grain	Test	Grain	Flowering Date		Plant	Maturity Date		Lodging	Pod	Grain	
			Stand	Yield	Weight	Moisture	Julian	Calendar	Height	Julian	Calendar	rating	Shatter	Oil	
			%	lb/ac	lb/bu	%	day	date	inches	day	date	0-9	%	%	lb/ac
Forge	Oriental	MSU - Check		827.8			174.0	Jun 23	57.0			1.0		36.1	298.4
Pacific Gold	Oriental	MSU - Check		1789.9	*		168.0	Jun 17	50.0			1.5		30.8	551.1
Andante	Yellow	MT Spec. Mills, LLC		1848.2	**		160.8	Jun 10	41.0			1.5		30.5	563.9
Ida Gold	Yellow	MT Spec. Mills, LLC		1537.3	*		160.0	Jun 9	41.0			1.8		30.8	473.8
Pennant	Yellow	MSU - Check		1702.9	*		160.5	Jun 10	39.0			1.3		31.1	530.1
Tilney	Yellow	MSU - Check		1602.8	*		161.3	Jun 10	39.0			1.3		31.6	506.7
Average				1551.5			164.1	Jun 13	44.5			1.4		31.8	487.3
LSD (p=0.05)				277.23			2.90	-	-			ns		-	-
CV%				11.86			1.17	-	-			33.20		-	-

Grain yield and percent oil is adjusted to 8 percent grain moisture content.

** Indicates highest yielding cultivar within a column.

* Indicates cultivars yielding equal to the highest yielding entry based on Fisher's Protected LSD at the 0.05 probability level.

Seeding Date: April 9, 2009
Swathing Date: August 10, 2009
Harvest Date: August 17, 2009

Table 7. Site Resource and Management Data: CONRAD ONLY (Exp. 09-MU18)									
Field	N		K (ppm) 0-6	442		Init PAW (in.) 0-6"			Fert. Rate (lbs/ac) P2O5
Quarter	SW		Ca (ppm) 0-6			Init PAW (in.) 6-24"			Fert. Rate (lbs/ac) K2O
Section	32		Mg (ppm) 0-6			Init PAW (in.) 24-36"			Herbicide App. Date
Township	30 N		Na (ppm) 0-6			Init PAW (in.) 36-48"			Herbicide Product
Range	2 W		SaltH ₂ O (MMHOS/cm) 0-6	0.5		Init PAW (in.) 0-48"			Herbicide Rate (/ac)
Latitude	48 18 25 N		SaltH ₂ O (MMHOS/cm) 6-24			Cropping System	Alt-crop-fall		Precip (in.) Plnt'g-Harvest
Longitude	111 55 30 W		S (ppm) 0-24	14		Previous Crop			Precip (>.1) Plnt'g-Harvest
Soil Series	Scobey cl		Zn (ppm) 0-6			Planting Date	4/9		Harvest Date
pH 0-6	7.7		Fe (ppm) 0-6			Planting Depth (in.)	0.25		Rooting Depth (in.)
Org.Matter (%) 0-6	2.8		Mn (ppm) 0-6			Moist Soil Depth @ Plnt'g	48+		Post PAW (in.) 0-6"
N (lbs/ac) 0-6	38		Cu (ppm) 0-6			Dry Surf Soil (in.) @ Plnt'g			Post PAW (in.) 6-24"
N (lbs/ac) 6-24	16		CEC 0-6			2" Soil Temp (°F) @ Plnt'g			Post PAW (in.) 24-36"
N (lbs/ac) 24-36	12		Soil Texture 0-6	CL		4" Soil Temp (°F) @ Plnt'g			Post PAW (in.) 36-48"
N (lbs/ac) 36-48	8		Soil Texture 6-24	CL		Fertilizer Formulation	20-20-10-24		Post PAW (in.) 0-48"
N (lbs/ac) 0-48	73		Soil Texture 24-36	CL		Fertilizer Placement			Precip (>.1) Hvst-Post
P (ppm) Olsen 0-6	29		Soil Texture 36-48	CL		Fert. Rate (lbs/ac) N			