PROJECT TITLE: Montana Specialty Mills, LLC Mustard Performance Evaluation under No-Till, Dryland, Chemical Fallow Conditions near Havre and Conrad, Montana. (Exps. 10-OC10 & 10MU18).

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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 2010, Montana Specialty Mills, LLC submitted two mustard entries for testing near Havre and Conrad, MT. The trial at Havre was seeded on April 21, 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 ft^2 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 at eight percent moisture. 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 22, swathed on August 11 and combined on August 20. 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 2010 at Havre was categorized as good with higher than normal precipitation and cooler than normal temperatures. Total annual growing season precipitation (9/1/09 through 8/31/10) was 14.61 inches, 22.6 percent greater than the average for all years since 1916 (Table 2). April 1 through July 31 precipitation was 9.69 inches or 143.6 percent of the 95-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 60 years (1951-2010). The last spring frost was 1 day early with the first fall frost 24 days late, resulting in 154 frost-free days, 25 days longer than the 95-year average. September 2009 through March 2010 precipitation was 91 percent of the long-term average. The April through June growing season saw an average daily temperature at 51.5 degrees F, 1.7 degrees below normal. July and August average temperatures were 2.3 percent lower than normal with the high for 2010 recorded on August 27, at 102 degrees F. There were 18 days 90 degrees F or above, and only one day 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 wetter and cooler than normal resulting in average oilseed production at NARC. Overall, the growing season was cooler than the 95-year average. The minimum winter temperature was -35 degrees F on December 7. 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 1318 lb/ac, with no statistical difference between entries. Grain oil ranged from 30.6 to 39.6 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 944 lb/ac. 'Pacific Gold' oriental mustard produced 1205 lb/ac while the yellow mustards 'Ida Gold' and 'Pennant' produced 1039 and 1049 lb/ac, respectively, which was statistically equal to the highest yielding entry. Seed yield of 'Forge' is likely low due stand establishment issues throughout all replications. This trial was also hit by a mid-season hail storm resulting in minimal damage. Grain oil ranged from 32.4 to 39.5 percent.

Mustard ID, mustard type, sponsor, grain yield, test weight, flowering date, plant height 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 2011 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. 10-OC10 & 10-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 2009-2010 crop year (September to August) and averages for the period 1916-2010 at the Northern Agricultural Research Center, Havre, Montana.

Month Year	Sep 2009	Oct 2009	Nov 2009	Dec 2009	Jan 2010	Feb 2010	Mar 2010	Apr 2010	May 2010	Jun 2010	Jul 2010	Aug 2010	Crop Year
Precipitation (inches)													**Total**
Current Year	0.39	1.25	0.00	0.69	0.72	0.28	0.31	2.39	3.36	2.54	1.40	1.28	14.61
95-Year Average (1916 to 2009-10)	1.14	0.66	0.43	0.45	0.44	0.32	0.54	0.99	1.78	2.55	1.43	1.19	11.92
Mean Temperature (^{o}F)													**Average**
Current Year	64.1	38.8	38.8	7.0	13.1	12.2	32.7	44.7	49.4	60.3	66.7	66.7	41.2
95-Year Average (1916 to 2009-10)	56.2	45.7	30.2	19.5	15.4	19.9	30.0	43.6	54.0	61.8	69.2	67.3	42.7

Last killing frost in spring*

2010	May 13th (31˚)
Ave. 1916-2010	May 14th

First killing frost in fall*

2010	October 14th (31˚)
Ave. 1916-2010	September 20th

Frost free period

2010	154 days
Ave. 1916-2010	129 days

Growing degree days (base 50)

May 1-Oct 31, 2010	2219.5
Ave. 1951-2010	2379.2

Maximum summer temperature	**102˚ August 27th**
Minimum winter temperature	**-35˚ December 7th**

*In this summary 32^{o} is considered a killing frost.

Table 3. Summary of climatic data by month for the '09-'10 crop year (September thru August) at the Western Triangle Agricultural Research Center, Conrad, MT.

Month	Precipitation (inches)		Mean Temperature (^{o}F)	
	Current Year	Average (25-yr)	Current Year	Average (25-yr)
September, 2009	.41	1.22	62.6	57.1
October, 2009	.77	0.58	36.2	44.9
November, 2009	0	0.29	36.9	32.7
December, 2009	.41	0.18	12.6	24.3
January, 2010	.53	0.18	20.4	23.1
February, 2010	.14	0.23	22.9	24.9
March, 2010	.14	0.43	37.5	33.3
April, 2010	2.03	0.95	40.2	43.1
May, 2010	3.03	1.80	44.3	51.9
June, 2010	3.79	2.87	55.7	59.6
July, 2010	2.29	1.43	62.4	66.9
August, 2010	1.98	1.23	62.1	66.0
Total	15.52	--		--
Average	--	11.35	41.2	44.0

Last killing frost in Spring (32^{o}F)

2010---------- May 30
Average 1986-2010---------- May 19

First killing frost in Fall (32^{o}F)

2010---------- Oct 16
Average 1986-2010---------- Sept 25

Frost free period (days)

2010---------- 139
Average---------- 128

Maximum summer temperature------- 95^{o}F (September 27, 2010)

Minimum winter temperature---------- -25^{o}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. 2010. (Exp. 10-OC10-OC)

ID	Mustard Type	Sponsor	Plant Stand	Grain Yield	Test Weight	Grain Moisture	Flowering Date Julian	Flowering Date Calendar	Plant Height	Maturity Date Julian	Maturity Date Calendar	Lodging rating	Pod Shatter	Grain Oil %	Grain Oil lb/ac
			%	lb/ac	lb/bu	%	day	date	inches	day	date	0-9	%	%	lb/ac
Forge	Oriental	MSU - Check	91.7	1184.7	53.8	4.2	174.0	Jun 23	42.2	215.3	Aug 3	0.0	0.3	37.1	435.5
Pacific Gold	Oriental	MSU - Check	95.1	1467.0	52.9	4.2	172.3	Jun 21	39.3	216.0	Aug 4	0.0	1.0	39.6	580.4
Andante	Yellow	MT Spec. Mills, LLC	90.7	1112.7	55.7	4.8	167.0	Jun 16	28.5	211.3	Jul 30	0.0	0.0	31.3	347.6
Ida Gold	Yellow	MT Spec. Mills, LLC	94.7	1444.6	55.5	4.2	164.0	Jun 13	34.2	208.3	Jul 27	0.0	0.0	30.6	442.1
Pennant	Yellow	MSU - Check	95.8	1344.4	55.8	4.5	163.7	Jun 13	31.9	207.3	Jul 26	0.0	0.0	31.0	415.2
Tilney	Yellow	MSU - Check	97.0	1357.6	55.3	4.3	163.7	Jun 13	28.8	207.3	Jul 26	0.0	0.3	31.3	424.5
Average			94.2	1318.5	54.8	4.4	167.4	Jun 16	34.1	210.9	Jul 30	0.0	0.3	33.5	440.9
LSD (p=0.05)			ns	ns	0.61	0.54	3.41	-	3.52	5.06	-	-	0.64	1.64	ns
CV%			3.73	18.76	0.61	6.82	1.12	-	5.67	1.32	-	-	125.85	2.69	17.28

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 21, 2010
Harvest Date: August 15, 2010

Table 5. Site Resource and Management Data: HAVRE ONLY (Exp. 10-OC10)

Field	An-3-5	K (ppm) 0-6	255	Init PAW (in.) 0-6"	0.69	Fert. Rate (lbs/ac) P2O5	n/a
Quarter	NW	Ca (ppm) 0-6	4096	Init PAW (in.) 6-24"	2.25	Fert. Rate (lbs/ac) K2O	n/a
Section	33	Mg (ppm) 0-6	424	Init PAW (in.) 24-36"	1.56	Herbicide App. Date	none
Township	32N	Na (ppm) 0-6	29	Init PAW (in.) 36-48"	1.91	Herbicide Product	n/a
Range	15E	SaltHaz (MMHOS/cm) 0-6	0.36	Init PAW (in.) 0-48"	6.41	Herbicide Rate (/ac)	n/a
Latitude	N48 29.431'	SaltHaz(MMHOS/cm) 6-24	0.43	Cropping System	NT-ChmFlw	Precip (in.) Plnt'g-Harvest	7.60
Longitude	W109 47.835'	S (ppm) 0-24	8	Previous Crop	Barley	Precip (>.1) Plnt'g-Harvest	6.87
Soil Series	Hillon CL	Zn (ppm) 0-6	0.4	Planting Date	4/21	Harvest Date	8/15
pH 0-6	8.0	Fe (ppm) 0-6	9.5	Planting Depth (in.)	1.0	Rooting Depth (in.)	30"
Org.Matter (%) 0-6	2.0	Mn (ppm) 0-6	3.0	Moist Soil Depth @ Plnt'g	48+	Post PAW (in.) 0-6"	0.69
N (lbs/ac) 0-6	20	Cu (ppm) 0-6	1.3	Dry Surf Soil (in.) @ Plnt'g	0.50	Post PAW (in.) 6-24"	2.25
N (lbs/ac) 6-24	30	CEC 0-6	24.8	2" Soil Temp (°F) @ Plnt'g	68	Post PAW (in.) 24-36"	1.56
N (lbs/ac) 24-36	140	Soil Texture 0-6	n/a	4" Soil Temp (°F) @ Plnt'g	65	Post PAW (in.) 36-48"	1.91
N (lbs/ac) 36-48		Soil Texture 6-24	n/a	Fertilizer Formulation	none	Post PAW (in.) 0-48"	6.41
N (lbs/ac) 0-48	190	Soil Texture 24-36	n/a	Fertilizer Placement	n/a	Precip (>.1) Hvst-Post	0.36
P (ppm) Olsen 0-6	12	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. 2010. (Exp. 10-MU18-OC)

ID	Mustard Type	Sponsor	Plant Stand	Grain Yield		Test Weight	Grain Moisture	Flowering Date Julian	Flowering Date Calendar	Plant Height	Maturity Date Julian	Maturity Date Calendar	Lodging rating	Pod Shatter	Grain Oil	
			%	lb/ac		lb/bu	%	day	date	inches	day	date	0-9	%	%	lb/ac
Forge	Oriental	MSU - Check		398.0		35.3		179.0	Jun 28	43.5					35.4	140.2
Pacific Gold	Oriental	MSU - Check		**1205.0**	**	31.4		176.0	Jun 25	48.0					39.5	475.3
Andante	Yellow	MT Spec. Mills, LLC		977.8		34.1		173.0	Jun 22	37.3					32.4	317.0
Ida Gold	Yellow	MT Spec. Mills, LLC		**1039.1**	*	34.4		172.0	Jun 21	40.3					32.8	340.5
Pennant	Yellow	MSU - Check		**1049.5**	*	33.6		169.0	Jun 18	35.8					33.3	350.3
Tilney	Yellow	MSU - Check		995.8		34.7		172.0	Jun 21	37.5					33.3	332.1
Average				944.2		33.9		173.5	Jun 23	40.4					34.4	325.9
LSD (p=0.05)				192.50		ns		-	-	4.63					0.74	67.20
CV%				13.52		4.76		-	-	7.60					1.42	13.68

Grain yield reported on a "as was" moisture basis at harvest time.

** 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 22, 2010
Swathing Date: August 11, 2010
Harvest Date: August 20, 2010

Table 7. Site Resource and Management Data: CONRAD ONLY (Exp. 10-MU18)

Field	G	K (ppm) 0-6	311	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	31	Mg (ppm) 0-6		Init PAW (in.) 24-36"		Herbicide App. Date	none
Township	30N	Na (ppm) 0-6		Init PAW (in.) 36-48"		Herbicide Product	na
Range	2W	SaltHaz (MMHOS/cm) 0-6	0.5	Init PAW (in.) 0-48"		Herbicide Rate (/ac)	
Latitude	48 18 25' N	SaltHaz(MMHOS/cm) 6-24		Cropping System	Alt-crop-fall	Precip (in.) Plnt'g-Harvest	
Longitude	111 55 30' W	S (ppm) 0-24		Previous Crop		Precip (>.1) Plnt'g-Harvest	
Soil Series	Scobey cl	Zn (ppm) 0-6		Planting Date	4/22	Harvest Date	8/20
pH 0-6	7.8	Fe (ppm) 0-6		Planting Depth (in.)	0.5	Rooting Depth (in.)	
Org.Matter (%) 0-6	2.6	Mn (ppm) 0-6		Moist Soil Depth @ Plnt'g	60+	Post PAW (in.) 0-6"	
N (lbs/ac) 0-6	52	Cu (ppm) 0-6		Dry Surf Soil (in.) @ Plnt'g		Post PAW (in.) 6-24"	
N (lbs/ac) 6-24	25	CEC 0-6		2" Soil Temp (°F) @ Plnt'g		Post PAW (in.) 24-36"	
N (lbs/ac) 24-36	16	Soil Texture 0-6		4" Soil Temp (°F) @ Plnt'g		Post PAW (in.) 36-48"	
N (lbs/ac) 36-48	10	Soil Texture 6-24		Fertilizer Formulation	20-20-10-15	Post PAW (in.) 0-48"	
N (lbs/ac) 0-48	104	Soil Texture 24-36		Fertilizer Placement		Precip (>.1) Hvst-Post	
P (ppm) Olsen 0-6	13	Soil Texture 36-48		Fert. Rate (lbs/ac) N			