PROJECT TITLE: Evaluation of regional spring wheat, durum, and oat yield trials – 2009 (4W2756)

PROJECT LEADER:
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Personnel:
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Dr. E.M. Elias, North Dakota State University

OBJECTIVES: To evaluate new and introduced lines and cultivars of spring wheat and durum developed by Universities, the USDA-ARS, and private seed companies, and to determine adaptability of those lines and varieties to conditions in eastern Montana.

Methods:
Dryland site:
Soil type: Williams clay loam
Previous crops: 2008 - fallow, 2007 – safflower, 2006 - small grain plots
Residual soil N to 3 ft: 95 lb N/ac
Residual soil P to 6 in: 31 ppm
Applied fertilizer: none
Herbicides: Brox M, 1.5 pt/ac, applied June 3
Precipitation April – August, 2009: 8.87 in
Ave (60 yr) precipitation April – August: 9.41 in
Precipitation September 2008 – August 2009: 13.93 in
Ave (60 yr) precipitation September – August: 13.82 in

Irrigated site:
Soil type: Savage silty clay
Previous crops: 2008 – safflower, 2007 – sugarbeet, 2006 – small grain
Residual soil N to 3 ft: 75 lb N/ac
Residual soil P to 6 in: 15 ppm
Applied fertilizer: 200 lb/ac 18-46-0, and 50 lb liquid N/ac, applied in November, 2008
Irrigated (sprinkler) on: May 22, June 17, July 24, 1 inch each application
Herbicides: Brox-M at a rate of 1.5 pt/ac, applied June 2
Precipitation April – August, 2009: 10.45 in
Ave (60 yr) precipitation April – August: 9.41 in
Precipitation September 2008 – August 2009: 15.77 in
Ave (60 yr) precipitation September – August: 13.82 in
Comments:
It was generally a cool summer. Soil moisture was good at planting, but conditions were very dry in May and June. Rain started in early July, causing secondary tillering.

Nursery	Planting date	Harvest date
Uniform regional hard spring wheat trial	April 23	August 12
Uniform regional durum trial – dryland	April 20	August 10
Uniform regional durum trial – irrigated	May 7	August 31

RESULTS:

Uniform Regional Hard Red Spring Wheat trial: The Uniform Regional Hard Red Spring wheat trial is conducted in cooperation with Dr. D. Garvin of the University of Minnesota, St. Paul. Dr. G. Hareland of North Dakota State University, Fargo, tests quality of each line and variety. Thirty-seven experimental lines and varieties of spring wheat were tested under dryland conditions (Table 1). Five lines and varieties yielded significantly more than the check variety, Keen, and four lines and varieties yielded significantly less than the check variety, Keene. Five-year summaries for yield, test weight, and protein are shown in Tables 2-4.

Uniform Regional Durum trial, dryland: The Uniform Regional Durum trial is conducted in cooperation with Dr. E.M. Elias, North Dakota State University, Fargo. Dr. G. Hareland of North Dakota State University, Fargo, tests quality of each line and variety. Thirty-two experimental lines and varieties were tested under dryland fallow conditions (Table 5). Eight lines and varieties yielded significantly less than the check variety, Mountrail. Five-year summaries for yield, test weight, protein, and hard vitreous amber color are shown in Tables 6-9.

Thirty-two experimental lines and varieties were tested under flood irrigated conditions (Table 10). Sixteen experimental lines and varieties yielded significantly less than the check variety, Mountrail. Five-year summaries for yield, test weight, protein content, lodging, and hard vitreous amber color of durum varieties grown under irrigation are shown in Tables 11-15.

SUMMARY: The experiments reported under this project are all of the replicated small plot type. The uniform regional yield trials are conducted at many sites in several states across the western USA, and have been in place since the 1930's. These trials provide important information about experimental lines from state breeding programs, private companies, and the USDA-ARS breeding programs. New varieties are released based on data from these trials.

FUNDING SUMMARY: Expenditure information to be provided by OSP. No other grants support this project.

MWBC FY2011GRANT SUBMISSION PLANS: It is planned to submit this project for funding consideration in the next fiscal year.

Table 1. Agronomic data obtained from a Uniform Regional hard red spring wheat yield trial grown under dryland fallow conditions at the Eastern Agricultural Research Center, Sidney, MT.

Entry	heading*	height, cm	percent protein	test wt, lb/bu	yield, bu/ac	
NDSW0703	60.7	59.0	15.46	61.0	58.6	a
BB34-CK-1-B-17	60.3	56.3	15.99	64.0	58.2	a
BZ903-504	59.0	52.7	15.42	62.7	57.8	a
MO5/1-3	60.3	51.7	15.93	62.8	55.0	a
BD94B*D0248	62.0	60.0	13.89	63.3	54.8	a
01S0263-28	59.3	50.3	16.36	64.0	54.2	
MN03169-2-062	60.7	57.7	15.46	63.5	53.3	
NDSW0612	62.0	56.0	16.35	63.7	51.2	
BZ901-678-g	60.3	47.7	14.13	64.8	50.1	
MO6/1-23	58.3	56.0	17.52	64.5	49.5	
MN05214-3	59.3	52.7	15.70	64.0	49.4	
SD3997	57.3	57.3	16.79	62.7	48.8	
2375	58.7	50.7	15.41	63.5	48.3	
Keene	60.3	61.0	14.27	63.8	48.1	
01S0236-6	57.3	51.0	16.60	63.5	47.2	
SD4024	60.0	48.3	16.19	64.3	46.6	
Chris	60.7	62.0	15.42	62.7	46.4	
NDSW0702	60.0	54.3	14.07	61.0	46.4	
01S0377-6	56.3	46.7	16.31	63.7	46.3	
MO6/1-24	59.0	54.7	15.24	64.0	46.1	
CA907-827	57.3	45.7	14.71	64.2	45.5	
MO3/3-23	61.3	52.3	14.92	63.0	45.3	
BW914	59.7	61.7	12.79	62.8	45.1	
SD4076	56.7	52.7	14.11	64.2	45.0	
MN05141-2	59.3	52.3	15.34	63.5	44.7	
MO5/1-2	58.0	56.3	15.00	63.5	44.6	
MN06018	59.0	49.7	16.17	65.0	44.6	
Verde	60.0	54.7	12.75	63.5	44.3	
SD4112	56.0	57.3	14.03	64.0	44.0	
SD4011	57.3	50.0	15.15	62.8	43.0	
02S0178-1	58.3	47.7	15.13	64.2	42.8	
NDSW0701	59.0	47.7	15.14	62.5	42.8	
Marquis	62.3	62.7	15.20	63.0	42.3	
CA908-801	58.0	43.0	14.97	65.2	41.7	x
CA905-781	58.7	51.3	16.11	63.2	39.7	x
MN06028	58.0	48.0	14.87	64.0	39.2	x
BZ901-658-j	54.7	50.7	17.31	63.0	37.5	x
average	59.1	53.2	15.30	63.5	47.3	
probability	<0.001	<0.001	<0.001	<0.001	<0.001	
CV (S/MEAN)	1.29	7.08	7.54	0.67	8.17	
CV (SE/MEAN)	0.74	4.09	4.35	0.39	4.72	
LSD (0.05)	1.24	6.13	1.878	0.70	6.28	

*days from planting

a indicates significantly greater yield than check variety, Keene, at probability of 0.05

x indicates significantly lower yield than check variety, Keene, at probability 0.05

Table 2. Relative yields of spring wheat varieties in bu/ac as compared to Verde when grown under dryland fallow conditions in the Uniform Regional Hard Red Spring Wheat trial at Sidney, MT.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Keene
NDSW0703	--	--	--	--	58.6	58.6	121.8
BZ903-504	--	--	--	--	57.8	57.8	120.2
NDSW0612	--	--	--	--	53.3	53.3	110.8
Keene	44.7	53.2	49.6	41.1	48.1	47.3	100.0
Verde	47.4	54.0	49.3	39.3	44.3	46.9	99.0
2375	45.2	51.1	45.4	40.3	48.3	46.1	97.3
Chris 525-1	34.6	41.5	38.0	31.6	46.4	38.4	81.2
Marquis	36.6	36.4	36.6	33.2	42.3	37.0	78.2

NOTE: Average yields in this summary should not be compared to each other since they are not grown in the same years. Compare yields only to the check variety.

Table 3. Relative test weights of spring wheat varieties in lb/bu as compared to Verde when grown under dryland fallow conditions in the Uniform Regional Hard Red Spring Wheat trial at Sidney, MT.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Keene
Keene	62.0	59.8	61.5	58.0	63.8	61.0	100.0
2375	62.0	60.0	61.0	57.5	63.5	60.8	99.6
NDSW0612	--	--	--	--	63.5	63.5	99.5
Verde	62.0	59.5	60.7	56.5	63.5	60.4	99.0
BZ903-504	--	--	--	--	62.7	62.7	98.3
Marquis	60.8	58.0	60.2	57.0	63.0	59.8	98.0
Chris 525-1	59.7	57.7	59.8	56.2	62.7	59.2	97.1
NDSW0703	--	--	--	--	61.0	61.0	95.6

NOTE: Average test weights in this summary should not be compared to each other since they are not grown in the same years. Compare test weights only to the check variety.

Table 4. Relative protein contents of spring wheat varieties in percent as compared to Verde when grown under dryland fallow conditions in the Uniform Regional Hard Red Spring Wheat trial at Sidney.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Keene
NDSW0703	--	--	--	--	15.5	15.5	108.4
NDSW0612	--	--	--	--	15.5	15.5	108.4
BZ903-504	--	--	--	--	15.4	15.4	107.7
Chris 525-1	13.3	14.4	14.4	16.2	15.4	14.7	102.6
Keene	13.5	14.4	14.4	15.2	14.3	14.4	100.0
Marquis	12.8	13.3	13.9	15.6	15.2	14.2	98.6
2375	12.3	12.3	12.6	15.5	15.4	13.6	94.8
Verde	12.6	12.5	12.7	15.2	12.8	13.2	91.6

NOTE: Average protein contents in this summary should not be compared to each other since they are not grown in the same years. Compare protein contents only to the check variety.

Table 5. Agronomic data obtained from a Uniform Regional durum yield trial grown under dryland fallow conditions at the Eastern Agricultural Research Center, Sidney, MT

Entry	heading*	height, cm	HVAV	grain protein, %	test wt, lb/bu	yield, bu/ac	
D021110	62.7	53.3	106.3	15.42	61.7	33.0	
DIVIDE	62.0	52.3	107.4	14.35	62.2	32.5	
D00095	62.7	55.7	107.1	14.48	62.7	31.8	
ALKABO	62.7	46.7	110.1	13.85	62.5	30.7	
MOUNTRAIL	63.0	50.0	104.8	14.46	61.7	30.4	
D05764	61.7	53.3	105.9	13.75	62.7	28.6	
D03028	64.0	51.0	96.8	13.47	61.8	28.5	
D05674	62.7	50.0	112.0	15.11	62.7	28.1	
D05642	63.7	48.3	103.1	15.12	61.7	27.8	
D041708(+)	61.3	50.7	110.7	14.67	62.5	27.8	
DH06073	62.3	51.3	110.2	15.01	62.0	27.6	
D031671	61.7	49.7	107.1	14.53	62.0	27.5	
D05809	62.0	54.0	107.0	14.66	62.2	27.2	
LEBSOCK	61.0	51.7	108.3	15.20	61.8	27.2	
PIERCE	62.0	52.7	107.1	15.37	62.2	27.1	
D04586	62.3	54.0	103.8	13.73	62.2	26.9	
D05745	62.0	49.7	112.0	14.22	63.3	26.9	
D04008	62.0	47.3	107.1	14.97	61.8	26.5	
D051629	61.7	52.0	102.1	15.52	62.3	26.1	
D051167	63.0	55.0	108.1	14.46	62.2	26.0	
D041735(+)	62.3	51.0	110.5	14.52	61.8	26.0	
GRENORA	60.7	44.0	107.9	14.94	61.5	25.7	
D051134	63.7	48.7	105.7	14.60	62.3	25.7	
D04581	62.7	48.7	109.5	14.67	61.7	25.7	
D051145	61.3	48.3	106.1	15.13	61.5	24.8	x
D041734(+)	62.7	50.3	108.3	14.35	61.7	24.8	x
D05547	60.7	49.3	104.3	15.67	62.0	24.6	x
DH06173	63.7	55.0	106.0	15.84	62.0	24.2	x
DH05047	62.0	53.7	108.6	14.92	62.2	24.1	x
D03708	61.3	43.7	100.5	14.91	61.2	23.6	x
D05925	63.0	49.0	110.0	14.52	62.2	23.4	x
DH06039	61.7	53.3	105.5	14.49	61.3	22.6	x
average	62.3	50.7	106.9	14.72	62.0	27.0	
probability	0	0.0005	0.005	0.0001	0.0091	0.0313	
CV (S/MEAN)	1.1	6.2	3.6	3.7	0.9	12.6	
CV (SE/MEAN)	0.6	3.6	2.1	2.2	0.5	7.3	
LSD (0.05)	1.1	5.1	6.3	0.90	0.9	5.5	

*days from planting
x indicates significantly lower yield than check variety, Mountrail, at probability <0.05

Table 6. Relative yields of durum varieties in bu/ac as compared to Mountraiil when grown in the Uniform Regional Durum trial under dryland fallow conditions at the EARC, Sidney, MT.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Mountrail
Alkabo	42.5	46.4	50.1	33.3	30.7	40.6	102.3
Mountrail	40.6	45.7	51.1	30.6	30.4	39.7	100.0
Divide	41.5	41.5	49.2	32	32.5	39.3	99.1
Grenora	40.7	45.7	52.3	31.6	25.7	39.2	98.8
Lebsock	41.1	47.6	44.9	32.5	27.2	38.7	97.4
Pierce	38.3	42.8	45.9	32.3	27.1	37.3	94.0

NOTE: Average yields in this summary should not be compared to each other since they are not grown in the same years. Compare yields only to the check variety.

Table 7. Relative test weights of durum varieties in lb/bu as compared to Mountrail when grown in the Uniform Regional Durum trial under dryland fallow conditions at the EARC, Sidney, MT.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Mountrail
Lebsock	61.8	60.8	63.0	59.3	61.8	61.3	102.3
Pierce	61.3	60.3	62.5	59.7	62.2	61.2	102.1
Alkabo	61.0	60.8	62.3	59.2	62.5	61.2	102.0
Divide	60.2	59.8	62.0	59.2	62.2	60.7	101.2
Grenora	59.8	59.0	62.0	58.5	61.5	60.2	100.4
Mountrail	59.7	59.8	61.0	57.5	61.7	59.9	100.0

NOTE: Average test weights in this summary should not be compared to each other since they are not grown in the same years. Compare test weights only to the check variety.

Table 8. Relative protein contents of durum varieties in percent as compared to Mountrail when grown in the Uniform Regional Durum trial under dryland fallow conditions at the EARC, Sidney, MT.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Mountrail
Pierce	12.5	13.3	12.4	14.3	15.4	13.6	100.7
Grenora	12.8	13.3	12.5	14.3	14.9	13.6	100.6
Mountrail	12.2	13.1	12.6	15	14.5	13.5	100.0
Lebsock	11.9	13.4	12	14.2	15.2	13.3	99.0
Alkabo	12.7	12.9	12	14.4	13.8	13.2	97.6
Divide	11.8	12.9	12.4	14.1	14.4	13.1	97.3

NOTE: Average protein contents in this summary should not be compared to each other since they are not grown in the same years. Compare only to the check variety.

Table 9. Relative hard vitreous amber color in percent of durum varieties as compared to Mountrail when grown in the Uniform Regional Durum trial under dryland fallow conditions at the EARC, Sidney, Montana.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Mountrail
Grenora	77	72	76	81	107	82.6	102.5
Pierce	78	70	71	81	107	81.4	101.0
Mountrail	78	69	73	78	105	80.6	100.0
Alkabo	79	61	63	79	110	78.4	97.3
Lebsock	77	63	64	76	108	77.6	96.3
Divide	58	53	70	77	108	73.2	90.8

NOTE: Average protein contents in this summary should not be compared to each other since they are not grown in the same years. Compare only to the check variety.

Table 10. Agronomic data obtained from a Uniform Regional durum yield trial grown under flood irrigated conditions at the Eastern Agricultural Research Center, Sidney, MT.

entry	heading*	height, cm	lodging index	grain protein, %	hvac	test wt, lb/bu	yield, bu/ac	
D04581	53.0	90.0	0.33	12.80	94.3	62.7	142.0	
MOUNTRAIL	52.7	86.3	2.00	12.72	97.0	62.3	138.6	
D04586	53.7	88.0	0.00	13.02	103.6	62.7	137.7	
D03708	53.0	84.7	3.50	12.66	104.6	62.7	136.8	
D03028	54.0	88.7	2.33	11.62	97.3	63.8	136.6	
D05745	53.0	88.3	0.67	13.64	107.9	63.7	134.8	
GRENORA	51.3	83.3	0.00	13.38	100.8	62.0	134.3	
D05764	53.0	89.3	0.00	12.36	103.6	63.7	134.0	
D05674	53.0	88.0	2.33	13.49	105.8	63.3	133.9	
D05642	55.0	86.3	0.00	13.48	101.4	63.3	133.7	
D04008	52.7	86.0	0.00	12.07	95.3	63.2	133.5	
D00095	52.0	91.0	0.00	13.57	98.2	62.0	132.1	
DIVIDE	53.0	89.0	1.33	12.44	97.9	62.5	129.1	
DH06039	51.7	92.3	3.00	13.01	102.7	62.3	128.8	
D041708(+)	53.0	85.3	0.00	12.91	105.6	63.2	128.7	
D05547	51.0	85.0	0.00	13.58	99.6	62.5	127.8	
D021110	52.7	92.3	1.00	14.54	103.8	62.3	127.0	x
D031671	52.0	87.7	0.33	12.26	97.5	63.0	126.2	x
DH06173	53.3	90.0	3.00	13.10	93.9	63.3	126.1	x
PIERCE	53.0	91.3	0.67	13.61	104.4	63.0	125.9	x
ALKABO	52.7	87.7	0.67	12.16	88.3	63.0	125.0	x
D041734(+)	53.0	85.3	0.00	12.98	98.3	62.7	124.0	x
D051629	52.0	94.3	0.33	12.98	101.9	63.7	122.2	x
D051134	53.7	89.3	0.67	12.76	108.0	63.2	121.9	x
LEBSOCK	51.7	87.0	0.00	12.67	97.3	62.5	121.9	x
DH05047	52.3	91.0	1.67	13.51	102.0	62.5	119.5	x
D05809	52.3	90.7	1.00	13.09	95.5	62.5	118.9	x
DH06073	52.7	90.7	1.00	13.02	97.8	62.8	118.7	x
D051167	53.0	88.7	1.00	14.06	110.4	62.7	118.5	x
D051145	51.0	88.0	0.00	13.70	95.7	61.8	117.6	x
D041735(+)	53.0	85.3	0.00	13.35	113.2	62.7	109.7	x
D05925	53.3	88.3	0.00	13.76	102.8	62.0	103.3	x
Average	52.7	88.4	0.84	13.07	100.8	62.8	127.1	
probability	<0.001	0.006	<0.001	<0.001	0.071	<0.001	<0.001	
CV (S/mean)	1.1	3.4	85.2	4.6	7.3	0.8	5.2	
CV (SE/mean)	0.7	2.0	49.2	2.7	4.2	0.4	3.0	
LSD (0.05)	1.0	5.0	1.17	0.98	12.1	0.8	10.9	

*days from planting
x indicates significantly lower yield than check variety, Mountrail, at a probability of 0.05

Table 11. Relative yields of durum varieties in bu/ac as compared to Mountrail when grown in the irrigated Uniform Regional Durum Trial at the EARC, Sidney, Montana

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Cultivar	2005	2006	2007	2008	2009	Ave	as % of Mountrail
Mountrail	93.5	92.4	42.5	104.0	138.6	94.2	100.0
Grenora	89.6	91.1	40.5	102.5	134.3	91.6	97.2
Divide	91.3	84.0	45.6	97.3	129.1	89.5	95.0
Pierce	88.1	83.4	31.4	92.8	125.9	84.3	89.5
Alkabo	84.4	79.7	43.8	70.7	125.0	80.7	85.7
Lebsock	85.8	74.1	28.5	72.1	121.9	76.5	81.2

NOTE: Average yields in this summary should not be compared to each other since they are not grown in the same years. Compare yields only to the check variety. Hail damage in 2007.

Table 12. Relative test weights of durum varieties in lb/bu as compared to Mountrail when grown in the irrigated Uniform Regional Durum Trial at the EARC, Sidney, Montana.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Mountrail
Lebsock	62.7	62.0	60.5	63.7	62.5	62.3	100.9
Pierce	62.5	62.2	58.8	64.5	63.0	62.2	100.7
Alkabo	62.5	61.3	60.0	63.3	63.0	62.0	100.5
Divide	62.7	61.5	59.0	63.8	62.5	61.9	100.3
Mountrail	62.3	61.8	58.8	63.5	62.3	61.7	100.0
Grenora	61.7	61.0	59.5	63.3	62.0	61.5	99.6

NOTE: Average test weights in this summary should not be compared to each other since they are not grown in the same years. Compare yields only to the check variety. Hail damage in 2007.

Table 13. Relative protein contents of durum varieties in percent as compared to Mountrail when grown in the irrigated Uniform Regional Durum Trial at the EARC, Sidney, Montana.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Mountrail
Pierce	13.4	11.8	15.1	11.9	13.6	13.2	102.8
Grenora	13.6	11.9	14.7	11.9	13.4	13.1	102.3
Divide	13.4	12.4	15.2	11.2	12.4	12.9	100.9
Mountrail	13.3	11.5	14.5	12.0	12.7	12.8	100.0
Lebsock	13.4	11.5	14.6	10.6	12.7	12.6	98.1
Alkabo	13.2	11.5	15.0	10.5	12.2	12.5	97.5

NOTE: Average protein contents in this summary should not be compared to each other since they are not grown in the same years. Compare yields only to the check variety. Hail damage in 2007.

Table 14. Relative lodging indices of durum varieties as compared to Mountrail when grown in the irrigated Uniform Regional Durum Trial at the EARC, Sidney, Montana.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Mountrail
Divide	1.3	1.0	0.0	0.3	1.3	0.8	118.2
Mountrail	1.3	0.0	0.0	0.0	2.0	0.7	100.0
Pierce	0.7	0.3	0.0	0.0	0.7	0.3	51.5
Alkabo	0.0	0.0	0.0	0.0	0.7	0.1	21.2
Grenora	0.3	0.0	0.0	0.0	0.0	0.1	9.1
Lebsock	0.3	0.0	0.0	0.0	0.0	0.1	9.1

NOTE: Average lodging indices in this summary should not be compared to each other since they are not grown in the same years. Compare yields only to the check variety.

Table 15. Relative hard vitreous amber color of durum varieties in percent as compared to Mountrail when grown in the irrigated Uniform Regional Durum Trial at the EARC, Sidney, MT.

Cultivar	2005	2006	2007	2008	2009	Ave	as % of Mountrail
Pierce	89	71	84	73	104	84.2	101.4
Mountrail	90	68	84	76	97	83.0	100.0
Grenora	89	69	88	62	101	81.8	98.6
Divide	88	71	86	47	98	78.0	94.0
Alkabo	90	38	89	42	88	69.4	83.6
Lebsock	85	59	74	14	97	65.8	79.3

NOTE: Average hard vitreous amber color values in this summary should not be compared to each other since they are not grown in the same years. Compare yields only to the check variety. Hail damage in 2007.