

PROJECT TITLE: Statewide Durum Variety Performance – 2010 (4W2756)

PRINCIPAL INVESTIGATOR:

J. Eckhoff, Agronomist, EARC, Sidney, MT

Personnel:

S. Lanning, Department of Plant Sciences, Bozeman

D.M. Wichman, CARC, Moccasin, MT

G.R. Carlson, NARC, Havre, MT

P. Lamb, NARC, Havre, MT

K. Kephart, SARC, Huntley, MT

G. Opena, SARC, Huntley, MT

J. Miller, WTARC, Conrad, MT

N. Riveland, WREC, Williston, ND

OBJECTIVE: To evaluate new and existing varieties and experimental lines of durum under various growing conditions and environments in Montana.

RESULTS: The 2010 Statewide durum yield trial was grown at one irrigated and seven dryland sites. The irrigated site was at Sidney, and dryland sites were at Bozeman, Huntley, Havre, Moccasin, Conrad, Sidney, and Williston, ND. Replicated multiple-row plots were established at all locations using standard research techniques. Summaries of heading, height, test weight, protein content, seed weight, NIR hardness, sawfly damage, stem solidness, and yield are in Tables 1-9. A summary of all characters across sites is shown in Table 10. The Bozeman site was not harvested because of hail damage.

Earliest blooming line across sites was CA808-803, latest blooming line was MT05162 (Table 1). Shortest line across sites was MT01649, tallest line was Tioga (Table 2). Pierce had the greatest test weight across sites (Table 3). MT04174 had the highest protein across sites (Table 4). Alzada had the heaviest seed across sites (Table 5). MT04340 had the highest NIR hardness across sites (Table 6). Pierce had the most sawfly damage, while Normanno and Cimmyt#8 had the least sawfly damage (Table 7). Levante had the most solid stem, and Tioga had the most hollow stem (Table 8).

Highest yielding varieties at each site were MT5162 at **Williston**, Strongfield at **Sidney dryland**, Divide at Sidney **irrigated**, Strongfield at **Conrad**, Alzada at **Moccasin**, **Strongfield** at **Havre**, and Alkabo at **Huntley** (Table 9). Highest yielding variety across dryland sites and all sites was Strongfield (Table 10).

SUMMARY: Highest yielding varieties at each site were MT5162 at **Williston**, Strongfield at **Sidney dryland**, Divide at Sidney **irrigated**, Strongfield at **Conrad**, Alzada at **Moccasin**, **Strongfield** at **Havre**, and Alkabo at **Huntley**. Highest yielding variety across dryland sites and all sites was Strongfield.

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. Heading (days from planting) of durum lines and varieties in the 2010 statewide durum yield trial.

entry	Williston	Sidney Dry	Sidney Irr	Conrad	Moccasin	Havre	Huntley	Average
Mountrail	61.7	67.5	49.7	61	84	71.3	84.0	68.5
Divide	62.0	66.0	51.0	62	84	71.3	82.0	68.3
Pierce	60.7	66.0	49.0	61	83	70.7	82.7	67.6
Alkabo	61.0	67.0	49.0	60	83	70.7	83.0	67.7
Grenora	60.7	66.5	48.0	60	83	70.7	81.3	67.2
Tioga	61.3	66.5	50.0	61	86	71.0	82.7	68.4
Alzada	59.0	65.0	48.0	56	81	69.0	80.7	65.5
Strongfield	61.3	67.0	48.3	64	86	71.3	83.7	68.8
Levante	59.7	65.0	47.3	59	82	69.3	81.0	66.2
Saragolla	60.7	65.5	48.0	59	81	69.0	80.7	66.3
Normanno	60.7	65.5	49.0	59	82	70.3	81.7	66.9
CA808-803	56.3	63.5	46.3	55	82	69.0	80.0	64.6
Cimmyt#5	60.3	66.5	48.0	62	84	70.3	82.0	67.6
Cimmyt#8	61.0	67.5	48.3	61	85	70.7	83.3	68.1
Cimmyt#11	59.0	64.5	47.7	56	80	68.3	80.3	65.1
MT03012	58.0	64.0	48.3	56	81	68.7	79.3	65.0
MT01649	57.3	64.0	46.3	59	80	69.0	80.0	65.1
MT04174	58.0	64.5	47.7	56	82	69.0	80.0	65.3
MT04340	60.7	65.0	50.0	62	85	70.7	81.7	67.9
MT05162	62.0	67.5	49.7	64	88	74.0	84.0	69.9
Average	60.1	65.7	48.5	59.7	83.1	70.2	81.7	66.2
Probability		0.001	<0.001			<0.001		
CV (S/mean)	1.0	1.3	0.8			3.9		
CV (SE/mean)		0.9	0.5			2.3		
LSD 5%	1.0	1.8	0.7			5.3		

Table 2. Height (cm) of durum lines and varieties in the 2010 statewide durum yield trial.

entry	Williston	Sidney		Conrad	Moccasin	Havre	Huntley	Average
		Dry	Irr					
Mountrail	83.0	71.5	89.3	110.3	87.7	91.9	108.2	91.7
Divide	85.0	79.5	93.7	106.7	89.7	93.4	103.4	93.0
Pierce	82.7	75.0	94.0	105.7	93.0	95.4	106.7	93.2
Alkabo	80.0	74.0	85.7	104.3	89.7	91.3	102.6	89.6
Grenora	76.7	75.0	84.3	100.0	83.3	86.7	96.0	86.0
Tioga	91.0	83.5	98.0	108.3	95.7	99.7	103.4	97.1
Alzada	72.3	66.5	71.3	78.7	75.7	77.4	83.1	75.0
Strongfield	80.7	78.5	86.3	106.7	90.7	95.2	104.6	91.8
Levante	65.0	62.5	68.3	76.0	63.0	69.5	77.2	68.8
Saragolla	65.7	65.5	71.0	83.0	72.0	73.5	85.3	73.7
Normanno	64.7	60.0	69.0	73.7	66.0	72.7	79.8	69.4
CA808-803	68.0	65.0	72.0	79.0	70.0	79.2	83.8	73.9
Cimmyt#5	61.0	56.5	67.0	75.3	65.3	73.1	83.1	68.8
Cimmyt#8	62.3	63.0	67.7	83.0	72.7	74.7	85.6	72.7
Cimmyt#11	67.3	64.5	70.0	81.3	77.3	80.6	91.4	76.1
MT03012	69.0	59.0	73.0	77.0	69.0	76.1	86.1	72.7
MT01649	58.7	55.0	57.3	67.7	62.7	67.7	82.8	64.5
MT04174	70.3	63.5	73.7	79.7	68.3	75.3	86.1	73.8
MT04340	62.7	61.0	75.0	72.0	62.7	70.3	78.2	68.8
MT05162	68.3	66.0	79.0	78.7	69.0	76.4	81.8	74.2
Average	71.7	67.3	77.3	87.4	76.2	81.0	90.5	78.7
Probability		0.001	<0.001	<0.001	<0.001	<0.001		
CV (S/mean)	4.3	8.1	4.8	2.833	3.5	3.9		
CV (SE/mean)		5.7	2.8	1.636	2.0	2.3		
LSD 5%	5.1	11.4	6.1	4.1	4.4	5.3		

Table 3. Test weight (lb/bu) of durum lines and varieties in the 2010 statewide durum yield trial.

entry	Williston	Sidney	Sidney	Conrad	Moccasin	Havre	Huntley	Average
		Dry	Irr					
Mountrail	58.2	60.8	57.3	62.1	59.9	58.4	63.2	60.0
Divide	59.2	61.0	58.5	62.6	60.8	58.2	63.2	60.5
Pierce	60.1	61.3	59.2	63.4	62.2	58.3	64.5	61.3
Alkabo	60.5	61.3	57.5	63.1	62.2	58.7	64.2	61.1
Grenora	58.4	60.0	57.8	62.8	60.7	58.0	64.0	60.2
Tioga	59.6	60.5	56.8	63.4	62.7	58.0	64.4	60.8
Alzada	58.9	60.8	53.2	60.3	60.7	58.2	62.8	59.3
Strongfield	57.7	61.3	56.7	62.8	60.1	58.7	64.2	60.2
Levante	58.2	60.0	51.7	61.5	60.4	58.1	63.6	59.1
Saragolla	56.0	59.3	54.2	62.5	58.9	56.3	63.0	58.6
Normanno	57.5	60.3	54.2	60.3	59.0	57.9	62.6	58.8
CA808-803	57.0	61.3	54.8	60.1	60.2	59.2	63.9	59.5
Cimmyt#5	56.3	58.8	54.0	60.9	61.5	55.5	63.8	58.7
Cimmyt#8	57.5	60.5	57.5	63.1	62.1	59.3	64.6	60.7
Cimmyt#11	54.1	59.3	52.0	61.7	59.4	57.5	62.6	58.1
MT03012	58.0	60.0	54.3	61.4	59.5	56.6	63.5	59.1
MT01649	56.0	59.0	52.0	59.4	57.4	56.3	61.6	57.4
MT04174	58.9	60.3	54.8	61.2	60.6	57.6	63.5	59.6
MT04340	56.1	60.0	51.8	58.9	59.4	58.3	61.1	57.9
MT05162	60.9	61.8	56.8	62.7	61.9	59.3	64.2	61.1
Average	58.0	60.4	55.3	61.7	60.5	57.9	63.4	59.6
Probability		<0.001	<0.001	<0.001	<0.001	<0.001		
CV (S/mean)	0.5	0.7	2.9	0.949	1.1	1.0	0.5	
CV (SE/mean)		0.5	1.7	0.5479	0.8	0.6		
LSD 5%	0.7	0.9	2.7	1.0	1.4	1.0	0.5	

Table 4. Grain protein (percent) of durum lines and varieties in the 2010 statewide durum yield trial.

entry	Williston	Sidney Dry	Sidney Irr	Conrad	Havre	Moccasin	Huntley	Average
Mountrail	15.41	11.88	12.88	11.75	11.96	12.21	11.31	12.49
Divide	14.99	11.82	13.36	11.78	11.55	11.42	11.33	12.32
Pierce	14.94	12.57	12.98	11.75	12.38	11.71	11.00	12.48
Alkabo	14.92	12.01	13.01	11.83	11.85	11.26	10.70	12.23
Grenora	14.83	12.69	13.08	12.12	11.86	11.62	10.95	12.45
Tioga	14.11	12.36	13.45	12.26	11.95	12.59	10.70	12.49
Alzada	14.02	12.81	14.10	11.70	11.69	12.15	10.97	12.49
Strongfield	15.02	13.23	13.64	12.20	11.81	11.35	10.62	12.55
Levante	15.05	12.67	13.62	11.46	11.59	11.38	10.44	12.32
Saragolla	13.56	12.14	13.71	10.62	11.93	11.45	10.62	12.00
Normanno	14.84	12.35	13.47	11.52	11.24	12.45	11.04	12.42
CA808-803	14.33	13.16	14.00	12.47	11.34	12.30	10.30	12.56
Cimmyt#5	14.11	12.55	13.61	11.25	11.65	12.07	10.05	12.18
Cimmyt#8	14.45	12.36	12.83	10.84	11.13	11.80	10.13	11.94
Cimmyt#11	13.52	12.64	14.40	10.97	10.77	12.61	10.57	12.21
MT03012	14.40	12.92	13.91	11.73	12.52	12.61	11.14	12.75
MT01649	14.05	12.85	14.27	12.39	12.15	12.53	10.82	12.72
MT04174	14.60	13.10	13.69	12.05	11.94	12.85	11.26	12.78
MT04340	15.19	12.60	14.12	11.46	11.72	11.47	11.91	12.64
MT05162	13.04	12.81	13.28	11.53	11.51	12.25	9.89	12.05
Average	14.47	12.58	13.57	11.69	11.73	12.00	10.79	12.40
Probability		0.146	<0.001					
CV (S/mean)		3.6	1.8					
CV (SE/mean)		2.5	1.0					
LSD 5%		0.94	0.40					

Table 5. Weight of 100 seed (gm) of durum lines and varieties in the 2010 statewide durum yield trial.

entry	Williston	Sidney Dry	Sidney Irr	Conrad	Huntley	Havre	Moccasin	Average
Mountrail	2.9	3.9	4.1	4.6	3.9	4.2	3.5	3.87
Divide	3.2	3.9	4.8	4.8	4.1	4.0	3.8	4.09
Pierce	2.9	3.8	4.2	4.5	4.0	3.7	3.4	3.79
Alkabo	3.3	4.3	4.5	4.8	4.5	4.3	3.9	4.23
Grenora	3.2	4.1	4.7	4.7	4.5	4.1	3.6	4.13
Tioga	3.0	4.2	5.0	5.3	4.7	4.3	3.8	4.33
Alzada	3.5	4.5	4.1	5.2	4.5	4.3	4.8	4.41
Strongfield	2.9	3.8	4.5	4.8	4.3	4.3	4.0	4.09
Levante	3.2	4.1	4.2	4.7	4.2	4.1	3.8	4.04
Saragolla	2.7	3.6	3.9	4.3	4.0	3.7	3.5	3.67
Normanno	3.0	4.1	3.8	4.4	4.2	4.2	3.4	3.87
CA808-803	2.7	3.7	3.7	4.3	4.5	4.3	3.5	3.81
Cimmyt#5	2.3	3.2	3.3	3.5	3.7	3.3	3.4	3.24
Cimmyt#8	2.4	3.7	3.3	3.6	3.7	3.5	3.9	3.44
Cimmyt#11	2.6	3.7	3.4	4.7	4.1	3.7	3.6	3.69
MT03012	3.0	3.7	3.4	4.5	4.1	3.4	3.4	3.64
MT01649	2.9	4.2	3.6	4.6	4.5	3.9	3.3	3.86
MT04174	3.0	3.8	3.4	4.3	3.8	3.9	3.4	3.66
MT04340	3.0	4.3	3.4	4.3	3.9	4.0	3.8	3.81
MT05162	3.5	4.4	3.8	4.7	4.2	4.9	3.5	4.14
Average	2.96	3.95	3.96	4.53	4.17	4.01	3.67	3.89

Table 6. NIR hardness of durum lines and varieties in the 2010 statewide durum yield trial.

entry	Williston	Sidney Dry	Sidney Irr	Conrad	Havre	Moccasin	Huntley	Average
Mountrail	86.3	49.8	75.6	85.8	55.8	98.2	88.6	77.2
Divide	89.9	43.7	80.1	89.5	46.0	91.5	76.6	73.9
Pierce	93.1	66.4	79.9	84.8	72.0	94.6	71.7	80.4
Alkabo	94.5	34.4	71.2	87.5	52.7	100.6	61.9	71.8
Grenora	94.5	57.8	81.7	97.6	46.5	95.9	78.9	79.0
Tioga	89.4	62.1	81.1	91.1	59.1	91.1	68.9	77.5
Alzada	85.3	71.9	83.0	93.4	64.9	90.6	91.9	83.0
Strongfield	85.4	74.1	85.2	94.3	61.5	96.8	82.3	82.8
Levante	82.8	62.2	69.0	82.8	50.2	85.4	60.0	70.4
Saragolla	68.3	46.0	74.2	86.7	53.6	76.6	65.3	67.2
Normanno	75.8	61.4	80.9	96.1	58.6	75.9	85.1	76.3
CA808-803	85.9	75.8	81.8	94.3	60.8	91.5	73.2	80.5
Cimmyt#5	82.9	53.4	79.2	80.2	49.7	87.5	74.0	72.4
Cimmyt#8	78.3	55.1	69.4	88.3	55.7	92.6	62.9	71.8
Cimmyt#11	67.4	55.2	79.8	81.9	41.7	80.1	66.2	67.5
MT03012	91.6	65.8	82.3	95.4	67.2	90.9	83.8	82.4
MT01649	75.8	59.0	78.8	89.8	55.8	86.0	63.3	72.6
MT04174	91.4	69.2	85.3	91.7	61.7	87.4	84.0	81.5
MT04340	80.7	74.9	82.0	89.1	72.4	91.1	92.0	83.2
MT05162	86.0	77.7	74.3	94.7	54.2	81.4	46.7	73.6
Average	84.3	60.8	78.7	89.7	57.0	89.3	73.9	76.2
Probability		<0.001	<0.001					
CV (S/mean)		11.3	3.1					
CV (SE/mean)		8.0	1.8					
LSD 5%		14.3	4.0					

Table 7. Sawfly damage (percent cut) of durum lines and varieties in the 2010 statewide durum yield trial.

entry	Havre	Moccasin	average
Mountrail	18.3	0.0	9.2
Divide	10.0	0.0	5.0
Pierce	38.3	5.0	21.7
Alkabo	26.7	0.0	13.3
Grenora	16.7	0.0	8.3
Tioga	13.3	0.0	6.7
Alzada	8.3	0.0	4.2
Strongfield	6.7	0.0	3.3
Levante	8.7	0.0	4.3
Saragolla	2.3	0.0	1.2
Normanno	1.0	0.0	0.5
CA808-803	6.7	0.0	3.3
Cimmyt#5	1.0	0.0	0.5
Cimmyt#8	1.0	0.0	0.5
Cimmyt#11	3.7	0.0	1.8
MT03012	23.3	0.0	11.7
MT01649	12.0	0.0	6.0
MT04174	20.0	0.0	10.0
MT04340	2.3	0.0	1.2
MT05162	5.0	0.0	2.5
Average	11.3	0.3	5.8
Probability	<0.001		
CV (S/mean)	63.0		
CV (SE/mean)	36.4		
LSD 5%	11.7		

Table 8. Stem solidness of durum lines and varieties in the 2010 statewide durum yield trial.

entry	Sidney Dry	Sidney Irr	Average
Mountrail	11.3	10.7	11.0
Divide	14.8	9.9	12.3
Pierce	10.2	9.7	9.9
Alkabo	10.7	7.8	9.3
Grenora	13.5	10.8	12.2
Tioga	10.1	8.0	9.1
Alzada	11.0	11.7	11.3
Strongfield	9.7	11.8	10.8
Levante	18.0	15.6	16.8
Saragolla	13.0	11.5	12.2
Normanno	16.1	13.3	14.7
CA808-803	12.6	16.0	14.3
Cimmyt#5	10.0	10.2	10.1
Cimmyt#8	12.0	11.9	11.9
Cimmyt#11	15.9	14.1	15.0
MT03012	12.5	10.4	11.5
MT01649	10.1	10.3	10.2
MT04174	15.6	13.7	14.7
MT04340	13.9	11.8	12.9
MT05162	11.3	12.0	11.7
Average	12.6	11.6	12.1
Probability	0.020	0.003	
CV (S/mean)	16.8	19.3	
CV (SE/mean)	11.9	11.1	
LSD 5%	4.4	3.7	

Table 9. Yields in bu/ac of durum lines and varieties in the 2010 statewide durum yield trial.

entry	Williston	Sidney Dry	Sidney Irr	Conrad	Moccasin	Havre	Huntley	average, all sites	average dryland
Mountrail	35.6	57.3	61.2	78.4	41.8	58.0	82.8	59.3	59.0
Divide	33.3	56.1	73.2	77.8	41.3	57.0	84.3	60.4	58.3
Pierce	34.1	55.6	71.2	71.0	41.1	50.3	80.8	57.7	55.5
Alkabo	35.7	55.9	59.4	83.4	44.4	60.7	91.2	61.5	61.9
Grenora	35.6	58.3	70.5	89.5	39.9	57.7	78.3	61.4	59.9
Tioga	35.3	56.0	73.1	72.4	42.4	64.0	88.0	61.6	59.7
Alzada	34.5	51.9	27.0	72.5	44.8	58.4	74.2	51.9	56.0
Strongfield	31.2	59.5	59.3	92.5	42.8	67.9	84.2	62.5	63.0
Levante	29.8	54.6	35.2	88.4	38.7	57.7	87.6	56.0	59.5
Saragolla	27.1	54.5	35.0	72.7	44.3	61.6	85.4	54.4	57.6
Normanno	34.7	50.1	48.7	82.9	40.8	66.6	80.4	57.8	59.3
CA808-803	30.3	53.6	24.9	71.9	39.3	61.0	82.7	52.0	56.5
Cimmyt#5	32.9	54.6	46.4	78.3	42.0	64.5	89.0	58.2	60.2
Cimmyt#8	28.3	56.5	54.9	92.4	37.3	63.7	87.0	60.0	60.9
Cimmyt#11	32.3	56.1	33.0	90.9	43.5	67.1	85.5	58.3	62.6
MT03012	31.8	43.8	43.9	68.8	38.3	55.3	84.3	52.3	53.7
MT01649	33.0	49.0	34.1	68.5	42.7	65.2	83.6	53.7	57.0
MT04174	29.3	49.6	43.5	66.1	38.5	52.1	86.0	52.1	53.6
MT04340	28.7	51.2	31.0	68.6	40.4	58.4	71.3	49.9	53.1
MT05162	37.2	58.2	64.6	86.0	43.8	66.6	81.2	62.5	62.2
Average	32.5	54.1	49.5	78.7	41.4	60.7	83.4	57.2	58.5
Probability		0.010	<0.001	<0.001	0.209	<0.001			
CV (S/mean)	8.4	5.8	11.8	6.708	8.0	7.8	6.1		
CV (SE/mean)		4.1	6.8	3.873	4.6	4.5			
LSD 5%	4.5	6.6	9.6	8.7	ns	7.8	8.4		

Table 10. Across site summary of durum lines and varieties in the 2010 statewide durum yield trial.

entry	Heading*	Height, cm	Test wt, lb/bu	Grain protein, %	NIR hardness	100-seed wt, gm	Yield, bu/ac, all sites	Yield, bu/ac, dryland sites	sawfly damage ¹	stem solidness ²
Mountrail	68.5	91.7	60.0	12.49	77.2	3.87	59.3	59.0	9.2	11.0
Divide	68.3	93.0	60.5	12.32	73.9	4.09	60.4	58.3	5.0	12.3
Pierce	67.6	93.2	61.3	12.48	80.4	3.79	57.7	55.5	21.7	9.9
Alkabo	67.7	89.6	61.1	12.23	71.8	4.23	61.5	61.9	13.3	9.3
Grenora	67.2	86.0	60.2	12.45	79.0	4.13	61.4	59.9	8.3	12.2
Tioga	68.4	97.1	60.8	12.49	77.5	4.33	61.6	59.7	6.7	9.1
Alzada	65.5	75.0	59.3	12.49	83.0	4.41	51.9	56.0	4.2	11.3
Strongfield	68.8	91.8	60.2	12.55	82.8	4.09	62.5	63.0	3.3	10.8
Levante	66.2	68.8	59.1	12.32	70.4	4.04	56.0	59.5	4.3	16.8
Saragolla	66.3	73.7	58.6	12.00	67.2	3.67	54.4	57.6	1.2	12.2
Normanno	66.9	69.4	58.8	12.42	76.3	3.87	57.8	59.3	0.5	14.7
CA808-803	64.6	73.9	59.5	12.56	80.5	3.81	52.0	56.5	3.3	14.3
Cimmyt#5	67.6	68.8	58.7	12.18	72.4	3.24	58.2	60.2	0.5	10.1
Cimmyt#8	68.1	72.7	60.7	11.94	71.8	3.44	60.0	60.9	0.5	11.9
Cimmyt#11	65.1	76.1	58.1	12.21	67.5	3.69	58.3	62.6	1.8	15.0
MT03012	65.0	72.7	59.1	12.75	82.4	3.64	52.3	53.7	11.7	11.5
MT01649	65.1	64.5	57.4	12.72	72.6	3.86	53.7	57.0	6.0	10.2
MT04174	65.3	73.8	59.6	12.78	81.5	3.66	52.1	53.6	10.0	14.7
MT04340	67.9	68.8	57.9	12.64	83.2	3.81	49.9	53.1	1.2	12.9
MT05162	69.9	74.2	61.1	12.05	73.6	4.14	62.5	62.2	2.5	11.7
overall average	66.2	78.7	59.6	12.40	76.2	3.89	57.2	58.5	5.8	12.1

*days from planting

1/Havre and Moccasin sites only

2/Sidney irrigated and dryland sites only