

PROJECT TITLE: Off-station durum yield trials - 1999

OBJECTIVE: To evaluate varieties of durum under irrigated and dryland conditions at various sites in eastern Montana.

PROJECT LEADER: Joyce Eckhoff, MSU Eastern Agricultural Research Center, Sidney, MT

COOPERATORS:

County	Producers	CES Agents
Daniels, dryland	Bobbie Roos	Bobbie Roos
McCone, dryland	Victor Wagner	Nels Boe
Roosevelt, dryland	Mark Swank	Chet Hill
Sheridan, dryland	Max Aasheim	Terry Angvick
Sheridan, irrigated	Steve Brekke	Terry Angvick
Valley, dryland	Bill Lauckner	Verlin Koenig
Valley, irrigated	Kelly Donovan	Verlin Koenig
Wibaux, dryland	David Maus	Dave Bertelsen

MATERIALS AND METHODS: Fifteen durum varieties were planted at six dryland and two irrigated sites. Plots were 20 feet long and three feet wide, with one foot between rows. Entire plots were harvested using a plot combine. Planting and harvest dates were

Location	Planted	Harvested
Scobey, Daniels County – dryland	21 May	31 Aug
Circle, McCone County – dryland	14 May	26 Aug
Poplar, Roosevelt County – dryland	18 May	30 Aug
Reserve, Sheridan County – dryland	18 May	1 Sep
Dagmar, Sheridan County – irrigated	18 May	7 Sep
Nashua, Valley County – dryland	4 May	Hailed out
Larslan, Valley County – irrigated	4 May	8 Sep
Wibaux, Wibaux County – dryland	25 May	9 Sep

RESULTS: Summaries of yields, test weights, heights and protein contents across **dryland sites** are shown in Tables 1-4, and summaries of yields, test weights, heights and protein contents across **irrigated sites** are shown in Tables 19-22. Plaza and Mountrail yielded most across dryland sites (Table 1). Mountrail yielded most across the irrigated sites (Table 19).

McCone County: Performance and relative values of durum varieties at **Circle** are shown in Tables 5-8. Voss, Maier, Kari, and Ben yielded significantly less than the check variety, Renville.

Roosevelt County: Performance and relative values of durum varieties at **Poplar** are shown in Tables 9-12. Lebsock, Voss, Sceptre, and experimental line PH894401 yielded significantly less than the check variety, Renville.

Sheridan County (dryland): Performance and relative values of durum varieties at Reserve are shown in Tables 13-16. Ben, experimental line PH894401, and Monroe yielded significantly less than the check variety, Munich. Two reps of Renville were severely damaged by deer, so Renville was not included in the statistical analysis, or in the relative tables.

Wibaux County: Performance of durum varieties at Wibaux are shown in Table 17. Utopia, Lebsock, Plaza, Kyle, and Maier yielded significantly more than the check variety, Renville. Monroe yielded significantly less than Renville. This is the first year for a dryland durum yield trial in Wibaux County, so no relative tables are yet available.

Daniels County (dryland): Performance of durum varieties at Scobey are shown in Table 18. Maier, experimental line PH894401, Sceptre, and Voss yielded significantly less than the check variety, Renville. This is the first year for a dryland yield trial in Daniels County, so no relative tables are yet available.

Sheridan County (irrigated): Performance and relative values of durum varieties at Dagmar are shown in Tables 23-26. All varieties except Kari, Mountrail, and Maier yielded significantly less than the check variety, Renville.

Valley County (irrigated): Performance and relative values of durum varieties at Larslan are shown in Tables 27. Mountrail yielded significantly more than the check variety, Renville, and Voss, Utopia, and experimental line PH894401 yielded significantly less. This is the first year for an irrigated durum yield trial in Valley County, so no relative tables are yet available.

SUMMARY: The off-station yield trials are conducted at several sites in eastern Montana. These trials provide important information about performance in the Mondak region of experimental lines from Montana and North Dakota, and new varieties from state breeding programs and private companies. Regional durum producers make decisions on varieties to grow based on data from these trials.

FUTURE PLANS: Off-station durum yield trials will continue indefinitely. Expansion to other locations in future years is possible.

Table 1. Summary of durum yields in bu/acre at five dryland off-station sites in eastern Montana, 1999.

Variety	Circle	Wibaux	Poplar	Reserve	Scobey	average
Plaza	31.3	40.0	49.5	42.0	43.7	41.3
Mountrail	30.4	37.1	48.6	38.2	50.1	40.9
Plenty	29.4	37.3	48.7	41.7	45.6	40.5
Kyle	30.5	38.7	47.8	38.2	46.5	40.3
Utopia	30.2	43.6	46.2	33.6	44.5	39.6
Munich	31.9	36.5	45.1	38.6	42.9	39.0
Lebsock	27.4	43.5	43.7	35.7	41.6	38.4
Maier	26.1	38.4	46.2	36.8	41.2	37.7
Kari	24.3	34.9	44.4	41.7	42.1	37.5
Voss	26.3	33.7	43.6	41.4	40.1	37.0
Sceptre	27.3	34.0	40.9	34.8	40.2	35.4
Ben	23.6	32.3	45.3	28.6	45.0	35.0
PH894401	29.3	33.6	33.1	26.5	41.0	32.7
Monroe	32.2	20.4	45.8	21.7	41.8	32.4
Renville	31.0	32.1	49.4	20.1**	46.3	35.8
site average	28.7	35.8	45.2	35.7	43.5	
p value	0.007	0.000	0.000	0.000	0.013	
CV (S/Mean)	9.6	9.8	7.0	9.0	6.9	
CV(SE/Mean)	5.6	5.7	4.0	5.2	4.0	
LSD _{0.05}	4.6	5.9	5.3	5.4	5.0	
Planting date	14 May	25 May	18 May	18 May	21 May	
Harvest date	26 Aug	9 Sep	30 Aug	1 Sep	31 Aug	

Nashua site hailed out 21 July.

**Severe deer damage to two reps of this variety - not included in statistics for this site

Cooperators:

County

Sheridan Co

Wibaux Co

McCone Co

Roosevelt Co

Valley Co (hailed out)

Daniels Co

Producer

Max Aasheim

David Maus

Victor Wagner

Mark Swank

Bill Lauckner

Bobbie Roos

CES Agent

Terry Angvick

Dave Bertelsen

Nels Boe

Chet Hill

Verlin Koenig

Bobbie Roos

Table 2. Summary of durum test weights in lb/bu at five dryland off-station sites in eastern Montana, 1999.

Variety	Circle	Wibaux	Poplar	Reserve	Scobey	average
PH894401	63.3	61.5	63.0	62.7	63.5	62.8
Voss	63.7	60.7	62.2	64.0	62.7	62.7
Lebsock	63.0	61.7	61.5	63.0	62.8	62.4
Maier	63.7	60.2	61.0	63.3	63.1	62.3
Ben	62.9	60.0	61.0	63.0	62.9	62.0
Plaza	62.5	60.5	60.8	63.5	62.9	62.0
Renville	63.0	60.3	61.5	62.8	62.2	62.0
Kyle	63.0	61.5	61.5	62.5	61.1	61.9
Kari	63.1	60.0	61.0	63.0	61.7	61.8
Mountrail	63.0	60.7	61.0	62.8	61.7	61.8
Plenty	62.2	61.0	60.5	63.0	62.1	61.8
Munich	61.5	59.0	60.5	63.0	61.7	61.1
Utopia	62.0	59.0	60.3	62.5	61.9	61.1
Monroe	61.2	59.3	60.5	62.2	61.7	61.0
Sceptre	61.8	59.2	59.8	61.8	61.7	60.9
site average	62.7	60.3	61.1	62.9	62.2	
p value	0.002	0.000	0.000	0.008	0.000	
CV (S/Mean)	1.1	0.6	0.5	0.9	0.6	
CV(SE/Mean)	0.6	0.3	0.3	0.5	0.3	
LSD _{0.05}	1.2	0.6	0.5	0.9	0.6	
Planting date	14 May	25 May	18 May	18 May	21 May	
Harvest date	26 Aug	9 Sep	30 Aug	1 Sep	31 Aug	

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|------------------------|-----------------|------------------|
| <u>Cooperators:</u> | | |
| <u>County</u> | <u>Producer</u> | <u>CES Agent</u> |
| Sheridan Co | Max Aasheim | Terry Angvick |
| Wibaux Co | David Maus | Dave Bertelsen |
| McCone Co | Victor Wagner | Nels Boe |
| Roosevelt Co | Mark Swank | Chet Hill |
| Valley Co (hailed out) | Bill Lauckner | Verlin Koenig |
| Daniels Co | Bobbie Roos | Bobbie Roos |

Table 3. Summary of durum heights in inches at five dryland off-station sites in eastern Montana, 1999.

Variety	Circle	Wibaux	Poplar	Reserve	Scobey	average
Plenty	33	37	36	35	32	34.6
Kyle	33	35	37	34	32	34.2
Renville	31	35	34	34	29	32.6
Monroe	30	36	34	32	29	32.2
Ben	29	35	33	30	29	31.2
Lebsock	29	32	32	32	29	30.8
Kari	28	31	29	31	29	29.6
Mountrail	27	30	31	30	30	29.6
Munich	28	31	30	30	28	29.4
Sceptre	29	31	30	29	28	29.4
Maier	28	31	29	30	26	28.8
Plaza	27	28	27	26	25	26.6
PH894401	24	27	24	23	24	24.4
Voss	24	26	24	25	23	24.4
Utopia	20	26	25	27	22	24.0
site average	28.0	31.3	30.3	29.4	27.8	
p value	0.000	0.000	0.000	0.000	0.000	
CV (S/Mean)	4.3	5.0	5.2	7.3	6.5	
CV(SE/Mean)	2.5	2.9	3.0	4.2	3.7	
LSD _{0.05}	2.0	2.6	2.6	3.6	3.0	
Planting date	14 May	25 May	18 May	18 May	21 May	
Harvest date	26 Aug	9 Sep	30 Aug	1 Sep	31 Aug	

Nashua site hailed out 21 July.

**Severe deer damage to two reps of this variety - not included in statistics for this site

Cooperators:

County

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 Wibaux Co
 McCone Co
 Roosevelt Co
 Valley Co (hailed out)
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Producer

Max Aasheim
 David Maus
 Victor Wagner
 Mark Swank
 Bill Lauckner
 Bobbie Roos

CES Agent

Terry Angvick
 Dave Bertelsen
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 Chet Hill
 Verlin Koenig
 Bobbie Roos

Table 4. Summary of durum grain protein contents at five dryland off-station sites in eastern Montana, 1999.

Variety	Circle	Wibaux	Poplar	Reserve	Scobey	average
Maier	11.1	14.9	13.4	11.7	9.3	12.1
Lebsock	11.4	14.6	13.1	11.5	9.2	12.0
Munich	11.0	14.5	12.9	11.5	9.9	12.0
Renville	11.8	14.5	12.5	11.8	9.3	12.0
Kari	10.8	14.7	12.6	11.8	9.4	11.9
Ben	10.9	14.8	12.6	11.4	9.4	11.8
Monroe	10.8	14.1	12.8	11.4	9.5	11.7
Mountrail	10.9	14.2	12.5	11.4	9.0	11.6
Sceptre	11.3	14.4	12.4	11.0	9.1	11.6
Plenty	10.4	14.8	12.6	10.8	9.0	11.5
Utopia	10.6	13.9	12.3	11.5	9.1	11.5
Kyle	10.9	14.4	12.5	10.8	8.4	11.4
PH894401	10.8	13.6	12.0	11.2	8.9	11.3
Voss	10.3	13.5	12.2	11.0	8.9	11.2
Plaza	10.0	14.4	12.0	10.2	8.8	11.1
site average	10.9	14.4	12.6	11.2	9.2	
p value	0.001	0.137	0.000	0.000	0.011	
CV (S/Mean)	3.6	4.1	2.4	2.7	4.1	
CV(SE/Mean)	2.1	2.4	1.4	1.6	2.4	
LSD _{0.05}	0.7	NS	0.5	0.5	0.6	
Planting date	14 May	25 May	18 May	18 May	21 May	
Harvest date	26 Aug	9 Sep	30 Aug	1 Sep	31 Aug	

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Bobbie Roos

Table 5. Performance of durum grown under dryland conditions at Circle, MT.
 Planted: 14 May 1999 Harvested: 26 August 1999 Cooperator: Victor Wagner

Variety	height, inches	grain protein	test weight	yield, bu/acre
Monroe	30	10.8	61.2	32.2
Munich	28	11.0	61.5	31.9
Plaza	27	10.0	62.5	31.3
Renville	31	11.8	63.0	31.0
Kyle	33	10.9	63.0	30.5
Mountrail	27	10.9	63.0	30.4
Utopia	20	10.6	62.0	30.2
Plenty	33	10.4	62.2	29.4
PH894401	24	10.8	63.3	29.3
Lebsock	29	11.4	63.0	27.4
Sceptre	29	11.3	61.8	27.3
Voss	24	10.3	63.7	26.3 x
Maier	28	11.1	63.7	26.1 x
Kari	28	10.8	63.1	24.3 x
Ben	29	10.9	62.9	23.6 x
average	28.0	10.9	62.7	28.7
p value	0.000	0.001	0.002	0.007
CV (S/Mean)	4.3	3.6	1.1	9.6
CV(SE/Mean)	2.5	2.1	0.6	5.6
LSD 0.05	2.0	0.7	1.2	4.6

x indicates significantly lower yield than check variety, Renville, at a probability of 0.05

Table 6. Relative yielding abilities of durum varieties compared to Renville when grown under dryland conditions in McCone County in cooperation with CES. Cooperator: Victor Wagner

Variety	1996	1998	1999	average	As % of Renville
Mountrail	--	33.9	30.4	32.2	109.9
Kyle	12.4	35.1	30.5	26.0	106.8
Plenty	14.0	32.6	29.4	25.3	104.1
Munich	13.1	30.0	31.9	25.0	102.7
Plaza	--	28.7	31.3	30.0	102.6
Monroe	11.0	30.6	32.2	24.6	101.1
Renville	14.5	27.5	31.0	24.3	100.0
Utopia	--	--	30.2	30.2	97.4
Maier	--	30.4	26.1	28.3	96.6
PH894401	--	--	29.3	29.3	94.5
Voss	14.0	27.2	26.3	22.5	92.5
Kari	--	28.0	24.3	26.2	89.4
Lebsock	--	--	27.4	27.4	88.4
Sceptre	--	--	27.3	27.3	88.1
Ben	11.6	28.9	23.6	21.4	87.8

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 as compared to Renville when grown under dryland conditions in McCone County in cooperation with CES. Cooperator: Victor Wagner

Variety	1996	1998	1999	average	As % of Renville
Maier	--	62.3	63.7	63.0	101.2
Voss	63.8	61.2	63.7	62.9	101.1
Kyle	63.4	62.0	63.0	62.8	100.9
Ben	63.2	61.8	62.9	62.6	100.6
PH894401	--	--	63.3	63.3	100.5
Mountrail	--	62.0	63.0	62.5	100.4
Kari	--	61.6	63.1	62.4	100.2
Renville	62.2	61.5	63.0	62.2	100.0
Plaza	--	62.0	62.5	62.3	100.0
Lebsock	--	--	63.0	63.0	100.0
Plenty	62.1	61.2	62.2	61.8	99.4
Monroe	62.8	60.8	61.7	61.8	99.3
Munich	61.6	61.3	61.5	61.5	98.8
Utopia	--	--	62.0	62.0	98.4
Sceptre	--	--	61.8	61.8	98.1

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 as compared to Renville when grown under dryland conditions in McCone County in cooperation with CES.
Cooperator: Victor Wagner

Variety	1996	1998	1999	average	As % of Renville
Renville	12.7	15.2	11.8	13.2	100.0
Maier	--	15.6	11.1	13.4	98.9
Monroe	13.1	15.2	10.8	13.0	98.5
Munich	13.0	15.1	11.0	13.0	98.5
Ben	13.0	15.1	10.9	13.0	98.2
Kyle	12.9	14.7	10.9	12.8	97.0
Lebsock	--	--	11.4	11.4	96.6
Plenty	12.9	14.8	10.4	12.7	96.0
Sceptre	--	--	11.3	11.3	95.8
Kari	--	14.6	10.8	12.7	94.1
Mountrail	--	14.4	10.9	12.7	93.7
Plaza	--	15.2	10.0	12.6	93.3
Voss	12.3	14.4	10.3	12.3	93.2
PH894401	--	--	10.8	10.8	91.5
Utopia	--	--	10.6	10.6	89.8

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

Table 9. Performance of durum grown under dryland conditions at Poplar, MT.
 Planted: 18 May 1999 Harvested: 30 August 1999 Cooperator: Mark Swank

Variety	height, inches	grain protein	test weight	yield, bu/acre
Plaza	27	12.0	60.8	49.5
Renville	34	12.5	61.5	49.4
Plenty	36	12.6	60.5	48.7
Mountrail	31	12.5	61.0	48.6
Kyle	37	12.5	61.5	47.8
Utopia	25	12.3	60.3	46.2
Maier	29	13.4	61.0	46.2
Monroe	34	12.8	60.5	45.8
Ben	33	12.6	61.0	45.3
Munich	30	12.9	60.5	45.1
Kari	29	12.6	61.0	44.4
Lebsock	32	13.1	61.5	43.7 x
Voss	24	12.2	62.2	43.6 x
Sceptre	30	12.4	59.8	40.9 x
PH894401	24	12.0	63.0	33.1 x
Average	30.3	12.6	61.1	45.2
p value	0.000	0.000	0.000	0.000
CV (S/Mean)	5.2	2.4	0.5	7.0
CV(SE/Mean)	3.0	1.4	0.3	4.0
LSD 0.05	2.6	0.5	0.5	5.3

x indicates significantly lower yield than check variety, Renville, at a probability of 0.05

Table 10. Relative yields of durum varieties as compared to Renville when grown under dryland conditions in Roosevelt County in cooperation with CES. Cooperator: Mark Swank

Cultivar	1995	1996	1997	1998	1999	Ave	as % of Renville
Kyle	45.3	23.7	26.0	39.0	47.8	36.4	106.5
Plenty	40.6	24.4	27.1	39.9	48.7	36.1	105.9
Mountrail	--	--	--	38.4	48.6	43.5	102.1
Maier	--	--	--	40.0	46.2	43.1	101.2
Plaza	--	--	--	35.9	49.5	42.7	100.2
Renville	40.2	24.3	21.0	35.8	49.4	34.1	100.0
Voss	38.7	23.0	24.7	39.8	43.6	34.0	99.5
Kari	--	--	--	38.7	44.4	41.6	97.5
Munich	43.2	22.8	20.9	34.3	45.1	33.3	97.4
Ben	--	21.4	18.8	41.5	45.3	31.8	97.3
Utopia	--	--	--	--	46.2	46.2	93.5
Monroe	37.3	21.0	18.4	34.3	45.8	31.4	91.9
Lebsock	--	--	--	--	43.7	43.7	88.5
Sceptre	--	--	--	--	40.9	40.9	82.8
PH894401	--	--	--	--	33.1	33.1	67.0

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 11. Relative test weights of durum varieties as compared to Renville when grown under dryland conditions in Roosevelt County in cooperation with CES. Cooperator: Mark Swank

Cultivar	1995	1996	1997	1998	1999	Ave	as % of Renville
PH894401	--	--	--	--	63.0	63.0	102.4
Ben	--	61.7	65.0	63.3	61.0	62.8	100.1
Renville	60.8	61.7	64.5	63.0	61.5	62.3	100.0
Lebsock	--	--	--	--	61.5	61.5	100.0
Voss	61.1	62.3	63.3	62.5	62.2	62.3	100.0
Maier	--	--	--	62.8	61.0	61.9	99.4
Kari	--	--	--	62.7	61.0	61.9	99.4
Munich	61.9	60.7	64.1	61.8	60.5	61.8	99.2
Monroe	60.2	61.5	64.2	62.2	60.5	61.7	99.1
Kyle	61.0	61.0	62.6	62.5	61.5	61.7	99.1
Mountrail	--	--	--	62.2	61.0	61.6	99.0
Plenty	60.8	61.0	62.4	61.8	60.5	61.3	98.4
Plaza	--	--	--	61.3	60.8	61.1	98.1
Utopia	--	--	--	--	60.3	60.3	98.0
Sceptre	--	--	--	--	59.8	59.8	97.2

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.

THE UNIVERSITY OF CHICAGO

PHYSICS DEPARTMENT

PHYSICS 351

LECTURE 1

1.1. Introduction

1.2. Kinematics

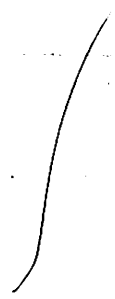


Table 12. Relative proteins of durum varieties as compared to Renville when grown under dryland conditions in Roosevelt County in cooperation with CES. Cooperator: Mark Swank

Cultivar	1995	1996	1997	1998	1999	Ave	as % of Renville
Lebsock	--	--	--	--	13.1	13.1	104.8
Maier	--	--	--	15.8	13.4	14.6	104.7
Ben	--	14.8	16.3	15.7	12.6	14.9	102.6
Kari	--	--	--	15.6	12.6	14.1	101.1
Plenty	15.7	15.0	15.6	15.2	12.6	14.8	100.8
Monroe	15.3	14.7	15.6	15.3	12.8	14.7	100.3
Munich	14.9	15.0	15.2	15.7	12.9	14.7	100.3
Renville	15.6	14.2	15.8	15.4	12.5	14.7	100.0
Mountrail	--	--	--	15.2	12.5	13.9	99.3
Sceptre	--	--	--	--	12.4	12.4	99.2
Kyle	16.0	14.0	15.8	14.6	12.5	14.6	99.2
Utopia	--	--	--	--	12.3	12.3	98.4
Plaza	--	--	--	15.1	12.0	13.6	97.1
PH894401	--	--	--	--	12.0	12.0	96.0
Voss	14.9	13.0	14.5	14.8	12.2	13.9	94.4

NOTE: Average proteins 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 13. Performance of durum grown under dryland conditions at Reserve, MT.
 Planted: 18 May 1999 Harvested: 1 September 1999 Cooperator: Max Aasheim

Variety	Height, inches	Grain protein	Test weight	Yield, bu/acre
Plaza	26	10.2	63.5	42.0
Kari	31	11.8	63.0	41.7
Plenty	35	10.8	63.0	41.7
Voss	25	11.0	64.0	41.4
Munich	30	11.5	63.0	38.6
Kyle	34	10.8	62.5	38.2
Mountrail	30	11.4	62.8	38.2
Maier	30	11.7	63.3	36.8
Lebsock	32	11.5	63.0	35.7
Sceptre	29	11.0	61.8	34.8
Utopia	27	11.5	62.5	33.6
Ben	30	11.4	63.0	28.6 x
PH894401	23	11.2	62.7	26.5 x
Monroe	32	11.4	62.2	21.7 x
Renville**	34	11.8	62.8	20.1 x
average	29.4	11.2	62.9	35.7
p value	0.000	0.000	0.008	0.000
CV (S/Mean)	7.3	2.7	0.9	9.0
CV(SE/Mean)	4.2	1.6	0.5	5.2
LSD _{0.05}	3.6	0.5	0.9	5.4

**Severe deer damage to two reps of this variety - not included in statistics

x indicates significantly lower yield than check variety, Munich, at a probability of 0.05

Table 14. Relative yields of durum varieties as compared to Renville when grown under dryland conditions in Sheridan County in cooperation with CES. Cooperator: Max Aasheim

Cultivar	1995	1996	1997	1998	1999	Ave	as % of Munich
Plaza	--	--	--	53.2	42.0	47.6	112.0
Mountrail	--	--	--	52.6	38.2	45.4	106.8
Kari	--	--	--	47.8	41.7	44.8	105.3
Kyle	33.2	32.8	36.1	43.0	38.2	36.7	103.4
Renville	29.5	35.5	31.0	45.8	--	35.5	102.2
Maier	--	--	--	49.4	36.8	43.1	101.4
Plenty	26.9	32.8	30.0	47.5	41.7	35.8	100.9
Munich	27.5	34.0	30.8	46.4	38.6	35.5	100.0
Voss	28.7	32.5	28.1	40.8	41.4	34.3	96.7
Lebsock	--	--	--	--	35.7	35.7	92.5
Ben	--	32.7	28.4	48.2	28.6	34.5	92.1
Sceptre	--	--	--	--	34.8	34.8	90.2
Utopia	--	--	--	--	33.6	33.6	87.0
Monroe	28.9	27.5	24.0	39.5	21.7	28.3	79.9
PH894401	--	--	--	--	26.5	26.5	68.7

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 15. Relative test weights of durum varieties as compared to Renville when grown under dryland conditions in Sheridan County in cooperation with CES. Cooperator: Max Aasheim

Cultivar	1995	1996	1997	1998	1999	Ave	as % of Munich
Ben	--	64.5	60.7	62.7	63.0	62.7	101.6
Maier	--	--	--	62.2	63.3	62.8	101.4
Plaza	--	--	--	62.0	63.5	62.8	101.4
Kyle	63.3	63.5	61.2	61.5	62.5	62.4	101.0
Renville	61.2	63.8	60.8	62.3	--	62.0	100.9
Voss	62.5	64.3	60.3	60.3	64.0	62.3	100.8
Kari	--	--	--	61.3	63.0	62.2	100.4
Plenty	62.1	64.0	59.2	61.5	63.0	62.0	100.3
Munich	62.0	64.0	59.2	60.8	63.0	61.8	100.0
Mountrail	--	--	--	61.0	62.8	61.9	100.0
Lebsock	--	--	--	--	63.0	63.0	100.0
PH894401	--	--	--	--	62.7	62.7	99.5
Monroe	59.8	63.7	60.2	60.8	62.3	61.4	99.3
Utopia	--	--	--	--	62.5	62.5	99.2
Sceptre	--	--	--	--	61.8	61.8	98.1

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 16. Relative proteins of durum varieties as compared to Renville when grown under dryland conditions in Sheridan County in cooperation with CES. Cooperator: Max Aasheim

Cultivar	1995	1996	1997	1998	1999	Ave	as % of Munich
Maier	--	--	--	13.1	11.7	12.4	101.6
Plenty	9.3	14.4	13.3	12.3	10.8	12.0	100.3
Ben	--	13.4	13.0	12.8	11.4	12.7	100.2
Munich	9.4	13.3	12.8	12.9	11.5	12.0	100.0
Lebsock	--	--	--	--	11.5	11.5	100.0
Utopia	--	--	--	--	11.5	11.5	100.0
Monroe	9.2	13.0	13.3	12.9	11.4	12.0	99.8
Kari	--	--	--	12.4	11.8	12.1	99.2
Kyle	9.2	13.5	13.5	12.1	10.8	11.8	98.7
Voss	10.0	12.9	12.2	12.4	11.0	11.7	97.7
PH894401	--	--	--	--	11.2	11.2	97.4
Mountrail	--	--	--	12.2	11.4	11.8	96.7
Renville	8.8	12.6	12.7	12.4	--	11.6	96.1
Sceptre	--	--	--	--	11.0	11.0	95.7
Plaza	--	--	--	12.3	10.2	11.3	92.2

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 17. Performance of durum grown under dryland conditions at Wibaux, MT.
 Planted: 25 May 1999 Harvested: 9 September 1999 Cooperator: David Maus

Variety	Height, inches	Grain protein	Test weight	Yield, bu/acre	
Utopia	26	13.9	59.0	43.6	a
Lebsock	32	14.6	61.7	43.5	a
Plaza	28	14.4	60.5	40.0	a
Kyle	35	14.4	61.5	38.7	a
Maier	31	14.9	60.2	38.4	a
Plenty	37	14.8	61.0	37.3	
Mountrail	30	14.2	60.7	37.1	
Munich	31	14.5	59.0	36.5	
Kari	31	14.7	60.0	34.9	
Sceptre	31	14.4	59.2	34.0	
Voss	26	13.5	60.7	33.7	
PH894401	27	13.6	61.5	33.6	
Ben	35	14.8	60.0	32.3	
Renville	35	14.5	60.3	32.1	
Monroe	36	14.1	59.3	20.4	x
average	31.3	14.4	60.3	35.8	
p value	0.000	0.137	0.000	0.000	
CV (S/Mean)	5.0	4.1	0.6	9.8	
CV(SE/Mean)	2.9	2.4	0.3	5.7	
LSD 0.05	2.6	NS	0.6	5.9	

a indicates significantly greater yield than check variety, Renville, at a probability of 0.05
 x indicates significantly lower yield than check variety, Renville, at a probability of 0.05

Table 18. Performance of durum grown under dryland conditions at Scobey, MT.
 Planted: 21 May 1999 Harvested: 31 August 1999 Cooperator: Bobbie Roos

Variety	Height, inches	Grain protein	Test weight	Yield, bu/acre
Mountrail	30	9.0	61.7	50.1
Kyle	32	8.4	61.1	46.5
Renville	29	9.3	62.2	46.3
Plenty	32	9.0	62.1	45.6
Ben	29	9.4	62.9	45.0
Utopia	22	9.1	61.9	44.5
Plaza	25	8.8	62.9	43.7
Munich	28	9.9	61.7	42.9
Kari	29	9.4	61.7	42.1
Monroe	29	9.5	61.7	41.8
Lebsock	29	9.2	62.8	41.6
Maier	26	9.3	63.1	41.2 x
PH894401	24	8.9	63.5	41.0 x
Sceptre	28	9.1	61.7	40.2 x
Voss	23	8.9	62.7	40.1 x
average	27.8	9.2	62.2	43.5
p value	0.000	0.011	0.000	0.013
CV (S/Mean)	6.5	4.1	0.6	6.9
CV(SE/Mean)	3.7	2.4	0.3	4.0
LSD 0.05	3.0	0.6	0.6	5.0

x indicates significantly lower yield than check variety, Renville, at a probability of 0.05

Table 19. Summary of durum yields in bu/acre at two irrigated off-station sites in eastern Montana, 1999. Both sites are under pivot irrigation.

Variety	Dagmar	Larslan	average
Mountrail	55.4	92.5	74.0
Renville	62.9	79.7	71.3
Kari	56.6	81.6	69.1
Maier	53.6	83.4	68.5
Ben	51.0	81.3	66.2
Plenty	53.0	78.1	65.6
Lebsock	52.6	75.6	64.1
Munich	50.5	73.1	61.8
Monroe	45.6	74.9	60.3
Sceptre	47.9	72.5	60.2
Plaza	44.5	75.7	60.1
Kyle	32.1	74.8	53.5
Voss	41.3	58.0	49.7
PH894401	28.4	44.0	36.2
Utopia	20.6	34.0	27.3
site average	46.4	72.0	
p value	0.000	0.000	
CV (S/Mean)	12.7	10.3	
CV(SE/Mean)	7.3	6.0	
LSD _{0.05}	9.8	12.4	
Planting date	18 May	4 May	
Harvest date	7 Sep	8 Sep	

Cooperators:

County

Sheridan Co

Valley Co

Producer

Steve Brekke

Kelly Donovan

CES Agent

Terry Angvick

Verlin Koenig

Table 20. Summary of durum test weights in lb/bu at two irrigated off-station sites in eastern Montana, 1999. Both sites are under pivot irrigation.

Variety	Dagmar	Larslan	average
Ben	60.0	62.0	61.0
Mountrail	60.3	61.2	60.8
Lebsock	59.0	62.3	60.7
Maier	59.3	62.0	60.7
Renville	59.3	61.7	60.5
Kari	58.5	61.2	59.9
Monroe	58.5	61.0	59.8
Munich	58.0	61.3	59.7
Plenty	58.3	60.5	59.4
Sceptre	57.0	60.7	58.9
Plaza	56.7	59.2	58.0
Kyle	56.3	59.5	57.9
Voss	55.7	58.3	57.0
PH894401	54.0	54.7	54.4
Utopia	49.0	49.5	49.3
site average	57.3	59.7	
p value	0.000	0.000	
CV (S/Mean)	1.5	1.7	
CV(SE/Mean)	0.9	1.0	
LSD _{0.05}	1.5	1.7	
Planting date	18 May	4 May	
Harvest date	7 Sep	8 Sep	

Cooperators:

County
Sheridan Co
Valley Co

Producer

Steve Brekke
Kelly Donovan

CES Agent

Terry Angvick
Verlin Koenig

Table 21. Summary of durum heights in inches at two irrigated off-station sites in eastern Montana, 1999. Both sites are under pivot irrigation.

Variety	Dagmar	Larslan	average
Kyle	43	43	43.0
Plenty	46	40	43.0
Renville	44	41	42.5
Ben	42	39	40.5
Mountrail	43	38	40.5
Monroe	41	39	40.0
Lebsock	42	37	39.5
Sceptre	41	38	39.5
Kari	40	37	38.5
Maier	39	35	37.0
Munich	37	35	36.0
Plaza	35	31	33.0
Voss	33	29	31.0
PH894401	30	29	29.5
Utopia	28	26	27.0
site average	38.9	35.9	
p value	0.000	0.000	
CV (S/Mean)	4.1	3.6	
CV(SE/Mean)	2.4	2.1	
LSD _{0.05}	2.7	2.2	
Planting date	18 May	4 May	
Harvest date	7 Sep	8 Sep	

Cooperators:

County
Sheridan Co
Valley Co

Producer

Steve Brekke
Kelly Donovan

CES Agent

Terry Angvick
Verlin Koenig

Table 22. Summary of durum grain protein contents in percent at two irrigated off-station sites in eastern Montana, 1999. Both sites are under pivot irrigation.

Variety	Dagmar	Larslan	average
Kyle	14.5	14.5	14.5
Maier	14.5	14.2	14.4
Kari	14.1	14.0	14.1
Munich	14.0	14.0	14.0
Lebsock	13.8	14.0	13.9
Mountrail	13.9	13.9	13.9
Ben	13.8	13.8	13.8
PH894401	13.8	13.7	13.8
Sceptre	13.7	13.7	13.7
Utopia	13.5	13.8	13.7
Monroe	13.6	13.5	13.6
Plenty	13.6	13.5	13.6
Renville	13.5	13.7	13.6
Voss	13.2	13.5	13.4
Plaza	13.3	13.0	13.2
site average	13.8	13.8	
p value	0.000	0.004	
CV (S/Mean)	2.3	2.5	
CV(SE/Mean)	1.3	1.4	
LSD _{0.05}	0.5	0.6	
Planting date	18 May	4 May	
Harvest date	7 Sep	8 Sep	

Cooperators:

County
Sheridan Co
Valley Co

Producer
Steve Brekke
Kelly Donovan

CES Agent
Terry Angvick
Verlin Koenig

Table 23. Performance of durum grown under irrigated conditions at Dagmar, MT.
 Planted: 18 May 1999 Harvested: 7 September 1999 Cooperator: Steve Brekke

Variety	height, inches	grain protein	test weight	yield, bu/acre
Renville	44	13.5	59.3	62.9
Kari	40	14.1	58.5	56.6
Mountrail	43	13.9	60.3	55.4
Maier	39	14.5	59.3	53.6
Plenty	46	13.6	58.3	53.0 x
Lebsock	42	13.8	59.0	52.6 x
Ben	42	13.8	60.0	51.0 x
Munich	37	14.0	58.0	50.5 x
Sceptre	41	13.7	57.0	47.9 x
Monroe	41	13.6	58.5	45.6 x
Plaza	35	13.3	56.7	44.5 x
Voss	33	13.2	55.7	41.3 x
Kyle*	43	14.5	56.3	32.1 x
PH894401**	30	13.8	54.0	28.4 x
Utopia**	28	13.5	49.0	20.6 x
average	38.9	13.8	57.3	46.4
p value	0.000	0.000	0.000	0.000
CV (S/Mean)	4.1	2.3	1.5	12.7
CV(SE/Mean)	2.4	1.3	0.9	7.3
LSD 0.05	2.7	0.5	1.5	9.8

*severely lodged

**severe leaf spotting disease

x indicates significantly lower yield than check variety, Renville, at a probability of 0.05

Table 24. Relative yields of durum varieties as compared to Renville when grown under irrigated conditions in Sheridan County in cooperation with CES. Cooperator: Steve Brekke

Cultivar	1991	1993	1996	1998	1999	Ave	as % of Renville
Plenty	--	--	47.8	68.8	53.0	56.5	106.8
Kari	--	--	--	72.0	56.6	64.3	104.6
Mountrail	--	--	--	72.3	55.4	63.9	103.8
Renville	33.6	67.1	35.8	60.1	62.9	51.9	100.0
Maier	--	--	--	68.8	53.6	61.2	99.5
Monroe	35.1	86.3	29.2	59.2	45.6	51.1	98.4
Ben	--	--	38.3	66.3	51.0	51.9	98.0
Munich	--	--	39.9	61.4	50.5	50.6	95.6
Sceptre	33.7	73.4	--	--	47.9	51.7	94.7
Kyle	--	--	48.9	65.1	32.1	48.7	92.0
Plaza	--	--	--	67.3	44.5	55.9	90.9
Voss	--	--	33.2	59.5	41.3	44.7	84.4
Lebsock	--	--	--	--	52.6	52.6	83.6
PH894401	--	--	--	--	28.4	28.4	45.2
Utopia	--	--	--	--	20.6	20.6	32.8

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 25. Relative test weights of durum varieties as compared to Renville when grown under irrigated conditions in Sheridan County in cooperation with CES. Cooperator: Steve Brekke

Cultivar	1991	1993	1996	1998	1999	Ave	as % of Renville
Ben	--	--	61.7	63.0	60.0	61.6	101.8
Plenty	--	--	62.3	61.3	58.3	60.6	100.3
Maier	--	--	--	62.5	59.3	60.9	100.2
Renville	58.0	59.7	59.8	62.3	59.3	59.8	100.0
Mountrail	--	--	--	61.0	60.3	60.7	99.8
Lebsock	--	--	--	--	59.0	59.0	99.5
Kyle	--	--	61.7	61.8	56.3	59.9	99.1
Kari	--	--	--	61.7	58.5	60.1	98.8
Monroe	57.8	59.7	58.9	60.5	58.5	59.1	98.8
Munich	--	--	60.3	60.7	58.0	59.7	98.7
Sceptre	57.8	58.0	--	--	57.0	57.6	97.6
Voss	--	--	60.2	60.5	55.7	58.8	97.2
Plaza	--	--	--	61.5	56.7	59.1	97.2
PH894401	--	--	--	--	54.0	54.0	91.1
Utopia	--	--	--	--	49.0	49.0	82.6

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 26. Relative protein contents of durum varieties as compared to Renville when grown under irrigated conditions in Sheridan County in cooperation with CES. Cooperator: Steve Brekke

Cultivar	1991	1993	1996	1998	1999	Ave	as % of Renville
Maier	--	--	--	14.4	14.5	14.5	103.6
Lebsock	--	--	--	--	13.8	13.8	102.2
PH894401	--	--	--	--	13.8	13.8	102.2
Kari	--	--	--	14.3	14.1	14.2	101.8
Mountrail	--	--	--	14.3	13.9	14.1	101.1
Kyle	--	--	10.5	14.6	14.5	13.2	101.0
Renville	13.6	14.2	11.3	14.4	13.5	13.4	100.0
Utopia	--	--	--	--	13.5	13.5	100.0
Ben	--	--	10.9	14.0	13.8	12.9	98.7
Monroe	13.0	14.0	11.1	13.8	13.6	13.1	97.8
Munich	--	--	10.5	13.8	14.0	12.8	97.7
Sceptre	12.4	14.2	--	--	13.7	13.4	97.6
Voss	--	--	11.3	13.7	13.2	12.7	97.4
Plenty	--	--	9.4	14.9	13.6	12.6	96.7
Plaza	--	--	--	13.1	13.3	13.2	94.6

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 27. Performance of durum grown under irrigated conditions at Larslan, MT.
 Planted: 4 May 1999 Harvested: 8 September 1999 Cooperator: Kelly Donovan

Variety	height, inches	grain protein	test weight	yield, bu/acre
Mountrail	38	13.9	61.2	92.5 a
Maier	35	14.2	62.0	83.4
Kari	37	14.0	61.2	81.6
Ben	39	13.8	62.0	81.3
Renville	41	13.7	61.7	79.7
Plenty	40	13.5	60.5	78.1
Plaza	31	13.0	59.2	75.7
Lebsock	37	14.0	62.3	75.6
Monroe	39	13.5	61.0	74.9
Kyle	43	14.5	59.5	74.8
Munich	35	14.0	61.3	73.1
Sceptre	38	13.7	60.7	72.5
Voss	29	13.5	58.3	58.0 x
PH894401*	29	13.7	54.7	44.0 x
Utopia*	26	13.8	49.5	34.0 x
average	35.9	13.8	59.7	72.0
p value	0.000	0.004	0.000	0.000
CV (S/Mean)	3.6	2.5	1.7	10.3
CV(SE/Mean)	2.1	1.4	1.0	6.0
LSD 0.05	2.2	0.6	1.7	12.4

*severe leaf spotting disease

a indicates significantly greater yield than check variety, Renville, at a probability of 0.05
 x indicates significantly lower yield than check variety, Renville, at a probability of 0.05