

Project Title: Effects of seeding rate and fertilizer rate on dryland malt barley

Project Leader: Grant Jackson, Professor of Agronomy, Western Triangle Ag. Research Center, Conrad.

Project Personnel: John Miller, Research Associate.

Objectives: To determine the planting rate for optimum, dryland malt barley yield and quality; and to evaluate the effects of nitrogen (N) and sulfur (S) fertilization on yield and quality of malt barley.

Results: Note - protein and seed S content unavailable at press time.

Grain yield and kernel plumpness data are tabulated in Tables 2 and 3. Site characteristics and soil test results are shown in Table 1. Average grain yields ranged from 58 bu/ac to 88 bu/ac, and grain plumpness at all locations exceeded 75%. Increasing planting rate increased grain yields all locations except Cut Bank and Ethridge. Kernel plumpness declined with increasing planting rate at all locations except Cut Bank; however, all plump data were above the minimum specification of 75 %. Nitrogen fertilization increased yields at all locations except Conrad (WTARC). Kernel plumpness declined with increasing N at Joplin, Sunburst, and Conrad (WTARC). Plump was unaffected by N at Cut Bank and Knees, and plump increased with increasing N at Ethridge. Grain yield at Cut Bank declined with increasing fertilizer S; however, yield was not significantly affected at the other locations. Kernel plumpness was unaffected by S.

Summary: Grain yields were exceptionally high this year as shown by many individual treatments that had yields that exceeded 90 bu/acre. All fertilizer and planting rate treatments had percent plump kernels that exceeded 75 %; however, the highest plump occurred when planting rate was 10 seeds per square foot with out N fertilizer. Sulfur fertilization did not affect plump, but one location had a yield reduction due to S. Counting the data from 2004, S fertilization has reduced yields in four out of 11 locations.

Future Plans: As advised by the Research Center's advisory committee, continue for one more growing season.

Table 1. Site characteristics and soil test results by location. Western Triangle Ag. Research Center. 2005.

Site Characteristics						
Character	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
Planting Date	April 25	April 11	April 19	April 12	April 20	April 26
Harvest Date	August 29	August 9	August 16	August 15	August 28	August 11
Previous Crop	Chem. Fallow	Chem. Fallow	Chem. Fallow	Chem. Fallow	Chem. Fallow	Conv. Fallow
Precipitation (inches)	8.45	ND	5.30	7.25	8.50	6.17
Spray Date	June 15**				May 26**	
Soil Test Results						
Test	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
pH	8.4	8.4	8.2	7.5	6.1	7.9
O.M. (%)	2.2	2.0	1.5	2.2	3.4	2.1
P (ppm)	7.4	5.5	10.0	19.4	29.1	19.5
K (ppm)	343	371	326	540	467	379
EC (mmhos/cm)	0.20	0.20	0.14	0.24	0.15	0.17
NO ₃ -N (0-3', lb/ac)	32.1*	45.5	69.7	88.5	122.1	93.8
SO ₄ -S (0-3', lb/ac)	126.5*	1968.5	1475.9	366.9	98.7	391.4

ND=Not determined. **=Bronate Advanced @ 1.6 pt/a tank mixed with Achieve SC @ 8oz/a. *=Soil sample to two feet depth.

Table 2. Effect of nitrogen, sulfur, and planting rate on yield of dryland malt barley.
Western Triangle Ag. Research Center. 2005.

Treatment		Location					
Plant. rate	N - S	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
seeds/ft ²	lb/acre	-----bu/acre-----					
10	0 - 0	45.0	51.8	77.2	68.1	76.7	76.3
15	0 - 0	41.3	58.6	79.3	73.8	82.6	83.7
20	0 - 0	36.3	73.6	79.6	79.2	89.0	83.1
10	30 - 0	59.2	65.2	80.6	78.5	80.2	76.5
15	30 - 0	66.2	75.7	86.6	86.2	87.0	84.2
20	30 - 0	68.2	70.7	91.3	93.5	88.0	81.5
10	60 - 0	77.7	94.8	82.4	86.3	84.1	79.7
15	60 - 0	81.3	75.9	90.8	89.6	85.1	78.1
20	60 - 0	83.6	89.0	84.3	90.9	100.1	83.3
10	0 - 10	34.7	56.2	77.4	73.2	82.0	79.0
15	0 - 10	38.6	58.4	77.6	76.1	82.8	85.1
20	0 - 10	40.4	57.1	78.4	85.1	86.7	81.7
10	30 - 10	61.2	80.7	83.7	83.1	88.4	81.6
15	30 - 10	62.5	75.7	85.8	89.5	92.1	83.0
20	30 - 10	61.6	76.5	84.8	92.8	92.4	89.2
10	60 - 10	71.2	91.5	82.6	84.1	87.6	80.4
15	60 - 10	75.4	95.3	88.3	90.5	97.5	81.4
20	60 - 10	72.7	100.7	89.3	92.6	98.3	85.8
10	0 - 20	39.4	48.2	74.2	69.2	77.7	75.4
15	0 - 20	34.4	64.8	83.3	74.7	83.3	81.8
20	0 - 20	33.6	62.3	79.6	83.2	85.1	79.3
10	30 - 20	55.3	79.2	83.1	80.5	85.4	73.1
15	30 - 20	64.7	78.6	87.5	86.2	88.7	89.9
20	30 - 20	62.3	90.2	86.2	90.2	99.5	94.5
10	60 - 20	65.2	96.1	84.8	87.8	91.4	81.7
15	60 - 20	73.1	86.1	90.3	90.6	94.4	85.6
20	60 - 20	80.9	90.4	88.2	94.3	98.9	87.8
Planting Rate Summary							
10		56.5 a	73.8 a	80.7 a	79.0 a	83.7 a	78.2 a
15		59.7 a	74.4 a	85.5 b	84.1 b	88.2 b	83.6 b
20		58.8 a	79.0 a	84.6 b	89.1 c	93.1 c	85.1 b
P-value, Linear contrast		0.373	0.135	0.005	0.001	0.001	0.001
P-value, Quad. contrast		0.362	0.504	0.020	0.925	0.878	0.256
Nitrogen Summary							
0		38.2 a	59.0 a	78.5 a	75.8 a	82.9 a	80.6 a
30		61.2 b	77.0 b	85.5 b	86.7 b	89.1 b	83.7 a
60		75.7 c	91.1 c	86.8 b	89.6 c	93.0 c	82.6 a
P-value, Linear contrast		0.001	0.001	0.001	0.001	0.001	0.308
P-value, Quad. contrast		0.058	0.527	0.019	0.002	0.485	0.227

Table 2. Continued						
Sulfur Summary						
Treatment	Location					
lbs S/ ac	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
0	62.1 a	72.8 a	83.6 a	82.9 a	85.9 a	80.7 a
10	57.6 ab	76.9 a	83.1 a	85.2 a	89.7 a	83.0 a
20	55.4 b	77.3 a	84.1 a	84.1 a	89.4 a	83.2 a
P-value, Linear contrast	0.012	0.196	0.684	0.415	0.060	0.208
P-value, Quad. contrast	0.600	0.540	0.533	0.164	0.191	0.549
Statistical Summary						
Mean	58.4	75.7	83.6	84.1	88.3	82.3
CV (%)	18.8	16.7	7.0	7.2	8.9	10.2
Interaction	Interaction p-values					
Plt Rate x N Rate	0.447	0.341	0.844	0.418	0.945	0.348
Plt Rate x S Rate	0.999	0.949	0.826	0.999	0.703	0.685
N Rate x S Rate	0.915	0.300	0.947	0.573	0.591	0.550
N Rate x S Rate x Plt rate	0.601	0.456	0.651	0.968	0.652	0.812

Yield means with the same letter are not significantly different accord to the LSD ($p=0.05$).

Table 3. Effect of nitrogen, sulfur, and planting rate on kernel plumpness of dryland malt barley. Western Triangle Ag. Research Center. 2005.

Treatment		Location					
Plant. rate	N - S	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
seeds/ft ²	lb/acre	-----%-----					
10	0 - 0	95.8	95.7	95.8	94.3	94.3	93.3
15	0 - 0	95.8	94.3	94.5	95.3	94.5	89.8
20	0 - 0	95.0	94.7	91.0	94.8	94.5	86.5
10	30 - 0	95.0	96.0	93.8	96.4	93.0	91.0
15	30 - 0	95.3	96.3	89.3	95.5	92.8	82.3
20	30 - 0	74.0	94.3	85.3	94.3	90.8	74.3
10	60 - 0	96.5	97.3	85.3	95.5	90.3	83.0
15	60 - 0	94.8	94.3	87.0	94.0	82.3	70.8
20	60 - 0	92.3	94.7	78.3	95.3	85.0	73.5
10	0 - 10	95.8	96.7	95.5	95.3	95.0	92.0
15	0 - 10	95.0	94.0	92.0	96.0	92.8	93.8
20	0 - 10	94.3	93.7	94.8	94.0	91.3	86.8
10	30 - 10	95.8	97.0	94.5	96.5	92.5	87.8
15	30 - 10	95.8	95.7	88.3	94.3	93.3	82.0
20	30 - 10	94.5	95.3	88.3	94.8	89.5	84.3
10	60 - 10	94.8	97.0	87.5	94.3	90.8	86.0
15	60 - 10	93.8	96.3	82.0	95.0	87.3	80.5
20	60 - 10	93.3	95.0	78.0	93.8	85.5	76.3
10	0 - 20	94.8	95.7	96.0	94.5	93.5	93.5
15	0 - 20	94.8	95.0	94.0	95.6	93.0	93.5
20	0 - 20	93.5	93.0	91.3	94.5	93.0	87.0
10	30 - 20	96.5	96.3	91.8	94.3	90.5	83.3
15	30 - 20	87.0	96.0	87.0	93.0	87.8	88.5
20	30 - 20	93.8	96.0	85.0	95.3	90.8	89.8
10	60 - 20	94.8	97.0	86.0	95.3	91.0	86.0
15	60 - 20	95.0	97.0	84.8	94.4	86.0	83.8
20	60 - 20	94.0	95.0	79.0	92.0	86.8	76.0
Planting Rate Summary							
10		95.5 a	96.5 a	91.8 a	95.1 a	92.3 a	88.4 a
15		94.1 a	95.4 b	88.7 b	94.8 ab	89.9 b	85.3 ab
20		91.6 a	94.6 c	85.6 c	94.3 b	89.7 b	81.6 b
P-value, Linear contrast		0.067	0.001	0.001	0.031	0.001	0.001
P-value, Quad. contrast		0.760	0.616	0.989	0.841	0.105	0.854
Nitrogen Summary							
0		94.9 a	94.7 a	93.8 a	94.9 a	93.5 a	90.7 a
30		91.9 a	95.9 b	89.5 b	94.9 a	91.1 b	85.1 b
60		94.3 a	96.0 b	83.1 c	94.4 a	87.2 c	79.5 c
P-value, Linear contrast		0.771	0.001	0.001	0.177	0.001	0.001
P-value, Quad. contrast		0.141	0.041	0.442	0.425	0.194	0.993

Table 3. Continued						
Sulfur Summary						
Treatment	Location					
lbs S/ ac	Cut Bank	Ethridge	Joplin	Knees	Sunburst	WTARC
0	92.7 a	95.3 a	88.9 a	95.0 a	90.8 a	83.0 a
10	94.8 a	95.6 a	89.0 a	94.9 a	90.9 a	85.5 a
20	93.8 a	95.7 a	88.3 a	94.3 a	90.3 a	86.8 a
P-value, Linear contrast	0.606	0.217	0.628	0.066	0.451	0.052
P-value, Quad. contrast	0.406	0.566	0.695	0.532	0.601	0.738
Statistical Summary						
Mean	93.7	95.5	88.7	94.7	90.6	85.1
CV (%)	9.5	1.1	5.5	1.7	3.4	9.5
Interaction	Interaction p-values					
Plt Rate x N Rate	0.675	0.489	0.240	0.118	0.052	0.664
Plt Rate x S Rate	0.346	0.462	0.494	0.947	0.357	0.425
N Rate x S Rate	0.523	0.546	0.833	0.623	0.085	0.831
N Rate x S Rate x Plt rate	0.458	0.125	0.988	0.081	0.357	0.430

Yield means with the same letter are not significantly different accord to the LSD ($p=0.05$).