I. Project Title: Effect of seeding rate and nitrogen on yield and quality of spring wheat and durum..

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IV. Objectives: Determine the optimum range of seed rates in durum, determine the nitrogen (N) requirements for desired protein and vitreous levels, and compare the responses between durum and spring wheat.

V. Results: This years report represents the third year of this project, and these data should be interpreted with caution due to the continuing drought. Agronomic and kernel characteristic data for both spring wheat and durum, durum only, and spring wheat only are presented in Tables 1, 2, and 3, respectively. The low seeding rate (15 seeds/ft^2) increased percent green kernels to unacceptable levels in 1999, and approached unacceptable levels in year 2000 and 2001. Seeding rate did not significantly affect yield and test weight under the conditions of this test. The data suggest that dryland seeding rates up to 30 seeds/ft^2 do not adversely affect test weight. However, since all test weights were below acceptable levels due to drought, kernel sizes were not measured this year. Even when yields are around 10 bu/a, the data indicate that 15 seeds/ft^2 is to low, resulting in high risk for green-kernel dockage. Since yield and test weights from previous years were favorable in the 20 to 30 seeds/ft^2 range, it is suggested that a rate of 23 seeds/ft^2 be used, which equals 1 million seeds per acre. The 1 million seed per acre rate facilitates calculations for the grower in determining quantities of seed to purchase. Durum and spring wheat did not respond to N in 2001. Previous years data indicate that durum needs about 2.5 lbs N/bu for 13 % protein and 2.8 lbs N/bu for 13.5 % protein.

VI. Summary: Grain yields were very low this year due to the continuing drought; spring wheat and durum yields averaged about 13 and 9 bu/a, respectively with below standard test weights. Neither crop responded to varying planting or nitrogen fertilizer rate. Previous years data indicate that the optimum planting rate for durum is about 23 seeds/ft^2 and that durum needs about 2.5 lbs N/bu for 13 % protein and 2.8 lbs N/bu for 13.5 % protein.

VII. Future Plans: Continue this test in 2002 in order to sample a variety of growing season conditions.

Table 1. Effect of seeding rate and N on spring wheat and durum yield and quality.
Experiment located at Western Triangle Ag. Research Center, Conrad, MT. 2001.

	Fertilizer	Seeding	Grain	Test		Protein		
Crop	N	Rate	Yield	Weight	Protein	Yield	DHV	Green
	(lbs./a)	(seed/ft^2)	(bu/a)	(lbs./bu)	(%)	(lbs./a)	(%)	(%)
SW	0	30	14.9	58.5	15.0	131.5		
SW	225	20	14.2	58.4	16.2	138.3		
SW	225	25	13.9	58.3	16.3	135.9		
SW	150	20	13.7	57.9	16.3	131.8		
SW	150	25	13.5	57.8	16.7	133.6		
SW	150	30	13.4	58.2	16.5	130.2		
SW	225	15	13.2	57.9	16.4	129.3		
SW	75	30	13.1	58.6	15.7	122.6		
SW	0	25	12.5	58.0	15.8	117.9		
SW	150	15	12.3	58.2	16.2	117.8		
SW	75	15	12.3	58.5	15.5	112.2		
SW	75	25	12.2	57.7	16.1	117.1		
SW	225	30	11.9	57.5	16.8	119.1		
SW	0	15	11.7	58.3	15.5	108.2		
SW	0	20	11.6	58.0	15.7	109.5		
SW	75	20	11.6	58.4	15.7	108.0		
DU	75	15	10.1	54.5	16.3	98.3	100	0.9
DU	150	25	9.9	55.0	16.6	98.7	100	0
DU	75	30	9.8	54.5	16.4	95.4	100	0
DU	150	20	9.8	54.7	16.6	97.5	100	0
DU	150	30	9.8	53.7	16.5	96.4	99.8	0
DU	150	15	9.7	54.4	16.5	95.5	100	1.5
DU	0	20	9.7	54.4	15.9	91.9	99	0
DU	75	20	9.6	55.3	16.3	93.7	100	0.8
DU	225	30	9.4	55.4	16.7	94.3	100	0
DU	225	20	9.2	53.5	16.7	91.6	100	0.3
DU	225	25	8.9	54.5	16.5	88.2	100	0
DU	75	25	8.6	54.6	16.3	83.6	100	0
DU	0	25	8.2	53.5	16.1	79.3	98.3	0
DU	225	15	8.2	54.1	16.7	81.9	100	0.5
DU	0	15	7.8	54.4	16.2	75.5	98.8	1.8
DU	0	30	7.4	53.6	16.3	71.4	98.5	0

[1] Dark Hard Vitreous

LSD for DHV = 1.42. The 0 lbs N/a was statistically different from plots that received N.

Table 1. Continued.

Summary Statistics

	Grain Yield (Bu/a)	Test Weight (lbs./bu)	Protein (%)	Protein Yield (lbs./a)
Experimental Means	10.99	56.24	16.21	106.1
Error Mean Square	3.83	2.85	0.25	289.20
C.V. 1: (s/mean)*100	17.8	3.00	3.07	16.02
Interaction P-value	0.3097	0.8391	0.6439	0.4021

Variety Summary

Utopia	9.12	54.35	16.42	89.6
McNeal	12.85	58.13	16.00	122.7
p-value	0.0000	0.0000	0.0000	0.0000
LSD (0.05)	0.69	0.59	0.17	5.97
S.E. of the Mean	0.25	0.21	0.06	2.10

Seeding Rate Summary

15	10.63	56.26	16.15	102.3
20	11.18	56.32	16.17	107.8
25	10.95	56.14	16.30	106.8
30	11.19	56.24	16.22	107.6
p-value	0.6398	0.9818	0.6313	0.5356
LSD (0.05)	NS	NS	NS	NS
S.E. of the Mean	0.35	0.30	0.09	3.00

Nitrogen Summary

0	10.47	56.07	15.80	98.1
75	10.89	56.49	16.05	103.9
150	11.48	56.20	16.46	112.7
225	11.11	56.20	16.53	109.8
p-value	0.2202	0.7819	0.0000	0.0046
LSD (0.05)	NS	NS	0.25	8.44
S.E. of the Mean	0.35	0.30	0.0000	3.00

Table 2. Effect of seeding rate and N on durum yield and quality. Experiment located at Western Triangle Ag. Research Center, Conrad, MT. 2001.

	Fertilizer	Seeding	Grain	Test		Protein		
Crop	N	Rate	Yield	Weight	Protein	Yield	DHV[1]	Green
	(lbs./a)	(seed/ft^2)	(bu/a)	(lbs./bu)	(%)	(lbs./a)	(%)	(%)
DU	75	15	10.1	54.5	16.3	98.3	100	0.9
DU	150	25	9.9	55.0	16.6	98.7	100	0
DU	75	30	9.8	54.5	16.4	95.4	100	0
DU	150	20	9.8	54.7	16.6	97.5	100	0
DU	150	30	9.8	53.7	16.5	96.4	99.8	0
DU	150	15	9.7	54.4	16.5	95.5	100	1.5
DU	0	20	9.7	54.4	15.9	91.9	99	0
DU	75	20	9.6	55.3	16.3	93.7	100	0.8
DU	225	30	9.4	55.4	16.7	94.3	100	0
DU	225	20	9.2	53.5	16.7	91.6	100	0.3
DU	225	25	8.9	54.5	16.5	88.2	100	0
DU	75	25	8.6	54.6	16.3	83.6	100	0
DU	0	25	8.2	53.5	16.1	79.3	98.3	0
DU	225	15	8.2	54.1	16.7	81.9	100	0.5
DU	0	15	7.8	54.4	16.2	75.5	98.8	1.8
DU	0	30	7.4	53.6	16.3	71.4	98.5	0

Durum Summary Statistics

	Grain Yield	Test Weight	Protein	Protein Yield	DHV	Green
	(Bu/a)	(lbs./bu)	(%)	(lbs./a)	(%)	(%)
Experimental Means	9.12	54.35	16.42	89.6	99.6	0.35
Error Mean Square	2.32	2.05	0.10	207.36	0.34	0.85
C.V. 1: (s/mean)*100	16.70	2.63	1.88	16.08	0.58	261.8
Interaction P-value	0.6335	0.5794	0.8947	0.6584	0.9578	0.7642

Durum Seeding Rate Summary

15	8.93	54.31	16.13	87.8	99.7	1.16
20	9.58	54.44	16.34	93.7	99.8	0.25
25	8.89	54.36	16.54	87.5	99.6	0
30	9.08	54.30	16.67	89.4	99.6	0
p-value	0.5617	0.9899	0.0001	0.6000	0.7397	0.0022
LSD (0.05)	NS	NS	0.22	NS	NS	0.66
S.E. of the Mean	0.38	0.36	0.08	3.60	0.15	0.23

Durum Nitrogen Summary

0	8.28	53.94	16.43	79.5	98.6	0.44
75	9.52	54.68	16.38	92.8	100	0.41
150	9.78	54.41	16.40	97.0	99.9	0.38
225	8.91	54.18	16.47	89.0	100	0.19
p-value	0.0355	0.5412	0.8675	0.0095	0.0000	0.8693
LSD (0.05)	1.08	NS	NS	10.25	0.41	NS
S.E. of the Mean	0.38	0.36	0.08	3.60	0.15	0.23

Table 3. Effect of seeding rate and N on spring wheat yield and quality. Experiment located at Western Triangle Ag. Research Center, Conrad, MT. 2001.

Crop	Fertilizer N (lbs./a)	Seeding Rate (seed/ft^2)	Grain Yield (bu/a)	Test Weight (lbs./bu)	Protein (%)	Protein Yield (lbs./a)
SW	0	30	14.9	58.5	15.0	129.3
SW	225	20	14.2	58.4	16.2	122.6
SW	225	25	13.9	58.3	16.3	130.2
SW	150	20	13.7	57.9	16.3	117.1
SW	150	25	13.5	57.8	16.7	133.6
SW	150	30	13.4	58.2	16.5	135.9
SW	225	15	13.2	57.9	16.4	131.5
SW	75	30	13.1	58.6	15.7	138.3
SW	0	25	12.5	58.0	15.8	117.8
SW	150	15	12.3	58.2	16.2	117.9
SW	75	15	12.3	58.5	15.5	109.5
SW	75	25	12.2	57.7	16.1	131.8
SW	225	30	11.9	57.5	16.8	119.1
SW	0	15	11.7	58.3	15.5	108.2
SW	0	20	11.6	58.0	15.7	112.2
SW	75	20	11.6	58.4	15.7	108.0

Spring Wheat Summary Statistics

	Grain Yield (Bu/a)	Test Weight (lbs./bu)	Protein (%)	Protein Yield (lbs./a)
Experimental Means	12.85	58.13	16.00	122.7
Error Mean Square	4.23	0.27	0.36	276.91
C.V. 1: (s/mean)*100	16.00	0.90	3.74	13.56
Interaction P-value	0.3890	0.1252	0.5473	0.4638

Spring Wheat Seeding Rate Summary

15	12.34	58.21	15.88	116.77
20	12.77	58.19	15.96	114.97
25	13.01	57.93	15.97	128.35
30	13.30	58.19	16.21	130.67
p-value	0.6020	0.3789	0.4592	0.0190
LSD (0.05)	NS	NS	NS	11.85
S.E. of the Mean	0.51	0.13	0.15	4.20

Spring Wheat Nitrogen Summary

0	12.66	58.19	15.48	116.85
75	12.27	58.31	15.76	121.93
150	13.18	58.00	16.38	126.12
225	13.31	58.03	16.40	125.86
p-value	0.4603	0.3078	0.0001	0.3642
LSD (0.05)	NS	NS	0.43	NS
Standard of the Mean	0.51	0.13	0.15	4.20

Notes:
Varieties: Durum = Utopia Spring Wheat = McNeal
Seeding Date: 4/25/01 Harvest Date: 8/6/01
Growing Season ppt: 3.46" Previous Crop: Fallow
Fertilizer: N (broadcast) applied as urea. Thirty lbs. P_2O_5 applied with the seed as mono-ammonium phosphate while planting. 30 lbs K/ac as KCl was applied, (broadcast), while planting.
Herbicide: Achieve @ 0.25 lbs. ai/ac and Bronate @ 1½ pt/ac applied on 6/21/01.

Soil Test Summary[1]

Depth	NO_3-N	NH_4-N	SO_4-S	Cl
(ft)	(lbs/a)	(lbs/a)	(lbs/a)	(lbs/a)
0 - 1	40.2	13.2	44.6	26.3
1 - 2	37.7	14.5	71.7	35.2
2 - 3	20.3	14.5	120.9	36.4
3 - 4	9.5	16.3	435.3	33.6
4 - 5	11.9	19.4	4179.0	42.5
K[2]	Olsen P[2]	O.M.[2]	EC[2]	pH[2]
(ppm)	(ppm)	(%)	(mmhos/cm)	
556	31.5	1.85	0.21	7.5

[1]The soil was sampled during autumn of 2000.
[2]Results are from 0 - 6 inch soil sample.