

MT-11F Effect of K and Cl on wheat stem sawfly damage and disease incidence in dryland and irrigated wheat production, 1992.

Project Leader:

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Field reports have indicated that potash increases wheat resistance to injury from wheat stem sawfly in the Golden Triangle of Montana. However, studies at 7 sites over 2 years have failed to verify producer observations that KCl reduces sawfly damage. Up to 50% of the stems at some sites were sawfly infested. KCl fertilizer consistently increased Cl levels in wheat tissue and the Cl component was responsible for yield increases in the spring wheat region of northern Montana.

TERMINATION REPORT TO THE
POTASH AND PHOSPHATE INSTITUTE

TITLE: Effect of potassium and chlorine on wheat stem sawfly damage and disease incidence in dryland wheat production.

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LOCATIONS:

1991:

1. Dryland winter wheat-Dan Picard, 30 miles east of Brady;
2. Dryland spring wheat-Research Center, 10 miles north of Conrad;
3. Dryland spring wheat-Don Bradley, 30 miles north of Cut Bank;
4. Dryland winter wheat-Paul Kronubush, 9 miles north of Conrad.

1992:

5. Dryland spring wheat-Bill Eney, 20 miles north of Cut Bank;
6. Dryland spring wheat-Roy Embody, 10 miles northeast of Choteau;
7. Dryland spring wheat-Bruce Bradley, 25 miles north of Cut Bank.

OBJECTIVES: (1) To evaluate the effect of K and Cl on (dryland root rot, take all, etc.) incidence and grain yield of dryland winter and spring wheat; (2) To determine if wheat stem sawfly damage is affected by K and Cl fertilizers in dryland winter wheat and spring wheat and irrigated spring wheat; and (3) To prepare a final report at the inclusion of this project to address the objectives stated above.

RESULTS - 1991: Specific results from each location are tabulated in tables 1-4. Grain yields were very high this year, doubling yield goals at most locations. The Cut Bank location had the only significant yield increase due to K, and it was difficult to interpret. Potassium chloride increased plant Cl conc. at all locations, but only the winter wheat locations significantly. Spring wheat Cl data was too variable for significance for some reason. Plant K conc. was not increased significantly by K at any location. Since plant K conc. was unaffected, differential sawfly damage would not be expected. In fact sawfly damage (lodging) did not occur at any of these locations in spite of sawfly larvae infection at all locations. Perhaps the high plant K concs. is the reason little sawfly damage was noted this year. Plant disease was virtually non-existent this year at all locations.

RESULTS - 1992: Specific results from each location are tabulated in Tables 5 through 7. Grain yields were excellent this year at the Cut Bank locations (Tables 5 and 7). Results from the Cut Bank locations were affected by an August freeze and snow storm which caused frost damage and lower test weights. All three locations suffered from severe spring drought which delayed germination. Neither potassium fertilizers increased yields at the Choteau location (Table 6), but Cl increased yields slightly at both Cut Bank locations. An interaction is evident at the Cut Bank locations (Tables 5 and 7); KNO₃ lowered grain yields while KCl increased yields. Potassium chloride increased plant Cl conc. at the Eney location (Table 5), and all K treatments increased plant Cl content at the Choteau location (Table 6). Plant K conc. was not increased significantly by K

at any location. Since plant K conc. was unaffected, differential sawfly damage would not be expected. At the Choteau location, 40 to 50 % of the stems were invested with sawflys, but the location was harvested before lodging occurred. Sawfly infestation was not evident at Cut Bank. Plant disease was not detected this year at any location.

Results from adjacent fertilizer trials are included for reference (see Tables 9 and 10). The fertilizer treatments in Tables 9 and 10 were applied before seeding, therefore, the difference between the trials, other than treatments was timing of fertilizer application. April and May were extremely dry, and the rains did not come until about June 1. In all probability, the fertilizer from the K experiments was not available to the plants until after it started raining. These data further document the KCl response measured in the adjacent locations.

INTERPRETATIVE SUMMARY: Yields and K and Cl analysis data are shown in Table 8. These experiments did not verify producer reports that K fertilizers reduce the sawfly damage. However KCl fertilizers consistently increased Cl levels in the wheat tissue, and the Cl component was responsible for yield increases in the spring wheat growing area north of Cut Bank.

PLANNED CHANGES FOR NEXT YEAR: Terminate the project.

TABLE 1. EFFECT OF POTASSIUM ON WINTER WHEAT - Brady location.
Western Triangle Ag. Research Center, Conrad, MT. 1991.

TREATMENT	GRAIN YIELD	TEST WT.	TOTAL YIELD	K CONTENT	Cl CONTENT	K UPTAKE	Cl UPTAKE
lbs K/ac	bu/ac	lb/bu	cwt/ac	%	%	lb/ac	lb/ac
30-K AS KCl	71.0	64.5	127.6	0.53	0.25	68.19	32.56
60-K AS KNO ₃	70.4	64.5	134.8	0.49	0.10	66.17	13.26
15-K AS KNO ₃	69.8	64.4	133.2	0.48	0.13	63.77	16.08
0-K	69.4	64.5	117.1	0.49	0.10	57.35	11.68
60-K AS KCl	68.9	64.8	119.1	0.55	0.31	64.96	37.68
30-K AS KNO ₃	68.1	64.8	137.4	0.47	0.10	64.58	13.36
15-K AS KCl	67.4	64.8	148.3	0.54	0.21	80.23	31.40
EXPERIMENTAL MEANS	69.3	64.6	131.1	0.51	0.17	66.46	22.29
TOTAL OBSERVATIONS	28.00	28.00	28.00	28.00	28.00	28.00	28.00
NO. OF REPS	4.00	4.00	4.00	4.00	4.00	4.00	4.00
TRT. MEAN SQUARE	6.31	.10	470.82	.00	.03	192.38	491.74
ERROR MEAN SQUARE	2.81	.03	327.35	.00	.00	84.94	31.85
ERROR DF	18.00	18.00	18.00	18.00	18.00	18.00	18.00
F TEST FOR REPS.	15.95	4.05	1.84	5.06	4.30	7.75	6.36
F TEST FOR TRT.	2.24	3.87	1.44	1.96	19.98	2.26	15.44
P-VALUE TRTS.	0.08	0.01	0.25	0.12	0.00	0.08	0.00
STANDARD ERROR	1.68	.16	18.09	.05	.04	9.22	5.64
STANDARD ERROR MEAN	.84	.08	9.05	.02	.02	4.61	2.82
C.V. 1: (S/MEAN)*100	2.42	.25	13.80	9.11	22.42	13.87	25.32
LSD (0.05)	2.49	.24	NS	NS	0.06	13.69	8.38

Grain yields based on 60 lb/bu.

Variety: Rocky

Planting date: September 12, 1990

Harvest date: August 5, 1991

Precipitation from May 15 to harvest: 4.9 in.

Previous crop: Fallow

Depth of moist soil at time of fertilizer application: 36 in +

Fertilizer: 60 lbs 11-52-0 with the seed + 60 lbs N as anhydrous ammonia + 20 lbs N as ammonium nitrate and potassium nitrate. Treatments applied topdress on March 19, 1991.

Soil tests:	Depth	O.M.	P	K	Zn	Cl	NO ₃ -N
		%	-----ppm-----			--lbs/ac--	
	0-6"	2.2	11	406	0.8	21	55
	6-12"					43	22
	12-24"					21	20
	24-36"					32	21
	Total					117	118

TABLE 2. EFFECT OF POTASSIUM ON SPRING WHEAT - Conrad Location.
Western Triangle Ag. Research Center, Conrad, MT 1991.

TREATMENT	GRAIN YIELD	PLANT HT.	TEST WT.	TOTAL YIELD	K CONTENT	Cl CONTENT	K UPTAKE	Cl UPTAKE
lbs K/ac	bu/ac	in	lb/bu	cwt/ac	%	%	lb/ac	lb/ac
15 K AS KNO ₃	82.2	35	64.5	123.2	0.98	0.09	122.1	10.13
60 K AS KCl	80.3	34	64.8	116.7	1.15	0.24	136.6	28.40
0 K	79.9	35	64.4	107.6	0.86	0.10	92.7	10.02
30 K AS KCl	78.1	35	64.6	127.5	0.98	0.20	126.2	26.34
30 K AS KNO ₃	78.0	35	64.5	113.6	0.91	0.13	102.8	15.25
15 K AS KCl	77.7	35	64.5	121.0	1.00	0.13	124.9	15.83
60 K AS KNO ₃	77.6	35	64.6	129.4	1.05	0.10	135.7	12.33
EXPERIMENTAL MEANS	79.1	35	64.5	119.8	0.99	0.14	120.1	16.90
TOTAL OBSERVATIONS	28	28	28	28	28	28	28	28
NO. OF REPS	4	4	4	4	4	4	4	4
TRT. MEAN SQUARE	12.15	0.49	0.05	241.3	0.03	0.01	1086.0	226.20
ERROR MEAN SQUARE	17.94	0.87	0.07	445.3	0.02	0.01	998.4	139.90
ERROR DF	18	18	18	18	18	18	18	18
F TEST FOR REPS.	1.62	0.71	0.90	1.11	5.83	0.11	3.0	0.14
F TEST FOR TRT.	0.68	0.56	0.67	0.54	2.30	1.51	1.1	1.62
P-VALUE TRTS.	0.69	0.78	0.70	0.79	0.07	0.23	0.4	0.19
STANDARD ERROR	4.24	0.93	0.26	21.10	0.12	0.95	31.6	11.83
STANDARD ERROR MEAN	2.12	0.47	0.13	10.55	0.06	0.47	15.8	5.91
C.V. 1: (S/MEAN)*100	5.36	2.69	0.40	17.61	12.45	67.55	26.3	69.99
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS

Grain yields based on 60 lb/bu.

Variety: Newana

Planting date: April 10, 1991

Harvest date: August 27, 1991

Precipitation from April 10 to harvest: 12.85 in.

Previous crop: Fallow

Depth of moist soil at planting: 36 in +

Fertilizer: 100 lbs 11-52-0 with the seed + 30 lbs N as urea, preplant + 20 lbs N topdress as ammonium nitrate and potassium nitrate.

Treatments applied topdress on May 2, 1991.

Soil tests:	Depth	pH	O.M.	P	K	SO ₄ -S	Zn	Cl	NO ₃ -N
			%			ppm		lbs/ac	
	0-6"	7.8	1.6	20	431	25	1.0	5	41
	6-12"					14		4	16
	12-24"							14	20
	24-36"							10	12
	36-48"							10	12
	48-60"							14	26
	Total							57	127

TABLE 3. EFFECT OF POTASSIUM ON SPRING WHEAT - Cut Bank Location.
Western Triangle Ag. Research Center, Conrad, MT. 1991.

TREATMENT	GRAIN YIELD	PLANT HT.	TEST WT.	TOTAL YIELD	K CONTENT	Cl CONTENT	K UPTAKE	Cl UPTAKE
lbs K/ac	bu/ac	in	lb/bu	cwt/ac	%	%	lb/ac	lb/ac
60 K as KCl	53.0	30	62.9	63.40	0.74	0.13	47.88	7.10
15 K as KNO ₃	44.6	30	63.0	66.27	0.74	0.07	50.43	5.38
0 K	44.6	30	63.3	68.17	0.81	0.07	55.76	4.46
60 K as KNO ₃	44.0	29	62.8	60.50	0.63	0.03	38.07	2.03
15 K as KCl	42.2	28	62.9	61.13	0.69	0.07	42.16	3.92
30 K as KNO ₃	38.4	29	62.1	71.07	0.74	0.03	52.53	1.86
30 K as KCL	36.9	29	63.0	62.07	0.67	0.11	43.32	7.22
EXPERIMENTAL MEANS	43.4			64.76	0.72	0.07	47.16	4.57
TOTAL OBSERVATIONS	21	7	7	21	21	21	21	21
NO. OF REPS	3	1	1	3	3	3	3	3
TRT. MEAN SQUARE	82.22			46.99	.01	.00	118.22	14.17
ERROR MEAN SQUARE	10.83			112.50	.01	.00	78.12	12.11
ERROR DF	12.00			12.00	12.00	12.00	12.00	12.00
F TEST FOR REPS.	6.82			6.77	12.14	.22	18.41	.43
F TEST FOR TRT.	7.59			.42	1.62	1.31	1.51	1.17
P-VALUE TRTS.	0.001			0.87	0.22	0.32	0.25	0.39
STANDARD ERROR	3.29			10.61	.08	.06	8.84	3.48
STANDARD ERROR MEAN	1.90			6.12	.04	.03	5.10	2.01
C.V. 1: (S/MEAN)*100	7.58			16.40	10.85	76.52	18.74	76.20
LSD (0.05)	5.85			NS	NS	NS	NS	NS

Grain yields based on 60 lb/bu.

Variety: Newana

Planting date: May 16, 1991

Harvest date: September 5, 1991

Precipitation from May 20 to harvest: 7.85 in.

Previous crop: Fallow

Depth of moist soil at planting: 36 in +

Fertilizer: 100 lbs 11-52-0 with the seed + 20 lbs N topdress as ammonium nitrate and potassium nitrate. Treatments applied topdress on May 23, 1991.

Soil tests:	Depth	O.M.	P	K	Cl	NO ₃ -N
		%	---ppm---		---lbs/ac---	
	0-6"	1.6	17	234	11	7
	6-12"				7	17
	12-24"				14	23
	24-36"				7	13
	Total				39	60

TABLE 5. EFFECT OF POTASSIUM ON SPRING WHEAT - Bill Eney Location
Western Triangle Ag. Research Center, Conrad, MT 1992.

TREATMENT	GRAIN YIELD	GRAIN PROTEIN	TEST WT.	PLANT K	PLANT Cl	K UPTAKE	Cl UPTAKE
lb K/a	bu/a	%	lb/bu	%	%	lb/a	lb/a
30K AS KCL	61.85	9.23	56.05	0.46	.17	15.22	5.58
0K	56.62	9.66	57.04	0.49	.08	21.19	3.39
15K AS KCL	56.13	9.25	58.50	0.56	.19	22.14	7.69
60K AS KNO3	55.95	9.00	57.37	0.47	.07	20.07	2.78
60K AS KCL	53.20	9.14	57.46	0.46	.19	16.52	6.75
30K AS KNO3	50.72	9.02	56.02	0.51	.09	19.91	3.16
15K AS KNO3	48.93	9.15	55.77	0.49	0.13	16.48	4.62
EXPERIMENTAL MEANS	54.77	9.21	56.89	0.49	0.13	18.79	4.62
TOTAL OBSERVATIONS	28.00	28.00	28.00	28.00	28.00	28.00	28.00
NO. OF REPLICATIONS	4.00	4.00	4.00	4.00	4.00	4.00	4.00
NO. OF TREATMENTS	7.00	7.00	7.00	7.00	7.00	7.00	7.00
REP. MEAN SQUARE	177.20	1.67	4.12	0.03	0.00	147.07	4.62
TRT. MEAN SQUARE	73.19	0.20	3.94	0.00	0.01	28.70	16.35
ERROR MEAN SQUARE	27.74	0.09	2.18	0.00	0.00	16.32	1.68
ERROR D OF F	18.00	18.00	18.00	18.00	18.00	18.00	18.00
F TEST FOR REPS.	6.39	18.53	1.89	13.84	2.14	9.01	2.75
F TEST FOR TRT.	2.64	2.19	1.81	2.37	21.23	1.76	9.73
STANDARD ERROR	5.27	0.30	1.48	0.05	0.02	4.04	1.30
SE OF THE MEAN	2.63	0.15	0.74	0.02	0.01	2.02	0.65
CV1: (S/MEAN)*100	9.62	3.26	2.59	9.29	19.30	21.50	28.05
CV2: (S OF MEAN/MEAN)	4.81	1.63	1.30	4.64	9.65	10.75	14.03
LSD (0.05)	NS	NS	NS	NS	0.04	NS	1.93

Grain yields based on 60 lb/bu.

Variety: Rambo

Seeding Date: April 15; Fertilizer application date: May 7

Harvest Date: September 1

Fertilizer with Seed: 65 lbs of 22-36-0

Potassium fertilizer sources were KCl and KNO₃. Ammonium nitrate was topdressed on each plot at the rate required for 40 lbs N/a.

Soil Test Results: pH = 7.8, O.M. = 2.2 %, P = 23 ppm,
K = 578 ppm, S = 16 ppm, NO₃-N (0-2') = 28 lb/a,
NO₃-N (0-4') = 47 lb/a, Cl (0-2') = 36 lb/a,
Cl (0-4') = 86 lb/a.

TABLE 6. Effect of Potassium on Spring Wheat - Roy Embody Location
Western Triangle Ag. Research Center, Conrad, MT. 1992.

TREATMENT	GRAIN YIELD	GRAIN PROTEIN	TEST WT.	PLANT K	PLANT Cl	K UPTAKE	Cl UPTAKE
OK	48.48	14.77	60.00	1.24	0.35	32.77	9.35
60K AS KCL	46.53	15.10	60.83	1.19	0.53	31.56	13.90
60K AS KNO3	46.25	15.08	61.03	1.00	0.41	31.90	12.90
15K AS KNO3	45.48	15.13	60.53	1.24	0.46	45.33	16.40
30K AS KCL	45.35	14.80	59.26	1.20	0.46	38.46	14.80
30K AS KNO3	45.28	14.82	60.16	1.11	0.44	37.96	15.05
15K AS KCL	43.80	14.98	60.73	1.23	0.45	37.17	17.05
EXPERIMENTAL MEANS	45.88	14.95	60.36	1.17	0.45	37.17	14.21
TOTAL OBSERVATIONS	28.00	28.00	28.00	28.00	28.00	28.00	28.00
NO. OF REPLICATIONS	4.00	4.00	4.00	4.00	4.00	4.00	4.00
NO. OF TREATMENTS	7.00	7.00	7.00	7.00	7.00	7.00	7.00
REP. MEAN SQUARE	113.33	0.28	6.62	0.02	0.00	183.70	32.20
TRT. MEAN SQUARE	8.28	0.09	1.47	0.03	0.01	115.20	26.23
ERROR MEAN SQUARE	9.54	0.05	2.42	0.03	0.00	127.70	14.60
ERROR D OF F	18.00	18.00	18.00	18.00	18.00	18.00	18.00
F TEST FOR REPS.	11.88	5.18	2.73	0.71	0.90	3.23	2.21
F TEST FOR TRT.	.87	1.71	.61	1.08	4.59	0.90	1.80
STANDARD ERROR	3.09	0.23	1.56	0.17	0.06	11.30	3.82
SE OF THE MEAN	1.54	0.12	.78	0.08	0.03	5.65	1.91
C.V. 1: (S/MEAN)*100	6.73	1.56	2.58	14.37	12.48	30.40	26.89
CV2(S OF MEAN/MEAN)	3.37	0.78	1.29	7.18	6.24	15.20	13.45
LSD (0.05)	NS	NS	NS	NS	0.08	NS	NS

Grain yields based on 60 lb/bu.

Variety: Rambo

Seeding Date: April 15; Fertilizer application date: May 8

Harvest Date: August 19

Fertilizer preplant: 60 lbs/a of N as anhydrous ammonia

Fertilizer with Seed: 60 lbs/a of 11-53-0

Potassium fertilizer sources were KCl and KNO₃. Ammonium nitrate was topdressed on each plot at the rate required for 20 lbs N/a.

Soil Test Results: pH = 7.2, O.M. = 1.9 %, P = 31 ppm,

K = 834 ppm, S = 11 ppm, NO₃-N (0-2') = 141 lb/a,

Cl (0-2') = 58 lb/a.

TABLE 7. Effect of potassium on spring wheat-B. Bradley Location
Western Triangle Ag. Research Center, Conrad, MT. 1992.

TREATMENT	GRAIN GRAIN TEST		
	YIELD	PROTEIN	WT.
lb K/a	bu/a	%	lb/bu
15K AS KCL	56.57	11.62	53.71
30K AS KCL	56.57	11.66	54.08
60K AS KCL	54.62	11.42	54.73
OK	54.18	11.66	53.92
15K AS KNO3	53.95	11.62	54.13
30K AS KNO3	53.55	11.65	53.74
60K AS KNO3	48.08	11.27	53.19
EXPERIMENTAL MEANS	53.93	11.56	53.93
TOTAL OBSERVATIONS	28.00	28.00	28.00
NO. OF REPLICATIONS	4.00	4.00	4.00
NO. OF TREATMENTS	7.00	7.00	7.00
REP. MEAN SQUARE	68.44	.35	4.91
TRT. MEAN SQUARE	32.64	.09	.88
ERROR MEAN SQUARE	10.51	.02	.97
ERROR DEGREES OF FREEDOM	18.00	18.00	18.00
F TEST FOR REPS.	6.51	16.35	5.07
F TEST FOR TRT.	3.11	4.39	.91
STANDARD ERROR	3.24	.15	.98
STANDARD ERROR OF THE MEAN	1.62	.07	.49
C.V. 1: (S/MEAN)*100	6.01	1.26	1.82
C.V. 2: (S OF MEAN/MEAN)*100	3.01	.63	.91
LSD (0.05)	4.82	0.22	NS

Grain yields based on 60 lb/bu.

Variety: Amidon

Seeding Date: April 24 Fertilizer Application Date: May 7

Harvest Date: September 18

Fertilizer with Seed: 50 lb/a 18-46-0

Potassium fertilizer sources were KCl and KNO₃. Ammonium nitrate was topdressed on each plot at the rate required for 60 lbs N/a.

Soil Test Results: pH = 6.9, O.M. = 1.5 %, P = 16 ppm,
K = 211 ppm, S = 10 ppm, NO₃-N (0-2') = 35 lb/a,
NO₃-N (0-4') = 56 lb/a, Cl (0-2') = 26 lb/a,
Cl (0-4') = 57 lb/a.

TABLE 8. SUMMARY OF POTASSIUM FERTILIZER EXPERIMENTS ON WHEAT - All Locations.
Western Triangle Ag. Research Center, Conrad, MT 1992

Treatment	Grain Yield	K Content	K Uptake	Cl Content	Cl Uptake
lb K/a	bu/a	%	lb/a	%	lb/a
0 K	62	0.78	58	0.15	10
15 K as KCl	61	0.77	63	0.22	17
30 K as KCl	62	0.75	63	0.24	20
60 K as KCl	63	0.80	61	0.28	20
15 K as KNO ₃	61	9.76	63	0.17	12
30 K as KNO ₃	59	0.74	61	0.16	12
60 K as KNO ₃	61	0.74	61	0.15	10
p-value	0.09	0.78	0.99	0.00	0.00
LSD	2†	NS	NS	0.03*	4*
Loc x Treat					
p-value	0.05	0.72	0.88	0.51	0.05
Location Summary					
1	69	0.51	66	0.17	22
2	79	0.99	120	0.14	17
3	43	0.72	47	0.07	5
4	84	0.70	79	0.21	24
5	55	0.49	19	0.13	5
6	46	1.17	37	0.45	14
7	54	ND	ND	ND	ND
p-value	0.00	0.00	0.00	0.00	0.00
LSD 0.05	3	0.08	12	0.03	4

* = Significant at p = 0.05.

† = Significant at p = 0.10

1 = Brady 1991 Winter Wheat

2 = Conrad 1991 Spring Wheat

3 = Cut Bank 1991 Spring Wheat

4 = Conrad 1991 Winter Wheat

5 = Cut Bank - Eney 1992 Spring Wheat

6 = Choteau 1992 Spring Wheat

7 = Cut Bank - Bradley 1992 Spring Wheat

TABLE 9. Effect of nitrogen on spring wheat - Bill Eney Loc.
Western Triangle Ag. Research Center, Conrad, MT 1992

TREATMENT	GRAIN YIELD	GRAIN PROTEIN	TEST WT.
lb/a, N-P ₂ O ₅ -K ₂ O-S	bu/a	%	lb/bu
90-0-25-0	64.95	9.52	57.39
60-50-25-0	64.15	9.44	57.92
60-0-25-0	61.10	9.71	57.89
60-50-25-20	59.05	9.48	58.52
60-50-0-0	58.00	9.19	57.99
30-0-25-0	55.48	8.58	57.90
0-0-25-0	52.83	8.52	58.50
EXPERIMENTAL MEANS	59.32	9.20	58.02
TOTAL OBSERVATIONS	28.00	28.00	28.00
NO. OF REPLICATIONS	4.00	4.00	4.00
NO. OF TREATMENTS	7.00	7.00	7.00
REP. MEAN SQUARE	103.48	1.40	.09
TRT. MEAN SQUARE	80.64	.90	.61
ERROR MEAN SQUARE	17.79	.25	.62
ERROR DEGREES OF FREEDOM	18.00	18.00	18.00
F TEST FOR REPS.	5.82	5.61	.15
F TEST FOR TRT.	4.53	3.62	1.00
STANDARD ERROR	4.22	.50	.79
STANDARD ERROR OF THE MEAN	2.11	.25	.39
C.V. 1: (S/MEAN)*100	7.11	5.42	1.35
C.V. 2: (S OF MEAN/MEAN)*100	3.55	2.71	.68
LSD (0.05)	6.27	.74	NS

Grain yields based on 60 lb/bu.

Variety: Rambo

Seeding Date: April 15

Harvest Date: September 1

Fertilizer with Seed: 65 lbs of 22-36-0

Fertilizer sources were urea, monoammonium phosphate, potassium chloride, and ammonium sulfate applied broadcast prior to planting.

Soil Test Results: pH = 7.8, O.M. = 2.2 %, P = 23 ppm,
K = 578 ppm, S = 16 ppm, NO₃-N (0-2') = 28 lb/a,
NO₃-N (0-4') = 47 lb/a.

TABLE 10. Effect of nitrogen on spring wheat - B. Bradley, Loc.
Western Triangle Ag. Research Center, Conrad, MT 1992

TREATMENT	GRAIN YIELD	GRAIN PROTEIN	TEST WT.
lb/a, N-P ₂ O ₅ -K ₂ O-S	bu/a	%	lb/bu
60-50-25-0	56.30	11.13	55.15
90-0-25-0	55.43	11.56	53.48
60-50-25-20	55.43	11.22	55.63
60-0-25-0	52.97	11.23	54.29
60-50-0-0	52.23	11.22	54.68
30-0-25-0	51.95	10.66	55.06
0-0-25-0	47.23	10.38	56.53
EXPERIMENTAL MEANS	53.08	11.06	54.97
TOTAL OBSERVATIONS	28.00	28.00	28.00
NO. OF REPLICATIONS	4.00	4.00	4.00
NO. OF TREATMENTS	7.00	7.00	7.00
REP. MEAN SQUARE	27.23	.17	.85
TRT. MEAN SQUARE	38.44	.63	3.79
ERROR MEAN SQUARE	10.45	.09	.74
ERROR DEGREES OF FREEDOM	18.00	18.00	18.00
F TEST FOR REPS.	2.61	1.96	1.15
F TEST FOR TRT.	3.68	7.44	5.13
STANDARD ERROR	3.23	.29	.86
STANDARD ERROR OF THE MEAN	1.62	.15	.43
C.V. 1: (S/MEAN)*100	6.09	2.64	1.56
C.V. 2: (S OF MEAN/MEAN)*100	3.04	1.32	.78
LSD (0.05)	4.80	.43	1.28

Grain yields based on 60 lb/bu.

Variety: Amidon

Seeding Date: April 24

Harvest Date: September 18

Fertilizer with Seed: 50 lb/a 18-46-0

Fertilizer sources were urea, monoammonium phosphate, potassium chloride, and ammonium sulfate applied broadcast prior to planting.

Soil Test Results: pH = 6.9, O.M. = 1.5 %, P = 16 ppm,
K = 211 ppm, S = 10 ppm, NO₃-N (0-2') = 35 lb/a,
NO₃-N (0-4') = 56 lb/a.