1991

ANNUAL 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:
1. Dryland spring wheat-Research Center, 10 miles north of Conrad, MT;
2. Dryland spring wheat-Bradley Farms, 30 miles north of Cutbank, MT;
3. Dryland winter wheat-Kronubush Farms, 9 miles north of Conrad, MT;
4. Dryland winter wheat-Picard Farms, 30 miles east of Brady, MT.

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 (3) To prepare a final report at the inclusion of this project to address the objectives stated above.

RESULTS: 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 Cutbank 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.

PLANNED CHANGES FOR NEXT YEAR: Include locations in the Choteau area to increase the chances of sawfly damage and gather data for another year.

CAN PPI/FAR CITE DATA? Yes

ECONOMIC ANALYSIS: No economic advantage for K fertilizers using these data.

INTERPRETIVE STATEMENT: Potassium chloride or nitrate fertilizers did not increase spring wheat or winter wheat yields in the 1991 experiments conducted in the Western Triangle area of Montana. The K fertilizers were evaluated for sawfly and disease control, but sawfly and plant disease were not production problems in the test areas during 1991.

TABLE 1. EFFECT OF POTASSIUM ON SAWFLY RESISTANCE IN SPRING WHEAT - CONRAD
Western Triangle Ag. Research Center, Conrad. 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)	6.29	1.39	0.40	31.35	0.18	0.14	49.9	17.57

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 2. EFFECT OF POTASSIUM ON SAWFLY RESISTANCE IN SPRING WHEAT - CUTBANK
Western Triangle Ag. Research Center, Conrad. 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			18.87	.14	.10	15.72	6.19

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

	KNO_3	KCl
0	44.6	
15	44.6	42.2
30	38.4	36.9
60	44.0	53.0

TABLE 3. EFFECT OF POTASSIUM ON SAWFLY RESISTANCE IN WINTER WHEAT - CONRAD
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	86.7	62.4	122.1	0.68	0.26	83.57	31.90
60 K AS KCl	85.7	62.2	98.1	0.72	0.27	70.36	26.00
15 K AS KNO_3	84.7	61.2	125.0	0.61	0.18	78.38	22.54
60 K AS KNO_3	83.7	61.0	94.0	0.78	0.18	73.11	17.79
15 K AS KCl	83.4	61.5	111.1	0.62	0.23	69.12	25.65
0 K	83.3	61.9	114.3	0.79	0.18	89.59	21.24
30 K AS KNO_3	81.8	61.0	126.7	0.69	0.17	90.43	21.39
EXPERIMENTAL MEANS	84.2	61.6	113.0	0.70	0.21	79.22	23.78
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	10.89	1.28	668.41	.02	.01	313.84	82.63
ERROR MEAN SQUARE	14.21	1.15	423.50	.02	.00	592.45	73.15
ERROR DF	18.00	18.00	18.00	18.00	18.00	18.00	18.00
F TEST FOR REPS.	.97	11.23	1.25	10.93	3.43	6.15	.66
F TEST FOR TRT.	.77	1.11	1.58	.93	2.80	.53	1.13
P-VALUE TRTS.	0.62	0.40	0.21	0.51	0.04	0.80	0.39
STANDARD ERROR	3.77	1.07	20.58	.15	.05	24.34	8.55
STANDARD ERROR MEAN	1.88	.54	10.29	.07	.03	12.17	4.28
C.V. 1: (S/MEAN)*100	4.48	1.74	18.21	20.80	23.89	30.72	35.96
LSD (0.05)	5.60	1.59	30.57	.22	.07	36.16	12.71

Grain yields based on 60 lb/bu. Variety: Rocky
Harvest date: August 15, 1991
Precipitation from March 22 to harvest: 12.63 in.
Previous crop: Fallow
Depth of moist soil at time of fertilizer application: 36 in +
Fertilizer: 70 lbs 11-52-0 with the seed + 46 lbs N topdress as urea + 20 lbs N as ammonium nitrate and potassium nitrate. Treatments applied topdress on March 19, 1991.

Soil tests:

Depth	pH	O.M.	P	K	SO_4-S	Zn	Cl	NO_3-N
		%	ppm				lbs/ac	
0-6"	7.6	2.2	19	361	15	0.8	12	32
6-12"					13		9	15
12-24"							13	14
24-36"							11	12
Total							45	73

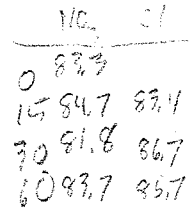

TABLE 4. EFFECT OF POTASSIUM ON SAWFLY RESISTANCE IN WINTER WHEAT - BRADY
Western Triangle Ag. Research Center, Conrad, MT. 1991.

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	26.88	.07	.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