KS-23 F

1999

PROJECT TITLE: EFFECT OF LONG TERM NITROGEN, PHOSPHORUS, AND POTASSIUM FERTILIZATION OF IRRIGATED CORN AND GRAIN SORGHUM

PROJECT LEADER:
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PROJECT LOCATION: West-central Kansas at the Tribune Unit, Southwest Research-Extension Center, Kansas State University.

OBJECTIVES:

1. Determine the optimum nitrogen rate for irrigated corn and grain sorghum.

2. Determine whether phosphorus fertilization is necessary for optimum grain production of irrigated corn and grain sorghum and optimal rate of P for corn.

3. Determine whether potassium fertilization is necessary for optimum grain production of irrigated grain sorghum.

4. Determine the effect of long term N and P applications on nitrate accumulation in the soil profile.

PROCEDURES:

Corn and grain sorghum were grown on Ulysses silt loam in adjacent plot areas. Fertilizer treatments for sorghum were N rates of 0, 40, 80, 120, 160, and 200 lb N acre^{-1} without P and K; with 40 lb P_2O_5 acre^{-1} and zero K; and with 40 lb P_2O_5 acre^{-1} and 40 lb K_2O acre^{-1}. In 1992, the treatments for the corn study were changed with the K variable being replaced by a higher rate of P. The current corn treatments are N rates of 0 to 200 lb N/acre in 40 lb increments in a factorial arrangement with P at 0, 40 and 80 lb P_2O_5/acre. Fertilizers were broadcast by hand on 1 March 1999 for corn and 27 May 1999 for sorghum. Corn (Pioneer 3395IR) was planted on 21 April and sorghum (Pioneer 8505) was planted on 29 May. Both studies were furrow irrigated as needed during the growing season. Both studies were damaged by hail on 1 July. The corn never recovered and no yield measurements were made. Sorghum plots were machine harvested (29 October) with yields adjusted to 12.5% moisture.

RESULTS:

Grain sorghum yields were variable in 1999, possibly because of the hail damage in early July. Phosphorus increased yields about 20 bu/acre averaged across all N rates. This is similar to yield responses in earlier years. Grain yields were not increased by N rates above 40 lb N/acre when applied with P, although typically 80 to 120 lb N/acre are needed to maximize yields. As in previous years, there was no yield response to K applications.

Table 1. Effect of N, P, and K fertilizers on irrigated sorghum. Tribune, KS, 1992-1998.

N	P_2O_5	K_2O	Grain Yield 1992	1993	1994*	1996	1997	1998	1999
----- lb/a -----			---------- bu/acre ----------						
0	0	0	27	46	64	74	81	77	74
0	40	0	28	42	82	77	75	77	85
0	40	40	35	37	78	79	83	76	84
40	0	0	46	69	76	74	104	91	83
40	40	0	72	97	113	100	114	118	117
40	40	40	72	92	112	101	121	114	114
80	0	0	68	91	96	73	100	111	94
80	40	0	85	105	123	103	121	125	113
80	40	40	85	118	131	103	130	130	123
120	0	0	56	77	91	79	91	102	76
120	40	0	87	120	131	94	124	125	102
120	40	40	90	117	133	99	128	128	105
160	0	0	62	93	105	85	118	118	100
160	40	0	92	122	137	92	116	131	116
160	40	40	88	123	125	91	119	124	107
200	0	0	80	107	114	86	107	121	113
200	40	0	91	127	133	109	126	133	110
200	40	40	103	123	130	95	115	130	120
ANOVA									
Nitrogen			0.001	0.001	0.001	0.003	0.001	0.001	0.001
Linear			0.001	0.001	0.001	0.002	0.001	0.001	0.001
Quadratic			0.001	0.001	0.001	0.116	0.001	0.001	0.227
P-K			0.001	0.001	0.001	0.001	0.001	0.001	0.001
Zero P vs P			0.001	0.001	0.001	0.001	0.001	0.001	0.001
P vs P-K			0.431	0.888	0.734	0.727	0.436	0.649	0.741
N x P-K			0.420	0.006	0.797	0.185	0.045	0.186	0.482
N_l* Zero P vs P-K			0.189	0.012	0.860	0.833	0.464	0.764	0.197
N_l* P vs P-K			0.814	0.958	0.777	0.196	0.150	0.781	0.787
N_q* Zero P vs P-K			0.049	0.001	0.060	0.051	0.007	0.010	0.044
N_q* P vs P-K			0.318	0.325	0.581	0.298	0.401	0.527	0.971
MEANS									
Nitrogen									
0 lb/acre			30	42	75	77	80	76	81
40			64	86	100	92	113	108	105
80			80	104	117	93	117	122	110
120			78	105	118	91	114	118	95
160			81	113	122	89	118	124	108
200			91	119	126	97	116	128	115
$LSD_{.05}$			10	10	14	9	10	8	13
P-K l									
0-0 lb/acre			56	81	91	79	100	103	90
40-0			76	102	120	96	113	118	107
40-40			79	102	118	95	116	117	109
$LSD_{.05}$			7	7	10	7	7	6	9

*Note: There was no yield data for 1995.