

KS-23F Long-term nitrogen, phosphorus, and potassium fertilization of irrigated corn and grain sorghum, 1995

Project leader:

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This long-term Kansas study shows that P along with N are essential for optimum yields of irrigated corn and grain sorghum. The project has shown that fertilizing at the economic optimal rate does not cause nitrate accumulation or potential leaching problems. The 1995 growing season for the site included two hail storms and an early killing frost which prevented the maturation of the sorghum and substantially reduced corn yields. In spite of these extreme conditions, balanced fertilization increased corn yield from 22 bu/A for the check treatment to 105 bu/A where optimum levels of N and P were applied, an 83 bu/A response. These results are consistent with other studies that show good nutrition is critical to reducing the negative impact of crop stresses.

Table 1. Effect of N and P on grain yield and yield components of irrigated corn. Tribune, KS, 1995.

N	P ₂ O ₅	Grain Yield	Grain Moist	Test wt	Plant Pop	Ear		Kernel	
						#	Wt	#	Wt
	lb/a	bu/a	%	lb/bu	10 ⁻³ /a	10 ⁻³ /a	lb/ear	#/ear	oz/1000
0	0	22	37.8	45.0	29.1	18.9	0.07	175	6.23
0	40	27	37.0	46.3	30.5	21.3	0.07	177	6.58
0	80	26	38.3	46.2	30.1	18.5	0.08	194	6.60
40	0	34	38.6	44.4	30.0	21.8	0.09	226	6.19
40	40	68	35.8	47.5	28.9	25.6	0.15	337	7.06
40	80	65	35.9	48.2	30.2	25.8	0.14	318	7.13
80	0	34	38.4	44.0	28.6	20.8	0.09	229	6.45
80	40	94	34.8	48.4	29.4	27.9	0.19	381	7.91
80	80	93	35.8	48.4	29.5	27.7	0.19	391	7.72
120	0	39	38.3	44.2	27.7	22.7	0.10	242	6.42
120	40	100	34.5	48.2	30.7	28.3	0.20	407	7.76
120	80	111	34.8	48.7	29.5	27.5	0.23	442	8.19
160	0	44	37.6	44.8	29.3	23.7	0.10	261	6.31
160	40	103	35.9	47.9	29.9	27.1	0.21	445	7.63
160	80	100	34.8	48.2	29.3	27.7	0.20	385	8.50
200	0	62	36.7	46.5	30.0	25.0	0.14	318	6.90
200	40	106	33.9	48.9	28.6	27.3	0.22	437	7.98
200	80	109	34.5	48.6	29.3	26.3	0.23	457	8.13
ANOVA									
Nitrogen		0.001	0.001	0.001	0.845	0.001	0.001	0.001	0.001
linear		0.001	0.001	0.001	0.322	0.001	0.001	0.001	0.001
quadratic		0.001	0.589	0.907	0.508	0.001	0.001	0.001	0.003
Phosphorus		0.001	0.001	0.001	0.374	0.001	0.001	0.001	0.001
linear		0.001	0.001	0.001	0.236	0.001	0.001	0.001	0.001
quadratic		0.001	0.001	0.001	0.453	0.001	0.001	0.001	0.001
N*P		0.001	0.135	0.002	0.301	0.082	0.001	0.001	0.001
N ₁ *P ₁		0.001	0.060	0.424	0.395	0.609	0.001	0.003	0.001
N ₁ *P _q		0.014	0.974	0.445	0.732	0.552	0.029	0.035	0.742
N _q *P ₁		0.001	0.014	0.001	0.328	0.001	0.001	0.001	0.002
N _q *P _q		0.006	0.512	0.102	0.235	0.426	0.022	0.028	0.173

Table 1 (cont.) Effect of N and P on grain yield and yield components of irrigated corn. Tribune, KS, 1995.

MAIN EFFECT MEANS

	Grain Yield	Grain Moist	Test wt	Plant Pop	Ear		Kernel	
					#	wt	#	wt
	bu/a	%	lb/bu	10 ⁻³ /a	10 ⁻³ /a	lb/ear	#/ear	oz/1000
<u>Nitrogen</u>								
lb/acre								
0	25	37.7	45.8	29.9	19.5	0.07	182	6.5
40	56	36.8	46.7	29.7	24.4	0.13	294	6.8
80	74	36.4	46.9	29.2	25.5	0.16	333	7.4
120	83	35.9	47.0	29.3	26.2	0.17	364	7.5
160	82	36.1	47.0	29.5	26.2	0.17	364	7.5
200	92	35.0	48.0	29.3	26.2	0.20	404	7.7
LSD .05	7	1.1	0.6	1.3	1.7	0.02	33	0.3
<u>Phosphorus</u>								
lb/acre								
0	39	37.9	44.8	29.1	22.1	0.10	242	6.4
40	83	35.3	47.9	29.7	26.2	0.17	364	7.5
80	84	35.7	48.1	29.7	25.6	0.18	364	7.7
LSD .05	5	0.8	0.5	0.9	1.2	0.01	23	0.2

Table 2. Effect of N and P fertilization of irrigated corn on leaf N, P, K, and Zn content. Tribune, KS, 1995.

N	P ₂ O ₅	Leaf			
		N	P	K	Zn
lb/a		%	%	%	ppm
0	0	1.44	0.14	2.26	19.4
0	40	1.40	0.25	2.18	17.4
0	80	1.47	0.25	2.25	20.4
40	0	1.95	0.13	2.36	22.2
40	40	1.72	0.20	2.39	17.8
40	80	1.80	0.20	2.43	17.8
80	0	2.08	0.12	2.38	23.0
80	40	2.21	0.21	2.40	19.6
80	80	2.04	0.22	2.48	19.6
120	0	2.13	0.14	2.42	23.6
120	40	2.30	0.21	2.40	21.0
120	80	2.28	0.23	2.44	17.4
160	0	2.16	0.15	2.38	22.6
160	40	2.20	0.21	2.47	19.0
160	80	2.25	0.22	2.47	17.2
200	0	2.14	0.14	2.34	24.2
200	40	2.32	0.22	2.32	21.2
200	80	2.30	0.23	2.48	15.4
ANOVA					
Nitrogen		0.001	0.001	0.001	0.314
linear		0.001	0.232	0.001	0.210
quadratic		0.001	0.001	0.001	0.198
Phosphorus		0.282	0.001	0.006	0.001
linear		0.176	0.001	0.004	0.001
quadratic		0.402	0.001	0.158	0.117
N*P		0.002	0.042	0.460	0.007
N _l *P _l		0.011	0.107	0.115	0.001
N _l *P _q		0.022	0.056	0.815	0.031
N _q *P _l		0.388	0.462	0.960	0.534
N _q *P _q		0.290	0.189	0.141	0.851

Table ~~10~~² (cont). Effect of N and P fertilization of irrigated corn on leaf nutrient content. Tribune, KS, 1995.

MAIN EFFECT MEANS

	Leaf			
	N	P	K	Zn
	%	%	%	ppm
Nitrogen (lb/a)				
0	1.44	0.21	2.23	19.1
40	1.82	0.18	2.40	19.3
80	2.11	0.18	2.42	20.7
120	2.23	0.19	2.42	20.7
160	2.20	0.19	2.44	19.6
200	2.25	0.19	2.38	20.3
LSD.05	0.08	0.01	0.06	1.8
P ₂ O ₅ (lb/a)				
0	1.98	0.14	2.35	22.5
40	2.02	0.21	2.36	19.3
80	2.02	0.23	2.42	18.0
LSD.05	0.06	0.01	0.05	1.3