



2015

Global Maize and Soy Study

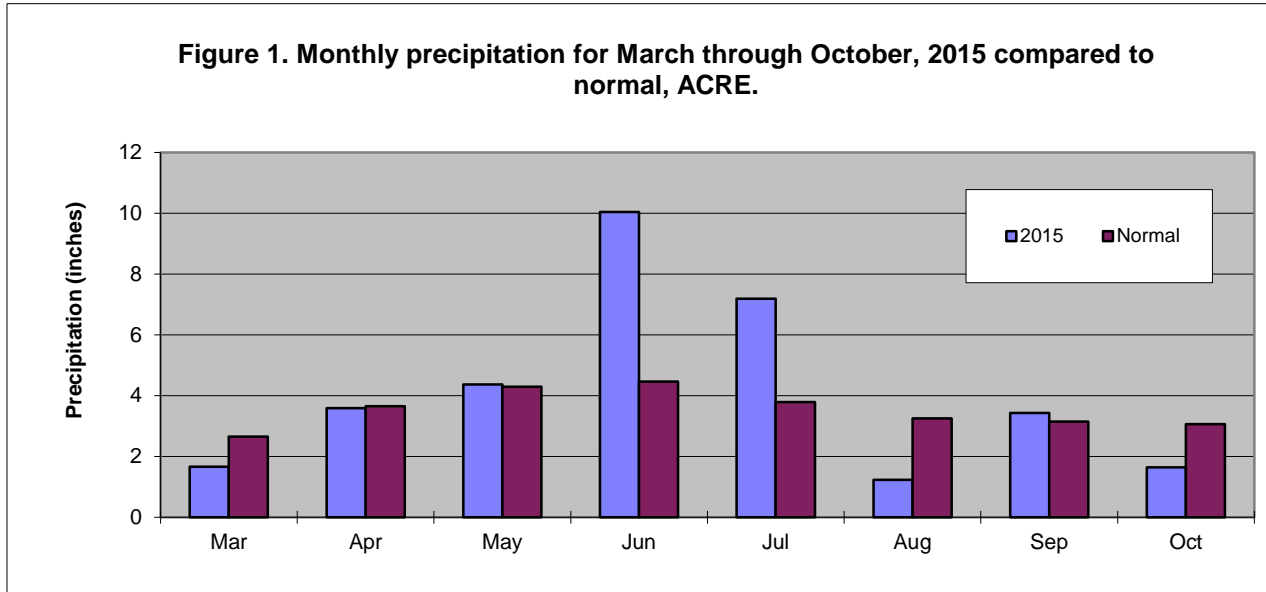


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Global Maize and Soy Study, ACRE, 2015



Corn in 2015

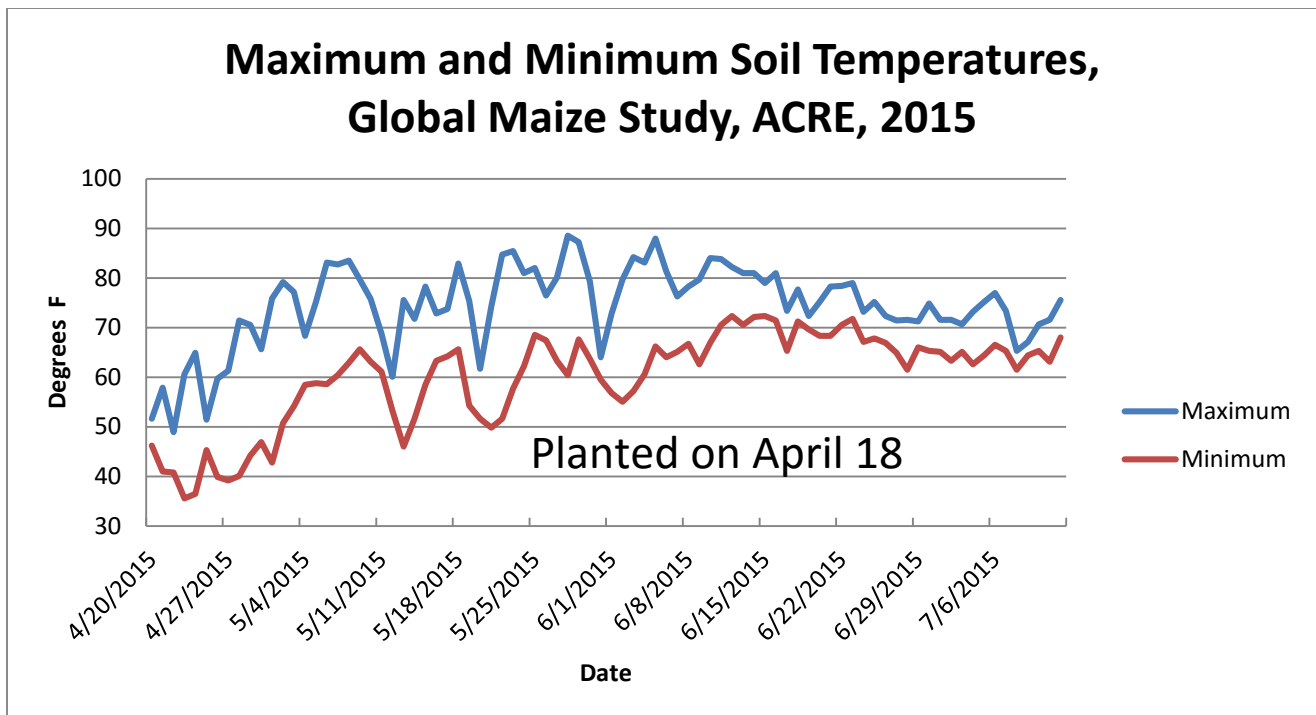


Table 1. Corn Cultural Practices Used, Field 131, ACRE, 2015

Field Operation	Date	Application Details
Tillage		No-till
Plot size		12-30" rows, 75-feet long
Replications		6
Trial plan		Included at end of this report
Planted	4/18	Planted with Vyn's John Deere 1780 6-row planter
Hybrid		Pioneer P1417AMX
Starter Fertilizer w/planter		20 gallons/acre of 10-34-0
Seeding rate		30,000 and 37,500 seeds/acre
Insecticide w/planter	4/25	<u>Early Pre-plant:</u> Roundup WeatherMax @ 28 oz/ac Class Act 1 gal/100 gallons water Interlock 2-4 oz/100 gallons water Bicep II Magnum 5 pt/ac
Weed Control	5/29	Post-emergence: Callisto @ 3 oz/ac Class Act 1 gal/100 gallons water Interlock 2-4 oz/100 gallons water
Nitrogen	5/22	First application as per treatment
	6/10	Second application as per treatment.
Fertilizer	5/29	Applied 150 pounds/a of Assure fertilizer (0-0-60)
Harvest	9/21	Harvest with Kincaid combine.
Harvest area		Four 30-inch rows, 75-feet
Fall Tillage	9/30	Strip-tilled for 2015 30-inch row soybeans. Used Remlinger strip-till machine set at 8-inches deep.

Table 2. Corn plant response to treatments, 2015.†

Treatment	Plant Population May 21 ppa	Plant Height in	Plant Height July 20 in	Days to 50% Silking days	Grain Moist %M	Grain Yield @ 15% bu/a
FP Control N, 30000 ppa	32083b	N/A	76.7c	86.7b	18.8d	71.5e
FP Intermediate N, 30000 ppa	30583c		94.9b	83.7cd	19.3cd	144.4d
FP Normal N, 30000 pa	30875bc		96.6b	83.2d	19.8bc	170.1c
EI Control N, 37500 ppa	38042a		77.3c	89.0a	19.9b	72.5e
EI Intermediate N, 37500 ppa	38750a		102.0a	85.2bc	20.7a	187.5b
EI Normal N, 37500 ppa	37958a		101.4a	85.5b	21.0a	211.9a
LSD @ 5%	1412		4.2	1.8	0.6	7.6

† Average of 6 replications

Table 3. Corn leaf SPAD and stalk diameter response to treatments, 2015.†

Treatment	Spad June 29	Spad July 20	Spad Aug 7	Stalk July 20 mm	Stalk Aug.7 mm
FP Control N, 30000 ppa	30.0c	21.9d	21.9d	24.5c	24.6b
FP Intermediate N, 30000 ppa	49.0b	42.8c	42.8c	26.2b	26.3a
FP Normal N, 30000 pa	51.2ab	46.9b	46.9b	27.2a	26.9a
EI Control N, 37500 ppa	30.1c	21.7d	21.7d	22.4d	22.5c
EI Intermediate N, 37500 ppa	51.3ab	46.4b	46.4b	25.7b	24.9b
EI Normal N, 37500 ppa	53.1a	49.7a	49.7a	25.5b	24.7b
LSD @ 5%	3.3	2.7	2.7	1.4	1.2

† Average of 6 replications.

Table 4. Corn plant biomass and N responses to treatments at R6, sample size of 10 plants per plot, 2015.†

Treatment	Shoot DM	Shoot N	Cob DM	Cob N	Grain DM	Grain N	Total DM
	kg/h	%	kg/h	%	kg/h	%	kg/h
FP Control N, 30000 ppa	5288d	0.40c	503d	0.64b	4128d	0.85e	9919d
FP Intermediate N, 30000 ppa	6497c	0.49b	868c	0.54c	8593c	0.96cd	15958c
FP Normal N, 30000 pa	7225b	0.48b	1052b	0.57bc	10289b	1.02bc	18566b
EI Control N, 37500 ppa	5750d	0.38c	515d	0.72a	3865d	0.93de	10129d
EI Intermediate N, 37500 ppa	8840a	0.47b	1170ab	0.52c	11618ab	1.05b	21628a
EI Normal N, 37500 ppa	8527a	0.57a	1205a	0.56c	12396a	1.16a	21913a
LSD @ 5%	684	0.04	150	0.07	1359	0.08	2055

† Average of 6 replications

Table 5. Corn plant grain component response to treatments at R6, sample size of 10 plants, 2015.†

Treatment	Kernel Wt (200 kernels)	Kernels per plant	Harvest Index
	g	#	
FP Control N, 30000 ppa	42.6c	274d	0.42b
FP Intermediate N, 30000 ppa	53.8b	511ab	0.54a
FP Normal N, 30000 pa	55.6ab	546a	0.55a
EI Control N, 37500 ppa	43.4c	206e	0.38c
EI Intermediate N, 37500 ppa	58.7a	454c	0.54a
EI Normal N, 37500 ppa	59.4a	465bc	0.56a
LSD @ 5%	3.8	47	0.03

† Average of 6 replications

Table 6. Soil analysis, 2015.†

Treatment	pH (1:1)	OM %	P ppm	K ppm	Mg ppm	Ca ppm	CEC	Nitrate ppm	Ammonium ppm
	0-8"							0-12"	
FP Control N, 30000 ppa	6.0	4.1	28.6	139.1	619	2377	21.4	7.19ab	6.60b
FP Intermediate N, 30000 ppa	6.0	4.0	25.4	127.8	594	2286	20.6	6.57b	6.65b
FP Normal N, 30000 pa	5.9	3.9	26.4	128.5	596	2316	21.0	8.15ab	8.28a
EI Control N, 37500 ppa	6.1	4.0	28.6	137.4	606	2322	20.5	8.32ab	6.94ab
EI Intermediate N, 37500 ppa	6.1	4.1	23.4	127.0	603	2323	20.5	7.28ab	7.43ab
EI Normal N, 37500 ppa	6.1	4.1	30.5	127.3	606	2298	20.5	9.19a	7.55ab
LSD @ 5%	0.2	0.5	8.2	12.9	64	271	2.1	2.36	1.60
	0-2"							12-24"	
FP Control N, 30000 ppa	6.1	4.4	44.2	212.8a	575	2171	19.6	7.33ab	5.82c
FP Intermediate N, 30000 ppa	6.1	4.6	35.3	192.8ab	555	2090	19.0	6.43b	6.22bc
FP Normal N, 30000 pa	6.1	4.5	35.3	189.5ab	587	2228	20.2	7.74ab	7.70a
EI Control N, 37500 ppa	6.1	4.3	41.8	207.5ab	579	2166	19.4	8.85ab	7.02abc
EI Intermediate N, 37500 ppa	6.1	4.5	33.2	187.8ab	561	2110	19.2	7.44ab	6.32bc
EI Normal N, 37500 ppa	6.2	4.6	48.2	180.7b	558	2053	18.4	9.10a	7.31ab
LSD @ 5%	0.3	0.4	16.2	31.7	61	233	2.0	2.48	1.28
	2-4"								
FP Control N, 30000 ppa	5.9	4.1	31.2	131.0	600	2284	21.0		
FP Intermediate N, 30000 ppa	5.8	4.0	27.7	122.2	576	2209	20.8		
FP Normal N, 30000 pa	5.8	3.9	28.7	119.2	582	2245	21.2		
EI Control N, 37500 ppa	5.9	4.1	35.7	130.7	578	2207	20.2		
EI Intermediate N, 37500 ppa	6.0	4.0	25.3	122.7	590	2257	20.2		
EI Normal N, 37500 ppa	6.1	4.5	26.2	121.6	609	2314	20.6		
LSD @ 5%	0.3	0.9	11.6	17.0	81	299	2.7		
	4-8"								
FP Control N, 30000 ppa	6.1	3.9	19.5	106.3	652	2526	22.4		
FP Intermediate N, 30000 ppa	6.1	3.8	19.3	98.2	623	2422	21.2		
FP Normal N, 30000 pa	5.9	3.6	20.8	102.7	609	2396	21.4		
EI Control N, 37500 ppa	6.2	3.8	18.5	105.7	633	2457	21.3		
EI Intermediate N, 37500 ppa	6.1	4.0	17.5	98.8	631	2463	21.3		
EI Normal N, 37500 ppa	6.1	3.7	21.8	104.8	649	2526	22.2		
LSD @ 5%	0.3	0.5	6.5	11.4	75	322	2.6		

† Average of 6 replications

Table 7. Corn ear leaf nutrient concentration response to treatments, 2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm
FP Control N, 30000 ppa	1.07d	0.21c	1.57c	0.23c	0.16b	0.08d	15.8b	32.3b	46.0c	3.83c	1.50c	13.7
FP Intermediate N, 30000 ppa	2.05c	0.27b	1.78b	0.35b	0.25a	0.14c	19.5a	47.2a	70.8b	8.33b	2.17b	7.83
FP Normal N, 30000 pa	2.35b	0.28b	1.75b	0.35b	0.26a	0.05bc	20.0a	47.8a	75.7b	8.33b	2.00bc	8.33
EI Control N, 37500 ppa	1.06d	0.21c	1.82b	0.23c	0.18b	0.08d	15.8b	29.2b	38.8c	3.67c	1.50c	4.67
EI Intermediate N, 37500 ppa	2.57a	0.30ab	2.04a	0.36ab	0.27a	0.16ab	21.5a	46.0a	79.5ab	8.83ab	2.83a	4.67
EI Normal N, 37500 ppa	2.76a	0.32a	2.15a	0.38a	0.27a	0.17a	21.7a	46.3a	86.2a	9.67a	3.17a	11.50
LSD @ 5%	0.21	0.04	0.17	0.03	0.03	0.01	2.6	9.5	9.9	1.33	0.63	10.2

† Average of 6 replications

* Indicates a non-significant overall F-test

Table 8. Corn grain nutrient concentration response to treatments at maturity, 2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm
FP Control N, 30000 ppa	0.86e	0.32ab	0.57	0.01	0.13ab	0.085a	21.3a	5.50	12.3d	1.83	1.00	15.2
FP Intermediate N, 30000 ppa	0.96cd	0.34ab	0.54	0.01	0.13ab	0.087a	19.5ab	6.17	16.7b	1.83	1.17	16.8
FP Normal N, 30000 pa	1.02bc	0.33ab	0.53	0.01	0.12ab	0.078b	18.8b	5.67	15.3bc	1.67	1.00	15.7
EI Control N, 37500 ppa	0.93de	0.29b	0.53	0.01	0.11b	0.077b	21.0ab	6.33	14.0cd	1.83	1.00	12.3
EI Intermediate N, 37500 ppa	1.05b	0.33ab	0.54	0.01	0.13ab	0.085a	20.8ab	5.83	19.5a	2.17	1.17	13.8
EI Normal N, 37500 ppa	1.16a	0.35a	0.55	0.01	0.13a	0.088a	19.2ab	5.00	17.2b	2.17	1.00	16.2
LSD @ 5%	0.08	0.05	0.05	0.00	0.02	0.007	2.45	1.41	2.0	0.53	0.29	13.5

† Average of 6 replications

* Indicates a non-significant overall F-test

Table 9. Corn shoot (stem plus leaves and husk) nutrient concentration response to treatments at maturity, 2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm
FP Control N, 30000 ppa	0.40c	0.19a	1.10c	0.22b	0.22ab	0.055a	28.7a	56.5a	60.0a	2.0b	4.3	37.7ab
FP Intermediate N, 30000 ppa	0.49b	0.08b	1.00c	0.25a	0.20b	0.050ab	19.6b	43.8ab	41.2b	6.6a	3.8	31.4bc
FP Normal N, 30000 pa	0.48b	0.05c	1.01c	0.26a	0.20b	0.046b	09.6b	36.6bc	33.4b	5.4a	4.0	19.6d
EI Control N, 37500 ppa	0.38c	0.19a	1.31a	0.23b	0.24a	0.050ab	27.6a	43.4abc	59.8a	2.2b	4.6	43.2a
EI Intermediate N, 37500 ppa	0.47b	0.06bc	1.12bc	0.26a	0.21ab	0.052a	20.6b	37.8bc	35.6b	4.8ab	3.8	26.4cd
EI Normal N, 37500 ppa	0.57a	0.07bc	1.29ab	0.27a	0.21ab	0.052a	16.1b	29.3c	40.5b	6.5a	3.3	24.2cd
LSD @ 5%	0.04	0.02	0.18	0.03	0.03	0.005	5.4	14.4	11.1	2.9	1.3	10.9

† Average of 6 replications

* Indicates a non-significant overall F-test

Table 10. Corn cob nutrient concentration response to treatments at maturity, 2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm
FP Control N, 30000 ppa	0.64b	0.08b	1.60a	0.025b	0.033b	0.060a	38.0a	12.3a	18.3	2.83	1.00b	1.33b
FP Intermediate N, 30000 ppa	0.54c	0.04c	1.12c	0.015c	0.013c	0.043b	22.7c	7.3b	14.0	3.00	1.17ab	6.00a
FP Normal N, 30000 pa	0.57bc	0.05c	1.07c	0.017c	0.015c	0.042b	16.3d	6.3b	14.8	3.17	1.00b	1.00b
EI Control N, 37500 ppa	0.72a	0.10a	1.44b	0.030a	0.050a	0.063a	33.2b	11.0a	13.2	2.83	1.50a	2.00b
EI Intermediate N, 37500 ppa	0.52c	0.05c	0.99c	0.017c	0.013c	0.042b	18.5d	5.0b	13.8	3.17	1.00b	1.00b
EI Normal N, 37500 ppa	0.56c	0.05c	0.98c	0.018c	0.012c	0.045b	15.2d	5.2b	14.8	3.33	1.00b	3.67ab
LSD @ 5%	0.07	0.01	0.16	0.005	0.009	0.008	3.7	2.7	7.6	0.71	0.35	3.44

† Average of 6 replications

* Indicates a non-significant overall F-test

Table 11. Corn grain nutrient uptake response to treatments at maturity, 2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h
FP Control N, 30000 ppa	35.4e	13.3d	23.5d	0.41d	5.3d	3.5c	0.09c	0.02c	0.05c	0.008c	0.004c	0.06b
FP Intermediate N, 30000 ppa	82.1d	28.8c	46.4c	0.86c	10.8c	7.5b	0.17b	0.05b	0.14b	0.016b	0.010b	0.15ab
FP Normal N, 30000 pa	104.7c	33.6bc	54.0b	1.03b	12.7bc	8.1b	0.19b	0.06ab	0.16b	0.017b	0.010b	0.16ab
EI Control N, 37500 ppa	36.1e	11.4d	20.5d	0.39d	4.4d	3.0c	0.08c	0.02c	0.05c	0.007c	0.003c	0.05b
EI Intermediate N, 37500 ppa	121.5b	38.2ab	61.9a	1.16ab	14.5ab	9.9a	0.24a	0.07a	0.23a	0.025a	0.013a	0.15ab
EI Normal N, 37500 ppa	144.5a	43.0a	67.4a	1.24a	16.2a	11.0a	0.24a	0.06ab	0.21a	0.028a	0.012ab	0.20a
LSD @ 5%	16.1	5.5	7.2	0.14	2.1	1.4	0.03	0.01	0.03	0.007	0.003	0.13

† Average of 6 replications

* Indicates a non-significant overall F-test

Table 12. Corn shoot (stem plus leaves and husk) nutrient uptake response to treatments at maturity, 2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h
FP Control N, 30000 ppa	20.9d	9.85a	58.1c	11.6c	11.7b	2.90b	0.15ab	0.30ab	0.32ab	0.01b	0.022b	0.20ab
FP Intermediate N, 30000 ppa	31.9c	4.98bc	64.4bc	16.5b	13.2b	3.23b	0.13b	0.28ab	0.27ab	0.04a	0.025ab	0.21ab
FP Normal N, 30000 pa	34.8c	3.90c	72.9b	18.5b	14.5b	3.33b	0.14b	0.26ab	0.24b	0.04a	0.029ab	0.14b
EI Control N, 37500 ppa	21.8d	10.84a	74.3b	13.1c	13.7b	2.87b	0.16ab	0.25b	0.34a	0.01b	0.027ab	0.25a
EI Intermediate N, 37500 ppa	41.2b	5.65	98.5a	22.5a	18.1a	4.58a	0.18a	0.34a	0.32ab	0.04a	0.034a	0.24a
EI Normal N, 37500 ppa	48.4a	9.85a	109.6a	23.2a	17.6a	4.41a	0.14b	0.25b	0.35	0.06a	0.029ab	0.21ab
LSD @ 5%	5.0	1.39	14.3	2.9	3.0	0.48	0.04	0.08	0.07	0.02	0.011	0.08

† Average of 6 replications

* Indicates a non-significant overall F-test

Table 13. Corn cob nutrient uptake response to treatments, 2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h
FP Control N, 30000 ppa	3.22c	0.42bc	8.01c	0.13c	0.17b	0.30d	0.019ab	0.006	0.009cd	0.001c	0.0005b	0.0007c
FP Intermediate N, 30000 ppa	4.64b	0.37c	9.60b	0.13c	0.11b	0.37cd	0.019ab	0.006	0.012bc	0.003b	0.0010a	0.0054a
FP Normal N, 30000 pa	5.95a	0.47abc	11.2a	0.17abc	0.16b	0.44bc	0.017b	0.007	0.016ab	0.003a	0.0011a	0.0011bc
EI Control N, 37500 ppa	3.75bc	0.53ab	7.4c	0.15bc	0.26a	0.33d	0.017b	0.006	0.007d	0.001c	0.0008b	0.0012bc
EI Intermediate N, 37500 ppa	6.00a	0.55ab	11.5a	0.19ab	0.16b	0.49ab	0.021a	0.006	0.016ab	0.004a	0.0012a	0.0012bc
EI Normal N, 37500 ppa	6.71a	0.60a	11.7a	0.22a	0.14b	0.55a	0.018ab	0.006	0.018a	0.004a	0.0012a	0.0045ab
LSD @ 5%	0.95	0.16	1.5	0.06	0.06	0.10	0.003	0.002	0.005	0.001	0.0003	0.0037

† Average of 6 replications

* Indicates a non-significant overall F-test

Table 14. Corn total plant nutrient uptake response to treatments, 2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h
FP Control N, 30000 ppa	59.5e	23.5c	89.6d	12.2c	17.2c	6.7c	0.26d	0.32b	0.38b	0.02c	0.027c	0.26
FP Intermediate N, 30000 ppa	118.6d	34.1b	120.4c	17.5b	24.2b	11.1b	0.31c	0.34ab	0.42b	0.06b	0.036bc	0.36
FP Normal N, 30000 pa	145.5c	38.0b	138.2b	19.7b	27.3b	11.9b	0.35bc	0.33b	0.42b	0.06b	0.040ab	0.31
EI Control N, 37500 ppa	61.7e	22.8c	102.2d	13.6c	18.4c	6.2c	0.26d	0.28b	0.40b	0.02c	0.031bc	0.29
EI Intermediate N, 37500 ppa	168.8b	44.4a	171.9a	23.9a	32.7a	14.9a	0.44a	0.41a	0.56a	0.07ab	0.048a	0.39
EI Normal N, 37500 ppa	199.6a	49.4a	188.7a	24.7a	33.9a	16.0a	0.39b	0.32b	0.58a	0.09a	0.042ab	0.42
LSD @ 5%	19.9	5.9	17.7	3.0	4.4	1.8	0.05	0.08	0.08	0.02	0.011	0.16

† Average of 6 replications

* Indicates a non-significant overall F-test

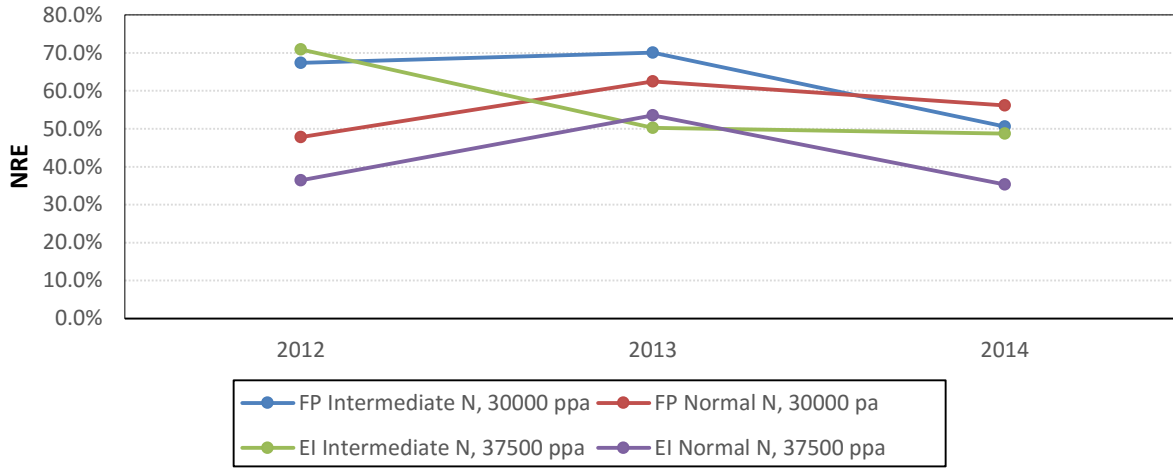
Table 15. Corn N relations response to treatments, 2015.†

Treatment	N to P	N to K	NUE	NRE	NIE
	1:1	1:1		%	
FP Control N, 30000 ppa	2.56c	0.67b	---	---	75.6
FP Intermediate N, 30000 ppa	3.52b	0.98a	40.8a	0.53	77.2
FP Normal N, 30000 pa	3.85ab	1.05a	34.5b	0.48	74.2
EI Control N, 37500 ppa	2.69c	0.61b	---	---	75.5
EI Intermediate N, 37500 ppa	3.80ab	1.00a	40.2a	0.60	70.2
EI Normal N, 37500 ppa	4.06a	1.06a	35.4	0.56	68.1
LSD @ 5%	0.37	0.12	3.4	0.13	10.5

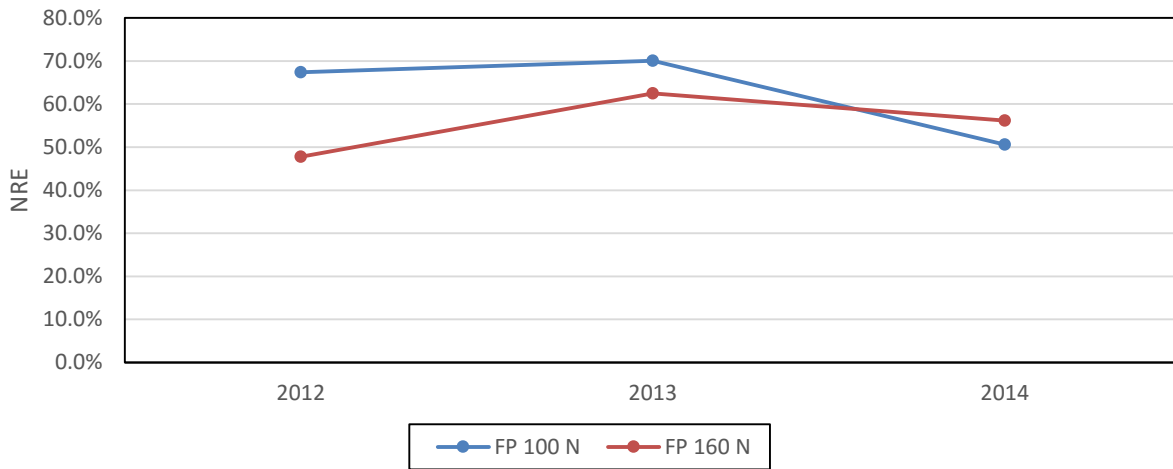
† Average of 6 replications

* Indicates a non-significant overall F-test

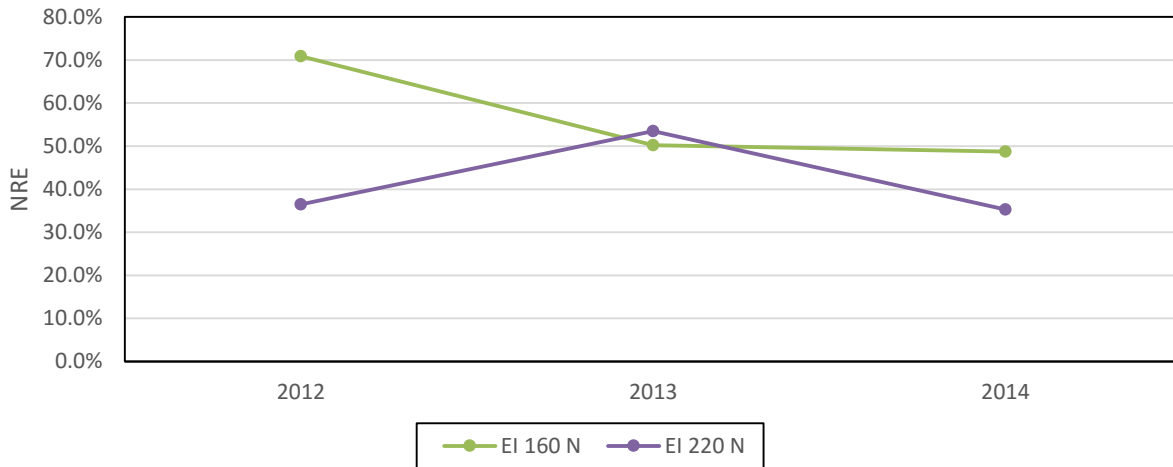
NRE Over time



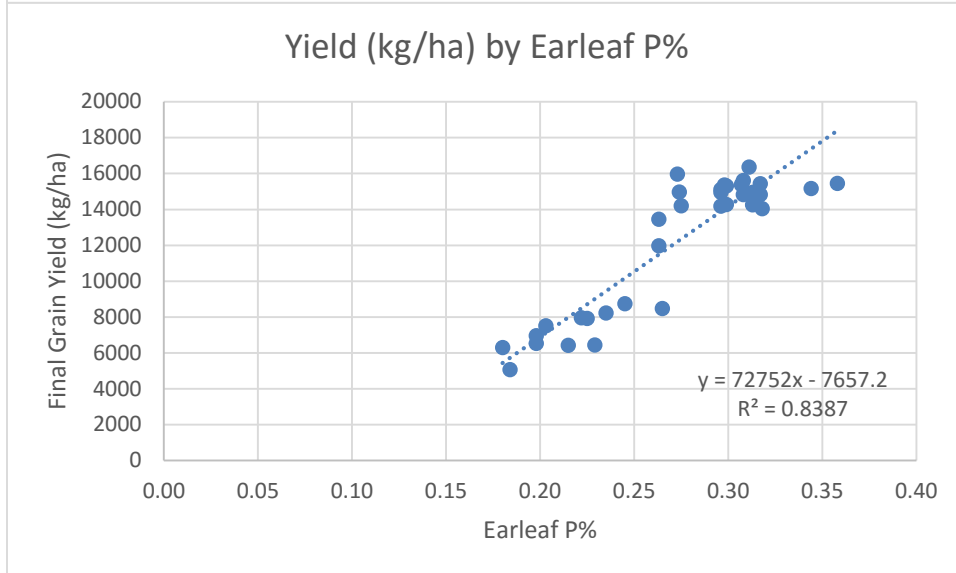
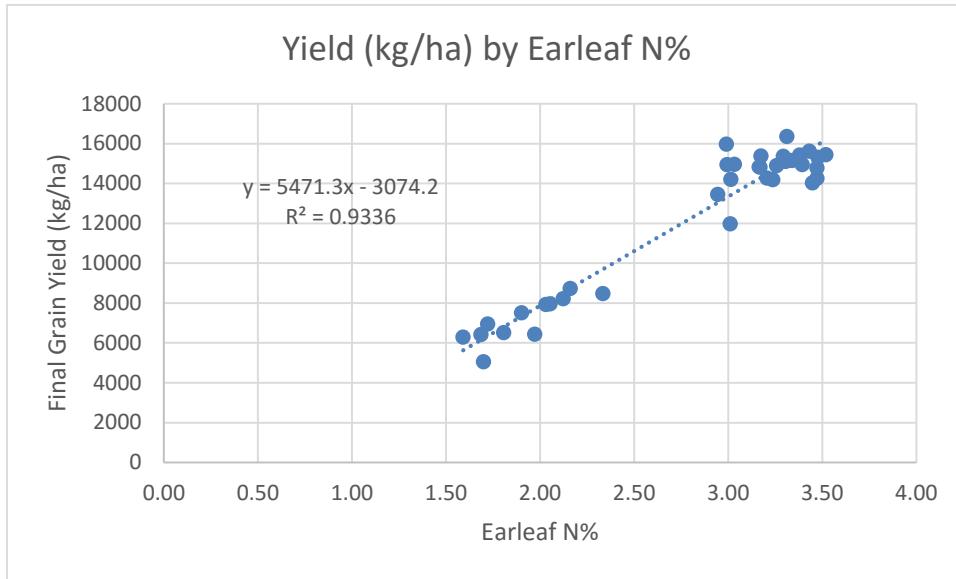
Farmer Practice: NRE Change over Time



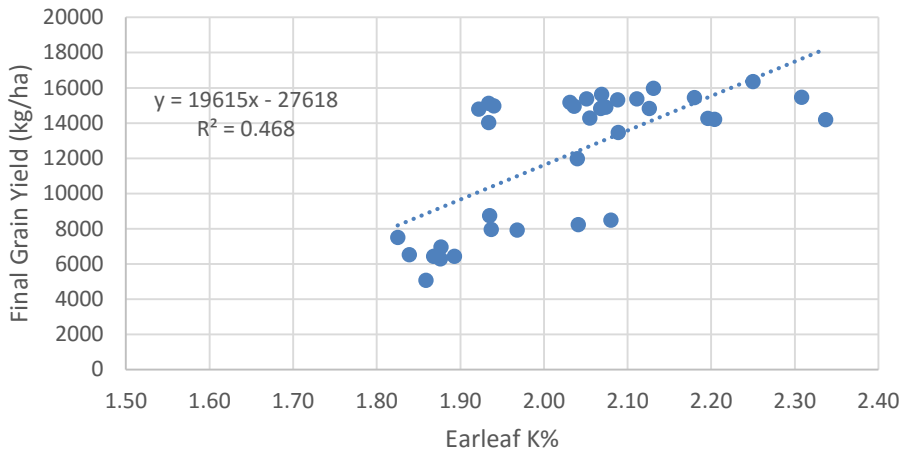
Ecological Intensification: NRE Change over Time



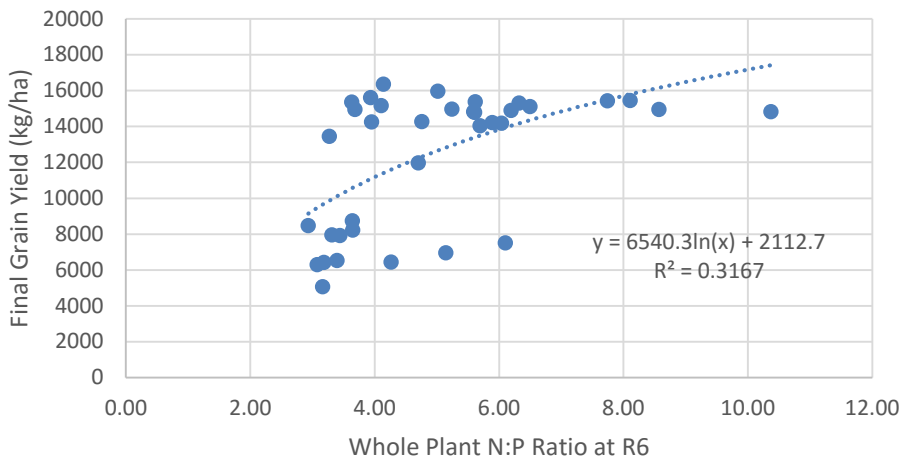
Regressions



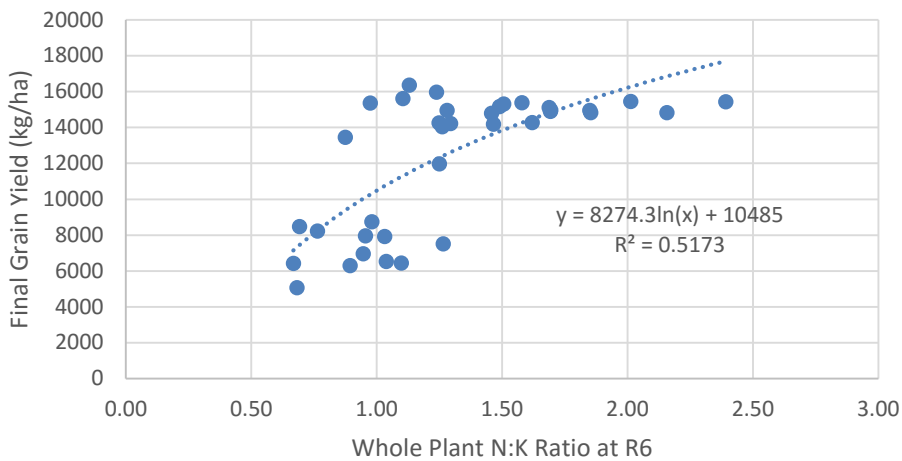
Yield (kg/ha) by Earleaf K%



Yield (kg/ha) by Whole Plant N:P at R6



Yield (kg/ha) by Whole Plant N:K at R6



Corn 4-year averages, 2012-2015

Table 16. Corn plant response to treatments, 2012-2015.†

Treatment	Plant Population	Plant* Height 1	Plant Height 2	Days to 50% Silking	Grain Moist	Grain Yield @ 15%
	ppa	in	in	days	%M	bu/a
FP Control N, 30000 ppa	31295b	22.7	80.8b	80.0b	19.2d	102.0d
FP Intermediate N, 30000 ppa	30830b	22.3	92.7a	78.2de	19.7c	181.0c
FP Normal N, 30000 pa	31174b	22.3	93.5a	77.5e	20.1b	198.8b
EI Control N, 37500 ppa	38410a	22.9	78.3c	81.2a	19.6cd	93.8e
EI Intermediate N, 37500 ppa	38080a	22.6	93.8a	78.8cd	20.4ab	204.1a
EI Normal N, 37500 ppa	37893a	22.3	92.5a	79.2c	20.6a	208.7a
LSD @ 5%	640	1.4	2.3	0.7	0.3	5.0

† Average of 6 replications

*Average of 2013 and 2014

Table 17. Corn plant response to treatments, 2012-2015.†

Treatment	Spad 1	Spad 2*	Spad 3*	Stalk 1**	Stalk 2**
				mm	mm
FP Control N, 30000 ppa	39.1b	35.6c	30.4c	22.8c	22.4b
FP Intermediate N, 30000 ppa	50.8a	52.4ab	46.1b	24.4b	23.6a
FP Normal N, 30000 pa	51.0a	54.5a	48.2ab	25.3a	24.0a
EI Control N, 37500 ppa	36.6c	34.9c	28.0d	21.1d	20.6c
EI Intermediate N, 37500 ppa	49.2a	52.0b	46.5b	22.9c	22.0b
EI Normal N, 37500 ppa	49.3a	54.1ab	49.0a	23.1c	22.0b
LSD @ 5%	1.9	2.2	2.1	0.6	0.5

† Average of 6 replications.

*Average of 6 replications in 2012, 3 replications in 2013, and 6 replications in 2015.

** Years 2012, 2013, and 2015

Table 18. Corn plant response to treatments, sample size of 10 plants per plot, 2012-2015.†

Treatment	Shoot DM	Shoot N	Cob DM	Cob N	Grain DM	Grain N	Total DM
	kg/h	%	kg/h	%	kg/h	%	kg/h
FP Control N, 30000 ppa	6207d	0.50c	725c	0.60b	5261c	1.00c	12194c
FP Intermediate N, 30000 ppa	7272bc	0.61b	1182b	0.54b	10072b	1.07bc	17976b
FP Normal N, 30000 pa	7401b	0.63ab	1386a	0.55b	11738a	1.10b	20526a
EI Control N, 37500 ppa	6646dc	0.50c	684c	0.67a	4728c	1.06bc	12059c
EI Intermediate N, 37500 ppa	8257a	0.61b	1350a	0.59b	11703a	1.10b	21311a
EI Normal N, 37500 ppa	8213a	0.65a	1345a	0.56b	11944a	1.17a	21448a
LSD @ 5%	660	0.04	89	0.05	807	0.06	1382

† Average of 6 replications

Table 19. Corn plant response to treatments, sample size of 20 plants, 2012-2015.†

Treatment	Kernel Wt (200 kernels) g	Kernels per plant #	Harvest Index
FP Control N, 30000 ppa	44.4c	350d	0.42c
FP Intermediate N, 30000 ppa	52.6b	553b	0.53b
FP Normal N, 30000 pa	55.4a	579a	0.56a
EI Control N, 37500 ppa	43.5c	260e	0.38d
EI Intermediate N, 37500 ppa	52.9b	489c	0.53b
EI Normal N, 37500 ppa	54.2ab	496c	0.54ab
LSD @ 5%	2.3	25	0.03

† Average of 6 replications

Table 20. Soil analysis, 2012-2015.†

Treatment	pH (1:1)	OM %	P ppm	K ppm	Mg ppm	Ca ppm	CEC	Nitrate ppm	Ammonium ppm
FP Control N, 30000 ppa	6.1	4.3	30.0abc	134.9	657ab	2566ab	22.4ab	8.7	2.7
FP Intermediate N, 30000 ppa	6.1	4.2	28.2bc	135.4	652b	2528ab	22.3ab	---	---
FP Normal N, 30000 pa	6.0	4.2	31.2ab	132.7	620c	2453b	21.9b	---	---
EI Control N, 37500 ppa	6.1	4.3	29.0bc	136.4	680a	2640a	23.0a	8.0	2.7
EI Intermediate N, 37500 ppa	6.2	4.2	27.4c	131.3	665ab	2600a	22.4ab	---	---
EI Normal N, 37500 ppa	6.1	4.3	33.6a	137.2	664ab	2595a	22.7ab	---	---
LSD @ 5%	0.1	0.2	3.7	9.9	28	116	0.9	1.2	0.7

† Average of 6 replications

Table 21. Corn ear leaf nutrient concentration response to treatments, 2012-2015.†

Treatment	N %	P %	K %	Ca %	Mg %	S %	Zn ppm	Mn ppm	Fe ppm	Cu ppm	B ppm	Al ppm
FP Control N, 30000 ppa	1.68d	0.22d	1.79c	0.36b	0.24b	0.12c	18.8b	28.5c	55.5c	5.61c	4.38ab	7.79
FP Intermediate N, 30000 ppa	2.50c	0.27c	1.91ab	0.46a	0.30a	0.17b	22.8a	43.7b	78.3b	8.55b	4.83a	7.38
FP Normal N, 30000 pa	2.65b	0.28bc	1.89ab	0.45a	0.30a	0.17b	22.9a	50.8a	78.6b	8.44b	4.82a	7.54
EI Control N, 37500 ppa	1.65d	0.21d	1.86bc	0.36b	0.24b	0.12c	17.6b	23.4d	52.6c	5.01c	4.26b	6.42
EI Intermediate N, 37500 ppa	2.71b	0.29ab	1.96a	0.46a	0.32a	0.18a	23.7a	41.5b	84.5a	8.76ab	4.93a	7.16
EI Normal N, 37500 ppa	2.87a	0.29a	1.95a	0.47ab	0.31a	0.19a	23.4a	42.9b	85.4a	9.48a	4.57ab	8.79
LSD @ 5%	0.13	0.01	0.08	0.02	0.02	0.01	1.5	4.2	4.9	0.83	0.56	4.45

† Average of 6 replications

Table 22. Corn grain nutrient concentration response to treatments, 2012-2015.†

Treatment	P %	K %	Ca %	Mg %	S %	Zn ppm	Mn ppm	Fe ppm	Cu ppm	B ppm	Al ppm
FP Control N, 30000 ppa	0.30a	0.51a	0.01	0.114ab	0.087cd	20.7ab	4.58	13.6b	1.45b	1.25	7.04
FP Intermediate N, 30000 ppa	0.28ab	0.46bc	0.01	0.106abc	0.091bc	18.4c	4.41	15.9a	1.50ab	1.29	7.75
FP Normal N, 30000 pa	0.25b	0.42c	0.01	0.100bc	0.091bc	17.1c	4.55	14.6ab	1.56ab	1.24	8.17
EI Control N, 37500 ppa	0.30a	0.50ab	0.01	0.115a	0.086d	21.7a	4.56	14.2ab	1.45b	1.25	6.42
EI Intermediate N, 37500 ppa	0.25b	0.42c	0.01	0.096c	0.092b	17.0c	3.77	15.5ab	1.69a	1.20	8.08
EI Normal N, 37500 ppa	0.26ab	0.45c	0.01	0.109abc	0.097a	18.7bc	4.14	16.2a	1.68ab	1.30	8.79
LSD @ 5%	0.04	0.04	0.00	0.014	0.004	2.2	0.87	2.1	0.23	0.21	4.37

† Average of 6 replications

Table 23. Corn shoot nutrient concentration response to treatments, 2012-2015.†

Treatment	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm
FP Control N, 30000 ppa	0.12b	0.91ab	0.28c	0.237ab	0.054b	22.6b	35.9a	157a	2.70b	3.54	113b
FP Intermediate N, 30000 ppa	0.17c	0.84bc	0.32b	0.233ab	0.061a	17.0c	32.0b	116b	4.75a	3.59	84c
FP Normal N, 30000 pa	0.06c	0.88abc	0.34a	0.233ab	0.060a	16.4cd	37.8a	121b	4.88a	3.56	79c
EI Control N, 37500 ppa	0.14a	0.95a	0.28c	0.242a	0.054b	25.2a	30.3b	175s	2.44b	3.67	132a
EI Intermediate N, 37500 ppa	0.06c	0.82c	0.33ab	0.235ab	0.062a	16.5cd	31.1b	118b	4.53a	3.35	80c
EI Normal N, 37500 ppa	0.06c	0.93a	0.33ab	0.223b	0.060a	14.6d	28.7b	119b	5.04a	3.85	83c
LSD @ 5%	0.01	0.08	0.02	0.015	0.003	1.9	3.9	25	0.77	0.63	17

† Average of 6 replications

Table 24. Corn cob nutrient concentration response to treatments, 2012-2015.†

Treatment	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm
FP Control N, 30000 ppa	0.06a	1.20a	0.020b	0.039b	0.046b	31.1b	8.04a	9.63	1.92c	1.17bc	8.33bc
FP Intermediate N, 30000 ppa	0.04cd	1.00b	0.014c	0.021c	0.036de	17.8c	4.95b	9.02	2.09bc	1.18bc	12.92a
FP Normal N, 30000 pa	0.03d	0.95b	0.015c	0.023c	0.035e	14.2d	4.67b	8.69	2.30ab	1.24bc	8.79abc
EI Control N, 37500 ppa	0.08a	1.17a	0.026a	0.055a	0.055a	36.1a	8.28a	9.65	1.98c	1.61a	11.54ab
EI Intermediate N, 37500 ppa	0.04c	0.98b	0.016c	0.024c	0.040c	16.5cd	4.62b	9.25	2.54a	1.34b	7.08c
EI Normal N, 37500 ppa	0.04cd	1.00b	0.016c	0.024c	0.039cd	15.1cd	4.62b	9.90	2.29a	1.05c	7.88bc
LSD @ 5%	0.01	0.07	0.003	0.007	0.004	2.9	1.15	2.28	0.27	0.24	4.20

† Average of 6 replications

Table 25. Corn grain nutrient uptake response to treatments, 2012-2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h
FP Control N, 30000 ppa	52.9c	15.5c	26.7c	0.53c	5.86c	4.54c	0.11c	0.024c	0.071d	0.008c	0.007c	0.036b
FP Intermediate N, 30000 ppa	105.9b	27.2b	46.5b	1.00b	10.36b	9.08b	0.18b	0.044b	0.157c	0.015b	0.013b	0.070ab
FP Normal N, 30000 pa	126.7a	29.0ab	50.1ab	1.17a	11.65ab	10.64a	0.20b	0.053a	0.172bc	0.019a	0.015ab	0.082a
EI Control N, 37500 ppa	49.6c	14.4c	24.1c	0.48c	5.47c	4.05c	0.10c	0.020c	0.068d	0.007c	0.006c	0.032b
EI Intermediate N, 37500 ppa	126.7a	28.6ab	49.8ab	1.17a	11.12b	10.64a	0.20b	0.043b	0.181ab	0.020a	0.014ab	0.085a
EI Normal N, 37500 ppa	137.8a	31.6a	54.3a	1.19a	12.96a	11.36a	0.22a	0.051ab	0.195a	0.021a	0.016a	0.105a
LSD @ 5%	11.5	3.7	4.8	0.08	1.45	0.77	0.02	0.010	0.022	0.003	0.002	0.039

† Average of 6 replications

Table 26. Corn shoot nutrient uptake response to treatments, 2012-2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h
FP Control N, 30000 ppa	32.0c	7.36b	55.5c	17.7c	14.8d	3.39c	0.139b	0.215cd	1.021ab	0.017c	0.022c	0.738b
FP Intermediate N, 30000 ppa	45.6b	4.88c	60.9bc	24.3b	17.3bc	4.51b	0.126bcd	0.229bd	0.903b	0.035b	0.026bc	0.642b
FP Normal N, 30000 pa	47.7b	4.27c	65.6b	25.9ab	17.5bc	4.49b	0.120d	0.282a	0.946b	0.036ab	0.026bc	0.619b
EI Control N, 37500 ppa	34.2c	8.95a	61.7bc	18.6c	16.2cd	3.60c	0.165a	0.195d	1.168a	0.164c	0.024bc	0.887a
EI Intermediate N, 37500 ppa	50.4ab	4.88c	68.3b	27.2a	19.5a	5.09a	0.138bc	0.260ab	0.982ab	0.038ab	0.028ab	0.686b
EI Normal N, 37500 ppa	55.0a	4.89c	76.8a	27.6	18.8ab	4.98a	0.121cd	0.237bc	0.978b	0.0418a	0.032a	0.682b
LSD @ 5%	5.1	0.90	7.7	2.7	1.9	0.43	0.017	0.033	0.186	0.006	0.005	0.131

† Average of 6 replications

Table 27. Corn cob nutrient uptake response to treatments, 2012-2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h
FP Control N, 30000 ppa	4.34c	0.41b	8.38c	0.14c	0.27bc	0.32d	0.0220ab	0.005	0.006c	0.0013d	0.0009c	0.0065d
FP Intermediate N, 30000 ppa	6.37b	0.41b	11.72b	0.16bc	0.24c	0.42c	0.020bcd	0.005	0.011b	0.0024c	0.0014b	0.0158a
FP Normal N, 30000 pa	7.45a	0.42b	13.12a	0.19a	0.29bc	0.47b	0.019d	0.006	0.011ab	0.0030b	0.0017a	0.0134ab
EI Control N, 37500 ppa	4.52c	0.51a	7.77c	0.17b	0.35a	0.36d	0.0239a	0.005	0.006c	0.0013d	0.0011c	0.0084cd
EI Intermediate N, 37500 ppa	7.86a	0.53a	13.30a	0.20a	0.31ab	0.53a	0.021abc	0.006	0.012ab	0.0034a	0.0018a	0.0106bcd
EI Normal N, 37500 ppa	7.31a	0.50a	13.71a	0.20a	0.30ab	0.51a	0.019cd	0.006	0.013a	0.0032ab	0.0014b	0.0117abc
LSD @ 5%	0.80	0.07	0.98	0.02	0.05	0.05	0.003	0.001	0.002	0.0003	0.0002	0.0050

† Average of 6 replications

Table 28. Corn total nutrient uptake response to treatments, 2012-2015.†

Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h	kg/h
FP Control N, 30000 ppa	89.3d	23.3c	90.6d	18.4c	21.0c	8.2d	0.27c	0.24cd	1.10	0.026d	0.029c	0.78b
FP Intermediate N, 30000 ppa	157.9c	32.4b	119.1c	25.4b	27.9b	14.0c	0.33b	0.28bc	1.07	0.052c	0.041b	0.73b
FP Normal N, 30000 pa	182.7b	33.7ab	128.8bc	27.3ab	29.4ab	15.6b	0.34ab	0.34a	1.13	0.028bc	0.043b	0.71b
EI Control N, 37500 ppa	88.3d	23.8c	93.6d	19.2c	22.0c	8.0d	0.29c	0.22d	1.24	0.025d	0.031c	0.93a
EI Intermediate N, 37500 ppa	185.0b	34.0ab	131.4b	28.6a	30.9a	16.3ab	0.36ab	0.31ab	1.18	0.061ab	0.044ab	0.76b
EI Normal N, 37500 ppa	200.1a	37.0a	144.9a	29.0a	32.1a	16.9a	0.36a	0.29b	1.19	0.066a	0.049a	0.80ab
LSD @ 5%	14.2	3.8	10.0	2.7	2.7	1.0	0.03	0.04	0.19	0.007	0.006	0.14

Table 29. Corn N relations response to treatments, 2012-2015.†

Treatment	N to P	N to K	NUE	NRE	NIE
	1:1	1:1		%	
FP Control N, 30000 ppa	4.07c	1.01c	---	---	73.9ab
FP Intermediate N, 30000 ppa	5.03b	1.34b	44.2a	0.60a	74.7a
FP Normal N, 30000 pa	5.78a	1.16ab	34.1c	0.54ab	69.5ab
EI Control N, 37500 ppa	3.91c	0.97c	---	---	70.1ab
EI Intermediate N, 37500 ppa	5.97a	1.49a	39.8b	0.57a	70.6ab
EI Normal N, 37500 ppa	6.01a	1.44ab	29.2d	0.45b	67.5b
LSD @ 5%	0.69	0.13	3.2	0.09	7.0

† Average of 6 replications

* Indicates a non-significant overall F-test

Soybean

Table 30. Soybean Cultural Practices Used, Field 131, ACRE, 2015

Tillage		No-till
Plot size		24-15" rows, 75-feet long
Replications		6
Trial plan		Included at end of this report
Planted	5/20	Planted with Vyn's John Deere 1780 planter
Variety		Pioneer P34TO7R2
Seeding rate		140,000 seeds/acre in 30" rows
Weed Control	6/2	<u>Pre-emergence:</u> Roundup WeatherMax @ 38 oz/ac Class Act 1 gal/100 gallons water Interlock 2-4 oz/100 gallons water
	7/23	<u>Post-emergence:</u> Roundup WeatherMax @ 32 oz/ac Class Act 1 gal/100 gallons water Interlock 2-4 oz/100 gallons water
Harvest	10/6	Harvest with Kincaid combine.
Harvest area		Four 30-inch rows, 75-feet
Fall tillage	10/15	Strip-till for 2016 corn crop. Used Remlinger toolbar set for 8-inches.

Table 31. Soybean plant response to previous year corn treatments, 2015.†

Previous Year Corn Treatment	Plant		
	Population June 23 ppa	Grain Moisture %M	Grain Yield @ 13% bu/a
FP Control N, 30000 ppa	123500a	14.7	54.3
FP Intermediate N, 30000 ppa	116200b	14.7	54.4
FP Normal N, 30000 pa	129800a	14.6	54.3
EI Control N, 37500 ppa	125900ab	14.6	55.5
EI Intermediate N, 37500 ppa	129800a	14.6	56.4
EI Normal N, 37500 ppa	125900ab	14.4	57.3
LSD @ 5%	9700	0.4	4.6

† Average of 6 replications

Table 32. Soybean trifoliolate leaf nutrient concentration response to previous year corn treatments, 2015.†

Previous Year Corn Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm
FP Control N, 30000 ppa	4.90	0.41	2.56	1.13	0.41	0.27	34.83	74.00	92.33	8.50b	55.50	22.83b
FP Intermediate N, 30000 ppa	4.77	0.42	2.51	1.16	0.43	0.27	35.50	70.50	98.17	8.67ab	57.50	30.67ab
FP Normal N, 30000 pa	4.74	0.40	2.53	1.18	0.43	0.26	35.50	69.17	92.83	8.67ab	56.83	27.83ab
EI Control N, 37500 ppa	4.88	0.41	2.51	1.16	0.43	0.28	35.50	70.83	101.50	11.67a	56.17	48.00a
EI Intermediate N, 37500 ppa	4.74	0.40	2.57	1.14	0.41	0.26	33.50	64.33	90.17	9.00ab	55.17	27.17ab
EI Normal N, 37500 ppa	4.89	0.41	2.57	1.14	0.40	0.27	35.17	74.00	98.00	8.83ab	56.67	27.00ab
LSD @ 5%	0.37	0.03	0.20	0.08	0.03	0.02	2.32	11.03	14.34	3.15	3.52	21.84

† Average of 6 replications

Table 33. Soybean seed nutrient concentration response to previous year corn treatments (at maturity), 2015.†

Previous Year Corn Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm
FP Control N, 30000 ppa												
FP Intermediate N, 30000 ppa												
FP Normal N, 30000 pa												
EI Control N, 37500 ppa												
EI Intermediate N, 37500 ppa												
EI Normal N, 37500 ppa												
LSD @ 5%												

† Average of 6 replications

Soybean 3-Year Average, 2013-2015

Table 34. Soybean plant response to previous year corn treatments, 2013-2015.†

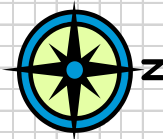
Previous Year Corn Treatment	Plant Population	Grain Moisture	Grain Yield @ 13%
	ppa	%M	bu/a
FP Control N, 30000 ppa	132917ab	13.5	57.1
FP Intermediate N, 30000 ppa	129021b	13.5	56.7
FP Normal N, 30000 pa	135311ab	13.5	56.1
EI Control N, 37500 ppa	140215a	13.5	57.3
EI Intermediate N, 37500 ppa	139736a	13.4	57.0
EI Normal N, 37500 ppa	136998ab	13.4	57.3
LSD @ 5%	9106	0.2	2.0

† Average of 6 replications

Table 35. Soybean trifoliolate leaf nutrient concentration response to previous year corn treatments, 2013-2015.†

Previous Year Corn Treatment	N	P	K	Ca	Mg	S	Zn	Mn	Fe	Cu	B	Al
	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	ppm
FP Control N, 30000 ppa	5.07ab	0.40	2.27	1.10b	0.45b	0.30	35.14ab	54.06a	92.70ab	9.60b	60.19b	20.78ab
FP Intermediate N, 30000 ppa	5.06ab	0.40	2.19	1.12ab	0.46ab	0.30	36.32a	52.53ab	95.86ab	9.71ab	62.39a	18.39ab
FP Normal N, 30000 pa	4.93b	0.39	2.22	1.14a	0.48ab	0.29	35.94a	50.70ab	91.24b	9.71ab	62.10a	18.61ab
EI Control N, 37500 ppa	5.10a	0.40	2.16	1.11ab	0.48a	0.30	35.44ab	52.89ab	97.42a	10.70a	61.39ab	26.56a
EI Intermediate N, 37500 ppa	5.03ab	0.39	2.17	1.11ab	0.48ab	0.29	34.40b	49.01b	90.21b	9.58b	60.86ab	16.83b
EI Normal N, 37500 ppa	5.03ab	0.40	2.21	1.11ab	0.46ab	0.29	35.61ab	54.11a	92.19ab	9.40b	61.30ab	15.94b
LSD @ 5%	0.16	0.01	0.13	0.04	0.03	0.01	1.32	4.32	6.05	1.05	1.88	8.80

† Average of 6 replications



600 feet

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43

Trmt	4	1	2	3	5	6	!	2	5	4	1	3	6	!	3	1	4	5	2	6	!	!	!
Plot	401	402	403	404	405	406	!	501	502	503	504	505	506	!	601	602	603	604	605	606	!	!	!

60 feet plus

8

8

8

Trmt	1	2	3	4	5	6	!	3	2	4	6	1	5	!	2	1	6	4	5	3	!	!	!
Plot	101	102	103	104	105	106	!	201	202	203	204	205	206	!	301	302	303	304	305	306	!	!	!

210 feet

8

#

#

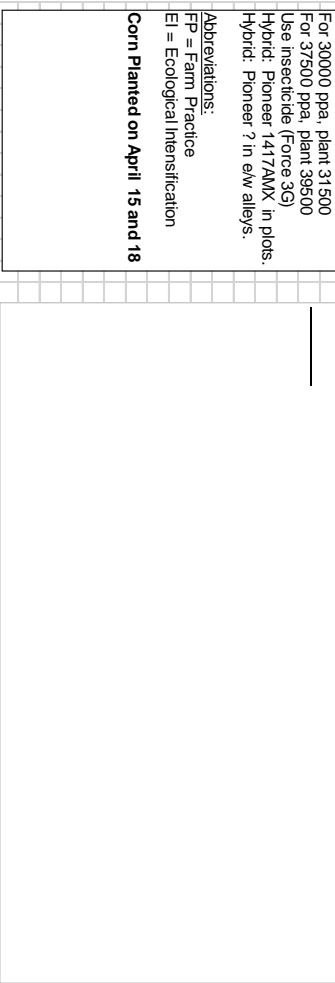
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43

Notes:

For 30000 ppa, plant 31500
 For 37500 ppa, plant 39500
 Use insecticide (Force 3G)
 Hybrid: Pioneer 1417AMX in plots.
 Hybrid: Pioneer ? in eww alleys.

Abbreviations:
 FP = Farm Practice
 EI = Ecological Intensification

Corn Planted on April 15 and 18



60 feet

Trmt	3	6	4	5	1	2	!	1	4	5	6	2	3	!	4	2	1	3	5	6	!	!	!
Plot	401	402	403	404	405	406	!	501	502	503	504	505	506	!	601	602	603	604	605	606	!	!	!

Border

Border (Low)

Trmt	1	2	3	4	5	6	!	2	1	6	4	5	3	!	1	6	3	2	4	5	!	!	!
Plot	101	102	103	104	105	106	!	201	202	203	204	205	206	!	301	302	303	304	305	306	!	!	!

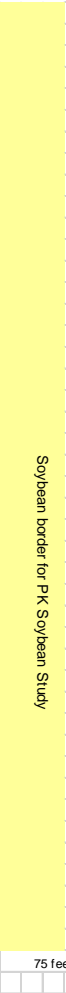
75 feet

75 feet

60 feet

75 feet

60 feet



Soybean border for PK Soybean Study