Optimizing Nitrogen and Irrigation Timing for Corn Fertigation Applications Using Remote Sensing

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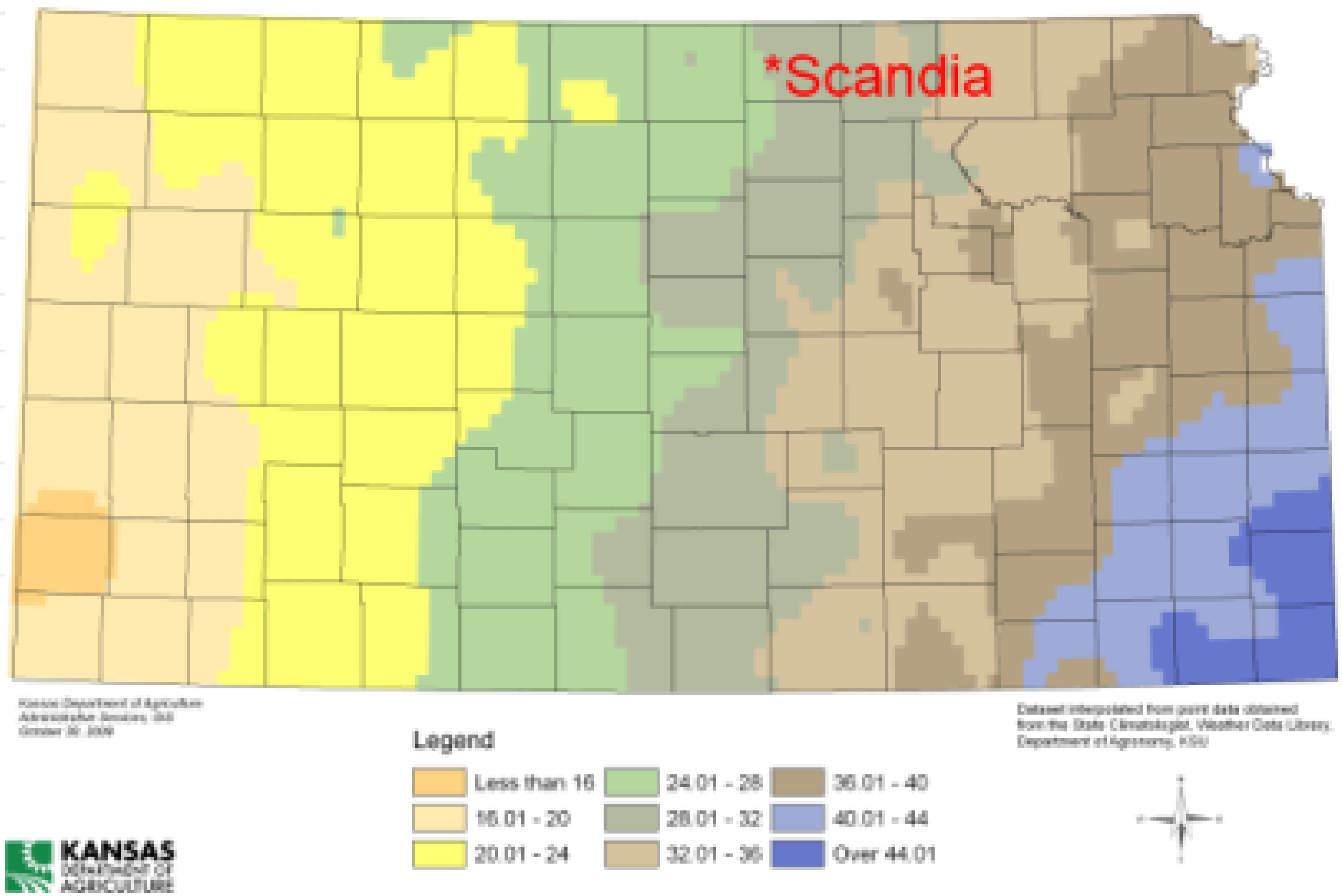
Annual Normal Precipitation 1971 - 2000



Objectives

-Understand interaction between water and N demand in sub-humid environments

-Improve NUE through proper fertigation practices

-Develop methodology to integrate active sensor technology into fertigation management

Methods

Site 1:

-Irrigation Experiment Field-Scandia

-Crete silt loam

-3rd year corn

-Planting date: 26 April

-Irrigation initiation: 4 June

-Growth stage V5

Site 2:

-Cooperating producer-Scandia

-Carr fine sandy loam

-2nd year corn

-Planting date: 24 April

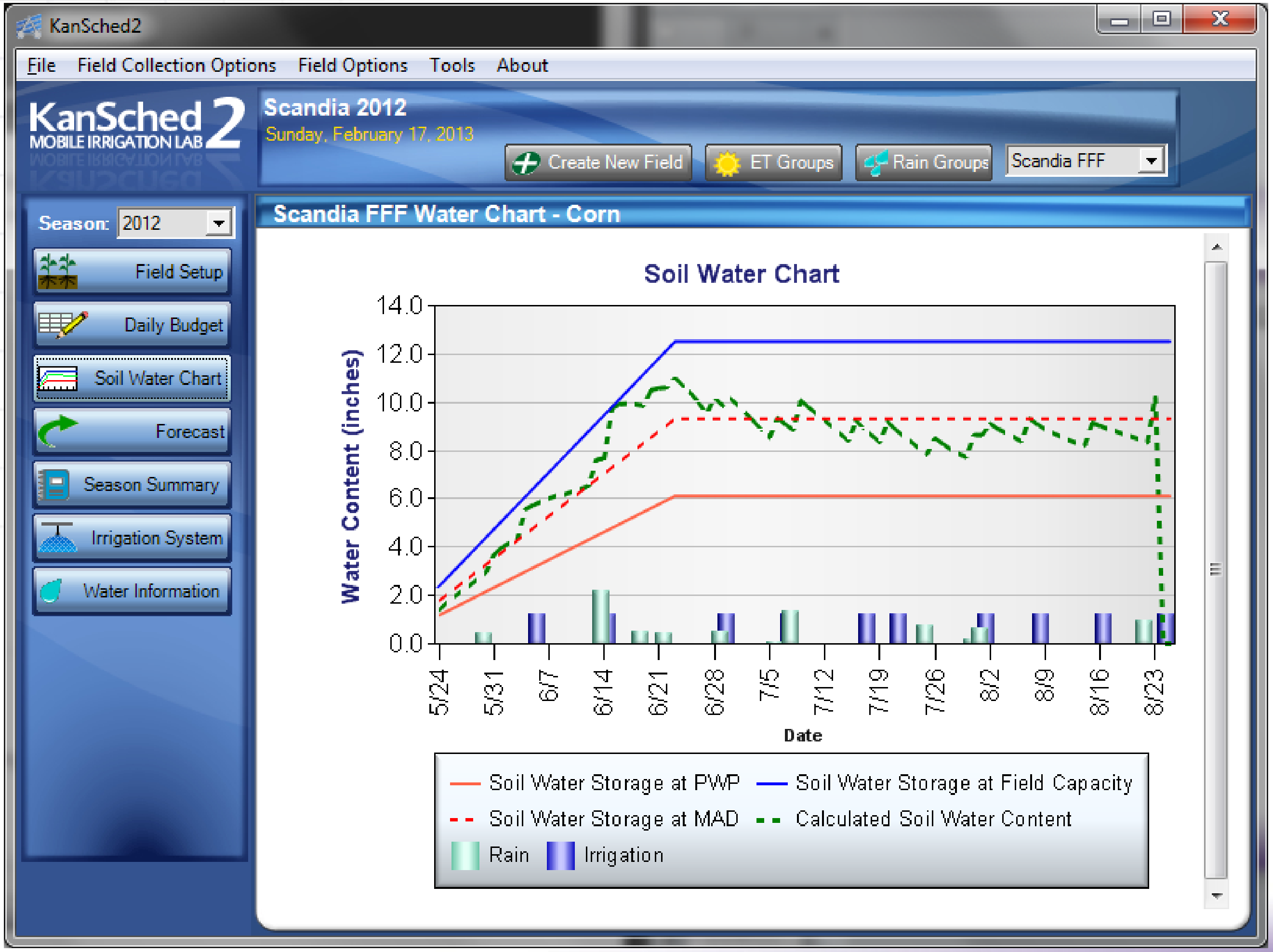
-Irrigation initiation: 5 June

-Growth stage V6

Methods

Irrigation Scheduling: -KanSched2 ET-based tool

-Irrigation trigger: 50% soil water depletion



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N Application/Sensor Methods

- Pre-plant N applied as urea
- In-season N applied as UAN
- “V4” applications made at initial irrigation event
- Sensor-based N applications made to correspond with scheduled irrigations
  - GreenSeeker optical sensor
- Over-canopy and in-canopy sensor readings collected at each irrigation event
  - All N recommendations made using over-canopy sensor data

Treatments – Site 1

Treatment	Timing Method	Starter N (lb/a)	Pre-plant N (lb/a)	In-Season N (lb/a)	Total N Applied (lb/a)
1	Pre-plant	20	60	0	80
2	Pre-plant	20	140	0	160
3	Pre-plant	20	230	0	250
4	Pre-plant/V4	20	20	20	60
5	Pre-plant/V4	20	80	80	180
6	Pre-plant/V4	20	105	105	230
7	Pre-plant/Sensor	20	40	91	151
8	Pre-plant/Sensor	20	80	44	144
9	Pre-plant/Sensor	20	125	86	231
Check	Check	20	0	0	20

Treatments – Site 2

Treatment	Timing Method	Starter N (lb/a)	Pre-plant N (lb/a)	In-Season N (lb/a)	Total N Applied (lb/a)
1	Pre-plant	20	60	0	80
2	Pre-plant	20	140	0	160
3	Pre-plant	20	230	0	250
4	Pre-plant/V4	20	20	20	60
5	Pre-plant/V4	20	80	80	180
6	Pre-plant/V4	20	105	105	230
7	Pre-plant/Sensor	20	40	94	154
8	Pre-plant/Sensor	20	80	86	186
9	Pre-plant/Sensor	20	125	30	175
Check	Check	20	0	0	20

In-season N applications – Site 1

Trt. No.	Timing Method	Preplant N (lb/a)	4 June Growth Stage V5	14 June Growth Stage V8	28 June Growth Stage V16	In-Season N (lb/a)	Total N Applied (lb/a)
4	Pre-plant/V4	20	20	0	0	20	60
5	Pre-plant/V4	80	80	0	0	80	180
6	Pre-plant/V4	105	105	0	0	105	230
7	Pre-plant/Sensor	40	43	27	21	91	151
8	Pre-plant/Sensor	80	0	27	17	44	144
9	Pre-plant/Sensor	125	34	35	17	86	231

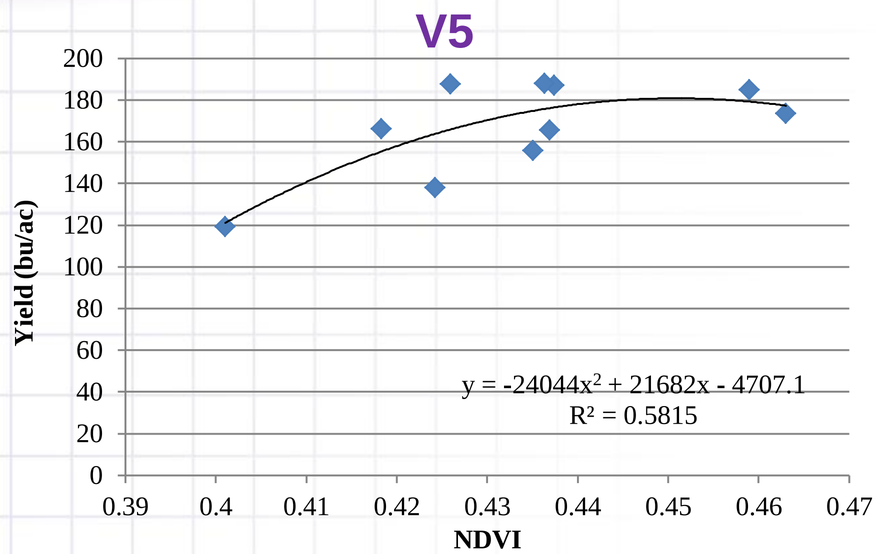
Results-Site 1

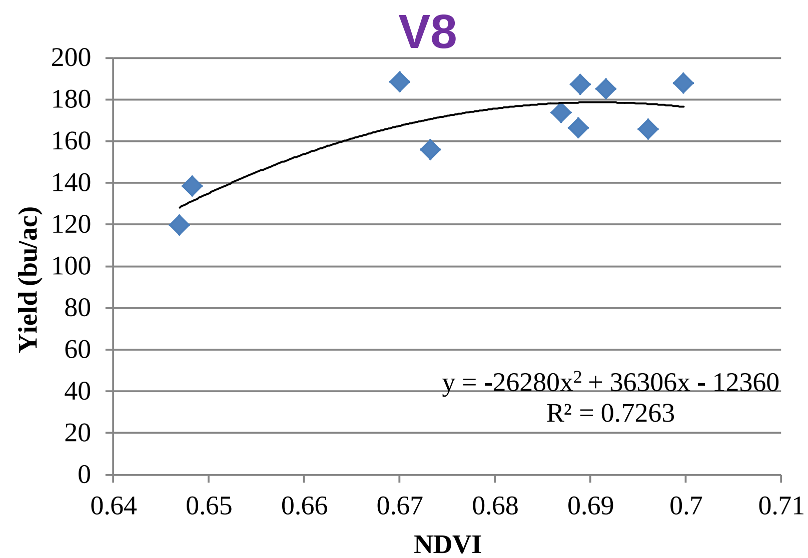
Treatment	Timing Method	Starter N (lb/a)	Pre-plant N (lb/a)	In-Season N (lb/a)	Total N Applied (lb/a)	Yield (bu/a)	LSD Grouping
6	Pre-plant/V4	20	105	105	230	188	a
5	Pre-plant/V4	20	80	80	180	187	a
3	Pre-plant	20	230	0	250	185	a
9	Pre-plant/Sensor	20	125	86	231	185	a
8	Pre-plant/Sensor	20	80	44	144	173	b
2	Pre-plant	20	140	0	160	166	bc
7	Pre-plant/Sensor	20	40	91	151	166	bc
1	Pre-plant	20	60	0	80	156	c
4	Pre-plant/V4	20	20	20	60	138	d
Check	**Check**	20	0	0	20	119	e

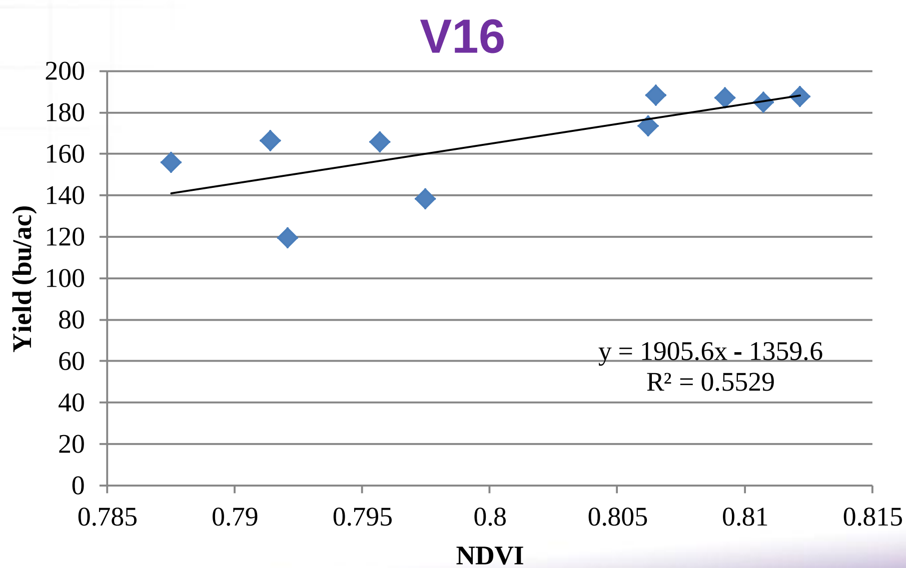
Results-Site 2

Treatment	Timing Method	Starter N (lb/a)	Pre-plant N (lb/a)	In-Season N (lb/a)	Total N Applied (lb/a)	Yield (bu/a)	LSD Grouping
4	Pre-plant/V4	20	20	20	60	209	ns
9	Pre-plant/Sensor	20	125	30	175	209	ns
1	Pre-plant	20	60	0	80	203	ns
2	Pre-plant	20	140	0	160	201	ns
3	Pre-plant	20	230	0	250	199	ns
7	Pre-plant/Sensor	20	40	94	154	199	ns
8	Pre-plant/Sensor	20	80	86	186	198	ns
5	Pre-plant/V4	20	80	80	180	197	ns
6	Pre-plant/V4	20	105	105	230	193	ns
Check	**Check**	20	0	0	20	193	ns

Sensor Performance – Over canopy







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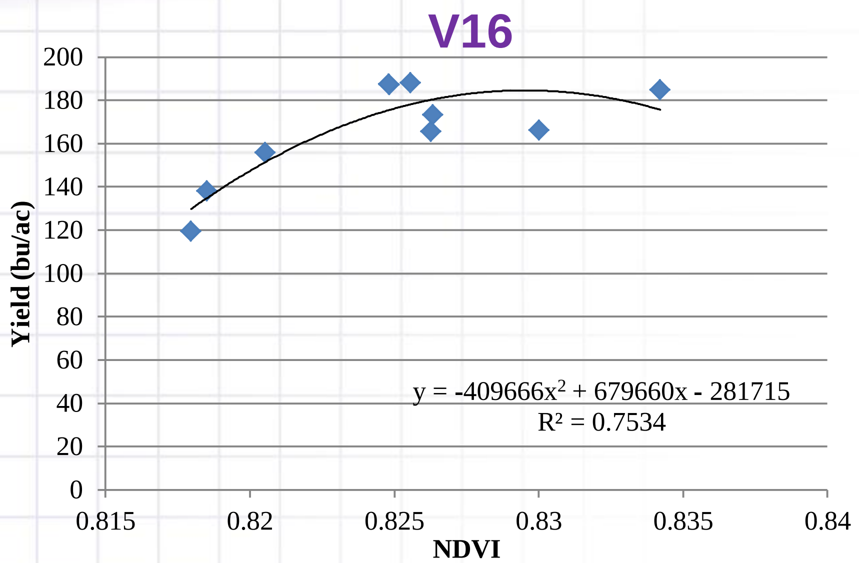
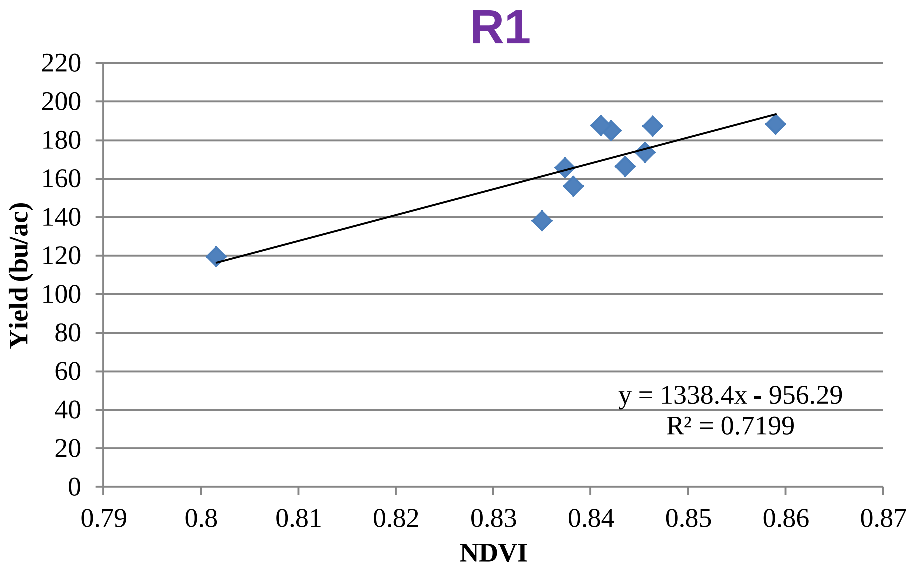
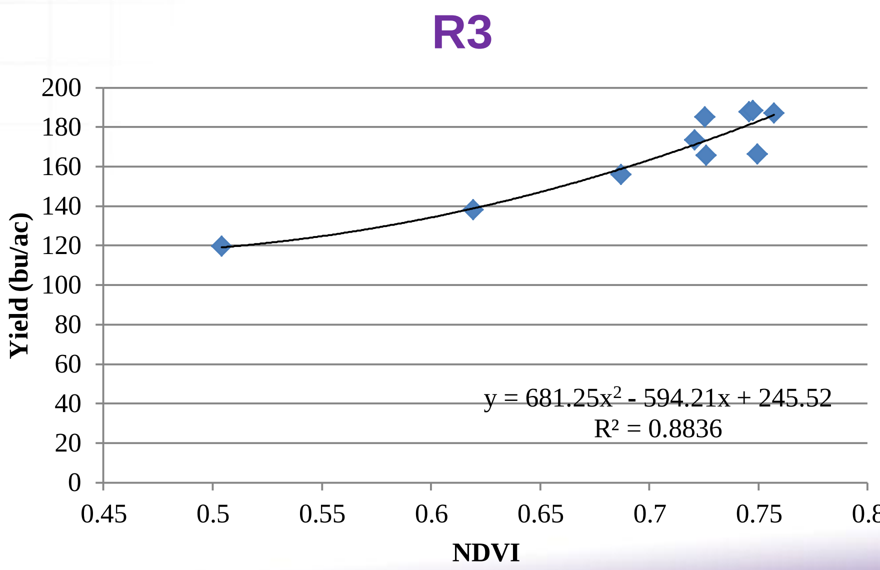
Sensor Performance – In canopy







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Sensor Performance – Site 1

R2-Over canopy

NDVI=0.752

R2-In canopy

NDVI=0.73

Untreated Check

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Sensor Performance – Site 1

R2-Over canopy

NDVI=0.761

R2-In canopy

NDVI=0.845

230 lb. N/acre Pre-Plant

Sensor Performance Summary

- Over crop sensing is adequate for making N recommendations during vegetative growth stages
- Sensor sensitivity decreases in late vegetative stages
  - Sensor saturation occurs in over canopy readings
- In canopy sensor readings could be effective in late vegetative and reproductive growth stages
  - Necessary for effective fertigation management

2012 Summary

- Correct pre-plant N applications are key to maximizing effectiveness of a fertigation management program

- Improved sensor use methods are key to making late-season N recommendations


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