Producing 300 Bushel Corn Sustainably

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Quest for 300 Bushel Corn

Herman
Warsaw's farm
Saybrook, IL
July 1985

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Seven Wonders of Corn Yield

- Ranks factors that can have a positive (and sometimes negative) impact on corn yield
- Gives each factor an average bushel per acre value
- Given key prerequisites like drainage, fertility, weed control

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Seven Wonders of the Corn Yield World

Rank	Factor	Value
		bu/acre
1	Weather	70+
2	Nitrogen	70
3	Hybrid	50
4	Previous Crop	25
5	Plant Population	20
6	Tillage	15
7	Growth Regulators	10

Given key prerequisites

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Leaf greening from Strobilurin Fungicides

Leaves greener 60 days after VT application

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7	Growth Regulators	10
	TOTAL	260 bu

Given key prerequisites

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Seven Wonders of the Corn Yield World

Rank	Factor	Value	
		bu/acre	%
1	Weather	70+	27
2	Nitrogen	70	26
3	Hybrid	50	19
4	Previous Crop	25	10
5	Plant Population	20	8
6	Tillage	15	6
7	Growth Regulators	10	4
	Total =	260bu	100%

Given key prerequisites

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How to Get 300 Bushels?

- **Provide better prerequisites, especially mineral nutrients**
- **Try to optimize each of the seven wonders and their positive interactions**

Prerequisites for 300 Bushels?

- **Proper soil pH & adequate levels of P and K based on soil tests**

- **Fertility- Required amounts of nutrients each year, Sulfur & Micronutrients?**

Where are the Positive Interactions?

Rank	Factor	Value	
		bu/acre	%
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	Total =	260bu	100%

Given key prerequisites

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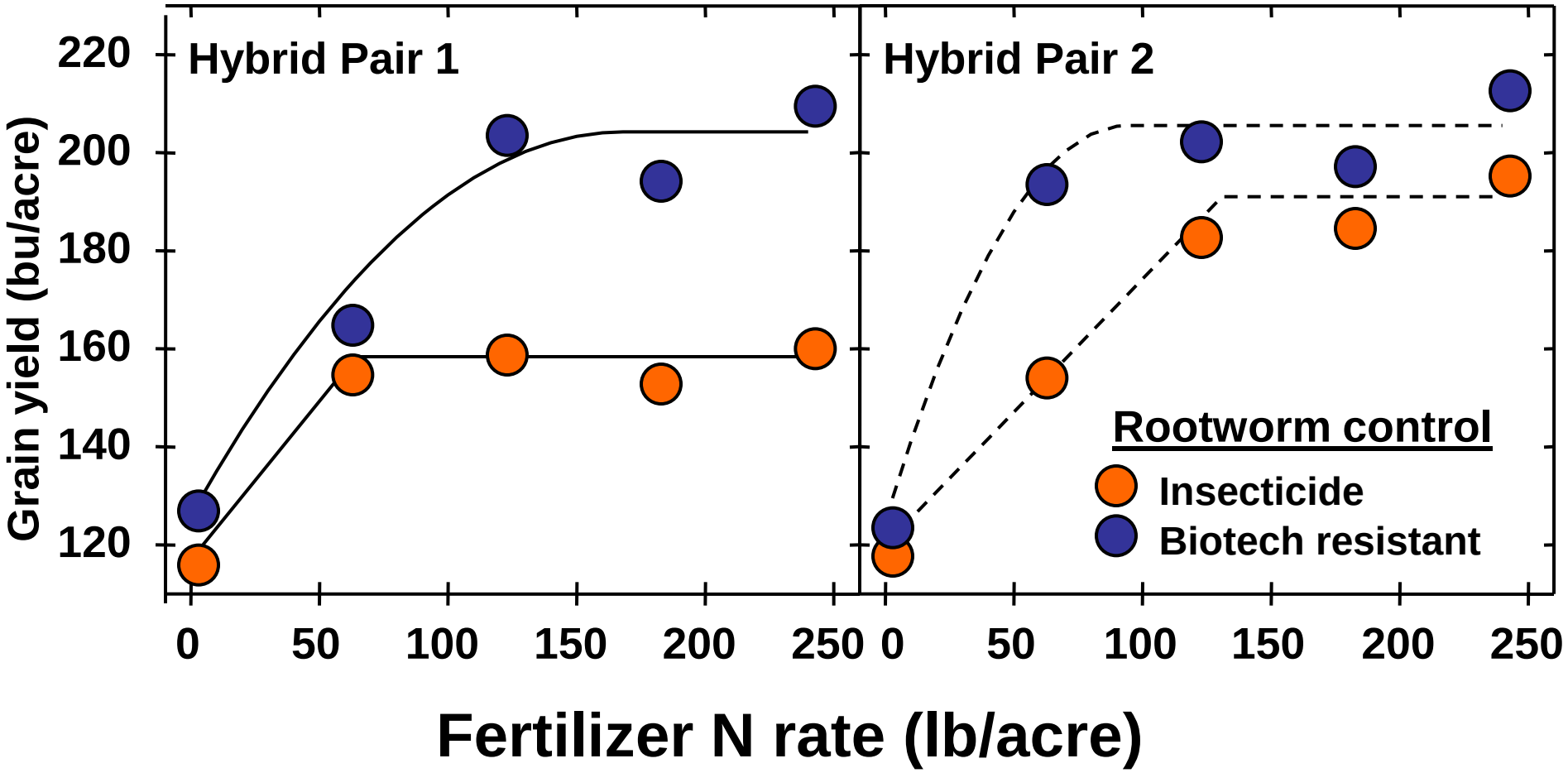
Better N use from Biotechnology Traits



Champaign, IL 2008

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Better N use from Biotechnology Traits

Hybrid	NUE	Uptake	Utilization
	kg/kg N	%	kg/kg N
RW-Bt	25.9*	71*	36.4
Non-RW	17.0	52	33.1
RW-Bt	31.7*	71*	44.6
Non-RW	22.4	56	40.1

*different from non-RW counterpart P< 0.05

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Greater Nutrient Removal with Grain as a Result of Biotechnology Traits

Nutrient	Non RW resistant	Root worm resistant	Difference
	bushels or lbs/acre removed		%
Yield	179	205	15
N	110	126	14
P	17	21	24
K	26	31	19
S	8.9	10.4	17
Zn (oz)	2.2	2.8	27

Champaign, IL 2008, average of two hybrid pairs

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How to Get 300 Bushels?

- **Better prerequisites along with packages of optimized yield wonders.**
- **Is the value of combined factors greater than their individual impact?**

Seven Wonders of the Corn Yield World

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	Total	260 bu

Improved Fertility Prerequisites

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Standard vs High Tech Package

Fertility

No P or K based on soil test

100 lbs P_2O_5 as MESZ (N, P, S, & Zn)

Nitrogen

180 lbs pre-plant as UAN

100 lbs extra N sidedress as Super-U

Genetics

RR Refuge Hybrid (DKC 61-22)

Triple stack Hybrid (DKC 61-19)

Both with soil insecticide at planting

Population

32,000 plants/ac vs 45,000 plants/ac

Both in 30 inch rows and twin rows in 2010

Fungicide

No Fungicide

Headline or Quilt-Xcel (@ R1)

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Best High Yield Factors- Omission Plot

		FACTOR				
	TREATMENT	Fertility	Nitrogen	Genetics	Population	Fungicide
	HIGH TECH	MESZ	Base + Slow release	Triple stack	45,000	Strobilurin
Decrease Technology	Fertility	No P & K	Base + Slow release	Triple stack	45,000	Strobilurin
	Nitrogen	MESZ	Base	Triple stack	45,000	Strobilurin
	Genetics	MESZ	Base + Slow release	Refuge	45,000	Strobilurin
	Population	MESZ	Base + Slow release	Triple stack	32,000	Strobilurin
	Fungicide	MESZ	Base + Slow release	Triple stack	45,000	none
	TRADITIONAL	No P & K	Base	Refuge	32,000	none
Add Technology	Fertility	MESZ	Base	Refuge	32,000	none
	Nitrogen	No P & K	Base + Slow release	Refuge	32,000	none
	Genetics	No P & K	Base	Triple stack	32,000	none
	Population	No P & K	Base	Refuge	45,000	none
	Fungicide	No P & K	Base	Refuge	32,000	Strobilurin

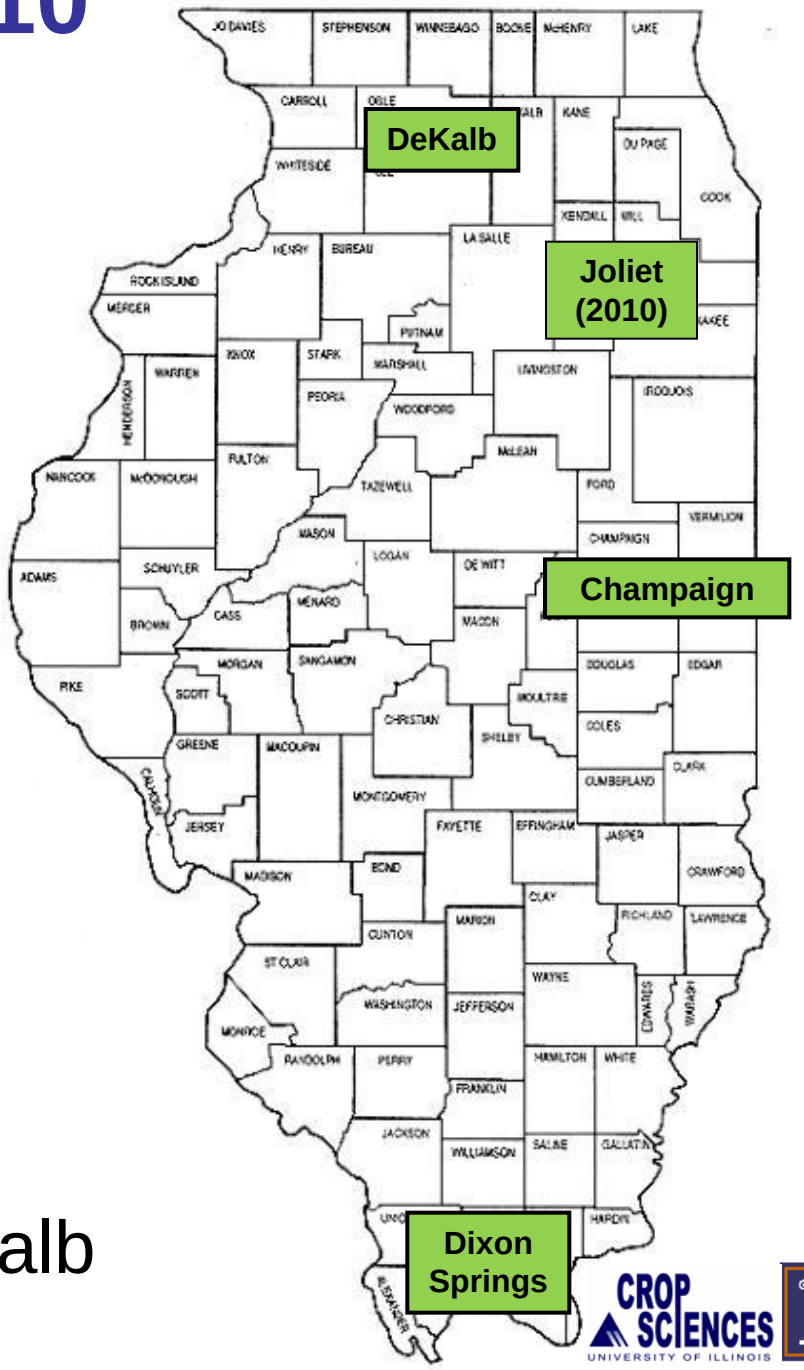
Omission Plots 2009-10

All Sites in both Years

- Medium to high soil P & K
- 180 lbs base N as UAN
- DKC 61-19 or 61-22
- Soybean as previous crop
- Conventional tillage
- 30 inch & twin-rows in 2010

Weather

- Wet spring in both years
- Abnormally cool in 2009
- Abnormally hot in 2010
- Early frost (2009) or severe wind damage (2010) in DeKalb



Weather Damage at DeKalb - 2010

Severe wind damage at R3

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Equipment Natural Disaster at Joliet -2010

Yield loss due to combine fire

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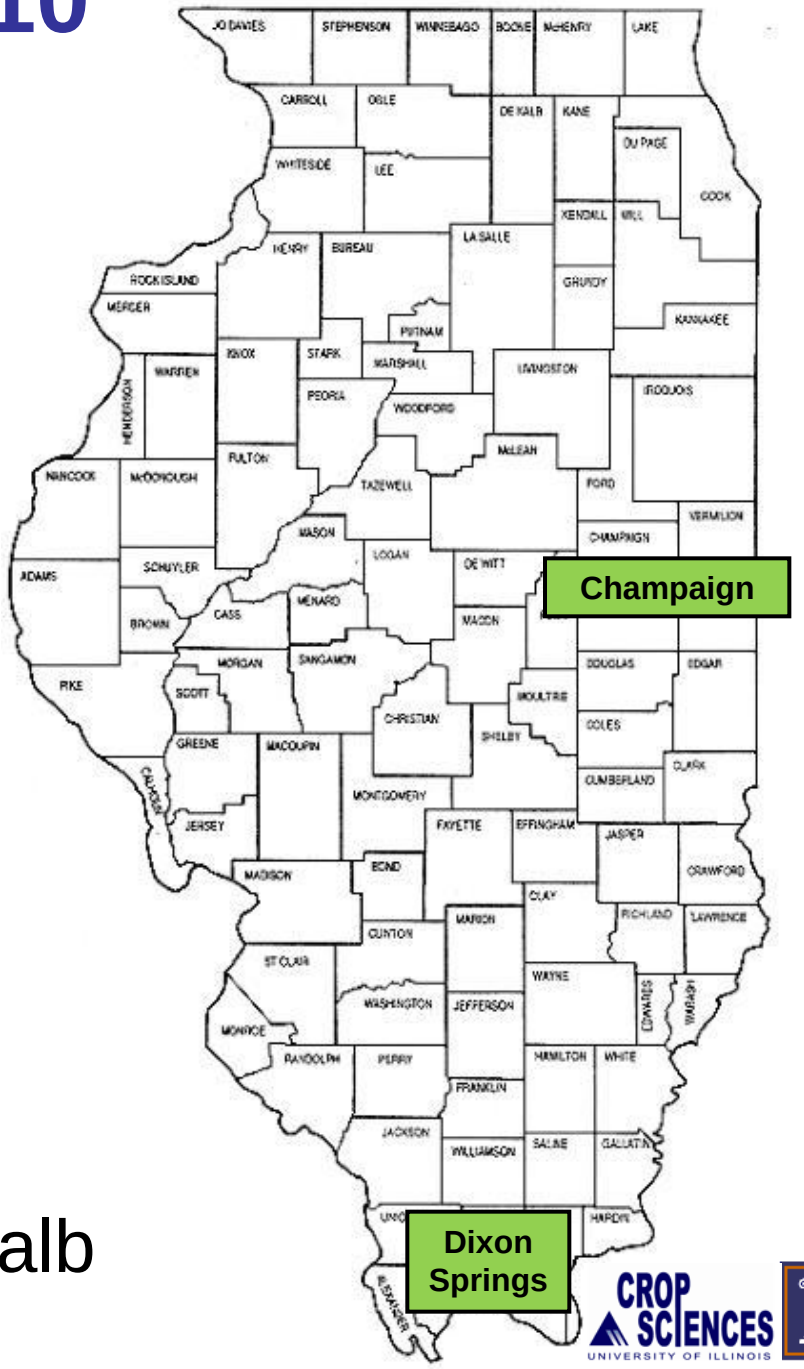
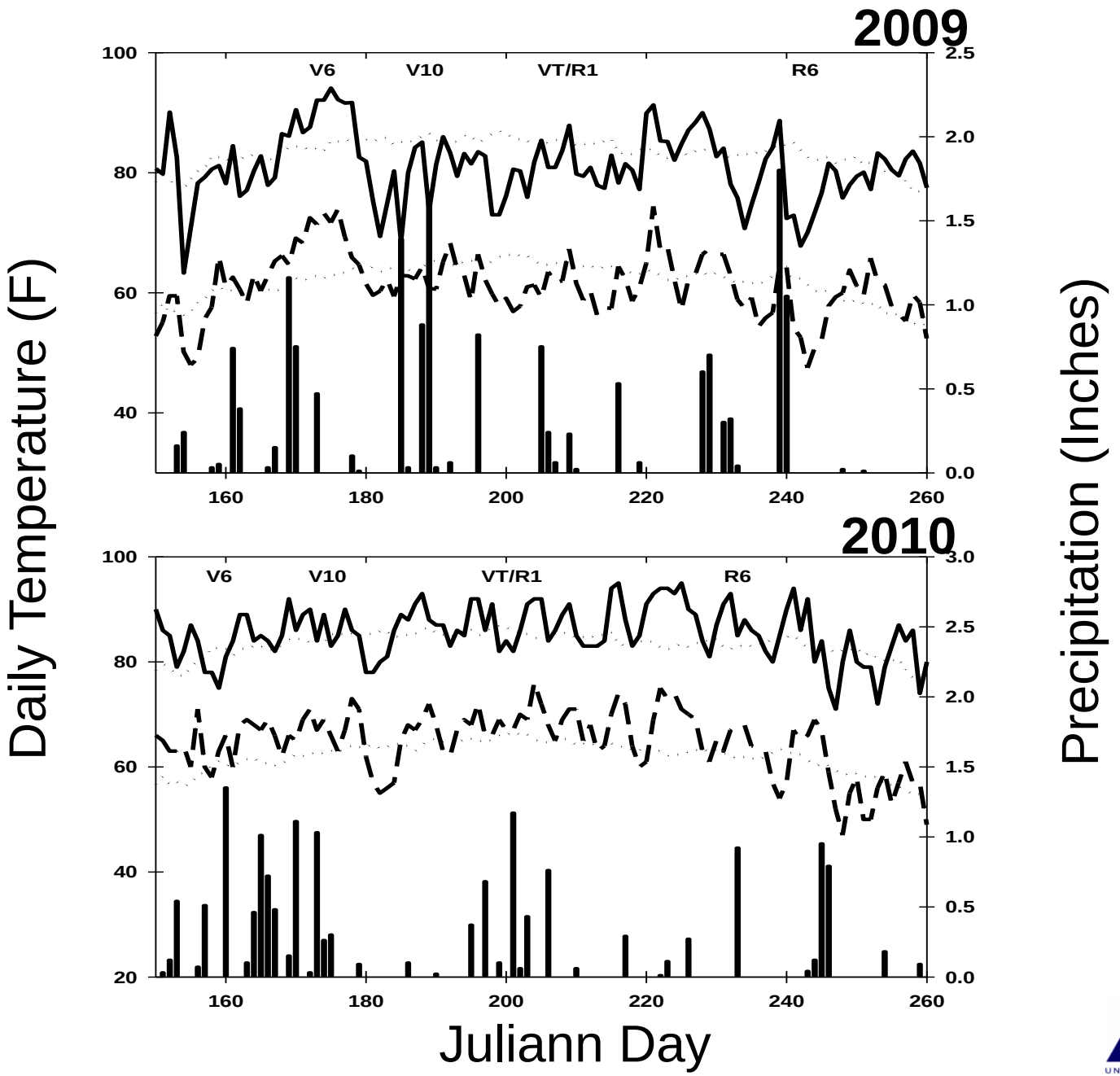


Different Weather Between Years- Champaign, IL



High Tech Package vs Traditional Champaign-2009

High Technology Package **Standard Practice**

Ears from 1/1000 of an acre

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Yield Enhancement with High Tech Package

Location	Traditional Practice	High Tech Package	Δ
	bu acre^{-1}		
Champaign	208	274	66*
Dixon Springs	188	245	57*

* Significance difference ($p<0.10$)

Data from 2009

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Traditional vs High Tech - 2009

Factor	Traditional		High Tech	
	Yield	Δ	Yield	Δ
	bu acre^{-1}			
None or All	198		260	
Fertility	202	+ 4	248	-12
Nitrogen	206	+ 8	240	-20
Genetics	208	+10	235	-25
Population	185	-13	250	-10
Fungicide	198	0	242	-18

LSD ($p<0.10$) = 6

Data from Champaign and Dixon Springs

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Yield Enhancement with High Tech Package

Location	Traditional Practice	High Tech Package	Δ
	bu acre^{-1}		
Champaign	192	232	40*
Dixon Springs	183	228	45*

* Significance difference ($p<0.10$)

Data from 2010

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Traditional vs High Tech - 2010

Factor	Traditional		High Tech	
	Yield	Δ	Yield	Δ
	bu acre^{-1}			
None or All	188		230	
Fertility	192	+ 4	225	- 5
Nitrogen	190	+ 2	225	- 5
Genetics	196	+ 8	215	-15
Population	190	+ 2	226	- 4
Fungicide	199	+11	195	-35

LSD ($p<0.10$) = 7

Data from Champaign and Dixon Springs

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Traditional vs High Tech – Two Years

Factor	Traditional Yield	Traditional Δ	High Tech Yield	High Tech Δ
		bu acre^{-1}		
None or All	193		245	
Fertility	197	+ 4	236	- 9
Nitrogen	198	+ 5	232	-13
Genetics	202	+ 9	225	-20
Population	187	- 6	238	- 7
Fungicide	198	+ 5	218	-27

LSD ($p<0.10$) = 6

Data from Champaign and Dixon Springs

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What is Agricultural Sustainability?

Assemble Complementary Technologies that Individually Impact Yield

more corn per unit area & greater input-use efficiency