Economic Findings From National Corn Grower Association Yield Contests: Crop Nutrients, Genetics, Equipment and Plant Protection

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What we read and hear

WV Governor Jim Justice

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What we/I think

How much was spent to get that yield?
What input levels did they use?
How much time did they spend?
Did they hand feed/water every plant?
They must have the best land in the county?
I wish I farmed some of that ground?
Why didn't I plant that variety/brand this year?
I wish I had a new $400k planter. Nope, not me.
I don't have time to compete.

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NCGA rules and policies

- 10-acre plot

- Various classes

- Supervisor/oversight

- 24-page handbook
  - Covers every situation that could give an advantage

Information Required for Online Contest Entry

- Choose the correct state where the contest field is located (not the state of residence)
- Select irrigated or non-irrigated. Irrigated fields that do not utilize artificial irrigation in a growing season due to rainfall must still be classified as irrigated.
- Select tillage type: Conventional, No-Till, or Strip-Till which includes Ridge-Till, Minimum-Till, and Mulch-Tillage
- Classes A through I: The online entry program will automatically assign the entry class based on tillage, irrigation and the state plot location
- Class J may be any tillage, irrigation and located in the states of Kansas, Iowa, Illinois, Indiana, Michigan, Missouri, Nebraska, Ohio and Wisconsin only.
- Estimated percent of crop residue on the field surface after planting for class entries other than conventional.
- Hybrid Brand and Number
- Name of Sales Rep
- Sales Rep I.D. # for Pioneer entries and MTSA # for DEKALB entries
- Date planted
- Row spacing (inches)
- Number of rows on planter (4, 6, 8, 12, etc.)
- Planter make & model
- Previous year's crop
- Is your farm participating in a sustainability program
- Are cover crops used on any part of your operation Yes/No
- Are you actively reducing tillage practices Yes/No
- Do you have an active integrated pest management plan Yes/No
- Are you an integrated crop and livestock operation utilizing manure Yes/No
- Chemical seed treatment
- Was a soil test taken for the contest field. If yes, what year?
- List Herbicides, Insecticides and Fungicides – how much, how applied & when applied
- List at least one Supervisor on the entry. Current, approved Supervisors can be located using the search bar.

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Main classes discussed today

- All practices combined – yield only

- All tillage practices combined, non irrigated in a typically non-irrigated county (compare to relevant NASS yield)

- All tillage practices combined, irrigated in a county with considerable irrigation (compare to relevant NASS yield)

- All tillage practices combined, non irrigated in a county with considerable irrigation (compare to relevant NASS yield)

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Entry Yield Distribution, all entries

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Entry Yield Distribution, all entries – difference from county avg. yield

Yield occurances of NCGA entries between 2015 and 2023 Differnce from County Average NASS Yield
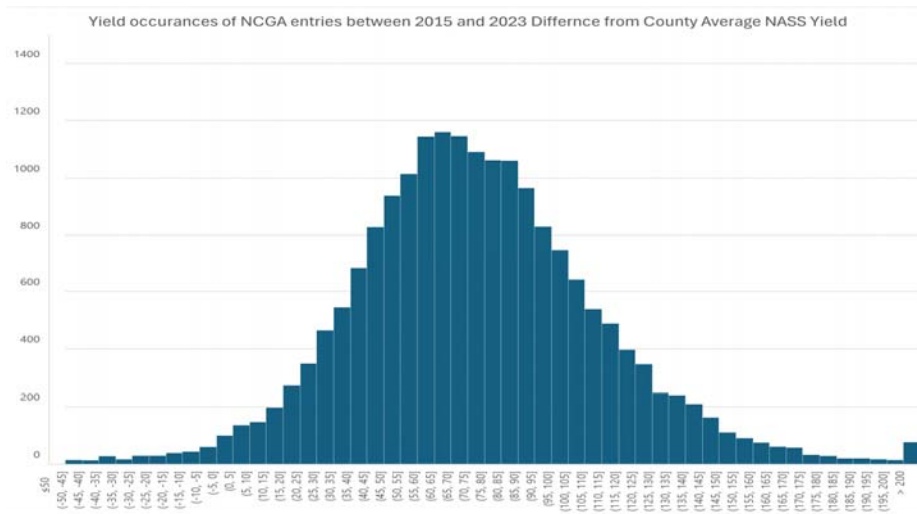
Entry Yield Distribution, all entries – % different from county avg. yield

Yield occurances of NCGA entries between 2015 and 2023 % Differnce from County Average NASS Yield
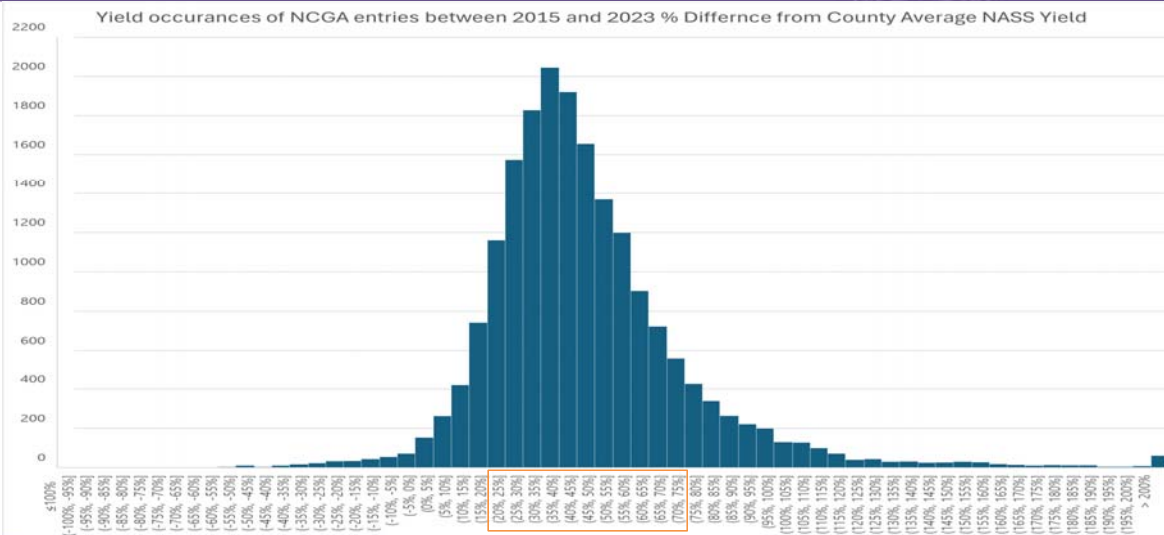
Summary Statistics, all entries (n = 16,619)

Year	Count	Entry Yield	% Difference Entry & NASS	# N applied	# P applied	# K applied	Trace elements	Plants/ acre
2015	2563	241	39%	216	64	88	39%	33,488
2016	2265	238	36%	212	61	85	40%	33,084
2017	2227	256	42%	222	64	92	45%	33,586
2018	1768	251	39%	222	67	91	41%	33,741
2019	1671	250	46%	228	71	99	44%	33,643
2020	1897	256	46%	227	67	98	49%	33,790
2021	1586	269	45%	227	68	103	48%	33,959
2022	1508	263	51%	225	66	92	51%	33,845
2023	1134	267	49%	220	67	94	49%	33,754

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Summary Statistics, all entries (n= 16,619)

Year	Entry Yield	% Difference Entry & NASS	Conservation Till	Seed Treatment	Insecticide	Fungicide	Cattle manure	Swine manure	Poultry litter
2015	241	39%	32%	82%	14%	16%	6%	4%	6%
2016	238	36%	33%	82%	11%	16%	5%	3%	6%
2017	256	42%	34%	79%	13%	16%	5%	4%	7%
2018	251	39%	36%	77%	13%	17%	6%	4%	6%
2019	250	46%	54%	77%	13%	19%	6%	4%	7%
2020	256	46%	56%	77%	9%	13%	6%	4%	6%
2021	269	45%	59%	73%	11%	15%	6%	3%	11%
2022	263	51%	60%	68%	12%	19%	7%	4%	7%
2023	267	49%	57%	67%	11%	20%	6%	4%	10%

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Summary Statistics, all entries – seed brand (n = 16,619)

Year	Pioneer	Channel	Dekalb	NK	Agrigold	Golden Harvest	Beck's	LG	FS	Wyffel
2015	56.8%	0.9%	35.7%	0.6%	0.4%	2.6%	0.0%	0.2%	0.2%	0.4%
2016	52.1%	0.8%	37.9%	0.1%	1.1%	2.6%	0.4%	0.1%	0.5%	0.5%
2017	48.3%	1.3%	37.1%	0.2%	4.0%	5.2%	0.2%	0.2%	1.6%	0.4%
2018	44.6%	1.5%	37.1%	0.1%	5.1%	6.7%	0.6%	0.5%	4.2%	0.6%
2019	46.3%	1.8%	34.6%	0.0%	6.6%	7.8%	0.9%	1.0%	3.0%	0.7%
2020	40.4%	1.9%	33.1%	0.1%	7.0%	9.3%	1.1%	1.1%	4.4%	1.5%
2021	35.2%	1.3%	38.3%	0.3%	5.0%	7.1%	0.9%	0.7%	4.6%	1.4%
2022	37.6%	1.9%	33.4%	0.7%	5.7%	9.2%	0.9%	1.0%	4.8%	0.9%
2023	32.4%	1.6%	38.6%	0.4%	5.1%	10.4%	0.6%	0.8%	5.0%	1.3%

Summary Statistics, all entries - harvester (n = 16,619)

Year	Deere	CIH	Claas	Gleaner	Challenger	New Holland
2015	63.8%	27.8%	0.9%	2.5%	0.0%	3.6%
2016	61.6%	30.2%	1.2%	2.8%	0.5%	2.5%
2017	62.8%	29.9%	1.3%	2.3%	0.2%	2.6%
2018	58.4%	31.6%	2.9%	3.3%	0.1%	2.3%
2019	58.3%	32.1%	2.3%	2.3%	0.1%	2.9%
2020	58.7%	31.8%	3.2%	2.2%	0.3%	2.4%
2021	59.8%	31.1%	2.9%	2.5%	0.0%	2.3%
2022	63.1%	28.2%	3.0%	2.1%	0.2%	2.9%
2023	63.4%	28.6%	3.6%	1.9%	0.3%	1.8%

Summary Statistics, all entries – planter (n = 16,619)

| Year	Kinze 3600	MNG	CIH 1250	CIH 2150	Deere 7000	Deere DB	Deere 1720	Deere 1775	Deere 1795	Deere 1760
2015	11.4%	1.2%	6.9%	0.0%	2.4%	5.1%	7.3%	1.2%	0.5%	5.2%
2016	10.3%	1.3%	7.2%	0.0%	2.3%	4.9%	7.1%	1.5%	1.4%	5.8%
2017	10.6%	2.3%	7.2%	0.4%	2.3%	5.4%	8.1%	1.8%	1.8%	3.3%
2018	10.1%	1.6%	6.4%	1.3%	2.3%	5.7%	8.1%	2.0%	2.0%	3.9%
2019	11.7%	1.2%	5.2%	2.0%	1.3%	5.1%	8.7%	4.1%	2.7%	4.9%
2020	9.0%	1.2%	5.7%	2.5%	1.8%	6.9%	8.6%	5.3%	1.8%	3.2%
2021	10.2%	1.8%	4.9%	3.0%	1.7%	3.9%	8.3%	7.9%	1.8%	4.0%
2022	8.2%	2.1%	5.4%	3.4%	1.2%	4.0%	7.1%	9.3%	2.1%	4.5%
2023	7.8%	1.1%	5.2%	3.9%	1.1%	3.6%	4.1%	13.2%	3.1%	5.1%

## Summary Statistics Kansas (n = 459)

| Year	Count	Entry Yield	% Difference Entry & NASS	# N applied	# P applied	# K applied	Trace elements	Plants/ acre	Seed Treatment	Insecticide	Fungicide
2015	79	222	46.8%	205	43	19	41.8%	29295	86.1%	3.8%	19.0%
2016	72	211	38.0%	191	45	24	38.9%	27624	63.9%	1.4%	19.4%
2017	54	243	58.4%	211	51	36	44.4%	29626	61.1%	9.3%	14.8%
2018	41	240	55.8%	204	42	38	39.0%	29822	65.9%	12.2%	19.5%
2019	41	222	62.4%	206	49	31	31.7%	28254	63.4%	2.4%	7.3%
2020	66	240	51.8%	213	43	30	37.9%	29079	68.2%	15.2%	10.6%
2021	39	259	71.0%	201	61	59	46.2%	29541	79.5%	7.7%	10.3%
2022	39	250	78.9%	224	51	34	61.5%	29573	64.1%	0.0%	5.1%
2023	28	250	125.2%	229	60	46	60.7%	30390	64.3%	0.0%	10.7%

Entry Yield Distribution – % different from county avg. yield, non-irrigated yield in typically non-irrigated county
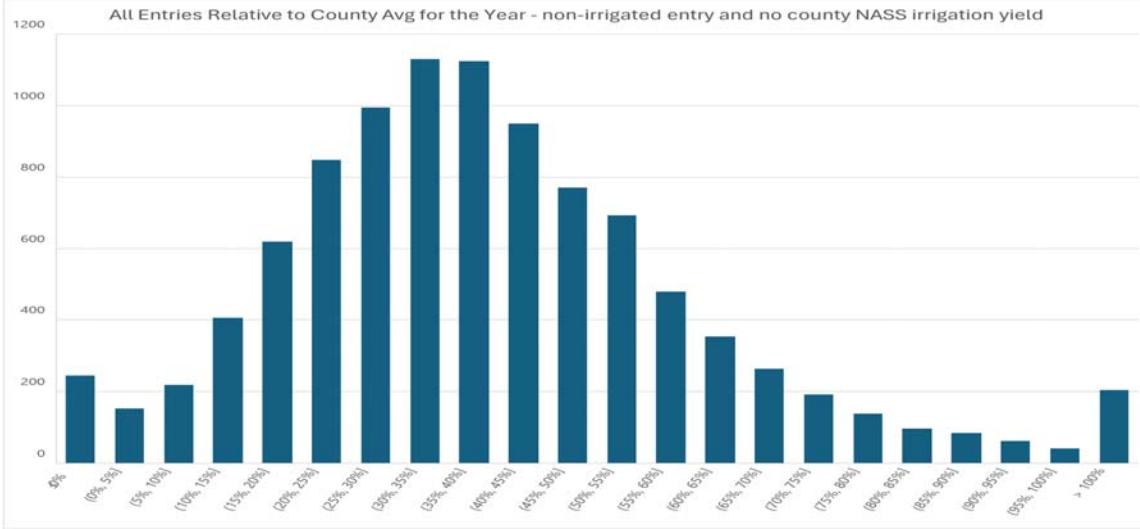
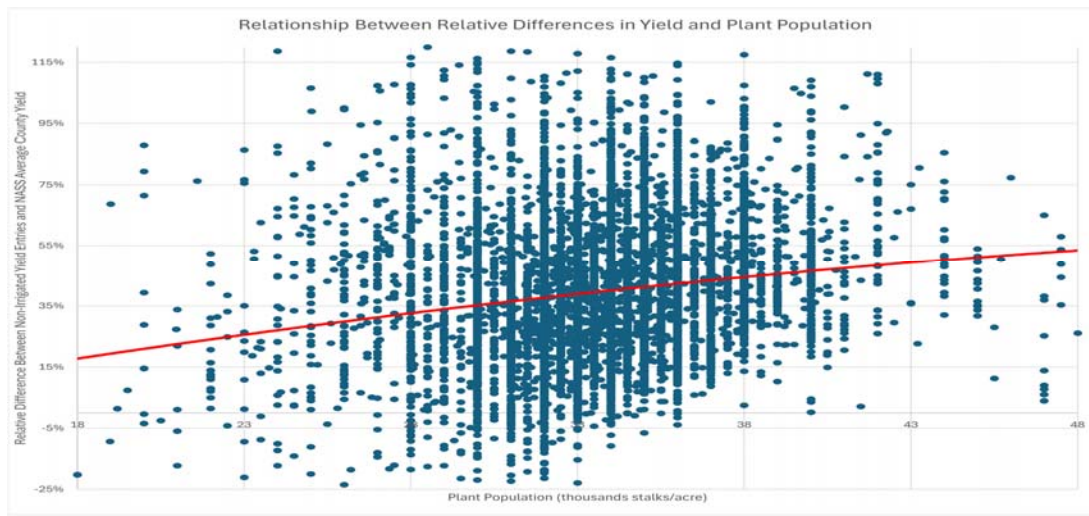**Entry Yield Distribution – % different from county avg. yield, irrigated yield in typically irrigated county**

Irrigation trims the bottom tail and extends out the top end tail.
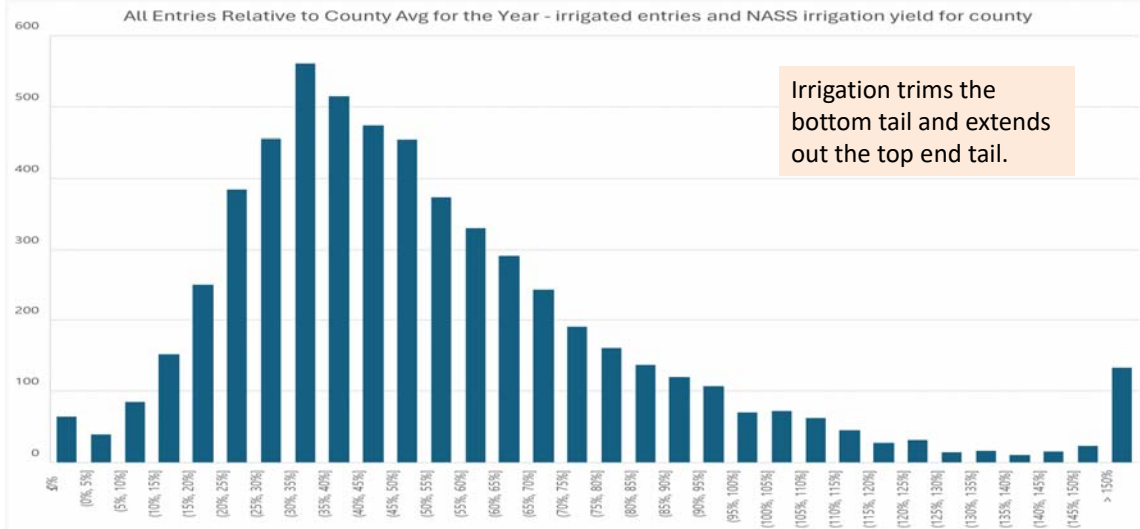
Entry Yield Distribution – % difference from county avg. yield, non-irrigated yield in typically irrigated county
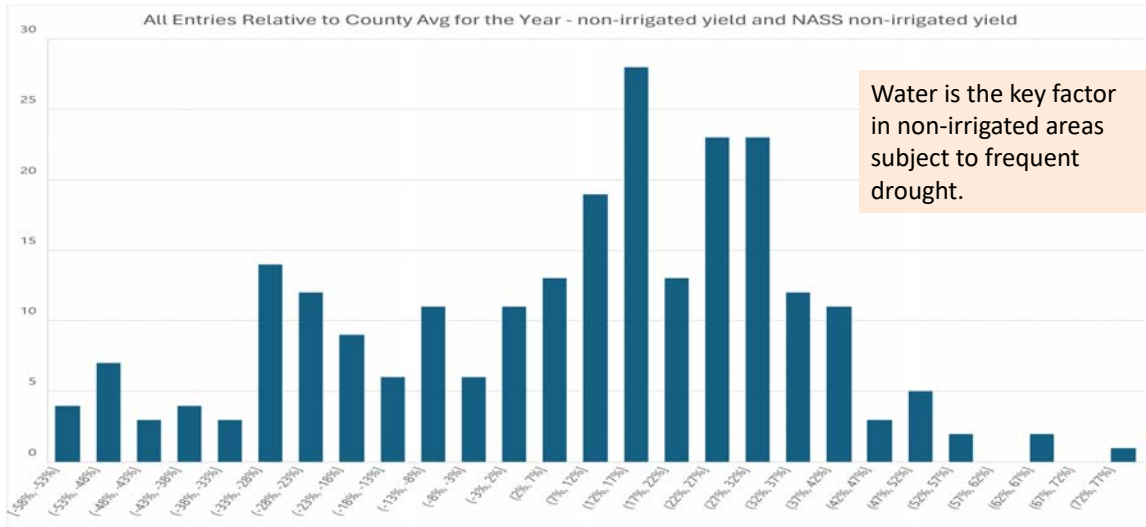
Water is the key factor in non-irrigated areas subject to frequent drought.

Non-irrigated entries in typically non-irrigated county (n = 6,300)

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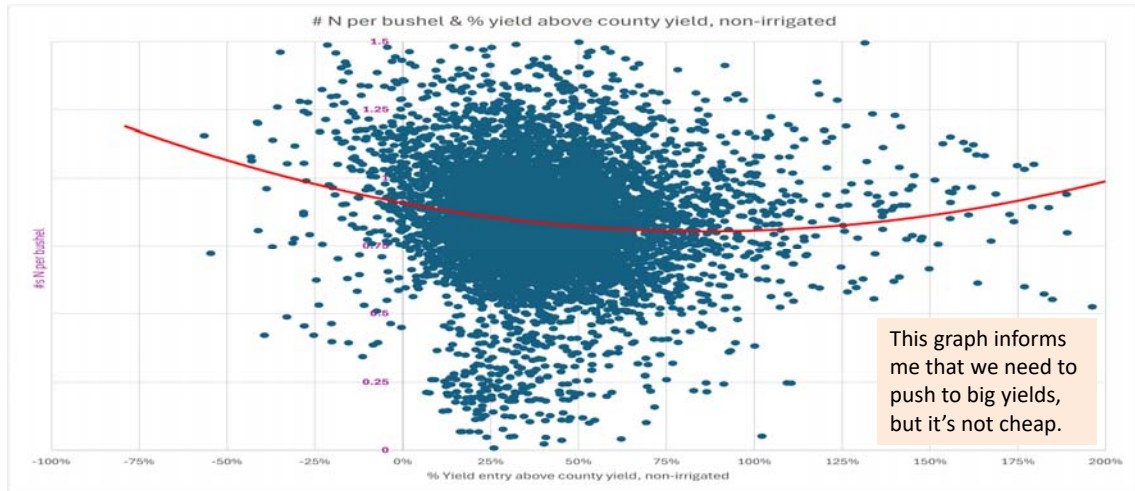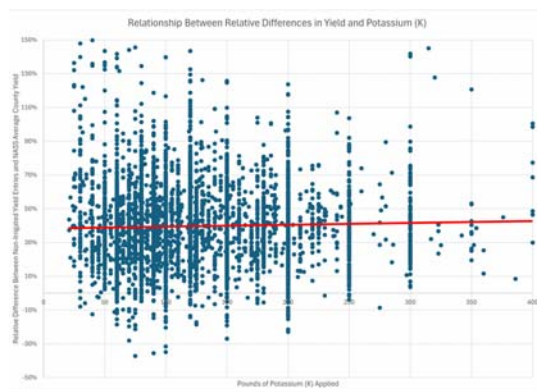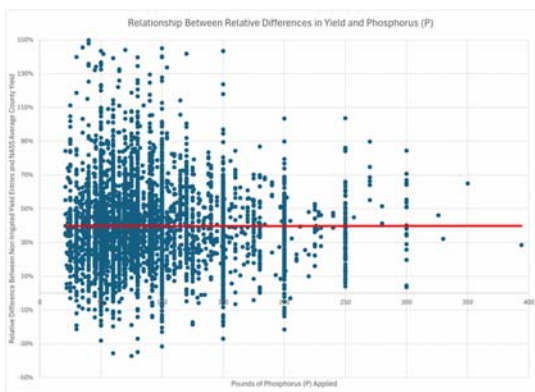This graph informs me that we need to push to big yields, but it's not cheap.
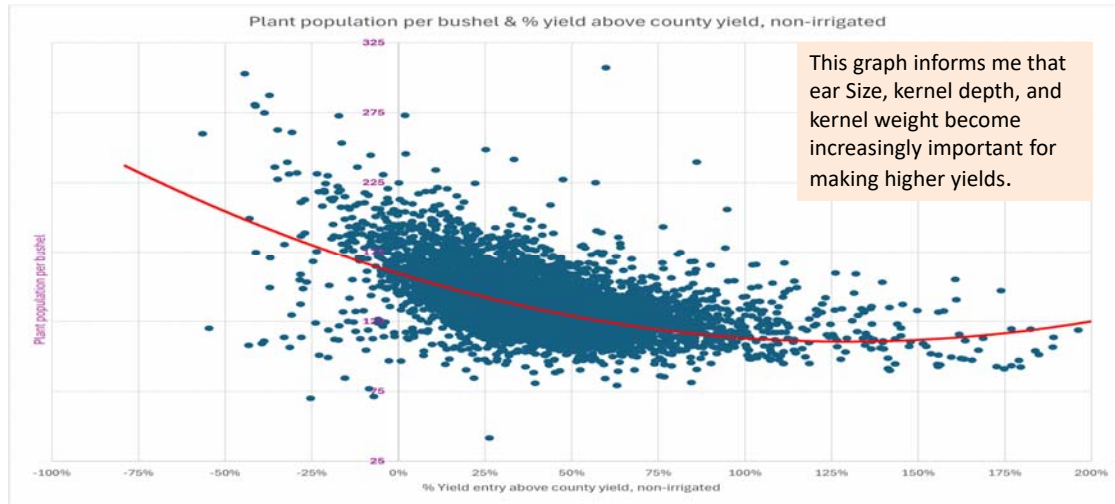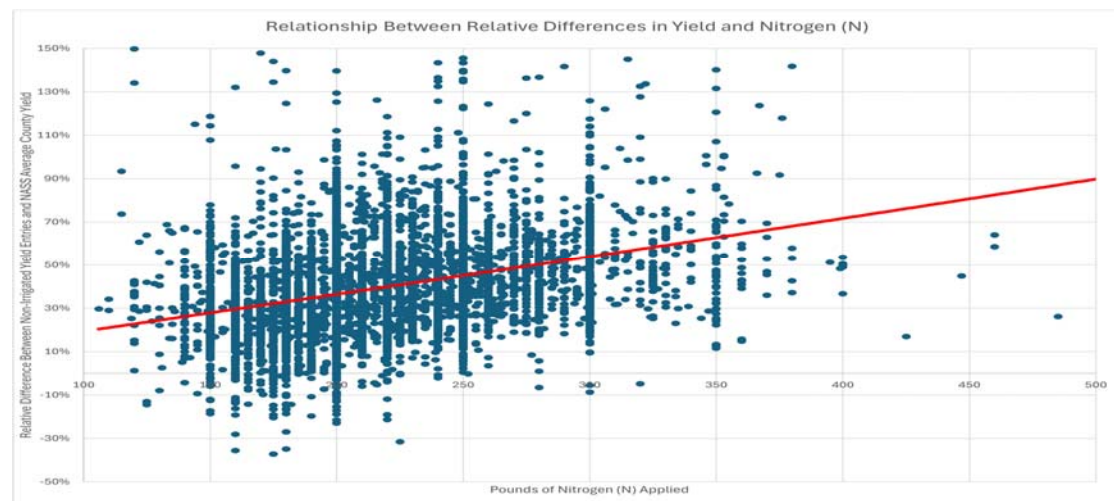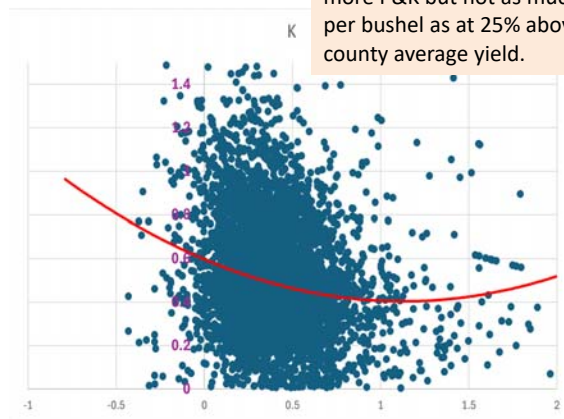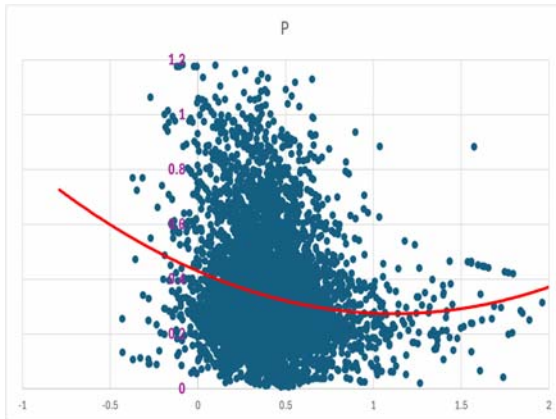

Non-irrigated entries in typically non-irrigated county (n = 6,300)

P & K applied per entry yield bushel

Keep in mind to get 50% above county average yield means it's going to take more P&K but not as much per bushel as at 25% above county average yield.

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Using a statistical model to separate out important factors leading to higher yield is the manufacturing equivalent of making ethanol, carbon dioxide, corn oil and distillers grains out of corn

- I used a statistical model to isolate individual factor input impact on yield from the mixed impacts of multiple factors on yield.
  - For example, nitrogen application versus nitrogen application and apply poultry litter.
  - For example, irrigated entry and plant population.

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Above County Average Yield

- IRRIGATION: 9.65%
- POULTRY LITTER: 8.97%
- TRACE NUTRIENTS: 3.70%
- INSECTICIDE: 2.11%
- FUNGICIDE: 1.60%

This impact is relative to the county avg. irrigated yield.

Context: 2.11% above 140-bushel yield is 2.95 bu; likely absolute benefit as well.
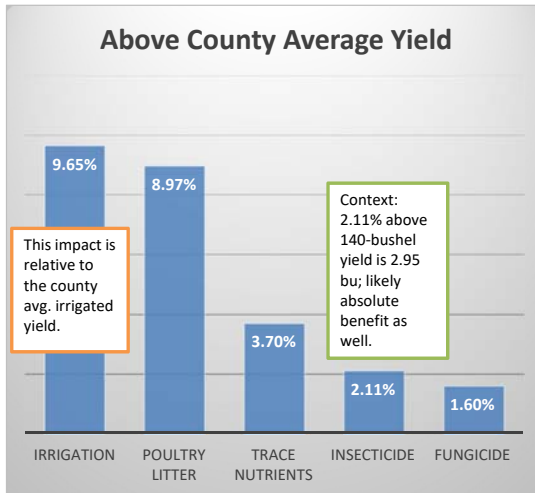
- Drop seed population by 5-8% & better yield
  - Avg. seed population is 34,300

- Choice of seed brand makes
  - Big caveat – hybrid, maturity, etc.

- Potassium (K)
  - Adding 1 lb/bushel yield increases relative yield by 8% (-$19 at $4 corn & $9 at $6.50 corn)
  - Adding 1 lb/bushel is a lot of added K per acre.

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Relationship between N Application and % Yield Above County Average
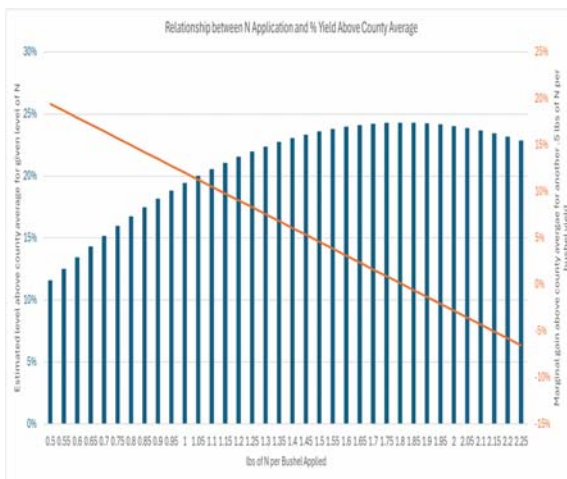
# of N applied	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5
Marginal Contribution above county average	140 bushel & $4/bushel corn	0.73%	1.42%	2.08%	2.70%	3.28%	3.83%	4.34%
cost of anhydrous (ton) $650		($1.32)	($2.86)	($4.59)	($6.54)	($8.70)	($11.06)	($13.63)
$700		($1.74)	($3.69)	($5.84)	($8.21)	($10.78)	($13.56)	($16.55)
$750		($2.16)	($4.52)	($7.09)	($9.87)	($12.86)	($16.06)	($19.46)
$800		($2.57)	($5.36)	($8.34)	($11.54)	($14.95)	($18.56)	($22.38)
$850		($2.99)	($6.19)	($9.59)	($13.21)	($17.03)	($21.06)	($25.30)
$900		($3.41)	($7.02)	($10.84)	($14.87)	($19.11)	($23.56)	($28.21)
$950		($3.82)	($7.86)	($12.09)	($16.54)	($21.20)	($26.06)	($31.13)

# of N applied	0.8	0.9	1	1.1	1.2	1.3	1.4	1.5
Marginal Contribution above county average	140 bushel & $6.50/bushel corn	0.73%	1.42%	2.08%	2.70%	3.28%	3.83%	4.34%
cost of anhydrous (ton) $650		$1.23	$2.13	$2.69	$2.91	$2.80	$2.34	$1.55
$700		$0.82	$1.30	$1.44	$1.25	$0.71	($0.16)	($1.37)
$750		$0.40	$0.46	$0.19	($0.42)	($1.37)	($2.66)	($4.28)
$800		($0.02)	($0.37)	($1.06)	($2.09)	($3.45)	($5.16)	($7.20)
$850		($0.43)	($1.20)	($2.31)	($3.75)	($5.54)	($7.66)	($10.12)
$900		($0.85)	($2.04)	($3.56)	($5.42)	($7.62)	($10.16)	($13.03)
$950		($1.27)	($2.87)	($4.81)	($7.09)	($9.70)	($12.66)	($15.95)

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When corn price is high and average planting conditions: risk management strategies
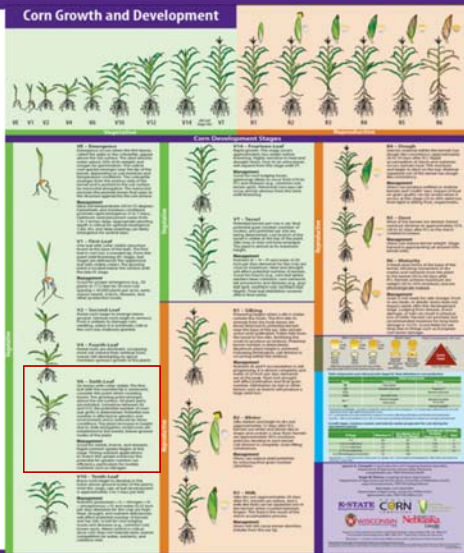
- Increase plant population rate by 5% (if already at 28k) or 10% (if already at 25k)
- Don't over till
- Don't change pre-plant N,P, or K
    - Supplemental N application after emergence & before V8
- Focus on the ear
    - Hybrid selection for high TW and ear size
    - Test for micronutrients (Zinc)
    - Minimize stress to roots at V6 forward: insect and fungus scouting & apply as necessary