Fertilizer Solutions and Opportunities

Fluid Technology Roundup

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Presentation Topics

A. N.A. Fertilization History

B. Plant Nutrition Today

C. Opportunities
- Farmer economics
- High yield systems
- 4 R's
- 16+ essential elements
- Weeds
- Decreasing soil nutrient levels

Fertilizer History 1940-50’s

Low rates /AC

NPK’s – all nutrients in same drop or granule

Limited bulk handling

Farmer applied with planters

Smaller applications

Fertilizer History 1960-70's

Fertilizer's Time

- Fertilizer's golden years
- Numbers of retailers expands
- Quality clear liquids and suspensions
- Bulk blends
- Increase of broadcast application
- Floaters/tenders
- Fertilizer grower meetings
- Industry marketed fertilizer and soil fertility concepts

Fertilizer History 1980-90's

New Weed Control Times

- Fertilizer application rates for P/K level out
- Weed/feed
- Farmers come to grower meeting for a free lunch and new chemical stories
- Fertilizer becoming a commodity
- Precision ag
- Variable rate application – fall 1986
- Crop consulting and services grow
- G.P.S. systems
- Yield monitors

Fertilizer History 2000-2010

Bio –tech

Rapid adoption of G.P.S.

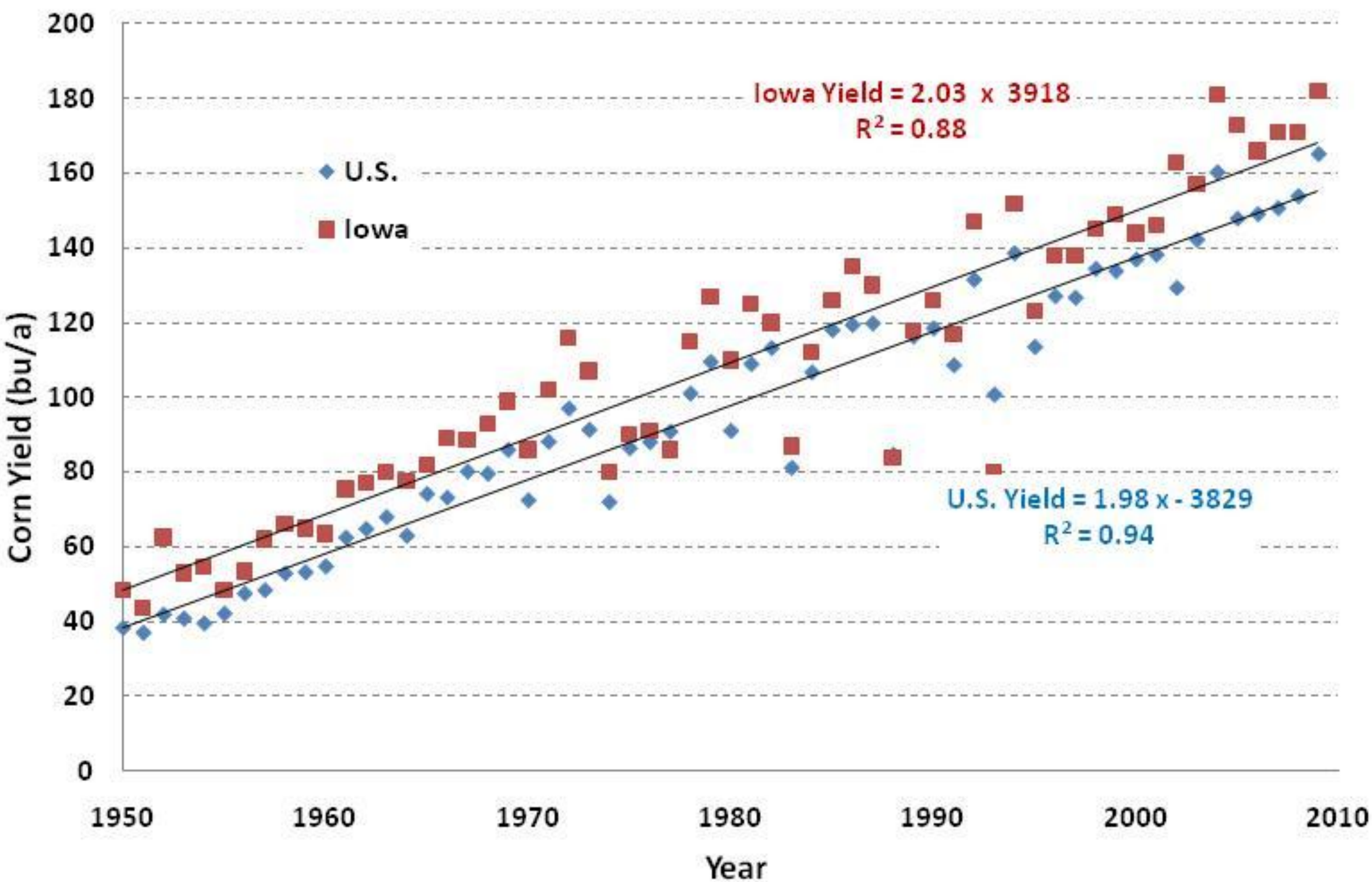
New high yield hybrids

Roundup

Information surplus

Rapid good/bad cycles

U.S. and Iowa Corn Yields - 1950-2009



Increasing Corn Yields

1970's - 2000: 1.9 bu/A/yr

2000-2009: 3 bu/A/yr

2030 goal: 250-300bu/A/yr or

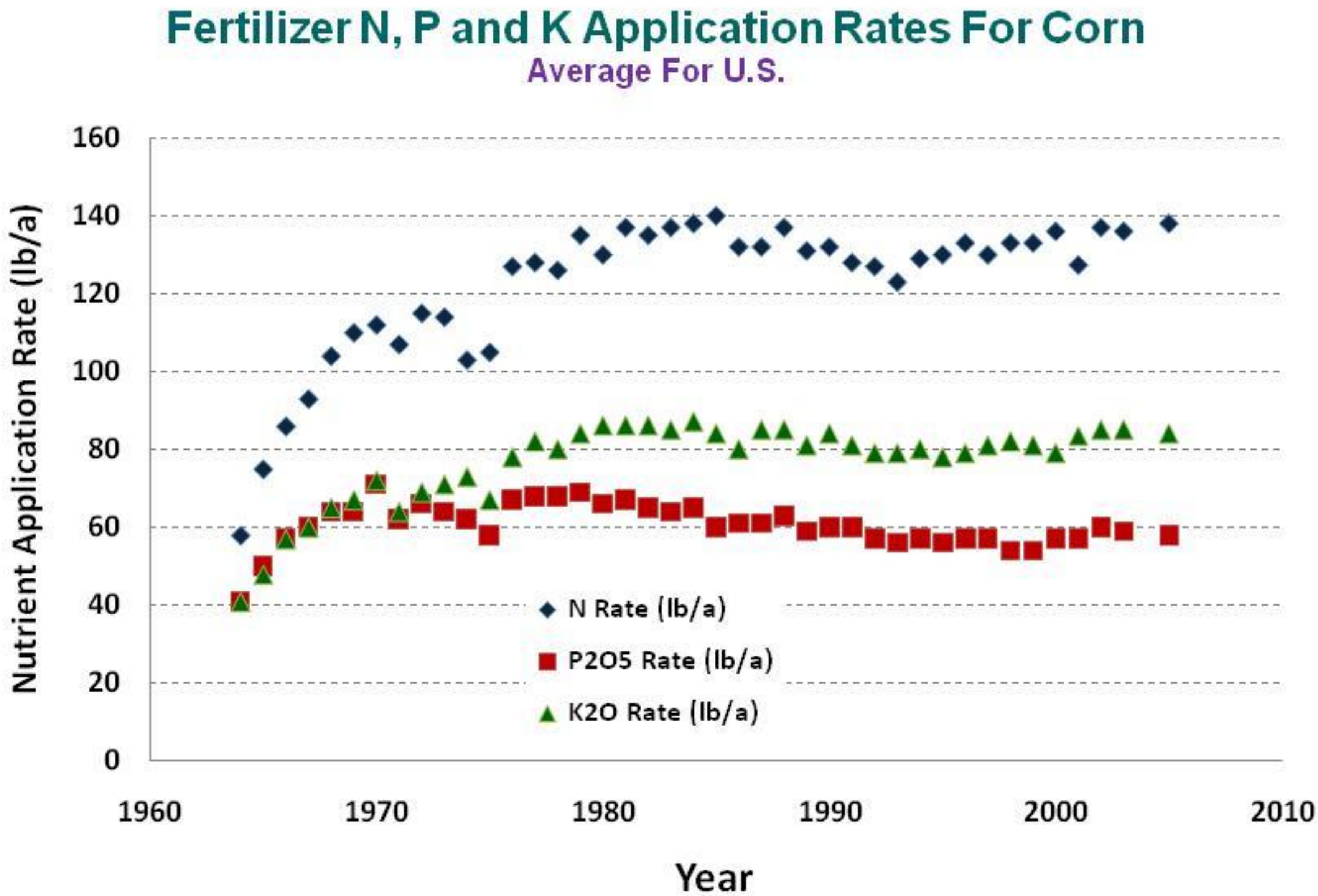
6bu/A/yr for next 20 years

Appleton, MN

Treatment	Yield (bu/ac)	
55K-250LB/AC	301.2	A
45K-250LB/AC	294.7	A
55K-125LB/AC	264.0	B
45K-125LB/AC	263.8	B
35K-125LB/AC	261.1	B
35K-250LB/AC	252.1	BC
45K-0LB/AC	243.0	BCD
35K-0LB/AC	232.6	CD
55K-0LB/AC	221.9	D
p-value	<0.0001	
LSD (0.1)	28.0	
CV (%)	6.4	

Means followed by a different letter are statistically significant (p<0.1)


CASE
1200 CASE IH



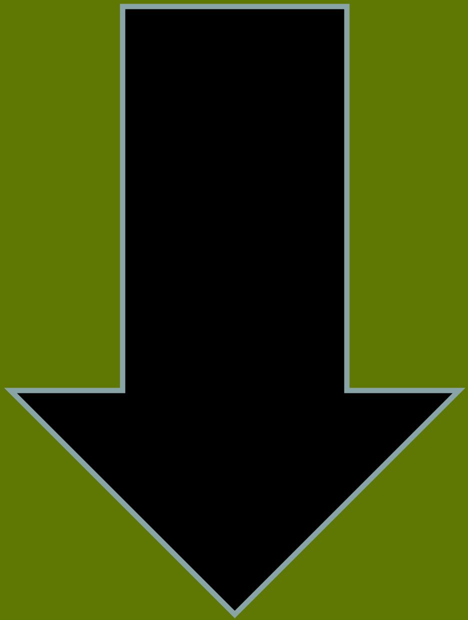
Fertilizer N, P and K Application Rates For Corn
Average For U.S.
Nutrient Application Rate (lb/a)
160
140
120
100
80
60
40
20
0
1960
1970
1980
1990
2000
2010
Year
N Rate (lb/a)
P2O5 Rate (lb/a)
K2O Rate (lb/a)

Farmer Dollars Gross/acre

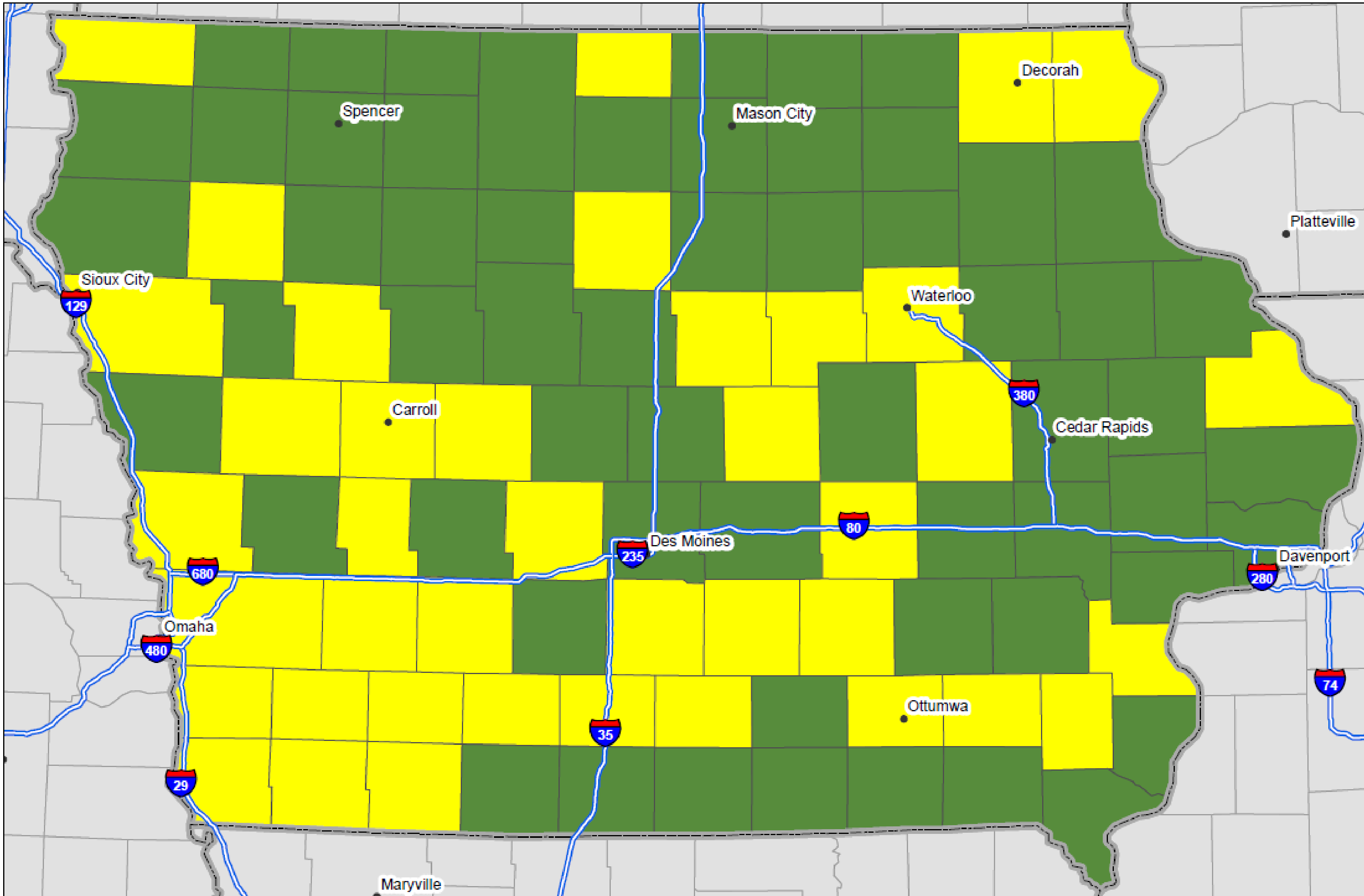
- 1990's
  - 150 bu/ac
  - Price/bu $1.90
  - LDP $.15
  - Gross/ac $307.50/ac
  - 1,000 acres - $307,500
- 2010
  - 205/bu/ac
  - Price/bu $4.60
  - Gross/ac $943/ac
  - 2000 acres $1,886,000

Different economic world today – higher gross, higher expenses, cash flows, risk, equipment size, etc.

- **Opportunity - Soil test levels are dropping**



N Nutrient Balance Map

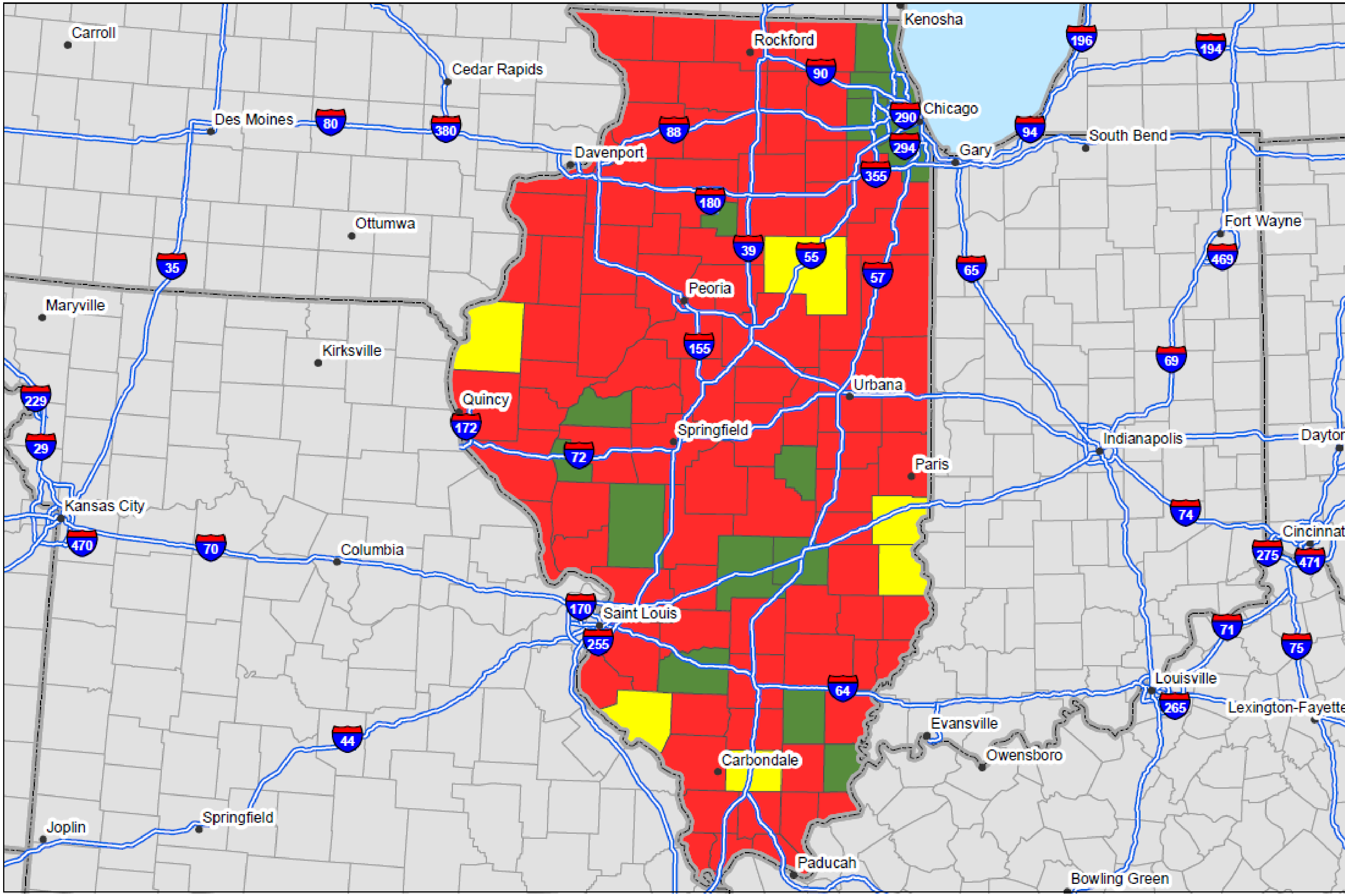


Nutrient inputs for 2007
Nutrient removal average of 2006 - 2008
Source: IPNI and PAQ - NuGIS Project

Removal less than nutrient replacement
Removal approx. equal to replacement
Removal exceeds nutrient replacement

Feb 24, 2010

P Nutrient Balance Map



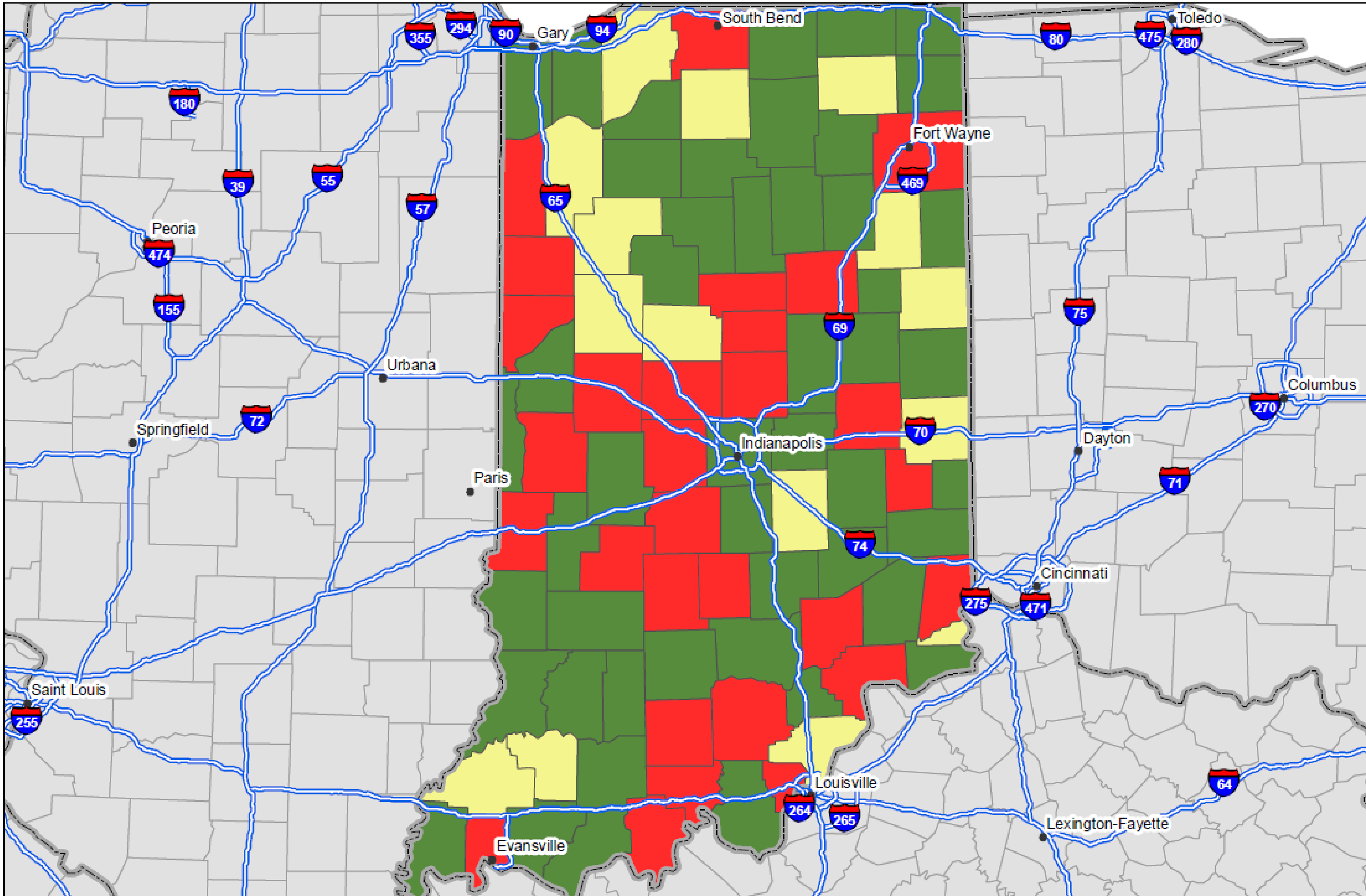
Nutrient inputs for 2007
Nutrient removal average of 2006 - 2008
Source: IPNI and PAQ - NuGIS Project

- Removal less than nutrient replacement
- Removal approx. equal to replacement
- Removal exceeds nutrient replacement

Feb 24, 2010

K Nutrient Balance Map

Mosaic



Nutrient inputs for 2007
Nutrient removal average of 2006 - 2008
Source: IPNI and PAQ - NuGIS Project

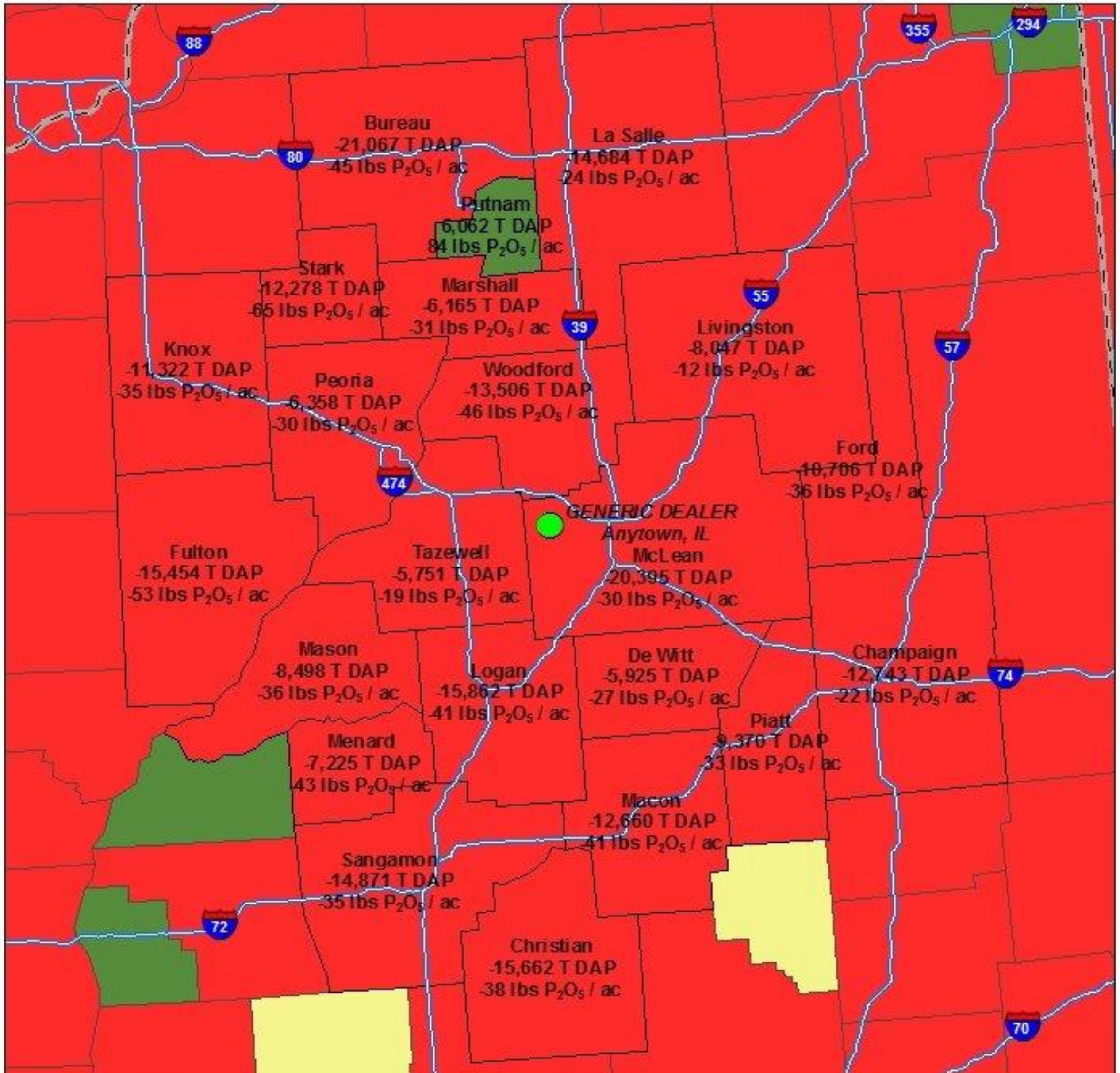
Indiana

Removal less than nutrient replacement
Removal approx. equal to replacement
Removal exceeds nutrient replacement

Nov 22, 2010

P Budget 2006-2008 Avg Yield + 20%

GENERIC DEALER - Anytown, IL



Labels represent the net budget of DAP in Tons and P_2O_5 in pounds per acre, remaining from inputs after removal by harvested crops, assuming crop yield 20% higher than the average yield.

Table below is a summary of all counties labeled on this map.

Total Harvested Acres
6,979,239

Net Tons of DAP
-242,487

Net Lbs of P_2O_5 / Harvested Acre
-30

Removal less than nutrient replacement
Removal approx. equal to replacement
Removal exceeds nutrient replacement

0 10 20 30 40 Miles

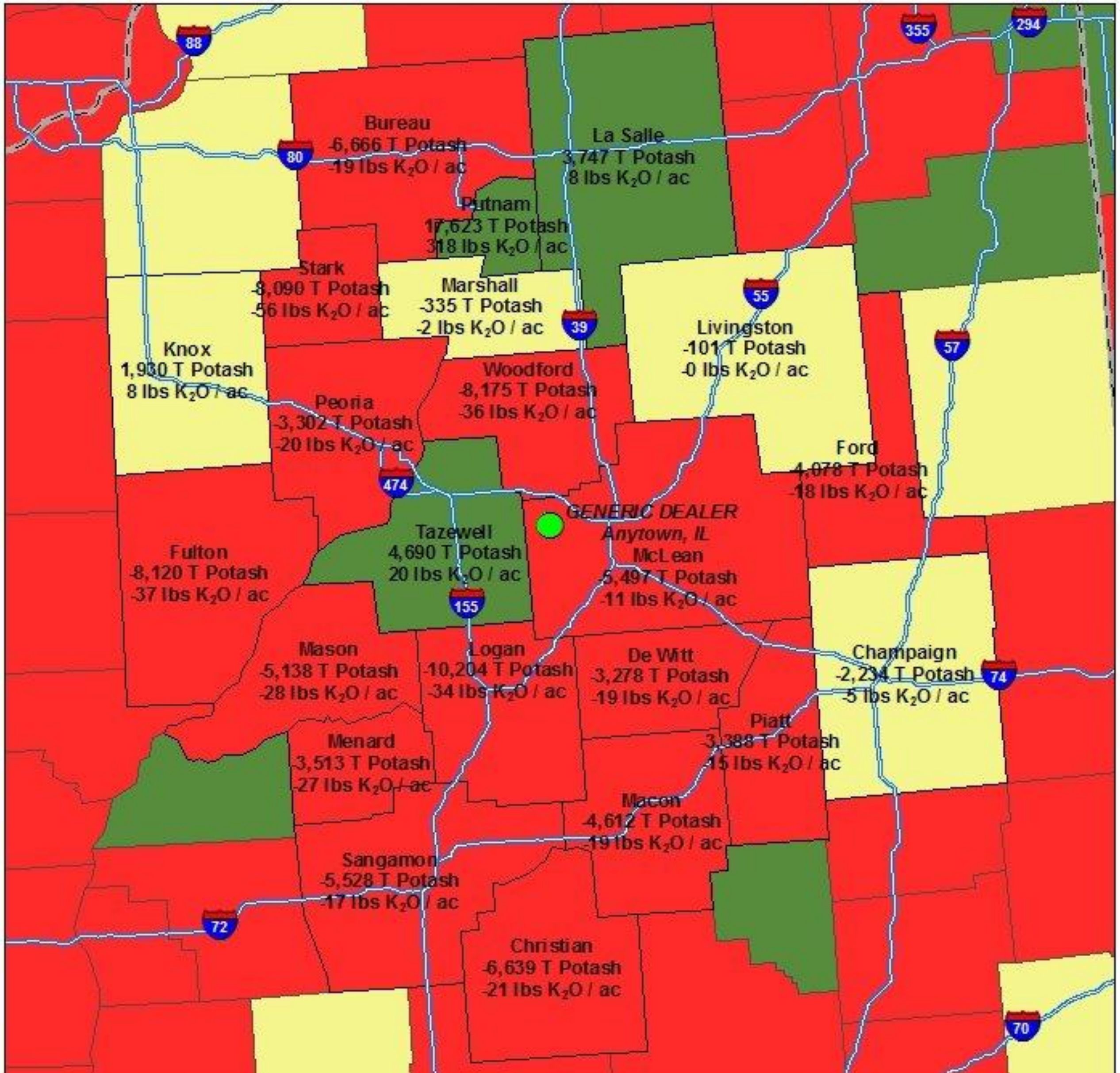
Map Code: 9000001_5011043_11

Sources: IPNI and PAQ Interactive - NuGIS Project

Oct 26, 2009

K Budget 2006-2008 Avg Yield + 20%

GENERIC DEALER - Anytown, IL



Mosaic

Labels represent the net budget of Potash in Tons and K_2O in pounds per acre, remaining from inputs after removal by harvested crops, assuming crop yield 20% higher than the average yield.

Table below is a summary of all counties labeled on this map.

Total Harvested Acres
6,979,239

Net Tons of Potash
-60,906

Net Lbs of K_2O / Harvested Acre
-1

Removal less than nutrient replacement
Removal approx. equal to replacement
Removal exceeds nutrient replacement

0 10 20 30 40 Miles

Map Code: 9000001_5011043_12

Sources: IPNI and PAQ Interactive - NuGIS Project

Oct 26, 2009

U.S. Corn Yield and Nutrient Applications

- Three Year Averages 1983-85 vs. 2003-05

Years	U.S. Corn Yield	Nutrient Application Rates			Rates per Bushel		
		N	P_2O_5	K_2O	N	P_2O_5	K_2O
	Bu / A	*- - - - - - Lbs / A - - - - - -*			*- - - - - - Lbs / Bu - - - - -*		
1983-85	101.9	138	63	85	1.36	0.62	0.84
2003-05	150.1	137	59	83	0.91	0.39	0.55

Sources: Compiled from ERS, TVA, AAPFCO, TFI data.

Soil Test P Levels Impacts*

	Low STP	VH STP	Yield Diff	Economies of high-P
P_20_5 Prior to corn	50 lbs/a	50 lbs/a		
Corn yields (3 yr av)	167 bu	193 bu	26 bu	$117.00**
Soybean yields (3 yr av)	39 bu	49 bu	10 bu	$97.50**

* Source: Randall, University of Minnesota
**Corn $4.50/bu, Soy $9.75/bu

Fertilizer Solutions for Lower Soil Fertility Trends

1. Combine systemic soil testing and yield MAPS to create nutrient balance MAPS by field for customers

2. Tell the story
   - Farm call topic
   - Newsletters
   - E-mail alerts
   - On-farm plots
   - Training and equipping sales/marketing staff

3. Tools for objection of cost of soil build decision, land tenure issue

4. Not an agronomy issue but marketing and economics

Opportunity – More Weeds!

Rapid trend back to preplant/preemerge weed control to supplement Roundup programs

Weed/feed with UAN

Weed/feed with NPK suspensions

Opportunity – High Yield Systems

Interactions

Rates

Placement

Timing

Source

4 R’s

Interactions/Rates

Higher nutrient levels required for population returns*

	Corn Yields		
Plant Population	Traditional 230+0+0	Enhanced 230+100+80+40S	Fertility Response
28,000	202	225	23
42,000	196	262	66
Population Response	-6	37	

*Kansas State University

Soil test for P and K - high

Liquids and High Yields

Placement and timing become very important +liquids

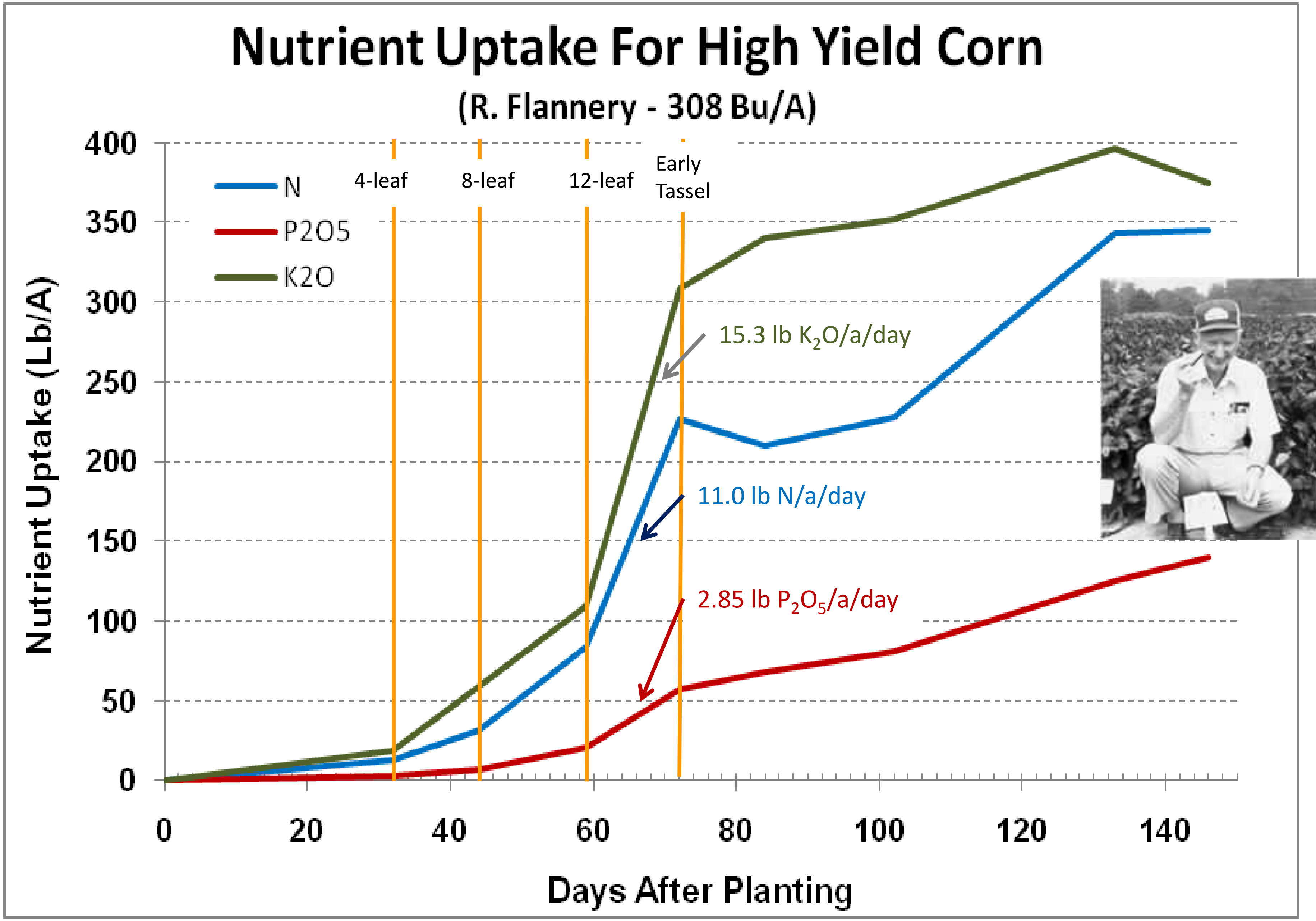
Need to go beyond N-P-K + liquids

Stalk yields with high population + liquids

Starters with big planters + liquids

Late season applications + liquids

Increase total nutrient uptake and amounts/day + liquids


Nutrient Uptake For High Yield Corn
(R. Flannery - 308 Bu/A)
N
P2O5
K2O
4-leaf
8-leaf
12-leaf
Early Tassel
15.3 lb K_2O/a/day
11.0 lb N/a/day
2.85 lb P_2O_5/a/day
Nutrient Uptake (Lb/A)
0
50
100
150
200
250
300
350
400
0
20
40
60
80
100
120
140
Days After Planting

Beyond N-P-K

16+ essential nutrients

Sulfur

1. More low S soil test
2. High yields
3. N/S, P/S interactions
4. Sulfate/elemental issue
5. Stalks and immobilization issues

Zinc

37% of soil samples in IPNI survey below critical level in zinc

Boron, Mn – Soybeans?

N-P-K-S*

Treatment	Corn Yields bu/ac
Check	137
N	187
N +P	243
N+P+K	256
N+P+K+S	265

*Kansas State University

Liquids and Micro's

Coverage /ft^2

Placement

Timing

Response maybe in parts of field vs. general

Yield increases 5-10 bu – hard to see without plots and yield measurements

Carrier for micro's

Reinforcing a Commodity Fertilizer Program

1. Dad was well trained in 70’s on fertility so new farm decision makers already understand soil fertility and fertilization

2. Soil testing for field average is fine

3. It’s too hot in growing corn to collect plant tissue samples

Reinforcing a Commodity Fertilizer Program

4. My customer are fine with 180-200 bu corn yields

5. High yields clubs are for 80-90’s

6. All fertilizer sources are the same “if applied correctly”.

7. Farmers will not pay for helping transform information and data into crop production decision.

Etc.