

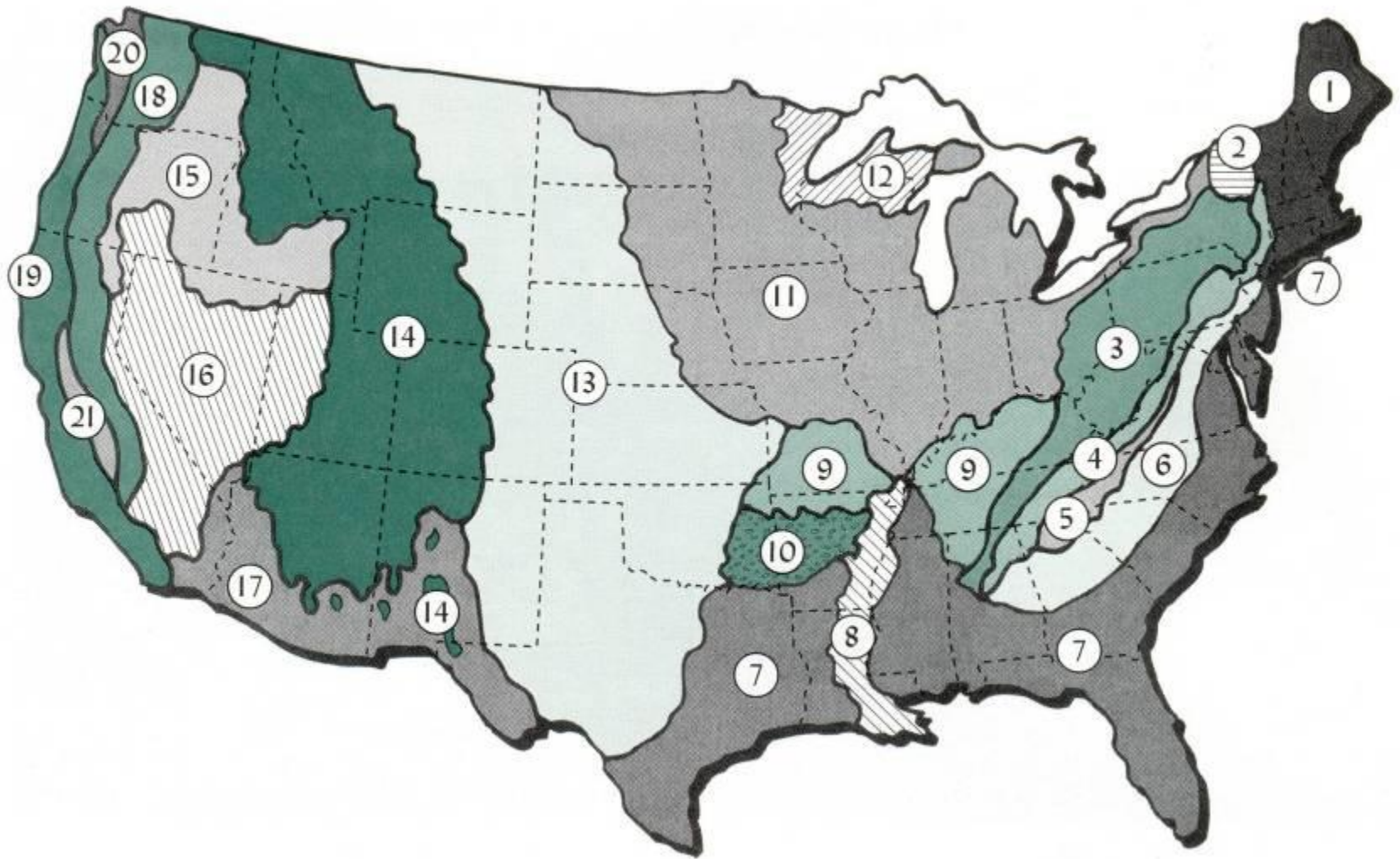
Fertilizing Corn (and Cotton) with N-P-K By Yield Goal

Glen Harris
University of Georgia

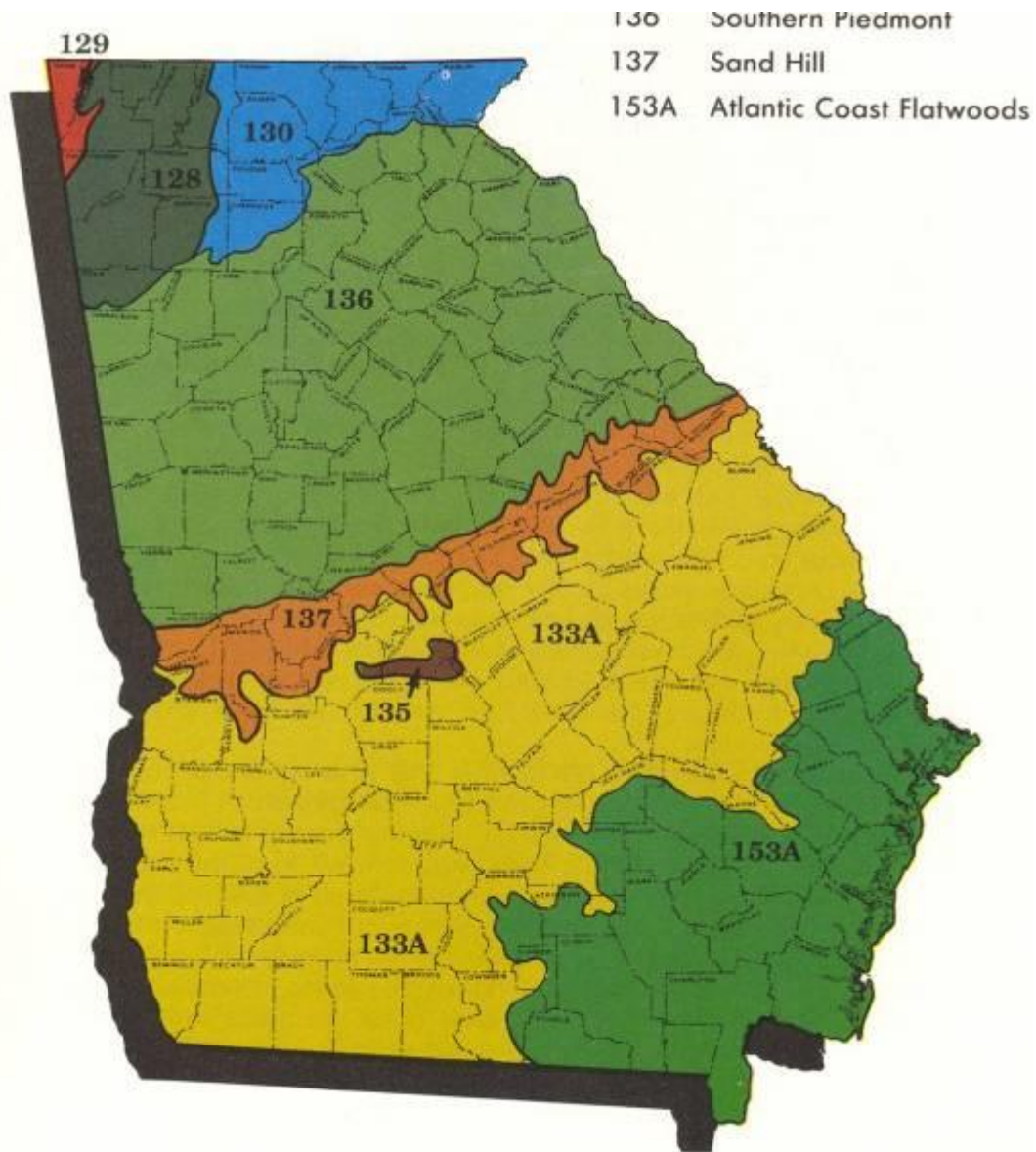


Glendon Hamilton Harris, Jr.

- Egg Harbor City, NJ
- BS – Penn State (1985)
- MS – Michigan State(1988)
- PhD – Michigan State (1993)
- Farm Background – Vegetables & Cut Flowers (NJ) and Alfalfa, Corn & Soybeans (PA)
- UGA Extension Agronomist – Soils & Fertilizer
- Since March 1994 @ UGA Tifton Campus
- Hobbies/Interests – Gardening, Reading, Music



Soil Regions of the United States



Soil Regions of Georgia

Georgia Soils

- In General
- Ultisols
- Highly Weathered
- Poorly Buffered
- Acidic (Low pH)
- Low Fertility
- Low Organic Matter



How Much Fertilizer Do I Need for 300 Bushel Corn ?

Soil Test Handbook of Georgia (aesl.ces.uga.edu)

Base (Irrigated) Yield Goal = 150 bu/a

For every 10 bushel increase → add 12-6-10 (lbs N-P₂O₅-K₂O/a)

Mehlich 1 Soil Test P/K	<u>Yield Goal (bu/a)</u>			
	<u>150</u>	<u>200</u>	<u>250</u>	<u>300</u>
Low/Low	180-110-130	240-140-180	300-170-230	360-200-280
Med/Med	180-90-90	240-120-140	300-150-190	360-180-240
High/High	180-70-70	240-100-120	300-130-170	360-160-220

4Rs = Rate, Timing, Source and Placement

Bowen Farm in Tifton : 2013-2017

Flatwood Soil (Leefield)
Irrigated
Corn-Peanut-Tobacco



High Yield Corn Study - 2016

<u>Yield Goal (bu/a)</u>	<u>lbs N-P2O5-K2O</u>
Starter Only	46 - 41 - 0
150	150- 90- 80
200	210-120-130
250	270-150-180
300	330-180-230
500	570-300-430

M17-01: Bowen Farm Corn High Yield Study 2017 (Pivot A)

M17-02					
3	4	6	2	1	5
19	20	21	22	23	24
7' Alley					
2	1	4	5	6	3
13	14	15	16	17	18
7' Alley					
6	3	5	1	2	4
7	8	9	10	11	12
7' Alley					
1	2	3	4	5	6
1	2	3	4	5	6

Treatment Key:

1	Starter Only 10gal each 10-34-0 and 28-0-0-5(S) (gave 46-41-0 at planting)
2	150bu/a yield goal (22oz 5-10-15/row middle + 3.3oz 0-0-60/row middle)
3	200bu/a yield goal (22oz 5-10-15/row middle + 7oz 0-0-60/row middle)
4	250bu/a yield goal (22oz 5-10-15/row middle + 10.6oz 0-0-60/row middle)
5	300bu/a yield goal (22oz 5-10-15/row middle + 14.3oz 0-0-60/row middle)
6	500bu/a yield goal (22oz 5-10-15/r.m. + 29oz 0-0-60/r.m. + 10.6 oz 10-50-0/r.m.)

Sidedress Rates: ALL with 28-0-0-5(S)

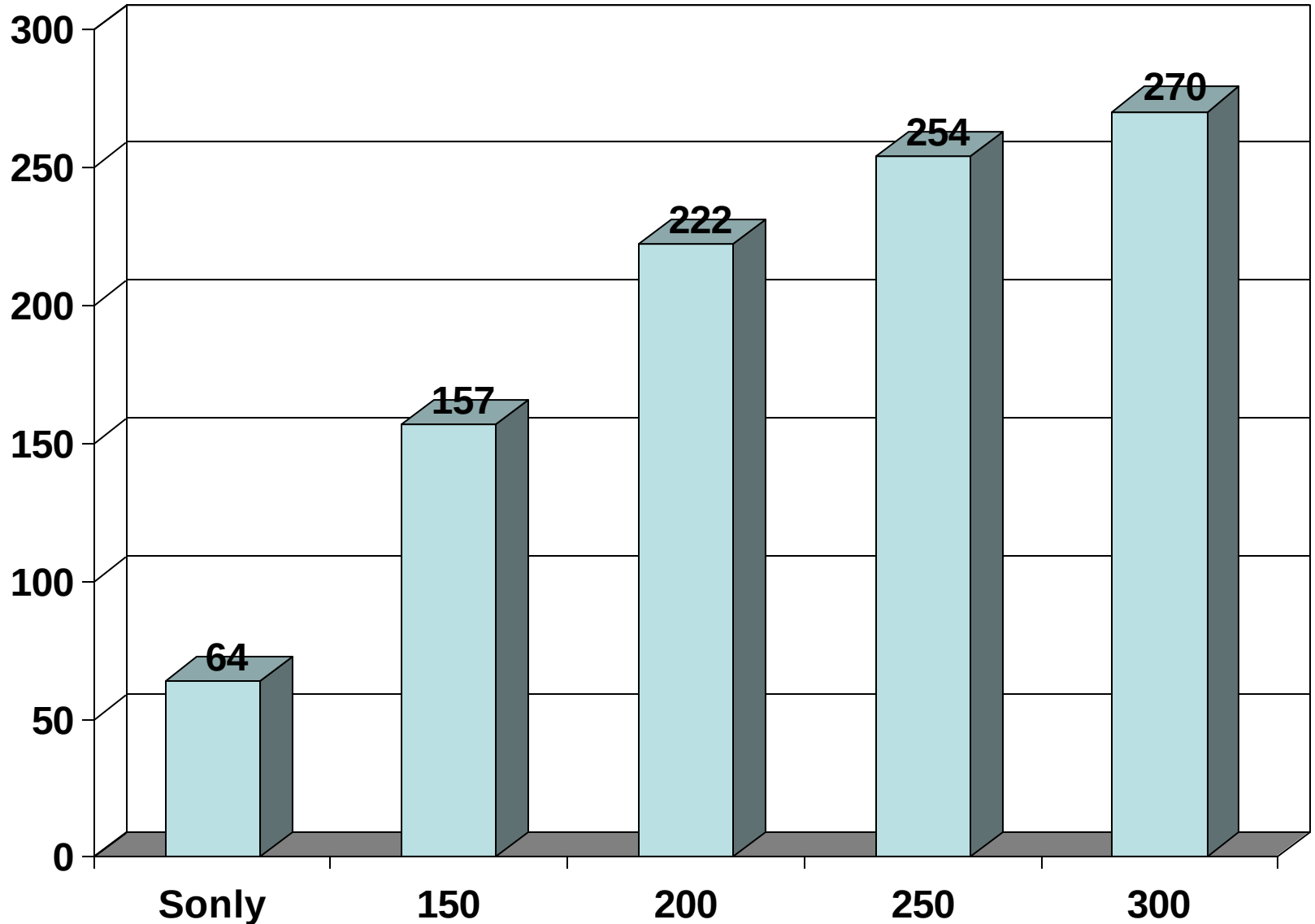
1	None
2	3.4oz/row twice
3	5.9oz/row twice
4	8.5oz/row twice
5	11.1oz/row twice
6	21.4oz/row twice

Important Events:

High Yield Corn – 2013

Bu/a

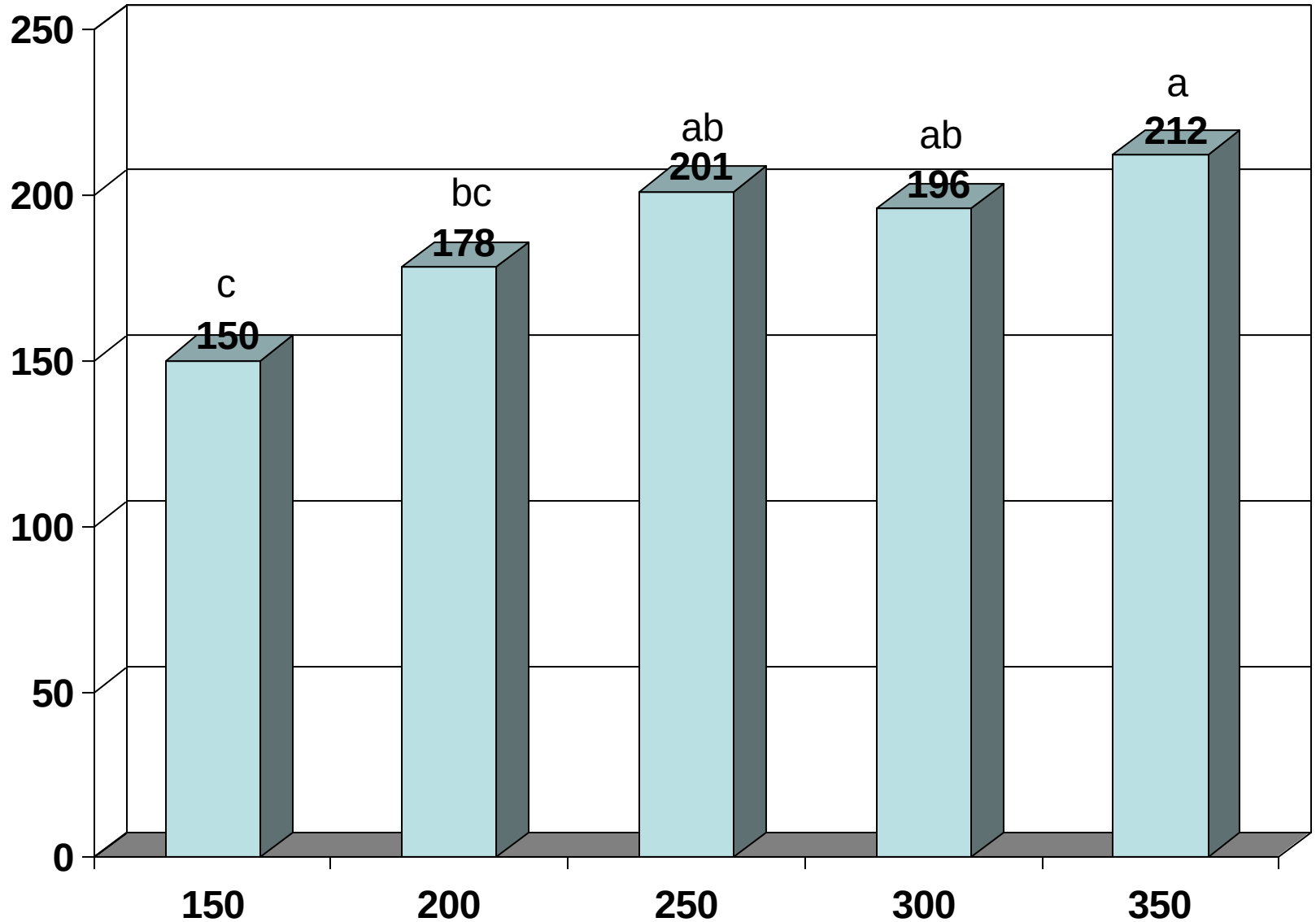
(Pioneer 2023 35,000 pop. planted 3/20)



High Yield Corn – 2014 Bowen Farm

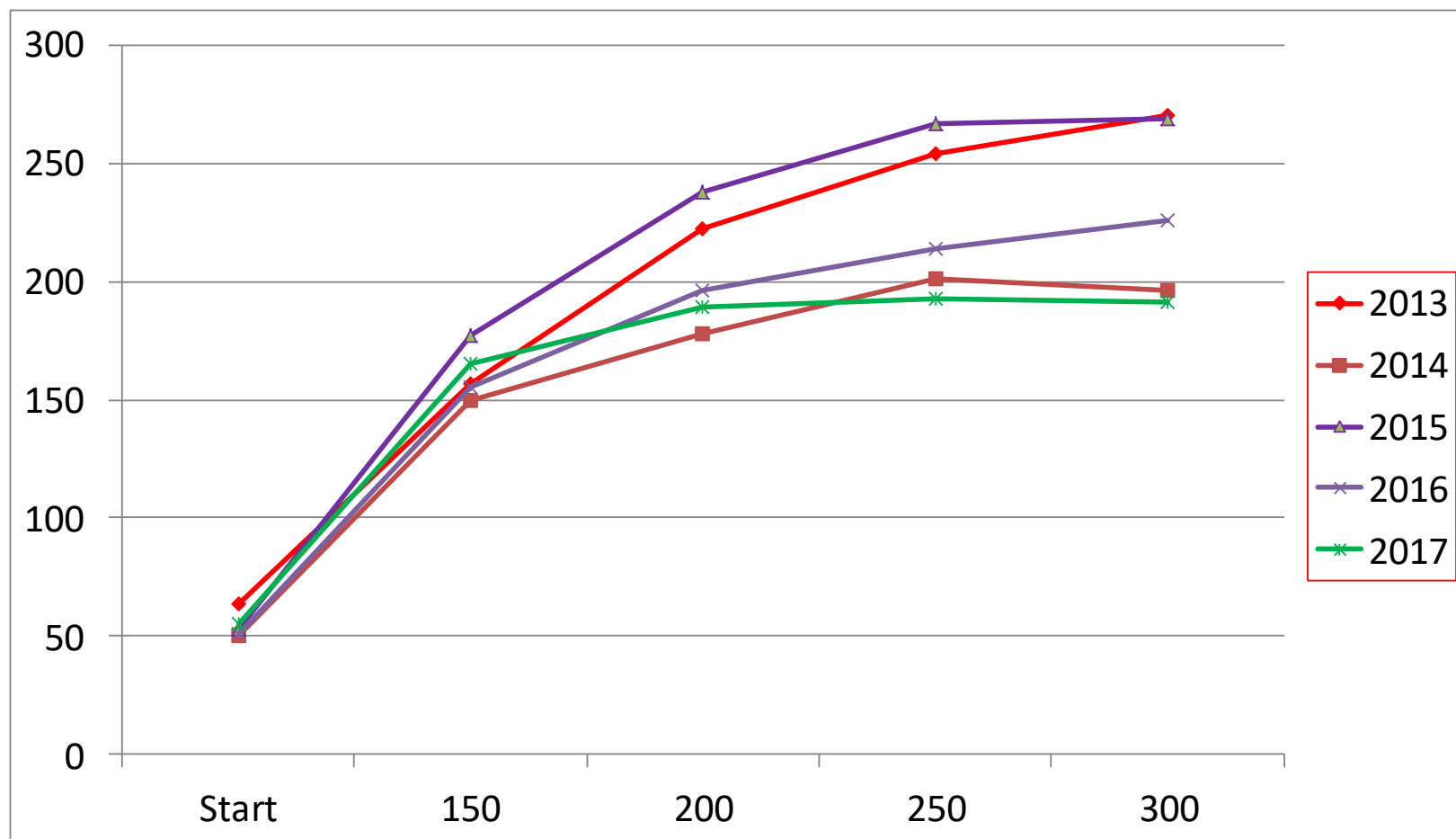
Bu/a

(Dekalb66-97 35,000 pop. planted 3/28)



Fertilizing Corn (N-P-K) By Yield Goal

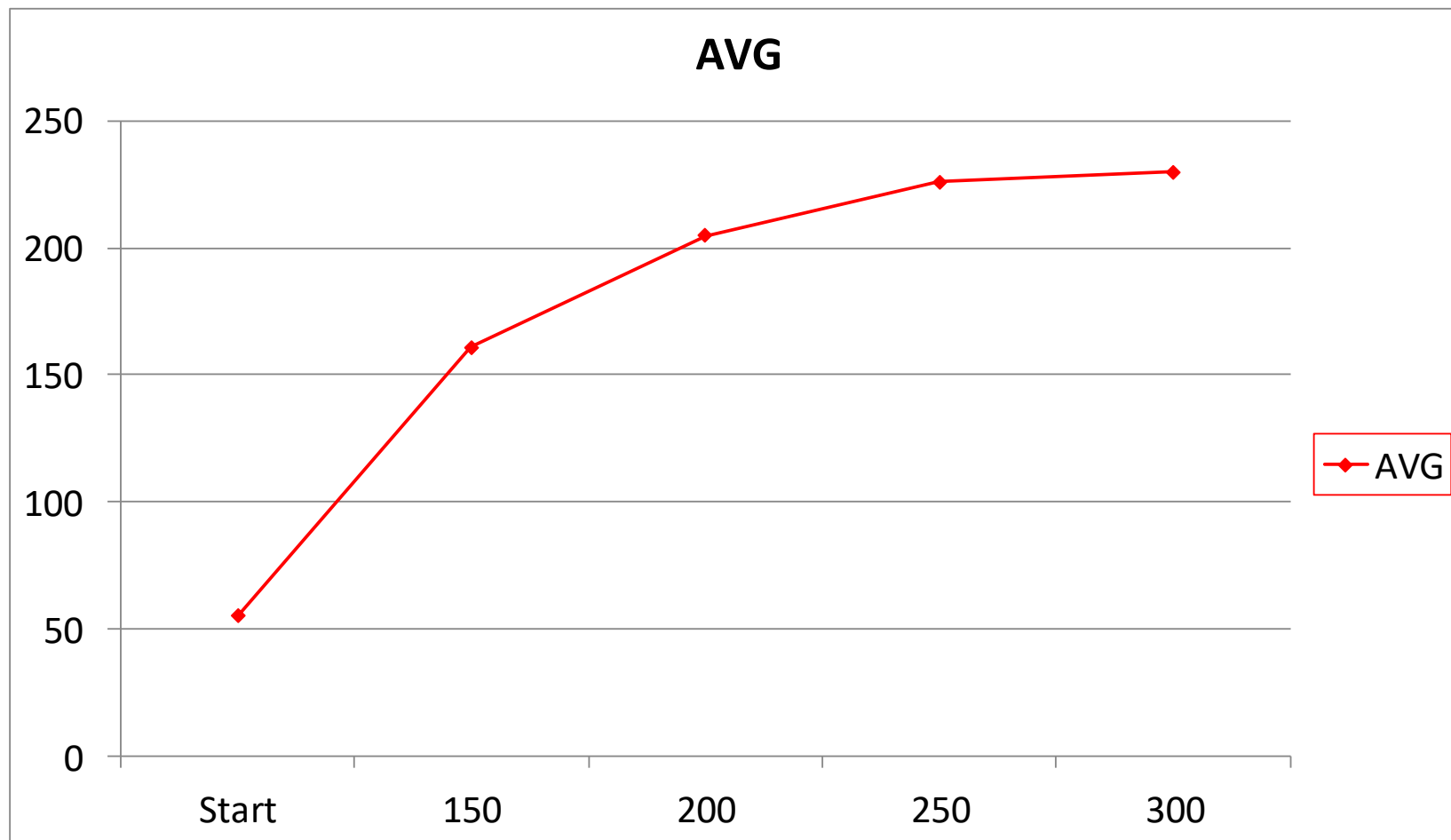
Actual Yield (bu/a)



Yield Goal (bu/a)

Fertilizing Corn (N-P-K) By Yield Goal

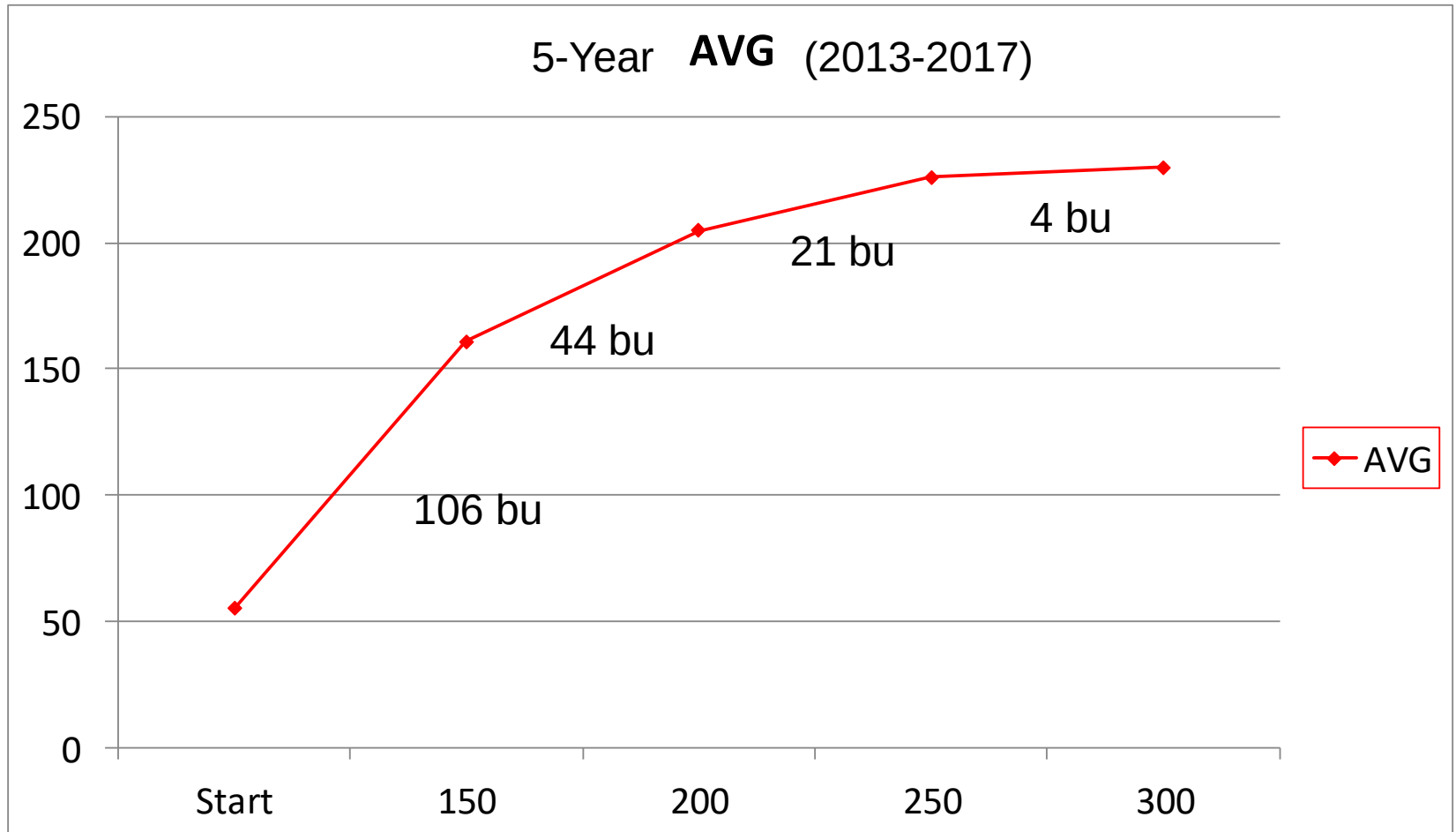
Actual Yield (bu/a)



Yield Goal (bu/a)

Fertilizing Corn (N-P-K) By Yield Goal

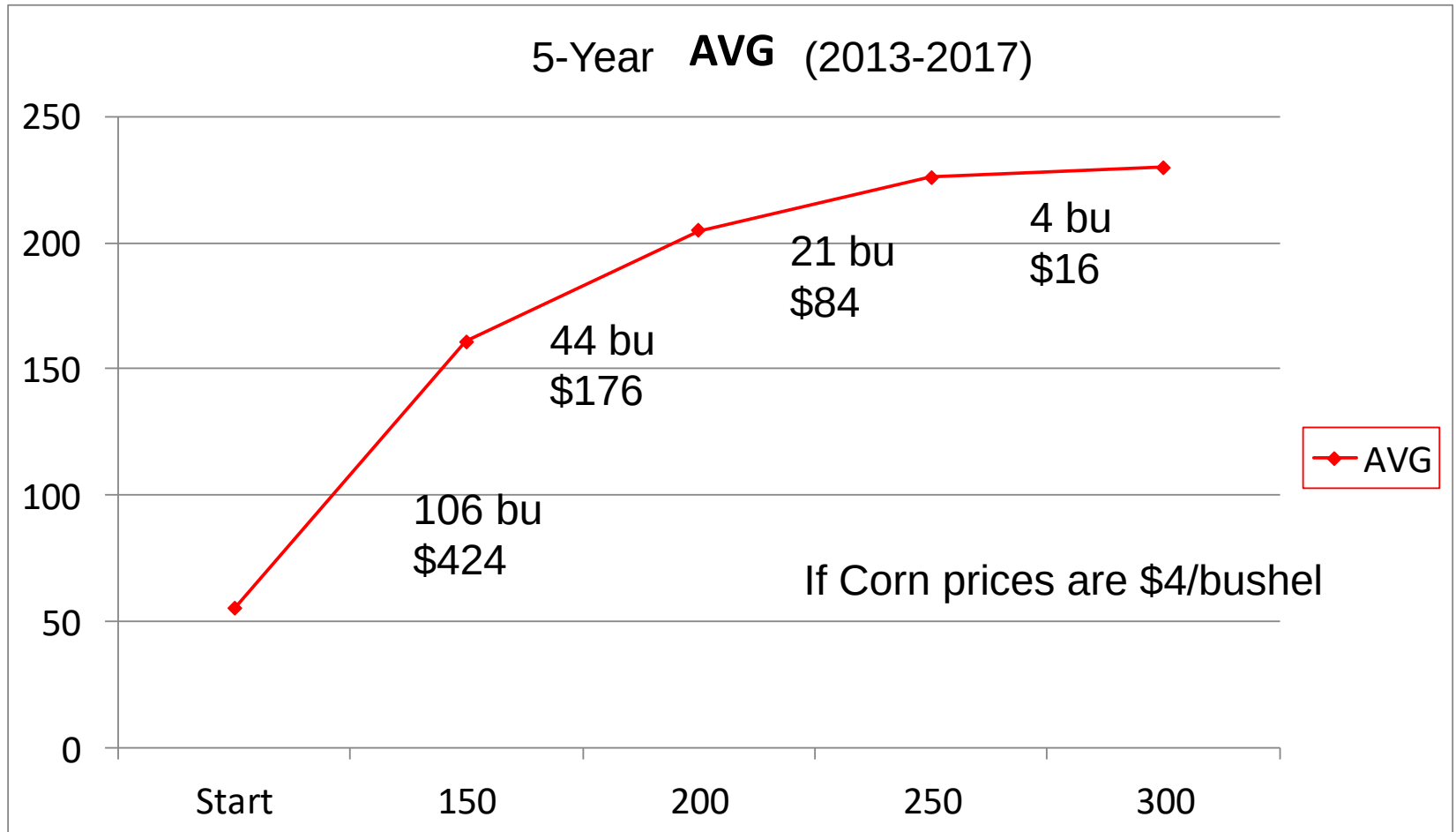
Actual Yield (bu/a)



Yield Goal (bu/a)

Fertilizing Corn (N-P-K) By Yield Goal

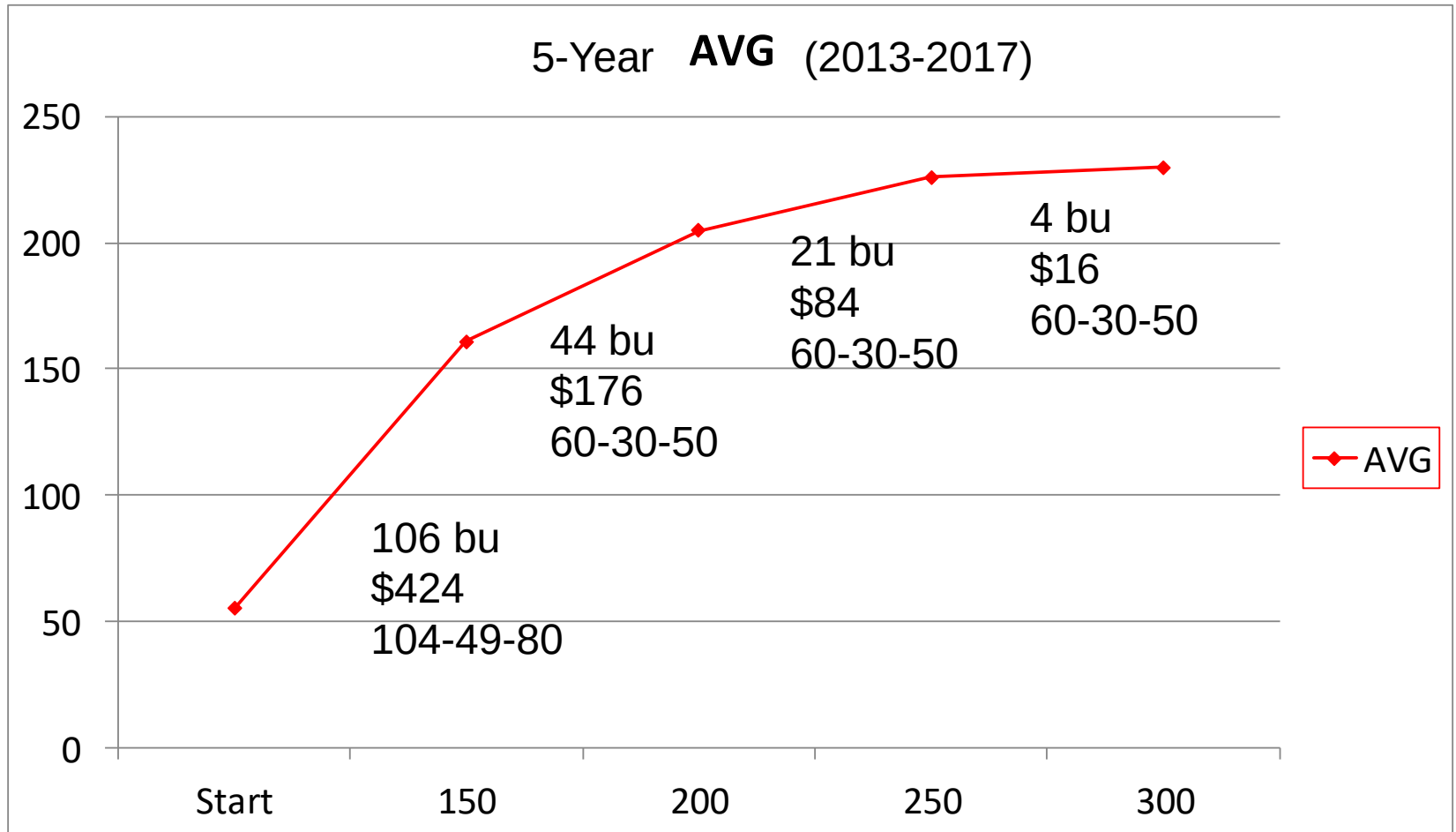
Actual Yield (bu/a)



Yield Goal (bu/a)

Fertilizing Corn (N-P-K) By Yield Goal

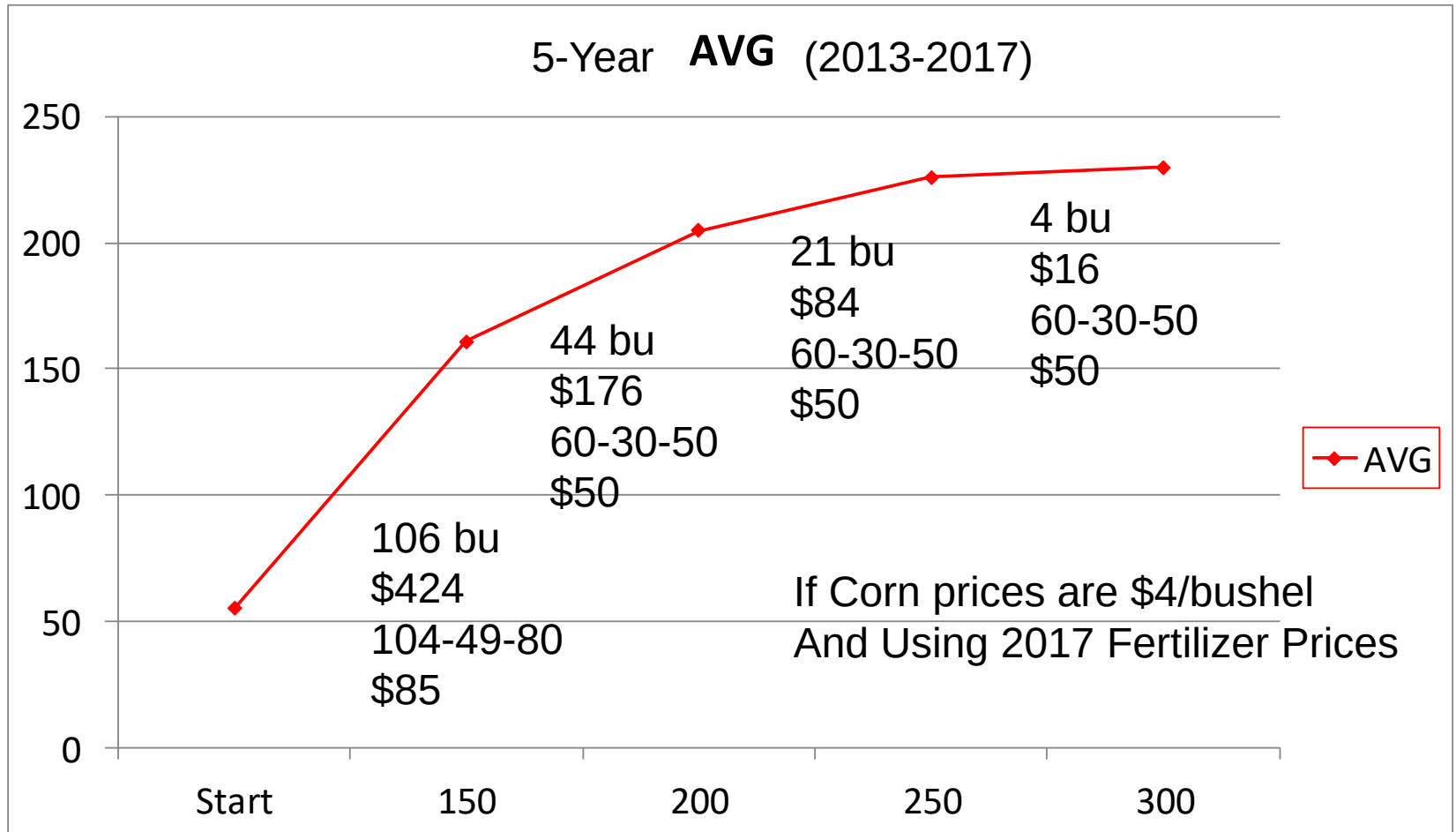
Actual Yield (bu/a)



Yield Goal (bu/a)

Fertilizing Corn (N-P-K) By Yield Goal

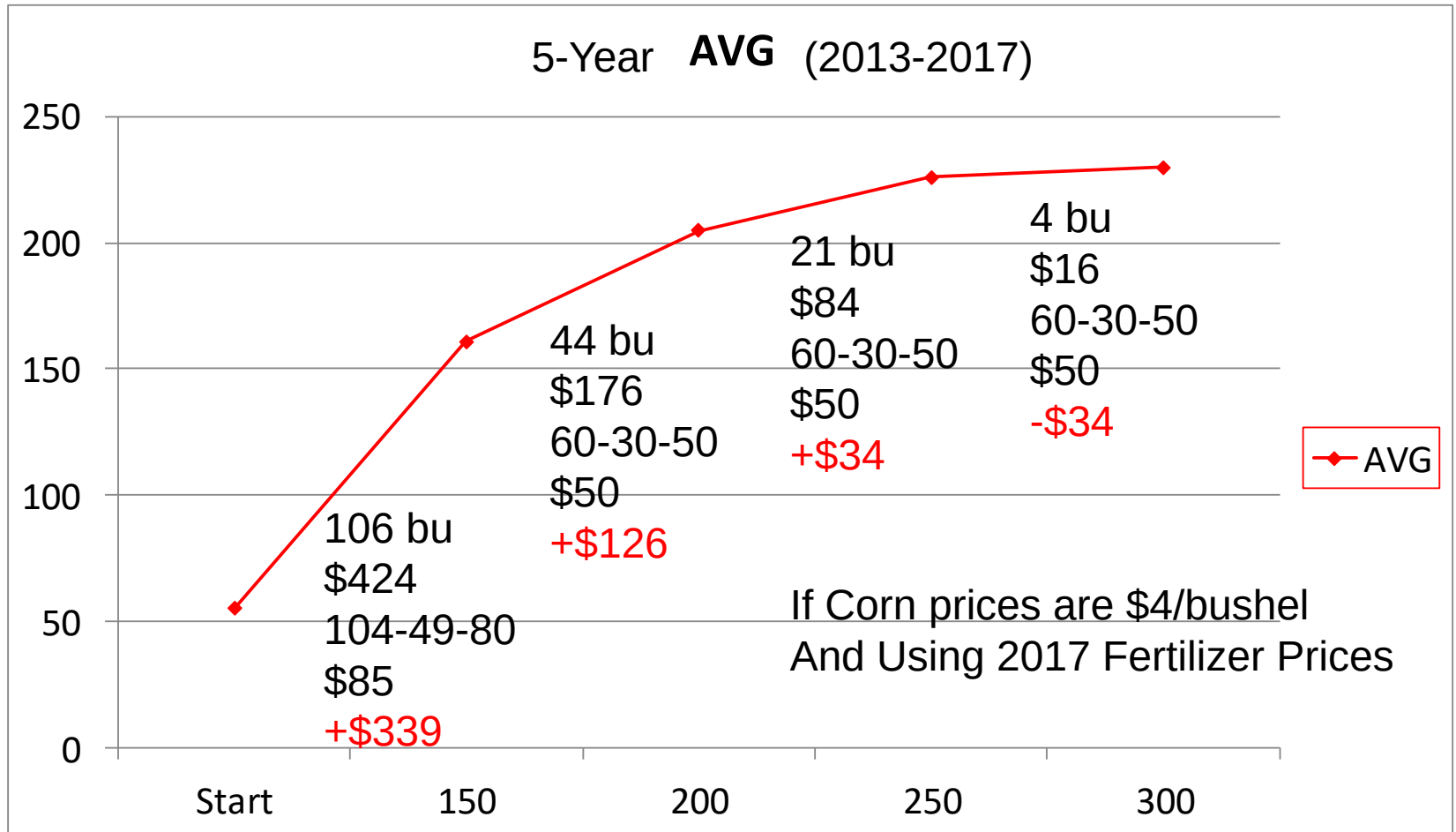
Actual Yield (bu/a)



Yield Goal (bu/a)

Fertilizing Corn (N-P-K) By Yield Goal

Actual Yield (bu/a)



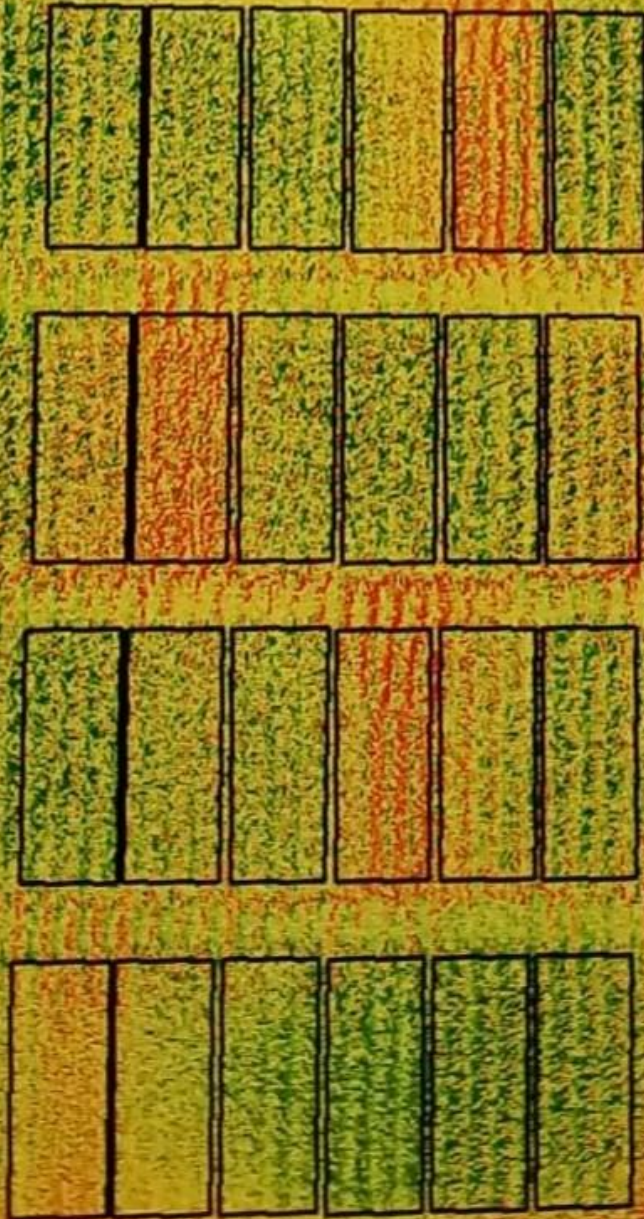
Yield Goal (bu/a)

Pivot A

Flight 5

09 June 2017





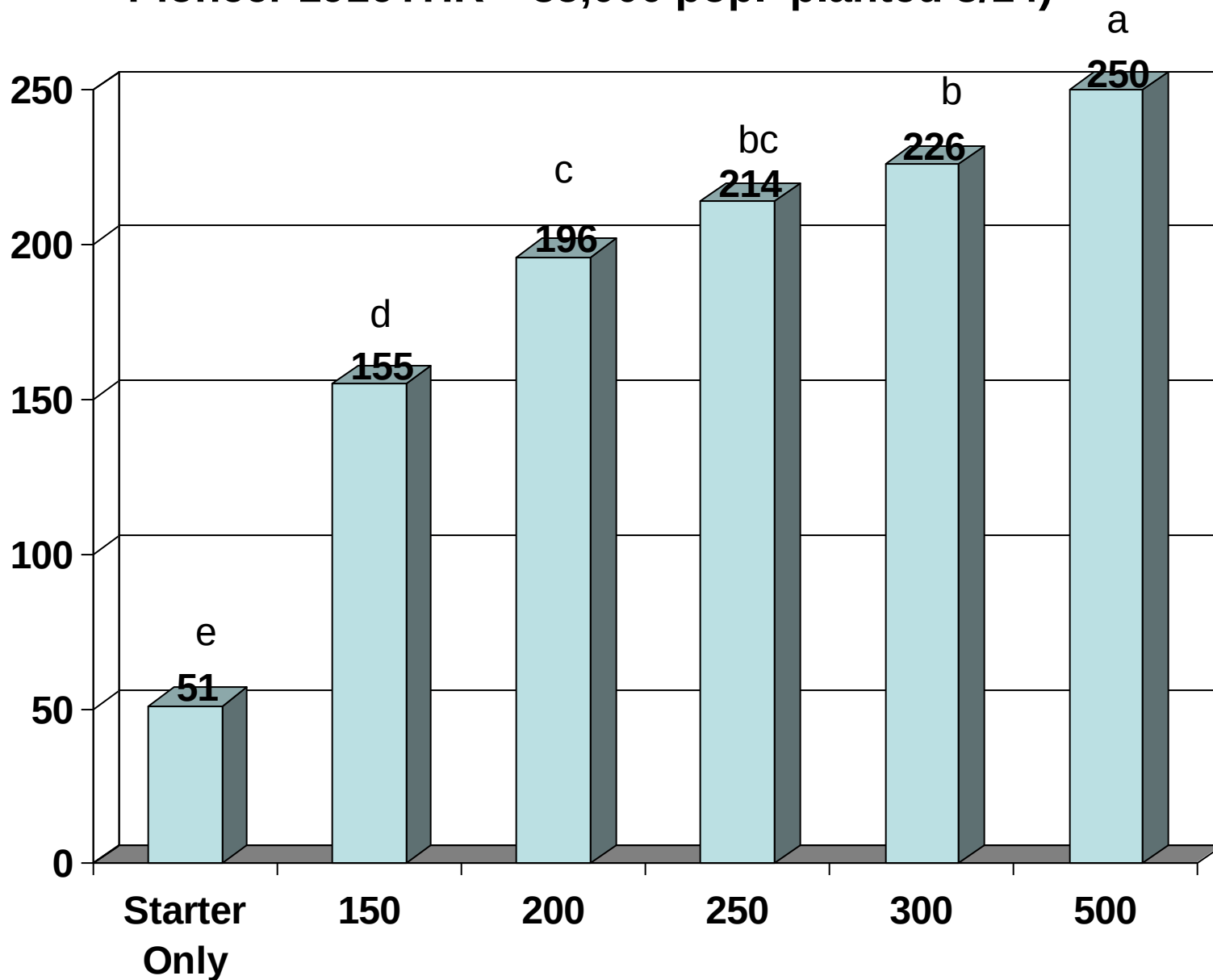
“NDRE”

(Normalized Difference Red Edge)

High Yield Corn – 2016 Bowen Farm

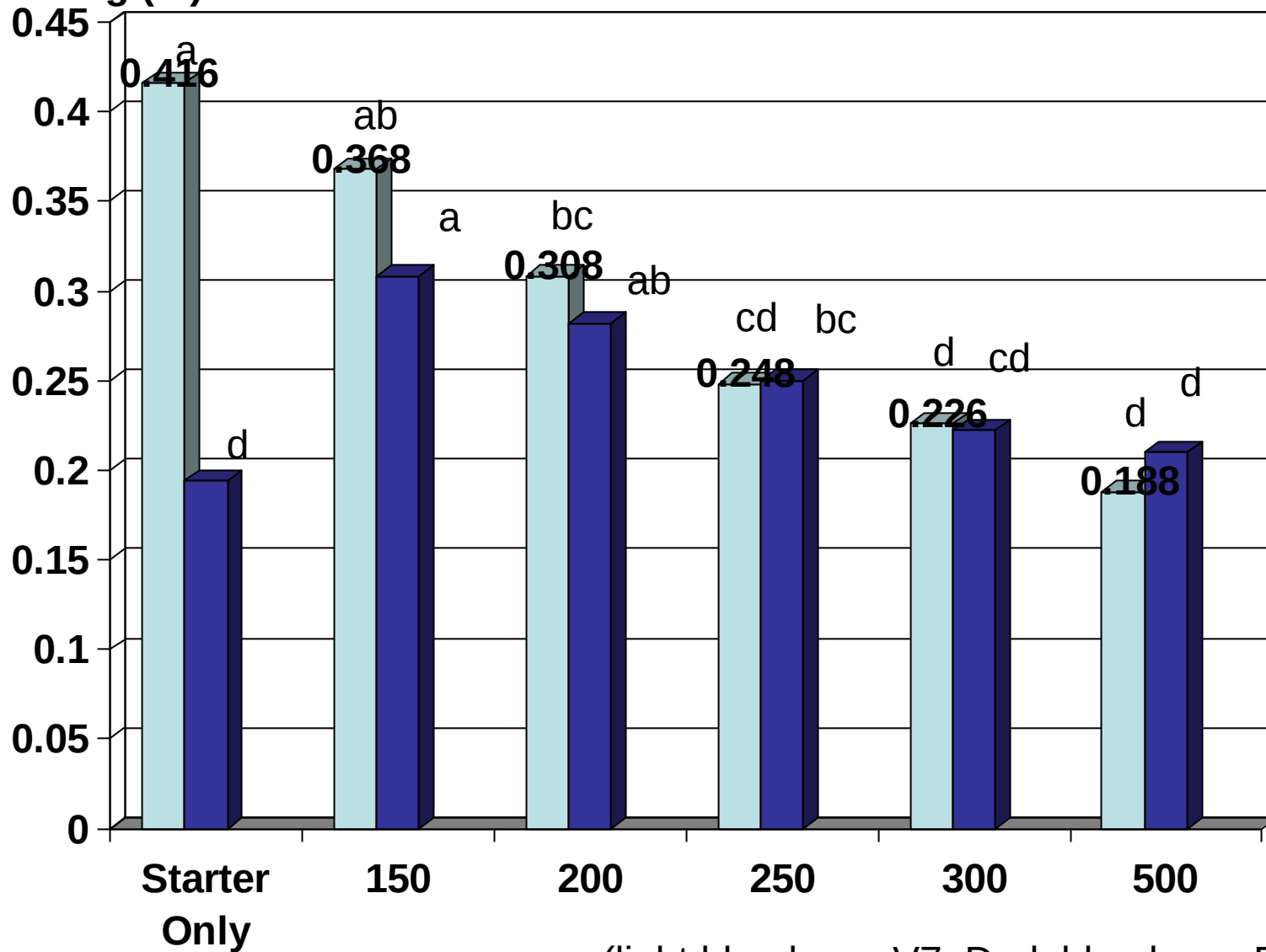
Pioneer 1916YHR 35,000 pop. planted 3/14)

Bu/a



High Yield Corn – 2016 Bowen Farm

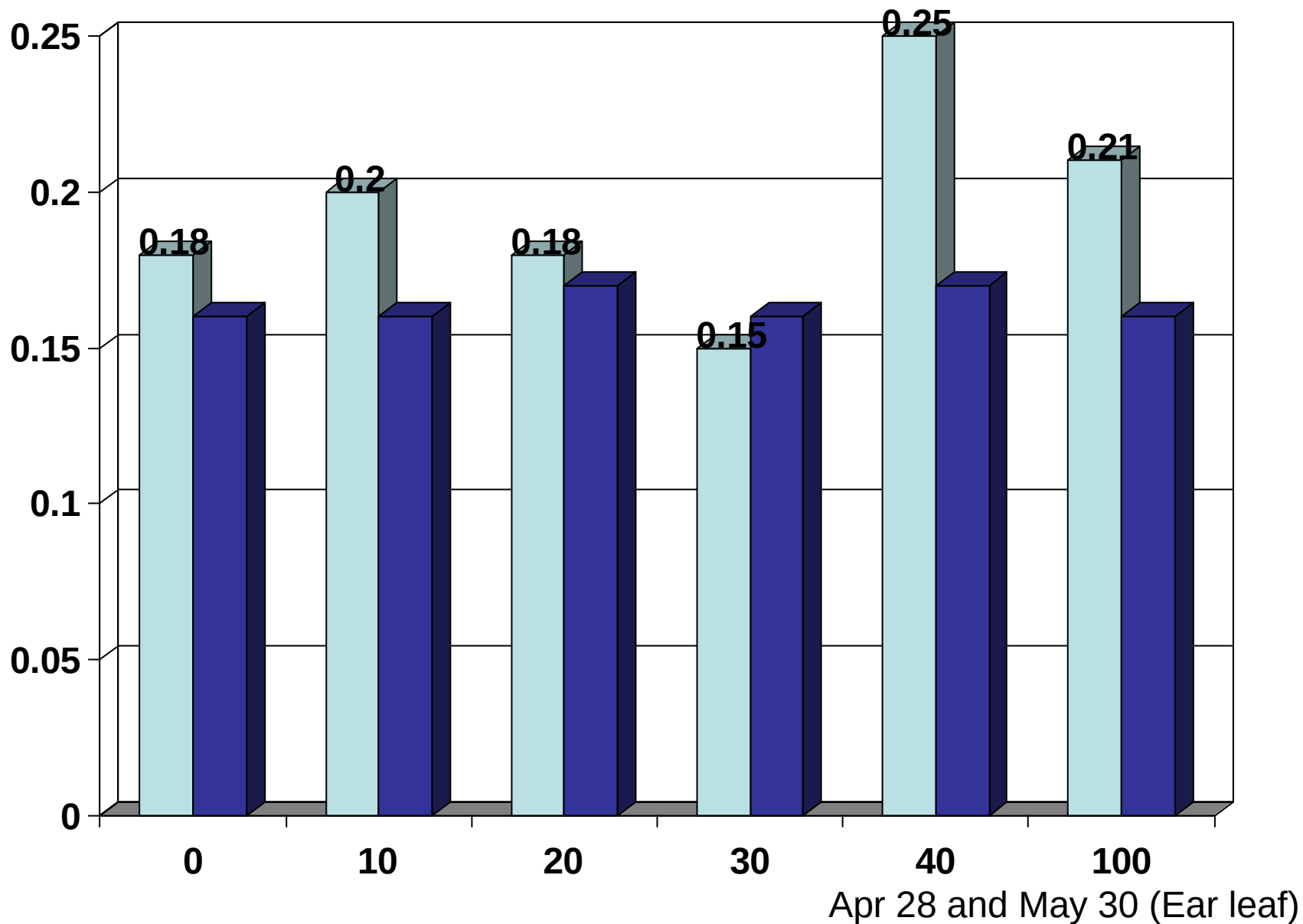
Tissue Mg (%)



(light blue bar = V7, Dark blue bar = Ear leaf)

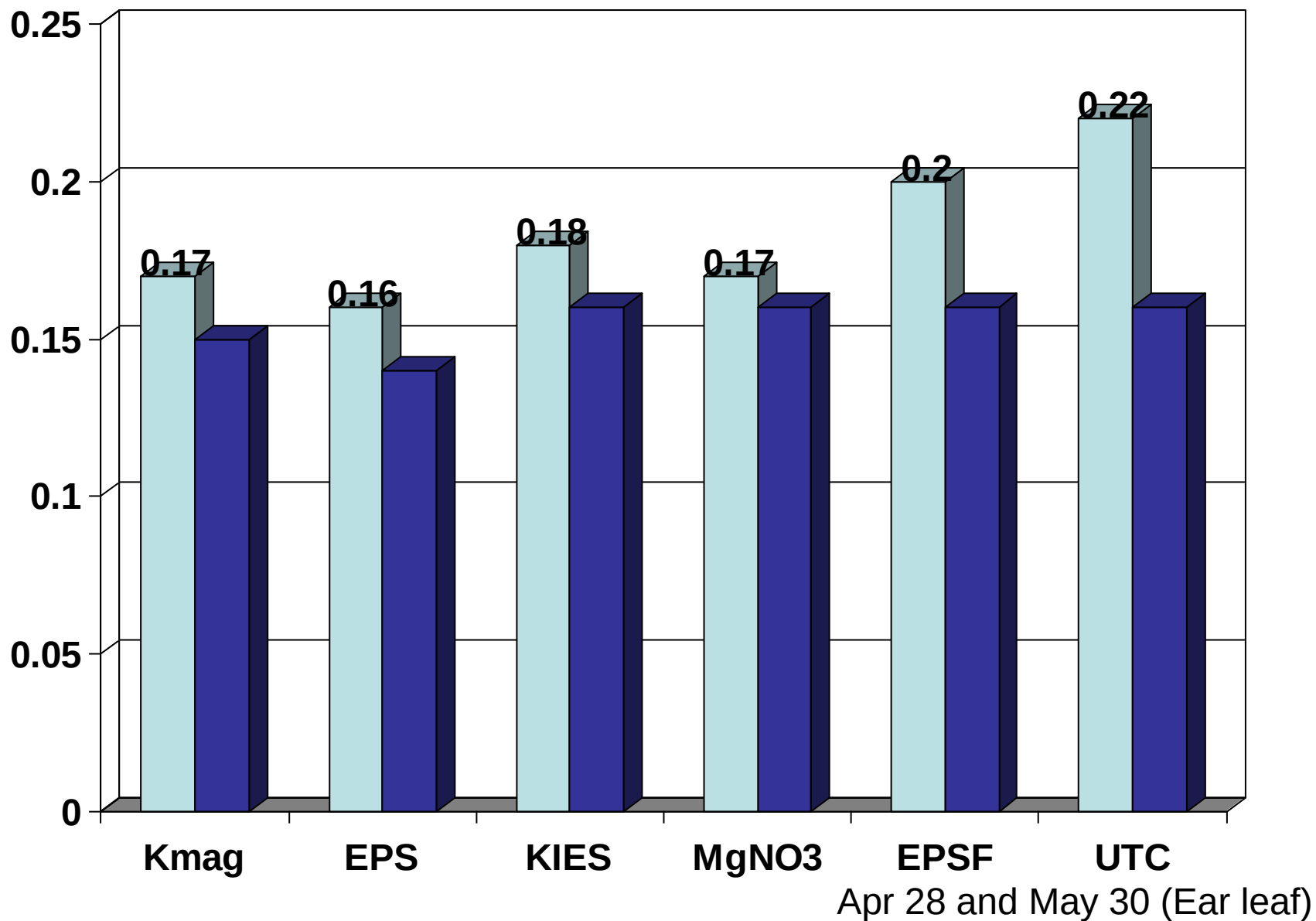
Tissue Mg (%)

Bowen Magnesium Rate- 2017



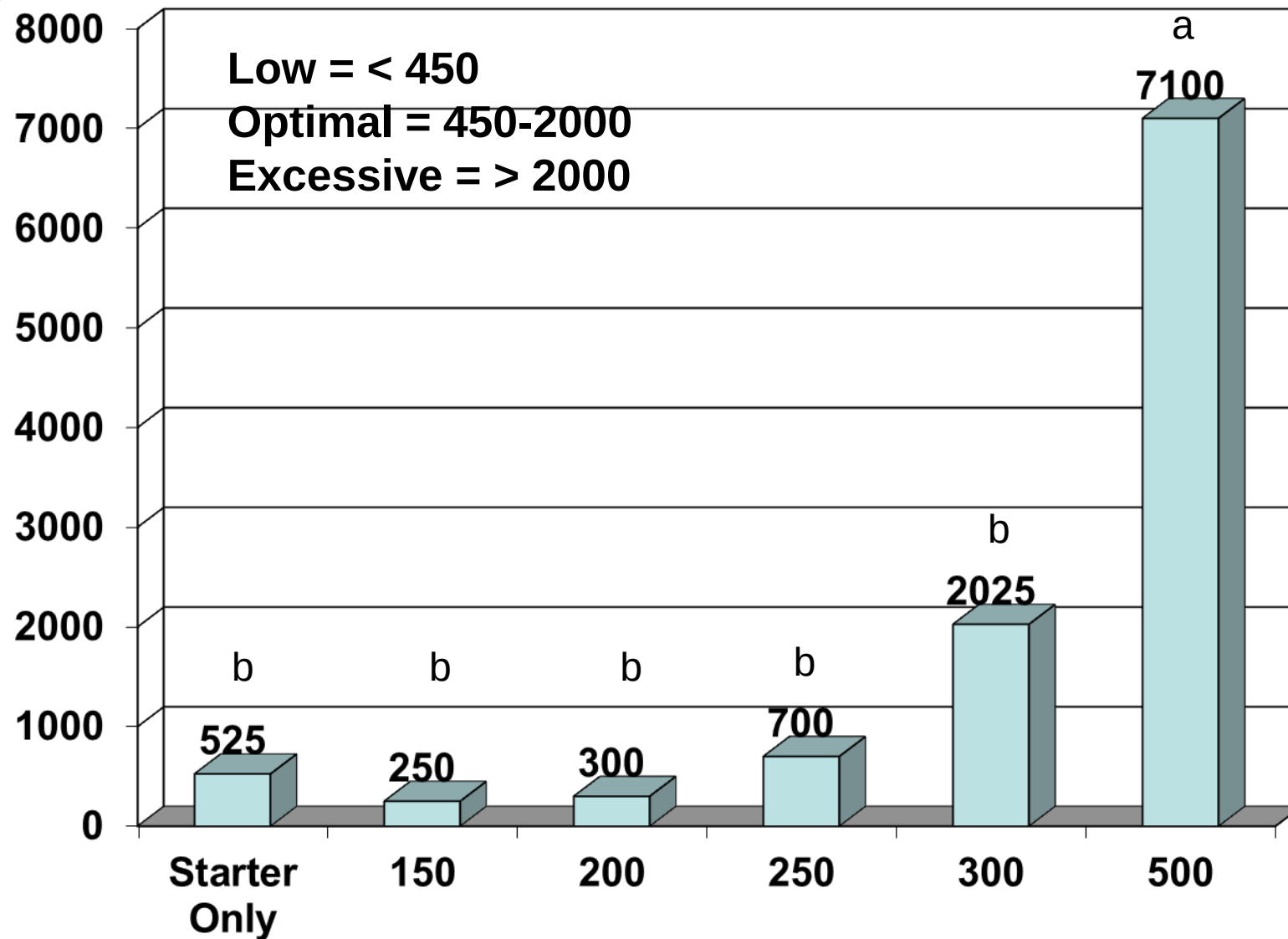
Tissue Mg (%)

Bowen Magnesium Source- 2017



High Yield Corn – 2017 Bowen Farm

Stalk Nitrate
(ppm)



Corn Population by N-P-K Fert Yield Goal Bowen Farm 2018

2 Factor Factorial

Planted March 29, Pioneer P1870HR, 10gal 10-34-0+10gal 28, 6 Row Plots

<u>Population</u> –	18,000
	26,000
	34,000
	42,000

<u>N-P-K Yield Goal</u> -	150 bu/a (150-0-110)
	200 bu/a (210-0-160)
	250 bu/a (270-0-210)
	300 bu/a (330-0-260)

<u>Tissue Sampling</u> -	May 1 (V6, 12 inches tall) – Whole Plant
	May 17 (V10) – Leaf Below Whorl
	June 1 (V12 ?) – Leaf Below Whorl
	June 11 (Ear Leaf)

pH=6.7 P=137(VH) K=70 (L) Ca=749(M) Mg=59(M) Zn=3(M) Mn=3(L)



UNIVERSITY OF GEORGIA EXTENSION

UGFertex-Based Nutrient Application Guidelines

Client:	GHH	Field ID:	Bowen-15
County:	Tift	Date:	1/2/2019
Soil Group:	Coastal Plain	Plow Depth:	8 inches
Crop:	Corn - Irrigated	Previous Crop:	Peanuts - Spanish & Runner Type
Yield Goal:	150 bushels	Irrigated:	Yes

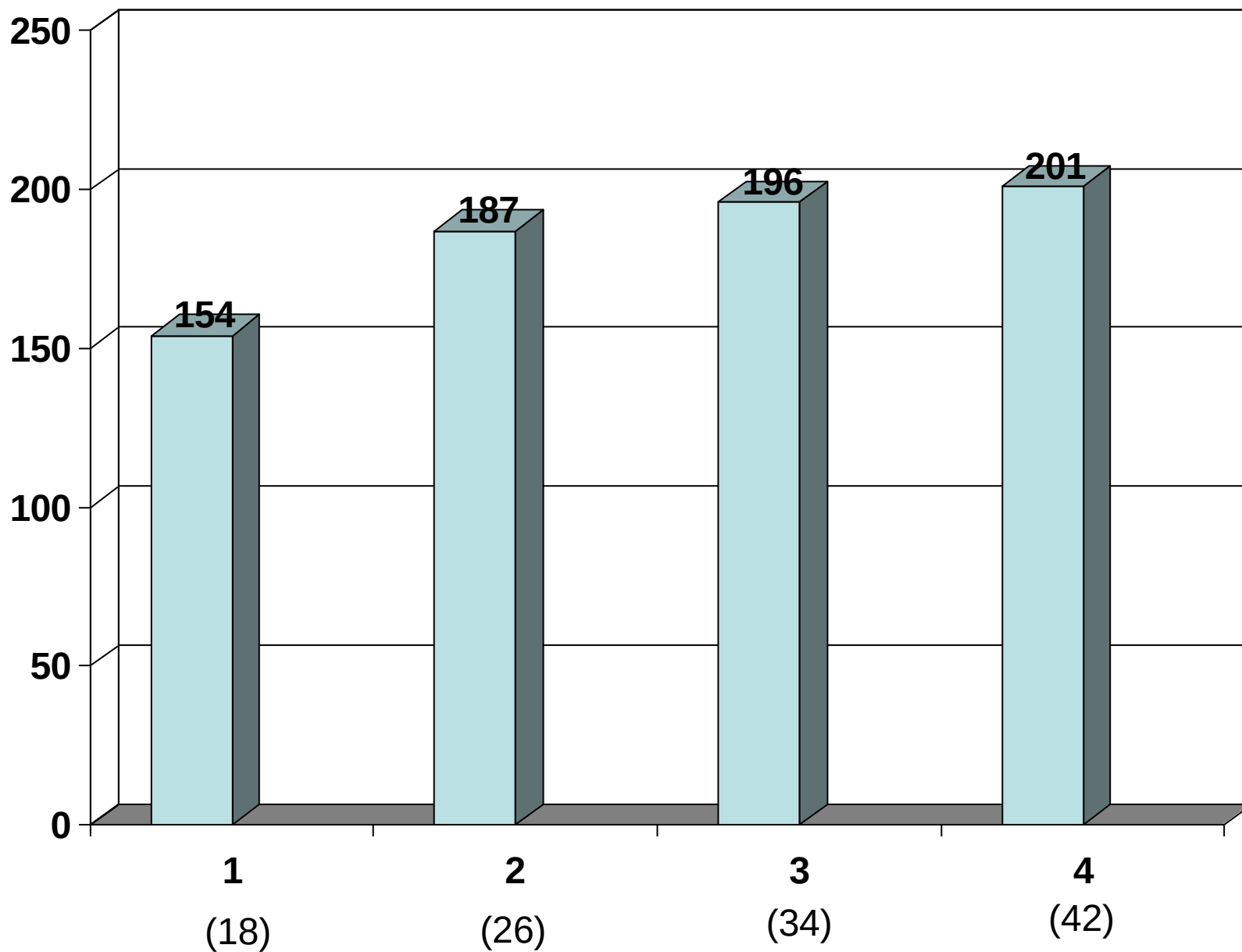
Results

Very High					High				
High					Sufficient				
Medium					Low				
Low									
	Phosphorus	Potassium	Calcium	Magnesium	Zinc	Manganese	Soil pH	Lime Buffer Capacity	
Soil Test Index	137 lbs/Acre	70 lbs/Acre	749 lbs/Acre	59 lbs/Acre	3 lbs/Acre	3 lbs/Acre	6.7	250	Soil Test Index
Buildup:	Soil P: 0	P ₂ O ₅ Required: 0 lbs/a/year			Years Required For Buildup: 1			Starter:	N: 0
	Soil K: 0	K ₂ O Required: 0 lbs/a/year							P ₂ O ₅ : 0

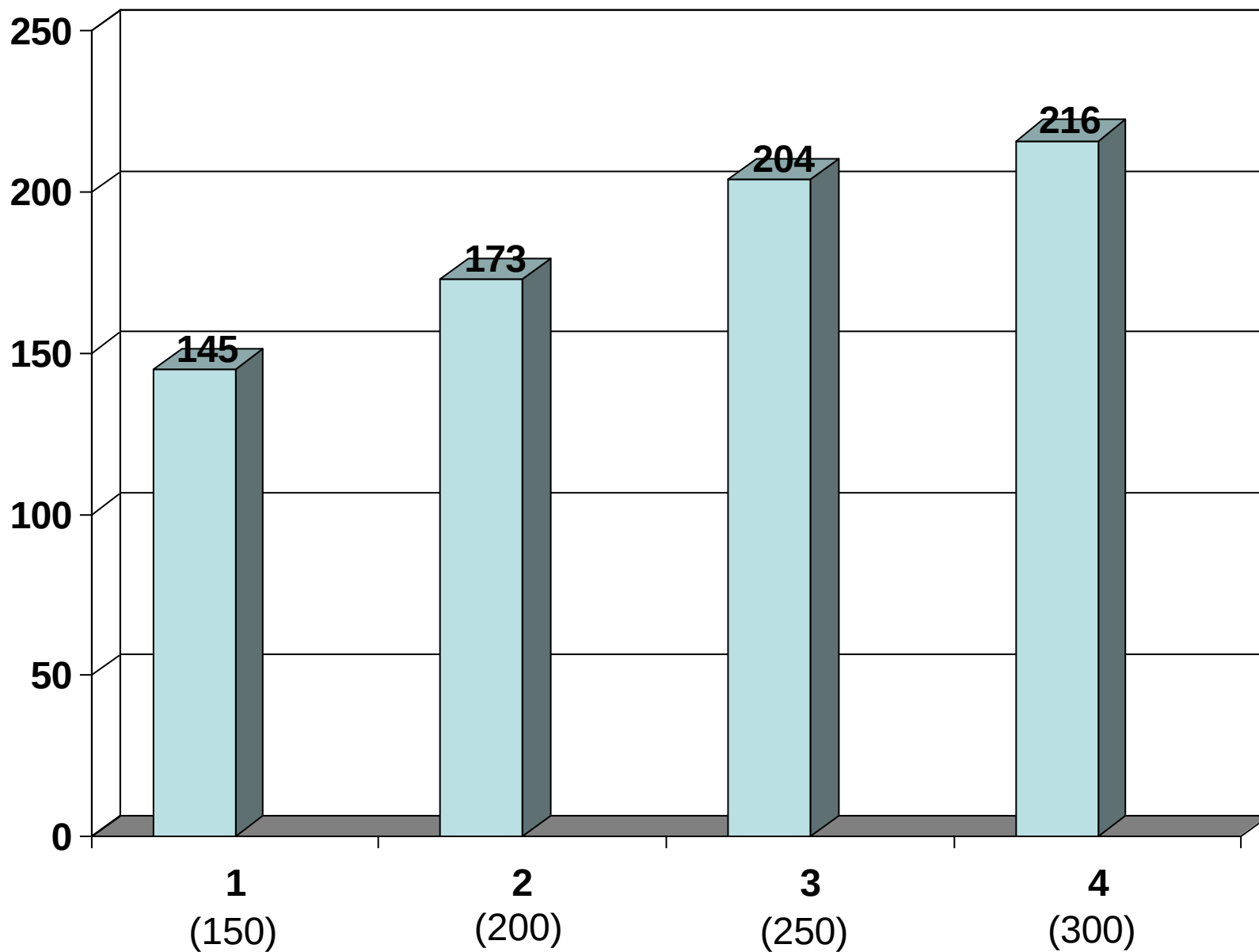
Lime and Nutrient Guidelines

Limestone	Nitrogen (N)	Phosphate (P ₂ O ₅)	Potash (K ₂ O)	Calcium (Ca)	Magnesium (Mg)	Sulfur (S)	Boron (B)	Manganese (Mn)	Zinc (Zn)
0 tons/Acre	150 lbs/Acre	0 lbs/Acre	110 lbs/Acre	0 lbs/Acre	0 lbs/Acre	10 lbs/Acre	0 lbs/Acre	0 lbs/Acre	0 lbs/Acre

Corn Yield (bu/a) Bowen Population (avg over Fert)- 2018

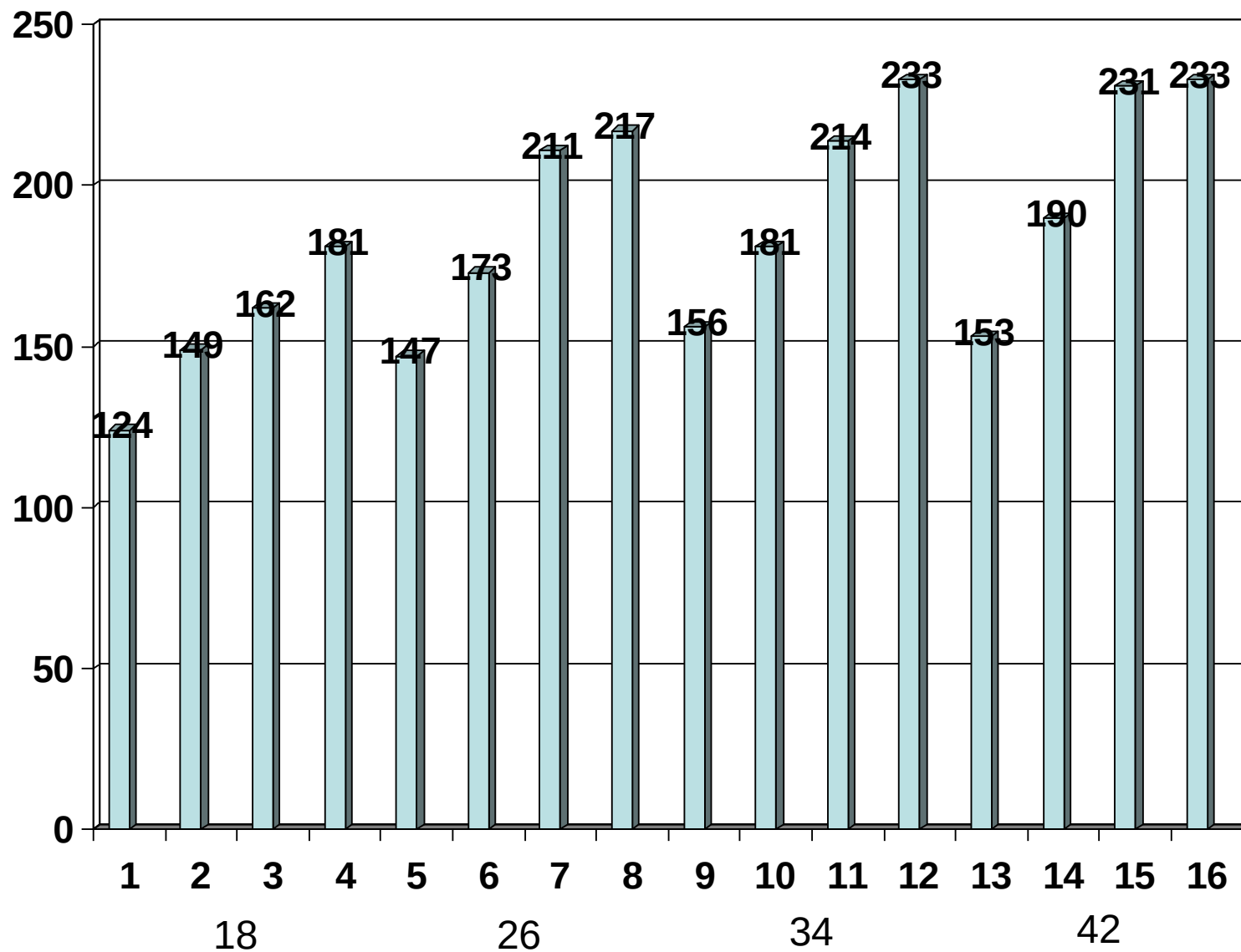


Corn Yield (bu/a) Bowen N-P-K Fert (avg over Pop)- 2018



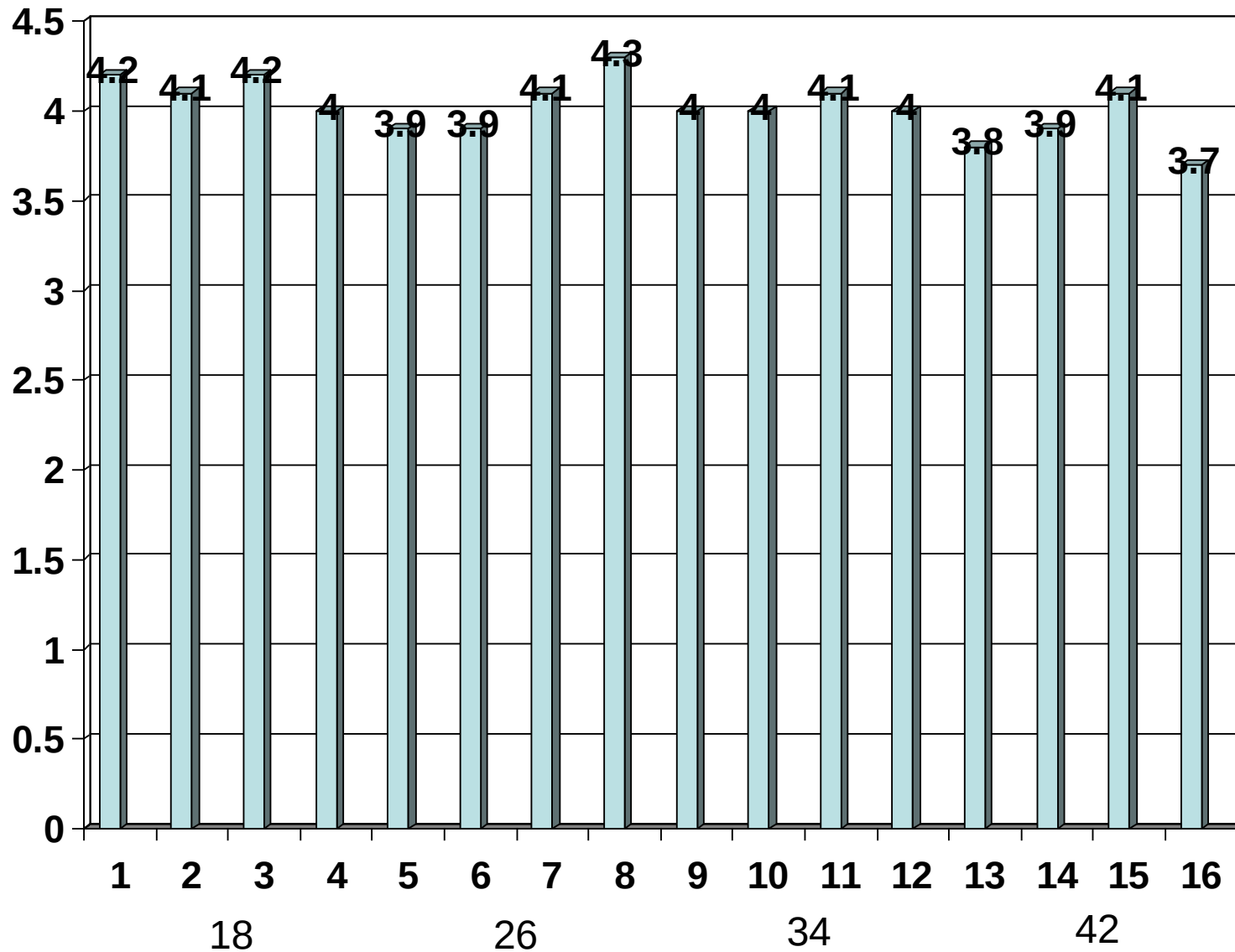
Corn Yield (bu/a)

Bowen Pop x Fert YG- 2018



CV = 6 %

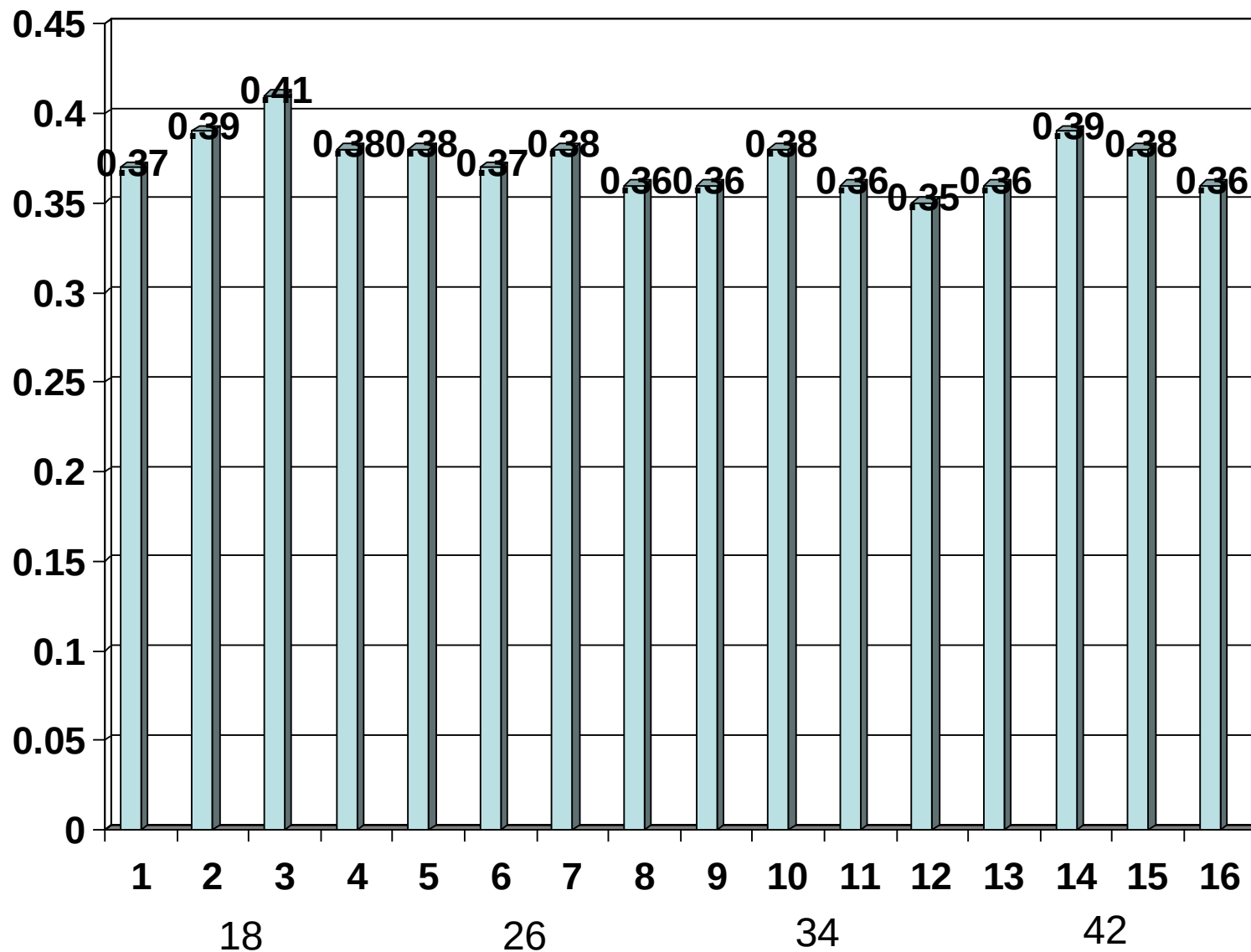
May 17 (V10) Tissue N (%) **Bowen Pop x Fert YG- 2018**



Sufficiency Range = 3-5

NS CV = 6 %

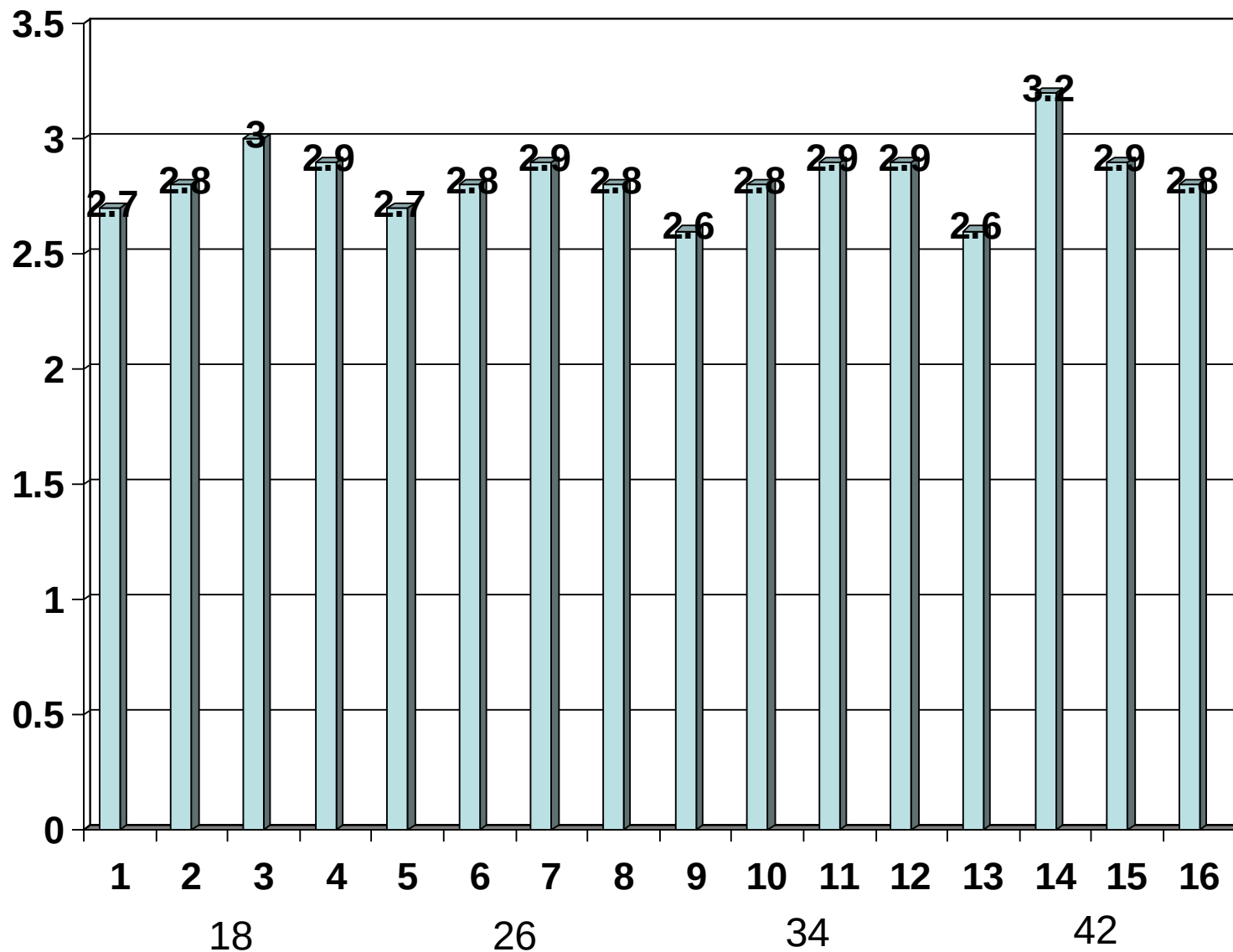
May 17 (V10) Tissue P (%) Bowen Pop x Fert YG- 2018



Sufficiency Range = .25-.45

NS CV = 8 %

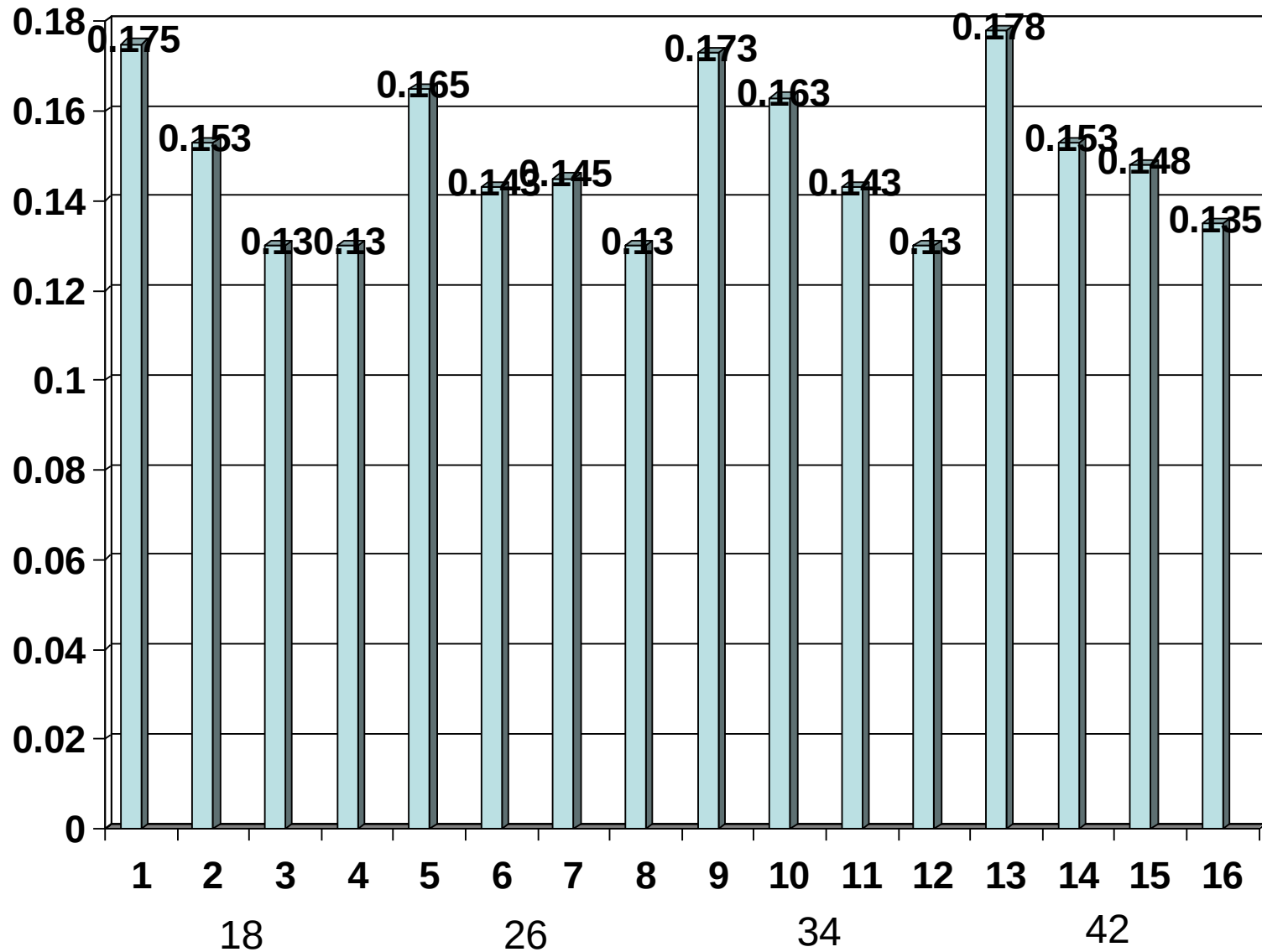
May 17 (V10) Tissue K (%) Bowen Pop x Fert YG- 2018



Sufficiency Range = 2-2.5

NS CV = 11 %

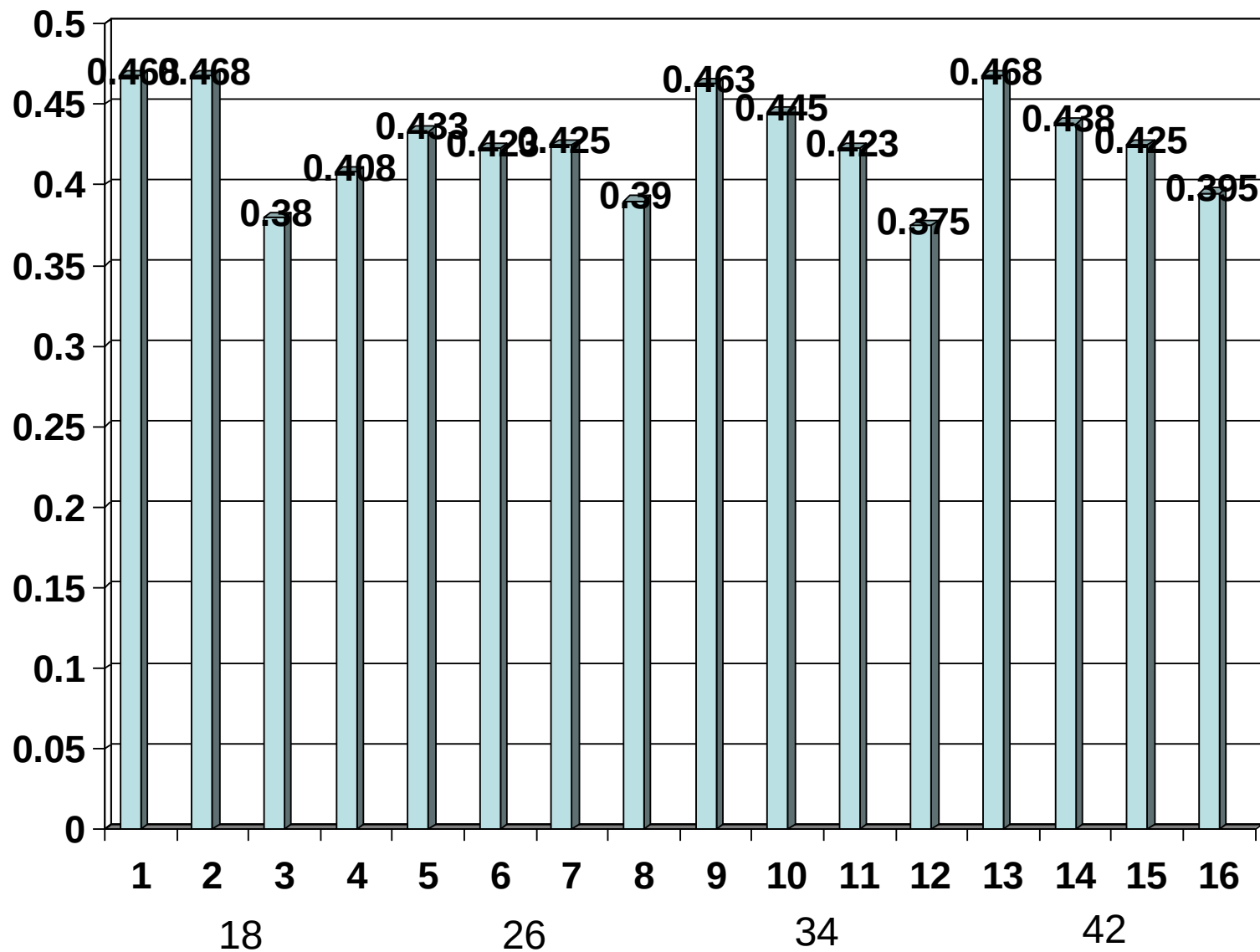
May 17 (V10) Tissue Mg (%) **Bowen Pop x Fert YG- 2018**



Sufficiency Range = .13-.3

P=0.0001 CV = 6 %

May 17 (V10) Tissue Ca (%) **Bowen Pop x Fert YG- 2018**



Sufficiency Range = .25-.5

P= 0.0205 CV = 6 %

Fertilizing Cotton with N-P-K by Yield Goal in Georgia

Glen Harris

University of Georgia - Tifton



Prior to 1994, UGA had one N recommendation for one yield goal
60 lb N/a for 750 lb lint/a



Nitrogen Recommendations for Cotton

Based on Yield Goals

Yield Goal (lbs lint/a)	N Rate (lb/a)
-------------------------	---------------

750



60

1000



75

1250



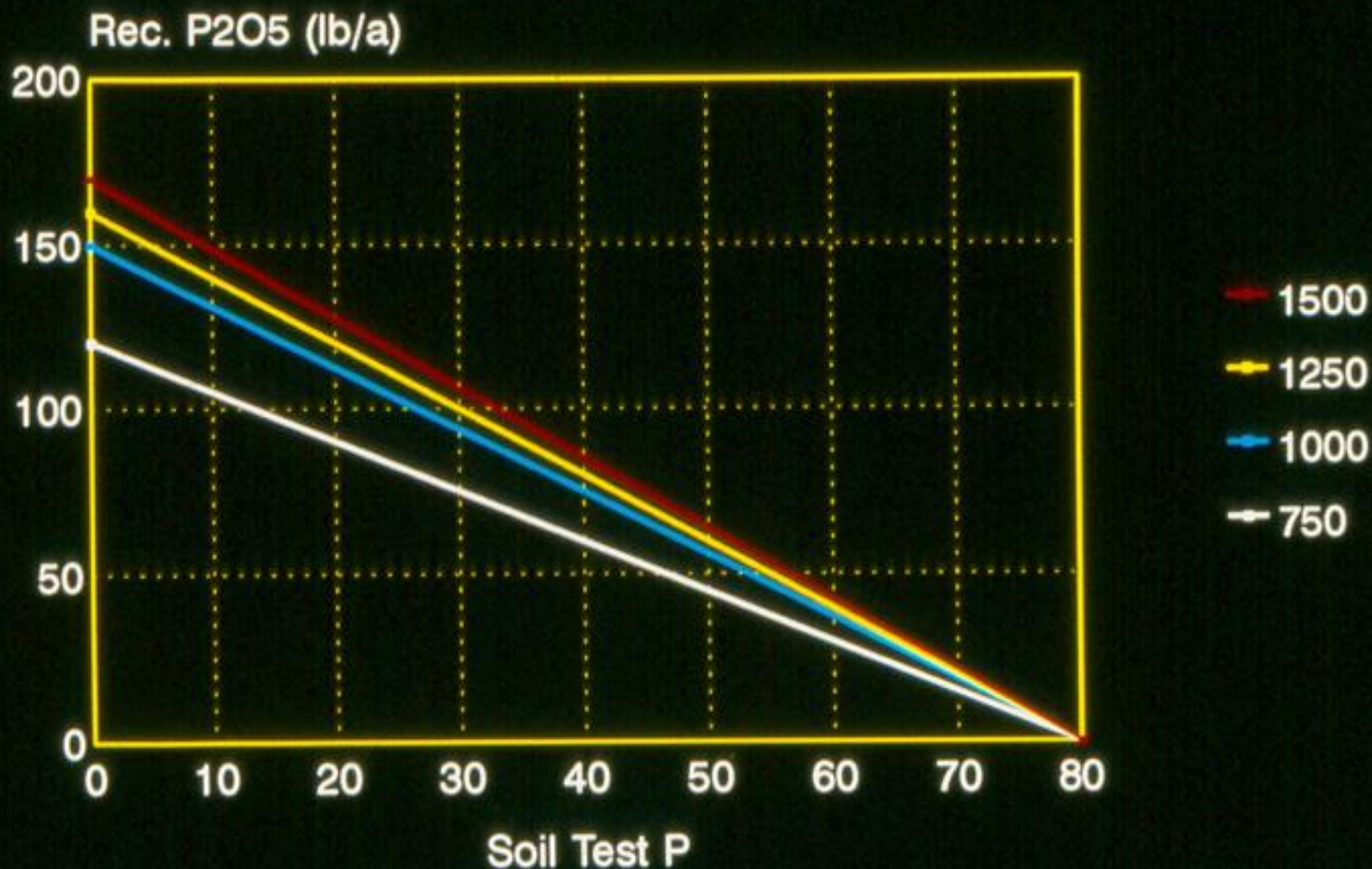
90

1500

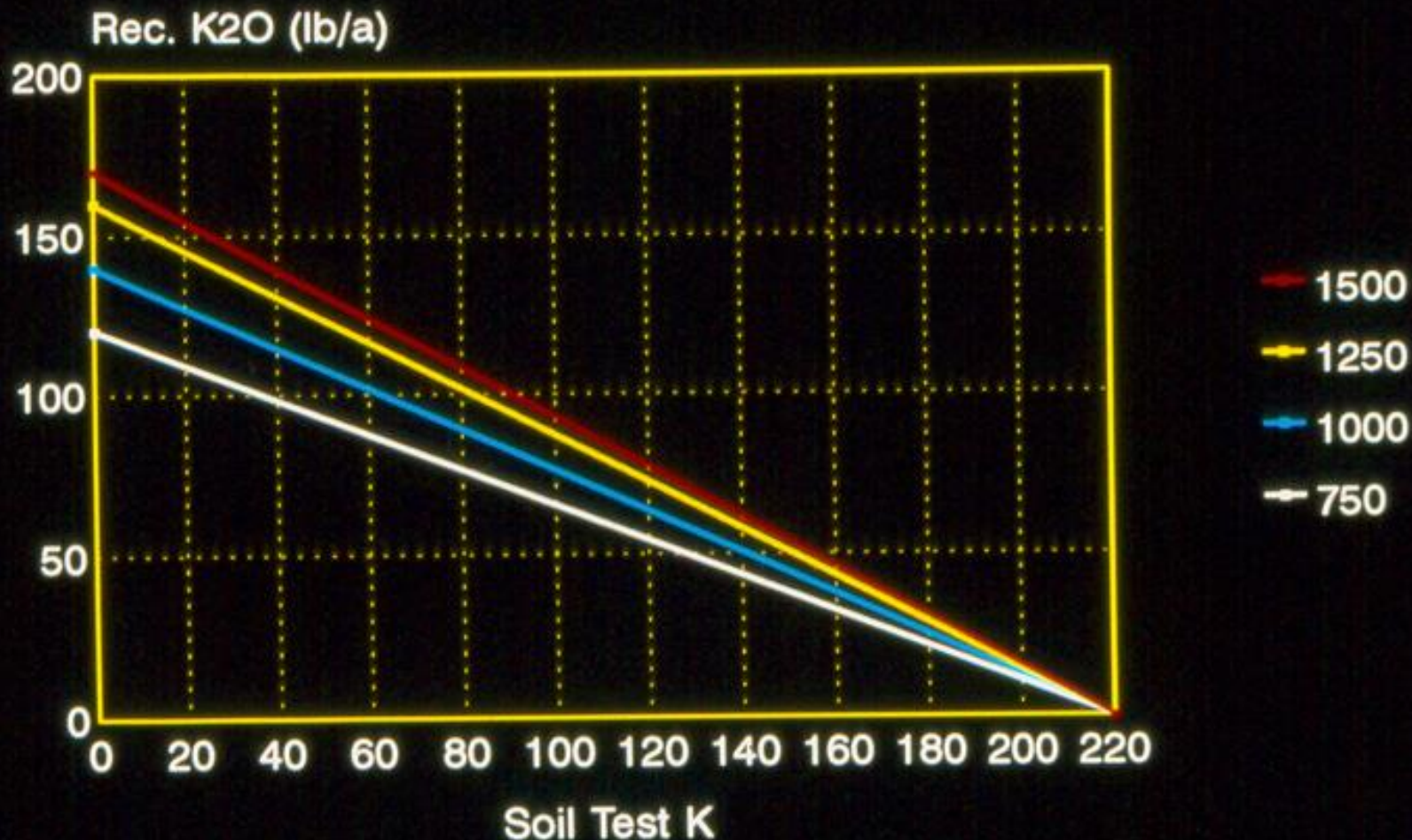


105

Phosphorous Recommendations for Cotton Based on Yield Goal



Potassium Recommendations for Cotton Based on Yield Goal



RDC Pivot Cotton – 2017

N-P-K Rates by Yield Goal

<u>Yield Goal</u>	<u>N-P-K Applied (lb/a)*</u>
750	30-50-80
1000	45-50-90
1250	60-60-90
1500	75-60-100
1750	90-70-110
2000	105-70-120

* Used 5-10-15 as a preplant base for all treatments
Then adjusted P using 0-46-0 , K using 0-0-60 and N at sidedress with A.N.

Materials & Methods

2017 and 2018

5 Locations : 1) RDC Pivot (Tifton)
2) Sunbelt Expo (Moultrie)
3) Stripling Irrigation Park (Camilla)
4) Lang Farm (Tifton)
5) Attapulgis

All center pivot irrigated and DP 1646

RCBD, 4 Reps, 12 x 30 foot plots, All fertilizer hand applied

6 Yield Goals: “Bale and Half” to “4-Bale”

Standard management including growth regulator

C17-02: RDC Pivot Cotton Yield Goal Study 2017 (Conservation Tillage)

C17-01							3 Border Rows
	5	4	3	1	6	2	
	67	68	69	70	71	72	
	10' Alley						
	4	6	2	5	1	3	
	61	62	63	64	65	66	
	10' Alley						
	6	1	4	2	3	5	
	55	56	57	58	59	60	
	10' Alley						
	1	2	3	4	5	6	
49	50	51	52	53	54		

Treatment Key: oz/row middle

	Yield Goal	5-10-15	Amidas SD	10-50-0	0-0-60	Total N-P-K
1	750lbs/a	22	0.55	0	0.4	30-50-80
2	1000lbs/a	22	2.2	0	1.1	45-50-90
3	1250lbs/a	22	3.8	0.9	1.1	60-60-90
4	1500lbs/a	22	5.5	0.9	1.8	75-60-100
5	1750lbs/a	22	7.2	1.8	2.6	90-70-110
6	2000lbs/a	22	8.8	1.8	3.3	105-70-120

N-P-K Rates by Yield Goal

<u>Yield Goal</u>	<u>N-P-K Applied</u>	<u>Increase</u>	<u>Cost*</u>
750	30-50-80	-----	-----
1000	45-50-90	15-0-10	\$ 9.10
1250	60-60-90	15-10-0	\$10.10
1500	75-60-100	15-0-10	\$ 9.10
1750	90-70-110	15-10-10	\$12.90
2000	105-70-120	15-0-10	\$ 9.10

All sites = “Medium” P & K

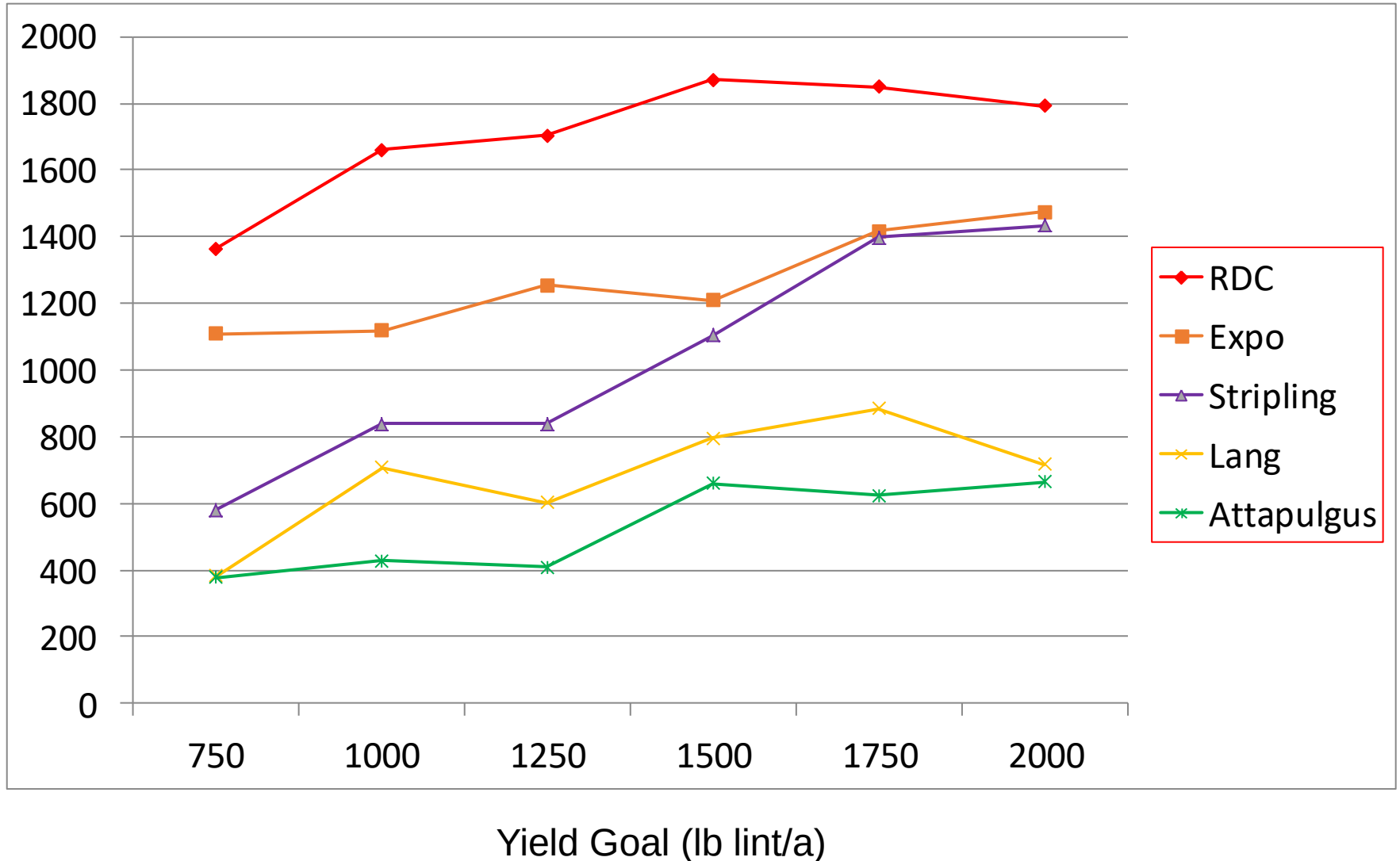
Used 5-10-15 with minors as a base, then adjusted P with 0-46-0 and K with 0-0-60
N Side dressed with “Amidas” 40-0-0 5.5(S)

* 2017 Fertilizer prices – 42-38-28 (cents/lb N-P₂O₅-K₂O)

Fertilizing Cotton (N-P-K) By Yield Goal - 2017

Actual Yield (lb lint/a)

Variety = DP 1646

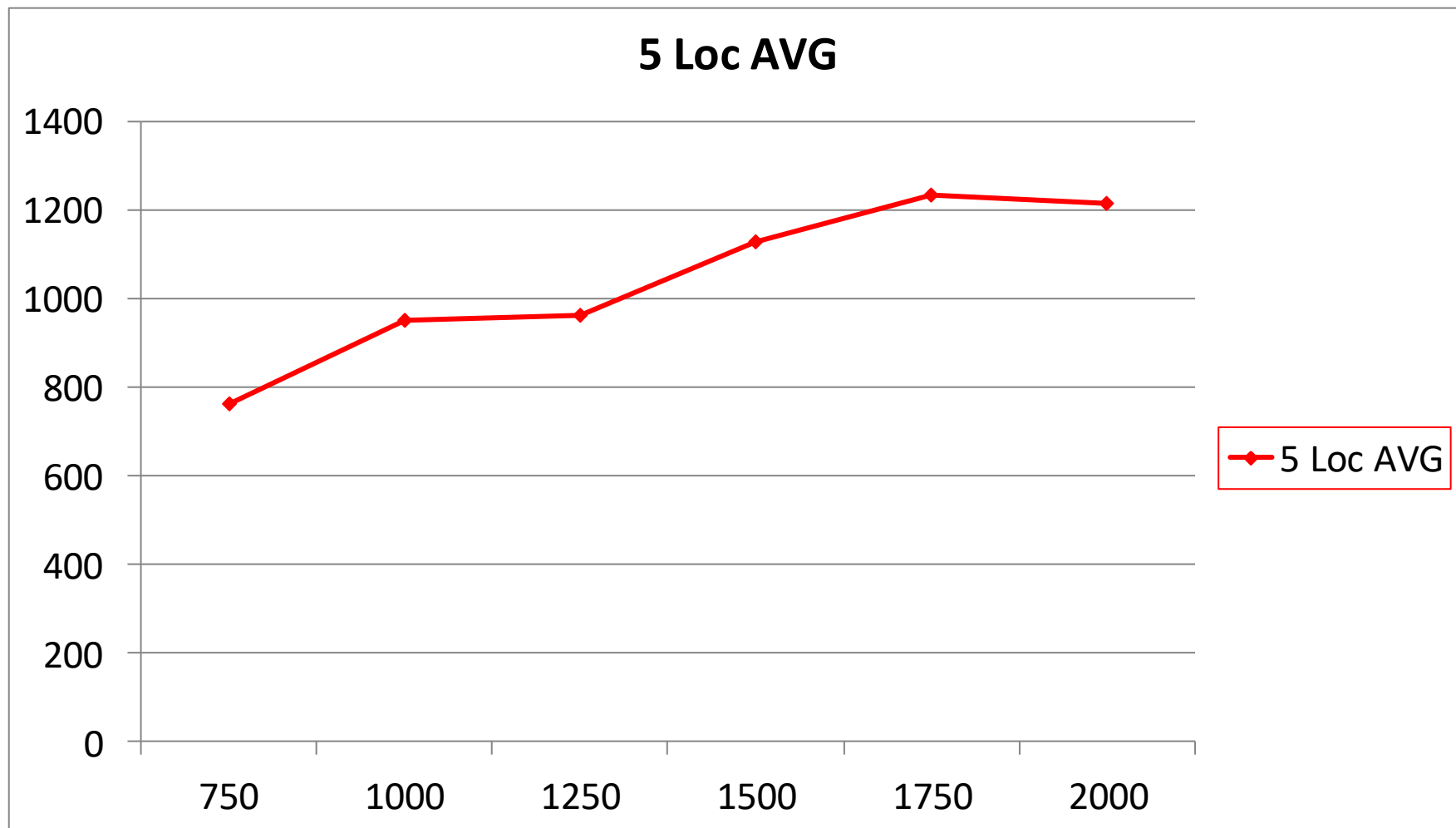


Fertilizing Cotton (N-P-K) By Yield Goal - 2017

Actual Yield (lb lint/a)

Variety = DP 1646

5 Loc AVG

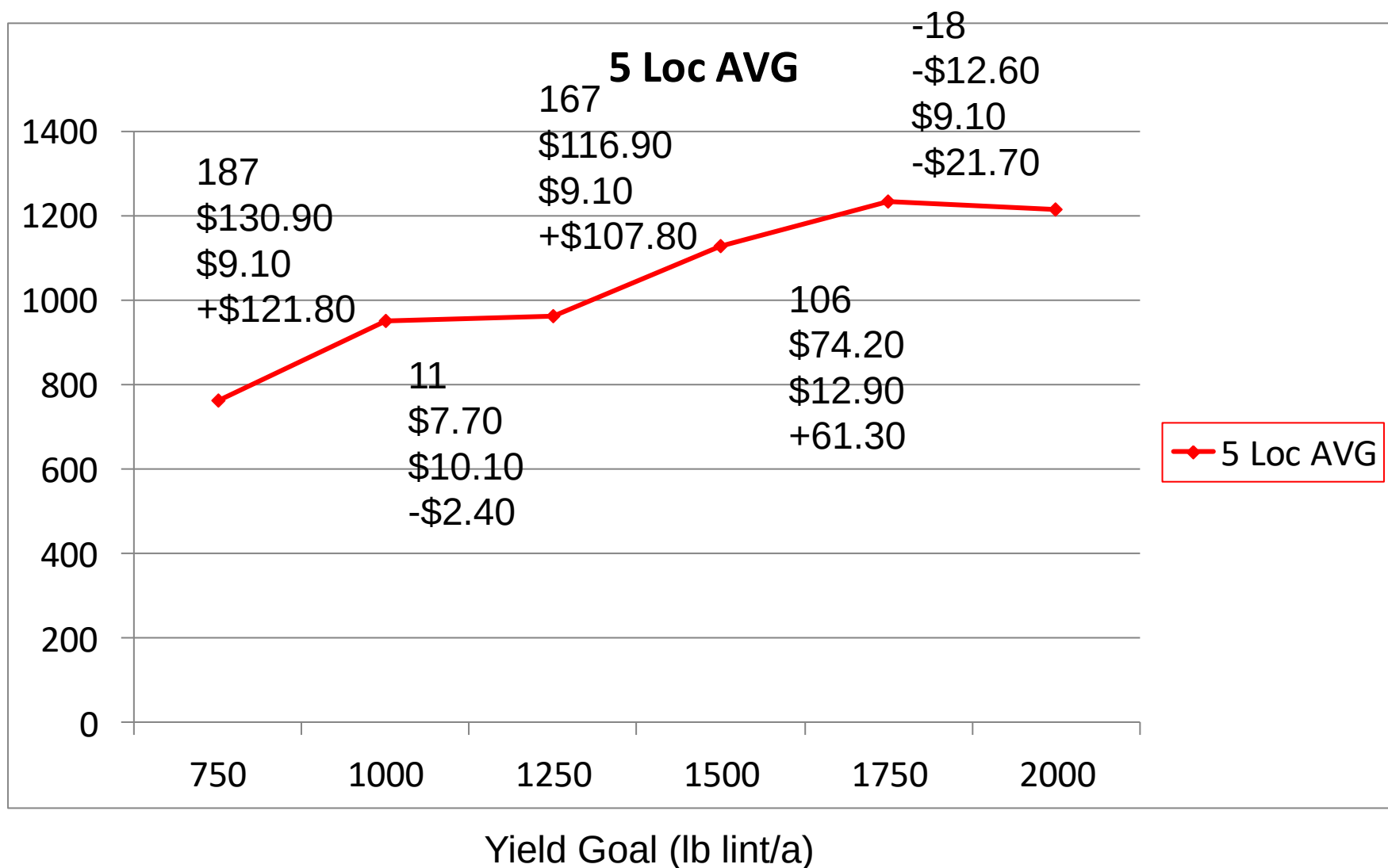


Yield Goal (lb lint/a)

Fertilizing Cotton (N-P-K) By Yield Goal - 2017

Actual Yield (lb lint/a)

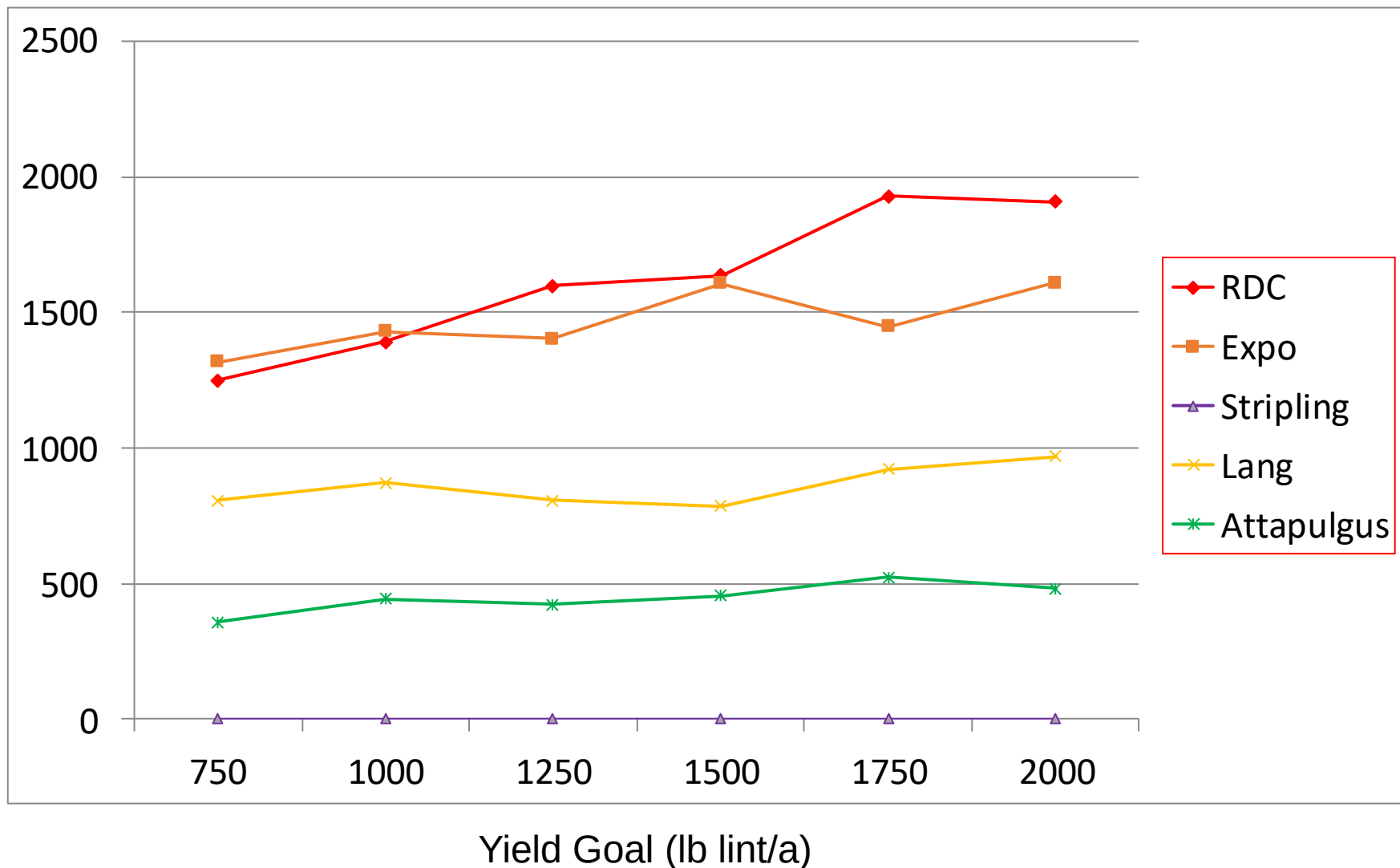
Variety = DP 1646

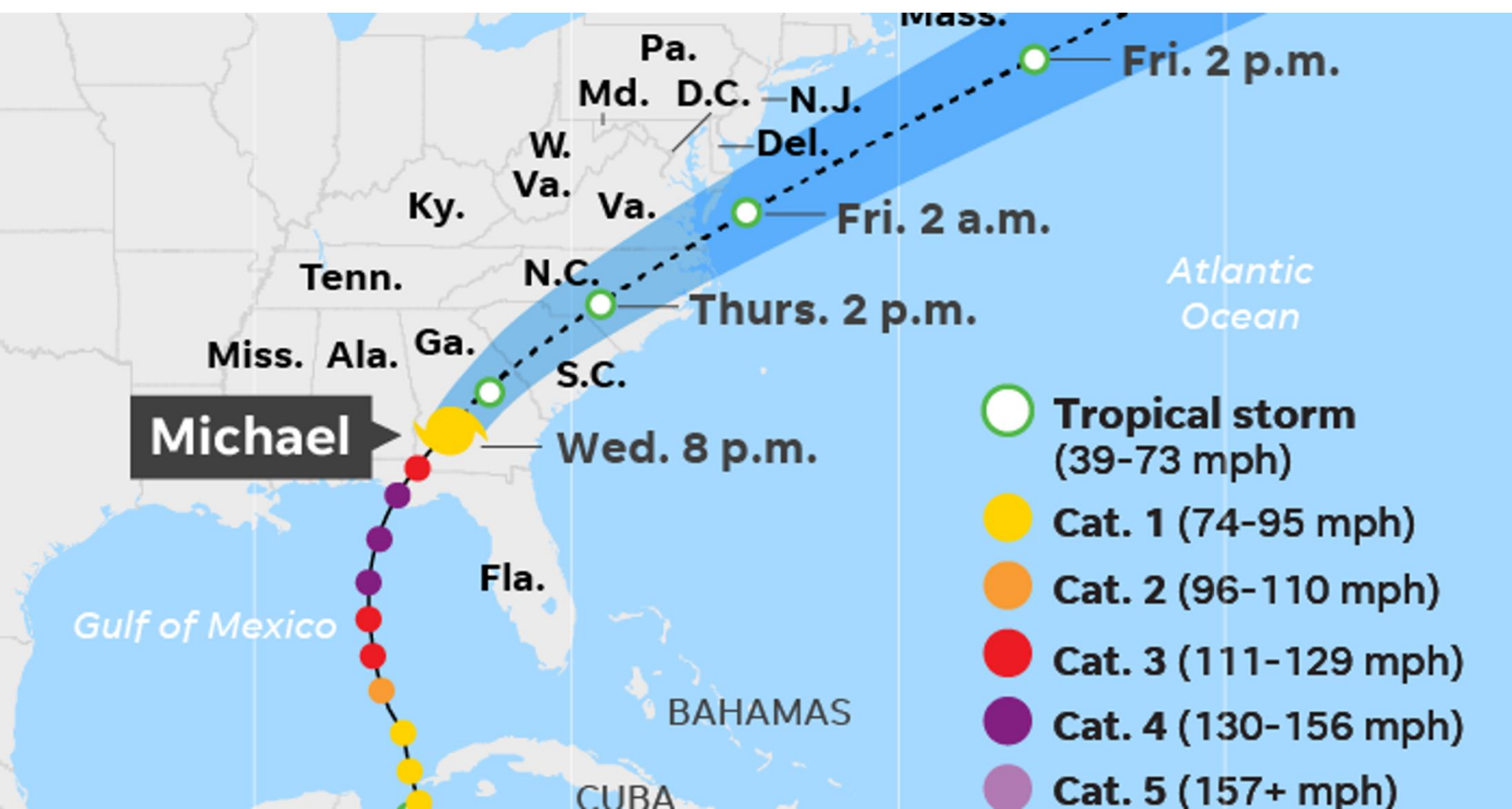


Fertilizing Cotton (N-P-K) By Yield Goal - 2018

Actual Yield (lb lint/a)

Variety = DP 1646







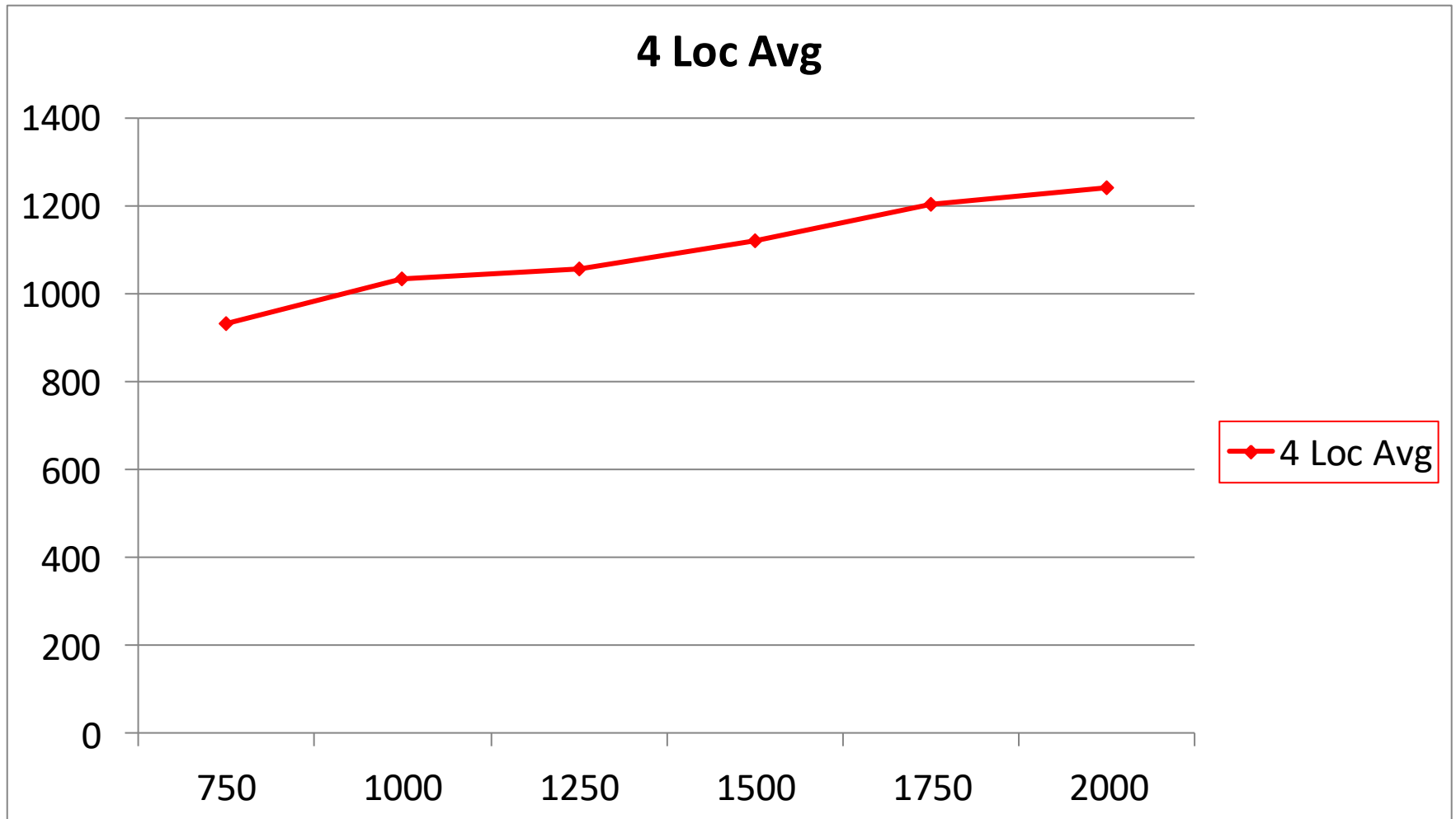


Fertilizing Cotton (N-P-K) By Yield Goal - 2018

Actual Yield (lb lint/a)

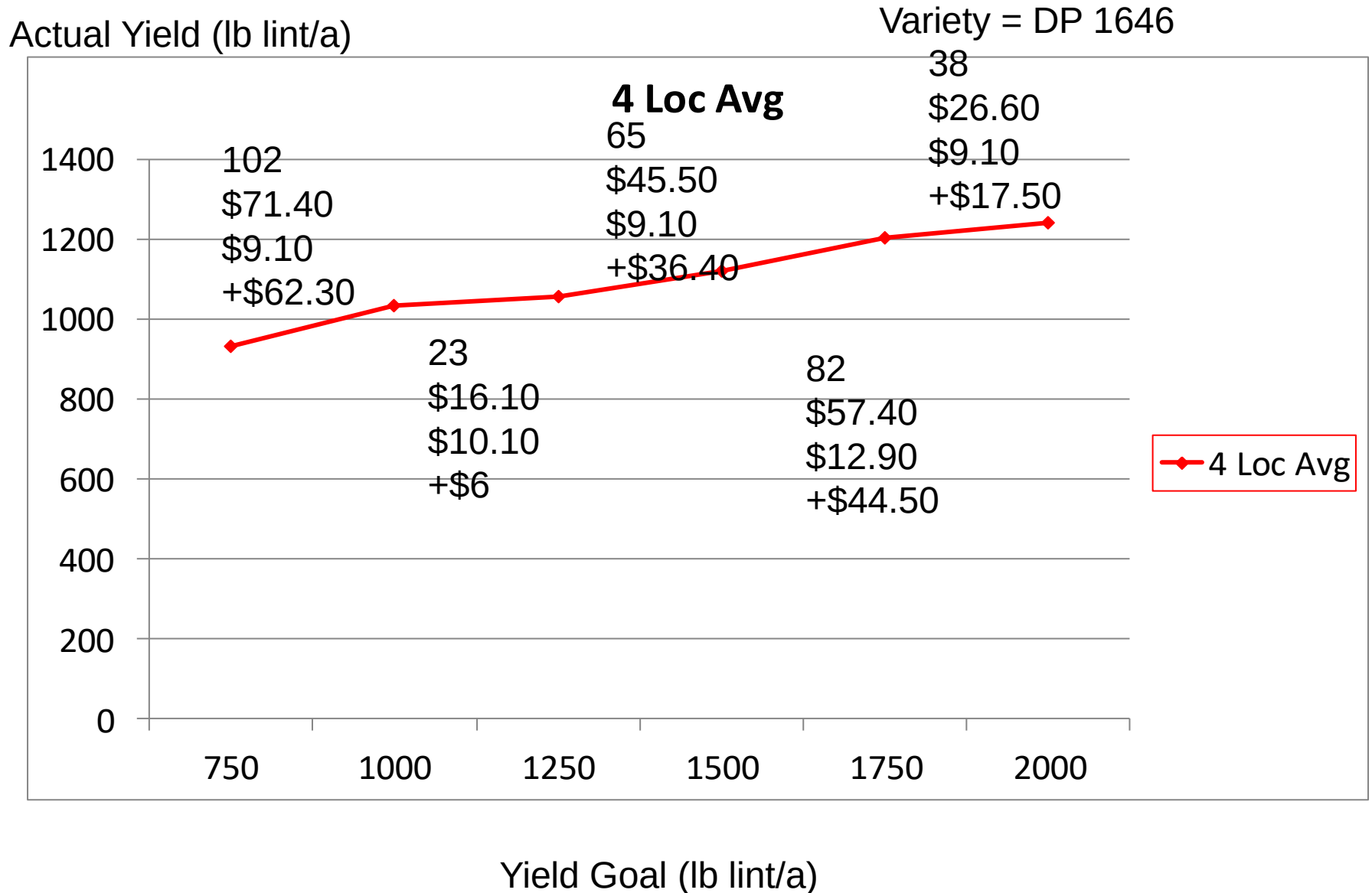
Variety = DP 1646

4 Loc Avg



Yield Goal (lb lint/a)

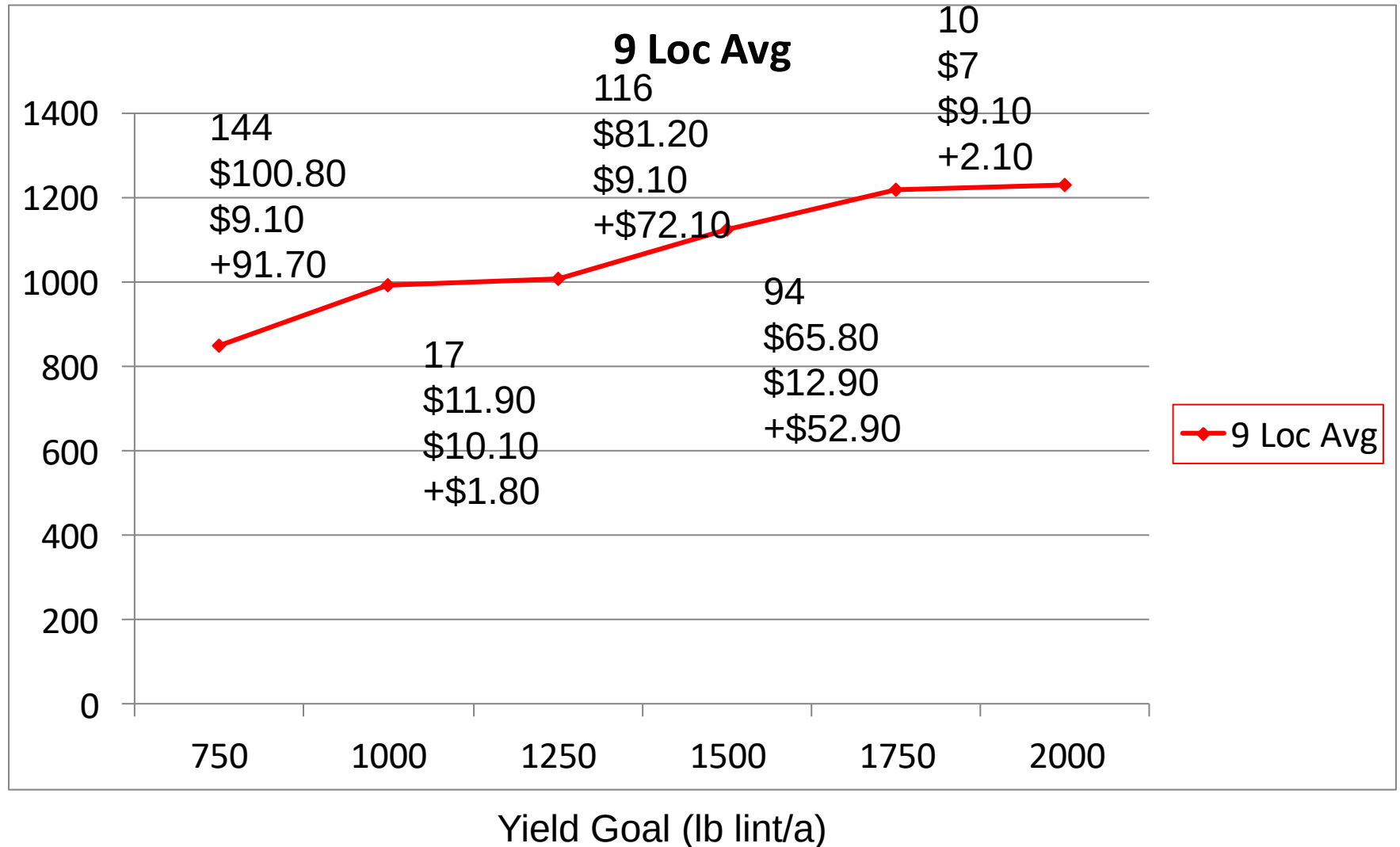
Fertilizing Cotton (N-P-K) By Yield Goal - 2018



Fertilizing Cotton (N-P-K) By Yield Goal – 2017+2018

Actual Yield (lb lint/a)

Variety = DP 1646



Conclusions

Despite a wide range in overall yields by location,
saw good response to small increases in N-P-K by yield goal

Cant separate out if the yield response was to due to N,P, K
....or what combination

On average, even when higher yield goal was not reached,
there was enough yield increase to cover the cost of more fertilizer

Sometimes it did not pay to shoot for a yield goal over 3-Bale
...but sometimes it did

Not environmentally sensitive? Not huge increases in fertilizer rates
between “half-bale” steps (15-10-10)