

Soil Sampling, Fertilizer, and Animal Waste Management and Potential Effects on Water Quality

Robert Lemon
Professor and Extension Agronomist - Cotton
College Station, Texas



Nitrogen Fertility Management

- ❖ Establish achievable yield goals and fertilize accordingly
 - ❖ Unrealistically high yield goals result in over-application and increased cost
- ❖ Do you have residual nitrate-nitrogen in the soil profile??
- ❖ Do you know???
- ❖ Crankcase is the soil / Dipstick is soil testing



Nitrogen Recommendations

Yield Goal

Rate (lbs/acre)

1.0 bale

50

1.5 bales

75

2.0 bales

100

2.5 bales

125

3.0 bales

150

Carryover Nitrogen in Soil

Cotton Nitrogen Studies, 2004

Nitrogen (lbs/A)

Depth (in.)	Calhoun	San Patricio	Hidalgo
0-6	64	32	42
6-12	42	20	28
12-24	48	20	36
24-36	36	16	40
36-48	—	16	64
Total	190	104	210

Previous crop: soybeans cotton corn

**Pre-plant Residual Soil Nitrate (lbs N/acre) at Various Depth Intervals
Southern High Plains Locations, 2004**

Location	County	Soil Nitrate at Various Depth Intervals (lbs N/acre)					
		0-2"	0-6"	0-12"	0-24"	0-36"	0-48"
Lamesa	Dawson	2	12	46	71	82	96
Keune	Dawson	3	8	18	42	126	216
Lubbock	Lubbock	17	48	88	178	242	280
Helms	Hale	5	13	26	77	114	137
Streety	Hockley	3	8	22	56	105	119

Bottomline Scenario for 2.0 Bale Yield Goal

Taylor, Texas

Current price UAN \$0.53/lbs.- N

- ◆ No sampling = 100 lbs N fertilizer = \$53/A
- ◆ Sample 0-6"-50 lbs. N Soil Test Rec.= 50 lbs N fertilizer = \$27/A
- ◆ Sample 0-12"-70 lbs N Soil Test Rec.= 30 lbs N fertilizer = \$16/A
- ◆ Sample 0-24"-106 lbs N Soil Test Rec.= 0 lbs N fertilizer = \$0/A



Seven-Year Summary of Results

Year	-----Sites-----		
	Total	Profile NO ₃ -N >100 lbs N/acre	Response to N
1998	6	1	3
1999	7	5	1
2000	7	5	0
2001	10	6	2
2002	9	5	2
2003	7	5	3
2004	8	6	2
Total	54	33	13
		(61 % of sites)	(24% of sites)

Effects of Supplemental Fertilizer N on Cotton Lint Yield Southern High Plains Locations, 2004

N Rate (lbs/acre)	Lint Yield (lbs/acre)				
	Lamesa	Keune	Lubbock	Helms	Streety
0	1,144 ab	771	1,064	1,327	1,385
25	1,174 a	818	1,054	1,311	1,387
50	1,200 a	827	1,069	1,388	1,461
100	1,043 b	832	1,079	1,391	1,435
P<0.05	---	NS	NS	NS	NS
N 0-12"	46	18	88	26	22
N 0-24"	71	42	178	77	56
N 0-48"	96	216	280	137	119

Colorado County Nitrogen Fertility Study, 2006

Mahalitc Farms

Available Nitrogen in Soil Profile Sampled Prior to Planting

0 - 6 inches	52 lbs N	
6 - 12 inches	47 lbs N	99 lbs N
<hr/>		
12 - 24 inches	54 lbs N	153 lbs N
<hr/>		
24 - 36 inches	37 lbs N	
36 - 48 inches	39 lbs N	
<hr/>		
Total	229 lbs N	



Colorado County Nitrogen Fertility Study, 2006

Mahalitic Farms

Treatment	Lint Yield Lbs/acre	Loan Value cents/lb	Net Return/acre
80 lbs N/acre	1286	56.57	728
0 lbs N/acre	1281	57.68	739
P>F	0.7146	0.1790	0.5143
LSD	NS	NS	NS
CV%	1.21	1.18	2.34

Colorado County Nitrogen Fertility Study, 2006

Mahalitic Farms

Treatment	Turnout %	Micronaire	Length inches	Strength g/tex	Uniformity %
80 lbs N/acre	35.0	3.93	1.12	32.0	81.87
0 lbs N/acre	34.3	3.93	1.13	31.0	82.27
P>F	0.5286	1.000	0.6047	0.3854	0.5825
LSD	NS	NS	NS	NS	NS
CV%	3.12	0.0	2.38	3.52	0.91

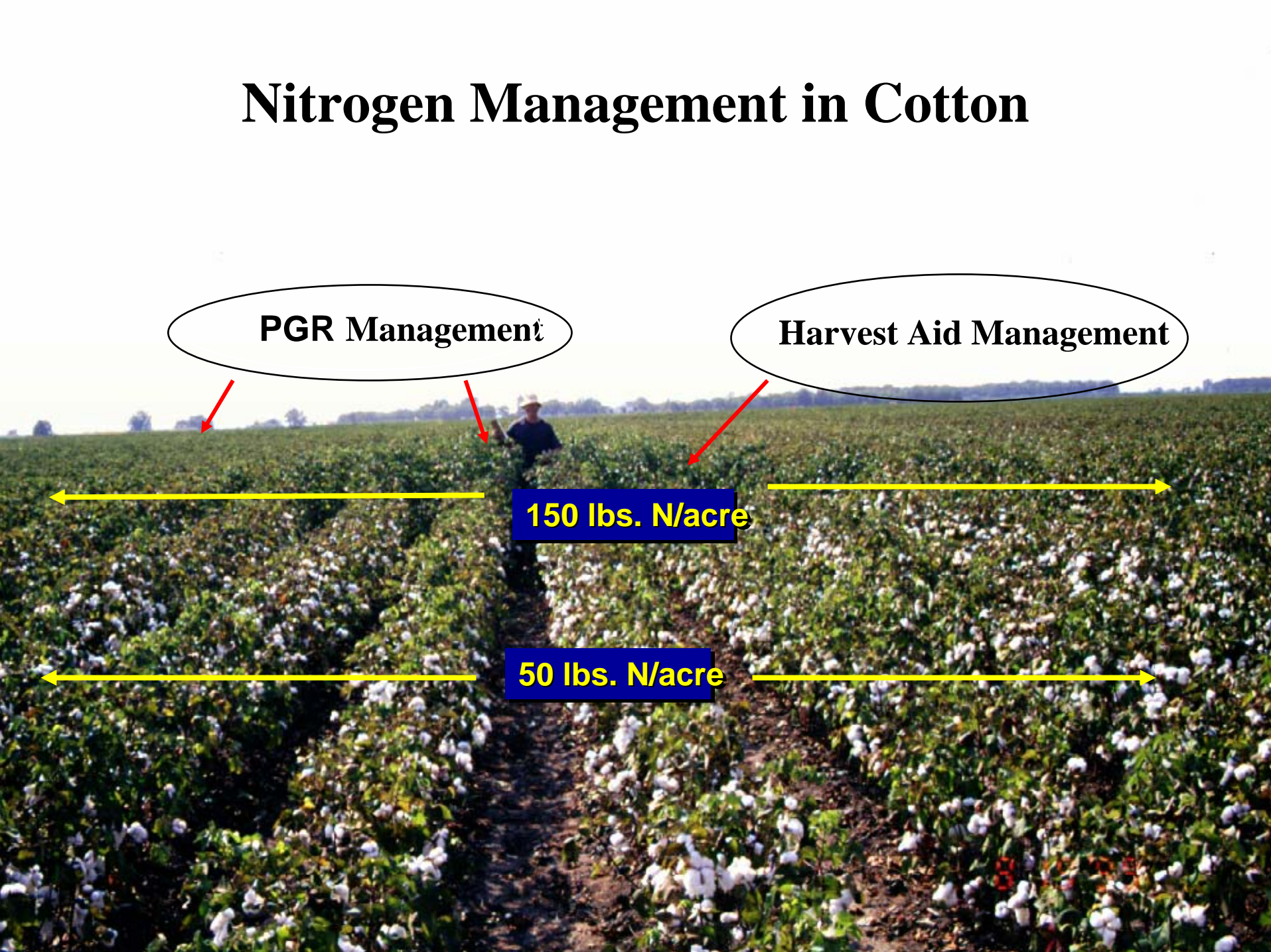
Nitrogen Management in Cotton

PGR Management

Harvest Aid Management

150 lbs. N/acre

50 lbs. N/acre



80 lbs N/A

0 lbs N/A

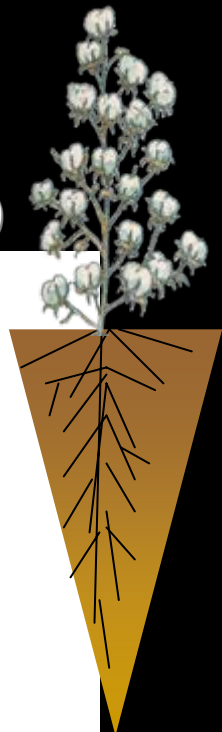
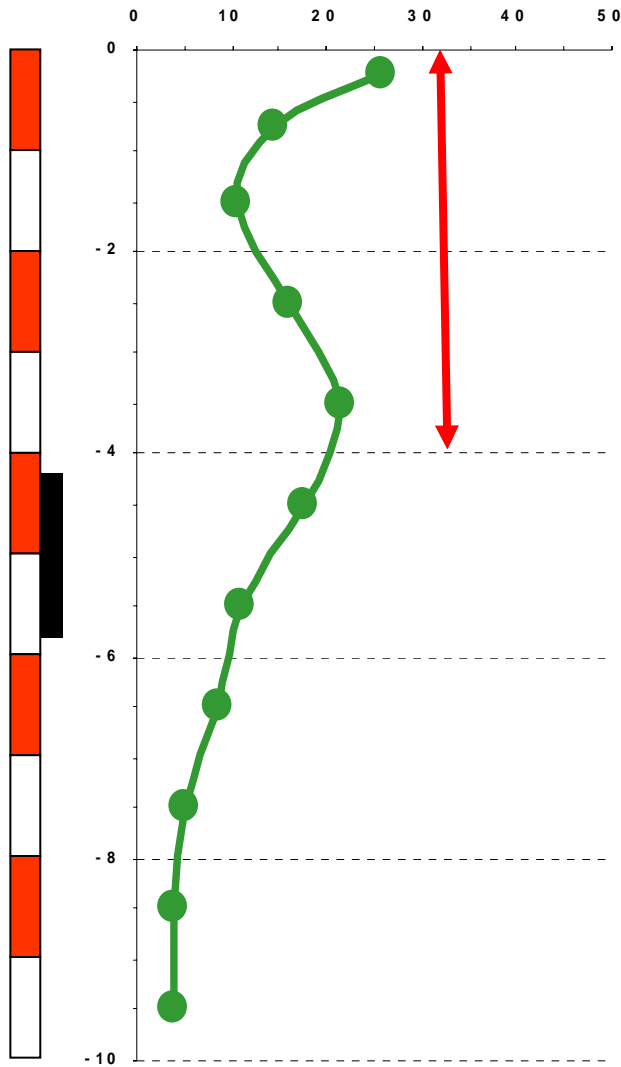
Yield = 2.83 bales/acre
80 lbs/A less fertilizer

Other possible advantages:

- Less PGR?
- Less insecticide?
- Less harvest aid?
- Earlier harvest?



Nitrogen in the Soil (lbs/A)

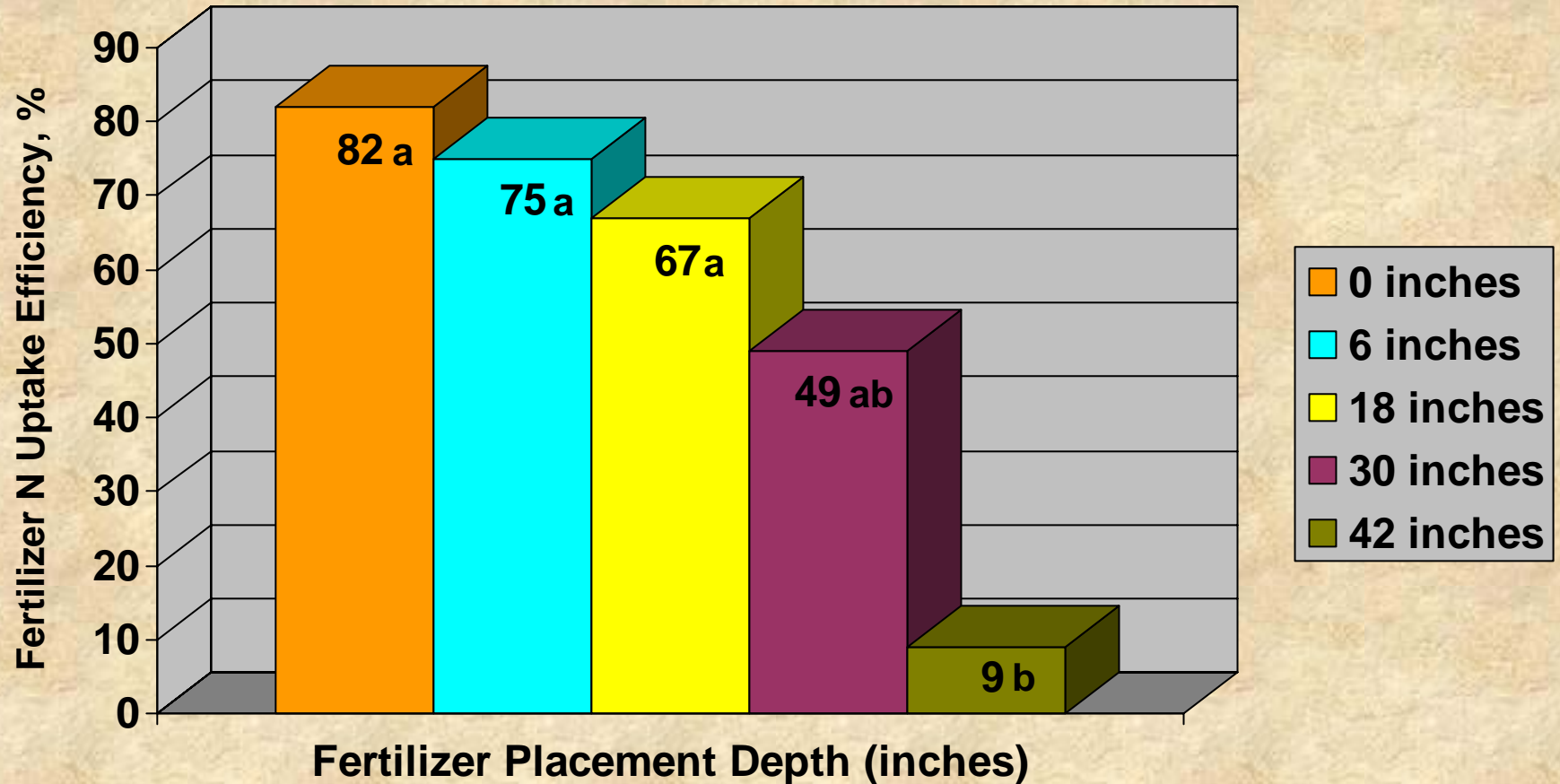


How much residual N do you have?

How much fertilizer N is needed?

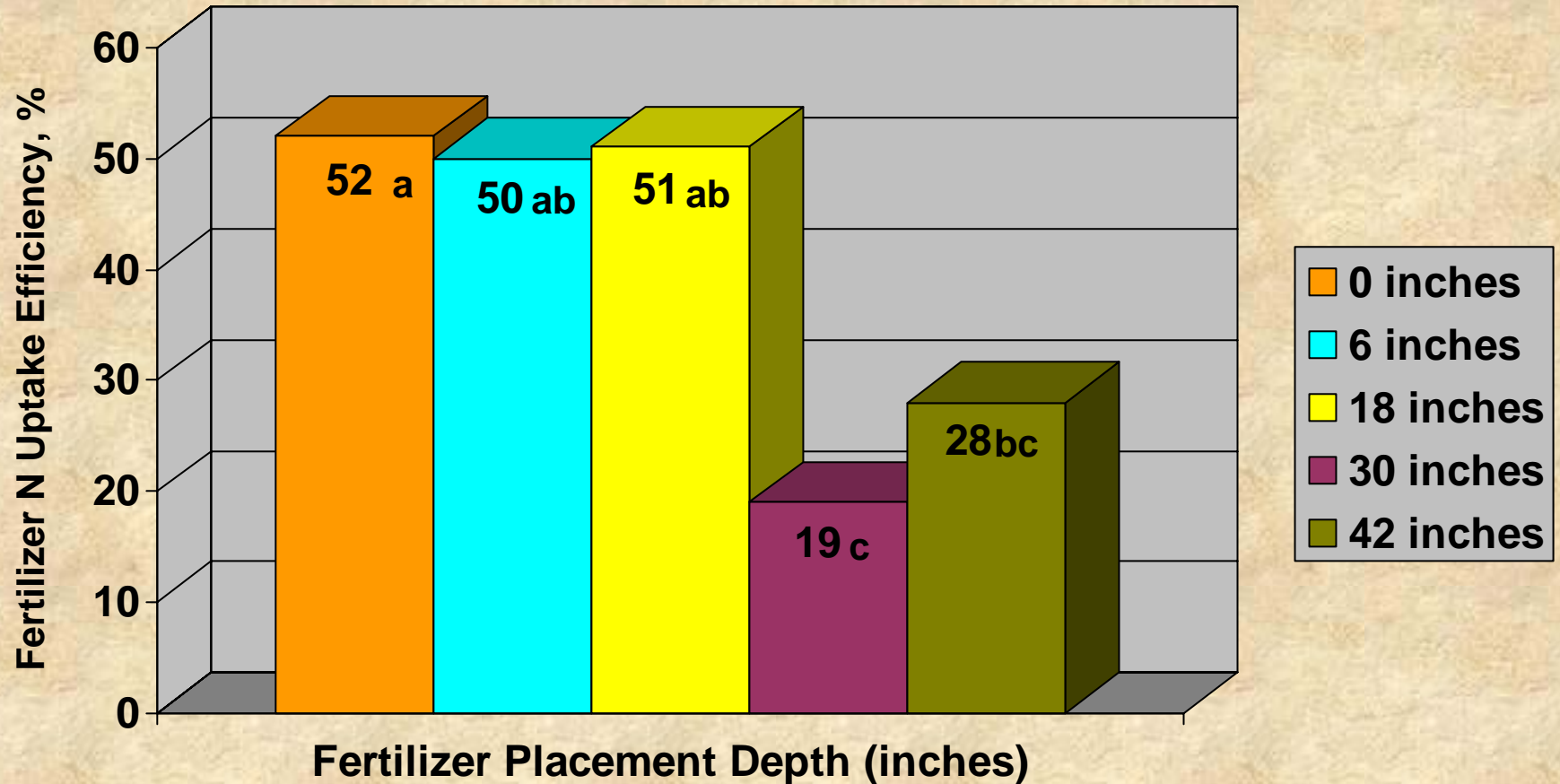
Uptake Efficiency of Cotton for ^{15}N -labeled Fertilizer Placed at Various Depths

Plant Samples Taken at Early-Bloom, July 11



Uptake Efficiency of Cotton for ^{15}N -labeled Fertilizer Placed at Various Depths

Plant Samples Taken at Late Boll Fill, August 7



Soil Sampling

The Most Important Step



High-level production requires a higher level of management:



Routine Soil Testing:

- ☞ 1-2 year interval
- ☞ Micro's every 2-4 years
- ☞ Nitrogen every year
- ☞ 12 inch depth
- ☞ 24 inches some soils

Sampling Methods:

- ☞ Composite samples
- ☞ 12-15 cores per 40 acres
- ☞ Mix and ship immediately

Average and Range for Nitrogen in Animal Manures

Nitrogen Source

(lbs N/ton)

Beef

27 (23-39)

Dairy

28 (4-44)

Broiler

58 (34-89)

Layer

30 (13-70)

Swine

10 (9-11)

Average and Range for Phosphorus in Animal Manures

Source	Phosphorus (lbs P₂O₅)/ton	
Beef	24	(15-39)
Dairy	11	(1-78)
Broiler	51	(32-67)
Layer	40	(2-85)
Swine	9	(7-13)

Average and Range in Nutrient Value for Animal Manures

Source	Nitrogen	Phosphorus	Potassium
	lbs/ton	lbs/ton	lbs/ton
Beef	27 (23-39)	24 (15-39)	36 (18-56)
Dairy	28 (4-44)	11 (1-78)	26 (1-48)
Broiler	58 (34-89)	51 (32-67)	40 (16-48)
Layer	30 (13-70)	40 (2-85)	20 (8-52)
Swine	10 (9-11)	9 (7-13)	7 (6-9)

Fertilizer Management

Environmental Issues

- **Nutrient Pollution of Water Resources**
 - **Nitrogen and Phosphorus – main concerns**
- **Regulation:**
 - **Total Maximum Daily Loads (TMDLs)**
 - **Source Water Protection – wellheads**
- **Fertilizer license??**

Environmental Regulations

Maryland

A person who applies nutrients to >10 acres must:

- Have an applicator voucher from DEQ**
- Be a certified nutrient management consultant or hire a certified consultant.**

Pennsylvania

- Nutrient management plan required for any operation of 10 acres or more.**

Arkansas

In “Nutrient Surplus Areas”:

- Must have a Nutrient Management Plan**
- Applicator must be “Certified”**