P and K For Cotton Risks and Benefits

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What nutrients are needed by cotton?

Cotton

- pH. 5.8 to 6.4, optimum
- Nitrogen. (60 LB. N per bale)
- 90 to 120 LB N/A for two bales.
- Phosphate. Soil test for rate.
- Potash. Soil test for rate, minimum of 45 LB K2O/A when yields are above 2 bales.
- Sulfur. Needed on sandy & sandy loam soils, low in organic matter. Use 10 LB S/A.
- Boron. 0.5 LB B/A.

Use soil testing to develop a fertility program and to monitor the program.

Cotton special considerations

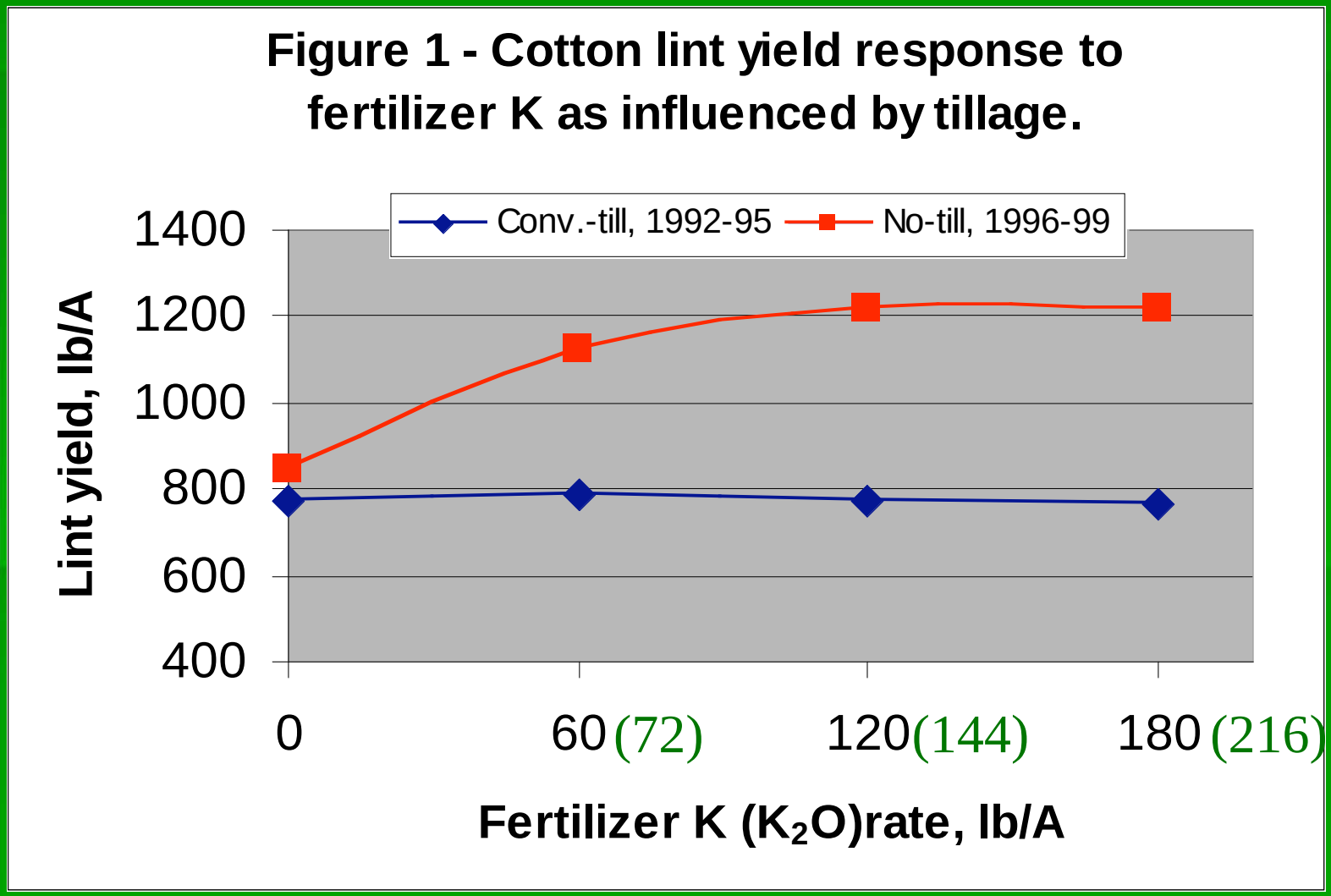
Phosphorus in high Mg soils can assist Mg uptake and thus cause K problems.

- Potash, important for short season, fast fruiting cultivars in preventing mid-season K deficiency.
- Potash, improves tolerance to Verticillium wilt and root knot nematode.
- 3-bale crop takes up about 120 lbs of K_2O.

No-till Cotton
special considerations for K

- **No-till cotton production systems need higher soil test P and K levels than conventional tillage systems do. Research in MS and TN found this to be the case.**
- **MS research by Dr. Jac Varco, MSU, follows.**

No-till Cotton Response to K in Mississippi on a High CEC Soil



Cotton Roots

When the cotton plant goes from vegetative to reproductive growth at first bloom, and with each following bloom cycle, growth of the root system slows and the root system actually decreases in size during the remainder of the growing season. This reduces K uptake at the time of greatest uptake rate, especially during drought.

K Uptake by Cotton

Occurs rapidly during peak bloom.

- In AL research, in 2 weeks after first bloom, 35% of total K was taken up.
- This equals a rate of 2.4 to 3.7 lbs.K2O/day.
- In MS research, 67% of total K was taken up in 6 weeks from July 1 to maturity.
- This equals a rate of 2.3 to 3.7 lbs. K2O/day

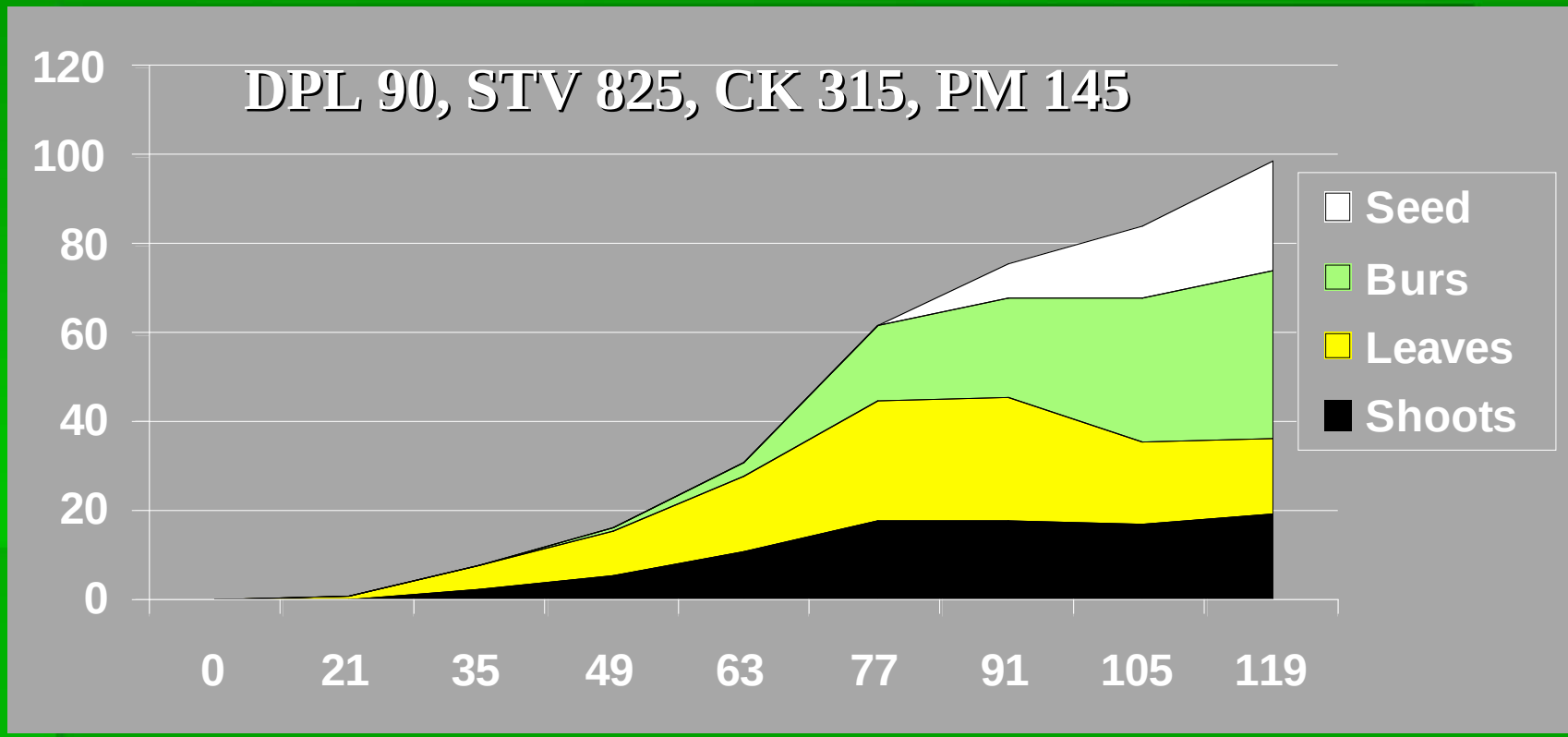
An important point to remember here is, as Dr. Will McCarty has said many times, 90% of a cotton crop is produced during a 30 day period, usually in July.

Cotton Peak Nutrient Uptake Rate
40 to 100 Days After Planting
Data from California, Israel, and Alabama

	Location		
	CA*	Israel *	AL
	----- lb/A per day ----		
N	1.8	4.1	3.5
P_2O_5	0.7	1.4	0.6
K_2O	3.6	4.9	3.1

* Irrigated

K Uptake by Modern Cotton Varieties Lint Yield 885 lb/A. Mullins & Burmester, 1990



P and K uptake and removal by cotton.

- 1500 lb lint crop takes up in pounds:
- 180 N, 63 P_2O_5, 126 K_2O and 30 S

- Cotton removes Per Bale:
  - 14 lbs P_2O_5
  - 20 lbs K_2O

Drought K Problems

- **Early maturity and reduced movement and availability of soil K, reduced K uptake and caused widespread mid and late season K deficiency, especially in dry land cotton and where Mg was high, over 20+% of base saturation.**

Response to K in dry and wet year, Verona BES.

K2O rate	Yield, lbs sc/a			
Lbs/a, bc	1976	dif	1977	dif
0	1463		1137	
30	1562	+99	1215	+78
60	1476	+13	1320	+183
120	1442	-21	1383	+246
Season	wet		dry	

2006 and 2007 Situation

- 1. Drought occurred early and continued during the growing season.
- 2. According to Dr. Tom Barber, In 2006 the cotton plant matured rapidly and early.
- 3. I saw cotton blooming out the top in early July 2006.
- 4. According to Dr. Barber, in many cases, initiation of irrigations were delayed and caused problems

2006 and 2007 Situation

- The drought and dry soil reduced the movement of N and K.
- N moves by mass flow, so most of remained between the soil surface and the root system.
- K moves by diffusion, so the dry soil reduced this movement.
- Soil clay lattices closed and reduced K availability.

Phosphorus

Phosphorus Points

- 1000 lb crop can take up over 50 lbs P_2O_5.
- Essential for good root and shoot growth. Advances maturity.
- Necessary for energy storage and transfer in plant.
- Helps overcome effects of compaction.

Low P:

> produces dwarf plants.

> delayed fruiting and maturity.

> reduced yields.

NC data found that when the M III soil P level was 33 ppm or 66lbs, or greater, only maintenance applications of phosphate were necessary.

My recommendation is maintain at 60 lbs M III P or above.

Especially true in Delta when soil Mg is above 20 to 25% base saturation.

Phosphorus Fertilization in a Corn and Cotton Rotation

- **In a cotton and corn rotation in the Delta and soil Mg is > than 25% of the base saturation, apply recommended phosphate to the corn in the rotation.**

Potash

Mid to Late Season K Deficiency

Cotton Response to K, MS

K2O	Lint	Boll Wt.	Turnout
lbs/A	lbs/A	g/boll	%
0	1061	4.1	38.6
120	1169	4.4	39.3
LSD .05	31	0.1	0.3

- Soil K, 0 to 6 ins. 211 lb
- 6 to 12 ins. 120 lb
- USDA, ARS, Stoneville

Potash and Magnesium

- The K and Mg ions are approx. the same size. This can cause competition for the uptake of the ions. MS Delta soils can have high Mg levels and in many cases, this is where K deficiency is often seen. MO, TX and AR research found that high P levels aid the uptake of Mg over K. So, my recommendation is, when soil base saturation of Mg is 25 to 30% and K saturation is less than 5%, increase K_2O rate by 50%.

Pettiet research in 1973. What happened?

N-P2O5-K2O lb/a	sc yield, lb/a Dundee si l	sc yield, lb/a Brettain si l
90 – 0 - 0	2351	2819
90 – 0 – 60	2641 (+290)	3505 (+686)
90 – 60 – 60	2595 (+ 244)	3282 (+463)

- 13 tests around Delta. Several others had
- Similar yield trends.

Thom research in 70's, what happened?

N – P – K	Dundee si l
	1978
Lbs/a	lint, lbs/a
90-0-0	779 (lsd 95; 874)
90–0-60	905
9–0-120	958
90–60-0	870
90-60-60	875
90-60-120	978

S.T.
P, M
K, H

MS Potash test, S Delta Dr. Varco, 2 year avg*.

K2O lb/a	App. meth.	lint lb/a
0	BC	1076
72	BC	1158
144	BC	1217
216	BC	1179

K2O lb/a	App. meth.	lint lb/a
36	BD	1128
72	BD	1215
72/72	bc/bd	1303
144/72	bc/bd	1346

- st K, M. rec'd K2O, 90 lb
- *1990-1991

Questions?
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