

Costs and Benefits of Different N Sources for Cotton

**Louisiana Agricultural Technology
and Management Conference**

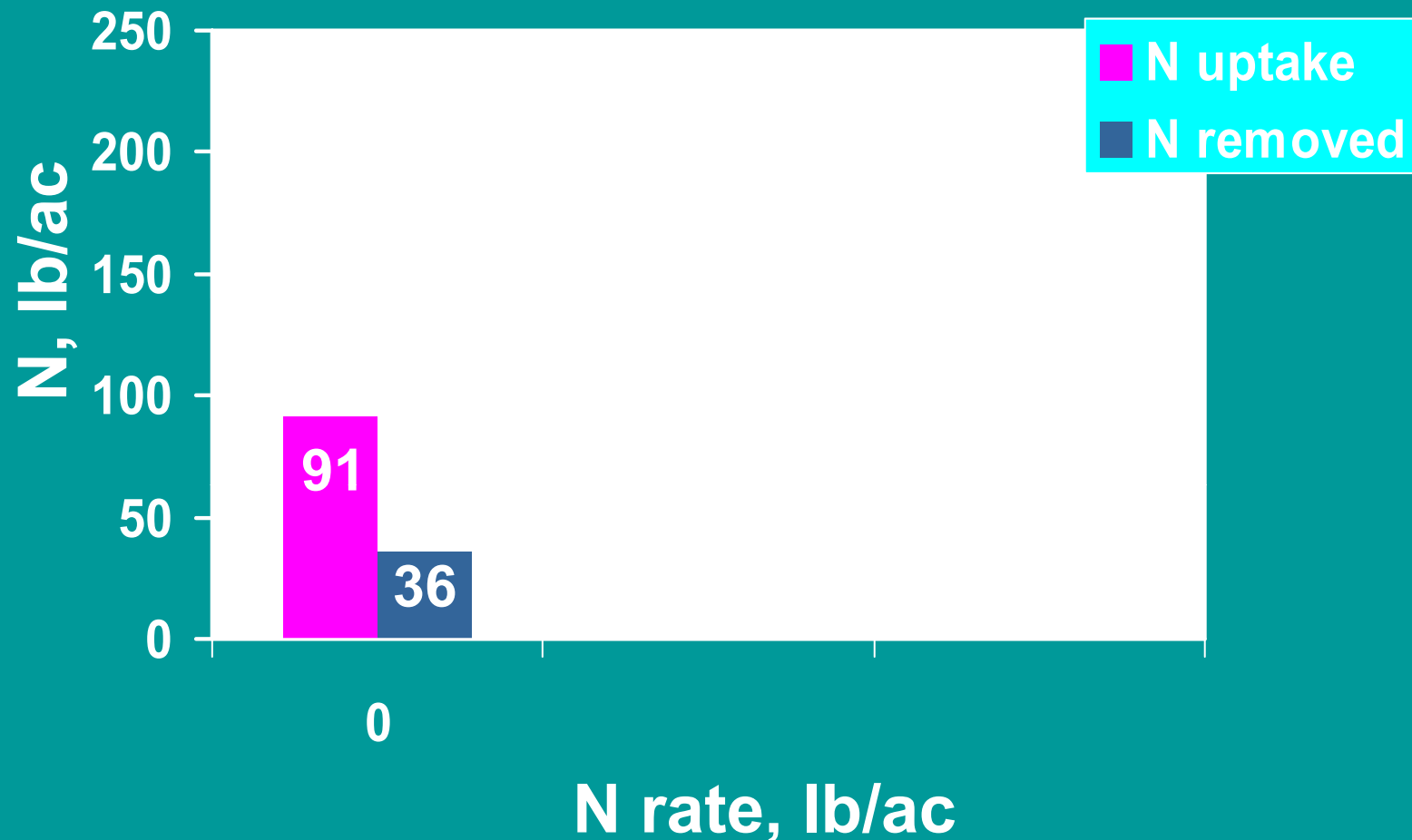
**Alexandria, LA
February 11-13, 2009**

**Donald Boquet
LSU AgCenter**

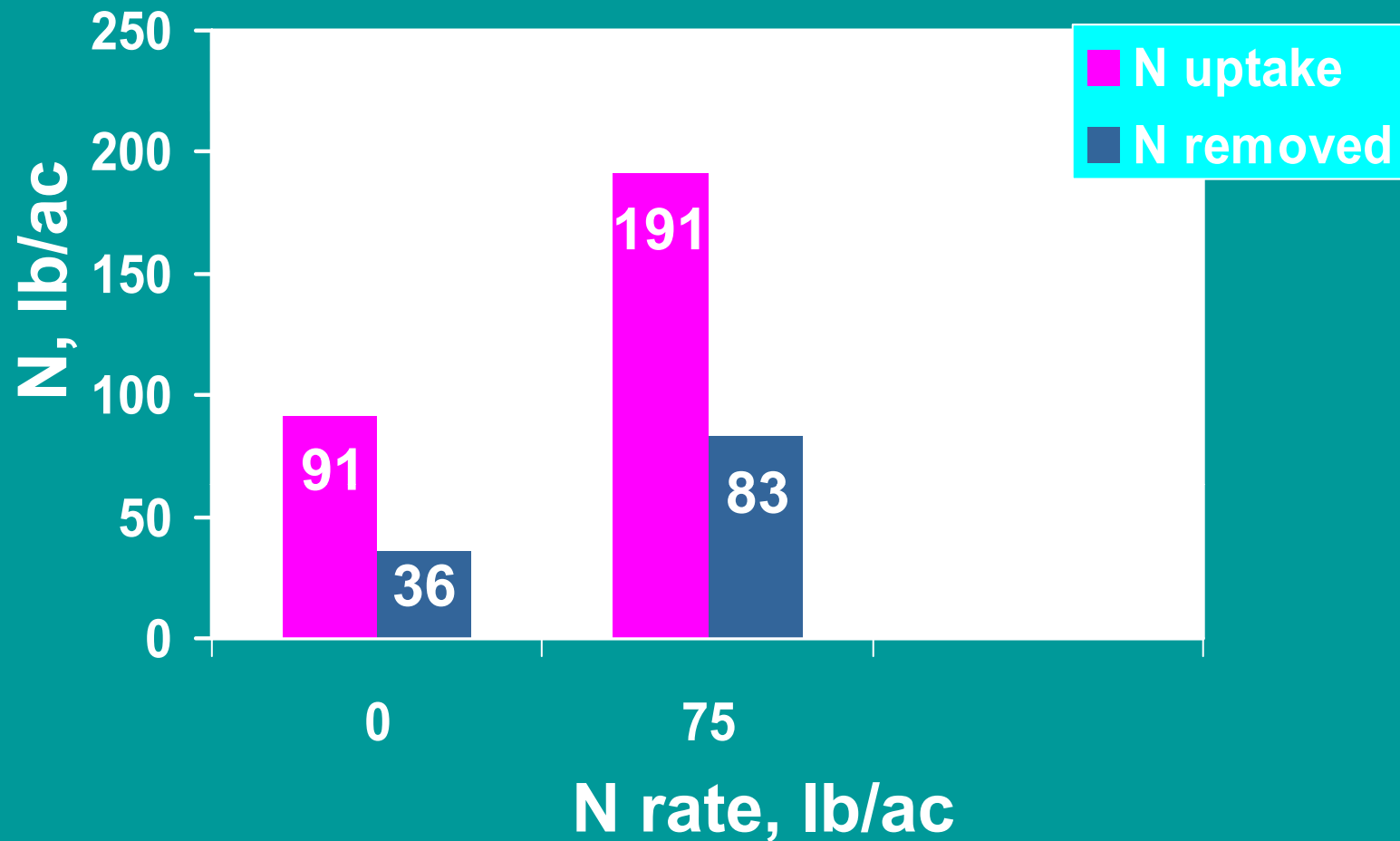


How much nitrogen does a cotton crop need for optimal growth and yield?

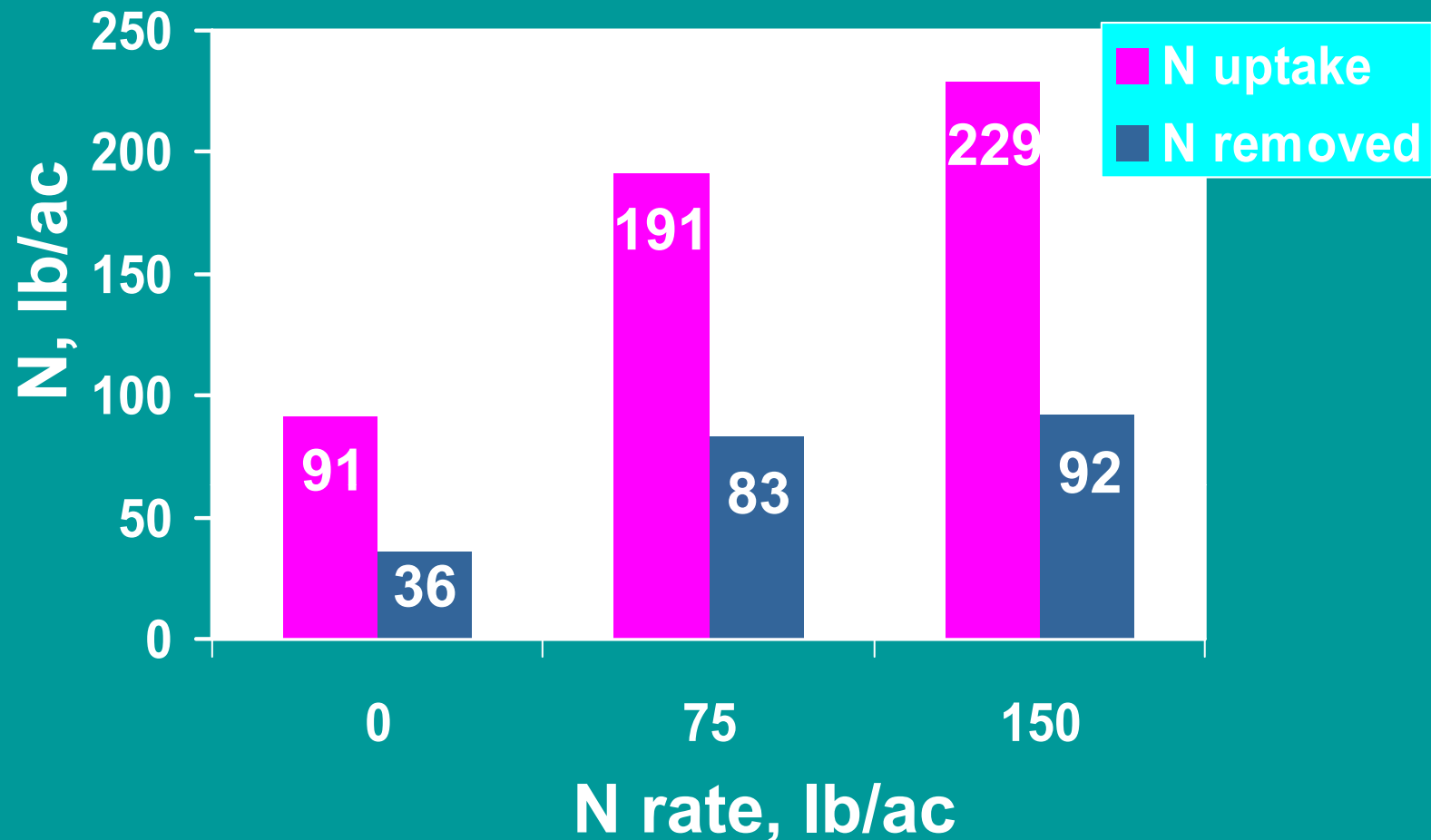
How much fertilizer nitrogen does a cotton crop need for optimal growth and yield??



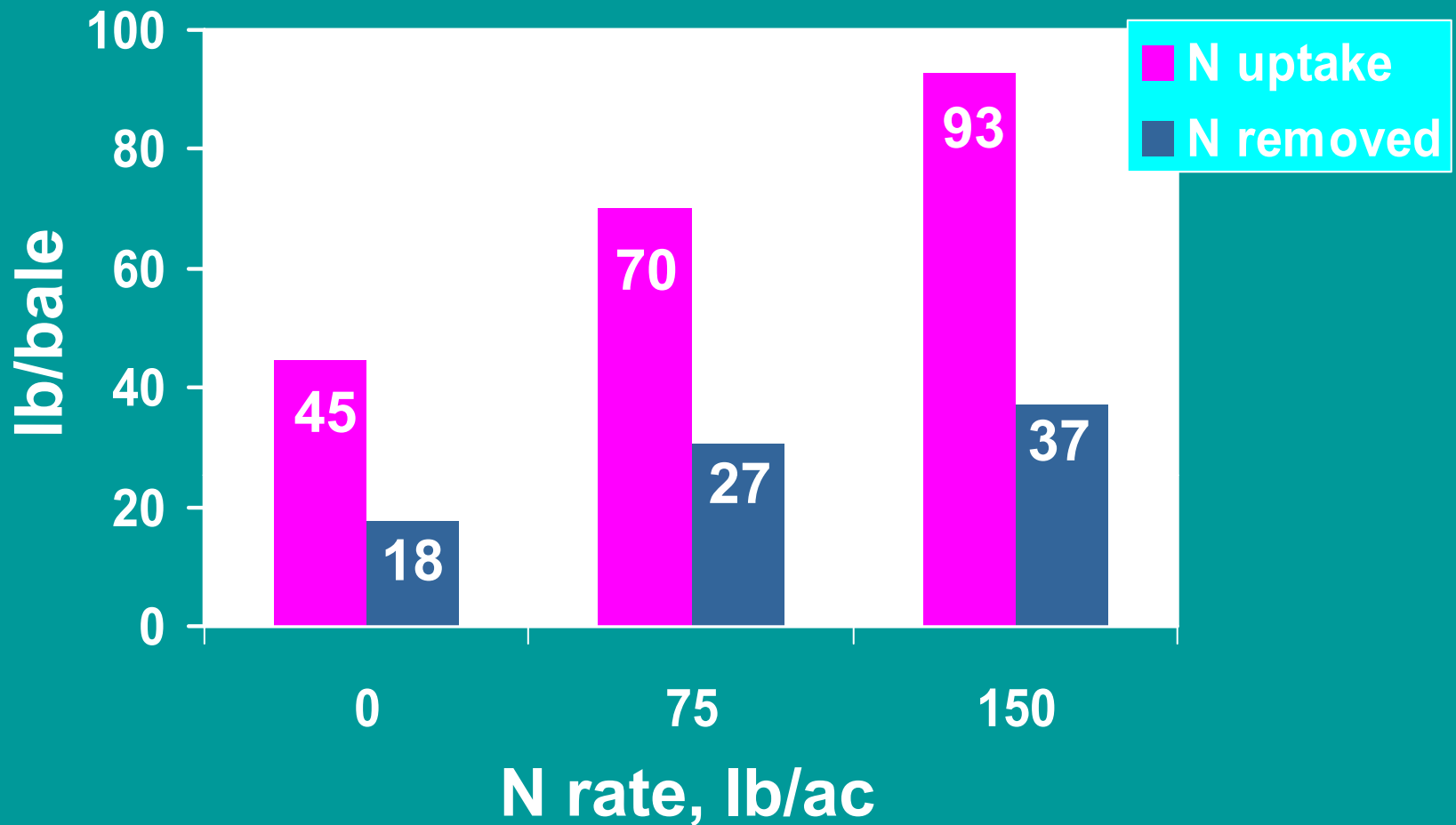
Total per acre nitrogen uptake and removal by cotton on Commerce sl, 2-yr average. (No residual N.)



**Total per acre nitrogen uptake and removal by cotton on Commerce silt loam, 2-yr average.
(With residual nitrogen)**



Total per acre nitrogen uptake and removal by cotton on Commerce sI, 2-yr average.



Nitrogen uptake and removal per bale of cotton on Commerce soil, 2-yr average.

Sources of Nitrogen

- Free
- Fertilizer N

Free Sources of Nitrogen

- Native soil N (Organic matter, Clay-fixed, N fixation by algae)
- Residual N (From fertilizer N applied in last 3 years)
- Vegetation mineralization
- Added N from all other sources

Not free sources Fertilizer N

2/09/09

Ammonium nitrate – 67 to 92 cents/lb

UAN 32 -- 59 cents/lb

UAN 30 + S – 61 to 71 cents/lb

Urea -- 45 to 46 cents/lb

Anhydrous – 20 cents/lb

Legume N – 40 to 60 cents/lb

Fertilizer N Costs

Cost of fertilizer N per acre* – \$36 to \$57

Cost of Fertilizer N as percentage of total input costs -- 6 to 10%

Cost of Fertilizer N per pound of lint – \$.036 to \$.057

* silt loam soils

Strategies to minimize fertilizer N costs?

Applying split applications of soil-applied or foliar-applied N?

Using in-season monitoring of crop N status -- sensing of leaf/crop 'greenness'?

Using site specific applications based on field variability?

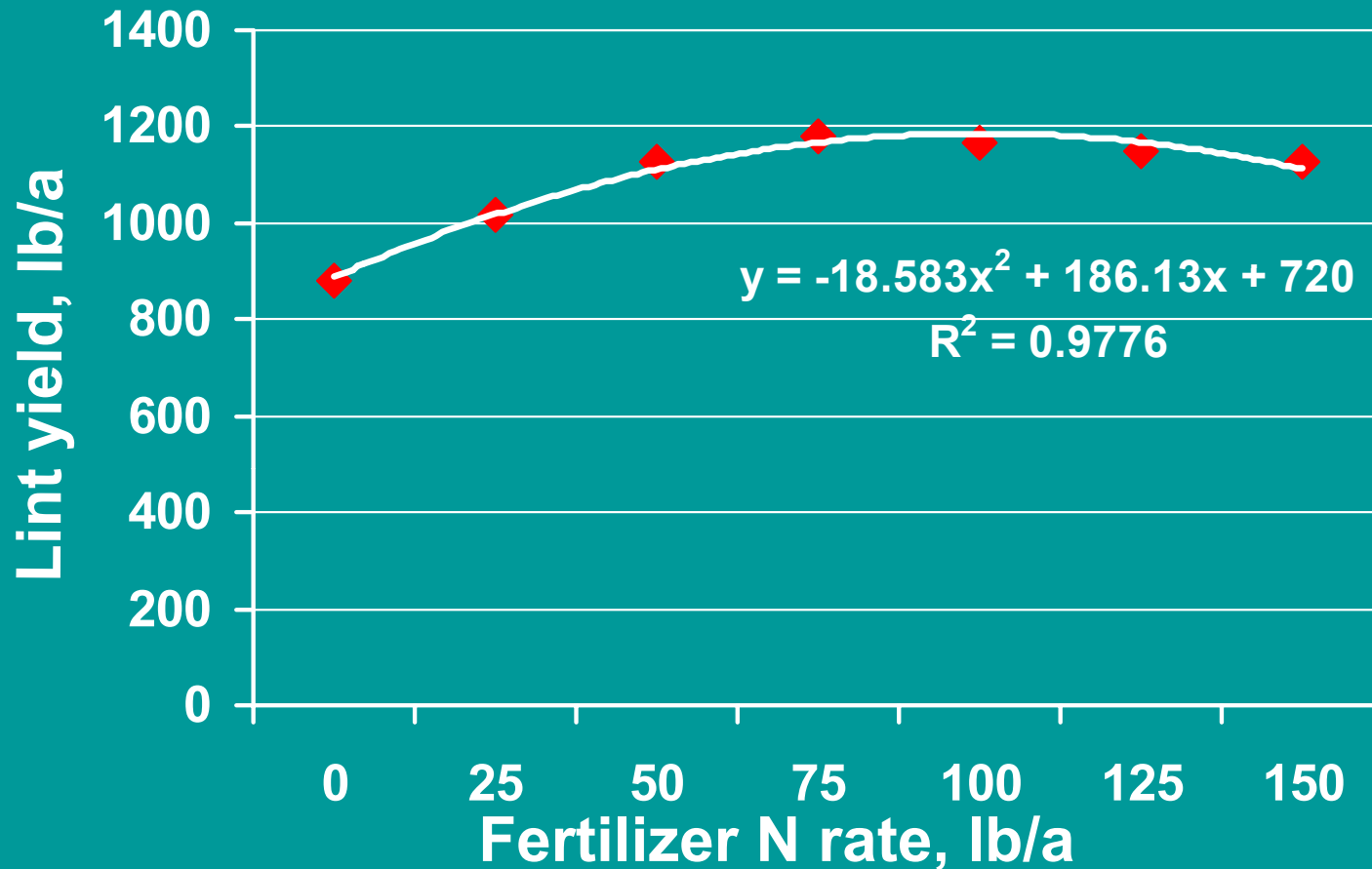
Strategies to minimize fertilizer N costs?

Delaying fertilizer application to wait for price to decrease?

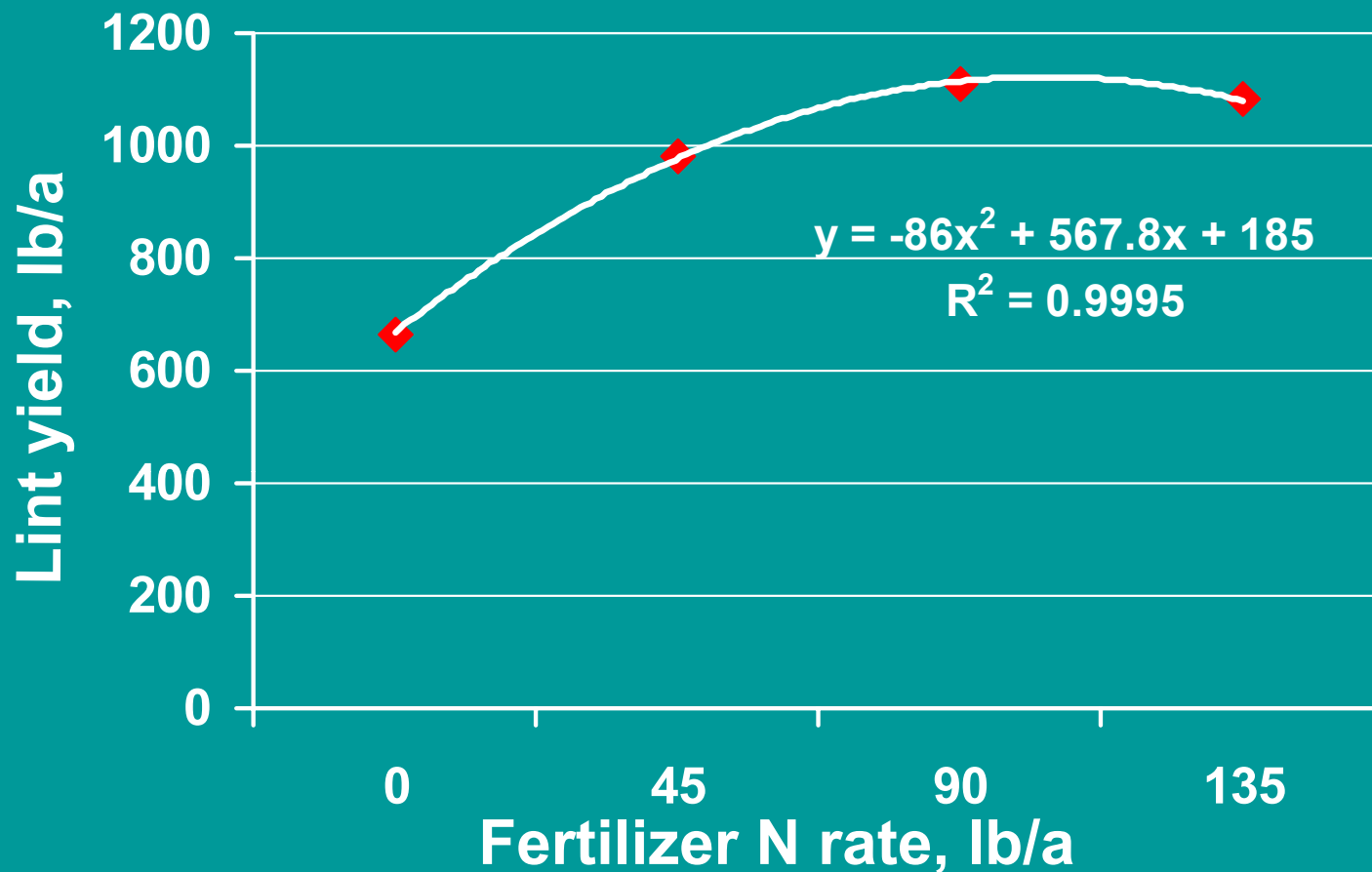
Use the minimal rates needed based on research and experience.



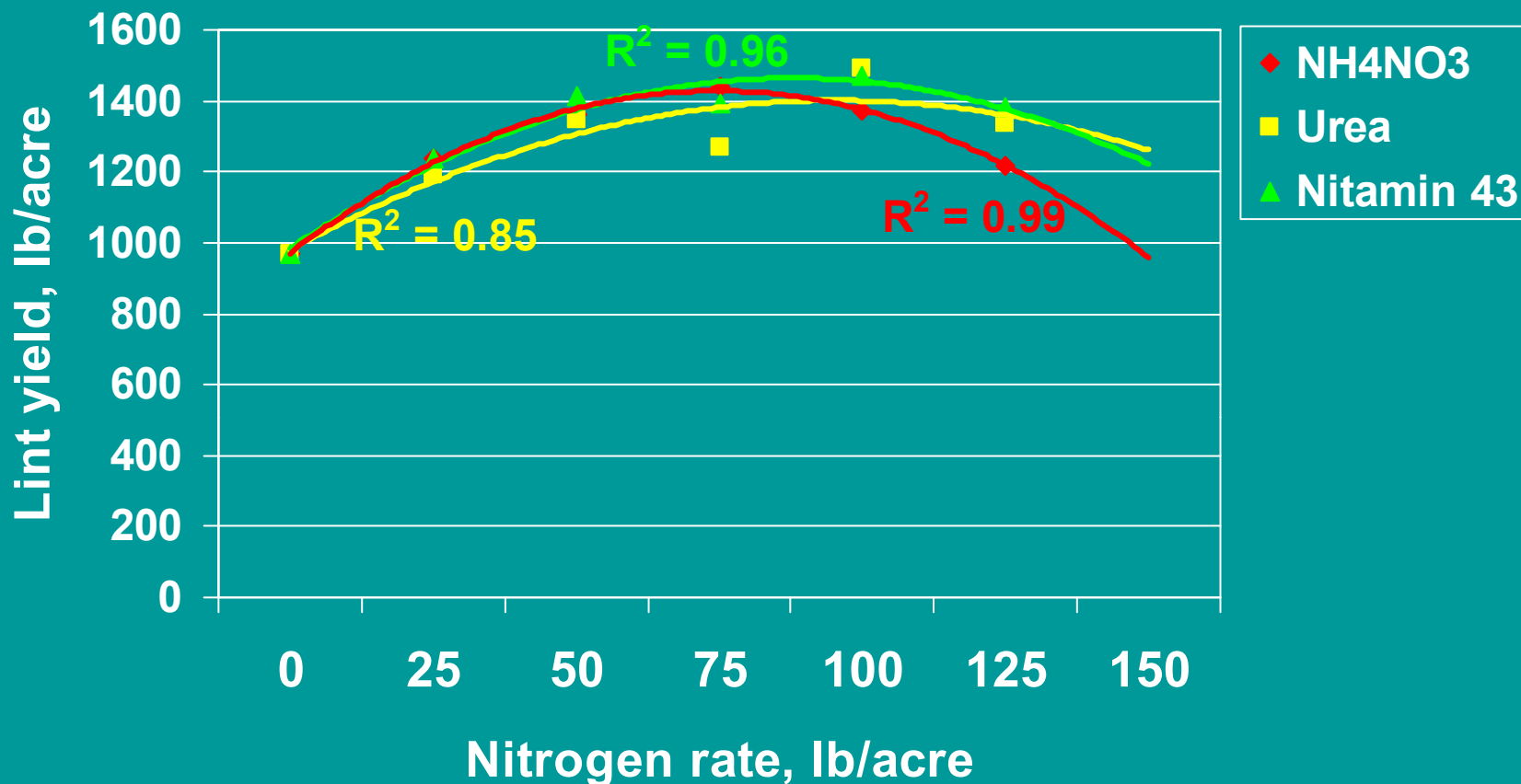
For most alluvial and loess silt loam soils, a fertilizer N rate of 75-80 lb/a is optimum for yield and management of cotton.



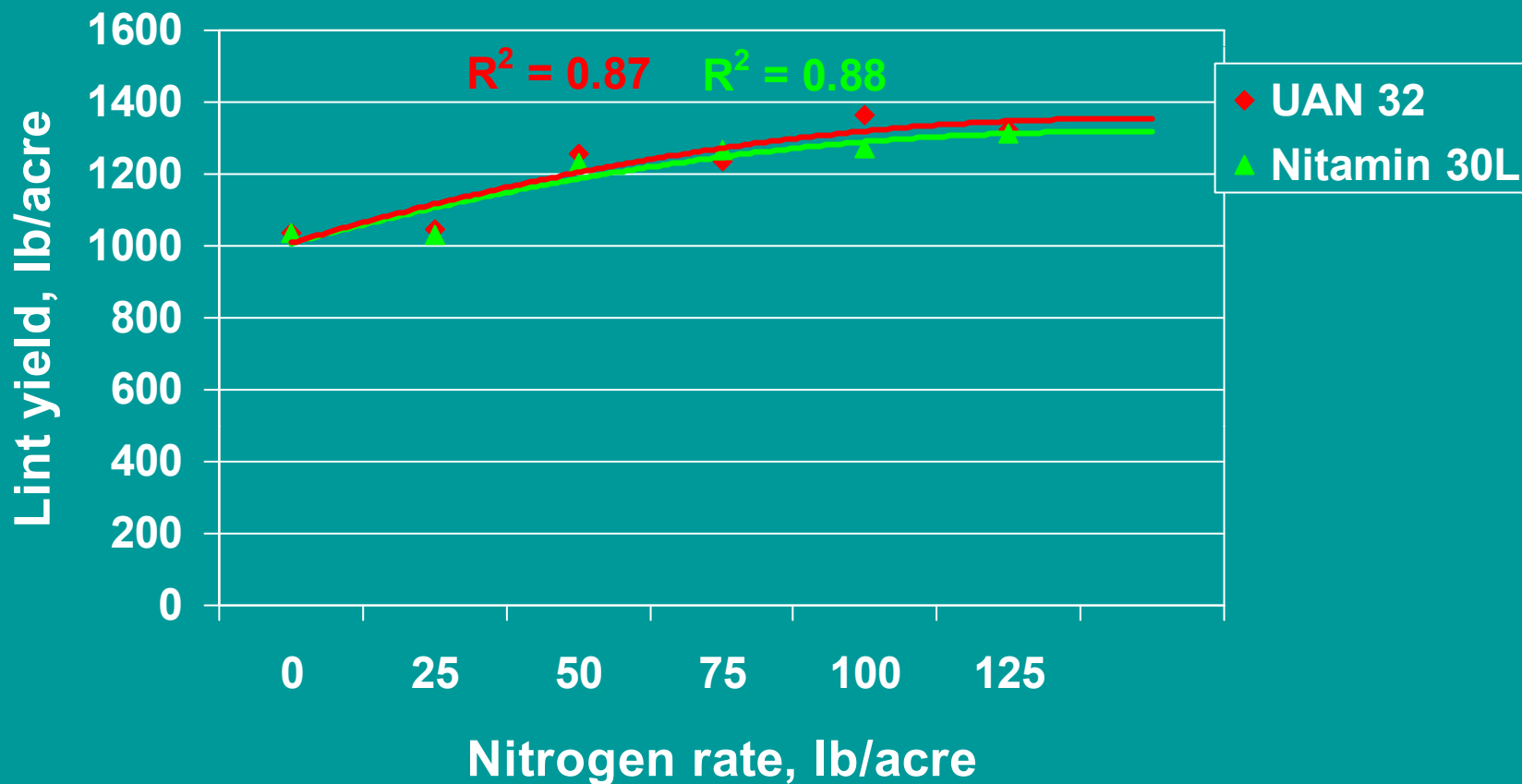
Dryland cotton response to cover crop and N rate on Commerce silt loam, 7-yr. avg.



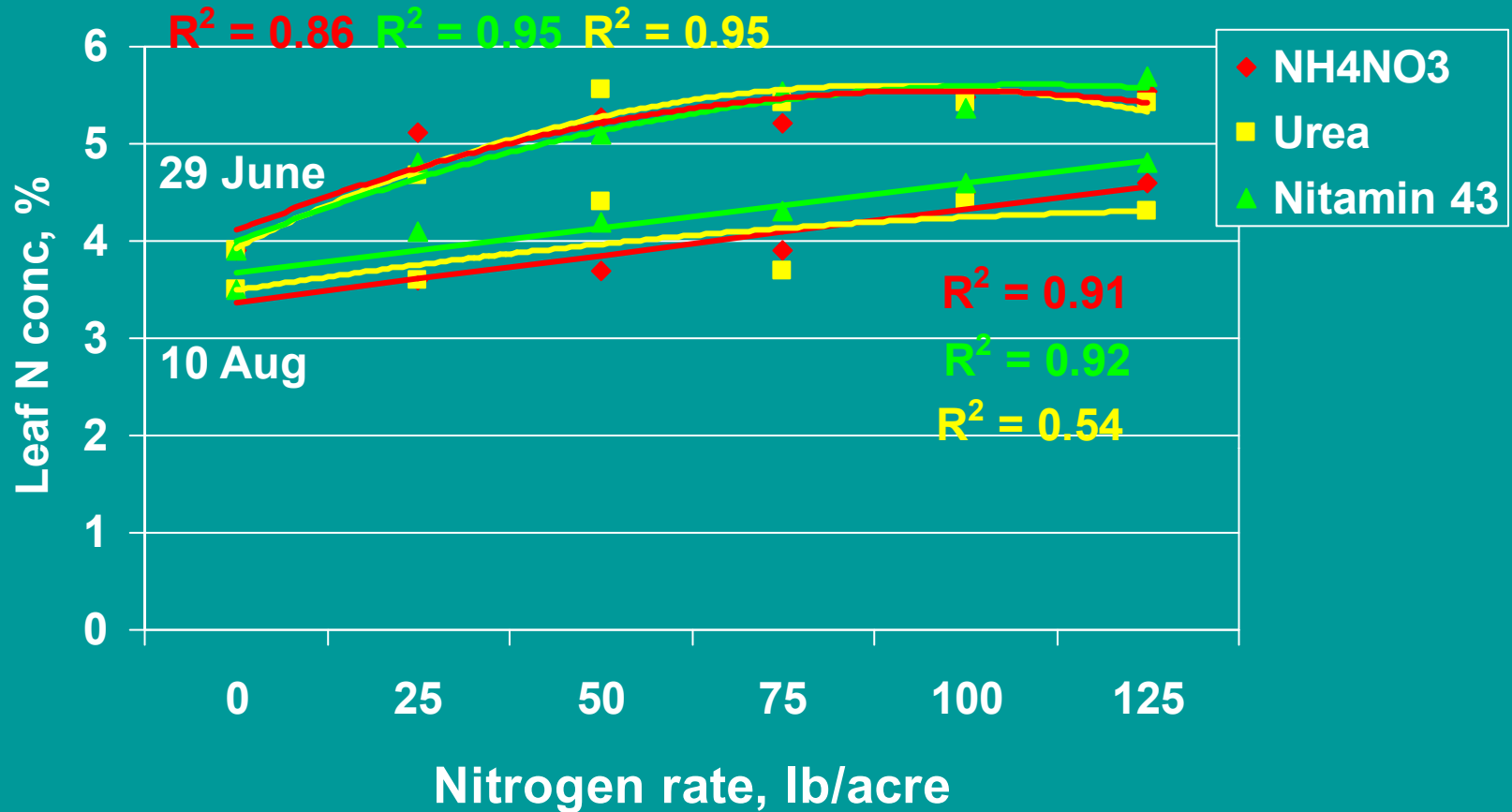
Dryland cotton response to cover crop and N rate on Sharkey clay, 2-year avg.



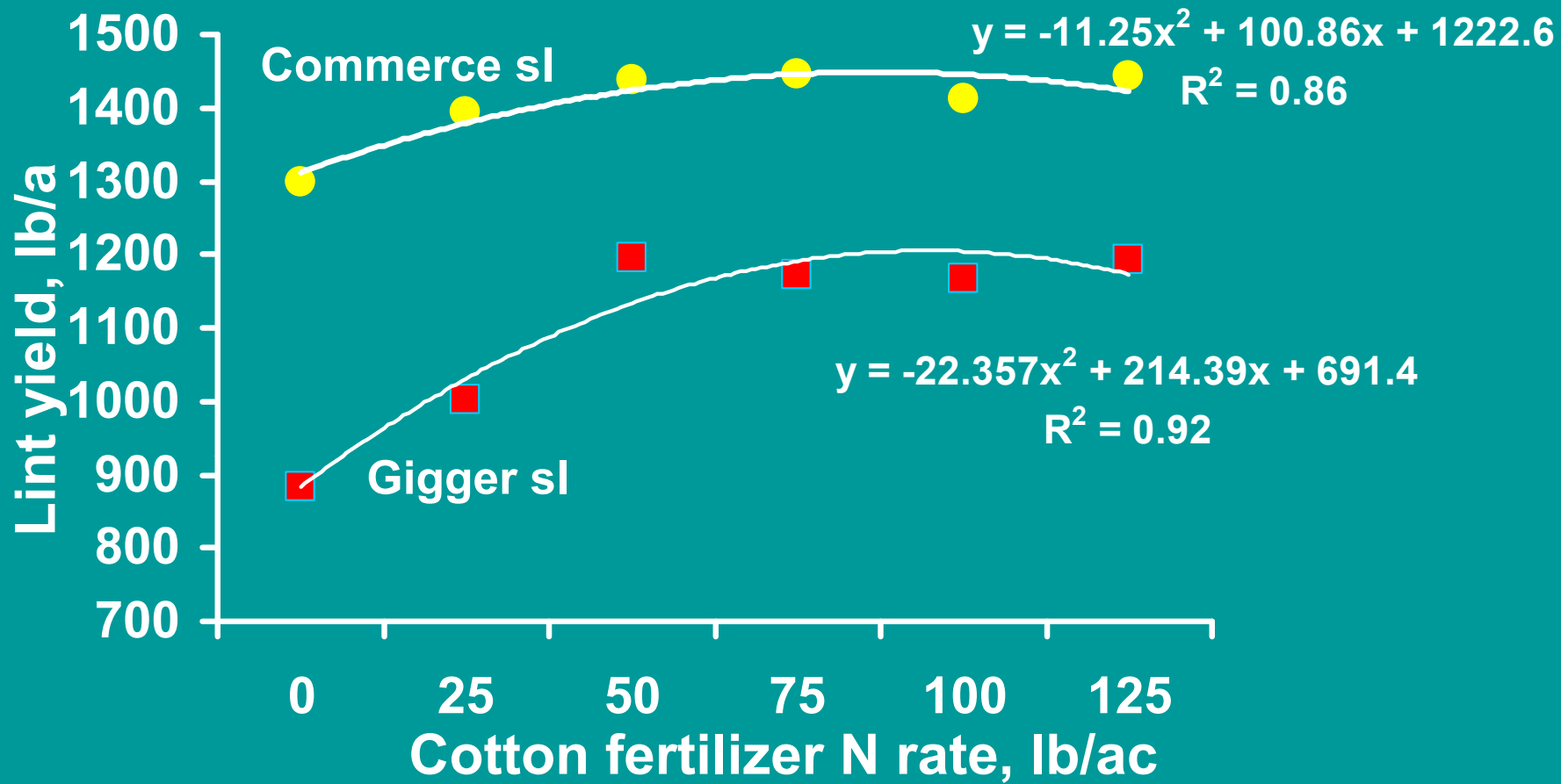
Cotton yield response to three formulations and six rates of N fertilizer on Gigger silt loam, 2006-08.



Cotton yield response to two formulations and six rates of N fertilizer on Commerce silty clay loam, 2007 and 2008.



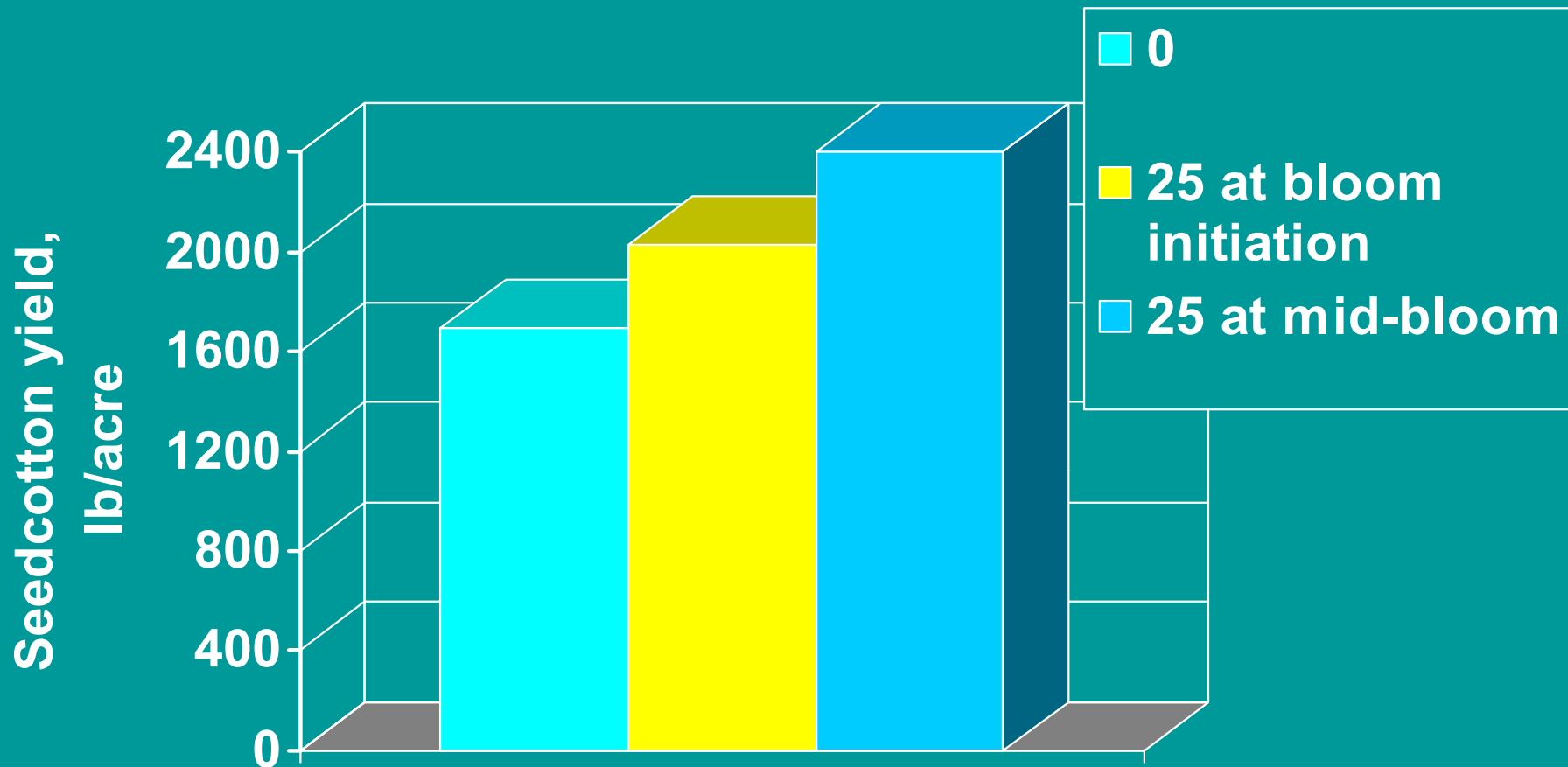
Cotton leaf N response at flower initiation and boll fill to fertilizer N forms and rates on Gigger silt loam, 2006.



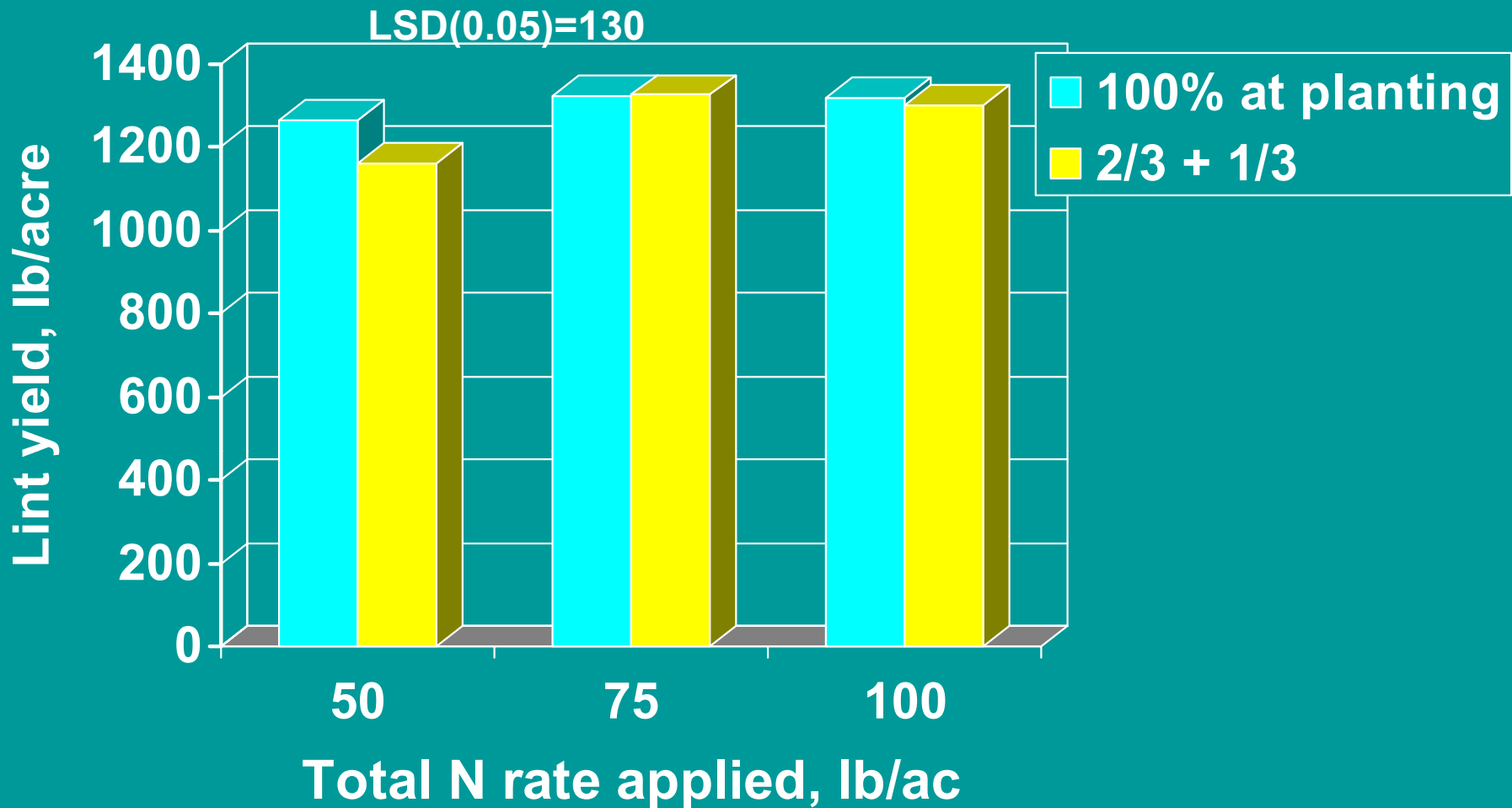
Response of cotton yield following corn to fertilizer N rate on Gigger sl and Commerce sl, 4-yr avg.

Split Nitrogen Applications

- Soil-applied
- Foliar-applied

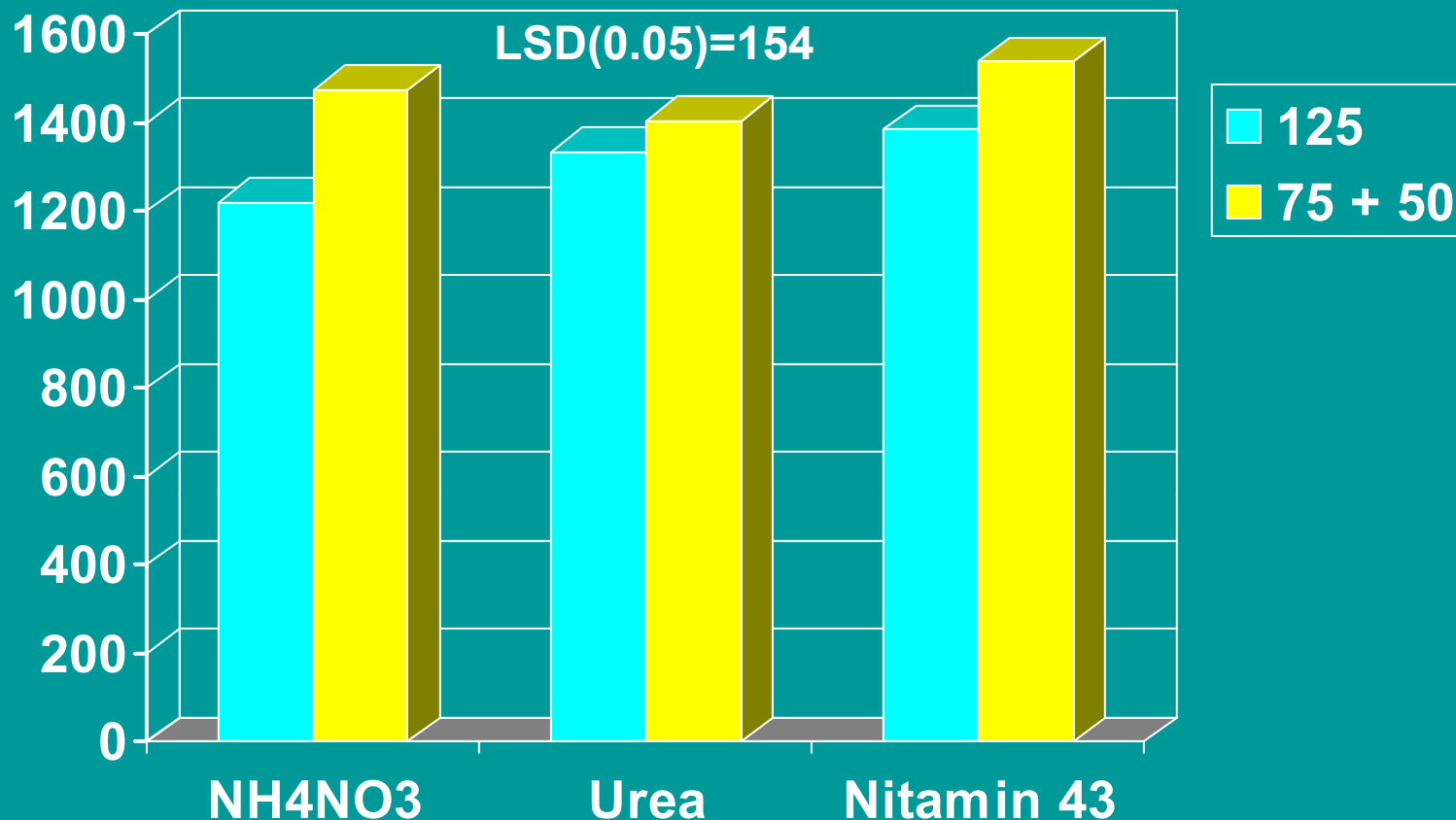


Response of cotton yield to single N applications at different times on Commerce silt loam.

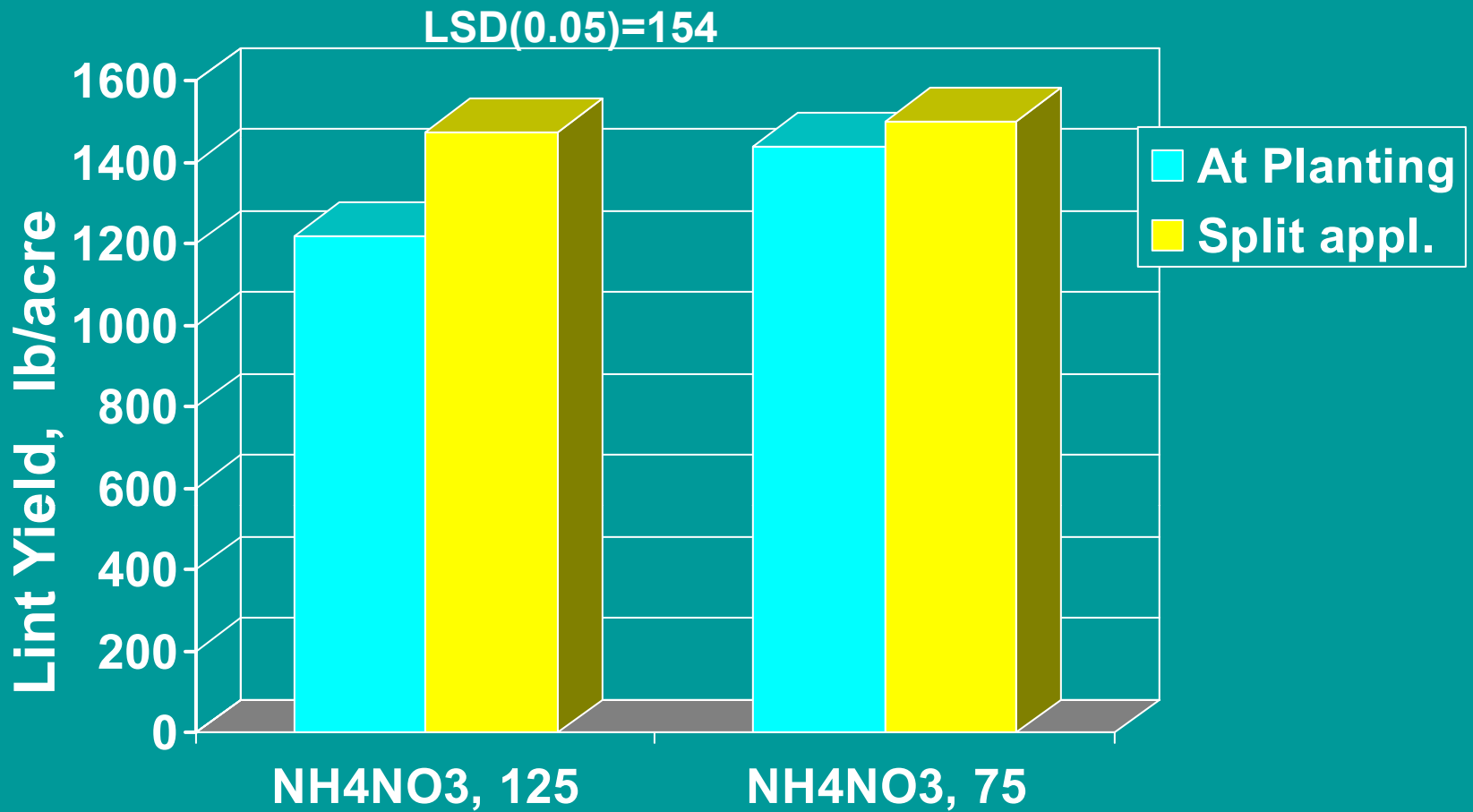


Response of cotton yield to single and split N applications of 50, 75, and 100 lb on Commerce sl. 4-yr avg.

Second appl. at flower initiation.

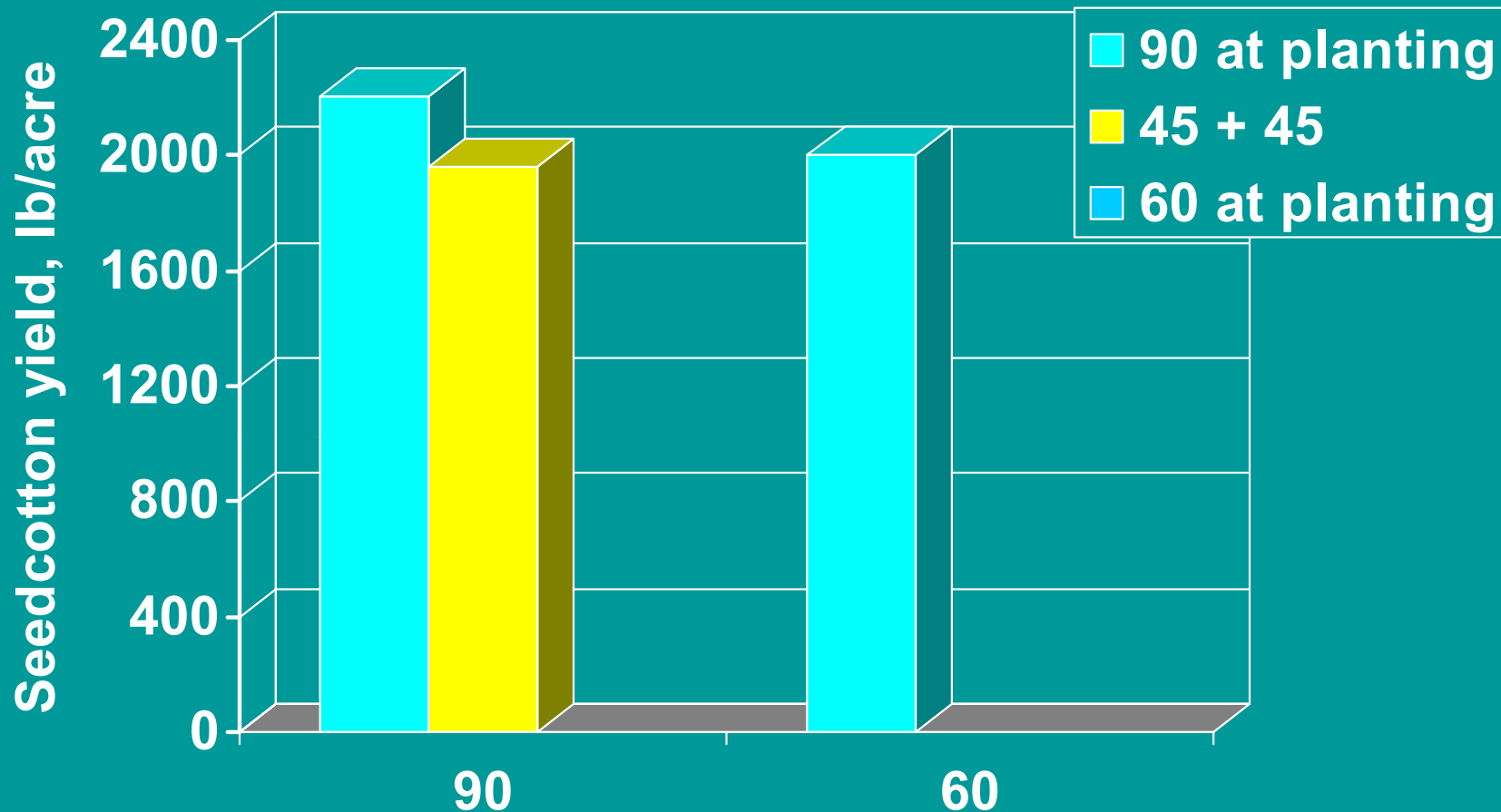


Response of cotton lint yield to single and split 125 applications of NH₄NO₃, Urea and Nitamin formulations on Gigger sl, 2006-07.

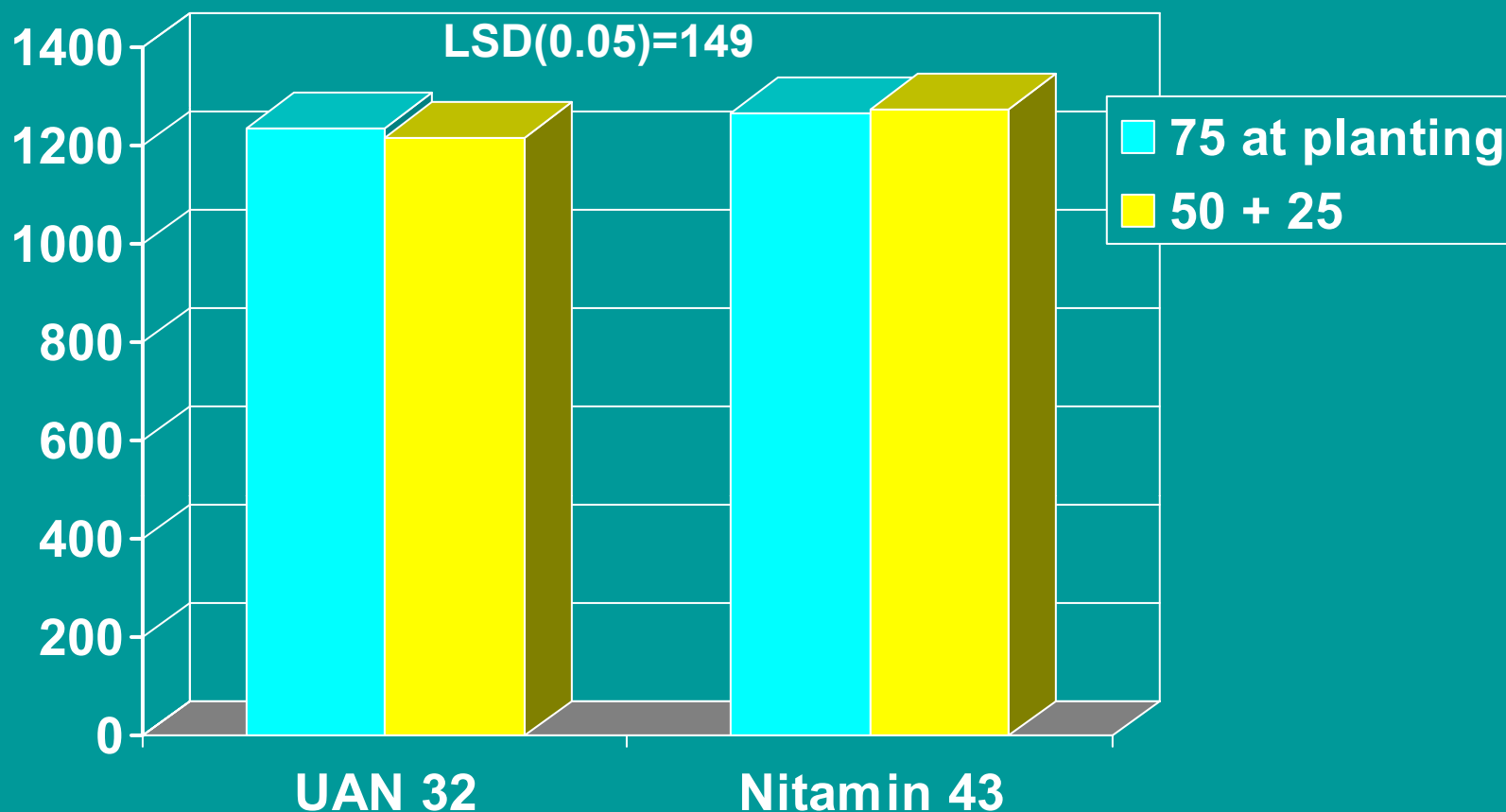


Response of cotton lint yield to single and split 75 and 125 lb NH₄NO₃ applications on Gigger sl, 2006.

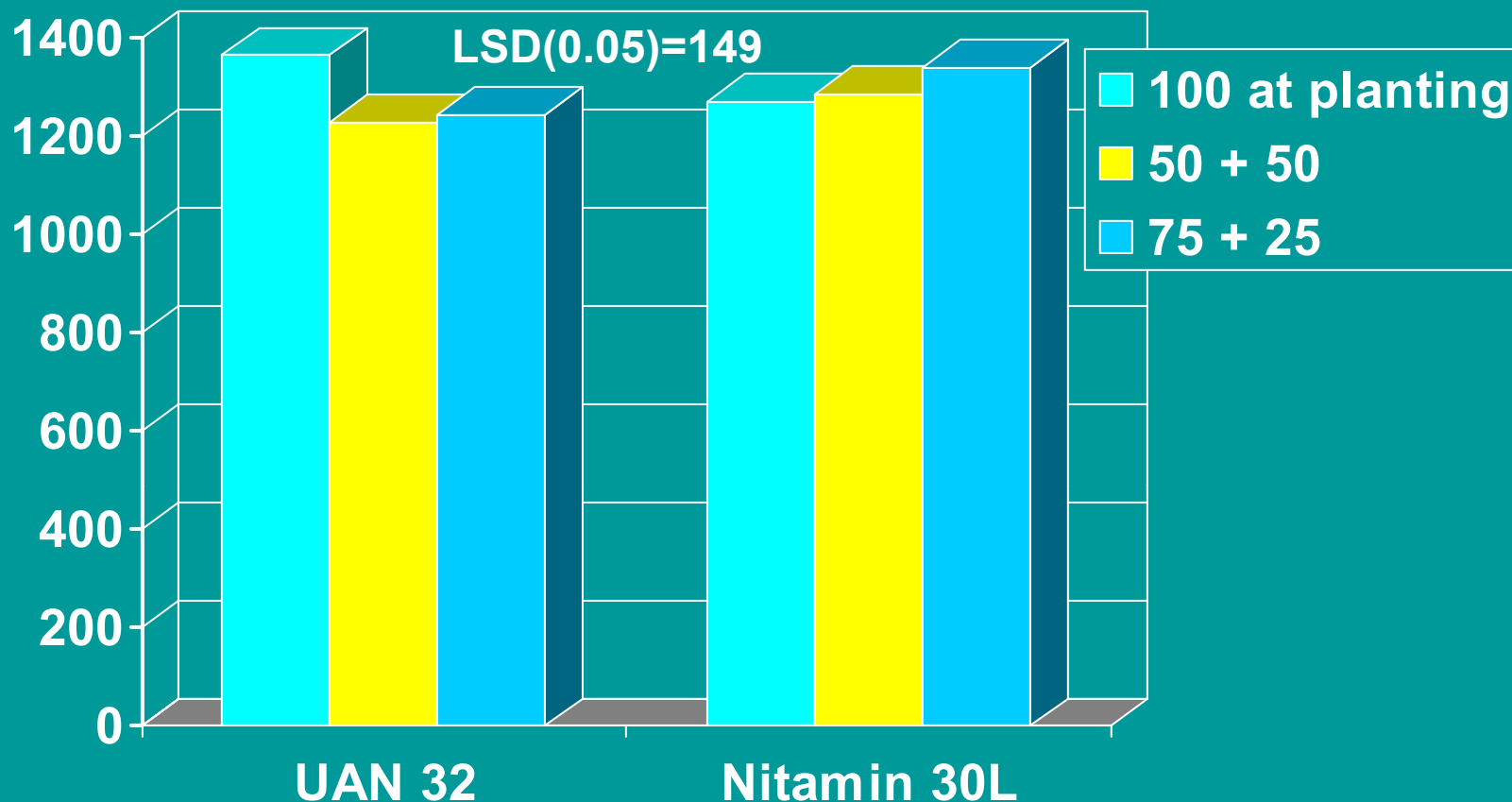
LSD(0.05)=187



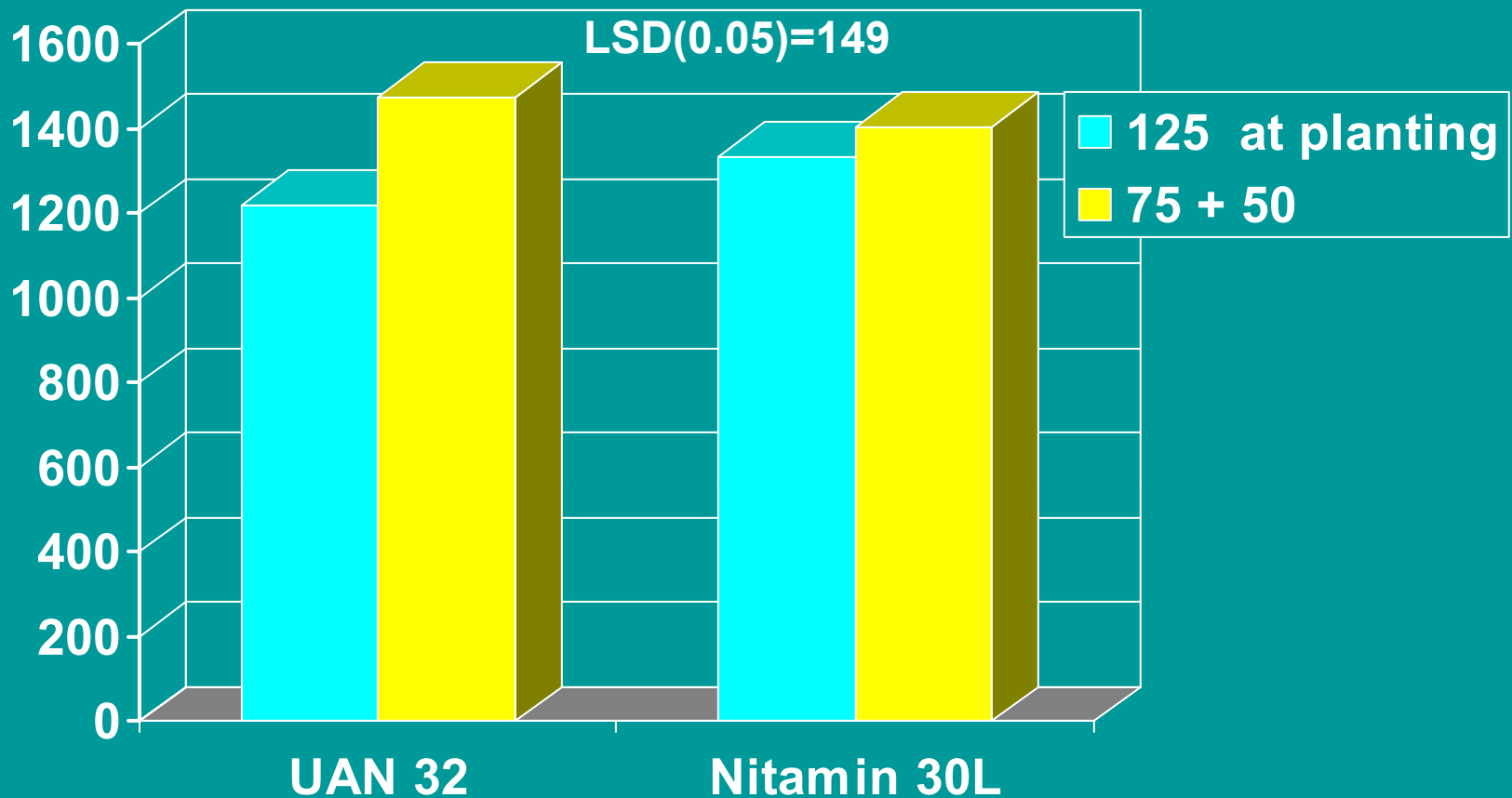
Response of cotton yield to single and split applications of 90 lb/ac N as UAN on Commerce silty clay loam, 2008.
Second application at flower initiation.



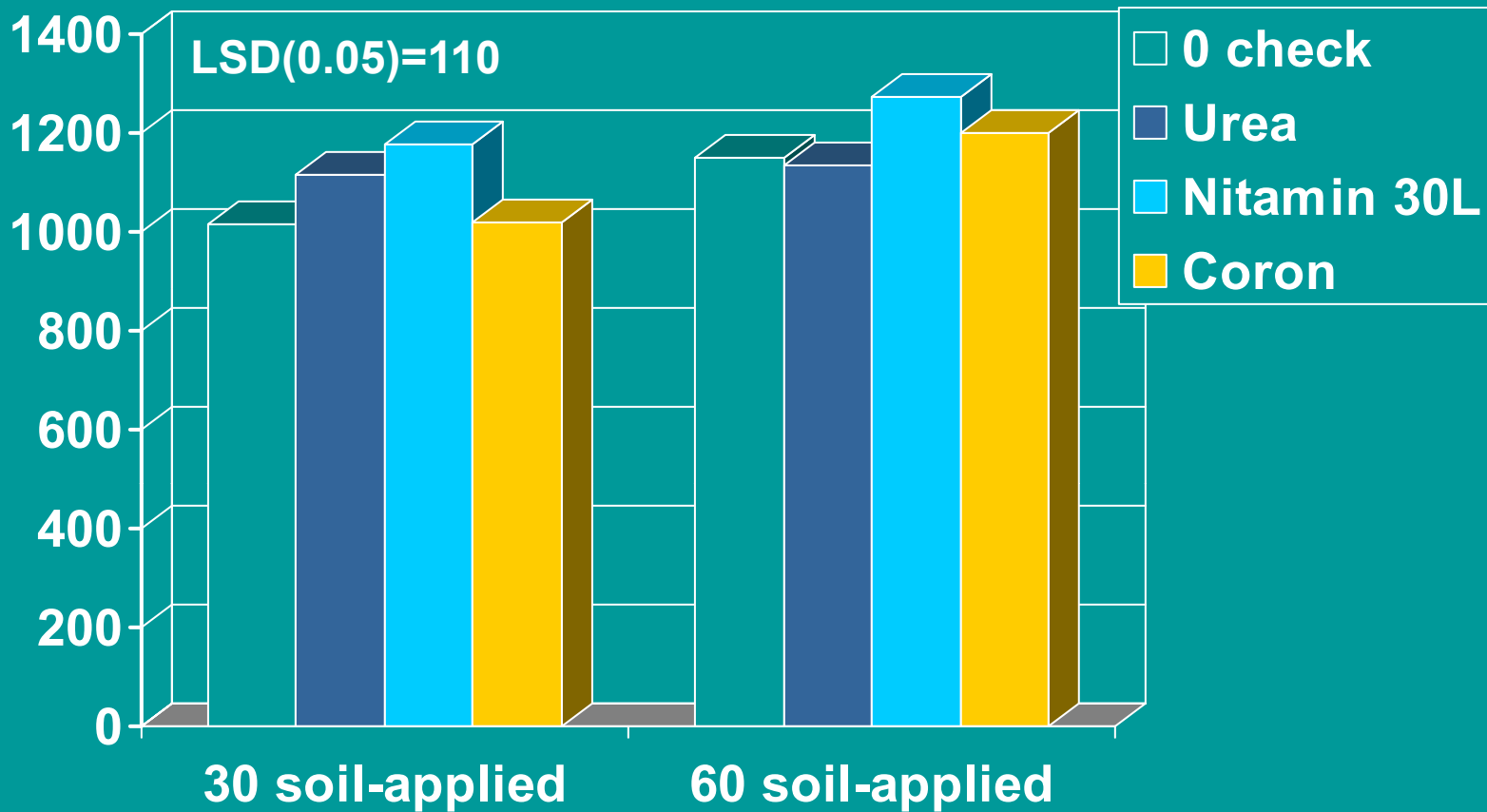
Response of cotton lint yield to single and split 75 lb N applications or UAN and Nitamin 43 on Commerce silty clay loam, 2006-07.



Response of cotton lint yield to single and split 100 lb N applications on Commerce silty clay loam, 2006-07.



Response of cotton lint yield to single and split 125 lb N applications on Commerce silty clay loam, 2007.



Response of cotton lint yield to soil- and foliar-applied N, 2006-07.

Summary for Fertilizer N

- N formulation has little or no effect on cotton lint yield response.
- The optimal N rate for soil-applied N is 75 lb/acre on the silt loam soils and 90 to 100 lb/acre on the silty clays and clays.
- Cost of fertilizer N varies with form - 45 to 71 cents per pound.

Summary for Fertilizer N

- Foliar-applied N effects are small and inconsistent –pointed out yesterday by Dr. Phillips.
- Split N applications are seldom economic, whether soil or foliar applied.
- The majority of the N used by a cotton crop is free.

Legume Nitrogen



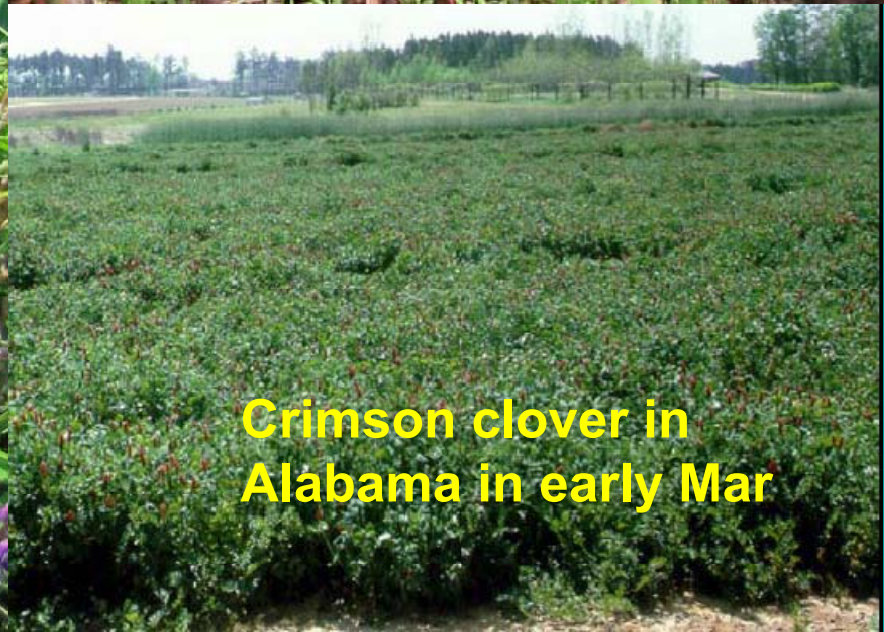
Crimson clover in Missouri in early May



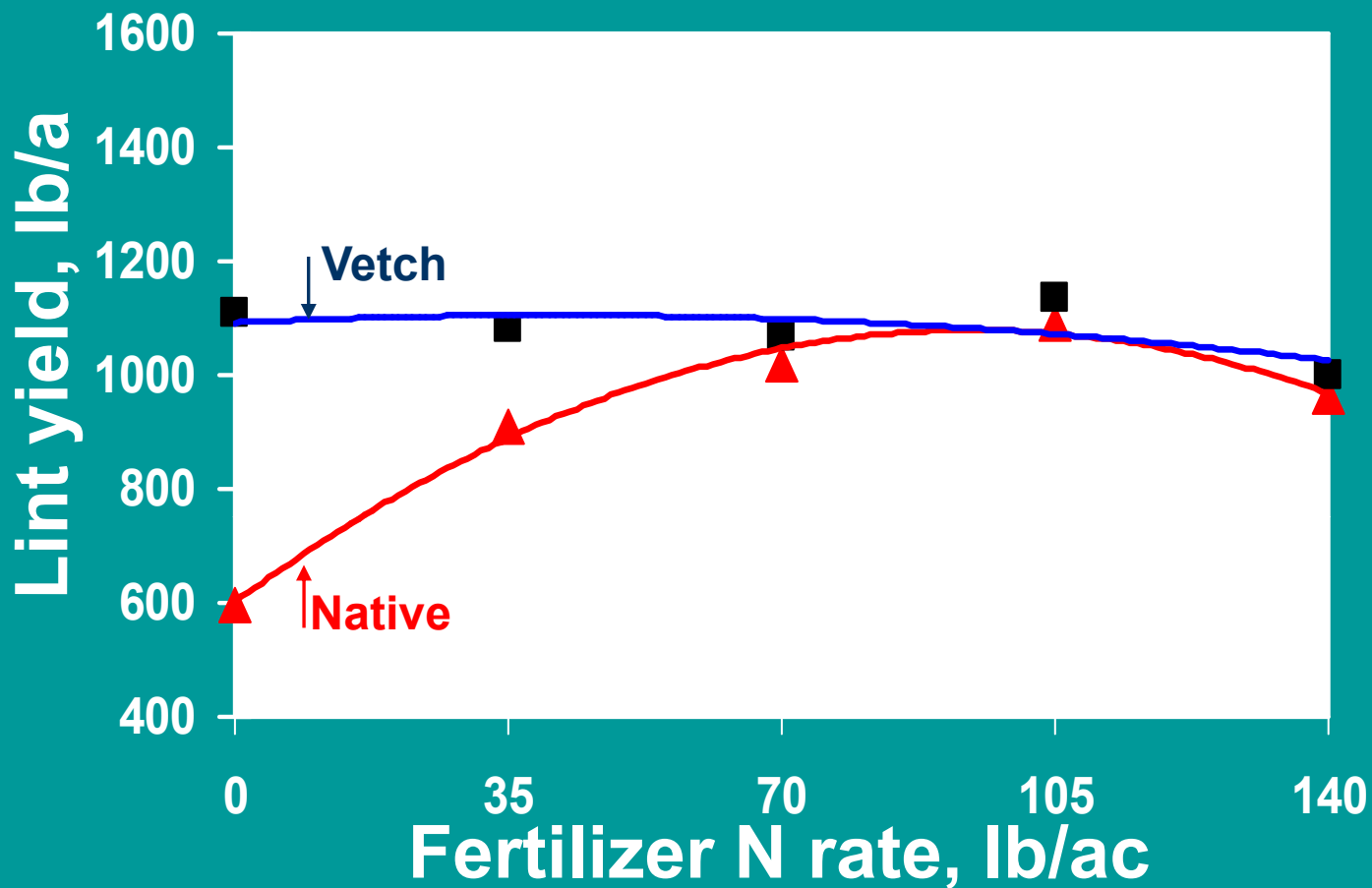
Self reseeding crimson clover in Missouri in October



Hairy vetch in early April in Louisiana



Crimson clover in Alabama in early Mar



Irrigated cotton response to N rate following different cover crops on Gigger sl, 5-yr avg.

Winter legume cover crop supplies 50% of N requirements on Sharkey clay.

NO-TILL
VETCH
45# N/A

8 10 '93

Legume crops for N

- **Vetches (hairy, common, big flower)**
- **Winter peas (Austrian, Caly, Roughpea, Singletary)**
- **Clovers - Crimson, Berseem, Arrowleaf, Bur, Sub, Red, White, many others)**
- **Medics – Barrel medic, annual lucerne**
- **Lupines – White, blue and yellow**

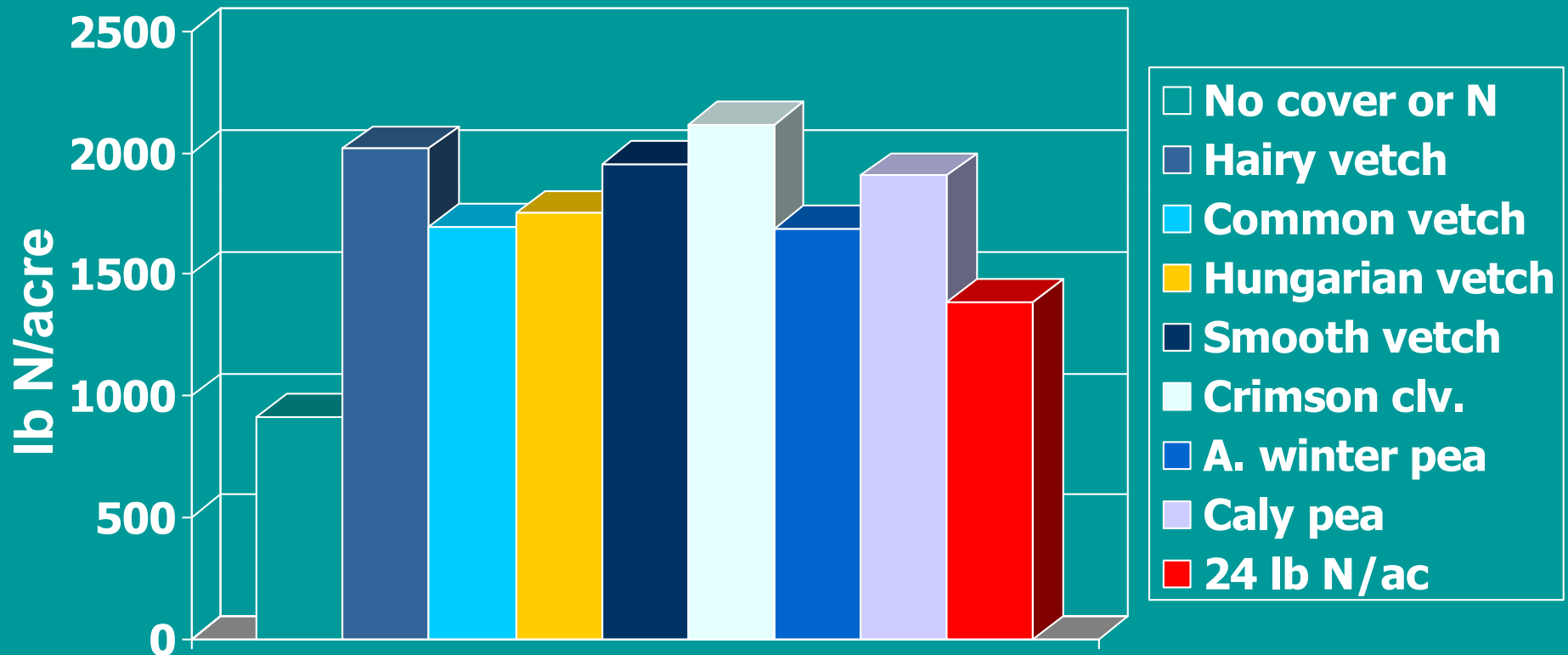
Why plant legume crops for N?

- **Relative cost of other N sources**
 - **Inorganic fertilizers**
 - **Organic (poultry litter, gin trash, composts)**
- **Soil organic matter increase**
- **Soil quality improvement**
- **Winter ground cover for BMPs**
- **Intangibles (improved soil tilth & biology)**

Why not plant legume crops for N?

- Relative cost of other N sources
- Uncertainty of production
- Time management – fall planting; possible delay with spring planting preparation and planting itself.
- The unknowns – Depletion of soil water; increase nematode numbers? diseases?; termination timing and cost.

Cotton yield following legume crops, LSU AgCenter Northeast Research Station, 22 years, 1929-51.



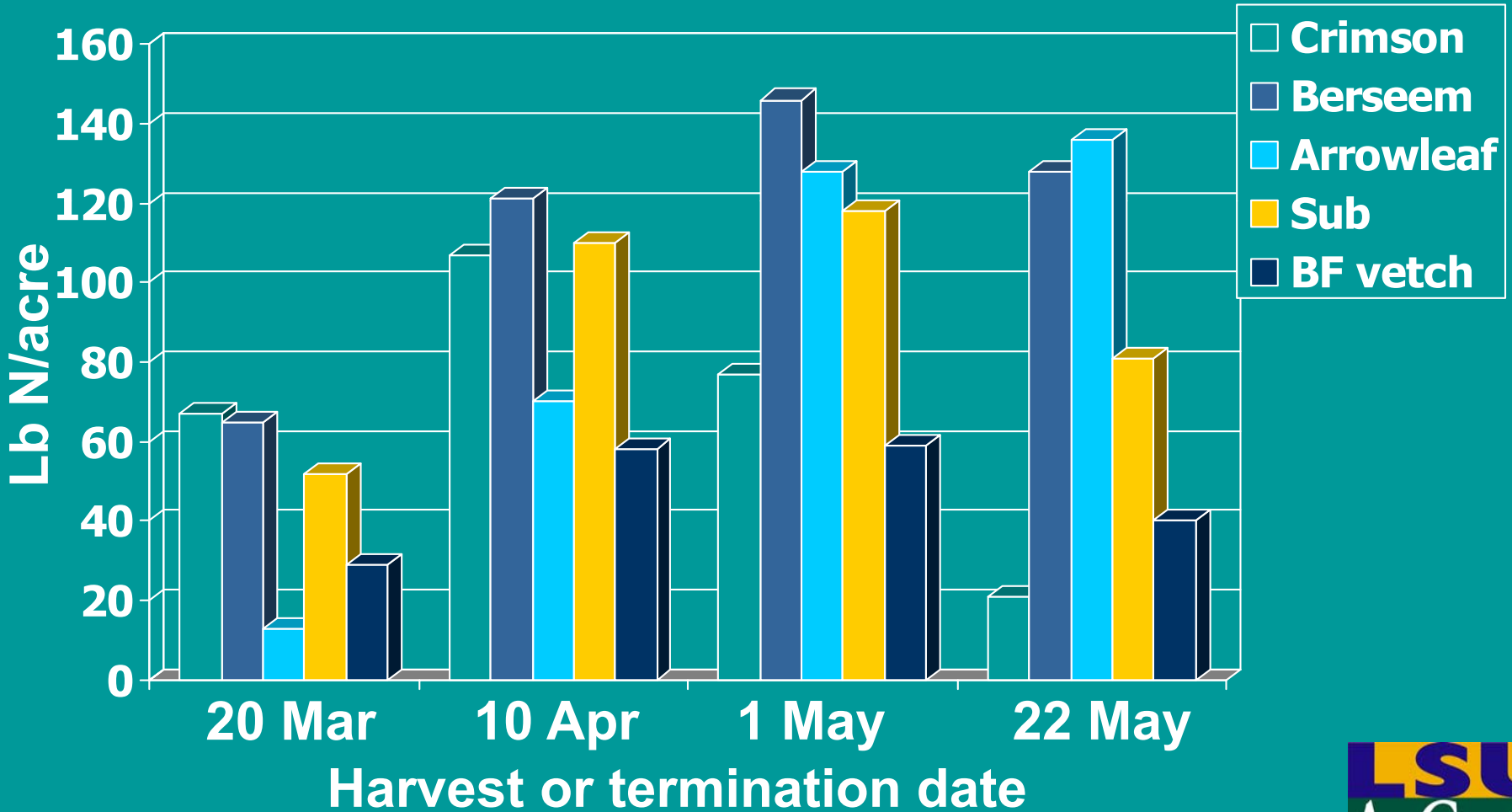
Data from C.B. Haddon from 36 species evaluated

Above ground biomass yield and N content of legume cover crops in LA, 5 yr. avg., 1986-90.

	Biomass	N content
	---- lb/ ac ----	
Hairy vetch	3402	121
Crimson clv. (Chief)	5535	150
Austrian winter pea	2902	86
Roughpea (Caley)	3364	130
Berseem clv.	4624	119
Bur clv. 'Serena'	5119	150
Lupin 'Tifblue 78'	5342	143

Data from Seth Dabney, formerly LSU AgCenter, now USDA

Nitrogen content of legume crops with time of harvest in Louisiana.



Summary for Legume N

Winter legumes' biomass contain from 100 to 150 lb N/acre in early spring.

Up to 80 % of this N can be available for the following summer crop.

Based on past research, the best overall legume is hairy vetch followed by several of the clover species and by winter peas.

Cotton planted in hairy vetch residue

Cotton planted in Austrian winter pea residue

Summary for Legume N

Legumes should be chosen for early growth, total N and tolerance to cold.

The largest impediment to effective use of winter cover crops for N is the conflict with maximum N fixation time (early spring) and planting of the following summer crop.

Cotton planted in hairy vetch residue

Cotton planted in Austrian winter pea residue

Thank You

Questions?

