COTMAN Defoliation Initiation

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Background

- Cotton lint yield and quality are influenced by defoliation and harvest timing (Bednarz et al., 2002 and Larson et al., 2002)
- Methods to determine crop maturity:
  - % open bolls
  - NACB
  - Boll and or thumb slicing

Background

- These methods do not provide an early prediction of crop maturity (Gwathmey et al., 2004)
- Bourland et al. (1992) developed the NAWF method to schedule defoliation timing.

Background

- NAWF=5
  - Last effective boll population to contribute to economic yield.
- 850 DD 60's
  - Required to mature the last effective boll population.

Background

- These guidelines were incorporated into the COTMAN defoliation initiation model.
- Validated by Benson et al. (2000) and Robertson et al. (2003) in AR.
- Reports from other parts of the cotton belt have shown inconsistent yield responses with this method (Whitten and Cothren, 2002; Fromme, 1999; Larson et al., 2002).

Background

- From 1998 – 2000 a regional study was conducted to evaluate the COTMAN defoliation initiation guidelines across a wide range of field environments (Gwathmey et al., 2004. J. Cotton Sci.)
  - Tifton, GA; St. Joseph, LA; Jackson, TN; multiple locations in coastal TX.

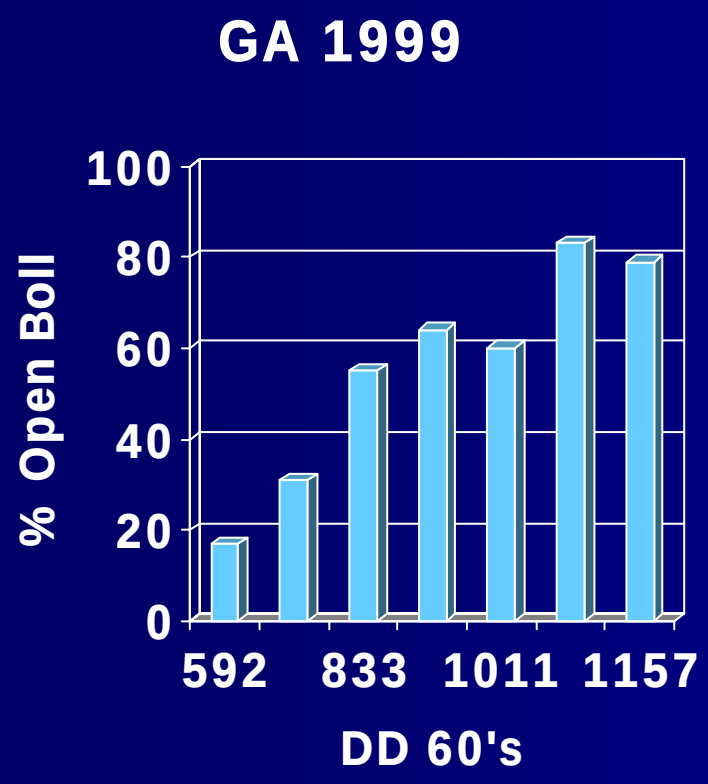
Methodology

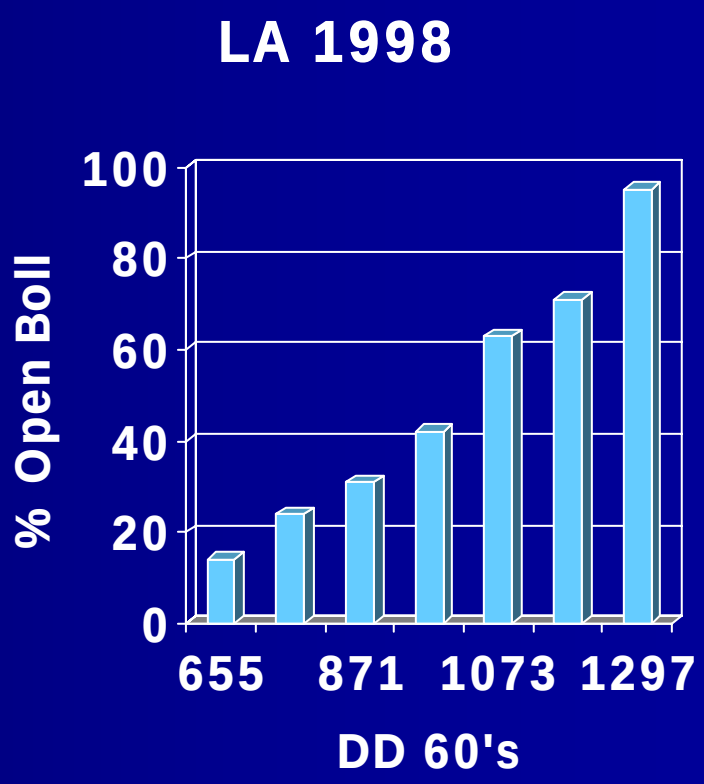
- Harvest aid applications at 650, 750, 850, and 950 DD 60's after NAWF = 5
- Additional timing treatments were included at some locations.
- Locally adapted cotton cultivar was managed according to local extension recommendations.

Methodology

- tribufos, thidiazuron and ethephon were used in all locations.
- % open bolls and NACB were determined in each plot on the day of treatment.
- Proc MIXED

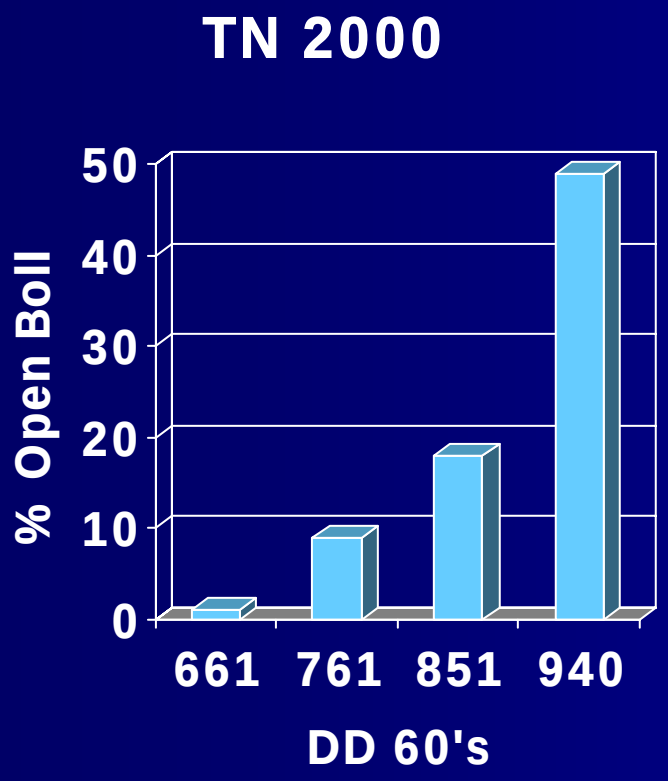
Heat Unit Accumulation vs. Percent Open Boll

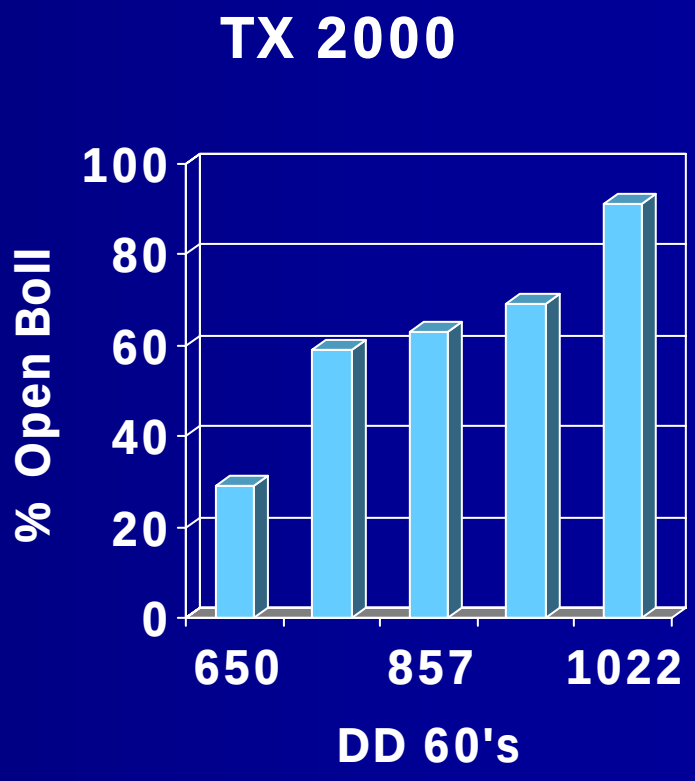




Gwathmey et al., 2004. J. Cotton Sci.

Heat Unit Accumulation vs. Percent Open Boll



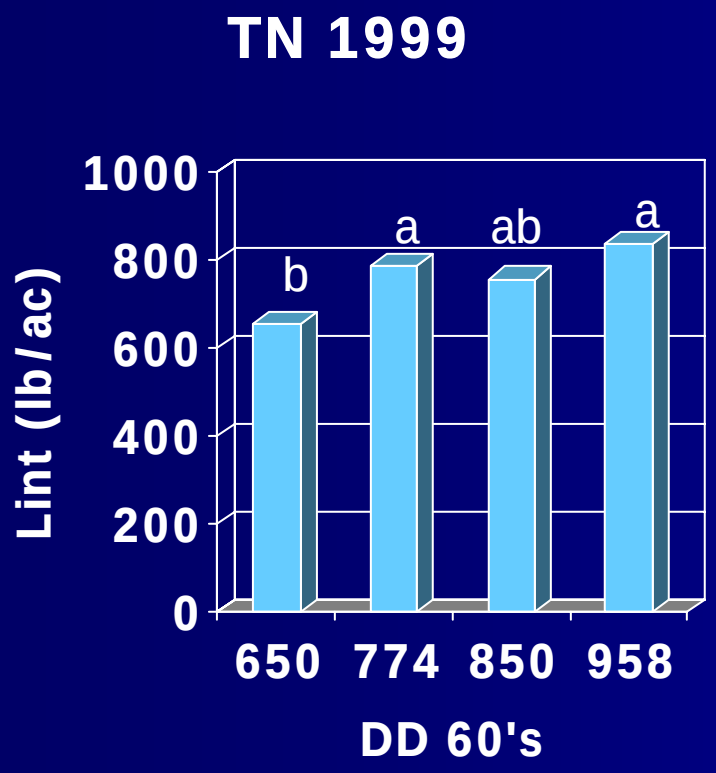


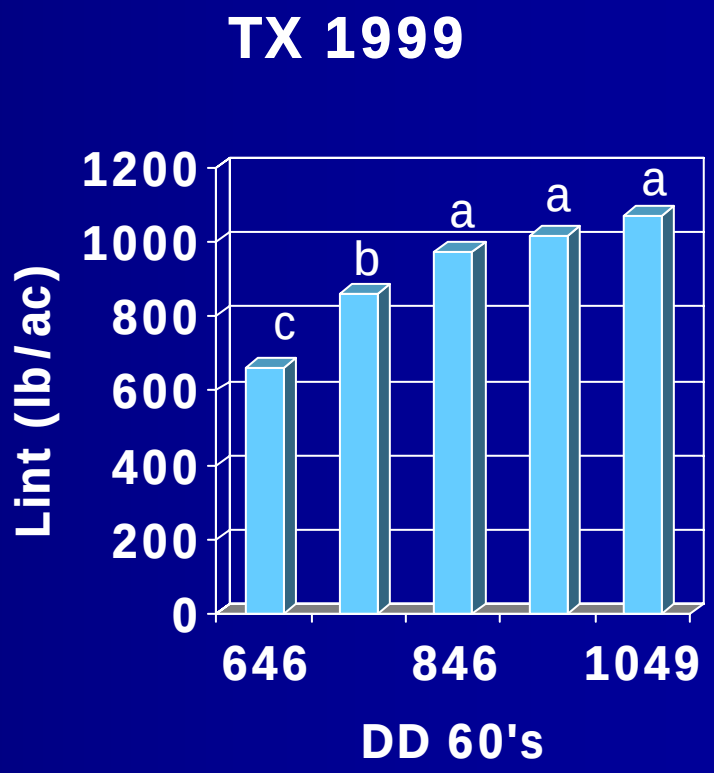
Gwathmey et al., 2004. J. Cotton Sci.

To safeguard against yield loss:

- Harvest aids should not be applied prior to 60% open boll (Snipes and Baskin, 1994).
- Cotton is generally safe to defoliate when NACB is less than or equal to 4 (Kerby et al., 1992).
- Few site years met both of these criteria at 850 DD 60's.

Heat Unit Accumulation vs. Lint Yield





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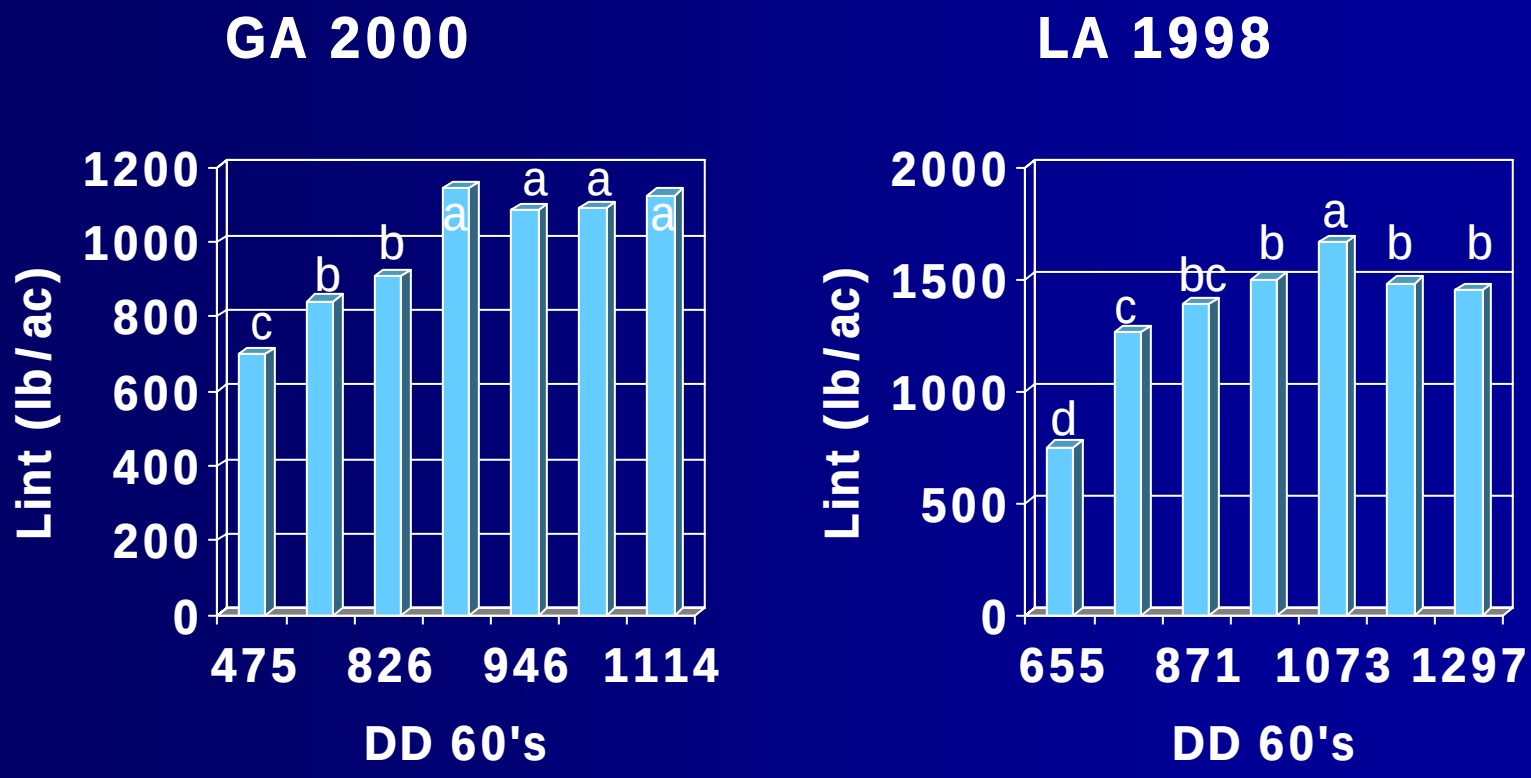
Heat Unit Accumulation vs. Lint Yield



Gwathmey et al., 2004. J. Cotton Sci.

Heat Unit Accumulation vs. Lint Yield

- In 9 of 13 site years defoliation at or near 850 DD 60's resulted in statistically highest yields.
- The DD 60 accumulation that corresponded to the earliest date of statistically highest yields ranged from 754 to 1073

Conclusions drawn:

- About 66% of the variation in heat units required to reach maximum yield was associated with yield level.

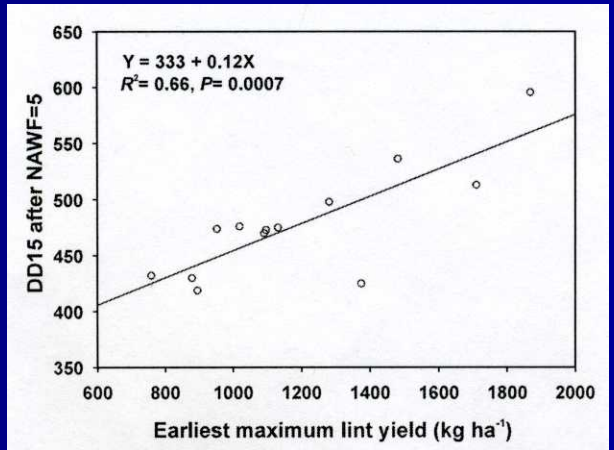


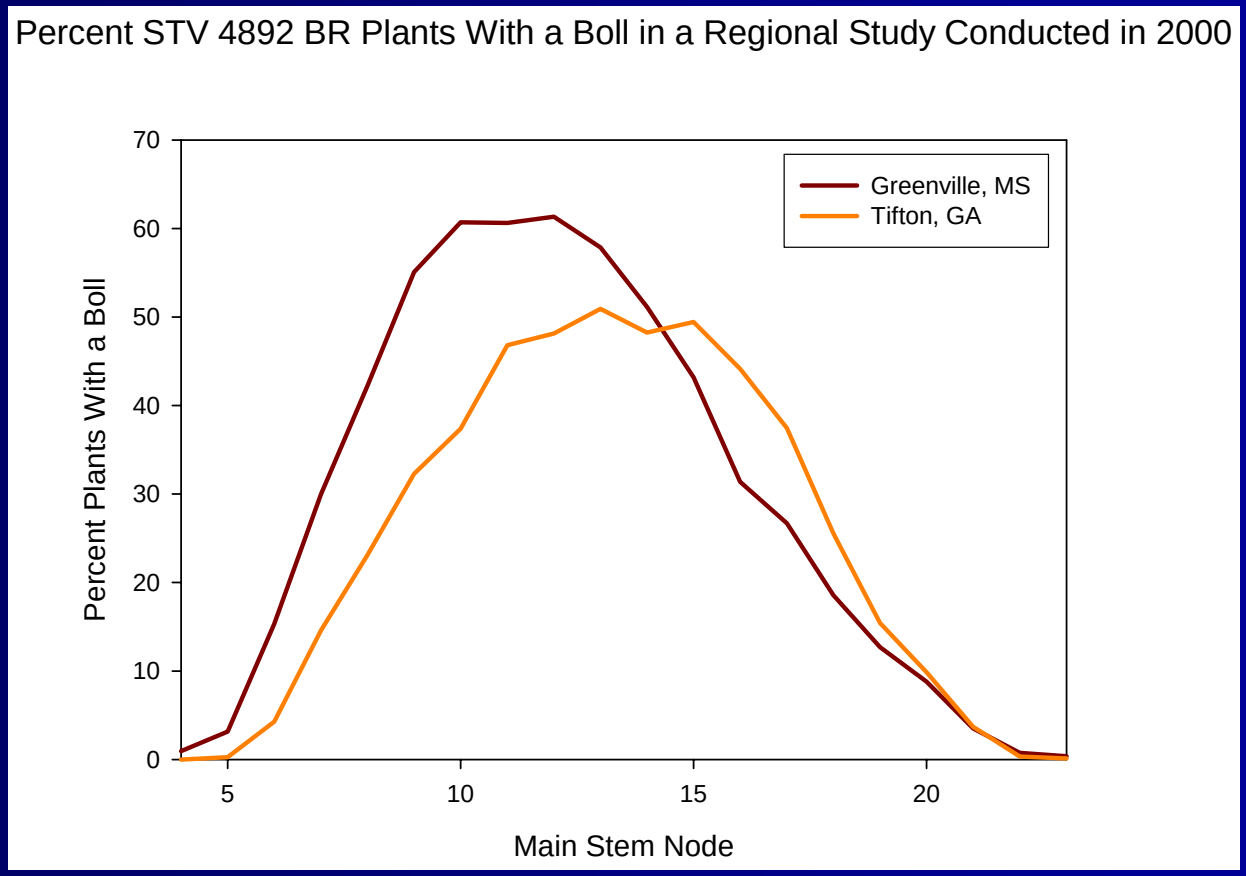
Fig. 1. Linear relationship between lint yield and degree-days, base 15.6 C (DD15), accumulated after five nodes above white flower (NAWF=5) corresponding to the earliest maximum yield at 13 site-years.

Gwathmey et al., 2004. J. Cotton Sci.

Defoliation initiation at NAWF = 5 plus 850 DD 60's

- Is a function of yield potential?
- Are there other clues to improve our defoliation initiation guidelines?

What about yield distribution?



Cotton 95% Zone

- 10 fruiting nodes (Kerby, 1995).
- In GA it is closer to 12-13 fruiting nodes.

The Georgia “top crop”

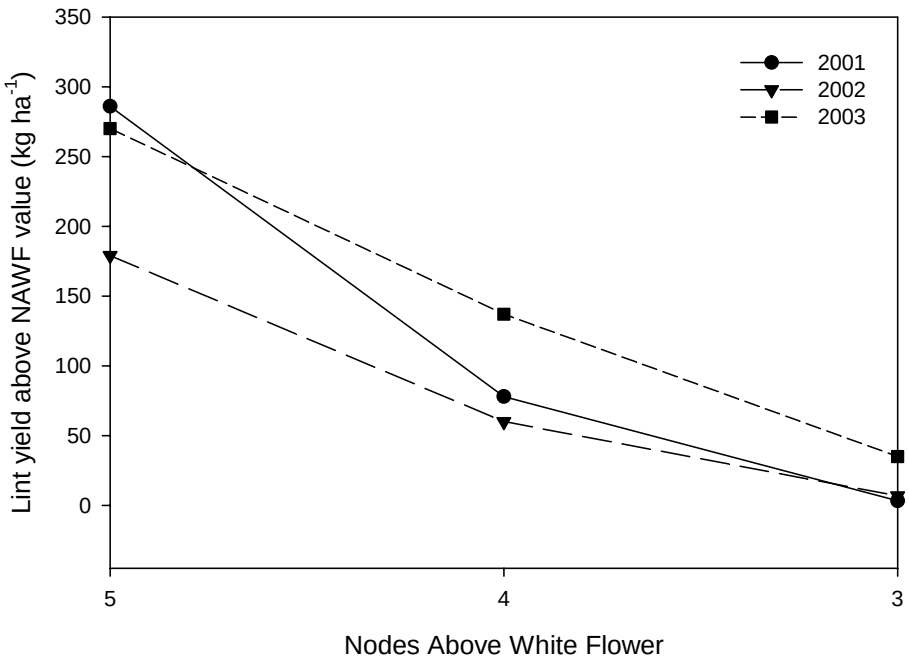


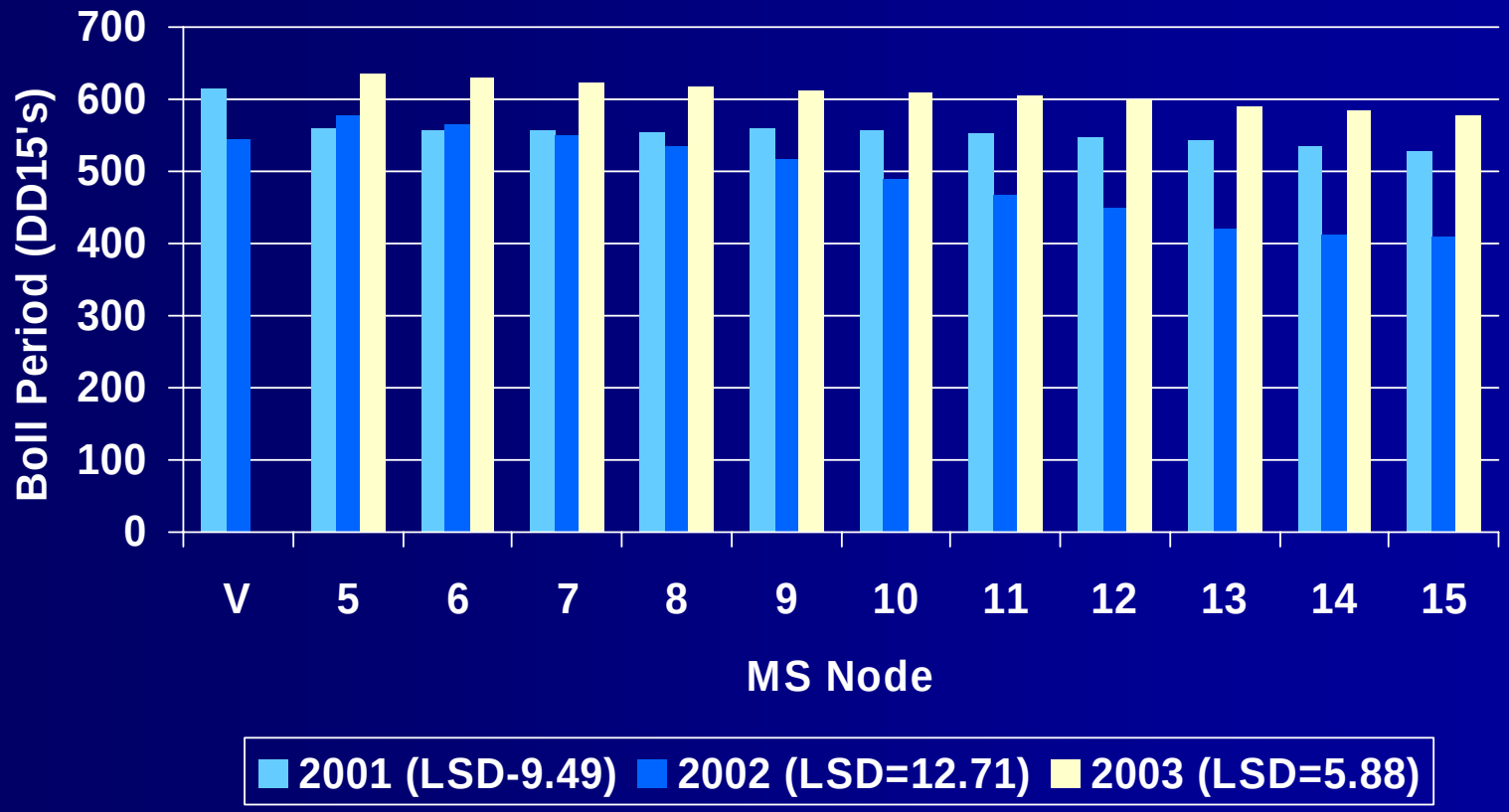
Figure 2. Lint yield (kg ha^{-1}) above several nodes above white flower (NAWF) values in studies conducted at the University of Georgia Coastal Plain Experiment Station in 2001-2003. Values presented are the mean of nine cultivars differing in maturity classification.

Bednarz and Nichols, 2005. Crop Sci.

COTMAN defoliation initiation rules:

- NAWF=5 is the last effective boll population to contribute to economic yield.
  - Depends on yield potential and yield distribution.
- 850 DD 60's is required to mature the last effective boll population.

Boll maturation period (DD 15's)



Bednarz and Nichols, 2005. Crop Sci.

DD 15 accumulation

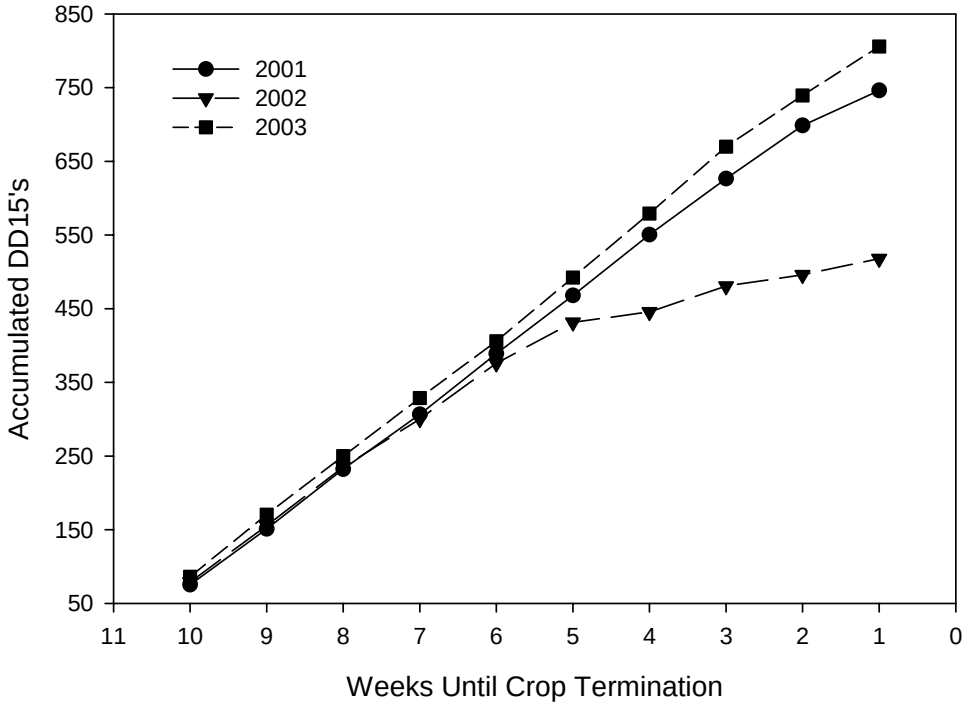


Figure 1. Heat unit accumulation (DD15) versus weeks until crop termination in studies conducted at the University of Georgia Coastal Plain Experiment Station in 2001-2003.

Bednarz and Nichols, 2005. Crop Sci.

COTMAN rules: 850 DD 60's are required to mature the last effective boll population

2001	2002	2003
mean-range	mean-range	mean-range
1000	891	1094
949-1107	738-1040	1042-1143

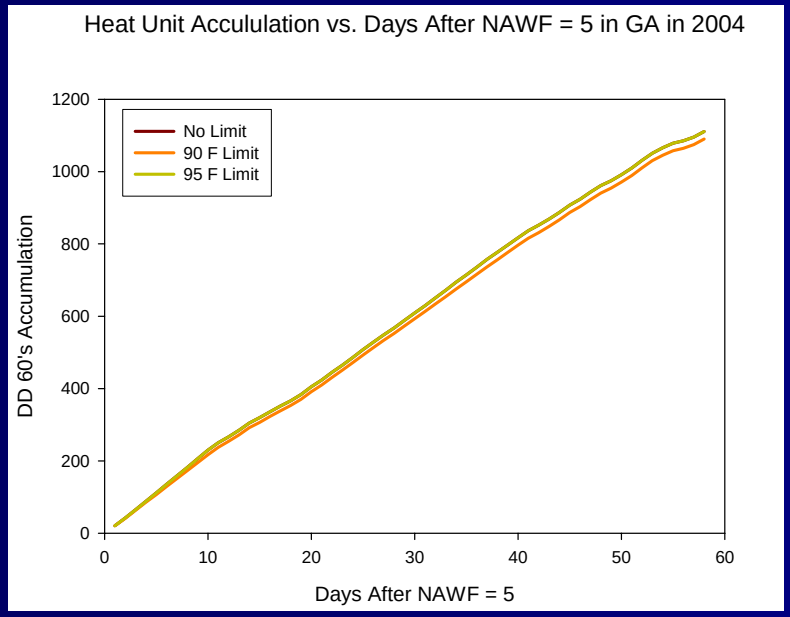
Bednarz and Nichols, 2005. Crop Sci.

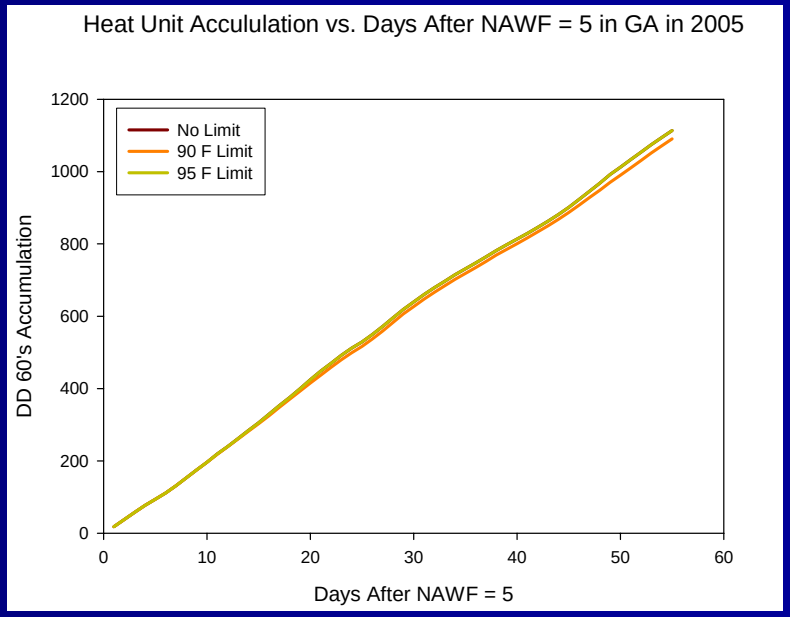
It is generally accepted the boll maturation period is ~50d and increases with MS node.

2001	2002	2003
mean-trend	mean-trend	mean-trend
49.5	57.4	51.7
NC	Increase	Decrease

Bednarz and Nichols, 2005. Crop Sci.

What about an upper temperature threshold?





Summary:

- NAWF=5 as the last effective boll population does not appear to be universal.
  - Yield potential.
  - Yield distribution (top crop).
  - Cultivar selection.
- 850 DD 60's to mature a boll population does not appear to be universal.
  - Related to latitude?.
- Create regional rules?