Cotton Crop Maturity Determination

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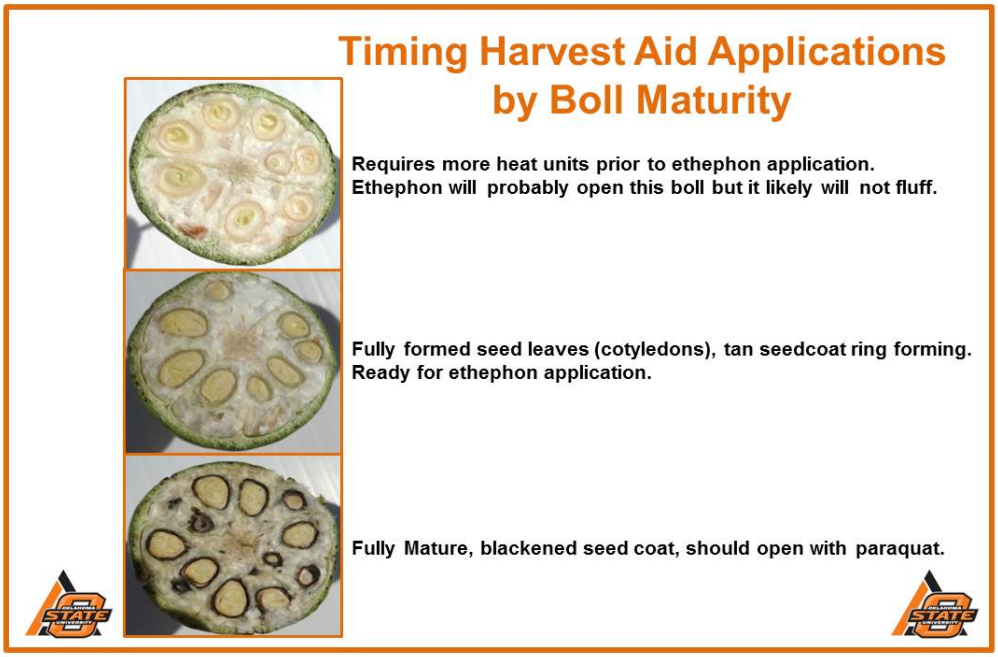
Crop maturity determination is critical for a successful harvest-aid program. Premature crop termination has been shown to reduce lint yield, seed quality, micronaire, and fiber strength. Harvest-aid chemicals cannot increase the rate of fiber development. Only additional good growing weather including open skies and adequate heat units combined with functional leaves can mature cotton bolls.

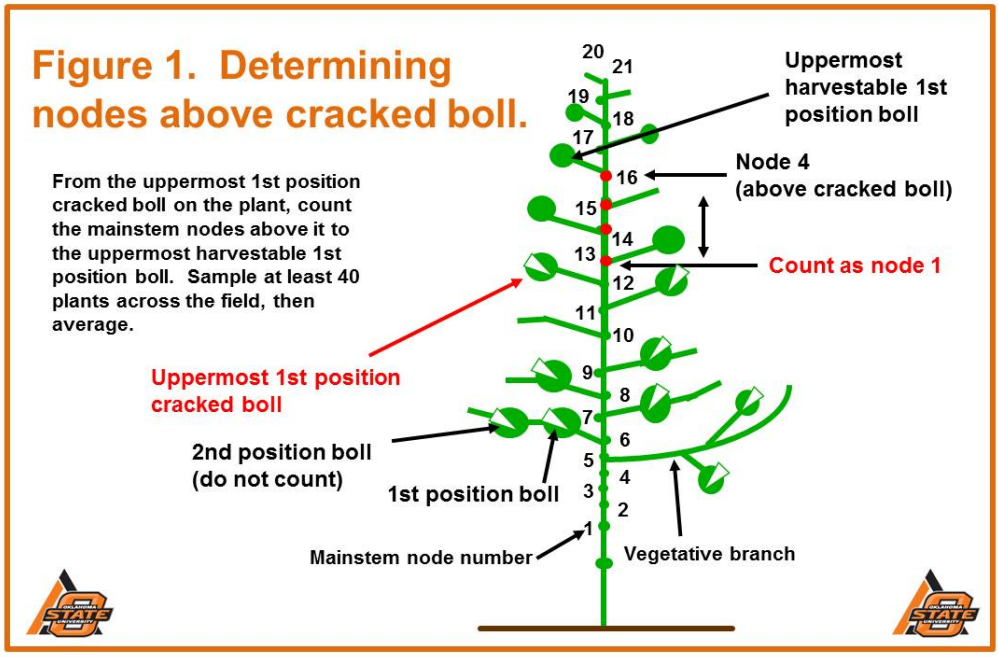
3 Methods of Determining Crop Maturity:

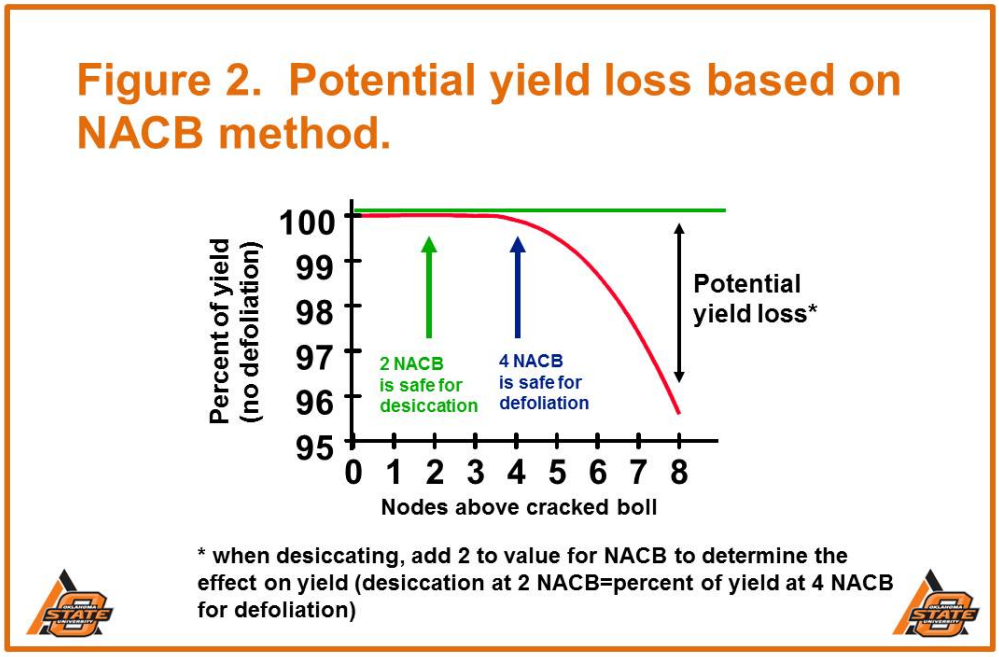
1) Knife Test - Maturity can be determined by using a sharp knife to cut into the bolls. If the boll is watery or jelly like on the inside, then it is immature and needs more heat units. If boll development is such that the knife cannot slice through the lint, then the boll is nearly mature. Close inspection of the seed will give further indication of boll maturity. If the seed coat is turning tan and the seed leaves (or cotyledons) are fully developed, the boll is mature. For an example of this, see below.



2) Percent open bolls is another method that can be used to determine crop maturity. This method is fairly easily accomplished, but can have limitations. One just needs to measure off a known number of row-feet in multiple areas of the field, then begin counting open bolls and unopened or "green bolls." Track these separately. Once both types have been counted, simply add the green boll count and the open boll count to obtain the total number of bolls. After that, divide the open boll total by the total bolls and multiply times 100. This allows for a reasonable observation of percent open bolls. The limitation that occurs with this method arises when a "fruiting gap" exists in the plant. We have seen fields that exhibit this problem this year. If bolls are present at the bottom of the plant, none in the middle, and more bolls at the top, this can give a skewed representation of the maturity of the field.

3) Nodes above cracked boll (NACB) is a tool that can be used to time harvest aid application (Figure 1). A Beltwide cotton harvest aid timing project was conducted about 20 years ago over multiple sites and years by a team of extension personnel in multiple states across the Cotton Belt. It was determined that if the uppermost first position-cracked boll is within three nodes of the uppermost harvestable first position boll then no lint weight will be lost if a defoliant-type harvest aid is applied at that time (Figures 1 and 2). However, if the uppermost harvestable first position boll is four or more nodes above the uppermost first position cracked boll, then potential for some lint loss exists. The lint loss potential increases as the NACB increases. Micronaire reduction generally follows a similar pattern when using the nodes above cracked boll criterion. When defoliant type chemicals are applied, some slight subsequent fiber development may occur before defoliation. If applying desiccants, more bolls must be mature in order to reduce the risk of fiber weight loss or reduction of micronaire, thus two NACB would be a better target.





When determining boll maturity of adjacent fruit, one can consider the following. When moving up the plant from a first position boll that has just cracked to a first position unopened boll on the next fruiting branch, about 60 additional heat units (DD60s) are required to obtain similar boll maturity. If moving out from a first position boll to a second position boll on the same fruiting branch, about 120 heat units will be required to reach the same level of maturity. For an individual boll, a total of about 800-850 heat units are required after pollination to produce normal size and quality. However, bolls obtaining fewer heat units may still make productive lint of lower micronaire that may contribute to final yield.

Using Heat Units for Harvest Aid Decisions

Week	Altus Normal Heat Unit Accumulation/Week (what to expect based on long-term weather data)	Theoretical Number of Nodes Maturing / Week moving up the stalk
1st Week of September	127 / week	2.1
2nd Week of September	111 / week	1.9
3rd Week of September	92 / week	1.5
4th Week of September	76 / week	1.3
1st Week of October	58 / week	1.0
2nd Week of October	41 / week	0.7
3rd Week of October	21 / week	0.3
4th Week of October*	2.5 / week	0.0
*Goes to Zero on October 23		

Assumptions:
DD60 heat units / day = ((daily high temperature + daily low temperature) / 2) - 60
From a mature 1st position boll, it takes 60 additional HU to mature a 1st position boll one mainstem node up the plant.
From any given mature boll on a fruiting branch, it takes about 120 HU to mature an additional position when moving out on a fruiting branch.
It takes about 700-750 HU from a flower to boll with minimal maturity (45-70 days) that can be opened by ethephon application.
It takes about 850 HU from a flower to boll with good maturity that opens naturally.

Daily High & Low Temperatures	Daily Heat Unit Accumulation	Weekly Heat Unit Accumulation
100-75	27.5	193
90-65	17.5	123
80-55	7.5	53
70-45	0	0

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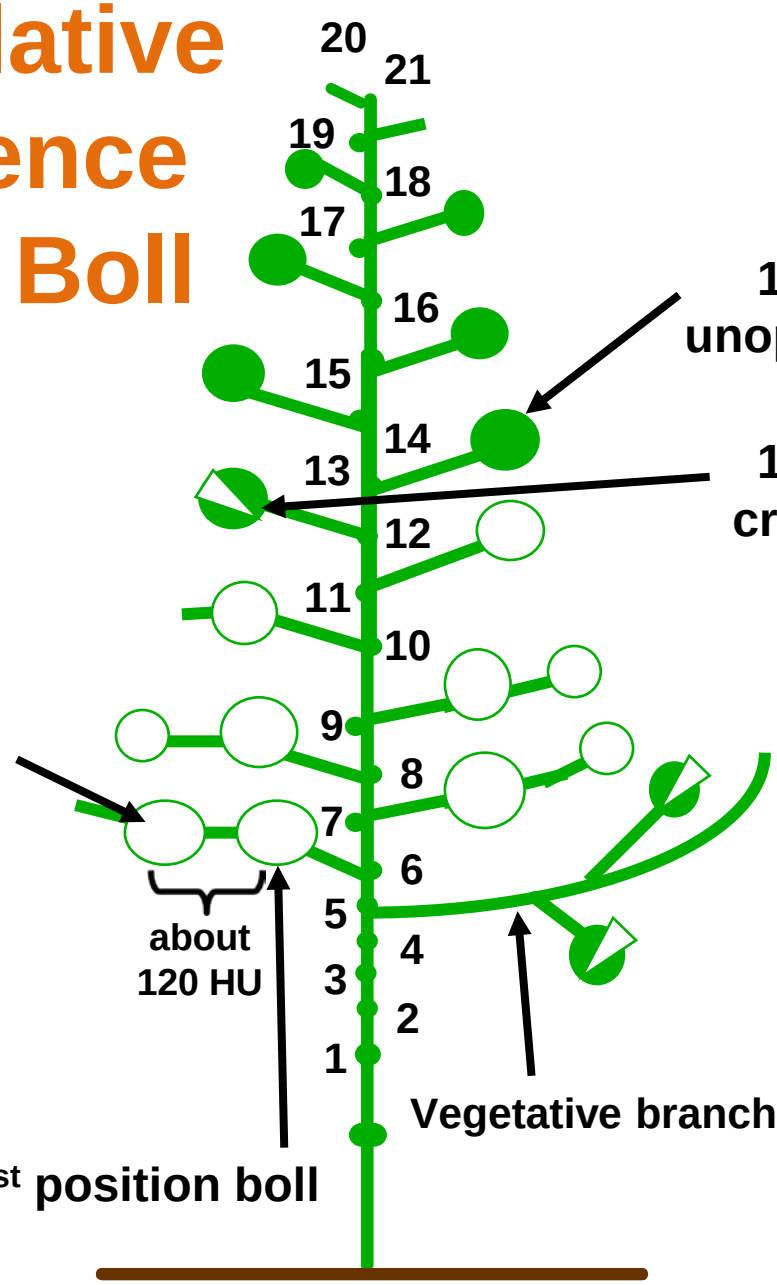
Theoretical Relative Maturity Difference As Affected by Boll Location (Out and Up)



1st position unopened boll

about 60 HU

1st position cracked boll

UP
From a mature 1st position boll, it takes about 60 additional HU to mature a 1st position boll one mainstem node up the plant.

2nd position boll

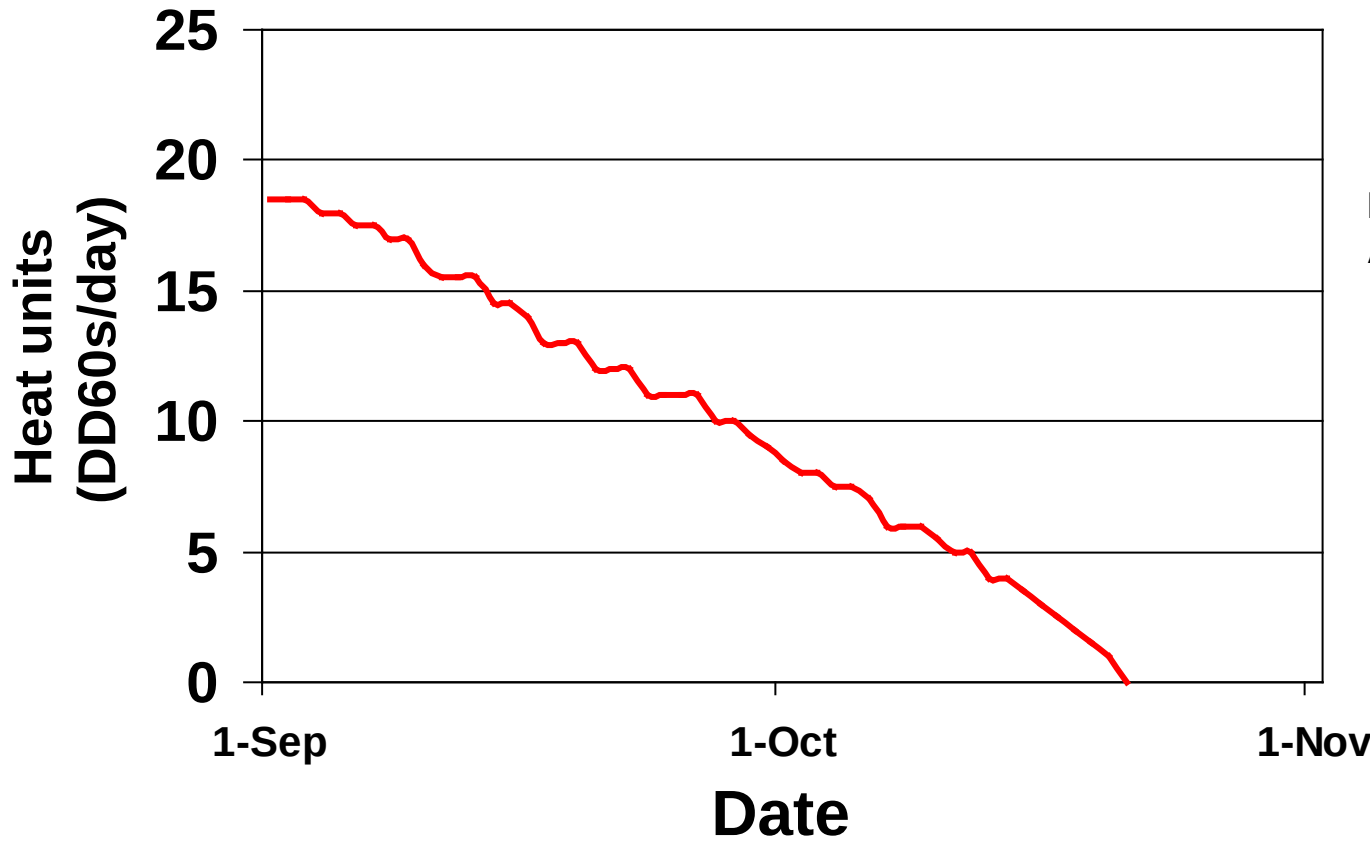
OUT
From any given mature boll on a fruiting branch, it takes about 120 HU to mature an additional position when moving out on a fruiting branch.

about 120 HU

Vegetative branch

1st position boll

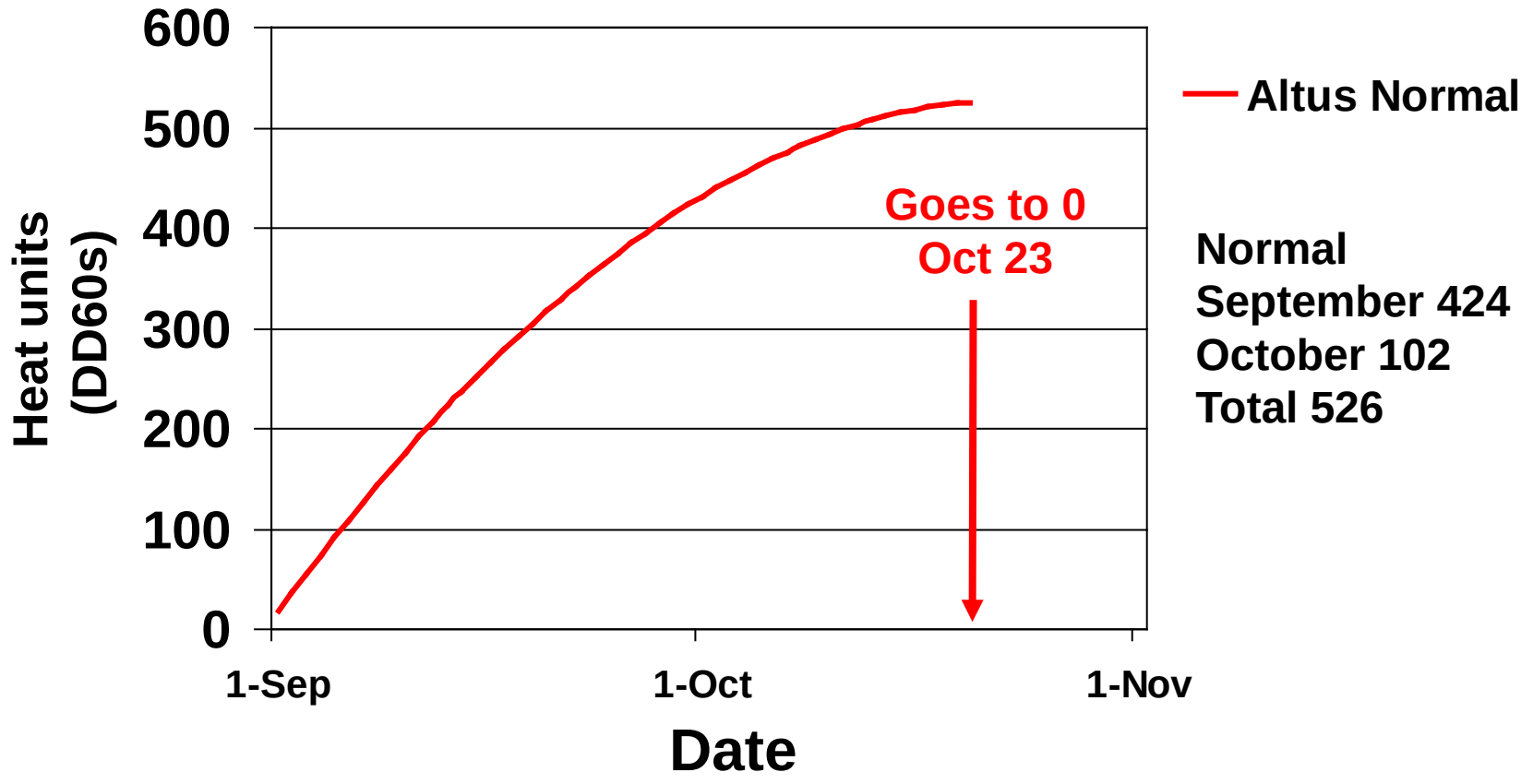
Altus 30-Yr Normal (1971-2000)
Daily Cotton Heat Units
For September and October



First freeze:
Altus – November 4

Altus: http://climate.ok.gov/county_climate/Products/QuickFacts/jackson.pdf

Altus 30-Yr Normal (1971-2000)
September and October
Cotton Heat Unit Accumulation



Altus first freeze: November 4

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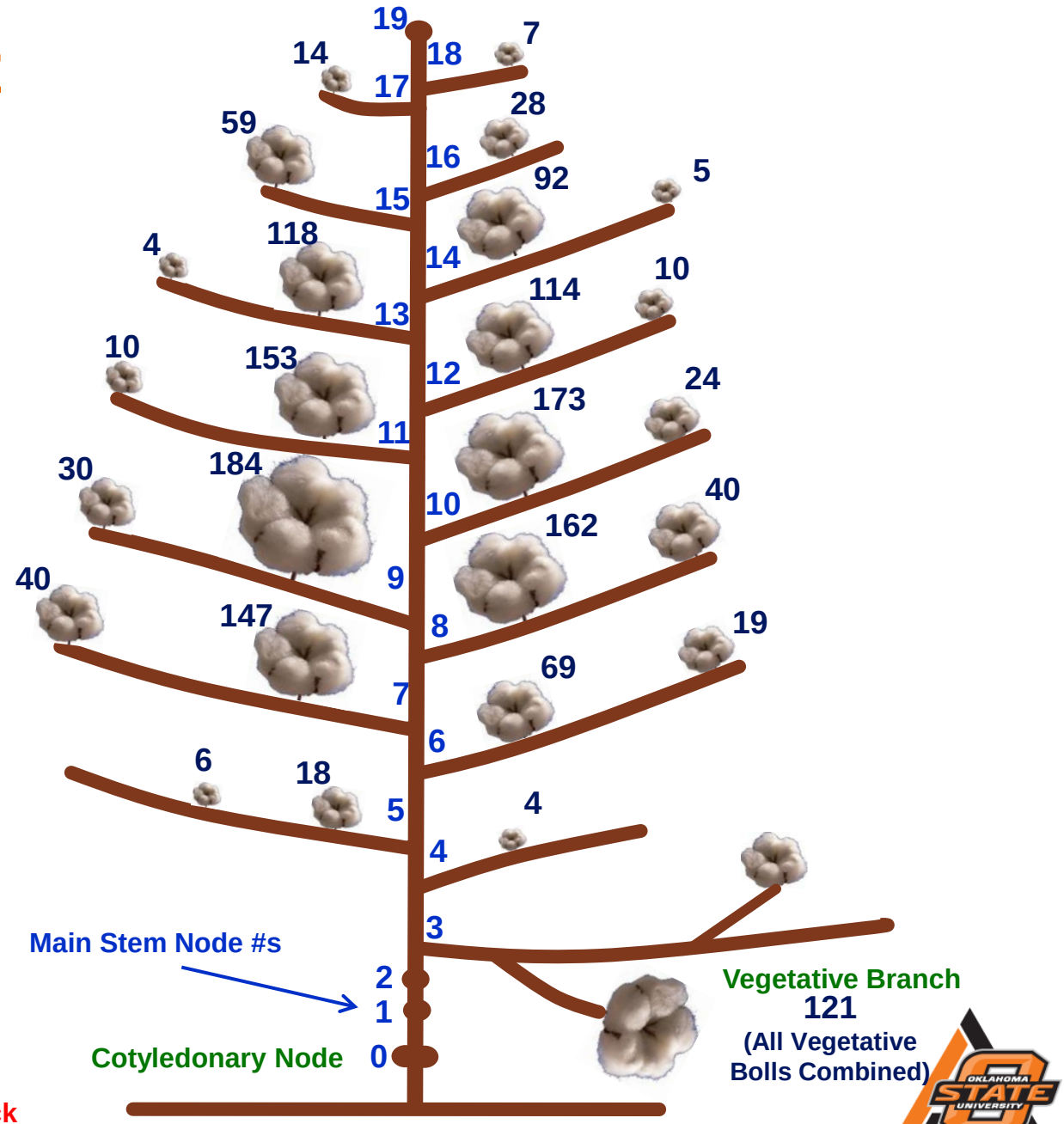
Contribution to Lint Yield by Fruiting Position (Lb/Acre)

2009 - Lubbock
100% Open Bolls
FM 9180 B2F

Boll Location	Lint Yield (lb/ac)
1st Position	1343 (81%)
2nd Position	188 (12%)
Vegetative	121 (7%)
Total yield	**1652**

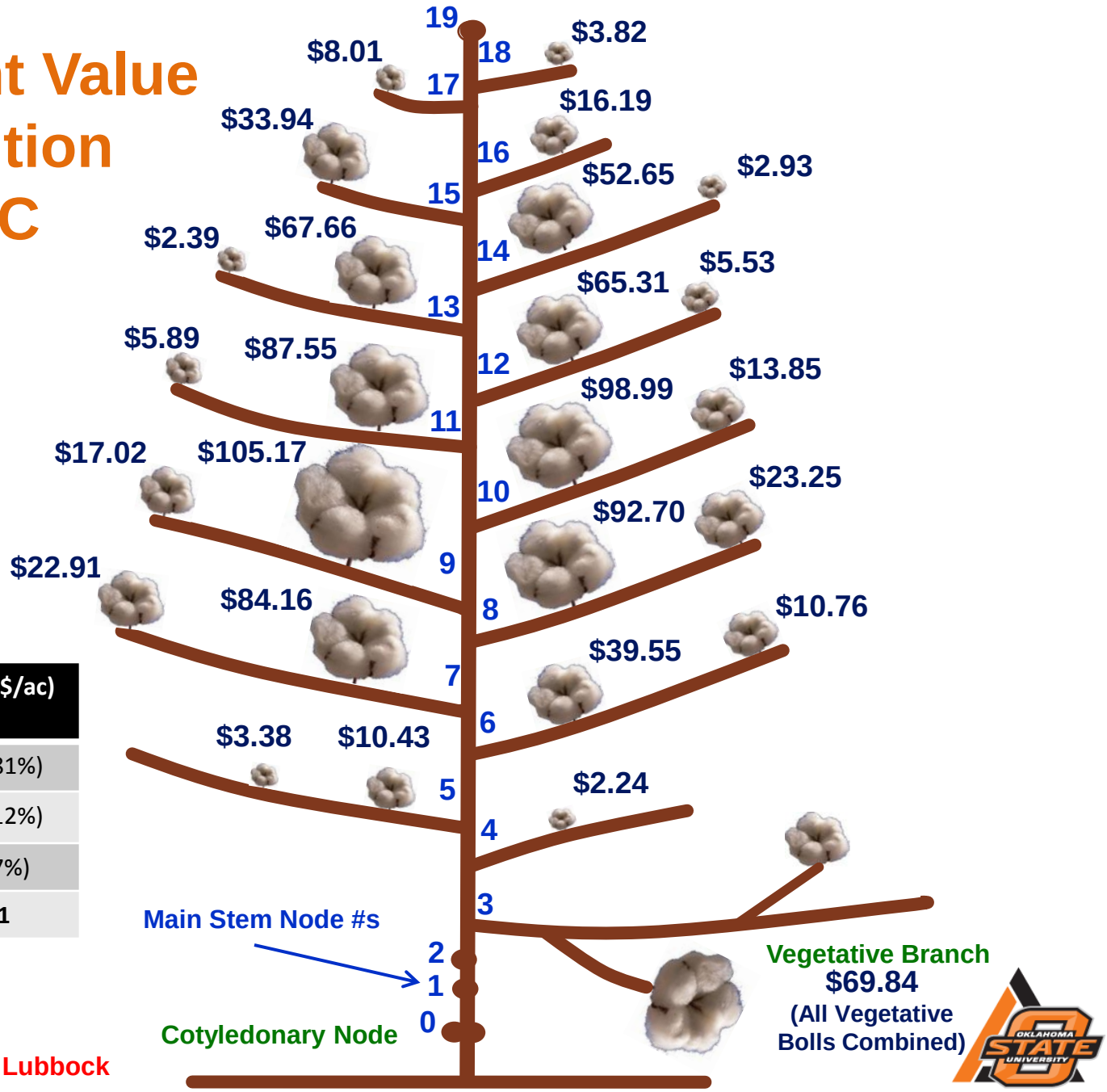


Source: Wanjura – USDA-ARS Lubbock

Contribution to Lint Value by Fruiting Position Based on CCC Loan Value ($/Acre)

2009 - Lubbock
100% Open Bolls
FM 9180 B2F

Boll Location	Lint Yield (lb/ac)	Lint Value ($/ac)
1st Position	1343 (81%)	$768.36 (81%)
2nd Position	188 (12%)	$107.91 (12%)
Vegetative	121 (7%)	$69.84 (7%)
Total	**1652**	**$946.11**



Source: Wanjura – USDA-ARS Lubbock

Contribution to Lint Yield by Fruiting Position (% of Total Lb/Acre)

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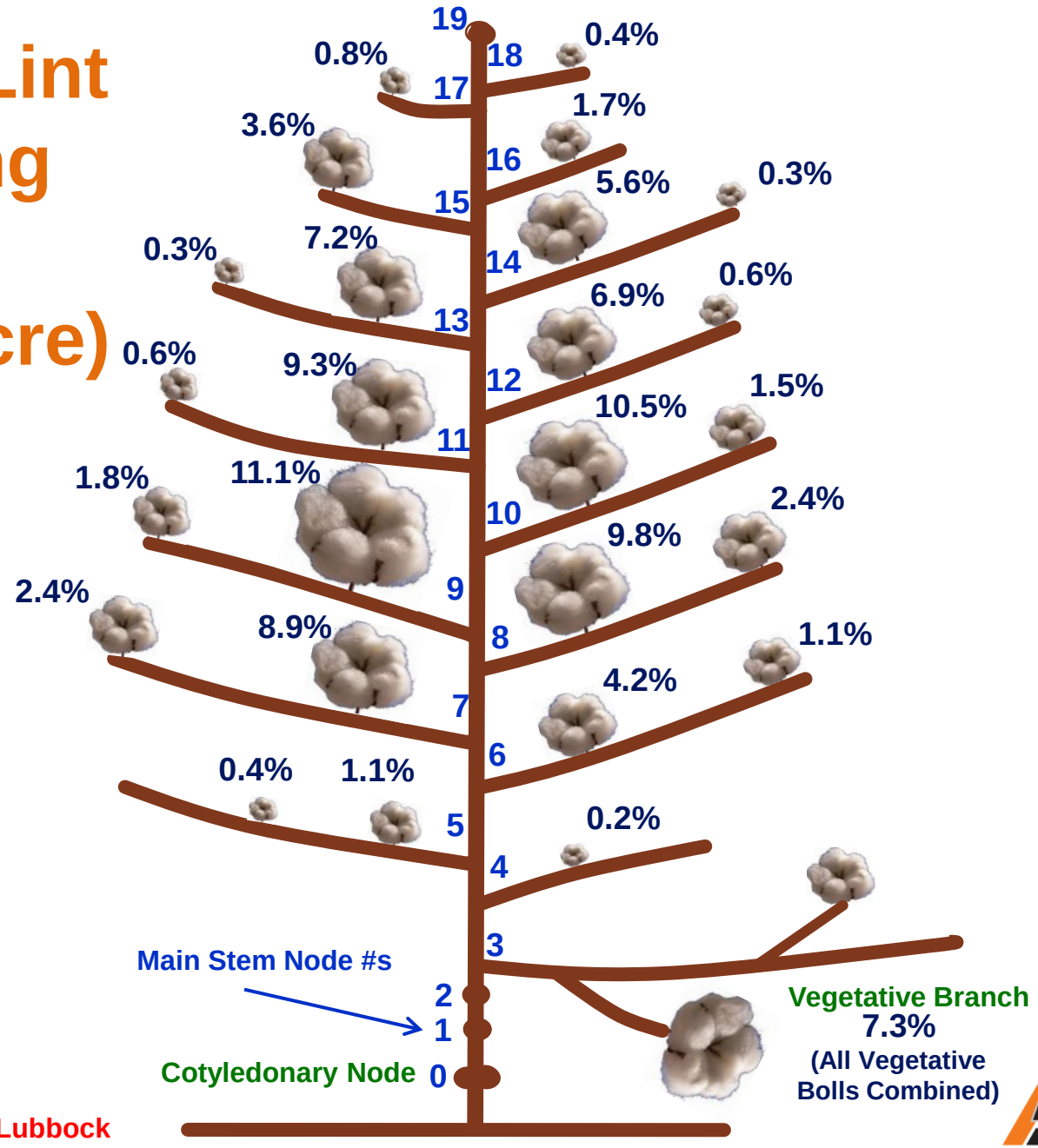

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