Cotton Maturity in the Texas Panhandle

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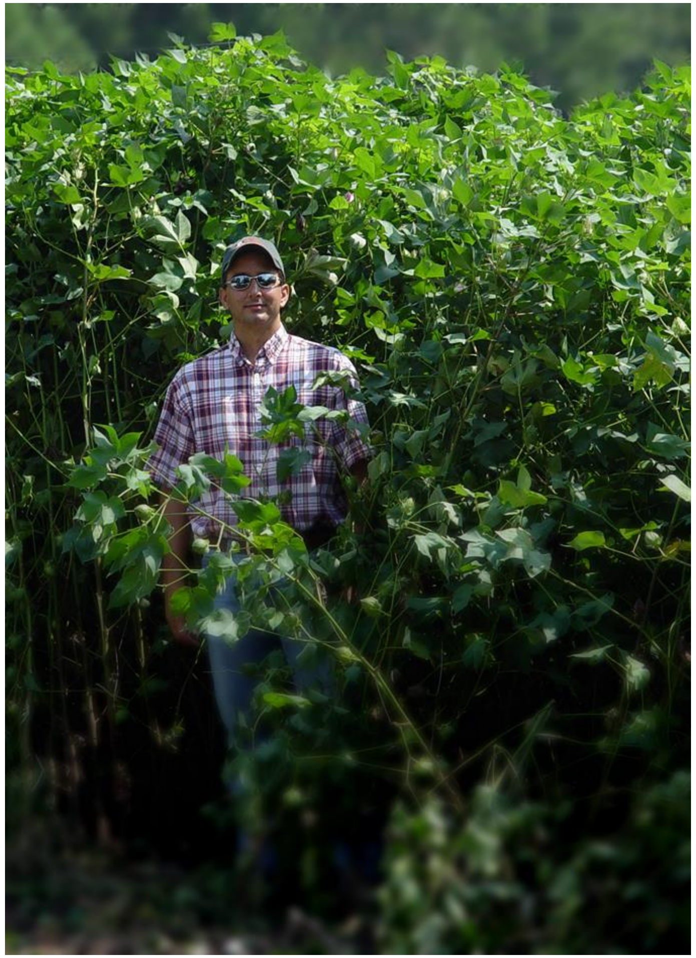
What is Earliness?

1. Variety selection
2. Technology selection
3. Early fruit retention.
4. Irrigation management
5. Nitrogen management
6. PGR management
7. Population / row spacing



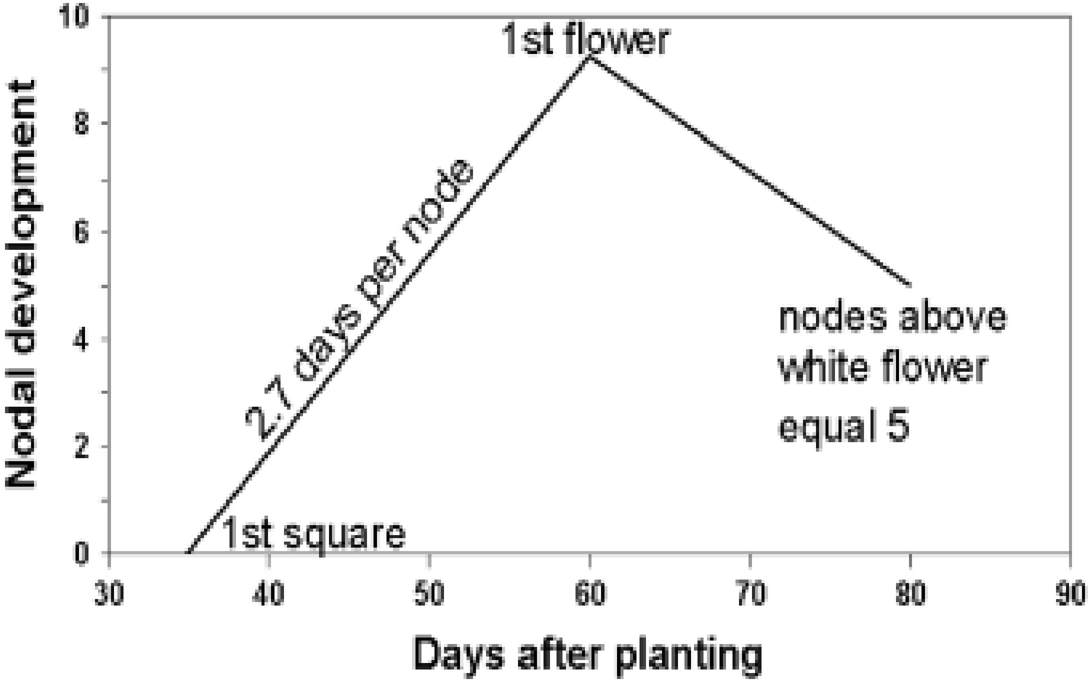
← Not this!

Objective

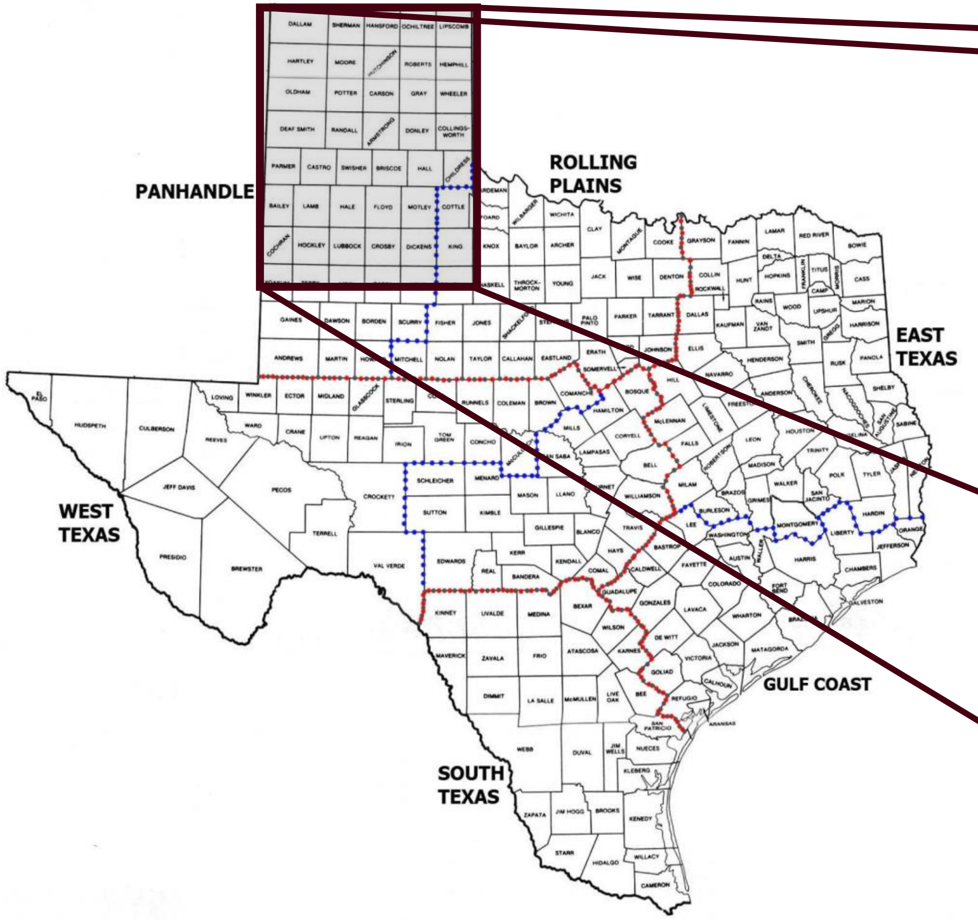
To recalibrate the Target Development Curve to better fit cropping systems representative of modern cultivars in the semi-arid climate of the Texas Panhandle.

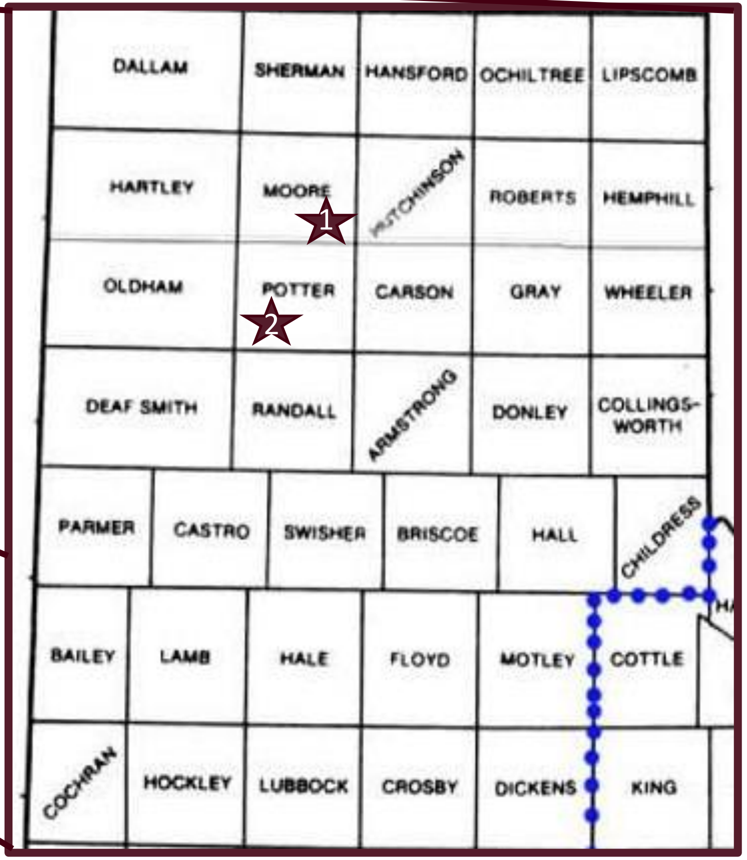
Target Development Curve

- Representative of a hypothetical normal non-stressed cotton crop (Bourland et al., 2008).
- TDC is not an accurate model for cultivars under stress (Oosterhuis et al., 2008b).
- Monitoring main stem nodal development is a proven appraisal of the status of growth – specifically early season vegetative growth (Bourland et al., 2008, 1992).
- Current standard for identifying the flowering date for cutout is NAWF=5 (Bourland et al., 1992).



Trial Locations





1 WCC

2 OAP

Methodology

Nodal Development

Nodes above first square and first flower are collected from 10 randomly sampled plants. 5 ft of row is tagged for NAWF values.

Lint Accumulation

Plants are hand harvested and box picked. Boll counts and lint weight is collected by fruiting position.

Heat Unit Accumulation

Heat units at major developmental stages are referenced from weather station data at each trial location.

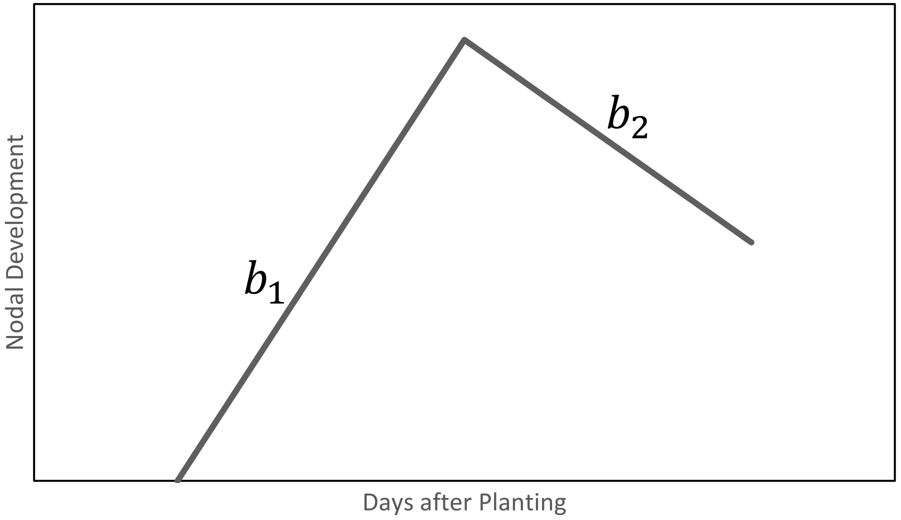
Approaching Cutout

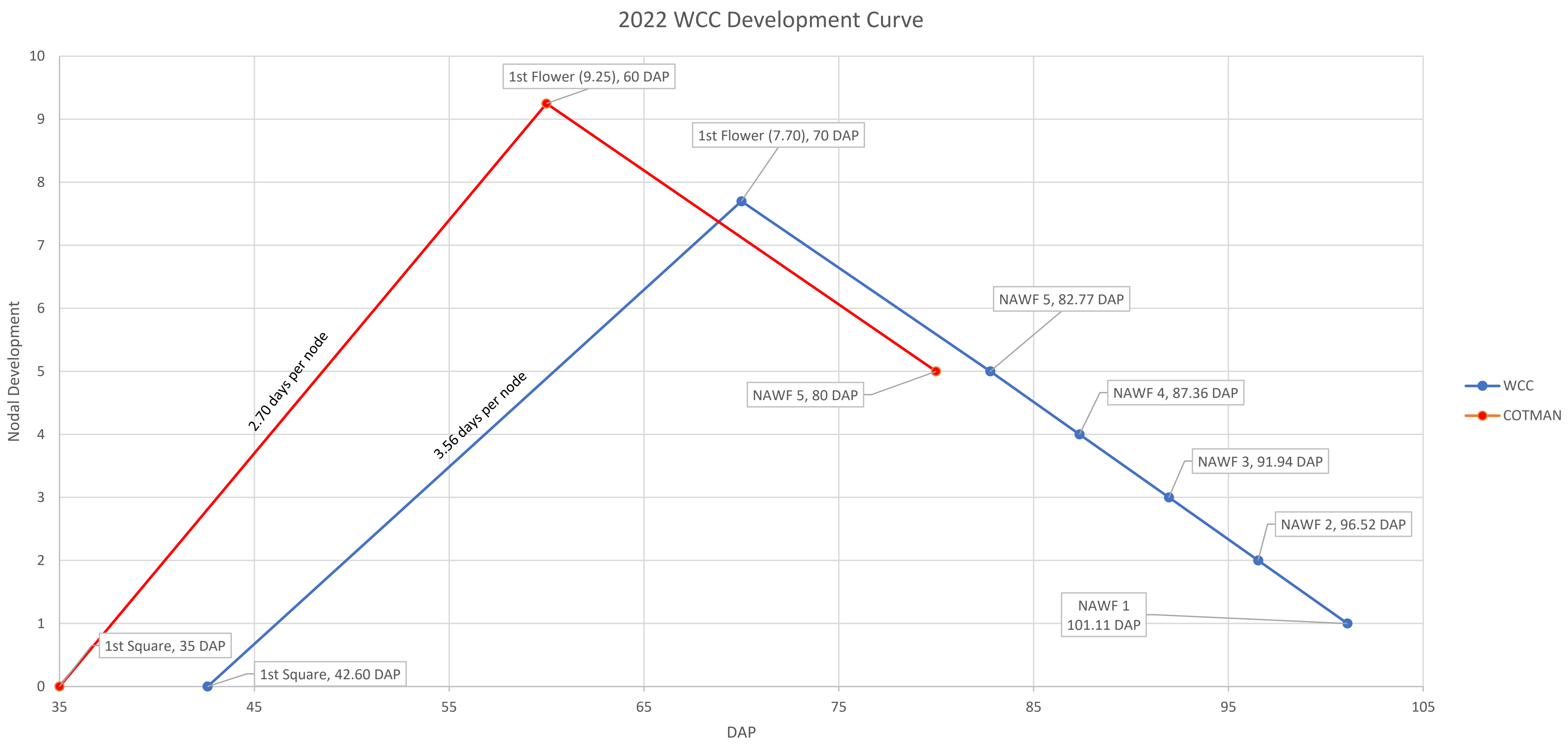
2022 WCC Analysis

General Equation: $NAWF = b_0 \pm b_1(DAP)$

$$NAWF = \begin{cases} f(DAP)b_1 + \epsilon \\ f(DAP)b_2 + \epsilon \end{cases}$$

Slope	Inflection Point (DAP)	Intercept	DAP	Nodal Development (days/node)	1st Square (DAP)	1st Flower (DAP)	1st Flower (NAWF)	NAWF=5 (DAP)	NAWF=4 (DAP)	NAWF=3 (DAP)	NAWF=2 (DAP)	NAWF=1 (DAP)
b1	<70	-11.97	0.28	3.56	42.60	70	7.70	82.77	87.36	91.94	96.52	101.11
b2	>=70	23.06	-0.22	-4.58								





2022 Etter, Texas (WCC)

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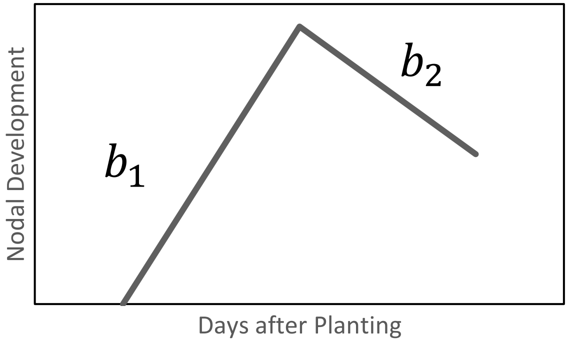
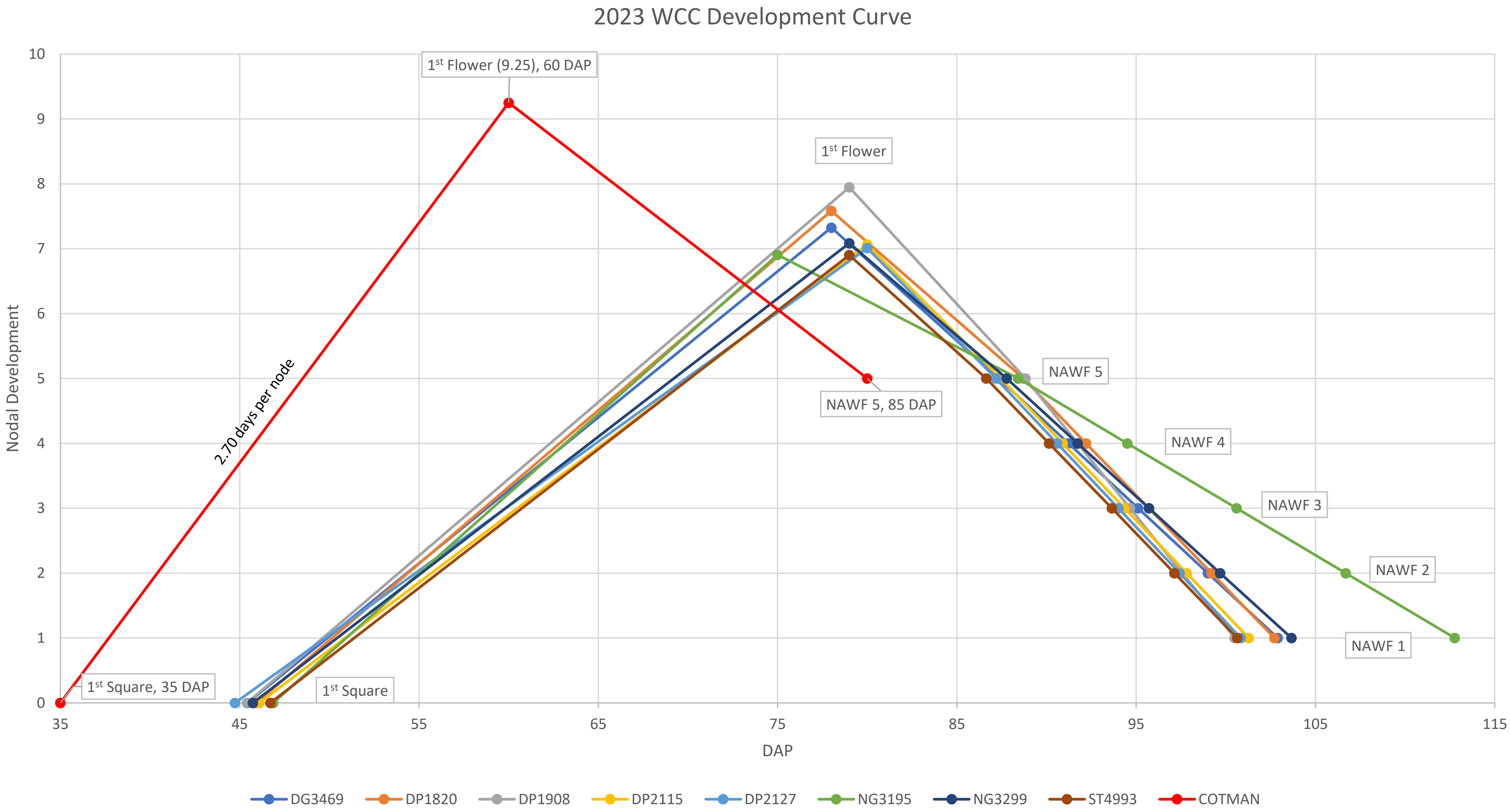
2023 WCC Analysis



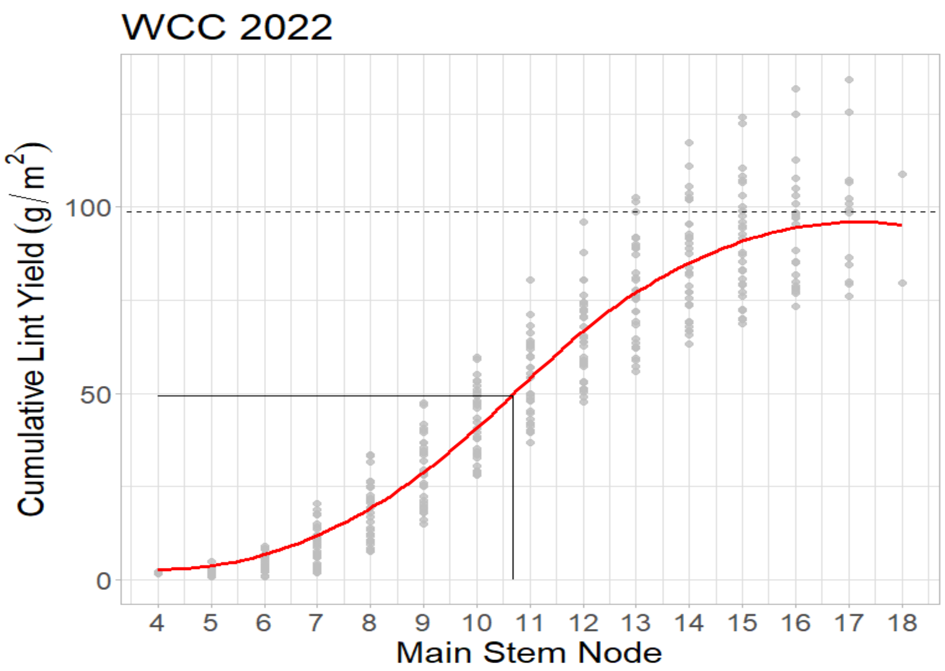
General Equation: $NAWF = b_0 \pm b_1(DAP)$

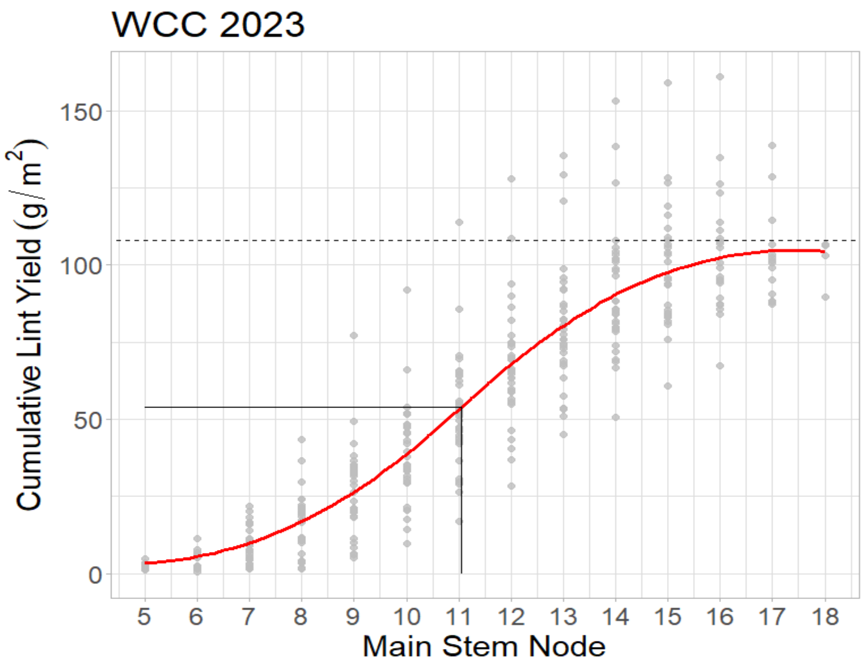
DG3469	NAWF= $\begin{cases} f(DAP)b_{11} + \epsilon \\ f(DAP)b_{21} + \epsilon \end{cases}$	DP2115	NAWF= $\begin{cases} f(DAP)b_{14} + \epsilon \\ f(DAP)b_{24} + \epsilon \end{cases}$	NG3299	NAWF= $\begin{cases} f(DAP)b_{17} + \epsilon \\ f(DAP)b_{27} + \epsilon \end{cases}$
DP1820	NAWF= $\begin{cases} f(DAP)b_{12} + \epsilon \\ f(DAP)b_{22} + \epsilon \end{cases}$	DP2127	NAWF= $\begin{cases} f(DAP)b_{15} + \epsilon \\ f(DAP)b_{25} + \epsilon \end{cases}$	ST4993	NAWF= $\begin{cases} f(DAP)b_{18} + \epsilon \\ f(DAP)b_{28} + \epsilon \end{cases}$
DP1908	NAWF= $\begin{cases} f(DAP)b_{13} + \epsilon \\ f(DAP)b_{23} + \epsilon \end{cases}$	NG3195	NAWF= $\begin{cases} f(DAP)b_{16} + \epsilon \\ f(DAP)b_{26} + \epsilon \end{cases}$		

Cultivar	Slope	Inflection Point (DAP)	Intercept	DAP	Nodal Development (days/node)	1st Square (DAP)	1st Flower (DAP)	1st Flower (NAWF)	NAWF=5 (DAP)	NAWF=4 (DAP)	NAWF=3 (DAP)	NAWF=2 (DAP)	NAWF=1 (DAP)
DG3469	b1	<78	-10.22	0.22	4.44	45.44	78.00	7.33	87.33	91.22	95.11	99.00	102.89
	b2	>=78	27.46	-0.26	-3.89								
DP1820	b1	<78	-10.86	0.24	4.23	45.93	78.00	7.58	88.71	92.21	95.71	99.21	102.71
	b2	>=78	30.35	-0.29	-3.50								
DP1908	b1	<79	-10.74	0.24	4.23	45.41	79.00	7.95	88.83	91.75	94.66	97.58	100.50
	b2	>=79	35.46	-0.34	-2.92								
DP2115	b1	<80	-9.60	0.21	4.80	46.09	80.00	7.06	87.44	90.90	94.36	97.81	101.27
	b2	>=80	30.30	-0.29	-3.46								
DP2127	b1	<80	-8.89	0.20	5.03	44.74	80.00	7.01	87.18	90.59	94.01	97.42	100.84
	b2	>=80	30.53	-0.29	-3.41								
NG3195	b1	<75	-11.51	0.25	4.07	46.87	75.00	6.91	88.42	94.51	100.60	106.68	112.77
	b2	>=75	19.53	-0.16	-6.09								
NG3299	b1	<79	-9.74	0.21	4.69	45.74	79.00	7.09	87.77	91.75	95.72	99.69	103.66
	b2	>=79	27.10	-0.25	-3.97								
ST4993	b1	<79	-9.98	0.21	4.68	46.71	79.00	6.90	86.64	90.14	93.64	97.14	100.64
	b2	>=79	29.75	-0.29	-3.50								


2023 WCC Development Curve
1st Flower (9.25), 60 DAP
1st Flower
NAWF 5
NAWF 5, 85 DAP
NAWF 4
NAWF 3
NAWF 2
NAWF 1
2.70 days per node
1st Square, 35 DAP
1st Square
Nodal Development
DAP
10
9
8
7
6
5
4
3
2
1
0
35
45
55
65
75
85
95
105
115
DG3469
DP1820
DP1908
DP2115
DP2127
NG3195
NG3299
ST4993
COTMAN

WCC Lint Accumulation





$$Y = \frac{Y_{max}}{1 + e^{-K(node - node_o)}}$$

Table 8. WCC - Logistic model estimates			
	Y_{max} (g/m^2)	$Node_0$	K
2022	98.82	10.67	0.56
Confidence Interval	[94.88, 103.35]	[10.43, 10.94]	[0.50, 0.61]
2023	107.99	11.06	0.56
Confidence Interval	[102.26, 114.88]	[10.75, 11.42]	[0.49, 0.65]

WCC Lint Accumulation

Table 9. WCC - Results of nonlinear regression estimations with corresponding NAWF values and identification of last effective flower population

Main-Stem Node	Average NAWF Value		Accumulated Yield (g/m^2)		% Max Yield	
	2022	2023	2022	2023	2022	2023
21	5.00	-	98.52	107.58	99.69%	99.62%
20	-	-	98.29	107.27	99.46%	99.33%
19	-	-	97.90	106.74	99.07%	98.84%
18	4.00	-	97.22	105.82	98.38%	97.99%
17	3.10	4.00	96.05	104.25	97.19%	96.53%
16	3.30	3.60	94.07	101.60	95.19%	94.08%
15	3.50	3.00	90.79	97.28	91.87%	90.08%
14	4.00	3.30	85.56	90.54	86.59%	83.84%
13	4.30	3.80	77.74	80.74	78.66%	74.77%
12	4.70	4.00	67.00	67.89	67.80%	62.86%
11	5.10	4.40	53.96	53.09	54.61%	49.16%
10	5.20	4.80	40.25	38.42	40.73%	35.58%
9	5.60	5.00	27.85	25.90	28.19%	23.98%
8	5.50	5.40	18.10	16.49	18.31%	15.27%
7	6.00	5.60	11.22	10.08	11.35%	9.33%
6	9.00	5.30	6.74	6.00	6.82%	5.55%
5	-	7.00	3.96	3.51	4.01%	3.25%
4	-	-	2.30	2.03	2.33%	1.88%

Preliminary Findings for Cotton Production in the Texas Panhandle

	WCC	TDC	Δ
First Square (DAP)	42-45 DAP	35 DAP	7-10 d
Vertical Fruiting Interval (days per node)	3.5-4.5 days/node	2.7 days/node	0.8-1.8 days/node
First Flower Node	70-78 DAP	60 DAP	10-18 d
	7.2-7.7	9.25	1.55-2.05
Cutout	NAWF=3-4	NAWF=5	1-2

What's next?

- Current work: Better understanding of cotton crop development and progression to maturity
- Current work: Better understanding of physiological cutout
- Future work: Heat units and days to mature last effective fruiting positions i.e. boll maturation trial
- Future work: Need to understand seasonal cutout as it related to cotton
- This information is needed to manage for earliness

Monitoring Cotton Growth and Development in the Texas Panhandle

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Cotton Incorporated

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