Burley Tobacco Yield and Leaf Chemistry Response to Topping Height Under Two Nitrogen Rates in Varieties Released Over Time

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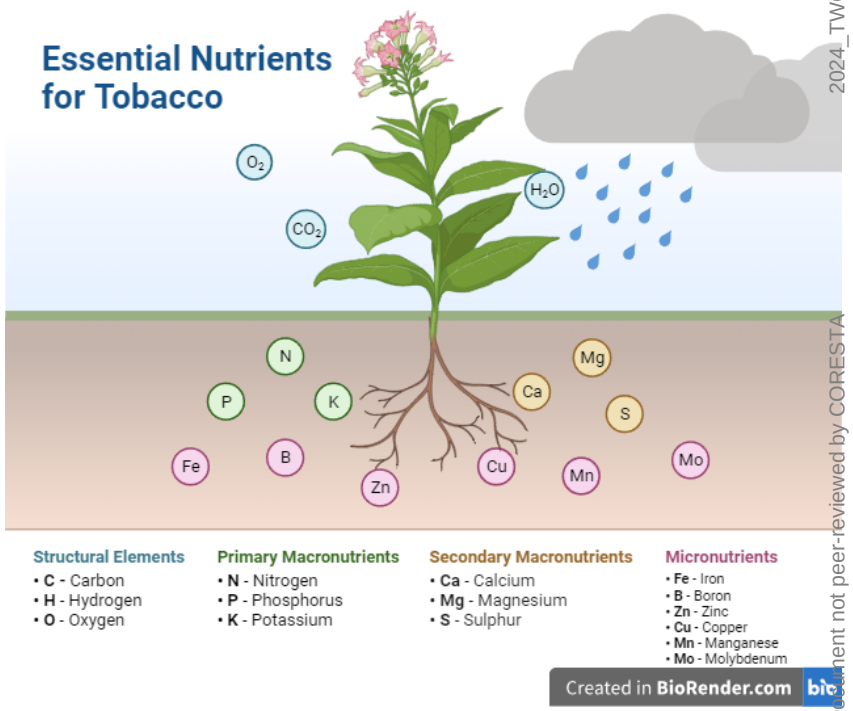
Nitrogen in Tobacco

- Nitrogen is considered to be the most important essential nutrient required by tobacco
  - Affects plant development more than any other nutrient
- Nitrogen is mobile and will translocate from lower leaves (more mature) to upper leaves (immature)
  - Deficiency symptoms develop on lower parts of the plant
- No reliable soil test indicators for fertilization
  - Recommendations are based on soil classification and field history



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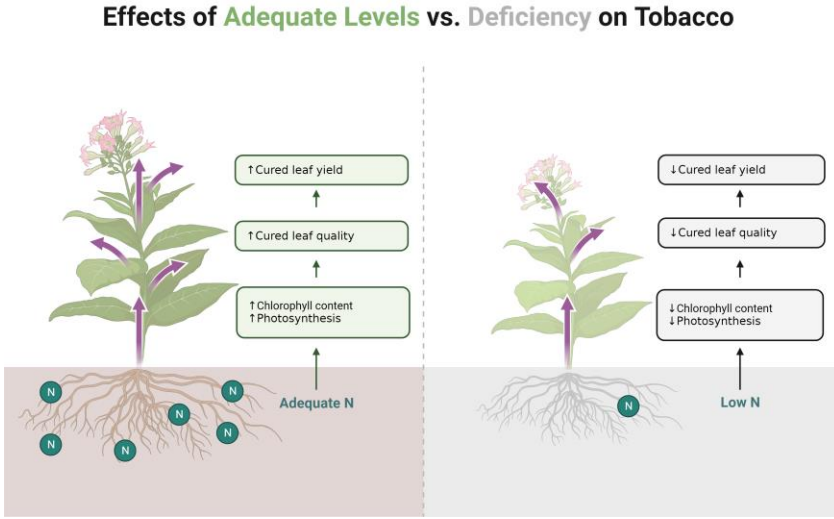
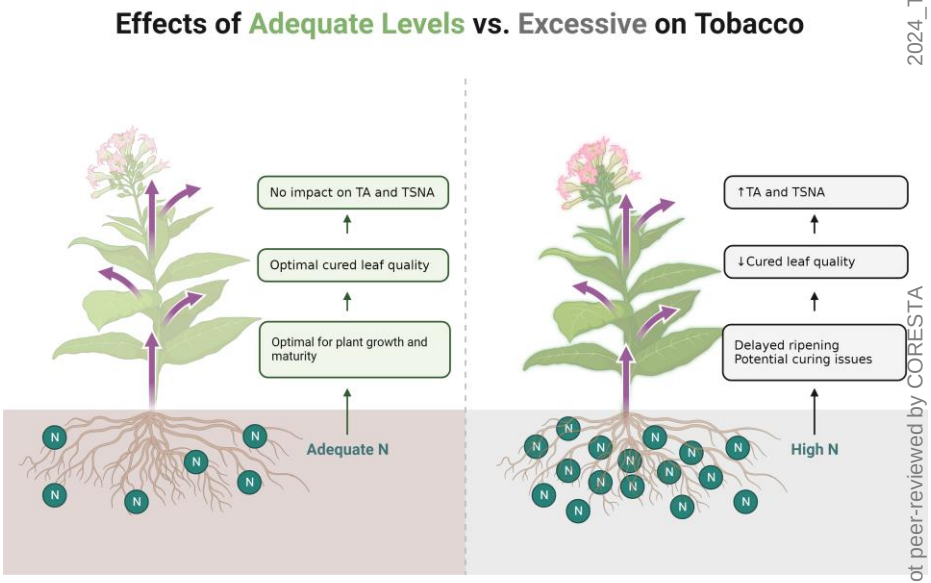


Nitrogen in Tobacco

- Burley (and dark) tobacco require more nitrogen than other tobacco types

- Excessive nitrogen fertilization may not show yield benefit
  - Can reduce cured leaf quality
  - Increase total alkaloids
    - Subsequent impact on TSNA



Topping Burley Tobacco

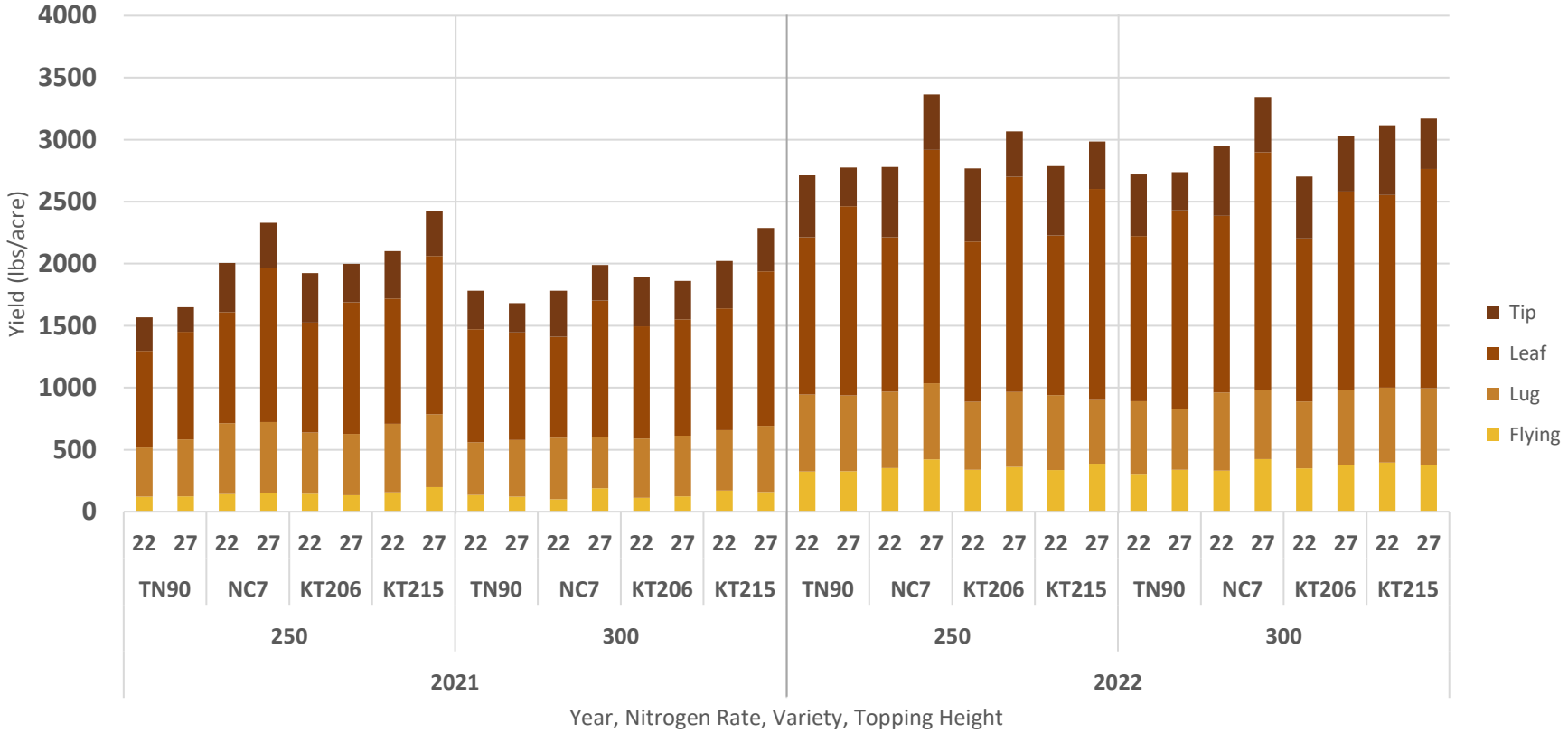
- Well known relationships between topping and subsequent yield and leaf quality
- Target 10% bloom and follow with sucker control applications
- 22-24 leaves ideal for true tip grade
  - Producers typically topping lower

Burley Agronomic Practices Evaluated with Four Varieties of Burley Tobacco

- Trial included:
  - Four varieties developed over time and location
    - TN90 (1990), NC7 (2001), KT206 (2006), KT215 (2015)
  - Two topping heights
    - 22 leaves or 27 leaves
  - Two rates of nitrogen
    - 250 or 300 lbs N acre^{-1}

- Objectives: Determine the influence of variety selection and topping height, when grown on two rates of nitrogen on yield, cured leaf quality, alkaloids, and tobacco-specific nitrosamines

Burley Agronomic Practices (raw yield)



Burley Agronomic Practices (2021 and 2022)

Table 1. Impact of Variety Selection on Yield Components in 2021 and 2022.

Treatment	Flying	Lug	Leaf	Tip	Total Yield
Variety	----------	----------	----------lbs/A ----------	----------	----------
TN90LC	225 B	505 B	1144 C	330 B	2193 C
KT206LC	243 B	532 AB	1219 BC	413 A	2396 B
NC7LC	265 A	561 A	1321 AB	431 A	2579 A
KT215LC	273 A	562 A	1349 A	422 A	2596 A
Standard Error	*18.38*	*47.80*	*270.89*	*66.95*	*498.58*
P-Value	*<.0001*	*0.0401*	*0.0005*	*<.0001*	*<.0001*

KT222 and NC7 were higher yielding than KT206 and TN90 when averaged over the two years

Burley Agronomic Practices (2021 and 2022)

Table 2. Impact of Topping Height on Yield Components in 2021 and 2022.

Treatment	Flying	Lug	Leaf	Tip	Total Yield
Topping	----------	----------	----------lbs/A----------	----------	----------
22 Leaves	239A	541	1119B	453A	2341B
27 Leaves	264B	539	1398A	345B	2541A
Standard Error	*18.25*	*46.38*	*269.56*	*66.37*	*497.14*
P-Value	*0.0010*	*0.8819*	*<.0001*	*<.0001*	*0.0002*

Topping at 27 leaves yielded significantly higher than topping at 22 leaves, however tip leaves were higher with the lower topping height.

Burley Agronomic Practices (2021 and 2022)

Table 3. Impact of Nitrogen Rate on Yield Components in 2021 and 2022.

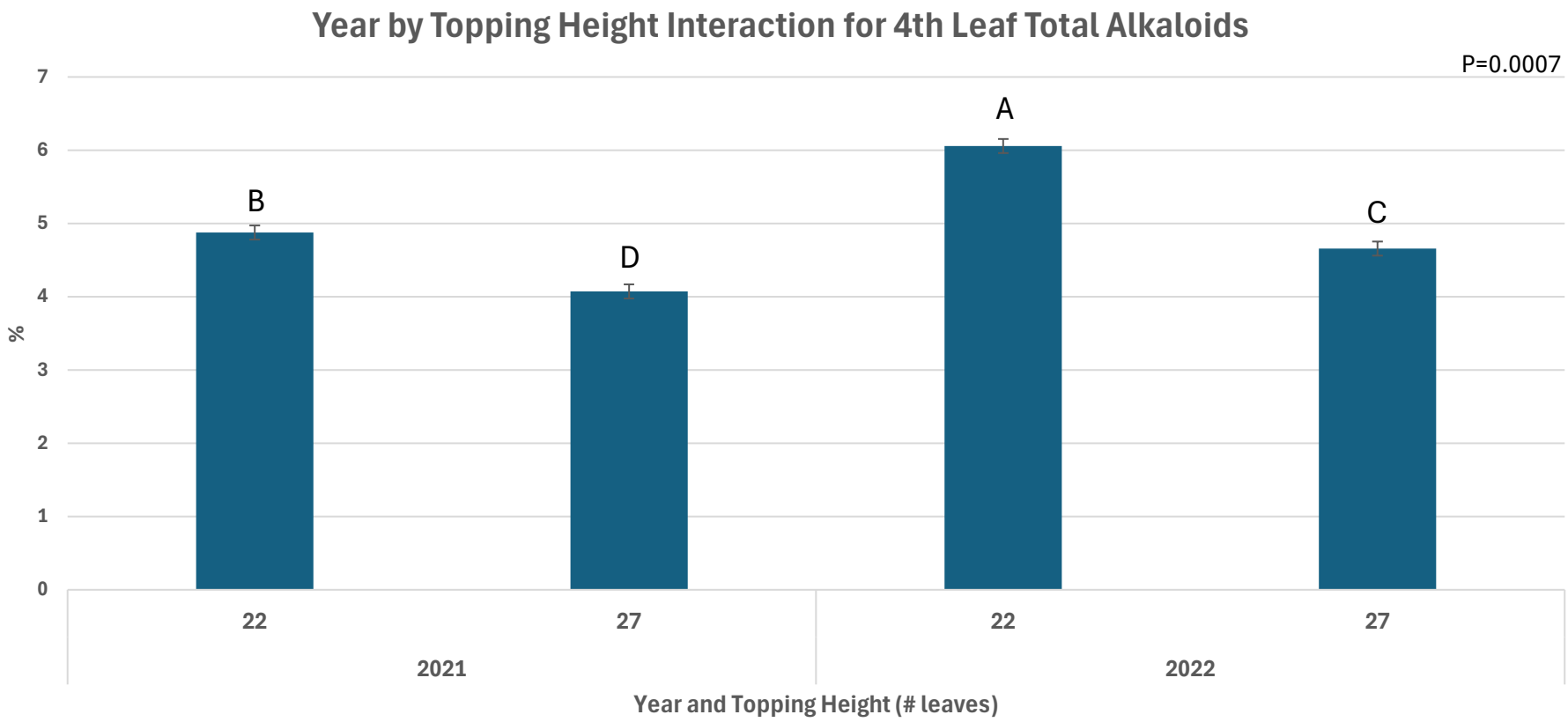
Treatment	Flying	Lug	Leaf	Tip	Total Yield
Nitrogen	----------	----------	lbs/A ----------	----------	----------
250 lbs/A	252	553	1246	399	2446
300 lbs/A	252	526	1270	399	2436
Standard Error	*18.25*	*46.36*	*269.53*	*66.35*	*497.12*
P-Value	*0.9985*	*0.0962*	*0.5243*	*0.9801*	*0.8524*

Nitrogen did not impact total yield or crop throw when comparing 250 to 300 lbs of N per acre

Alkaloids, Conversion, Leaf Nitrate, & TSNA

Analysis of Variance

Effect	Nicotine	Nornicotine	Anabasine	Anatabine	Total Alkaloids	Conversion	Nitrate
Year	***<.0001***	***<.0001***	***<.0001***	***<.0001***	***<.0001***	***0.0058***	***<.0001***
Variety	***<.0001***	***<.0001***	***<.0001***	***<.0001***	***<.0001***	***<.0001***	***0.0443***
Year*Variety	*0.8633*	*0.3200*	*0.1877*	***0.0195***	*0.7821*	*0.4536*	*0.1051*
Nitrogen	*0.2883*	***0.0118***	*0.7205*	*0.4931*	*0.2523*	***0.0352***	***<.0001***
Year*Nitrogen	*0.2065*	*0.6326*	*0.7800*	*0.4140*	*0.2872*	*0.2185*	*0.2878*
Variety*Nitrogen	*0.7004*	*0.7210*	*0.4768*	*0.4405*	*0.7223*	*0.3359*	*0.2072*
Year*Variety*Nitrogen	*0.7204*	*0.9118*	*0.6517*	*0.7261*	*0.7569*	*0.6134*	*0.2504*
Topping	***<.0001***	***<.0001***	***<.0001***	***<.0001***	***<.0001***	***0.0406***	*0.1354*
Year*Topping	***0.0007***	*0.2334*	***0.0288***	***0.0006***	***0.0007***	*0.6274*	*0.2912*
Variety*Topping	*0.4630*	*0.7382*	*0.7544*	*0.6585*	*0.5208*	*0.7988*	*0.7721*
Year*Variety*Topping	*0.1917*	*0.9094*	*0.2555*	*0.2920*	*0.1957*	*0.9878*	*0.8607*
Nitrogen*Topping	*0.6291*	*0.1424*	*0.5426*	*0.2847*	*0.7012*	*0.1348*	*0.3180*
Year*Nitrogen*Topping	*0.3012*	*0.3621*	*0.3617*	*0.1771*	*0.2685*	*0.7203*	*0.7448*
Variety*Nitrogen*Topping	*0.8751*	*0.9306*	*0.9646*	*0.8141*	*0.9070*	*0.7204*	*0.9820*
Year*Variety*Nitrogen*Topping	*0.8645*	*0.5869*	*0.8881*	*0.7885*	*0.8578*	*0.5453*	*0.7970*



Main Effects of N Rate and Topping Height:

Statistically significant but not biologically relevant with LC seed

	Conversion of Nicotine to Nornicotine
Nitrogen Rate (lbs N acre^{-1})	
250	3.21% B
300	3.46% A
P-value	*0.0352*
Topping Height (# Leaves)	
22	3.47% a
27	3.20% b
P-value	*0.0406*

Main Effect of N Rate on Leaf Nitrate

Nitrogen Rate (lbs N acre^{-1})	Nitrate (ppm)
250	6,555 B
300	8,871 A
P-value	*<0.0001*

Additional 50 units of nitrogen increased leaf nitrate by 35%

Analysis of Variance for Tobacco-Specific Nitrosamines

Effect	NNN	NNK	NAB	NAT	Total TSNA
Year	***<.0001***	***<.0001***	*0.1829*	***<.0001***	***<.0001***
Variety	***<.0001***	***<.0001***	***<.0001***	***<.0001***	***<.0001***
Year*Variety	*0.2548*	*0.2979*	*0.3016*	*0.6629*	*0.4157*
Nitrogen	***<.0001***	***0.0255***	***0.0016***	***0.0018***	***<.0001***
Year*Nitrogen	*0.3565*	***0.0394***	***0.0616***	*0.3297*	*0.2719*
Variety*Nitrogen	*0.3039*	*0.2827*	*0.2898*	*0.4391*	*0.3299*
Year*Variety*Nitrogen	*0.9140*	*0.7227*	*0.7469*	*0.7480*	*0.9302*
Topping	***<.0001***	***0.0001***	***<.0001***	***<.0001***	***<.0001***
Year*Topping	*0.4142*	***0.0841***	*0.9522*	*0.2180*	*0.3069*
Variety*Topping	*0.7481*	*0.6105*	*0.5692*	*0.8356*	*0.7827*
Year*Variety*Topping	*0.6463*	*0.6622*	*0.4408*	*0.5372*	*0.5193*
Nitrogen*Topping	*0.1579*	*0.6704*	*0.6532*	*0.6515*	*0.6721*
Year*Nitrogen*Topping	*0.9862*	*0.3421*	*0.8494*	*0.9674*	*0.9565*
Variety*Nitrogen*Topping	*0.9234*	*0.5077*	*0.7321*	*0.7308*	*0.7887*
Year*Variety*Nitrogen*Topping	*0.8776*	*0.7791*	*0.5226*	*0.7667*	*0.7927*

Main Effects of Variety, N Rate, and Topping Height:

	Total TSNA
Variety	µg/g
TN90LC	1.84 A
KT206LC	1.72 A
NC7LC	1.36 B
KT215LC	1.07 C
P-value	*<0.0001*
Nitrogen Rate (lbs N acre^{-1})	
250	1.35 B
300	1.63 A
P-value	*<0.0001*
Topping Height (# Leaves)	
22	1.79 A
27	1.19 B
P-value	*<0.0001*

Conclusions

- Observed yield tended to increase when comparing varieties developed over time
- The additional 50 lbs of nitrogen did not increase yield, but did increase Total TSNA
- Topping higher resulted in increase yields but less lbs of tip leaves
  - Possibly more true tips leaves (#) with less weight

Thank you for the support!

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