

De-Lugging Programs: Agronomic and Economic Impacts

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Current Industry Situation

- Renewed interest in leaf removal during the 2015 growing season
 - Global oversupply of P and X grades
 - Somewhat poor P and X quality due to weather conditions
 - Strong US dollar
- End result has been the suggestion to discard lower leaves
 - Low contribution to total yield
 - Low market price
 - Low filling value in cigarettes



What Did We Know in 2015?

- Timing of Removal:⁴
 - Pre-topping – leaves above are thinner
 - Post-topping – more yield loss
 - Strong focus on topping so that machines can be used
- Non-flowering Varieties:⁴
 - Leaf removal and higher topping height
 - Topping higher did not increase yield when lower leaves were removed
 - Conventional varieties may not mature fast enough with higher topping heights
- Leaf Removal Number Drives Everything



Leaf Removal Programs

3 – 4 leaves/plant

- ↑ price, no impact to yield^{2,5,6}
- ≈11% yield and value loss¹
- 4-9% yield loss³
- 11-20% value loss³
- No impact to crop throw³

6 leaves/plant

- Yield and value reductions⁵
 - 715 lbs./acre and \$US 1,125/acre

8 leaves/plant^{4,5}

- Yield and value reductions
 - 21-23% and 20-22%, respectively
- ↓ lug grades by 0-30%
- ↑ quality and price
 - not enough to offset effects of yield loss



What Other Practices Can We Explore?



What Other Practices Can We Explore?

1. Late-season nitrogen application?
2. Leaf removal timing?



Leaf Removal: Number & Nitrogen Rate

- Number: 0, 4, or 8
- Additional Nitrogen Rate: 0, 5, 10, or 15 lbs. N/acre
- Focus on topping for treatment application



De-lugging Information

Table 1. Effect of lower leaf removal number and nitrogen application to cured leaf yield, quality, price, value, and crop throw^a.

Treatment	Yield	Quality ^b	Price	Value	Crop Throw		
<u>Removal^c</u>	lbs/acre		\$/lb	\$/acre	%X	%C	%B
0/plant	2,702 a	75 a	1.54 a	4,102 a	30 a	26 a	44 c
4/plant	2,187 b	75 a	1.58 a	3,450 b	14 b	27 a	59 b
8/plant	1,866 c	75 a	1.62 a	3,031 b	2 c	12 b	86 a
<u>N Rate^d</u>							
0 lbs/acre	2,194 a	74 a	1.55 b	3,417 b	17 a	21 a	62 a
5 lbs/acre	2,240 a	75 a	1.59 ab	3,494 b	16 a	21 a	63 a
10 lbs/acre	2,274 a	75 a	1.57 ab	3,491 b	16 a	21 a	63 a
15 lbs/acre	2,297 a	77 a	1.62 a	3,708 a	12 a	25 a	63 a

^a Treatment results followed by the same letter within a column and main effect (leaf removal or N application) are not significantly different at the $\alpha=0.10$ level.

^b Quality is assessed on a scale of 1-100, with 100 being of the highest quality.

^c Leaves removed from the bottom of each plant at topping. All plants topped to 20 leaves.

^d Nitrogen sourced from 28% UAN and applied directly to the soil surface following leaf removal using a solution volume of 20 GPA.

Leaf Removal: Number & Timing

Leaves Removed per Plant	Timing
0	n/a
8	10 Days Before Topping
8	At Topping
8	10 Days After Topping

^a Plants topped to 20 leaves prior to lower leaf removal.



Table 2. Cured leaf yield, quality, value, and crop throw as impacted by leaf removal timing^a. Data are pooled across four growing environments.

Timing ^c	Yield	Quality	Value	Crop Throw		
	lbs./acre		\$/acre	%X	%C	%B
10 DBT	1,890 a	72 a	2,896 a	0 a	19 a	81 a
At Topping	1,943 a	66 a	2,644 a	0 a	9 a	91 a
10 DAT	1,870 a	76 a	3,044 a	0 a	13 a	87 a
No Deluging	2,815	72	4,004	30	25	45

^a Treatment means followed by the same letter within the same column are not significantly different at the $\alpha = 0.05$ level.

^b Quality assessed on a scale of 1-100, with 100 being of the highest quality.

^c DBT; days before topping, DAT; days after topping.



Takeaways from North Carolina Research

- De-lugging programs reduce yield
 - How much is determined by variety, growing conditions, and number of leaves removed
- Yield reductions are too large to overcome economically
- Higher N application is not the answer
- Increased topping height is not the answer



Economic Impact



Previous De-Lugging Research

- Research conducted in 2016 & 2017 by Finch et al. (2019)
- 0, 4, and 8 leaf removal programs
- Data was collected on yield, quality, value, and crop throw

Table 3. The influence of leaf removal number to tobacco yield, quality, price, value, and crop throw. Data are pooled across four growing environments.^a

Leaf Removal num./plant	Yield lbs./acre	Quality ^b	X	C	B
				%	
0	2,654 a	74 a	31 a	26 a	43 b
4	2,079 b	74 a	19 a	25 a	56 b
8	1,849 b	75 a	0 b	13 a	87 a

^a Treatment means followed by the same letter within the same column are not significantly different at the $\alpha=0.05$ level.

^b Quality is assessed on a scale of 1-100, with 100 being of the highest quality.

Data Source: Finch, CE, MC Vann, LR Fisher, R Wells, and AB Brown. 2019. Lower-Leaf Removal and Nitrogen Application Programs for Flue-Cured Tobacco Production. Agron. J. 111:1933-1939.



Model Inputs

- Labor cost of \$11.46 per hour
- 6,000 plants per acre
- Yield: 2,654 pounds per acre in a conventional four harvest program
- Yield Loss:
 - 20% loss following 4 leaf removal
 - 30% loss following 8 leaf removal



Model Assumptions

- Crop Throw:
 - 0 leaf: 31% X 26% C 43% B
 - 4 leaf: 19% X 25% C 56% B
 - 8 leaf: 0% X 13% C 87% B
- Average Price per Pound
 - X Stalk Position: \$1.57
 - C Stalk Position: \$1.77
 - B Stalk Position: \$2.03
- De-Lugging Cost
 - 1 man-hour per acre for Machine Harvest



Machine Harvest Budgets

Base Yield 2654

Scenarios with 0, 4, and 8 leaf removal

PER ACRE

Leaf Removal	0 leaf	4 leaf	8 leaf
Yield	2654	2079	1849
Avg. Price Per Pound	\$ 1.82	\$ 1.88	\$ 2.00
Total Revenue	\$ 4829.75	\$ 3903.53	\$ 3690.97
Operating Expenses	\$ 2922.78	\$ 2934.24	\$ 2934.24
Cost Savings	\$ 0	\$ 216.02	\$ 302.58
Return over Operating Expenses	\$ 1906.97	\$ 1185.31	\$ 1059.31
Fixed Costs	\$ 787.54	\$ 787.54	\$ 787.54
Return to land, risk & mgt	\$ 1119.43	\$ 397.77	\$ 271.77
Change from Base		\$ (721.66)	\$ (847.66)

Additional needed per pound to make net return equal to base scenario \$ 0.34 \$ 0.45

Price needed per pound \$ 2.22 \$ 2.45

Conclusions

- These programs are not economically feasible or sustainable for US producers in their current model
- “Return to Base” scenario achieved with price increase
 - 4 leaf program = \$US 0.34 per lb. average
 - 8 leaf program = \$US 0.45 per lb. average



Moving Forward

1. Funding secured to develop a customizable budget
 - Publish online in mid-April
 - Publish budget in peer-reviewed journal by end of 2020
2. Conduct cost/benefit analysis of industry wide de-lugging program



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Questions??

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