

Tobacco Agronomic Management and the Evolution of Harm Reduction

Dr. Matthew C. Vann

Associate Professor & Tobacco Extension Specialist

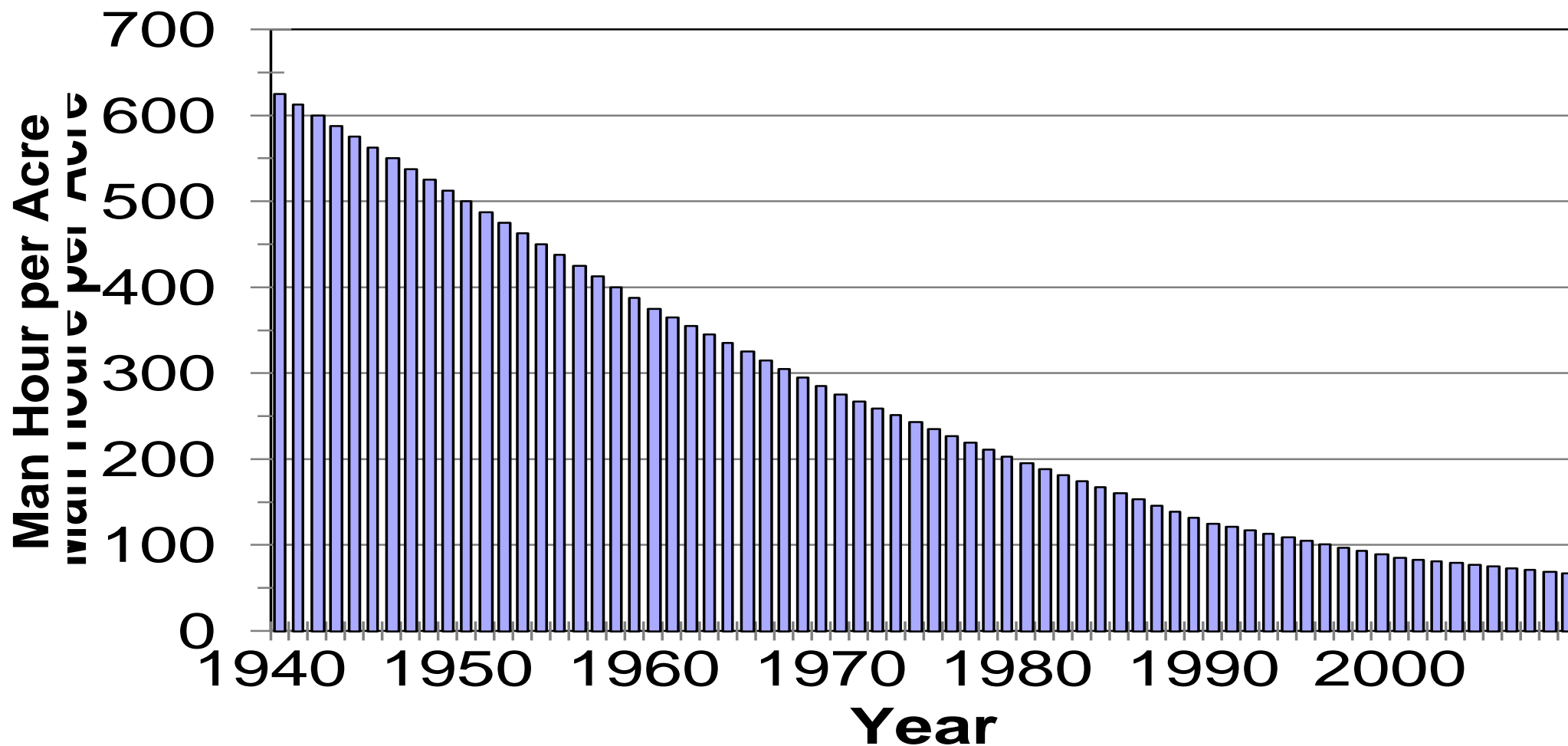
William K. and Ann T. Collins Distinguished Scholar in Tobacco Research and Extension

Department of Crop & Soil Sciences



Estimated Production Labor

Flue-Cured Type 12 - NC Eastern Belt



Boyette, M. 2010. The Limits of Efficiency in Flue-Cured Tobacco Production. 44th Tobacco Workers Conference. Abstract 54.

<https://www.coresta.org/abstracts/limits-efficiency-flue-cured-tobacco-production-31549.htm>





**Reduced seedling production
timeline by ≈ 30 days**



99% man hour reduction



2 hours per acre



**20x increase in curing
throughput per day**

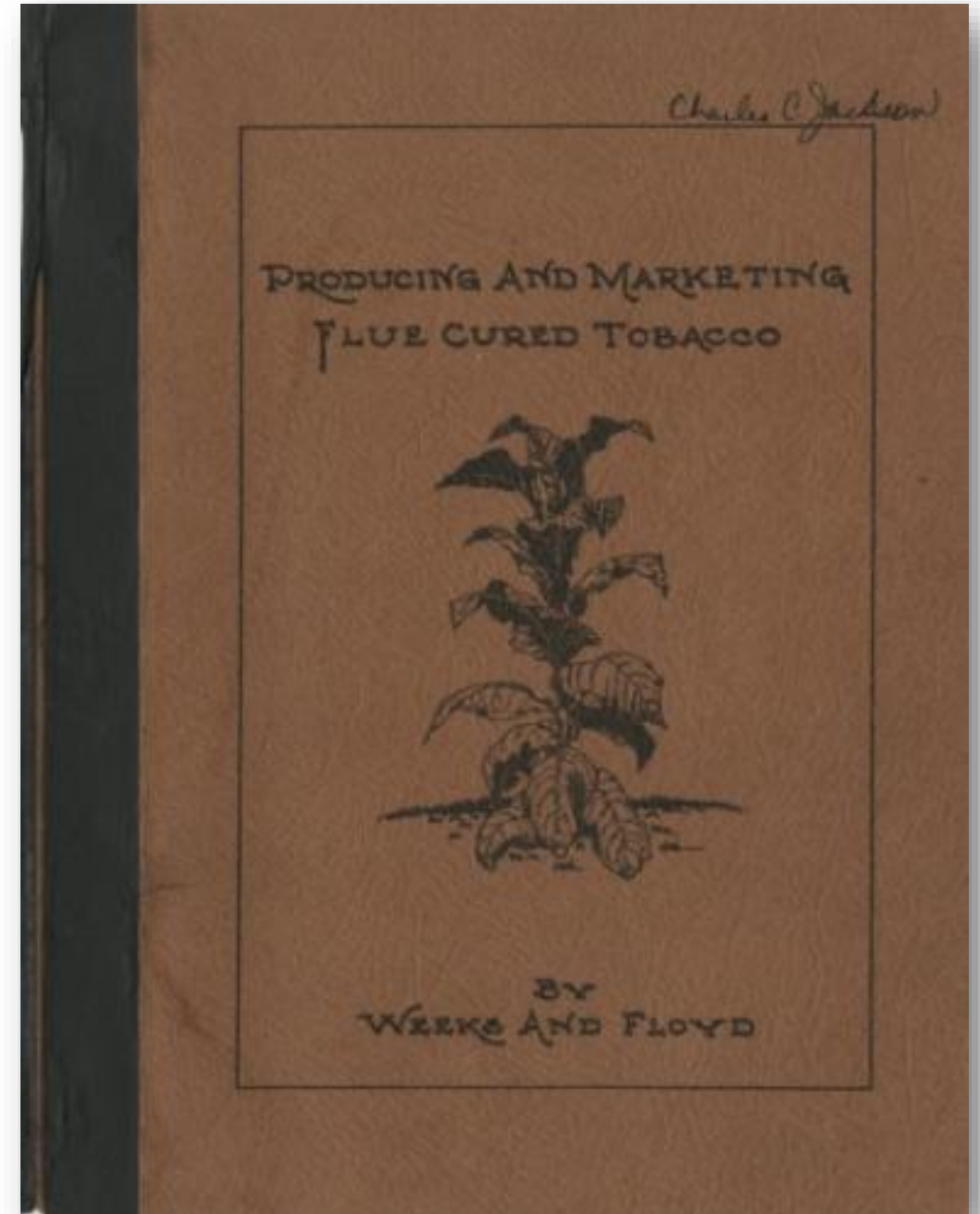


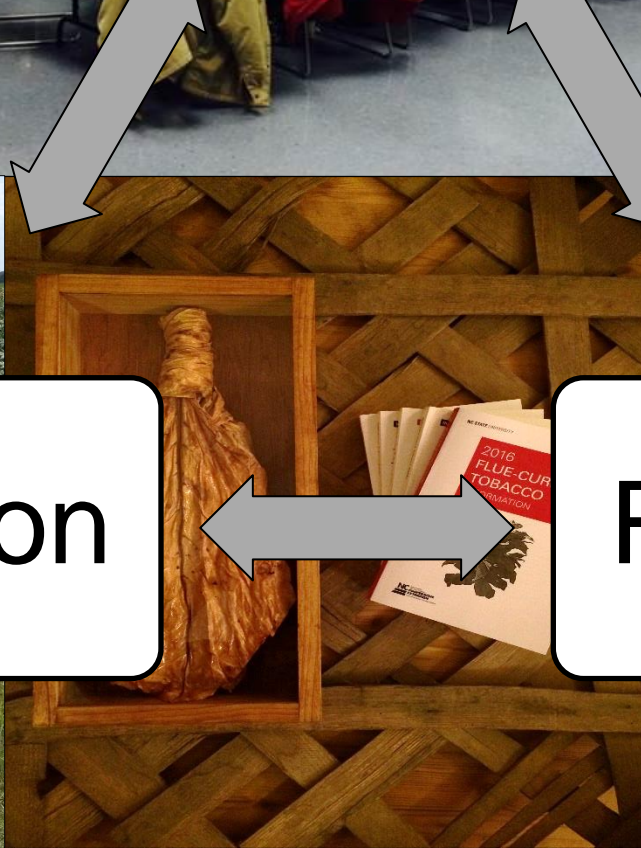
>10 acres per day per sprayer



>200,000 lbs. per day

- 🌿 Identify the principles of production
- 🌿 Develop best local practices
- 🌿 Increase operating efficiencies
- 🌿 Troubleshoot production related issues
- 🌿 Provide technical training
- 🌿 Educating clientele

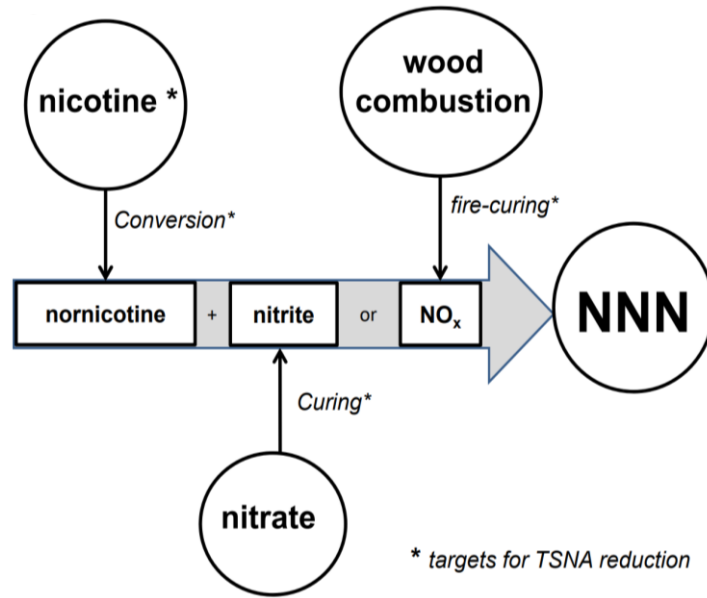




Education

Extension

Research



1. Breeding & Genetics

2. Plant Nutrition

3. Agrochemical Application

4. Curing & On-Farm Storage



Figure Source: Fisher, A, L Bush, & A Bailey. 2021. TSNA's in Burley and Dark Tobacco. *In* 2021-2022 Burley and Dark Tobacco Production Guide. Pgs 65-70.
<https://tobacco.ces.ncsu.edu/wp-content/uploads/2020/12/2021-2022-Burley-and-Dark-Tob-Prod-Guide.pdf?fwd=no>

Photo Source: Dr. Grant Ellington, NC State University – Department of Biological & Agricultural Engineering

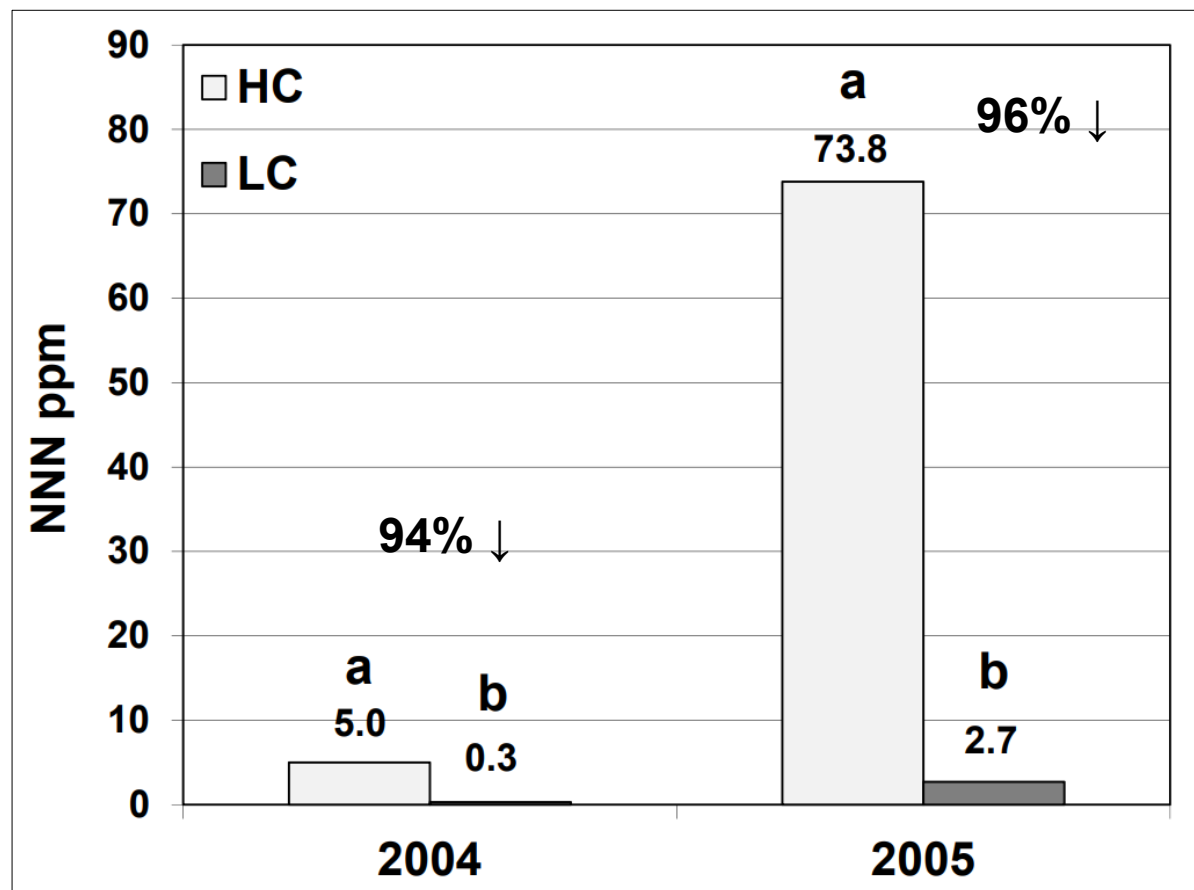
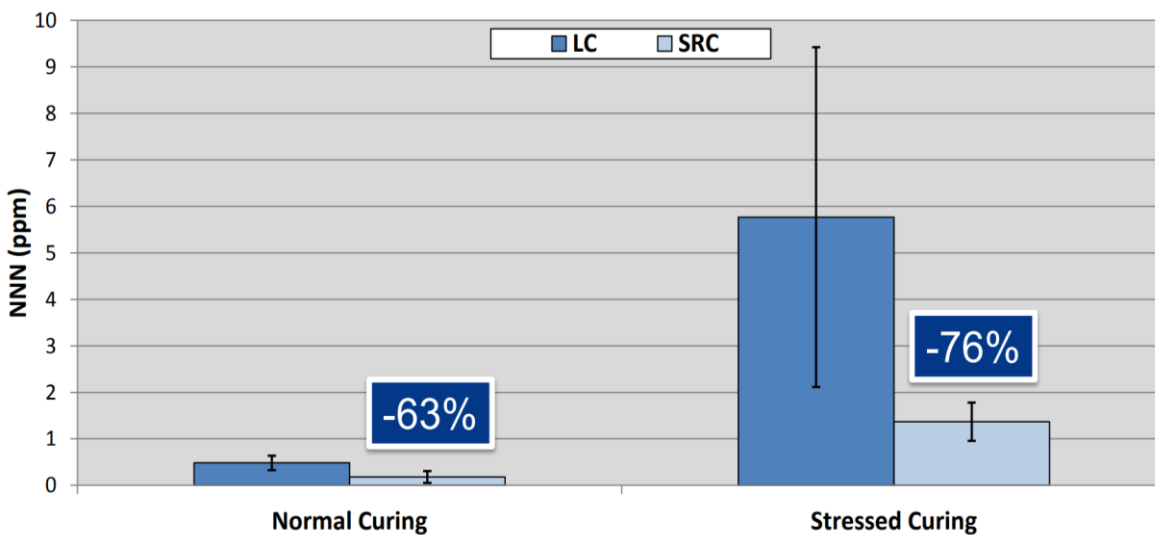
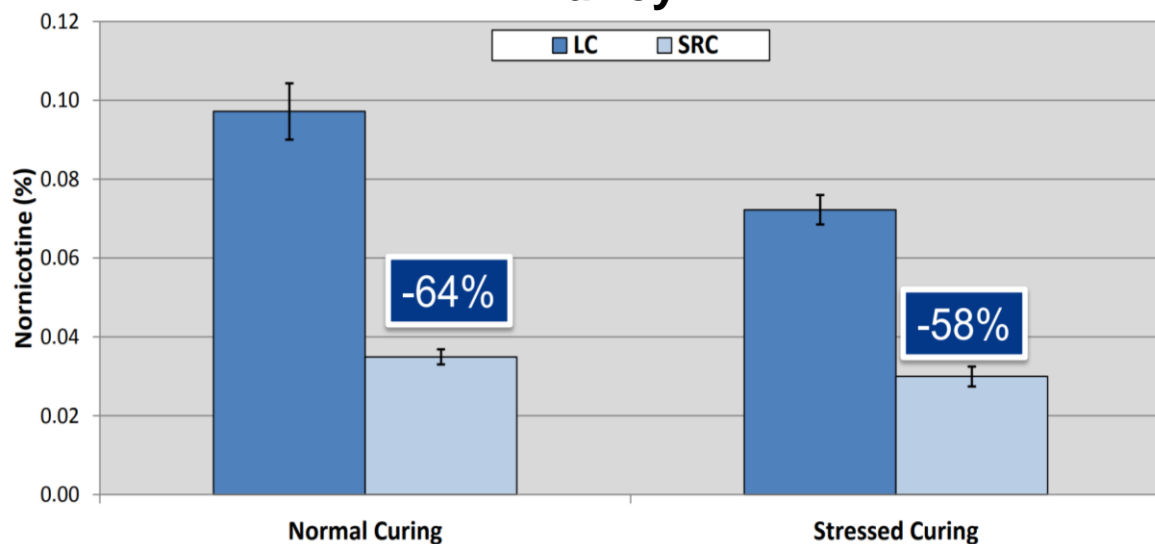


Figure 1. NNN (ppm) for high converter (HC) and low converter (LC) burley varieties over two years. Within each year, bars with different letters are significantly different at the 5% level.

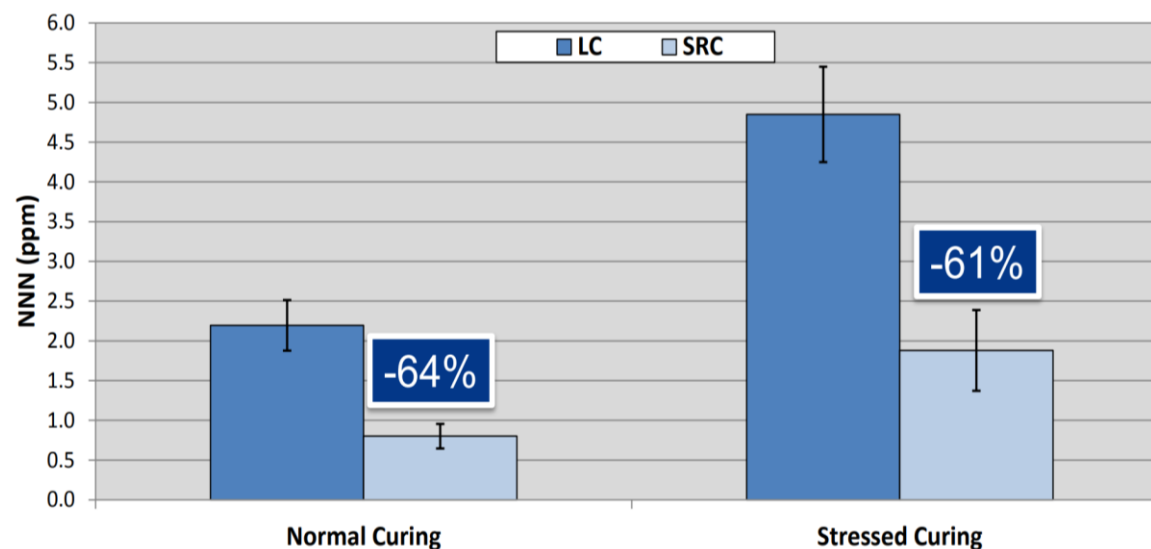
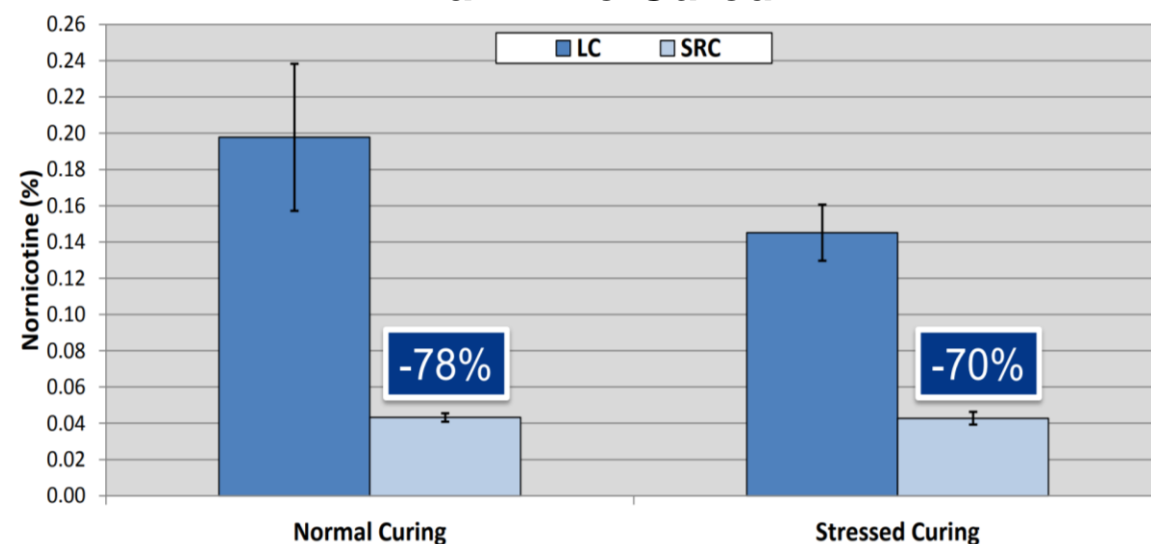
- ☛ Reduction in Nornicotine concentration
 - ☛ Reduction in NNN concentration
- ☛ All commercial seedlots are LC
 - ☛ Indicated in variety name or on seed package
- ☛ GAP requirement



Burley



Dark Fire-Cured



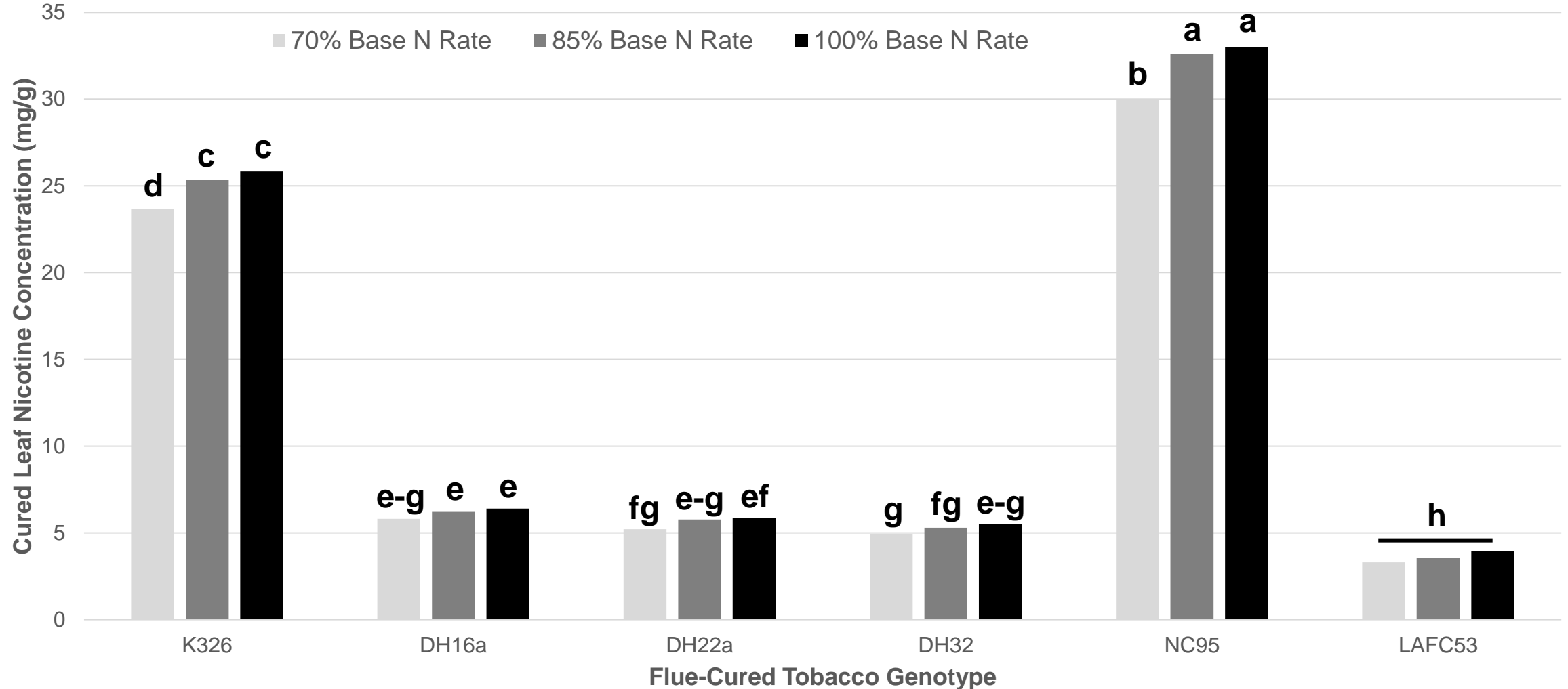


Figure 3. Cured leaf nicotine concentration as influenced by tobacco genotype and nitrogen application rate. Treatment means with the same letter are not statistically different at the $\alpha=0.05$ level.

Adapted from: Cheek, JA, MC Vann, RS Lewis, & LR Fisher. 2020. Genetics Influence Postharvest Measurements of Flue-Cured Tobacco More than Nitrogen Application Rate. *Agronomy Journal*. <https://doi.org/10.1002/agj2.20565>



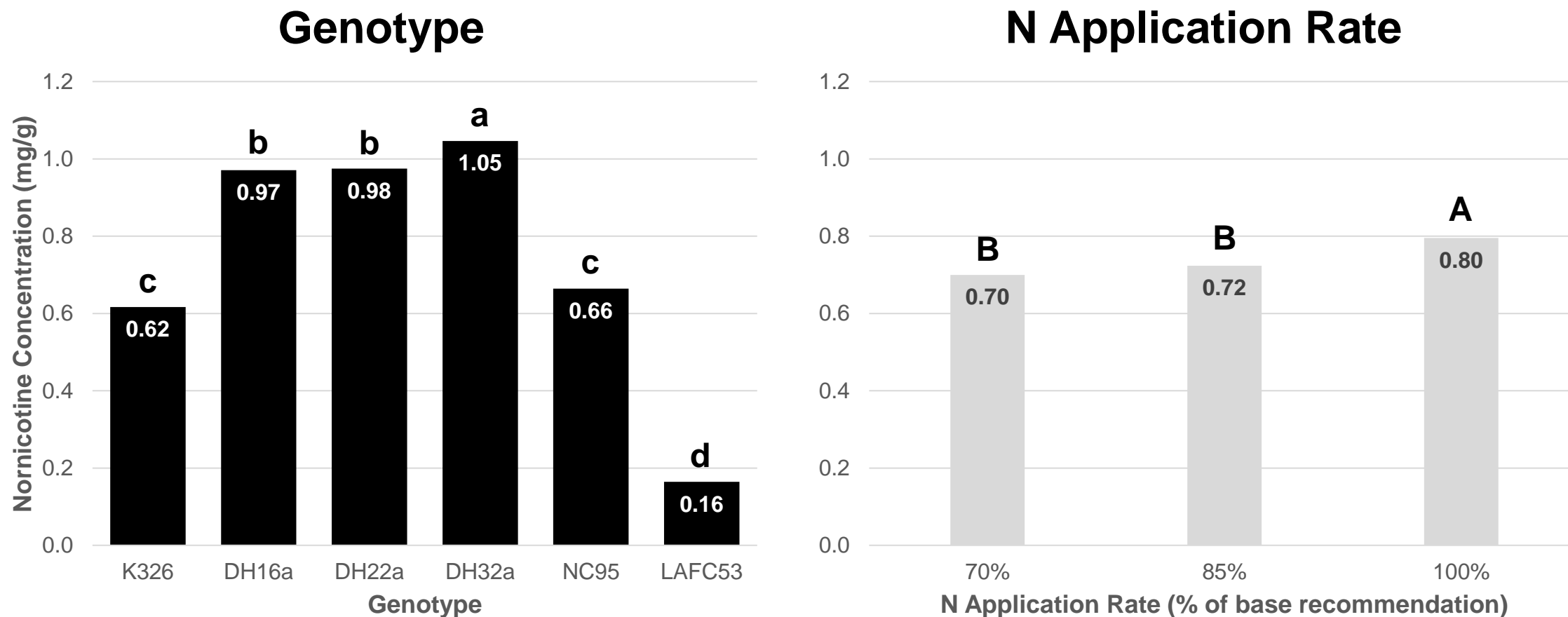
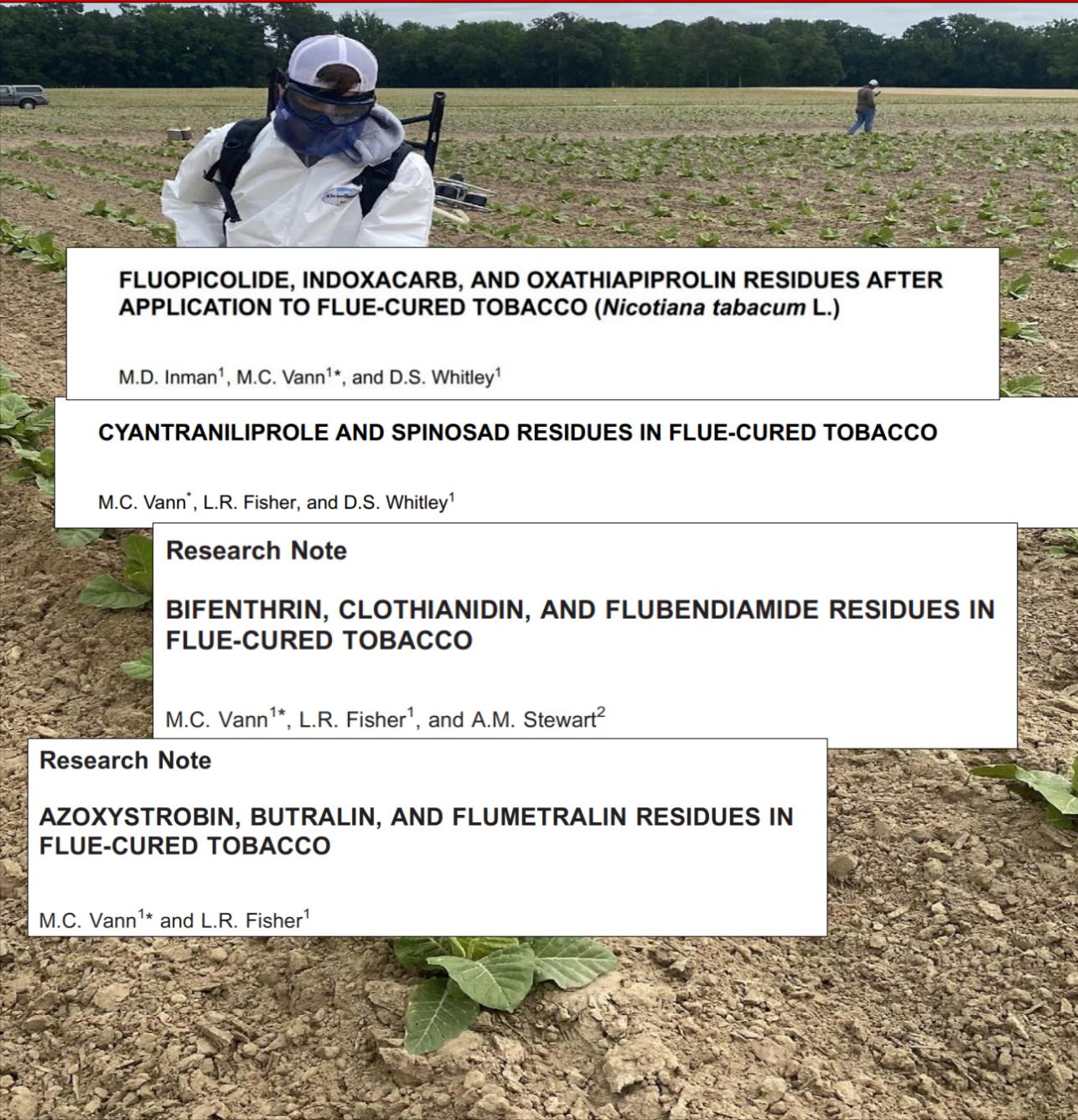


Figure 4. The effect of tobacco genotype and nitrogen application rate on cured leaf nornicotine concentration. Treatments means with the same lower or uppercase letters are not significantly different at the $\alpha=0.05$ level.





FLUOPICOLIDE, INDOXACARB, AND OXATHIPIPROLIN RESIDUES AFTER APPLICATION TO FLUE-CURED TOBACCO (*Nicotiana tabacum* L.)

M.D. Inman¹, M.C. Vann^{1*}, and D.S. Whitley¹

CYANTRANILIPROLE AND SPINOSAD RESIDUES IN FLUE-CURED TOBACCO

M.C. Vann^{*}, L.R. Fisher, and D.S. Whitley¹

Research Note

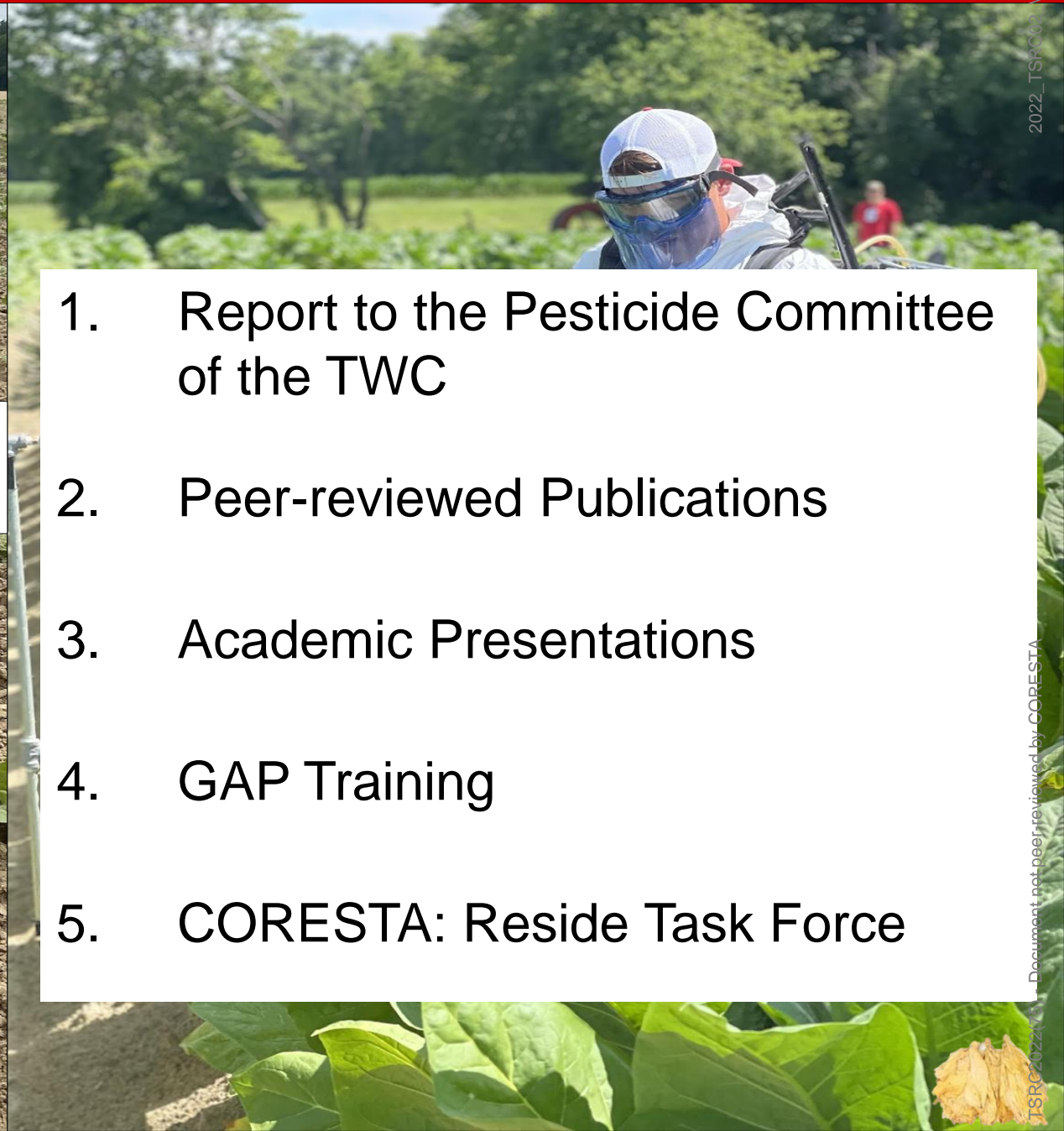
BIFENTHRIN, CLOTHIANIDIN, AND FLUBENDIAMIDE RESIDUES IN FLUE-CURED TOBACCO

M.C. Vann^{1*}, L.R. Fisher¹, and A.M. Stewart²

Research Note

AZOXYSTROBIN, BUTRALIN, AND FLUMETRALIN RESIDUES IN FLUE-CURED TOBACCO

M.C. Vann^{1*} and L.R. Fisher¹

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1. Report to the Pesticide Committee of the TWC
 2. Peer-reviewed Publications
 3. Academic Presentations
 4. GAP Training
 5. CORESTA: Residue Task Force

Smoke Sensory

- 🌿 Advised by the Pesticide Committee
 - 🌿 Voluntary participation
- 🌿 Two Part Program:
 - 🌿 Smoke Flavor
 - 🌿 Toxicology Assessment
- 🌿 Ensures quality control

Shifting Products

- 🌿 Out with the Old:
 - 🌿 Acephate
 - 🌿 Methomyl
 - 🌿 Aldicarb
 - 🌿 Chlorpyrifos
 - 🌿 Carbaryl
- 🌿 In with the New:
 - 🌿 Chlorantraniliprole
 - 🌿 Indoxacarb
 - 🌿 Cyantraniliprole
 - 🌿 Spinosad



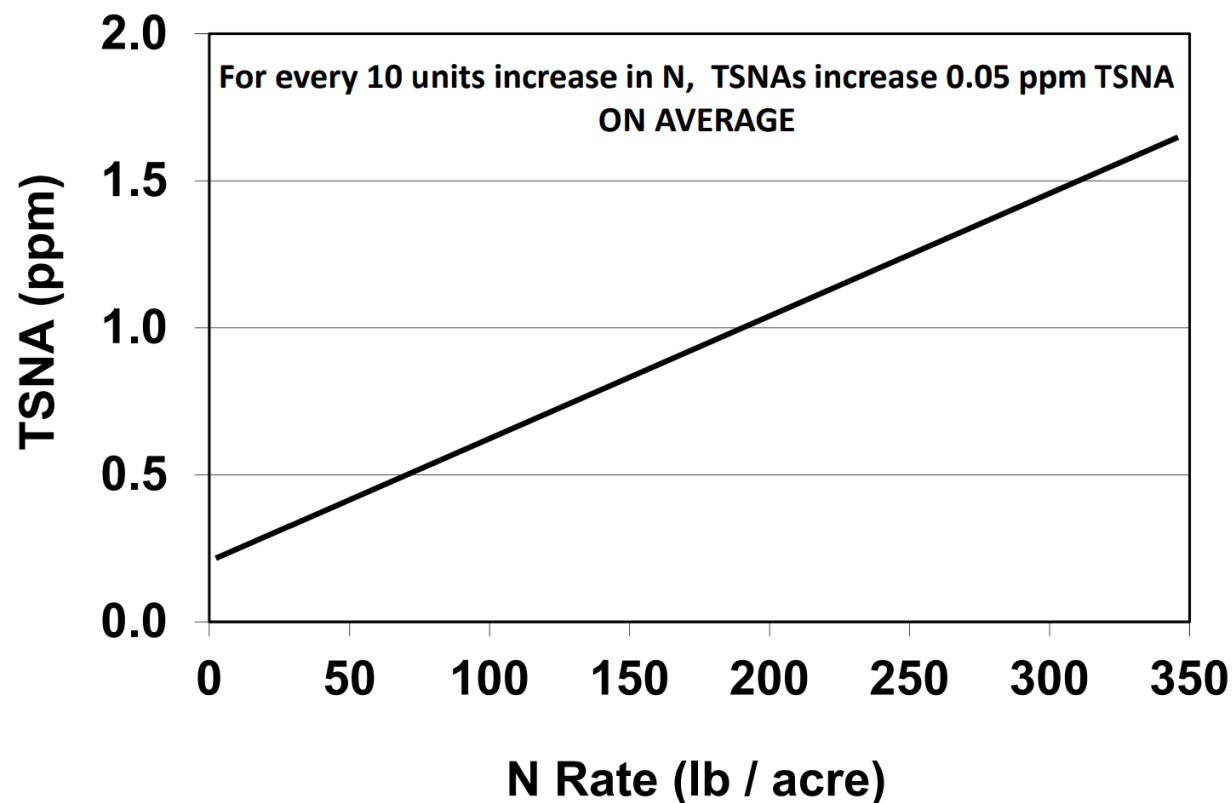


Figure 5. TSNA vs. N rates for three years, five locations.

Nitrogen:

- Reasonable N application rates
 - Do not apply later than 6 WAT

Chloride:

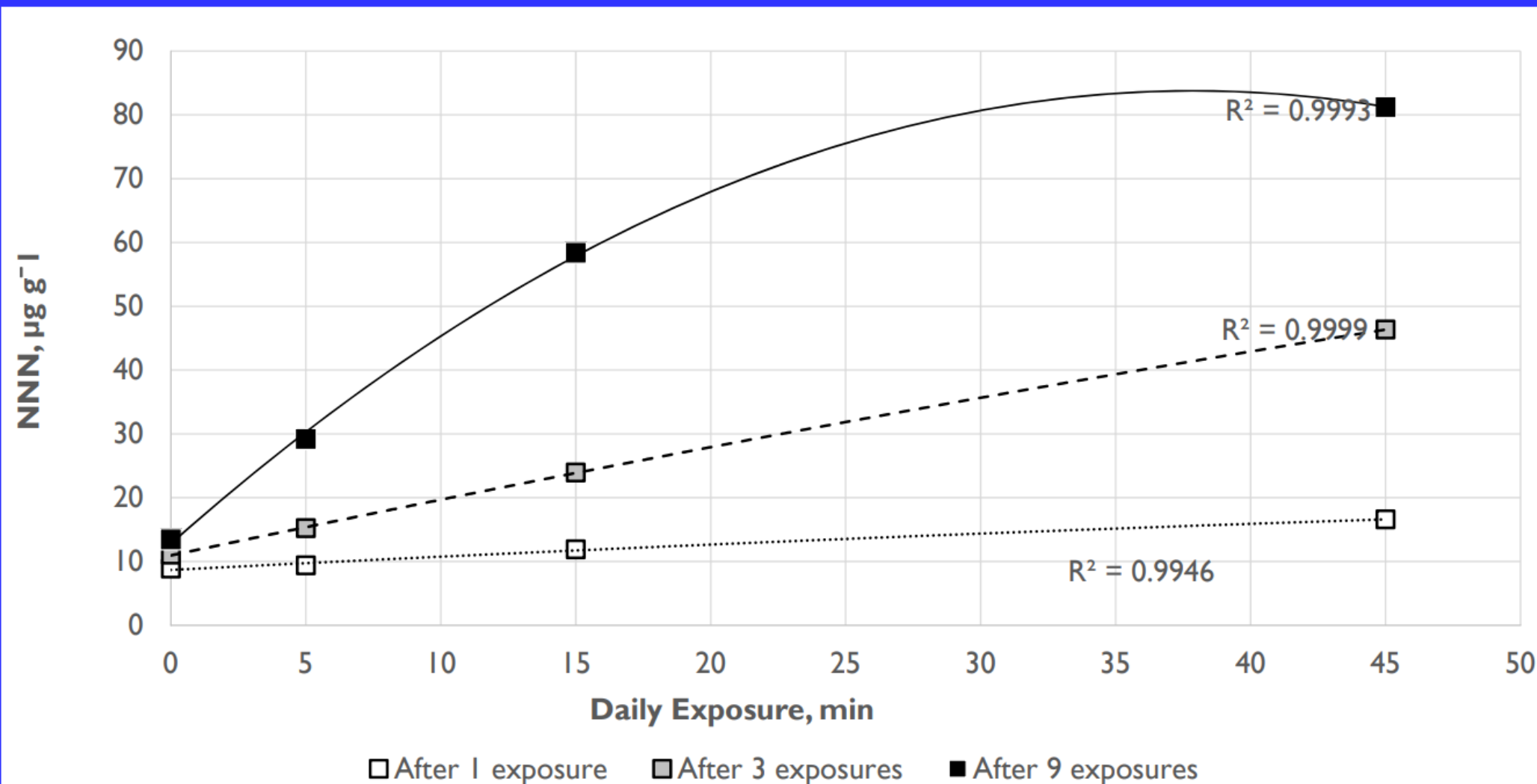
- 0-0-60 will reduce total N and TSNA concentration

Cadmium:

- Focus on fertilizer source
- Genetics?

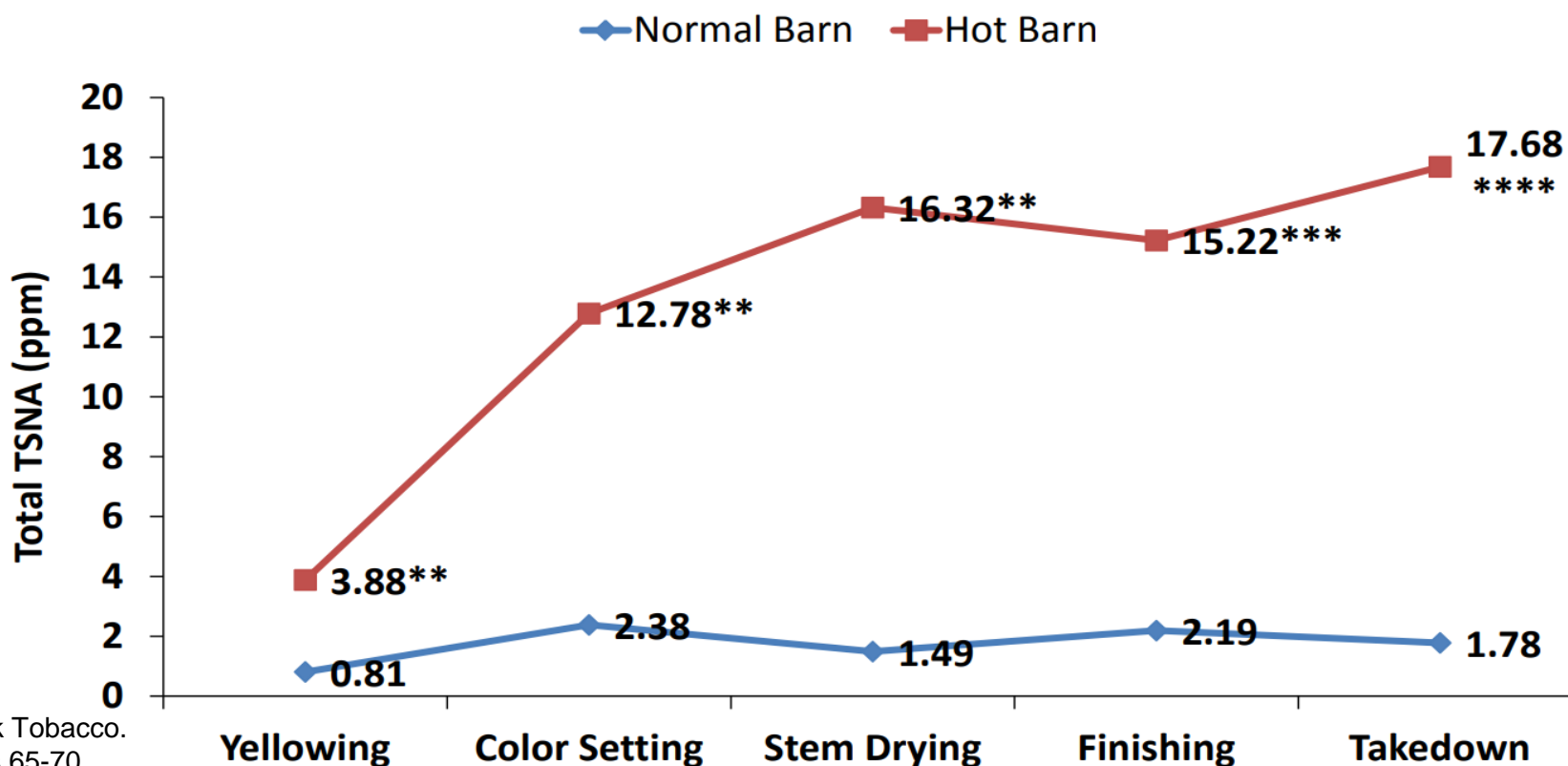


Effect of exposure time on NNN accumulation



- 2x to 11x increase in TSNA
- Dependent upon max curing temperature
- Fire temperature $<130^{\circ}\text{F}$ and no longer than 4-5 days
- Do not fire tobacco more than necessary
- Start firing within 7 days of housing
- Even plant and stick spacing

Sequential Sampling Experiment - HRREC, Springfield TN - 2012



Fisher, A, L Bush, & A Bailey. 2021. TSNA in Burley and Dark Tobacco. In 2021-2022 Burley and Dark Tobacco Production Guide. Pgs 65-70. <https://tobacco.ces.ncsu.edu/wp-content/uploads/2020/12/2021-2022-Burley-and-Dark-Tob-Prod-Guide.pdf?fw=0>

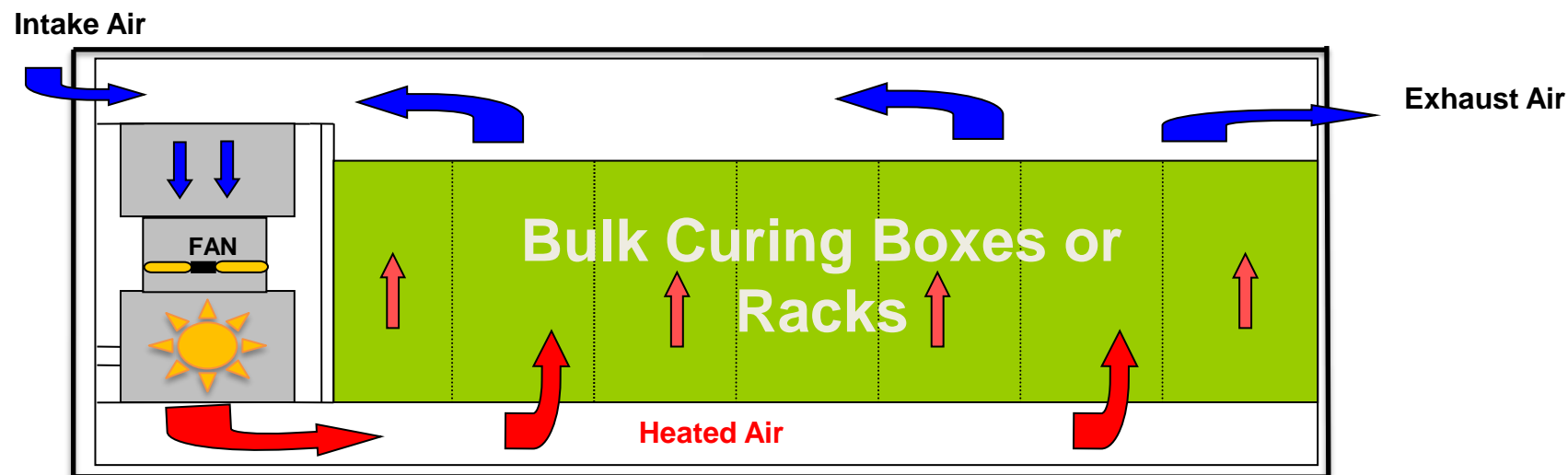
Pitt, WD and A Bailey. 2014. Effect of Excessive Heat During Fire-Curing on TSNA in Dark Fire-Cured Tobacco. 46th Tobacco Workers Conference. https://www.coresta.org/sites/default/files/abstracts/2014_TWC09_Pitt.pdf



Diagrams courtesy of Dr. Grant Ellington, NC State – Bio & Ag Engineering

Direct-Fired Heating System

- mixing of combustion gases with the curing air
- NO_x reaction with alkaloids



Indirect-Fired Heating System

- prevents mixing of combustion gases with air
- 93% TSNA reduction

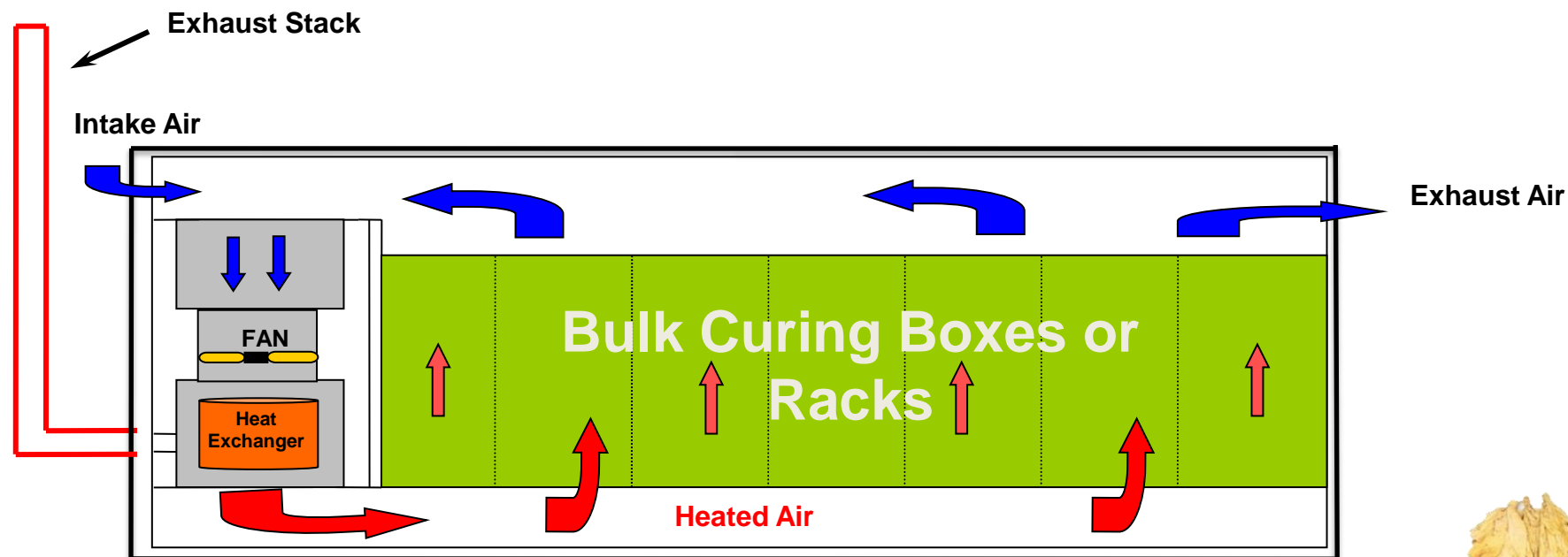


Table 1. TSNA levels by heating system type.^a

	NNN	NAT	NAB	NNK	Total
<u>Indirect</u>	ppm				
Average	0.078	0.129	0.012	0.091	0.298
Std. Dev.	0.139	0.174	0.030	0.158	0.438
<u>Direct</u>					
Average	1.114	1.567	0.134	1.520	4.346
Std. Dev.	1.154	1.973	0.222	1.245	4.427

^a NNN; N'-nitrosonornicotine, NAT; N'-nitrosoanatabine, NAB; N'-nitrosoanabasine, NNK; (4-(methylnitrosomino)-1-(-3-pyridyl)-1-butanone

- 🌿 Goal of retrofitting 36,000 barns for the 2000 season
 - 🌿 40% retrofitted
 - 🌿 375 samples collected from Florida through Virginia
- 🌿 93% TSNA reduction
 - 🌿 n=103, BDL (indirect only)
 - 🌿 n=0, BDL (direct only)
 - 🌿 n=4, <1 mg/kg (direct only)
 - 🌿 Indirect: BDL to ≈1 ppm
 - 🌿 Direct: 1 mg/kg to 10 ppm



Summary

🍃 Impressive progress has been made in harm reduction

🍃 2000 to current

🍃 Collaborative effort

🍃 Cooperative Extension

🍃 Tobacco Faculty

🍃 Allied Industry

🍃 What will the next 75 years bring?

🍃 Public/Private partnerships must continue

🍃 New tobacco/nicotine products create more opportunity

🍃 Forums to share information are needed



Acknowledgements

- 🌿 75th TSRC Organizing Committee
- 🌿 Fraser Williamson
- 🌿 Ramsey Lewis & Grant Ellington – NC State Tobacco Program
- 🌿 University of Kentucky: Anne Fisher, Colin Fisher, Andy Bailey, Bob Pearce, & Lowell Bush (...as well as Mitchell Richmond & Andrea Keeney-Webb)
- 🌿 Allied US Tobacco Industry



Questions??

Matthew C. Vann: matthew_vann@ncsu.edu

Website: tobacco.ces.ncsu.edu



North Carolina Tobacco Information



@NCSUtobacco



@ncsu_tobacco

