Nicotine Variability of Low Nicotine Cultivars versus Normal Nicotine Cultivars

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Objective

- To assess whether the year-to-year nicotine variability observed for ALCS research trials was comparable to that observed for similar trials conducted by others, data was gathered from the Burley and Flue-Cured Variety Evaluation Minimum Standards Programs which evaluate many different normal nicotine level cultivars at multiple locations on an annual basis.
- Assess the nicotine variability of low nicotine cultivars against normal nicotine cultivars for both burley and flue-cured tobacco types in ALCS field research trials.



Test Methods

Methods and Values	ALCS Research Trials	Burley and Flue-Cured Variety Evaluation Minimum Standards Programs		
Design	Randomized complete block design	Randomized complete block design		
Replicates	3-8 plot replicates per cultivar per trial (each cultivar within given trial has same number of plot replicates)	3 plot replicates per cultivar per trial		
Sampling Stage	end of cure	end of cure		
Tissue Type	lamina only (midrib removed from leaf)	lamina only (midrib removed from leaf)		
Sample Description	weighted composite of all stalk positions (500 g sample) or "leaf" grade position only (10-15 leaves) depending on trial	weighted composite of all stalk positions (500 g sample)		
Chemistry Analysis	nicotine/total alkaloids	Burley – nicotine/total alkaloids, Flue-Cured – total alkaloids only		
Variability Values	Relative Standard Deviation % Standard Deviation/Average*100	Relative Standard Deviation % Standard Deviation/Average*100		



Table 1. Nicotine Averages for Burley Cultivars – ALCS Research Trials

			Average Nicotine Value (mg/g dwb)		
Field Trial	Crop Year	Location	BU 21	TN 90 LC	LA BU 21
1	2012	Blackstone, VA	61.62	59.92	4.16
2	2013	Blackstone, VA	51.10	47.97	1.38*
3	2015	Blackstone, VA	61.63	69.58	3.35
4	2015	Blackstone, VA	71.45	77.28	1.20*
5	2016	Blackstone, VA	60.72	71.03	0.98*
6	2016	Rancagua, Chile		52.90	1.33*
7	2017	Blackstone, VA		55.25	1.34*
8	2017	Rancagua, Chile		41.88	1.51
9**	2018	Blackstone, VA		45.70	0.22

*Nicotine average contains at least one data point that was below the limit of quantitation (LOQ) but above the limit of detection (LOD) of the analytical method. Such data points were treated as extrapolated values determined using the standard calibration regression.

** Environmental conditions in Blackstone, VA in 2018 produced unusable tobacco with an average grade index of 6 (out of 100) for LA BU 21 and 35 for TN 90.



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Table 2. Nicotine Averages for Flue-Cured Cultivars – ALCS Research Trials

			Average Nicotine Value (mg/g dwb)		
Field Trial	Crop Year	Location	NC 95	К 326	LAFC 53
1	2013	Blackstone, VA		29.73	1.72*
2	2014	Blackstone, VA	48.85	39.59	3.72
3	2015	Blackstone, VA	51.90	46.13	4.35
4	2016	Blackstone, VA		45.80	7.38
5	2016	Rancagua, Chile		33.50	4.27
6	2016	Blackstone, VA	44.90	37.35	5.00
7	2017	Tifton, GA	29.76		1.21*
8	2018	Blackstone, VA		24.15	2.29
9	2018	Kinston, NC	18.87	22.47	1.84
10	2018	Rocky Mount, NC	29.57	29.19	2.86
11	2018	Tifton, GA	38.45		0.87

*Nicotine average contains at least one data point that was below the limit of quantitation (LOQ) but above the limit of detection (LOD) of the analytical method. Such data points were treated as extrapolated values determined using the standard calibration regression.



Chart 1. Year-to-Year Nicotine Variability of Burley Normal Nicotine Cultivars



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Chart 2. Year-to-Year Total Alkaloid Variability of Flue-Cured Normal Nicotine Cultivars



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Chart 3. Year-to-Year Nicotine Variability of Burley Cultivars



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Chart 4. Year-to-Year Nicotine Variability of Flue-Cured Cultivars



Limitations

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- ALCS research trials were not designed with the purpose of evaluating yearto-year and location-to-location nicotine variability. The research trials would have incorporated greater geographic diversity and more consistency in sampling plans from one trial to the next if they would have been designed for this purpose from the beginning.
- Nicotine levels of the publicly available low nicotine cultivars used in this analysis were considerably greater than the levels of interest by FDA in the 2018 ANPRM.



Conclusions

- As data collected over decades through the Minimum Standards Programs have shown, there is considerable variability in nicotine levels in normal nicotine cultivars from year-to-year and location-to-location.
- Nicotine variability for normal nicotine cultivars within ALCS research trials falls right in line with nicotine variability shown in both the Burley and Flue-Cured Minimum Standards Programs over the same timeframe.
- Six crop years worth of research trials across multiple geographic regions represents a substantial data set with which to analyze nicotine variability.
- Results from this study indicate that nicotine variability are even greater for low nicotine cultivars from year-to-year and location-to-location.



References

- Regional Burley Variety Evaluation Committee
 - Committee Chair: Dr. Carol Wilkinson, Virginia Polytechnic Institute and State University; wilki@vt.edu
- Flue-Cured Tobacco Variety Evaluation Committee
 - Committee Chair: Dr. Loren Fisher, North Carolina State University; loren_fisher@ncsu.edu







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