TSNA Sub-group

Storage sub-committee Report

Agronomy/Phytopathology

Study Group Meeting - October 2007
Krakow, Poland

Selected data from two reports

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2006 Coresta Air-Cured TSNA Storage Study

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Objective

- **To determine TSNA change in burley and dark air-cured tobacco leaf from end-of-curing until initial processing (threshing and re-drying).**

Background / Test Matrix

- **Three burley producers and one dark air-cured producer participated in study. Burley producers were relatively new to burley production and were first and second year growers located in the Piedmont section of North Carolina and Virginia. The dark air-cured producer was located in Western Kentucky and is well experienced in growing both burley and dark air-cure.**

Cured Leaf Storage

Producer	Cured Leaf Storage Package	On-Farm Storage Location	Final Market Package
Poole	~125 lbs. per sheet	Stored inside “pack house” on wooden floor	Large Bale (42” x 42” x 40”) (~ 1 cubic meter)
Renegar	~ 200 lbs. per sheet	Stored on chicken house floor on spaced lumber, ~ 2 sheets high	Large Bale
Eaton	None – stripped and sent to market within 1 week of stripping	NA	Large Bale
Elliott	~ 80 lbs. traditional farmer bale	Stacked on pallets on concrete floor in metal building	Farmer Bale

Warehouse Receiving / Core Sampling

Sampling

- Lamina only – samples were freeze-dried within 24 hours
- Composite samples were collected via combination of coring tool and "grab" whole leaf – mid rib removed
- All burley samples and related data are single submissions (N = 1)
- All Dark Air-Cure (Elliott) samples are in triplicate (N=3)

Producer	Sheet Sample	Bale Sample
Poole	Grab	Core
Renegar	Grab	Core
Eaton	NA	Core
Elliott	NA	Core

Bale Weights / (%) Moisture / Grade

Producer	Low Stalk lbs./ Moisture/Grade	Mid Stalk lbs./Moisture/Grade	Upper Stalk lbs./ Moisture/Grade
Poole	NA	454 / NA / B1	NA
Renegar	512 / 24.06% / X1	509 / 26.71% / B1	536 / 25.39% / BFR1
Eaton	606 / NA / X1	607 / NA / B1	601 / NA / BFR2
Elliott	NA	NA	NA

X1 – Premium quality tan, thin, over ripe, fluffy
B1 – Premium quality tan uniform color and length
BFR1 – Premium quality bodied, dark red, uniform color and length
BFR2 – Very good quality bodied, dark red, uniform color and length

- Receiving Station moisture equipment was only operable for Reneger delivery
- Poole Lower & Upper stalk bales identity lost after delivery
- Poole farm storage moisture ~ 22% by feel
- Eaton bale moisture ~ 24% by feel

Average Storage Temp (F) / RH (%)

On-Farm Storage					
	Ambient		Tobacco		
Producer	Temp (F)	RH (%)	Temp (F)	RH (%)	Weeks
Poole	54	66	57	72	~4
Renegar	49	78	51	82	~10
Eaton	NA	NA	NA	NA	~1
Elliott	48	67	48	79	~4

Warehouse Storage					
	Ambient		Tobacco		
Producer	Temp (F)	RH (%)	Temp (F)	RH (%)	Weeks
Poole	55	58	56	59	~8
Renegar	NA	NA	NA	NA	0
Eaton	55	58	54	79	~6
Elliott	NA	NA	NA	NA	NA

Renegar Data

Sample Date	Stalk Position	Nitrogen (%)	Nitrate (%)	Total Alkaloids (%)	2nd Total Alkaloids (%)	Nicotine (%)	2nd / Total Ratio (%)	Percent Convert (%)
11/06	Low	4.15	3.13	4.61	0.61	3.99	13.32	7.97
	Mid	5.09	1.93	6.33	0.44	5.87	6.97	2.36
	Upper	5.83	1.84	6.51	0.44	6.07	6.87	2.76
1/11	Low	4.07	3.70	3.76	0.30	3.46	7.95	2.84
	Mid	5.08	3.40	5.02	0.34	4.67	6.74	2.38
	Upper	5.51	1.93	6.13	0.42	5.71	6.82	2.78

Renegar Secondary Alkaloids / TSNA

Date	Stalk Position	Nornicotine (%)	Myosmine (%)	Anabasine (%)	Anatabine (%)	NAB (ug/g)	NAT (ug/g)	NNK (ug/g)	NNN (ug/g)	TSNA (ug/g)
11/06	Low	0.3458	0.0087	0.0207	0.2385	BDL	2.313	0.277	4.002	6.592
	Mid	0.1424	0.0046	0.0274	0.2663	BDL	1.581	0.306	1.502	3.389
	High	0.1721	0.0037	0.0271	0.2442	BDL	1.303	0.401	0.940	2.644
1/11	Low	0.1012	0.0041	0.0178	0.1756	BDL	5.632	0.724	3.551	9.907
	Mid	0.1141	0.0046	0.0228	0.1972	BDL	12.519	1.360	8.722	22.601
	High	0.1630	0.0041	0.0266	0.2243	BDL	2.230	0.287	3.094	5.611

BDL – Below Detection Limit
NAB <0.65 NAT <0.16 NNK <0.16 NNN < .01

Poole Data

Sample Date	Stalk Position	Nitrogen (%)	Nitrate (%)	Total Alkaloids (%)	2nd Total Alkaloids (%)	Nicotine (%)	2nd / Total Ratio (%)	Percent Convert (%)
10/18	**At**	**stripping**						
	Mid	4.87	1.63	4.56	0.39	4.18	8.46	3.66
	At	**receiving**	**station**					
11/30	Mid	3.89	1.24	3.67	0.40	3.28	10.80	5.85
	After	**warehouse**	**storage**					
1/11	Mid	5.08	2.27	5.14	0.46	4.68	8.98	3.55

Poole --TSNA

	Date	Stalk Position			NAB (ug/g)	NAT (ug/g)	NNK (ug/g)	NNN (ug/g)	TSNA (ug/g)
	10/18		**At**		**strippping**				
		Mid			BDL	0.315	BDL	0.225	0.540
			At		**receiving**	**station**			
	11/30	Mid			BDL	0.190	BDL	0.292	0.482
			After		**warehouse**	**storage**			
	1/11	Mid			BDL	0.491	BDL	0.446	0.937

BDL – Below Detection Limit

Elliott Data

Sample Date	Stalk Position	Nitrogen (%)	Nitrate (%)	Total Alkaloids (%)	2nd Total Alkaloids (%)	Nicotine (%)	2nd / Total Ratio (%)	Percent Convert (%)
11/5	Low	4.22	3.65	3.773	0.292	3.481	7.85	2.23
	Mid	4.21	2.61	3.859	0.271	3.588	7.02	2.36
	Upper	4.41	1.50	5.042	0.351	4.691	7.06	2.03
12/07	Low	4.19	3.96	3.454	0.266	3.187	7.86	2.61
	Mid	4.20	2.71	4.059	0.287	3.772	7.19	2.03
	Upper	3.97	1.34	4.542	0.282	4.259	6.23	1.78

Average Results / N = 3

Elliott Secondary Alkaloids / TSNA

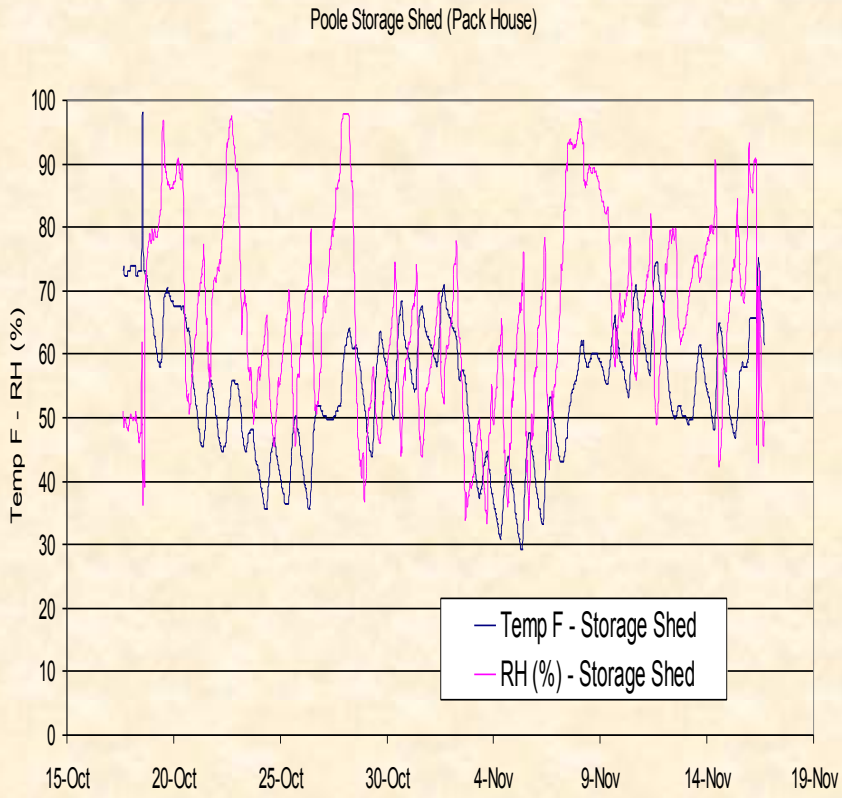
Date	Stalk Position	Nornicotine (%)	Myosmine (%)	Anabasine (%)	Anatabine (%)	NAB (ug/g)	NAT (ug/g)	NNK (ug/g)	NNN (ug/g)	TSNA (ug/g)
11/5	Low	0.078	0.002	0.018	0.194	BDL	1.294	0.346	0.556	2.195
	Mid	0.087	0.002	0.017	0.165	BDL	1.450	0.381	0.753	2.457
	High	0.095	0.003	0.024	0.229	BDL	0.826	BDL	0.401	1.227
	4 weeks	**on farm**	**storage**							
12/07	Low	0.083	0.003	0.016	0.164	BDL	1.477	0.189	0.831	2.434
	Mid	0.077	0.003	0.0230	0.187	BDL	0.779	BDL	0.379	1.158
	High	0.077	0.002	0.021	0.182	BDL	1.569	0.298	0.751	2.519

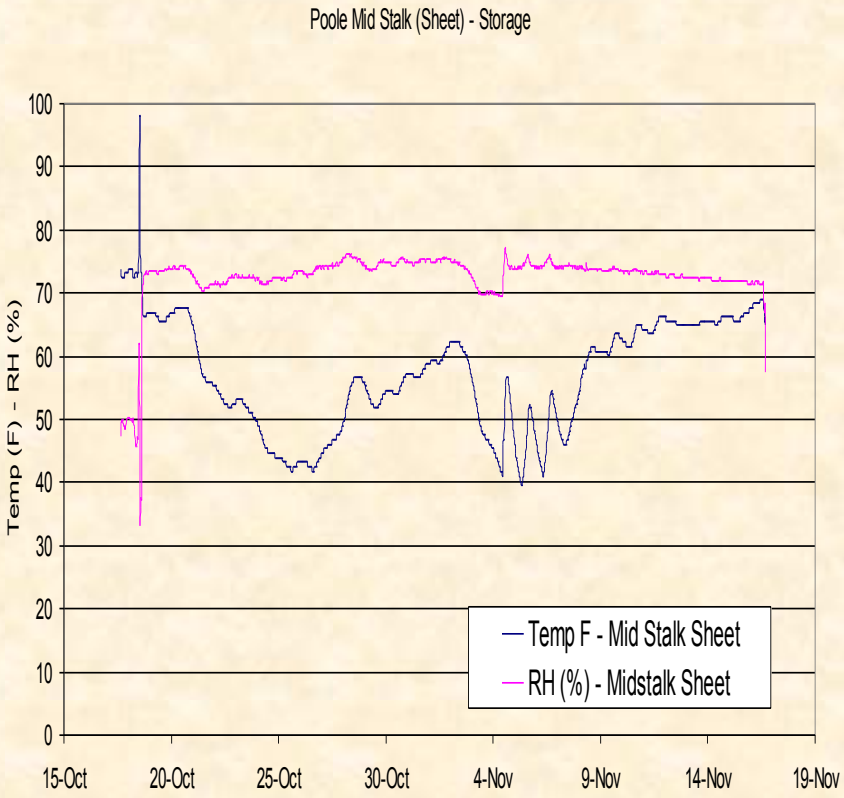
Average Results / N = 3

BDL – Below Detection Limit

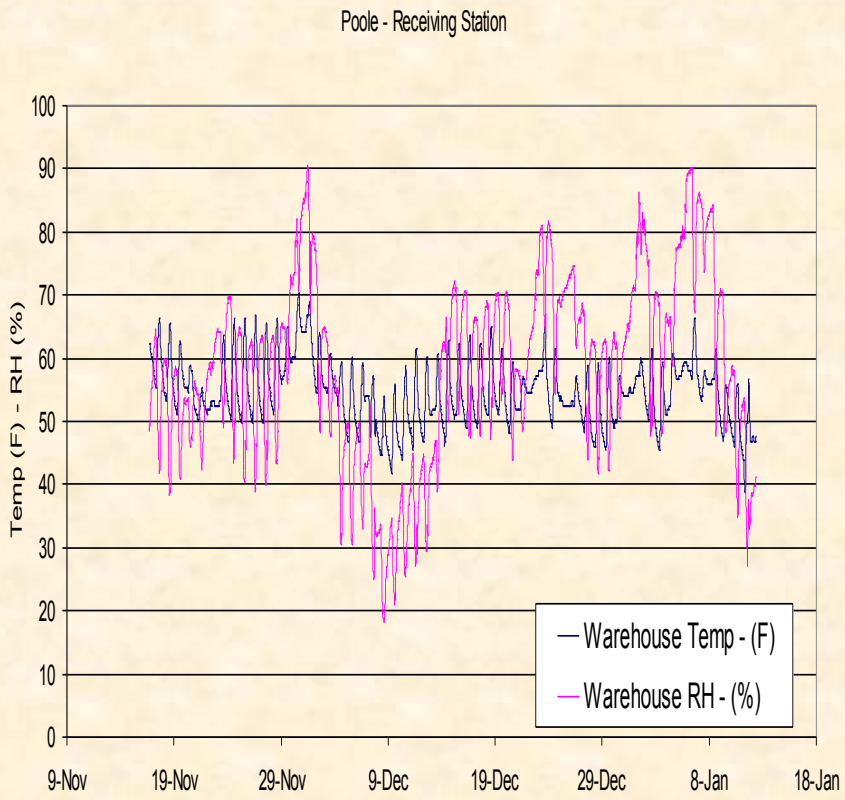
Poole Temp/RH Data – Storage Shed

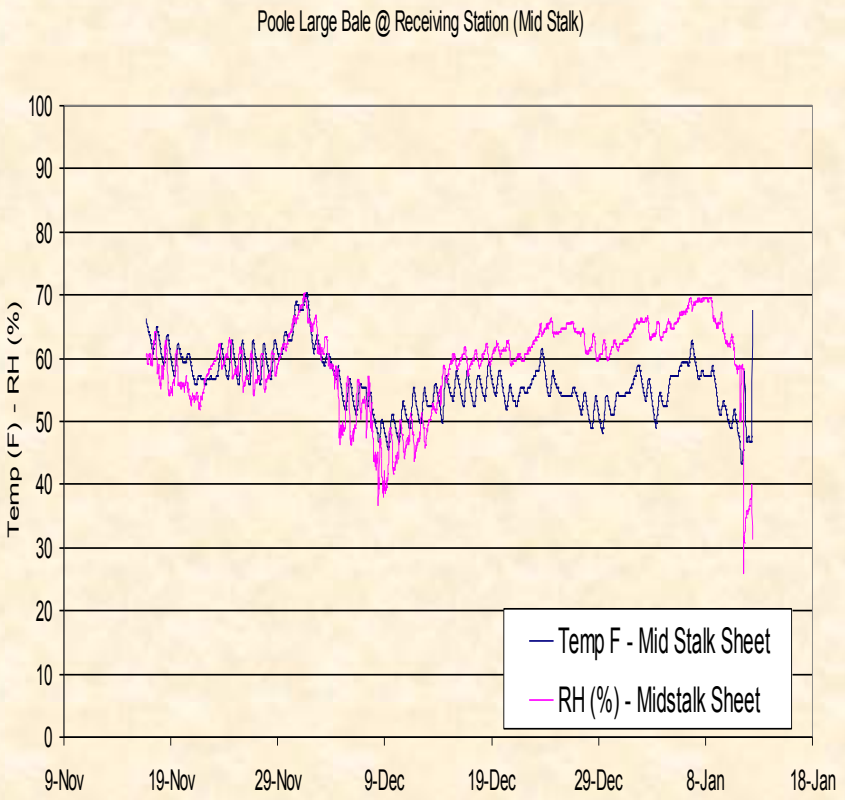
Temp / RH recorder placed in center of sheet





Poole Temp / RH Receiving Station





Result Summary (TSNA ug/gm)

Producer	Stalk Pos.	Initial Sample	Final Sample	Time (Weeks)	(%) Change
Renegar On-Farm Storage Only High Density Sheets	Low	6.59	9.91	10	50%
	Mid	3.39	22.60	"	567%
	Upper	2.64	5.61	"	112%
	Avg.	4.21	12.71		202%
Poole On-Farm Storage Low Density Sheets (4 weeks) Warehouse Storage (8 weeks)	Mid	0.54	0.48	6	-11%
	Mid	0.48	0.95	8	+48%
	Avg.				

BDL – Below Detection Limit

NA – Sample Not Available

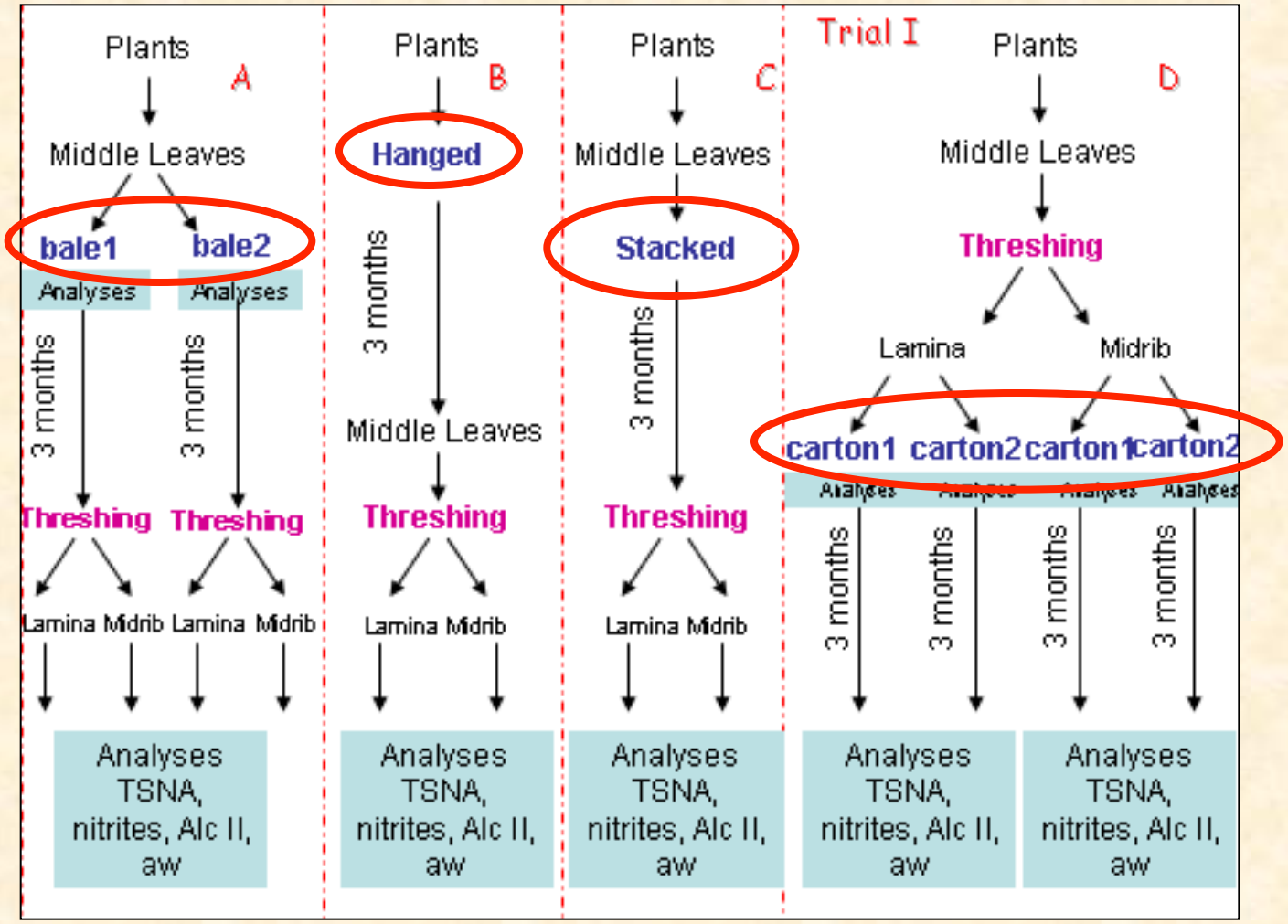
Result Summary (TSNA ug/gm)

Producer	Stalk Pos.	Initial Sample	Final Sample	Time (Weeks)	(%) Change
Eaton Warehouse Storage Only	Low	8.97	10.77	6	20%
	Mid	6.90	3.48	"	-50%
	Upper	2.36	3.46	"	46%
	Avg.	6.08	5.90		-3%
Elliott On-Farm Storage Only	Low	2.20	2.43	4	11%
	Mid	2.46	1.16	"	-53%
	Upper	1.23	2.52	"	105%
	Avg.	1.96	2.04		4%

Post Curing Study 2005-2006

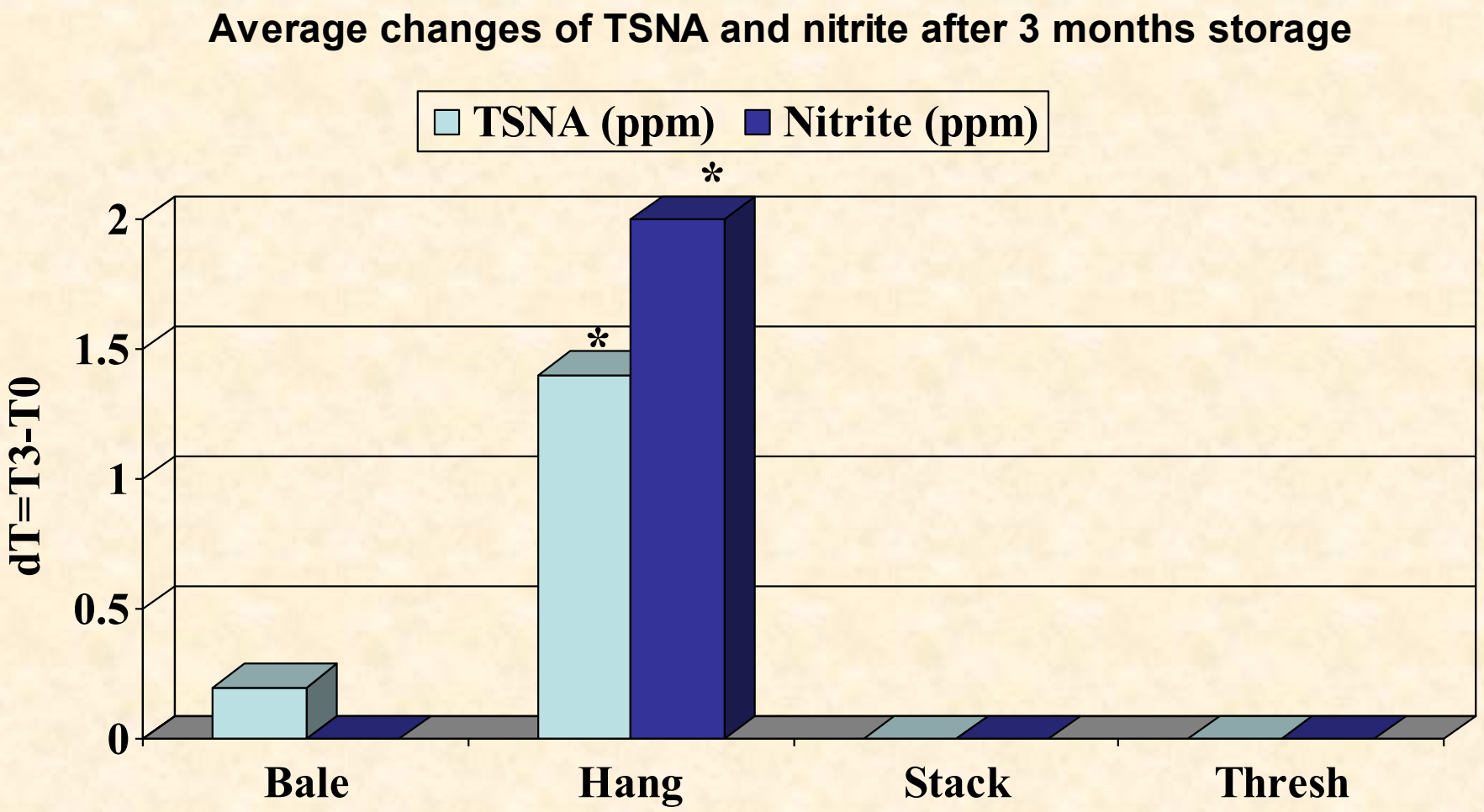
Altadis - Swedish Match

Trial I: Effect of storage mode

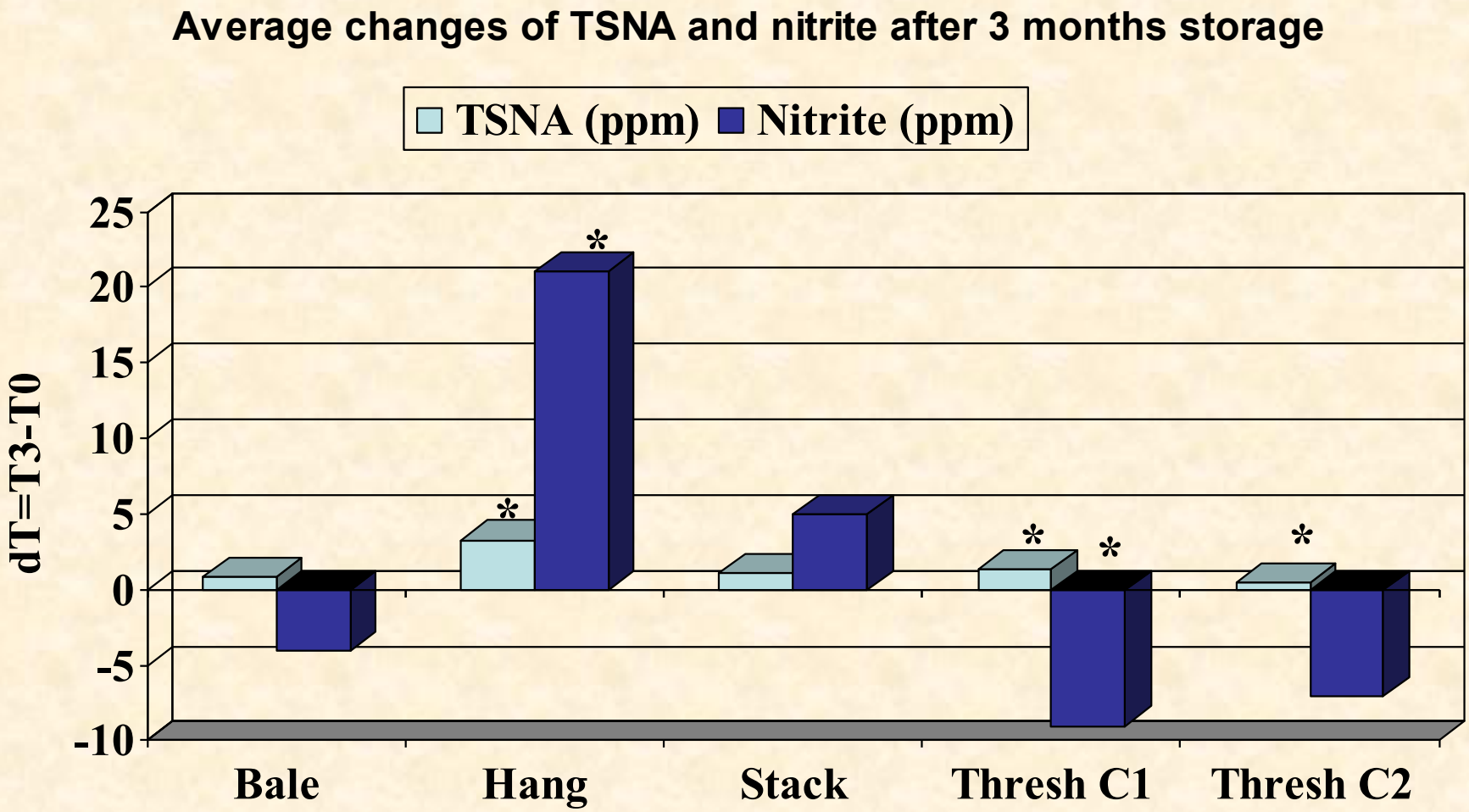


Variety: ITB 501 (Burley)

Trial I (Lamina)



Trial I (Midrib)



Trial II: Effect of pressure and moisture during 3 months of bale storage

- Experiments performed on cutters and tips
- Baling pressure: normal and low pressure (-50 %)
- Baling moisture: normal and low humidity
  - Normal = 22 % for tips and 18-20 % for cutters
  - Low = 15 %

Variety: ITB 501 (Burley)

Trial II (Cutters-Lamina)