Burley Yield and TSNA Response to Nitrogen Fertilization in the Traditional U.S. Growing Area.

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Objectives

- Reevaluate the major burley tobacco producing state's nitrogen fertilization recommendations
- Evaluate PSNT as a nitrogen management tool in burley tobacco
- Evaluate the Cardy nitrate meter as a nitrogen management tool and TSNA prediction tool
- Evaluate CM 1000 chlorophyll meter as a nitrogen management tool
- Evaluate impact of nitrogen fertilization on TSNA formation

2007 Nitrogen Management Study

- Conducted trials at five locations over two years, nine total
  - Lexington, KY; Greeneville, TN; Springfield, TN; and Dixon Springs, IL and Glade Springs, VA
- 2007 had 10 nitrogen treatments of factorial design:
  - Five preplant N rates: 0, 67, 135, 202, 270 kg/ha
  - Two sidedress N rates: 0, 67 kg/ha
  - KT 204LC only variety used
- Pre-sidedress, topping, harvest sampling dates
  - Petiole sap nitrate-N concentration (Cardy nitrate meter)
  - Chlorophyll content (CM 1000 chlorophyll meter)
- Pre-sidedress nitrate soil test (PSNT) samples taken to a depth of 15 cm
- Yield and Grade Index data collected at grading
- Tobacco-specific nitrosamine (TSNA) samples pulled at grading from leaf stalk positions (B grade) and sent to University of Kentucky for analysis

2008 Nitrogen Management Study

- 2008 had 8 nitrogen treatments and four varieties
  - Same N rates as 2007 minus the 270 kg N/ha preplant rate
  - KT 204LC, TN 90LC, TN 90 high converter, and NC7
- TN 90LC and KT 204LC received all nitrogen treatments
  - Only varieties sampled for petiole nitrate and chlorophyll content except at harvest sampling date (TN 90HC also)
- TN 90HC and NC 7 only received five nitrogen treatments
- Added plant sampling date at five weeks after transplant (5WAT)
- Dropped chlorophyll sampling at harvest due to use of Maleic Hydrazide (Trade name: MH-30)

Statistical Design and Analysis

- 2007 Randomized Complete Block (RBD)
  - Factorial treatment design
- 2008 RBD
  - Split-plot with nitrogen treatments in whole plots
    - Factorial design for preplant and sidedress N treatments
  - Varieties in sub-plots
- Statistical Analysis Systems (SAS 9.2)
  - Mixed model Analysis of Variances (ANOVA)
    - 0.1 alpha level used with Tukey-Kramer mean separation
  - Simple Linear and Quadratic Regression Analysis
  - PROC NLIN: quadratic plateau model for evaluating critical levels

PSNT Sampling

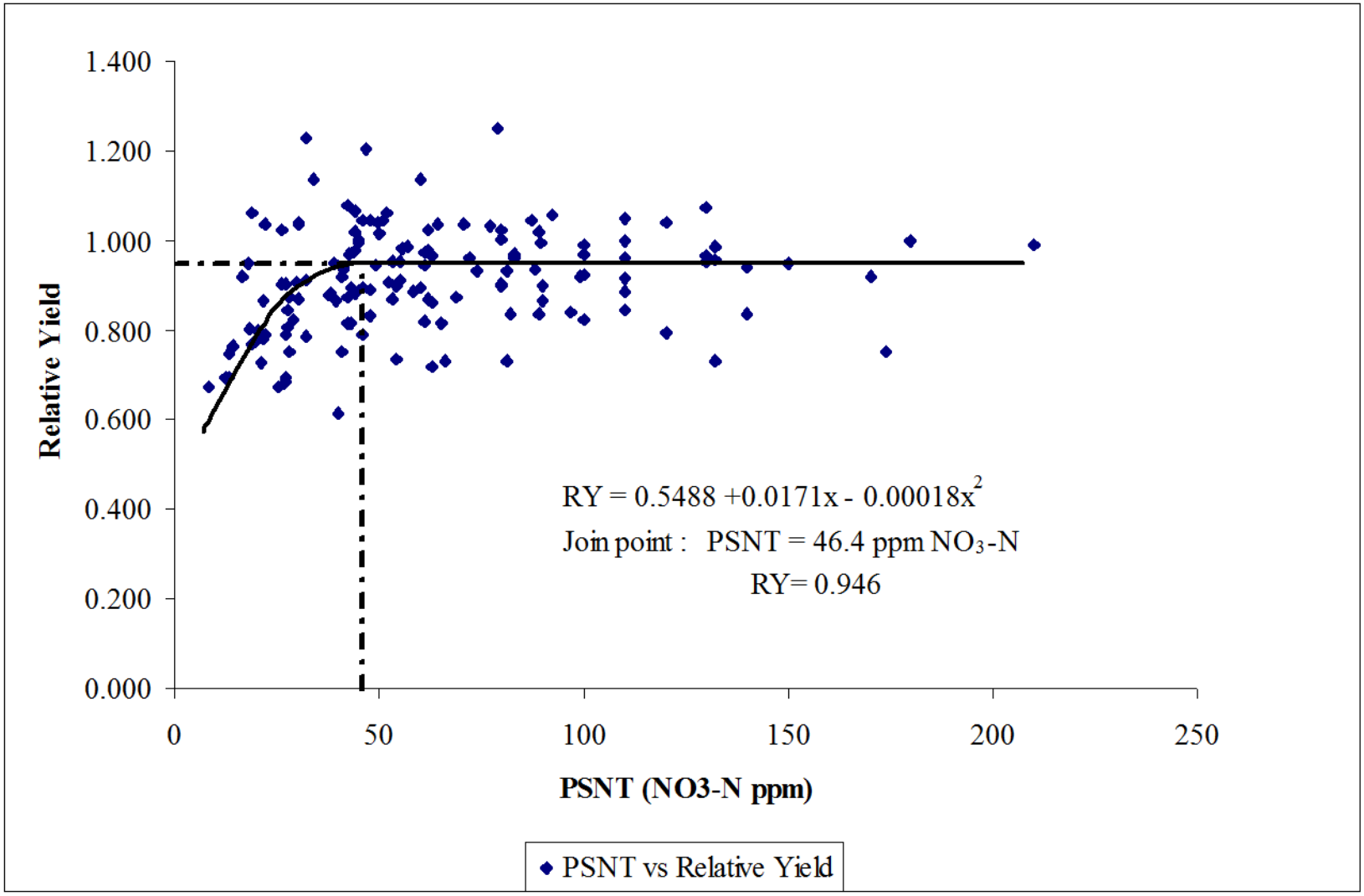
- Standard soil probes were used to take cores from plots
  - 8-10 cores were taken from middle two rows in plots
  - Samples taken at a depth of 15 cm
    - This differs from standard PSNT sampling depth of 30 cm
- Samples were air-dried and ground to pass a 2 mm sieve
- Boxed and sent to the University of Tennessee Soil Testing Laboratory for nitrate-N analysis

Combined PSNT Results

Preplant N	Sidedress N	All Locations
kg/ha	kg/ha	--- ppm ---
0	-	38.7 d
67	-	53.7 c
135	-	67.9 b
202	-	82.6 a

* Values with the same letters are not significantly different at 0.1 level of probability

Combined PSNT vs Relative Yield



Combined Yields for KT 204LC

Preplant N	Sidedress N		Avg. Yield
kg/ha	----- kg/ha -----		
	0	67	
0	2713 d	3005 bc	2859 C
67	2952 c	3168 ab	3060 B
135	3152 ab	3177 ab	3165 AB
202	3188 ab	3246 a	3217 A
Avg. Yield	3002 B	3149 A	

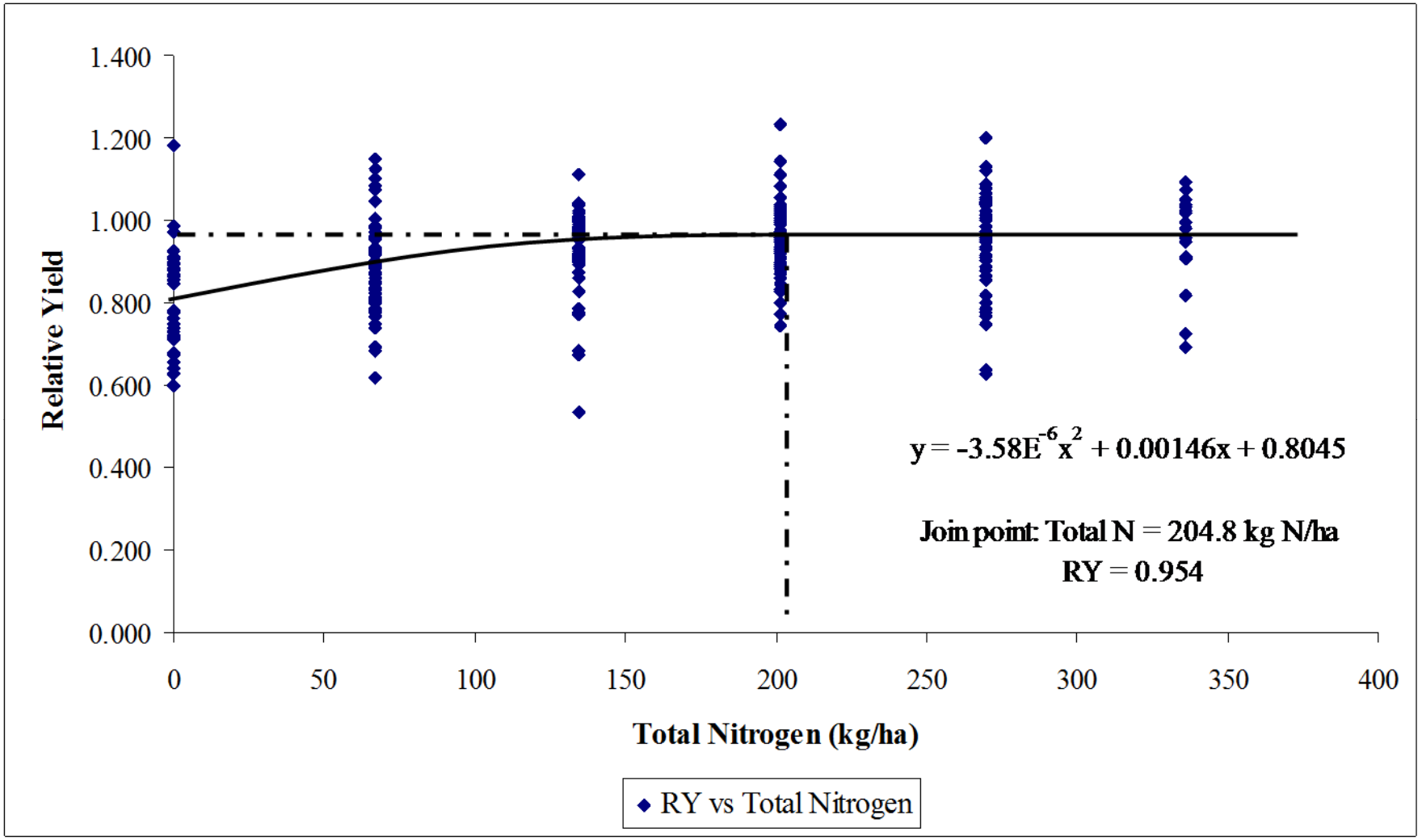
* Values with the same letters are not significantly different at 0.1 level of probability

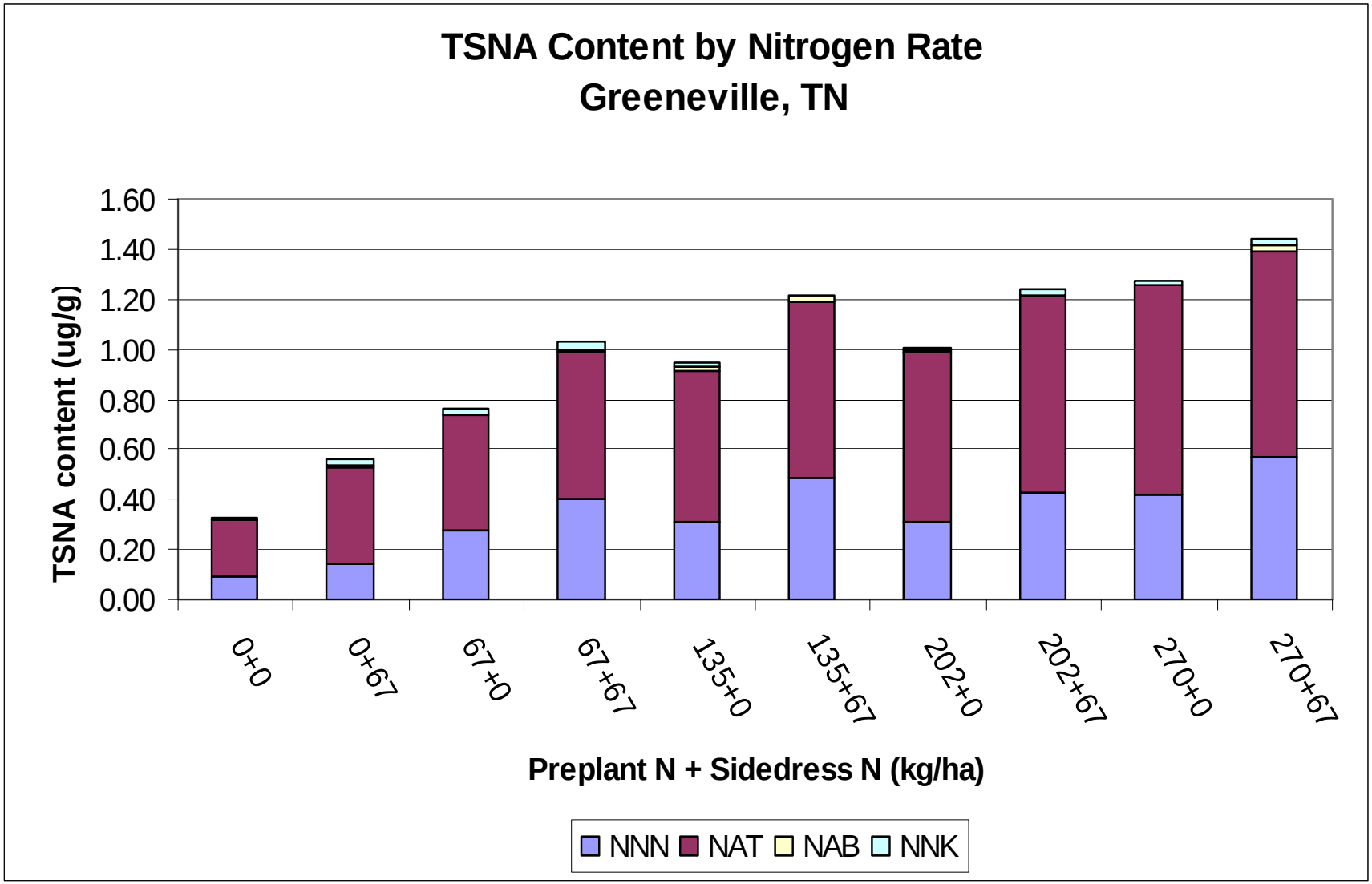
Combined Yields for all Varieties in 2008

Location	Variety	Total Nitrogen Applied					Variety
		0	67	135	202	270	Avg. Yield
		——— kg/ha ———					kg/ha
All Sites	KT 204LC	2204	2564	2747	2781	2967	2652 A
	TN 90LC	2101	2434	2589	2614	2866	2521 B
	TN 90HC	1952	2286	2382	2668	2783	2414 C
	NC 7	2215	2514	2815	2959	3060	2712 A
		2118 D	2449 C	2633BC	2755 AB	2919 A	
	Avg. Yield						

* Values with the same letters are not significantly different with all treaments and main effect means at 0.1 level of probability

Total Nitrogen vs Relative Yield



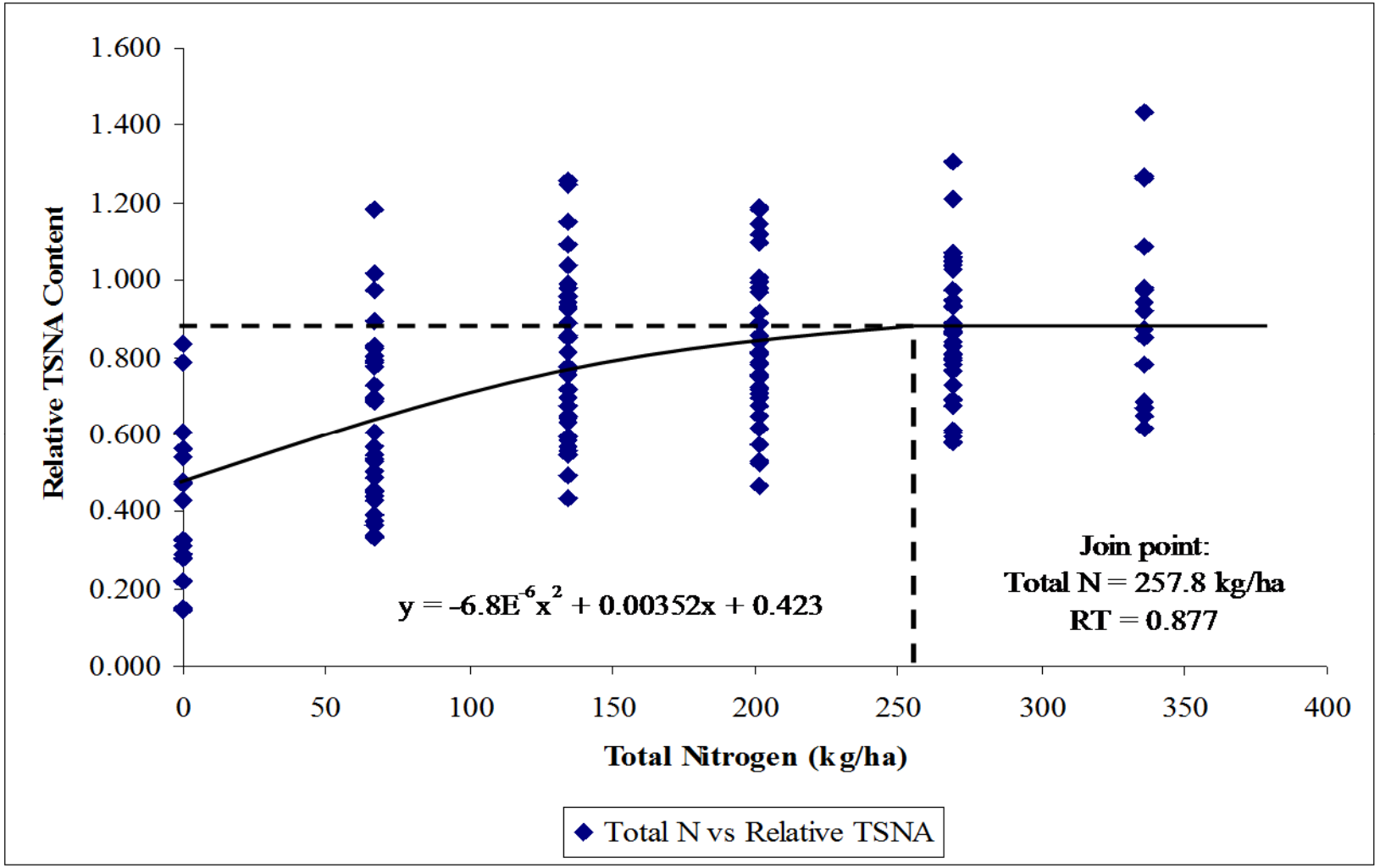


2007 TSNA Content at all Locations

Preplant N	Sidedress N	NNN	NAT	Total TSNA
kg/ha	kg/ha	µg/g	µg/g	µg/g
0	0	0.388 c	0.691 d	1.1667 d
0	67	0.537 bc	1.022 bc	1.716 bc
67	0	0.589 abc	0.931 cd	1.647 cd
67	67	0.655 ab	1.114 bc	1.941 abc
135	0	0.725 ab	1.148 abc	1.976 abc
135	67	0.718 ab	1.245 ab	2.124 abc
202	0	0.750 ab	1.216 abc	2.138 abc
202	67	0.777 a	1.297 ab	2.245 ab
270	0	0.652 ab	1.267 ab	2.087 abc
270	67	0.805 a	1.439 a	2.422 a

* Values with different letters are significantly different at 0.1 level of probability

Total Nitrogen vs Total TSNA Content



Conclusions

- A PSNT critical value of 46.4 ppm NO_3-N was establish over all sites.
  - PSNT needs to be evaluated on a soil type basis in order to further develop nitrogen fertilization recommendations
- Yields were optimized with 135 kg N/ha over all locations
- TSNA content increased with increasing nitrogen fertilization

Conclusions (cont.)

- Total Nitrogen applied was the best predictor of yield and total TSNA content
  - Critical value of 204.8 kg N/ha in order to reach maximum relative yields (0.954)
- This nitrogen rate is within the nitrogen fertilization recommendations for the major burley tobacco producing states
- Yielded 2,713 kg/ha with 0 kg total N/ha over all sites
  - Tennessee 40 year average of 2,197 kg/ha

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Questions?