

Using Exogenous Auxin Application to Control Axillary Shoot Development in Burley Tobacco

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Axillary Shoots

- Colloquially known as 'suckers'
- An axillary bud that develops into an actively growing stem
- Cured sucker tissue does not meet quality standards
- Hydroponic transplant production exacerbated the problem



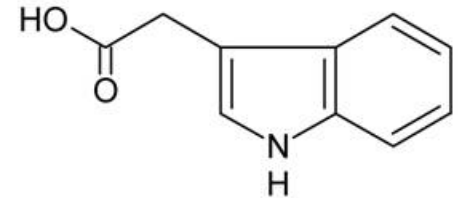
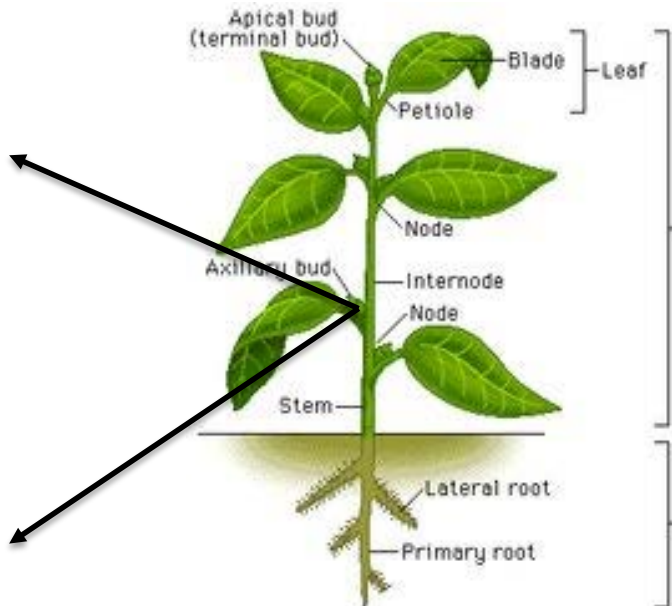
Will manipulating the endogenous auxin to cytokinin ratio suppress axillary shoot development and ensure apical dominance?



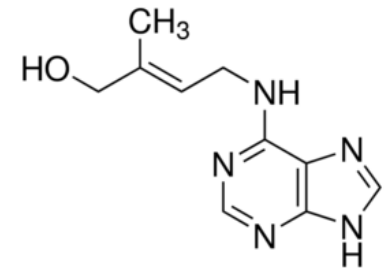
Petiole with axillary shoot (undesirable phenotype)



Petiole without axillary shoot (desirable phenotype)



IAA (auxin) synthesized in apical meristem (inhibits axillary shoot growth)



Zeatin (cytokinin) synthesized in roots (promotes axillary bud growth)

The auxin/cytokinin ratio controls apical dominance.

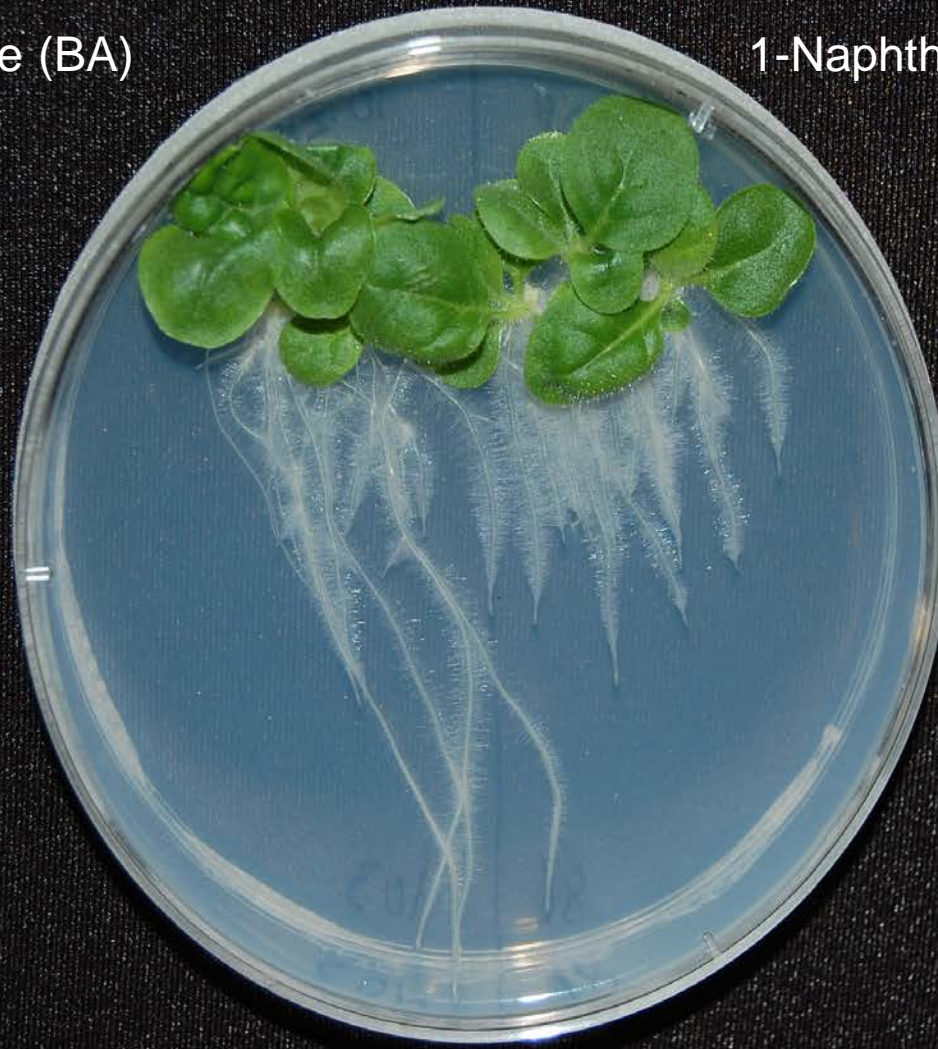
In Vitro Experiments

6-Benzylaminopurine (BA)

10 nM
50 nM
250 nM

1-Naphthaleneacetic acid (NAA)

200 nM
1000 nM
5000 nM



In vitro Results BA/NAA



Greenhouse Experiments

- H 403 and TN 86
- Germinated in 242-cell trays floating in 4 gallons of water
- The hormone treatments were applied 2, 4, and 6 weeks post seeding
- At 8 weeks post seeding 10 plants from each treatment were potted
- After 2 weeks chlorophyll content and # of suckers were measured

Initial Greenhouse Concentrations

6-Benzylaminopurine (BA)

2 nM

10 nM

50 nM

1-Naphthaleneacetic acid (NAA)

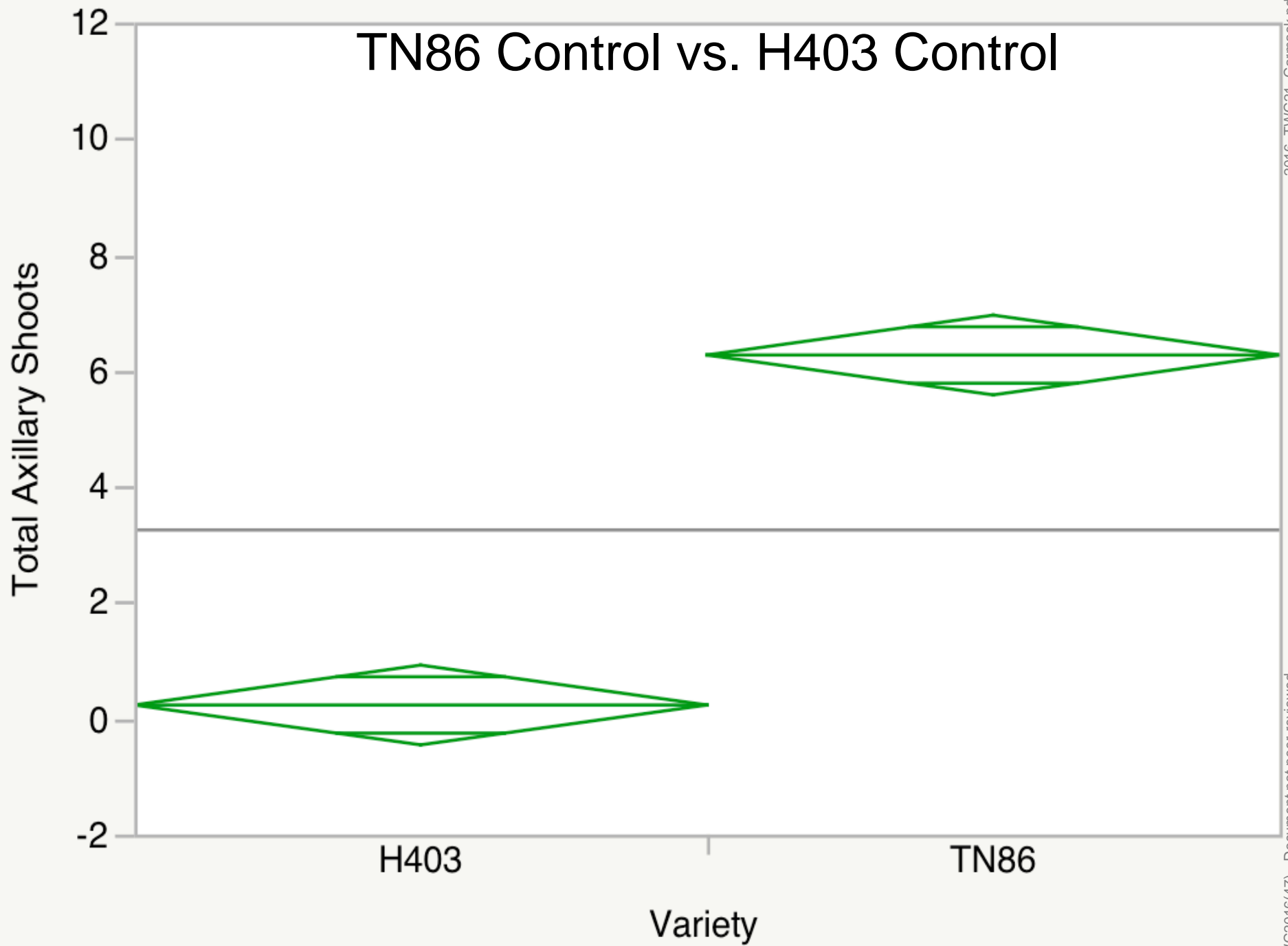
2 nM

10 nM

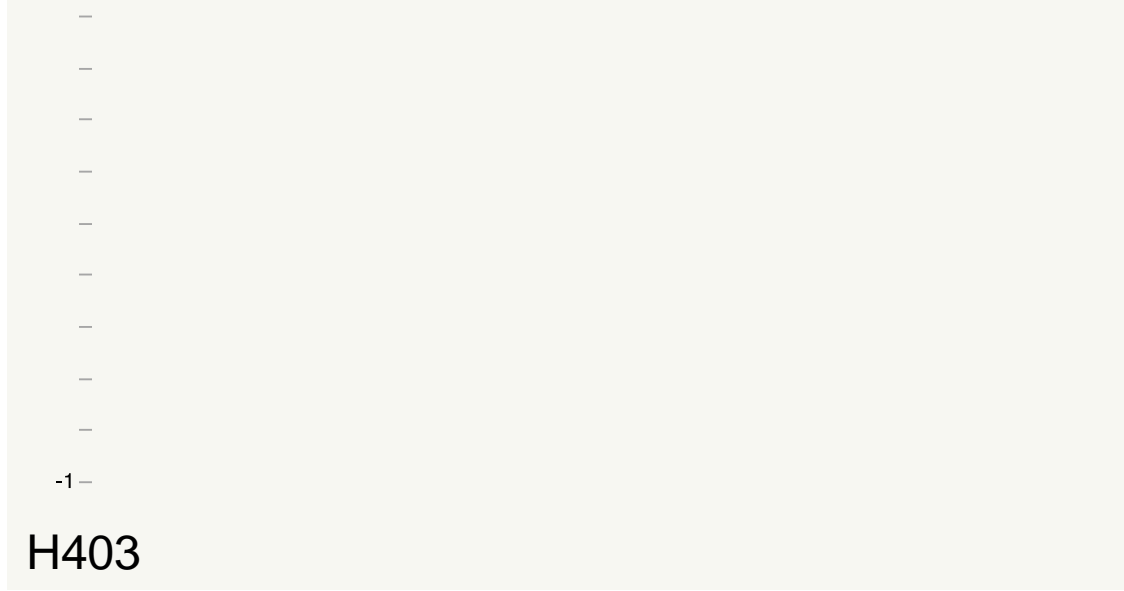
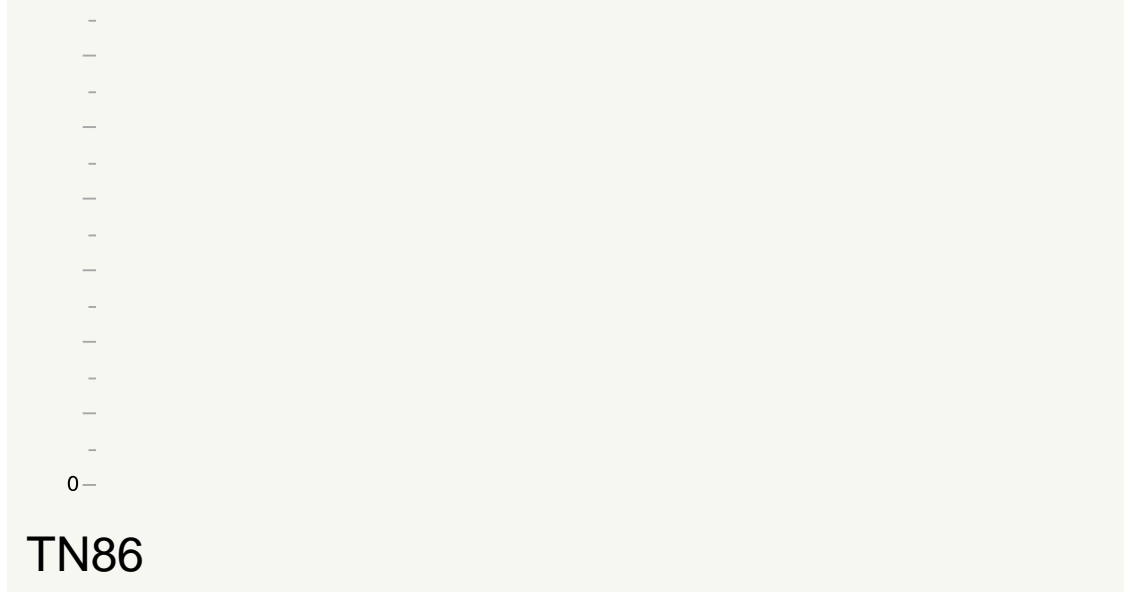
50 nM



TN86 Control vs. H403 Control

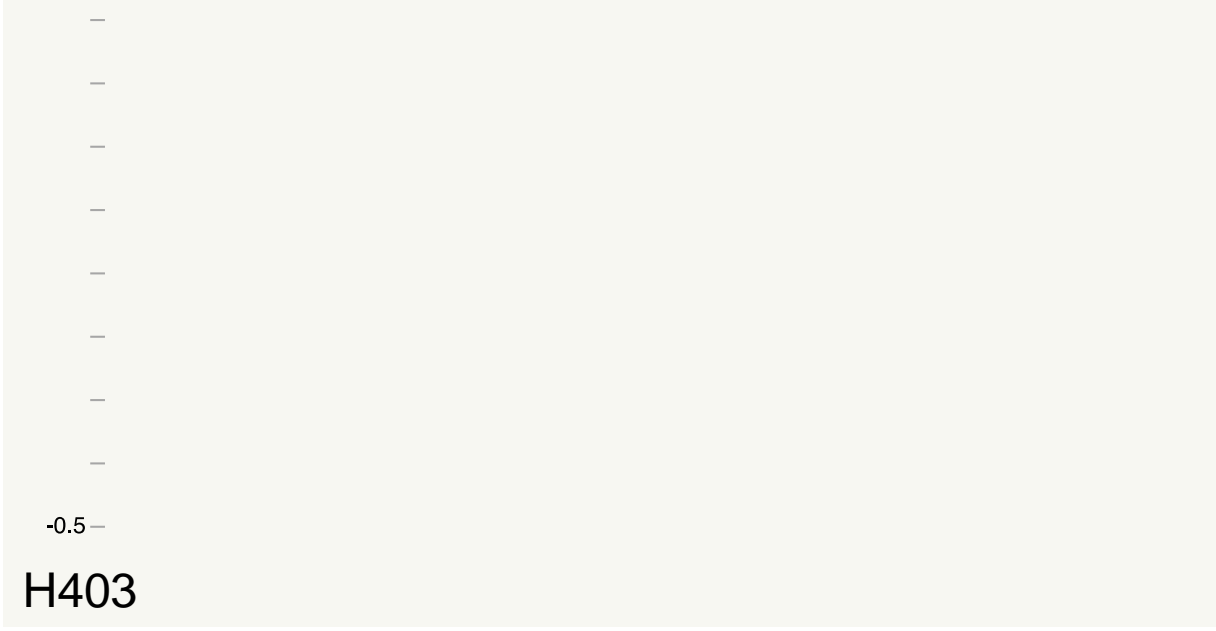
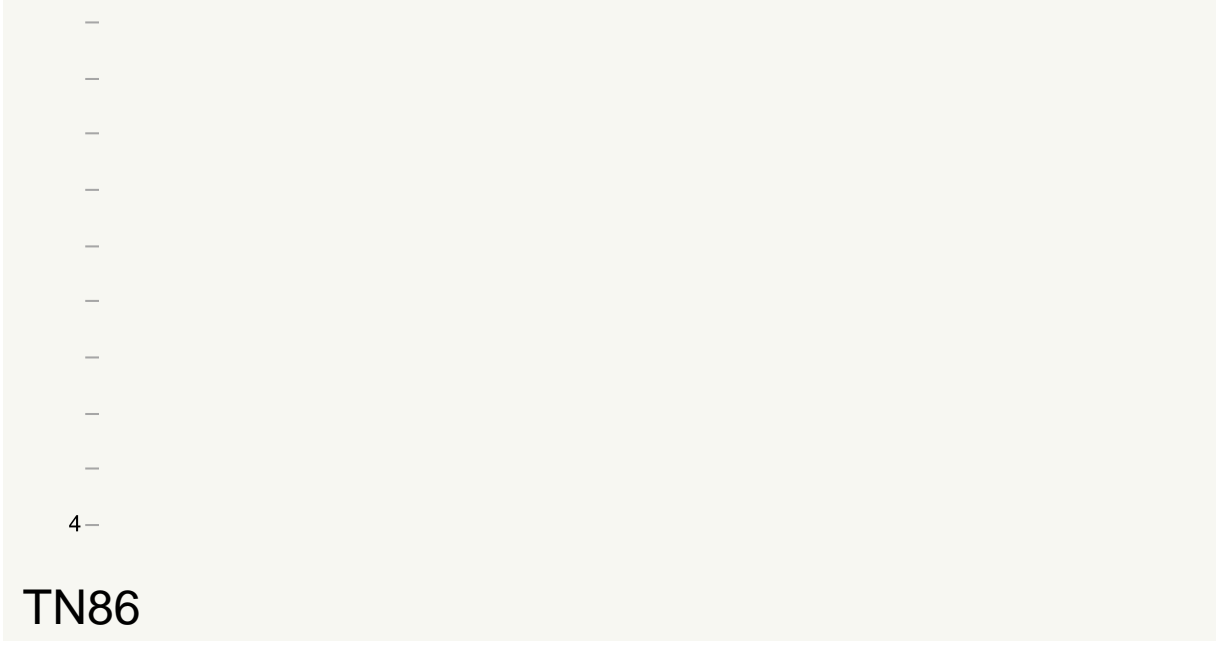


GH Results



Trt @ 2 Weeks

Trt @ 4 Weeks



GH Results

GH Results

TN86

-1-

H403

0-

Trt @ 6 Weeks

2015 Field Studies

Split Split-Plot design at three locations
Lexington and Versailles, KY; Greeneville, TN

Whole plots: Varieties
Hybrid 403 and TN 86

Sub-plot : Time of Application
2 weeks or 4 weeks after seeding

Sub-Sub-plots: Hormone Treatments

Hormone	Concentration
A1	2nM
A2	10nM
A3	50nM
C1	2nM
C2	10nM
C3	50nM
Water CK	0

Variety Effects - Greeneville, 2015

Variety	Hormone Treatment	Number of Suckers		
		<6"	6"-12"	>12"
H 403	Auxin	0.40	0.02	0.05
H 403	Cytokinin	0.35	0.03	0.00
H 403	Water Check	0.28	0.03	0.00
TN 86	Auxin	1.59	0.53	0.09
TN 86	Cytokinin	1.40	0.45	0.16
TN 86	Water Check	1.85	0.20	0.20

Variety Effects - Versailles, 2015

Variety	Hormone Treatment	Number of Suckers		
		<6"	6"-12"	>12"
H 403	Auxin	0.04	0.01	0.01
H 403	Cytokinin	0.03	0.00	0.01
H 403	Water Check	0.03	0.02	0.05
TN 86	Auxin	0.92	0.20	0.20
TN 86	Cytokinin	1.09	0.19	0.24
TN 86	Water Check	1.08	0.37	0.13

Variety Effects - Lexington, 2015

Variety	Hormone Treatment	Number of Suckers		
		<6"	6"-12"	>12"
H 403	Auxin	0.08	0.19	0.05
H 403	Cytokinin	0.02	0.07	0.02
H 403	Water Check	0.15	0.15	0.02
TN 86	Auxin	0.41	0.82	0.56
TN 86	Cytokinin	0.40	0.74	0.59
TN 86	Water Check	0.75	0.68	0.47

Hormone Effects - 2015

Hormone	Number of Suckers		
	<6"	6"-12"	>12"
Greeneville			
Auxin Mean	0.99	0.28	0.07
Cytokinin	0.88	0.24	0.08
Check	1.07	0.12	0.10
Lexington			
Auxin	0.25	0.50	0.31
Cytokinin	0.21	0.40	0.31
Water Check	0.45	0.42	0.24
Versailles			
Auxin	0.48	0.10	0.10
Cytokinin	0.56	0.09	0.13
Water Check	0.56	0.19	0.09

Time of Application Effects - 2015

Time of Application	Number of Suckers		
	<6"	6"-12"	>12"
Greeneville			
Two Weeks	1.03	0.20	0.11
Four Weeks	0.93	0.22	0.06
Lexington			
Two Weeks	0.25	0.49	0.34
Four Weeks	0.35	0.39	0.23
Versailles			
Two Weeks	0.64	0.13	0.06
Four Weeks	0.43	0.13	0.15

**Cytokinin Effects on Axillary Shoot Formation In Tobacco
Greenhouse Study 2, Fall 2015**

Rate	Height	Suckers < 1"	Suckers 1-6"	Suckers > 6"	total
BA Cytokinin Treatments - Applied one time 2 weeks after seeding					
1250 nM	53.2	2.8	1.4	0.2	4.4
250 nM	46.5	3.7	0.6	0	4.3
50 nM	53.9	3.1	1.8	0	4.9
BA Cytokinin Treatments - Applied each time water was added					
1250 nM	49.3	3.8	1	0	4.8
250 nM	48.6	3.9	1.3	0	5.2
50 nM	46.5	4	0.6	0	4.6
Control (0)	46.5	3.2	1.9	0	5.1

**Auxin Effects on Axillary Shoot Formation In Tobacco
Greenhouse Study 2, Fall 2015**

Rate	Height	Suckers < 1"	Suckers 1-6"	Suckers > 6"	total
NAA Auxin Treatments - Applied one time 2 weeks after seeding					
5 μM	72.0	1.1	0.4	0	1.5
1 μM	51.6	0.7	0.1	0	0.8
200 nM	48.4	2.3	0.6	0	2.9
NAA Auxin Treatments - Applied each time water was added					
5 μM	76.7	2.8	0.1	0	2.9
1 μM	42.0	2.3	0.6	0	2.9
200 nM	48.4	2.3	0.5	0.1	2.9
Control (0)	46.5	3.2	1.9	0	5.1

2016 Field Growth Regulator Study

Variety: TN 86
 Locations: LEX and WC, KY; GRV and SPFD, TN
 Whole plots: Hormone Concentration
 Sub-plots: Tray Cell Size
 * Treatment with hormone 14 days after seeding

NAA Conc.	Tray Size	Cell Size (cc)
Check	128	2.6
500nM	200	1.9
1 uM	242	1.6
3uM	288	1.2
5uM	338	0.7

Summary of Goals

- First year of research identified that a one time auxin application can be used
- Second year of research aims to fine tune the concentration of auxin applied
- Ultimately this project will provide the ability to make auxin application recommendations to growers

Acknowledgements

- Altria
- University of Kentucky