Burley Tobacco Update

Eric Walker
FOOD & AGRIBUSINESS IN THE UNITED STATES

Above the Fruited Plain

04/06/2014
Nicotine Effects

• Stimulant and relaxant
  – Positive sensations increased
  – Negative symptoms relieved

• Appetite suppressant

• Addictive

• Increases risk of:
  – elevated blood sugar levels
  – heart attack
  – stroke
  – respiratory disease
  – cancer
TSNAs

• Tobacco-specific nitrosamines
  – nitrogenous substances, some of which are carcinogenic
  – formed only from tobacco alkaloids
  – TSNAs: NNK, NNN, NAT, NAB
• Major emphasis in tobacco research
• Funded by tobacco industry
• Significant advancements in last decade
**TSNA reduction**

- Major emphasis in tobacco research
- Funded by tobacco industry
- Significant advancements in last decade
- Incorporated into tobacco production recommendations
- Compliance required in contracts between producers and tobacco companies
- Major emphasis in tobacco research
- Funded by tobacco industry
- Significant advancements in last decade
- Incorporated into tobacco production recommendations
- Compliance required in contracts between producers and tobacco companies
- Further progress needed
- Challenges to overcome
• Nitrogen management – no more N than necessary
  – Avoid spring applications of muriate fertilizers
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  – Avoid spring applications of muriate fertilizers
• Use low-conversion (LC) or screened seed
  – Mutant alleles being transferred into commercial burley tobacco varieties developed by the Kentucky-Tennessee Tobacco Improvement Initiative (KTTII)
  – Burley is mutant
• Nitrogen management – no more N than necessary
  – Avoid spring applications of muriate fertilizers
• Use low-conversion (LC) or screened seed
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    – Burley is mutant
• Harvest at maturity
• Field-wilt no longer than three days
• House as soon as possible after cutting
  – Do not cut or house tobacco with free moisture on leaves
• Avoid overpacking the barn
  – Space sticks and plants on sticks evenly
• Ensure adequate but not excessive moisture when air curing
• Nitrogen management – no more N than necessary
  – Avoid spring applications of muriate fertilizers
• Use low-conversion (LC) or screened seed
  – Mutant alleles being transferred into commercial burley tobacco varieties
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  – Burley is mutant
• Harvest at maturity
• Field-wilt no longer than three days
• House as soon as possible after cutting
  – Do not cut or house tobacco with free moisture on leaves
• Avoid overpacking the barn
  – Space sticks and plants on sticks evenly
• Ensure adequate but not excessive moisture when air curing
• Use minimal casing when stripping
• Do not leave tobacco in storage longer than necessary: strip, bale, deliver as soon as possible
• Avoid high moisture tobacco
1. Incorporation of mutant genes reducing the level of nitroso-nornicotine and TSNA content into existing burley tobacco varieties

2. Development of a burley variety having high levels of resistance to race 0 and race 1 black shank, fusarium wilt, high yield potential, and good cured leaf quality
## 2015 Burley Variety Guide

<table>
<thead>
<tr>
<th>VARIETY</th>
<th>BLACK SHANK</th>
<th>VIRUS COMPLEX</th>
<th>BLACK ROOT ROT</th>
<th>TMV</th>
<th>Fusarium WILT</th>
<th>RELATIVE YIELD SCORE</th>
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3-Year Yield Average (No-Stress) 2011-2013
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<th>Race 1 Black Shank % Survival</th>
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<td>Hybrid 404LC</td>
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<td>KY 14 X L8LC</td>
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<tr>
<td><strong>Seasonal Avg.</strong></td>
<td>46</td>
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TSNAs

Nicotine → Nornicotine → Anabasine → Anatabine

alkaloid + nitrosating agent

NNK
NNN
NAB
NAT

TSNA
TSNA reduction – Use low-conversion (LC) or screened seed

- Single most effective step in TSNA reduction
  - Reduces amount of nornicotine precursor for NNN
- All contracts require use
- Designed by LC in variety name (KT 204LC) or “screened seed” on seed pack
• The release of LC burley tobacco varieties, which began in 2004, reduced the conversion of nicotine to nornicotine substantially, thereby reducing TSNA levels in burley tobacco to 2-4 ppm during most growing seasons.

• Researchers at NCSU have identified CYP82e4, CYP82e5v2 and CYP82e10 mutant alleles that reduce nicotine to nornicotine conversion even further, resulting in TSNA levels ranging from 0.5 to 0.8 ppm.

• Currently, these mutant alleles are being transferred into commercial burley tobacco varieties developed by the Kentucky-Tennessee Tobacco Improvement Initiative (KTTII).
  - TN 86, TN 90, KT 204, KT 206, KT 209, KT 210, KT 212
Results of 2013 Field Trials

• In general, within families there were visible differences among entries for plant type, leaf angle, leaf shape, etc.
Extremely off-type plant within a TKF 2002e3-C
Three phenotypes within TKF 6400e3-C
## Commercial Variety Evaluations

### Variety KT 204

<table>
<thead>
<tr>
<th>Variety</th>
<th>Yield Lbs/A)</th>
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<tbody>
<tr>
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<td><strong>Means</strong></td>
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<td>KT 204e3B</td>
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<td>KT 204e3C</td>
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<td>KT 204e3D</td>
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# Commercial Variety Evaluations

**Variety KT 210**

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<th>Statistic / Variety</th>
<th>Yield (Lbs/A)</th>
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<td>Versailles</td>
<td>Mean</td>
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<td>2082</td>
<td>2485</td>
<td>2284</td>
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</table>
Photo 3: TN RLC: 8-27-13 Birdwell Nursery
Rep 1, 71.4%; Rep 2, 90.5%
Mean BS Survival = 81.0%

Photo 4: ms TN 90e3 8-27-13 BW
Rep 1, 40.9%; Rep 2, 14.3%
Mean BS survival = 27.7%

Photo 5: TN 90e3 8-27-13 BW
Rep 1, 57.1%; Rep 2, 25.0%
Mean BS Survival = 41.1%
• NNK and NNN – harmful/potentially harmful by FDA
• Mutant alleles control nicotine N-demethylase synthesis
  - Catalyzes reaction of nicotine to nornicotine
• 100% burley cigarette
  - Smoke test: ~70% reduction in NNN
- 100% burley cigarette
  - Smoke test: ~70% reduction in NNN
- 23% burley cigarette (blended cigarette)
  - Smoke test: ~30% reduction in NNN
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  - Smoke test: ~70% reduction in NNN
• 23% burley cigarette (blended cigarette)
  - Smoke test: ~30% reduction in NNN
  - Blended cigarettes
    • Burley, bright, Maryland, Oriental, reconstituted
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• 23% burley cigarette (blended cigarette)
  - Smoke test: ~30% reduction in NNN
  - Blended cigarettes
    • Burley, bright, Maryland, Oriental, reconstituted
    • With ZYVERT reconstituted tobacco, possible 50-60% reduction in NNN
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  - Blended cigarettes
    • Burley, bright, Maryland, Oriental, reconstituted
    • With ZYVERT reconstituted tobacco, possible 50-60% reduction in NNN
• ZYVERT burley, dark, and flue-cured varieties
• **Float trays**
  – Start with clean and sanitized trays
    • New trays at least every 3 years
  – Plastic trays
Transplanting
Conservation tillage for tobacco

- Recently increased interest and acreage, especially for dark tobacco
- Driven initially by energy cost, labor and conservation concerns
- Given a boost by conservation compliance
• Strip-till
  – Tobacco transplanted into a tilled strip 12-18 inches wide
  – May use subsoiler or chisel shank, narrow rototiller, or combination
  – Conventional transplanter
Strip Till vs No-till

- No-till = less soil disturbance
- Modified transplanter not needed for strip till
- Specialized tillage equipment needed for strip till
- Strip till – more consistent performance
Conventional tillage
Conventional vs. Conservation Tillage

• No-till yields tend to be lower than tilled

• Strip till essentially equal to full tillage for tobacco production

• Conservation tillage requires more management than conventional tilled tobacco
  – Early kill of cover crops, fall kill of sod
  – Good weed control is critical
Need for Early Maturing Varieties

- Following the “tobacco buy-out”, fewer growers but larger crop size per grower
- Many growers want to spread out the crop to allow more timely management
  - Double use of curing structures
  - Better utilize available labor
### Relative Maturity of Burley Tobacco Varieties

**Percent Bloom 60 - 65 Days After Transplanting**

<table>
<thead>
<tr>
<th>Variety</th>
<th>Maturity Rating</th>
<th>Percent Bloom</th>
<th>3 Year Mean</th>
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<td><strong>Seasonal Avg.</strong></td>
<td>46</td>
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2013 Topping Management Study

Looked at four varieties

- ms KY 14 X L8LC
- KT 212LC
  - Topped when KT 12LC was in 50% bloom and harvested four weeks later
- KT 206LC (Three sets of plots)
- KT 204LC (Three sets of plots)
  - Topped when KT 12LC was in 50% bloom and harvested four weeks later
  - Topped when KT 206LC was in 10% bloom, harvested in 4 weeks
  - Topped when KT 206LC was in 50% bloom, harvested in 4 weeks
### 2013 Topping Management Study
Effects of Early Topping on KT 206LC and KT 210LC

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*All plots planted on the same day and harvested 4 weeks after topping*
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<td>KT 206LC</td>
<td>KT 206 50% Bloom</td>
<td>Springfield</td>
<td>2606</td>
<td>2926</td>
<td>2463</td>
<td>2665</td>
<td></td>
</tr>
<tr>
<td>KT 210LC</td>
<td>KT 212LC 50% Bloom</td>
<td>Versailles</td>
<td>2746</td>
<td>2490</td>
<td>2557</td>
<td>2598</td>
<td></td>
</tr>
<tr>
<td>KT 210LC</td>
<td>KT 206 10% Bloom</td>
<td>Lexington</td>
<td>2890</td>
<td>2588</td>
<td>2448</td>
<td>2642</td>
<td></td>
</tr>
<tr>
<td>KT 210LC</td>
<td>KT 206 50% Bloom</td>
<td>Springfield</td>
<td>2544</td>
<td>2887</td>
<td>2547</td>
<td>2659</td>
<td></td>
</tr>
</tbody>
</table>

*All Plots planted on the same day and harvested 4 weeks after topping.
Advantages of Early Topping

- **Faster Topping**
  - Tops are very tender and snap out easily
  - No need to remove suckers larger than 2”

- **Better Sucker Control**
  - No suckers too large for chemical control
  - Upper leaves are more tender and receptive to chemical control

- **Effects on percentage of tip leaves?**
  - Possibly throwing away more leaves, thereby decreasing the percentage of tips
  - Some upper leaves may be somewhat effected by sucker compounds, thereby increasing the percentage of tips
Chemical Topping Experiment

- Applying MH to burley at early bloom stage in an attempt to stop further growth of terminal bud and eliminate manual topping.
## Burley Chemical Topping

<table>
<thead>
<tr>
<th>Trt</th>
<th>Timing</th>
<th>Description</th>
<th>Manual Topping</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prebud stage</td>
<td>Bud not visible or top of bud barely visible</td>
<td>No</td>
</tr>
<tr>
<td>2</td>
<td>Elongated Bud</td>
<td>Bud emerged from leaf sheath bud no open flowers</td>
<td>No</td>
</tr>
<tr>
<td>3</td>
<td>10% Bloom</td>
<td>10% of plants have at least one open flower</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>10% Bloom</td>
<td>10% of plants have at least one open flower</td>
<td>Yes (standard)</td>
</tr>
</tbody>
</table>

*Standard recommendation is topping when 10 to 25% of plants have at least one open flower. All treatments received standard treatments of 2.25 lbs MH/A (1.5 gal Royal MH-30) plus 0.5 gal/A Butralin.*
## Burley Chemical Topping
### KT206 – Murray KY - 2014

<table>
<thead>
<tr>
<th>Trt</th>
<th>Timing</th>
<th>Manual Topping</th>
<th>% Sucker Control</th>
<th>Total Yield (lbs/A)</th>
<th>Quality Grade Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prebud stage</td>
<td>No</td>
<td>100</td>
<td>1914</td>
<td>74.7</td>
</tr>
<tr>
<td>2</td>
<td>Elongated Bud</td>
<td>No</td>
<td>100</td>
<td>2022</td>
<td>76.3</td>
</tr>
<tr>
<td>3</td>
<td>10% Bloom</td>
<td>No</td>
<td>100</td>
<td>1964</td>
<td>76.7</td>
</tr>
<tr>
<td>4</td>
<td>10% Bloom (standard)</td>
<td>Yes</td>
<td>100</td>
<td>2230</td>
<td>76.4</td>
</tr>
<tr>
<td>Trt</td>
<td>Timing</td>
<td>Manual Topping</td>
<td>% Sucker Control</td>
<td>Total Yield (lbs/A)</td>
<td>Quality Grade Index</td>
</tr>
<tr>
<td>-----</td>
<td>---------------</td>
<td>----------------</td>
<td>------------------</td>
<td>---------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>1</td>
<td>Prebud stage</td>
<td>No</td>
<td>100</td>
<td>2869</td>
<td>60.0</td>
</tr>
<tr>
<td>2</td>
<td>Elongated Bud</td>
<td>No</td>
<td>100</td>
<td>3182</td>
<td>61.9</td>
</tr>
<tr>
<td>3</td>
<td>10% Bloom</td>
<td>No</td>
<td>100</td>
<td>3255 (&gt;26 leaves)</td>
<td>66.5</td>
</tr>
<tr>
<td>4</td>
<td>10% Bloom</td>
<td>Yes (standard)</td>
<td>100</td>
<td>3104</td>
<td>59.5</td>
</tr>
</tbody>
</table>
Sucker Control

- Three types of materials
  - Contacts: fatty alcohols
    - Off-Shoot T, Royaltac, Royaltac-M, Fair 85, Sucker-Plucker, Antak, O-TAC
  - Short term: 5-7 days
  - Local systemics: butralin and flumetralin
    - Butrelin and Prime+, Flupro, Drexalin Plus
  - Systemics: maleic hydrazide (MH)
    - Most effective if applied properly
Reduced Rates of MH Averaged Across Five Locations for Seven Years

MH 3.00*  
MH 2.25  
MH 2.25 + DNA  
MH 1.68 + DNA

Sucker Control (%)

97.7 97.6 98.7 98.1

*MH rate lbs ai/ac and DNA 0.6 lb ai/ac
Tips for good sucker control

• Use adequate water
  – (at least 50 G/A)
• Do not spray in the heat of the day when plants are under stress
• Drive carefully and spray fewer rows at a time
• Calibrate
• Correct rate
MH formulations

- 1.5 lb ai/gal = Royal MH 30, Super Sucker Stuff
- 2.25 lb ai/gal = Sucker Stuff, Royal MH-30 Extra