Tobacco Fertilization

Andy Bailey
Plant nutrition
16 “Essential Elements”

• Non-mineral: Carbon, Hydrogen, Oxygen
• Macronutrients: Nitrogen, Potassium, Phosphorous
  – Needed in large amounts
  – Deficiency common
• Secondary: Calcium, Magnesium, Sulfur
  – Needed in lesser amounts
  – “natural” supply usually sufficient
• Micronutrients: Copper, Zinc, Iron, Boron, Molybdenum, Manganese, Chlorine
  – Needed in very small amounts
  – Too much can be toxic
General Tobacco Growth Curve

- **Dry wt (lbs./A)**
  - 0
  - 1000
  - 2000
  - 3000
  - 4000
  - 5000

- **Weeks after transplant**
  - 1
  - 2
  - 3
  - 4
  - 5
  - 6
  - 7
  - 8
  - 9
  - 10
  - 11
  - 12
  - 13
  - 14

- **Reduction nutrient uptake, Maturation**
- **Rapid top growth**
- **Nutrient uptake**
- **Slow top growth**
- **Rapid root growth**

- **Not topped**
- **topped**
A Typical Dark Tobacco Crop (3000 lbs/A) Removes:

- 210 lbs of N
  - Mid Season to Topping
- 18 lbs of P$_2$O$_5$
  - Early
- 180 lbs of K$_2$O
  - Mid Season to Harvest
Nitrogen Recommendations for Tobacco
Univ. of KY - Revised for 2006-2007 (AGR-1)
Dark and Burley

<table>
<thead>
<tr>
<th>Soil N Level</th>
<th>Well-Drained</th>
<th>Moderately well-drained</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low N (following tobacco or row crops)</td>
<td>225-250</td>
<td>250-275</td>
</tr>
<tr>
<td>Medium N (first year tobacco following grass or grass-legume)</td>
<td>200-225</td>
<td>225-250</td>
</tr>
<tr>
<td>High N (first year tobacco following legume)</td>
<td>150-175</td>
<td>175-200</td>
</tr>
</tbody>
</table>

Tennessee recommendations: 150 to 250 lbs N/A
Nitrogen

• Tobacco highly responsive
  – Deficiency
    • Pale green/yellow
    • Stunted growth

• Nitrate-N form is taken up by plants
  – Ammonium-N fertilizer sources have to be converted to nitrate in soil
    • Lowers soil pH
    • Some N may be lost
Effect of N rate and method of application on burley tobacco yield.

If 1/3 or more of N is sidedressed, Total N used can be reduced by 15 to 25 lbs/A
Excessive rates of N

- Nitrate loading in top of plant
  - Green tobacco at harvest and after curing
  - Fleshy yellow spots that won’t cure
  - Fat stems that persist after 8 weeks curing
  - Potentially high levels of nitrosamines

- Lower soil pH
  - Mn toxicity

- Result in loss of contract???
Possible Effects of Excessive Nitrogen

- Increased amounts of green tobacco following curing
  - Delayed maturity from excessive N in plant at season’s end
- Swelled or “fat” stems
  - Nitrate loading of leaf midrib causing decreased moisture loss
- Possible negative effects on cured leaf chemistry
Dark Tobacco Nitrogen Rate Trials
10 trials over 4 locations and 4 years
Varieties: NL Madole, DF 911, KY 171, KT D4LC

Total N Rate (lbs N/A)

Total Yield (lbs/A)
Soil Nitrate Nitrogen Levels Immediately Following Tobacco Harvest
N Rate Trial – Springfield, TN - 2006

\[ \text{LSD}_{0.05} = 12.5 \quad 31.1 \]

- **NO\textsubscript{3}-N (mg/L)**
- **NO\textsubscript{3}-N (mg/kg)**

<table>
<thead>
<tr>
<th>Total N applied</th>
<th>Res Soil N (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>5.3, 13.2</td>
</tr>
<tr>
<td>300</td>
<td>18.2, 45.4</td>
</tr>
<tr>
<td>500</td>
<td>36.8, 92</td>
</tr>
<tr>
<td>1000</td>
<td>72.5, 181.1</td>
</tr>
</tbody>
</table>
Soil pH and Mn Toxicity

- Caused by low soil pH
  - not enough lime
  - too much N fertilizer
- Stunts growth
- May reduce yield 200 to 300 lbs./A
- Soil test and add lime as needed
- Recommended soil pH = 6.4 to 6.6
Ammonium Nitrate Issues

• Most common N source for tobacco growers
• Homeland security concerns
  – Can be used to make explosives
  – Easy availability
• Some manufacturing plants have closed
  – Tighter supplies
    • Some imported ammonium nitrate will be brought in
  – Higher costs
New N Source

- Dolomite – Ammonium Nitrate (27-0-0)
  - Ammonium nitrate mixed with dolomitic lime
    - 80% ammonium nitrate
  - Theoretically similar to ammonium nitrate
    - Can impregnate some chemicals?
  - Relatively high cost
    - Availability?
    - Bagged only?
  - Limited practical experience
Ammonium N Sources

- Urea (46% N)
  - Intermediate cost
  - Handling similar to ammon nitrate
    - Can impregnate some chemicals
    - Same lime requirement as AN
  - Converted to nitrate in the soil
    - Subject to loss if surface applied
      - Apply to dry soil
      - Incorporate or water in
    - Delayed uptake (Don’t use for sidedress)
  - Feasible alternative if managed properly
Liquid N Sources

- Liquid Solutions (28 – 32% N)
  - Intermediate cost
  - Mixture of urea, ammonium nitrate, and water
  - Relatively easy to transport, store, and apply
    - Most nurse tanks
    - Many types of sprayers
      - Corrosive to equipment
      - Should be incorporated
  - Feasible for tobacco production
Nitrate N Sources

- Calcium Nitrate (15.5% N)
- Sodium-Potassium Nitrate (15% N)
- Potassium Nitrate
  - Immediate uptake (good for sidedress)
  - Good for low pH soils
  - Erratic availability
  - High cost
    - Low analysis
    - high transport cost
# Conversion to Nitrate in Soil

<table>
<thead>
<tr>
<th>N Source</th>
<th>% of Fertilizer as $\text{NO}_3^{-}\text{N}$</th>
<th>Weeks After Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Ammonium Nitrate</td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>Anhydrous Ammonia</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Urea</td>
<td>0</td>
<td>50</td>
</tr>
<tr>
<td>UAN Solution</td>
<td>25</td>
<td>60</td>
</tr>
<tr>
<td>Nitrate Sources</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Phosphorous and Potassium Fertilization

• Use soil test to determine need
  – 70% of tobacco patches do not need additional P
  – 30% of tobacco patches do not need additional K

• Lower price and more available in Fall

• Scout fields for signs of deficiency
  – adjust rates to fit specific soil conditions

• Do not use muriate of potash in spring
  – Chloride is detrimental to leaf quality

• Use animal manure in moderation
  – Chicken litter – no more than 2 tons/A
High chloride in tobacco

• Poor cured leaf color
  – dingy, muddy, variegated
• Imparts unpleasant flavor and aroma to smoke
• Reduces burn rate
• Cause cured leaf to hold moisture
  – moldy stems / fat stems
  – high case can lead to rot during storage
  – nitrosamines ??
• Limit on spring Muriate of Potash:
  – No more than 50 lbs Cl/A
  – Muriate of Potash = ~50% Cl (100 lbs/A 0-0-60)
Phosphorus Deficiency
Potassium Deficiency
Calcium Deficiency

- Usually noticed around topping time
  - Can be confused with phenoxy herbicide drift
- Temporary
  - Usually alleviated by change in moisture
- Worse in some burley varieties
  - KT 200
- Yield losses thought to be minor
Possible Boron Deficiency

Soil pH = 7.5
Plant Boron = 24 ppm

Soil pH = 7.3
Plant Boron = 14 ppm

Foliar Boron may Alleviate
0.25 lbs/A Boron = 1.5 Solubor DF/A foliar