Strategies for Tight Budgets and Minimal Risk
Making Your Fertilizer Investment Less Risky and More Efficient

Making Your Fertilizer Investment Less Risky and More Efficient

Dennis Hancock, PhD.
Extension Forage Agronomist
UGA - Dept. of Crop and Soil Sciences

Outline
- Comparing nutrient sources
- Risk of Nitrate Toxicity
- Control of N volatilization
- Use of legumes

Hay Production - 2008
Cost Breakdown

Fertilizer  Fuel & Repairs  Interest on Var. Costs  Pesticides  Fixed & Mgmt Costs

Hay Production - 2008
Cost Breakdown

Get a Grip on Your Forage Costs

N  P  K
$0.50  -  $0.50  -  $0.70

Hybrid Bermudagrass Yield
Response to N Rate

Forage Yield (tons/A) @15% moisture

Nitrogen Rate (lbs N/A)

Hybrid Bermudagrass Yield
Response to N Rate

Forage Yield (tons/A) @15% moisture

Nitrogen Rate (lbs N/A)
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The False Economy of Shortcuts

<table>
<thead>
<tr>
<th>Yield (t/ac)</th>
<th>60%</th>
<th>75%</th>
<th>90%</th>
<th>100%</th>
<th>110%</th>
<th>125%</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>$56</td>
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<td>$103</td>
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<td>$133</td>
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<tr>
<td>3</td>
<td>$150</td>
<td>$188</td>
<td>$225</td>
<td>$250</td>
<td>$275</td>
<td>$313</td>
</tr>
</tbody>
</table>

Adapted from R.C. Lacy, 2008

Do you really need anything else...

Cost of Production Compared to Average

<table>
<thead>
<tr>
<th>Yield (t/ac)</th>
<th>60%</th>
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Soil Test and Follow Fertility Recommendations

Sample 1/3 of your pastures each year and hayfields every year.

DO NOT cut back on lime!

Get your priorities right!
1. Lime is still job #1.

Fertilization Strategies

Hayfield 1
pH = 6.0
P = 25
K = 120
OM = 2.5%

Hayfield 2 & 3
pH = 5.5
P = 15
K = 90
OM = 1.5%

How Soil pH Affects Availability of Plant Nutrients

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amt. Used Annually</th>
<th>Unit Price</th>
<th>Dec. in Efficiency</th>
<th>Value of Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>200</td>
<td>$0.85</td>
<td>20%</td>
<td>$-34</td>
</tr>
<tr>
<td>P₂O₅</td>
<td>50</td>
<td>$0.80</td>
<td>25%</td>
<td>$-10</td>
</tr>
<tr>
<td>K₂O</td>
<td>150</td>
<td>$0.60</td>
<td>10%</td>
<td>$-9</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>$-53</td>
</tr>
</tbody>
</table>

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A Fertilization Trick
Avoid the Use of Standard Blends

<table>
<thead>
<tr>
<th>Fertilizer Strategy</th>
<th>Price, $/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blended Fertilizer</td>
<td>$367.65</td>
</tr>
<tr>
<td>- Urea (46-0-0)</td>
<td>488 $85.43</td>
</tr>
<tr>
<td>- DAP (18-46-0)</td>
<td>141 $28.26</td>
</tr>
<tr>
<td>- Potash (0-0-60)</td>
<td>375 $150.00</td>
</tr>
<tr>
<td>Poultry Litter</td>
<td>$164.00</td>
</tr>
<tr>
<td>- 3-3-2</td>
<td>8000 $120.00</td>
</tr>
<tr>
<td>- Potash</td>
<td>110 $44.00</td>
</tr>
</tbody>
</table>

Target Fertilizer Rate: 250-65-225 (Assumes Medium Soil Test Level P & K)

Another Fertilization Trick
Split Your Nitrogen Applications!

- Long-term, this can increase yields by 5-10% and increase NUE by 25-30%.
- Especially important under extremes:
  - Leaching
  - Volatilization (in the case of urea-based products)
  - Late freeze
  - Drought
- Helps to prevent NITRATE TOXICITY!

Monitor Climate Predictions
http://www.cpc.ncep.noaa.gov/

N Concentration in the Forage Crop

Days of Growth

N Concentration in the Forage Crop

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Days of Growth

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Days of Growth

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Another Fertilization Trick
Account for N Loss from Urea-based Products

The Effectiveness of Some Alternative N Sources at Low, Medium, and High Fertilization Rates on Hybrid Bermudagrasses (Relative to Ammonium Nitrate).

<table>
<thead>
<tr>
<th>Nitrogen Source</th>
<th>Fertilization Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt; 200 lbs*</td>
</tr>
<tr>
<td>Ammonium Nitrate</td>
<td>100%</td>
</tr>
<tr>
<td>Amm. Sulfate</td>
<td>95-97%</td>
</tr>
<tr>
<td>Anhyd. Ammonia</td>
<td>92-94%</td>
</tr>
<tr>
<td>UAN Solution</td>
<td>80-85%</td>
</tr>
<tr>
<td>Urea</td>
<td>79-82%</td>
</tr>
</tbody>
</table>

* Actual lbs of N per acre per year.
Source: Burton and Jackson, 1962; Silveria et al., 2007.

Alternative N Sources
Take-home message:
If you have to use a urea-based product, be careful about cutting your rate back too much.
- They are relatively less effective at low rates.

Volatility Control?
Apply P in late summer or fall.

• P can essentially be applied any time during the year on established forage crops.
• Purchase P fertilizer in “off-peak” times of the year (i.e., summer and fall)
  - Demand for the product is low
  - Demand for spreading services is low
  - Less risk of P runoff
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Another Fertilization Trick
Split Your Potassium Applications!

K is for Persistence
Not Competitive  Leafspot Diseases
Poor Winterhardiness  Grows Very Slow
Poor Stress Tolerance
The Stand is Gone!

K is the Key to a Good Stand

Benefits of Adding Legumes
A valuable source of N (time-released).

Quality Differences in the Major Forage Species

Use Legumes to the Extent Possible
Top 4 Uses of Legumes in Georgia

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4) Summer Annual N Crops
- Forage Soybeans (Hay/Silage)
- Cowpeas (Hay/Silage)
- Annual lespedezas (Pasture)
- Others

3) Winter Annual N Crops
BH: Overseeding CSA in Bermuda hayfields
CC: Cover crop
PO: Pecan Orchard

3) Winter Annual N Crops
- Crimson clover (BH, CC, PO)
- Ball clover (PO)
- White clover* (PO)
- Arrowleaf clover (CC, PO)
- Red clover* (CC, PO)

The effect of annual clover addition on 'Coastal' bermudagrass yields.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>1965</th>
<th>1966</th>
<th>1967</th>
<th>1968</th>
</tr>
</thead>
<tbody>
<tr>
<td>------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td>------</td>
</tr>
<tr>
<td>Crimson: 200 lbs N/Acre</td>
<td>22500</td>
<td>22300</td>
<td>17500</td>
<td>24500</td>
</tr>
<tr>
<td>Arrowleaf: 200 lbs N/Acre</td>
<td>24000</td>
<td>21600</td>
<td>16500</td>
<td>27100</td>
</tr>
<tr>
<td>No Clover: 200 lbs N/Acre</td>
<td>17100</td>
<td>19800</td>
<td>15400</td>
<td>21600</td>
</tr>
<tr>
<td>No Clover: 0 N</td>
<td>7700</td>
<td>6600</td>
<td>3500</td>
<td>6200</td>
</tr>
</tbody>
</table>

Location: Starkville, MS

2) Grow with the grass
Pasture
- White Clover
  - Close: Durana
  - Tall: Patriot
  - Short Duration: Osceola

Benefits of Adding White Clover
Lessen the effects of endophyte-infected tall fescue

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Effect of Tall Fescue, Endophyte, and White Clover on Stocker Production in the Spring

<table>
<thead>
<tr>
<th>Species</th>
<th>ADG (lbs/hd/d)</th>
<th>Gain (lb/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E+</td>
<td>1.10</td>
<td>126</td>
</tr>
<tr>
<td>NE</td>
<td>1.83</td>
<td>186</td>
</tr>
<tr>
<td>E+ &amp; WC</td>
<td>1.60</td>
<td>150</td>
</tr>
<tr>
<td>NE &amp; WC</td>
<td>2.61</td>
<td>252</td>
</tr>
</tbody>
</table>

Jesup Tall Fescue and Durana White Clover. 3-yr trial. Eatonton, GA. Hill, Andrae, and Bouton (unpublished data)

Value of Legume Establishment

<table>
<thead>
<tr>
<th>Species</th>
<th>Cost of Adding Legume to Ryegrass</th>
<th>N Needed to BE*</th>
<th>Expected N Fixation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrowleaf</td>
<td>$2.00 cost/lb, $12 cost/acre</td>
<td>16</td>
<td>50-110</td>
</tr>
<tr>
<td>Crimson</td>
<td>$1.80 cost/lb, $27 cost/acre</td>
<td>36</td>
<td>70-140</td>
</tr>
<tr>
<td>W. Clover</td>
<td>$6.50 cost/lb, $20 cost/acre</td>
<td>27</td>
<td>30-60</td>
</tr>
<tr>
<td>Red Clover</td>
<td>$3.00 cost/lb, $24 cost/acre</td>
<td>32</td>
<td>50-130</td>
</tr>
</tbody>
</table>

* Amount of N that the seed cost/acre would have purchased (e.g., $12 per acre / $0.75 per lb of N = 16 lbs of N fixed per acre)

2) Grow with the grass

Pasture
- White Clover
  - Close: Durana, Resolute
  - Tall: Patriot, Will
  - Short Duration: Will

Hayfield
- Red clover (w/ CSP Grass)
- Alfalfa (w/ CS or WSP Grass)
- Not many will compete

1) Grazed Winter Annual Forage Systems

Overseeding CSA into Bermuda
- Ryegrass (Annual)
- Rye
- Oats
- Wheat
- Triticale

- Arrowleaf clover
- Crimson clover
- Red clover*

Effect of Annual Clover on Cow-Calf Grazing Days on Coastal Bermudagrass (3 yr avg.)

<table>
<thead>
<tr>
<th>Species Overseeded on Bermuda Sod</th>
<th>N Added (lbs/A/yr)</th>
<th>Grazing Dates</th>
<th>Grazing Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rye-Arrowleaf-Crimson</td>
<td>100</td>
<td>Jan 8 - Oct 5</td>
<td>268</td>
</tr>
<tr>
<td>Arrowleaf-Crimson</td>
<td>0</td>
<td>Mar 11 - Oct 5</td>
<td>211</td>
</tr>
<tr>
<td>Ryegrass</td>
<td>150</td>
<td>Feb 14 - Oct 5</td>
<td>240</td>
</tr>
<tr>
<td>No Annuals</td>
<td>100</td>
<td>Apr 6 - Oct 5</td>
<td>187</td>
</tr>
</tbody>
</table>


Effect of Annual Clover on Cow-Calf Performance on Coastal Bermudagrass (3 yr avg.)

<table>
<thead>
<tr>
<th>Species Overseeded on Bermuda Sod</th>
<th>N Added (lbs/A/yr)</th>
<th>Cows ADG</th>
<th>Calves Gain/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rye-Arrowleaf-Crimson</td>
<td>100</td>
<td>0.90</td>
<td>1.91 510</td>
</tr>
<tr>
<td>Arrowleaf-Crimson</td>
<td>0</td>
<td>1.37</td>
<td>1.94 410</td>
</tr>
<tr>
<td>Ryegrass</td>
<td>150</td>
<td>0.38</td>
<td>1.76 420</td>
</tr>
<tr>
<td>No Annuals</td>
<td>100</td>
<td>0.49</td>
<td>1.57 290</td>
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QUESTIONS?

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