2010 Georgia Grazing School:
Legumes for use in pasture-based dairies in the Coastal Plain

Dr. Dennis Hancock
Extension Forage Agronomist

Legumes for use in pasture-based dairies in the Coastal Plain

Dennis Hancock
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UGA – Dept. of Crop and Soil Sciences

Nitrogen Fixation
Legume plants and Rhizobium bacteria form a symbiotic relationship
- Rhizobia colonize nodules on the roots of healthy legumes
- Absorb nitrogen from the air (N₂)
- Fix it into ammonia (NH₃).

Relationship is mutually beneficial:  
- Plant gets N from bacteria
- Bacteria get energy from plant

Nodules on crimson clover
(Photo Credit: Dr. Gerald Evans, TAMU)

Nitrogen Transfer
Exudates from the nodules and roots

Animal Deposition

Nodules slough off and decay

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COLLEGE OF AGRICULTURAL & ENVIRONMENTAL SCIENCES
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Nitrogen Transfer

Quality Differences in the Major Forage Species

Organic Matter Decomposition

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

<table>
<thead>
<tr>
<th>Species</th>
<th>Annual lbs (N/acre)</th>
<th>N value at $0.45/lb. of N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfalfa</td>
<td>200-300</td>
<td>$90-135</td>
</tr>
<tr>
<td>Red clover</td>
<td>100-200</td>
<td>$45-90</td>
</tr>
<tr>
<td>White clover</td>
<td>100-150</td>
<td>$45-68</td>
</tr>
<tr>
<td>Annual clover</td>
<td>50-150</td>
<td>$23-68</td>
</tr>
</tbody>
</table>

Cool Season Annual Legumes

Arrowleaf Clover

- Adaptation: Coastal Plain & lower Piedmont. Requires well drained soil, not tolerant of soil acidity or low fertility.
- Maturity: Late
- Cold Tolerance: Good
- Bloat Potential: Low
- Reseeding: High
- Establishment: Drill: 5-7 lbs/A, Broadcast: 8-10 lbs/A
- Varieties: Apache, better virus resistance but susceptible to crown and stem rot. Yuchi is disease prone.

Ball Clover

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**Ball Clover**

- **Maturity**: Medium
- **Cold Tolerance**: Good
- **Bloat Potential**: High
- **Establishment**: Drill: n/a, Broadcast: 2-3 lbs/A
- **Reseeding Potential**: High
- **Varieties**: Segrest

**Crimson Clover**

- **Adaptation**: Coastal Plain & lower Piedmont. Fairly tolerant of soil acidity but does not tolerate poor drainage.
- **Maturity**: Early
- **Cold Tolerance**: Good
- **Bloat Potential**: Low
- **Establishment**: Drill: 15-20 lbs/A, Broadcast: 20-30 lbs/A
- **Reseeding Potential**: Low
- **Varieties**: AU Robin, Flame produce well & early. Dixie, Tibbee, & Chief may give satisfactory results.

**Preferred soil characteristics and management traits of selected cool season annual legumes.**

<table>
<thead>
<tr>
<th>Species</th>
<th>Min. pH</th>
<th>Soil Texture</th>
<th>Drainage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arrowleaf Clover</td>
<td>6.0</td>
<td>sand, loam</td>
<td>good</td>
</tr>
<tr>
<td>Ball Clover</td>
<td>6.5</td>
<td>sand, loam, clay loam</td>
<td>fair</td>
</tr>
<tr>
<td>Berseem Clover</td>
<td>6.5</td>
<td>loam, clay</td>
<td>poor</td>
</tr>
<tr>
<td>Crimson Clover</td>
<td>6.0</td>
<td>sand, loam</td>
<td>good</td>
</tr>
<tr>
<td>Medics, Annual</td>
<td>7.0</td>
<td>sand, loam, clay</td>
<td>fair</td>
</tr>
<tr>
<td>Persian Clover</td>
<td>6.0</td>
<td>loam, clay</td>
<td>poor</td>
</tr>
<tr>
<td>Red Clover</td>
<td>6.5</td>
<td>loam, clay</td>
<td>good</td>
</tr>
<tr>
<td>Rose Clover</td>
<td>6.0</td>
<td>sand, loam, clay</td>
<td>good</td>
</tr>
<tr>
<td>Sub. Clover</td>
<td>6.0</td>
<td>loam, clay</td>
<td>fair</td>
</tr>
<tr>
<td>Vetch, Hairy</td>
<td>5.5</td>
<td>sand, loam, clay</td>
<td>good</td>
</tr>
<tr>
<td>Winter Pea</td>
<td>6.0</td>
<td>loam, clay loam</td>
<td>good</td>
</tr>
</tbody>
</table>

1 Adapted from Evers, 2005.
2 Min pH is soil pH value for acceptable yields.
3 Red Clover is a perennial clover species, however it is often used as a late maturing cool season annual legume.

**Clover Yields in the Coastal Plain**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Feb-Mar</th>
<th>Apr-May</th>
<th>Jun-Jul</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annuals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrowleaf</td>
<td>425</td>
<td>2,525</td>
<td>522</td>
<td>3,472</td>
</tr>
<tr>
<td>Ball</td>
<td>530</td>
<td>2,099</td>
<td>134</td>
<td>2,763</td>
</tr>
<tr>
<td>Berseem</td>
<td>1,359</td>
<td>2,327</td>
<td>589</td>
<td>4,276</td>
</tr>
<tr>
<td>Crimson</td>
<td>1,871</td>
<td>1,698</td>
<td>-</td>
<td>3,568</td>
</tr>
<tr>
<td>Subterranean</td>
<td>646</td>
<td>1,214</td>
<td>-</td>
<td>1,860</td>
</tr>
<tr>
<td><strong>Perennials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>254</td>
<td>2,188</td>
<td>1,455</td>
<td>3,896</td>
</tr>
<tr>
<td>White</td>
<td>467</td>
<td>1,612</td>
<td>1,282</td>
<td>3,321</td>
</tr>
</tbody>
</table>

Average of 3 years and 4 locations

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**Clover Yield Variability in the Coastal Plain**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Feb-Mar</th>
<th>Apr-May</th>
<th>Jun-Jul</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Annuals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arrowleaf</td>
<td>VVV</td>
<td>V</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Ball</td>
<td>V</td>
<td>W</td>
<td>V</td>
<td>V</td>
</tr>
<tr>
<td>Berseem</td>
<td>VV</td>
<td>VVV</td>
<td>VVV</td>
<td>VVV</td>
</tr>
<tr>
<td>Crimson</td>
<td>VVV</td>
<td>V</td>
<td>-</td>
<td>W</td>
</tr>
<tr>
<td>Subterranean</td>
<td>VV</td>
<td>V</td>
<td>-</td>
<td>VV</td>
</tr>
<tr>
<td><strong>Perennials</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red</td>
<td>V</td>
<td>WWW</td>
<td>VVVV</td>
<td>VV</td>
</tr>
<tr>
<td>White</td>
<td>V</td>
<td>W</td>
<td>V</td>
<td>VV</td>
</tr>
</tbody>
</table>

The number of "V"s indicates the amount of variability in yield that there was over the 3 years and 4 locations (i.e., more "V"s = more variable).


**Stocker gains using combinations of cereal rye.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Grazing Period</th>
<th>Avg. SR (head/acre)</th>
<th>Avg. Daily Gain (ADG) (lbs/head/day)</th>
<th>Gain/Acre (lbs/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rye Only</td>
<td>83</td>
<td>1.87</td>
<td>2.73</td>
<td>421</td>
</tr>
<tr>
<td>+ Wheat</td>
<td>83</td>
<td>1.96</td>
<td>2.57</td>
<td>412</td>
</tr>
<tr>
<td>+ A. Ryegrass</td>
<td>134</td>
<td>1.60</td>
<td>1.92</td>
<td>409</td>
</tr>
<tr>
<td>+ Crimson + Arrowleaf clover</td>
<td>129</td>
<td>1.51</td>
<td>2.29</td>
<td>444</td>
</tr>
</tbody>
</table>

* Summary of research from Eatonton, GA in 2010. Sod-seeding into killed mixed pasture in early November, 2009. Grazing began on February 3 for all treatments. Stocking rate varied with "put-and-take" grazing management. All treatments received 40 lbs of N/acre at planting. Grass treatments received 50 lbs N/acre in late January, while clover mixtures received 25 lbs N/acre. Ryegrass treatment received additional 40 lbs N/acre in early April.

**Cool Season Perennial Legumes**

**Alfalfa**

- Adaptation: Well-drained soils statewide, if fertile soil and with good management. Best if irrigated.
- Lifespan: 4-7 years in LVM & Pied; 3-5 years in Coastal Plain
- Yield: 4-6 tons/A (dry); 5-8 tons/A (irrigated)
- Soil Considerations: Soil pH ≥ 6.5 (0-6 in. depth); Subsoil pH ≥ 5.5 (down to 4 ft.) Well-drained, deep, and fertile
- Bloat Potential: High
- Uses: 1) Hay, 2) Grazing, 3) Silage
- Establishment: Drill: 20-25 lbs/A; Broadcast: 22-25 lbs/A
- Varieties: North GA – Bulldog 505; South GA – Bulldog 805
- Comments: Highest quality forage. Best for dairy or horse hay.

**Alfalfa Hayfield, Colquitt County**

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### Red Clover
- **Adaptation**: Statewide, if good soil and management. More forgiving of soil conditions than alfalfa.
- **Lifespan**: 1-2 years in LVM & Pied; 1 spring in Coastal Plain
- **Yield**: 2-3 tons/A (LVM & Pied); 1-2 tons/A (Coastal Plain)
- **Soil Considerations**: Soil pH ≥ 6.0 (4-6 in. depth); Medium well- to well-drained
- **Bloat Potential**: Low
- **Uses**: 1) Rotational Grazing, 2) Hay
- **Establishment**: Drill: 6-8 lbs/A; Broadcast: 12-15 lbs/A
- **Varieties**: Bulldog Red, Cimarron Plus & Redland Max in N GA, Cherokee in S GA.
- **Comments**: Late maturing “annual” in Coastal Plain

### White Clover
- **Adaptation**: Statewide, except for very sandy sites.
- **Lifespan**: If adapted variety, it may survive for many years (esp. if allowed to set seed).
- **Yield**: < 1 ton/A
- **Soil Considerations**: Soil pH ≥ 5.8 (4-6 in. depth)
- **Bloat Potential**: Medium
- **Uses**: Mixed with grasses for grazing
- **Establishment**: Drill: 2-3 lbs/A; Broadcast: 2-3 lbs/A
- **Varieties**: Durana, Patriot
- **Comments**: Only recommended varieties recommended in Coastal Plain. Can be frost seeded in north GA

### Focus: ‘Durana’ is great in combination with Tifton 85.

### Focus: White Clover cv. ‘Durana’

### Warm Season Perennial Legumes

Focus: ‘Durana’ is NOT so good in prepared ground (annuals) pastures.

Dr. Dennis Hancock
Extension Forage Agronomist
Perennial Peanut

Adaptation  
Areas south of south of 31.5°F parallel (roughly a line from Albany to Jesup).

Lifespan  
Many years

Yield  
2-5 tons/A

Soil Considerations  
Soil pH ≥ 6.0 (4-6 in. depth)  
Medium well- to well-drained

Bloat Potential  
Low

Uses  
1) Hay, 2) Rotational Grazing

Establishment  
Sprigged: 60-80 bu/A

Varieties  
Florigraze, Arbrook

Comments  
Best if irrigated. Long (18-24 months) establishment phase. Infection with Peanut Stunt Virus is widespread.

Milk income after supplement costs for cows grazing Tifton 85 bermudagrass or perennial peanut and fed supplements at high or low rates.

<table>
<thead>
<tr>
<th></th>
<th>Tifton 85</th>
<th>Perennial Peanut</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Supplement</td>
<td>$3.80</td>
<td>$4.27</td>
</tr>
<tr>
<td>High Supplement</td>
<td>$3.90</td>
<td>$3.99</td>
</tr>
</tbody>
</table>

Adapted from Solenberger et al., 2000. Pasture-based systems for lactating cows: Summary of five years of research. 37th Florida Dairy Production Conf.

Milk income after supplement costs for cows grazing Tifton 85 bermudagrass or perennial peanut when grazing pastures stocked at high or low grazing pressure.

<table>
<thead>
<tr>
<th>Stocking Rate (cows/acre)</th>
<th>Tifton 85 ($/acre/day)</th>
<th>Perennial Peanut ($/acre/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>$9.57</td>
<td>$6.30</td>
</tr>
<tr>
<td>4</td>
<td>$13.85</td>
<td>$10.42</td>
</tr>
</tbody>
</table>

Adapted from Solenberger et al., 2000. Pasture-based systems for lactating cows: Summary of five years of research. 37th Florida Dairy Production Conf.
Warm Season Annual Legumes

Forage Soybeans
- Essentially same as row crop soybeans.
- Some use of RR soybeans for weed control.
- Adapted to a wide range of soils, but most productive on soil pH > 6.0 and fertile.
- Yields range from 2-4 tons/a.
- Sometimes grown with annuals, but contributes little N or forage quality to the crop.
- Grazing tolerance is low.

Cowpeas ("Iron & Clay Peas")
- Similar to soybeans, but lower yields
- Develops a viney, prostrate growth habit under grazing.
- Adapted to a wide range of soils, but most productive on soil pH > 6.0 and fertile.
- Yields range from 1-2 ½ tons/a.
- Sometimes grown with summer annuals, but contributes little N or forage quality to the crop.

Other Warm Season Annual Legumes
- Alyceclover
- Annual peanut
- Hairy indigo
- Kudzu
- Lablab (sweet hyacinth bean)
- Velvetbean

These species are:
- Relatively expensive to establish,
- Difficult to establish,
- Provide relatively low yields, and/or
- Are not very tolerant of grazing

Production generally relegated to specific niche situations.

Questions?

Dr. Dennis Hancock
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