Improving the Productivity of Livestock with Warm-Season Legumes

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Warm-Season Grass Challenges

- Main Florida grasses
  - Bahiagrass
  - Bermudagrass

- Quantity adequate until winter

- Quality consistently lacking due to:
  - Low crude protein (CP)
  - Low in vitro digestibility
Legumes Can Bridge the Gap

• Legumes provide:
  – High quality grazing
  – Make excellent hay
  – Excellent haylage
Benefits of Legumes

• Generally greater [CP] than grasses
• Improve soil N status
  – Reduce inorganic N application
• Reduce pesticide application
• Improve biodiversity
• Improve DM intake of ruminants
  – Less [NDF] than grasses (Frame, 2005)
  – Greater particle reduction than grasses
Challenges with Perennial Peanut Production

• Is the main warm-season pasture legume in FLA.
• Establishment takes ≥ 1 yr
• May not persist when grazed
• We need seeded alternative legumes
Experiment 1

Herbage Mass Production and Nutritive Value of Seeded Warm-Season Legume
Objective

• To quantify and compare maturity-related changes in the herbage mass, nutritive value of:
  – Cowpea
  – Soybean
  – Pigeon pea
Establishment

- Seeds inoculated with *Bradyrhizobium* spp.
- Drilled at 56 kg/ha in 4 replicated plots
- Irrigated
- Study repeated in a second year
Means at each WAP without a common letter differ \((P < 0.05)\)
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Linear (L), quadratic (Q), cubic (C) contrasts; \(***(P < 0.001)**, **(P < 0.01)**, *(P < 0.05)*
Whole Plant in vitro digestibility (IVTD) % DM

Means at each WAP without a common letter differ \((P < 0.05)\)
Linear (L), quadratic (Q), cubic (C) contrasts; ***(\(P < 0.001\)), **(\(P < 0.01\)), *(\(P < 0.05\))
Conclusions

- Soybean & pigeonpea had greater herbage mass than cowpea
- Cowpea had greatest nut. value
- Pigeonpea had worst nut. value
- Soybean & cowpea show promise
Experiment 2

Effects of Supplementing Bahiagrass Hay with Warm-Season Legume Hays on Lamb Performance
Objective

• To determine the feed intake, digestibility and nitrogen balance of lambs fed bahiagrass hay supplemented with soybean meal (SBM) or hays of:
  – Annual peanut (APNUT)
  – Perrenial peanut (PPNUT)
  – Cowpea (CWP)
  – Pigeonpea (PGNP)
  – Soybean (SYB)
Dietary Treatments

- Fed *ad libitum* levels of:
  1) Bahiagrass (Control)

- Or 50% of bahiagrass + 50% of one of the legumes:
  2) PPNUT
  3) APNUT
  4) CWP
  5) PGNP
  6) SYB

- Or: Bahiagrass +
  7) SBM to average [CP] of legume diets (4.25% of diet DM)
## Forage Nutritive Value (% DM Basis)

<table>
<thead>
<tr>
<th>Item</th>
<th>Bahia</th>
<th>APNUT</th>
<th>PPNUT</th>
<th>CWP</th>
<th>PGNP</th>
<th>SYB</th>
<th>SEM</th>
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<tbody>
<tr>
<td>CP</td>
<td>8.1&lt;sup&gt;d&lt;/sup&gt;</td>
<td>14.7&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>15.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11.7&lt;sup&gt;c&lt;/sup&gt;</td>
<td>12.2&lt;sup&gt;c&lt;/sup&gt;</td>
<td>13.5&lt;sup&gt;b&lt;/sup&gt;</td>
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<td>NDF</td>
<td>73.8&lt;sup&gt;b&lt;/sup&gt;</td>
<td>46.2&lt;sup&gt;e&lt;/sup&gt;</td>
<td>43.3&lt;sup&gt;f&lt;/sup&gt;</td>
<td>62.2&lt;sup&gt;c&lt;/sup&gt;</td>
<td>78.6&lt;sup&gt;a&lt;/sup&gt;</td>
<td>59.0&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>ADF</td>
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<td>37.8&lt;sup&gt;d&lt;/sup&gt;</td>
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<td>42.8&lt;sup&gt;c&lt;/sup&gt;</td>
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<td>ADL</td>
<td>6.2&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.9&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.7&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9.5&lt;sup&gt;b&lt;/sup&gt;</td>
<td>17.1&lt;sup&gt;a&lt;/sup&gt;</td>
<td>9.6&lt;sup&gt;b&lt;/sup&gt;</td>
<td>1.1</td>
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<tr>
<td>IVTD</td>
<td>50.7&lt;sup&gt;d&lt;/sup&gt;</td>
<td>71.4&lt;sup&gt;b&lt;/sup&gt;</td>
<td>77.2&lt;sup&gt;a&lt;/sup&gt;</td>
<td>57.9&lt;sup&gt;c&lt;/sup&gt;</td>
<td>35.1&lt;sup&gt;e&lt;/sup&gt;</td>
<td>57.4&lt;sup&gt;c&lt;/sup&gt;</td>
<td>1.1</td>
</tr>
</tbody>
</table>

Within a row means without a common superscript letter differ ($P < 0.05$).
Columns without a common superscript letter differ ($P < 0.05$)
Columns without a common superscript letter differ ($P < 0.05$)
N Retention (g/d)

Columns without a common superscript letter differ ($P < 0.05$)
Conclusions

• Feeding legumes or SBM ↑ intake, digestion & N retention
  – Supplementation is necessary for optimizing bahiagrass utilization

• APNUT & PPNUT gave the greatest performance followed by CWP & SYB

• Similar results obtained when these legumes were fed as haylages
Experiment 3

Effect of creep grazing with warm season legumes on performance of cow-calf pairs on bahiagrass pasture
Creep grazing trial

- Treatments
  - Bahiagrass alone or bahiagrass + creep CWP or PPNUT or feed
- Animals and paddocks
  - Two Brangus cow-calf pairs per paddock; 2 paddocks per treatment
- Results from Yr 1.
  - Tendency for greater ADG (+0.5lb/d) and greater blood N and glucose in calves creep-grazed CWP;
  - CWP is promising for creep grazing
Live Weight Gain Benefit

- PPNUT 0.98 kg/d for grazing beef calves versus 0.68 kg/d for other pure warm-season legume stands
  - Sollenberger and Collins, 1989
- PPNUT creep grazing 1.2 to 1.3 kg/d and CWP creep grazing 1.3 kg/d (Foster, 2008)
- SYB silage supplemented to beef steers grazing ryegrass provided 0.51 kg/d (Allen et al., 2000)
Relative production costs

Economic analysis on 20-year horizon (Foster, 2008)

<table>
<thead>
<tr>
<th>Forage</th>
<th>Hay production net present value, $/ha</th>
<th>Haylage production net present value, $/ha</th>
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<tbody>
<tr>
<td>PPNUT</td>
<td>9,320</td>
<td>11,490</td>
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<tr>
<td>APNUT</td>
<td>8,230</td>
<td>10,170</td>
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<td>CWP</td>
<td>1,440</td>
<td>2,660</td>
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<tr>
<td>PGNP</td>
<td>6,660</td>
<td>8,800</td>
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<tr>
<td>SYB</td>
<td>7,690</td>
<td>9,730</td>
</tr>
</tbody>
</table>
Take home messages

• Perennial peanut and annual peanut are very promising for hay, haylage or grazing

• Soybean gives good yields & moderate quality hay

• Cowpea gives moderate yields & is promising for creep grazing/ as a protein bank

• Pigeonpea is only suitable as a browse
Acknowledgements

• USDA T-STAR
• Perennial Peanut Producers Association
• Dr. Phatak
Experimental Design

- Two soil types
- RCBD
  - 4 Blocks
  - 3 Forages
  - 1 Replicate/Block