

# 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

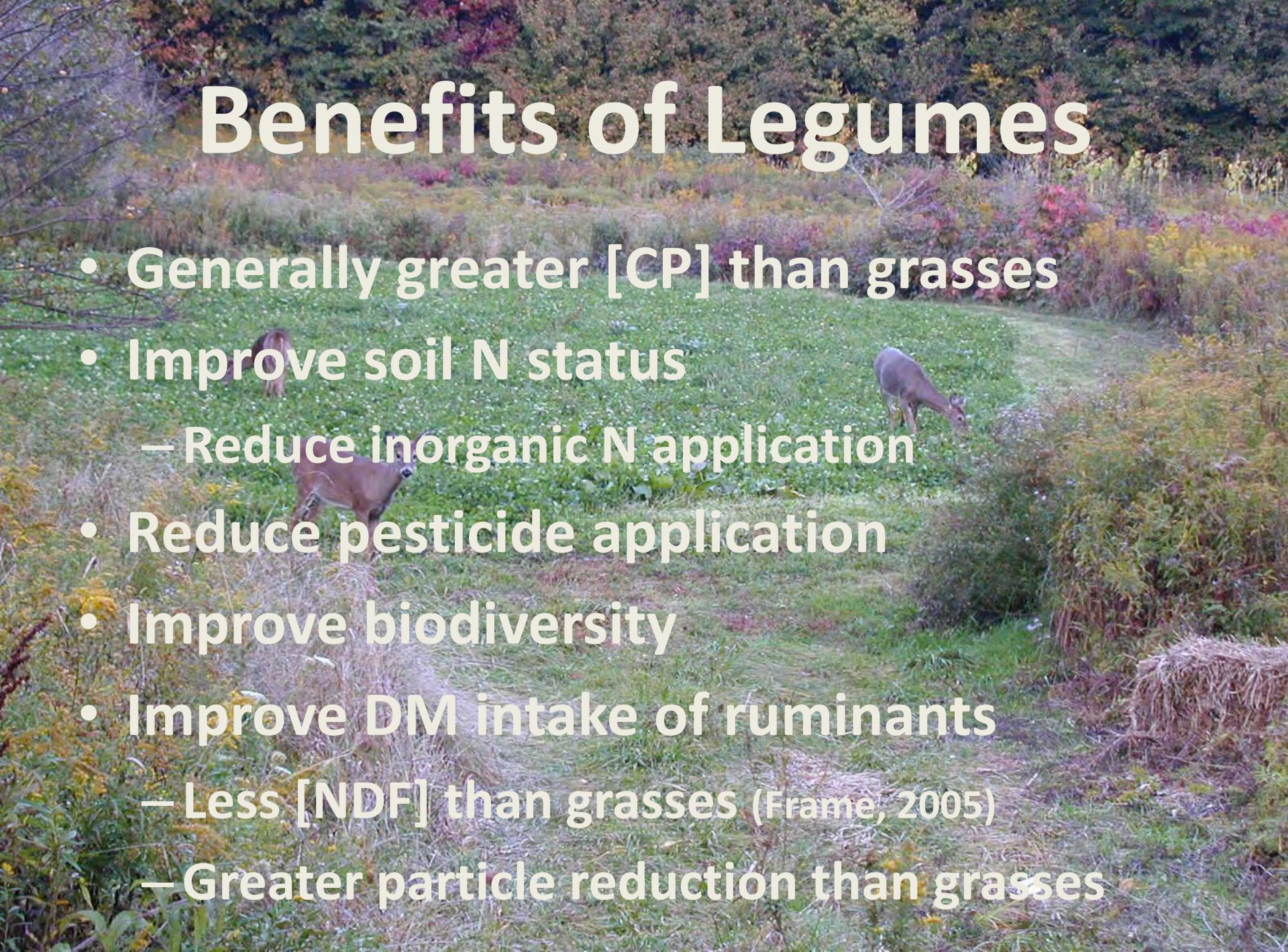


# Legumes Can Bridge the Gap



- 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
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# Challenges with Perennial Peanut Production

- Is the main warm-season pasture legume in FLA.
- Establishment takes  $\geq 1$  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

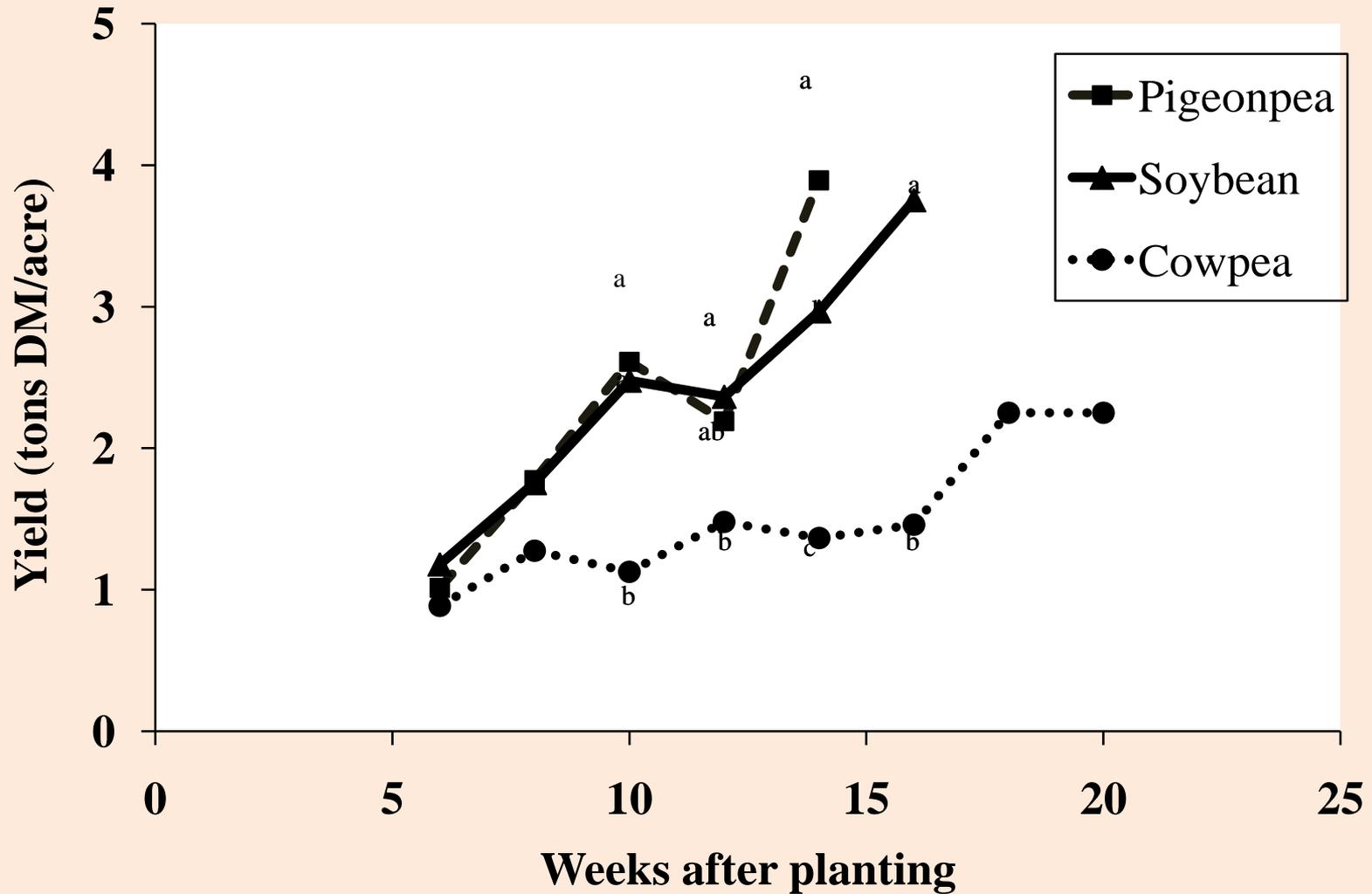
- To quantify and compare maturity-related changes in the herbage mass, nutritive value of:
  - Cowpea
  - Soybean
  - Pigeon pea

# Establishment

- Seeds inoculated with *Bradyrhizobium* spp.
- Drilled at 56 kg/ha in 4 replicated plots
- Irrigated
- Study repeated in a second year

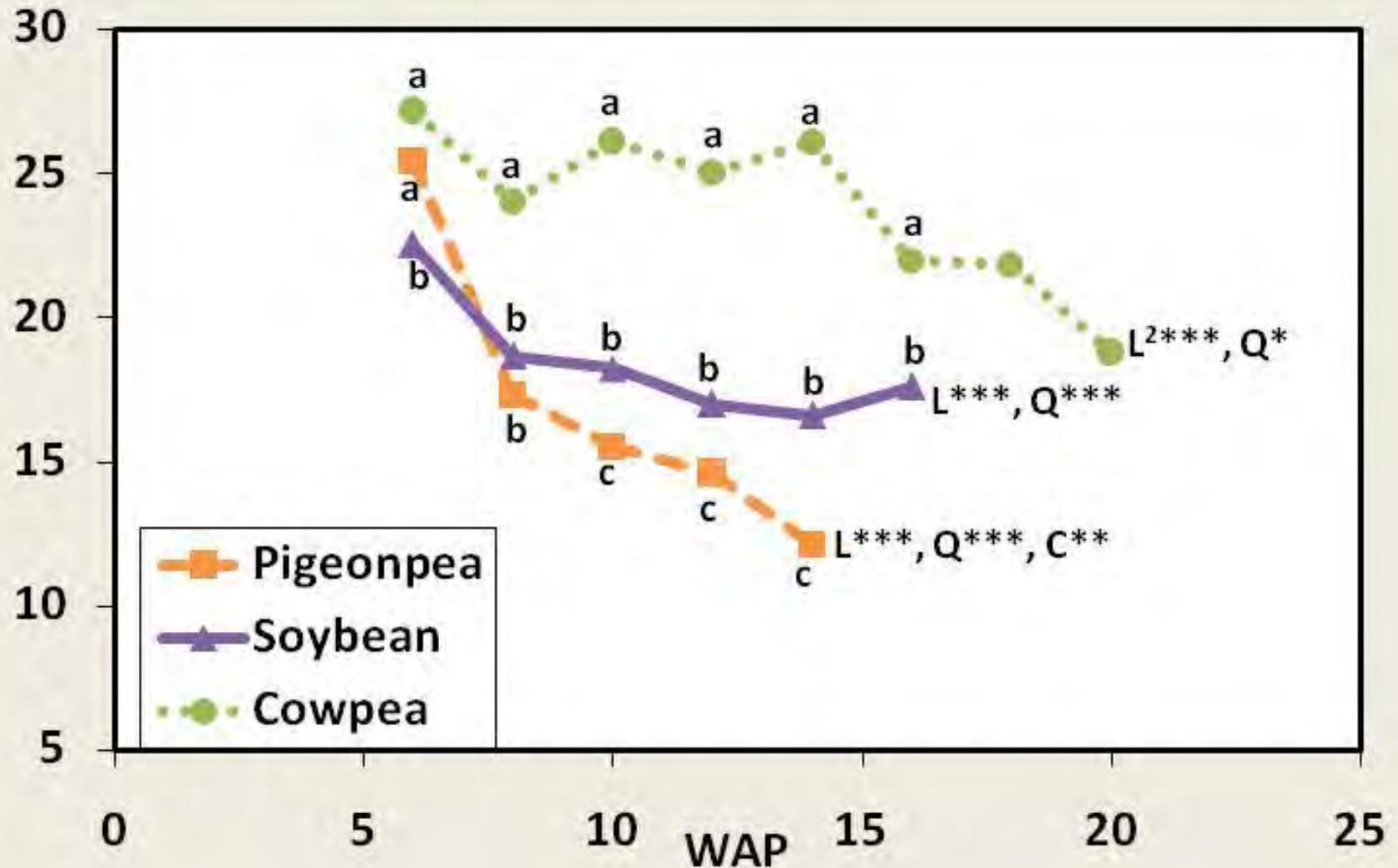


# Herbage Mass (tons DM/A)



Means at each WAP without a common letter differ ( $P < 0.05$ )

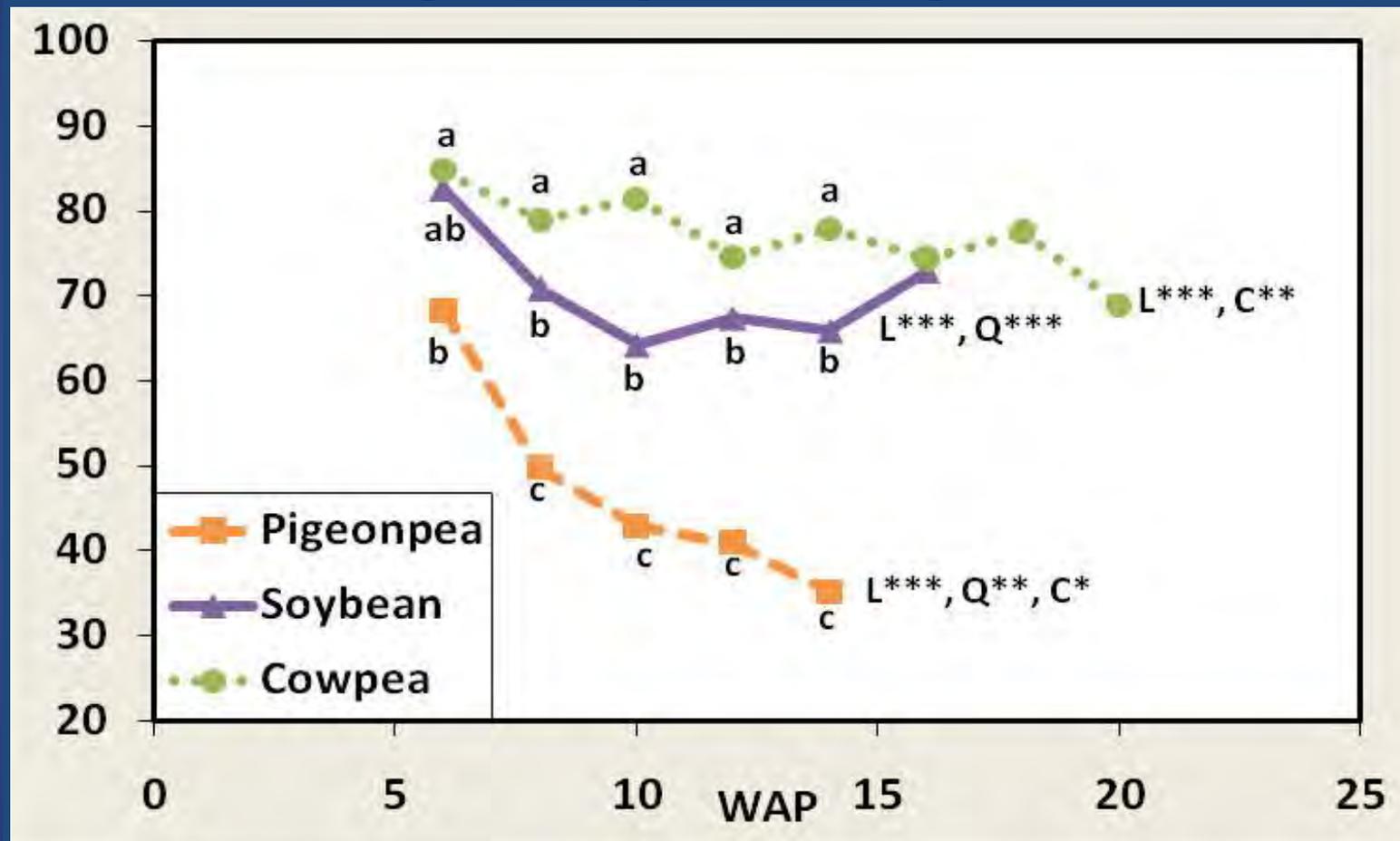
# Whole Plant CP (% DM)



Means at each WAP without a common letter differ ( $P < 0.05$ )

Linear (L), quadratic (Q), cubic (C) contrasts; \*\*\*\*( $P < 0.001$ ), \*\*( $P < 0.01$ ), \*( $P < 0.05$ )

# 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  
Bahiaagrass 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)

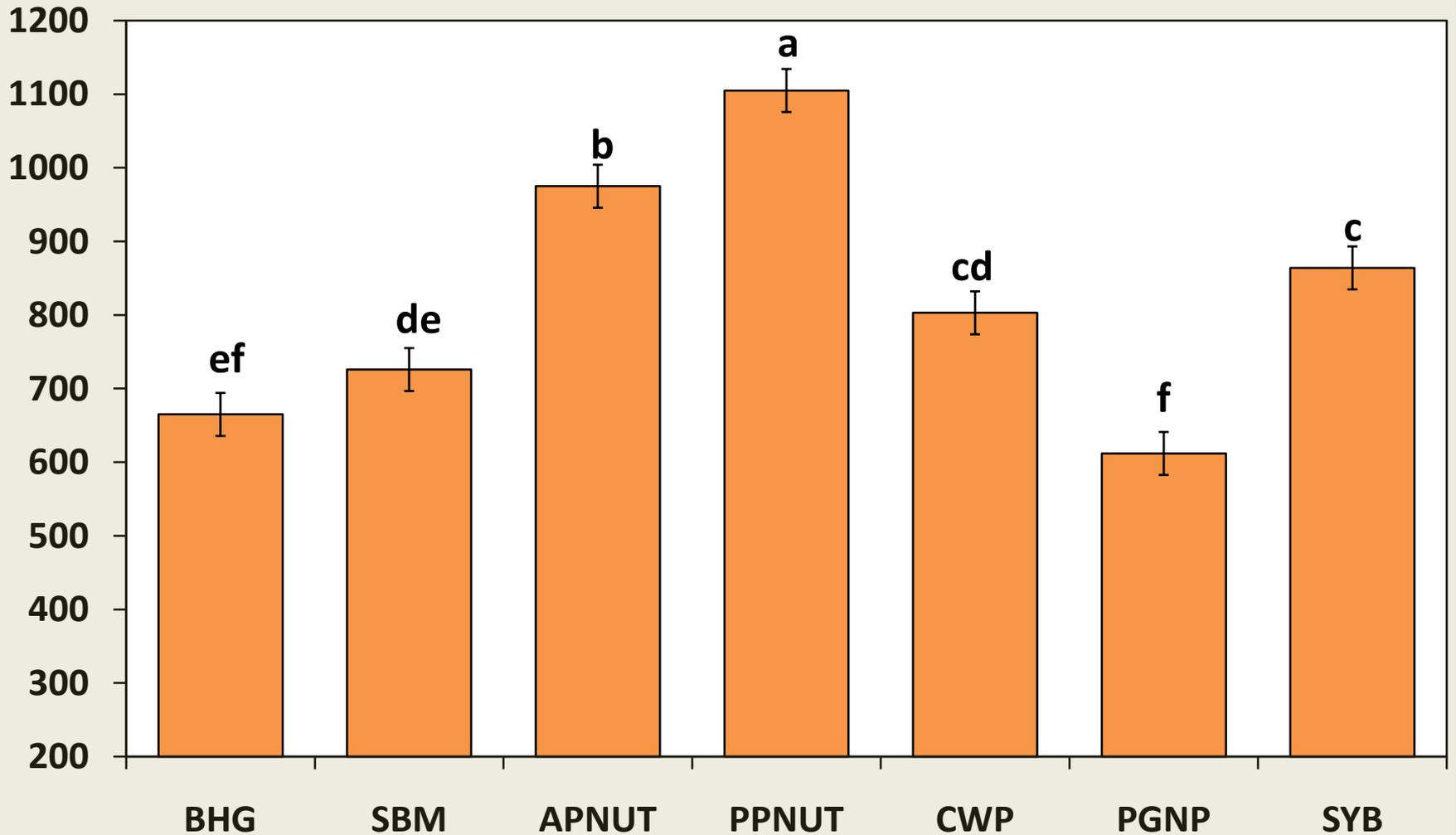


# Forage Nutritive Value (% DM Basis)

Item	Bahia	APNUT	PPNUT	CWP	PGNP	SYB	SEM
CP	8.1 <sup>d</sup>	14.7 <sup>ab</sup>	15.2 <sup>a</sup>	11.7 <sup>c</sup>	12.2 <sup>c</sup>	13.5 <sup>b</sup>	0.4
NDF	73.8 <sup>b</sup>	46.2 <sup>e</sup>	43.3 <sup>f</sup>	62.2 <sup>c</sup>	78.6 <sup>a</sup>	59.0 <sup>d</sup>	1.0
ADF	39.8 <sup>cd</sup>	37.8 <sup>d</sup>	32.1 <sup>e</sup>	48.7 <sup>b</sup>	60.2 <sup>a</sup>	42.8 <sup>c</sup>	1.3
ADL	6.2 <sup>b</sup>	7.9 <sup>b</sup>	6.7 <sup>b</sup>	9.5 <sup>b</sup>	17.1 <sup>a</sup>	9.6 <sup>b</sup>	1.1
IVTD	50.7 <sup>d</sup>	71.4 <sup>b</sup>	77.2 <sup>a</sup>	57.9 <sup>c</sup>	35.1 <sup>e</sup>	57.4 <sup>c</sup>	1.1

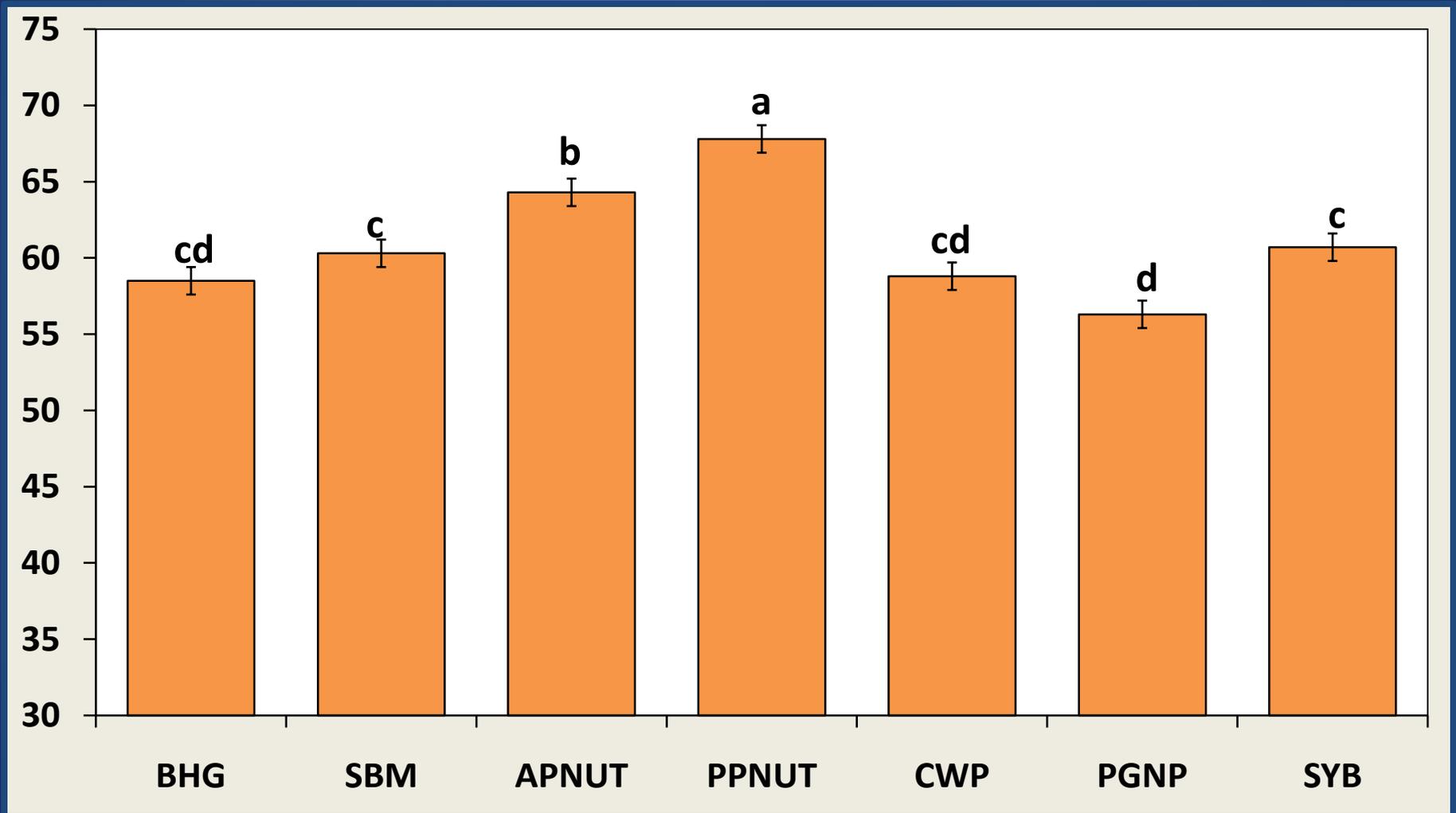
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# DM Intake (g/d)



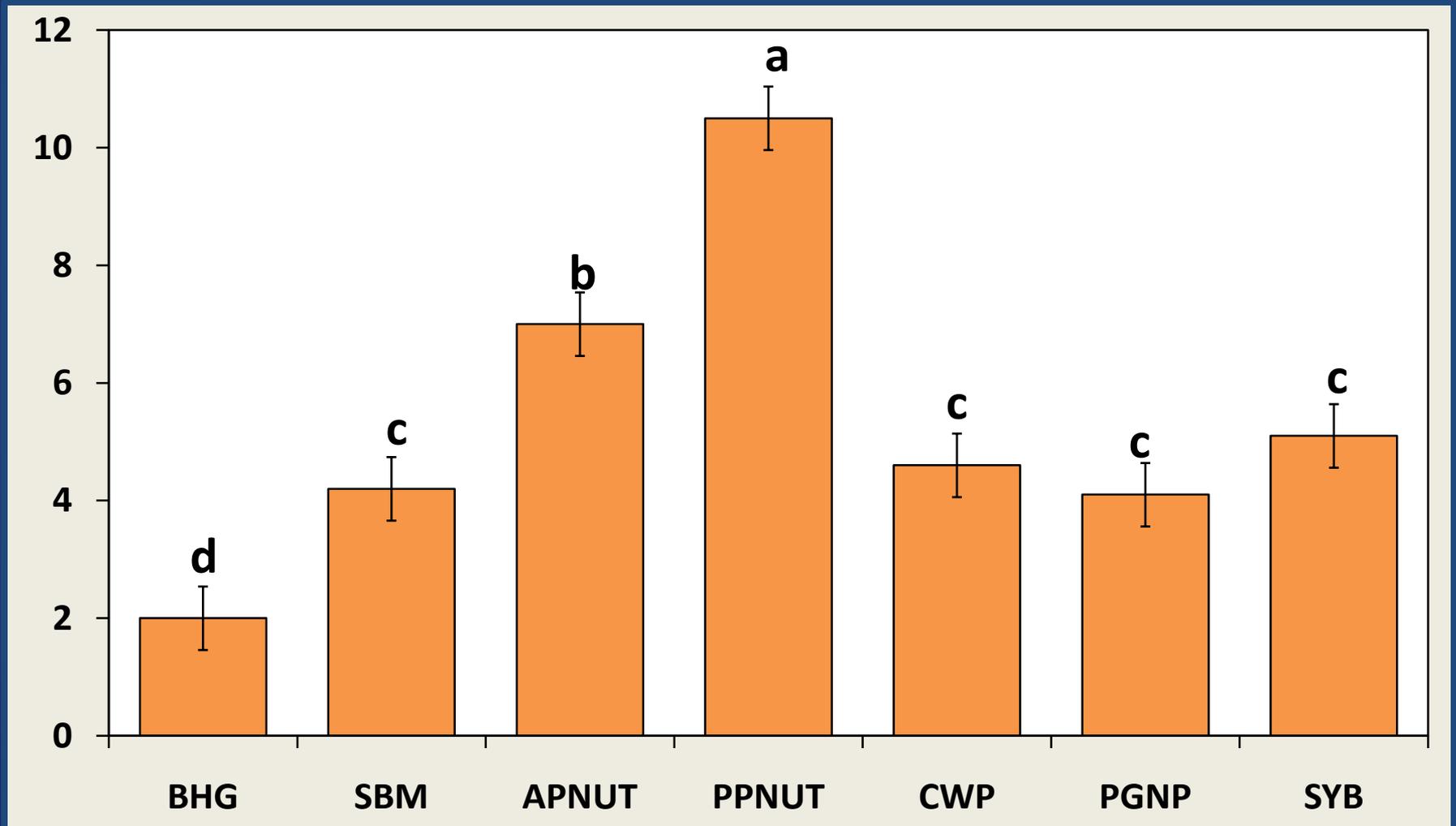
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# DM Digestibility (%)



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

<b>Forage</b>	<b>Hay production net present value, \$/ha</b>	<b>Haylage production net present value, \$/ha</b>
<b>PPNUT</b>	<b>9,320</b>	<b>11,490</b>
<b>APNUT</b>	<b>8,230</b>	<b>10,170</b>
<b>CWP</b>	<b>1,440</b>	<b>2,660</b>
<b>PGNP</b>	<b>6,660</b>	<b>8,800</b>
<b>SYB</b>	<b>7,690</b>	<b>9,730</b>

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

# 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

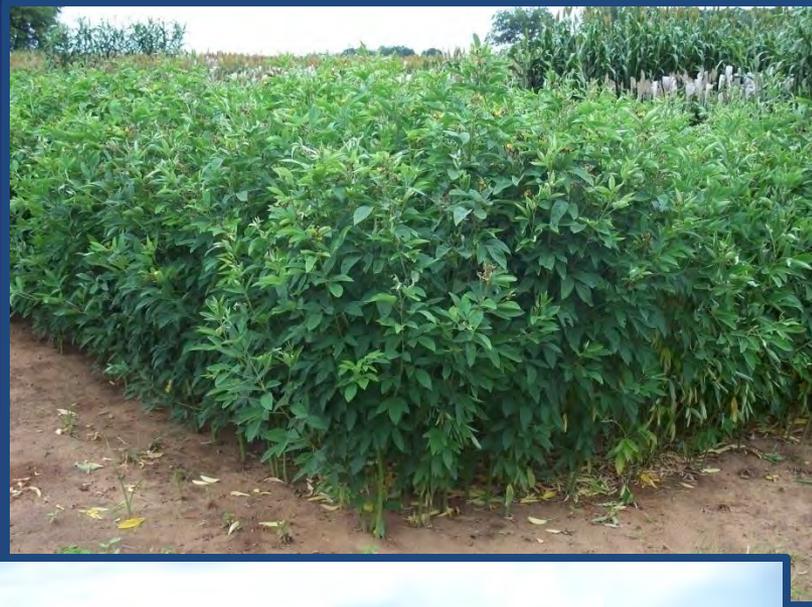
# Acknowledgements

- **USDA T-STAR**
- **Perennial Peanut Producers Association**
- **Dr. Phatak**



Questions?

# Experimental Design



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