CATTLE WEIGHT GAIN AND SWARD-ANIMAL NITROGEN RELATIONSHIPS IN GRAZED HEMARTHRIA ALTISSIMA PASTURES

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ABSTRACT
Limpograss (*Hemarthria altissima* [Poir.] Stapf et C.E. Hubb.) in vitro digestion is greater than most perennial grasses adapted to Florida. Weight gain of cattle grazing limpograss has been lower than expected due in part to low herbage N concentration. Experiments were conducted on limpograss pastures to assess N fertilization, overseeding of the legume aeschynomene (*Aeschynomene americana* L), and feeding of N supplements to cattle as means of overcoming this limitation. Greater N fertilization, overseeding aeschynomene, and supplementation (corn-urea mixtures) increased weight gain 0.30, 0.23, and 0.24-0.35 kg d^{-1}, respectively, over control treatments. Herbage digestible organic matter:crude protein ratio and cattle blood urea N concentration showed potential as predictors of response to N supplementation. Limpograss leaf blade crude protein (90-130 g kg^{-1}) was two to three times greater than stem plus sheath. Stem plus sheath:leaf ratio was more than three times as great in the bottom as in the top half of the canopy, suggesting that lower stocking rates that allow greater diet selection may increase protein concentration of herbage consumed and increase gain.

KEYWORDS
Grazing management, animal performance, plant-animal interface, forage quality

ACRONYMNS
CP, crude protein; DOM:CP, digestible organic matter:crude protein; BUN, blood urea N

INTRODUCTION
Low digestibility and intake by cattle of perennial grass pastures limit weight gain during summer in Florida. Limpograss (cv. Floralta) in vitro digestion is greater than that of most adapted perennial grasses. Initial studies of cattle performance on limpograss reported lower than expected gains and low herbage CP concentration (Sollenberger et al., 1988; 1989). Thus, three studies were conducted to determine the potential for increasing cattle weight gain by overseeding a legume into limpograss, increasing N fertilization rates on limpograss pasture, and feeding N supplements to cattle grazing limpograss. Additional objectives were to characterize limpograss canopy plant part and N distribution and to assess the use of herbage DOM:CP ratio and cattle BUN concentration as predictors of cattle response to N supplementation. This paper will review these experiments and summarize their findings.

METHODS
The experiments were conducted near Gainesville, FL (30×N lat.) from 1984 through 1993. Rainfall at the site averages 1350 mm yr^{-1} with approximately 55% of annual rainfall occurring during June through September. Soils are poorly drained, sandy Spodosols of the Pomona and Smyrna series. Floralta limpograss pastures were well established and rotationally stocked using a variable stocking rate. Grazing ended on a given paddock when stubble height was approximately 20 cm. Cattle used were crossbred yearling steers except for the study by Lima (1995) when yearling heifers were used. Initial weights were between 310 and 350 kg. Shrunk weights and blood plasma samples for BUN were obtained every 21 or 28 d (no BUN data for Rusland et al., 1988). Pastures were sampled every 2 wk to quantify herbage mass, botanical composition (for grass-legume swards), and nutritive value (by handplucked sampling to represent cattle diets).

Detailed descriptions of methods used in the three experiments have been provided by Rusland et al. (1988), Holderbaum et al. (1991), and Lima (1995). Information regarding rest periods between grazings, N fertilization rates, and duration of experiments is described in Table 1. A general description of treatments and sampling is provided below.

Rusland et al. (1988) compared N-fertilized limpograss pastures and limpograss pastures that were overseeded each year with the summer-annual legume aeschynomene. Each treatment was replicated three times in completely randomized design.

Holderbaum et al. (1991) compared N-fertilized limpograss pastures on which cattle received a) no supplement, b) 0.63 kg d^{-1} of a 21% CP corn-urea supplement, or c) 0.73 kg d^{-1} of a 50% CP corn-urea supplement. Aeschynomene overseeded into limpograss pasture was the fourth treatment. Treatments were replicated two times in a completely randomized design. Herbage above 5 cm was clipped in two strata of equal depth and separated into leaf blade and stem plus leaf sheath fractions.

Lima (1995) compared two pasture N fertilizer rates (50 or 150 kg N ha^{-1} during the grazing season) and two supplementation treatments (cattle fed no supplement or 0.79 kg d^{-1} of a 39% CP corn-urea supplement). The factorial set of four treatments was replicated twice in a completely randomized design.

RESULTS AND DISCUSSION
Overseeding with aeschynomene. In both experiments that included the legume, CP of limpograss-legume handplucked herbage was approximately three percentage units greater than that of the N-fertilized grass (Table 1; References e and f). Herbage DOM:CP ratio was 1.8 units lower for the mixed sward than grass alone in both experiments. Cattle daily gain averaged 0.23 to 0.31 kg greater when the legume was used (Table 1). Cattle BUN increased from 6.0 mg dL^{-1} for limpograss-N to 11.0 for limpograss-aeschynomene.

Supplementation with corn-urea. When limpograss pastures were fertilized with 120 kg N ha^{-1} or less, cattle receiving corn-urea supplement gained 0.24 to 0.35 kg d^{-1} more than those receiving no supplement (Table 1; References f and g). There was little additional gain from supplementation (0.03 kg d^{-1}) when pastures were fertilized with 150 kg N ha^{-1}. Supplementation with corn-urea mixtures increased cattle BUN 2.2 to 10.8 mg dL^{-1}, with greatest increases occurring when pastures received 50 kg N fertilizer ha^{-1}.

Fertilization with N. Increasing N rate from 50 to 150 kg ha^{-1} improved cattle daily weight gain 0.30 kg, comparable to gains achieved by supplementation with corn-urea mixtures (Table 1; Reference g). The higher N rate increased herbage CP, decreased herbage DOM:CP ratio, and increased cattle BUN concentration (Table 1). Considering only the four treatments described as "Nitrogen" (no legume or supplement) in Table 1, as N rate increased from 50 to 180 kg ha^{-1}, herbage CP increased from 5.3 to 8.2%, herbage DOM:CP decreased from 9.7 to 7.5, cattle BUN increased from 4.2 to 9.2 mg dL^{-1} (no data are available for the 180 N rate), and cattle daily gain increased from 0.06 to 0.39 kg (Table 1; last four lines).

Distribution of plant parts and N is important in limpograss canopies. Stem plus sheath:leaf blade ratio was 2.1 in the top half of the canopy and 7.3 in the bottom half (adapted from Holderbaum et al., 1992). Stem plus sheath CP averaged 4% and leaf blade CP averaged 10% across strata. Grazing to a 20-cm stubble, as done in these studies, may force animals to consume a high proportion of low CP stem plus sheath, thus limiting gain.

These studies show that overseeding aeschynomene, feeding low rates of corn-urea supplement, or increasing N fertilizer rate of limpograss pastures can increase cattle daily gain by approximately 0.25 to 0.30 kg. Data from these experiments support the conclusions of Hammond et al. (1993) and Moore and Kunkle (1995) that cattle BUN and herbage DOM:CP ratio have potential as predictors of response to N supplementation.

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Table 1
Summary of management practices and animal responses for experiments evaluating rotationally stocked limpograss pastures.

Treatment[a]	Fertilizer N rate	Rest period	CP[b]	Herbage DOM:CP[c]	Cattle BUN[d]	Daily Gain	Reference
	kg ha^{-1}	days	%		mg dL^{-1}	kg	
Nitrogen	180	35	8.2	7.5	NA	0.39	e
Aeschynomene	0	35	11.3	5.7	NA	0.70	e
Nitrogen	120	35	6.7	8.7	6.0	0.29	f
CP-21	120	35	6.7	8.7	8.2	0.53	f
CP-50	120	35	6.7	8.7	11.4	0.59	f
Aeschynomene	0	35	9.9	6.9	11.0	0.52	f
Nitrogen	50	28	5.3	9.7	4.2	0.06	g
CP-39	50	28	6.0	8.4	15.0	0.41	g
Nitrogen	150	28	7.0	7.7	9.2	0.36	g
CP-39	150	28	7.0	7.6	17.2	0.39	g
Nitrogen	50	28	5.3	9.7	4.2	0.06	g
Nitrogen	120	35	6.7	8.7	6.0	0.29	f
Nitrogen	150	28	7.0	7.7	9.2	0.36	g
Nitrogen	180	35	8.2	7.5	NA	0.39	e

[a]Nitrogen=N fertilizer to pasture, but no supplement; Aeschynomene=aeschynomene-limpograss association; CP-21, CP-50, and CP-39=corn-urea supplement with 21, 50, or 39% crude protein.
[b]Crude protein
[c]In vitro digestible organic matter:crude protein ratio.
[d]Blood urea nitrogen
[e]Rusland et al., 1988; Experiment conducted for 112 d during summer of 3 yr (1984-1986).
[f]Holderbaum et al., 1991; Experiment conducted for 84 d during summer of 2 yr (1987-1988).
[g]Lima, 1995; Experiment conducted for 91 d during summer of 2 yr (1992-1993).