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DAIRY COW PERFORMANCE ON PASTURE-BASED FEEDING SYSTEMS AND IN CONFINEMENT

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Abstract

Interest in grazing systems is growing among farmers in the USA as a means of reducing feed costs for lactating dairy cows. An experiment was conducted near Gainesville, FL to compare milk production and composition and milk income minus feed costs from two pasture-based systems with those of a conventional confinement housing system over a 276-d period. System 1 was based on a mixture of rye (*Secale cereale* L.), annual ryegrass (*Lolium multiflorum* Lam.), crimson clover (*Trifolium incarnatum* L.), and red clover (*Trifolium pratense* L.) during the winter-spring seasons and pearl millet (*Pennisetum glaucum* [L.] R.Br.) during the summer-fall seasons. System 2 utilized a rye-ryegrass mixture (no clover) during winter-spring and bermudagrass (*Cynodon spp*.) during summer-fall. Concurrently, cows managed in free-stall housing at the university farm comprised System 3. Cows in confined housing produced 20% more milk than cows on pasture, but feed cost of grazing cows was about one half that of confined cows. Milk income minus feed costs was $5.56, $5.84, and $5.34 cow^{-1} d^{-1} for Systems 1, 2, and 3, respectively.

Keywords: Bermudagrass, pearl millet, feed cost, intake, milk composition, nutritive value

Introduction

Use of pasture for lactating dairy cows in the USA has increased due to lower feed costs with grazed forage, reduced costs for housing and waste management, and a more favorable public perception of pasture-based than confined housing systems (Staples et al., 1994). Most research done with pasture-based systems, however, has been short term. Longer, full-lactation comparisons of pasture and confinement systems are needed. This experiment was conducted to compare pasture-based and confinement systems for lactating dairy cows over a period from January to October 1998. Objectives were: 1) to compare milk production and composition from pasture-based systems for lactating dairy cows with those of a conventional confinement housing system, and 2) to compare feed costs per unit of milk produced for the two pasture systems and a conventional confinement housing system.

Material and Methods

The experiment was performed at the University of Florida Dairy Research Unit in Hague, located about 20 km north of Gainesville, Florida (30^{o} N latitude and 82.5^{o}W longitude). System 1 included a mixture of rye, ryegrass, and crimson and red clover during the winter-spring seasons and Tifleaf 2 pearl millet during the summer-fall. System 2 utilized rye-ryegrass mixtures during winter-spring and Tifton 85 bermudagrass during summer-fall. Concurrently, cows fed a total mixed ration and managed in free-stall housing comprised System 3.

Two pasture systems were replicated four times in a randomized block design. Pasture size for each experimental unit was 1.2 ha with 0.8 ha of this area being grazed during winter-spring and 0.4 ha being grazed during summer-fall. Three multiparous Holstein cows were assigned to each pasture for a base stocking rate of 3.75 cows per hectare during winter and 7.5 cows per hectare during summer (based on data from Sollenberger et al., 1995), and a total of 12 cows per pasture system. Sixteen cows were assigned as controls in the free-stall facility, for a total of 40 cows in the experiment.

The grazing period was from January to October 1998. Pastures were rotationally stocked. A 1-d grazing period was used with a 28-d rest period during winter-spring and a 21-d rest period during summer. Target postgraze stubble heights for bermudagrass and millet were 20 and 15 cm, respectively.

Pasture fertilization totaled 280-17-99 kg ha^{-1} of N-P-K on System 1 and 360-17-99 on System 2. Nitrogen was applied as ammonium nitrate at rates of 40 kg N ha^{-1} at each application.

Handplucked herbage was collected to determine nutritive value. Voluntary intake by cows on pasture was measured once during winter (average of 81 d in milk) and once during summer (178 d in milk) using a pulse dose technique (Pond et al., 1989).

Supplement was fed at a rate of 1 kg (as-fed) for each 2.5 kg of milk produced during winter and 1:2 during the summer. The average composition was 17.5% CP, 36.4% NDF, 24.7% ADF, 7.3% fat, 1.13% Ca, 0.4% P, and 1.25% K, with an NEL of 1.86 Mcal kg^{-1} DM.

Results and Discussion

Cows in confined housing produced an average of 20% more milk than cows on the pasture systems (Table 1); milk production was greater than that observed by Vilela et al. (1996) in Brazil for cows grazing Costcross bermudagrass (20.6 vs. 16.6 kg cow^{-1} d^{-1}) but receiving less concentrate in their diet. Milk yield did not differ between grazing systems, nor did milk fat (3.65%), milk protein (2.93%), and milk urea nitrogen (16 mg %) concentrations among the three systems tested. Grazing cows lost 0.19 (System 2) and 0.26 kg d^{-1} (System 1), while confined cows gained 0.13 kg d^{-1} of body weight. Grazing cows had more days open (177 vs. 136 d) and required more services per conception (3.3 vs. 2.1) than confined cows (Table 1).

There were no differences between grazing systems in either winter or summer for forage or total DM intake (Table 2). Barn cows consumed about 8% more total DM than grazing cows. Forage intake from pasture was approximately 55% of total intake (Table 2), while Vilela et al. (1996) reported intake of 11.6 kg DM cow^{-1} d^{-1}, about 80% of total intake.

There were no differences in herbage mass between pasture systems during winter through early August, but after that bermudagrass had greater herbage mass than pearl millet. Herbage digestibility, CP, and NDF concentration were similar between grazing systems during winter, but NDF concentration of bermudagrass herbage was greater than that of pearl millet during summer (Table 2). Pearl millet herbage CP was greater than that of bermudagrass during August and September, resulting in a trend ($P=0.14$) toward greater CP in pearl millet during summer (Table 2).

Although confined cows produced 20% more milk than grazing cows, the feed cost of grazing cows was about one half that of confined cows. Milk income minus feeding costs was \$5.56, \$5.84, and \$5.32 cow^{-1} d^{-1} for Systems 1 (pearl millet), 2 (bermudagrass), and 3 (confinement), respectively (Table 1). Vilela et al. (1996) in Brazil reported no difference in gross margin per cow in free-stall cows and in bermudagrass pastures. Data from the current experiment show no animal production or economic benefit of using pearl millet instead of bermudagrass during summer. This is likely due to the shorter season of production and greater cost of millet versus bermudagrass systems, and to the relatively high amount of concentrate fed in this study. The latter likely reduced the impact of the higher nutritive value of pearl millet.

These data suggest that reduction in feed costs and potentially greater milk income over feed costs are reasons for considering pasture-based systems for dairy cows in north central Florida.

References

Pond, K.R., Burns J.C., Fisher D.S. and Quiroz R.A. (1989). Appropriate markers and methodology for grazing studies. p. 62-66. *In* Proc. 42nd Southern Pasture and Forage Crop Improvement Conference. Dept. of Animal Science, N. C. State University, Raleigh, NC.

Sollenberger, L.E., Chambliss C.G., Wright D.L. and Staples C.R. (1995). Warm-season forages and pasture management for dairy cows. p. 46-57. *In* Proc. Dairy Prod. Conf., 32nd, Gainesville, FL, Apr. 1995. Inst. Food Agric. Sci., Univ. of Florida., Gainesville, FL.

Staples, C.R., Van Horn H.H. and Sollenberger L.E. (1994). Grazing for lactating cows – a step ahead or two-steps back? p. 76-82. *In* Proc. Dairy Prod. Conf. 31st , Gainesville, FL, Inst. Food Agric. Sci., Univ. of Florida, Gainesville, FL.

Vilela, D., Alvim M.J., Campos O.F. and Rezende J.C. (1996). Milk production of cows in free stall or grazing on coast-cross pasture. R. Soc. Bras. Zoot., **25**:1228-1244.

Table 1 - Seasonal average of milk yield, milk income over feed cost, daily liveweight (LW) change, days open, and services per conception on pasture sustems for grazing

ystem†	Raw milk	Difference milk income over feed cost	LW change	Days open	Services per conception
	kg cow^{-1} d^{-1}	\$ cow^{-1} d^{-1}	kg d^{-1}		
1	25.2 b	5.56 a	-0.26b	183 b	3.3 b
2	25.0 b	5.84 a	-0.19b	172 b	3.3 b
Barn	29.8 a	5.32 a	+0.13a	136 a	2.1 a

† System 1 = rye-ryegrass-clovers/pearl millet and System 2 = rye-ryegrass/bermudagrass

Table 2 - Intake, pregraze herbage mass, and average forage nutritive value of handplucked herbage across evaluation dates within seasons of on pasture systems for grazing.

Response Variable	Period	System 1†	System 2	SE	P-value
Total Intake	Year	21.9	21.8	3.1	0.91
kg DM cow^{-1} d^{-1}	Winter	24.7	24.8	2.9	0.95
	Summer	19.1	18.9	3.1	0.86
Forage Intake	Year	12.1	11.9	2.8	0.73
kg DM cow^{-1} d^{-1}	Winter	13.3	13.5	2.8	0.87
	Summer	10.9	10.3	2.8	0.59
Herbage mass	Year	2470	3250	386	0.35
Kg DM ha^{-1}	Winter	2330	2370	375	0.47
	Summer	2670	4490	402	0.19
Forage IVOMD	Year	721	711	14.5	0.52
g kg^{-1} OM	Winter	749	753	14.3	0.75
	Summer	681	652	14.8	0.21
Forage CP	Year	238	223	14.0	0.46
g kg^{-1} DM	Winter	248	247	13.8	0.69
	Summer	223	190	14.4	0.14
Forage NDF	Year	516	583	21.1	0.15
g kg^{-1} DM	Winter	466	481	20.8	0.26
	Summer	586	726	21.6	0.0002

† System 1 = rye-ryegrass-clovers/pearl millet and System 2 = rye-ryegrass/bermudagrass