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DAIRY CATTLE PERFORMANCE ON OASIS PHALARIS, LOW-ENDOPHYTE KY-31 FESCUE, AND WINTER ANNUALS

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DAIRY CATTLE PERFORMANCE ON Oasis Phalaris, Low-Endophyte Ky-31 Fescue, and Winter Annuals

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PASTURE CONTINUES to be a major source of forage for many dairy producers nationwide and especially in Alabama. Temporary winter pastures have traditionally been used because they can fit into a two-crop system, provide a nutritious forage, and excess growth can be ensiled or hayed.

Research studies with dairy cattle on temporary pastures in the United States are limited, but rye-ryegrass-legume yield tests have shown these to be especially productive winter pastures in Alabama. More problems are encountered with cows "bogging down" during wet seasons on temporary pastures than on permanent pastures. Tall fescue (*Festuca arundinacea Shreb*) is a perennial grass, is widespread throughout Alabama, and is predominantly of the Kentucky-31 (Ky-31) variety. Despite its widespread availability, Ky-31 fescue has never been considered a satisfactory forage for dairy cattle.

During the past 10 years, problems with animal performance on fescue have been studied extensively. The presence of the fungus *Acremonium coenophialum*, an endophyte in a high percentage of fescue pasture, has been shown to reduce animal performance. The identification of this fungus as a problem in fescue and the subsequent propagation of low-endophyte fescues have caused renewed interest in tall fescue as a pasture. With low infestations, fescue has been shown to be an excellent pasture for beef cattle (*3,4*). Dairy cattle are evidently affected at low levels of the endophyte (*1*), but environmental temperatures have a major effect on toxicity (2). Most studies with dairy cattle have involved green chop, rather than grazing. Several low-endophyte varieties of fescue show promise for use in pasture.

Phalaris (*Phalaris aquatica* L.) is a cool season perennial grass which has shown considerable promise as a pasture forage. Although

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not adaptable to north Alabama, Oasis phalaris, a new cultivar developed at the Alabama Agricultural Experiment Station, made higher forage yields than Ky-31 fescue during a 2-year comparison (5). Average daily gains for steers were similar to those obtained on high quality small grain pasture (5) or low endophyte Ky-31 fescue (3), but carrying capacity was lower on phalaris grass than on low-endophyte fescue (4).

Little information is available to compare the performance of dairy cattle grazing pastures consisting of fescue, phalaris, or annuals. This report summarizes the results of three experiments conducted at the Black Belt Substation in west-central Alabama to evaluate the performance of dairy cattle on these pastures.

EXPERIMENTAL PROCEDURES AND RESULTS

Oasis Phalaris vs. Gulf Ryegrass for Lactating Cows

PROCEDURE. Milk production and grazing capacity were compared during 1976-77. Three 2-acre paddocks of phalaris grass were established on predominantly calcareous soils during the fall of 1976. Three adjacent paddocks were established in Gulf ryegrass during the falls of 1976 and 1977. In the spring of each of the 2 years, following a 10- to 12-day standardization, 12 lactating Holstein cows were paired according to milk production. Six cows were assigned to each of the two types of pasture (two cows per paddock) for a 6-week study from late March to early May. The cows grazed continuously except for 2 hours twice each day when removed for milking. At this time, the cows received a 16 percent protein grain mix, table 1, at the rate of 1 pound per 3 pounds of 4 percent fat-corrected milk (FCM). Each

TABLE 1. COMPOSITION OF EXPERIMENTAL GRAIN MIXTURE FED TO COWS ON PASTURE STUDIES

Ingredients	Percent
Ground corn	45.0
Ground oats	20.0
Ground wheat	15.0
Cottonseed meal	13.6
Soybean meal	3.2
Urea	.4
Dehydrated alfalfa meal	1.4
Limestone	.8
Mineral supplement[1]	.6
Crude protein, pct. of dry matter	*16.0*

[1]Commercial supplement containing 14 percent calcium, 5 percent phosphorous, 2.5 percent magnesium, and 13 percent salt.

paddock was grazed by additional cattle as needed to maintain similar availability of forage among paddocks and to determine grazing capacity. Milk was weighed at each milking and a composite a.m.-p.m. milk sample taken weekly to determine butterfat content. Milk production data were analyzed by least squares analysis with SAS procedures. Treatment means for actual milk, butterfat, and fat-corrected milk production were adjusted by covariance analysis using pretreatment measurements.

RESULTS. The evaluation of the two pastures and production response on the pastures are reported in table 2. More ryegrass forage was available than on phalaris pasture, which allowed a heavier stocking rate (1.5 versus 1.3 cows per acre).

Total milk production was greater on phalaris pasture than on ryegrass (67.5 pounds versus 64.2 pounds per cow per day), but butterfat content was higher on ryegrass than phalaris (4.08 versus 3.87 percent). This resulted in the 4 percent fat-corrected milk being higher for cows on ryegrass compared to cows on phalaris grass, but the difference was not significant.

Differences in milk production between cows on the two pastures did not appear during the second week, table 3. Differences in butterfat composition were not significant until the fifth week, although this trend started during the third week. This drop in milk production with a corresponding increase in butterfat over time could be due to increased maturity of the ryegrass. Maturity and dry matter

TABLE 2. COMPARISON OF PHALARIS AND RYEGRASS PASTURE FOR DAIRY CATTLE

Item	Phalaris	Ryegrass	SE
PASTURE EVALUATION			
Stocking, cows/acre			
Lactating cows	1.0	1.0	
All cows	1.3	1.5	
Cow days/acre			
Lactating cows	42	42	
All cows	52	60	
Grass height, inches			
Start of study	9.68	13.3	
End of study	6.3	8.3	
Maturity (DM%)			
Start of study	vegetative (15.5)	vegetative (14.8)	
End of study	vegetative (16.4)	late boot (19.3)	
PRODUCTION RESPONSE			
Milk production, lb./day	67.5a[1]	64.2b	1.5
Butterfat, pct.	3.87a	4.08b	.09
Fat-corrected milk, lb.	63.6	67.1	1.5
Gain, lb./day	2.4	2.1	.5

[1]Means within rows with unlike superscripts differ ($P<.05$). Standard error of least square means.

TABLE 3. MILK YIELD AND MILK FAT AS AFFECTED BY TIME COWS WERE ON PASTURE

Time on pasture	Milk, lb./day		Milk fat, pct.	
	Phalaris	Ryegrass	Phalaris	Ryegrass
Standard	67.8	68.2	4.20	4.26
Week 1	64.9a[1]	67.8b	4.12	4.13
Week 2	67.5	67.8	4.12	4.13
Week 3	70.8a	66.4b	3.81	4.08
Week 4	70.0a	64.2b	3.81	4.08
Week 5	67.5a	60.5b	3.70a	3.98b
Week 6	64.7a	59.4b	3.73a	3.98b

[1]Means within milk or butterfat rows with unlike superscripts differ.

content were essentially the same at the start of the study, but ryegrass was more mature at termination, table 2.

Ryegrass is an annual pasture commonly used in Alabama. These studies indicate that milk production as high or higher can be obtained on phalaris grass as on ryegrass. There was less damage to the sod due to cow movement during wet weather in the permanent phalaris than on the annual grass pasture.

Low-Endophyte Fescue vs. Phalaris Grass, Annual Pasture, or Corn Silage for Lactating Cows

Two separate studies were conducted. Study A compared low-endophyte fescue with phalaris grass and Study B compared low-endophyte fescue with corn silage feeding.

STUDY A PROCEDURES. Milk production and grazing capacity of phalaris and Ky-31 fescue were compared in a 3-year study during 1981-84. Oasis phalaris and low-endophyte (6.6 percent infestation) Ky-31 fescue were each established in three 2-acre adjoining paddocks during the fall of 1980. During fall (October - December) 1981 and during the following three springs (late March - early May), 12 cows were paired and assigned to each of the pasture treatments. They were handled and fed as outlined for the comparison of Oasis phalaris and Gulf ryegrass described earlier. Due to prolonged dormancy of phalaris grass or lack of lactating cows, a comparison of milk production was not conducted in the fall of 1982 and 1983. During the lactation studies, additional cattle were grazed, as needed, to maintain similar forage growth. Total grazing days were determined during the fall periods when a lactation study was not conducted, as well as during the lactation studies.

RESULTS. The evaluation of fescue versus phalaris pastures is given in table 4. The percentage of forage of the respective grasses,

TABLE 4. EVALUATION OF PHALARIS AND KY-31 FESCUE

Item	Phalaris	Ky-31 fescue
Percentage of forage[1]	98-98-100	98-96-88
Ground cover[1]	93-98-100	98-94-91
Grass height (inches)		
Fall: start of study	5.2	4.8
end of study	4.1	3.1
Spring: start of study	4.7	4.1
end of study	3.8	5.4
Maturity		
Fall: start/end	vegetative	vegetative
Spring: start of study	vegetative	vegetative
end of study	vegetative	early boot
Stocking rate, cows/acre[2]		
Lactating cows	1.0	1.0
All cows	1.24	1.21
Calendar days grazed/year	99	123
Cow days/acre	122	150

[1]In years 1982, 1983, 1984, respectively.
[2]Yearly stocking and grazing rates. Includes two fall grazing periods (one fall lactation study). Summer dormancy prevented phalaris grazing in the third fall period. Neither pasture was evaluated that period.

ground coverages, height, and maturity are similar except that fescue was taller and more mature at the end of the spring trials than was phalaris grass. The stocking rates with lactating cows and all cows were almost identical for both pastures. However, summer dormancy delayed grazing phalaris grass during the fall, which resulted in more total days grazing on fescue.

Milk production (actual and FCM) was significantly higher on Ky-31 fescue than on phalaris grass during the one fall trial, but butterfat composition was not affected, table 5. This difference in production occurred during the 1982 spring trial but not thereafter. The lack of difference during the last two spring periods could have been due to the fescue maturing earlier during those years. No difference existed between milk production performance when data over the 3-year period were analyzed together. Milk per acre varied considerably from season to season and between the two types of grasses. However, the values in table 5 do not include the 1983 fall period when fescue was grazed but phalaris was not grazed due to prolonged dormancy. These results indicate that milk production on low-endophyte fescue can at least equal that on phalaris, but grazing potential is better on fescue than phalaris during fall periods.

STUDY B PROCEDURES. During fall 1983 and spring 1984, a study comprised of two 8-week periods was conducted to compare production among cows on low-endophyte Ky-31 fescue pasture and those on a drylot feeding regime. Twelve cows were assigned to

TABLE 5. THREE-YEAR SUMMARY: PHALARIS AND FUNGUS-FREE KY-31 FESCUE GRAZING WITH LACTATING DAIRY ANIMALS, BLACK BELT SUBSTATION

Item	Fall 1981[3] 11/10-12/21		Spring 1982 3/3-4/27		Spring 1983 3/7-5/1		Spring 1984 3/12-5/6		3-year average	
	Phalaris	Fescue	Phalaris	Fescue	Phalaris	Fescue	Phalaris	Fescue	Phalaris	Fescue
Calendar days, no.	42	42	56	56	56	56	56	56	70	70
Cow days/acre	49	49	108.5	98	73	60.7	72.3	86.3	100.9	98
Milk, lb./day	53.9a	61.4b	62.7	67.1	63.4	61.1	61.4	58.3	60.3	62.0
Butterfat, pct.	3.66	3.66	3.57	3.78	3.64	3.78	3.62	3.67	3.62	3.72
FCM, lb.	52.4a	59.2b	59.2	64.7	58.7	58.3	58.5	55.2	57.2	59.4
Av. persistency, pct.	96.9	98.2	99.6	100	100	99.6	98.7	97.4	98.9	98.9
FCM milk/acre, lb.	2565	2900	6420	6338	4288	3538	4230	4765	5647	5711
Body wt. changes/cow, lb.	−32	10	30	58	25.8	−16	14	63.5	—	—

[1]Study was not conducted during the fall of 1982. Dormancy of phalaris prevented grazing in the fall of 1983, but fescue was grazed for 49 calendar days (October 25, 1983-December 12, 1983) to provide 72.3 grazing days per acre not included in the above table.

[2]Data for milk production are least square means adjusted by covariance for production preceding the trial.

[3]Means within this time period with unlike superscripts differ.

either graze low-endophyte Ky-31 pasture or receive a corn silage-based diet in an experimental barn. Cows on the pasture were handled as previously described. The drylot cows were kept in the drylot continuously except during milking. Corn silage was fed individually, free choice, behind Calan Brodbent electronic doors. The same 16 percent crude protein grain mix was fed individually to both groups. The amount of grain allotted was based on the ratio of 1 pound per 2½ pounds 4 percent FCM, but the amount given the corn silage group was reduced by the amount of 48 percent soybean meal needed to increase the protein content of the grain mix to 20 percent. This additional soybean meal was fed with the corn silage. Feed intake was determined daily on silage and grain.

RESULTS. Table 6 gives actual milk, butterfat percentage, and fat-corrected milk produced when cows received either low endophyte fescue or corn silage as the forage. Actual milk production for the two periods combined was lower for cows grazing fescue than those fed corn silage. The difference was not significant through week five when data were combined for the two periods. However, production was significantly lower for cows on pasture by the third week during the fall period but not until the sixth week for the spring period. Butterfat percentage varied but there were no consistent trends. Butterfat percentage often decreases when cows are first placed on pasture, but this did not occur during either period of this study. The FCM values were similar to actual milk production, with lower production on pasture than corn silage during the last 3 weeks of the trial. The average FCM for the entire trial did not differ due to lower butterfat in cows fed corn silage during the first few weeks of the study. The decreased production for cows on pasture probably re-

TABLE 6. PRODUCTION PERFORMANCE OF COWS RECEIVING FESCUE PASTURE (FP) OR CORN SILAGE (CS) AS THE PRIMARY FORAGE[1]

Week	Actual milk, lb.		Butterfat, pct.		Fat-corrected milk, lb.	
	FP	CS	FP	CS	FP	CS
1	52.1	50.8	3.6	3.5	48.6	46.8
2	51.5	49.9	3.6a	3.3b	48.6a	44.9b
3	51.3	52.4	3.7	3.5	49.3	48.0
4	51.5	52.6	3.7	3.7	49.3	49.9
5	51.0	53.0	3.7	3.7	48.4	50.1
6	49.7a[2]	53.5b	3.5	3.7	46.2a	50.1b
7	47.5a	52.4b	3.4a	3.6b	42.9a	48.8b
8	44.9a	53.2b	3.4	3.6	40.7a	49.9b
Overall	49.9a	52.4b	3.6	3.6	46.6	48.6

[1]Least square means adjusted by covariance for production preceding the trials. Data represent two 8-week periods run on 10/25/83 to 12/19/83 and 3/12/84 to 5/6/84.

[2]Values within variable rows with unlike superscripts differ ($P<.05$).

flected lower intake, nutrient content, and/or palatability of pasture as dry matter intake of concentrates was similar for the two periods on pasture (18.0 and 15.6 pounds) and corn silage (16.9 and 16.1 pounds). Protein of the fescue pasture was 19.8 percent at the start of the fall study but varied from 12.4 to 15.4 percent during the last 6 weeks. Although other nutrient contents were not determined, energy content often parallels protein content. Corn silage nutrient content for the same period remained at 7.5 percent CP and 0.68 megacalories of net energy-lactation per pound.

The results during the first few weeks of the study indicate that production on fescue pasture can be similar to that obtained from corn silage. However, lower production is obtained on fescue as forage maturity increases. Endophyte levels as low as 6 percent have been reported to depress milk production (*1*). Even though the endophyte level in this study was 6.6 percent infected, maturity was probably more of a factor in the depressed production. Cows grazing fescue pasture in earlier studies had produced at levels similar to cows grazing phalaris pasture, which in other studies had shown similar performance in relation to traditional ryegrass pasture.

Oasis Phalaris Grass vs. Conventional Drylot System for Replacement Heifers

PROCEDURES. In February 1980 and 1981, heifers born the previous fall were assigned to either an older or younger age group (15 were 178 days old and weighed an average of 308 pounds each and 21 were 103 days old and averaged 201 pounds). Subsequent growth and development of calves in both age groups were evaluated during an initial phase of drylot with free choice johnsongrass hay versus phalaris grass pasture (Phase I, approximately February - May). Following Phase I, all calves were moved to a dallisgrass pasture (Phase II, approximately June - November). Although there were no treatment differences during Phase II, this allowed an evaluation of any long-term effects of Phase I. Grain mixes were provided as shown below:

Phase	*Feed group*	*Pounds grain mix*	*Pct. protein of grain mix*
	OLDER HEIFERS		
I	johnsongrass hay	5	18.7
	phalaris pasture	0	
II	dallisgrass	5	12.0
	YOUNGER HEIFERS		
I	johnsongrass hay	5	20.0
	phalaris pasture	3	20.0
II	dallisgrass pasture	4	12.0

The heifers of both age groups were weighed at the beginning of the study and every 28 days. Weight data for the two treatment groups were compared using least squares analyses with adjustments for initial body weight by covariance.

Economic analysis of the different regimens were calculated with the following prices: phalaris grass, $149.40 per acre; dallisgrass, $122.18 per acre; grain mix, $160.00 per ton; and johnsongrass hay, $75 per ton.

RESULTS. The effects of the different feeding regimens on growth, cost, and other factors are given in table 7. Results were similar for all weighings so values are given for only day 84 (time at which groups went on dallisgrass pasture) and day 266. Due to available numbers, growth data for the two age groups were combined for analyses. Although growth appears to be better for calves on phalaris pasture than drylot during Phase I, the differences were not signifi-

TABLE 7. THE EFFECTS OF FEEDING REGIMEN AT AN EARLY AGE ON GROWTH AND COST FOR DAIRY HEIFERS

Item	Result, by feeding regime and age					
	Phalaris pasture			Dry lot		
	Younger		Older	Younger		Older
PHASE ONE						
Number	12		7	9		8
Initial age, days	110		178	98		178
Initial wt., lb.	205		316	189		300
Days on phase one	118		118	88		88
Grain/head/day, lb.	3		0	5		5
Hay/head/day, lb.	0		0	5.4		7.8
Cost/lb. of gain, $	.30		.28	.45		.48
Body wt., lb. after 84 days	—	397	—	—	3.80	—
ADG, lb.	—	1.71	—	—	1.54	—
PHASE TWO, dallisgrass pasture						
Days grazed	148		148	178		178
Stocking rate/acre	1.39		1.40	1.39		1.40
Gain/acre, lb.	335		321	400		425
Grain/head/day, lb.	4.0		5.0	4.0		5.0
Weight, 365 days	651		—	634		—
Weight, 440 days	—		740	—		719
Cost/lb. of gain, $	.47		.55	.49		.45
ADG, lb.	—	1.63	—	—	1.65	—
COMBINED PHASES						
Total grain/head, lb.	959		735	1,154		1,279
Feed and pasture costs, $	172.54		174.50	193.63		206.98
Cost/lb. of gain, $	.39		.44	.45		.48
Final wt., lb.	—	690	—	—	677	—
ADG, lb.	—	1.67	—	—	1.63	—

[1]Least square means for 84 days, combination of two groups.
[2]Least square means, day 84 through 266, combination of two groups.
[3]Least square means, day 1 through 266, combination of two groups.

cant. The same trend existed both years and approached a significant difference (P = .10) during the first year of study. Pasture for calves the age of the young group has never been recommended, but their growth on pasture also exceeded that of calves in drylot. Although analyses of the pasture were not conducted, it should be noted that these pastures were lush and of excess supply to the calves. Calves continued to grow satisfactorily throughout the second phase during which all calves were on dallisgrass pasture. Average daily gains were not different during Phase II nor when both phases were combined.

Due to the cost of grain and hay for the drylot system, total feed costs were considerably higher for drylot-fed calves than calves pastured, regardless of calf size. Labor was not considered in calculating costs, but would not be much less for pastured calves since these calves were fed grain daily except for the older group during Phase I. Regardless of whether grain was fed, some daily observation is needed for calves of this age.

The final body weights of these calves equaled or exceeded the National Research Council's (6) recommendations for Holsteins. This indicates that high quality pasture can be a viable option for growing calves at a very early age. However, this requires that the pasture be of exceptionally high quality and of plentiful supply, and that younger animals be supplied with a grain mixture.

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