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Research Summary

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Intramammary Antibiotic Therapy on Postpartum Milk Production, Milk Quality and Intramammary Infection Levels in Dairy Heifers

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Introduction. Mastitis has been shown to occur in the developing mammary glands of preparturient dairy heifers. Intra-mammary infusions of commercially available antibiotics have been shown to decrease the number of mastitis pathogens in dairy heifers during the early postpartum period. However, the effects of prepartum intramammary infusions on postpartum milk production and milk quality are mixed.

A recent study involving both Holstein and Jersey heifers was conducted at the Hill Farm Research Station, the LSU Agricultural Center campus dairy and the Southeast Research Station to investigate the effects of different strategies of intramammary antibiotic treatment on milk production and quality in dairy heifers.

Procedures. In this study conducted during the fall of 2004, 75 Holstein and Jersey heifers from all three dairy herds were randomly assigned to one of two treatment groups or to an untreated control group. Treatments consisted of a dry cow antibiotic therapy administered at either 60 days or 30 days pre-partum.

Aseptic quarter secretions were obtained from all animals immediately prior to treatment and prior to the 12th milking postpartum. Aseptic quarter secretions were obtained from control heifers at 60 and 30 days prepartum and prior to the 12th milking postpartum. All samples were analyzed at the Hill Farm Mastitis Research Lab. Composite milk samples were obtained from each animal prior to 3rd milking postpartum and at each subsequent milking until the animal was designated free from antibiotics using the Delvo-P antibiotic residue test.

All samples were tested for the presence of any of four major mastitis causing pathogens; *Streptococcus agalactiae*, environmental streptococcus organisms, *Staphylococcus Aureus* and coagulase positive *staphylococcus* species.

Results. Results indicated that both 30 day and 60 day prepartum treatments were effective in lowering postpartum infection rates for coagulase positive *staphylococcus* species and all mastitis pathogens tested as compared to the untreated controls. Both 30 day and 60 day prepartum dry cow treatments completely eliminated *Staphylococcus Aureus* infections in quarters identified with *Staph. Aureus* infections prior to treatment. The 30 day treatment group also appeared to have higher milk production and lower somatic cell counts in early lactation as compared to the untreated controls or the 60 day treatment group. None of the animals in the study tested positive for antibiotic residues past the 6th milking postpartum.

Pre-partum treatment of dairy heifers with a commercially available dry cow intra-mammary infusion product is recommended as a method to reduce postpartum mammary infection rates and lower somatic cell counts in herds experiencing problems with high somatic cell counts or elevated intra-mammary infection rates in early lactation dairy heifers.

Table 1. Dry-cow antibiotic treatment of dairy heifers to control mastitis.

	Treatments					
	Control		30-day pre-calving		60-day precalving	
Infected quarters, %	Pre-treat	Post-treat	Pre-treat	Post-treat	Pre-treat	Post-treat
Observations	23		23		23	
Organism (% of total):						
<i>Staph. Aureus</i>	13.9	7.8	1.8	0.0	6.7	0.0
<i>CNS</i>	27.0	23.5	20.5	5.4	33.3	14.0
<i>Environ. Strep.</i>	2.0	3.0	8.0	0.0	7.6	0.0
<i>Coliforms</i>	0.0	2.0	0.9	0.0	0.0	0.0
Total quarters infected, %	43.6	36.3	34.3	5.4	47.6	14.0
SCC score, 1st lactation	2.6		2.1		2.7	
Milk yield, ME/lactation						
1 st lactation (observations)	23,039 (23)		23,505 (23)		22,932 (23)	
2 nd lactation ¹	21,891 (19)		24,170 (21)		22,248 (23)	
3 rd lactation	22,297 (8)		24,679 (5)		23,545 (11)	
Average, ME/lactation	22,409		24,118		22,908	

¹ Two groups (control and 60 days) had lower 2nd lactation production. All of these animals calved to begin their second lactation between August 2005 and December 2005 (immediately post-hurricane Katrina). Most of the animals used in this study came from the Southeast Research Station which experienced a 2000 pound decline in RHA in the year following the hurricane.

Dairy Waste Lagoon Clean-outs on Southeast Louisiana Dairy Farms: Costs and Returns

Ronnie Bardwell, PhD, Area Dairy Agent and Vinicius Moreira, Asst. Professor, Southeast Research Station

Introduction. In 1989, one cell waste lagoons were being installed on dairy farms in Southeast Louisiana. Many were new installations, but the majority was established two-stage, aerobic and anaerobic cell lagoons, that were being modified with cost shared dollars. These types of waste lagoon installations continued until 2000. As part of the best management practices (BMP) on dairy farms, waste lagoons were designed to hold solids for four years. However, dairy lagoon cleaning requires expensive agitators, pumps, and piping that most dairymen do not possess. Though custom clean-out services are available, costs are quite prohibitive particularly in an era when dairy production costs often outstrip returns.

Procedures. In 2001, monies became available through the Lake Ponchartrain Restoration Act for the purpose of improving the water quality of the Lake. This Act established the Lake Ponchartrain Basin Foundation which designated \$100,000 per year to establish a cost-share program for dairymen in the Florida parishes of Southeast Louisiana, the northern end of Lake Ponchartrain. This 75% cost share program was used to maintain the dairy waste lagoon, a BMP, which allowed dairymen to utilize the solids by pumping onto pasture and cropland. Waste lagoon water and soil samples from pastures were collected so analyses could be utilized to calculate a nutrient management program for each farm. Maintenance on these waste lagoons was scheduled for every four years.

Results. Since 2001, 128 dairy waste lagoons have been pumped and manure incorporated into pastures and cropland. There were 19 in Washington Parish and 109 from Tangipahoa and St. Helena parishes. This represents 117 different dairy farmers. The average amount of manure removed per lagoon was 624,918 gallons. Manure was applied to approximately 23 acres per farm. The average cost for pump-out per lagoon was \$5,000. The producer's cost was \$1,250 (25%) and the Lake Ponchartrain Basin share was \$3,750 (75%). Manure fertilizer value was approximately \$2840 per farm and based on current N, P, and K costs (See calculations below.). So, the average producer realized a 227% return on his initial \$1500 cost share investment.

When analyzing benefits from this successful program, two are immediately evident. First, all manure was contained on the farm and not in waterways of Louisiana and, secondly, dairy farmers received twice the amount of their cost share dollars based on the fertilizer value of manure applied to their pastures and croplands. However, it is important to realize that without the cost share, manure fertilizer value would have only been a little more than half the cost required for producers to pump out lagoons.

This lagoon clean-out program is managed through the USDA's Natural Resources Conservation Service. The LSU Ag Center participates by making certain dairy farmers are aware of the program and by facilitating waste lagoon water and soil samples collections.

Estimated nutrient value per 1,000 gallons of manure:

Nutrient	\$
N	\$ 2.88
P	\$ 0.93
K	\$ 0.73
NPK	\$ 4.54

ASSUMPTIONS:

- * Fertilizer values are based on:
- N from Ammonium Nitrate @ \$403/ton
- P from Triple Phosphate @ \$405/ton
- K from Potash @ \$315/ton
- 65% N availability
- 8.34 lbs/gal

Estimated average manure nutrient composition/content (as is):

Nutrient	Averages	unit
N	4,675	lbs hauled
N	0.10	%
P	3,036	lbs hauled
P	0.06	%
K	1,734	lbs hauled
K	0.04	%
Manure	624,918	gals hauled
Manure	5,211,812	lbs hauled

Costs:

\$ 0.008	per gallon pumped (real cost)
\$ 4,999.34	cost for the average pumpout
25	% is producer costs
\$ 1,249.84	out of pocket for the farmer
2.27	return on the investment
\$ 2,839.85	average nutrient worth pumped out (per event)
\$363,501.04	overall nutrient worth pumped out (total from 2001-2007)

Note: The authors wish to gratefully acknowledge the NRCS offices in Washington, Tangipahoa, and St. Helena Parishes for providing information on producer participation and lagoon nutrient composition.

Evaluation of Multiple-Stage Lagoons and Constructed Wetlands Treatment of Dairy Parlor Waste Effluent

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Introduction. The dairy industry is a vital component of the economy in the Lake Pontchartrain Basin. There are nearly 230 dairies (120 cows/farm) currently operating in the northern-most regions of the Basin, near the border between Louisiana and Mississippi. In the recent past, dairy waste effluent has been cited as a source of nutrients and coliform contamination to the basin's tributaries and ultimately the Lake itself. Consequently, all dairy operations have been required to install single-stage lagoons. Nonetheless, a single-stage lagoon is a BMP that provides limited treatment. A promising cost-effective alternative is thought to be the expanded use of secondary lagoons and constructed wetlands. The main objective of this study was to determine the efficacy of wastewater treatment in a two-stage lagoon system. The secondary objective was to evaluate the use of Pickerelweed in constructed wetlands following two-stage lagoons.

Procedures. The Dairy Wastewater Treatment Evaluation System (**DWTES**) consists of replicated two-stage lagoons and constructed wetlands. Untreated dairy waste and wash-water enters the system twice daily (am and pm). Wastewater was pumped to the distribution box and was equally split between two 156 x 93 x 9 foot **anaerobic lagoons**. Wastewater flowed by gravity through the system, independently for each of the replicates. The effluent entered the next treatment stage, two 232 x 134 x 6 foot **aerobic lagoons**, at each new influx of wastewater. The outflow from the aerobic lagoons was distributed among six 102 x 42 x 3 feet tertiary treatment cells (**constructed wetlands**). Wetlands 1, 3, 4 and 6 are **control cells** consisting of spontaneously emerging native wetland plants, comprising of filamentous algae and duckweed. Wetland 2 and 5 were each planted with 175 Pickerelweed (*Pontederia cordata*) rhizomes of similar masses (**treatment cells**). Wetlands 1 and 6 were planted with *Valisneria americana* (test cells). Wetlands 3 and 4 were control cells. Wastewater quality monitoring began June 1, 2005 and was completed in May 31, 2006. Sampling was conducted bi-weekly at all sites, starting with the untreated dairy wastewater and at the terminal end of each stage of the treatment system. Samples were analyzed for total solids (**TS**), total suspended solids (**TSS**), total diluted solids (**TDS**), fecal coliforms, E. coli (*Escherichia coli*), nitrate (**NO₃**), nitrite (**NO₂**), total Kjeldahl nitrogen (**TKN**), ammonia N (**NH₃-N**), total phosphorus (**TP**), chlorophyll-A, chemical oxygen demand (**COD**), dissolved oxygen measured at the surface (**DOs**), dissolved oxygen measured at mid-depth (**DOm**), pH, temperature, chloride, bromide, and sulfate. Analyses were performed at the W. A. Callegari Environmental Center according to EPA and Standard Methods for Examination of Water and Wastewater (American Public Health Association, 1995). Results were analyzed as repeated measurements using Proc Mixed (SAS, version 9.1). Comparisons were made at each treatment levels in the system as anaerobic lagoons versus aerobic lagoons; and aerobic lagoons versus constructed wetlands.

Results. This report includes samples collected for 12 months, from June 2005 until May 2006. *Valisneria* planted in constructed wetlands did not survive the partially treated dairy wastewater and their respective wetland cells (1 and 6) were deemed control cells thereafter. Hurricane Katrina compromised the stands of Pickerelweed after August 2005. Sampling was suspended for a month, then reestablished in September 2005. Plants in both constructed wetlands appeared to be affected similarly and were expected to recover to pre-Katrina densities until a parcel of wild hogs attacked and destroyed the stands completely shortly after the hurricane damaged fencing designed to keep wildlife out. Not a single plant of Pickerelweed recovered throughout the remaining experimental period. On the other hand, some preliminary trends could be gleaned from the data. Most water quality characteristics seemed to improve as wastewater moved through the treatment system (Table 1). This was especially noticeable between anaerobic and aerobic stage lagoon treatments (pH, COD, TSS, TDS, TS, TKN, NH₃-N, NO₃, TP, Cl, Br, SO₃, logTC, logFC, and logE. coli). Total nitrogen for instance decreased by nearly 67% of nitrogen input to the aerobic lagoon compared to less than 20% from the anaerobic lagoon (Figure 1). Less obvious, lower rates of decrease in the concentration of some parameters (COD, TDS, TS, TKN, NH₃-N, NO₃, TP, SO₃, logFC and logE. coli) after the aerobic lagoons may suggest further potential for treatment with wetlands cells. Planted wetlands had little impact on wastewater treatment characteristics estimated. Only pH and chlorophyll-A were significantly decreased by planted wetland cells. There was no clear trend suggesting that heavy biomass of Pickerelweed plants was any more effective than naturally occurring wetland plants such as duckweed and filamentous algae at improving water quality parameters. In fact, it may actually have had a negative effect on fecal coliforms and E. coli, likely caused by wildlife contamination. Overall, DWTES system removed 86% of the nitrogen, 48% of the phosphorus, and 93% of the settleable solids. Pathogens were extensively diminished, but not completely destroyed. Number of *E. coli* colonies was 4.5 orders of magnitude lower at the end of constructed wetlands than input wastewater in DWTES.

Implications. Increasing herd size and greater proximity of human dwellings require improved waste management systems. Sequential anaerobic-aerobic lagoons followed by constructed wetlands, planted or not, intensified nutrient and pathogen removal in this study.

Table 1. Multi-stage biological treatment of dairy milking center wastewater.

Variable	Unit	Treatments					SEM	$P \leq$					
		Fresh wastewater	Anaerobic lagoon	Aerobic Lagoon	Wetlands			TRT	DAY (repeat)	TRT vs. DAY	ANL vs. AEL	AEL vs. WTLND	WTLND vs. PWTLND
					Control	Planted							
Water quality analyses													
Temperature	°C	24.2	24.4	24.4	24.1	23.4	0.20	0.10	<0.001	<0.001	0.94	0.27	0.07
pH		7.19	7.32	8.12	7.97	7.38	0.07	0.006	<0.001	<0.001	0.004	0.16	0.006
COD	mg O ₂ /L	1594	552	255	177	155	10.2	<0.001	<0.001	<0.001	<0.001	0.007	0.17
DOs	mg/L	2.18	0.39	0.86	1.04	0.95	0.20	0.22	<0.001	0.06	0.18	0.49	0.71
DOm	mg/L	-	0.42	0.66	0.82	0.80	0.18	0.44	<0.001	0.16	0.40	0.53	0.91
Chlorophyll-A	µg/L	72.9	56.5	76.7	68.0	21.5	9.45	0.07	0.02	0.18	0.22	0.50	0.03
Nutrient analyses													
TSS	mg/L	651	140.3	72.4	50.5	38.5	7.6	0.006	0.001	0.001	0.007	0.09	0.27
TDS	mg/L	832	762	550	468	501	26.2	0.001	<0.001	<0.001	0.002	0.02	0.14
TS	mg/L	1564	986	691	546	567	26.7	0.001	<0.001	<0.001	0.001	0.006	0.39
TKN	mg/L	140	121.2	37.6	18.8	23.9	2.49	<0.001	<0.001	<0.001	<0.001	0.01	0.22
NH ₃ -N	mg/L	122	85.4	29.3	14.3	20.5	2.93	0.001	<0.001	<0.001	0.001	0.02	0.15
NO ₃	mg/L	4.62	4.62	2.06	1.35	1.46	0.14	0.001	<0.001	<0.001	0.001	0.02	0.49
NO ₂	mg/L	0.45	0.26	0.38	0.11	0.08	0.08	0.17	0.02	0.003	0.37	0.08	0.81
TP	mg/L	33.7	38.07	16.01	9.11	11.64	1.11	<0.001	<0.001	<0.001	<0.001	0.006	0.08
Cl	mg/L	132	119.4	77.9	73.7	79.5	3.44	0.004	<0.001	<0.001	0.002	0.34	0.22
Br	mg/L	13.2	11.24	5.84	5.98	5.99	0.55	0.01	<0.001	0.33	0.006	0.84	0.99
SO ₃	mg/L	7.90	4.16	4.32	1.55	1.31	0.24	0.004	<0.001	0.08	0.65	0.002	0.45
Bacteriological analyses													
Total Coliforms	MPN/100mL	8757500	891600	260323	172065	134000	79149	0.02	<0.001	<0.001	0.01	0.47	0.74
Log TC	log MPN/100mL	6.78	5.87	4.96	5.10	5.12	0.11	0.02	<0.001	<0.001	0.008	0.35	0.92
Fecal Coliforms	MPN/100mL	1425556	702300	17286	1852	8130	69869	0.01	0.02	0.008	0.006	0.88	0.95
Log FC	log MPN/100mL	6.01	5.55	3.56	2.47	3.05	0.13	0.001	<0.001	<0.001	0.001	0.005	0.03
E. coli	MPN/100mL	4565000	327500	2944	251	835	25163	0.005	0.23	0.20	0.003	0.94	0.98
Log E. coli	log MPN/100mL	6.56	5.45	3.15	1.91	2.64	0.21	0.001	0.06	0.10	0.002	0.008	0.03
E. coli	% TC	64.4	46.25	3.83	0.19	0.57	4.00	0.008	0.001	<0.001	0.004	0.53	0.95
Ratios													
COD:TKN			5.87	14.99	22.62	12.45	2.84	0.05	<0.001	<0.001	0.10	0.11	0.06
COD:TP			17.7	18.1	63.8	29.6	22.5	0.36	0.587	0.95	0.99	0.18	0.28
Log COD:DOS			3.22	2.58	2.45	2.50	0.05	0.004	<0.001	<0.001	0.003	0.13	0.46
Log COD:DOM			3.20	2.76	2.58	2.57	0.05	0.007	<0.001	<0.001	0.008	0.06	0.82

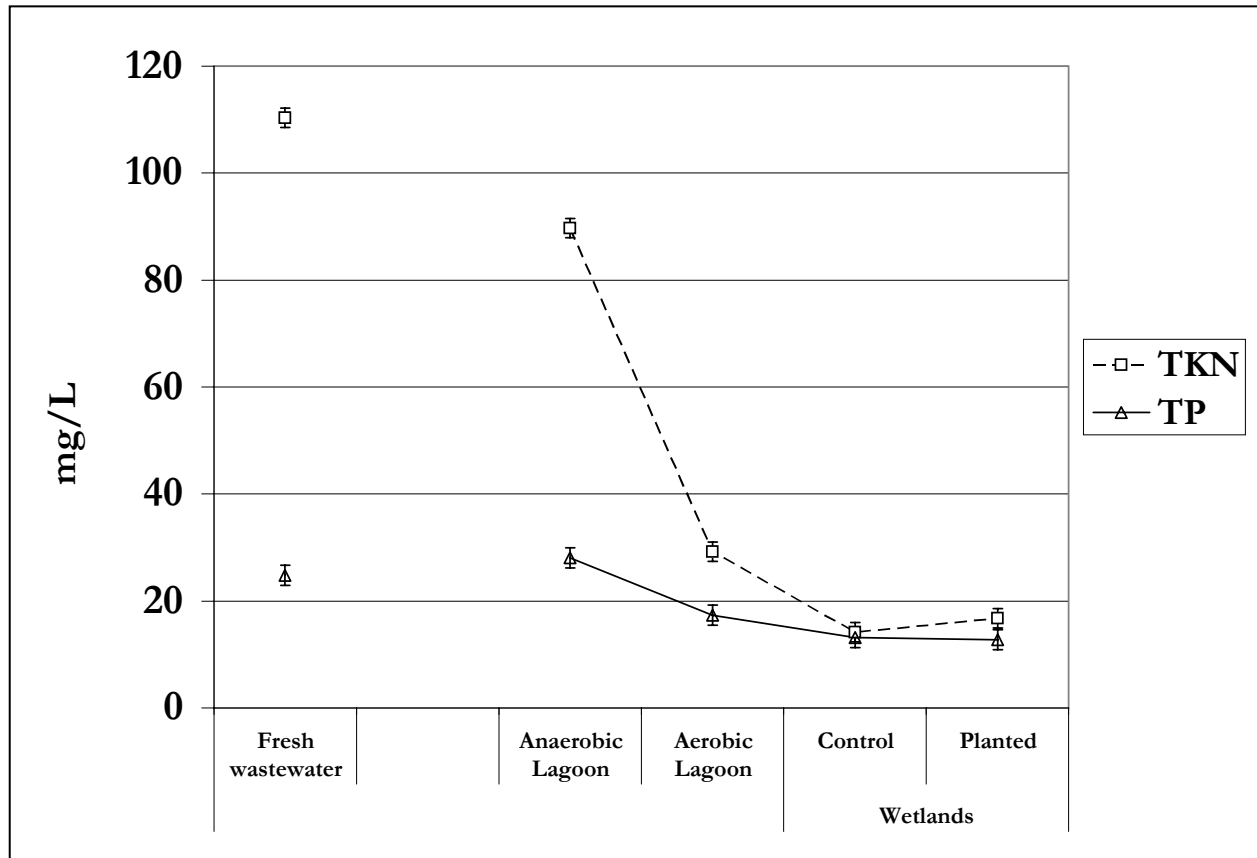


Figure 1. Nutrient abatement as wastewater flowed through each stage of DWTES (TKN = total Kjeldahl nitrogen; TP = total phosphorus). Circles indicate significant difference at $P \leq 0.05$ between treatment stages.

Calcium and Phosphorus Supplementation for Transition Cows: Animal Performance

Vinicius R. Moreira, Asst. Professor; Laura Zeringue, Research Associate and Michael E. McCormick, Professor and Resident Coordinator, Southeast Research Station

Introduction. Phosphorus-rich soils are considered among the most important reasons for fresh water eutrophication. Eutrophication is the nutrient over-enrichment of certain water bodies. In dairy operations, P enters the property mainly as fertilizers and animal feed. Farmers have historically fed between 0.48 – 0.50 % P in the diet dry matter (**DM**) to lactating dairy cows. Those levels are well above recommendation (NRC, 2001), but resistance to change has been mainly because of reproductive concerns. The combination of these factors can contribute to soil P build-up. The objective of this study is to evaluate the effect of Ca and P use by transition cows with the intent to increase feed phosphorus efficiency of utilization and to minimize mineral output in the excreta.

Experimental design. Forty-three transition multiparous (3 lactations or more) dairy cows completed the feeding trial in 12 blocks (4 cows each). Cows were brought to the free-stall barn fit with electronic gates approximately 20 days before calving and remained in the study until the last cow in each block achieved 31 days in milk (**DIM**). Cows were milked twice daily.

Diets. All cows were fed the same close-up diet from their arrival to the barn until the second day after calving. Cows were offered treatment diets on the third day after calving. A basal diet was estimated to contain 15 % below NRC (2001) mineral “total absorbed requirement” (**TAR**). Supplemental mineral premixed with ground corn was provided to achieve 20 % above TAR, in a factorial design. Four premixes were prepared to supplement the basal diet. Treatments were arranged in a 2x2 factorial as higher Ca – higher P (0.72 % HCa : 0.48 % HP, diet DM), higher Ca – lower P (0.72% HCa : 0.36 % LP, diet DM), lower Ca – higher P (0.53 % LCa : 0.48 % HP, diet DM), and lower Ca – lower P (0.53 % LCa : 0.36 % LP, diet DM). Total mixed rations (**TMR**) included alfalfa hay, bermuda grass hay, corn silage, ground shelled corn, mineral mix, and salt. Dietary mineral concentrations were adjusted with calcium carbonate and monosodium phosphate.

Sampling, analyses and data collection. Feeds were offered twice daily and refusals collected before the morning feeding. Amounts of feed offered and refusals and milk yield were recorded daily. Apparent digestibility (**DMD**) was determined based on total fecal collection for 3 consecutive days when each block of cows averaged 20 DIM. For milk composition, samples were collected for 3 consecutive days when cows in a block averaged 30 DIM. Body condition score was estimated at -10 days before expected calving and 30 days in milk by 3 individuals.

Statistics. Milk yield, dry matter intake (**DMI**), DMD, and milk composition data were analyzed as repeated measurements using Proc Mixed (SAS, version 9.1). Milk production in the previous

lactation and average DMI of the second week pre-partum were used as covariates for milk yield and DMI post-partum, respectively.

Results. Fresh multiparous cows used in this study achieved high levels of milk production during their first month of lactation (>96 lb/cow/d). There was no significant effect of Ca and P levels on intake, milk yield, or milk composition (Table 1). Large variation among cows may explain the absence of significant milk yield differences despite the fact that cows on HCa diet were 2.6 lbs greater and 1.2 lbs greater for HP. Also, a tendency for greater difference between Ca levels was observed in peak production ($P \leq 0.08$). Higher Ca ($P \leq 0.02$) and P ($P \leq 0.10$) contents in the diet resulted in lower DM digestibility, which could have reduced energy availability for the cows. That observation, however, did not reflect in statistically significant changes in body condition score and body weight. A preliminary evaluation of the data suggests that feeding Ca and P below NRC (2001) recommended levels did not limit animal performance during the first 30 days of lactation.

The practical application of this project can benefit both, farmers and environment. Nearly half a million dollars per year can be saved as lower feed costs because of a reduced need for mineral purchase as farmers can feel confident to decrease P supplementation for dairy cows in Louisiana from 0.48 % P to levels within NRC (2001) recommendation (around 0.40 % P). That represents \$1,600 per year for an average Louisiana dairy farm (120 cows). Moreover, as much as 230 tons of P can be voided from manure of dairy cows, thus decreasing the risk of P enrichment of Louisiana soils and public waters.

Table 1. Performance of fresh cows fed Ca and P 20% above or 15% below NRC (2001) recommendations.

	HCa	LCa	HP	LP	SEM	cov	Ca	P	Ca*P
lb/d	Treatments ¹						$P \leq$		
DMI (6-31 DIM) ²	46.1	47.6	47.5	46.2	1.26	0.01	0.29	0.31	0.82
Milk yield (6-31 DIM)	97.7	95.1	97.0	95.8	2.01	< 0.001	0.79	0.68	0.16
Peak milk yield (6-31d)	117.2	112.8	116.2	113.8	2.47	< 0.001	0.29	0.87	0.08
Fat	5.21	4.98	5.15	5.04	0.70	0.85	0.45	0.71	0.27
Protein	4.13	4.09	4.06	4.16	0.46	0.03	0.75	0.37	0.76
SCS (units) ³	3.51	2.29	2.56	3.24	0.51	0.81	0.06	0.35	0.10
DM digestibility (%)	66.3	71.3	67.2	70.4	1.29	0.014	0.02	0.10	0.61
BW lost (0-31DIM)	5.09	4.48	4.63	4.94	0.53	--	0.62	0.59	0.72
BCS lost (units)	0.57	0.53	0.61	0.48	0.09	--	0.76	0.13	0.65

¹ HCa = higher calcium; LCa = lower calcium; HP = higher phosphorus; LP = lower phosphorus.

² DMI = dry matter intake. ³ SCS = somatic cells score.

⁴ BW = body weight.

⁵ BCS = body condition score.

Phosphorus Digestibility of Common Feeds in Louisiana Dairy Diets: Animal Performance

Vinicius R. Moreira, Asst. Professor; Laura Zeringue, Research Associate and Michael E. McCormick, Professor and Research Coordinator, Southeast Research Station

Introduction. Phosphorus-rich soils are considered among the most important reasons for fresh water eutrophication. In dairy operations, phosphorus (**P**) enters the property mainly as fertilizers and animal feed. Farmers have historically fed between 0.48 – 0.50 % **P** in the diet dry matter (**DM**) to lactating dairy cows. Those levels are well above recommendation (NRC, 2001), but resistance to change has been mainly because of reproductive concerns. Another concern particularly important is the lack of knowledge of **P** availability in feeds of different sources. The main objective of this trial was to estimate the **P** availability of feeds commonly used in Louisiana. A secondary objective will be to verify a possible relationship between dry matter intake (**DMI**) and estimated absorption coefficient.

Procedures. Two studies were carried out to evaluate **P** availability in feeds.

Study 1. Two forage sources (**Bahiagrass hay**, and **Ryegrass hay**) commonly used in Louisiana dairy diets were compared to **cottonseed hulls (CTR)** for apparent digestibility of **P**.

Study 2. Two byproducts (**expelled extruded soybean meal, XXSBM**, and **dried distillers grains, DDG**) commonly used in Louisiana dairy diets were compared to **cottonseed hulls (CTR)** for apparent digestibility of **P**.

Both studies. Diets based on corn silage, alfalfa hay, ground corn grain, soybean meal, urea, starch, cottonseed hulls, calcium carbonate, and mineral mix (Table 1) were formulated to contain energy, protein, Ca and **P** (0.32% **DM**) levels sufficient to supply cows' requirements at predicted intakes (NRC, 2001). Cows were housed in the Calan gate (American Calan[®], Northwood, NH) barn at least 10 days before (pretrial) and throughout the experimental period. Diets were fed twice daily as a TMR mixed in a Data Ranger (American Calan[®], Northwood, NH). Dietary **DM** adjustments were made based on corn silage weekly **DM** content. Cows were fed in the Calan gate barn to record weights offered and refused for each individual.

Experimental design: Twelve mid-lactation multiparous cows in each study were divided among the three treatments in a 3 x 3 Latin square replicated four times. Period lengths were 21 days, with 14 days of adaptation and seven days of data and sample collection. Feed offered was limited to 90% of fresh intake allowance measured during the first 6 days of week 2 in each experimental period.

Sampling, analyses and data collection: Milk yield was electronically recorded during each milking (2x/d) during the last 7 days of each period. Milk samples were collected with preservative for the last three days of each period, from each milking. Milk samples were analyzed for fat and protein by near infrared spectroscopy. Milk composition was calculated

according to milk yield at each milking. Mixed feeds offered and refusals were weighed daily to estimate dry matter intake (DMI).

Forage samples were collected daily, frozen and composited weekly for nutrient analyses. Weekly fresh corn silage samples were used for DM adjustment of the diets. Mixed feeds offered and refused were sampled daily, frozen and composited weekly for DMI estimation. Concentrates were sampled weekly. Samples were dried in air-forced 60°C drying oven for 72 h and ground through a 1-mm screen in a Wiley mill. Ground samples are being analyzed for nitrogen (AOAC, 1990), fibers (NDF and ADF) adapted from Van Soest et al. (1991) for Ankom^{200/220} Fiber Analyzer, Ca and P (AOAC, 1990). Feed composition and digestibility will be presented on later publication.

Body weights were measured for two consecutive days at the beginning and end of the experiment. Body condition scores were evaluated by three scorers at the beginning and end of the experiment.

Animal performance data was analyzed using the MIXED procedure of SAS (2007). Least square means were reported, and significance was declared at $P \leq 0.05$, and tendencies at $0.05 < P \leq 0.10$.

Results – Study 1. Cottonseed hulls control treatment increased ($P < 0.05$) milk yield and dry matter intake by 2 and 4 pounds, respectively. Despite small variation in milk composition, fat and protein yields followed a similar pattern to those observed for milk yield and dry matter intake. Cows used in Study 1 rapidly dropped in milk production after the onset. Production remained low throughout that study. Advanced lactation (days in milk; DIM = 223) may have played a role, but intake was probably the main factor limiting milk production. Although all treatments had high levels of fiber, small particles of cottonseed hulls are less likely to limit rate of passage through the rumen. High levels of long lignified fiber in bahiagrass and ryegrass hays could have limited intake in this trial.

Results - Study 2. Milk yield was higher with DDG diet and intermediary with XXSBM diet, despite lower dietary protein content with the latter (Table 4). However, diets DDG and XXSBM did not differ statistically when milk yield was corrected for energy output calculated based on butterfat (3.5% FCM) and based on butterfat and protein contents (ECM). Cows in both treatments (DDG and XXSBM) produced more milk than CTR treatment diet. Two factors may have caused this. This study used late lactation dairy cows (averaging 240 days in milk at the study's end) that had lower milk yield and higher intake by design. Those cows would not likely respond to higher dietary protein content with XXSBM. Also, all diets included high proportions of cottonseed hulls, a highly palatable feed with low nutrient content. Cottonseed hulls were added to decrease dietary phosphorus concentration to maximize this nutrient's digestibility.

Dry matter intake was high (~55 lb/cow/d), despite feed offered was fixed below ad libitum intake during the last week of every period. Nonetheless, intake did not change appreciably across diets, and thus feed efficiency reflected milk yield differences (milk yield/dry matter intake).

Milk fat content, milk fat yield, and somatic cells score (Table 5) were similar across diets ($P < 0.05$). Significant differences were detected for milk protein content and yield however those differences were small and have probably little biological significance.

Little research has been carried out with extruded expelled soybean meal. Extruded expelled soybean meal showed potential for improved fat metabolism by lactating cows in an earlier study (Ure et al., 2005). In the current study, high production was surprising for heat-stressed, late lactation animals. Nonetheless, cows fed similar amounts of dry distillers' grains or extruded expelled soybean meal performed similarly, despite a slightly higher estimated ether extract (fat) content with the former. One possible explanation is that higher dietary protein in XXSBM diet could have counteracted lower availability of energy from fat. Future research should focus on relative value of extruded expelled soybean meal compared to other protein and oil sources, using high-producing early lactation dairy cows.

Acknowledgement: Expelled extruded soybean meal was processed and donated by Ferriday Oil Seed Processor's, L.L.C.

Table 1. Feed components and estimated diet composition¹.

	Study 1			Study 2		
	BGH	RGH	CTR	XXSBM	DDG	CTR
	(% DM)			(% DM)		
Corn Silage	23.2	23.2	23.2	20.0	20.0	20.0
Ryegrass Hay	--	20.0	--	--	--	--
Bahiagrass Hay	20.0	--	--	--	--	--
Dry Distillers Grains	--	--	--	--	8.0	--
Extruded Soybean Meal	--	--	--	8.00	--	--
Alfalfa Hay	24.1	24.2	24.2	26.0	26.0	26.0
Corn Grain, Ground	15.4	15.4	15.4	16.5	16.5	16.5
Soybean Meal 48	8.78	8.78	8.78	8.58	8.58	8.58
Mineral ²	1.00	1.00	1.00	1.50	1.50	1.50
Calcium Carbonate	0.80	0.80	0.80	0.80	0.80	0.80
Cottonseed Hulls	4.20	4.39	16.3	13.9	13.9	13.9
Starch	2.40	2.40	9.98	4.65	4.65	12.0
Urea	0.25	0.00	0.50	0.10	0.10	0.80
Total	100.0	100.0	100.0	100.0	100.0	100.0
Forage %	67.2	67.3	47.3	46.0	46.0	46.0
Composition (Estimated)³	NRC (2001)			NRC (2001)		
DM (% as is)	72.8	73.2	73.5	76.1	75.8	75.9
CP (% DM)	16.1	16.3	16.0	18.4	17.2	16.5
RUP (% DM)	5.10	5.30	5.10	7.30	6.10	5.00
NE _L (MCal/kg)	1.48	1.51	1.48	0.70	0.69	0.68
NDF (% DM)	40.3	38.1	36.3	34.3	36.4	33.8
ADF (% DM)	25.4	24.5	25.3	23.8	24.8	23.6
NFC (% DM)	36.6	37.6	41.9	41.2	39.9	43.9
Ca (% DM)	0.77	0.79	0.74	0.80	0.78	0.76
P (% DM)	0.27	0.31	0.25	0.30	0.31	0.25

¹ Treatments: BGH = Bahiagrass hay; RGH = Ryegrass hay; XXSBM = Ferriday extruded expelled soybean meal; DDG = Dry distillers grains; CTR = Cottonseed hulls.

² Mineral mix contained 1.33% Ca, 13.9% Mg, 27.3% Cl, 3.47% K, 18.2% Na, 5.02% S, 96ppm Co, 1937ppm Cu, 182ppm I, 259ppm Fe, 4139ppm Mn, 69ppm Se, 12770ppm Zn, 520KIU/kg vitamin A, 105KIU/kg vitamin D, 1730IU/kg vitamin E.

³ Composition: DM = dry matter; CP = crude protein; RUP = rumen undegradable protein; NE_L = net energy for lactation; NDF = neutral detergent fiber; ADF = acid detergent fiber; NFC = non-fibrous carbohydrate; Ca = calcium; P = phosphorus.

Table 2: Milk production and dry matter intake for Study 1¹.

	Hays		Hulls	SEM	Trt
	BGH	RGH	Cottonseed		
Milk yield, lb/d	46.3	45.6	50.3	3.40	0.001
Dry matter intake, lb/d	41.0	41.7	49.7	1.12	< 0.001
Milk yield/dry matter intake	1.14	1.09	1.01	0.07	< 0.001

¹ Treatments: BGH = bahiagrass hay; RGH = Ryegrass hay; CTR = Cottonseed hulls.

Table 3. Milk composition and components yield for Study 1¹.

	Byproducts		Hulls	SEM	trt
	BGH	RGH	Cottonseed		
Fat, %	3.81	3.72	3.91	0.13	0.14
Protein, %	3.32	3.33	3.39	0.05	< 0.001
SCS ²	4.04	3.94	3.98	0.44	0.80
Fat, lb/d	1.60	1.66	1.85	0.17	0.01
Protein, lb/d	1.41	1.45	1.56	0.11	0.01

¹ Treatments: BGH = bahiagrass hay; RGH = Ryegrass hay; CTR = Cottonseed hulls.

² SCS (somatic cells score) = $3 + \{[\ln(\text{SCC}/100)]/0.6931\}$.

Table 4: Milk production and dry matter intake for Study 2¹.

	Byproducts		Hulls	SEM	Trt
	XXSBM	DDG	Cottonseed		
Milk yield, lb/d	67.9	69.6	65.4	2.93	0.0002
3.5% FCM ² , lb/d	67.7	68.9	65.1	3.19	0.02
ECM ³ , lb/d	66.7	68.1	64.8	2.92	0.02
Dry matter intake, lb/d	54.9	54.5	54.4	2.75	0.84
Milk yield/dry matter intake	1.25	1.28	1.21	0.07	0.009

¹ Treatments: XXSBM = Ferriday extruded expelled soybean meal; DDG = Dry distillers grains; CTR = Cottonseed hulls.

² 3.5% FCM (3.5% fat corrected milk) = $(0.432 \times \text{milk yield}) + (16.2 \times \text{fat yield})$.

³ ECM (energy corrected milk) = $(0.3246 \times \text{milk yield}) + (12.86 \times \text{fat yield}) + (7.04 \times \text{protein yield})$.

Table 5. Milk composition and components yield for Study 2¹.

	Byproducts		Hulls	SEM	trt
	XXSBM	DDG	Cottonseed		
Fat, %	3.61	3.52	3.68	0.13	0.30
Protein, %	3.05	3.04	3.18	0.06	<0.001
SCS ²	3.37	3.20	3.26	0.53	0.86
Fat, lb/d	2.39	2.42	2.32	0.12	0.30
Protein, lb/d	2.01	2.08	2.02	0.07	0.08

¹ Treatments: XXSBM = Ferriday extruded expelled soybean meal; DDG = Dry distillers grains; CTR = Cottonseed hulls.

² SCS (somatic cells score) = $3 + \{[\ln(\text{SCC}/100)]/0.6931\}$.

Embryo Transfer in Heat-Stressed Holstein Cows

Dennis French, DVM, Department of Veterinary Science, Mike McCormick, Professor and Resident Coordinator, Doug McKean, Research Associate, Shannon Forbes, Research Associate, and Ronnie Bardwell, PhD, LCES Area Dairy Agent, Southeast Research Station

Introduction. Heat stress has been shown to have a negative effect on fertility in dairy cows with high producing cows suffering more than low milking herd mates. In 2001, the Southeast Research Station began confining cows in a new freestall barn and in 2002 the barn was equipped with fans and sprinklers to aid in cow cooling. Beginning in 2003 the breeding season was extended through July in an attempt to get more cows bred before the traditional summer time breeding holiday. However, despite our best efforts at cooling cows, conception rates from June 15th through July 30th averaged less than 15% for the next three years. This data supports observations reported on commercial dairy farms in Florida where they noted average pregnancy rates (PR) of 13% for the months of July, August and September compared to over 25% PR for the rest of the year. According to Florida researchers, the low pregnancy rate of heat-stressed cows may be related to 1) poor heat detection (often <25%), 2) low quality oocytes (eggs), 3) elevated body temperature damaging oocyte/embryo, and/or 4) low blood progesterone concentrations. Embryo transfer (ET) has been suggested as a substitute for artificial insemination to improve fertility of heat-stressed Holsteins. In this preliminary study, we were interested in determining the value of embryo transfer when applied to high-producing (25,000 ME or more) recipient cows during summer months. High genetic merit Holstein embryos obtained via super-ovulation were used with the objectives of the study being to generate a new line of high genetic merit heifers and to improve retention of our multiparous, high producing milk cows (lower reproductive cull numbers).

Procedures. Twenty high merit embryos (7-8 day blastocysts) were purchased from Dykshorn Holsteins (Sioux Center, Iowa) at an average cost of \$248/ embryo. Twenty three multiparous Holstein cows were selected as potential recipients. Prior to study initiation, cows were evaluated for reproductive soundness and condition scored. Recipient cows averaged 75 lbs milk/day (27,600 ME), 231 days in milk, and 3.7 A. I. services (1-8 services/cow) at study initiation. Ten cows were implanted on June 20th, 2007 and seven cows were implanted on July 12th, 2007. The following synchronization protocol was used to prepare cows for ET: 1) Day 0 - Insert CIDR and inject 2 cc GnRH, 2) Day 6 - Inject prostaglandin (5 cc Lutalyse), 3) Day 7 - remove CIDR, 4) Day 8-10 - check heats and inject GNRH at standing heat, and 5) Day 16 - inject with 5cc Banamine IM and transfer embryos. On day-of-transfer (7-8 days post estrus) embryos were thawed according to standard procedures, examined microscopically for quality and then transferred by an ET specialist (Dr. Joel Carter). On approximately day 27 (embryo age) embryos were examined for viability via ultrasound. On or about day 42, cows were palpated for pregnancy at routine vet check. Between days 55-65, embryos were re-examined using ultrasonography to determine fetal sex.

Results. Although an insufficient number of cows were implanted for statistical analyses in this preliminary study, study means are presented in Table 1. A total of 23 cows were set up as candidates for embryo transfer (GnRH, CIDRs, etc). Of these 17 (73.9%) came into heat in the

appropriate window and were implanted with an embryo. Ten of thirteen synchronized cows were implanted on June 20th and seven of ten cows were implanted on July 12th. Six of ten (60%) June-group recipients were pregnant when examined via ultrasound on d26-d28 and four of seven (57.1%) of the July group were pregnant by ultrasound. However, two weeks later when checked for pregnancy by rectal palpation, one cow in each group was found to be non-pregnant. Either a late embryonic death occurred or a false positive pregnancy via ultrasound was reported. Cows were again pregnancy checked at day 55-65 via ultrasound to determine sex of the fetus. All cows diagnosed pregnant via rectal palpation were found to possess viable fetuses. Ultrasound analysis revealed that 63.0% of fetuses were female and 37% were male. No remarkable trends were noted concerning previous number of A.I attempts or body condition scores, though cows with more than five services did tend to have a lower success rate than those with five services or less. In previous research at the University of Florida cows with BCS greater than 2.5 had double the ET pregnancy rate compared to cows with BCS less than 2.5. But, cows in this study were all fairly thin (avg. = 2.3) which may explain why differences related to BCS were not observed. Never the less, an overall pregnancy rate of 47.1% for ET is nearly three times greater than July pregnancy rates recorded at this unit over the last three years. Also, similar multiparous cows bred from June 1-20, 2007 only had a 30% pregnancy rate (3/10) and ambient temperatures were cooler at service than temperature experienced by the first group of ET's (June 20th, 2007). Though the data appear promising, fetal death (d90 to term) is often higher with ET embryos than A.I embryos. So, final pregnancy rates, and a final assessment of ET value, will not be known until March of 2008.

Impact/Economics: Preliminary data from this study indicates that fertility of high-merit Holstein cows may be improved over A.I during hot months. The ET procedure may be a viable tool to keep high value cows in the herd and as techniques improve (in vitro fertilization, freezing methods, use of sexed semen, etc.) cost of embryo transfer may become economically competitive with timed A.I. Overall ET costs were \$4216 for embryos, \$850 for transfer specialist, and \$441 for synchronization drugs (for 17 embryo transfers). Assuming we retained five more high merit cows than possible through summer time A.I. breeding, the difference in value of the retained cows and reproductive cull cows sold through local sales barns would likely approach \$1300/cow (\$2000-700). So, if current pregnancy rates hold, the value of the retained cows (5 cows x \$1300 = \$6500) would more than pay for the ET program and these calculations do not consider the value of the high quality offspring. Further research is needed to evaluate ET from less expensive "breeder" embryos and or embryos generated from high merit cows on the station.

Table 1. Embryo transfer in high genetic merit, heat-stressed Holstein cows.

Item	Month		
	June	July	Overall
Ambient Temp. (Max./Min.,F) ¹	90.1/70.5	89.5/70.9	89.8/70.7
Cows implanted	10	7	17
Pregnancy rate, %			
Day 26-28 (ultrasound)	60.0	57.1	58.8
Day 40-42 (rectal palpation)	50.0	42.9	47.1
Day 55-65 (ultrasound)	50.0	42.9	47.1
< or = 5 A.I. services	57.1	50.0	54.5
> 5 A.I services	33.3	33.3	33.3
> 2.5 body condition score	40.0	33.3	36.5
< 2.5 body condition score	60.0	66.6	63.3
Sex (ultrasound d55-d65)			
Female, %	60.0	66.6	63.0
Male, %	40.0	33.4	37.0
Body condition score (1-5)	2.43	2.21	2.34

¹ Average of temperatures recorded 21 days following embryo transfer.

Limit-Grazing Oat Pastures vs Total Mixed Rations for Late Lactation Holstein Cows

Mike McCormick, Professor and Resident Coordinator, Doug McKean, Research Associate, Tara Doughty, Research Associate, Ronnie Bardwell, Area Dairy Agent, and Vinicius Moreira, Assistant Professor, Southeast Research Station

Introduction. Winter annuals provide some of the most nutritious pasture available for dairy cattle in Louisiana. Annual ryegrass is the winter annual most commonly planted due to its ease of establishment, long growing season and high nutritive value. However, new oat varieties that have high yield potential and reasonable cold tolerance have spurred renewed interest in this cereal grain for early fall grazing. The recommended planting date for oat pastures in Louisiana is September 1st through October 15th. In south Louisiana, early-September planted oats are often ready for fall grazing by late October providing lush pasture several weeks before most annual ryegrass pastures are ready to graze.

Procedures. The objective of this study was to evaluate the ability of limit-grazed oat pastures to off- set silage and feed costs for late lactation Holstein cows (260 days in milk; 59 lb/hd/d milk average) receiving a corn silage based total mixed ration (TMR). On September 6, 2006, ‘Plot Spike’ oats, 60 lb/acre, was no-till planted into pasture previously (1-3 days earlier) treated with one quart of 1% glyphosphate per acre. Twenty pounds of ‘Prine’ ryegrass was also broadcast per acre and roller-harrowed. Oat/ryegrass pasture was fertilized with 500 pounds of 5-10-15 at planting and 150 pounds of urea per acre in mid October. The control diet consisted of approximately 20 pounds of feed (20% protein), 5 pounds whole cottonseed, 65 pounds corn silage, and 5 pounds chopped hay, 40% of which was offered in the morning and 60% of which was offered in the afternoon feeding. Cows on the experimental diet had access to oat pasture (approx. 0.7 acres/cow) from 8 a.m. to 2 p.m. each day and received a TMR in the evening. Cows on oat pasture received a TMR similar to that of control cows except that it contained 10 pounds less corn silage and 5 pounds less feed. The study was conducted from November 1st, 2006 through December 27th, 2006 (56 days).

Results. The overall results from the study are presented in Table 1. Oats were the dominant forage grazed by cows during the study period. Although the study terminated in late December as cows approached voluntary dry-off dates, the oat/ryegrass pasture was grazed by growing animals through late spring. Study cows consumed 32% less TMR than cows that had continuous access to TMR i.e. control cows. Daily pasture consumption was estimated at about 15 pounds of dry matter per cow which was several pounds higher than predicted. Pasture availability was high and forage quality was excellent with protein averaging over 28% and fiber less than 22% (ADF) throughout the 56-day grazing period. Study-long actual milk yield averaged a little over fifty pounds per cow per day and was not statistically different between diets. Low pasture fiber content caused milk fat to remain at pre-study levels for the grazing group (3.8%), but normal increases in milk fat associated with advanced stage of lactation were recorded for the TMR group (avg. =4.3%). As a result, fat-corrected milk yield was 5.5 lb per head higher for the TMR group than for those cows offered oat pasture. Milk urea nitrogen (MUN) was higher for grazed cows than those fed TMR but levels were not above 20 mg/dl, the threshold above which our research has shown MUNs to impair reproduction in Holstein cows.

No differences in cow weight or body condition were noted between cows fed the different diets. Although feed costs were \$0.46 lower for cows with access to oat pasture, milk value was \$0.70 higher for the TMR-fed cows. Therefore, income over feed cost was about \$0.24 per cow per day higher for the TMR cows than cows offered oat pasture. Although income over feed costs were similar between diets, several unmeasured factors may make limit-grazing attractive. In years when corn silage availability is low, corn silage saved by limit grazing may be targeted for more productive fresh cows. Also, though not quantified in this study, limit grazing has been shown to improve hoof quality and reduce lameness in confined cows. Finally, reducing the hours cows spend in confinement may reduce stall bedding costs and the labor required to maintain stalls.

Table 1. Effect of Oat Grazing A.M. and Total Mixed Ration (TMR) P.M. vs TMR only (total confinement) on performance of late lactation Holsteins.

Item	Experimental Diets		
	A.M. Oat Grazing and P.M. TMR	TMR (Fully confined)	<i>P</i>
Cows per diet	22	22	
TMR intake, fresh lbs/cow/day	71.9	105.3	
TMR intake, dry weight lbs/cow/d	31.6	47.2	*
Pasture intake, lbs dry weight/cow/d ¹	15.0	0.0	
Milk yield, lbs/cow/day	50.4	51.0	
% milk fat	3.8	4.3	*
% milk protein	3.5	3.5	
Urea nitrogen, mg/dl (MUN)	17.6	11.6	*
3.5% fat-corrected milk, lbs/h/d	52.9	57.4	*
Cow wt., lbs	1508	1492	
Cow body condition score ²	2.88	2.93	
Economics:			
TMR cost/cow/day	\$2.14	\$3.23	
Pasture cost/cow/day ³	\$0.63	\$0.0	
Milk value/cow/day ⁴	\$8.20	\$8.90	
Returns over feed costs/cow/day	\$5.43	\$5.67	

¹ Estimated from total dry matter intake requirements less TMR consumption.

² Based on a 1-5 scale where 1 = excessively thin and 5 equals excessively obese.

³ Based on establishment costs (seed, fertilizer, and diesel, etc.) prorated over sixty days of a normal 180 day grazing season plus nitrogen fertilizer (150 pounds of urea) applied October 10th, 2006.

⁴ Based on \$15.50/cwt for 3.5%fat-corrected milk.

* Values in a row are statistically different ($P < 0.05$).

Rubber Matting vs Concrete in Freestall Cow Alleys – Effect on Performance of Early-lactation Holstein Cows.

Mike McCormick, Professor and Resident Coordinator, Vinicius Moreira, Assistant Professor, Doug McKean, Research Associate, Tara Doughty, Research Associate, Southeast Research Station, and Dennis French, DVM, Department of Veterinary Science Dept.

Introduction. According to industry experts, lameness among dairy cows has grown from 5% in the 1970's to more than 20% in dairy herds today. Oftentimes, producers do not realize the extent of lameness in their herds or the impact it has on overall farm profitability. Cows often begin losing production from lameness long before they show obvious signs of hip, leg, or hoof injuries. California researchers categorized lameness via a scoring system from 1-5, where 1 is normal and 5 is severely lame. They noted that cows with scores of 2-3 (arched backs standing or walking) were less productive than cows with normal locomotion and cows scoring in the 4-5 range ate 36% less feed and produced 12 pounds less milk than normal-gaited cows. Cornell researchers estimate that the average case of lameness in dairy cows costs the producer in excess of three hundred dollars.

A number of factors such as high concentrate feeding, heel warts, etc. have been implicated in the increase in lameness on today's dairy farms. However, confinement feeding of cows in concrete-floored barns is seen by many as a major contributor. In 2005, the Southeast Research Station dairy research herd initiated total confinement feeding in a freestall barn where cows received a total mixed ration (TMR) twice daily (cows do occasionally get off concrete during the dry period and for grazing studies). The objective of this study was to evaluate the effect of a minimal amount of rubber matting placed over the concrete cow alley on performance of Holstein milk cows.

Procedures: The cow alley adjacent to the feed alley was equipped with $\frac{3}{4}$ -inch thick interlocking rubber matting. The mats were 3'x6' rectangles that were cut on farm into two pieces one of which was 1'x6' and the other was 2'x6'. The narrower piece was nailed adjacent to the chain wall of the feed alley and the wider piece was placed approximately 22" farther away. In these positions, a relatively small amount of matting provided comfortable footing for all four feet of a Holstein cow consuming TMR. The small amount of matting was used to minimize costs and to prevent cows from lying on the rubber mats. The south side of the free stall barn was not equipped with rubber matting and cows stood on grooved concrete while consuming TMR.

Sixty early lactation Holstein cows (20 mature cows and 10 first-lactation heifers/treatment) were allotted to either rubber matting or concrete alley treatments. Cows in each treatment were balanced for milk yield and days in milk. Cows were fed a corn silage-based TMR twice daily that contained 17.7% crude protein, 24.1% ADF, and 36.5% NDF (DM basis). Cows remained on treatments for 60 days and then were assigned to opposite treatments for a second 60-day period (in an attempt to remove environmental effects due to location in the barn). Cows were weighed, locomotion scored, and body condition scored every two weeks; however data for the last period only are presented in this report. During the last week of each 60-day period, cows

were divided into two pens of 15 cows each and TMR offered and refusals were recorded daily. Cows were assigned to DHIA strings by treatment to provide a monthly estimate of heat detection.

Results: The overall treatment averages for the two groups are presented in Table 1. Cows on the rubber matting exhibited fewer signs of lameness than cows on concrete as evidenced by lower overall locomotion scores. However, most first-lactation cows exhibited excellent locomotion whether on concrete or rubber matting (1.13 vs 1.08, respectively). In contrast, locomotion scores for older cows on rubber matting were substantially lower (1.44) than those cows on concrete (1.85). Equally important, older cow scores decreased substantially (0.3 units) when cows were moved from concrete to rubber matting in the second 60-day period. Feed intake tended to be higher (1.5 lbs DM/cow/d) for cows on rubber mats than concrete, yet milk production was not significantly improved. An absence of milk response may have been due to an insufficient period for the flooring differences to cause effects when the cows were switched from one treatment to another. No differences in cow body condition scores or weight were detected during the study, but a numerical improvement in heat detection rate was recorded. Improved locomotion scores, enhanced intake and increased heat detection suggest that rubber matting will improve performance and profitability of confined dairy cows. Longer duration studies are needed to determine the true impact of mats on cow health and lactation performance. Yet, the data does indicate that the modest cost of installing rubber mats in freestall alleys (\$15/cow) would be quickly recouped with confined dairy cows.

Table 1. Rubber matting vs concrete in freestall barn cow alleys - effect on performance of early-lactation Holstein cows (120-day study).

Items	Treatments		P ¹
	Rubber matting	Concrete	
Cows/treatment	30	30	
Days in milk, initial	36	39	
Dry matter intake, lb/d	57.6	56.1	0.14
Milk yield, lb/d	81.2	80.8	NS
Locomotion score, (1-5) ²	1.26	1.50	0.05
Body condition score, (1-5) ³	2.57	2.60	NS
Cow weight, lbs	1383	1400	NS
Heats detected, %	74.3	54.8	NA
> 100 DIM at first service, %	7	17	NA

¹ Probability of averages being statistically different (lower numbers indicate greater likelihood of differences being significant). NS = non-significant.

² Score of one is normal and five is extremely lame.

³ Score of one is extremely thin and five is extremely obese.

Summer Annual Baleage Crops: Feeding Value and Palatability Assessment with Growing Holstein Heifers

Mike McCormick, Professor and Resident Coordinator, Tara Doughty, Research Associate, Shannon Forbes, Research Associate, and Doug McKean, Research Associate, Southeast Research Station

Introduction. Summer annuals such as millet, sorghum sudan, and forage sorghum are crops that double crop well with annual ryegrass and are high yielding, drought resistant. However, they have not been found to be high in nutritive value. Earlier research at this unit compared soft dough-stage forage sorghum to annual ryegrass and corn silage. The forage sorghum was found to be 5-7 units lower in digestibility and produced 4-6 pounds less milk than other silage crops. In recent years, comparisons were made between forage sorghum and signalgrass, bermudagrass, and ryegrass stored as baleage. Ryegrass and signalgrass consistently produced more milk than either bermudagrass or sorghum baleages (2005 Field Day Summary, # 05-63-0168).

Procedures: The study described in this report is a continuation of a project designed to assess the value of brown mid rib (BMR) sorghum types for milk cows. In earlier plot work, several of the newer BMR sorghums yielded as much or more than conventional types (NK-300) and lab analyses revealed one or two that possessed substantially higher nutritive value. The ultimate goal of this research is to identify sorghum types and management strategies that allow cows to produce as much milk from sorghum bale silage as from corn silage or high quality ryegrass. Initial plans were to compare a BMR type for both forage sorghum and sorghum sudan; however, no seed was available for the experimental BMR sorghum sudan variety. Therefore, we elected to assess the feeding value and palatability of 'NK-300' forage sorghum, 'BMR 106' forage sorghum, 'Super Sue' sorghum sudan, and 'Tifleaf' millet.

Summer annuals described above were planted in 36 inch rows on approximately 20 acres (5 acres/forage) in early June of 2006. Crops received approximately 100 pounds of N at planting and P and K fertilizer according to soil tests. On July 26th, 2006, all forages were cut with a flail type mower conditioner, allowed to wilt 48-hr, baled with a round baler, and wrapped in six layers of white stretch film. All crops were vegetative (4-5ft) except the sorghum sudan (6-7ft) which was in the early bloom stage at harvest. At least 8 bales of each forage type were core-sampled and weighed prior to wrapping. Following a six-month storage period, bales were weighed, opened, scored for surface mold, and re-cored before being offered to 800-lb Holstein heifers in a bale silage palatability trial.

In the feeding study (February 2007), one bale of each forage type was ground (2-6 inch lengths) and placed in front (heifer lock-up barn) of 19 heifers. Sufficient trough space was available so that heifers could have access to any forage type. Bales were weighed before feeding and refusals were weighed 24-hr after feeding. This palatability trial was conducted twice per week for four weeks. While not being offered the experimental baleages, calves received five pounds of grain and free-choice bermudagrass hay daily.

Results. Averaged data on bale storage losses, feeding value, and baleage consumption are presented in Table 1. None of the summer annuals wilted to the 40% minimum dry matter recommended for bale silage crops. High stem moisture content greatly limits dry down rate of these crops, but high sugar content and low buffering of these crops often allows them to store successfully as high moisture baleage. Bale storage losses were less than 2% for all bales, which is similar to losses normally recorded for barn-stored hay. Bale sugar content was highest for the BMR sorghum and lowest for millet baleage. Bale pH was lower for the forage sorghums than the other summer annuals, but no significant differences were noted for exterior bale mold scores (1= no mold to 5 = extensively molded). Brown-mid rib varieties are noted for being lower in fiber and higher in digestibility than other forage types. The data from this study support this characterization with remarkable consistency. The BMR forage sorghum was lower in cellulose, lignin (indigestible fiber), acid detergent fiber, etc than all other summer annuals. The lower fiber levels resulted in substantially higher lab measures of digestibility (IVTD) for BMR sorghums compared to other summer annuals. Furthermore, heifers were able to detect the higher quality of the BMR sorghum and selected heavily for it in the palatability trial. Daily average dry silage consumption equaled 42, 25, 16, and 17% of total forage consumed for BMR forage sorghum, NK300 forage sorghum, Super Sue sorghum sudan, and Tifleaf millet, respectively. At present, the greatest liability associated with the BMR summer annual forages appears to be susceptibility to lodging.

Future work will be conducted to determine the milk potential of BMR sorghum types. This crop, in rotation with annual ryegrass, may provide much needed high quality forage for beef and dairy producers that do not employ traditional silage systems.

Table 1. Storage losses, quality and palatability of summer annual bale silage crops.

Item	Summer Annual Bale Silage Crops				
	BMR-106 Forage Sorghum	NK300 Forage Sorghum	Super Sue Sorg. Sudan	Tifleaf Millet	SE
Silage Fermentation:					
Bale wt., lbs (initial) ¹	1790 ^d	1418 ^b	1276 ^a	1603 ^c	32
Bale wt., lbs (final)	1790 ^d	1419 ^b	1268 ^a	1565 ^c	31
Storage loss, % dry matter	0	0	0.7	1.5	0.2
Bale pH	4.15 ^a	4.33 ^a	4.95 ^b	5.21 ^b	0.26
Bale mold score, (1-5)	1.38	1.00	1.50	1.25	0.31
Forage Quality:					
Dry matter, %	21.95 ^a	24.38 ^b	29.25 ^c	23.81 ^b	0.45
Crude protein, %	10.52	10.69	10.23	9.74	0.35
Cellulose, %	33.04 ^a	33.83 ^a	35.36 ^b	35.68 ^b	0.32
Acid detergent fiber, %	37.82 ^a	40.53 ^b	42.47 ^c	43.26 ^c	0.62
Neutral detergent fiber, %	60.27 ^a	64.05 ^b	63.78 ^b	63.65 ^b	0.47
Lignin,%	2.88 ^a	5.25 ^b	5.14 ^b	3.46 ^{ab}	0.45
Sugars (WSC ²)	13.72 ^a	9.14 ^b	7.61 ^c	6.61 ^c	0.61
IVTD ³	79.64 ^a	60.77 ^c	58.57 ^c	68.01 ^b	0.59
Silage consumption:					
Fresh wt., lbs	29.01 ^a	17.9 ^b	11.7 ^c	17.5 ^b	2.09
Dry wt., lbs	6.30 ^a	3.82 ^{ab}	2.40 ^b	2.61 ^b	0.91

¹ Four by four and a half foot round bales.

² WSC = water soluble carbohydrates.

³ IVTD = in vitro true digestibility.

^{a,b,c} Average values with different superscripts differ significantly ($P < 0.05$), SE = standard error.

Alfalfa Baleage Production, Quality, and Persistence – Three Year Summary

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Introduction. Alfalfa is the premiere forage used in most Midwestern and Western U.S. dairies, though trucking costs usually limit widespread incorporation of this nutritious forage in diets of southern dairy cows. Legume production in the south has been hampered due to a hostile summer time environment, acid soils, insect pressure, and plant diseases. Earlier plot work at the Southeast Research Station indicated that alfalfa harvested at 4-week intervals (early bloom) rarely survived more than one year, but delaying harvest to at least 6 weeks promoted stand longevity.

Procedures: A twelve acre field of alfalfa was planted November 21, 2002 to determine the feasibility/economic potential of growing alfalfa in southern Louisiana. Optimum management practices were employed including liming soil to a 7.0 pH, fertilizing with N, P, K, S, and B according to soil recommendations, using inoculated seed, harvesting at 6-week intervals, and suppressing weeds and insects. Details on planting and management procedures may be found in the 2003 Southeast Research Station Field Day Summaries, LSU AgCenter Research Summary #153. All forage was cut with a mower-conditioner, left in windrows for about 24 hours, baled and individually wrapped in stretch film. Data on yield per acre, forage quality, plant density, and weed infestation were collected following each cutting. Economic data on establishment costs, baleage production costs, and hay value were collected. The project was terminated in the fall of 2005 (year 3).

Results. Yield, quality, and persistence data are presented in Table 1. Initial stand establishment was excellent with over 9 plants per square foot in the early spring of year-1 post-establishment. Four to five cutting were made in each of the three years in which the alfalfa was evaluated. Warm early spring temperatures promoted early growth and the first harvest was usually taken by mid-April of each year. This first cutting, though yielding only about 2.5 bales per acre, was the highest quality often averaging over 24% protein and 65% TDN. Typically, mid-summer cuttings yielded the most forage (4-5 bales per acre), but forage quality was considerably lower. Sevin was applied in early July of year 1 to control fall army worms. By the end of year one, alfalfa plant density had declined considerably and increasing weed pressure was evident. Never the less, close to 5 tons of hay equivalent per acre were harvested in year one and net returns of \$150.76 per acre were realized.

In early summer of year two an additional one ton of lime per acre and more K, P, S, and B fertilizer were applied. Aphid damage was substantial in the early summer of the second year which weakened the stand. In addition, a tropical storm struck the area just before time to harvest dumping over 10 inches of rain on the alfalfa field. This caused the alfalfa to lodge and considerable disease and leaf loss occurred. Again, yields were similar to year one at about 5 tons of hay equivalent per acre, though weed competition increased from 1.8 to 4.3 plants per square ft. The herbicide Poast-Plus was applied in late summer in an attempt to control

Johnsongrass and crabgrass, Net returns, compared to trucking in similar quality hay, were \$169.21 per acre.

In the spring of year three the remaining alfalfa stand appeared healthy, though it was heavily infested with annual ryegrass and nutsedge. By late summer, the ryegrass was replaced by crabgrass and the last cutting contained about 25% alfalfa and 75% weeds, primarily crabgrass. At the last cutting in mid-August 2005, baleage quality had diminished greatly with protein falling below 12% and TDN below 52%. The alfalfa field was abandoned after Hurricane Katrina struck on August 29, 2005.

In summary, we learned that alfalfa may be grown in Louisiana and will store well as baleage, particularly when baled at about 50% moisture and wrapped with six layers of plastic stretch film. Baleage yield was adequate to be moderately profitable for two years, but quality of most cuttings was inferior to alfalfa hay imported from out of state. Major deterrents to stand longevity appeared to be plant diseases (related to high rain fall) and weed encroachment. Future research should focus on herbicide resistant varieties that are also resistant to fungal-type plant diseases.

Table 1. Alfalfa yield, quality, persistence, and market value (summarized by year¹).

Year	Annual Yield/acre		Forage Quality			Stand Persistence		Net returns ³ \$/acre
	Bales	Tons	Dry matter, %	Protein, %	TDN ² , %	Alfalfa plants/sq.ft.	Weeds/sq.ft.	
2003	11.5	4.90	58.5	17.2	59.2	5.4	1.8	150.76
2004	12.4	5.18	54.6	17.5	61.2	5.7	4.3	169.21
2005 ⁴	10.2	3.65	55.3	13.8	52.7	2.6	6.6	-8.58

¹ Yields based on 4-5 harvests per year.

² Total digestible nutrients.

³ Based on hay market value less annual production costs and prorated establishment costs. Establishment costs were \$320.85/acre prorated over three years. Annual production costs for 2003-2005 were \$318.99, \$416.14, and \$212.59/acre, respectively).

⁴ Last (8/11/05) cutting valued at \$60/ton due to heavy weed (crabgrass) contamination.

Performance of Warm Season Forage Crops at the Southeast Research Station 2007

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Introduction. Pearl millet, sorghum x sudangrass and forage sorghum are annual warm season varieties recommended by the LSU AgCenter for summer grazing and greenchop and for the production of hay and silage/baleage. The summer annual performance trials are open to all public and private breeding programs. Both commercially available and advanced experimental lines were tested for yield performance. The trial was conducted according to practices recommended by the LSU AgCenter for each species. Summer annuals were planted in early June. Phosphorus (P) and potassium (K) were applied at planting at the rate of 48 lbs per acre for each. Nitrogen (N) was applied at planting, at establishment and after the first cutting for a total of 118 lbs per acre. Applications of pesticides are on an as needed basis to control insects, weeds and diseases. Each variety was tested with four replications and yield performance was reported as average of three years. Researchers harvest the plots periodically throughout the growing season and collect data from each trial. The summer annual forages were cut approximately 45 days after planting and subsequent harvests are made at approximately 30-day intervals. Yield difference was noted with letters following the yield values. Averages followed by the same letter indicate the two varieties are not different in performance more than 95% probability.

Pearl Millet

Pearl millet is a summer annual grass suitable for use on well-drained upland soil. It tolerates drought stress more easily than sorghum x sudangrass hybrids and it is capable of tolerating more acidic soils. It has a tendency to tiller out from the base of the plant, improving the ability to recover from harvesting. Unlike sorghum x sudangrass, pearl millet does not contain prussic acid. Pearl millet can be recommended for grazing, hay and baleage. The slow drying time of this forage because of thick stems may limit the use of pearl millet as a hay crop. Grazing should be delayed until the plants are 18 to 20 inches tall. Pearl millet varieties were planted at the rate of 25 lbs/acre with a drill.

Sorghum x Sudangrass

Sorghum x sudangrass hybrids are recommended for use in areas with limited drainage and heavy soils. It is intolerant of low soil pH and should only be planted on those soils with a pH of 5.5 or above. Sorghum x sudangrass hybrid contains prussic acid when it is immature or under drought stress. Prussic acid intoxication suffocates livestock and results in instant death. Recommended grazing height to avoid intoxication is more than 24' tall. Also it is necessary to feed drought stressed sorghum x sudan as hay or silage. Seeding rates were 30 lbs/acre, drilled.

Forage Sorghum

Forage sorghum is recommended for silage production in limited moisture areas or if it is too late to plant temperate corn. It can also be harvested for hay or utilized as summer grazing. As with the other large stemmed summer annuals, drying for hay is difficult. It can, however, be harvested more easily as baleage because of the lower drying time to reach the appropriate dry matter percent. Silage quality is typically not as high as with temperate corn silage; however this annual can be useful in improving the quantity of silage capable of being stored in a season when corn production is limited. Seeding rates were 25 lbs/acre, drilled. Forty-eight pounds of phosphorus (P) and of potassium (K) were applied at planting and nitrogen (N) was applied at planting, establishment and after harvesting for a total seasonal application of 118 lbs/acre of nitrogen.

Results. ‘NK 300’ forage sorghum and ‘BMR 106’ forage sorghum produced the most dry matter during the growing season. ‘BMR EXP 3017’ is an experimental line of Sorghum × sudangrass hybrid. In terms of dry matter yield, it is a promising line but more yearly data need to be collected. The pearl millet variety ‘Tifleaf 3’ did not produce as much as sorghum-sudan hybrids or forage sorghum. However, yield distribution seems to be more balanced. Tested summer annuals will be further analyzed for forage quality and digestibility at the Southeast Research Station Forage Quality Analysis Lab.

Table. Dry matter yield of warm-season annual forage crop varieties by cuttings in 2007, Southeast Research Station.

Variety	Dry matter yield, lbs per acre		
	Cut† 1	Cut 2	Total dry matter yield‡
BMR 106 Forage Sorghum	12230	2730	14960 a
Tifleaf 3 Pearl Millet	6405	4212	10617 b
BMR Exp 2027 Sorghum X Sudan	7110	3974	11084 b
BMR Exp 3017 Sorghum X Sudan	11183	4769	15952 a
NK 300 Forage Sorghum	11022	4596	15618 a

†: cutting dates: cut 1, 7/31 cut 2, 9/25.

‡: Average yields followed by the same letters are not significantly different.

Performance of Cool Season Annual Forage Crops at the Southeast Research Station 2005-2007

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Introduction. Each year, LSU AgCenter researchers conduct variety trials of cool-season annual grasses at LSU AgCenter research stations and cooperating agencies across the state. These trials provide information on the performance of annual ryegrass, cereal rye, and oats varieties in various climates. A list of recommended varieties is available for producers through the LSU AgCenter Cooperative Extension Service and at the LSU AgCenter web site, www.lsuagcenter.com. Recommendations are made among the commercially available varieties tested for three consecutive years and yielded not less than 90% of the top three producing varieties' dry matter yield.

Tables 1-3 present the average of three years of total forage yield per variety, as well as the forage yield per cutting within the 2007 growing season. Annually, the planting date was set for mid October. Harvesting of the trial plots occurred periodically throughout the growing season by cutting to a stubble height of two to four inches. Cumulative forage yield data were combined over three years and yield performance was evaluated. The three year average followed by the same letter is not potentially different in terms of dry matter yield. For an example three year yield average of '4X' and 'Big Boss' in Table 1 were 10852 and 11995 lbs per acre, respectively. Numerically, the yields were different, however, averages followed by the same letter 'a' means that there is a 95% chance that the yield of the two varieties will not be different in an actual growing situation.

Annual Ryegrass

Annual ryegrass is an excellent cool-season forage crop with high sugar content and high digestibility. It can be successfully grown on most soils and can be planted into a prepared seedbed or over seeded into permanent summer pastures. Annual ryegrass varieties were planted at the rate of 30 lbs/acre into a prepared seedbed of Tangi silt loam soil. Phosphorus (P) and potassium (K) fertilizer was applied to the plots at planting according to soil test recommendations made by the LSU AG Center Cooperative Extension Service. Nitrogen (N) was applied at planting, at establishment and after the second and fourth harvest. The total amount of nitrogen was 190 lbs per acre per season.

Currently, in addition to the presented varieties, thirteen varieties are being tested to accumulate three years of data. The three year average yield shows that numerically 'Big Boss' produced the highest pounds of dry matter among the tested varieties. However, most of the varieties (followed by letter 'a') produced equivalent dry matter yields to 'Big Boss'. However, varieties followed by 'cd' or 'd' are lower yielding varieties than 'Big Boss' or 'Marshall' in the southeast region.

Table 1. Southeast Research Station dry matter yield of ryegrass varieties by cuttings in 2007 and 3 year averages (2005-2007).

Variety	Dry matter yield, lbs/acre					3-Yr Average
	-----2007-----					
	Cut 1	Cut 2	Cut 3	Cut 4	Total	
Big Boss	5844	3892	3590	3013	16339	11995 a‡
Marshall	5735	2983	3026	3858	15602	11954 ab
Striker	5614	2346	3849	3815	15624	11797 abc
Prine	5352	2696	3309	3069	14426	11738 abc
ME94	4112	2356	4045	3122	13635	11268 abcd
Gulf	3888	2545	4105	2752	13290	11114 abcd
Passerel Plus	4382	2735	2920	3214	13251	11012 abcd
Maximus	5570	2326	2930	3328	14154	10988 abcd
4X	4297	2478	2931	3553	13259	10852 abcd
Rio	3578	2706	3643	3142	13069	10787 abcd
Graze-N-Gro	4277	2382	3057	2909	12625	10766 abcd
Dyna-Gain	5003	2264	2874	2729	12870	10762 abcd
TAM 90	4485	3109	2711	2948	13253	10699 bcd
Ed	4177	2745	3424	2372	12718	10661 dc
Jumbo	3422	2483	2763	3574	12242	10600 dc
Diamond T	4729	3354	2723	2676	13482	10593 dc
Flying A	3072	2636	3274	2907	11889	10322 d
Verdure	4038	1901	3276	3295	12510	10292 d
Jackson	2875	2020	3692	3325	11912	10067 d
WMN 97	3546	2837	3355	3122	12860	10065 d

†: cutting dates: cut 1, 1/31 cut 2, 3/7, cut 3, 4/4, cut 4, 5/2.

‡: average yield followed by the same letters are not significantly different.

Cereal Rye

Cereal rye is generally more cold tolerant than most varieties of annual ryegrass and more tolerant to low soil pH than ryegrass or other small-grain species. It has the capacity to produce more forage during late fall and early spring than does annual ryegrass. Cereal rye is recommended either alone or in a mixture with annual ryegrass for winter grazing and as a spring hay crop on most types of soils. Cereal rye varieties were planted into a Tangi silt loam soil in mid-October as pure stands at the rate of 90 lbs. of seed per acre into a prepared seedbed. Phosphorus (P) and Potassium (K) were applied according to soil test recommendations made by the LSU AgCenter Cooperative Extension Service. Nitrogen (N) was applied at planting, at establishment and after every other harvest, beginning with the second, for a total N application of 140 lbs per acre.

Currently, in addition to the presented varieties, two more rye varieties are being tested or will be tested to accumulate three years of data. ‘Maton II’ is the best variety in terms of dry matter yield. ‘Maton’ and ‘Oklon’ may be other choices in southeast LA because there will be a good chance of the same dry matter yield as with Maton II. Definitely ‘Bates’ and ‘Wintergrazer 70’ are less productive varieties than ‘Maton II’.

Table 2. Southeast Research Station dry matter yield of rye varieties by cuttings in 2007 and 3 year averages (2005-2007).

Variety	<i>Dry matter yield, lbs/ acre</i>				3-Yr Average
	-----2007-----				
	Cut 1	Cut 2	Cut 3	Total	
Maton II	4150	2886	2943	9979	9190 a
Oklon	4370	3154	2503	10027	8828 ab
Maton	4122	3318	2948	10388	8708 ab
Bates	4150	3273	2596	10019	8247 b
Wintergrazer 70	3930	2399	2558	8887	8239 b

†: cutting dates: cut 1, 1/31 cut 2, 3/8, cut 3, 4/4.

‡: Average yields followed by the same letters are not significantly different.

Oats

Oats can be planted somewhat earlier than any other small grains and produce forage earlier than ryegrass. Palatability and digestibility are known to be higher than rye. Varieties can be planted either alone or as mixtures with annual ryegrass. Cold tolerance is weaker than annual ryegrass or cereal rye.

Trial plots of oats were planted into a Tangi silt loam soil in mid-October as pure stands. Seeding rate was 100 lbs/acre, planted into a prepared seedbed. Phosphorus (P) and potassium (K) were applied according to soil test recommendations made by the LSU AgCenter Cooperative Extension Service. Nitrogen was applied at planting, at establishment and after every other harvest, beginning with the second, for a total nitrogen application of 140 lbs per acre.

Currently, in addition to the presented varieties, eleven more varieties are being tested or will be tested to accumulate three years of data. Yield performance of oats varieties is not showing an exceptionally high yielding variety. Although numerically ‘PlotSpike LA 9339’ produced the highest dry matter, statistical analysis did not confirm this yield difference as pure performance difference from the variety. ‘Horizon 321’ produced more balanced dry matter in each harvest than ‘Horizon 474’ and ‘LA966BSB-270-S2-C’.

Table 3. Southeast Research Station dry matter yield of oats varieties by cuttings in 2007 and 3 year averages (2005-2007).

Variety	<i>Dry matter Yield, lbs/ acre</i>			3-Yr Average
	-----2007-----			
	Cut 1	Cut 2	Total	
PlotSpike LA 9339	5093	3252	8345	7977 a
Horizon 474	4516	1827	6343	7884 a
Horizon 321	4467	4197	8664	7331 a
LA966BSB-270-S2-C	4396	1703	6099	7032 a
LA95033D63-1-C-S3	3832	3259	7091	7030 a

†: cutting dates: cut 1, 1/31 cut 2, 4/4.

‡: Average yields followed by the same letters are not significantly different.

Forage Quality Results from Louisiana and Mississippi Producer Forage Samples, 1999-2006

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Introduction. Quality analysis results of producer's forage samples during the last eight years may be a useful indicator showing forage production and utilization in LA and MS. Mature warm-season perennial grass quality is often insufficient to meet the nutrient requirements of non pregnant heifers. The two most significant nutrients, TDN (total digestible nutrients) and CP (crude protein) are the most easily applicable quality criteria in forage based livestock production. Florida researchers demonstrated TDN:CP ratio as a useful tool for estimation of forage intake potential in warm season grasses. Further research confirmed TDN:CP ratio as a possible indicator to judge effectiveness of protein supplements for increasing forage intake. The proposed TDN:CP ratio near 7 was applied to evaluate producer's forage sample quality.

Procedure. Producer samples were weighed, re-dried at 131 °F for 48 hours, and ground to 0.04 inch particle size with an experimental grinder. Samples were scanned with a specialized scanner for determinations of TDN and CP. Samples with inconsistent results (outliers) after scanning were re-analyzed using traditional chemical analysis. TDN:CP ratio was calculated by dividing percentage of TDN by percentage CP. For example, TDN is 54% and CP is 9%, then TDN:CP ratio is 6 ($54/9 = 6$).

Results. The TDN value in fresh cool season forages (alfalfa, clover, annual ryegrass, cool-season grass mixture, and small grains) ranged from 70 to 77 % (Table 1), which is approximately 15% higher than warm-season grasses. Cool-season forages preserved as silage or hay did not retain similar TDN value as fresh forage samples; however, the TDN remained higher than those of warm-season grass silages or hays. The average of CP concentration in cool-season forages ranged from 21 to 25 % in fresh samples, 12 to 16 % in silage, and 6 to 22 % in hay (Table 2). However, we did notice a large variation in CP %, indicating forage quality was quite different among producers. Also, the large differences in fresh samples and in the post-preserved cool-season forages indicated that nutrient loss during the preservation is substantial.

Research indicates that when livestock are fed only with forages, the supply of energy and CP is usually below the nutrient requirements of the livestock because of low intakes. The recommended TDN:CP ratio below 7 is usually indicative of high CP concentration and therefore, forage quality is high. Table 3 is presented to show the percentages of producer's forage samples of which quality is more than enough to meet the TDN and CP requirement of a non-pregnant 800 pound heifer. Warm-season perennial grass samples more frequently suffered from low CP content than low TDN content. The percentage of samples with a TDN:CP ratio below 7 was only 10% in bahiagrass hay and 39% in bermudagrass hay, which was markedly lower than either alfalfa hay or annual ryegrass.

Conclusions. Large variations in quality of producer samples suggest a need to develop more consistent production management practices. Especially, production management of

bermudagrass and bahiagrass need to be developed for higher quality forage production. Inter-seeding of legumes into warm-season grass or native grassland may be a reasonable approach. Also, more intensive management is required for native warm season grassland to produce high CP forages. Besides major forage resources, alternative high quality forages need to be developed for sustainable agriculture in Louisiana and Mississippi.

Table 1. Average TDN content in forage samples submitted by the producers in Louisiana (LA) and Mississippi (MS).

Forage	Utilization Method					
	<u>Fresh</u>	SE	<u>Silage</u>	SE	<u>Hay</u>	SE
	-----TDN-----					
Alfalfa	71	2.2	59	5.2	65	5.9
Clover	72	9.2	59	8.2	59	5.9
Annual ryegrass	71	8.7	62	5.6	57	5.3
Cool-season grass mix	70	10.0	59	8.3	57	5.5
Oats	71	11.8	60	6.1	62	8.9
Wheat	77	4.5	61	3.7	52	12.3
Other legumes	71	10.5	59	9.9	57	8.1
Bahiagrass	55	5.0	51	3.8	50	4.0
Bermudagrass	57	7.1	51	4.4	53	3.9
Other tropical grass	55	7.9	55	7.9	49	6.8
Warm-season grass mix	56	6.8	59	7.3	51	4.1
Corn silage	65	8.6	64	7.3	NA†	NA
Crabgrass	57	7.3	53	6.4	51	4.4
Forage sorghum	53	11.3	56	7.5	55	7.7
Pearl millet	NA	NA	47	7.3	49	3.9
Sorghum-sudangrass	61	6.8	56	8.6	49	8.8

†: Not enough data. SE = standard error.

Table 2. CP content in forage samples submitted by the producers in Louisiana (LA) and Mississippi (MS).

Forage	Utilization Method					
	Fresh	SE ¹	Silage	SE	Hay	SE
	-----% CP-----					
Alfalfa	24	4.0	16	3.3	21	3.3
Clover	23	6.7	15	4.1	15	3.7
Annual ryegrass	21	7.8	14	3.9	11	3.8
Cool-season grass mix	21	8.5	13	4.2	11	3.9
Oats	22	7.6	12	3.3	11	2.4
Wheat	25	3.4	13	4.0	6.3	3.5
Other legumes	22	6.7	16	3.7	13	3.4
Bahiagrass	12	4.1	10	2.6	8.2	2.5
Bermudagrass	13	5.2	9.7	3.1	10	3.2
Other tropical grass	11	5.0	13	4.4	8.6	7.7
Warm-season grass mix	13	5.6	9.1	2.3	9.3	5.1
Corn silage	12	6.2	8.6	3.4	NA†	NA
Crabgrass	14	4.6	12	4.1	9.5	3.1
Forage sorghum	12	6.7	12	3.2	11	5.2
Sorghum-sudangrass	9.6	1.0	11	2.6	9.5	3.5
Pearl millet	NA	NA	12	3.0	7.9	3.1

†: Not enough data. ¹ SE = Standard Error.

Table 3. Percentages of forage samples TDN:CP ratio below 7.0.

Forage	TDN:CP < 7.0		
	Fresh	Silage	Hay
	-----%-----		
	100	79	97
Clover	91	71	81
Annual ryegrass	98	92	70
Cool-season grass mix	90	74	73
Oats	91	77	85
Wheat	100	90	31
Other legumes	90	80	62
Bahiagrass	51	14	10
Bermudagrass	64	17	39
Other tropical grass	37	58	20
Warm-season grass mix	53	67	18
Corn silage	90	79	NA†
Crabgrass	50	26	22
Forage sorghum	29	50	43
Pearl millet	NA	20	0
Sorghum-sudangrass	88	47	15

†: Not enough data.

Forage Utilization Trends as Determined from Eight Years of Forage Quality Analyses in Louisiana and Mississippi

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Introduction. Forage is the backbone of livestock production in the US and forage utilization will be different depending on climate, soil type and production management practices. Eight years of forage quality analysis requests from the producers in Louisiana (LA) and Mississippi (MS) may reveal trends of forage utilization in the corresponding areas. Database generated from producer forage sample analysis results were reviewed by year, agricultural region, and utilization type.

Procedures. Forage Quality Laboratory in LSU AgCenter SERS is a National Forage Testing Association certified laboratory. Annually more than 2,000 samples of forage, byproducts, total mixed rations, and concentrated feed have been analyzed for feed value and mineral content as requested by producers. Forage database generated during the period from 1999 to 2006 included a total of 11,135 samples. Regional divisions of LA producers (NW, northwest; NC, north central; NE, northeast; CE, central; SW, southwest, SC; south central; SE; southeast; CR; crescent) were established according to the agricultural divisions assigned by the LSU Agricultural Center. Mississippi regional divisions (DEL, delta; NMERC, North Mississippi Extension Research Center, CEN, central; COA, coastal) were made according to MAFES regional divisions. (Fig. 1). This review was made based on an assumption that producers used the forage as they submitted to the laboratory.

Results. Total forage entries were different in every year. Therefore, forage samples were re-categorized into nine types based on agricultural characteristics to compare annual sample submission frequencies (Fig. 2). Except for 2005, bermudagrass & bahiagrass accounted for more than 30% of total samples through the years. Sample portion of warm-season annuals, corn silage, forage sorghum, sorghum sudangrass hybrids, pearl millet, and crabgrass was less than 20%. Other legumes including various peas, beans, and warm season legumes occupied 1 to 3% of total sample numbers. Other warm-season grass included less commonly grown warm-season tall grasses like dallisgrass, johnsongrass, switchgrass, etc. Warm-season grass mixes were more like native grass pastures and represented only 10% of total submittals. Annual ryegrass was the single most commonly utilized cool season grass through the years. Although ryegrass submissions fluctuated, sample proportion maintained more than 18% annually. The percentage of alfalfa samples did not show a trend. Mixed cool-season grasses included some orchardgrass, timothy, and tall fescue. The proportion of mixed cool-season grass samples was near 5%. Small grain sample submittals were less than 1% of the total.

Major monoculture forage sample submissions were different between beef and dairy areas (Table 1). Ryegrass and corn silage were the most common forage samples submitted in southeast LA, where most of the state's dairy area is located. Dairy area producers submitted similar numbers of corn silage samples and ryegrass samples, reflecting greater demand for high energy feeds in this area. Other non-dairy areas submitted bermudagrass samples most frequently and native summer grass mixes were the second most often submitted forage sample.

Small grain samples represented less than 5% of samples submitted, indicating more utilization potential in the future.

Hay is the most highly utilized forage type in LA and MS (Table 2). However, utilization of forage as pasture, silage or hay showed slightly different usage patterns with different forage species. Forage utilization for alfalfa, bahiagrass and bermudagrass was primarily as hay in LA and MS. Annual ryegrass utilization was more diverse. Percentage of ryegrass stored as hay or baleage was similar in LA, while annual ryegrass baleage proportion was about three times more than hay in MS. The majority of warm-season grass utilization seems to be as hay. Natural pasture or native grassland is presumed to be utilized in grazing or hay.

Conclusions. Estimation of forage utilization based on producer sample submissions does show short term trends in warm-season perennial grasses and annual ryegrass with warm season forages being primarily stored as hay and annual ryegrass being stored as hay or baleage. Producers in Louisiana and Mississippi seem to grow appropriate forages to meet their production purposes. Overall, forage utilization is mostly as hay though many of the higher quality forages are preserved as either baleage or chopped silage.

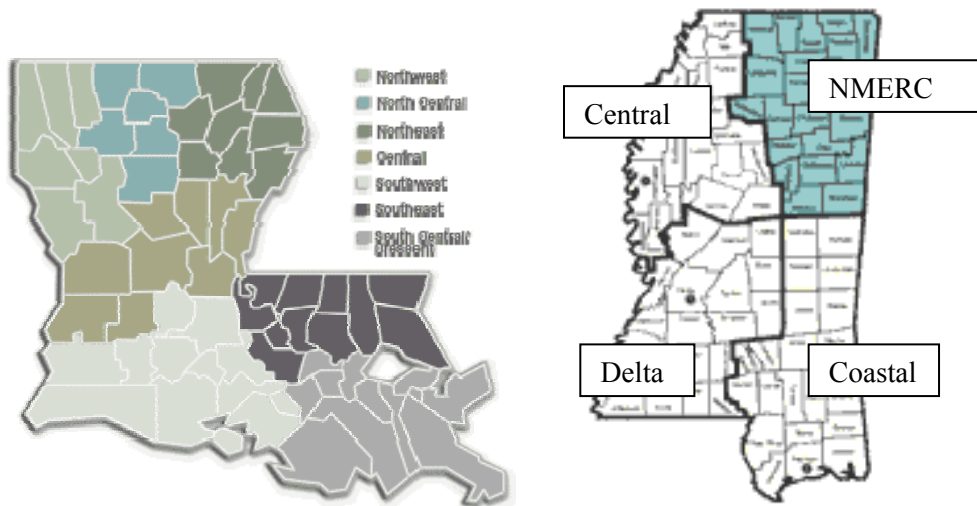


Fig. 1. Regional divisions of Louisiana and Mississippi

Table 1. Percent of forages submitted by Louisiana (LA) or Mississippi (MS) producers for forage quality analysis.

Forage	LA Region								MS Region			
	CE	CR	NC	NE	NW	SC	SE	SW	CEN	COA	DEL	NMREC
	%											
Alfalfa	0.8	11.7	2.1	0.9	3.5	1.8	6.8	3.0	3.8	3.0	4.0	2.4
Clover	6.0	3.3	0.5	0.5	0.1	4.9	0.3	0.8	0.9	0.3	0.0	0.0
Annual Ryegrass	6.6	5.8	7.3	5.9	19.9	38.7	28.3	8.7	34.8	43.7	4.0	7.7
Cool-season grass mix	6.8	44.2	4.4	3.3	5.6	9.4	3.5	3.1	1.9	2.4	4.0	6.8
Oats	0.2	0.0	0.0	0.5	0.1	0.2	0.5	0.0	0.9	0.0	0.0	0.0
Wheat	0.6	0.0	0.2	0.3	0.3	0.0	0.2	0.4	0.2	0.1	4.0	0.0
Other legumes	0.4	0.0	0.2	0.3	0.2	4.9	2.1	0.5	1.0	1.6	12.0	1.4
Bahiagrass	13.0	9.2	6.4	5.2	12.7	2.8	9.8	9.9	9.1	18.9	0.0	2.9
Bermudagrass	35.4	24.2	56.3	57.8	31.9	21.9	9.6	52.8	14.7	11.5	40.0	31.4
Other tropical	3.7	0.0	0.5	2.8	1.2	2.1	1.9	5.2	2.6	2.2	0.0	7.2
Warm-season grass mix	24.2	1.7	17.9	14.0	20.5	9.4	7.2	11.1	7.6	5.4	28.0	31.9
Corn silage	1.9	0.0	1.8	6.4	2.4	3.5	24.5	3.5	17.9	8.3	4.0	5.8
Forage sorghum	0.2	0.0	0.0	0.2	0.1	0.0	2.1	0.2	1.5	1.0	0.0	0.0
Sorghum sudangrass	0.2	0.0	1.6	1.0	1.0	0.0	0.3	0.1	0.7	0.0	0.0	1.0
Pearl millet	0.0	0.0	0.2	0.5	0.0	0.2	0.3	0.1	0.5	0.0	0.0	0.5
Crabgrass	0.2	0.0	0.5	0.3	0.5	0.2	2.7	0.5	1.8	1.5	0.0	1.0
Total number†	517	120	563	578	1051	566	3120	1611	1635	1120	25	207

† Total number of samples from all regions.

Table 2. Forage utilization methods of producer samples submitted to LSU AgCenter's Southeast Research Station.

Forage	LA					MS				
	Pasture	Green chop	Chopped silage	Balage	Hay	Pasture	Green chop	Chopped silage	Balage	Hay
	%									
Alfalfa	1.5	0.6	0.0	3.2	94.7	0.0	0.0	0.0	2.9	97.1
Clover	15.1	1.1	1.1	3.2	79.6	35.3	0.0	5.9	11.8	47.1
Annual Ryegrass	14.7	3.3	19.3	31.7	30.9	4.3	0.9	11.5	61.8	21.5
Cool-season grass mix	15.1	0.2	3.7	9.9	71.0	21.9	0.0	5.5	26.0	46.6
Oats	43.5	0.0	21.7	8.7	26.1	7.1	0.0	21.4	21.4	50.0
Wheat	15.0	0.0	0.0	30.0	55.0	0.0	0.0	50.0	16.7	33.3
Other legumes	56.9	0.0	5.5	3.7	33.9	19.5	0.0	4.9	19.5	56.1
Bahiagrass	3.3	0.5	0.0	3.7	92.5	13.9	0.3	0.0	2.5	83.4
Bermudagrass	5.5	0.2	0.2	1.1	93.0	6.0	0.0	2.0	6.4	85.6
Other tropical grass	33.2	0.5	4.9	9.3	52.2	20.2	3.6	14.3	15.5	46.4
Tropical grass mix	13.1	0.7	9.7	2.8	73.7	10.8	0.4	13.9	4.6	70.3
Corn silage	4.1	6.7	89.2	1.8	NA	3.5	4.0	92.2	1.0	0.3
Forage sorghum	12.3	2.7	61.6	16.4	6.8	2.8	0.0	61.1	33.3	2.8
Sorghum sudangrass	2.7	8.1	13.5	5.4	70.3	0.0	28.6	42.9	28.6	0.0
Pearl millet	0.0	0.0	0.0	50.0	50.0	0.0	0.0	0.0	70.0	30.0
Crabgrass	13.5	1.0	6.7	35.6	43.3	8.2	0.0	6.1	46.9	38.8

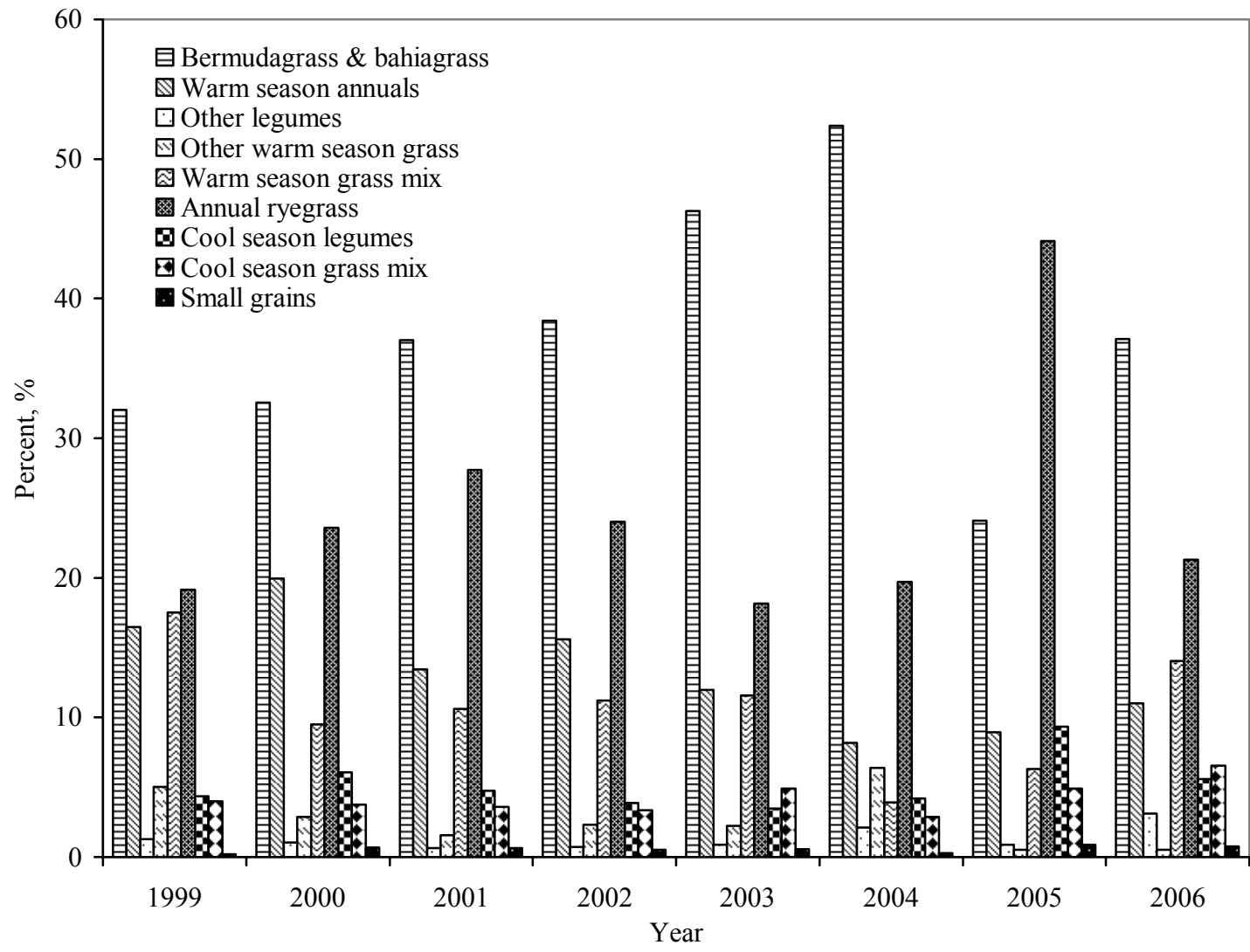


Fig. 2. Annual major forage species submitted to LSU SERS for quality analysis from Louisiana and Mississippi producers.



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