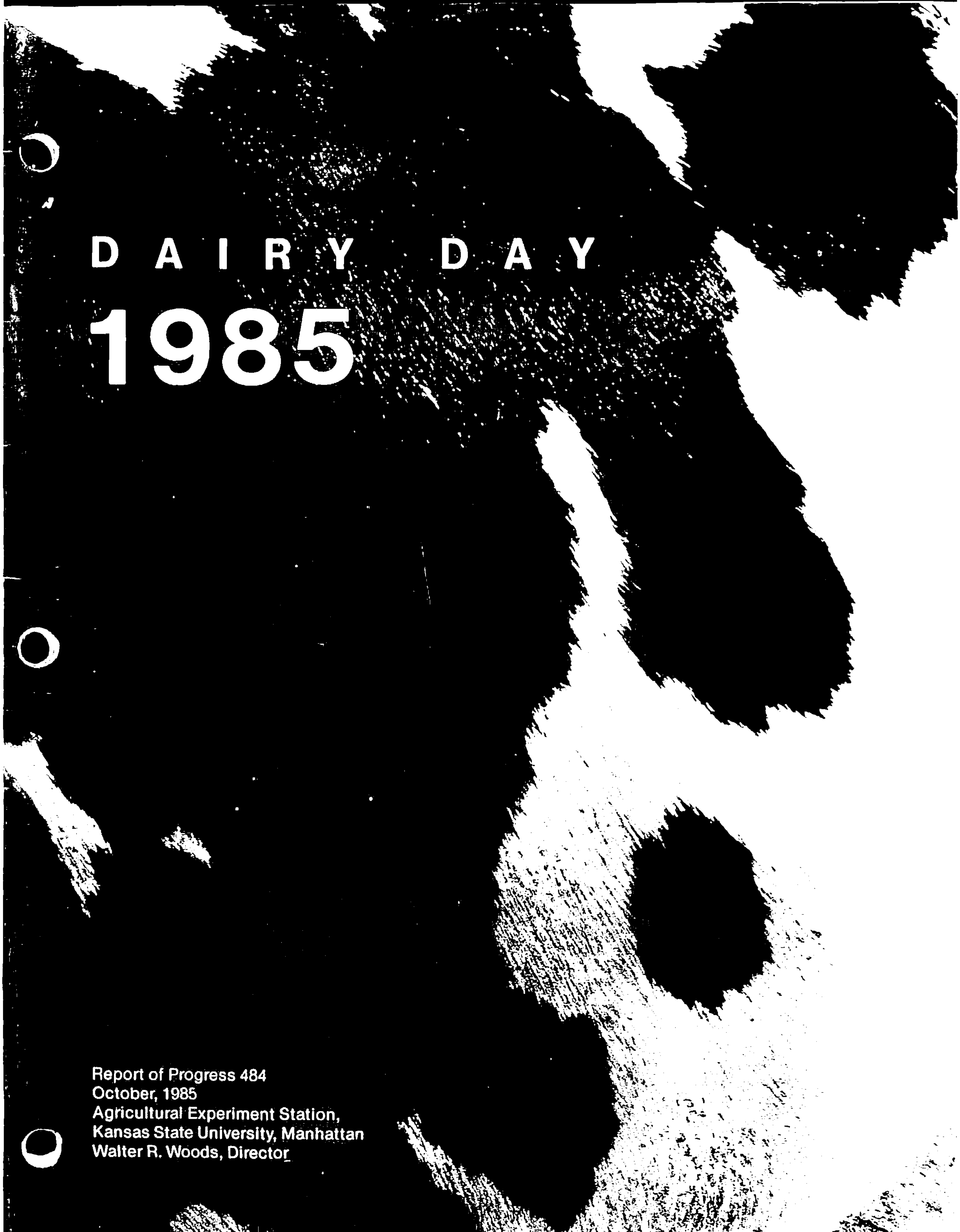


DAIRY DAY 1985

Report of Progress 484
October, 1985
Agricultural Experiment Station,
Kansas State University, Manhattan
Walter R. Woods, Director

Biological Variability and Chances of Error

The variability among individual animals in an experiment leads to problems in interpreting the results. Although the cattle on treatment X may have had a larger average daily gain than those on treatment Y, variability within treatments may mean that the difference was not the result of the treatment alone. Statistical analysis lets researchers calculate the probability that such differences were from chance rather than the treatment.

In some of the articles that follow, you will see the notation "P<.05". That means the probability of the differences resulting from chance is less than 5%. If two averages are said to be "significantly different", the probability is less than 5% that the difference is from chance— the probability exceeds 95% that the difference results from the treatment.

Some papers report correlations; measures of the relationship between traits. The relationship may be positive (both traits tend to get bigger or small together) or negative (as one traits gets bigger, the other gets smaller). A perfect correlation is one (+1 or -1). If there is no relationship, the correlation is zero.

In other papers, you may see a mean given as 2.50±.10. The 2.50 is the mean; .10 is the "standard error". The standard error is calculated to be 68% certain that the real mean (with unlimit number of animals) would fall within one standard error from the mean, in this case between 2.40 and 2.60.

Many animals per treatment, replicating treatments several times, and using uniform animals increases the probability of finding real differences when they exist. Statistical analysis allows more valid interpretation of the results regardless of the number of animals. In nearly all the research reported here, statistical analyses are included to increase the confidence you can place in the results.

FOREWARD

Members of the Dairy Commodity Group of the Department of Animal Sciences and Industry are pleased to present this Report of Progress, 1985. Dairying continues to be a viable business and contributes significantly to the total agricultural economy of Kansas. There are presently 11.1 million dairy cows in the U.S. with Kansas ranking about 23rd with approximately 107,000 cows. At the beginning of the year, about 2,100 farms in Kansas were marketing milk with 1,409 in the Grade A phase. Annual estimates indicate that dairying generates $195 million in farm value of milk and another $72 million attributed to the sale of meat from bull calves, steers, and cull cows. Wide variation exists in the productivity per cow as indicated by the production testing program (DHIA) in Kansas. About one-half of the dairy herds in Kansas are enrolled in DHIA. Dairy cows enrolled in DHIA average more income-over-feed cost ($872/cow) than nontested cows ($472/cow). Much emphasis should be placed on furthering the DHIA program and encouraging use of its records in making management decisions.

With our herd expansion program that was begun in 1978 after moving to our new Dairy Teaching and Research Center (DTRC), we have peaked at about 210 cows. The herd expansion was made possible by the generous donation of 72 heifers and some monetary donations by Kansas dairy producers and friends. Herd expansion has enabled our research efforts to increase while making the herd more efficient. Our rolling herd average recently peaked over 18,000 lb, despite many research projects that do not always promote production efficiency. Much of our recent improvement in production was because of good management and culling of low producing cows during the Dairy Diversion Program. Updated information on the results of culling practices are contained in this publication.

The excellent functioning of our dairy center is because of the special dedication of our DTRC staff. Appreciation is expressed to Bill Carinder (Unit supervisor), Ken Frantz (herdsman), Dan Umsheid, Mary Rogers, Charlotte Kobiskie, Bill Hanson, Robert Resser, Don Allen, Mark Sellens, and Lloyd Manthe. Special thanks is given to Steve Galitzer, Lynn Rosenkrans, Neil Wallace, Natalie Brockish, and Mary McDonald for their technical assistance in our laboratories.

Since the recent retirements of Drs. George Ward and Earl Farmer, we welcome Dr. John Shirley to our Dairy faculty. John is a native of Kentucky and will be involved in teaching milk secretion, dairy cattle management, and an introductory course in dairy science. John will be conducting research in dairy cattle nutrition and management as well as directing the operation of DTRC.

As demonstrated, each dollar spent for research yields a 30 to 50 percent return in practical application. Research is not only tedious and painstakingly slow but expensive. Those interested in supporting dairy research are encouraged to consider participation in the Livestock and Meat Industry Council (LMIC) - philanthropic organization dedicated to furthering academic and research pursuits by the Department. More details about LMIC are contained in this publication. Appreciation also is expressed to Charles Michaels (Director) and the Kansas Artificial Breeding Service Unit (KABSU) for their continued support of dairy research in the Department.

Lastly, appreciation is expressed to the College of Veterinary Medicine for their continued support and cooperation. An excellent working relationship has enabled us to develop cooperative research and establish an exemplary herd health program.

J.S. Stevenson, Editor
1985 Report of Progress

CONTENTS

EFFECT OF CALF-STARTER PROTEIN SOLUBILITY ON CALF PERFORMANCE

J. L. Morrill, P. G. Reddy, K. C. Behnke[1], and J. J. Higgins[2]

Summary

Three starters containing differently processed protein supplements were fed to Holstein heifer calves, using an early weaning program. One starter contained soybean meal. The other starters contained soybean grits processed through an extrusion cooker to reduce the protein solubility to an intermediate (PDI > 50%) or low (PDI < 15%) level. Calf performance was similar on all three starters.

Introduction

Protein that is digested in the intestines by ruminants may come from microbial protein synthesized in the rumen or from feed protein that is not degraded in the rumen. Compared to quality of feed protein that can be fed, quality of microbial protein is intermediate. Therefore, under some conditions it is advantageous to somehow cause feed protein to escape rumen degradation. Proper heat treatment can cause protein to escape rumen degradation, yet be available for digestion in the intestines. This experiment was an effort to increase efficiency of protein utilization in the young calf by causing the protein to escape rumen degradation.

Procedures

Seventy-one Holstein heifer calves were assigned to one of three experimental groups at 1 day of age and remained on the experiment for 6 weeks. The calves were fed colostrum until 3 days of age, then milk until weaning. Each was fed at 8% of birth weight daily in two equal feedings. A prestarter (Table 1) was fed until consumption was ½ lb. per animal per day, then a mixture of ½ lb. prestarter and as much starter as the calf would eat was fed. The calves were weaned at any time after 2 weeks of age when they were consuming 1 lb. of dry feed daily, or at 3 weeks of age if not yet weaned.

Calves in the three groups were treated the same except for the starter they received. Calves in one group were fed a starter (Table 2) containing commercial soybean meal. Calves in the other groups were fed starters that differed in that the soybean meal was replaced by soybean grits processed through a Wenger X-20 Extruder at low heat to produce a product with a protein dispersibility index (P.D.I.) of 65.5 or at high heat to produce a product with P.D.I. of 13.3.

[1]Department of Grain Science and Industry.
[2]Department of Statistics.

Feed consumption, weight gains, and other performance criteria of the calves were recorded.

Table 1. Composition of prestarter[1].

Ingredient	%
Whey, dried	46
7-60[2]	23
Skim milk, dried	19
Sodium caseinate	12
Additives	+

[1] Calfweena, Merricks, Union Center, Wisconsin
[2] A mixture of milk solids and fat containing 7% protein and 60% animal fat.

Table 2. Composition of calf starter[1].

Ingredient	%
Alfalfa, ground	25
Corn, cracked	30
Oats, rolled	20
Sorghum Grain, rolled	8.5
Soybean Meal	10.0
Molasses, dry	5.0
Dicalcium Phosphate	.7
Limestone, ground	.3
Salt	.25
Trace Mineral Salt	.25
Vitamins A&D	+[2]

[1] Pellet, 3/8 inch Diameter
[2] 1000 I.U. Vitamin A and 136 I.U. vitamin D per lb.

Results and Discussion

The amount of starter consumed and body weight gained are shown as weekly averages in Tables 3 and 4, respectively. There were no significant differences in either of these responses or in incidence of scours or general appearance of the calves with type of protein supplement used. Therefore, although the treatment used was effective in changing the solubility of the protein, under the conditions of this experiment these treatments did not cause a detectable change in calf response. Possibly, the responses would be different if other types of feedstuffs were used, especially if the other sources of protein were more completely degraded in the rumen than those used in this experiment.

Table 3. Weekly starter consumption, pounds[1].

Processing Condition	Weeks 1	2	3	4	5	6	Weekly average
Low heat	.11	.35	1.34	8.14	15.2	21.6	7.79
High heat	.15	.31	1.72	7.70	14.3	19.1	7.22
Soybean meal	.15	.35	1.56	7.04	13.0	19.1	6.80

[1] Differences from processing conditions were not significant (P>.05).

Table 4. Weekly weight gains, pounds[1]

Processing Condition	Weeks 1	2	3	4	5	6	Weekly average
Low heat	3.3	1.5	4.2	4.6	10.3	13.9	6.3
High heat	4.0	1.1	5.9	5.1	8.8	12.3	6.2
Soybean meal	3.1	1.8	5.5	3.7	7.9	12.1	5.7

[1] Differences from processing conditions were not significant (P>.05).

Recommendations

Based on the results of this experiment, commercial soybean meal is as satisfactory a protein supplement for calf starters as a specially processed soybean protein source. However, previous results (see 1984 Dairy Day, Report of Progress 460, page 16) have shown the importance of processing whole soybeans and further research may demonstrate significant benefits from modified methods of processing soybean meal.

EFFECT OF BUFFER IN PRESTARTER ON CALF PERFORMANCE

K. J. Jordan, J. L. Morrill,
P. G. Reddy, and J. J. Higgins

Summary

Including 3.0% sodium bicarbonate in the prestarter fed to young calves did not improve performance significantly.

Introduction

Previous work at the Kansas Agricultural Experiment Station contributed to the development of an early weaning program (see 1984 Dairy Day, Report of Progress 460). This program involves the use of a prestarter, which is a specially prepared feed intended to encourage early dry feed consumption and rumen development. Because all of the carbohydrate in the prestarter is lactose and because the rumen of the very young calf is not adapted to utilization of starch, rapid fermentation might cause excessive acidity in the developing rumen, a condition that might be avoided by adding a buffer to the prestarter. This experiment was conducted to test that hypothesis.

Procedures

Twenty-seven Holstein bull calves were assigned to one of two experimental groups at 1 day of age and remained on the experiment for 6 weeks. The calves were fed colostrum for 3 days after birth, then milk until weaning. Each was fed at 8% of birth weight daily in two equal feedings. Prestarter was fed until consumption was ½ lb. per animal per day, then a mixture of ½ lb. prestarter and as much starter as the calf would eat was fed. The calves were weaned when consuming 1 pound of dry feed daily if at least 2 weeks of age, or at 3 weeks of age if not yet weaned.

Calves in one group were fed normal prestarter (Table 1), and calves in the other group were fed the same prestarter with 3% sodium bicarbonate added. The composition of the starter fed is shown in Table 2. All calves were stimulated to eat dry feed by putting a small amount of prestarter in their milk.

Feed consumption, weight gains, fecal consistency, and observations of health were recorded. Blood samples were analyzed for glucose and urea nitrogen as indicators of rumen development.

Table 1. Composition of Prestarter[1]

Ingredient	%
Whey, dried	46
7-60[2]	23
Skim milk, dried	19
Sodium caseinate	12
Additives	+

[1]Calfweena, Merricks, Union Center, Wisconsin
[2]A mixture of milk solids and fat containing 7% protein and 60% animal fat.

Table 2. Composition of calf starter[1]

Ingredient	%
Alfalfa, ground	25
Corn, cracked	30
Oats, rolled	20
Sorghum Grain, rolled	8.5
Soybean Meal	10.0
Molasses, dry	5.0
Dicalcium Phosphate	.7
Limestone, ground	.3
Salt	.25
Trace Mineral Salt	.25
Vitamins A&D	+[2]

[1]Pellet, 3/8 inch Diameter
[2]1000 I.U. Vitamin A and 136 I.U. vitamin D per lb.

Results and Discussion

Starter consumption and body weight gains are shown as weekly averages in Tables 3 and 4, respectively. Differences between groups in weight gains, feed consumed, incidence of scours, or general health of the calves were not significant. Overall averages for serum glucose were 73.1 and 76.2 mg/dl and for serum urea nitrogen were 11.3 and 11.2 mg/dl for calves given control and buffered prestarter, respectively. Neither of those measurements were significantly different between groups.

Under the conditions of this experiment the added buffer was not beneficial. Only one type of buffer was used and that was added at only one level. Possibly sodium bicarbonate at a greater or lesser concentration, or a different type of buffer would be beneficial.

Recommendation

Based on the results of this study, do not add buffer to prestarter.

Table 3. Weekly starter consumption, pounds[1].

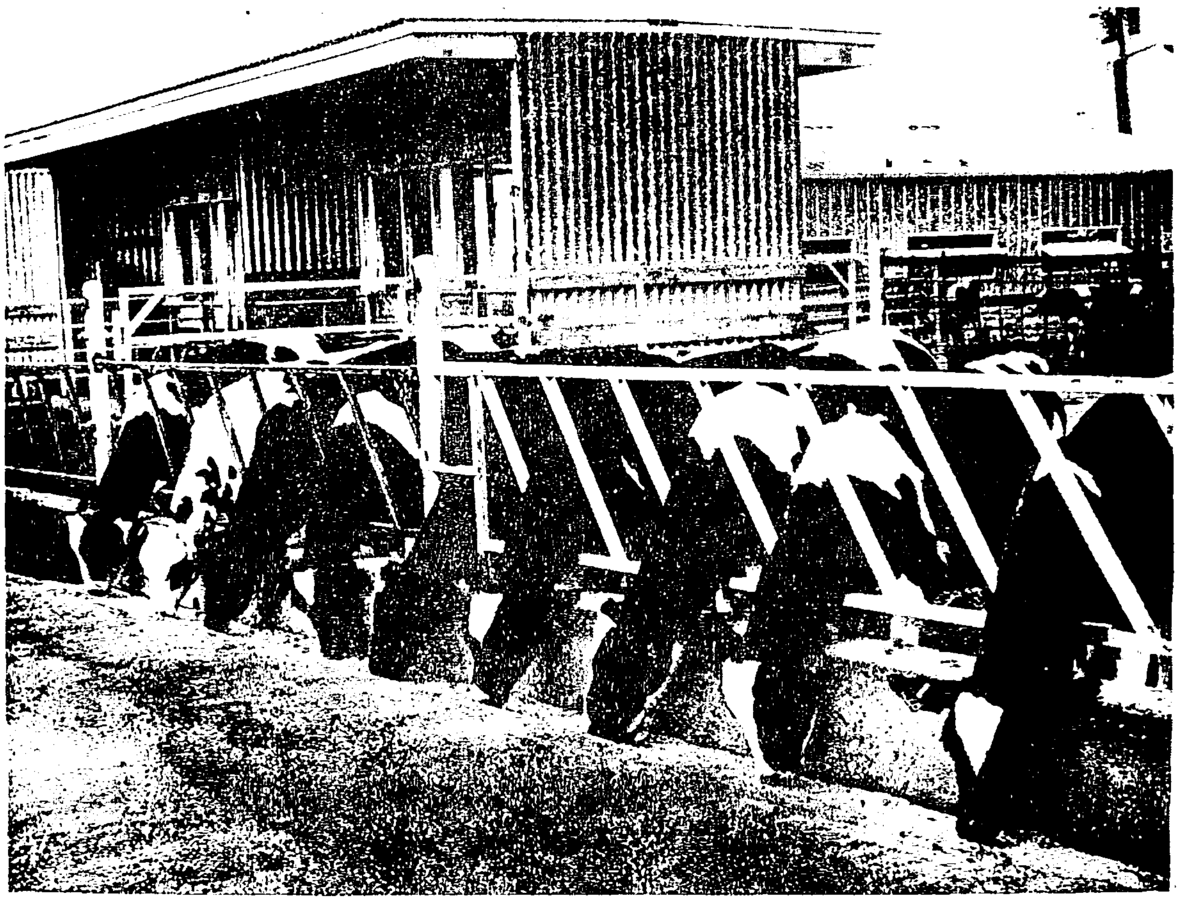
Type Prestarter	Weeks 1	2	3	4	5	6	Weekly average
Control	.09	.35	1.96	10.6	18.3	26.4	9.68
Buffered	.11	.46	2.44	12.1	21.1	27.5	10.56

[1] Differences from addition of buffer were not significant (P>.05)

Table 4. Weekly weight gains, pounds[1]

Type Prestarter	Weeks 1	2	3	4	5	6	Weekly average
Control	4.62	4.84	5.28	7.7	12.1	16.1	8.45
Buffered	4.84	1.1	7.04	8.1	15.6	13.0	8.29

[1] Differences from addition of buffer were not significant (P>.05)



POTENTIAL OF INTERPLANTED SOYBEAN AND GRAIN SORGHUM AS A FORAGE FOR DAIRY CATTLE - I

J.E. Shirley and J. Evans[1]

Summary

Interplanted soybean (100 to 120 lbs/acre) and grain sorghum (15 to 20 lbs/acre) were harvested at 64, 88, 102, 123, and 130 days postplanting to determine the ratio and chemical composition of vegetative and seed parts for each plant at advancing stages of maturity. Initial vegetative dry matter yield was 6,300 lbs/acre and increased to 15,000 lbs/acre with 63% vegetative at 123 days postplanting. Vegetative portions (stems, leaves, stalks) of the soybean and grain sorghum plants constituted 100% of the dry matter at day 64, then decreased to 52% at day 130, whereas the contribution of the soy pod (plus bean) and milo head to total dry matter increased from 0% at day 64 to 13% and 35%, respectively, at day 130. Generally, TDN and crude protein decreased over time in the vegetative plant parts and increased in the seed parts, whereas neutral detergent fiber (NDF) increased in the vegetative plant parts and decreased in the seed parts. Chemical composition at day 123 for the vegetative parts was 56% estimated TDN, 46% ADF, and 9% crude protein. NDF was 74% for grain sorghum and 57% for soy, with the difference contributed by hemicellulose. For the grain parts, TDN was 75%; NDF was 40% for grain sorghum and 28% for soy with the difference contributed by hemicellulose; ADF was 18%; and protein was 9% for grain sorghum and 29% for soy.

Introduction

Localized groups of farmers in Kentucky, Indiana, Tennessee, Virginia, West Virginia, Georgia, South Carolina, Alabama, and Arkansas have been utilizing interseeded soybean-grain sorghum combinations as silage for dairy and beef cattle for many years. More recently, this practice has received much attention because of economic factors.

Selected varieties of soybeans and grain sorghum, under favorable management, will produce as much dry matter per acre as corn silage and cost less to produce. Further, soybean and grain sorghum (soy-sorghum) haylage is higher in protein and mineral content, thus reducing the amount of supplement needed to balance the ration relative to corn silage. Soy-sorghum haylage is of lesser quality than alfalfa but fits into a rotation schedule and has the potential of being an excellent emergency forage crop.

Seeding dates range from early May (soil temperature approximately 60 degrees F) to mid-July (dependent on soil moisture availability). Fertilization rate

[1]Rutgers University, New Jersey.

is dependent on soil test but generally includes 30 to 40 lbs of actual nitrogen, 60 to 90 lbs of P_2O_5, and 90 to 120 lbs of K_2O per acre applied preplant. An additional 30 lbs of K_2O is used if the soy-sorghum follows small grain silage.

Harvest dates range from 65 days postseeding (total vegetative stage) to 125 days postseeding (mature). The wide range in potential harvest dates adds flexibility to a soy-sorghum forage system.

The purpose of this study was to ascertain 1) the dry matter and nutritive contribution of vegetative and seed parts of the soybean and grain sorghum to the total composition of the mass, 2) the change in nutrient composition of vegetative and seed parts at various stages of maturity, and 3) the potential nutritive value of soy-sorghum as a forage for ruminants.

Procedures

Lee 74 soybeans and Dekalb C42A grain sorghum were mixed in the ratio of 120 lbs of soybeans to 20 lbs. of grain sorghum then seeded in 7-inch rows with a conventional John Deere grain drill calibrated to deliver 120 lbs of soybean and 20 lbs of grain sorghum seed per acre. Fertilization program included 36 lbs. of actual N, 90 lbs of P_2O_5 and 120 lbs. of K_2O per acre. Fertilizer was applied pre-plant and disked into the top 4 inches of soil.

Plots were replicated 5 times and samples taken from each plot at days 64, 88, 102, 123, and 130 postseeding. Sample sites were selected at random by tossing a large plastic ring of known area into the plots at either two or four locations, dependent on sampling date. All material within the ring was collected and sorted into soybean vegetative (leaves and stems), soybean pod (pod and seed), grain sorghum vegetative (leaves and stems), and grain sorghum seed head (seed head severed from stalk one inch below bottom seed). Plant parts were air dried to 90% dry matter by spreading in a large room maintained at 85 degrees Fahrenheit and equipped with a forced-air ventilation system. Each air-dried plant part was weighed and analyzed for nutrients, and the values from plots were averaged for statistical analyses. Chemical analyses were done by K-C Agriculture Laboratory Services, Nevada, Missouri, except for neutral detergent fiber (NDF) and sodium chloride insoluble nitrogen (Na-I-N), which were determined at Rutgers University, New Jersey.

Total dry matter yield per acre and percent contribution from individual plant parts were determined by relating the amount harvested within the ring to the area represented in the ring and expanding to a per acre basis. Values obtained with this method were determined to be reasonable estimates by direct comparison to weights obtained from whole plot harvest.

Results and Discussion

Total dry matter yield per acre and the contribution of vegetative and seed parts to the total dry matter over time is shown in Table 1. Maximum dry matter

Table 1. Contribution of soybean and grain sorghum plant parts to dry matter yield

	Age of Forage, Days				
Item	64	88	102	123	130
DM, lbs/acre	6,291	10,082	13,162	15,008	12,388
Soy Pod, %	0	2	6	9	13
Grain Sorghum Head, %	0	14	26	28	35
Vegetative, %	100	84	68	63	52

(DM) yield occurred at day 123 postseeding and just prior to a heavy frost (day 125). Soy pod and grain sorghum head contributions to total DM increased rapidly between day 88 and day 102. This followed a rapid increase in grain sorghum heads from 0% at day 64 to 14% at day 88.

Total digestible nutrients (TDN) remained relatively constant over time (Table 2) in the vegetative plant parts and the soy pod but increased from 62% at day 88 to 77% at day 123 in the grain sorghum head. TDN from all sources maximized at day 123.

Table 2. TDN, % of dry matter.

	Age of Forage, Days				
Item	64	88	102	123	130
Grain Part					
Soy	--	71	69	74	74
Grain Sorghum	--	62	73	77	78
Vegetative Part					
Soy	59	59	58	56	51
Grain Sorghum	59	56	56	56	54

Differences from forage and forage part were significant [P<.02].

R^2 from $A + T + T^2$ regression from top to bottom were .34, .92, .53 and .39.

Total protein remained constant in the soy pod and grain sorghum head from day 88 through day 130 but decreased in the vegetative parts with advancing maturity (Table 3). Neutral detergent fiber (NDF) content in the vegetative part

Table 3. Total protein, % of dry matter

	Age of Forage, Days				
Item	64	88	102	123	130
Grain Part					
Soy	—	22	28	29	28
Grain Sorghum	--	9	10	9	8
Vegetative Part					
Soy	17	14	15	11	9
Grain Sorghum	12	8	7	7	6

Differences from forage and forage part were significant [P<.01].

R^2 from $A + T + T^2$ regression from top to bottom were .30, .32, .41 and .54.

was not affected by stage of maturity. However, NDF decreased dramatically in the grain sorghum head between 88 and 123 days postseeding. Only a slight decrease in NDF was observed in the soy pod by day 123. (Table 4).

Table 4. NDF, % of dry matter

	Age of Forage, Days				
Item	64	88	102	123	130
Grain Part					
Soy	—	36	36	28	29
Grain Sorghum	--	72	51	40	35
Vegetative Part					
Soy	50	53	55	57	62
Grain Sorghum	71	72	73	74	77

Differences from forage and forage part were significant [P<.01].

R^2 from $A + T + T^2$ regression from top to bottom were .40, .74, .54 and .35.

Acid detergent fiber insoluble protein (ADF-I-P) remained relatively constant in seed parts but increased in the vegetative parts of both soybean and grain sorghum through day 123 (Table 5).

Table 5. ADF IP, % of total protein

	Age of Forage, Days				
Item	64	88	102	123	130
Grain Part					
Soy	--	4	3	5	6
Milo	--	23	19	24	19
Vegetative Part					
Soy	15	13	17	23	25
Milo	22	21	31	30	22

Differences from forage and forage part were significant.

R^2 from A + T + T^2 regression from top to bottom were .41, .00, .34 and .12.

These results suggest that soy-sorghum may be harvested as silage either in the vegetative stage or during various stages of soy pod and grain sorghum head formation with little change in total nutrient composition. However, maximum dry matter yield per acre is obtained when the grain sorghum is near the soft dough stage. Decreased TDN and protein percentage in vegetative parts with advancing maturity were offset by an increase in TDN and protein percentage of the seed parts. Subsequent animal acceptance of soy-sorghum silage was apparently not affected by stage of maturity.

Further studies involving animal performance and digestibility at the various soy-sorghum maturity stages is needed to ascertain the best time to harvest the crop.

POTENTIAL OF INTERSEEDED SOYBEAN AND GRAIN SORGHUM AS A FORAGE FOR DAIRY CATTLE - II

J.E. Shirley and J. Koger[1]

Summary

Soybeans interseeded with grain sorghum (soy-sorghum) was compared to corn silage as a silage crop for ruminant animals over a 3-year period. Results indicate that DM yields are comparable if soy-sorghum is seeded early (June 6) but less than corn silage when seeded late (June 28). Liquid manure may be substituted for commercial fertilizer without a significant decrease in soy-sorghum DM yield per acre.

Introduction

Soybean interseeded with grain sorghum for use as a silage crop for livestock has the potential of replacing corn silage and alfalfa in some farm operations. Soy-sorghum fits well into a double-crop system and is more drought tolerate than corn. Previous research suggests that the crop can be harvested in the vegetative stage through the soft dough stage of grain sorghum. Maximum dry matter yield is obtained when the grain sorghum is in the soft dough stage (at 90 to 125 days post-seeding dependent on moisture conditions and seeding date). A wide array of varieties and seeding dates have been used by producers. Dry matter yield per acre has been quite variable, probably because of the variable seeding dates and varieties used.

This study was conducted to examine seeding date, multi-year yields and production cost.

Procedures

Trial 1 involved a three-year comparison of dry matter (DM), total digestible nutrients (TDN), and crude protein (CP) yield per acre between soy-sorghum and corn when harvested as ensilage. Accepted cultural practices were used for the crops. Seeding rates were 26,000 kernels/acre for corn and 120 lbs soybeans plus 20 lbs of grain sorghum seed/acre for soy-sorghum.

Trial 2 compared early (June 6) versus late (June 28) seeding dates for soy-sorghum. Cultural practices were similar to those employed in trial 1.

Trial 3 compared commercial fertilizer versus liquid manure from a beef feedlot (total confinement on slots) as a fertility program for soy-sorghum production.

[1]Eastern Kentucky University, Richmond, Kentucky.

Results and Discussion

Corn silage yields over the 3-year period averaged 7.5 tons of DM/acre compared to 6 tons of DM/acre for the soy-sorghum (Table 1). This is partially confounded with seeding dates for the soy-sorghum. Soy-sorghum DM yield shown is an average of both early and late seeded plots. The TDN and CP content of corn silage and soy-sorghum were 67.5% and 8.23%; 60.2% and 11.89%, respectively.

Table 1. Dry matter, crude protein, and total digestible nutrient yields/acre for corn and soy-sorghum silages.[1]

Crop	Dry Matter (tons)	Crude Protein (%)	TDN (% DM)
Corn silage	7.5 (12)[2]	8.23 (12)	67.5 (12)
Soy-sorghum	6.0 (7)	11.89 (7)	60.2 (7)

[1] Three year study at Richmond, Kentucky (1978,'79,'80)
[2] Numbers in parentheses are the no. of plots used.

The percent protein of soy-sorghum ranged from 9.5 to 16.4 on a dry basis. Sampling error can be quite high in a mixed crop silage because the protein content of soy leaves and seed pods tend to be higher than that of grain sorghum leaves and grain head.

Effect of seeding date on DM yield of soy-sorghum is shown in Table 2. Earlier seeded crops tend to mature later and receive the benefit of elevated soil

Table 2. Effect of seeding date on DM yield of soy-sorghum

Seeding Date	DM Yield/Acre
June 6	8.73 tons
June 28	5.42 tons

moisture at seeding time. The June 28 date corresponds to wheat harvested for grain, thus ample time is available to obtain a respectable forage yield in a double-crop situation.

Production cost per acre and the affect of liquid manure on DM yield and production cost are depicted in Table 3. Cost figures are based on 1980 values which can be converted to current values since inputs are noted.

Table 3. Influence of liquid manure on production cost and DM yield of soy-sorghum

Item	Commercial Fertilizer	Liquid Manure
	— per acre basis —	
DM yield (tons)	8.73	8.25
Production inputs		
120 lbs soybean seed	$25.50	$25.50
20 lbs grain sorghum seed	9.30	9.30
Innoculant for soybeans	1.50	1.50
30 lbs of actual nitrogen	6.40	--
90 lbs of P_2O_5	15.48	--
120 lbs of K_2O	11.22	--
one (1) ton of lime	7.00	7.00
4714 gal liquid manure	--	10.51[a]
Total production cost[b]	$76.40	$53.81

[a]Value of liquid manure reflects labor, machinery, equipment operation cost, and ownership cost of specialized equipment. It does not include cost of the holding facility.

[b]Labor, machinery, equipment, and land were not included because of the extreme variability of these cost among farms.

Soy-sorghum requires a lower production cost than corn and is quite adaptable to liquid manure as a replacement for commercial fertilizer. Soybeans and grain sorghum are more drought tolerate than corn and early-seeded, soy-sorghum DM yields are similar to those for corn silage, thus, soy-sorghum deserves further investigation as a silage crop for ruminants.

EFFECT OF SODIUM BICARBONATE AND SODIUM BENTONITE ON DIGESTION AND RUMEN FERMENTATION CHARACTERISTICS OF FORAGE SORGHUM SILAGE-BASED DIETS FED TO GROWING STEERS

K. A. Jacques, D. E. Axe, T. R. Harris, D. L. Harmon, K. K. Bolsen, and D. E. Johnson

Summary

One percent sodium bicarbonate ($NaHCo_3$) increased intake of a 50% silage - 50% grain diet, but had no effect on intake of a full-feed sorghum silage diet. The addition of concentrate (rolled milo) slightly lowered rumen pH and decreased acid detergent fiber (ADF) and starch digestion. $NaHCO_3$ had no effect on digestibility, but 2% bentonite lowered digestibility of NDF and ADF. Neither compound affected rumen fermentation characteristics.

Introduction

The concept of adding buffering compounds to silages has generated considerable interest. Silages present a dietary lactic acid load to the rumen and their high moisture content and low pH are thought to be responsible for decreased intake. Bicarbonate, a natural component of the rumen buffering system, has proven beneficial when added to high concentrate diets, but performance results with growing cattle fed high silage diets have been inconclusive. Bentonite, an aluminum silicate clay used in the feeding industry to improve pellet binding, has also been shown to aid in the transition to high concentrate diets. The following experiment was conducted to test the effects of $NaHCO_3$ and bentonite on intake, digestibility and rumen fermentation when added to 50% silage and full-feed forage sorghum silage diets.

Procedures

Six diets were offered ad libitum to rumen-fistulated steers. Three were full-feed silage and three included rolled milo such that grain comprised 50% of the dry matter (DM) intake. Two diets, one at each grain level, included $NaHCO_3$ (1% of DM) or bentonite (2% of DM) and two served as controls. All steers were given 2 pounds of a protein supplement daily (12.5% CP).

Results and Discussion

$NaHCO_3$ increased intake (table 1) of the 50% silage but not the full-feed silage diet. Steers fed the 50% silage - $NaHCO_3$ diet reached peak intake levels quickly in the adjustment period. Bentonite had no effect on the intake of either diet. Digestibilities of diets including $NaHCO_3$ were unchanged, but bentonite lowered NDF and ADF digestibility. A comparison of 50% silage and full-feed silage diets showed that added milo increased total intake, but lowered digestibility of ADF and starch.

Rumen fermentation characteristics (Table 2) were unchanged by $NaHCO_3$ or bentonite addition. Lactate concentrations were at typical low levels. Rumen pH values were high on all six diets, indicating the well-buffered conditions needed for optimum fiber digestion. Volatile fatty acid concentrations, while higher for the three 50% silage rations, were low for all six diets when compared to values from more fermentable forages and grains.

Conclusions

Bentonite proved to be of no benefit in improving intake or digestion of the diets studied. $NaHCO_3$ improved intake of the 50% silage diet, but had no effect on digestibility or rumen fermentation characteristics. Because rumen measurements did not indicate that the silage created an acidic rumen condition, it was thought that the intake response may have been a result of increased palatability.

Table 1. Effect of $NaHCO_3$ and bentonite on intake and digestibility of forage sorghum in silage-based diets.

	50% Silage			Full-Feed Silage		
Item	Control	$NaHCO_3$	Bentonite	Control	$NaHCO_3$	Bentonite
Dry matter intakes (lbs/day)[a]	16.9[b]	18.3[c]	16.5[b]	13.6	13.9	13.9
			% Digestibility			
Dry matter	57.0	56.8	55.1	57.6	56.8	53.6
Organic matter	61.0	60.7	61.4	61.9	61.7	58.7
NDF[h]	51.5[d]	49.3[d]	45.4[e]	52.2[f]	49.9[f]	50.0[g]
ADF[h]	43.4[d]	41.1[d]	36.1[e]	48.6[f]	47.2[f]	43.5[g]
Starch[h]	78.8	78.0	76.0	84.1	82.8	87.5

[a] 50% Silage diets>full-feed silage diets ($P<.001$)
[b,c] 50% Silage - $NaHCO_3$> 50% silage control ($P<.001$)
[d,e,f,g] Diets including bentonite < controls ($P<.05$)
[h] 50% grain diets < full-feed silage diets ($P<.05$)

Table 2. Effect of $NaHCO_3$ and bentonite on rumen fermentation characteristics of steers fed forage sorghum silage-based diets.

	50% Silage			Full-Feed Silage		
Characteristic	Control	$NaHCO_3$	Bentonite	Control	$NaHCO_3$	Bentonite
Rumen pH[a]	6.66	6.62	6.66	6.76	6.80	6.73
L (+) lactate (mM)	0.66	0.44	0.48	0.36	0.43	0.54
D (-) lactate (mM)	0.42	0.13	0.48	0.12	0.28	0.38
Total volatile fatty acids (mM)	71.0	76.7	71.6	70.0	71.1	68.1

[a] 50% Silage diets<full-feed silage diets ($P<.05$)
[b] 50% Silage diets>full-feed silage diets ($P<.05$)

KSU

EFFECT OF MOISTURE LEVEL AND BALE SIZE ON ALFALFA HAY QUALITY

A. Laytimi, C. Grimes, and K.K. Bolsen

Summary

Third cutting alfalfa was baled in large 1-ton rectangular bales and in small conventional bales at three moisture levels, low (10%), medium (16%), and high (22%). During 120 days of storage under a roof, the high-moisture, large bales heated the most, reaching 128° F by 2 days post baling in a first peak and 133° F in a second peak by the 11th day. Moderate heating occurred in the high-moisture, small bales (108° F) and medium-moisture, large bales (103° F). Only the high-moisture, small and large bales had significant loss of dry matter during storage. Also, heating decreased the water soluble carbohydrate and increased the concentration of cell wall contents by the 120th day of storage. A three-period collection and digestion trial with lambs showed higher voluntary intakes of small-bale hays than of large-bale hays and higher intakes of high-moisture hays than of low-moisture hays. Also, the dry matter and crude protein digestibilities were lowest for the high-moisture, large bale hay. These data indicate that baling alfalfa hay in large bales at 22% moisture results in extensive heating, which negatively affects storage loss, nutrient content, and digestibility.

Introduction

Alfalfa hay has long been considered an important ingredient in dairy cattle rations. Its nutritive quality depends on the hay-making process, which is greatly affected by the uncontrollable factor, weather. Under unfavorable climatic conditions, making hay can result in substantial nutritive losses from the original crop. The losses, which may approach 50-60%, start in the field and continue through storage and feeding. Plant respiration after cutting, mechanical treatment, and leaching contribute to field losses, whereas continued respiration, microbial activity, and chemical oxidation, which all lead to heating, contribute to storage losses.

Hay-making aims at achieving a rapid loss of moisture from the cut plant and baling it with minimum losses. However, optimum moisture level for efficient handling and safe storage of alfalfa hay has not been well established yet. Difficulties arise from interacting factors such as varying climatic conditions, bale types, bale size and density, and method of storage.

To reduce weather risk, leaf loss, and increase the potential of higher quality, alfalfa hay can be baled at higher moisture. However, this may result in overheating, molding, and nutrient damage during storage. Therefore, the objectives of this experiment were to study the effects of high, medium, or low-moisture levels and conventional or large bale size on alfalfa hay composition and digestibility.

Procedures

The alfalfa for this experiment was provided by Slentz-McAllister, Inc., at Lewis, Kansas. The hay was baled near Lewis on August 17-19, 1983.

Irrigated, third cutting alfalfa was baled at three moisture levels, 10, 16 or 22% using the model 336 John Deere to produce 15 x 19 x 37 inch small rectangular bales or using the model 4800 Hesston to produce large rectangular bales of 49 x 49 x 98 inch. The initial moisture of the windrows at baling was determined arbitrarily. The two balers ran simultaneously, side by side in adjacent windrows. As the bales came out of the balers, they were identified and thermocoupled for temperature measurement. Two thermocouple wires were inserted into each small bale and four into each large bale. Initial temperatures were recorded within 1 hour after baling and, thereafter, temperatures were taken twice daily for the first 7 days and then once daily until each bale returned to its initial temperature. All bales were core-sampled using a Pennsylvania State University sampler within 1 hour after baling and then at 10, 17, and 120 days post baling. All samples were immediately frozen in liquid nitrogen until analyzed for moisture and chemical composition. All the bales were weighed initially and on 120th day after storage under a roof. They then were flaked and visually appraised from the fore to the butt end for color, aroma, mold, mildew, and dust. The six hay treatments were each ground and fed to 24 lambs in a three-period, collection and digestion trial. Total feed offered, feed refused, and daily urine and fecal outputs were recorded. Samples were analyzed in the laboratory and digestion coefficients were calculated.

Results and Discussion

Only three bale treatments showed any temperature rise above ambient: 1) the high-moisture, large bales, 2) the high-moisture, small bales; and 3) the medium-moisture, large bales. Two peak temperatures were observed in the high and medium-moisture, large bales. The first peaks occurred in the first 2 days of storage. The high-moisture, large bales heated the most, reaching 128° F in the first peak and 133° F in the second peak which lasted from the 11th to the 20th day. The high-moisture small bales followed a similar trend, reaching 117° F in the first peak in the first 2 days and 108° F in the second peak on day 11. The temperature change of the medium-moisture, large bales followed a similar trend to that of the high-moisture, small bales, but the peak temperatures were lower.

For all the low-moisture hay and medium-moisture, small bales, there was no visible discoloration or mold growth. There was very little discoloration and molding in the high-moisture, small bales and medium-moisture, large bales. However, for the high-moisture, large bales, the discoloration and mold growth were more apparent, very extensive, and heaviest in the fore, center, and butt portions, respectively.

Shown in Table 1 are initial weights and dry matter loss during storage. For both types of bales, initial weight increased with increasing moisture. Significant dry matter loss during storage occurred in the treatments that heated, ranging from 1.5% loss in the medium-moisture, large bales to 11.0% in the high-moisture, large bales. The heating and the subsequent dry matter loss reflect the activity of thermophilic microbes in the hay.

Also shown in Table 1 is the chemical composition change of the hay from initial to the 120th day of storage. In the small bales, initial crude protein (CP) content decreased from 18.5 to 16.5% as moisture level decreased, indicating higher field loss of leaves at the low moisture level. In general, the initial CP was lower in the large than in the small bales at each moisture level. This is not surprising, when the difference in ground speed between the 4800 Hesston and the 336 John Deere balers is considered. Initial acid detergent insoluble nitrogen (ADIN) values were very high. Drill powered core sampling of the bales did result in heating of the probe from friction and very likely increased the amount of ADIN in the initial samples. Therefore, the values obtained here are in error and reflect the difficulty encountered with obtaining representative samples from cores.

With respect to water soluble carbohydrates (WSC), the initial content of the hay was not affected by moisture level or bale size. The content ranged from 6.5 to 7.0%. However, the change after 120 days of storage was closely related to the amount of heating and bale size. At each moisture level, large bales lost more WSC than small bales and the loss increased to approximately 62% in the high-moisture, large bales.

Initial acid detergent fiber (ADF) (mostly cellulose and insoluble lignin) and cell wall (CW) contents (mostly cellulose, hemicellulose, and lignin) were not affected by moisture level or bale size. The values were nearly identical (35.2 to 35.9% for ADF and 43.9 to 44.9% for CW), except for the unexpected ones for high-moisture, small bales (31.1% ADF and 38.2% CW) which were out of range and may have been in error. After 120 days of storage, changes in both ADF and CW contents were related to the heating that occurred in the bales. Their concentrations increased in the medium-moisture, large and in the high-moisture, small and large bales.

Shown in Table 2 are voluntary intakes and digestibility coefficients of the six alfalfa hays. Although the voluntary intakes were statistically similar, two trends were observed. First, intake was higher for the small bales than for the large bales at each moisture level. Second, intake increased with increasing moisture level in both the small and the large bales.

The results for the digestion coefficients show that the high-moisture, large bales had the lowest dry matter (57.0%) and nitrogen (64.5%) digestibilities, indicating the extent of nutrient damage that occurred as a result of the heating during storage. The other five hays had similar dry matter and nitrogen digestibilities, ranging from 60.5 to 61.9% and from 73.9 to 78.9%, respectively. Neither ADF nor CW digestibilities were affected by bale moisture or size.

Table 1. Effect of moisture and bale size on alfalfa hay composition (DM basis).

Bale characteristics	Moisture, % 10 Initial	10 End*	16 Initial	16 End	22 Initial	22 End
Large bales						
Wt., lbs of DM	1098.0	1098.0	1376.3	1355.2	1560.0	1388.2
CP, %	15.9	15.4	15.8	16.0	16.2	17.0
ADIN, %	.306	.215	.183	.208	.209	.320
WSC, %	7.0	5.3	6.5	4.6	6.8	2.6
ADF, %	35.2	34.2	35.5	36.2	31.1	32.3
CW, %	44.6	42.1	44.9	45.2	43.9	47.1
Small bales						
Wt., lbs of DM	50.8	50.4	56.0	55.4	70.6	66.9
CP, %	16.5	15.7	16.8	16.5	18.5	18.3
ADIN, %	.306	.177	.326	.173	.307	.184
WSC, %	6.7	6.6	6.7	6.1	6.8	5.4
ADF, %	35.5	34.1	35.7	34.2	31.1	32.3
CW, %	44.9	44.9	44.9	44.7	38.2	47.7

*The end was on 120th day of storage.

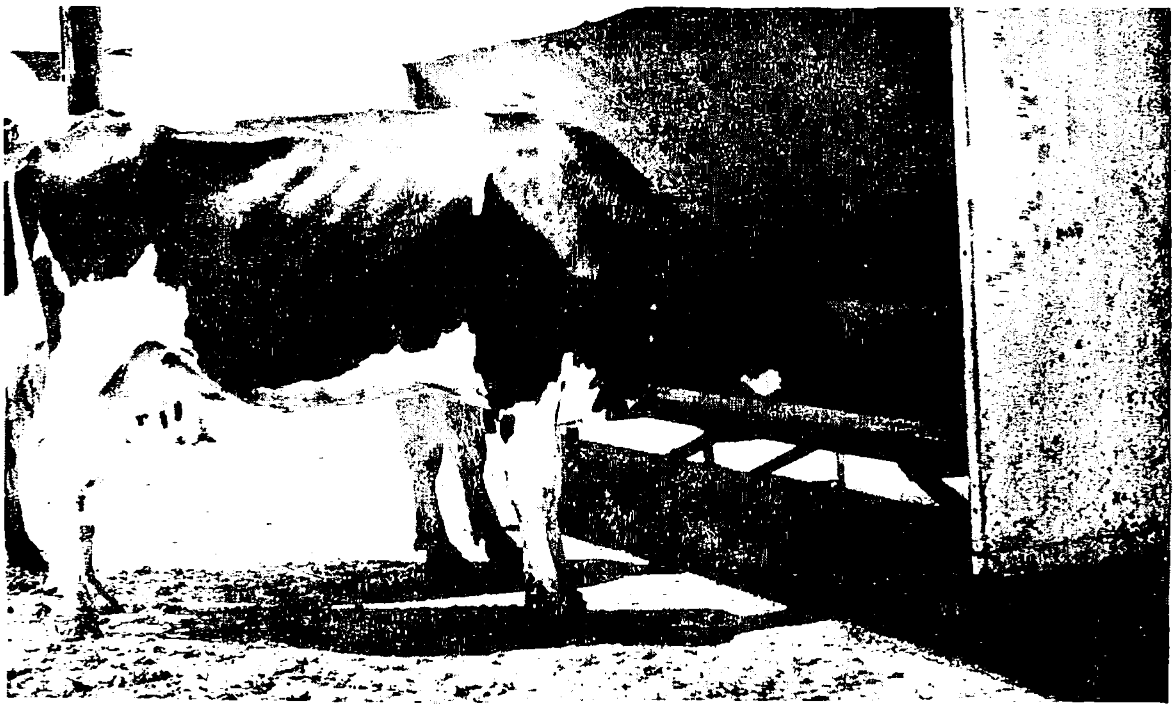


Table 2. Effect of moisture and bale size on alfalfa hay voluntary intake and digestibility by lambs.

Bale size and moisture	Intake lbs/day	Digestibility, %			
		DMD	Nitrogen	ADF	Cell wall
Low moisture (10%)					
small bales	3.80	61.9[a]	78.9[a]	42.9	41.9
large bales	3.63	60.6[a]	75.1[a]	40.3	40.3
Medium moisture (16%)					
small bales	3.85	60.5[a]	73.9[a]	42.5	44.1
large bales	3.74	60.7[a]	74.8[a]	45.9	45.3
High moistue (22%)					
small bales	3.90	60.9[a]	74.6[a]	47.5	47.2
large bales	3.83	57.0[b]	64.5[b]	41.6	43.0

[a,b]Means in the same column differ (P<.05).

DM = Dry matter.

ADF = Acid detergent fiber.

KSU

SILAGE ADDITIVE UPDATE: 1985

K.K. Bolsen and J.D. Hoover

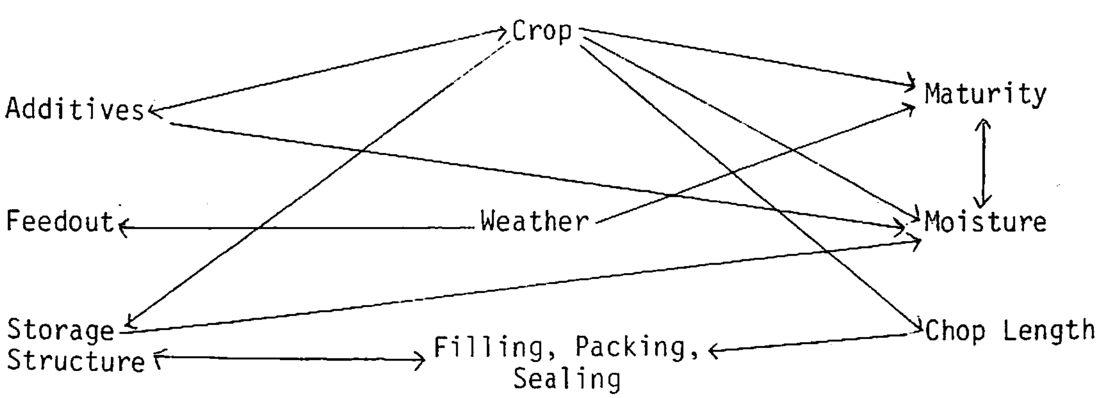
Summary

Silage additives are receiving fairly widespread acceptance in the U.S. as management tools that are important for silage-making. Many products, which are added to the crop at the time of harvest or ensiling, are available commercially in Kansas. Some manufacturers/distributors make no claims for their products, primarily because management is such an important factor in making a good quality silage. Others claim their product will improve silage quality. When a claim is made, it is wise to check for evidence that the product has a favorable effect on the silage crop in question. Farm-scale silo trials at Kansas State University have shown that a few silage additives repeatedly reduced "in silo" losses. But results will probably not be favorable with all additives under every farm condition. Therefore, results obtained with a commercial product in our trials may not apply to other products on the market, however similar in ingredient formulation.

Introduction

With few exceptions, a satisfactory silage can be made from most crops grown in Kansas. However, to consistently make high quality silage, the silage-maker must pay attention to details, apply sound management, and understand the importance of the main factors that affect the quality.

Figure 1. Factors that affect silage quality.



CROP. The ideal crop should offer the greatest economic advantage with the most nutrients per acre. It should have adequate fermentable carbohydrates, a low buffering capacity; a physical structure suitable for compacting (to exclude oxygen), and a harvest period of several days.

MATURITY. Harvesting at the optimum stage of maturity is often a compromise between increasing yield and decreasing quality as the crop matures. The following harvesting guidelines are most common:

Alfalfa	late bud to 1/10 bloom
Corn	fully dented kernels
Sorghum	hard-dough kernels
Winter cereals ...	Boot stage for maximum protein content, or soft-dough stage for maximum tonnage and TDN yields.

MOISTURE. This is probably the most important factor affecting silage quality. The optimum level for most crops lies between 60 and 70% moisture. However, the level varies with the crop. If silage is made below 55 to 60% in conventional silos, it is difficult to pack well enough to eliminate air for proper fermentation. Above 70%, high fermentation losses, seepage and reduced animal performance occur.

CHOP LENGTH. Theoretically, 1/4 to 1/2-inch length is recommended, but fineness varies with the crop, power requirement, tonnage per hour, etc.

FILLING, PACKING, SEALING. The crop should be harvested and the silo filled, packed, and sealed in the shortest possible time.

STORAGE STRUCTURE. A solid, well-constructed, properly managed silo is essential if storage losses are to be kept to a minimum.

FEEDOUT. In practice, the rate of silage removal from the face and progress through the silo must be fast enough to prevent deterioration and heating.

WEATHER. This uncontrollable factor interacts with most of the other factors. It can delay harvest and prevent crops from being ensiled at their optimum maturity, can lengthen wilting time, or may cause over-wilting.

ADDITIVES. Silage additives are designed to improve the job of silage-making. They can be classified into 5 main categories: 1) Fermentation products, 2) Cereal by-products and other energy and nitrogen containing ingredients, 3) Organic chemicals, 4) Inorganic chemicals, and 5) Other.

Silage Additive Results

Many questions arise when assessing an additive. The most important assessment of a product is its efficacy and the best way for dairy farmers to determine this is to compare in-silo losses and pounds of milk produced per ton of crop ensiled. Five criteria are essential when treated and untreated silages are evaluated: 1) Does the additive lower the ensiling temperature? 2) Does it increase dry matter and nutrient recovery from the silo? 3) Does it increase aerobic stability? 4) Does it improve feed value and animal performance? and finally 5) Does the improvement offset costs and give a return on investment?

Results of research conducted from 1975 to 1983 at Kansas State University with several fermentation and nitrogen additives were presented in 1984 Cattlemen's Day Report of Progress 448.

For more details on silage additives, see K.K. Bolsen and J.I. Heidker. 1985. Silage Additives USA. A Guide to Products Available in the United States. Chalcombe Publications. P.O. Box 1222. Manhattan, Kansas 66502.

KSU

RELATIONSHIP OF HERD AVERAGE SOMATIC CELL COUNT AND SPONTANEOUS RECOVERY FROM SUBCLINICAL MASTITIS

J. R. Dunham

Summary

The rate of spontaneous recovery from subclinical mastitis was evaluated in 56 Kansas DHI herds participating in the Somatic Cell Count (SCC) program. Herds were classified as low (<300,000) or high (>600,000) based on herd SCC average. Comparisons between low and high SCC-herds were made for each cow's ability to recover from a subclinical case of mastitis (>600,000 SCC). Low-SCC herds had a rate of spontaneous recovery that was more than three times greater than that of high-SCC herds. Average SCC of cows with subclinical mastitis was similar in low and high herds, as well as the average SCC of cows following spontaneous recovery. Results illustrate the importance of monitoring monthly SCC reports. Proper attention to good procedures of milking management includes: attention to milking techniques, proper function of milking equipment, and attention to sanitation and housing conditions. As a result, herds with low SCC tests will have higher production and fewer subclinical cases of mastitis.

Introduction

The Somatic Cell Count (SCC) of an individual cow is a good indicator of intramammary infection (subclinical mastitis). As the SCC increases above 200,000, there is an increasing chance that one or more quarters are infected with mastitis causing bacteria. These infections are considered subclinical when there are no signs of abnormal milk.

Subclinical mastitis causes increased SCCs since leucocytes migrate to the mammary system in an attempt to destroy the invading bacteria. If the leucocytes win the battle, as evidenced by a SCC lower than 200,000, then it is considered that the cow spontaneously recovered from subclinical mastitis.

The Mid-States Dairy Records Processing Center's SCC Report denotes cows with SCCs greater than 600,000. These cows are considered to be subclinical mastitis cases, although any cow with a SCC higher than 200,000 might be infected. Some of the cows appearing on the high SCC list drop below 200,000 SCC without any treatment, which suggests that the leucocytes cured the infection and thus spontaneous recovery occurred.

Procedure

The rate of spontaneous recovery from subclinical mastitis in Kansas DHIA herds was evaluated by surveying 56 herds participating in the Kansas DHIA SCC program. The herds were ranked high or low according to the SCC average. Those herds averaging more than 600,000 SCC were summarized in the high group and those averaging less than 300,000 were included in the low group. Each cow was evaluated during the previous six DHI tests. Cows showing SCC greater than 600,000 were considered subclinical cases. Those cows with SCC lower than 200,000 the following month were considered to be spontaneous recovery cases.

Results and Discussion

The survey (Table 1) illustrates that the rate of spontaneous recovery from subclinical mastitis is more than three times higher (43.4% vs 12.1%) in herds averaging <300,000 SCC than in herds averaging >600,000 SCC. The function of leucocytes, which are the major components of the SCC, is to alleviate stress. Therefore, it appears that milking management results in much less stressful conditions in lower SCC herds. Another interpretation would be that the leucocytes have a much better opportunity to cure subclinical mastitis in low SCC herds.

Table 1. Rate of spontaneous recovery from subclinical mastitis[a].

Item	SCC Avg > 600,000	SCC Avg < 300,000
Number herds	27	29
Number cows	1714	1766
Avg SCC	853,667	215,055
Subclinical cases[b]	744	213
% cases subclinical[c]	43.4	12.1
No. spontaneous recoveries	91	92
% spontaneous recovery	12.2	43.2

[a]Any cow with a SCC >600,000 is designated as subclinical, however, some of these cows probably were showing clinical mastitis.

[b]Subclinical cows were defined as those cows having one or more SCC >600,000 during the last six tests.

[c]Percent cows subclinical is the percentage of cows with at least one SCC >600,000 during the last six tests.

Table 2 shows that the average SCC of cows with subclinical mastitis and those that recovered was similar. Again, this illustrates that milking management, which includes 1) cow preparation and milking techniques, 2) sanitation, 3) housing, and 4) milking equipment, are such that cows with subclinical mastitius have a much better chance for spontaneous recovery.

Table 2. Somatic Cell Count of cows with subclinical mastitis.

Item	Avg SCC Subclinical Cows	Avg SCC Next Test
Herds >600,000 SCC		
Spontaneous recovery	1,677,703	126,175
Non-spontaneous recovery	1,855,305	1,887,315
Herds <300,000 SCC		
Spontaneous recovery	1,416,780	111,693
Non-spontaneous recovery	1,875,719	1,406,063

The much higher incidence of subclinical mastitis in high SCC herds and the low rate of spontaneous recovery should be reason enough for every dairy producer to review milking management. In addition, many studies have shown that milk production is reduced as the SCC increases, since there is more subclinical mastitis.

Most authorities do not recommend treating high-SCC cows with antibiotics as an effective means of lowering the SCC. Apparently the most effective means of reducing high SCC is to improve milking management, so that the leucocytes have an opportunity to cure subclinical mastitis.

RUMENSIN HELPS TO REDUCE THE INCIDENCE AND SEVERITY OF LEGUME BLOAT IN CATTLE

T.G. Nagaraja, M.P. Katz, and L.R. Fina[1]

Summary

Monensin at 300 mg and 450 mg per 1000 lbs body weight reduced the severity of alfalfa pasture bloat by 41.2 and 73.1%, respectively. Lasalocid at the same levels reduced the bloat score by 25.5 and 12.4%. The difference between the two antibiotics appears to be in their ability to inhibit rumen protozoa. Monensin reduced protozoal population in the rumen, whereas lasalocid had no effect. A smaller protozoal population decreases compounds that contribute to frothiness and also increases substances such as plant chloroplasts, which have antifrothing properties.

Introduction

Legume or pasture bloat in cattle is caused by retention of gas - a normal product of microbial fermentation - in the rumen. Excessive gas production in the rumen is not a problem because cattle can void gas by eructation or belching. However, when frothing compounds are present, gas gets trapped in the rumen contents to form stable foam or froth. Froth inhibits eructation. The frothing compounds are supplied mainly by plants (primarily soluble protein) and to some extent by rumen microorganisms.

Bloat occurs mainly on legume forages but there are also reports of its occurrence on succulent grasses. The legumes most commonly causing bloat are alfalfa and various clovers. Cattle also bloat on wheat pasture. The full economic impact of bloat is not easy to deduce. Besides death loss, there are losses from lowered production (less gain or fewer pounds of milk), disruption of farm work and management programs, and cost of preventive medicines and treatment. Presently, poloxalone, sold under the trade name Bloatguard® (Smith Kline Co., Philadelphia, PA) is the only approved drug for the prevention of legume bloat in cattle. Many cattlemen have observed that cattle fed monensin, (trade name - Rumensin, Elanco Products Co., Indianapolis, IN) while grazing alfalfa pasture have fewer bloat problems. That led us to investigate the effect of monensin on alfalfa-pasture bloat. For comparison, lasalocid (trade name - Bovatec, Hoffmann-LaRoche Inc., Nutley, NJ), a feed additive similar to monensin, was also included in the study.

[1] Division of Biology.

Procedures

We divided our alfalfa pasture into small plots, which were strip-grazed to provide bloat-provocative lush forage at all times. Cattle equipped with rumen-fistulas were used in the study to facilitate visual examination of the rumen contents for frothiness and to collect rumen samples for laboratory analysis. Cattle were allowed to graze alfalfa for 1 hr in the morning and 1 hr in the evening - a schedule designed to cause bloat. When not grazing, cattle were held in dry lot with shade, salt, and water available. Bloat was scored on a scale of 0 to 5 (0 = no bloat; 1 or 2 = moderate bloat; 3 to 5 = severe bloat). We tested monensin and lasalocid at 300 mg (approved dose) and 450 mg per 1000 lbs of body weight. Drugs were given via the rumen fistula before the morning grazing period. Treatment was initiated after cattle had bloated for 3 consecutive days. Treatment periods were 7 days or fewer if there were 3 consecutive days without bloat. Rumen contents were sampled for various laboratory analyses before and after each treatment.

Results and Discussion

Bloat scores before and after treatment of each drug were compared, and percentages of reduction in bloat are shown in Table 1. Monensin at 300 mg and 450 mg reduced bloat by 41.2 and 73.1%, respectively. Lasalocid had almost no effect on the severity of bloat.

Analysis of rumen fluid collected before and after treatment revealed no changes in pH, ammonia, soluble nitrogen, total carbohydrate, ethanol-precipitable slime, and bacterial numbers (Table 2). The only significant difference we observed was a reduction in the total protozoal numbers in monensin-treated cattle. Lasalocid had no effect on protozoal numbers. When we incubated rumen fluid samples for 6 hr in a flask, total gas produced was considerably less in that from monensin-treated cattle. Again, lasalocid had no effect on the total gas production. Total volatile fatty acid concentration remained unchanged and, as expected, the acetate-propionate ratio declined in both monensin- and lasalocid-treated cattle.

Conclusions

Monensin reduced the severity of bloat in cattle grazing alfalfa pasture. Lasalocid had no effect on legume bloat. The difference between the two antibiotics appears to be in their activity against rumen protozoa. Monensin reduced protozoal population, whereas lasalocid did not. Protozoa contribute to frothiness by producing slime or carbohydrate and also by engulfing plant substances like chloroplasts, which have antifrothing effects in the rumen. Reduction of protozoal population thus lowers carbohydrate or slime content in the rumen fluid and also increases the natural substances of the plant that have antifrothing properties.

Even at doses slightly higher than the recommended dose, monensin was not 100% effective in reducing the incidence and severity of legume bloat. To ensure complete protection, Bloatguard is still the drug of choice.

NOTE: RUMENSIN IS APPROVED FOR DAIRY REPLACEMENT HEIFERS TO IMPROVE GROWTH RATE AND FEED EFFICIENCY. RUMENSIN IS NOT APPROVED FOR USE IN MILKING DAIRY COWS. BOVATEC IS NOT APPROVED FOR DAIRY HEIFERS OR COWS.

Table 1. Effect of monensin or lasalocid on alfalfa pasture bloat.

Treatment	Bloat Score[a]	Percent Reduction from Pretreatment
Pretreatment	3.23	
300 mg monensin	1.90	41.2
Pretreatment	2.94	
300 mg lasalocid	2.19	25.5
Pretreatment	3.08	
450 mg monensin	.83	73.1
Pretreatment	2.75	
450 mg lasalocid	2.41	12.4

[a]Bloat score based on visual evaluation 0 = no froth, 1-2 = moderate bloat, and 3-5 = severe bloat.

Table 2. Ruminal changes in monensin- or lasalocid-fed cattle grazing alfalfa pasture.

Rumen Fluid Measurements	Monensin[a] Before Treatment	Monensin[a] After Treatment	Lasalocid[a] Before Treatment	Lasalocid[a] After Treatment
pH	7.01	6.87	6.92	6.92
Ammonia, mg/100 ml	10.0	9.6	9.1	8.4
Soluble nitrogen, mg/100 ml	27.9	29.5	26.8	27.5
Total carbohydrate, mg/100 ml	1.1	1.1	1.2	0.9
Ethanol-precipitable Slime, mg/100 ml	54.4	61.5	45.5	58.6
Bacteria, billions/ml	3.4	3.2	2.4	2.4
Protozoa, millions/ml	0.39	0.25	0.35	0.33
Volatile fatty acids, mM[b]	107.1	102.3	112.0	103.8
Acetate:Propionate ratio[b]	3.6	2.8	3.7	3.1
Gas, ml[b]	194.8	148.4	164.2	168.5

[a]Average of 300 and 450 mg doses.

[b]Measured during 6 hr fermentation in the laboratory.

EFFECT OF SERUM FROM VITAMIN E-SUPPLEMENTED CALVES ON INFECTIOUS BOVINE RHINOTRACHEITIS VIRUS REPLICATION

P. G. Reddy, J. L. Morrill, H. C. Minocha[1], and R. A. Frey[2]

Summary

Blood serum from Holstein calves supplemented with vitamin E at levels of 2800 mg orally or 1400 mg by injection at weekly intervals inhibited replication of Infectious Bovine Rhinotracheitis Virus in tissue cultures. Supplementing typical calf diets with vitamin E may increase protection against pathogens, at a time when they are more vulnerable to problems such as respiratory diseases.

Introduction

Under present, intensive-management conditions, calves on typical diets may not receive adequate amount of alpha-tocopherol, which is the biologically active form of vitamin E. Recent studies have indicated that supplemental vitamin E can enhance the immuno-competency of several species of animals, including calves.

Respiratory diseases continue to be a serious problem affecting dairy calves. Infectious Bovine Rhinotracheitis Virus (IBR) is one of the principal causes of these respiratory diseases. The present experiment was conducted to study the effect of supplemental vitamin E on serum factors of calves, which in turn may influence the replication of IBR virus in tissue cultures.

Procedures

Twenty-eight Holstein heifer calves at 24 hrs of age were allotted to one of four treatments: 1) 0 mg 2) 1400 mg 3) 2800 mg of dl-α-tocopherol acetate fed orally at weekly intervals or 4) 1400 mg of dl-α-tocopherol given by intramuscular injection at weekly intervals.

Calves were fed colostrum for the first 3 days and then milk at 8% of birth weight until weaning at 6 wk. Water and a complete high fiber calf starter were always available to all calves. Calves were housed in fiberglass hutches until the end of the experiment at 12 wks of age.

Serum samples, collected at alternate weeks starting from 1-2 days of age, were used to study the replication of IBR virus in tissue cultures.

[1]Dept. of Laboratory Medicine.
[2]Dept. of Anatomy and Physiology.

Results and Discussion

Virus titers as influenced by serum from experimental calves at different weeks are shown in Table 1.

Serum samples obtained after 6 wks of age from calves given supplemental vitamin E showed a trend toward inhibiting IBR virus replication and at week 12 the inhibition was significant with serum from calves given the high level of oral supplementation and injected calves, as compared to that from unsupplemented calves. Viral titers were similar for all groups of calves until week 6, probably because passive transfer of antibodies through colostrum was similar in all calves and/or because vitamin E did not alter other serum factors until week 6.

Results of the present experiment suggest that during the transition period between the loss of maternal antibody and the production of antibodies by the calf, supplemental vitamin E alters serum factors in such a way that there may be less morbidity caused by a pathogen.

Table 1. Effect of serum from experimental calves on IBR virus titers (Log $TCID_{50} \times 10^5$).

Treatments		Weeks						
		0	2	4	6	8	10	12
0 mg		0.2	0.4	0.6	1.2	1.6	2.6	3.6^a
1400 mg	ORAL	0.4	0.3	0.5	0.9	1.7	0.9	2.1^a
2800 mg		0.2	0.6	0.3	0.5	0.6	1.3	1.7^b
1400 mg	INJ.	0.3	0.3	0.5	0.9	0.9	1.4	1.4^b

[ab]Means within a week with different superscripts differ ($P<.05$).

REPRODUCTIVE CHARACTERISTICS OF KANSAS HOLSTEIN HERDS GROUPED BY ROLLING HERD AVERAGE

E.P. Call and J.S. Stevenson

Summary

An analysis of 635 Kansas Holstein herds with 41,426 cows indicated that the negative genetic antagonism between production and reproduction can be overcome with good management practices. As rolling herd average increased, only services per conception increased by 0.2 units. All other reproductive traits favored higher yearly production. Days to first service and cows not yet bred are the main factors responsible for less than ideal reproductive performance in Kansas Holstein herds.

Introduction

Research data, as well as a common belief among dairy producers, indicate that a negative correlation exists between production and reproduction. This antagonism suggests that higher producing cows have more days open, require more services per conception and have fewer calves born. Even though this genetic antagonism appears to be real, research indicates that management practices can overcome this deterimental effect, and it should not be a deterent to achieving higher levels of production with the accompanying increase in potential profit. This study was undertaken to investigate the effect of milk production on reproduction in Kansas Holstein herds enrolled in Dairy Herd Improvement (DHIA).

Procedures

In 1984, there were 635 DHIA Holstein herds in Kansas that reported reproduction information on 41,426 cows. The herds were stratified according to rolling herd average (RHA) as a means of evaluating the effect of yearly production on various reproductive traits. While calving interval is the most common assessment of reproductive efficiency, the percent of cows open and especially the average days open contribute to reproductive losses within a herd. Services per conception indicate the efficiency of getting cows bred. Average days dry may be indirectly related to reproductive problems. However, dry days have a definite effect on RHA, since total cows days are used in calculating RHA. In this study, the average calving interval is calculated with the assumption that the last recorded service date was successful and is referred to as "minimum" calving interval.

Results and Discussion

RHA is stressed in the production testing program because it is highly correlated with efficiency as measured by income-over feed costs. Cows producing at higher levels convert feed into milk more efficiently, since maintenance feed costs are the same no matter what the level of production for cows of simlar body weight. Calving interval is stressed, since cows calving with greater frequency will spend a greater portion of their lactations in the more profitable early phase when peak yields are highest and will also produce more calves in their lifetime.

The analysis indicates that the only effect of yearly production on reproduction is an increase in services per conception by 0.2 units as noted in Table 1. Herds with higher RHA had shorter calving intervals primarily because cows were bred sooner as indicated by days to first service. The most striking difference was noted in the cows not yet bred, i.e., open cows. While any herd will have open cows, the percent of cows open varied inversely with RHA, as did the average days open which was 147 in the lowest group and 66 in the highest producing herds. Another measure of reproductive management is the percent of cows open for more than 120 days. As noted, 41% of the open cows fell into this category in the lowest group, whereas only 11% had not been bred in the herds averaging 19,152 lb. A similar trend was seen in the average dry period with higher RHA herds having fewer days dry and a smaller percentage of cows dry for more than 70 days.

Table 1. Average reproductive characterization of 635 Kansas Holstein herd with 41,426 cows grouped by level of rolling herd average (RHA) (January, 1985).

RHA Milk (lb)	Minimum[a] calving interval (days)	Days to first breeding (days)	Open cows[b]			Serv/ Conception	Dry period	
			(%)	(days)	(%>120 d)		(days)	(%>70 d)
10,699	411	94	37.9	147	40.9	1.8	84	48.4
12,565	401	83	34.9	111	31.8	1.8	75	44.1
13,569	399	80	28.4	92	26.3	1.9	73	39.0
14,510	404	86	30.2	91	21.1	1.9	69	31.4
15,504	406	85	30.8	83	19.0	1.9	67	30.7
16,514	403	84	29.0	80	15.0	1.9	67	27.0
17,414	403	79	24.7	65	11.1	2.0	63	23.1
19,152	402	81	30.2	66	10.5	2.0	63	20.0

[a] Assumes last reported service was successful.

[b] Cows not yet reported bred since calving.

Recommendations

1. Average days to first breeding is the most important management factor involved in long calving intervals. Reducing days to first breeding by one day will lower calving intervals by one-half day. Cows not bred by 60-70 days after calving should be evaluated and treated with prostaglandin $F_{2\alpha}$ (Lutalyse® or Estrumate®) if appropriate.

2. In average herds, cows not yet bred contribute the greatest loss in reproductive efficiency. A preventive herd health program (PHHP) in conjunction with a consulting veterinarian is the most cost-effective method of improving reproductive efficiency in a dairy herd.

INFLUENCE OF TEMPERATURE AND HUMIDITY ON THE REPRODUCTIVE EFFICIENCY OF DAIRY CATTLE

J. E. Shirley and G. G. Lagombra[1]

Summary

The reproductive performance of 179 Holstein cows during the period from December 1978 through March 1984 was evaluated with respect to environmental temperature and humidity at the time of insemination. This study was conducted at the Western Kentucky University Farm, Bowling Green, Kentucky. Average monthly temperatures are similar to eastern Kansas, but average humidity is approximately 10 per cent higher. Average seasonal temperature and humidity values during the study period were 37.5°F, 81.2%; 60.2°F, 84.4%; 74.9°F, 89.4%; and 53.6°F, 85.3% for winter, spring, summer and fall, respectively. Conception rates observed were 54%, 46%, 15%, and 39% for winter, spring, summer, and fall, respectively. A complete randomized design was used to determine significant differences among seasonal conception rates and among months within seasons. Conception rates were significantly different ($P<.01$) among seasons but not significantly different ($P>.05$) among months within seasons.

Introduction

Ideally, a cow should produce a calf every 12 months. This would provide the most offspring for possible inclusion into the herd and provide the highest lifetime milk production because a greater proportion of time would be spent in that part of the lactation when production is highest. To achieve the goal of a calf per year, the cow must conceive within 82 days postpartum. Various factors that affect reproductive performance have been identified but the degree of effect for each factor has not been quantified. This study was an initial step toward quantification of temperature and humidity effects on conception rate.

Procedures

Reproductive performance data from 179 Holstein cows of various ages were obtained from records maintained on the Western Kentucky University dairy herd. Data used were extracted from recordings made between December 1978 and March 1984. Performance data on cows that were culled prior to calving and on cows with incomplete lactations were not used in this study. No allowance was made with regard to age or number of lactations, even though it is realized that primiparous animals might react different than multiparous animals. Further, cows than exhibited gross health problems during the observation period were excluded from the study.

[1] Head of Animal Production Project. Santo Domingo, Republica Dominicana.

Information obtained from individual cow records included calving dates, breeding dates, days in milk, days dry, and age at each breeding. These data were used to calculate services per conception, days open, calving interval, and days to first service. Individual cow data were grouped for month and seasonal analyses.

Seasonal, monthly and daily temperature data were obtained from records secured and maintained by the Kentucky Climatic Center under the auspices of the Department of Geography and Geology, Western Kentucky University. The Climatic Center is located approximately six miles from the Dairy Center. Humidity values used were also obtained from the Kentucky Climatic Center records. However, humidity recordings were taken at the Bowling Green-Warren County airport which is approximately four miles from the Dairy Center. Monthly and seasonal averages for temperature and humidity represented six and five years, respectively.

Results and Discussion

Conception rate and temperature were negatively correlated (-.15) with a coefficient of determination of 2.25% (Table 1). This non-significant (P>.05) correlation is not a true reflection of the relationship between conception rate and temperature because dairy cows are negatively affected by both low and high temperatures. This problem is explained quite well by the concepts of

Table 1. Seasonal variation in temperature[1] and conception rate.[2]

Season	Conception rate	Temperature °F
Winter[3]	54.09% (185)[7]	37.54
Spring[4]	46.4% (125)	60.20
Summer[5]	15.59% (150)	74.91
Fall[6]	38.99% (240)	53.55

[1] Values are five-year averages: Dec., 1978, through March, 1984.
[2] Values are five-year averages for Holstein cows.
[3] Inclusive dates December 22 through March 20.
[4] Inclusive dates March 21 through June 20.
[5] Inclusive dates June 21 through September 20.
[6] Inclusive dates September 21 through December 21.
[7] No. of observations.

"zone of Thermal Neutrality" and "Critical Temperatures". The zone of Thermal Neutrality is defined as the zone in which metabolic heat production is independent of air temperature. This zone is bounded by high and low critical temperatures. When the air temperature falls below the low limit, the animals' metabolic processes increase heat production to maintain body temperature, whereas, elevation of air temperature above the high limit stimulates the animals' body to accelerate heat loss through increased respiration rate and evaporative water loss through the skin. The correlation between conception rate and temperature in this study was determined with values collected throughout the year, including times when both high and low critical temperatures (limits) were exceeded.

Conception rate was highest in a temperature range of 46°F to 65°F (Table 2). The notable exception was February when the highest conception rate (58%) was obtained at an average temperature of 34°F. One possible explanation is that the cows have adjusted to cooler temperatures by this time coupled with the fact that daily temperatures are quite variable during February in Kentucky. Other studies have reported that air temperatures 0.9°F above or below the mean uterine temperature on the day of or day after insemination reduced conception rate. Thus, inseminations on the warmer days in February would possibly confound the data reported herein.

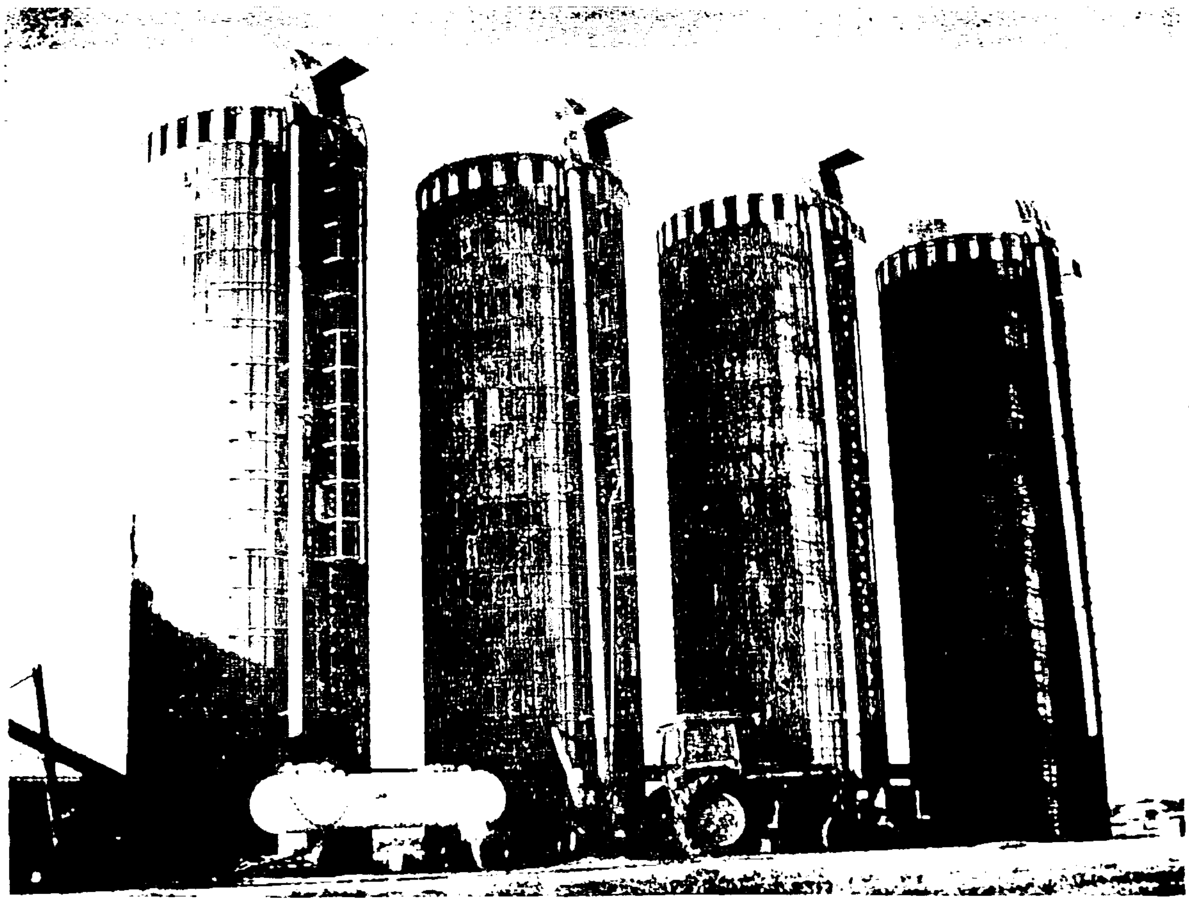
Table 2. Average monthly temperature, humidity, and conception rate.

	Month	Temperature[1] °C	°F	Humidity[2] (%)	Conception[1] (%)
1.	January	-0.98	30.23	80.2	34.04 (63)[3]
2.	February	1.03	33.85	80.5	58.33 (57)
3.	March	7.96	46.33	79.9	43.48 (66)
4.	April	13.35	56.03	78.0	41.94 (44)
5.	May	18.24	64.83	85.9	40.74 (38)
6.	June	23.12	73.62	89.8	38.89 (25)
7.	July	26.17	79.1	90.5	21.43 (34)
8.	August	25.18	77.32	89.4	13.89 (44)
9.	September	20.88	69.58	88.1	22.37 (93)
10.	October	13.76	56.76	85.4	44.44 (81)
11.	November	8.96	48.12	83.5	35.19 (73)
12.	December	4.3	39.74	84.2	32.20 (78)

[1]Inclusive dates: Dec., 1978, through March, 1984.
[2]Inclusive dates: Jan., 1979, through March, 1984.
[3]No. of observations.

A significant ($P<.05$) negative correlation (-0.65) was observed between humidity and conception rate. Conception rate was significantly ($P<.01$) lower during the summer relative to fall, winter, and spring. In general, conception rate was affected ($P<.05$) by season but unaffected ($P>.05$) by months within a season.

Further work needs to be done on quantification of both temperature and humidity effects on reproductive efficiency and means to overcome the negative effects observed.



KSU

EARLY POSTPARTUM HORMONAL THERAPY IMPROVES FERTILITY OF DAIRY COWS[1]

J. S. Stevenson and M. BenMrad

Summary

A study of 234 Holstein cows was conducted to determine if hormonal treatments of gonadotropin-releasing hormone (GnRH or Cystorelin®) and(or) prostaglandin $F_{2\alpha}$ (PGF or Lutalyse®) given early after calving would improve subsequent fertility of dairy cows. Treatment of cows having abnormal conditions associated with calving (puerperal problems) reduced interval from calving to conception by 43 to 48 days when GnRH was given once between days 10 and 14 postpartum or when PGF was administered once between 20 and 24 days after calving compared with cows given only saline (controls). The reduction in days open was 27 to 29 days overall for all cows (normal and abnormal) treated with either hormone compared with controls. Cows (normal and abnormal) given either hormone required 26 to 41% fewer inseminations per conception than controls. Reasons for improved fertility are discussed. We conclude that early postpartum treatments with GnRH or PGF improved fertility of dairy cows, especially those that experienced puerperal problems.

Introduction

Initiating early reestablishment of estrous cycles after calving is essential for allowing adequate time for cows to be inseminated and maintain a yearly calving interval. Normally, intervals from parturition to first ovulation average about 3 wk. Because not all first ovulations are preceded by estrus, interval to first heat averages about 5 to 6 wk. Both intervals are delayed in cows with periparturient problems such as calving problems, uterine infections, ovarian cysts, injury, or metabolic diseases (ketosis, displaced abomasum, etc.). Gonadotropin-releasing hormone (GnRH or Cystorelin®) is effective for treating ovarian follicular cysts, enhancing uterine involution, and inducing ovulation of ovarian follicles early postpartum. Another hormone, prostaglandin $F_{2\alpha}$ (PGF), is luteolytic or capable of regressing the corpus luteum and bringing the cow into heat in 2 to 5 days after treatment. PGF has been used effectively to treat ovarian luteal cysts and cows with pyometra or endometritis (if there was a corpus luteum present on the ovary). The objective of our study was to determine if treatments of GnRH and(or) PGF could improve fertility by altering the frequency and occurrence of early postpartum estrus and ovulation.

[1] We gratefully acknowledge Dr. M. D. Brown and CEVA Laboratories, Overland Park, KS for their donation of Cystorelin® and J. F. McAllister and The Upjohn Company, Kalamazoo, MI for their gift of Lutalyse® used in this study.

Procedures

This study utilized 234 Holstein cows in the KSU dairy herd, which calved between July 1, 1982 and June 30, 1983. Cows were allotted randomly at calving to one of four experimental groups (Table 1).

Table 1. Assignment of cows to treatment groups[a]

	Group			
Item	1	2	3	4
Treatment	GnRH	PGF	GnRH-PGF	Saline
GnRH (200 μg)	days 10-14	-	days 10-14	-
PGF (25 mg)	-	days 20-24	days 20-24	-
No. cows	59	59	57	59

[a]Days after calving when one intramuscular dose was given.

Cows were examined at calving and between 25 and 40 days postpartum for various abnormalities. Observations at both times determined whether a cow was classified as having a normal or abnormal puerperium. Abnormal classification included any cow that had dystocia, retained placenta, uterine infections, milk fever, ketosis, or unusual enlargement of the uterine horns or cervix.

Blood was collected thrice weekly to monitor blood serum concentrations of progesterone. This allowed us to know when ovulations occurred and when a corpus luteum was present. Intervals to estrus, inseminations, and conception were determined as well as average number of services per conception.

Results and Discussion

Reproductive traits were improved for cows treated with either GnRH or PGF (Table 2).

Cows given GnRH or PGF conceived earlier after calving with fewer services, and tended to have higher conception rates at first service than control cows treated with saline alone. Responses after both hormones were intermediate for the most part, except for reducing services per conception.

An additional benefit of these treatments was the positive effects on cows with an abnormal puerperium. Nearly 30% of the cows had one or more postpartum abnormalities including dystocia, retained placenta, uterine infection, purulent discharge, milk fever, ketosis, or abnormal enlargement of the uterine horns or cervix. At least 77% of the abnormalities observed were of reproductive origin. In all cases, treatment of these cows with GnRH or PGF improved subsequent reproductive performance.

Table 2. Reproductive measures of cows after treatment

Item	GnRH	PGF	GnRH-PGF	Control
First service conception, %	40	42	38	29
Normal cows	42	48	44	35
Abnormal cows	31	21	29	13
Days from calving to conception	88*	86*	96	115
Normal cows	92	83	82	97
Abnormal cows	85*	90*	109	133
Services per conception	1.7*	1.8*	2.1	2.3
Normal cows	1.7*	1.6*	1.7*	2.2
Abnormal cows	1.7*	1.9*	2.4*	2.4

*Significant improvement compared with control cows ($P<.05$).

Examining various other measurements revealed possible explanations for the improvements in fertility. GnRH treatment reduced intervals to when cows first ovulated and came into estrus after calving, as well as increasing the proportion of cows with three or more ovulations before first service from 54% for controls to 83%. Treatment with PGF reduced intervals to second and third ovulations and shortened the duration of the first estrous cycle. Both treatments increased the proportion of cows with estrous cycles of normal duration (18-24 days) before 6 wk postpartum. Therefore, improvement of fertility was associated with increased frequency and occurrence of ovulation and estrus before first services and the re-establishment of estrous cycles of normal duration. Our work suggests that all cows, especially those with an abnormal pueriperium, had improved fertility when treatment early postpartum with GnRH or PGF.

At present we do not know if such treatments are repeatable in all dairy herds or if they are economical. We are conducting further studies in other herds to verify our present findings. Based on our initial work, it would appear that such treatments (GnRH on days 10, 11, 12, 13, or 14 or PGF on days 20, 21, 22, 23, or 24) are of economic value for cows that experience postpartum abnormalities because treatments result in improved reproductive performance.

CONTROLLING CALVING INTERVALS WITH PROSTAGLANDIN $F_{2\alpha}$ AND FIXED-TIME INSEMINATIONS

J. S. Stevenson, M. C. Lucy, and E. P. Call

Summary

Prolonged or delayed interval to first breeding is a major cause of long calving intervals. Our objective was to test two methods of artificial insemination by appointment after controlling the onset of estrus for all first breedings after calving. Prostaglandin $F_{2\alpha}$ (PGF) was used to time the onset of estrus for cows in two experimental groups. Control cows (inseminated at first heat after 42 days postpartum) had longer intervals to first breeding than the two experimental groups given PGF at 40 to 46 and 51 to 57 days postpartum. Conception rates were lower in the treated cows than in control cows. However, no differences were observed for calving intervals, which ranged in average days from 379 to 384 for treated cows and averaged 376 days for control cows. We were able to reduce successfully the interval to first breeding so all cows were first bred by approximately 60 days postpartum in the experimental groups, but we were unable to shorten overall calving intervals.

Introduction

Maintaining a calf-a-year program is an economic necessity for maximizing profits on the dairy farm. Many studies have indicated that when cows spend a greater proportion of their herd time in periods of peak lactation (first 3 to 4 months of lactation), they will be more profitable and produce more calves during their herd life. To maximize this efficiency for each cow in the herd, maintaining a calving interval of 12 to 13 months is an absolute must. Optimizing herd calving interval, however, does not always optimize the calving intervals for each individual cow. There remain cows with extremely short or extremely long intervals, which are included in the herd average. This can be likened to a fellow who stands with his right foot in a tube of boiling water and his left foot in one of ice water. On the average, the water temperature in which he stands is quite comfortable. We must treat cows as individuals in the herd, so calving intervals can be as uniform as possible for the entire herd.

Procedures

Using 283 Holstein cows in the KSU dairy herd during a 2-year study (July 1, 1983 to June 30, 1985), we tested the idea that calving intervals could be controlled and perhaps reduced by breeding all cows between 51 and 57 days postpartum following an estrus induced by prostaglandin $F_{2\alpha}$ (PGF). Group 1 consisted of 77 control cows that were inseminated at their first heat observed after 40 days postpartum. Group 2 consisted of 139 cows and Group 3 of 67 cows. Cows in the latter two groups were given PGF (25 mg or 5 cc Lutalyse®) on a Thursday when they were 40 to 46 days postpartum. Eleven days later, on a Monday, cows were retreated with PGF and inseminated at 80 h (Group 2) or 72 and 96 h (Group 3) after the last PGF treatment. This allowed all treated cows to be first bred between 51 and 57 days postpartum, thus, precisely controlling the first breeding interval.

Results and Discussion

Results of those reproductive traits measured are illustrated in Table 1. Controlling the time of first services with PGF accounted for all cows first bred by no later than 60 days postpartum. Controls had a longer average interval to first breeding by 5 to 6 days, whereas some control cows were first bred as early as 40 days and others as late as 122 days postpartum. Conception rates were poorer after PGF treatment than in control cows. This was due in part to several reasons. There were some cows that were cycling and failed to respond to the PGF treatment, whereas others were not in a responsive stage of an estrous cycle for PGF to regress the corpus luteum and bring the cow into estrus. Some cows were

Table 1. Reproductive traits for cows following fixed-time first services.

Reproductive Trait	Control	AI at 80 h	AI at 72 and 96 h
No. cows	77	139	67
Days to first service	62.6	57.0*	57.1*
Conception rate at first service, %	50.6	25.9*	31.3*
Services/conception	1.8	2.3	2.2
Calving interval, days	376	379	384

*Different from control ($P<.01$).

anestrus at PGF treatment, resulting from ovulation failure after an earlier estrous cycle or had not cycled since calving. Services per conception tended to be higher for PGF-treated cows, but because of good conception rates at second and third services for treated cows, calving intervals were similar for treated and control cows.

The methodology employed guaranteed that all cows were first bred by approximately 60 days postpartum, but because of problems encountered with approximately 28% of cows not in true estrus at the fixed-time insemination, low conception rates occurred at first service. We are investigating presently another scheme for controlling intervals to first service where one injection of PGF is given around 60 days after calving, and cows are inseminated according to heat detection. Based on the results of the present study, using the two injection scheme will only increase the number cows in estrus by 20% beyond what could be achieved with one injection alone. One injection was adequate to synchronize estrus for first services in about 60% of all cows treated. Whether this method will maintain an acceptable calving interval remains to be tested in our future work.

KSU

COMPARISON OF AM-PM AND DHI RECORDS

J. R. Dunham

Summary

A comparison was made of the AM-PM production testing program with the traditional DHI program during 13 test periods of 1984 in the KSU Dairy Teaching and Research Center herd. Although there were slight variations in daily milk weights and percentages of fat and protein in milk, rolling herd averages were nearly identical. Individual 305-2X-M.E. milk and fat records also were compared for 107 cows using both testing programs. Differences between testing programs were minimal, as most records varied by less than 1%. Therefore, it was concluded that the AM-PM program is a very accurate production test.

Introduction

The AM-PM production testing program offers several advantages over the regular DHI program. These include: 1) less time and labor in collecting production data, 2) lower cost, 3) less travel for the DHI Supervisor, 4) more herds tested in a given period of time, and 5) production estimates based on an exact 24 hr period. Yet, the AM-PM program has not been widely accepted in the dairy industry even though it is recognized as an official testing program.

Procedure

Beginning in January 1984, the Kansas State University Dairy Teaching and Research Center herd was enrolled in an unofficial AM-PM production testing program (code 3) in addition to the regular DHI program (code 0). The code 3 program was chosen to avoid duplication of official records. The DHIA Supervisor collected milk weights and samples from the same cows so that a comparison of the two programs could be made. In the case of the DHI test, evening and morning milk weights and samples were taken and these data were used as the 24 hr production. For the AM-PM test, one milk weight and sample was taken on alternate evening and morning milkings each test day. The evening or morning weight was the same weight corresponding to the DHI test. The AM-PM weights and component tests were adjusted by computer for the 24 hr period.

Results and Discussion

The results of the 13 tests conducted during 1984 are shown in Table 1. Average milk weights and components were quite comparable. Two different test dates, one in May and the other in August, showed a variation in average milk weight of 2.3 lb. These offset each other, since the higher milk weight occurred under both testing plans. At the end of the 361-day test period, the rolling herd averages were nearly identical.

Table 1. Comparison of AM-PM and DHI Programs.

Sample Date	DHI Avg lb Milk/Cow	DHI % Fat	DHI % Protein	AM-PM Avg lb Milk/Cow	AM-PM % Fat	AM-PM % Protein
1-03-84	53.5	3.6	3.6	51.8	3.6	3.3
2-02-84	53.5	3.4	3.3	53.1	3.3	3.3
3-01-84	56.0	3.3	3.2	55.6	3.4	3.2
4-04-84	58.8	3.5	3.3	57.6	3.5	3.3
5-02-84	59.2	3.3	3.2	61.5	3.3	3.2
6-01-84	61.0	3.2	3.1	62.3	3.4	3.2
7-03-84	58.6	3.3	3.2	58.0	3.2	3.2
8-02-84	57.7	3.2	3.1	55.4	3.3	3.2
9-05-84	56.7	3.2	3.2	56.5	3.2	3.2
10-02-84	53.5	3.3	3.4	52.6	3.3	3.4
11-01-84	49.7	3.8	3.4	50.9	3.6	3.4
12-04-84	52.3	3.9	3.3	52.8	3.7	3.3
12-28-84	52.8	3.7	3.1	53.4	3.6	3.1

	DHI Rolling Herd Avg.					AM-PM Rolling Herd Avg.				
	Milk	% Fat	Fat	% Prot.	Prot.	Milk	% Fat	Fat	% Prot.	Prot.
12-28-84	17977	3.43	616	3.27	587	17984	3.40	612	3.25	585

Some dairy producers have expressed concern that there may be too much variation among individual records when tested by the AM-PM plan compared to DHI. Therefore, the 305-2X-M.E. records of all cows completing a record during the last six months of the study were compared. The results are shown in Table 2. The average 305-2X-M.E. for milk and fat under the two testing plans were not significantly different. There were only two 305-2X-M.E. records with variation greater than 1000 lbs and 18 records with variation greater than 50 lbs. Therefore, it was concluded that the AM-PM plan is a very accurate production testing program.

Table 2. Comparison of the 305-2X-M.E. records made under AM-PM and DHI Programs.

Item	AM-PM	DHI
No. records	107	107
305-2X-M.E. (Milk)	18,304	18,376
305-2X-M.E. (Fat)	626	619

GENETIC SELECTION AND BREEDING PRACTICES OF KANSAS HOLSTEIN HERDS IN RELATION TO YEARLY LEVEL OF PRODUCTION

E. P. Call

Summary

An analysis of 41,426 cows in 635 Kansas Holstein herds indicated that considerable improvement can be made in genetic gain by more stringent sire selection and greater use of proved bulls. The generation interval in dairy cattle is about 5 yr so a dairy producer has only a limited number of decisions by which to make genetic improvement. Maximum genetic gain is possible by breeding 80 percent of the herd to bulls in the 80+ percentile. The remainder of the herd should be bred to several young sires in a progeny test program to aid in selecting the meritorious sires of the next generation. All heifers should be bred to superior bulls using calving ease as an additional selection criterion.

Introduction

Great variation exists in the inherent ability of dairy cows to produce milk. Of this variation, about 25% is genetic and 75% is due to other factors, such as feeding, management, environment, and chance. Since the heritability of milk production is relatively low ($h^2 = .25$), great emphasis must be placed on systems that will determine the estimated transmitting ability of dams and sires of the next generation. Evaluating dams becomes more difficult since cows have a few records and daughters upon which to make estimates. Most of the genetic progress must come from the sire's side since he is more prolific, and the sire proving system through progeny test programs can be very accurate in ranking a bull's transmitting ability. Such a system for proving bulls has been available industry-wide for the last 15 yr. The degree of acceptance of this system is the reason for the analysis in this paper.

Procedures

The data for this analysis was obtained from the Dairy Herd Improvement (DHIA) records of 635 Kansas Holstein herds with 41,426 cows that completed a testing year in December, 1984. These herds provide breeding information as an adjunct to the regular testing procedures. The herds were grouped by level of rolling herd average (RHA) to assess possible differences in attitudes toward sire selection. Criteria used to evaluate selection practices were the average Predicted Difference for dollars (PD82$) of cows in the herd and the same evaluation for service sires used to breed these cows. Service sires were ranked according to the percentile ranking system where the top 1% of the PD$ bulls would be in the 99 percentile and the poorest bulls at 0 percentile. Any genetic evaluation program must be based upon accurate identification of sires and dams. These values also were analyzed according to RHA groups.

Results and Discussion

The data are summarized in Table 1. There was a positive linear relationship in all of the categories analyzed. Higher producing herds not only have more complete identification, but they have used a higher percentage of proved bulls of greater genetic merit in the milking herd. Because genetic progress is an on-going process, the PD$ value of sires of the current herd is expected to be less than that of the generation of bulls being used now as service sires. However, the $43 dollar difference between the low group and the high group of herds (RHA) represents a significant amount of yearly milk production. The same disparity is seen in the quality of service sires being used. The percent of proved bulls ranges from 50% in the low group to 75% in the high group and a difference of $37 is noted in PD$. In July, 1985, the average AI Holstein bull had a PD$ = +82, whereas all non-AI proved bulls had PD$ = -51, or a difference of $133. On the average, Holstein dairy producers in Kansas are not taking full advantage of the genetic potential that is available through the AI industry. When all service sires are considered, non-proven bulls are assumed to be zero (Based upon the summary of all non-AI proven bulls in Kansas in 1985, only 16% were greater than zero). Under the category of All Bulls, the percentile ranking varied from 13 to 55 as RHA increased.

Recommendations

1. Kansas Holstein dairy producers need to place more emphasis upon sire selection.

2. Breed 80 percent of the herd to bulls in the upper 20% or bulls with 80+ percentile (PD$ > 115).

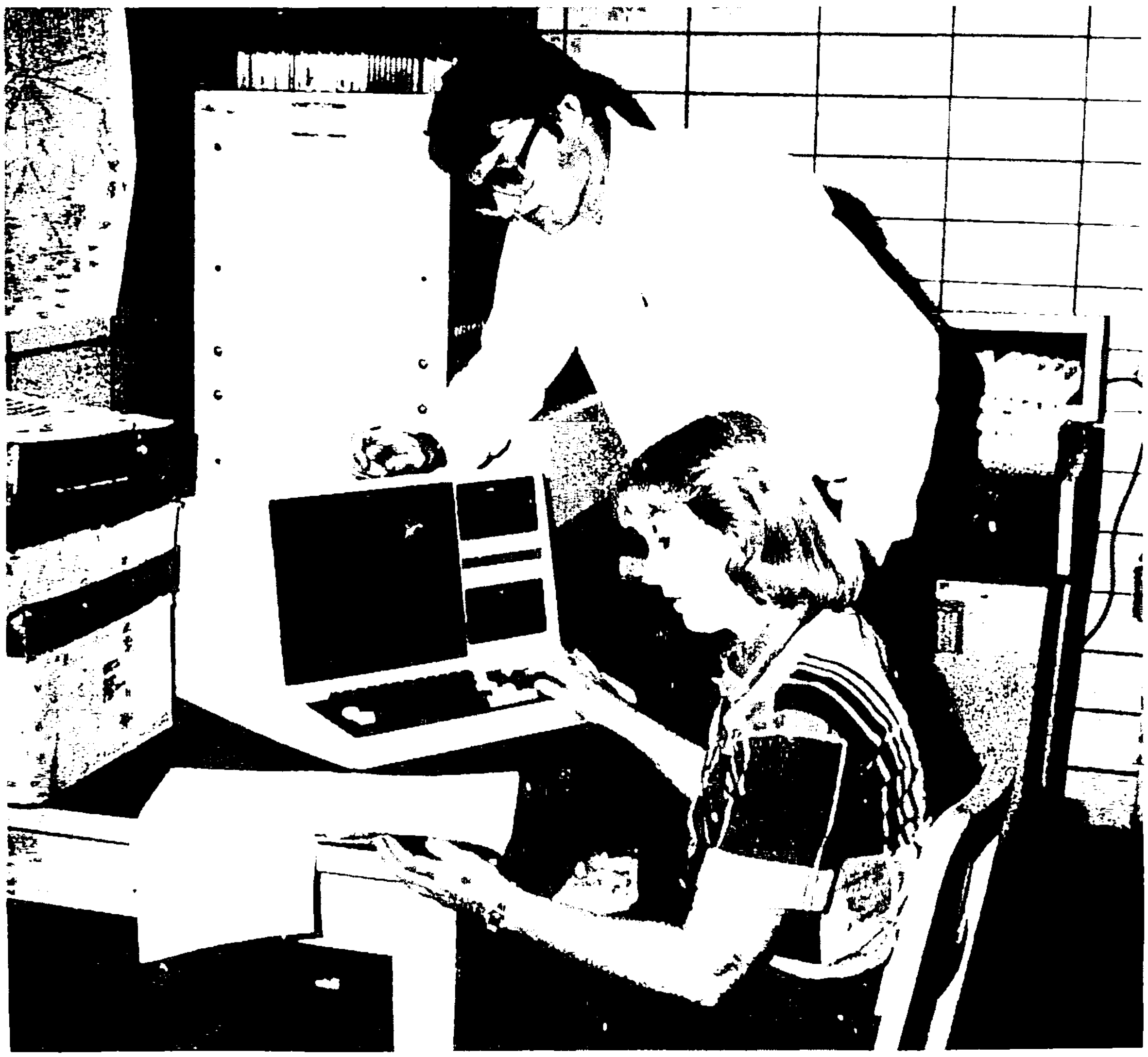
3. Select several young bulls to service the remaining 20 percent of the herd to help the AI industry prove the superior bulls of the next generation.

4. Use a herd mating service as an aid in selecting conformation or type traits that are of economic importance.

5. Breed all heifers to bulls in the upper 20% (80+ percentile) with final selection based upon ease of calving rank.

Table 1. Average genetic characteristics of 635 Kansas Holstein herds with 41,426 cows grouped by level of rolling herd average (RHA).

Rolling Herd Avg Milk (lb)	Identification Sire ($)	Identification Dam (%)	Cows Sired by P.D. Bulls (%)	Cows Sired by P.D. Bulls (PD$)	Service Sires With PD ($)	Service Sires PD$	Service Sires Rank (%tile)	All Bulls PD$	All Bulls Rank (%tile)
10,699	49	74	33.3	-26	50.0	+75	45	+39	13
12,565	56	78	40.3	-16	53.7	+76	46	+41	14
13,569	57	83	42.3	0	64.7	+89	62	+57	24
14,510	72	88	58.1	-2	67.3	+89	62	+59	26
15,504	74	91	67.1	-4	65.4	+90	63	+60	27
16,514	81	93	75.0	+2	69.0	+99	72	+69	37
17,414	79	94	76.7	+18	71.9	+100	72	+71	39
19,152	86	94	79.4	+17	75.0	+112	84	+84	55



THE IMPACT OF CULLING ON PRODUCTION AND PROFIT

E. P. Call

Summary

Profit or loss in the dairy enterprise is dependent upon yearly production per cow and degree of capitalization. Higher producing cows convert feed into milk more efficiently. Cows of similar body size have similar maintenance requirements, regardless of level of yearly production. The successful dairy enterprise must establish yearly production goals needed to satisfy cash flow requirements and then implement management procedures to obtain maximal yearly milk per cow on the number of cows required to meet the herd's goal.

Introduction

Profitability in the dairy enterprise is dependent upon a number of factors. Each operator needs to decide the annual pounds of milk marketed to create the necessary cash flow to remain viable. For example, if one million pounds of milk is required to generate adequate dollars, then the next decision is the numbers of cows required to generate this level of production. Cows respond differently because of their genetic potential, but feeding and management account for about 75% of the variation among cows. In the example of one million lb of milk per year, 100 cows producing 10,000 lb annually will meet the requirement. This example will almost surely fail. At current economic conditions, a 20,000 lb average production will meet with success, providing the producer is not over-capitalized in facilities and machinery. The primary reason for success or failure is determined by individual cow maintenance cost, i.e., the cost of keeping cows alive regardless of their level of yearly production. Table 1 illustrates this principle in Kansas DHIA herds, assuming that body weight is constant among cows.

Procedures

The dairy diversion program (DDP) in 1984-85 provided an opportunity in the Kansas State University dairy herd (DTRC) to demonstrate the effects of culling for production and health-related reasons on the net income of the operation. It was assumed that about 3.0 million lb of milk were required to justify the DTRC and maintain sufficient cows for the intended teaching and research activities of the herd. Other assumptions and variables that were held constant for the purpose of this study were:

1. Milk price was static at $12.47/cwt.

2. Dairy maintenance feed costs were $1.22 per cow throughout the study.

3. Feed costs were established at 1983 levels and were considered to be $826 per cow in 1983 and $874 per cow in 1984 when production increased by 11%.

4. Other costs of production were obtained from the Southwest Dairy Economic Analysis, Oklahoma State University and were held constant at 1983 levels. The values were $1,096 for 1983 at an average production of 16,216 lb per cow and $1,150 for 1984 when production increased 11% by greater culling pressure.

Results and Discussion

The basis for culling was primarily low production, with some cows removed for chronic mastitis and other health-related problems. Culling for low production was emphasized at the end of the 4th mo. of lactation, when the average cow has produced about 50% of the yearly total. The effect of culling is shown in Table 2. Herd size was reduced by 21 cows with a 1.5% decline in total pounds of milk marketed and a subsequent decline in total income. Because of effective culling, average production per cow resulted in an increase of 11% in rolling herd average to 17,984 pounds per cow. Table 3 notes the effect on maintenance costs of milking fewer cows and the increased feed requirement for an 11% increase in average milk production. While feed costs were essentially the same, milking 21 fewer cows resulted in an 11% reduction in maintenance costs. The effect of cullinng was a decrease of 6% in total feed cost, even with an increase of 11% in production per cows. Table 4 summarizes the total costs of producing about the same volume of milk with fewer cows. Other costs increased with higher levels of production. However, the lowered feed costs resulted in a decrease of 6.5% in the total cost of production.

Assuming a normal culling rate of 30 percent, fewer cows mean fewer cull cows for dairy beef under routine operations. This effect can be seen in Table 5. Not including the 21 extra cows culled in 1984, income from cull cows was about $3000 less in 1984. This decrease in cash flow was more than offset by the decrease in total cost in 1984 from the increased efficiency of production. The endpoint of culling with a corresponding increase in production resulted in an increase of 87% in net income. In addition, 1.5% less milk was marketed, which contributed to decreasing the surplus.

Recommendations

1. Determine the total annual production required to justify the capital investment in a dairy operation.

2. Establish a minimum-level production per cow based upon the current economic situation.

3. Implement feeding and management procedures to obtain or better the minimum level of production per cow per year.

4. Utilize financial and production records, such as farm management and D.H.I.A., to make sound management decisions.

Table 1. The effect of rolling herd average (RHA) per cow on feed costs and income-over-feed costs in 462 Kansas Holstein herds in 1984.

Rolling Herd Avg. (lb)	Daily Bulk Tank Wt. (lb)	Yearly Feed Costs Maintenance	+ Milk	= Total	Income-Over-Feed Costs
		$			
10,700	33	445	207	= 652	626
13,570	43	445	322	= 676	861
17,410	55	445	440	= 885	1225
19,150	60	445	513	= 958	1351

Table 2. Comparison of variables at the DTRC during the last two years.

Year	Cows	Milk/Cow (lb)	Milk/Year (lb)	Income/Year ($)
1983	188	16,216	2,896,178	361,153
1984	167	17,984	2,853,162	355,789

Table 3. Differences in maintenance and milk feed costs at the DTRC during 1983 and 1984.

Year	Cows	Feed Cost Maintenance	+ Milk	= Total Feed Cost
		$		
1983	188	83,716	71,547 =	155,288
1984	167	74,365	71,593 =	145,958

Table 4. Comparison of feed costs and other costs of producing milk at the DTRC during 1983 and 1984.

Year	Cows	Other Costs +	Feed Costs	=	Total Costs
		$			
1983	188	206,048	155,288	=	361,336
1984	167	192,050	145,958	=	338,008

Table 5. Effect of culling on profitability of the DTRC during 1983 and 1984.

Year	Cows	Total Milk -	Total Cost =	Profit (Loss) +	Cull Cows =	Net Income
		$				
1983	188	361,153	361,336	(-183)	27,072 =	26,889
1984	167	355,789	338,008	17,781	24,048 =	50,847

KSU

RESEARCH IN PROGRESS

*** RUMINANT NUTRITION ***

Effects of Sodium Diacetate and Ammonium Acetate in Grain Rations for Lactating Cows

W. H. Carinder and L. H. Harbers

Sodium diacetate (a common silage preservative) and ammonium acetate were added at the rate of 1% acetate to each of two grain diets fed to high-producing cows in early lactation. Weekly milk samples were obtained to determine milk composition and yield. Acetate combines with water in the rumen to yield a source of acetic acid, which is absorbed into the bloodstream, and can be used for either cellular energy, or as a milkfat precursor in the mammary gland.

Evaluation of Pelleted and Unpelleted Hominy Feed for Lactating Dairy Cows

K. D. Frantz and J. L. Morrill

Large quantities of hominy feed are produced in Kansas. As produced, it is bulky and somewhat difficult to handle with conventional feed-handling equipment. Pelleting feed improves handling characteristics and may increase consumption but may cause lowered milk-fat tests. We are conducting an experiment to compare hominy feed to corn as a feed for dairy cows and to determine the effects of pelleting the hominy feed, with special emphasis on handling characteristics, feed consumption, and milk-fat production.

Influence of In-The-Parlor Water Availability on Water Consumption and Milk Production

K. D. Frantz, J. L. Morrill, and J.E. Shirley

Dairy cattle suffer more quickly and severely from a lack of water than from a deficiency of any other nutrient. Anything that might reduce water deficits in the animal would likely be of some benefit. Individually metered water cups were installed in the milking parlor, enabling us to monitor water consumption of individual cows. In-the-parlor water may help alleviate water deficits by: 1) making water readily available to the cow at least 2 or 3 additional times during a 24-hr period (2x or 3x milking), especially during times of environmental stress when animals may be less willing or unable to seek the water source in outside lots, and 2) making water readily available at the same time significant water loss is occurring through the milking process.

*** CALF NUTRITION ***

Rumen Microbial Development in Calves After Early or Conventional Weaning

K.L. Anderson, T.G. Nagaraja,
J.L. Morrill and T.B. Avery[1]

The rumen in the calf is neither well developed nor functional at birth. Anatomical and functional development of the rumen is stimulated by dry feed and by its products of digestion. It is highly desirable to obtain rapid development of ruminal function in the calf so that the animal can utilize high fiber and starch in the diet at an earlier age. In addition to the benefits of reduced cost of labor and higher feed efficiency, calves with a functional rumen have fewer health problems. In conventional feeding programs, calves are usually weaned after 6 weeks of age. Recent research at Kansas State has led to the development of a program that allows successful weaning at 2 to 3 weeks of age. The early weaning program involves the use of a "prestarter", a highly palatable feed containing milk solids, supplementary fat, and additives, which stimulate dry feed consumption.

The objectives of our research are to study the evolution of microbial development in calves from birth to 3 months of age and to document differences in microbial development between calves weaned at 2 to 3 weeks of age (early weaning) and those weaned at 6 weeks of age (conventional weaning). We have 4 Holstein or Ayrshire bull calves for each weaning program. Calves in each group were rumen-fistulated at 3 days of age and rumen contents were sampled periodically starting from day 3 to 3 months of age. Rumen samples were analyzed for fermentation products (volatile fatty acids, ammonia, lactic acid) and types of microbes. Analysis of microbial types include total number of anaerobic and aerobic bacteria, and also individual groups of bacteria such as those that can utilize cellulose, starch, lactic acid, and casein.

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[1]Department of Surgery and Medicine.

Effect of Potassium and Buffered Starter on Calf Performance

K. J. Jordan, J. L. Morrill, S. Galitzer, P. G. Reddy, and J. J. Higgins

Calves differ greatly in amount of dry feed consumed early in life, for reasons we do not understand. We are investigating the effect of potassium status on feed consumption when potassium comes from natural feedstuffs or is given as a supplement. Additionally, we are investigating the effect of addition of buffer to the starter used in an early weaning program.

Comparison of Methods for Thawing Colostrum

P. G. Reddy and J. L. Morrill

Sometimes high quality colostrum is not available from the dam of a newborn calf and an alternate source is needed quickly. Freezing does not destroy antibodies in colostrum but excessive heat will denature the antibodies, which are proteins. We are investigating various methods of thawing colostrum to determine the most rapid way to use it without antibody destruction.

Effect of Amount of Milk and Method of Weaning on Calf Performance

P. Flynn, J. L. Morrill, P. G. Reddy,
J. S. Stevenson, H. Minocha, and J. J. Higgins

It would appear that increasing the amount of milk fed to a calf would increase growth; however, considering the entire growing period, this may not be true if dry feed consumption is reduced. Likewise, gradual weaning would appear to be less stressful than abrupt weaning. Again, this may not be true if the abruptly weaned calf adapts more quickly to dry feed. We are comparing performance of calves fed milk at either 8 or 10% of their body weight daily and of calves weaned either abruptly or over a period of 1 week. Extensive measurements of hormonal and immune systems are being made to determine degree of stress encountered.

Study to Determine the Vitamin E Requirements of Dairy Calves

P. G. Reddy, J. L. Morrill, H. C. Minocha,[1] and R. A. Frey[2]

The National Research Council does not recommend a level of vitamin E for calf starters or rations for growing heifers, probably because of lack of adequate data. Recent research has shown that calves on typical diets do not receive adequate amounts of alpha-tocopherol, the biologically active form of vitamin E, and supplemental vitamin E may enhance the immuno-competency of calves. In order to determine the optimum level of supplementation, 32 Holstein heifer calves are being fed either 0, 125, 250, or 500 IU of vitamin E from birth to 6 mo of age. In addition to growth rate data, we are recording various metabolic, hematological, and immune responses at different ages as the calf goes through certain management practices such as weaning, changing over to an adult ration, and shifting from hutches to group pens. Further, we are evaluating both cell-mediated and humoral immune response to IBR vaccine given at 7 wk and 5 months of age.

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[1] Department of Laboratory Medicine
[2] Department of Anatomy and Physiology

Measurement of Protein Utilization by Young Calves

D. P. Dawson, J. L. Morrill, P. G. Reddy, and H. Minocha

There are several possible reasons why certain proteins are not well utilized by young calves. These include low digestibility, lack of essential amino acids, presence of interfering factors such as trypsin inhibitor, and an antigenic effect. In a series of experiments, we are developing techniques to measure these different responses and are using these techniques to prepare and compare different protein sources in an effort to develop more nutritious and economical feeds for young calves.

*** HEALTH ***

Bacteriological and Histopathological Studies of Liver Abscesses in Feedlot Cattle

K.F. Lechtenberg, T.G. Nagaraja, and H.W. Liepold[1]

Liver abscesses in cattle fed high-grain finishing diet are a serious economic problem in the feedlot industry. The incidence of the abscessed livers in cattle at slaughter averages 25-30 percent. Presently, tylosin (trade name Tylan[R], Elanco Products Co., Indianapolis, IN) is widely used for the prevention of liver abscesses. This product reduces the incidence significantly; however, it does not eliminate the problem completely. The objectives of this research are to isolate and characterize bacteria from abscessed livers and to relate the bacteriological findings to histopathological changes.

We have cultured 51 abscesses from 32 abscessed livers collected from a slaughter house. Anaerobic bacteria was cultured from all 51 abscesses, whereas faculatively anaerobic bacteria were cultured from only 22 abscesses. Research on the characterization of these anaerobic isolates, their antibiotic sensitivities, and histopathological changes is in progress.

[1]Department of Pathology.

*** REPRODUCTION ***

Progesterone Priming and Fertility of Dairy Cows

J. S. Stevenson, R. E. Stewart, and E. P. Call

Several studies suggest that fertility can be improved when progesterone is given to cows during the first 15 to 20 days after insemination. Timing of additional progesterone treatments after breeding is critical as well as the method of its delivery to the cow in a practical situation. We are examining the role of prebreeding progesterone priming on subsequent fertility. Progesterone will be delivered via an intravaginal progesterone-releasing silastic coil that will be in place for 7 days. About 24 h before the device is to be removed, prostaglandin $F_{2\alpha}$ (Lutalyse® or Estrumate®) will be given to destroy the corpus luteum, if one is present, and cows will be bred after heat is detected during 24 to 72 h after the device is removed. A second treatment will consist of one injection of prostaglandin $F_{2\alpha}$ alone; followed by insemination at estrus. Control cows will be inseminated when spontaneous heat is observed. Our results should provide information concerning the effect of progesterone priming on fertility as well as verifying if similar treatments, when given at about 60 days postpartum, are efficacious for controlling first breeding and subsequent calving intervals.

Role of Oxytocin in Postpartum Reinitiation of Estrous Cycles in Dairy Cows

R. E. Stewart and J. S. Stevenson

Various hormones secreted by the brain and pituitary are known or have been hypothesized to be involved in controlling the onset of estrous cycles in cows after calving. Normally, dairy cows begin to cycle within 3 to 4 wk after calving and are observed in heat by 5 to 6 wk postpartum. Oxytocin, the hormone responsible for inducing milk let-down, is released each time the cow is milked. We have hypothesized that oxytocin may be involved in preventing the reoccurrence of estrous cycles in dairy cows during the early postpartum period. We administered oxytocin to 10 cows four times daily via indwelling jugular catheters for 4 wk after calving and saline was given to 10 control cows. We are monitoring the effect of oxytocin on serum concentrations of gonadotropins, estradiol, cortisol, and progesterone. In addition, we will determine its effects on days to first ovulation, estrus, and on various milk production traits including milk yield, fat, protein, and somatic cell counts. Our results should help us understand more about the endocrine mechanisms associated with postpartum ovarian function.

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The Livestock and Meat Industry Council, Inc. is a nonprofit, educational and charitable corporation that receives, pools, and distributes funds that play an important role in the Department of Animal Science and Industry programs. The council is controlled by industry people. Funds generated by the LMIC have already helped accomplish many teaching and research goals.

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The Council's individual projects are numerous. LMIC recently funded research in the Departments of Agricultural Engineering and Animal Science and Industry to study sulfur dioxide as a grain preservative. Funds from the Harry Burger Student Enrichment Fund help support the dairy judging team. LMIC funds helped fund the research that led to the development of lasalocid by scientists in the Department of Animal Sciences and Industry.

If we are to get the research results we need so badly, our industry needs to supplement state and federal funds. Our industry needs to help support its own research and teaching programs to train tomorrow's industry leaders.

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