UNIVERSITY OF MINNESOTA

The North Central Quarterly

Published by the North Central Experiment Station

GRAND RAPIDS, MINNESOTA NOVEMBER 1993 VOLUME 63 NUMBER 4

A Comparison of Intensive Rotational Grazing vs Confined Feeding Systems for Dairy Cows

Joe W. Rust, Professor Emeritus

Guernsey and Guernsey x Holstein cows that were lactating throughout the summer were allotted to two groups in mid May of 1991 and 1992. Cows were allotted to two groups by pairing cows of similar age, genetics, stage of lactation and preliminary milk production. The experiment was designed to compare rotational grazing (RG) to a conventional system (CS) where cows are confined in a barn and fed only stored forages.

A control group of cows was fed alfalfa haylage and corn silage ad lib, 4 lb of alfalfa hay per day and concentrates to balance their diet for individual milk production. The CS cows were kept in a tie-stall barn except for one hour per day when turned out in a dry lot for heat detection.

The group of cows on pasture obtained all of their forage from approximately 20.5 acres of mixed grass pasture except for 4 lb alfalfa hay per day in the barn at milking time. Grazing was controlled with electric fence to provide the cows access to only the amount of forage they would consume during each 12-hour period. Cows were moved to a fresh area every 12 hours. Concentrates were fed to balance their diet for individual milk production. During a three-week period in August of 1991 when there was insufficient pasture due to drought, the RG cows were fed some supplemental alfalfa haylage.

Samples of the pasture forage were taken and analyzed twice per week. Stored feeds were also analyzed each year for nutrient components (Table 1).

In 1991 thirteen lactating cows were allotted to each group (RG and CS) on May 20. The trial concluded on October 3, 1991(137 days). In 1992 twelve cows were allotted to the RG group and nine cows were allotted to the CS group on May 11. The trial concluded on October 1 (144 days).

In 1991, average 4% fat corrected milk production per cow for 137 days was 6,519 lb for CS compared to 6,167 for RG, a difference of 352 lb. Average milk fat was 4.68% and 4.42% for CS and RG, respectively. Average milk protein was slightly greater for CS (Table 2). Average somatic cell counts were similar for both treatments.

The quality of the pasture in 1991 was lowest in mid June when the grass was allowed to become too mature and during August when there was insufficient rainfall to promote growth. The 20.5 acres of grass pasture supported on average 1.28 animal units (1,000 lb) per day for the 137-day grazing season. An additional 25,000 lb of excess forage was harvested for hay in early June. The amount of forage available in late May and early June was considerably greater compared to later in the season.

In 1992, average 4% fat corrected milk production per cow for 144 days was 8,157 lb for CS compared to 7,544 for RG, a difference of 613 lb. Average milk fat was 4.60% and 4.52% for CS and RG, respectively. The average percent milk protein was slightly greater for RG and somatic cell count of the milk was highest for CS (Table 2).

The 20.5 acres of grass pasture supported on average 1.40 animals units (1,000 lb) per day for the 144-day grazing season in 1992. The quality of pasture was better in 1992 than 1991. Like 1991, however, the quality was lowest in August and early September, a period of very little rainfall.

Economic analysis for the pasturing period indicated net return per cow was $64.05 and $88.66 greater in 1991 and 1992, respectively, for RG compared to the CS cows (Table 3). The pasture system resulted in lower receipts and lower expenses each year than the confined system.

Milk production was very sensitive to change in the quality of pasture. Milk production dropped when the pasture matured and increased again when better quality pasture became available. On the other hand, milk production did not suffer when supplemental haylage was fed to cows on pasture when pasture quality deteriorated due to drought in August of 1991.

While cows on pasture produced less milk of lower fat content, savings resulted from less feeding of stored feeds, less use of facilities and equipment, and less labor. Consequently, net returns per cow were greater for the pasture system.

This research was funded by a USDA low input sustainable agriculture (LISA) grant.

Table 1. Average analysis of pasture and stored feeds.

	Analysis (DM basis)				
	DM%	CP%	ADF%	NDF%	RFV
Pasture					
Year 1		18.5	31.9	50.5	117
Year 2	21.8	22.1	27.9	45.9	137
Haylage					
Year 1		19.1	35.4	48.1	119
Year 2	52.5	17.9	32.3	40.9	147
Hay					
Year1		17.0	33.5	45.2	128
Year2	84.3	19.2	32.9	38.2	152
Corn Silage					
Year 1		8.7	27.1	43.1	
Year 2	32.6	7.3	27.1	45.7	

Table 2. Responses of dairy cows managed in rotational grazing (RG) and confined systems (CS).

	1991		1992	
Variables	RG	CS	RG	CS
Number of Cows	13	13	12	9
Number of Days	137	137	144	144
Total 4% FCM, Avg/cow,lb	6167	6519	7544	8157
Avg 4% FCM, lb/cow/day	45.0	47.6	52.4	56.6
Avg Butterfat, %	4.42	4.68	4.52	4.60
Avg Milk Protein, %	3.39	3.49	3.55	3.51
Avg SCC, (000)	171	179	235	382
Stored feed consumed, lb DM/cow, during trial periods				
Grain	1996	2033	1959	2337
Soybean Meal	117	336	258	387
Haylage	368	2194	0	2702
Hay Consumed	490	490	449	579
Corn Silage	0	798	0	540

Table 3. Economic comparison of dairy cows rotationally grazed or fed stored feed during the grazing period.[1]

Variables	1991		1992	
	Grazed	Confined	Grazed	Confined
	----$/cow----		----$/cow----	
Income				
Milk	729.32	771.43	1005.89	1069.28
Expenses				
Feed[2]	244.91	267.85	242.98	303.44
Bedding	00.00	10.28	00.00	10.50
Facilities/Equip[3]	18.37	36.36	16.00	39.02
Labor[4]	76.56	131.52	80.16	138.24
Total	339.84	446.01	339.14	491.20
Net difference	389.47	325.42	666.75	578.08

[1]Analysis is for 137 grazing days in 1991 and 144 days in 1992.
[2]Pasture value assigned to provide approximately same net return per acre of pasture as would be obtained from hay production.
[3]Expenses include estimates on feed storage costs, fencing, manure disposal and clipping of pastures.
[4]Labor includes general cow care and fence building and movement.

1992 Resort Pricing Study

Dan Erkkila, Tourism & Travel Specialist

In June of 1992, a survey was mailed out to resorters across the state soliciting information ranging from housekeeping and American/Modified American plan rates, prices for other products and amenities offered, as well as information about those services and other resort policies. With the aid of the Minnesota Office of Tourism and endorsement of the Minnesota Resort Association and the Congress of Minnesota Resorts, the survey was the fourth resort pricing study conducted out of North Central Experiment Station by the University of Minnesota Tourism Center. Previous surveys were in 1973, 1979, and 1986. While the number of resorts regularly offering lodging is not known, most estimates suggest the number to be around 1,000. With 614 resorts responding, then, the 1992 survey reflects a 61% response rate.

On average, over two thirds of all Minnesota resorts have from five to thirteen cabins, with an overall state average of 9 cabins per resort. Approximately 22% of the resorts with cabins reported being open for winter lodging business, while 34% reported have camping sites available for summer guests.

State-wide, rates for housekeeping cabins were up 18 to 30% (above inflation) since 1986, depending on the number of bedrooms and the size of the resort. Increasing business costs, including liability insurance, property taxes and environmental regulations (like maintenance of or upgrading septic systems) were cited as contributing to price increases. Table 1 shows average housekeeping rates for medium-size resorts (5 to 13 cabins) in different counties/regions across Minnesota.

While past surveys did not provide benchmark data for many comparisons, 1992's survey did suggest that Minnesota resorters are continuing to provide a wide range of services and amenities for their customers. The most prevalent cabin feature noted, as one might expect, is a full kitchen (94% of all cabins). The second most available amenity is some type of "quality" deck or porch (49%), followed by microwave ovens (35%). Low on the list (but possibly on the rise) were indoor pools, spas, hot tubs, and air conditioning. Growing attention to people with disabilities, stimulated by the Americans with Disabilities Act of 1990, will require more wheelchair accessibility in cabins at Minnesota resorts in the future. Currently, an average of 7% of all cabins are wheelchair accessible state-wide. Increased accessibility comes as cabins are remodeled or new ones built (39% of all cabins were new or remodeled in the last five years.)

Resorters continue to provide boats, motors, boat launching, and a host of other traditional services for their guests at various rates. It will be interesting to observe future trends, for example, for services like child day care. Currently, 88% of the resorts do not provide day care for their resort guests (ten percent do provide care at average baby-sitting rates of $2.50/hour).

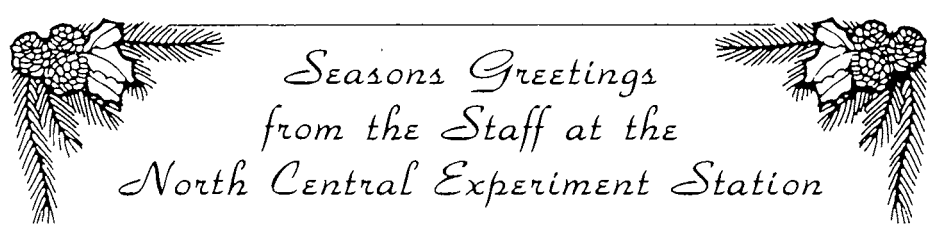
Finally, numerous resort policies were reported. Day visitors are allowed at 96% of all resorts, for example, while resorters were surprised to learn that 65% of the surveyed facilities still allow pets. Further, a significant number (54%) allow pets at no charge. Many owners believe that the number of resorts allowing pets will drop due to higher clean-up costs associated with pet stays, as well as out of courtesy to other guests. To facilitate this change, resorters are frequently referring guests with pets to near-by kennels where their favorite pooch, kitty, or parrot (true story!) will be cared for. Another policy of note, and much to the resort industry's credit, is the fact that 94% of surveyed resorts recycle, typically aluminum cans (92%). Other recyclable items included glass (47%); plastic (36%); cardboard (25%); newsprint (40%); and other metal cans (36%).

The 1992 survey provides resorters with a snap-shot profile of their industry that they can use to compare with their own operations. For observers of this valuable component of Minnesota's tourism industry, the survey shows emerging trends from lodging providers, indicating possible changes in consumer preferences.

TABLE 1. AVERAGE WEEKLY HOUSEKEEPING RATES FOR MEDIUM-SIZE RESORTS (5-13 CABINS) FOR SELECTED COUNTIES/REGIONS (1992$).[1]

COUNTIES[2]	1 Bedroom	2 Bedroom	3 Bedroom	4 Bedroom
Becker/Mahnomen/Clearwater (32)	$247 (22)	$400 (102)	$553 (48)	$621 (5)
Cass (96)	$288 (46)	$353 (271)	$460 (114)	$572 (11)
Crow Wing (60)	$318 (74)	$424 (236)	$558 (80)	$917 (5)
Hubbard (59)	$304 (47)	$419 (198)	$528 (95)	$723 (8)
Itasca (44)	$265 (18)	$356 (167)	$460 (51)	$518 (10)
Otter Tail (59)	$221 (44)	$307 (265)	$457 (59)	$441 (5)
Beltrami (32)	$330 (23)	$368 (126)	$494 (67)	$707 (8)
Douglas/Grant (29)	$272 (40)	$365 (133)	$458 (51)	$636 (7)
Cook/Lake (39)	$411 (50)	$513 (99)	$723 (26)	$638 (10)
East Central (21)	$217 (22)	$317 (38)	$391 (23)	$499 (6)
Northern Border (15)	$323 (8)	$469 (39)	$632 (21)	$1,030 (3)
Central (47)	$277 (44)	$374 (130)	$460 (58)	$619 (5)
South (10)	$239 (24)	$341 (38)	$408 (26)	$506 (8)
STATE (614)	$297 (504)	$386 (2016)	$512 (772)	$646 (95)

[1] Number of cabins comprising average rates in parenthesis.
[2] Number of resorts reporting in parenthesis.
Counties making up regions:
East Central (Aitkin, Isanti, Kanabec, Mille Lacs, Pine)
Northern Border (Koochiching, Lake of the Woods, Roseau)
Central (Kandiyohi, Morrison, Pope, Stearns, Todd, Wright)
South (Blue Earth, Freeborne, Le Sueur, Martin, Rice, Wabasha)



Cattle Performance Equals Hay Quality

Dan Brown, Assistant Animal Scientist

This past summer's deluge of rain did more than irritate you by causing havoc with your forage production schedule; it has robbed you of essential nutrients you expected to be feeding your stock this winter. Leaching of proteins, starches, vitamins and minerals; and reduced digestibility caused by delayed harvesting combine to make supplementation a necessity this year. We often think of supplying extra energy or protein to our mature cow herd. But what about minerals and vitamins?

Nutritional deficiencies in minerals or vitamins cause reduced performance, reproductive problems, and an insufficient immune system. Supplementation is essential for herd performance and health. Start with what the animals need. Table 1 contains the requirements for beef cows; these are minimums, research continues to increase these figures. Table 2 contains the level of micro-elements found in some mature forages Keep in mind that these are averages from many samples; yours will vary. These figures are also from hay put up in normal conditions. Greatly delayed harvesting and heavy rainfall prior to baling can reduce these figures by 20 to 30 percent.

Just by comparing the two tables you can see that deficiencies will develop even when cows are fed forages harvested in good condition. Bromegrass is the only forage listed that will meet the cobalt requirements of the cow; but if reduced by 25% due to poor quality it will no longer supply the required level of .1 ppm. Magnesium is supplied adequately by all the forages in this table except timothy. Reducing the remaining forages' level by 20-30% for poor quality will drop brome or orchardgrass into the deficient category as well. Notice all forages are more than adequate in potassium and this is usually the case for forages produced in the midwest due to the soil level of potassium. If you purchase hay from southern or western states this may be a concern A selenium level is not listed due to the variability in forage level from one area to another. This mineral requires supplementation on a regional basis. A large portion of Minnesota is in a selenium deficient region.

At the same time you are supplementing minerals you need to be wary of mineral levels which are too high causing toxicity or mineral excesses binding with other minerals causing a deficiency in those minerals. Selenium is one mineral that our area typically supplements. Alkaline soil areas have the opposing problem and supplementing while feeding forages purchased from such regions may cause toxicity. Excessive levels of potassium interfere with the absorption of magnesium. There are many more combinations of excesses causing deficiencies so don't overdo mineral supplementation.

This comparison will give you an idea on what type of mineral supplementation you may need. Of course it would be best to test your own forages to see what you actually have and purchase mineral supplementation that balances your herd's ration. Trace mineral salt will not meet the mineral requirements of the mature cow herd especially for calcium, phosphorous, magnesium and those on poorer quality forages. The vitamin most likely deficient in beef rations is Vitamin A. Due to oxidation at harvesting and during storage of forages and the poor efficiency of beef to convert the plant precursor, carotene, to Vitamin A, supplementation is usually required. Keep in mind that supplementing vitamins by addition to your trace mineral salt will cause oxidation of those vitamins when in certain forms.

This article is not a lesson in how to balance your ration for micro-elements and it does not touch all aspects of mineral and vitamin feeding. It is a reminder to check your mineral and vitamin program. If you have never had a mineral and vitamin program, this is the year you will really need to implement one. Poorly conditioned cows, weak and partially blind calves at birth, respiratory problems and many more conditions may be what you face without proper mineral and vitamin supplementation this year. The cost is minimal compared to treatments, labor and losses that will be experienced later.

Table 1. Mineral & Vitamin Requirements for Beef Cattle

Nutrient	% of ration dry matter	Parts per basis million
Calcium		
Pg cow	.18-.23	
Lact. cow	.28-.44	
Phosphorus		
Pg cow	.18	
Lact. cow	.28-.40	
Salt	.10	
Magnesium	.18	
Potassium	.6-.8	
Sulfur	.1	
Cobalt		0.1
Copper		10.0
Iodine		0.2
Iron		50.0
Manganese		20.0
Zinc		30.0
Selenium		0.1

Vitamin	IU/kg Dry cow	Lact. cow
A	2800	3900
D	275	275
E		15-6

Table 2. Mineral Content of Forages

Forage	Dry Matter Basis Ca %	P %	Na %	Mg %	K %	S %	Co ppm	Cu ppm	Fe %	Mn ppm	Zn ppm
Mature Alfalfa	1.17	.17	.15	.32	1.98	.20	.090	13.4	.020	33.1	17.2
Brome	.36	.25	.12	.19	1.58	.31	.100	10.8	.014	54.2	
Orchard	.35	.31		.20	3.01	.26	.021	13.7	.010	249.4	18.1
Timothy	.45	.23	.18	.13	1.63	.13		5.0	.016	81.0	

Alumni News

Tom Carpenter

It is time again to plan an All Class/Staff/Employee Reunion. We only have ten months to put something together. I checked with the Sawmill Inn and booked Saturday, July 16, 1994. So mark that date on your vacation calendar. Please let me know what you would like to see or do at the reunion. We can't please everyone, but will do our best.

The scholarship that we are planning will be given in the year of North Central's 100th anniversary (1996). This will give me time to work on matching funds from other sources and get the scholarship leaning toward an education in agriculture or forestry.

I would like to thank Tom Carey and his work crew for doing such a good job of mounting the flag pole and monument. The

continued on next page

Alumni News *continued*

memorial reads "U of M, North Central School of Agriculture Flagpole, 1925 to 1965, Reinstated by the Alumni Association in 1992." Thanks again.

A note from Bob Sather informs us that Myra E. Smart who worked in the horticulture area (1942-46) passed away on September 18, 1993 in Moscow, Idaho. She is survived by a sister Caroline, Watertown, SD.

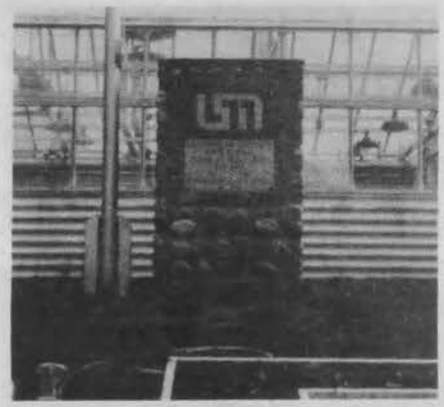
A second note from Paul Warble informs us that Charles Gustafsson, Class of 1941, died on Monday, August 16,1993 in Arizona. He is survived by his wife Velma, a daughter, five grandchildren and two sisters. The Gustafssons lived in Buckeye, Arizona since 1944.

A REMINDER to Vern Strom, Tom Hopkins, Bud Lackner, Lonny Ross, and Jim Dethloff. I would like to meet with the alumni officers on January 6 at the Station greenhouse at 6:00 p.m.

Class History Quotes from the Evergreen:

1956 - Additions to the class — Alvin Diedrich, James Hamm, Darrell Herring, Rodney Newton and Emmet Weidenborner. Mr. Scott and Mrs. Matalamaki were added to the staff. The social event of the year was the Junior-Senior Banquet and Prom.

1958 - Mr. Cromell, Mrs. Johnson and Mrs. Nielsen were added to the faculty. Keith Aho, Gary Beach and Vance Clement enrolled as students. The big event was ordering class rings.



"Memorial flagpole"

News from North Central

David L. Rabas

The arrival of the first snow has brought to a close another cropping season at North Central. Like many northern Minnesota farmers, our farm crew struggled with trying to dry our hay and later in the fall with immature corn. It was a good year for those small grain crops which managed to stay above water. Unfortunately for much of Minnesota, scab on wheat and barley caused serious yield and quality problems.

The past season brought some significant events and milestones in the lives of some of our North Central family. Dan Carey, maintenance equipment operator (shown on the left of the farm crew photo), completed forty years of work at North Central. Dan spent some time as a student worker at the station and then returned to the station as a full time employee following service with the army in Korea. Dan is a valued North Central employee and the source of numerous stories about activities at the North Central Experiment Station beginning in the late forties and early fifties.

Russ Mathison who came to the station in 1980 as a junior scientist in agronomy has been promoted from the civil service position of scientist to a faculty position of research fellow. Russ has assumed responsibility for most of the leadership in the agronomy research program following my change of responsibilities from agronomist to station administrator. Russ has proven himself to be a very capable scientist and research project leader.

Paul Warble, North Central School of Agriculture Class of 1940, has joined our NCES Research Fund Committee. Paul currently lives in Bemidji and has many fond memories of his days as a student at North Central. On behalf of the committee I want to thank Paul for volunteering to share some of his time helping our station seek gifts and other private funding to support our research programs.

November marked the completion of a new laboratory and machine storage facility at the South Farm. The University purchased the 202 acre farm located four miles south of Grand Rapids on the Harristown road in 1985 from Leo and Eileen Hauser. The farm is being developed as a beef/forage research center. The laboratory building is expected to provide space for animal science and agronomy researchers as well as other research projects which may move to the South Farm area in future years. A beef shelter and handling facilities will be built on the farm in 1994.

As we move forward with our plans for growth and service, I would like to take this opportunity on behalf of all the staff at the North Central Experiment Station to thank all of you for your support and to wish all our friends a happy and safe holiday season and a successful and rewarding new year.

"Farm crew, left to right, Dan Carey, John Teske and John Sucher"

"Laboratory and machine storage building at South Farm"

"Russ Mathison, Research Fellow"

The North Central Quarterly

Issued by
THE UNIVERSITY OF MINNESOTA
North Central Experiment Station
1861 Hwy. 169 East
Grand Rapids, Minnesota 55744-3396
218-327-4490

DR. DAVID L. RABAS
Head

Published February, April, July, November
ISSN 0199-6347
by the North Central
Experiment Station,
Grand Rapids, Minnesota

The University of Minnesota is an equal opportunity educator and employer.

Second-class postage paid at Grand Rapids, Minnesota