Proceedings of the 15th Annual

Florida Dairy Production Conference

"Effective Management"
University of Florida, Gainesville
May 2-3, 1978

Sponsored by
Department of Dairy Sciences
Cooperative Extension Service
Agricultural Experiment Station
of the
Institute of Food and Agricultural Sciences
with Cooperation of State Dairy Organizations
Paul Glasscock (right) was presented the 1978 Florida Purebred Dairy Cattle Association (PDCA) Extension Service Award by Fred Ward, President of the Florida PDCA at the 15th Annual Florida Dairy Production Conference, May 2.

The Cecil Reagan family, owner of Milky Way Farm in Bradenton, are shown receiving the Distinguished Dairy Family Award from J. B. Strickland (second from right) representing Florida Farm Bureau Federation and with congratulations from Commissioner of Agriculture, Doyle Connor. Other family members (left to right) Kenny Griffin (step son), Terry Reagan, Carl Lowe (son-in-law), Dean Reagan, Mrs. Lowe, Sue Roagan and Cecil Reagan.

Cover photo: Winners in the Dairy Herd Management Divisions are: (left to right) Bill Bassett, Bassett's Dairy Farm, Monticello (large division); Mike Carey, Russell's Dairy Inc., Bradenton (medium division); and Charles Thomas, Thomas Dairy (small division), Mayo. Presenting the awards is Al Hammond, Farm Credit Service, Gainesville, and representing Federal Land Bank and Production Credit Associations of Florida.

This publication was promulgated at an annual cost of $763.75, or 51 cents per copy, to provide participants of the conference with a copy of each presentation.
Those attending the Dairy Production Conference will long remember the excellent singing provided by the Marshall sisters.

The Guest Speaker, Dr. Bronson Lane, Vice President of Operations, Dairy Farmers, Inc., addressed the 215 dairymen, wives, and supporting industries attending the 15th Annual Florida Dairy Production Conference in Gainesville.
TO: FLORIDA DAIRYMEN AND THOSE IN RELATED ENTERPRISES

SUBJECT: FIFTEENTH ANNUAL FLORIDA DAIRY PRODUCTION CONFERENCE
MAY 2-3, 1978

Dear Dairy Cooperators:

The 15th Annual Florida Dairy Production Conference brought together authoritative speakers on topics of current major interest to the progressive minded dairymen and agri-business friends in attendance. Use of a variety of speakers on several topics of interest to dairymen was the approach used in presenting the information to those in attendance. The Dairy Advisory Committee, consisting of the DFI Board of Directors, is given specific thanks for their help in planning the 1978 program.

Appreciation is expressed to all who participated in making it a successful Conference. We think the Proceedings with resumes on the different topics serve as a reminder and source of information for reference.

Special appreciation is expressed to Dairy Farmers, Inc. (DFI), South Florida Independent Dairy Farmers Association (IDFA), the Tampa IDFA, the Upper Florida Milk Producers Association, and the U.S. Sugar Corporation for helping to finance the Dairy Production Conference.

Special thanks is given to the Dairy Division of the State Department of Agriculture and Consumer Services, the Federal Land Bank & Production Credit Associations of Florida, the Florida Farm Bureau Federation, FDCA, and State DHIA Board for their support and participation in the awards program on Tuesday evening, May 2.

There were ten displays presented at the 1978 Conference. We would like to express appreciation to the following representatives of those displays: Mr. Walter Oelfke, NOBA; Rodney Moore, Curtiss Breeding Service; George Manter, American Breeders Service; Danny Yant, Select Sires; Tom McAmis, Miller Machinery; Don Riesenbarg, Masonite Corp.; Jon Donven, Kemin Industries, Inc.; Del Burnett, Nutri-Rations, and Bill Isaacs, Surge.

A list of those attending the conference is included.

H.H. Van Horn
Chairman, Dairy Science
Department

Barney Harris, Jr.
Conference Chairman
Extension Dairyman

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OUTLOOK AND IMPACT FOR DAINING IN FLORIDA

Dr. Ralph A. Eastwood
Professor Extension Marketing Economist
IFAS, University of Florida

INTRODUCTION

You appear headed for your year of highest milk production, and perhaps your highest milk prices. Your short-term net profits appear likely to be close to last year, and your whole-life earnings to be up.

In the national rankings by states, you rate first in milk prices per hundredweight among the contiguous states, and third in the nation. You are eleventh in cash receipts from farm milk marketings, although among the very lowest in producer numbers. Nobody comes close to you in average milk production per producer.

REVIEW

In 1977 total milk output rose more than 2 percent to 123 billion pounds, the most produced in the U.S. since 1965. This compares with about 200 billion pounds in the Soviet Union. With farm milk prices held up by the higher support price, milk-feed price relationships were favorable through most of 1977 and resulted in large gains in output per cow. Declines in milk cow numbers stayed relatively small, partially because of the large number of replacement heifers. Meanwhile, commercial use of milk and dairy products held at the 1976 level. This combination of a large increase in milk production, stagnant commercial use, and large industry stocks at the start of 1977 resulted in USDA purchases under the price support program jumping to the equivalent of 6.1 billion pounds of milk, the largest since 1971 and considerably more than the combined total of the 3 previous years.

The April 1 adjustment required by the Food and Agriculture Act of 1977 raised the support price about 43 cents. This will keep 1978 farm milk prices above a year earlier. However, there is little chance of manufacturing grade milk prices moving significantly above the support price until at least late summer.

Following a sharp rise in 1976, cash receipts from dairying were up only 3 percent last year to almost $11.8 billion. Larger marketings caused most of the 1977 rise.

In Florida, although outnumbered on the order of 40 to one by the beef cattle producers, you are nip and tuck with them for the lead in cash receipts by farmers from marketings of livestock and livestock products. You left them far behind in 1976, but they may have been gaining on you.

National gains in milk production slowed substantially during the past fall and winter. Feed prices, bad weather and lower cow numbers took their tolls. Even so, production for April was above a year ago.

Per capita consumption in 1977 totaled 552 pounds, milk equivalent, up slightly from 1976, and a drop of 23 percent in 23 years. Larger government donations outweighed a small decline in per person commercial use.
Possible comfort may be taken from the fact that the 552 pounds last year equalled 1973; therefore, signalling full recovery in per capita consumption probably will be about the same, as USDA donations will remain substantial and sales are expected to increase at about the same rate as the population.

ECONOMIC OUTLOOK

Human Nutrition Policy - Human nutrition policy probably is the most fundamental business problem of the dairy industry. Each person, family and government unit has its policy in this respect. They are implicit or explicit, enunciated or active, shadowy or substantial, aspirational or implemented. Each has far more facets than a policy for, say, broiler nutrition. Supply, availability, effective substitutes, prices, mores, clinical dietetics, personal preferences, purchasing power differences, scientific knowledge, and techniques of persuasion are at least most of the interactors. The emphasis changes. Some efforts and effects are sequential, and concurrent.

Anachronisms highly charged with contending emotions abound. Population management is one. Resources used, or governmentally encouraged to be used, to produce allegedly neutral or deleterious goods and services is another. The most emotionally charged seems to be observable coexistence of mountainous commercial surpluses of grain and livestock products while people are malnourished or starving.

In the long run, these controversies between neo-malthusians and the livestock industries are likely to be settled in the court and market arenas of the world, with help from time to time by the military forces. Hopefully, the essential decisions will be made by people well informed in nutrition sciences as well as by those with leadership and technical knowledge in the law, economics and military arts and sciences.

General Economic Outlook - The precipitate devaluation of the dollar, by nearly 20 percent in recent months, is the most important part of the economic news so far as its effect on our outlook is concerned.

Concerning the total economy, Citiban, in its March, 1978, "Monthly Economic Letter," has this to say: 1 "Many would attribute the (recent) slide (of the U.S. economy) to the frailties of advancing old age, citing the fact that the recovery celebrates its third birthday this month. Judging by the length of other post-World War II business cycles, this makes the ongoing expansion a senior citizen. But this is stretching anthropomorphic license. It is true that a recovery goes through a maturation process that causes shifts in the relationships between sectors. For instance, consumer spending on durable goods in usually robust early in the expansion while business spending on plant and equipment posts hefty gains later on. But there is not a set lifeline.

It must be remembered that economies is a social, not a natural science. In other words, while for the most part people can only talk about the weather, they can do something about the economy, particularly through the actions of monetary and fiscal policy. And the intentions currently are to keep the recovery alive. The monetary base, the money aggregate

over which the fed has most direct control, rose at a stunning near-15% annual rate in January—the strongest monthly showing in annual rate in more than two and a half years. And the administration's ambitious plans for the future were made known in the Council of Economic Advisers' Report...

"With this amount of fuel propelling the recovery, the slowdown is not likely to continue. So the spring and summer months, which will bring higher temperatures, should also witness pickup in economic growth."

Unemployment - "This remains a festering problem. For the nation as a whole, the rate of unemployment is about 7 percent, down a little from the 8.5 percent rate of 1975, but still double the rates of the 1950's. But these overall figures do not reveal what the crux of the unemployment problem is. This is the uneven distribution of unemployment, the skewed manner in which the problem is borne by the working populations.

If we take the core of the work force—white male workers between the ages of 25 and 55—unemployment seems a very small problem. Only about 3.7 percent of this group is without work, and a large part of that group, perhaps half, is workless because it has voluntarily left one job to search for another. In fact, the rate of unemployment among the prime group is slowly dropping, for employers seek out, and try to hold on to, this most skilled and reliable portion of the labor force. (White males in the 25 to 55 age group provide about 40 percent of all labor hours in the economy.)

But the situation changes dramatically when we look at the remainder of the work force. Unemployment among women is about double the rate among white male workers, largely because women are the main suppliers of part-time labor and are often the first to be dismissed when business is slow. Among all adult blacks unemployment is 11 percent. Among teenagers as a group, unemployment is higher yet, averaging about 17 percent, meaning that 40 percent of black youngsters who are looking for work cannot find it. In some central city ghettos this rate reaches 85 percent.

These terrific differentials lie at the heart of our problem in coping with unemployment. Any strategy that relies on pumping up aggregate demand leads first to an expansion of job opportunities for the central white male labor force. Quickly this force exhausts its unemployed slack. Wages then begin to rise in this strongly unionized group, and the "spread effect" of their high wages brings wage increases to other sections of the work force. Inflationary pressure thus exerts itself before we have made any real inroads into the unemployment pools for the less favored sections of the work force."

Court Actions - Two Federal Court actions are of particular importance to Florida dairy farmers.

1) U.S. vs. National Broiler Marketing Association, Inc. - Everyone is awaiting the decision of the United States Supreme Court on this case. The issue is whether a corporate contractor owning broilers grown for it by independent contractees who supply labor and real estate and are paid

by contractor for the growing can be considered a farmer for purposes of shelter from anti-trust laws under the Capper-Volstead Act.

The District Court for the Northern District of Georgia dismissed and Government appealed to the United States Court of appeals, Fifth Circuit. The Court of Appeals reversed on April 22, 1977. The NBMA appealed to the U.S. Supreme Court, it accepted the case, and heard the testimony. U.S. agriculture, related industries and lawyers are awaiting the Supreme Court decision which they expect momentarily.

One paragraph of the opinion of the Court of Appeals is of great interest:

"We cannot conceive that the ordinary, popular sense of the word 'farmers' would fit broiler integrator companies. The husbandry of the broiler flocks is carried out neither by these firms nor by their employees, but by the contract growers. The farms where the husbandry is done are owned not by NBMA members or their employees, but by these growers. Whatever else farming may mean, an irreducible minimum must be either husbandry of animals or crops or farm ownership. Given the absence of both of these elements here, none of the factors suggested by NBMA as indicative of farming nor all of the factors together would seem a sufficient shoe horn to squeeze these companies into farmers' boots. Asked to examine the broiler business and to identify the 'farmers', Justice Frankfurter's common rule of men, we think, would point to the contract growers--the persons who own and operate the farms--as the 'farmers'."

2) U.S. vs. Dairymen, Inc. - This case was, and could still be if appealed, a real landmark in the law of farmer marketing cooperatives. The principal charge was that Dairymen, Inc. attempted to monopolize trade and commerce in the production and sale of raw Grade A milk in the South-eastern United States, in violation of Section 2 of the Sherman Act by means of anticompetitive and predatory practices and unlawful agreements. The U.S. District Court sustained DI on all but one count. We will be glad to send anyone a photocopy of the decision."

Dairy Farming

SRAES - The Southern Region Agricultural Experiment Stations jointly published "The Emerging Structure of the Southern Dairy Industry" in February. Its summary says:

"Changes in the Southern dairy industry can be largely summarized in three words; fewer but larger. From 1950 to 1970, there has been a 90 percent reduction in the number of farms reporting dairy cows. Milk cow numbers in the 12 Southern States decreased from 5.2 million to 2 million in 1975. Total milk production has remained relatively stable in face of


of the decreases in the number of dairy farms and dairy cows due to herd improvement through improved management, culling, and breeding. Milk production increased from about 3,600 pounds per cow to approximately 9,000 pounds during the 1950-75 period. Another significant change has been the percentage of total milk produced that moves through commercial channels. Milk marketing increased from 50 percent of production in 1950 to over 94 percent in 1975. Most of the milk marketed (92%) was eligible for fluid use. The remaining commercial dairy farms across the south are relatively large Grade A units with improving efficiency in production per cow.

A significant change in milk marketing in the southern region in the past decade has been the movement toward federally regulated markets. In 1962, approximately 40 percent of all milk sold to plants and dealers by dairy farmers was subject to federal order regulations, but by 1975 this had increased to 67 percent. Volume of milk regulated by state milk control agencies declined.

Dairy cooperatives are playing a significant role in milk marketing in the region. Initially, dairy cooperative development progressed more slowly in the south than in the northeast and midwest, however, the growth patterns have been somewhat similar.

The early cooperatives were formed to produce butter and cheese. Fluid milk processing cooperatives developed during the 1940's with a peak in numbers reached in the early 1960's. Local bargaining associations were formed and became rather prominent in the 1940's and 1950's. In the 1960's many of the local bargaining associations in the south joined together to form federated bargaining associations. These organizations became successful in bargaining for prices in excess of federal order minimum prices.

The federates approach became rather burdensome resulting in the federated groups exploring other cooperative structures. Many of the local bargaining associations and fluid milk processing cooperatives merged to form regional milk marketing cooperatives. Two of the primary cooperatives in the south are Associated Milk Producers, Inc. (AMPI) and Dairymen, Inc. (DI). As a result of mergers and consolidations, the number of dairy cooperatives marketed 55 percent of the total volume of milk sold to plants and dealers, but by 1973 the percentage increased to about 77 percent.

Although most of the milk marketed in the region is eligible for fluid use, the manufactured milk industry utilizes approximately one-third of the volume marketed. Trends in the manufactured milk industry in the south have paralleled those in other regions. Plants have decreased in numbers and increased in average output per plant. Except in isolated cases, the manufacturing milk industry in the south is dependent on surplus Grade A milk. Little manufacturing grade milk is produced in the region.

Changing consumer tastes and purchase patterns coupled with technological advances affecting processing, refrigeration, and distribution were major factors influencing changes in the fluid milk market. In most markets, home delivery is a small percentage of milk sales and producer-
distribution have all but disappeared. Between 1954 and 1972 the number of fluid milk plants decreased by 54 percent with the exit of small plants accounting for most of the decline. It is significant from a structural point of view that 28 percent of the fluid processing plants operated by national and regional firms processed about one-half of the total volume of fluid milk in the south.

Along with the changes in plant numbers, distribution areas have widened. Perhaps, in the southern region, relaxed institutional barriers to milk movements gave greater impetus to the trend toward wider distribution areas than did nonreusable containers, improved refrigeration, and transportation facilities.

One of the more noticeable trends in fluid milk marketing during the past decade has been the increase in vertical integration by both ownership and processing facilities by retail chains and contractual arrangements with existing processors to supply private label milk. With these market changes the smaller dairy firms are finding survival more difficult, particularly the single unit operation."

U.S. Omnibus - All American farmers will be vitally affected by the new four-year farm bill, especially those producing wheat, feed grain and cotton. It will bolster price supports on major farm commodities, continued authorization of a food stamp program, and sharply stepped-up research in agriculture and nutrition.

U.S. Dairy Demand - Robinson and Babb of Purdue University have estimated that total U.S. consumption of selected dairy foods will change to the following pattern during 1977-1981:

<table>
<thead>
<tr>
<th>Item</th>
<th>Percentage Change</th>
<th>Item</th>
<th>Percentage Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid whole milk</td>
<td>-14.7</td>
<td>Total frozen dessert products</td>
<td>-4.0</td>
</tr>
<tr>
<td>Fluid low fat milk</td>
<td>+50.4</td>
<td>Cottage cheese</td>
<td>+15.8</td>
</tr>
<tr>
<td>Total fluid milk</td>
<td>+7.0</td>
<td>American Cheddar cheese</td>
<td>+29.6</td>
</tr>
<tr>
<td>Fresh cream</td>
<td>-12.3</td>
<td>Total natural cheese</td>
<td>+39.9</td>
</tr>
<tr>
<td>Ice cream</td>
<td>-0.9</td>
<td>Nonfat dry milk powder</td>
<td>+21.1</td>
</tr>
<tr>
<td>Ice milk</td>
<td>-8.7</td>
<td>Butter</td>
<td>-5.5</td>
</tr>
</tbody>
</table>

These forecasts are quoted with approval as to their general thrust, with one important caveat. They appear to assume that the dairy product mix available to consumers will remain essentially as it is during the period. That probably will prove true. Nevertheless, the possibility of substantial increases in filled products seems good. The legal barriers to intra and inter-state commerce in a wide selection of filled dairy foods seem to be weakening as consumers' sensitivity and articulation increase about the situation. Once these products are legally permitted, they will succeed or fail on their market merits. Evidently, they are perceived to have great potential in such circumstances, otherwise there would be little reason for the industrial opposition to them.

U.S. Feed — The national feed grain program, if effective, will tend to stabilize dairy feed prices at levels somewhat above the purely competitive market levels which would have prevailed for at least a crop or two without it. The reserve stocks will prevent runaway feed prices through at least the early months of any world feed disaster which may occur in the next four years. It also will prevent feed prices from falling to disastrously low levels for grain growers.

Milk/Feed Ratio — Milk-feed price relationships this year probably will be conductive to high or increased feeding of grain and other concentrates and to substantial increase in output per cow. Higher prices for beef cows probably will encourage culling. That will be partially offset by the large number of replacement heifers available to farmers.

Effects of weather and inflation are so imponderable that a best guess may be a modest to 2 percent increase in national milk production for the year compared to 1977.

The probable combination of higher milk prices and feed prices may signal dairy farmers to pull out all production stops. If so the resulting production could take U.S. milk production to 123-125 billion pounds in 1978. That would prove very difficult for the public and private sectors to manage without embarrassment of plenty.

U.S. Labor — The rising cost of hired labor and the desire to ease somewhat the inflexible nature of dairying has led U.S. dairy farmers to capital-intensive technology and heavy concentrate feeding as substitutes for labor. USDA estimates that in 1976 it took only about half as much labor to produce slightly more milk than in 1967.

Other Costs — There is no reason to expect most other dairy production costs to decline. They may be expected to rise. Interest rates may be an exception. They undoubtedly will rise, but they are capable of being reduced. The erratic supply of liabilities from the U.S. treasury and demand for them by the Federal Reserve Board causes too much of their fluctuation. The remainder comes from non-federal government and all private sector business.

U.S. Dairy — The U.S. support price for manufacturing milk testing 3.67 percent butterfat was increased effective April 1, 1978 from $9.00 to $9.43 per hundredweight. The equivalent support price for 3.5 percent milk was $9.21. Accordingly, it is reasonable to expect that prices to Florida dairy farmers will work higher by as much as 43 cents per hundredweight if the Florida dairy cooperatives are effective in their marketing strategies. In any case, the new price structure virtually assures the highest cash prices, and some of the higher purchasing power prices, on record in most of all fluid milk markets of the United States during this half year.

Florida

Cow Numbers — Cow number in Florida have been remarkably constant in recent years. That can be expected to continue unless enough milk is needed in the low production months to justify adding cows.
Milk Marketings - Florida producers marketed less milk and had a lower percentage share of the U.S. market in 1977 than in 1976. In absolute terms, their 1977 production was 1,963 million pounds, second only to 2,023 million in 1976. That was a reduction of 3 percent in state production. Florida's U.S. market share dropped from 1.68 percent in 1976 to 1.60 percent in 1977.

Inter-State Shipments - Florida marketers compensated for their reduced aggregate Florida herd production by purchasing a net of 60 million pounds of milk from sellers in other states.

The 60 million pounds of net inshipments of fluid milk were almost exactly equal to the reduction in Florida herd production between 1976 and 1977. They represented 3 percent of the milk apparently used in Florida in 1977.

During the first quarter of 1978, fluid inshipments in tankers were about 25 million pounds, compared with about 15 million in 1977. Similar figures for inshipments of packaged milk are about 3.5 million pounds in 1978 compared with 299,000 in 1977. Outshipments in tankers were only about 44,000 pounds in the first quarter of 1978, and 800,000 the same period in 1977. Packaged outshipments the first quarter of 1978 were 4.3 million pounds, and 5.1 million in 1977. Net shipments in the first quarter of 1978 were 24.3 million pounds, compared with 8.9 million in 1977.

SUMMARY

Probable price and cost relationships suggest profits this year comparable to last.

Whole life earnings of dairy farmers continue to rise.
Molds growing on feed, particularly grains, may produce toxins hazardous to cattle, and because of residue problems be harmful to young calves or the milk or tissues may be harmful to humans. Acute toxicity may produce hyperexcitability, decreased feed consumption, stunting, liver damage, diarrhea with straining, hemorrhage and increases susceptibility to bacterial, viral or parasitic diseases. Chronic toxicity results in decreased growth rates, liver damage, hemorrhage and even abortions. Such animals, when put on new, well-balanced rations free from aflatoxin, rubratoxin or ochratoxin, will slowly recover. Generally, cattle are more tolerant to aflatoxin B1 than are other Florida farm animals. The FDA guideline for milk is up to 0.5 ppm.

### Molds and Their Toxins Hazardous to Cattle

<table>
<thead>
<tr>
<th>TOXIN</th>
<th>MOULDS INVOLVED</th>
<th>SYMPTOMS*</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 B2 G1 G2</td>
<td>A. flavus, A. parasiticus</td>
<td>Reduced feed intake, liver damage, jaundice, hemorrhage, diarrhea, prostration, hair color change, death</td>
</tr>
<tr>
<td>Ochratoxin</td>
<td>A. ochraceus, P. commune</td>
<td>Liver, kidney damage, depressed appetite, diarrhea, prostration, death</td>
</tr>
<tr>
<td>Rubratoxin</td>
<td>P. rubrum</td>
<td>Similar to aflatoxin</td>
</tr>
<tr>
<td>Ergotoxin</td>
<td>C. purpurea</td>
<td>Hyperexcitability, blood clots, dry gangrene, loss of tail, ears, hooves</td>
</tr>
<tr>
<td>Oxalic acid</td>
<td>A. niger, P. oxalicum</td>
<td>Gastric irritation, hemorrhage, CNS damage, coma, death</td>
</tr>
<tr>
<td>Penitrem A</td>
<td>Penicillium sp.</td>
<td>Ryegrass, Bermuda grass, Maize and Paspalum; staggerers, muscle tremors, convulsions, mortality</td>
</tr>
<tr>
<td>Kojic Acid</td>
<td>A. flavus, A. oryzae</td>
<td>Convulsions, edema, prostration</td>
</tr>
</tbody>
</table>

*Some symptoms observed in field cases are caused by more than one toxin being present.

Factors Influencing Mycotoxin Production (1-6) and Toxicity (7-10).

1. Moisture content
2. Temperature
3. Trace elements, Zinc and Copper
4. Pre-storage and storage problems
5. Drought stress
6. Insect damage
7. Species
8. Age
9. Vitamins
10. Protein Levels
Ergotism or Tremorgens

Claviceps purpurea - ergot on rye, oats, wheat, barley or grasses. C. paspali on Dallis or Argentine bahia grass-brown scleroteca. Warm, moist, humid growing seasons predispose to "ergotism"

Ergotoxins - stimulate smooth muscle; contains lysergic acid causing CNS stimulation. Produces the acute, hyperexcitable form or chronic, gangrenous effects. If animals eat ergot-infected grain and develop nervous excitability, the grain is toxic; the chronic effect is to cause serious circulatory disturbances with obliterate endarteritis and gangrene. There may be sloughing of feet, hooves, tails, ears and tongue. Grain must not contain more than 0.3% for feed usage.

Clinical signs - include hyperexcitability, belligerency, weaving, incoordination, falling with death or recovery in 10-14 days if put on clean feed or pasture.

Treatment - Acepromazine, chlorpromazine or Diazepam.

Pescue foot - a related disease of cattle where one or both hind feet become gangrenous, the tip of the tail or ears may also slough and there may be gangrenous patches of skin above the affected hooves.

Fusarium, sp. - may produce T-2 toxin, diacetoscirpenol, DAS. Swine may refuse to eat the moldy feed, but poultry may consume it. It has produced impaired growth rates, intestinal hemorrhage and death. In humans, the problem is called Alimentary Toxic Aleukia, ATA. F-2 Toxin, or Zearalenone is associated with corn at high moisture levels, i.e., more than 18%. Toxic levels may reach 200 ppm. It produces poor reproductive performance in sows, interfering with normal estrous cycles resulting in a marked decrease in the number and size of pigs farrowed per litter.

Penicillium, sp. - has produced Penitrem A on ryegrass, bermudagrass, and maize resulting in muscle tremors, staggerers, convulsions and death.
THE ECONOMIC IMPACT OF ADULT VACCINATION
UPON FLORIDA DAIRY HERDS

by Paul Nicoletti DVM MS
Epidemiologist, U.S.D.A.
Gainesville, Florida

The dairy and beef cattle industries in Florida have special problems
with brucellosis. The herd infection rate is the highest in the nation
(approx. 40/1000). Over 25% of the dairies are infected and these contain
about 50% of the cows (100,000). On the average, less than 20% of the cows
are vaccinated as calves which has resulted in highly susceptible popula-
tions. Large numbers of replacement cattle are imported which are mostly
unvaccinated and sometimes incubating the disease. The variable incubation
period of brucellosis and cows which may calve prematurely or normally and
react positively to blood tests later cause infections which are very dif-
ficult to prevent. Regulations, which will become effective in mid-1979,
to require imported cattle to be calf vaccinates may do little to prevent
introductions of new infections. Bradulent tattoos may become common. It
is my opinion that herd vaccination and vaccination of replacements upon
arrival are the only practical methods to prevent serious outbreaks.

History of the Adult Vaccination Program

In 1973, many concerned dairymen and animal health officials peti-
tioned for herd vaccinations to reduce the growing difficulties of the
test and slaughter methods. This petition was denied by the Brucellosis
Committee of the U.S. Animal Health Association (USAHA). In late 1974,
this group requested USDA to conduct special studies in Florida. These
began in May 1975. Five experimental herds were eventually included in
the studies. Different doses and methods of administration of Strain 19
were evaluated by extensive serologic (blood test) and bacteriologic
studies. In late 1976 the results were presented to the USAHA and adult
cattle vaccination (AV) was adopted as part of the national program, with
certain restrictions.

The AV program began approximately 1 year ago in Florida and certain
appraisals can now be made:

Profile of 17 Dairy Herds

<table>
<thead>
<tr>
<th>Prevaccination</th>
<th>Postvaccination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(4-5 months)</td>
</tr>
<tr>
<td>Number of Cows</td>
<td>13,429</td>
</tr>
<tr>
<td>Ave. Cows per Herd</td>
<td>790</td>
</tr>
<tr>
<td>Card test reactors</td>
<td></td>
</tr>
<tr>
<td>Previous Year Total</td>
<td>2,447</td>
</tr>
<tr>
<td>Average per Month</td>
<td>204</td>
</tr>
<tr>
<td>At Vaccination</td>
<td>593 (4.4%)</td>
</tr>
<tr>
<td>Card Test Pos.</td>
<td>1,778 (12.8%)</td>
</tr>
<tr>
<td>Probably Infected</td>
<td>671 (4.8%)</td>
</tr>
<tr>
<td>False Positive</td>
<td>1,107 (8.0%)</td>
</tr>
<tr>
<td>Rivanol Test Pos.</td>
<td>968 (7.0%)</td>
</tr>
<tr>
<td>Probably Infected</td>
<td>671 (4.8%)</td>
</tr>
<tr>
<td>False Positive</td>
<td>297 (2.2%)</td>
</tr>
<tr>
<td>Complement-Fixation</td>
<td></td>
</tr>
<tr>
<td>Test Positive</td>
<td>671 (4.8%)</td>
</tr>
</tbody>
</table>
In these 17 herds, the rivanol test positives were reduced from 968 to 349 (2.5%) on the second herd retest. The number of probable infected cows (complement-fixation test positive) reduced from 671 to 217 (1.6%) or more than 63% from the initial test. Extensive bacteriologic studies have shown that the CF test is superior to others in a correct diagnosis.

In Florida there are 89 dairy and 45 beef herds which have been adult vaccinated. Data can be presented on 51 dairy herds which have had 1 or more retests during the past calendar year. The 51 herds contain 34,625 cows (679 ave/herd) and had 1529 reactors (4.4%) on the tests at time of vaccination. On the first postvaccinal test there were 1399 CF test positive cattle. These mostly represent cows which were incubating the disease when inoculated. Not all 51 herds have been retested the second time but the percentage of CF test positive cows has been reduced as in the 17 herds previously mentioned.

Economic Studies

In the early part of the experimental studies we began an economics study in 4 herds in cooperation with the Department of Agricultural Economics. A graduate student, Walter Prevatt, compiled data under the guidance of Prof. Ed Finlayson. The results were published in Hoards Dairyman in the February 25, 1978 issue. The evaluations included the effects of vaccinal methods (milk production and feed consumption), reduction of disease (comparisons of reactors sold prior to and after vaccination - including salvage and replacement values considering depreciation based upon 3 lactations), cost of labor to owners and governments, effects of abortions, equipment depreciation, indemnities, losses of milk production due to testing and costs of laboratory personnel.

In the 4 herds, the prevaccination costs averaged $40,000/year/ herd. During the first year after vaccination, these were reduced to $16,000 or a 50% reduction. During the second year, these costs were further reduced to an estimated $8000 or 80% reduction of prevaccination costs. Complete studies were not performed in the 5th experimental herd due to the methods of vaccination and other herd studies. It seems quite sure that without vaccination, none of these herds could have survived test and slaughter methods.

Calculations of some Economic Effects of Adult Vaccination
1. In 51 dairy herds:
   Estimated reactors 1 year prior to vaccination 6240
   Reactors removed during past year 1745
   Estimated reduction in number of cattle sold 4495 (72%)

   Values of $100 indemnities and $300 difference in replacement and salvage values:
   4495 x $400 x 1 year $1,798,000

2. In 4 experimental herds:
   Prevaccination costs of $40,000/year x 4 herds x 2 years $320,000
   Reduction first year = $24,000 x 4 herds 96,000
   Reduction second year = $32,000 x 4 herds 128,000
   Estimated Savings $224,000

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3. In 1 Large Experimental Herd:
   Prevaccination reactor percentage (75%) = 1800 x $400  
   2 years = $1,440,000
   Reductions - First year, est. 5% = 360 x $400 = 144,000
   - Second year, est. 2% = 144 x $500 = 72,000
   Savings estimated for 2 years = $201,600
   Total estimated savings = $1,238,400

These figures do not include savings in labor costs (fewer tests) to owners and governments in the 51 herds or in 1 large experimental herd. They also do not include inestimable cost of certain bankruptcy of several dairies if adult vaccination had not been introduced.

Summary

Florida dairies will continue to become infected with brucellosis as long as other states have the disease. The impact can be minimized by keeping the herd resistance high by adult vaccination. The adult vaccination program has resulted in dramatic reductions in the economic impact of brucellosis and the brucellosis program in many dairy herds in Florida. It is certain that it has prevented the bankruptcy of several owners.

The reduced Strain 19 dosage combined with proper diagnostic tests and interpretations offer a practical program for the control of brucellosis in large susceptible cattle populations.
PREVENTATIVE PROGRAMS FOR TB
AND JOHNE'S DISEASES IN DAIRY HERDS

by Dr. Bruce Abbott
University of Florida
Gainesville, Florida

Bovine Tuberculosis

Tuberculosis is an infectious disease of cattle caused by bacteria of the genus Mycobacterium, primarily Mycobacterium bovis. The infection is characterized by the formation of tubercles, encapsulated areas containing this bacteria and other debris. The lungs and abdominal organs are most often infected although the bacteria may be located in any portion of the cow's body. The bacteria shed in bodily secretions such as sputum, saliva or manure contaminate the environment. Herdmates contact with feed, air or water contaminated in this manner spread the disease within a herd. Close confinement and group feeding of dairy cattle provides an ideal setting for rapid spread of tuberculosis.

Cattle infected with tuberculosis often do not appear ill. Those with signs of illness generally lose weight and exhibit a variety of other signs which may be common of many diseases. For these reasons, a simple test (caudal fold tuberculin) is used to detect cattle with tuberculosis. Other tests such as the comparative cervical are also used under some circumstances. The presence or absence of tuberculosis is confirmed by postmortem examination. Despite the availability of diagnostic tests, the incidental finding of tubercles on routine postmortem examination is a common method of locating infected herds. Infected herds are quarantined and a test and slaughter program allows the possibility of subsequent outbreaks of the disease on the same farm. Thirty percent of the herds depopulated for tuberculosis in 1973 through 1975 contained one or more nonreacting cattle with lesions of tuberculosis on postmortem. Because of the difficulty in eliminating tuberculosis once it occurs, prevention is extremely important in eliminating economic losses.

The best method to prevent introduction of tuberculosis is to maintain a closed herd. However, this is not a practical solution for all dairymen. For those purchasing replacements, emphasis should be placed on knowledge of the source of the replacements and testing for tuberculosis.

Replacement animals that are grouped from several farms or have been through several sale barns, auction markets, dealers, etc. should generally be avoided. Each additional herd represented in the group and each additional sale barn or other concentration point contacted increases the chances that an infectious disease will be introduced. Therefore, if possible, buy from the original owner. He knows the history of the animals and usually feels responsible for their health and absence of infectious disease. Secondly, prior to purchase, insist that all animals be tested for tuberculosis. The testing veterinarian will first inject .01 ml of the test tuberculin into the tail fold of the cow. Seventy-two hours later, he will palpate the area of injection for any signs of swelling. Ideally, you should observe the testing procedure. If you cannot, reques
the testing forms signed by the veterinarian. Carefully check the identification of each purchased animal against those listed on the official form for any mistakes. If replacements are delivered to your farm and there is any question as to whether or not a tuberculosis test was performed, either refuse delivery or isolate immediately. An immediate test may result in some confusion. If a test was not actually performed (no tuberculin injected) before purchase or delivery, an immediate test will be a legitimate screening test. If the test was performed before delivery (tuberculin injected) and a retest is conducted within 60 days of the original test, the results may be inaccurate as both false negative and false positive reactions may occur. Therefore, to assure an accurate test prior to introducing the replacements into your herd, maintain them in isolation for 60 days and then retest. These problems stress the importance of documented reliable evidence of an accurate test for tuberculosis prior to purchase.

Once accepted, all replacements should be isolated for at least 60 days and then retested before introduction into the main herd. This serves as a check on the first test or may identify animals that have developed detectable tuberculosis since the first test. Even if the replacements are introduced directly into the herd, they should be retested in 60 days to allow for discovery of the disease before it is widespread. However, if introduced into the herd before discovery is made, the entire herd will have been exposed and thus face quarantine. It may also be advisable to test heifers you raise prior to introducing them into the main herd. Close contact with fowl or allowing the replacements access to pasture fertilized with chicken litter may result in false positive reactions to the test. However, if necessary, regulatory veterinarians can determine the accuracy of the test by performing a comparative cervical test.

Another source of tuberculosis in cattle is transmission of the disease from humans. All persons seeking employment of the dairy should be tested for tuberculosis prior to beginning work and periodically thereafter. This service is provided at no charge or for a nominal fee through county health departments.

Even the best screening techniques to prevent the introduction of tuberculosis will occasionally fail. Therefore, a method of detection and controlling spread is essential. Probably, the most reliable procedure is a frequent (at least yearly) test of the entire herd (all animals over 24 months of age). Of equal importance is thorough postmortem examination of dead animals on the farm as well as those sold to slaughter. Your local veterinarian will in most instances supply postmortem services for cows dying on the farm. Cull cows should be sold to slaughtering establishments utilizing either state or federal meat inspection services. Other techniques to minimize spread of infection are routine cleaning of feed bunks and isolation of sick animals. The above suggestions should be followed even in closed herds.

In summary, bovine tuberculosis control should be approached with strong emphasis on preventing introduction into your herd. Once introduced, economic losses will usually be severe. Preventive and surveillance practices should include the following.

1. Buy animals from a known source.
2. Insist on tuberculosis testing prior to purchase. If on arrival there is any question as to the performance of the original test,
do not accept these animals or isolate and perform another test.
3. Keep new animals isolated from the rest of the herd for 60 days and then retest.
4. Have all employees tested for tuberculosis before they begin working.
5. Have postmortem examinations performed on cows dying on the farm. Send cull cows to slaughtering plants utilizing state or federal meat inspectors.
6. All cows over 24 months of age should be tested yearly for tuberculosis.

Paratuberculosis of Cattle

Paratuberculosis (Johne's disease) of cattle is prevalent in Florida. Constant to intermittent diarrhea with progressive weight loss is typical of clinical Johne's disease in adult cows. Clinical disease may result in culling 0 to 10% of adult cows each year in an infected herd. An increased incidence of mastitis and infertility may cause even greater economic loss in infected cows or herds.

Paratuberculosis is apparently more prevalent in areas with acidic soil, a possible explanation for the widespread incidence in Florida. The disease is caused by a bacterium (Mycobacterium paratuberculosis). Cattle primarily contact the disease by ingesting these bacteria. Calves are more susceptible than older cattle. Once ingested, the bacteria reproduce in the walls of the intestine and associated lymph nodes. The bacteria may remain in these areas for many years without causing clinical signs of weight loss and diarrhea. However, some cattle begin shedding large numbers of these bacteria in their feces for many months prior to onset of clinical illness. Manure from these cattle and those with diarrhea contaminate the environment and are a source of infection for other herd members, particularly calves.

Cows in an infected herd can be divided into four groups:
1. Clinically ill cows shedding bacteria in their manure.
2. Inapparently infected cows shedding bacteria in large numbers in their manure.
3. Inapparently infected cows shedding bacteria in small numbers in their manure.
4. Non-infected cows.

A variable percentage of adult cows in an infected herd will be in each group. Inadequate nutrition and/or poor sanitation seems to increase the percent of the herd in infected groups, especially group one. Factors responsible for the change from an inapparent carrier to a cow with clinical signs is largely unknow. Regardless, improvements in herd sanitary practices and nutrition may lower clinical losses.

A controlled study of one infected herd strongly indicated that inapparently infected cows (groups two and three) had more mastitis and infertility than cows in group four in the same herd. In this study, mastitis was given by the herdsman as the reason for culling 22.6% of inapparently infected cattle and 3.6% of their non-infected herdmates (P < 0.01).
Because of these possible affects, the economic significance of herd infections with Johne's disease is difficult to assess.

Many procedures are available to make a presumptive individual or herd diagnosis of Johne's disease. A definitive diagnosis is usually based on demonstration of the causative bacteria in the feces, or in a section of the cow's intestine removed after death. The bacteria can be demonstrated by culture of feces if the cow is passing approximately 100 or more bacteria per gram of fecal material. Culturing requires 60-90 days as this bacteria grows slowly under laboratory conditions. The bacteria can also be seen using microscopy on specially prepared scrapings from the lining of the rectum or sections of the intestine.

Prevention depends on either maintaining a closed herd or purchasing replacements from herds with no history of Johne's disease and/or a complete negative herd test for Johne's disease.

Control in infected herds depend on preventing exposure of susceptible animals (especially calves) to the bacteria and decreasing the amount of bacteria present by identifying and culling cattle shedding the organism in their feces. Calves in infected herds should be removed from their dams as soon after birth as possible and reared in separate facilities. The possibility of transfer of manure from the adult herd to the calf rearing facilities should be minimized. Procedures such as routine cleaning of boots, tractor tires, etc. between facilities may be helpful. Fecal samples should be collected periodically from each adult cows and cultured for the causative bacteria. Cows positive on culture (groups one and two) shed millions of the bacteria per day in their feces and should be culled. Cattle not shedding large number of Mycobacterium paratuberculosis organisms in their feces (group three) may not be detected by culturing. These cattle may begin shedding large numbers of the bacteria in the long interin between taking a sample and obtaining the laboratory results. This long period is due to the 60-90 day period required for growth of the bacteria on culture media. Therefore, a program of culling based on routine culturing approximately every six months may be required for several years to control the disease in a large herd. Elimination of the disease may be impractical especially in large herds.

Selected References:


SELF-FEEDING DAIRY REPLACEMENTS UNDER DRY LOT CONDITIONS

A. H. Rakes
North Carolina State University, Raleigh

The traditional system for feeding herd replacements involves the offering of both roughage and concentrate feeds at least once daily. If this method is used with proper precautions, excellent results can be obtained. However, there are a number of potential problems associated with it. Some of the disadvantages are:

1. It is difficult to obtain uniform growth rates within heifer age groups. A few heifers are "dominant" in the group and consume more than their share of concentrate feed. On the other hand, the less aggressive heifers are not able to obtain a sufficient quantity and balance of nutrients to grow at an acceptable rate. Although the "timid" heifers tend to overcome their growth deficiencies when ample quantities of good roughage are available, many of them are either bred later than desirable or enter the milking herd in poor condition.

2. The daily transportation of feed to heifers causes labor problems. This is particularly true during weekends, holiday periods, and the cropping season.

3. Heifers tend to consume their concentrate allowance in one large meal each day. In extreme cases the adding of large "slugs" of feed to their rumens in a few minutes may cause digestive upsets. At the least, decreased feed utilization efficiency can be expected.

In order to minimize these difficulties, we have worked with two other feeding systems for herd replacements; (1) using complete blended rations, and (2) using salt as a regulator of concentrate intake.

Complete Rations

Total blended rations or complete feeds contain all ingredients in the desired proportions and are balanced nutritionally. The heifers are allowed to consume the rations ad libitum with the fiber and/or bulk of the ration being used to regulate intake. Dry complete feeds can be made available in gravity-flow self-feeders which require refilling only periodically; for example, weekly rather than daily. Silage based complete feeds can be stored in bunker silos with self-feeding gates. The labor saving aspects of these systems are obvious. They are particularly advantageous on weekends and holidays. With the exception of checking for health problems and/or illness, no effort during these inconvenient times is required.

A major advantage associated with the complete feed systems is the minimizing of competition among heifers for feed. Since the ration is available at all times, all animals are able to obtain their share. The dominant or "boss heifers" simply do not have the patience to guard the feeder throughout the entire 24-hour period. Additionally, the constant
availability results in the consumption of several smaller meals spread throughout the day, rather than one or two large meals. This system also provides the opportunity for utilizing by-products and low quality roughages. When such ingredients are offered separately, heifers tend to eat only minimum quantities. However, when they are mixed with grains or protein concentrates, heifers consume much larger amounts.

In areas where soybean hulls are available at a reasonable price, they have been used as the sole source of protein and energy for weaned heifers. A mineral-vitamin supplement is made available on a free-choice basis. Of course no mixing is required. Also, the handling qualities of soybean hulls are very desirable.

Complete rations for heifers younger than six months

It has been demonstrated that heifers can be placed on complete rations as soon as they are two months of age. However, those younger than approximately six months require a ration with higher concentrations of energy and less fiber than the older heifers. Although no major problems were encountered with a complete ration containing only 10.5% crude protein, the overall condition and/or appearance of the calves were improved when higher protein levels were used. Examples of rations used successfully for heifers in this age group are presented in tables 1 and 2.

Complete rations for heifers six months and older

After heifers are approximately six months of age, it is generally necessary to raise the percentage of roughage in the ration to prevent overconditioning. At the same time the protein percentage can be lowered. Some complete rations that have been successfully used for heifers between six months and calving are shown in tables 3 and 4.

Limitations of complete feed system for feeding heifers

With some roughages (cottonseed hulls and ground hay) bridging may occur and the feeders may require attention periodically. This problem can be minimized by lining the feeders with sheet metal and not overloading or packing them. With other roughages (soybean hulls and ground corn cobs) these precautions may not be necessary. No major health problems have been encountered when heifers are fed these feeds. In one study using soybean hulls as the sole protein and energy source a few animals appeared to have distended rumens. Although they were neither treated for bloat nor removed from the feeding trial, they soon returned to normal without any apparent ill effects. When animals have been slaughtered after at least 100 days on these feeds no abnormalities of either the rumen wall or the liver have been detected.

If it is advantageous in a given management system to handle all heifers over six months of age in one group, this can be done successfully. The growth rate data shown in tables 3 and 4 were obtained with heifers fed in this manner. However, growth rate can be more precisely controlled by separating the heifers into two groups and offering rations containing different energy levels. Basically the group assignments are made on the
basis of age. However, in some instances it is necessary to formulate groups with a wide variation in age to compensate for previous over or under feeding or other factors affecting growth rate. Heifers can be switched from one group to the other according to their condition at a given time.

Using salt as a regulator of concentrate intake

If concentrate intake can be controlled, allowing the heifers free access to concentrates and roughages separately has many of the advantages of the complete ration system without the problems and expense associated with mixing high fiber rations. Using salt to control concentrate intake is practiced widely in beef operations and to some extent in feeding dairy herd replacements. This practice involves mixing large quantities of salt in the concentrate mixture and allowing free choice consumption. In some preliminary studies this procedure has been successful. Heifers have gained at a satisfactory rate, and no health problems have been encountered. There are a number of factors that apparently influence the consumption level of concentrates containing a given level of salt (age, roughage, water, etc.). Adding 20 to 30 percent salt is a reasonable starting point. The amounts can be adjusted if heifer response is not satisfactory.

Many users of this system of feeding herd replacements have expressed satisfaction with it. However, there are potential problems associated with its use. First, the consumption of other mineral mixtures is reduced. It is probably desirable to incorporate all of the minerals in the concentrate at the desirable levels. Also, the consumption of such large amounts of salt could alter the requirements of the heifer of other minerals. Of course, salt taken in sufficiently large doses is toxic, especially if the availability of water is limited. It is desirable to hand feed the heifers until they have adjusted to the high salt ration and to maintain a readily accessible water supply. Since there is evidence that even normal amounts of salt in the diet of heifers increases the severity of udder edema at calving, salt should not be used to limit the concentrate intake of heifers nearing the end of gestation. Although there are no data to measure this, there may be some salt accumulation in the soil of areas where this procedure is practiced for extended periods.
**TABLE 1. COMPLETE RATION FED TO HOLSTEIN HEIFERS (2-6 MONTHS OF AGE)**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn (ground, shelled) (%)</td>
<td>53.75</td>
</tr>
<tr>
<td>Soybean oil meal (%)</td>
<td>15.00</td>
</tr>
<tr>
<td>Cottonseed hulls (%)</td>
<td>30.00</td>
</tr>
<tr>
<td>Dicalcium phosphate (%)</td>
<td>0.75</td>
</tr>
<tr>
<td>Trace mineralized salt (%)</td>
<td>0.50</td>
</tr>
<tr>
<td>6 million IU of Vitamin A supplement</td>
<td></td>
</tr>
<tr>
<td>Avg. daily gain (lb)</td>
<td>2.2</td>
</tr>
</tbody>
</table>


**TABLE 2. COMPLETE RATIONS FED TO HOLSTEIN AND JERSEY HEIFERS (2-6 MONTHS OF AGE)**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Ration concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Corn (ground, shelled) (%)</td>
<td>44.2</td>
</tr>
<tr>
<td>Cottonseed meal (%)</td>
<td>22.1</td>
</tr>
<tr>
<td>Citrus pulp, dried (%)</td>
<td>8.8</td>
</tr>
<tr>
<td>Coastal Bermudagrass pellets (%)</td>
<td>8.8</td>
</tr>
<tr>
<td>Peanut hulls, unground (%)</td>
<td>15.0</td>
</tr>
<tr>
<td>Cottonseed hulls (%)</td>
<td>--</td>
</tr>
<tr>
<td>Vitamins A, D, E, salt and Dical. Phos. (remainder)</td>
<td></td>
</tr>
<tr>
<td>Avg. daily wt. gain (lb)</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Clifton and Fowler, 1975.
### TABLE 3. RATIONS SUPPORTING 1.5-2.0 POUNDS AVERAGE DAILY GAINS

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Ration concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Ground corn cobs (%)</td>
<td>75.3</td>
</tr>
<tr>
<td>Cottonseed hulls (%)</td>
<td></td>
</tr>
<tr>
<td>Ground corn (%)</td>
<td></td>
</tr>
<tr>
<td>Soybean oil meal (%)</td>
<td></td>
</tr>
<tr>
<td>Feather meal (%)</td>
<td></td>
</tr>
<tr>
<td>Dicalcium phosphate (%)</td>
<td></td>
</tr>
<tr>
<td>Trace mineral salt (%)</td>
<td></td>
</tr>
<tr>
<td>Vitamin A (IU/lb)</td>
<td>3,000</td>
</tr>
<tr>
<td>Daily gain (lb)</td>
<td>1.7</td>
</tr>
<tr>
<td>Daily consumption (lb)</td>
<td>25.0</td>
</tr>
<tr>
<td>Range daily gain (lb)</td>
<td>1.0-2.5</td>
</tr>
</tbody>
</table>

### TABLE 4. RATIONS SUPPORTING MORE THAN 2.0 POUNDS AVERAGE DAILY GAIN

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Ration concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Ground corn cobs (%)</td>
<td></td>
</tr>
<tr>
<td>Cottonseed hulls (%)</td>
<td></td>
</tr>
<tr>
<td>Ground yellow corn (%)</td>
<td></td>
</tr>
<tr>
<td>44% soybean oil meal (%)</td>
<td></td>
</tr>
<tr>
<td>Dicalcium phosphate (%)</td>
<td></td>
</tr>
<tr>
<td>Trace mineralized salt (%)</td>
<td></td>
</tr>
<tr>
<td>Supplemental Vitamin A (IU/lb)</td>
<td>3,000</td>
</tr>
<tr>
<td>Average daily gain (lb)</td>
<td>2.2</td>
</tr>
<tr>
<td>Average daily consumption (lb)</td>
<td>25.4</td>
</tr>
<tr>
<td>Range average daily gain (lb)</td>
<td>1.5-2.9</td>
</tr>
</tbody>
</table>
HEAT STRESS INDICES IN HOLSTEIN AND JERSEY CATTLE

By R. J. Collier
Assistant Professor (Animal Physiologist)
Dairy Science Department
University of Florida
Gainesville, Florida

Previously, it has been shown that shade is beneficial to dairy cattle during warm summer months. Since Jersey cattle tend to be more "heat tolerant" than Holstein cattle we examined their responses to a shade. Ten Jerseys and fifteen Holstein cattle were assigned to a lot with no shade and an equal number to an adjacent lot containing a shade structure from June 6 to September 20, 1977. Details concerning construction of the shade have been published previously and are available upon request.

Table 1 illustrates the average Black Globe temperature between the shade and no shade areas from 12:00 noon to 5:00 p.m. Black Globe temperature is an integrated measurement of air temperature, solar radiation and wind speed. It is more accurate than dry bulb or air temperature alone in assessing the amount of heat the animals are exposed to. Black Globe temperatures were an average 8.73 degrees Centigrade higher in the no shade area during these time periods. Jersey cattle were cooler than Holstein cattle in both the shade and no shade areas. However, respiration rates were similar between breeds under shade or without shade. Respiration rates were different between animals under shade or without shade. We also measured rumen contractions in animals under shade or without shade during this same period of intense heat. Rumen contraction rate was greater in Jerseys than Holsteins and was greater in animals under shade. It is known that rumen contraction rate is influenced by body temperature and could be involved in reduced milk production during thermal stress.

Table 1. Milk Yield and Heat Stress Indices in Holstein and Jersey Cattle.

<table>
<thead>
<tr>
<th></th>
<th>Shade Holstein</th>
<th>Holstein-</th>
<th>Shade Holstein</th>
<th>Holstein-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rectal Temp.</td>
<td>38.53</td>
<td>38.75</td>
<td>38.65</td>
<td></td>
</tr>
<tr>
<td>Respiration Rate</td>
<td>78.62</td>
<td>77.48</td>
<td>79.58</td>
<td></td>
</tr>
<tr>
<td>Rumen Contractions</td>
<td>2.63</td>
<td>2.19</td>
<td>2.34</td>
<td></td>
</tr>
<tr>
<td>Black Globe Temp.</td>
<td>30.05</td>
<td></td>
<td></td>
<td>38.78</td>
</tr>
<tr>
<td>Milk Yield A.M. (kg)</td>
<td>16.6</td>
<td>18.9</td>
<td>18.07</td>
<td>15.7</td>
</tr>
</tbody>
</table>

In addition to examining the above parameters an a.m. and p.m. milk sample was taken once weekly and analyzed for fat %, freezing point depression, % acidity, total protein and somatic cells by the State milk testing laboratory at White Springs, Florida. Differences between shade and no shade areas in milk constituents were not apparent.
However, there were significant differences between a.m. and p.m. milk samples in freezing point depression, milk fat % and % acidity. These differences could be due to a reduction in water content of milk in the p.m. sample.

Table 2. Effect of Shade and Time of Day on Selected Milk Parameters.

<table>
<thead>
<tr>
<th></th>
<th>Shade AM</th>
<th>Shade PM</th>
<th>No Shade AM</th>
<th>No Shade PM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freezing Point Depression**</td>
<td>.5490</td>
<td>.5504</td>
<td>.5451</td>
<td>.5519</td>
</tr>
<tr>
<td>% Acidity**</td>
<td>.1580</td>
<td>.1720</td>
<td>.1650</td>
<td>.1800</td>
</tr>
<tr>
<td>Total Protein</td>
<td>3.33</td>
<td>3.34</td>
<td>3.26</td>
<td>3.35</td>
</tr>
<tr>
<td>Fat %*</td>
<td>3.41</td>
<td>3.83</td>
<td>3.60</td>
<td>3.62</td>
</tr>
<tr>
<td>Somatic Cells</td>
<td>655,826</td>
<td>594,260</td>
<td>569,619</td>
<td>591,395</td>
</tr>
</tbody>
</table>

**AM different than PM P<.0001
* AM different than PM P<.025

Another method of looking at differences between Holsteins and Jerseys is to examine them around a 24 hr period. This provides a more complete picture of the cows' response to heat during the day and cooling at night.

The average milk production of the animals used in this study is presented in Table 3. Both Holsteins and Jerseys in the no shade area had slightly lower average milk yields than animals under the shade. Physiological patterns in Holsteins were examined on August 5-6 and those of Jerseys, August 15-16. Figure 1 illustrates Black Globe temperatures under the shade structure and in an adjacent no shade area on these days. Black Globe temperature is an integrated measurement of dry bulb temperature, solar radiation and wind speed. As shown in Figure 1 the daily Black Goobe temperature patterns were almost identical for the two 24 hour periods. It also is interesting to note that in both studies the afternoon thundershower common to this area occurred between 3 and 4 p.m., lowering temperatures most dramatically in the no shade area. It is quite evident that Black Globe temperatures are much lower under shade during the late morning and afternoon hours. This is due primarily to reduction in solar radiation by the shade.

Table 3. Ave Milk Production of Cows on Shade Experiment.

<table>
<thead>
<tr>
<th>Breed</th>
<th>Shade</th>
<th>Animals</th>
<th>Lbs</th>
<th>Date</th>
<th>No Shade</th>
<th>Animals</th>
<th>Lbs</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Holstein</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jersey</td>
<td>5</td>
<td>41.1</td>
<td>8-5-77</td>
<td></td>
<td>Holstein</td>
<td>5</td>
<td>37.8</td>
<td>8-5-77</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>29.6</td>
<td>8-15-77</td>
<td></td>
<td>Jersey</td>
<td>5</td>
<td>27.6</td>
<td>8-15-77</td>
</tr>
</tbody>
</table>

Figure 2 depicts rectal temperatures of Holstein and Jersey cattle under shade or in the adjacent no shade area. Points on the graph are means of five animals for each treatment. Rectal temperatures of Holsteins were higher than those of Jerseys during daylight
but were similar between midnight and 7 a.m. This probably is due to the Holsteins' greater body mass and milk yield. Both Holstein and Jersey cattle in the no shade area had higher rectal temperatures than they did under shade during daylight. However, Jerseys in the no shade area cooled much faster than Holsteins without shade. The well known heat tolerance of the Jersey is no doubt due in part to this ability to cool rapidly. If one uses a rectal temperature of 38.4°C as inside the normal temperature range it is evident that Jerseys reached this temperature by 9 p.m. while Holsteins did not until 1 a.m. It appears that Holsteins have a much greater heat load than Jerseys to dissipate during the night.

Figure 3 illustrates respiration rates of the cattle in these studies. Increased respiration frequency is a major avenue of heat dissipation in the heat stressed dairy cow. The respiration rates paralleled rectal temperatures. Holsteins and Jerseys in the shade and likewise in the no shade area had similar respiration rates during hours of peak environmental temperatures. However, respiration rates of Jerseys in the no shade area dropped quickly following sunset, whereas those of Holsteins declined much more slowly. Respiration rates of Jerseys in the no shade area agreed with rectal temperatures and indicated that these cattle were as cool as the Jersey cattle under the shade by 7 p.m. Respiration rates of Holstein cattle also paralleled their rectal temperatures and indicated that Holstein cattle in the no shade area were dissipating excess heat until approximately 1 a.m. or 6 hours longer than Jersey cattle under the same environmental conditions. These data indicate that respiratory frequency is not a major factor in heat tolerance but rather an indication of the heat load an animal is carrying.

Figure 4 depicts rumen contractions per 2 min for Holsteins and Jerseys in the shade and no shade areas. Both Holsteins and Jerseys in the no shade area had lower rumen contraction rates than their counterparts in the shade area during the afternoon. After sunset rumen contraction rate speeds up in animals housed without shade. Thus, it appears that heat stress adversely affects rumen contraction rates and could be involved in reduced milk yield of heat stressed cows.

In conclusion, it is evident that the use of a shade structure to alleviate environmental stress reduces rectal temperatures and respiration rates and prevents a decline in rumen contraction rates in cattle. Jersey cattle do not build up as great an excess heat load as Holstein cattle and cool off much more quickly following sunset. We postulate that hair coloration, body mass and milk yield are primary factors in causing a greater excess heat load in the Holstein cow. However, Holstein cows can carry on a greater level of milk yield than Jersey cows despite this greater heat buildup during the day.
FIGURE 3

HOLSTEINS

△ SHADE
○ -- NO SHADE

RESPIRATIONS PER MINUTE

PM 5 AUG

AM 6 AUG

JERSEYS

△ SHADE
○ -- NO SHADE

RESPIRATIONS PER MINUTE

PM 15 AUG

AM 16 AUG
Factors Affecting Frequency of
Blind Quarters in the Dairy
Research Herd

M. C. Durães, C. J. Wilcox and H. H. Van Horn
Empresa Brasileira de Pesquisas Agropecuárias
EMBRAPA-M.A., Brasil, and
University of Florida, Gainesville

Introduction

Dairy cows which freshen for the first time with one or more
quarters which do not produce any milk are an obvious economic loss to
the dairyman. These quarters usually are called blind, and either re-
represent quarters which did not develop and were atrophied, or quarters
with teats with canals which did not develop. Some of the blind quar-
ters in the present investigation apparently were secreting milk but in
no case could this milk be obtained without surgical intervention. We
did not count quarters which apparently were functioning at time of
parturition but which were mastitic and later dried up. Objectives of
our research were to determine the frequency of occurrence of blind
quarters, genetic and environmental factors which affected frequency,
and the loss in productivity following parturition.

Although Turner recognized and discussed the problem back in 1952,
there exists very little information about it. He described the condi-
tion as blind or imperforate teat or quarter and discussed it in detail.
Genetic influence was suggested by Johansson and Rendel in 1968, as well
as possible origin from injury or mastitis.

Materials and Methods

Available were detailed daily records of the Florida Agricultural
Experiment Station Dairy Research Unit for the period 1959 to 1977.
Total number of first parturitions was 1112. Animals represented six
breed groups. Recorded on each animal were status of each quarter
(blind or normal), breed, sire, dates of birth and parturition, days in
lactation, milk yield, fat yield and fat percent. Since not all ani-
mals had completed their first lactations at the time of the statistical
analysis, some of the analyses included fewer than 1112 observations,
but always 1059 or more.

Results and Discussion

Mean performance. Characteristics of the 1112 animals are shown in
Table 1. Mean age at first parturition of all animals was 25.8 months,
which reflected the practice in the herd until recently of breeding
heifers during a 6-month breeding season following first normal estrus
after 13 months of age. Lactation records ranged in length from 5 to
305 days in length. Breed 6 (Holstein crossbreds) consisted primarily
of Holstein by Guernsey F1 crosses, but also at least one F1 offspring
resulting from crossing Holstein with three other breeds (Ayrshire,
Brown Swiss, and Jersey).

Table 1. Mean performance of 1112 first lactation cows.

<table>
<thead>
<tr>
<th>Breeda</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>41</td>
<td>51</td>
<td>146</td>
<td>404</td>
<td>436</td>
<td>34</td>
</tr>
<tr>
<td>Age (months)</td>
<td>26.7</td>
<td>27.5</td>
<td>26.7</td>
<td>25.1</td>
<td>26.0</td>
<td>23.8</td>
</tr>
<tr>
<td>Days in lactation</td>
<td>213</td>
<td>224</td>
<td>244</td>
<td>270</td>
<td>259</td>
<td>241</td>
</tr>
<tr>
<td>Milk yield (lb)</td>
<td>6041</td>
<td>6801</td>
<td>6151</td>
<td>10077</td>
<td>6036</td>
<td>8133</td>
</tr>
<tr>
<td>Fat percent</td>
<td>3.89</td>
<td>3.96</td>
<td>4.67</td>
<td>3.35</td>
<td>4.97</td>
<td>3.56</td>
</tr>
<tr>
<td>Fat yield (lb)</td>
<td>240</td>
<td>278</td>
<td>295</td>
<td>340</td>
<td>302</td>
<td>298</td>
</tr>
</tbody>
</table>

a1 = Ayrshire, 2 = Brown Swiss, 3 = Guernsey, 4 = Holstein,
5 = Jersey, 6 = Holstein crossbreds.

-38-
Frequencies of blind quarters. Table 2 shows that 38 cows (3.42%) of all cows had one or more blind quarters. Standard error of this estimate was .54%. One cow had three blind quarters and nine had two blind quarters. Hence the percentage of all 4448 quarters which were blind was 1.10 ± .16%. Statistical analysis showed that breed frequencies differed, with Holsteins and Holstein crossbreds having higher frequencies than the other four breeds. Subsequent analyses confirmed these differences and provided additional evidence of genetic effects.

Table 2. Frequencies of blind quarters by breed.

<table>
<thead>
<tr>
<th>Breed</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal cows</td>
<td>41</td>
<td>51</td>
<td>144</td>
<td>378</td>
<td>429</td>
<td>31</td>
</tr>
<tr>
<td>Blind cows b</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>26</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Blind quarters c</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>36</td>
<td>7</td>
<td>4</td>
</tr>
</tbody>
</table>

\textsuperscript{a}1 = Ayrshire, 2 = Brown Swiss, 3 = Guernsey, 4 = Holstein, 5 = Jersey, 6 = Holstein crossbreds.

\textsuperscript{b}Cows with one or more blind quarters (breed differences statistically significant).

\textsuperscript{c}Total number of blind quarters (breed differences statistically significant).

In Table 3 are frequencies of blind quarters by quarter. Although the right rear quarter had the fewest cases, statistical tests of front versus rear, and left versus right, were not significant (meaning no real evidence that frequencies differed).
Table 3. Location of blind quarters.

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Blind</th>
<th>Normal</th>
<th>% Blind</th>
</tr>
</thead>
<tbody>
<tr>
<td>Left front</td>
<td>14</td>
<td>1098</td>
<td>1.26</td>
</tr>
<tr>
<td>Right front</td>
<td>15</td>
<td>1097</td>
<td>1.35</td>
</tr>
<tr>
<td>Left rear</td>
<td>13</td>
<td>1099</td>
<td>1.18</td>
</tr>
<tr>
<td>Right rear</td>
<td>7</td>
<td>1105</td>
<td>0.63</td>
</tr>
<tr>
<td>Overall</td>
<td>49</td>
<td>4399</td>
<td>1.11</td>
</tr>
</tbody>
</table>

*Differences in frequencies among quarters not significant.*

**Environmental and genetic effects:**

In this phase, variables studied were breed, sire in breed, season, year, breed by season, year by season and age of cow. The response variables were presence of one or more blind quarters (variable coded 0 or 1) and number of blind quarters (0, 1, 2 or 3). The two responses obviously are highly correlated \( r = .93 \) since there were few animals with either two or three blind quarters.

When breed and sire in breed were studied, in no case could effects due to year, season, year-season or breed-season be detected. In several analyses there appeared to be a slight positive linear effect of age at parturition. Regression of presence of one or more blind quarters on age at parturition was 0.23% and for number of blind quarters, 0.10%. These values suggest that the frequencies of blind quarters are higher in heifers freshening at older ages. The increase per month is the regression coefficient (.23% or .10%).

Effects of breed and sire in breed were significant, suggesting that the trait was heritable. Heritabilities for the two dependent variables ranged between 0.10 and 0.20.
Effects of blind quarters on production:

In additional analyses the effects of blind quarters on length of record, milk yield, fat yield and fat percentage were evaluated. Results are summarized in Table 4. Cows with one or more blind quarters produced 2176 lb less milk, and milked 48 days less, than normal cows. Obviously part of the decreased yield was due to the shorter milking period. Adjustment of milk yield for days in lactation would account for only a portion of the loss, however. Effects on fat percentage were variable and not statistically significant. Loss of 1329 lb milk with one blind quarter, and 4358 lb with two, seemed reasonable, since days in lactation decreased linearly ($b = -41$ days) with number of blind quarters. Loss due to one blind quarter adjusted for number of days milked was 243 lb.

<table>
<thead>
<tr>
<th>Trait</th>
<th>Number of blind quarters</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One or More</td>
</tr>
<tr>
<td>Milk yield (lb)$^a$</td>
<td>-2176</td>
</tr>
<tr>
<td>Fat percent$^b$</td>
<td>-.016</td>
</tr>
<tr>
<td>Fat yield (lb)$^a$</td>
<td>-75</td>
</tr>
<tr>
<td>Days in lactation$^a$</td>
<td>-48</td>
</tr>
</tbody>
</table>

$^a$Effects statistically significant.

$^b$Effect not significant.

$^c$Based on linear regression.
Summary

We studied 1112 first-calf heifers in our Dairy Research Unit herd for the period 1959–77. The animals frequency of heifers with one or more blind quarters was $3.42 \pm .54\%$; percentage of all quarters which were afflicted was $1.10 \pm .16$. There was no evidence of differences in frequencies among quarters. Analyses failed to detect any effects due to year of parturition, season, or year by season or breed by season interactions. A small but significant positive linear effect of age at parturition was detected. Breed effects were large; frequency for Holsteins and Holstein crossbreds was five times that of four other dairy breeds. Differences among sire groups were found and suggested heritabilities of .1 to .2. Animals with one blind quarter averaged 1329 lb less milk and 51 lb less fat during first lactation than normal animals, and milked 41 days less. Even greater losses were sustained for animals with two or more blind quarters. Indicated further research is to obtain estimates of factors studied here from other populations, and to characterize the trait anatomically.

Acknowledgements

Courteous assistance of H. H. Head, R. J. Collier, and A. L. Green, University of Florida, and M. J. Paape, USDA, are gratefully acknowledged.

References


PROTEIN NEEDS FOR LACTATION BUTTER DEFINED

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University of Florida, Gainesville 32611

In recent years there have been a large number of experiments at the University of Florida measuring the response of high producing dairy cows to various increments of protein in the complete ration. Various presentations and reports have been given to the dairy industry on individual experiments. However, it has not been until recently when we have surveyed the results of a large number of experiments that we have been able to develop what we think is a reliable response curve to increasing protein in complete rations.

First, let's consider soybean meal as the protein supplement. The response that would be given in increased milk yield by increasing the percent protein in the complete ration is a diminishing returns curve. That is, you would get a large increase in going from 8% protein in the complete diet to 10%, a medium response from 10% to 12%, and very little or none from 12% to 14%. The following table represents an estimate obtained from the results of 13 experiments with soybean meal to the milk yield and feed intake changes for each 1% increase in crude protein percent of the total ration dry matter. The changes are presented as expected increase in milk yield per cow daily and increase in feed cost so that actual increases in dollars returned and in dollars extra feed cost could be calculated. Feed costs increase both from some extra feed being consumed and in increases in the costs of each unit of all that is fed through the cost of increasing the percent protein. In this example, using $10/cwt. milk, $100/ton for the total air dry ration, and soybean meal costing $100/ton more than corn, feed costs exceeded added value of milk in changing crude protein from 14% to 15% of the total ration dry matter. Increasing protein up to 14% gave more milk value than added cost. Thus, it might be concluded that 14% of the total ration dry matter is the most economical level of protein to feed under most situations if soybean meal is the supplement. If $12/cwt. milk had been chosen, no financial loss would have been incurred in increasing to 15% crude protein in the total ration dry matter.

Of considerable interest is the fact that cottonseed meal apparently gives a bit different response curve than soybean meal. In a number of experiments where cottonseed meal was the supplement used to vary protein, we have found that cows do not perform quite as well at low levels of protein with cottonseed meal and hence respond more readily to increasing protein by adding more cottonseed meal. The conclusion we made was that it takes about 15% protein (13.5% of air-dry complete ration) with cottonseed meal as the supplement to equal 14% protein (about 12.5% air-dry) when soybean meal was the supplement.
A committee of scientists revising the publication entitled "Nutrient Requirements of Dairy Cattle" are recommending about 15% of the dry matter for situations fitting most of our milking cows in Florida. Thus, their recommendations are higher than would be indicated by supplementation with soybean meal but are probably appropriate recommendations for many general situations where supplements such as cottonseed meal are used, or .5% urea or other soluble protein are included in the diet.

Summary

1. Protein requirements are really not as specific as sometimes stated but can be determined on economic basis through costs and returns comparisons.

2. Soybean meal is superior to cottonseed meal at lower levels of protein feeding. Generally, protein requirements for milk production are quoted on a very liberal basis to allow use of supplements such as cottonseed meal and/or some urea. Equal performance can be obtained with about 1% less protein if soybean meal is the only nitrogen supplement used in the complete ration than if cottonseed meal is used. The same probably holds when comparing to rations containing 0.5% urea.

3. With these considerations, 14% protein in complete ration (12.5% on air-dry basis) is recommended if soybean meal is only supplement added in complete rations containing low protein forages. With other supplements, or in rations which need little added protein because they contain large amounts of high protein forage, 15% crude protein is recommended (13.5% on air-dry basis).

4. There may be some other protein supplements equal or better than soybean meal. However, without the extensive data necessary to make comparative response curves like we now have available for soybean meal and cottonseed meal I recommend the 15% feeding level being recommended for cottonseed meal for these other supplements.
Table 1. Marginal changes in milk, dry matter (DM) intake and estimated returns to changing ration protein percent WITH SOYBEAN MEAL.

<table>
<thead>
<tr>
<th>Change in protein % of DM from:</th>
<th>% increase in:</th>
<th>Lbs/day increase in:</th>
<th>Daily increase in:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>milk&lt;sup&gt;a&lt;/sup&gt;</td>
<td>milk&lt;sup&gt;a&lt;/sup&gt;</td>
<td>milk value&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>9 to 10%</td>
<td>7.9%</td>
<td>3.9%</td>
<td>3.2 lbs</td>
</tr>
<tr>
<td>10 to 11%</td>
<td>5.6</td>
<td>2.9</td>
<td>2.5</td>
</tr>
<tr>
<td>11 to 12%</td>
<td>4.0</td>
<td>2.1</td>
<td>1.8</td>
</tr>
<tr>
<td>12 to 13%</td>
<td>2.7</td>
<td>1.6</td>
<td>1.3</td>
</tr>
<tr>
<td>13 to 14%</td>
<td>1.8</td>
<td>.8</td>
<td>.9</td>
</tr>
<tr>
<td>14 to 15%</td>
<td>1.2</td>
<td>.6</td>
<td>.6</td>
</tr>
<tr>
<td>15 to 16%</td>
<td>.9</td>
<td>.3</td>
<td>.4</td>
</tr>
<tr>
<td>16 to 17%</td>
<td>.7</td>
<td>.1</td>
<td>.3</td>
</tr>
</tbody>
</table>

<sup>a</sup>The base values for 9% diets used in this example are 40.5 lbs of milk per day and 35.6 lbs feed intake per day.

<sup>b</sup>Milk value for this estimate is assumed to be $10 per 100 pounds and feed cost of $100 per ton for 9% crude protein ration. It is assumed also that soybean meal costs $100/ton more than corn.
SUGGESTIVE SIGNALS INDICATING PROBLEMS
IN FEEDING

by B. Harris, Jr.
Extension Dairyman
University of Florida

Dairymen in the late 70's and early 80's will be faced with many
challenging opportunities involving total management. The increased cost
of labor, depreciation, taxes, capital, mechanical equipment, waste man-
age, and other operating expenses makes high gross income per cow es-
sential.

Maximizing net income over feed costs is an achievement worthy of
serious concern and consideration by any dairymen since the greatest
single costs involved in operating a dairy is the cost of feed. The ques-
tion that one must ask is whether or not there is an art to feeding dairy
cows or is one feeder as good as another in presenting the feed to the
cow? Also, should all cows have the same ration and equal time at the
feed bunk? Will cows adjust their feed intake according to their body
weight and level of milk production or will they get fat? If they start
a fattening process, will this effect their persistency in producing milk?
Attempts will be made to answer many of these questions as we enter our
discussions.

A big challenge facing dairymen in regard to feeding is in the se-
lection of the most economical total ration. To properly achieve this,
dairymen must examine all avenues available to them such as the feasibility
of growing forages, purchasing all or certain ingredients, feeding inside
and/or outside, and using a mixer wagon, badger system or other feeding
systems.

Growing forages has certain advantages and may frequently be the most
economical way to feed dairy cattle. This is especially true for dairymen
located at fairly great distances from feed outlets, having good soil ferti-
licity, and the necessary labor and facilities for growing, harvesting
and storing forages. On the other side though, dairymen located near
large metropolitan centers or with restricted acreage and/or poor quality
soil can seldom afford to get excited about growing a lot of forages.

The Digestive System

The ruminant stomach consists of four compartments: the rumen or
paunch, the reticulum or honeycomb, the omasum or manyplies, and the
abomasum or true stomach. The compound stomach of the mature cow will
hold from 50 to 75 gallons.

Rumination may occur in calves as early as two weeks of age where
 grain is consumed early in life. By 3 to 4 weeks of age the calf may be
weaned and by two months of age the rumen descends into its normal posi-
tion followed by a rapid development of the reticulum and omasum. At 3
months of age the size of the rumen becomes established to bear the ratio
to total size which will pertain throughout the animal's life.
High-concentrate low-fiber diets for newborn calves stimulates more rapid rumen development than high fiber diets. Apparently, the end products of rumen fermentation (fatty acids) are primarily responsible for the rapid development. A number of studies have shown that the rumen will reach its normal size with very little fiber being consumed by the calf. It seems evident that some fiber, perhaps no more than 10%, is needed to maintain a healthy rumen in calves after they reach 1 to 2 months of age.

Feed material ingested by the animal is mixed with saliva in the mouth and passed down the esophagus to the rumen where the feed is temporarily stored for the process of rumination. Rumination involves the cycle of regurgitation, mastitation, re-insalivation and re-swallowing. Boluses are not easily formed from certain rations eaten by cows and therefore less cud-chewing is observed. The rumen and reticulum, however, does continue the process of mixing and churning the ingested feed. Animals eating a high forage or roughage ration will spend about one-third of their time in the process of rumination.

The rumination process reduces the size of the feed particles, exposes more surface area for bacteria action and adds saliva which moistens and buffers the feed. During the period of a day, ruminants may secrete from 10 to 20 gallons of saliva which is essential in the swallowing of dry feedstuffs. The buffers in saliva (sodium bicarbonate, etc.) helps in maintaining a normal pH in the rumen. The ingested feed is retained in the rumen and reticulum until it attains a fine consistency, and then passes on to the lower regions of the digestive system.

The reticulum is involved in the process of rumination or cud-chewing. Sometimes it is referred to as the "hardware" compartment, since heavy objects such as nails may be swallowed and collected in it. Hardware disease is a result of metal objects accumulating in the reticulum and causing irritations or discomfort to the cow.

The third compartment or omasum lies between the reticulum and abomasum. It contains numerous leaves or a series of folds which provides a tremendous absorption area. The solid material is retained in the omasum for further grinding while 60-70% of the water content is absorbed and the more liquid portions of the ingesta pass directly to the abomasum or true stomach. The abomasum of the ruminant is very similar to the stomach of a pig or dog. In the abomasum, gastric juice is secreted at a rate similar to the amount of liquid absorbed or lost in the omasum. The hydrochloric acid content of the gastric juice causes the pH to fall to 1.5 to 3.0. This type of acid condition destroys the protozoa and bacteria, making the nutrients in their bodies available to the cow. Nutrients synthesized by the microorganisms (bacteria and protozoa) include all the amino acids and B-vitamins.

Developing Feeding Programs

A variety of successful feeding programs may be developed for dairy cattle that will promote high levels of milk production. The reason is because of the vast number of ingredients that are available to select from and many are quite similar in nutritional value. Basically, a good ration will contain adequate roughage or fiber and sufficient protein and energy for a given level of milk production. In addition, the minerals
and vitamins are added to provide good balance. In formulating good balanced rations, care must be taken in arriving at a good textured and palatable ration. Once the ration is put together in a least-cost manner the next important step becomes feeding management (the art of feeding).

Understanding Problems

1. **Milk Production** - The level of milk production in a herd is influenced by all environmental factors as well as the genetic ability of the cow to produce milk. With feed the main variable, reduced milk production is influenced the greatest by an inconsistency in the feeding program, a lack of attention to the dry cows, a shortage of feed to the high producing cows, an imbalanced ration, and a high soluble protein ration. High producing cows will consume upwards of 50 lbs. of complete feed (4.0 lbs. dry matter per 100 lbs. body weight) per cow per day. Less is consumed per day where cows are on silage rations. For maximum consumption the following are needed: 1) fresh water must be readily available, 2) a shade over the eating area, 3) feeding the cows 2-3 times per day and 4) having the cows eat all the feed in the trough each day. Consumption of feed can be increased by more frequent feeding of the ration.

2. **High Feed Cost Per Cow** - The cost of producing milk in Florida dairy herds frequently varies from a low of $0.40 to a high of $0.65 per gallon. As one would readily acknowledge, a cost of $0.65 per gallon spells disaster for a dairyman over a period of time that may be relatively short. High feed costs usually result from the following reasons: 1) a failure to check with your feed dealer on the price of feed, 2) too many low producing cows in the herd, and 3) a lack of understanding of the feeds presented to the cows.

3. **Uncomfortable Appearing Cows** - Cows are like humans in that they enjoy comfort and freedom from stress. Cow comfort is increased with shade and freedom from mud and long periods of time on concrete. Overcrowded conditions, lack of space for resting, flies and other insects, and lack of bunk space for eating causes uncomfortable cows.

4. **Reduced Milk Fat Test** - Maintaining normal milk composition usually means producing milk with an acceptable butterfat test. A lower fat test than commonly observed in your herd is caused by a lack of effective fiber. Common signals that are indicative of a lowering of the milk fat test is loose bowels and acidosis. Loose bowels may result from grazing young tender pasture, lack of effective fiber, or an abrupt change in the feeding program.

5. **Acidosis** - Acidosis usually results from a major change in the ration such as moving cows from pasture to heavy grain or energy rations. Symptoms observed are diarrhea, depressed appetite, and frequently a rise in body temperature. Physiological changes observed include high levels of lactic acid in the blood and rumen, a lowered rumen pH and renal shutdown and dehydration. The problem can usually be avoided by properly adjusting animals to high energy rations and preventing lengthy gaps of time where animals are without feed in the feeding program. Thus, animals
off feed for 1-2 days because of shipment or diseases unrelated to feeding may need to be treated as unadapted animals during refeeding. Low level feeding of sodium bicarbonate (15 lbs/ton) is sometimes used as a preventative. Diarrhea in dairy cattle results in high water losses from the body which includes sodium, potassium and chloride.

6. Milk Fever - Milk fever is a metabolic disorder that occurs most frequently in high producing cows within the first three days after calving. The most obvious and consistent abnormality displayed in milk fever cases is low blood calcium. The level of calcium in the blood serum drops from a normal of about 10 mg/100 ml to levels of 3 to 7 mg/100 ml.

Excessive calcium and the resulting lack of phosphorus or an imbalance of the calcium-phosphorus ratio are key factors in causing milk fever in dairy cattle. Most research studies have shown that the level of calcium and phosphorus in the total ration and their ratio are important in controlling the incidence of milk fever in a herd.

Since milk fever occurs more frequently in early lactation, it is reasonable to assume that the dry herd ration is responsible for the major portion of the problem. The most widely accepted and workable plan for reducing the incidence of milk fever is by providing rations containing adequate levels of calcium and phosphorus during the dry period. During the dry period the dairy cow should be maintained in good condition. Thinner cows will need to gain in extra flesh. Every attempt, however, should be made to maintain the dry cow in real good flesh rather than fatten her. The nutrient requirements for dry cows are outlined in Table 1.

<table>
<thead>
<tr>
<th>Body Wt.</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Crude (lbs)</td>
</tr>
<tr>
<td>800</td>
<td>1.31</td>
</tr>
<tr>
<td></td>
<td>1.63</td>
</tr>
<tr>
<td></td>
<td>1.87</td>
</tr>
<tr>
<td></td>
<td>2.09</td>
</tr>
<tr>
<td></td>
<td>2.30</td>
</tr>
</tbody>
</table>

Milk fever problems have been rarely observed in Florida dairy herds when dairy rations contained adequate levels of calcium and phosphorus (0.40 to 0.50% phosphorus and 0.60 to 1.0% calcium).

7. Udder Edema - Udder edema is frequently a problem in certain herds at different times throughout the year. Restricting salt intake in order to control water balance in humans with edema problems is an accepted practice by many medical doctors. A recent report by researchers at the University of Maryland and elsewhere indicate
that salt intake could affect the severity of udder edema in dairy cows. The results are shown in Table 2.

Table 2: Average Udder Edema on Farms A & B

<table>
<thead>
<tr>
<th>Location</th>
<th>Control</th>
<th>Added Potassium</th>
<th>Added Sodium</th>
<th>Added Potassium &amp; Sodium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farm A</td>
<td>2.19</td>
<td>3.64</td>
<td>3.77</td>
<td>4.22</td>
</tr>
<tr>
<td>Farm B</td>
<td>1.75</td>
<td>3.08</td>
<td>2.76</td>
<td>2.67</td>
</tr>
</tbody>
</table>

The more common cause of udder edema in Florida dairy herds has been the use of appetized mineral supplements. Also, cows receiving fairly large amounts of silage during the dry period are more likely to consume fairly large amounts of salt. If udder edema is a problem in your dairy herd, examine the availability of salt, especially where an appetizer is added to the salt.

It has been demonstrated that salt intake during the last month before calving has more influence on udder edema than concentrate feeding. It also is very evident that the practice of limiting concentrate intake by including high levels of salt in the mix certainly cannot be recommended for springing heifers or dry cows.

8. Ketosis - Ketosis or Acetonemia is a common metabolic disease of lactating cows occurring within a few days to a few weeks after freshening. The disease results in a lowered glucose concentration in the circulating blood with an increase in ketone bodies. Also, an increase of ketone bodies is observed in the urine.

Increased incidences of ketosis appear to result from two different types of feeding programs. In the first case, nutrition appears to be lacking; whereas, in the second case, nutrition is abundant. Case one will be discussed first.

Animals susceptible to ketosis should be maintained on a relatively high energy ration prior to calving and the level should be increased substantially after the cow freshens.

Body tissue is used for milk production with relatively high energetic efficiency and a moderate amount of weight loss in early lactation appears to have no harmful effects. On the other hand, excessive weight loss appears to make a cow more susceptible to ketosis, and should be avoided. Maximum energy intake by cows relatively early in lactation can be attained by challenge feeding after calving. This is an effective means of holding weight loss to a minimum and also for attaining high peak production and greater lactation yield.

Placing cows on full feed immediately after calving frequently causes some cows to go off-feed and within a short period secondary ketosis develops. Generally, this problem can be partially avoided by placing the fresh cows in a freshening group for a week to 10 days prior to putting them in the high group. This is especially true for many cows that may not have had the
opportunity of having been on the lactating cows ration prior to calving. Avoid all forms of stress as much as possible.

Overfeeding during late lactation or the dry period increases the incidence of ketosis. Certain dairymen in Florida during the past few years have observed an increased incidence of ketosis when cows were fed ad lib or allowed to fatten toward the end of lactation and maintained in this condition until freshening. Apparently, cows in a fattening condition cannot tolerate as much stress or perhaps are under more stress as compared to cows freshening in excellent condition. The ketosis problem was eliminated in the herds studied by changing the feeding program to a program such as group feeding so that the cows will not fatten in late lactation or during the dry period.

9. **Displaced Abomasum** - Displaced abomasum is the term applied to a condition associated with the abomasum (the fourth or true stomach) rotating from its normal position on the right ventral abdominal wall. The abomasum becomes dilated with fluid and/or gas with subsequent migration to the right or left and dorsally within the abdominal cavity. In displacement to the left, distention of the abomasum is caused primarily by gas; displacement to the right is usually accompanied by torsion and accumulation of fluid within the organ. Most displacements encountered in this country have been to the left. A number of cases have been observed in Florida. The condition is more likely to occur in older cows near the parturition or within 30 days after freshening.

Most cows with abomasal displacement (AD) are off-feed and show some signs of ketosis. Most have scanty bowel movements, some degree of dehydration, and about half have uterine infections or virus diseases such as IBR, BVD, and PI3. The distinguishing feature between AD and ketosis is the diarrhea-like condition frequently observed in AD cases and constipation with ketosis. The field test for ketosis on milk and urine is strong for ketotic cows but only mild with the occurrence of AD. The depressed area over the rumen stays full with AD because the abomasum is displaced and filled with gas or fluid.

Several factors are probably responsible for the condition. The type of ration being fed in combination with some type of infection seems to dominate in most cases. High concentrate rations fed near freshening could possibly lower abomasal motility and increase abomasal gas production, resulting in AD in some cows near parturition. Cows carrying excessive flesh (fat) are more prone to have AD than cows freshening in good condition. Feeding some long hay during the dry period helps to avoid the problem.

10. **Feedlot Bloat** - Feedlot bloat, sometimes called frothy bloat, has been more commonly observed in Florida dairy herds than common bloat which is normally seen in cows consuming lush legumes such as alfalfa and clovers. Feedlot bloat has not been a real problem in most herds but has been a problem in a few herds under...
certain conditions. The condition normally develops from a lack of roughage or where the ration contains more than 50% concentrate. It is thought to be caused partially by acid indigestion. Even so, it is not related to the eating habits of the animals or the fact that feed consumption has been increased. The fatty acid ratios and pH of the rumen contents are similar for bloaters and nonbloaters. It has been demonstrated that certain bacteria increase in cattle as bloating becomes a problem. Possible solutions to the problem would be the addition of more roughage to the ration or the addition of 12-15 lbs of sodium bicarbonate per ton of feed. The use of sodium bicarbonate would aid in preventing acid indigestion.

11. Fat Cow Syndrome - The fat cow syndrome is a problem in some herds where cows are fed too heavy in late lactation or allowed to fatten during the dry period. To maintain high production in the early part of the lactation, a cow must be in good condition, but hungry and active when she freshens. Specific signs include loss of appetite, depression, marked drop in milk production, progressive weight loss, chronic ketosis, nervous signs and an elevated temperature due to associated disease problems. Post mortem examinations on these cows show excessive fat throughout the body, plus a severely affected liver. To avoid the problem, feed less energy and more roughage.
WHAT'S NEW IN FREQUENCY OF MILKING COWS

by D.W. Webb and H.H. Head
University of Florida
Gainesville, Florida

Three-time (3X) milking was quite popular 25 to 30 years ago but was then not practiced widely for a number of years. Apparently, the thinking was that 3X milking was not worth the trouble. However, during recent years, limited interest in 3X milking has returned. With today's larger herds, the fixed costs of milking facilities have increased and labor costs have become a smaller portion of total costs. Further, with longer milking shifts and single shifts on many dairies, 3X milking becomes more feasible to schedule.

A number of Florida dairies have experimented with 3X milking and many are employing this practice currently. Several questions regarding 3X milking are apparent.

1. Do cows milked 3X give more milk than if milked 2X? The answer is yes.

2. Why?
   a) More frequent emptying of the mammary gland allows less pressure build-up.
   b) Greater frequency of udder stimulation increases oxytocin releases. Oxytocin itself may stimulate milk synthesis even in the absence of milk removal. This is referred to as the galactopoietic effect of oxytocin.
   c) More frequent milking causes more frequent release of the hormones (prolactin, growth hormone, ACTH) which are necessary to maintain and stimulate milk synthesis.

3. How much increase can be expected and which cows will benefit most from 3X milking?

Factors to correct 3X records to 2X equivalent have been in use for a number of years. The reciprocals of these factors give the expected increase from milking 3X for cows of different ages and milked 3X for different durations (table 1). The factors indicate a 15-20% increase in production for cows milked 3X for the entire lactation.

One California study compared 3X and 2X production. Cows were paired on the basis age and season of calving. The control group was milked 2X the entire lactation. Cows in the test group were milked 3X for periods varying from 2 to 9 months and 2X the rest of the time. Results (table 2) show a 16.6% advantage for 3X including all cows in the study.

A study from New England reported recently in Hoard's Dairyman compared 2X and 3X milking. Cows were started on 2X milking then changed to 3X. Actual 3X production was compared to "expected" 2X production on two monthly test days following the switch-over. The results indicated a 10-12% difference for two-year olds and 6-7% increase for cows in second or later lactation (table 3).
USDA researchers at Beltsville have studied effects of 3X milking in early lactation. Three milking schemes were compared in a preliminary study: 1) 2X for the entire lactation 2) 3X until production dropped below 53 pounds (at least 45 days 3X and no more than 150 days) and 3) 3X until production dropped below 68 pounds (not less than 45 and no more than 150 days 3X). The 2X milking intervals were 10 and 14 hours. The 3X intervals were 10, 8 and 6 hours.

Cows in the 3X-53 group stayed on 3X for an average of 143 days. Cows on 3X-68 averaged 93 days on 3X milking. Results (table 4) indicate an 8% increase for cows milked 3X-53 and 5.5% for cows on the 3X-68 scheme. Table 5 shows the effect of switching cows from 3X back to 2X milking. Figure 1 shows a graph of the experiment's results.

Arizona has major interest in 3X milking. About 30% of the cows on DHIA in the state are currently being milked 3X. A comprehensive study of 3X milking, its costs and returns is underway. Preliminary data indicate about 17% increase in production with 7-8% required to break-even. Of all herds on 3X, 8% is the smallest increase yet observed. The majority of the increase has been apparent in 10 days. Accompanying increase in feed intake is averaging about 5% (net energy basis).

4. Should cows be milked 3X for the entire lactation?

I don’t think we can answer this question fully. I have talked with many people who feel that switching cows from 3X to 2X causes them to produce at a level below where they would if milked 2X for the entire lactation. The Arizona workers feel this way. I am still unsure.

5. Will it pay dollars to milk 3X?

Yes, for some but not for all. The data indicate that not much response will be realized until after the peak of lactation and therefore switching back to 2X too early or at too high a level may be counterproductive.

In summary we can say that:

1. 3X milking does increase production;
2. feed efficiency is improved with 3X milking;
3. 3X milking is not a cure-all - it will not improve poor management but requires better management;
4. higher producing cows will show greater response although data indicate that the percentage increase is not different;
5. two-year olds may show greater response than older cows of equal production;
6. we are not sure whether 3X milking will show its greatest benefit if practiced throughout the entire lactation, only in early post-peak or during late lactation when persistency declines greatest.
### Table 1. DHIA FACTORS FOR PREDICTING 3X PRODUCTION FROM 2X.

<table>
<thead>
<tr>
<th>DAYS MILKED</th>
<th>AGE AT CALVING</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>36 MOS.</td>
</tr>
<tr>
<td>3X</td>
<td></td>
</tr>
<tr>
<td>90</td>
<td>1.053</td>
</tr>
<tr>
<td>120</td>
<td>1.072</td>
</tr>
<tr>
<td>150</td>
<td>1.092</td>
</tr>
<tr>
<td>180</td>
<td>1.111</td>
</tr>
<tr>
<td>240</td>
<td>1.155</td>
</tr>
<tr>
<td>305</td>
<td>1.205</td>
</tr>
</tbody>
</table>

K.R. Butcher, DRPC at Raleigh, N.C.

### Table 2. 3X VS. 2X MILK AND FAT PRODUCTION

<table>
<thead>
<tr>
<th>LACTATION NO.</th>
<th>3 OR MORE</th>
<th>ALL</th>
</tr>
</thead>
<tbody>
<tr>
<td>TEST DAY COMPARISONS</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>3X MILK (lbs./day)</td>
<td>64.00</td>
<td>74.70</td>
</tr>
<tr>
<td>2X MILK (lbs./day)</td>
<td>54.50</td>
<td>64.30</td>
</tr>
<tr>
<td>INCREASE</td>
<td>9.50</td>
<td>10.40</td>
</tr>
<tr>
<td>% INCREASE</td>
<td>17.40</td>
<td>16.20</td>
</tr>
<tr>
<td>3X FAT (lbs./day)</td>
<td>2.23</td>
<td>2.56</td>
</tr>
<tr>
<td>2X FAT (lbs./day)</td>
<td>2.19</td>
<td>2.39</td>
</tr>
<tr>
<td>INCREASE</td>
<td>.34</td>
<td>.37</td>
</tr>
<tr>
<td>% INCREASE</td>
<td>18.00</td>
<td>16.90</td>
</tr>
</tbody>
</table>

CALIFORNIA STUDY 1978.
Table 3. COMPARISON OF 3X PRODUCTION TO "EXPECTED" 2X PRODUCTION.

<table>
<thead>
<tr>
<th>State of Lactation</th>
<th>First Lactation</th>
<th>Second and Later Lactation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>First Sample</td>
<td>Second Sample</td>
</tr>
<tr>
<td>Very Early</td>
<td>6.4 lbs</td>
<td>6.7 lbs</td>
</tr>
<tr>
<td>Early</td>
<td>5.4</td>
<td>6.7</td>
</tr>
<tr>
<td>Mid</td>
<td>5.1</td>
<td>4.3</td>
</tr>
<tr>
<td>Late</td>
<td>3.5</td>
<td>5.5</td>
</tr>
<tr>
<td>Average</td>
<td>5.1</td>
<td>5.8</td>
</tr>
<tr>
<td>%</td>
<td>+10.0</td>
<td>+12.2</td>
</tr>
</tbody>
</table>

Hoard's Dairyman 2/25/78

Table 4. THREE-TIMES-A-DAY MILKING STUDY (CUMULATIVE MILK YIELDS AT VARIOUS STAGES OF LACTATION)

<table>
<thead>
<tr>
<th>No. of Days</th>
<th>2X</th>
<th>3X&lt;sub&gt;50&lt;/sub&gt;</th>
<th>3X&lt;sub&gt;60&lt;/sub&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>lbs</td>
<td>lbs</td>
<td>lbs</td>
</tr>
<tr>
<td>56</td>
<td>Milk yield 3672</td>
<td>3722</td>
<td>3725</td>
</tr>
<tr>
<td></td>
<td>Milk discarded 211</td>
<td>194</td>
<td>304</td>
</tr>
<tr>
<td>154</td>
<td>Milk yield 9273</td>
<td>10091</td>
<td>9746</td>
</tr>
<tr>
<td></td>
<td>Milk discarded 733</td>
<td>317</td>
<td>480</td>
</tr>
<tr>
<td>180</td>
<td>Milk yield 10562</td>
<td>11552</td>
<td>11103</td>
</tr>
<tr>
<td></td>
<td>Milk discarded 840</td>
<td>378</td>
<td>596</td>
</tr>
<tr>
<td>280</td>
<td>Milk yield 14223</td>
<td>15367</td>
<td>15006</td>
</tr>
<tr>
<td></td>
<td>Milk discarded 977</td>
<td>422</td>
<td>697</td>
</tr>
</tbody>
</table>

Increase over 2X milking: 1147 lbs, 785 lbs

R.E. Pearson. USDA, Beltsville

-50-
Table 5. THREE-TIMES-A-DAY MILKING - AVERAGE MILK YIELD BEFORE AND AFTER CHANGE FROM 3X TO 2X.

<table>
<thead>
<tr>
<th>Item</th>
<th>3X 55</th>
<th>3X 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 days before change</td>
<td>59.6</td>
<td>64.2</td>
</tr>
<tr>
<td>Day after change</td>
<td>46.0</td>
<td>48.0</td>
</tr>
<tr>
<td>Days 2 and 3 after change</td>
<td>55.7</td>
<td>59.8</td>
</tr>
<tr>
<td>Days 4 to 7 after change</td>
<td>55.9</td>
<td>59.5</td>
</tr>
<tr>
<td>Days in milk at change</td>
<td>143</td>
<td>93</td>
</tr>
</tbody>
</table>

R.E. Pearson, USDA, Beltsville.

FIGURE 1

R.E. Pearson, USDA, Beltsville
<table>
<thead>
<tr>
<th>Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abbitt, Bruce</td>
<td>Box J136 VMTH University of Florida Gainesville, FL 32611</td>
</tr>
<tr>
<td>Acree, James A</td>
<td>8601 Acree Rd. Jacksonville, FL 32219</td>
</tr>
<tr>
<td>Allen, Stanley D.</td>
<td>P.O. Box 138 Penny Farms, FL 32079</td>
</tr>
<tr>
<td>Amiel, Donald K.</td>
<td>Jamaica Livestock Assn. P.O. Box 36 Kingston, Jamica</td>
</tr>
<tr>
<td>Arnold, G. Dan, Jr.</td>
<td>1642 Doanld St. Jacksonville, FL 32205</td>
</tr>
<tr>
<td>Aprile, Jimmie V.</td>
<td>5701 15th St. Tampa, FL 33610</td>
</tr>
<tr>
<td>Bailey, John M.</td>
<td>Rt. 6, Box 271 Jacksonville, FL 32223</td>
</tr>
<tr>
<td>Baker, Joe B.</td>
<td>Rt. 3, Box 585 Sanford, FL 32771</td>
</tr>
<tr>
<td>Baker, Stephen N.</td>
<td>Rt. 3, Box 585 Sanford, FL 32771</td>
</tr>
<tr>
<td>Bassett, Wimer W.</td>
<td>P.O. Box 172 Monticello, FL 32344</td>
</tr>
<tr>
<td>Bassett, William F.</td>
<td>Rt. 1, Box 223A-1 Century, FL 32535</td>
</tr>
<tr>
<td>Benecke, Thomas L.</td>
<td>170 Viking Ct. Apt. 2 Athens, GA 30605</td>
</tr>
<tr>
<td>Benson, Robert W.</td>
<td>4285 Memorial Suite J Decanter, GA 30032</td>
</tr>
<tr>
<td>Bishop, Carl</td>
<td>Bishop's Dairy P.O. Box 119 Florida, FL 33857</td>
</tr>
<tr>
<td>Bishop, L. Donald</td>
<td>Bishop's Dairy P.O. Box 119 Florida, FL 33857</td>
</tr>
<tr>
<td>Bispham, Cy</td>
<td>Rt 1, Box 85A Sarasota, FL 33583</td>
</tr>
<tr>
<td>Bispham, Paul J.</td>
<td>Rt. 1, Box 85-A Sarasota, FL 33583</td>
</tr>
<tr>
<td>Black, John</td>
<td>513 E. Avenida Clewiston, FL 33440</td>
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<tr>
<td>Blackadar, Vernon E.</td>
<td>Rt. 1, Box 148 Lithia, FL 33547</td>
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<td>Bogg, John P.</td>
<td>3105 NW 4th Terr Gainesville, FL 32601</td>
</tr>
<tr>
<td>Bond, Michael J.</td>
<td>Rt. 2, Box 33-1 Monticello, FL 32344</td>
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<tr>
<td>Name</td>
<td>Address</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Bongers, Bart</td>
<td>Rt. 1, Box 192</td>
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<tr>
<td></td>
<td>Alachua, FL 32601</td>
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<tr>
<td>Boosinger, Jay B.</td>
<td>213 Mill Branch</td>
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<tr>
<td></td>
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<tr>
<td>Bouchard, Joseph G</td>
<td>5603 42nd St.</td>
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<tr>
<td></td>
<td>East Bradenton, FL 33505</td>
</tr>
<tr>
<td>Bowon, Kent</td>
<td>Rt. 2, Box 457</td>
</tr>
<tr>
<td></td>
<td>Okeechobee, FL 33472</td>
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<tr>
<td>Boyd, J. Bruce</td>
<td>P.O. Box 13504</td>
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<tr>
<td></td>
<td>Orlando, FL 32809</td>
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<tr>
<td>Brenneman, John S.</td>
<td>P.O. Box 50</td>
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<tr>
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<td>Bartow, FL 33830</td>
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<tr>
<td>Brewer, Larry E.</td>
<td>1509 Harris Rd.</td>
</tr>
<tr>
<td></td>
<td>Lawrenceville, GA 30245</td>
</tr>
<tr>
<td>Brown, William A</td>
<td>2308 Hampshire Way</td>
</tr>
<tr>
<td></td>
<td>Tallahassee, FL 32308</td>
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<tr>
<td>Buckler, Joseph R.</td>
<td>4520 Old Tampa Rd</td>
</tr>
<tr>
<td></td>
<td>Lakeland, FL 33803</td>
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<tr>
<td>Burnett, Del W.</td>
<td>540 So Pearl St.</td>
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<td></td>
<td>Versailles, Ohio</td>
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<tr>
<td>Burnham, Aubrey L.</td>
<td>419 SE 5th Ave.</td>
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<td></td>
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<tr>
<td>Butler, Robert L.</td>
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<tr>
<td>Carey, Michael J.</td>
<td>2517 W. Brandon Blvd.</td>
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