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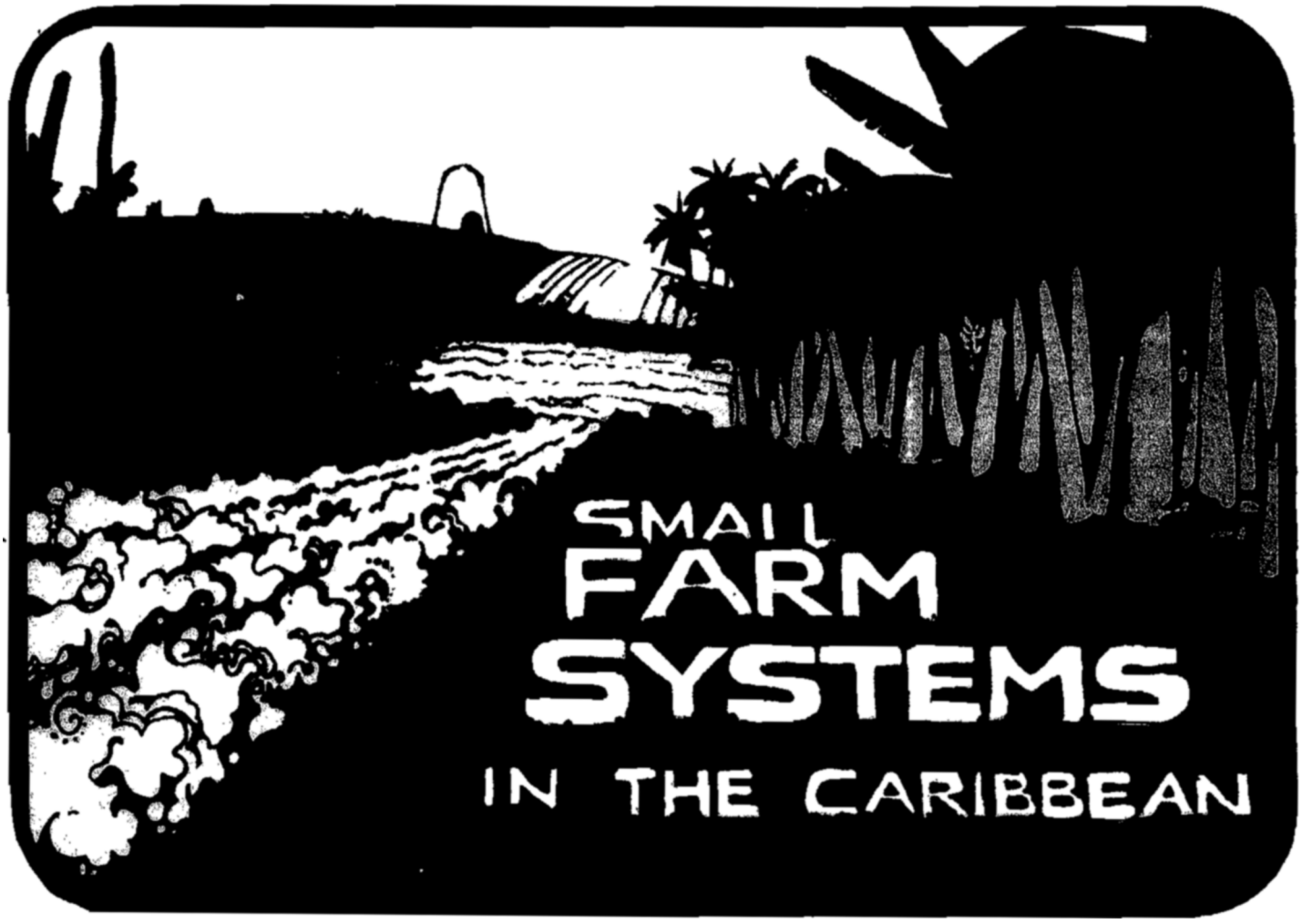

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Integrated Dairy Management for the Caribbean

Charles D. Gibson
Department of Large Animal Clinic Sciences
Michigan State University, East Lansing, MI

Harold Hupp
College of the Virgin Islands
St. Croix, U.S. Virgin Islands

Dairy production in the eastern Caribbean is severely limited by environment, animal production units, lack of knowledge and marketing systems. The U.S. Virgin Islands import 50% of the fluid milk requirements and all of the milk product requirements, resulting in economic hardship. Low production and infertility as identified by DHIA records account for the low milk yield, (3,650-7,848 lbs/cow/year in 1981). An evaluation made in 1982 revealed problems of nutritional deficiency, leptospirosis and infertility. Improvements in milk production and reproduction were seen as a result of changes in management and immunization recommendations (413,002 lbs of milk increase, 1.1 month decrease in calving interval in 1983). These improvements resulted in $148,875 increase in gross revenue. A major Caribbean dairy management research study is being developed using the St. Croix dairy cooperative herds as a model to study the problems of milk production in the Caribbean. The major components of this study are nutrition, genetic improvement, herd health programs, forage development, and water conservation.
Keywords: Dairy, herd health, reproduction, energy, phosphorus.

The agricultural industry on St. Croix represenrs the eastern Caribbean region in environment, forage development, and topography and is quite advanced in dairy technology as noted by a modern processing plant and computer production and health records in the form of Dairy Herd Improvement (DHIA) and Food Animal Health Records (FAHRMX). The dairy producers in St. Croix are beset by the same problem of low production seen in the rest of the Caribbean (Craig, 1983). The causes for this deficit are multiple and additive in nature, resulting in very low milk production and very inefficient reproduction. Cattle populations of the eastern Caribbean suffer from disease and parasite problems common to all tropical areas and require well-defined health programs (IICA/IBA, 1981). In addition, genetic improvement is lacking becasue artificial inseminarion has not been used ro any extent in this region (Everson et al., 1982). The result of disease problems, genetic deficiency, and lack of adequate nutrition is a dairy industry unable to provide fluid milk and milk products adequate to the needs of the population.

The problems of low milk production and infertility in the dairy herds of St. Croix resulting in milk production levels between 3,650 lbs and 7,848 lbs/cow/year prompted Dr. Hupp of the College of the Virgin Islands to request assistance from Michigan State University in 1982. Problems of infertility and nutritional deficiency were revealed by clinical and laboratory findings. As a result of these findings, some changes were made in disease control, breeding practices, and nutrition. This resulted in an increase in milk production of 770 lbs of milk/cow/year average and improved reproduction in the form of a reduction in the calving inrerval of 30 days in 1983. This improvement in dairy production, although inadequare to resolve the deficit, demonstrated the urgent need for a conrrolled, well organized, comprehensive study of the problems of dairy production in the Caribbean.

A five-year research proposal has been prepared by Dr. Charles Gibson of Michigan State University and Dr. Harold Hupp of the College of the Virgin Islands entitled "Inregrated Dairy Management for the Caribbean." This study is designed to evaluate the roles and interactions of nutrition, genetics, disease conrrol, forage development and warer management on improvement of dairy production in the Caribbean.

MATERIALS AND METHODS

1982 situation:

The five dairy herds providing milk ro the St. Croix Dairy Products Inc. processing plant contained the approximarely 600 cows involved in this srudy. The cows involved are primarily holstein with some jersey and a few one-half senepol holstein animals involved in the milking strings.

The breeding program consisted of using holstein bulls to breed the holstein cows and jersey bulls for rhe jersey cows in a pasture mating situarion. The senepol bulls were used as backup cleanup bulls when the problem of infertility became acute. Periodic veterinary examinarions were performed ro verify pregnancy and diagnose problem animals.

Disease conrrol consisred of tick conrrol by periodic dipping of cows with organophosphates and sporadic vaccination with infectious bovine rhinorracheitis (IBR), 5-way leptospira, and clostridial vaccines.

The nurrition program consisred of a complete pelleted feed and pasture with some fresh chopped maize forage. The cows were fed 25 lbs of the complere pellet while they were being milked in rhe parlor.

RESULTS AND DISCUSSION

Two major problem areas were revealed by the indepth evaluation in 1983. These were nutritional deficiency and leptospirosis.

The nutritional problems were as follows. Energy deficiency was one of the major problem areas as nored by laborarory analysis (Table 1). The energy requirement would be met for 50 lbs of milk provided the cow was allowed to eat 25 lbs of pellet. It was questionable rhar this was happening since the only exposure ro rhe pellet was during the milking process in the parlor. The recommendarion was made ro allow access to pelleted feed additional periods of time to allow greater intake by the cows producing 50 lbs or more of milk. It was further advised to feed additional pellets at the rate of 5 lbs of pellet/10 lbs of milk over 50 lbs of milk produced to provide energy necessary to maintain a posirive energy balance. A posirive energy balance has been shown to be essential to maintain high milk production (Hillman et al., 1975). It has been shown that it is almost impossible to mainrain a positive energy intake in cows ar peak lacration using

corn as the energy source since the limiting factor is dry matter intake. Dry matter intake may have been the limiting factor in these cows since they were on a full feed of guinea grass pasture prior to pellet feeding.

Phosphorus was also determined to be a deficiency in the dry cow ration since these animals were not given any mineral or pelleted feed. The guinea grass pasture was shown to be deficient in phosphorus as well as calcium, protein, energy and total digestible nutrients (Table 2).

Recommendation was given to feed 8 lbs of the complete pellet to the dry cows on pasture to correct the energy and phosphorus deficiency.

TABLE 1. Lactation ration.

1000 lbs	TDN(lb)	Net Energy	Protein	Ca(lbs)	Phos(lbs)
Maintenance	7.5	8.3	1.3	.04	.03
50 lbs 4% Milk	16.5	16.5	3.9	.14	.1
	24.0	24.8	5.2	.18	.13
50 lbs grass 35% dry matter	8.5	5.74	1.2	.013	.012
	-15.95	-20.06	-4.1	-.165	-.111
25 lbs pellet	20.5	19.75	5.5	.5	.2
	+4.55	-.31	+1.4	+3.35	+.089
requirement/10 lbs milk over 50 lbs	3.05	3.1	.74	.026	.019

TABLE 2. Dry cow requirement (last 2 months of pregnancy).

1320 lbs	TDN(lb)	Net Energy Kcal	Protein (lbs)	Ca(lbs)	Phos(lbs)
Maintenance & pregnancy	12.3	13.5	1.6	.07	.06
50 lbs 35% DM guinea grass	10.8	7	1	.06	.03
Deficit	-1.5	-6.5	-.6	-.01	-.03
8 lbs pellet/day	6.6	6.34	1.8	.16	.06

Reproduction problems were apparent in all five herds examined. Fertility examination of the holstein bulls used in the breeding programs revealed a serious deficiency in sperm quality of most of the bulls (Cates et al., 1976). The etiology was complex in nature. The scrotal size was adequate and the libido was good, but the sperm cell concentration, motility and morphology were seriously deficient in most of the holstein bulls. In contrast, most of the senepol bulls examined had excellent semen quality. It was very obvious that a breed difference exists in terms of adaptation and nutritional efficiency between the holstein and the senepol breeds since the two breeds were used in an identical manner in regard to nutrition and breeding environment. The holstein bulls were being used in pasture mating situations without grain or supplement feeding. They obviously could not successfully breed cows continually without ration and test. They also required additional nutrients and energy.

The infertility in the cows was caused in part by nutritional deficiency, especially phosphorus deficiency. Deficiency in phosphorus has been shown to cause infertility as exhibited by retained placenta, metritis, repeat breeders, and anestrus. The infertility in these herds, as exhibited by repeat breeding and metritis, caused the bulls to work excessively hard due to the large numbers of females returning to estrus instead of becoming pregnant. The breeding failures compounded the fertility problems of the holstein bulls who were marginally fertile due to inadequate nutrients (Morrow, 1980, 1969).

Leptospira harjo was incriminated in infertility in one of the herds. Serological tests revealed high titers to this organism (1:800) in several cows who were showing clinical signs of early embryonic death and repeat breeding. These animals were not vaccinated with Leptospira vaccine. Therefore, although the single high titer is not conclusive, it is good evidence of an ongoing infection with this organism. Vaccination programs were advised to correct the problem (Hanson, 1980).

Herd health program changes were recommended by the visiting consultant to comprehensively deal with the multifaceted dairy production problem in the dairies of St. Croix. They are as follows:

Reproduction:

1. Veterinary examination at two to four week intervals.
2. Cows to be examined:
   a. All open cows once/month.
   b. Examine for pregnancy at 35 days post-breeding and re-examine at 70-90 days of pregnancy.
   c. All problem cows; *e.g.* merritis, pyometra, cystic ovaries.
   d. All post-partum cows 15-30 days post-calving.
3. One fertile bull/25 open cows.
4. Individual cow records—written or computer.
5. Fertility check bulls—prior to first use and annual recheck.
6. Culture all bulls for Vibrio fetus and Trichomonas.
7. Initiate artificial insemination using positive P.D. holstein bulls on all cows the first 90 days of lactation or first 3 breedings.

Immunizations:

1. Leptospirosis—5-way vaccine to all breeding animals 12 months and older. Vaccinate all breeding animals including bulls annually.
2. Infectious Bovine Rhinotracheitis—annual to all animals beginning at five months of age.
3. Vibriosis—twice to heifers prior to breeding age and to all breeding animals annually.
4. Oprional—Bovine Virus Diarrhea and Closrridium vaccine.

Nutrition:

1. Feed and forage analysis four times/year.
2. Eighty grams phosphorus intake/lactating cow/day. Forty grams phosphorus intake/dry cow/day.
3. Challenge feed the high producing cows for the first 90 days of lactation—2.5 lbs corn or corn equivalent for 5 lbs milk.
4. Good quality mineral mix with Se added fed free choice to all animals on pasture including bulls.
5. Supplement all growing and breeding bulls with 5-8 lbs/day of complete pellered feed or grain with mineral.

Parasite Control:

1. Dip or spray for external parasites every 2-4 weeks depending on season or chemical.
2. Deworm all young animals every three months.

Mastitis Control:

1. Dry cow treatment at dry off time.
2. Teat dip after milking.
3. Use individual towels.
4. Use strip cup prior to milking.
5. Equipment evaluation every six months—vacuum test, liners and pump.
6. Somatic cell count of bulk tank monthly.

Summary of St. Croix Dairies Work

A milk production two year comparison was done for the four herds on DHIA records between the years 1981-82 and 1982-83 (Table 3). The total cows, average cows/herd, and percent cows in milk remained the same, but the rolling herd average (average milk/cow/year) increased by 772 lbs. The ner dollars over feed cost was esrimated to be $86,730 based on a $21.00/100 milk market price.

TABLE 3. Milk production summary.

		March 1981-March 1982	March 1982-March 1983
4 herds	total cows	533	537
	average no. cows/herd	133.4	134.5
	% cows in milk	69.8%	70.5%
	total milk diff, 1981-83	413,002 lbs	
	Net $ over feed cost	$86,730	

The reproduction comparison between 1981-82 and 1982-83 is shown in Table 4. The total number of cows remained the same over the 2 years of the comparison, but the calving interval (CI) was reduced by an average of 1.13 months or 32 days. A 13-month calving interval is considered to be a reasonable goal for dairy cows with production records of under 20,000 lbs of milk/year. A $3.00/day loss for every day over 13 months CI is considered by economists to be appropriate. The total dollar savings is estimated to be approximately $62,145 for the four herds on DHIA records. The CI for these herds on St. Croix is considerably longer than the optimal 13 months. There are several reasons for this problem which is depressing the milk production of the cows in these herds. The culling rate for infertility is low because of the high incidence of infertile cows and the delay in achieving pregnancy. Cows are kept in the milking herd after they are not profitable in order to maintain cow numbers since native replacement heifers numbers are not sufficent to replace the low production cows. Imported replacement heifers are expensive and are not adapted to the environment if imported from the U.S. Therefore, the native replacement heifer supply is a limiting factor in the culling process. Improved fertility rates by disease control, good nutrition, and improved management techniques will allow a more aggressive and realistic culling rate. Culling of low production and infertile cows and widespread use of artifical insemination to introduce new genetics will have immediate posirive impact on milk production and reproduction.

TABLE 4. Production summary.

4 herds 1981-83

Herd#	Total Cows		Calving Interval		Days Open		Diff (Days)	$/cow/year	Total $*
	81-82	81-82	81-82	81-82	81-82	81-82			
1	109	104	15.1	14.6	178	163	15	$ 45	$ 4,680
2	221	22	17.7	15.6	257	196	61	$183	$41,175
3	69	68	16.4	15.2			32	$108	$ 7,344
4	134	142	17	16.3	236	215	21	$ 63	$ 8,946
Average change			1.13				29		$62,145

* The dollar value is based on $3/day over 13 months calving interval.

Future Plans

A five year research proposal, if funded, will employ the multiphased research/demonstration approach to the complex problem of inadequate dairy production in the Caribbean. It will utilize five dairy units on St. Croix to model actual field production conditions, but under a controlled test situation. The use of this model will validate the usefulness and reproducibility of the results obtained. Demonstration herds will be established throughout the Caribbean region to provide application and implementation of new techniques and knowledge gained from the controlled study on St. Croix.

The overall objective of this project is to develop and test management and technology alternatives ro increase dairy production in the Caribbean in a cost-effective, sustainable manner.

Objectives:

1. Test the production potential of existing dairy stock through managed energy feeding and challenge feeding trials.
2. Identify genetically superior alternatives for cost-effective tropical dairy production animals through arrificial insemination, crossbreeding, and embryo transfer techniques. Explore long-term feasibility of above techniques with exisring management and infrastructure conditions in the Caribbean region.
3. Minimize reliance on imported feedstuffs by identifying forage varieties as alternatives to improve the grasses and legumes available for dairy nutrition.
4. Explore water catchment, storage and irrigation methods to stabilize water supplies for crop forage production.

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