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FOOD & FERTILIZER TECHNOLOGY CENTER

THE DAIRY INDUSTRY IN ASIA

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FOREWORD

Dairy production has risen rapidly in Taiwan and Japan over the last four decades, in response to a growing demand for fresh milk and dairy products. This development involved much dedicated effort by livestock specialists and dairy farmers, in order to adapt dairying to Asian conditions and achieve efficient production on relatively small land holdings. In the case of Taiwan, this also involved adaptation to a humid, subtropical climate. Their success can be seen by the fact that Taiwan's dairy farmers can now supply all Taiwan's fresh milk needs, while the milk yield per cow in Japan is one of the highest in the world. The two papers published in this Bulletin discuss the development of the dairy industry in Taiwan and Japan, respectively. They also discuss plans for future development, to help the domestic dairy industry survive under the threat of world trade liberalization.

Livestock production is becoming increasingly important in Asia, and is is the main source of income for hundreds of thousands of farmers. We hope this bulletin will be helpful to those working to develop a domestic dairy industry in Asian countries. Both papers were first presented by their authors at an international workshop on "*Development Approaches for Livestock Based Rural Enterprises*", held in the Philippines in May 1994. The workshop was co-sponsored by the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), and the Department of Agriculture of the Philippines.

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(Chinese Abstract) 摘　　要

雖然奶粉及其他乳製品的進口，台灣的乳牛產業能夠供給國內所需的鮮乳。在過去四十年，牛乳生產穩定成長，專斯丁乳牛是主要乳牛，平均一群大小是94頭。

(Japanese Abstract) 摘　　要

台湾の酪農業は国内の全鮮乳需要をみたしているが、粉ミルク及び各種乳製品は輸入にたよっている。過去40年間にわたって酪農生産は上昇を続けている。乳牛の大部分はホルスタイン種で飼育頭数の平均は94頭である。

(Korean Abstract) 초　　록

대만에서 낙농업은 주로 시제품 생우유 생산에 치중하고 있고 분유나 기타 유제품은 수입되고 있다. 지난 40여년 동안 대만 낙농업은 꾸준한 성장을 지속해온 바, 홀스타인이 그 대종을 이루고 있으며 그 평균사육두수는 94마리로 조사되었다.

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ABSTRACT

The dairy industry in Taiwan supplies all domestic fresh milk needs, although powdered milk and other milk products are imported. In the past forty years, dairy production has risen steadily. Holstein cattle are the major dairy breed, and average herd size is 94 head.

AGRICULTURE

Taiwan, R.O.C. is situated on the Tropic of Cancer in the Pacific Ocean, east of the Mainland China. It has a total area of 35,981 km², of which 26.4% is coastal plain, 26.9% is slopeland, and 46.7 is mountainous. The average farm size is 1.19 ha. Taiwan has an average temperature of 22.5 C, a yearly rainfall of 2,000 mm, and a total population of 21 million.

The livestock production in 1993 is shown below.

Over the past few decades, a large area of cultivated land in Taiwan has been used for industrial, commercial and housing purposes, so that the cultivated land area has become very limited. Intensive livestock production is an efficient way of utilizing a limited land area. In 1992, the livestock production value represented 32% of the total agricultural production value. The animal industry in Taiwan has become more important than ever before. Today, in addition to the promotion of production, the stabilization of supply and demand and the disposal of animal wastes are serious problems in Taiwan.

DAIRY INDUSTRY

Development of the Dairy Industry

The development of the dairy industry began in 1957, with the second four-year economic reconstruction project. To utilize

	No. (Head)	Annual Production	
Dairy cattle	93,537	246,281	mt (milk)
Beef cattle	64,333	5,324	mt
Pigs	9,754,460	13,310,000	head
Goats	201,833	34,449	head
Broilers	63,457,000	257,666,000	eggs
Layers	23,961,000	4,754,761,000	eggs
Ducks	12,063,000	38,794,000	head
Tsaiya (laying ducks)	2,565,000	391,648,000	eggs
Turkeys	267,000	543,000	head
Geese	2,305,000	5,683,000	head

Keywords: Dairy industry, Holstein, mastitis, milk production, milk yield, somatic cell count (SCC)

surplus labor in rural areas, 20 farming families who owned parcels of infertile slopeland in Northern Taiwan were encouraged to raise dairy cattle under a loan program sponsored by the government. Initially, each farmer raised only one or two imported Holstein dairy cows. These dairy farmers gained additional income from jobs off the farm. Later, other farmers also joined this program, and subsequently both the number of cattle and levels of milk production increased. In 1964, there were as many as 356 dairy farms that produced 11,283 mt of milk.

In 1965, the government opened the market to imported powdered milk. This had a big impact on the local dairy industry. Dairy plants found it no longer feasible to purchase fresh milk from local farmers. The dairy industry encountered its first crisis. The government issued guidelines and established the Taiwan Dairy Development Committee (TDDC) to save the dairy industry. An additional surcharge on imported dairy products was levied, and funds were allocated to the TDDC. These funds were used to reduce the price difference between local and imported milk. This policy helped the number of dairy farmers to increase to 1,290, and milk production rose to 41,879 tons.

Taiwan faced a second crisis in 1975, when frozen beef was imported. This led to a reduction of the income of dairy farmers from selling culled cattle and calves, and the cost of milk production went up. Many farmers gave up dairying. To solve this problem, the TDDC discussed with both milk plants and farmers an increase in the price of fresh milk. A higher guaranteed price helped the dairy industry to restore its position. In 1981, the number of dairy farmers was only 699, but milk production went up to 50,154 tons.

Since 1981, dairy farming has been practiced as a full-time occupation. Infrastructure, and the relationship between farmers and milk processing plants, also improved. In May 1981, the government passed the "Policy Measures for Raising Cattle", which gave the highest priority to dairy cattle, followed by beef cattle. The dairy industry was considered to be one of the focal development industries. In 1993, although the number of dairy farmers remained at only 1,063, the number of dairy cattle increased to 100,392 head, with an average herd size of 94 head, and total milk production went up to 278,472 tons.

MAJOR DAIRY PROGRAMS

Breeding

There are no native dairy cattle breeds in Taiwan, and Holstein cattle from Australia were introduced in 1957. Breeding was conducted to improve their performance and adaptation to Taiwan's subtropical conditions. Tests of both purebreds and crossbreds were conducted. It was observed that the performance and adaptability of Holstein purebreds were better than those of the crossbreds. Thus, Holstein cattle were recognized as the sole dairy breed in Taiwan.

Dairy Herd Improvement

The dairy herd improvement (DHI) program was introduced from the United States 15 years ago. At present, a total of 14 supervisors are employed by research stations and farmers' associations. They visit DHI farms once a month to collect herd management records on cattle pedigrees, reproduction, calving, diseases, and feed. Milk yield is measured, and samples of the milk of individual cows are taken. The milk samples and record sheets are sent to a central laboratory for further analysis. The central laboratory tests the milk components, including fat content, protein, total solids, and somatic cell count (SCC). The management and milk test reports are returned to dairy farmers within seven days, to help them make management decisions and genetic evaluation.

In 1993, there were a total of 7,908 milking cows in 183 herds under the DHI program, representing 17% of Taiwan's total herds. The average DHI herd size was 43 milking cows. Their genetic improvement records are presented in Tables 1 to 6.

Forage Supply

The most important types of local forage are Pangola grass, Napier grass and corn silage. In recent years, farmers have been eager to enlarge the size of their herds, but there has not been enough local forage. In

Table 1. Taiwan DHI records from 1981 to 1993

	1981	82	83	84	85	86	87	88	89	90	91	92	93
Herds enrolled	344	396	391	381	414	345	215	175	189	210	160	177	183
Total no. of cows	3250	4293	4878	4902	5546	5448	3660	3740	3920	5124	5115	6539	7908
305 2x-ME milk yield (kg)	5308	5634	5689	5437	5480	5283	5798	5862	5941	6135	6258	6364	6368
305 2x ME milk fat yield (kg)	168	180	176	177	166	171	197	199	204	207	225	229	250
Dairy milk cow (kg)	15.1	15.3	14.6	14.6	15.0	14.3	15.7	16.0	16.3	17.1	18.3	19.1	19.5
Av. herd size	9.4	10.7	12.5	12.9	13.4	15.8	17.2	18.4	20.4	23.2	31.9	36.9	43.2

Table 2. Monthly milk components and SCC from July 1992 to June 1993

Month	No. of Cows	Dairy milk yield	SCC (x 1000/cc)	Fat (%)	Protein (%)	Total solids (%)
1992						
July	7328	17.30 • 0.08	690.49 • 17.42	3.80 • 0.01	3.18 • 0.01	12.45 • 0.01
Aug.	7460	17.09 • 0.08	761.97 • 28.71	3.73 • 0.01	3.19 • 0.01	11.96 • 0.01
Sept.	7473	17.79 • 0.08	740.49 • 18.57	3.77 • 0.01	3.19 • 0.01	12.04 • 0.02
Oct.	8088	19.01 • 0.09	723.08 • 17.83	3.71 • 0.01	3.21 • 0.01	12.14 • 0.01
Nov.	7130	20.42 • 0.01	605.21 • 14.58	3.66 • 0.01	3.20 • 0.01	12.11 • 0.01
Dec.	7920	20.81 • 0.09	543.01 • 17.05	3.62 • 0.01	3.14 • 0.00	11.86 • 0.01
1993						
Jan.	7391	21.15 • 0.09	457.66 • 16.84	3.67 • 0.01	3.20 • 0.01	12.94 • 0.01
Feb.	8322	21.01 • 0.09	484.92 • 13.11	3.60 • 0.01	3.64 • 0.01	12.73 • 0.01
Mar.	8554	20.96 • 0.09	480.70 • 18.25	3.69 • 0.01	3.70 • 0.00	12.78 • 0.01
Apr.	8597	20.75 • 0.08	512.24 • 16.82	3.61 • 0.01	3.18 • 0.02	12.09 • 0.02
May	8661	19.43 • 0.08	585.49 • 13.49	3.70 • 0.00	3.14 • 0.01	12.78 • 0.01
Jun.	7906	18.77 • 0.08	629.13 • 16.31	3.74 • 0.01	3.14 • 0.01	12.02 • 0.02
Average	7902	19.50 • 0.09	600.27 • 17.42	3.69 • 0.01	3.26 • 0.01	12.33 • 0.01

Note: Means • S.E.

Table 3. Monthly distribution of somatic cell counts in DHI herds, July 1992 to June 1993

Grade	SCC (x 1000)	Ideal value in tropics	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
0	0-18	11	3.2	3.8	4.9	6.1	8.5	5.0	5.0	5.8	5.5	5.2	3.8	3.9
1	19-35	16	6.8	7.7	6.7	9.3	10.9	9.6	9.7	9.6	9.0	9.3	8.7	8.2
2	36-71	11	14.0	13.1	10.7	12.8	13.7	13.7	14.4	14.9	14.2	15.2	14.5	13.6
3	72-141	12	16.7	15.9	14.5	15.6	16.0	16.4	16.9	17.9	17.6	16.7	16.8	16.5
4	142-283	13	18.2	17.6	17.4	17.0	15.5	16.6	18.1	17.2	17.5	16.9	17.8	17.9
	Subtotal	63	58.9	58.1	54.2	60.8	64.7	64.8	64.0	65.5	63.9	63.2	61.6	60.1
5	284-565	11	14.7	14.4	15.6	13.7	12.8	13.4	14.3	12.6	13.7	13.5	15.2	15.0
6	566-1130	10	11.2	11.2	12.7	10.2	10.2	10.2	10.0	9.8	10.5	10.7	9.8	10.1
7	1131-2262	6	7.7	8.2	9.3	7.9	6.5	6.2	5.9	6.5	6.1	6.6	6.8	7.5
8	2263-4523	5	4.5	5.2	5.5	4.8	3.8	3.8	3.9	3.7	4.0	3.9	4.4	4.6
9	4524-9999	5	3.0	2.9	2.7	2.6	2.0	1.6	1.9	1.8	1.7	2.2	2.2	2.8
	Subtotal	37	41.1	41.9	45.8	39.2	35.3	35.2	36.0	34.5	36.1	36.8	38.4	39.9

SCC = Somatic Cell Count

Table 4. Comparison of somatic cell counts and production levels on DHI farms, July 1992 to June 1993

Production level (kg/year)	No. of herds	Average Somatic Cell Counts			
		Sept. (1992)	Oct. (1992)	Mar. (1993)	July (1993)
<5500	14	778 • 94	613 • 95	560 • 109	688 • 81
5501-6000	30	763 • 82	548 • 49	528 • 53	670 • 59
6001-6500	52	749 • 43	530 • 30	483 • 67	621 • 47
6501-7000	42	718 • 55	517 • 37	464 • 36	633 • 58
7001-7500	26	750 • 72	525 • 47	428 • 38	591 • 52
>7500	15	680 • 40	511 • 27	445 • 58	578 • 77
Average	179	740 • 18	534 • 17	480 • 18	629 • 16

Table 5. Average 305-2x-ME milk yield of DHI cows per lactation, July 1992 to June 1993

Lactation	No. of cows	%	Average 305-2x-ME milk yield
1	1641	23.11	6429 • 32
2	1921	27.88	6487 • 39
3	1275	17.96	6388 • 47
4	892	12.56	6393 • 50
5	699	9.84	6270 • 60
6	402	5.66	6290 • 90
7	167	2.35	6402 • 128
>8	104	1.46	6157 • 202
2.89 (Average)	7101	100.0	6386 • 18

Table 6. The reproductive efficiency of DHI cows, July 1992 to June 1993

Days open	No. of cows	%	Services/conception	No. of cows	%
<60	563	12.24	1	991	21.54
61-90	877	19.07	2	1156	25.31
91-120	800	12.39	3	1084	23.57
121-150	586	12.35	4	682	14.83
151-180	642	13.96	5	376	8.17
181-210	595	12.93	6	171	3.72
Over 211 days	539	11.72	Over 7	140	3.04
Average 156	4600	100	Average 2.9	4600	100

1981, the government carried out a "paddy field diversification" program, which converted rice fields to the production of other designated crops. Pasture forage crops were accepted as designated crops. In 1993, the forage area rose to 9,200 ha, supplying 70% of the forage needs of dairy farms. The rest was made up by imported alfalfa hay and Bermuda grass during the winter season. Therefore, this program simultaneously solved the problems of a shortage of forage paddy and an oversupply of rice.

Satellite Farms

To set up an efficient sales channel for milk, the government carried out a "satellite farm" project in 1986. Under this project, the government persuaded milk plants to cooperate with farmers. The volume and price of milk were decided by contract and revised annually. In addition, the plants assumed responsibility for providing farmers with extension advice.

Market Promotion of Milk

To increase milk consumption, the Milk Plants Association was entrusted by the government to promote dairy products. In 1988 under the program, various activities such as media advertisement, supply of milk to the military, schools and orphanages, and the promotion of yogurt, were carried out. The annual growth in milk consumption is steady at 12% to 16%. In view of this growth, dairy plants are willing to purchase a great deal of milk to meet market requirements.

Major Problems and Constraints

Although the dairy industry in Taiwan has been growing and prospering over the past few years, dairy farms still face some herd management problems. The impact of liquid milk importation will become more serious when Taiwan enters GATT. Other major problems include high raw milk costs, heat stress in cattle, waste pollution, a labor shortage, mastitis, and a milk surplus in winter.

Proposed Strategies

Looking back at the history of dairy development in Taiwan, we have solved several crises and kept the business in good shape. However, the industry will have to face trade liberalization in the near future. Therefore, strategies and policies should be renewed by the government. The proposed strategies for the dairy industry are as follows:

1. Farm management
   - Enlarging herd size to an economical scale.
   - Automation of feeding and milking.
   - Programs to reduce the cost of milk.
   - Strengthening dairy farmers' organizations.
   - Joint purchase of farming materials.
   - Integrating research projects.
   - Conducting a contract veterinarian system.
   - Increasing loans to farmers.

2. Milk marketing
   - Distinguishing the fresh and long-life milk markets.
   - Simplifying market channels.
   - Using large aseptic facilities to store surplus milk.
   - Promoting milk and yoghurt consumption

3. Administrative support
   - Amending present regulations governing the administration of the dairy industry.
   - Strengthening the fresh milk stamp program.
   - Adjusting the tariff on liquid milk
   - Adjusting the period during which importation of liquid milk is permitted.

CONCLUSION

In the long run, milk prices should be determined directly by supply and demand. The local dairy industry should concentrate on fresh milk and yogurt. To retain a steady market, the reduction of production costs and

simplification of market channels are important. It is believed that this goal can be realized by the joint efforts of farmers, milk processing plants and the government.

DISCUSSION

Dr. Lustria pointed out that Taiwan has a highly developed industrial economy, and dairy production is not part of the traditional agricultural economy. He asked whether Taiwan might consider importing dairy products, rather than producing them domestically. Dr. Wang answered that this is a matter of government policy. In 1965, Taiwan's dairy industry had its first crisis because of large imports of powdered milk. The economy at this time was not very strong, and to protect the dairy industry, the government decided to impose a levy on imports. The funds raised by this levy were used to extend or promote the consumption of other dairy products such as yogurt. In 1988, Taiwan stopped imposing this tariff to comply with GATT, although there is still a ban on the importation of fresh milk. Perhaps in 1995, Taiwan will have to open its domestic market to imported fresh milk.

Dr. Zainuddin asked the somatic cell count level at which milk is rejected. Dr. Wang replied that the somatic cell count is not yet included in milk assessment. Information on somatic cell counts in milk has been collected and analyzed for the past three years, and used to educate farmers. The somatic cell count will shortly be included as an item in milk assessment, and the maximum permissable somatic cell count will be set at 500,000. Milk with a count higher than this will be rejected. Dr. Wang added that the mastitis problem in Taiwan is very serious, especially in summer. If farmers are to improve this situation, they must change their production system, and the somatic cell count is a good way of ensuring that they do.

THE DAIRY INDUSTRY IN ASIA

B. JAPAN

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(Chinese Abstract)

摘　　要

日本牛乳事業在戰後呈現驚人的成長，但受到貿易自由化的影響，乳牛農場結構發生變化。牛乳產量由1972年4.8百萬公噸增加至1990年8.2百萬公噸，在日本每一乳牛牛奶生產量是全世界最高，然而，乳牛場數目，特別是乳牛數目少於十頭的小農農場數目明顯的減少。爲了牛乳產業的發展，新技術如何改善牛乳生產是急切需要的。

(Japanese Abstract)

摘　　要

日本の酪農業は戦後急速な発展を遂げたが、酪農家は現在急激な貿易自由化と構造変化に直面している。日本の生乳生産量は480万トン(1970年)から820万トン(1990年)に増加し、乳牛の乳生産レベルは世界でもトップクラスにある。しかし、酪農家数、特に飼養頭数が10頭以下の酪農家は急減した。日本の酪農業の発展のためには、生産性改善を目標にした新技術の導入が必要である。

(Korean Abstract)

초　　록

전후 일본의 낙농업은 매우 괄목할 만한 성장을 해 왔으나 최근의 수입개방에 따라 농가구조조정등의 변화를 겪고 있다. 우유생산은 1970-90년 기간동안 4.8백만톤에서 8.2 백만톤으로 약 두배의 양적 성장을 가졌으며 현재 두당 우유생산치는 세계 최고수준으로 알려져 있다. 현재 낙농가의 구조조정이 빠르게 진전되고 있는 가운데 사육두수 10두 이하의 농가수가 급격히 줄어들고 있다. 이와 같은 사육규모의 증가에 맞는 새로운 사육기술의 개발이 요구되고 있다.

THE DAIRY INDUSTRY IN ASIA

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ABSTRACT

The Japanese dairy industry achieved dramatic post-war growth, but it has been affected by rapid trade liberalization and structural changes on dairy farms. Milk production increased from 4.8 million tons in 1970 to 8.2 million tons in 1990. Milk yield per cow in Japan is the highest in the world. However, the number of dairy farms, especially small farms with less than ten head, has declined drastically. New technology for improved milk productivity is needed for the future development of the dairy industry in Japan.

INTRODUCTION

The Japanese livestock industry achieved dramatic post-war growth, as higher national income created an increased consumer demand for livestock products. In Japan today, the livestock industry is the most important agricultural sector in terms of gross agricultural output (Table 1). The gross output of the Japanese dairy industry increased rapidly up until 1980, but since then has remained constant. However, livestock production, including dairying, has been affected by a strong trend towards trade liberalization and structural changes on dairy farms, while consumer needs have become extremely diverse.

DAIRY FARMS IN JAPAN

The number of dairy farms in Japan has declined drastically in recent years (Table 2). The number of farms fell by half in a single decade, from 1980 to 1990, and this decline has since continued. The number of dairy cattle, 99% of which were Holstein, increased until 1980 and thereafter remained stable at 2.0 to 2.1 million head. This means that the number of cattle per farm has increased greatly, reaching 38 head in 1992. In 1970, farms with less than ten head constituted 67% of all dairy farms (Table 3). These had fallen to only 20% by 1992. On the other hand, farms with more than 30 head increased from 0.5% of all farms in 1970 to 37% in 1992.

The most dramatic change in the number of dairy cattle was in these farms with 30 head or more. Their total inventory increased from 340,000 head in 1975 to 1.43 million head in 1992, while the total number and percentage of dairy cattle on farms with less than 30 head declined. A similar trend took place in the United States, where the number of dairy farms fell from 444,000 in 1975 to 182,000 in 1991. A comparison of the dairy industry in Japan with that of the United States shows far more similarities than differences (Simpson and Blokland 1993).

MILK PRODUCTION AND SELF-SUFFICIENCY RATE IN JAPAN

Milk production in Japan increased from 4.8 million tons in 1970 to 8.2 million tons in 1990 (Table 4). The proportion of fresh milk in total milk production was fairly constant, at 58% in 1980 and 62% in the level of 1991. The level of self-sufficiency in milk and milk products was more than 80%

Keywords: Dairy industry, farm size, Japan, Hokkaido, mastitis, milk quality

Table 1. Gross agricultural and livestock output in Japan

Unit: billion yen (1 US$ = 110 yen)

	1970	1975	1980	1985	1990	1991
Gross output	4,551	9,051	10,262	11,630	11,493	11,455
Rice	1,735	3,466	3,078	3,830	3,196	2,920
Vegetables	701	1,467	1,904	2,110	2,588	2,771
Fruit and nuts	394	646	692	938	1,045	1,096
Livestock, total	1,012	2,340	3,068	3,169	3,084	3,106
Dairy cattle	291	566	809	888	906	895

Source: MAFF Statistics 1993.

Table 2. Number of dairy farms and dairy cattle in Japan

Unit: 1,000 head

	1970	1975	1980	1985	1990	1991	1992
No. dairy farms (x 1000)	308	160	115	82	63	60	55
No. dairy cattle (x 1000)	1,804	1,787	2,091	2,111	2,058	2,068	2,082
Lactating cows	885	910	1,066	1,101	-	1,082	1,081
Heifers (>2 year)	607	550	669	649	-	654	664
Number of cattle per farm (head)	6	11	18	26	33	35	38

Source: Livestock Statistics 1993.

Table 3. Number of dairy farms by size in Japan

	Number of cows per dairy farm					
	1 9	10 19	20 29	30 49	<50	Calves only
1970	207,010	28,289	5,085	1,216	378	65,580
1975	91,210	30,717	11,537	4,936	957	20,640
1981	44,400	22,930	13,500	12,000	3,140	9,980
1985	26,760	19,130	12,600	14,100	3,870	5,920
1991	13,650	12,160	10,100	13,780	6,300	3,330
1992	11,200	10,950	9,460	13,510	6,900	2,720

Source: Livestock Statistics 1993.

Table 4. Milk production in Japan, 1970 to 1991

Unit: 1,000 tons

	1970	1975	1980	1985	1990	1991
Raw milk production	4,.61	4,961	6,504	7,380	8,189	8,259
Fresh milk	2,623	3,130	3,988	4,307	5,060	5,092
Milk for processing	1,962	1,713	2,334	2,996	3,002	3,044
Self-sufficiency rate (%)	89	81	82	85	78	77

Source: MAFF Statistics, 1993

in 1985, 78% in 1990 and 77% in 1991.

There are no imports of fresh milk into Japan, but imports of butter, cheese, and other milk products have increased (MAFF 1993). Consumer's needs for milk and milk products have become more diversified, and consumers are more conscious of quality, safety, and freshness. Since milk production has often exceeded consumer demand during the past decade, dairy farmers have agreed to regulate the supply to match the demand. Today, the Japanese dairy industry faces rapid trade liberalization following the GATT agreement. Japanese dairy producers are afraid that there will be a rapid increase in the importation of milk and milk products.

THE CURRENT DAIRY INDUSTRY IN JAPAN

Japanese dairy production can be divided into two different areas according to the pattern of milk utilization. Dairy farms in Hokkaido, where there are cool temperatures throughout the year, produce processed milk products because of the long distance to urban markets. Dairy farms in the rest of Japan produce mainly fresh milk for drinking. In 1992, the prices for milk used for processing in Hokkaido were 20% lower than those for fresh milk for drinking (Livestock Improvement Association of Japan 1993).

In 1992, there were 13,900 dairy farms in Hokkaido (25.2% of the total number of dairy farms in Japan) and 908,000 head of dairy cattle (43.6% of Japan's total number) (MAFF 1993). The number of dairy cattle per farm in Hokkaido was 65 head, compared to 29 head in the other parts of Japan. The total area of fields growing forage was 36.7 ha per farm in Hokkaido 1992, but in other areas only 4.1 ha. Thus, dairy cattle management in Hokkaido is on a comparatively large scale, and is rather different from that found in the rest of Japan.

Trends in Milk Production

According to dairy herd improvement records, milk production per cow for a 305-day period in Japan increased from 5,826 kg in 1975 to 7,994 kg in 1992 (Table 5). During 1984 and 1993, 33 "supercows" produced a milk yield of more than 20,000 kg in 365 days, or 18,000 kg in 305 days. Milk fat increased from 3.6% in 1975 to 3.76% in 1992, although the calving interval did not improve.

These rapid improvements in milk yield and milk fat content in Japan's Holstein dairy cattle were the result of good breeding and feeding programs. Over the past ten years, of this annual increase in milk production, 46.6 kg is estimated to be the result of breeding improvements, while improved management contributed 109.6 kg for the first lactation and 147.7 kg in later lactations (Isogai *et al.* 1993). These values indicate that in these annual improvements, management had two to three times the effect of genetic improvement. The intake per head of feed concentrates increased from 1,889 kg in 1975 to 2,908 kg in 1992. The increase in the intake feed concentrates between 1975 and 1992 was higher than that of milk yield, which shows that the improvement in milk yield depended

on the increased use of feed concentrates.

With the exception of Hokkaido, heat stress in summer adversely affects milk production in Japan. Milk yield and milk composition, in terms of e.g. milk fat and protein content, often decline when mean monthly temperatures are above 22 C (Table 6). In July and August, when the mean monthly temperature is more than 26 C, the reduction is very marked (Kume *et al.* 1990). However, milk prices are high between July and November, since consumers often drink more milk during the summer. Thus, an improvement in milk yield and milk composition during the summer is very important for improved dairy cattle management in Japan.

Feeding System for Dairy Cattle

The yield of forage crops such as grass, corn and sorghum has not changed in Japan in recent years, but the production of concentrates for dairy cattle has increased (Table 7). In 1992 there were 528,400 ha of forage cultivated in Japan, with an average of 1.9 crops per year (MAFF 1993). Apart from Hokkaido, Italian ryegrass and corn or sorghum are the most common forage crops in Japan.

The Japanese livestock industry depends mainly on imported feed grains. Any change in international economic conditions, such as changes in the production level in foreign countries or in currency exchange rates, has a

Table 5. Milk yield per cow per 305-day period in Japan

	1975	1980	1985	1990	1991	1992
Number of cows (x1000)	7	98	211	262	282	283
Average milk yield per cow (kg)	5,826	6,339	7,008	7,798	7,781	7,994
Milk fat (%)	3.6	3.7	3.65	3.69	3.70	3.76
Intake of feed concentrates (kg)	1,889	2,029	2,478	2,807	2,833	2,908
Calving interval (days)	-	399	402	404	408	-

Source: Summary of dairy herd improvement records by year 1993

Table 6. Dairy milk production per cow in Japan (excluding Hokkaido), 1992

	Jan.	March	May	July	Aug.	Sept.	Nov.
Milk yield (kg/day)	23.90	24.30	24.50	23.70	23.03	23.60	24.00
Milk fat (%)	3.86	3.83	3.75	3.70	3.67	3.71	3.87
Milk protein (%)	3.15	3.12	3.10	3.06	3.05	3.10	3.20
Intake of feed concentrates (kg/day)	9.80	9.90	9.90	9.80	9.70	9.70	9.90
Body weight (kg)	606	609	611	607	604	602	603
Milk price	0.95	0.93	0.94	0.98	1.02	1.02	1.03

Source: summary of dairy herd improvement records by year 1993
1US$ = 99.9 yen

Table 7. Forage yield and concentrate production in Japan

Unit: 1,000 ha (mt)

	Grass		Corn		Sorghum		Concentrates for dairy cattle
	Area	Yield	Area	Yield	Area	Yield	
1987	828	(32,497)	127	(6,617)	37	(2,377)	(2,641)
1988	834	(31,722)	125	(6,201)	37	(2,462)	(2,765)
1989	835	(32,389)	126	(6,495)	37	(2,353)	(2,916)
1990	838	(34,060)	126	(6,845)	36	(2,323)	(3,004)
1991	842	(32,962)	124	(6,070)	36	(2,072)	(3,073)

Source: MAFF Statistics 1993

Table 8. Import of major feeds into Japan

Unit: 1,000 mt

	1989	1990	1991	1992
Corn	11,279	11,753	11,997	11,676
Grain sorghum	3,839	3,618	3,363	2,888
Barley	1,307	1,256	1,519	1,490
Wheat	1,132	1,056	1,150	1,245
Soybean meal	442	642	841	899
Hay cubes	682	713	720	764
Hay, not cubed	680	837	1,038	1,099
Beet pulp and bagasse	822	836	789	—

Source: MAFF Statistics 1993

considerable impact. In recent years, imports of grain have remained constant, but there has been a marked increase in imports of soybean meal and roughage (Table 8). If we take into account the importation of feed, the self-sufficiency rate in milk products is less than 77%.

Good quality silage and hay is produced by controlling fermentation and storage. Roll baled silage or hay has been rapidly adopted on dairy farms in recent years. A year long silage supply, harvesting grasses in spring and corn or sorghum in summer, or total mixed rations, have come into widespread use, because these are useful in maintaining rumen fermentation in high producing cows. Fats and protein which bypass the rumen, such as calcium soaps of fatty acid, cottonseed, and soybean, are used for cows producing more than 30 kg/day, to improve milk yield and milk composition.

A basic part of management during the summer is physical modification of the environment, particularly by intercepting incoming solar radiation. Various other solutions have been evaluated, including fans, misting with fans, and natural or artificial shade, to see whether they help prevent the loss of milk production. Another basic aspect of management is improved nutrition to help the cattle maintain a proper body temperature and rumen fermentation. Since reduced feed intake is a common response in summer, increased amounts of feed concentrates and supplements, such as fat, protein and minerals, are widely used under high temperatures in Japan.

NEW TECHNOLOGY IN DAIRY PRODUCTION

The milk yield per cow in Japan is one of the highest in the world, but the cost of milk production is relatively high. In addition, Japan's dairy farming has various problems such as environmental pollution from livestock wastes, urban growth, a lack of young farmers who wish to carry on their fathers' farms, and the diverse requirements of consumer demand. Especially with rapid trade liberalization, the number of dairy farms in Japan is expected to fall to below 30,000 by the year 2000, from 55,000 in 1992.

To cope with competition from imported products, the Japanese dairy industry must develop even more efficient milk production, which is however in harmony with the environment and rural society. Costs have to be lowered, and there must be a focus on supplying high quality, safe dairy products which meet consumer needs. Some new technology has been developed to help Japanese dairy farmers achieve this.

Embryo Transfer

The first successful embryo transfer in Japan was achieved at the National Institute of Animal Industry in 1964, and since then embryo transfer has become widely used in Japan. Techniques of embryo transfer have greatly improved, and many organizations, including private companies, make use of them. In 1991, 7163 calves, including 1,094 twin calves, were born through embryo transfer (Table 9).

In breeding dairy cattle, embryo transfer is mainly used to improve genetic quality, using highly productive cows as donors. About 80% of dairy breeding bulls were produced by embryo transfer in Japan (Kojima 1993), and the technique is now expected to produce beef cattle. About 90% of calves born after embryo transfer in 1991 were Japanese beef calves, with Holstein cows being used as recipients. In the future, embryo transfer will also continue to be used for the improvement of dairy cows.

Milking Parlors and Free Stall Barns

In recent years, the number of milking parlors and free stall barns has increased in Japan, a trend which is likely to continue (Table 10). Between 1989 and 1992, 61.9% of newly built milking parlors were of the herring bone type, and 24.2% were the parallel type, but the number of parallel parlors is increasing (Hasegawa 1993). About 70% of dairy farms with milking parlors had facilities for producing mixed feed, and cows were fed on complete mixed rations.

Free stall barns are commonly used for large herds. Sixty lactating cows are fed in Japanese free stall barns (Hasegawa 1993). With the development of large-scale operations, the number of free stall barns can be expected to increase.

Physiological Function of Nutrients in Feed

Milk production has drastically increased in Japan, and farmers now aim at a milk yield per cow of 10,000 kg/305 days. However, the reproductive performance of dairy cows, measured in terms of calving interval, did not improve between 1980 and 1991 (Table 3), and the occurrence of mastitis and metabolic disorders around parturition has increased. In addition, although the use of embryo transfer to induce twinning has increased, anemia often occurs in twin calves (Table 11). Improvements in reproduction and general health, as well as in milk production, are important for the future development of the dairy industry.

Well balanced feed rations benefit animal health. Vitamins and minerals have a useful physiological function for high producing cows, by preventing metabolic disorders and improving reproduction. Colostral components, such as immunoglobulin, lactoferrin, minerals and vitamins, are very important to the immune system and general health of calves (Kume and Tanabe 1993). More needs to be known about the physiological functions of nutrients, and of feed generally, to make better practical use of them and to improve the health status of high producing cows.

Table 9. Number of embryo transfer calves in Japan, 1975-1991

	1975	1980	1985	1990	1991
Donors	32	317	2,724	7,704	9,099
Recipients	10	498	5,034	19,865	26,613
ET calves	1	73	887	5,912	7,163
Twins	0	0	94	924	1,094

Source: Statistics of MAFF 1993.

Table 10. Total number of milking parlors in Japan

	1975	1980	1985	1990	1991	1992
Total number	57	147	241	584	707	814
Hokkaido alone	34	82	114	267	328	377
All Japan except Hokkaido	23	65	127	317	379	437

Source: Hasegawa 1993.

Table 11. Blood components of calves born after embryo transfer and their dams at parturition

	Primiparous single	Multiparous single	Multiparous twins
No. of calves	5	20	18
Calf body weight, kg	31	34	31
Blood hematocrit, %			
dam	34	35	36
calf	36	41	33
Blood hemoglobin, g/dl			
dam	12	12	13
calf	12	13	10

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DISCUSSION

Dr. Zainuddin pointed out that Table 4 shows an increase in milk production between 1970 and 1991, but a fall in the self-sufficiency rate, and asked the reason for this. Dr. Kume answered that this probably reflects the higher international prices for feedstuffs. Dr. Zainuddijn was also interested in why there is a lack of young dairy farmers to take over the farm when fathers retire. Dr Kume explained that this is because dairy farmers work very long hours with no holidays, while there are plenty of jobs available in business with a shorter working week and regular holidays, which sons of farmers prefer.

Dr. Lustria asked how production costs could be reduced, particularly in view of the very high land prices in Japan. Dr. Kume replied that animal scientists in Japan would try to reduce the price of milk by reducing the cost of feed, and finding import substitutes. The cost of feed made from imported feed concentrates is very expensive, with an average price of 45 Yen per kilogram (c. US$0.45/kg). There would be active efforts to make increased use of local roughage resources.