A Comparison of the Structure and Practice of Dairy Farming in New Zealand and Japan

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Preface

The AERU regularly has visitors from overseas universities who come to New Zealand to undertake study on some aspects of New Zealand's economy or society. The author of this report, Dr Araki, comes from Hokkaido, Japan and uses his experience of dairy farming there to compare dairying in Japan with dairying in New Zealand. While based on only limited numbers of interviews with dairy farmers from each country, the report uses these and official statistics to make useful comparisons of both structural factors and on-farm practices which highlight the key differences in dairying in each country. The report is useful as an example of comparative research and also as an insight into the intricacies of the Japanese dairy farming system. It will be of value to researchers with a focus on comparative farming systems and to those interested in dairy farming generally.

Dr Araki intends to return to New Zealand later this year and complete analysis of a survey of sharemilkers who work for Tasman Agriculture.

Dr Ross Cullen
Director

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Dr John Fairweather has assisted by supporting my visit and in reviewing the draft of this report. Thanks are due to all the dairy farmers in New Zealand and Japan who gave me their time for an interview and to the Hamanaka Agricultural Cooperatives who were very supportive of my research. In particular, I wish to thank Mr John Sheat who helped arranged several interviews with Dunsandel dairy farmers. I would like to thank Mr Yuji Yoshikawa who arranged the interviews with the Morrinsville dairy farmers. Also, I would like to thank Miss Gina Pemberton for assisting me in the completion of this report.

Summary

Japan's production cost for milk is the highest in the world. In contrast, New Zealand's production cost for milk is the lowest in the world. The purpose of this report is to examine the difference in the structure of dairy farming between New Zealand and Hokkaido, Japan. Hokkaido dairy farms account for over 40% of milk production in Japan.

New Zealand dairy farming has several things in common with Hokkaido dairy farming. First, New Zealand is a relatively new country and Hokkaido is a new area (Hokkaido has a history of 130 years of development). Second, both have significant areas of grassland. Third, both produce milk of which most parts are supplied to milk processing factories. Finally, both have made remarkable progress in the development of dairy farming. In 1975/76 New Zealand produced 5,403 million litres of milk, and in 1995/96 9,325 million litres of milk. Hokkaido produced 1,447 million kgs of milk in 1975 and in 1996 3,530 million kgs. However, there are many differences in dairy farming between New Zealand and Hokkaido. Differences occur for each of the following: first, the ownership of land, buildings and machinery; second, the use of farmland and the management of cows; third, the treatment of manure; and fourth, the use of labour and the process of farm succession.

The complex and inefficient Japanese dairy farming system results in the highest milk production costs in the world. In contrast, New Zealand dairy farming is very simple and efficient. After the negotiations of the World Trade Organisation in 2001, the Japanese government will be obliged to reduce tariffs, and also reduce subsidies for dairy farmers. As a result of tariff reduction and the reduction of subsidies, the situation of Japanese dairy farm management will worsen. Many retiring farmers will not be replaced which will result in decreased milk production. New Zealand will be able to export more dairy products to Japan in the future.

CHAPTER 1

SOME LITERATURE, OBJECTIVES AND METHOD

1.1 Dairy Farming in Japan and Other Countries

Some comparative studies of world milk production costs were undertaken by several students in Japan. Shyogenji (1991) compared the cost of milk in Japan with England, and concluded that the high cost of milk production in Japan was the result of the high price of materials, machinery and so on, and low labour productivity. Kobayashi (1997) found that the average cost curve went down rapidly in accordance with farm size in comparison with other dairy producing countries. He identified excessive investment in fixed capital. These studies were limited to comparative studies of Japan and other countries' milk production costs. The cost of milk production results from the structure of dairy farming in each country.

There seems to be few studies which compare the structure of Japanese dairy farming with other countries through the investigation of dairy farms, and typically, comparative assessments focus on the dairy industry as a whole. For example, Moffitt (1987) advised that Hokkaido dairy farming should introduce the pasture grazing technique of New Zealand for the benefit of Hokkaido dairy farming. This came as a result of comparing Hokkaido dairy farming with New Zealand dairy farming. Watanabe (1985) pointed out the high cost of feed in milk production in Japan as a result of comparing the cost of milk production in Japan with New Zealand.

The structure of New Zealand livestock industries has changed rapidly since the economic reform which started in 1984 in New Zealand. Some studies highlight the main changes especially these relevant to dairy farming. For example, Fairweather (1992) analysed changes in the structure of the livestock industry from 1972 to 1990, and pointed out the decrease in sheep and beef numbers and the increase in deer numbers. He also examined changes in the structure of labour and pointed out the increase in the amount of family labour and the decrease in the amount of paid labour from 1984 to 1990. Kishida (1993) surveyed nine farmers in New Zealand in 1985, 1988 and 1991. There were no farmers who gave up their farms under the policy of the economic reform. They all changed their style of livestock farming from sheep and other livestock farming to deer and beef, dairy and beef or only deer farming. His interpretation was that they changed their farming style in order to suit the conditions of their situation and their economic environment to survive in world competition. Watanabe (1985) interviewed eight dairy farmers in South Auckland and Waikato. He surveyed the elements of the farms and the techniques of the dairy farmers but did not clearly explain the structure of labour and the structure of dairy farming. Fairweather (1994) analysed the structure of labour on large herd dairy farms, and pointed out that dairy farmers were moving away from routine work, especially milking, and were involved in the management of the farm and in farm development.

In Japan, there are many studies of Japanese dairy farming and the dairy industry. There are two representative studies about the structure of Hokkaido dairy farming. Shichinohe (1983) clearly explained that the base of productivity of dairy farming was formed in the 1960s and 1970s. He pointed out that it was extremely urgent to change Hokkaido cow management

their sixties or seventies. For example: Farm No.4's owner is 66 years old and is still involved in milking twice a day, which takes about 60 minutes each time. Farm No.9's owner is 65 years old and is also involved in milking twice a day, which takes about 30 minutes each time. The size of dairy farms in New Zealand is large compared with Hokkaido, Japan.

Table 1
Outline of New Zealand Dairy Farms Studied

Area	No.	Farm type	Milking type	Effective dairy ha.	No. of cows	Sharemilker owner	husband	wife	(age) workers
Interviewed farms									
South Island	1	50-50 sharemilked	seasonal	265	850		37	36	24/17/16
	2	50-50 sharemilked	seasonal	200	630	46	35		24
	3	50-50 sharemilked	seasonal	150	485		42	38	20/16
	4	50-50 sharemilked	seasonal	160	525		29	29	
	5	owner operator	town	184	248	38			50/38
	6	owner operator	seas./town	120	250	41			29/30
	7	owner operator	seasonal	97	190	58/28			
	8	owner operator	town	118	180	46			32
North	9	50-50 sharemilked	seasonal	130	340		30		20/20
Island	10	50-50 sharemilked	seasonal	115	330	38			43/40
	11	50-50 sharemilked	seasonal	60	173	35			
	12	50-50 sharemilked	seasonal	60	200		30		
	13	50-50 sharemilked	seasonal	43	161		38		
Answered questionnaire farms									
North	1	19-81 sharemilked	seasonal	125	280		24	23	
Island	2	50-50 sharemilked	seasonal	57	206		23	26	
	3	29-71 sharemilked	seasonal	82	200		26		
	4	owner operator	seasonal	70	200	31			?
	5	20-80 sharemilked	seasonal	82	167		35	33	

Table 2
Outline of Hokkaido Dairy Farms Studies

	No	Cow number			Effec	Labour (age)							
		cow	hei.	total	tive ha	husband	wife	son	sons	wife	father	mother	trainee	worker	total
	1	109	101	210	82	48	45(0.8)	23(0.8)	-					3man	2.6
	2	102	28	130	112	52	52(0.5)	31	24(0.8)				33	28	4.3
	3	99	70	169	71	44	40(0.8)				66(0.3)	65(0.3)			2.4
Hamanaka	4	92	80	172	90	66		38	37						3.0
dairy	5	84	70	154	82.5	57	54(0.8)	31	33						3.8
farms	6	80	58	138	66	58	53(0.75)	31	32						3.75
	7	68	89	157	90	43	42(0.8)								1.8
	8	68	52	120	67	57(0.3)		31	25				27		3.3
	9	65	55	120	57.6	65	59	38	33						4
	10	60	75	135	64	48	45(0.8)	20(0.7)			78(0.3)				3.8
	11	153	9	162	45.9	44	43								4
	12	125	100	225	73.9	38	35						28		3
F.M.	13	116	109	225	58	44	42					76(0.5)			2.5
dairy	14	105	95	200	65	38	38				63	60(0.5)			3.5
farms	15	77	68	145	56	42	42								2
	16	76	59	135	53	43	41								2
	17	71	83	154	72	43	34				67				3

Note: hei. = heifer, labour ( ) is the labour ability which, husband's labour ability is 1.0.

CHAPTER 2

TRENDS IN NEW ZEALAND AND JAPAN'S DAIRY FARMING

2.1 Introduction

This chapter gives an overview of the structure of New Zealand and Japanese dairying by using the data from official statistics. In addition, this chapter shows the detailed changes of the structure of dairy farming in Hamanaka, Hokkaido of which dairy farmers gave us the data for their farms.

2.2 Main Trends in New Zealand Dairy Farming

New Zealand dairy farming has achieved remarkable developments in the last twenty years. The quantity of milk production has increased by 73 per cent from 5,403 million litres in 1975/76 to 9,325 million litres in 1995/96. In this period, the number of herds has decreased from 18,442 to 14,736, but the number of cows have increased from 2,091,950 to 2,935,759. As a result of the above changes, the average herd size has increased from 113 cows to 199 cows (Table 3). Table 4 describes changes in herd size distribution. The number of herds under 149 cows decreased and over the 200 cows has increased from 1988/89 to 1996/97. Herds over 400 cows have increased by 672 per cent.

Table 3
Base Data on New Zealand Dairy Farming, 1975/76 to 1995/96

	Milk processed (million litres)	Herds	Total cows	Average herd size	Average effective hectares
1975/76	5,403	18,442	2,091,950	113	-
1980/81	5,868	16,089	2,027,096	126	-
1985/86	7,326	15,753	2,321,012	147	64
1990/91	7,077	14,685	2,402,145	164	70
1995/96	9,325	14,736	2,935 ,759	199	82

Dairy Statistics (Livestock Improvement)

Table 4
The Change in Herd Size Distribution, 1988/89 to 1996/97

Herd size	88/89	96/97	96/97 / 88/89
10- 49	343	290	85%
50- 99	2,077	1,613	78%
100-149	4,862	3,412	70%
159-199	3,359	3,318	99%
200-249	1,582	2,333	147%
250-299	726	1,369	189%
300-349	366	826	226%
350-399	142	531	374%
400-449	136	342	
450-499		201	772%
500-		506	
Total	14,744	14,741	100%

Dairy Statistics (Livestock Improvement)

In 1996/97 large herd dairy farms have been increasing in the South Island, especially the South Canterbury region, which has the biggest average herd size. The number of cows have increased by 218 per cent in the South Island and by 128 per cent in the North Island from 1988/89 to 1996/97. The proportion of cows in the South Island of New Zealand increased from 8 per cent to 17.9 per cent (Table 5). In 1995/96, the number of owner-operators was 9,581(65%) and the number of 50/50 sharemilkers was 3,614 (24.5%) (Table 6). The number of 50/50 sharemilkers has increased and contract milkers and lower order sharemilkers have decreased between 1985/86 and 1995/96.

Table 5
Cow Numbers by Region, 1988/89 and 1996/97 in New Zealand

Region	88/89 number	88/89 %	96/97 number	96/97 %	96/97 / 88/89
Northland	242	11.3	272	8.9	112%
Central Auckland	104	4.9	141	4.6	136%
South Auckland	844	39.5	974	31.8	115%
Bay of Plenty	147	6.9	189	6.2	129%
Central Plateau	68	3.2	157	5.1	231%
Western Uplands	8	0.4	15	0.5	188%
East Coast	-	-	3	-	-
Hawke's Bay	28	1.3	18	0.6	64%
Taranaki	387	18.1	532	17.6	137%
Wellington	80	3.7	162	5.3	203%
Wairarapa	60	2.8	55	1.8	92%
North Island	1,966	92.0	2,518	82.2	128%
Nelson/Marborough	43	2.0	69	2.3	160%
West Coast	46	2.2	72	2.4	156%
North Canterbury	35	1.6	132	4.3	377%
South Canterbury	11	0.5	41	1.3	373%
Otago	20	0.9	88	2.9	440%
South Land	17	0.8	145	4.7	853%
South Island	172	8.0	547	17.9	318%
New Zealand	2,138	100	3,065	100	143%

Dairy Statistics
(Livestock Improvement)

Table 6
Number of Farms by Type of Ownership, 1985/86 to 1995/96

	1985/86	90/91	95/96
Sharemilker			
29%	304	322	133
39%	507	146	138
50%	3,248	3,140	3,614
Leased	116	-	-
Contract	536	130	121
Other	203	467	1,149
Total	4,915	4,205	5,155
Owner Operators	9,584	9,220	9,581
Total	14,499	13,425	14,73

Dairy Statistics
(Livestock Improvement)

2.3 An Outline of Dairying in Hokkaido

2.3.1 The Position of Hokkaido Agriculture in Japan

Hokkaido is situated in the northernmost prefecture of the 47 prefectures in Japan. It is known as the food-supply base in Japan. Table 7 describes the position of Hokkaido's agriculture compared to Japanese agriculture as a whole. Its cultivated land area is about 1.2 million hectares, which is 24 per cent of the national total. In 1996, the number of farming households in Hokkaido was 79,000 which was only 2.3 per cent of the national total, but the gross agricultural output amounted to about 1,114 billion yen in 1995, which accounted for 10.5 per cent of the national total.

Table 7
Hokkaido's Share of Agriculture in Japan

Dimension	Hokkaido(A)	Japan(B)	Share(A/B)	Year
Aggregate land (1,000 ha)	8,345	37,782	22.1%	1994
Cultivated land	1,199	4,994	24.0%	
Paddy fields	239	2,724	8.8%	
Upland Fields	417	1,219	34.2%	1996
Orchards	4	392	0.9%	
Grasslands	539	658	81.9%	
(1,000 households)				
Total farming households	79	3,388	2.3%	
Full-time	34	436	7.9%	1996
Part-time(*Class 1) holds)	28	454	6.1%	
Part-time(*Class 2)	10	1,717	0.6%	
Total output (100,000,000 yen)	11,143	105,846	10.5%	
Crop Cultivation	6,690	78,719	8.5%	
(Rice)	2,188	31,453	7.0%	1995
Livestock & products	4,450	26,267	16.9%	
(milk)	2,542	7,108	35.8%	
Cultivated land per farm household (ha)	15.1	1.1	13.7 times	1996
Number of dairy cattle (head)	77.9	34.4	2.3 times	

Source: MAF, Ministry of Construction (aggregate land).
Note: Part-time Class 1= part-time farmers mainly engaged in farming
Class 2= farmers mainly engaged in jobs other than farming

Compared with other regions in Japan, the size of farms in Hokkaido is quite large. In 1996, the average cultivated area per farm in prefectures other than Hokkaido was 1.1 hectares, compared to 15.5 hectares in Hokkaido. The size of upland farms and dairy farms in eastern and northern Hokkaido have already surpassed the average farm size of EU countries. Many agricultural products rank Hokkaido in the top position in domestic production. These are rice, milk and upland crops such as sugar beet, beans, wheat and potatoes. There are also crops such as onions, sweet corn, pumpkins, Japanese radishes, carrots and so on. In addition, recently the production of commercial flowers has been increasing.

The number of farming households in Hokkaido has steadily declined from 234,000 in 1960 to 79,000 in 1996. In 1996, 48 per cent of the total farming households were full-time farmers, 38 per cent were part-time farmers; mainly engaged in farming (Class One), and 14 per cent were part-time farmers; mainly engaged in jobs other than farming (Class Two). The proportion of full-time and part-time farming households (Class One) in Hokkaido is very high (86%), in comparison with other regions (33%). In addition, the farmers are young compared with other regions in Japan: 39 per cent are over 60 years old in Hokkaido, but 64 per cent are over 60 years old in other regions in Japan.

2.3.2 The Development of Dairying in Hokkaido

Japanese dairying and livestock breeding industries have developed rapidly since WWII. Milk production has increased from 1.94 million tonnes in 1960 to 8.39 million tonnes in 1995. Beef production (dressed carcass) has increased from 141,000 tonnes to 605,000 tonnes in the same period. Pork production (dressed carcass) has increased from 149,000 tonnes to 1,380,000 tonnes in the same period. The above developments are due to the change in the diet of Japanese people according to the increase of their income (Hokkaido Agricultural Statistics, Hokkaido Government).

Table 8
Structural Change in Hokkaido Dairying, 1970 to 1995

Dimension		Units	1970	1980	1990	1995
①Milk production		1000tonnes	1180	2120	3060	3530
②Number of dairy cattle		1000	489	752	847	883
③Total farming households		1000	39	21	15	12
④Grassland area		1000 ha	209	462	523	540
⑤Milk production per cow		kg	4114(*2)	5118	6700	7194
⑥Concentrate per cow (*1)		kg	1204	1518	2271	2834
per farming house-holds	⑦Dairy cattle		12	35	57	74
	⑧Agricultural gross income	1000 yen	3290	18810	33540	29280(*3)
	⑨Agricultural expenditure	1000 yen	2200	13780	23880	21790(*3)
	⑩Agricultural income	1000 yen	1090	5030	9660	7490(*3)
	⑫Debt	1000 yen	5660	29280	38200	41510(*3)
	⑬Fixed capital	1000 yen	2150	21060	26180	24560(*3)

Source: Hokkaido Agricultural Statistics,
6 Hokkaido Herd Testing Association Annual Report,
8 - 9 MAF Statistics.
Note: (*1) quantity of feed concentrate (grain) per cow, (*2)1971, (*3)1994.

Dairying in Hokkaido has grown due to the increase in milk consumption, making it the largest milk producing region in Japan. Milk production in Hokkaido was 3.53 million tonnes in 1996. This was 41 per cent of the total Japanese milk production, totalling 8.66 million tonnes in 1996. The basis of this growth is due to four factors. Firstly, the area of grassland has increased. The government and the local government have actively developed the grassland from 1960 to 1980. As a result of this development, the area of grassland has increased from 63,000 ha in 1960 to 462,000 ha in 1980 and to 540,000 ha in 1995. The number of cows has increased according to the increase in the area of grassland. Secondly, the government gave economic support to dairy farmers: about 50-70 per cent of the annual fixed capital of dairy farmers was financed by the government and agricultural cooperatives. Resulting from this, the debt per dairy farm increased rapidly from 2.51 million yen in 1970 to 21.06 million yen in 1980, since then, the debt has increased gradually. Thirdly, efficient machinery and large buildings were introduced into dairying by using the available finance. For example, the number of tractors with 50 or more horsepower increased from 2,079 in 1970 to 87,440 in 1995. Finally, the average quantity of milk per cow has increased according to the rise in supply of grain being fed to the cattle. Therefore, the quantity of grain which feeds one cow per year has increased from 1,204 kg in 1970 to 2,271 kg in 1990. Cow and heifer numbers have increased from 12.5 cows per dairy farm in 1970 to 74.2 cows in 1995. In the same period, the gross agricultural income per dairy farm increased from 3.29 million yen to 29.28 million yen, and the agricultural expenditure per dairy farm increased from 2.2 million yen to 27.79 million yen. Also, between 1970-1995 agricultural income per dairy farm increased from 1.09 million yen to 7.49 million yen. However, over the period of this development many dairy farmers have given up farming due to either debt or the absence of a successor. The number of dairy farms has decreased from 39,000 in 1970 to 12,000 in 1995 (Table 8).

2.3.3 The Types of Regions in Hokkaido Dairying

Hokkaido consists of 14 districts (Figure 1). These districts are grouped into three regions: the Doo region, the Donan region, and the Dotohoku region. The Dotohoku region is the most prosperous for dairying and supplies 80 per cent of the milk production in Hokkaido (Table 9). It is divided into a single agricultural area, specialising in dairying, and a mixed area which has both upland farming and dairying. The single agricultural area is comprised of the Kushiro, Nemuro and Soya districts. The mixed area is comprised of the Tokachi and Abashiri districts. In the single agricultural area, only various grasses are planted. In addition, in the mixed area both grasses and dent corns are planted.

There are three different ways in which the grass is used in Hokkaido:

1. For grazing only.
2. For hay and silage production.
3. For grazing after the production of hay and silage.

The proportion of grazing land has gradually decreased since 1980, this is lower in the mixed area than in the single agricultural area. The proportion of land in use for hay and silage production is above 80 per cent in the mixed area. One of the reasons for this is that cows are housed in barns all the year round (Table 10).

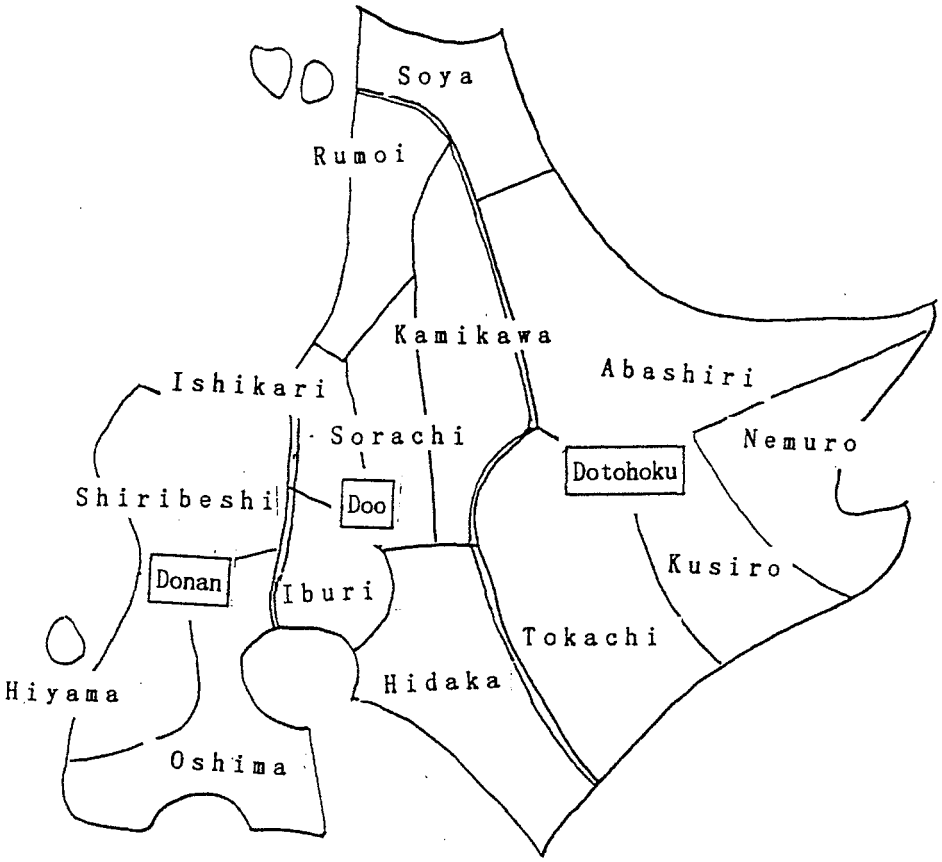

Figure 1
Map Showing the Three Main Regions in Hokkaido and Minor Districts

Table 9
Production of Milk and the Area of Arable Land in Hokkaido by Region and District(1996)

Region	District	Production of milk (1,000t)	Area of Arable Land (1,000ha) Total	Upland field	Grass land	Paddy field
Do-tohoku	Tokachi	857(24%)	261	177(68%)	82(31%)	2(1%)
	Kushiro	499(14%)	94	3(3%)	91(97%)	-
	Nemuro	688(19%)	111	2(2%)	109(98%)	-
	Abashiri	522(15%)	174	105(60%)	65(37%)	4(3%)
	Soya	274(8%)	57	0.4(1%)	56(99%)	-
Doo	Rumoi	123(3%)	37	3(7%)	26(69%)	9(24%)
	Kamikawa	180(5%)	131	44(33%)	24(19%)	63(48%)
	Ishikari	75(2%)	48	17(35%)	9(19%)	22(46%)
	Sorachi	40(1%)	124	20(16%)	8(7%)	95(77%)
	Iburi	54(2%)	35	12(33%)	13(37%)	10(30%)
	Hidaka	63(2%)	41	3(6%)	31(77%)	7(17%)
Donan	Shiribeshi	38(1%)	39	19(49%)	8(20%)	9(23%)
	Hiyama	26(1%)	21	6(29%)	5(24%)	10(48%)
	Oshima	92(3%)	28	9(32%)	12(42%)	7(26%)
Hokkaido Total		3,530(100%)	1,199	417(35%)	539(45%)	239(20%)

Source: Hokkaido Government (unpublished)

Table 10
Hectares of Grass and Utilisation in the Dotohoku Region(1996)

District	Area of grass	Hay and silage production	Grazing after production of hay and silage	Grazing
Tokachi	68,600	55,131(80%)	7,475(11%)	5,994(9%)
Kushiro	77,569	53,749(69%)	20,966(27%)	2,854(4%)
Nemuro	95,738	61,868(64%)	18,744(20%)	15,126(16%)
Abashiri	41,043	34,988(85%)	2,695(7%)	3,360(8%)
Soya	49,101	30,749(63%)	11,968(24%)	6,384(13%)

Source: Hokkaido Government (unpublished)

2.3.4 The Agricultural Organisations in Hokkaido

The organisations in Hokkaido dairying are grouped into profit making organisations and non-profit making organisations. The profit making organisations are agricultural cooperatives, milk processing companies, various manufacturers and agencies, general trading companies and agencies and banks. In addition to these organisations, there are the Dairy Farm Support Systems which attend to the dairy farm duties instead of the needs of the farmers. The non-profit making organisations are the local public bodies and the Agricultural Cooperative Society which provides veterinary treatment for cows. The local public bodies include the Agricultural Technical Diffusion Centre (which guides dairy farmers), the Agricultural Committee (which deals with farmland affairs), and The Town Hall (which deals with the farmers affairs and subsidises dairy farming activities). The Town Hall also subsidises agricultural cooperatives. Among all of the above organisations, the agricultural cooperatives are the most important for dairy farmers.

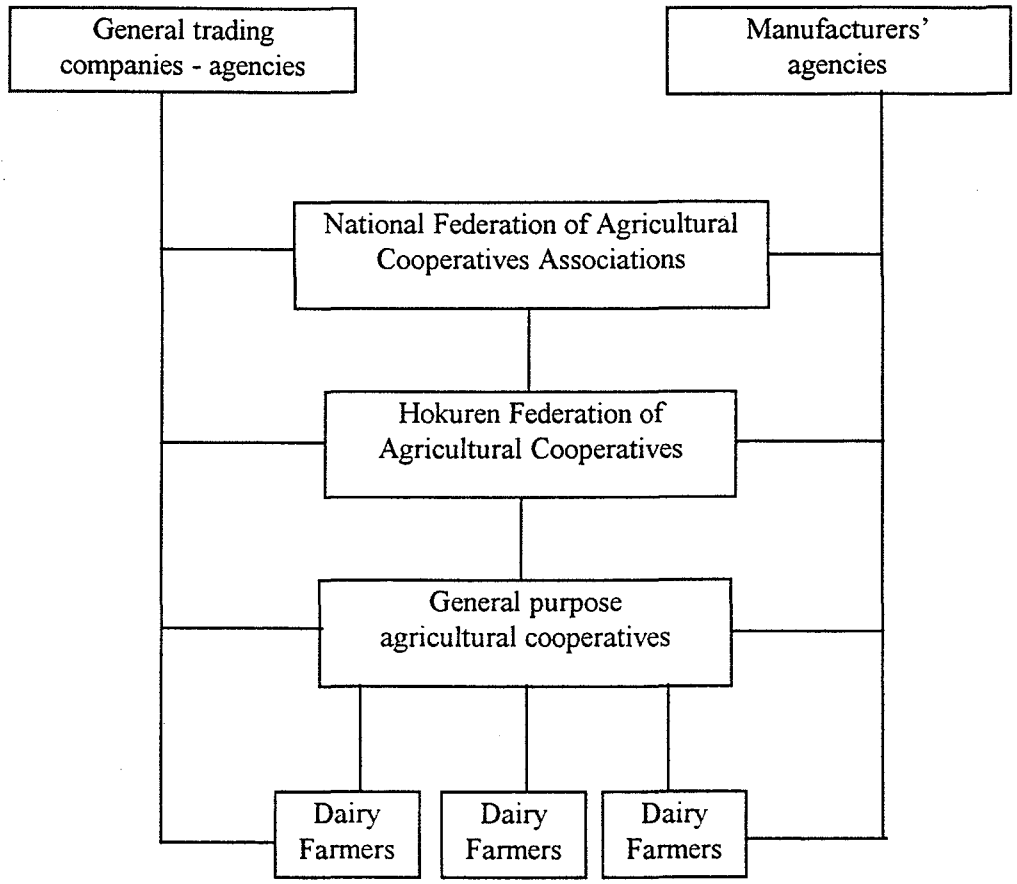

Figure 2
The Distribution of Materials and Machinery in Hokkaido Dairying

All Japanese farmers are organised into agricultural cooperative systems which are called "Nokyo" for short. There are two types of agricultural cooperative systems in Japan. The first is a general purpose agricultural cooperative and the second is a special purpose agricultural cooperative. Members of the special purpose agricultural cooperatives are organised into the general purpose agricultural cooperatives. The general purpose agricultural cooperatives have five kinds of activities including: marketing, giving advice on agricultural techniques and management, credit services, mutual relief insurance and welfare activities.

The special purpose agricultural cooperative is similar to European and American agricultural cooperatives, and they are organised by farmers for special farm production. In addition to local agricultural cooperatives, there are prefectural cooperatives and central agricultural cooperatives for each activity. These organisations can be shown in a diagrammatical representation of a pyramid. Agricultural cooperatives, unlike corporations which act by the centralisation of power, act by the decentralisation of power. Besides economic activities, Japanese agricultural cooperatives act politically and support the Liberal Democratic Party which at present is in government. Figure 2 describes the four levels of distribution of agricultural materials, machinery and so on.

The National Federation of Agricultural Cooperatives Associations gets materials and products from various manufacturers and general trading companies. These are then sold to farmers through the Hokuren Federation of Agricultural Cooperatives and general purpose agricultural cooperatives. The Hokuren Federation of Agricultural Cooperatives has other materials and products, which is also sold to farmers through the general purpose agricultural cooperatives. The general purpose agricultural cooperatives then sell their own materials and products which is also sold to farmers as well. In addition, milk distribution is controlled by the government in Hokkaido and most of the milk produced is used in dairy products. Recently, the proportion of milk for drinking, which is transported to Honshu, has been increasing. Approximately 188,000 tonnes of milk was transported from Hokkaido to Honshu in 1995.

The Hokuren Federation of Agricultural Cooperatives collects milk and sells it to several milk processing companies (Figure 3). It also receives subsidies from the government and distributes these subsidies to dairy farmers through the general purpose agricultural cooperatives. Alternatively, various manufacturers and general trading companies sell products and materials directly to farmers.

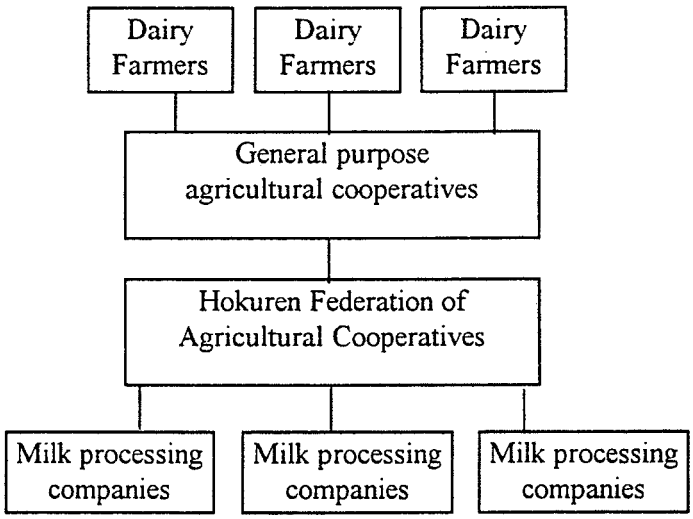

Figure 3
The Distribution of Milk in Hokkaido Dairying

In Japan, the number of general purpose agricultural cooperatives has been decreasing, over a number of years due to mergers. They were 12,050 in 1960, 4,803 in 1975, and 2,635 in 1994. There are currently 8.97 million members of the agricultural cooperatives, this is separated into two types of members: regular members and associate members. The regular

members are farmers and agricultural corporate organisations and the associate members are residents who live in the business area of the agricultural cooperatives. The number of staff in the agricultural cooperatives was about 301,000 in 1993, an average of 104 staff per cooperative. Agricultural cooperatives have seven functions including credit services, mutual relief insurance, purchase of materials and daily food items for farmers, selling of farm products, warehousing, processing and giving advice on agricultural techniques and management. In these business activities, only credit services and mutual relief insurances are in credit, the others are in deficit. But due to the bankruptcy of many financial companies that have lent money for property, the credit services and mutual relief insurances have suffered heavy losses since 1993. So, Japan Agricultural Cooperatives have decided to reduce the number of general purpose agricultural cooperatives to 549 by the year 2000 and the number of staff to about 250,000 in the same year.

2.3.5 The Problems and Trends in Hokkaido Dairying

The number of farms in Hokkaido has decreased from approximately 200,000 in 1965 to approximately 81,000 in 1995. Furthermore, the number of dairy farms has decreased from approximately 49,000 to approximately 12,000 in the same period. Hokkaido farmers have given up farming for many reasons; A survey conducted on farmers who gave up farming in 1995 found that 33.5 per cent gave up due to labour shortages, 43.6 per cent due to the lack of a successor, 14.6 per cent due to large debt and 8.4 per cent due to the uncertainty of their future (Hokkaido Government, 1995). In Hokkaido, the working hours varies for each type of farming(Table 11). The largest size of the four types is dairy farming, which has a number of people mainly engaged in it. The average numbers are 1.4 men and 1.0 women per farm. In addition to this, in 1994, the largest amount of working hours per farm was on dairy farms. The men work 4,354 hours and women work 2,789 hours per year. If this is converted into working hours per person, the average for a man would be 2,988 hours and the average for a woman would be 2,789 hours. Further, converting this into daily hours per person, the average for a man would be 8.18 hours and average for a woman would be 7.47 hours.

The women on dairy farms have to have time for cooking, washing, child care, cleaning and so on, and are the hardest workers in Japanese society. So not only town women but also country women dislike marrying farmers, and as a consequence the number of single farmers is increasing. Consequentially, this has an effect on the parents, as when they are at retirement age, they have no one to take over the farm. This is a key factor in the decrease in the number of dairy farms.

Methods which solve the problems of labour shortages include: the construction of free stall type sheds and milking parlours, farmer's corporations, the labour support systems and grazing of cattle. Most dairy farmers constructed the milking parlours with the free stall sheds. The number of dairy farms which have milking parlours is 647, this is approximately six per cent of the 10,785 dairy farms in total. The purpose of constructing free stall sheds and milking parlours is to save labour and to improve the quality of milk. However, the quantity of grain which is fed to cows increases after this construction.

Table 11
Persons Engaged in Farming and Their Working Hours, 1994

	Engaged in own farming	Mainly engaged in own farm		Working hours own farm			
	total/person	men	women	total	family	men	women
Paddy rice farming	2.45	1.27	0.73	3761	3587	2206	1381
Vegetable farming	2.18	1.00	0.82	4580	3779	2014	1765
Field crop farming	3.07	1.37	0.98	6402	5568	3363	2205
Dairy farming	3.00	1.40	1.00	7201	7143	4354	2789

Source: Ministry of Agriculture, Forestry and Fisheries (MAFF)

The purpose of having farmer's corporations is to secure holidays for dairy farmers and to get employees from other industries. The number of farmer's corporations was 1,609 in all types of farming in 1996, and about 90 per cent of farmer's corporations are limited companies. There are two organisations in the labour support system, one is the Dairy Farms Helpers' Association which is active in doing routine work on dairy farms, when the farmers take a few days off or go on vacation. The other is the Agricultural Contractors who are employed by the farmer to make grass silage and spread manure, which allows more efficient use of the farmers time. There were 82 Dairy Farms Helper Associations and 41 Agricultural Contractors in Hokkaido in 1996. The three organisations above promote the expansion of milk production and each is connected to the other. Most new farmers corporations have free stall sheds and milking parlours and contract out to Agricultural Contractors.

The number of dairy farms which graze cows, instead of feeding grain and silage, has been increasing. Whereas until recently, the total number of dairy farms grazing cows was decreasing, now, some dairy farmers value the grazing of cows because of a reduction in working hours and disease, and because of improvement in income. Some farmers have also reduced the number of their cows, resulting in a reduction of milk production. Some farmers have introduced grazing techniques from New Zealand. In addition to this, all dairy farmers grazing cows have reduced the quantity of grains being fed.

2.4 Dairy Farming in Hamanaka

2.4.1 An Outline of Hamanaka

Hamanaka is located on the far east coast of Hokkaido. The main industries are fishing and agriculture. Hamanaka's climate is rather cool throughout the year and fog rolls in along the coastal area between June and August. The average temperature is 5°C-6 °C. The maximum temperature is 20 °C, the minimum temperature is -10 °C. The population of Hamanaka was 8,223 in 1995. The total number of people involved in industrial employment was 5,048 in 1990. The total number of people involved in the primary industry was 2,944 which included 818 people involved in agriculture and 2,115 people involved in the fishing industry. The major turning points in Hamanaka agriculture were the serious damage to crops from cold weather in 1931 and in 1932. Agriculture changed from field crop farming to dairy farming.

After WWII, Hamanaka dairy farming achieved amazing development due to grassland development projects.

Table 12
The Change of Agricultural Structure in Hamanaka District

Source: The Agricultural Census of Japan

Year		1970	1975	1980	1985	1990	1995
Number of farms		519	421	385	361	329	293
Upland field		330	86	40	9	26	1,264
Grass land		7,143	11,013	13,144	14,094	14,025	13,850
Wild grass land		6,062	3,705	4,110	2,565	1,404	470
Number of Farms by Size (ha)	～5.0	128	59	51	42	28	13
	5.0～10.0	56	25	21	16	11	12
	10.0～20.0	166	39	23	17	29	18
	20.0～30.0	118	100	48	28	21	13
	30.0～40.0	43	191	242	252	42	28
	40.0～50.0	-	-	-	-	70	56
	50.0～	-	-	-	-	126	149
Number of Dairy Farms	1～4	28	10	6	8	3	5
	5～9	57	25	11	6	7	2
	10～19	186	52	26	16	14	6
	20～29	90	93	38	22	15	17
	30～49	29	130	170	123	66	55
	50～99	2	34	48	100	153	143
	100～	-	-	-	-	-	16
	Total	398	348	304	279	263	244
Number of cows		5,373	8,001	9,400	9,875	10,717	12,113
Cows and heifers		8,882	13,983	16,471	18,515	20,177	22,187
Milk production(t)		—	34,466	49,925	60,521	71,714	(82,545)
Number of Tractors by Power(HP)	～30	67(1)	56	28	14	6	5
	30～50	106(9)	110(5)	81	58	48	43
	50～70	69(4)	162(12)	181(2)	204(9)	192	181
	70～100	-	72(12)	286(3)	384(6)	477(2)	494
	100～	-	-	-	14	70	144
	Total	42(14)	400(29)	585(5)	679(15)	739(2)	867
Bucket milker		-	647	364	189	37	94
Pipeline milker		-	51	168	197	212	230

2.4.2 Large-scale Dairy Farming

Hamanaka is located in the Konsen Scrub Land. The Konsen Scrub Land is also called the Konsen Tableland, and is less than 200 metres above sea level. There are peat lands in which drainage is bad. In Hamanaka the grassland development projects were undertaken on the scrub lands, including peat lands, after 1965. The largest grassland development project was the National Comprehensive Land Development Project which developed 6,500 hectares of grasslands from 1961 to 1991. The number of cows has increased in proportion to the enlargement of the grasslands. Table 10 describes the change in cow and heifer numbers. There were 8,882 cows and heifers in 1970, 16,471 cows and heifers in 1980, 22,187 cows and heifers in 1995. On the other hand, the number of dairy farms decreased from 519 farms in 1970 to 293 farms in 1995. Thus, the number of cows and heifers per farm has increased. The proportion of dairy farms holding above 50 cows and heifers was 0.5 percent in 1970, 16 percent in 1980 and 65 percent in 1995. Milk production in Hamanaka has increased from about 34,000 tons in 1975 to about 83,000 tons in 1995.

Hamanaka has been able to enlarge its production through the mechanisation of dairy farming. The number of tractors has increased rapidly since 1970. Recently, the number of large-sized tractors have been increasing. Ninety three percent of all engines are 50 or more horsepower (Table 12). With the use of tractors, new attachment have been incorporated into the farming system.

2.4.3 The Hamanaka Dairy Farms Support System

The Hamanaka Dairy Farms Support Systems is another factor underlying the enlargement the dairy farms.

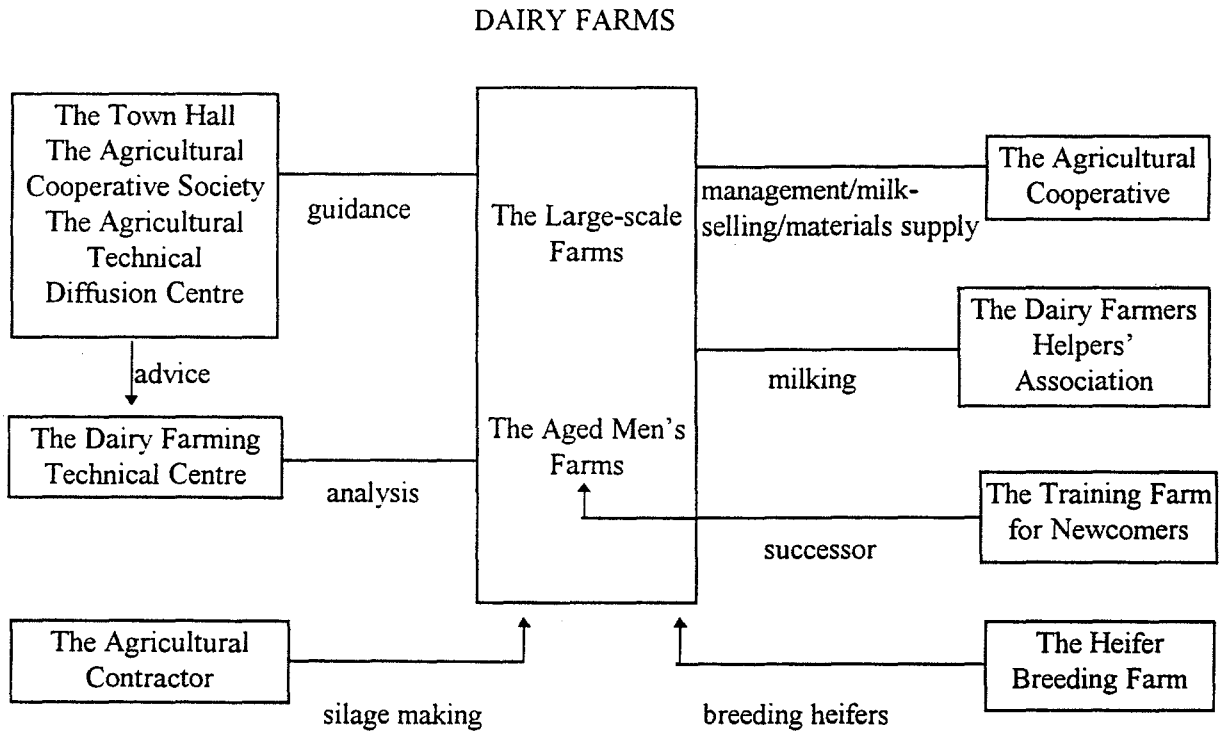

Figure 4
The Hamanaka Town Dairy Farms Support System

Figure 4 describes the design of the Hamanaka Dairy Farms Support System. The organisations consist of the Dairy Farming Technical Centre, the Dairy Farmers Helpers' Association, the Heifer Breeding Farm, the Training Farm for Newcomers and the Agricultural Contractor and so on. The Dairy Farming Technical Centre analyses the milk, feed, soil and so on at the farmers request. This organisation presently has contributed greatly to improvement of the quality of milk. The Dairy Farmers Helpers' Association is active in doing routine work on dairy farms when the farmers take a few days off or go on a vacation. The Heifers Breeding Farm breeds the heifers which farmers select. The Training Farm for Newcomers in Hamanaka was the first such institution in Japan. After the newcomers learn the techniques of dairy farming and the management of dairy farms, they take over farms where the previous farmers have given up farming. The Agricultural Contractor has been organised by the Hamanaka Agricultural Cooperatives and the local construction company. Its main duty is making grass silage. The Hamanaka Dairy Farms Support Systems has been organised for the purpose of solving the problems which occur with the enlargement of dairy farms. The major problems are difficulties in dairy farming techniques, overwork and excessive possession of machines.

CHAPTER 3

NEW ZEALAND AND JAPAN'S DAIRY FARMING COMPARED

3.1 Introduction

This chapter shows the difference in the structure and practice of dairy farming between New Zealand and Japan. The data shows the ownership of land, machinery and buildings. In addition, this chapter examines: the land use system, the milking system, the cow management system, the manure treatment system, working hours, income and expenditure, and the agricultural distribution system in both countries.

3.2 Ownership of Farmland in New Zealand and Hokkaido

There is a fundamental difference in the ownership of farmland between New Zealand and Hokkaido. The dairy farmers in New Zealand have a concentrated farm, in contrast to Hokkaido dairy farmers who have several pieces of farmland. The reason for this is that when dairy farmers give up their farms, their land is divided into several pieces and sold or lent to other farmers. In contrast to this, typically the whole farm is bought and sold in New Zealand. Only two dairy farmers that were interviewed in New Zealand have a run off.

Table 13 describes the ownership of farmland of dairy farmers from Hokkaido. This table reports data for just the farms in Hamanaka. All dairy farmers have 2-4 blocks and these are near their cow shed and/or are 0.5-3km away from them. Farm No.7 has a block which is 10km away from his cowshed. Most dairy farmers have 10-20 fields on which they can do mechanical work continuously. For example, farm No.1 has 33 fields. Possessing many fields result in inefficient mechanical work and a high cost milk production.

Table 13
The Ownership of Fields on Each Block of Dairy Farms in Hamanaka, Hokkaido

	Block					
No.	1	2	3	4	5	Total
1	10(0.2km)	10(2km)	10(2km)	3(2km)		33
2	1(0km)	1(1km)	1(1km)	1(2km)	1(4km)	5
3	7(0.3km)	1(-)	1(6km)	1(6km)		10
4	2(0.5km)	3(2km)	10(5km)			15
5	2(1km)	1(3km)	1(3.5km)			4
7	7(0)	7(5km)	6(10km)			20
8	3(0.1km)	2(0.5km)	1(1.5km)	1(3km)		7
9	8(0.2km)	5(0.5km)	5(1.2km)	1(1.4km)		19
10	5(0.5km)	9(1km)				14

Note: ( ) = distance from the sheds.

Table 14 describes the use of farmland which for all survey dairy farmers from Hokkaido. There are four methods of making use of the farmland: harvesting grassland, grazing land, grazing land after harvesting grass and forage crop fields. Hamanaka dairy farmers use their farmland for harvesting grassland, grazing land and grazing land after harvesting grass. In contrast, FM farmers use their farm land for cutting grassland only, except farm No.1 and farm No.7, this means that they do not do grazing. The parentheses in Table 14 show the area of leased farmland. Fourteen out of seventeen farmers have leased farmland. The average area of leased farmland per farm is 11 hectares. The average area of the farmland per farm is 71 hectares, so the leased farmland accounts for 15 per cent of the farmland.

Table 14
The Use of Dairy Farms in Hokkaido(ha)

	No.	Harvesting grassland	Grazing land after harvesting grass	Grazing land	Forage crop field	Total
	1	75(7)	-	-	-	82
	2	40(20)	30	20	-	110
	3	55(16)	-	-	-	71
Hamanaka	4	73	-	8(9)	-	90
dairy	5	39(10)	17	16.5	-	82.5
farms	6	22	20	24	-	66
	7	60(5)	25	-	-	90
	8	45(12)	-	10	-	67
	9	57.6	-	-	-	57.6
	10	30(10)	14	10	-	64
	11	32.3(7.6)	-	6.0	-	45.9
	12	73.9	-	-	-	73.9
FM	13	46(12)	-	-	-	58
dairy	14	45(20)	-	-	-	65
farms	15	41(15)	-	-	-	56
	16	50(3)	-	-	-	53
	17	43	-	10(8)	11	72

Note: number of ( ) is leased land.

Table 15 describes the condition of leased farmland of dairy farms in Hamanaka. Nine leased farmlands out of twelve were contracted in 1985-1990. The reason why these farmlands rent out is that the owners were intending to cease farming. When the landowners ceased their farming, they owned 18-71 hectares, and each has leased their land to 3-4 dairy farmers.

Table 15
The Condition of Leased Farmland of Dairy Farms in Hamanaka

No	Year of Lease	Area of leased land(ha)	Reasons of lender	Amount of land owned at cessation farming(ha)	Use of land after cessation
1	1987	7.0	giving up farming	20	lending 20ha(3 persons)
2	1985	10.0	giving up farming	70	lending 50ha(4 persons)
2	1990	10.0	giving up farming	56	lending 45ha(7 persons) selling 11ha(1 person)
3	1985	5.0	giving up farming	18	lending 18ha(5 persons)
3	1987	5.0	giving up farming	32	lending 32ha(6 persons)
4	1990	4.0	giving up farming	34	lending 9ha(1 person) selling 25ha(2 persons)
5	1996	10.0	giving up farming	40	lending 40ha(5 persons)
7	1970	2.0	giving up farming	18	lending 18ha(5 persons)
7	1985	3.0	giving up farming	32	lending 32ha(6 persons)
8	1985	12.0	giving up farming	14	lending 12ha(1 person) selling 2ha(1 person)
10	1990	4.5	giving up farming	18	lending 18ha(4 persons)
10	1996	5.5	giving up farming	32	lending 32ha(6 persons)

Table 16
The Condition of Purchased Farmland of Dairy Farms in Hamanaka

No	Purchased year	Area of purchased land (ha)	Reasons of seller	Possesion of farmland at giving up farming (ha)	Content of disposal of farmland
2	1989	5	giving up farming	45	selling 5ha(1 person) lending 40ha(4 persons)
2	1991	11	giving up farming	56	selling 11ha(1 person) lending 45ha(7 persons)
3	1993	11	giving up farming	20	selling 20ha(5 persons)
4	1993	6	giving up farming	40	selling 40ha(6 persons)
4	1993	4	giving up farming	34	selling 25ha(2 persons)
6	1996	5	giving up farming	58	selling 58ha(8 persons)
9	1995	2.4	giving up farming	20	selling 20ha(3 persons)

Table 16 describes the conditions of farmlands which Hamanaka dairy farmers have purchased in the last decade. Five farmers out of ten have purchased farmland and the area per farm was 5.6 hectares. All former owners of this farmland gave up their farming. When they gave up farming, they had 20-71 hectares. Three former owners sold their farmland, two former owners sold and/or leased their farmland. We see from Table 13 and Table 16 that when the dairy farmers gave up their farming, there was more farmland to lease than to be sold. The reason for this is that they judged that it was more profitable for them to lease their farmland than to sell it because of low interest rates of banks in Japan. Hokkaido dairy farms own more farmland than other area's dairy farmers in Japan. However, most Hokkaido dairy farmers have some blocks which are away from their sheds and have some fields. On only one fields, they can do continuous working by machines. The reasons why they have a lot of fields, all dairy farmers sell or lease their divided farmland to other farmers when they intend to cease their farming.

3.3 Pasture Renovation

In New Zealand, dairy farmers typically do over sowing to promote the productivity of grassland. In Hokkaido, most dairy farmers renew the grassland every year. Table 17 describes the area of pasture renovation on dairy farms in Hamanaka for the last three years. The area of pasture renovation is between three hectares and eighteen hectares. The average area on each farm is between 1.0 and 11.7 hectares. The ratio of the average area of pasture renovation to the whole grassland on each farm is between 1.6 and 14.7 per cent. The average ratio is 8.0 per cent. This means that all farmers renew their glassland every 12.5 years. Pasture renovation is performed by construction companies. The cost of pasture renovation is very expensive (about $6,250 per hectare which is the same as the price of land). So the government pays a lot of subsidies to dairy farmers.

Table 17
Hectares Pasture Renovation on Dairy Farms in Hamanaka

No.	1995	1996	1997	Total	Average	Ownership of effective ha	Average effective ha
1	5	7	-	12	4	82	4.8%
2	10	10	5.3	25.3	8.4	112	7.5%
3	5	5	-	10	3.3	71	4.6%
4	-	8	10	18	6	90	6.7%
5	6	10	9	25	8.3	82.5	10.1%
6	10	10	9	29	9.7	66	14.7%
7	7	10	18	35	11.7	90	13%
8	?	5	5	10	5	67	7.4%
9	3	7	5	15	5	57.6	8.7%
10	3	-	-	3	1	64	1.6%
total	-	-	-	-	62.4	782.1	8.0%

3.4 Buildings and Sheds

There is a big difference between the climate of New Zealand and the climate of Hokkaido. The climate of New Zealand is temperate, but the climate of Hokkaido is very cold in winter. In Hokkaido there are 10 to 20 days per year where the temperature does not rise above 0°C. There is a lot of snow in Hokkaido, so cows are in need of a shed for shelter. Also, the number of dairy farms breeding cows during summer is increasing. The reasons for this is that dairy farmers think that there is more grass production and milk production when making silage as opposed to grazing cows, thus, an increase in profit has been found. They also believe that moving cows around their farms takes too much time, especially since they own land in different places. Breeding cows in sheds all year round means that dairy farmers are in need of facilities for grass and manure storage.

Tables 18 - Table 21 describe the facilities of the dairy farmers that were interviewed at Hamanaka in East Hokkaido. We can group these facilities into six types: the first is a cow shed, the second is a milking parlour, the third is a hay shed, the fourth is a machinery shed, the fifth is a silage silo, and the final ones are a slurry store, a urine tank and a dung storage.

Table 18 describes the area and cost of cow and heifer sheds. Seven farmers have stanchion stall type sheds and three farmers have the free stall type sheds. Recently, especially since 1990, the number of free stall type sheds has increased. The cost of the free stall type sheds, however, is very expensive. For example, farmer No.4's free stall type sheds constructed in 1995 was $512,500, farmer No.7's constructed in 1992 was $375,000. The high cost of these free stall type sheds is due to their bigger size than other stanchion stall type sheds. On the other hand, the cost of all stanchion stall type sheds is below $100,000 each.

Table 18
Area and Cost of Cow Sheds and Heifer Sheds

	Cow shed 1	Cow shed 2	Cow shed 3	Cow shed 4	Heifer shed1	Heifer shed2	Heifer shed3
No.	yr area cost	yr area cost	yr area cost	yr area cost	yr area cost	yr area cost	yr area cost
1	F'67 198 290	F'72 237 480	F'95 237 720	F'95 217 421	'77 198 400	'87 415 658	'88 231 296
2	S'76 369 520	S'65 115 87	S'70 115 125		'84 297 620		
3	S'63 200 120	S'84 154 220	S'79 227 650		'89 346 500		
4	F'95 660 4100	S'70					
5	S'61 106 57	S'71 91 110	S'72 91 365	S'73 238 432	'91 238 706	*'87 396 706	
6	S'68 145 270	S'73 145 511	S'79 73 286	F'92 740 1700	'85 145 350	'89 185 280	
7	F'92 1150 3000				'90 800	'96 500	
8	S'72 336 800	S'76 275 800			'90 362 900		
9	S'75 376 740				'84 120 400		
10	S'78 287 660				'75 198 360	'68 99 70	'89 422 510

Notes:
1. Area is M^2.
2. Cost is ¥10,000 ($125).
3. S is stanchion stall type cow shed, F is free stall type cow shed.
4. One NZ$ = ¥80.

Table 19 describes the area and cost of a milking parlour, a hay shed, a machinery shed and so on. Each farmer has two haysheds and one or two machinery sheds. All farmers having free stall type sheds also have feeding sheds. The cost of hay sheds and machinery sheds are below about $30,000.

Table 19

Area and Costs of Milking Parlours, Hay Sheds and Machinery Sheds

	MK parlor			hay shed 1			hay shed 2			MC shed1			MC shed2			Garage			Feeding shed		
No.	yr	area	cost	yr	area	cost	yr	area	cost	yr	area	cost	yr	area	cost	yr	area	cost	yr	area	cost
1	H' 89	6D	2800	'84	297	100	'86	376	174	'79	198	100							'96	198	230
2				'88	198	120	'87	198	120	'74	198	95	'81	396	220						
3	0	4D	2600	'83	396	170	'87	198	127	'89	198	181							'93	300	350
4	H	6d	1100	'89	60	80	'90	60	80	'87	130	300							'75		50
5				'73	238	106	'77	198	86	'86	198	105	'96	277	206	'82	198	110			
6				'75		90	'86		253												
7		12D		'80		120	82, 84		120	'76	198	70	'84	297	150				'90	165	87
8				'85	311	185				'73	162	30	'81	162	80	'72	24	15			
9				'74	198	52	'89	120	150	'79	120	120	'89	120	120	'73	198	85			
10				'83	165	60	'73	198	43	'74	198	80	'76	79	60						

Notes:

1. Area is M^2. 2. Cost is ¥10,000 ($125). 3. MK: milking, MC: machinery.
4. One NZ$ = ¥80.

Table 20 describes a silage storage and they are two types: one is a bunker silo and the other is a tower silo. Recently, the number of bunker silos has increased because of the efficiency in taking out the silage, so several silos are not used.

Table 20

Capacity and Cost of Silage Storage

	Bunker silo1			Bunker silo2			Bunker silo3			Tower silo 1			Tower silo 2			Tower silo 3		
No.	yr	cap.	cost	yr	cap.	cost	yr	cap.	cost	yr	cap.	cost	yr	cap.	cost	yr	cap.	cost
1	'93	640	255	'96	640	185				C' 79	650	600	C' 77	400	340	×B' 74	400	400
2	'95		367							'82		500						
3										C' 75	166	60	C' 87	630	600			
4	'85	700	700							×B' 75	500	500	×B' 75	200	150			
5	'73	864	135							C' 88	351	454						
6	×71	210								B' 80		630						
7	'92	930	250	'94	930	450				C' 67		50	C' 69		80	×F' 77	500	1200
8	×' 74		150	'95		513				×C' 79		900	C' 79		450			
9	'77	440	550	'88	200	75	'89	280	75									
10										C' 79	1080	1000						

Notes:

1. Area is m^2. 2. Cost is ¥10,000 ($125). 3. One NZ$ = ¥80
4. x : no use. In tower silo, C: concrete, B: concrete block, F:FRP(fibreglass plastic).

Table 21 describes a slurry store, a underground slurry tank, a dung storage and a urine tank. There are two different forms of dung, one is slurry which has colloid form and the other is dung which has a muddy form. Slurry is stored in a slurry store and a underground slurry tank. Dung is stored in a dung storage and urine is stored in a urine tank. The cost of a slurry store is very expensive, for example, farm No.1's slurry store was $150,000.

Table 21

Capacity and Costs of Slurry Stores, Underground Slurry Tanks and Dung Storage

	Slurry store	Underground slurry tank	Dung storage 1	Dung storage 2	Dung storage 3	Urine tank	Paddock
No.	yr cap. cost	yr cap. cost	yr area cost	yr area cost	yr area cost	yr cap. cost	yr cap. cost
1	'78 1000 1200						
2			'76	'76 50			'85 1500 309
3		'93 1200 600	'86 330 250			'75 42 100	
4			'85 200 300				
5			'73 28	'73-81 221	'79 110 110	'81 50 60	
6			'81 187	'91 100		'80 150	
7	'92 800 500						
8	'80 870 1080		'71 144				
9			'75 150 70			'75 450 130	
10	'82 930 495	'82 35 216	'76 330 75				

Notes:

1. Area is m^2. 2. Cost is ¥10,000 ($125). 3. One NZ$ = ¥80

Table 22 describes the facilities of seven FM farms in Kushiro district. There are three different points in comparison with the dairy farmers that were interviewed: Firstly, three farmers do not have hay sheds and two farmers do not use their hay sheds because they have stopped making hay. Secondly, four farmers have bunker silos and one farmer has a underground silo for grass silage. Two farmers do not have silos. The reason why the farmer No.1 and farmer No.3 do not have silos is that they make roll bale silage only. Thirdly, three farmers have a slurry pond which is dug in the ground to store the slurry.

Among these farmers, farmer No.16 has the most facilities (17) and the farmer No.11 has the least facilities (8). The facilities have been constructed since 1990, because they have changed the hitch type from the stanchion stall type to the free stalls. Farmers No.12, No.13 and No.15 do not use their hay sheds because they have stopped hay making. Farmer No.16, in addition, does not use his steel silo which is very expensive because his silage making style and technique have changed. Thus, investment in facilities for dairying have continued in Hokkaido.

Table 22
Buildings and Sheds on FM Dairy Farms in East Hokkaido

	11	12	13	14	15	16	17
Cow numbers	153	125	116	105	77	76	71
Breeding in shed	all year round	all year round	all year round	all year round	all year round	all year round	except summer
Free stall type shed	(90)257	(92)759	(93)120H	(88)	(85)148	(91)100H	(91)R85H
	(91)528			(91)			
	(95)478			(93)			
Stanchion stall type shed			(72)	(52)116			
			(74)	(85)370			
			(80)				
Calf shed	(?)116		(91)	(73)198	(73)100	(63)452	(86)113
	(95)136					(86)346	(90)113
Milking parlor	(95)12D		(93)8D	(88)4D	(92)6D	(92)4D	(91)5D
Feeding shed	(95)231		(92)				
Hay shed		x(76)198	x(80)		x(77)198	(78)297	(75)130
		x(83)188	x(80)			(80)116	(80)388
		x(83)198					
Material shed		(92)				(73)165	
						(76)198	
Silage silo		(80)U	x(80)S	(91)B	(85)B	(89)178B	(80)423B
				(92)B		(90)238B	(92)324B
				(95)B		(95)594B	(93)324B
Machinery shed			(87)(90)		(70)396		(83)103
Dung shed				(88)		(90)	
Dung strage	(?)430				(?)	(83)165	
						(91)231	
						(95)238	
Urine(under ground tank*)			(76)			(80)	
			(94)				
Site pavement						(94)457	
Office		(94)					
Slurry pond		○		○			○

Notes:

1. Area is m^2.
2. Cost is ¥10,000 ($125).
3. One NZ$ = ¥80
4. ( ) = year
5. free stall style: H = number of cows, R = renew,
6. milking parlor: D = double number of milking machine
7. hay shed: x = no use, silage silo: U = underground, B = bunker, S = steel.

Table 23 shows the different sheds on dairy farms in New Zealand. The main shed is a dairy shed and the others are calf rearing sheds, material sheds, tractor sheds, implement sheds, and hay sheds. Most of the dairy sheds are very new because of being converted from other kinds of farming, or the dairy farms have been recently developed. Most of the other sheds are old, the reason for this is that they utilise existing shed facilities left by the previous farmers or used for their other forms of farming. By contrast, in Hokkaido, many buildings and sheds are pulled down when farmers give up farming, because the land is divided and sold.

Table 23
Buildings and Sheds on Dairy Farms in New Zealand

	Area	No.	Dairy shed (bail)	Calf rearing building	Materials shed	Tractor shed	Other shed
Interviewed farms	South Island	1	(95) R50	(?)	(?)		workshop(?)
		2	(96) R44	(56/69) 540	(40) 150	(12) 150	
		3	(95) R40	(50) 400	(80) 330	(80) 112	
		4	(95) R40	(?) 100	(?) 50	(?) 150	
		5	(60) H12			(70) 135	hay shed(95) 126
		6	(91) H18	(91) 30		(87) 108	hay feed shed(60~70)
		7	(93) H12		(94) 90	(93) 270	
		8	(91) H12	(91) 26	(92/94)	(1900)	
	North Island	9	(95) H32	(23) 100 (65) 120		(65) 120 (68) 160	
		10	(89) H34	(50) 324	(?) 128		
		11	(55) H16A	(94) 200	(76) 400	(82) 300	
		12	(89) H20A	(85) 100		(?) 60	implement shed(?) 120
		13	(60) H12A	(87) 250			hay shed(?) 250
answered questionnaire farms	north	①	(95) H30	(95) 140	(?) 36		implement shed(?) 140
		②	(70) H16	(85) 160	(75) 20	(85) 40	implement shed(85) 40
		③	(45) H16	(45) 30		(?) 80	
		④	(?) H20	(?) 54	(?) 124	(?) 99	
		⑤	(86) R28	(?) 64	(?) 96		

Notes: 1. Area is m^2. 2.( ) = year 3. R: Rotary Turn style, H: Herringbone style, A: aside

Table 24 shows the cost of different main buildings on dairy farms in Hokkaido. The cost of the free type stall sheds average $414,000, and that of calf rearing sheds average $51,000 and that of milking parlours average $323,000. So new dairy farms in Japan need at least $800,000 for the cost of buildings. On the other hand, in New Zealand the cost of Rotary Turnstile dairy sheds average $312,500 and that of new Herringbone style dairy sheds average $103,400 (Table 25).

Table 24
The Cost of Main Buildings on F.M.Dairy Farms

	11	12	13	14	15	16	17	av.
Free stall shed	413	○	144	549	236	763	381	414
Calf rearing shed	○	○	43	25	○	85	○	51
Milking parlor	○	375	210	566	○	388	75	323
Total	413	375	396	1140	236	1235	456	

Notes:
1. Costs is $1,000. 2. ○ is unknown.

If converted into the cost for one cow, the cost of the milking parlour is $3,136 per cow in Hokkaido. In New Zealand the cost of Rotary Turnstile is $502 per cow and the new Herringbone style is $417 per cow. The cost of Hokkaido's milking parlour per cow is 6-7.5 times as much as the New Zealand dairy shed per cow. The reason for the high cost of Hokkaido's milking parlours are that they are strongly built to a very high standard, similar to houses, to meet earthquake and snowfall standards and also have some automatic devices. Also, some dairy farmers tend to buy more expensive free type stall sheds and milking parlours because of the high subsidy rates from the government (a maximum of 50 per cent).

Table 25
The Cost of Main Buildings on Dairy Farms in New Zealand

	1	2	3	4	5	6	7	8	9	10	11	12	13
Dairy shed	R 280	R 320	R 350	R 300	H 4	H	H 40	H 115	H 180	H 102	H	H 80	H
Other shed					C13 T15	C4 T3	M6 T18	C4 M20		C0.7 T11.5		C5	C.M T.5

Notes:
1. Cost is $1,000
2. R: Rotary Turn style, H: Herringbone style
3. Other shed: C = calf rearing shed, T = tractor shed, M = material shed.

3.5 Machinery

Table 26 describes include machinery of dairy farmers that were interviewed in New Zealand. The main types of machinery is tractors, feeder wagons, buggy motorcycles, trucks and hay mowers. Most farmers have two tractors and the horsepower of all these tractors are under 100HP except farmer No.4's tractor which has 105HP. Eighteen out of 25 have tractor with 50HP to 80HP. Most tractors are secondhand.

Table 26
Machinery on Dairy Farms in New Zealand

No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Tractor	S91 28 65HP	S96 17 105HP	S92 20 72HP	S91 78HP	S87 11 95HP	S94 7 52HP	S93 18 64HP	95 58 82HP	 52HP	S94 4 35HP	74 60HP	70 32 70HP	97 21 59HP
Tractor	S94 10 70HP	S96 5 55HP		S93 27 62HP	S72 5 -	S82 10 52HP	S91 6 39HP	96 11 68HP	92 40 65HP	N92 40 65HP		86 1.8 40HP	
Tractor	S95 24 50HP							77 1.7 45HP					
Feeder wagon	N94 15			S92 8	S72 5 S60 5			87 5.6		N93 12	85	95 5	97 5
Buggy motercycle	N95 3 S95 1	S96 3	S92 5	N94 4	S94 2	S95 5	N88 7	92 1.8 96 3.5	N96 S96	S93 4	96 9	96 7.5	94 7
Truck	S96 23	S96 2	S97 3	S97 3	S75 4	S93 4	N82 10	74 3	S95		95	92 36	
Truck					S80 2								
Hay mower	N97		S96 3			S93 4	N87 7			N93 5			94 1.5
Forage harvester					S87 4								
Roll baler					N90 32								
Compact baler						N82 4	N78 12						
Rake							N87 6						
Trailer										6			
Fertilizer spreader											96 1.5		

Notes: 1. Purchase year and N: new, S: second hand. 2. Cost is $1,000. HP: horsepower

Farm No.10's tractor is the only one that is new with the exception of several tractors which are unknown. The maximum cost is $58,000 for farmer No.8's tractor. Table 27 describes the tractors of dairy farmers that were interviewed in Hamanaka, Hokkaido. All the farmers have 3 to 6 tractors and most have large tractors which have about 100HP. Farmer No.4 has the largest tractor which is 160HP. About 50% of tractors are new, so, several tractors cost over $100,000. The maximum total cost of tractors is $300,000 for farmer No.2.

Table 27
Tractors on Dairy Farms in Hamanaka

Farm	Tructor 1			Tructor 2			Tructor 3			Tructor 4			Tructor 5			Tructer 6		
No.	HP	year	cost	HP	year	cost	HP	year	cost	HP	year	cost	HP	year	cost	HP	year	cost
1	s108	'93	300	s97	'87	498	n85	'95	470	s80	'84	210	s65	'93	41			
2	n77	'75	325	n99	'78	400	s77	'91	326	s90	'93	340	s110	'85	690	s60	'84	320
3	n105	'90	880	n79	'88	600	s65	'90	300									
4	s105	'87	610	n160	'93	700	n95	'83		s85	'82		s72	'85		s85	'95	
5	n155	'96	950	s108	'93	450	s88	'94	405	s79		560						
6	n68	'69	196	n95	'80	904	n60	'85	480	n105	'96	720						
7	s135	'97	400	n98	'93	550	s80	'94	85	s85	'82	210	s75	'86	100			
8	s	'89	85	n	'85	677	n	'92	680									
9	n78	'88	480	n95	'83	660	n105	'95	740									
10	n78	'80	385	n85	'89	450	n125	'96	870									

Notes: 1. Purchase year and n: new, s: second hand. 2. HP: horsepower
3. Cost is ¥10,000 ($125). 4. One NZ$ = ¥80.

Table 28 describes their other machinery and we can group this machinery into five types: moving machines such as a truck, cultivating and leveling machines, hay and silage making machines, manure spreading machines and feeding machines. About 80% of these machines are new, so the cost is very expensive. Five farmers have invested over $375,000 in these machines. Farmer No.5 has invested about $522,000 in these machines. The total cost of the tractors and other machines in which farmer No.5 has invested is $818,000. Hokkaido's farmers also have to bear the large depreciation cost for machinery.

Table 29 describes the machinery of F.M. farmers and they have as many machines as Hamanaka farmers. New Zealand farmers use 7 kinds of machinery, in contrast Hokkaido farmers use 42 kinds of machinery except for pipeline milkers and bulk coolers. A number of factors help explain why Hokkaido dairy farmers have more machinery than New Zealand dairy farmers. Firstly, New Zealand dairy farmers use their grassland for grazing, whereas Hokkaido farmers have to cut and carry grass, so this requires additional machinery. Furthermore, in New Zealand, cows excrete their dung and urine on the pasture, but in Hokkaido these are stored in a slurry pond and in dung storage devices respectively, because the cows are housed in a shed all year round. So Hokkaido dairy farmers have need of machinery for carrying and spreading manure. Thirdly, tractor, power shovel, skid loader, foil loader, dump truck, barn-cleaner and scraper are used for moving dung from the cow or heifer shed to the dung storage device, the dung shed and slurry pond. After fermenting, the dung is spread on the grassland or crop land by a manure-spreader, slurry-spreader or a vacuum car. Fourthly, Hokkaido's dairy farmers have need of machinery for feeding cows, because they breed their cows in sheds, this is all year round. In contrast, New Zealand dairy farmers have only a few machines because of their grazing methods. Finally, there are many agricultural contractors in New Zealand, whereas there are very few in Hokkaido. So Hokkaido dairy farmers have to have a lot of their own machinery.

Table 28
Purchase Year and Cost of Machinery on Dairy Farms in Hamanaka

	1	2	3	4	5	6	7	8	9	10
Machine	yr cost	yr cost	yr cost	yr cost	yr cost	yr cost	yr cost	yr cost	yr cost	yr cost
dump truck	s93 38		s95 70		s97 300		s95 154	s89 80	s90 300	s96 36
truck	s88 45		s90 120	n75 400	n90 350			n88 220		n79 234
tyre shovel				s93 150	n95 721	n93 312		s96 327		
power shovel							s89 128			s95 144
mini foil loader		s89 74	s95 150		n91 300		n91 319			
trailer	s86 24	s83 31			s95 35			s93 100		s95 37
power harrow					n88 95					
plogh	n82 16	n79 33		n89 80	n85 51		n85 45	n90 30	n80 25	n81 31
disc harrow	n88 26			n89 50	n93 30					n82 38
rotary harrow	n88 8						n88 33		n83 48	n82 48
roller	n88 20				n89 122		s90 21		n83 63	n85 15
broadcaster		n89 50	n88 50			n92 36	n90 45	n97 53	n78 38	n91 23
limesoar	n76 9								n83 22	n83 25
mower						n89 210				
mowerconditioner					n93 235	n87 85			n89 230	
discbine	n94 300	n90 220	n91 220	n94 400		n90 80	n93 278	n84 185		n93 270
teeter		s91 85	n91 110	n93 200	n90 70		s96 149	n93 58		n87 80
rake				n94 180	n95 200			n89 53		n83 50
rotary rake		s96 130	n94 170				n93 90			
teeter rake	n91 114								n94 100	n93 154
roll baler	n95 350	s89 300		n93 300	n94 240	n94 251	s95 87	n93 262	n85 220	n82 305
forage harvester	n93 460	n86 400	n90 450		s89 300		n89 340		n87 310	n90 290
blower	s94 23	n90 152			n78 64					n79 127
crop carrier										n94 150
wrapping machine	n95 200	n95 187	n96 150			s92 60	s94 60	n90 166	n94 140	n92 188
roll gripper	n89 25	s91 39				n92 15	n90 22	n95 40		n92 30
front loader	n95 100		n91 130				n93 120	n95 94		n89 140
back hoe	s93 100	s96 120	s89 170		s93 131				s86 130	
vacuum car		n95 257			n94 115	n86 170			n88 140	n76 40
manuae-spreader		n95 333	n89 230	n94 400	n90 195	n97 90		n95 290	n83 160	n86 152
slurry-spreader	n91 294		n96 230				n97 280	s88 70		n82 110
slurry-pump	n91 160		n95 120	n94 280			n92 120	n91 125		n96 128
barn-cleaner		n83 160	n90 240		n78 105			n85 128	n90 80	n93 104
scraper							n94 242			
scumbenger					n95 321					
skid loader	n94 300							n91 293		
feed mixes	n92 515			n94 380			n94 650	n95 222		
silage cutter							n92 113		n89 130	
roll cutter	n96 175	n88 170	n93 200		n91 196		n91 180			
distributer										
computer feeder				n89 200						
alpha feed	n89 600									
bulk cooler										n94 150
pipeline milker										n79 280

Notes: 1. Cost is ¥10,000 ($125). 2. One NZ$ = ¥80 3. .n: new, s: second hand

Table 29

Purchase Year of Machinery of F.M. Dairy Farms in East Hokkaiko

	11	12	13	14	15	16	17
tractor	○	'89	'81	'90	'80	'75	'73
tractor	○	'90	'90	'93	'90	'77	'89
tractor	○	'93	'91	'93	'92	'86	'94
tractor	○	'94	'95	'95		'94	
tractor	○						
dump track		'85		'87, 91			○
truck					'93	'90	○
tyre shovel		'89		'90		'92	
power shovel		'94	'88	'89		'93	
mini foil loader							'91
trailer	○		'94				
plough						'91, 91	
rotary harrow						'82, 82	
pasture harrow				'86			
disc harrow				'90			
broadcaster	○	'81		'94	'82	'94	'94
roller	○				'87		
mower	oo	'89					
mower-conditioner				'90, 95	'93	'93	
discbine			'94				
haybine			'87				
teeter	ooo		'86, 93			'85	'90
rake	o						
rotary rake		'92	'88				
teeter-rake				'89			
roll baler	○		'83, 94				
load wagon		'87					
blower			'84				
wrapping mchine	○		'91, 94				
roll gripper			'90				
front loader	○		'90				
back hoe			'88				
one man harvester						'94	
vaccum car				'92	'90	'82	
manure-spreader	○			'88	'89	'95	
slurry-spreader		'89					
slurry pump		'90	'95				'93
slurry mixer				'94			
skid loader		'90, 94					
barn-cleaner							
scraper		'93					
foil loader	○						
feed mixer	○	'94		'88	'92	'95	'91
silage cutter		'95					'92
roll cutter			'91, 94	'90			
distributer	○						
alpha feed				'88			
rotor beater					'90.		
washing spray		'88					'93

Note: ○ is unknown.

3.6 The Daily Routine on Dairy Farms in New Zealand and Hokkaido

Hokkaido dairy farmers have more daily routines than New Zealand dairy farmers. The reason for this is that Hokkaido dairy farmers need to feed their cows as they do not graze. They have to remove dung from their barns, and breed their calves and heifers through to maturity, rather than sending them away as some farms in New Zealand do.

Table 30 describes the daily routines and the people in charge of these routines on dairy farms in New Zealand. The kinds of routines consist of cow driving, milking, platform washing, treating injured cows, nursing and so on. On large dairy farms sharemilkers and workers are in charge of routines, whereas on small dairy farms only the sharemilker or owners are in charge of routines. Only the sharemilkers wives who answered the questions do milking and are quite young. For example: Farmer No.1's wife is 23 years old; Farmer No.2's wife is 26 years old; Farmer No.7's wife is 33 years old. Several dairy farmers wives are also in charge of feeding calves.

Table 30
The Routine Work of Dairy Farms in New Zealand

	Area	No.	Cow Driving	Milking	Platform Washing	Ttreating Injured Cows	Nursing	Other Work
Interviewed Farmers	South Island	1	W/W	S/W	S/W	S	Swi	S(breeding)
		2	S/W/O	S/W/O	S/W/O	-	W	
		3	S/W/W	S/W/W	S/W/W	S/W	Swi/W	
		4	S	S/W	S/W	S/W	Swi	
		5	W	W/O	W/O	W/O	O	
		6	W	W	O/W	O/W	W	O/W (grazing kayle)
		7	Os	Os	Os	Os	Of	Of(bull calfs)
		8	W	O/W	O/W	O/W	O	O/W(feeding out)
	North Island	9	W	S/W/W	S/W/W	S/W/W	S/W/W	
		10	W	Wwi/O	W	W	Wwi	
		11	S	S	S	S	S	
		12	S	S	S	S	S	
		13	S	S	S	S	S	
Answered Question naire Farms	North Island	①	S/Swi	S/Swi	S/Swi	S	S/Swi	
		②	S	S/Swi	Swi	S	S/Swi	
		③	W	S/W	W		O	
		④	O	O	O		O	
		⑤	S	S/Swi	S/Swi	S	Swi	

Note: S: sharemilker, Swi: sharemilker's wife, W: worker, O: owner, Of: Owner(father)
Os: Owner (son)

Table 31 describes the daily routines and the people in charge of the routines on dairy farms in Hokkaido. The kinds of daily routines consist of cow driving which is sometimes only from the barn to the milking parlour, milking, equipment and platform washing, feeding, removal of dung, nursing, breeding heifers, treating injured cows and so on. On most dairy farms, the owners and their wives are in charge of milking and equipment and platform washing. On dairy farms in which two generations are involved, the owners, their wives, their sons and their son's wives are in charge of milking and equipment and platform washing. On most dairy farms the owners, and their wives are in charge of nursing and breeding heifers.

Table 31
The Routine Work of Dairy Farms in Hokkaido

No.	Cow Driving	Milking	Platform Washing	Taking out Silage	Feeding Cows	Removing Dung	Nursing	Breeding Heifers	Cleaning Dung of Heifers	Treating Injured Cows
1	Wi/S	Wi/S	Wi/S	H	H	H	Wi	S	H	-
2	H/S	H/Wi/S/Swi/W	H/Wi	S	S		H	Wi		H
3	H	H/Wi	Wi	H	H	H	M	F/M	M	
4	S/T	H/S/Swi/T	H/S/Swi	S	H/S	S	H	H	H	S
5	Wi/Swi	H/Wi/S/Swi	H/Wi/Swi	S	Wi/S	H/Wi	Swi	Wi/Swi	S	Wi/Swi
6	H/wi	H/Wi/S/Swi	Wi	H/Wi/S	H/Wi/Swi	H/Wi	Swi	Wi	Wi	Wi
7	H	H/Wi	H/Wi	H	H	H	H	Wi	Wi	H/Wi
8	S/T	H/Wi/T	H/S	T	S/T	S/T	S	S	T	S/T
9		H/Wi/S/Swi	S/Swi	H/S/Swi	H/Wi/S/Swi	Swi	Wi	H/Wi	H/Wi	
10	Wi/S	H/Wi/S	S	Wi/S	H	Wi	M	Wi	Wi	H
11		H/Wi/Pw	H/Wi/Pw	W	W	W	W	W	W	
12		Wi/W	Wi/W	W	W	W	Wi	Wi	W	
13		H/Wi	H/Wi	H	H	H	Wi	H	H	
14		H/Wi	H/Wi	H/Wi	H/Wi	H/Wi	F	F	F	
15		H/Wi	H/Wi	H	H	H	Wi	H	Wi	
16		H/Wi	H/Wi	H/Wi	H	H	Wi	H	H	
17		H/Wi/F	Wi	H	H	H	H	F	H	

Note: H: Owner, Wi: Owner's wife, S: Owner's son, Swi: Son's wife,
Pw: Permanent worker, T: trainee , F: Owner's father, M: Owner's mother

Table 32 describes the method of feeding and the different kinds of feed on Hokkaido dairy farms. There are two feeding methods: one is feeding each cow in proportion to their quantity of milk, the other is T.M.R (total mixtured ration) which is the method of feeding mixed feed for one, two or three groups of cows. Feeds include formula feed, beet pulp, processed maize, processed barley, silage, hay, hay cube and so on. The number of times of feeding is usually two or four times a day. However, everyday farmer No.6 feeds his cows six times; at 8 a.m., 10 a.m., 12 a.m., 3 p.m., 6 p.m., and 8 p.m.

Table 32
Methods of Feeding and Feed

No.	Method of feeding	Machine and implement	Kinds of feed	Feeding times per day
1	FRM+TMR	Feeding Mixer	Formula feed, beet pulp, processed maize, silage	2 times
2	FRM	Wheelbarrow, Tractor	Formula feed, beet pulp	2 times
3	FRM	Wheelbarrow, Feederwagon	Formula feed	6 times
4	TMR 2G	Feeding Mixer	Formula feed, processed maize, beet pulp	2 times
5	FRM	Wheelbarrow	Formula feed, processed maize,	4 times
6	FRM	Wheelbarrow	Formula feed, processed barley,	2 times
7	TMR 3G	Feeding Mixer	Formula feed, lucerne pellet	2 times
8	TMR 1G	Tractor, Wheelbarrow	Formula feed, beet pulp, lucerne pellet	3 times
9	FRM	Wheelbarrow	F.f., beet pulp, lucerne pellet, p.barley	4 times
10	FRM	Wheelbarrow	F.f., beet pulp, p.maize, soybean meal, hay cube, silage	3 times

Notes: FMR: feeding in proportion to producing milk cows. TMR: Total mixed ratio.
F.f.: formula feed, p. maize: processed maize, p. barley: processed barley, G: group.

3.7 Main Work Outside of Routines

Table 33 describes the main work outside of routines on dairy farms in New Zealand. The kinds of main work includes spreading fertiliser, over sowing, fence repairing, artificial insemination, treating diseased cows, measuring milk quantity, crop harvesting, grass mowing, silage making, hay making and raising heifers. Most large dairy farms entrust spreading fertiliser, over sowing, grass mowing and silage making to contractors. Most middle-sized dairy farms and small dairy farms also entrust spreading fertiliser, silage making and crop harvesting to contractors. Most dairy farms entrust artificial insemination to Livestock Improvement Corporation, and treating diseased cows to veterinarians.

Table 34 describes the method of treating sewage. There are two methods of treating sewage: one is spraying back on to the pasture every day. This does not require labour as it is an automatic spreading system. The other is the two pond system which stores sewage in ponds and the sewage is then sprayed on the pasture by a contractor every couple of years.

Table 33

The Main Work Outside of Routine Work on Dairy Farms in New Zealand

	No.	Spreading Fertilizer	Over Sowing	Fence Reparing	Artificial Insemination	Treating Disease Cows	Meassuring Milk Quantity	Crop Harvesting	Grass Mowing	Silage Making	Hay Making	Raising Heifers
	1	C	C	S/W	S/W	S/W	-	-	C	C	-	E
	2	C	C	S/O/W	LIC	V	LIC	-	-	C	-	E
	3	C	C	S/W	S	V	-	-	S/W	C	-	E
	4	C	C	S/W	S/W	S/W	Swi/S/W	-	C	C	-	E
Interviewed farms	5	O/W/C	-	O/W	O	O/C/V	O	C	W	C	O/W	O/W
	6	O	O/W	S/W	O/W	V	LIC	O/W	O/W	O/W	-	O/W
	7	OS	O	O	LIC	OS/O/V	OS/O	O	O	-	O/C	E
	8	O/W	O/W	O/W	O/W	V/O	O/C	-	O/W	O/C	-	O/W
	9	C	C	S	S	S/V	LIC/S	C	C	C	-	E
	10	C	-	O/W	LIC	O/V	O	C	O	C	C	E
	11	S	S	S	LIC	S/V	LIC/O	S	S	C	-	E
	12	S	S	O	S	S	S/SWi	S/O	S	S/O	-	E
	13	C/S	-	-	LIC	S	LIC/O	-	S	C	-	E
Ansewered questionnaire farms	①	C	C	S/O/C	LIC	V	S	-	S	S	O	E
	②	S	S	S	LIC	V	E	C	S	S	C	E
	③	S/O	-	O	LIC	S/V	S/W/O	S/W/O	S/W/O	S/W/O	S/O	E
	④	C	C	O	LIC	O	O	C	O	C	O	O
	⑤	C	S/O	S	LIC	S	S/O	C	S	S/C	S/O/C	S

Notes: 1. C: contractor, S: sharemilker, O: owner, W: worker, Swi: sharemilker wife, OS: owner's son, LIC: livestock Improvement Company, V: veterinary, E: other farm.

2. 1-8: the South Island 9-13, (1) - (5): the North Island

Table 34

The Treating Sewage of Dairy Farms in New Zealand

Area	No.	The Method of Treating Sewage
South Island	1.	Spray back onto the pastures every day.
	2.	Spray back onto the pastures every day.
	3.	Ponded spray back over grass.
	4.	Spray back onto the pastures every day.
	5.	Pumped onto pasture.
	6.	Fed to sump from shed, sprayed.
	7.	30-40 ha./day by travelling irrigation.
North Island	8.	Spray over pasture.
	9.	Irrigation on pasture.
	10.	Two pond system.
	11.	Two pond system.
	12.	Spraying on pasture.
	13.	Two pond system.

The main work outside of routines on dairy farms in Hokkaido is silage making, hay making and treating dung and urine.

Silage making and hay making

Table 35 describes the areas of silage making and hay making on dairy farms in Hokkaido. There are two types of silage making: one is silo silage, the other is big bale silage. Big bale silage is packed into bales of wilted grass inside plastic film. All dairy farms make silage and hay two times a year, with the exception of three dairy farms which make it three times a year. The ratio of the area among silo silage making, big bale silage making and hay making is different between the first time and the second time. In the first time, 61% is silo silage, 25% is big bale silage and 14% is hay. In the second time, 59% is silo silage, 38% is big bale silage and 3% is hay. The difference in the above ratios between first time and second time depends on the rain in each season. On the farms having free style stall sheds and milking parlours, the ratio of silo silage is high, because they work efficiently in feeding silage to cows.

Table 35

The Area (ha) and Type of Conserved Feed on Dairy Farms in Hokkaido

		Fist Cutting			Second Cutting			Third Cutting
	No.	Silo Silage	Roll Bale Silage	Hay	Silo Silage	Roll Bale Silage	Hay	Roll Bale Silage
Hamanaka Dairy Farms	1	60	60	2	30	30	-	-
	2	40	20	5	-	40	-	-
	3	30	40	-	40	30	-	-
	4	60	-	5	60	-	-	-
	5	30	19	34	-	30	-	12
	6	15	9	9	-	-	-	-
	7	45	7	45	40	-	-	-
	8	54	3	-	28	15	-	-
	9	18	18	-	18	18	-	10
	10	30	8	5	-	30	-	-
F.M. Dairy Farms	11	-	20	7	-	27	-	-
	12	74	-	-	74	-	-	-
	13	-	58	-	-	58	-	-
	14	55	-	10	55	-	-	-
	15	55	-	-	55	-	-	-
	16	35	-	15	40	-	17.5	-
	17	35	3	5	20	15	8	-
Total		636	265	142	460	293	25.5	22
Ratio		61%	25%	14%	59%	38%	3%	

Table 36 describes the people in charge of each activity in first, second and third cutting. The kind of work is grass mowing, grass drying and gathering, grass picking up and cutting or grass rounding, grass carrying and grass stacking or wrapping. There are five types of farms on which different people are involved in silage making and hay making: on the first type of farm, it is performed by the family, second, most work is performed by the family and a little of the work is done by a contractor. Third, most work is performed by a contractor and a little of the work is performed by the family, forth, most work is performed by a cooperative family group and a little of the work is performed by the family. Lastly the work is performed by the family, the cooperative family group and the contractor. The contractor limits himself to making silo silage. Most big bale silage making and hay making is performed by the family. Five out of 10 farmers entrust silage making to a contractor. The areas of these farms making silage for the first time during the year are as follows: Farm No.1 has 20 hectares, Farm No.2 has 34 hectares, Farm No.4 has 60 hectares, Farm No.7 has 29 hectares and Farm No.8 has 54 hectares. The area used the second time of making silage is: Farm No.4 has 60 hectares and Farm No.8 has 35 hectares. The other farms do not make silage for a second time. Several procedures in silage making require the use of machinery.

Table 36

The Share in Work for Making Grass and Hay on Dairy Farms in Hamanaka

	Grass mowing				Grass drying and gathering				Grass cutting picking up or baling				Grass trasportation				Grass stacking or storage			
No.	G1	G2	RS	Hay	G1	G2	RS	Hay	G1	G2	RS	Hay	G1	G2	RS	Hay	G1	G2	RS	Hay
1	F	F	F	F	F/C	F	F	F	F/C	F	F	F	F/C	F	F	F	F/C	F	F	F
2	C	F	F	F	C	F	F	F	C	F	F	F	C	F	F	F	C	F	F	F
3	G	G	F	-	G	G	F	-	G	G	F	-	G	G	F	-	G	G	F	-
4	F	F	-	F	C	C	-	F	C	C	-	-	C	C	-	F	C	C	-	F
5	F	F	F	F	F	F	F	F	F	F	-	-	F	F	F	F	F	F	F	F
6	G	G	F	F	G	G	F	F	G	G	-	-	G	G	F	F	G	G	F	F
7	C/G	G	F/G	F	F/C/G	G	F/G	F	C/G	G	F/G	F	C/G	G	F/G	F	C/G	G	F/G	F
8	C	C	F	-	C	C	F	-	C	C	F	-	C	C	F	-	C	C	F	-
9	F	F	F	-	F	F	F	-	F	F	F	-	F	F	F	-	F	F	F	-
10	F	-	F	F	F	-	F	F	F	-	F	F	F	-	F	F	F	-	F	F

Note: G1: first grass cutting, G2: second grass cutting, RS: roll bale silage
F: family, C: contractor, G: working group.

Table 37 describes the machinery used in each procedure in silage making and hay making on F.M.dairyfarms according to government data. A mower-conditioner is used for grass mowing; a teeter for grass drying; a rake for grass gathering; a rollbaler for grass rounding; a harvester and a load wagon for grass picking and cutting; a dump truck for grass carrying; a power shovel and a foil loader for grass stacking and a wrapping machine for grass wrapping.

Table 38 describes grazing and there are six dairy farms which do grazing. The grazing term is from May to October and the type of grazing is daytime grazing and night and day grazing. Most grazing areas are 3-5 hectares for 2-6 days. Farm No.5 uses only 1-3 hectares for grazing for 160 days. The grazing areas of Farm No.5 is similar to a paddock without grass. Only three farms use electric fences. Four dairy farmers have stopped grazing from 1988 to 1993. The reasons for stopping grazing are as follows: first, F.M. dairy farms breed their cows in barns all year round, second, there were few pastures around their barns, third, dairy farmers disliked the work of cow driving.

Table 37

The Machinery Used in Each Procedure in Forage Making on F.M. Farms in Hokkaido

No.	Type of forage making	Harvest first time	Harvest second time	Grass mowing	Grass drying & gathering	Grass rounding, picking & cutting	Grass carring	Grass stacking & wrapping
11	Roll Silage	20	27	mower	teeter, rake	rollbaler	dump truck	wrapping
	Hay	7	-	-conditioner			dump truck	
12	Grass Silage	73.9	73.9	mower-con.	rotary rake	load wagon	load wagon	power shove
13	Roll Silage	58	58	discbine	teeter, rake	rollbaler	trailer	wapping m.
14	Grass Silage	55	55	mower-	teeter, rake	harvester	dump truck	power shove
	Hay	10	-	coditioner	teeter, rake	rollbaler	dump truck	front load
15	Grass Silage	55	55	mower-con.	-	one-man harvester	one-man hrv	power shove
16	Grass Silage	35	40	mower-	-	one-man harvester	one-man hrv	tructor
	Hay	15	17.5	conditioner	teeter, rake	rollbaler	truck	
	Grass Silage	35	20		-	forage harvester	dump truck	foil loader
17	Corn Silage	11.		mower-	-	forage harvester	dump truck	dump box
	Roll Silage	3	15	conditioner	teeter, rake	rollbaler	dump truck	foil loader
	Hay	5	8		teeter, rake	rollbaler	dump truck	-

Notes: Grass and Corn Silage: storage in silo Roll silage: storage in plastic.

Table 38

The Term, Type and Area of Grazing and The Reasons for Stopping Grazing

	No.	Grazing term	Grazing type	Grazing area	Use of electric fence	Working times in a day
Farms carring out grazing	2	end of May - middle of Oct.	daytime	5 ha/ 2 days	Yes	60 min.
	5	middle of May- end of Oct.	daytime	1-3ha/160days	Yes	
	6	middle of June- end of Sept.	night and day	3.5ha/17days	No	10 min.
	8	biggining of June -middle of Aug.	daytime	3ha/3days	Yes	40 min.
	10	biggining of June biggining of Sept	daytime	3ha/days	No	30 min.

	No.	year stopped	the reasons of stopping grazing
Farms stopped grazing	1	1988	construction of free stall type shed
	3	1992	a few grassland near the barn
	7	1991	construction of free stall type shed
	9	1993	trouble with grazing work

Methods of Treating Dung and Slurry

There are two different forms of dung on Hokkaido dairy farms: one is called slurry form which is a mixture of dung and urine. It has a colloid form excluding hay and wheat straw in the free stall type cow shed. The other is muddy form including hay or straw wheat in the stanchion stall type cow shed and heifer shed. Table 39 describes the process of treating dung and slurry. Dung is removed from the cow sheds and the heifer sheds to the dung storage by using a barn-cleaner or a tractor. Urine is stored in a urine tank. Slurry is removed from the shed to the slurry pond, the slurry tank, the underground pit or artificial ponds which are called "lagoons" by using skid loaders, foil loaders, tractors, scrapers, or barn-cleaners. After fermenting, the dung is spread on the grassland by a manure-spreader. The slurry is also spread on the grassland by a slurry-spreader or a vacuum car. The urine is spread on the grassland by a vacuum car.

Table 39
The Process of Treating Dung and Slurry on Dairy Farms in Hokkaido

	No.	Type of excretion	Removing machine	Storage	Spreading machine
Hamanaka dairy farms	1	slurry	skid loader	slurry store	slurry spreader
	2	separating dung & urine	barn cleaner	dung storage	manure spreader
	3	slurry	skid loader	underground tank	slurry spreader
	4	mixing with bedding	tructor	dung storage	manure spreader
	5	separating dung & urine	barn cleaner	dung storage	manure spreader
	6	separating dung & urine			
	7	slurry	slurry spreader	slurry tank	slurry spreader
	8	slurry	barn cleaner	dung storage s. t.	slurry spreader
	9	separating dung & urine			
	10	slurry	barn cleaner	slurry store	slurry spreader
F.M. dairy farms	11	mixing with bedding	foil loader	stacking on field d. s.	manure spreader
	12	slurry	scraper	slurry pond	slurry spreader
	13	slurry	tructor	underground tank	slurry spreader
	14	slurry	skid loader b. c.	slurry pond	vacuum car
	15	mixing with bedding	tructor b. c.	dung storage	manure spreader
	16	separating dung & urine	tyre shovel	dung storage with roof	vacuum car m. v.
	17	slurry	mini foil loader	slurry pond	slurry spreader

Note: b.c. = barn cleaner, s.t. = slurry tank, d.s. = dung storage, m.v. = manure spreader.

3.8 Working Hours in New Zealand and Hokkaido

Table 40 describes working hours on dairy farms in New Zealand. This table does not include the working hours involving irrigation, fence repairing, artificial insemination, measuring milk quantity (herd testing), grass mowing and so on. Farm No.1 which breeds 850 cows spends 5,328 hours in a year. This is the highest among the New Zealand farms. Most dairy farms which breed between 250 and 500 cows spend 2,000 to 3,000 hours in a year. Most dairy farms which breed below 250 cows spend between 1,000 and 2,000 hours a year. Farm No.8 spends a lot of working hours for a smaller number of cows. This is because the farm supplies milk all year round and feeds every day from March to September. Farm No.2 spends 1,655 working hours per person which is the largest number of working hours of all the farms surveyed. Farm No.11 spends 438 working hours per person which is the smallest. There is no connection between herd size and working hours per person. The working hours per cow on each farm are between 5 and 10 hours with exception of Farm No.8 with 22.4 hours.

Table 40
Working Time (minutes) on Dairy Farms in New Zealand

	Area	No.	Cow driving	Milking	Platform washing	Treating injuried cows	Nursing	Other work	Annual total (hour)	Annual working hours per person	Annual working hours per cow
Interviewed Farms	South Island	1	120	720	120	30	240	60	5238	1066	6.3
		2	180	810	180	-	180	-	4965	1655	7.9
		3	90	480	60	20	180	-	2798	700	5.3
		4	40	440	80	10	300	-	2525	1263	5.2
		5	40	480	60	10	15	-	2466	822	9.8
		6	40	180	60	6	30	30	1929	643	7.8
		7	60	240	60	5	90	-	1566	783	8.2
		8	45	360	120	10	60	300	4035	1614	22.4
	North Island	9	-	-	-	-	-	-	-	-	-
		10	90	360	90	-	180	-	2340	780	7.1
		11	60	190	50	10	45	-	1314	438	7.6
		12	40	180	40	10	60	-	1155	1155	5.8
		13	10	240	40	5	30	-	1244	1244	7.7
Answered Questionaire Farms	North Island	①	120	360	120	15	100	-	2613	1307	9.3
		②	40	340	30	5	25	-	1742	871	8.5
		③	30	300	60	-	90	-	1670	835	8.4
		④	40	240	60	-	60	-	1447	1447	7.2
		⑤	90	150	90	15	150	-	1513	757	9.1

Table 41 describes working hours on dairy farms in Hamanaka Town, Hokkaido. This table contains all working hours except fertiliser spreading. Farm No.2 spends 9,547 working hours which is the largest number of working hours of all the farms surveyed. This is because they use a pipeline milker which is an old milking system. On the farm, the farm owner, wife, son, sons wife and worker are involved in milking which takes 16 hours a day, 6,083 hours a year in total and occupies 63.7 percent of the total. Farm No.1, No.3, No.4 and No.7 are F.M. farms which have a free stall type shed and a milking parlour. They spend between 50 and 80 hours per year. Other farms which have the stanchion stall type shed and pipeline milker spend 80 to 100 hours per cow per year with the exception of Farm No.6. The comparison between working hours in New Zealand and Hokkaido are as follows: the working hours per person is 1,022 hours which exclude irrigation in New Zealand and is 1,993 hours in Hokkaido. The working hours per cow is 8.4 hours in New Zealand and is 78 hours in Hokkaido. The main reason for this is because of differences in the cow management system, the milking system and the division of labour.

Table 41
Working Hour on Dairy Farms in Hamanaka, Hokkaido

Work		1	2	3	4	5	6	7	8	9	10
Routines in a day (minute)	cow driving	20	40	10	60	40	30	25	60		40
	milking	460	1000	360	600	510	400	225	380	480	480
	milk equipement washing	60	120	20	180	110	45	80	80	60	60
	silage taking out	20	20	10	40	30	60	40	30	150	80
	feeding	20	60	80	100	45	60	20	80	170	60
	cow's dung removal	60	30	30	10	40	15	20	60	20	60
	nursing	30	30	60	30	50	15	15	30	30	40
	raising heifers	30	30	120	30	40	15	30	30	120	30
	heifer's dung removal	10		40	50	30	5	15	60	60	30
	treating injuried cows		30		30	60	10	40	55		30
	other		60								
	total	710	1420	730	1130	955	655	510	865	1090	910
	total in a year(hour)	4317	8634	4438	6870	5806	3982	3101	5259	6627	5533
Main work except routines in a year (hour)	making silage and hay	653	490	343	40	550	80	648	27	958	665
	spreading manure	240	98	48	136	64	30	96	126	120	280
	assistance for veterinarian	36	60	36		60	12	24	180	12	48
	calving	12	36	36	120	180	36	12	60	12	24
	assistance for inseminator	36	84	60	120	120	24	12	180	12	72
	managing for grazing		145				18		90		65
	total	977	913	523	416	974	200	792	663	1114	1154
Total (hour)		5294	9547	4961	7286	6780	4182	3893	5922	7741	6687
Annual working hour per person		2036	2220	2067	2429	1784	1115	2163	1795	1935	2388
Annual working hour per cow		48.6	93.6	50.1	79.2	80.7	52.3	57.3	87.1	119.1	111.5

3.9 Incomes on Dairy Farms in New Zealand and Hokkaido

Table 42 describes milk production, the average payout of milk and milk sales on dairy farms in New Zealand, 1996/97. Farm No.1, No.2, No.3 and No.4 have a large milk production due to their large herd. The average payout is about $3.30 per kg milk solid in the South Island and $3.88 per kg milk solid in the North Island. Milk sales are between $143,329 and $1,081,600. Table 43 describes milk production, the average payout of milk and milk sales on dairy farms in 1996 in Hamanaka, Hokkaido. Total milk production is between 395 tons and 885 tons. Average payout is between ¥74 which includes the subsidy of ¥11.49 in Japan in 1996. Milk sales are between $431,000 and $840,000. The range of milk sales in Hokkaido are similar to New Zealand.

Table 42
Milk Sales, New Zealand, 1996/97

Area	No	Total Milksolids (kg)	Average payout ($)	Sales milk (income) ($)
South Island	1	320,000	3.38	1,081,600
	2	189,788	3.30	626,300
	3	177,871	3.30	586,974
	4	170,000	3.25	552,500
	5	85,000	3.30	280,500
	6	70,000	?	?
	7	43,433	3.30	143,329
	8	*(720,000)	S0.30, Wo.52	268,800
North Isrand	9	103,910	3.50	363,685
	10	114,540	4.10	469,614
	11	51,789	4.10	212,335
	12	64,000	4.18	267,520
	13	43,234	3.50	151,319

Note: 1. No.8*: milk (litre). 2. S: summer, W: winter.

Table 43
Milk Sales, Hamanaka, 1996

No	Total milk production (t)	Milk price (¥/kg)	Sales of milk (¥1,000)	Sales of milk ($1,000)
1	885	75.9	67,172	840
2	672	75.7	50,870	636
3	504	74	37,870	466
4	670	76	50,920	637
5	626	76.6	47,952	599
6	393	?	?	?
7	665	78	51,870	648
8	596	76.3	45,475	568
9	426	83	35,358	442
10	460	75	35,500	431

Note: Exchange rate: $1 = ¥80.

Table 44 describes the gross income, the expenses, the net income, living expenses and so on of dairy farmers in Hamanaka, Hokkaido, in 1996. All dairy farmers pay a lot of money for grain. They also have to pay interest on debts and they have to repay loans. However, they get surpluses after paying for their living expenses.

Table 44
Financial Data for Dairy Farms in Hamanaka

No	① Gross income	② Expenses (grain)	(depreciation) (building)	(depreciation) (machinery)	total	③ Net income (①-②)	④ Interest on debt	⑤ Repayment on loans	⑥ Household expense	⑦ Surplus (③-④-⑤-⑥)	⑦ NZ$
1	81,960	19,840	3,060	7,080	65,400	16,560	1,590	4,950	8,000	2,020	25,250
2	66,540	12,350	570	3,440	38,780	20,640	1,530	1,970	9,170	9,490	118,625
3	54,080	11,970	1,150	5,750	47,360	6,440	1,070	2,300	3,000	70	1
4	56,050	21,290	?	?	54,260	1,790	3,140	6,580	6,190	-14,120	-176,500
5	52,640	10,380	?	?	29,600	23,040	0	0	9,190	6,040	75,500
7	59,800	17,250	3,538	4,380	49,210	10,590	1,590	2,840	5,000	1,160	14,500
8	59,180	13,540	2,560	4,990	48,020	11,160	1,150	3,270	6,360	380	4,750
9	36,000	8,500	?	?	23,000	13,000	?	?	3,200	?	
10	45,280	8,650	?	?	26,530	18,750	760	4,690	9,780	3,520	44,000
AV	56,837	13,752	2,176	5,128	42,484	13,621	1,354	3,325	6,654	1,070	13,375

Note: Unit of money is ¥1,000 (NZ$12.5)

3.10 The Agricultural Companies and Organisations Concerned with Dairy Farmers

Most business connections of New Zealand dairy farms are with companies. Table 45 describes the suppliers of fertiliser, feed, seeds, machinery, milking equipment and fuel. These business connections are Ravensdown for fertiliser, Wrightson and Anchor Mart for feed, Wrightson for seeds, Alfa Laval for milking equipment and Caltex and Mobil for fuel. Most dairy farmers have bought second hand machinery in private sales from other farmers. Table 46 describes the milk processing companies and livestock companies in New Zealand. The milk processing companies in the South Island are Alpine Dairy Company and South Island Dairy Farmers Limited (Meadow Fresh). In the North Island, it is the New Zealand Dairy Group (Anchor). The companies dealing in calves are Primary Producers Co-operative Society Ltd (P.P.C.S) in the South Island and Dairy Meat in the North Island. Most dairy farmers keep heifers on their own farms or other farms. Some dairy farmers sell heifers to P.P.C.S in the South Island. The companies dealing with culling cows are P.P.C.S in the South Island and AFFCO and Lowe Walker in the North Island. Most dairy farmers entrust some of their work to contractors and many consult with the Farm Wise consultant of Livestock Improvement Advisory.

Table 45
The Suppliers of Materials for Dairy Farms in New Zealand

Location	No.	Fertiliser	Feed	Seeds	Machinery	Milking equipment	Fuel
South Island	1	Ravensdown	Burnham farm	Peter Cates	Ch. Ch.	Alfa Laval	Caltex
	2	Ravensdown	Calfmed PGG	Wrightsons		Alfa Laval	Mobil
	3	Ravensdown	crop farms	Hodder and Tolly	Private sale	Alfa Laval	SHELL
	4	Ch. Ch.	other farm	-	company/ private	Ch. Ch.	Caltex
	5	Ravensdown	crop farm	A. B. Annan	Cockrans	Reads	Caltex
	6	Ravensdown	Farmer	Luisetti Seeds	Murry Implement	Alfa Laval	Caltex
	7	Ellesmear Transport		private farmer	Private Sales	Reads	Caltex
	8	Ravensdown	crop farm	Wrightson	Nords	Reads	Waitoki Fuel-Shell
North Island	9	Wrightson	Anchor Mart	Wrightson	- -	Mclaren Rural Service	-
	10	BOP	Wrightson	Wrightson	-		Mobil
	11	BOP	Anchor Mert	Anchor Mert	Maber Motors	Nu Palse	Anchor Mert
	12	BOP	TATUA	TATUA -	Maber Motors	Alfa Laval	TATUA
	13	BOP	Wrightson		Farm Cleaning Sale	Supreme Milking Machine	B. P.

Most business connections of Hokkaido dairy farms are agricultural cooperatives. Table 47 describes the business connections of Hamanaka dairy farms. The interviewed dairy farmers had to choose one answer from four options.

1. Those who did business with agricultural cooperatives only.

2. Those who did almost all their business with agricultural cooperatives.

3. Those who did business mainly with agricultural cooperatives and subordinately with companies and merchants.

4. Those who did business mainly with companies and merchants and subordinately with agricultural cooperatives.

There were three farms which bought materials from agricultural cooperatives only (Option, 1). There were five farms which bought almost all their materials from agricultural cooperatives (Option, 2). There were two farms which bought materials mainly from

agricultural cooperatives and subordinately from companies and merchants (Option, 3). All dairy farms sold their milk to agricultural cooperatives according to milk distribution regulations. There were four farms which sold their cows and heifers to agricultural cooperatives only (Option, 1). There were four farms which sold almost all their heifers and cows to agricultural cooperatives (Option, 2). There were two farms which sold heifers and cows mainly to agricultural cooperatives and subordinately to companies and merchants (Option, 3).

Table 46
The Milk Processing Company and Livestock Company Dealing with Dairy Farms in New Zealand

Location	No.	Milk	Calf	Heifer	Culling Cow
South Island	1	Alpine Dairy Co.	P. P. C. S	Private Sale	
	2	Alpine Dairy Co.	P. P. C. S	-	Wrightsons rural agant
	3	Alpine Ashburton	P. P. C. S	keep PPCS	Alliance
	4	Meadow Fresh	P. P. C. S	keep or sales	
	5	Meadow Fresh	P. P. C. S		
	6	Meadow Fresh	Wrightson	-	P. P. C. S
	7	Meadow Fresh	Steven Lew the waite PPCS	PPCS	P. P. C. S Canterbury Meat
	8	Meadow Fresh	Addington Meat Works	keep	Addington Meat Works
North Island	9	NZ D. G. Co.	?	?	?
	10	NZ D. G. Co.	Dairy Meat	Private Farmer	Lowe Walker
	11	NZ D. G. Co.	Dairy Meat	Dairy Meat	AFFCO
	12	TATUA	Dairy Meat		AFFCO
	13	NZ D. G. Co.	Dairy Meat	-	Lowe Wolker

There were six farms which insured their lives with agricultural cooperatives only (Option, 1). There were four farms which insured their lives with almost all agricultural cooperatives only (Option, 1). Five farms entrusted some work to a contractor which is owned by agricultural cooperatives. Most farms consulted agricultural cooperatives and agricultural technical diffusion centres about farm management and technical problems. Most dairy farms consulted veterinarians of the Agricultural Cooperative Society about their sick cows. Most farms asked agricultural cooperatives and machinery companies about their broken-down machinery which they can not repair.

Table 47
The Business Connections of Dairy Farmers in Hamanaka, Hokkaido

No.	Purchase of Materials	Selling of cows and heifers	life insurance
1	only A.C.	almost A.C.	almost A.C.
2	mainly A.C.	mainly A.C.	only A.C.
3	almost A.C.	only A.C.	almost A.C.
4	mainly A.C.	almost A.C.	only A.C.
5	almost A.C.	only A.C.	almost A.C.
6	only A.C.	mainly A.C.	only A.C.
7	mainly A.C.	mainly A.C.	mainly A.C.
8	almost A.C.	only A.C.	only A.C.
9	only A.C.	only A.C.	only A.C.
10	almost A.C.	almost A.C.	only A.C.

(note) A.C. :Agricultural Cooperatives

CHAPTER 4

CONCLUSION

The data presented in Chapter 3 provide the bases for making comparisons of dairy farming in New Zealand and Hokkaido, Japan. Table 48 and 49 highlight the key points of comparison. There are two fundamental differences in dairy farming between New Zealand and Japan. One is the difference in the land ownership system; the other is the difference in the cow management system. In New Zealand, dairy farmers sell their land and buy a bigger property when expanding their dairy farms. Sharemilkers change their farms in order to suit their size of herd. In Japan, most retiring dairy farmers divide their farmlands into several parts and sell or lease them to other farmers. So most Japanese dairy farmers have several pieces of farmland which are away from their sheds. The land market in Japan is limited by the hereditary system of their farming. The buying and selling of farm lands is limited by the Land Law. Companies and people other than farmers can not buy farm land. In contrast, the land market in New Zealand is open. The second fundamental difference in dairy farming is the cow management system. The cow management system in New Zealand is very simple, compared to the complex system in Japan. Most Japanese dairy farmers breed cows in barns all year round. So they have to harvest grasses and forage crops, and store them in silos and then feed them to their cows. They have to also carry out dung or slurry. This kind of work requires considerable machinery and labour (Table 48,49).

Table 48
The Comparison of the Structure of New Zealand and Japanese Dairy Farming

	New Zealand	Japan(Hokkaido)
Farm land	united farm land	some pieces of farm land
Grass and forage crop growing	mainly grass	grass, maize
Silage and hay making	sometimes making silage	mainly silage making part of hay making
Feeding	sometimes feeding grass silage on the pasture	grain, silage and hay feeding in the barn
Milking	milking by rotary turnstyle or herringbone shed	mainly milking by pipeline milker
Heifer raising	entrusting raising heifers to other farms	entrusting raising heifers to the heifer breeding farm in summer
Handling sewage or manure	spreading sewage onto the pasture every day or a two pond system which is spreading sewage onto the pasture every several years	removing dung and slurry from barn to manure storage, slurry tank and lagoon and then spreading manure and slurry onto the meadow several times a year

As well as this, Japanese dairy farmers feed a lot of grain to their cows because they want to increase milk production per cow. This means a lot of dairy farmers have stopped grazing their cows. The complex cow management system requires many sheds, facilities and machines. It is very expensive and it is mainly supported by the Government. In addition, some dairy farmers are giving up farming owing to their debts. The complex Japanese cow management system also requires a lot of labour. All adult members of families on dairy farms have been involved in dairy farming. But many young men who were expected to be successors have left their farms. One of the reasons for the long hours of hard labour on Japanese dairy farms is because of the milking system. Most milking systems on Japanese dairy farms are pipeline milkers where farmers have to carry the milk buckets to each cow. So recently, some dairy farmers have been introducing milking parlours onto their farms. The number of Hokkaido dairy farms on which milking parlours and free-stall type sheds have been introduced was 647 which was 5.8 percent of the total in 1995 (11,133). The cost of this system is very high. Thus, the complex Japanese cow management system which feeds a lot of grain to cows results in the highest milk production cost in the world. In contrast, New Zealand's simple cow management system, which depends on grazing, achieves the lowest cost in the world in spite of the changeable climate. In the future, the complex Japanese cow management system will probably not change and it will be very difficult to reduce the cost of milk. Japanese dairy farmers will be threatened by changes in the cost of grain on the world market, because the demand of grain will exceed the supply due to the increase of consumption of grain in China and South East Asia countries. Furthermore in Japan, a decline in production of milk is due to the decreasing number of dairy farms. The main reasons are the aging of farmers (the percentage of farmers who are above 60 was 39.1% in Hokkaido and 63% in Japan in 1996), the problem of manure treatment and the decrease in farmers' income. Japanese dairy farmers, especially Hokkaido dairy farmers will have to shift milk production away from dairy production to fresh town milk in order to compete with cheap dairy products imported from New Zealand, Australia and so on. Japanese people like fresh town milk which is supplied from all over the country. They dislike long life milk which can be imported from overseas. In addition, the price of fresh town milk is higher than for dairy products.

Japanese dairy farms have to pursue more efficient dairy farming practices for producing cheaper milk. The grazing technique is a very efficient cow management system for Hokkaido dairy farming. However, grazing is very difficult for Hokkaido dairy farming because of the distance away of some pieces of their land. Also, it is very difficult for newcomers to start dairy farming owing to the high cost of land, machinery and buildings. So, the Japanese government has to supply low cost dairy farming systems for newcomers. For example, providing the lease farm which is similar to New Zealand sharemilking farms. The New Zealand dairy farming system suggests many ideas to Japanese dairy farming. For example, the grazing system, the farm ownership system, a sharemilking system and the use of the type of management systems used by corporate entities like Tasman Agriculture.

Table 49

The Comparison in Labour, Machinery and Costs Between New Zealand and Japan (Hokkaido)

	Labour		Machinery		Cost	
	New Zealand	Japan (Hokkaido)	New Zealand	Japan (Hokkaido)	New Zealand	Japan (Hokkaido)
Pasture renovation	nothing or small	some or nothing (construction company)	nothing or few	some or nothing	small	large
Grazing	small	nothing or small	-	-	some	nothing or small
Hay or silage milking	small or nothing (contractor)	a lot of	few or nothing (contractor)	a lot of	small	large
Feeding	small	a lot of	nothing or few	few	small	large
Milking	a lot of	a lot of	large	small or large	large	large
Breeding cattle	a lot of	a lot of	-	-	some	some
Breeding heifers	nothing (other farm) or a lot of	a lot of	-	-	a lot of	a lot of
Treating sewage or dung (slurry)	nothing	a lot of	few or nothing (contractor)	some	small	large
Total	some	a lot of	few	a lot of	small	large

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