
A Thesis
for the Degree of Master of Science

BUSINESS ANALYSIS OF DAIRY
FARMING IN CHE-JU PROVINCE

by
CHANG SEOB KIM B.Sc.

Department of Animal Science
Graduate School, Che-ju National University
Che-ju 590
KOREA

1987

濟州道内 酪農家の 經營分析

指導教授 康 太 淑

金 昌 燮

이 論文을 農學 碩士學位 論文으로 提出함

1987年 12月

金昌燮의 農學 碩士學位 論文을 認准함

審査委員長 金 文 哲 
委 員 玄 公 南 
委 員 康 太 淑 

濟州大學校 大學院

1987年 12月

BUSINESS ANALYSIS OF DAIRY FARMING IN CHE-JU PROVINCE

Chang-Seob, Kim

(Supervised by Professor Tae-Sook, Kang)

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF AGRICULTURE

DEPARTMENT OF ANIMAL SCIENCE
GRADUATE SCHOOL
CHEJU NATIONAL UNIVERSITY

1987

TABLE OF CONTENT

ACKNOWLEDGEMENTS	1
SUMMARY IN KOREAN	2
SUMMARY	4
I. INTRODUCTION	6
II. REVIEW OF THE LITERATURE	8
III. MATERIALS AND METHODS	10
IV. RESULTS AND DISCUSSION	12
V. CONCLUSION	35
APPENDIX	37
REFERENCES	40

Acknowledgements

I am especially grateful to my academic supervisor, Associate Professor Tae-sook Kang, for his enthusiastic encouragement and his kindly guidance throughout the course of my graduate study. He has offered generous co-operation and assistance in many areas, such as collecting and analyzing materials, and providing many references.

Dr. Kyu-il Kim, Associate Professor, Department of Animal Science, has assisted me patiently by proof-reading the manuscript of my thesis. I wish to thank him for this assistance.

Visiting Professor Gury Boivin, Department of English Education, and Visiting Professor Penny Boivin, Department of English Language and Literature, constantly advised and encouraged me throughout the course of my graduate study with sincere kindness. I offer special thanks to them.

I wish to thank the staff of Electronic Data Processing Institute of Che-ju National University for processing and classifying the data analyzed in my thesis.

I am also grateful for the interest and encouragement of the staff of the Che-ju Dairy Association, especially Miss Eun-sim Chang, and all the farmers who prepared their materials and advice. I give special thanks to them.

I wish to thank all the professors and fellow graduate students, Department of Animal Science, for their ceaseless guidance and assistance.

Dr. Moon-cheol Kim, Associate Professor, Department of Animal Science, assisted me with sincere advice on my thesis. I wish to thank him for his kindness.

Dr. Kong-nam Hyun, Assistant Professor, Department of Agricultural Economy, assisted me by proof-reading the manuscript of my thesis. I am much obliged to him for his help.

Finally, my thanks go to my parents, brothers, sisters and friends for their patience and understanding.

요 약

본 연구는 제주도내 33개 낙농가를 대상으로 낙농현황, 경영기반 및 경영성과를 분석하기 위하여 1985년 8월 1일부터 1986년 7월 31일까지 1년간 실시하였으며 그 결과를 요약하면 다음과 같다.

1. 조사농가 33호의 연령분포는 41-50세 계층이 14호로 전체의 42.4%를 차지하고 있어 중장년층을 대상으로 분포하고 있었고, 경영주의 학력수준은 고졸이 45.4% (15호), 중졸과 전문대졸 이상이 24.2%(8호)로 나타났다. 경영주의 평균낙농경험 연수는 6.5년이었고, 7-9년 계층이 20호(60.6%)로 가장 많았으나 경험연수 3년 이하의 신규낙농농가도 7호(21.2%)를 차지하여 타지역에 비해 경험연수가 떨어졌다.
2. 표본조사된 낙농가의 평균 성우환산두수는 13.6두였고, 실제두수로는 호당평균 16.6두를 사육하고 있었다. 낙농의 기반이 되는 초지에 있어서는 제주지역이 호당 차용지를 포함해서 130,132m²(39,434평), 두당 9,119m³(2,763평)을 확보하고 있다. 노동력 투하측면을 보면 두당 연간 평균 369.5시간으로 나타났고 자가노동비율이 전국평균에 비해 낮은 것이 낙농경영개선에 문제점으로 지적되었다.
3. 성우 두당 연간 경영비는 평균 1,166천원, 총생산비는 두당 평균 1,616천원으로 나타났으며, 경영비 항목중 사료비와 감가상각비가 차지하는 비율은 사료비가 54.9%, 감가상각비가 17.7%였다. 한편 조수입은 우유판매액(75.2%), 송아지 판매액(22.2%), 구비평가액(2.6%)으로 구성되고 있고 우유판매액이 차지하는 비율은 전국평균 80.1%에 비해 떨어지고 있었으며 산유량도 연간 두당 4,141kg으로 전국 평균 4,940kg에 비해 크게 떨어지고 있었다.
4. kg당 우유생산비는 332.90원으로 분석되어 전국 평균치인 295.7원에 비해 37.2원이 더 높은 것으로 나타났다. 산유량별로는 4,500-5,000kg을 생산하는 농가 계층에서 kg당 판매가인 322원 이하의 생산비인 272.78원을 보여 앞으로 제주도내의 낙농경영 개선을 위해서는 적어도 두당 연간 4,500kg 이상의 우유생산이 이루어져야 될 것으로 사료된다.
5. 낙농농가의 연간 소득은 두당 평균 454천원인 것으로 분석되었으며, 그 소득율에 있어서는 28.0%로 농가소득과 소득율 양측면에서 전국평균에 비해 크게 떨어

지는 것으로 나타났는데, 그 주요한 원인은 낮은 산유량과 고용노동력의 과다에 기인한 것으로 사료된다. 따라서 앞으로 제주지역의 낙농경영 개선과 발전을 위해서는 가족노동력 이용의 극대화, 토지이용의 합리화에 초점을 맞추는 한편 산유량향상을 위한 노력이 뒤따라야 할 것으로 사료된다.

Summary

The present study was conducted to analyze dairy farm management in Che-ju province, examining 33 dairy farms cross Che-ju province, between August 1, 1985 and July 31, 1986.

45.3% of dairy farmers belonged in the age range of 41–50, and those under 30 and over 61 were each only one of 33 dairy farmers, respectively. This age distribution showed some similiarity to that of Kyung–nam province; however, it is somewhat different to that of Kyung–gi province.

The percentage of those who received a high schol–levle education was the highest, 45.5%, and that of a college–level education, 24.2%. Generally, education level of Che-ju dairy farmeers was lower than that of those in Kyung–gi province or Kyung–nam province.

The average of years of experience was 6.5, and the percentage of those who are engaged in dairy farming over 7 years was the highest, 63.6%, however, this is shorter than that of Kyung–gi province, considering the history of the dairy business.

Average grassland per household was 130, 132m², and per head, 9, 119m². These are about 10 times larger than those of the national average. Therefore, Che-ju dairy farmers have been oppressed in managing dairy businesses by this fact.

The average numbers of dairy cattle were 16.61 for the real number and 13.66, for the livestock unit. This is more than those of the national average, 10.30. However, that heifers exchanged for old cows were not secured enough was pointed out to be a problem.

Percentage of tractors, cultivators, milking–machines, cuters, mowers, coolers and cars secured by a household were 20, 90, 100, 70, 73, 100 and 23%, respectively, on the average. This is somewhat higher than that of the national average.

average labor–hour per head per year was 369.5, and the percentage of

self-labor was 51.5%. Average total labor-hour per head was less than that at the national average. However, that self-labor ratio was lower than that at national average was pointed out to be a problem in order to improve the dairy business in Che-ju province.

Average operating costs per head were 1, 166, 129 won, and total costs per head were 1, 616, 253 won. Percentages of feed cost and depreciation cost to operating cost were 54.9% and 17.7%, respectively. That hired labor ratio was higher than that of the national level was pointed out to be a problem. Average yearly milk production per cow was 4,141kg, and this is much lower than that of the national average, 4,940kg. One of the main factors lowering milk production in Che-ju province was found to be that there were many old cows not exchanged in time.

Components of gross receipts per head were milk sales (75.2%), calf sales(22.2%) and value of manure(2.6%) on the average, and value of milk sales was closely related to the amount of milk production. Percentage of milk sales was lower than that of national average, 80.8%, and this was due to low milk production.

Average milk production cost was 332.90 won, and it was higher than that of the national average by 37.2 won, the main reason that milk production costs were higher in Che-ju province than those of the national average was found to be lower milk production of Che-ju.

In the group classified by milk production, the group of 4,500–5,000kg showed lower production cost, 272.78won, than selling cost, 322won, first. This indicates that a dairy farmer must produce 4,500kg of milk per head per year in order to manage his dairy business in profit.

Average farm income per head was 454,192won, and the average income rate was 28.0. These are much lower than those of the national average, and the main reasons for this were low milk production and high hired labor costs.

Finally, to improve dairy business in Che-ju province and maintain its prosperity, Che-ju dairy farmers must face and try to resolve three problems: that is, to have to maximize the use of family labor forces, to have to maximize the use of farm land and to have to improve milk production.

I. INTRODUCTION

Since 188 dairy cattle from Australia were imported in 1976, dairy farming in Che-ju province has progressed noticeably.

As of July, 1986, there are 141 dairy farms and about 1,800 dairy cattle in Che-ju province.

In management of dairy farming in Che-ju province, it is considered there are some advantages, and some disadvantages compared to that in mainland. What are those, and which factors affect them? Analysis of these factors and demonstration of them are aims of the present study.

Unfortunately, there have been only a few previous studies in this field. Those concerning business analysis were Yang(1981), *Study of Dairy Farming and Management in Che-ju—Do*; Kang(1983), *Economic Analysis of the Farm Structure and Dairy Farm Management*; kang(1984), *Analysis of the Management of New and Advanced Dairy Farms in Che-ju—Do* and Kang(1984), *An economic Analysis of the Results of Management of Dairy Farms*.

In these studies, the dairy business in Che-ju province has not been analyzed sufficiently so as to be able to offer Che-ju dairy farmers management information comparing local conditions to those of the mainland.

Che-ju is different from the mainland in many ways, such as human, social, conventional and natural conditions. These factors affect the dairy business indirectly.

Che-ju island is favored in temperature growing pasture all year round, and at the same time, unfavored in soil made of non-disintegrating organic matter, such as volcanic ash soil.

Though there are a large native grassland of about 60,000 ha and a large market in which are consumed about 9,000M/T of milk products compared to 3,000M/T of milk of milk production in Che-ju province, most of the native grassland is rocky and dairy products produced in Che-ju province have not been consumed optimally due to lack of advertisement by the Che-ju dairy industry.

Additionally, the fact that there are only two processing factories adds to the difficulties of the dairy business in Che-ju province.

The study aims to demonstrate the present situation of the Che-ju dairy business, and to offer fundamental data to dairy farmers and other concerned authorities, in order to assist dairy farmers in their decision-making and to further develop the science of dairy farming for the future.

II. REVIEW OF THE LITERATURE

Concerning farm land, Yang(1981), Kang(1983 and 1984) and National Livestock Cooperatives Federation(1986) reported their research, and Che-ju's was tending to be much larger than that of the national average, and concerning dairy cattle, Kim and Kim(1970), Chu(1970), Ishii (1974), Park et al. (1975), Kang et al.(1977), Yang(1981), Kang(1986) and Moon et al.(1986) conducted their research, which showed somewhat different results, according to their research ranges or districts.

Meanwhile, Kim(1962), Kim(1969), Kimball and Saupe(1970), Kim and Kim(1970), Wells and Pardue(1970), Yook(1971), Chai et al.(1972), Kobayashi and Kawateiik(1972), Nishiyama(1973), Takehara(1973, 1978 and 1978), Ishii(1974) and 1975), Komuro(1974), Kume(1974), Ha(1975), Aono(1976), Shiozawa(1977), Nishibu et al.(1978), Yang(1981), Babb(1981), Benson and Sutter(1981), Kang(1983, 1984, and 1984), Jorge et al.(1983), Kwon (1984), Cheon(1985), Hu and Lee(1985), National Livestock Cooperatives Federation(1986) and Moon et al.(1986) reported their studies on business analysis of dairy farming, and even though their studies showed varying degrees of difference, between them there were two factors which showed the same trends, that is, feed cost and livestock depreciation. However, other factors showed many differences according to country, region, farm size, time, sample range, surveying manner and so on.

Concerning milk production and milk production cost, Kim(1962), Kim(1969), Katayama(1974), Kume(1976), Ha(1976), Orth and Hutjens(1980), Cheong(1981), Yangk(1981), Kang(1983 and 1984), Kin et al.(1984), National Livestock Cooperatives Federation(1986), Moon et al.(1986) and Seoul Milk Cooperatives Federation(1987) conducted their research, and in their reports, milk production and milk production cost showed much variation according to country, region and farm size. All their reports pointed out that milk production and milk

production cost were very closely correlated, and some of their reports pointed out that operators' educationla level and yeaes of experience were also important to the dairy business.

Kang(1983 and 1984) and National Livestock Cooperatives Federation(1986) reported their research on farm income, and in comparing these studies, it is found that Che-ju was much lower than the nation as a whole in farm income and net returns.

III. MATERIALS AND METHODS

Deciding the scope of sampling districts and selecting the farms for the present study

The sampling districts in the present study ranged over all of Che-ju province. It was classified into 4 dairy farming districts and 5 groups, then 33 dairy farms were selected at random for this study. 14 farms are in Han-rim, 8, in Che-ju-si, 5, in Seong-up, 6, in Son-whul.

the reason why the farms were classified from 4 districts into 5 groups is that they are grouped distinctively by themselves, and the peculiarities of each distinguished it from others.

For analytical purposes, these farms were classified into 3 groups by herd size in terms of cow unit.

Among the farms which are analyzed for the present study, 7 farms belong to the group of less than 10 head, 14 farms, to the group of 10–15 head and 12 farms, to the group of 15 head or more.

All these farms are selected from among the farms whose milk had been sold for over a year as of the time surveyed.

Methods of survey

For the present study, all the farms were visited and farmers surveyed directly or by questionnaire. Their record books were also examined. Also visited were *Che-ju Dairy Association*, *veterinary drugstores*, *Che-ju Feed Factory*, *Isidore Feed Factory*, *Che-ju Purina Agent*, *Seo-guy Purina Agent* and *The Che-ju Livestock Cooperative*.

Period of survey

The period of survey for the present study was from August 1, 1985 to July 31, 1986.

Methods of material analysis

For the present study, a mainly electronic data processing system was used with manual processing involved subordinately.

Statements of main cost items

- A. Livestock expenses: (The average transaction price of the first calving cow during the previous 5 years–Remaining value(50%))/Durable years(6 years)
- B. Depreciation cost(Building & Large implements): Repurchasing or Rebuilding price–Remaining price (5%)/Durable years
- C. Capital service interest
- i) Borrowed capital: Interest paid for loan capital.
 - ii) Fixed capital: (Value of buildings & Large implements+Value of Livestock capital)×own capital ratio×10%
 - iii) Fluid capital: (Operating cost–Depreciation cost–Losing value in disposing fixed assets)/No. of capital rotation during the year/2×own capital ratio×10%
 - iv) Land service interest
 - a) Rent: Money paid for rent of land & value of payments in kind.
 - b) Own land: Value of own land×own capital ratio×5%
 - v) Costs of feed & other materials
 - a) Purchasing feed cost: Purchasing price+other concerned incidental expenses
 - b) Self–support feed cost
 - 1. Cultivated feed cost: Counted by the expenses of the invested materials.
 - 2. Agricultural by–products of own household: Evaluated by the transaction price.
 - vi) Wages
 - 1. Hired wages: Invested cash amounts+Value of payments in kind
 - 2. Family labor cost: Applied the conversion table of labor by the authorities concerned.

VI. RESULTS AND DISCUSSION

1. The present condition of the dairy business

A general condition of dairy farmers in sampling farms

Table 1 showed the age distribution of dairy farmers in Che-ju province. According to Table 1, the age range of 41–50 showed the highest percentage, 42.4, and the age ranges of under 30 and over 61 showed the lowest, on the average. This age distribution shows some similarity to that of Kyung-nam province (Kim and Kim, 1970); however, it is somewhat different to that of Kyung-gi province (Cheong, 1981). In Kyung-gi province, the age range of 31–40 showed the highest distribution, 38.2%, and those who received college-level education were higher than that of Che-ju. The main reason for that is that many young people who graduated from college are engaged in the dairy business in that province. By herd size, all the farm groups showed similar pattern in age distribution. A prominent peculiarity was observed on the age distribution in Che-ju province compared to Kyung-nam and Kyung-gi province. In Che-ju province there are no dairy farmers under 30 and over 61, and only one each on the sampling dairy farms.

Yang (1981) reported that the 31–40 age range showed the highest percentage. There showed a somewhat different age range between his report and the present study. That difference is considered to be due to the time transition between them.

Meanwhile, though Cheong (1981) reported that as the farm size became larger the age range became higher, that relationship was not found in the present study.

By regional groups, all groups showed similar age distribution except Hae-an. There half of the dairy farmers had received college-level education, and there seems to be more young dairy farmers who graduated from college and are engaged in dairy farming in that region.

Table 1. Age distribution of operators, by herd size and region.

Herd size	Age distribution					Total
	Under 30	31-40	41-50	51-60	Over 61	
number(%)						
Less than 10 head	-	2(28.6)	3(42.8)	1(14.3)	1(14.3)	7(100)
10-15 head	1 (7.1)	4(28.6)	5(35.7)	4(28.6)	-	14(100)
15 head or more	-	3(25.0)	6(50.0)	3(25.0)	-	12(100)
Total	1 (3.0)	9(27.3)	14(42.4)	8(24.3)	1 (3.0)	33(100)
<i>Region</i>						
Chu-chuk	-	1(16.7)	3(50.0)	2(33.3)	-	6(100)
Kae-cheok	-	2(25.0)	3(37.5)	3(37.5)	-	8(100)
Hae-an	1(12.5)	3(37.5)	2(25.0)	2(25.0)	-	8(100)
Seong-up	-	2(40.0)	2(40.0)	-	1(20.0)	5(100)
Son-whal	-	1(16.7)	4(66.6)	1(16.7)	-	6(100)
Total	1 (3.0)	9(27.3)	14(42.4)	8(24.3)	1 (3.0)	33(100)

Table 2 showed the educational level of Che-ju dairy farmers by herd size and region. According to Table 2, farmers who received a high school-level education were 15 out of 33, or 45.5%; however, this figure is lower than that of Kyung-gi province, 50.9%(Cheong, 1981). The farmers who received a college-level education were 8 of 33, or 24.2%, and this figure was also lower than those of Kyung-gi province and Kyung-nam province, 32.7% and 38.6%(Cheong, 1981 and Kim and Kim, 1970), respectively. Considering that educational level is closely related to the dairy business, this low educational level is considered one of the obstacles to appropriate management of dairy farming. Concerning the group of herd sizes, the groups of 10-15 head and 15 head or more showed a relatively higher educational level than the group of less than 10 head. By regional groups, Hae-an showed the highest percentage of college-level education, and Chu-chuk showed the highest percentage of high school-level education, and Chu-chuk showed the highest percentage of high school-level education.

Though Cheong(1981) reported that educational level and results of dairy business is closely related, that trend was not observed in the Che-ju province. The main reason is considered to be that other factors are stronger than educational level for the dairy business in Che-ju province because the history of Che-ju dairy farming was relatively shorter than other countries or provinces.

Table 2. Educational level of operators, by herd size and region.

Herd size	Education level				Total
	Primary school	Junior high school	High school	Junior college or higher	
	----- number(%) -----				
Less than 10 head	1(14.2)	3(42.9)	3(42.9)	-	7(100)
10-15 head	1 (7.1)	3(21.4)	6(42.9)	4(28.6)	14(100)
15 head or more	-	2(16.7)	6(50.0)	4(33.3)	12(100)
Total	2 (6.1)	8(24.2)	15(45.5)	8(24.2)	33(100)
<i>Region</i>					
Chu-chuk	-	1(16.7)	5(83.3)	-	6(100)
Kae-cheok	-	3(37.5)	4(50.0)	1(12.5)	8(100)
Hae-an	1(12.5)	1(12.5)	2(25.0)	4(50.0)	8(100)
Seong-up	1(20.0)	1(20.0)	2(40.0)	1(20.0)	5(100)
Son whul	-	2(33.3)	2(33.3)	2(33.3)	6(100)
Total	2 (6.1)	8(24.2)	15(45.5)	8(24.2)	33(100)

Table 3 showed years of experience of Che-ju dairy farmers. Concerning herd size, 15 head or more showed the most years, 7.3, on the average, and the larger a farm becomes, the more years of experience there are. By regional group, Chu-chuk showed the most years, 8.5, and Son-Whul showed the least years, 5. The average of years of experience was 6.5, and it was the same as that of Kyung-gi province(Cheong, 1981); however, much less than that of Japan, 23.3(Nishibu et al., 1978).

Even though years of experience of Che-ju dairy farmers were the same as that of the Kyung-gi province, considering the longer history of dairy farming in

Kyung-gi province. Che-ju's is shorter than that of Kyung-gi province. yang(1981) reported that years of experience of Che-ju dairy farmers were actually much shorter than that of dairy farmers on the mainland. The above fact—that the years of experience of Che-ju dairy farmers is also one of the obstacles for developing the dairy business in Che-ju province—is not clearly seen in the present study.

Table 3. Years of experience of operators, by herd size and region.

Herd size	Years of experience				Total	Average year
	Under 3	4-6	7-9	Over 10		
----- number(%)-----						
Less than 10 head	3(42.9)	1(14.1)	3(42.9)	-	7(100)	5
10-15 head	3(21.4)	3(21.4)	7(50.0)	1 (7.2)	14(100)	6.6
15 head or more	1 (8.3)	1 (8.3)	10(83.4)	-	12(100)	7.3
Total	7(21.2)	5(15.2)	20(60.6)	1 (3.0)	33(100)	6.5
<i>Region</i>						
Chu-chuk	-	-	6(100)	-	6(100)	8.5
Kae-cheok	-	-	8(100)	-	8(100)	7.5
Hae-an	2(25.0)	1(12.5)	4(50.0)	1(12.5)	8(100)	6.6
Seong-up	1(20.0)	3(60.0)	1(20.0)	-	5(100)	4.8
Son-whul	4(66.7)	1(16.7)	1(16.7)	-	6(100)	4
Total	7(21.2)	5(15.2)	20(60.6)	1 (3.0)	33(100)	6.5

Status of farm land kept in sampling farms

Table 4 showed the utilization area per household by herd size. Average farm land per household was 130.132m² including rent area, and for less than 10 head, 10-15 head and 15 head or more, it was 109.734m², 113.489m² and 167.174m², respectively.

Comparing this utilization area to that of the national average, it was much larger than the national average, 10.763m² (National Livestock Cooperatives

Federation, 1986), land utilization of farm land was also more open than that of the national average. Practically, in Che-ju province the dairy farmers use their farm land for fodder fields, cultivated pasture, native pasture and others for 42,141, 72,646, 12,086 and 3,206m², respectively, and only 32.3% of the total area was used for fodder field. This is much lower than the 78.1% national average(National Livestock Cooperatives Federation, 1986).

Farm land per household kept in Che-ju province was about 10 times that of the national average, and even much larger than that of absolute required area, 4,500m², per head. Therefore, most dairy farmers used their farm land for cultivated pasture(55.8%), and its condition is not well kept. Therefore, most dairy farmers in Che-ju province have been pressured in managing their farms. The groups of 10–15 head used their farm land mostly for fodder fields (49.6%) and the group of 15 head or more, for cultivated pasture (59.8%). These figures illustrate the fact that Che-ju dairy farmers feed their dairy cattle by grazing as their herd size becomes larger. However, the fact that the groups of less than 10 head used their farm land mostly for cultivated pasture(71.7%) was considered that because they have excessively large farm land compared to their herd size, they need not use their farm land much for fodder fields, and they keep their dairy cattle grazing.

Table 4. Utilization area per household, by herd size.

Herd size	Fodder fields	Cultivated Pasture	Native pasture	Others	Total
	----- m ² (%) -----				
Less than 10 head	24,986(22.7)	78,729(71.7)	5,548 (5.2)	471(0.4)	109,734(100)
10-15 head	56,336(49.6)	42,546(37.5)	11,432(10.1)	3,175(2.8)	113,489(100)
15 head or more	45,100(27.0)	96,663(59.8)	19,278(11.5)	6,133(3.7)	167,174(100)
Average	42,141(32.4)	72,646(65.8)	12,086 (9.3)	3,260(2.5)	130,132(100)

Note: Others include building site, playground and so on.

While for the groups classified by region, the average farm area per head was 9,119m² as shown in Table 5. The utilization of farm land was 7,775, 8,050, 13,126, 7,670 and 8,973m² for Chu-chuk, Kae-cheok, Hae-an, Seong-up and Son-whul, respectively.

Chu-Chuk used its farm land mostly for fodder fields(71.8%), and the main reason was found to be that, because Chu-Chuk keeps the most dairy cattle, it had to use its farm land more intensively than other regions did. However, Son-whul used its farm land mostly for cultivated pasture(74.0%); the main reason for this was that since dairy cattle kept in that region were not so many, it need not use its farm land so intensively.

Meanwhile, Hae-an used its farm land mostly for cultivated pasture (71.9%). This is because its farm land per head for keeping dairy cattle was largest of all regions; however, though it had not so many dairy cattle compared to other regions, Seong-up used its farm land intensively, its main importance was found to be that it has the most native pasture of all regions.

As to Che-ju dairy farming, it can be safely said that the farm land owned for dairy farming is sufficient to raise dairy cattle, but its use is not so concentrated as to improve dairy business.

Table 5. Utilization area per head, by region.

Region	Fodder fields	Cultivated Pasture	Native pasture	Others	Total
	----- m ² (%) -----				
Chu-chuk	5,586(71.8)	1,897(24.4)	200 (2.6)	92(1.2)	7,776(100)
Kae-cheok	2,892(35.9)	4,416(54.9)	227 (2.8)	425(5.4)	8,050(100)
Hae-an	2,755(21.0)	9,436(71.9)	799 (6.1)	136(1.0)	13,126(100)
Seong up	3,709(48.4)	1,854(24.2)	2,043(26.6)	64(0.8)	7,670(100)
Son-whul	1,932(21.5)	6,643(74.0)	197 (2.2)	201(2.3)	8,973(100)
Average	3,375(32.4)	4,849(55.8)	693 (9.3)	184(2.5)	9,119(100)

Note: Others include building site, playground and so on.

Status of dairy cattle kept in sampling farms

Table 6 showed the number of dairy cattle kept in sampling farms. According to Table 6, the average number of dairy cattle kept in Che-ju province was 13.66 head in cow unit, and it is higher than the national average, 10.30 head and 10.42 head(National Livestock Cooperatives Federation, 1986 and Moon et al., 1986), respectively, in number.

Actually, the Che-ju dairy farmer keeps 8.35, 12.38 and 18.26 head in cow units for less than 10 head, 10–15 head and 15 head or more, respectively, and at the national level, a farmer keeps 6.25, 11.86 and 18.07 head in cow units, respectively, with an average of 10.30 head (national Livestock Cooperatives Federation, 1986).

That the number of heifers was only 1.58 head, on an average, indicates that there are some problems in exchanging old cows over time, as we consider that many a dairy cow kept in Che-ju province is at least 9 or 10 years old, and was imported from foreign countries many years ago. In fact, many a farmer who surveyed pointed out this problem.

Milk production per head per year in Che-ju province is much lower than that of the national average, 4.940kg(National Livestock Cooperatives Federation, 1986). One of the main reasons for this was found that there were many old

Table 6. No. of dairy cattle on farm surveyed, by herd size.

Herd size	No. of farms	Ratio (%)	Cows	Bred-heifers	Heifers	Calves	Total	Live-stock unit	Proportion of cow(%)
----- head -----									
Less than 10 head	7	21.2	6.86	0.86	1.14	0.71	9.57	8.35	82.2
10-15 head	14	42.2	11.43	0.71	1.5	1.43	15.07	12.38	92.3
15 head or more	12	36.4	15.75	1.75	1.92	3.08	22.5	18.26	86.3
Average	33	100	12.03	1.12	1.58	1.88	16.61	13.66	88.1

Note: Heifer and Calf are 6–12 and 0–6 months old, respectively.

cows whose milk production had fallen down in Che-ju province, and the fact that the group of 10-15 head showed the lowest milk production per head per year was also illustrated by this, because the ratio of dairy cows to the total number of cattle was highest, 92.3%, in that group. The highest cow ratio proved that that group have had hardly any heifers that could not be exchanged for its old cows in time.

Table 7 showed the number of dairy cattle by region. According to taht, the number of dairy cattle in livestock unit was 15.95, 15.83, 12.13, 11.39 and 12.44 for Chu-chuk, Kae-cheok, Hae-an, Seong-up and Son-Whul, respectively.

The cow ratio showed 87.8, 82.9, 84.5, 94.8 and 91.1%, respectively, for regions of Chu-chuk, Kae-cheok, Hae-an, Seong-up and Son-whul. Kae-cheok showed the lowest cow ratio. This indicates that there were timely exchanges for its old cows in that region, and this must have influenced high milk production in taht region. Generally, the smaller number of dairy cattle a region has, the higher a cow ratio it shows, except in Chu-chuk. This indicates that the room keeping new cows is smaller, as herd size is smaller.

Table 7. No. of dairy cattle on farm surveyed, by region.

Region	No. of farms	Ratio (%)	Cows	Bred-heifers	Heifers	Calves	Total	Lives-stock unit	Proportion of cow(%)
----- head -----									
Chu-Chuk	6	18.2	14.00	1	2.17	1.83	19.00	15.95	87.8
Kae Cheok	8	24.2	13.13	2.25	2.13	1.38	18.89	15.83	82.9
Hae-An	8	24.2	10.25	1	1.88	2.25	15.38	12.13	84.5
Seong-Up	5	15.2	10.08	0.6	0.4	0.6	11.68	11.39	94.8
Son-Whul	6	18.2	11.33	0.33	0.83	3.17	15.66	12.44	91.1
Average	33	100	12.03	1.12	1.58	1.88	16.61	13.66	88.1

Note: Heifer and calf are 6-12 and 0-6 months old, respectively.

Status of large implements secured in sampling farms

Table 8 showed the status of large implements kept in a household. Tractors

were secured by 20%, cultivators, by 90%, milking-machines and coolers, by 100% and cutters and mowers, by over 70%, on the average, per household. Comparing these figures to that of the National Livestock Cooperatives Federation(1986), the percentages of mowers and cutters secured in Che-ju province were lower by 20% than those of the national average, and milking-machines and ciers were almost the same level. However, cultivators, tractors and cars secured in Che-ju porvince showed a higher level than that of the nation as a whole. The fact that large implements were secured on a higher level than that of the national average indicates that it can act to hinder Che-ju dairy business, even though it is desirable for mechanizing the dairy business. Though the number of other machines secured by a household showed different figures according to herd size, milking-machines and coolers were secured on the same level, without hred size.

The fact that cultivators, tactors and cars were secured at a higher percentage in Che-ju province than that of national level was derived from the fact that Che-ju dairy farmers keep much larger farm land per household thn the average Korean dairy farmers do.

Meanwhile, because milking-machines and coolers were secured on the same level, without respect to herd size, it is recommended that here size should be large enough to use these machines appropriately.

Table 8. Status of large implements kept in a household, by herd size.

Herd size	Tractor	Culti- vator	Cutter	Mower	Milking machine	Cooler	Car
Less than 10 head	0.25	1.00	0.62	0.15	1.00	1.00	0.12
10-15 head	0.09	0.91	0.64	0.82	1.00	1.00	-
15 head or more	0.27	0.82	0.82	0.82	1.00	1.00	0.50
Average	0.20	0.90	0.70	0.73	1.00	1.00	0.23

Labor—hours invested per head per year in sampling farms

Table 9 showed labor—hours per head, per year. Average labor—hours per head, per year were 369.5, and by herd size, the group of less than 10 head showed the most hours, 475.8, and this tended to be lesser, as herd size increased. Meanwhile, the percentage of self—labor became smaller as the herd size increased, showing the same trend as that of Kyung—gi province(Cheong, 1981). The percentage of self—labor was 51.5% and of hired labor appeared at a higher level than that of the national average(National Livestock Cooperatives Federation, 1986), and this is pointed out as a problem in developing Che—ju dairy business. According to the report of National Livestock Cooperatives Federation(1986), total labor—hours per head, per year in Che—ju province were lesser, by 41 hours, than those of the nation as a whole, however, a problem is that self—labor percentage is lower by 20% than that of the national average, 62.3%.

Yang(1981) reported that 49% of Che—ju dairy farmers solved their labor problems through self—supplied labor, and the result of the study showed conclusions similar to his report.

However, according to Aono(1976), the time used in taking care of a head was 150 hours a year in Japan, and the dairy farmers in Japan used much less time in taking care of their dairy cattle than the average Korean farmer did. This is verified by Kown(1984). In his report, he came to conclusion that a low rate of

Table 9. Labor—hours per head, per year, by herd size.

Herd size	Self-labor	Hired-labor	Total	Percentage of self-labor
	----- hour -----			%
Less than 10 head	362.5	113.3	475.8	76.2
10-15 head	206.8	177.2	384.0	53.9
15 head or more	113.5	205.3	318.9	35.6
Average	190.3	179.2	369.5	51.5
Percentage(%)	51.5	48.5	100	-

interest in Japan enables capital-intensive dairy management, especially in farm building and machinery, whereas the Korean situation of dairy farming shows a labor-intensive operation, because of low wage levels.

2. Performance of dairy business

Operating expenses and production cost in sampling farms

Table 10 showed operating expenses and production cost per head by herd size. The total operating expenses were 1,137, 1,177 and 1,163 thousand won, respectively, with an average 1,166 thousand won for less than 10 head, 10–15 head and 15 head or more, respectively.

Among the components of total operating expenses, feed cost and depreciation costs were the main components, occupying 54.9 and 17.7% of the budget, respectively, and also the percentage of hired labor cost was high, occupying 10.5% of the budget, as considering that the business size of Cheju province is small enough to be managed by family labor forces.

Kim(1962) reported that the ratio of feed cost to operational costs was 47.4%, Babb(1981) reported, 75% and Kang(1984) reported, 51.9%, and comparing these figures to the present study, one may note a similarity, as time and distance are closer.

Kobayashi and Kawateii(1972) reported that the ratio of cattle depreciation to total production cost was 10% and Kobayashi(1973) reported, 10.3%, and that of Japan is higher than that of Cheju. However, Ishii(1975) reported that the ratio of depreciation cost to total production cost was 12% and Kang(1984) reported, 11.8%, and those showed similarity to the present study.

Comparing hired labor percentage to the national average, it is 4.1% higher(National Livestock Cooperatives Federation, 1986). The percentage of feed cost and concentrates was lower than the national averages by 8.9 and 1.7%, respectively. However, the percentage of roughage was higher than the national average by 3.7%; also the percentage of roughage to concentrates was higher than the national average by 15.3%(National Livestock Cooperative Federation, 1986).

Roughly, these figures indicate that concentrates are used less in Che-ju province than at the national level, while roughage is used more in Che-ju province than at the national level.

The reason that hired labor ratio was higher than that of the national average was found to be that many dairy farmers in Che-ju province do not engage in the dairy business by themselves, and the reason that Che-ju dairy farmers use much more roughage than that of the average Korean dairy farmers is considered to be that they could secure more farm land for roughage.

Concerning total operating expenses, the group of 10–15 head showed the highest expenses, and less than 10 head, the lowest, the main reason being the differences of feed cost and hired labor; however, concerning total cost, the smaller the herd size is, the higher the total cost will be. The reason for this can be explained as lack of family labor, because as the herd size becomes larger, family labor per head becomes smaller. This was found to be a general pattern in other provinces. Cheong(1981) reported the same trend in his study.

Table 11 showed the operating expenses and production cost per head by region. According to Table 11, total operating expenses were 1,270, 1,145, 1,103, 1,114 and 1,102 thousand won, respectively, with an average of 1,166 thousand won, and total cost was 1,640, 1,478, 1,636, 1,598 and 1,570 thousand won, respectively, with an average of 1,616 won for Chu-chuk, Kae-cheok, Hae-an, Seong-uP and Son-whul.

In the total operating expenses and total cost, Chu-chuk showed the highest expenditure, and in total operating expenses, Son-whul showed the lowest expenditure. In total cost, Kae-cheok showed the lowest expenditure.

The reason Chu-chuk showed the highest expenditure in total operating expenses and total cost is considered to be because it spent more money on feed, miscellaneous and interest on borrowed capital than any other region did.

The reason Son-whu showed the lowest expenditure is considered to be because it spent less money on feed, miscellaneous expenses and hired labor; however, that it showed higher expenditure in total cost than Kae-cheok was because its family labor cost and land capital interest were higher than those of Kae-cheok.

Table 10. Operating expenses and production cost per head, by herd size.

Items	Herd size			Average	Percentage of investment
	Less than 10 Head	10-15 Head	15 Head or more		
	----- won -----				
(Feed)	(615,831)	(641,376)	(651,785)	(639,742)	(54.9)
Concentrates	416,658	482,995	497,871	469,091	40.2
Roughage	199,658	158,381	153,914	170,651	14.6
Water, power & Fuel	43,149	35,704	31,341	35,697	3.1
Veternary & Medicine	48,317	24,273	29,680	31,340	2.7
Repair	9,935	14,531	7,624	11,045	0.9
Small implement	1,576	2,996	2,223	2,414	0.2
Miscellaneous expences	31,977	14,225	12,830	17,483	1.5
Hired labor	65,552	123,567	154,004	122,329	10.5
Interest on borrowed capital	63,957	93,663	51,153	71,903	6.2
Breeding fees	31,075	17,790	17,835	20,624	1.8
Rent	6,039	7,484	7,774	7,283	0.6
(Depreciation)	(220,487)	(201,532)	(196,788)	(206,269)	(17.7)
Building	18,354	18,286	17,939	18,193	1.6
Large implement	71,897	53,010	48,613	57,840	5.0
Livestock	130,236	130,236	130,236	130,236	11.2
Total operating expenses	1,137,895	1,177,141	1,163,037	1,166,129	100
Family labor	214,339	135,601	62,255	125,643	
Fixed capital interest	94,340	48,019	84,736	71,196	
Liquid capital interest	45,870	48,734	48,719	47,925	
Land capital interest	226,085	215,081	181,929	205,360	
Total cost	1,718,579	1,624,576	1,540,136	1,616,253	

The main components of total cost were feed cost, land capital interest, depreciation cost, family labor and hired labor. The percentage of land capital interest and family labor were 12.7 and 7.8%, respectively. The percentage of family labor was twice as low as the national average, while the percentage of land capital interest was 6.4% higher than that of the national average(National Livestock Cooperatives Federation, 1986). The percentage of total operating expenses to total cost was, however, almost the same, 72.2% for Che-ju province and 70.2% at the national level(National Livestock Cooperatives Federation, 1986).

These figures indicate that a Che-ju dairy farmer uses not so much family labor in operating his business as does the average Korean farmer, and a Che-ju dairy farmer keeps much more farm land than the average Korean dairy farmer does.

Additionally, percentage of fixed capital interest was lower than national average by 3.3%(National Livestock Cooperatives Federation, 1986). This indicates that a Che-ju dairy farmer invests not so much capital into fixed facilities as the average Korean dairy farmer does.

Amount of milk production per head per year in sampling farms

Table 12 showed yearly milk production per cow by region and herd size. Yearly milk production per cow by region was 4,300, 4,554, 3,842, 4,082 and 4,172kg for Chu-chuk, Kae-cheok, Hae-an, Seong-up and Son-whul, respectively, with an average of 4.14kg, and by herd size, it was 4,003, 3,785 and 4,476kg for less than 10 head, 10-15 head and 15 head or more, respectively.

The main reason that the group of 10-15 head showed the lowest milk production was considered to be that its cow ratio was the highest of all groups, meaning an old cow was not exchanged in time. Therefore, milk production per head per year had fallen down in that group, and hired labor was used greatly in that group. Therefore, the skill of keeping dairy cattle or sincerity of hired labor keeping dairy cattle have affected milk production in that group. This fact was proven by Chai et al.(1972). They pointed out that the full-time employee is very fluid and has varieties of skill.

Table 11. Operating expenses and production cost per head, by region.

Items	Region					Average	Percentage of investment
	Che-chuk	Kae-Cheok	Hae-An	Seong-Up	Son-Whul		
	----- won -----						
(Feed)	(684,650)	(655,119)	(617,929)	(644,382)	(603,092)	(639,742)	(39.6)
Concentrates	513,900	500,171	443,094	509,632	439,062	469,091	29.0
Roughage	170,750	154,948	174,835	134,750	164,025	170,651	10.6
Water, Power & Fuel	36,742	34,491	34,727	30,497	33,971	35,697	2.2
Veterinary & Medicine	33,390	25,101	30,179	35,888	31,860	31,340	1.9
repair	18,339	3,159	15,097	6,497	12,728	11,045	0.7
Small implement	3,553	2,878	670	2,107	2,880	2,414	0.2
Miscellaneous expenses	27,482	9,965	23,609	1,844	14,764	17,483	1.1
Hired labor	171,787	139,292	71,723	122,212	155,949	122,329	7.6
Interest on borrowed capital	102,926	75,82	57,244	54,522	41,764	71,903	4.5
Breeding fees	17,503	17,783	26,958	17,963	17,136	20,624	1.3
Rent		7,975	20,610	7,199		7,283	0.5
(Depreciation)	(190,052)	(196,577)	(224,718)	(198,268)	(200,526)	(206,269)	(11.8)
Building	18,718	16,877	21,017	19,729	17,167	18,193	1.1
Large implement	41,098	49,464	73,465	48,303	53,123	57,840	3.6
Livestock	130,236	130,236	130,236	130,236	130,236	130,236	7.1
Total operating expenses	1,270,500	1,145,949	1,103,280	1,114,634	1,102,549	1,166,129	72.2
Family labor	66,708	73,367	164,724	142,386	116,809	125,643	7.8
Fixed capital interest	51,285	51,740	90,438	95,116	94,323	71,196	4.4
Liquid capital interest	54,635	48,453	45,133	46,156	45,339	47,925	3.0
Land capital interest	197,753	159,290	233,151	200,615	211,850	205,253	12.7
Total cost	1,640,881	1,478,800	1,636,726	1,598,906	1,570,870	1,616,253	100

Note: Family labor includes operator's.

Miscellaneous expenses includes expenses of other materials
(example: Polyethylene etc.)

In the regional group, Kae-cheok showed the highest milk production, and Hae-an showed the lowest milk production, and in the group of herd size, 15 head or more showed the highest milk production and 10-15 head showed the lowest milk production.

The reason that Kae-cheok showed the highest level was found to be that it could keep relatively many heifers by exchanging its old cows, and it succeeded in this as shown in Table 7. Its cow ratio was lowest of all regions. Meanwhile, the reason that Hae-an showed the lowest milk production level could be explained by two reasons. One is that its expenses for feed per head was the lowest, except in Son-Whul, therefore, its feeding management was considered to be inadequate, and the other is that it spent the most money for breeding fees, meaning its dairy cattle have had many breeding disorders. Eventually, the result of these two factors appeared to be a decrease in milk production.

Comparing this milk production quantity to the national average, Che-ju's is lower than the national average, 4,940kg(National Livestock Cooperatives Federation, 1986) by 799kg, and considering that Che-ju milk production quantity is to be adjusted by a fat ratio of 3.4, the yearly milk production per head of Che-ju is even lower than this.

Table 12. Yearly milk production per cow, by region and herd size.

	Region					Average
	Chu-chuk	Kae-cheok	Hae-an	Seong-up	Son-whole	
Milk production(kg)	4,300	4,554	3,842	4,082	4,172	4,141

	Herd size			Average
	Less than 10 head	10-15 head	15 head or more	
Milk production(kg)	4,003	3,785	4,476	4,141

Note: Milk production is the quantity adjusted by a mean fat ratio of 3.4.

The milk fed to calves and self-consumption is not included the milk production.

Components of gross receipts per head in sampling farms

Table 13 showed components of gross receipts per head by herd size and region. According to Table 13, farm gross receipts mainly consist of milk sales and calf sales. Milk sales occupied 75.2% of total gross receipts, on the average; calf sales, 22.2% and value of manure 2.6%. This percentage of milk sales is lower than that of the national average, 80.8%(National Livestock Cooperatives Federation, 1986). The main reason is that milk production in Che-ju province is much lower than that of the national average. Concerning herd size, as herd size became larger, the value of milk sales per head became larger. As is shown in Table 12, the group of 10-15 head recorded the least milk production; however, the fact that the value of milk sales is higher in the group of 10-15 head than in the group of less than 10 head derives from the fact that the cow ratio in the group of 10-15 head is higher than that of the group of less than 10 head.

Table 13. Components of gross receipts per head, by herd size and region.

Herd size	Milk sale	Calf sale	Value of manure	Total
	----- won -----			
Less than 10 head	1,143,414	350,184	39,007	1,532,605
10-15 head	1,165,114	338,379	41,542	1,545,035
15 head or more	1,279,372	380,367	42,717	1,702,456
Average	1,218,125	360,402	41,794	1,620,321
Percentage(%)	75.2	22.2	2.6	100
<i>Region</i>				
Chu-chuk	1,269,411	350,275	42,633	1,662,319
Kae-cheok	1,254,822	343,168	41,692	1,639,682
Hae-an	1,091,591	409,591	42,045	1,545,227
Seong-up	1,184,017	371,686	42,142	1,597,845
Son-whul	1,277,533	329,150	40,193	1,646,876
Average	1,218,125	360,402	40,193	1,620,321
Percentage(%)	75.2	22.2	2.6	100

Concerning the regional groups, the value of milk sales almost paralleled the amount of milk production, except in Chu-chuk. Though Chu-chuk recorded the second highest level of milk production, the value of its milk sales was highest. This is because its cow ratio is higher than that of Kae-cheok, which recorded the highest milk production.

Milk production cost in sampling farms

Table 14 showed production cost per kg of milk by herd size. Average production cost per kg of milk was 332.90won, and it is higher than the selling cost of 322won per kg of milk with a fat ratio of 3.4. Comparing this production cost to that of the national average, 295.70won(National Livestock Cooperatives Federation, 1986), Che-ju is higher by 37.2won than that the nation as a whole.

In the group of herd size, production costs were 404.24, 356.15 and 289.31won for less than 10 head, 10-15 head and 15 head or more, respectively. The group of less than 10 head showed the highest milk production cost, and the group of 15 head or more showed the lowest milk production cost.

The reason that the group of less than 10 head showed the highest milk production cost is because of lack of the optimal size. As shown in Table 8, without herd size, fundamental facilities are required for appropriate management.

Table 14. Production cost per kg of milk, by herd size.

Herd size	Total production cost (A)	Income on by-production (B)	Net production cost (C)=(A-B)	Total amount of milk sale (kg) (D)	Production cost (C/D)
	----- won -----				
Less than 10 head	14,350,135	3,249,750	11,100,385	27,459	404,25
10-15 head	20,112,551	4,703,414	15,409,137	43,266	356,15
15 head or more	28,112,883	7,725,500	20,397,385	70,504	289,31
Average	22,078,016	5,494,002	16,584,014	49,817	332,90

Note: Total amount of milk sale is the quantity adjusted by a mean fat ratio of 3.4.

like milking-machines and coolers. Moreover, shelter or electricity requires almost the same capital in the some measure, and in using both hired labor and family labor, if the farm size is too small, there will occur labor loss.

Meanwhile, the group of 15 head or more showed the lowest milk production cost. The main reason for this can also be explained by the theory of optimal size. Because a dairy farm managed mainly by family labor is considered to be of an optimal size consisting of around 15 head, in Korea. This trend appeared in the present study, and this is also shown by Hu and Lee(1985). They reported that the optimal size of dairy farming was 15.2 head in cow units.

Table 15 showed production cost per kg of milk by region. The production costs per kg of milk were 330.67, 289.59, 365.02, 328.07 and 316.18 won for the group of Chu-chuk, Kae-cheok, Hae-an, Seong-up and Son-whul, respectively. Hae-an showed the highest milk production cost.

The main reason Hae-an showed the highest production cost was considered to be that its milk production quantity is the lowest among all the regions. The reason that Hae-an showed the lowest milk production is considered to be that its feeding management and cattle reproduction were poor. These are proven by Table 11. Hae-an spent the lowest expenses for feed, except those of Son-whul, and its roughage expense were the least of all. This indicates that dairy cows in that region were fed mainly by concentrates therefore, milking years for dairy cattle in that region were relatively shorter than for others. Consequently, dairy cows in that region were weeded out before the top of their milk production was reached. Dairy cows fed mainly by concentrates show a shorter career of milk production than those which were fed enough roughage. Moreover, breeding fees were the highest of all in that region, supporting the claim that there must have been many breeding disorders in that region. For breeding disorders affect milk production vitally.

Kae-cheok showed the lowest milk production cost. The main reason was that its milk production per cow per year was the highest of all, and its total production cost per head per year was the lowest of all. Years of experience of

operators and reasonable feeding management can explain these. First of all, dairy farmers in Kar-cheok were all engaged in dairy farming over 7 years. This experience must have influenced the dairy business in that region, and according to Table 11, Kae-cheok spent the least money of all for breeding fees. This proved that dairy farmers in that region had managed their business reasonably, and thereby, milk production in that area could have improved.

Table 15. Production cost per kg of milk, by region.

Region	Total production cost (A)	Income on by-products (B)	Net production cost (C)=(A-B)	Total amount of milk sale (kg) (D)	Production cost (C/D)
	----- won -----				
Chu-Chuk	26,172,051	6,266,833	19,905,168	60,196	330.67
Kae-Cheok	23,409,397	6,092,344	17,317,053	59,798	289.59
Hae-An	19,853,488	5,478,344	14,375,144	39,382	365.02
Seong-Up	18,211,542	4,713,500	13,498,042	41,144	328.07
Son-Whoul	19,541,618	4,594,625	14,946,993	47,274	316.18
Average	22,078,016	5,494,002	16,584,014	49,817	332.90

Note: Table amount of milk sale is the quantity by a mean fat ratio of 3.4.

Table 16 showed the production cost per kg of milk by milk yield. The production costs per kg of milk were 459.30, 362.00, 328.77, 272.78 and 262.02 won for the group of producing less than 3,500, 3,500-4,000, 4,000-4,500, 4,500-5,000 and 5,000kg or more.

The milk production cost is lower and lower as milk production is higher, and, finally, it comes to the point at which the milk production cost is lower than that of the selling cost, 322 won per kg of milk with fat ratio of 3.4, for the group of 4,500-5,000kg. This indicates that a dairy farmer must produce at least 4,500kg of milk per cow a year in order to manage his dairy business at a profit.

Comparing these milk production costs to those of Kang's research (1984)—the average milk production cost per kg of milk was 390.97won in the group

producing less than 3,000kg. 313.04won in the group of 3,000–3,500kg, 296.55won in the group of 3,500–4,000kg, 246.10won in the group of more than 4,500kg of milk annually–, there are some differences between them, and these are considered to be due to time transition.

Table 16. Production cost per kg of milk, by milk yield.

Milk production	Total production cost (A)	Income on by-products (B)	Net production cost (C)=(A-B)	Total amount of milk sale (D)	production cost (C/D)
----- won -----					
Less than 3,500 kg	17,573,301	5,228,321	12,344,980	26,878	459.30
3,500-4,000	21,111,235	4,907,778	16,203,457	44,761	362.00
4,000-4,500	21,616,181	5,613,410	16,002,771	48,674	328.77
4,500-5,000	26,096,994	6,641,469	19,455,525	71,323	272.78
5,000 kg or more	20,465,011	4,833,750	15,631,261	59,657	262.02
Average	22,078,016	5,494,002	16,584,014	49,817	332.90

Note: Total amount of milk sale is the quantity by mean fat ratio of 3.4.

Farm income per head per year in sampling farms

Table 17 showed incomes and net returns per head by herd size. According to Table 17, incomes and net returns per head are 394, 367 and 539 thousand won and -185, -79 and 162 thousand won for the group of less than 10 head, 10–15 head or more, respectively with average of 454 and 4 thousand won, comparing these incomes and net returns per head to those at the national level, 733 thousand won and 183 won, respectively (National Livestock Cooperatives Federation, 1986). Che-ju is lower by 279 thousand won and 179 thousand won, respectively, than those at the national level, and the income ratio was 28.0, this is also lower by 8.1% than the national average (National Livestock Cooperatives Federation, 1986). Except of the group of 15 head or more, the other groups recorded deficits in net returns. The group of 15 head or more recorded the

highest income per head, and the group of 10–15 head, the lowest. Differences in farm income mainly came from differences in milk production. As shown in Table 13, the group of 10–15 head recorded the lowest milk production, and the group of 15 head or more recorded the highest milk production. That is why they showed opposite results. In net returns, the group of less than 10 head and the group of 10–15 head recorded deficits. This was also derived from low milk production, and proven by Yoo(1971) and Takehara(1978). Yoo reported that the net income per cow is raised over two times on the same feeding scale by increasing the milk production per cow and saving the management cost, and Takehara reported that the main reason for a recorded deficit was that yearly milk production per head was low.

The group of 10–15 head showed the highest operating expense, this is also one reason why it showed the lowest farm income. Especially, this group spent the highest amount of all for repair and interest on borrowed capital.

Table 17. Income and net returns per head, by herd size.

Herd size	Gross receipts (A)	Operational expenditures (B)	Production cost (C)	Income (A-B)	Net returns (A-C)	Income rate (%)
-----won-----						
Less than 10 head	1,532,605	1,137,895	1,718,579	394,710	-185,974	25.8
10-15 head	1,545,035	1,177,141	1,624,576	367,894	-79,541	23.8
15 head or more	1,702,456	1,163,037	1,540,136	539,419	162,320	31.7
Average	1,620,321	1,166,129	1,616,253	454,192	4,068	28.0

Note: Gross receipts include the value of feeding quantity of milk to calves and self-consumption.

Table 18 showed incomes and net returns per head by region. According to Table 18, income and net returns per head were 391, 493, 439, 483 and 544 thousand won and 21, 160, -93, -1 and 76 thousand won for the group of

Chu-chuk, Kae-cheok, Hae-an, Seong-up and Son-whul, respectively, with averages of 454 and 4 thousand won.

In income per head, Son-whul recorded the highest, and Chu-chuk, the lowest, and in net returns per head, hae-an and Seong-up recorded deficits. The reasons that Son-whul recorded the highest, and Chu-chuk, the lowest in farm income were found to be that because Son-whul spent the lowest operating expenses, and Chu-chuk, the highest. Son-whul spent less money than other regions did for feed, interest on borrowed capital and breeding fees, while Chu-chuk spent more money than other regions did for feed, water, power & fuel, small implements, miscellaneous expenses, hired labor and interest on borrowed capital. Meanwhile, the reasons that Hae-an and Seong-up recorded deficits in net returns were found to be that, because their milk production per head per year was the lowest, and they spent more money than other regions did for family labor, fixed capital interest and land capital interest. Among these, that pay for family labor is high is desirable for improving a dairy business, however, those factors that fixed capital interest and land capital interest were high have to be corrected, especially, the fact that they owned excessively large amounts of farm land compared to their herd size vitally affected dairy business.

Table 18. Income and net returns per head, by region.

Region	Gross receipts (A)	Operational expenditure (B)	Production cost (C)	Income (A-B)	Net returns (A-C)	Income rate (%)
----- won -----						
Chu-Chuk	1,662,319	1,270,500	1,640,881	391,819	21,438	23.6
Kae-Cheok	1,639,682	1,145,949	1,478,800	493,733	160,882	30.1
Hae-An	1,543,227	1,103,280	1,636,726	439,947	-93,499	28.5
Seong-Up	1,597,845	1,114,634	1,598,906	483,211	-1,061	30.2
Son Whul	1,646,876	1,102,549	1,570,870	544,327	76,006	33.1
Average	1,620,321	1,166,129	1,616,253	454,192	4,068	28.0

Note: Gross receipts include the value of feeding quantity of milk to calves and self-consumption.

V. CONCLUSION

As the results of present study, several problems were found. These are that milk production cost is very high, percentage of hired labor is high, while percentage of family labor is low, utility of farm land is also low and quantity of milk production is very low. So, many a dairy farmer in Che-ju province recorded a deficit in net returns, meaning his dairy business pays only himself, his family labor and land capital interest. Strictly speaking, it can not be said to be a dairy business, as there is hardly enough pay for management. Therefore, to keep a stable dairy business and improve one's dairy business further, one must face the following matters and try to solve these problems.

To have to maximize the use of family labor forces

Considering the size of dairy business in Che-ju province, it can be managed properly mainly by family labor forces, therefore, to improve farm income, one who manages a dairy business must maximize the use of family labor forces and minimize the use of hired labor as much as possible.

Use of family labor in managing a dairy business is good, not only in saving operating costs, but also to improve milk production by treating one's dairy cattle properly, because dairy cattle are so sensitive that if they are treated badly, their milk production will fall down greatly.

To have to maximize the use of farm land

Though it is considered that Che-ju dairy farmer owns enough farm land to manage his dairy business, the use of farm land is not so concentrated that he has to spend a large portion of the total cost in paying for the use of farm land. Therefore, to improve his dairy business, it is recommended that he has to save his operating costs by using his farm land in a more concentrated fashion.

To have to improve milk production

Milk production per cow in Che-ju province is much lower than the national average, and it is thought to be a cause of the operation of dairy business in Che-ju province. Therefore, to improve dairy business in Che-ju province it is most necessary to improve milk production.

At present, we can find out two main causes of a decline in milk production. One is that a Che-ju dairy farmer, as shown in Table 10, has used much hired labor, and as hired labor tends to change frequently, he could not feed his dairy cattle properly. Therefore, dairy cattle kept in Che-ju province have lowered their capacity for milk production.

The other main factor is that old dairy cows in Che-ju province were not exchanged in time because there were hardly any heifers for exchange with old cows in time as shown in Table 6. Meanwhile, Che-ju dairy farmers could not solve this problem because of their management difficulties.

Additionally, another main factor lowering milk production is accumulated inbreeding. From the beginning of the dairy business to the present time, so many dairy farmers in Che-ju province have not paid attention to the problem of inbreeding. Therefore, there have been so many cases in which the same semen that had been used for one generation was used for succeeding generations, and there have even been cases in which bulls have mated with their own offspring. As to the present point, this has become a very serious block to improvement of dairy cattle in Che-ju province.

Fortunately, nowadays, the dairy farmers in Che-ju province have come to take this problem seriously and have tried to eliminate this practice.

Finally, to improve dairy business in Che-ju province and maintain its prosperity, Che-ju dairy farmers must face and try to resolve these three problems: that is, to have to maximize the use of family forces, to have to maximize the use of farm land and to have to improve milk production.

Appendix A. Operating expenses and production cost per household, by region.

Items	Region					Average
	Chu- Chuk	Kae- Cheok	Hae-An	Seong- Up	Son- Whul	
(Feed)	(10,920,169)	(10,370,531)	(7,495,482)	(7,339,509)	(7,502,462)	(8,738,876)
Concentrates	8,196,711	7,917,702	5,374,732	5,804,709	5,461,933	6,407,783
Roughage	2,723,458	2,452,829	2,120,750	1,534,800	2,040,469	2,331,093
Water, Power & Fuel	586,033	546,000	421,238	347,360	422,600	487,621
Veterinary & Medicine	532,575	397,350	366,069	408,770	396,333	428,104
Repair	292,500	50,000	183,125	74,000	158,333	150,874
Small implement	56,667	45,563	8,125	24,000	35,833	32,975
Miscellaneous expenses	138,333	157,750	286,375	21,000	183,667	238,818
Hired labor	2,740,000	2,205,000	870,000	1,392,000	1,940,000	1,671,014
Interest on borrowed capital	1,641,667	1,200,250	694,375	621,000	513,333	982,195
Breeding fees	279,167	281,500	327,000	204,600	213,167	281,724
Rent		126,250	250,000	82,000		99,486
(Depreciation)	(2,777,363)	(2,760,182)	(2,480,993)	(2,181,437)	(2,349,977)	(2,605,349)
Building	298,549	267,166	254,938	224,715	213,558	248,516
Large implement	655,510	783,017	891,136	550,173	660,845	790,094
Livestock	1,823,304	1,709,999	1,334,919	1,406,549	1,475,574	1,566,739
Total operating expenses	20,264,474	18,140,376	13,382,782	12,695,676	13,715,705	15,929,322
Family labor	1,063,992	1,161,405	1,998,102	1,621,780	1,450,100	1,716,253
Fixed capital interest	817,990	819,043	1,097,016	1,083,374	1,173,377	972,537
Liquid capital interest	871,428	767,010	547,463	525,712	564,019	654,656
Land capital interest	3,154,167	2,521,563	2,828,125	2,285,000	2,635,417	2,805,218
Total cost	26,172,051	23,409,397	19,853,488	18,211,542	19,541,618	22,078,016

Appendix B. Operating expenses and production cost per household, by region.

Items	Herd size			Average
	Less than 10 Head	10-15 Head	15 Head or more	
	----- won -----			
(Feed)	(5,142,189)	(7,940,235)	(11,991,594)	(8,738,876)
Concentrates	3,475,045	5,979,478	9,091,124	6,407,783
Roughage	1,667,144	1,960,757	2,810,470	2,331,093
Water, Power & Fuel	360,294	422,016	572,287	487,621
Veterinary & Medicine	403,447	300,500	541,957	428,104
Repair	82,957	179,894	139,214	150,874
Small implement	131,596	37,090	40,592	32,975
Miscellaneous expenses	267,008	176,106	234,276	238,818
Hired labor	547,359	1,529,759	2,812,113	1,671,014
Interest on borrowed capital	534,041	1,159,548	93,405	982,195
Breeding fees	259,476	220,240	325,667	281,724
Rent	50,426	92,652	141,953	99,486
(Depreciation)	(1,647,016)	(2,371,242)	(3,266,456)	(2,605,349)
Building	153,256	226,381	327,566	248,516
Large implement	600,340	656,264	887,673	790,094
Livestock	893,419	1,488,597	2,051,217	1,566,739
Total operating expenses	9,501,423	14,573,006	21,237,056	15,929,322
Family labor	1,790,148	1,678,740	1,136,776	1,716,283
Fixed capital interest	787,739	594,475	1,547,279	972,537
Liquid capital interest	385,05	603,327	879,749	654,656
Land capital interest	1,887,810	2,662,703	3,322,024	2,805,218
Total cost	14,359,135	20,112,551	28,122,883	22,078,016

Appendix C. Income and net returns per household, by region.

Region	Gross receipts (A)	Operational expenditure (B)	Production cost (C)	Income (A-B)	Net returns (A-C)	Income rate (%)
----- (won) -----						
Che-Chuk	26,513,989	20,264,474	26,172,051	6,249,515	341,938	23.6
Kae-Cheok	25,955,172	18,140,376	23,409,397	7,815,796	2,546,775	30.1
Hae-An	18,719,348	13,382,782	19,853,488	5,336,566	-1,134,140	28.5
Seong-Up	18,199,460	12,695,676	18,211,542	5,503,784	-12,082	30.2
Son-Whul	20,487,143	13,715,705	19,541,618	6,771,438	945,525	33.1
Average	22,133,583	15,929,32	22,078,016	6,204,262	55,568	28.0

Note: Gross receipts include the value of feeding quantity of milk to calves and self-consumption.

Appendix D. Income and net returns per household, by herd size.

Region	Gross receipts (A)	Operational expenditure (B)	Production cost (C)	Income (A-B)	Net returns (A-C)	Income rate (%)
----- (won) -----						
Less than 10 head	12,797,250	9,501,423	14,573,006	3,295,827	-1,775,756	25.8
10-15 head	19,127,530	14,573,006	20,112,551	4,554,524	-985,021	23.8
15 head or more	31,086,840	21,237,056	28,122,833	9,849,784	2,964,007	31.7
Average	22,133,583	15,929,322	22,078,016	6,204,262	55,568	28.0

Note: Gross receipts include the value of feeding quantity of milk to calves and self-consumption.

REFERENCES

1. 青野守雄, 1976, 酪農 經營改善のための經營診斷とその方法, J. Dairy Sci., 30: 1099~1104.
2. Babb Emerson, M., 1981, Analysis of Regional Milk Prices and Production Costs, J. Dairy Sci., 64: 2043-2047.
3. Benson G. A. and Stephen R. Sutter, 1981, 1981 Dairy Farm Business Summary and Business Evaluation Workbook.
4. 全昌坤, 1985, 首都圈 酪農立地에 관한 研究, 農村經濟, 8(3): 77~104.
5. 鄭文敎, 1981, 酪農經營의 水益性分析(京畿地方을 中心으로).
6. 周玄培, 1970, 뉴질랜드 Rotorau 地方의 酪農生産 및 經營에 관한 調査, 韓畜誌, 12(40): 263~269.
7. 蔡榮錫·李寅浩·申百洙, 1972, 地域的 立地條件이 酪農經營展開에 미치는 影響, 韓畜誌 14(1): 9~15.
8. 畜산업 협동조합 중앙회, 1986, 畜산물 생산비 조사보고, pp.18~54.
9. 畜산업 협동조합 중앙회, 1986, 畜산물 가격 및 수급자료, pp.82~119.
10. 夏本博司·長澤滋, 1979, 紋別市の酪農家における乳用育成の飼養實態 畜産の研究, 33(4): 509~514.
11. 河瑞鉉, 1976, 乳牛用飼料 配合의 費用分析, 韓畜誌, 17(4): 485~491.
12. 許吉行, 李成珪, 1985, 養畜農家飼育 頭數의 適正規模推定, 農村經濟, 8(3): 25-38.
13. 石井幹, 1974, 酪農經營における育成牛の評價增畜産の研究, 28(11): 1319~1320.
14. 石井幹, 1975, 酪農の經營診斷における見掛けの収益性, 畜産の研究, 29(7): 979~982.
15. Jore T. Salaverry, G. Joachim Elterich and Harry E. Brautigam, 1983, Effects of Equity and Money Market Conditions on the Feasibility of Establishing and Operating a Dairy Farm in the Mid-atlantic Region.
16. 姜冕熙, 1966, 濟州道 畜産의 展望, 제주도 26: 34~41.

17. 康誠元, 1984, 한국 낙농업의 나아갈 길, 韓畜誌, pp.25~31.
18. 康太淑·鄭昌朝·邊時烈, 1977, 濟州道內 導入乳牛에 關한 研究, 濟州大學論文集, 9: 115~123.
19. 康太淑, 1983, 酪農經營基盤과 經營成果分析, 濟州大下校 論文集 16: 97~108.
20. 康太淑, 1984, 酪農經營에 있어서 經營成果 分析, 石龜, 金承贊 先生 停年退任 記念論文集, pp.122~129.
22. 姜泰律, 1974, 濟州道 畜産의 靑寫眞, 제주도 63: 117~121.
23. Kimball, N. D. and W. E. Saqupe, 1970, Cost of Producing Milk on Selected Wisconsin Dairy Farms, Research Report of Wisconsin University 61: 1-9.
24. 片山正孝, 1974, 經産牛の産乳量に及ぼす諸要因, 畜産の研究 28(8): 971~974.
25. 小林茂樹·川廷謹造, 1972, 酪農經營における乳牛減價償却費の算出基準に關する一私見, 畜産の研究26(6): 765~770.
26. 小林茂樹, 1979, 酪農經營における乳牛減價償却に關する檢討, 畜産の研究 27(2): 265~269.
27. 小室重雄, 1974, 酪農經營の施設 28(11): 1305~1309.
28. 久末小十郎, 1974, 北海道 酪農の現狀とその問題點 (4), 畜産の研究, 28(10): 1171~1176.
29. 久米小十郎, 1976, 酪農經營經濟からみた乳牛の搾乳年數と搾乳量, 畜産の研究, 30(12): 1403~1408.
30. 權五鈺, 1984, 酪農經營의 韓日間比較 分析, 嶺南大學校 資源問題 研究所 論文集 3(11): 171~180.
31. 金基元, 金厚根, 1970, 酪農經營에 關한 調査, 韓畜誌, 12(3): 221~227.
32. 金東熙·金曾喆·閔炳列, 1984, 酪農業의 經營實態 調査分析, 韓國1業經濟學會, pp.17~21.
33. 金瑞燕, 1974, 濟州道 畜産의 史考, 제주도 63: 105~106.
34. 金容斗, 1969, 酪農經營의 指標值 設定에 關한 研究, 韓畜誌 11(1): 49~52.
35. 金昌柱, 1962, 酪農經營에 關한 研究, 韓畜誌 4: 43~49.
36. 李哲鉉, 1984, 酪農業의 現況과 發展方向에 대한 小考, 농촌경제 7(4): 81~91.
37. 文八龍·金炯華·閔炳列, 1986, 酪農業의 經營實態 및 原乳生産費調査研究, 建國大學校附設畜産科學研究所, pp.27~44.

38. 농업진흥청, 1982, 농축산물소득분석, p.369.
39. 内藤元男, 日本の酪農からみた今後のホルスタイン種乳牛とその改良方向, 畜産の研究 29(12): 1505~1511.
40. 西部潤・及川博・稻村裕文, 1978, 乳用雌子牛の育成管理の現状と問題点(1) 畜産の研究 32(9): 1103~1108.
41. 西山太平, 1973, 本州の酪農経営の規模拡大とその条件(1), 畜産の研究 27(12): 1457~1460.
42. 小川正則, 1977, 都市近郊酪農の経営形態とその改善方向, 畜産の研究 3(4): 494~500.
43. 朴喜圭・朴恒均・申百洙, 1975. 遠靈酪農地區의 酪農牧場 實態調査, 韓畜誌 17(4): 438~444.
44. Orth, R. I. and M. F. Hutjens, 1980. Illinois-Iowa Dairy Guide. Iows State University and University of Illinois.
45. 染澤照俊, 1977. 北海道, 酪農の現状と課題(根釧地域における酪農経営の實態と問題点), 畜産の研究 31(3): 364~370.
46. 서울우유 협동조합, 1987, 月刊 서울우유 11월호, p.67.
47. 竹原祐睦, 1973, 酪農収益からみた経営改善の狙い所(1), 畜産の研究 27(4): 509~522.
48. 竹原祐睦, 1977, 飼料基盤の異なる2戸の都市近郊酪農経営の比較, 畜産の研究 31(7): 849~855.
49. 竹原祐睦, 1978 近年の酪農経営の内容とその改善すべき点(3), 畜産の研究 32(2): 302~306.
50. 竹原祐睦, 1978 近年の酪農経営の内容とその改善すべき点(4), 畜産の研究 32(3): 402~424.
51. 竹原祐睦, 1978 近年の酪農経営の内容とその改善すべき点(5), 畜産の研究 32(4): 545~548.
52. 梁昇柱, 1981, 濟州地域의 乳牛飼育과 酪農經營에 관한 研究(1), 濟州實業專門大學 論文集 3: 239~261.
53. 柳濟昌, 1971, 酪農經營에 있어서 經營成果와 牛乳生産量에 影響을 미치는 諸要因에 관한 研究, 韓畜誌 13(4): 373~379.
54. Wells R. C. and Don C. Pardue, 1970, 1970 Dairy Farm Business Summary.