Dairying and its Contribution to Farm Economy in Daerah Istimewa Yogyakarta Province, Indonesia

Endang SULASTRI[1]
Visiting Researcher,
Graduate School for International Development and Cooperation, Hiroshima University,
1-5-1 Kagamiyama, Higashi-Hiroshima, 739-8529, Japan
E-mail: endang@hiroshima-u.ac.jp

Keshav Lall MAHARJAN
Associate Professor,
Graduate School for International Development and Cooperation, Hiroshima University,
1-5-1 Kagamiyama, Higashi-Hiroshima, 739-8529, Japan
E-mail: mkeshav@hiroshima-u.ac.jp

Abstract

This article tries to explore the situation of dairying in Daerah Istimewa Yogyakarta Province (hereafter DIY Province), Indonesia. The study has shown that dairying in DIY Province is labor intensive. The data reveals a greater use of family labor in rural and sub urban areas compared to that of hired labor in dairy cows care and delivering milk. In urban areas, there is a greater use of hired male labor in dairy activities. Income from the dairy activities is selling milk, cows, calves and manure and can be used to meet/provide household expenses, savings, investment and insurance.

Finding can be used as an evident that there is relationship between locational characteristic and level of development of dairying. Sleman, as a rural area and agriculture as the primary activity among most of the people, has good chance to develop dairying.

1. Introduction

Between 95% and 99% of dairying in Indonesia can be classified as smallholder dairying under mixed crop livestock farming systems. Some of the older dairy colonies have become sub urban smallholder dairying and they still rely on the use of crop wastes and residues, such as maize stover from neighboring farming areas, as a source of feed supply. For smallholder dairying in rural areas, the dairy operation is generally integrated with the production of rice, upland crops, or various plantation crops. There is a general tendency for the dairy cows holding by each milk producer[2] to increase the milk production. Moreover, there is a steady shift in the role of dairying from providing a source of supplementary income to being a major or specialized enterprise in mixed farming system (Hutabarat, 1996).

There is distinctive feature about dairying in integrated systems. Dairying is a very important money-

generating component of integrated farming systems. This importance is more apparent especially in smallholder farming systems where multi-cropping is the rule, and production resources have to be used to maximum advantage to generate immediate farm income. Therefore, as fresh milk can be sold daily, and money generated likewise, farm operations are able to become more flexible and perhaps even stable. In general, the integrated systems are more important in the rural areas, whereas in sub urban and urban areas, more intensive and specialized units are found in which dairy is a major enterprise.

Within integrated systems, animals play a particularly vital role, the extent of which is dependent on the type of production system and scale of operation. In this context, dairy production is becoming an increasingly important integrated system, in which this component generates significant, and more importantly, daily cash income, as well as contributing to the improvement of the livelihoods of poor people and the stability of farm households. According to Kurien (1987), it is for these reasons that dairying in the developing countries is considered to be an important instrument of social and economic change, and is identified with rural development.

In Indonesia, the need to develop the dairying is not only an economic process to meet the domestic demand for milk but is also in line with the government objectives to increase income; to create employment opportunities; to increase foreign exchange earning; and to improve the nutritional status of the people. Dairy development is expected to reduce the milk and milk products import and lead to export of processed milk in those cases when the domestic production is high and is competitive in international markets. Because of this, the development of dairying has become very important in terms of the balance of payments.

2. Objectives and Research Method

The main objectives of the study are, 1) to study the dairying in DIY Province, especially about the cows holding, sources of cows, feeding and breeding practices as well as labor use, 2) to study the profitability of dairying and 3) to study the contribution of dairying on household income.

To achieve the objectives, the study of dairy cooperative was undertaken in DIY Province (**Figure 1**), one of 30 provinces in Indonesia, undertaking research survey that represent different regencies; Sleman Regency (mountainous and rural area), Bantul Regency (costal and sub urban area) and Yogyakarta Municipality (capital city of the province, urban area). 76 of 1,133 dairy households in Sleman Regency, 7 of 22 dairy households in Bantul Regency and 5 of 20 dairy households in Yogyakarta Municipality were randomly selected in 2001. They were interviewed through a structured questionnaire, on site observation and participatory appraisal. In the year of 2003 the same interview was made again with the same households in order to know the changing of their dairying. They were interviewed about their dairying in terms of dairy cows holding, milk production, sources of dairy cows, feeding and breeding practices, labor use and cost and income of dairying at the household level. The collected data were both qualitative and quantitative. The statistical analysis was used to interpret the quantitative data. The data were tabulated according to the objectives of the study.

Some secondary information was also collected from the official records such as statistical data of Central Bureau of Statistics, Directorate General of Livestock, cooperative data, books and publications. These were used to explore the potential that the raising of dairy cows has solved the problem of disguised unemployment and the household income.

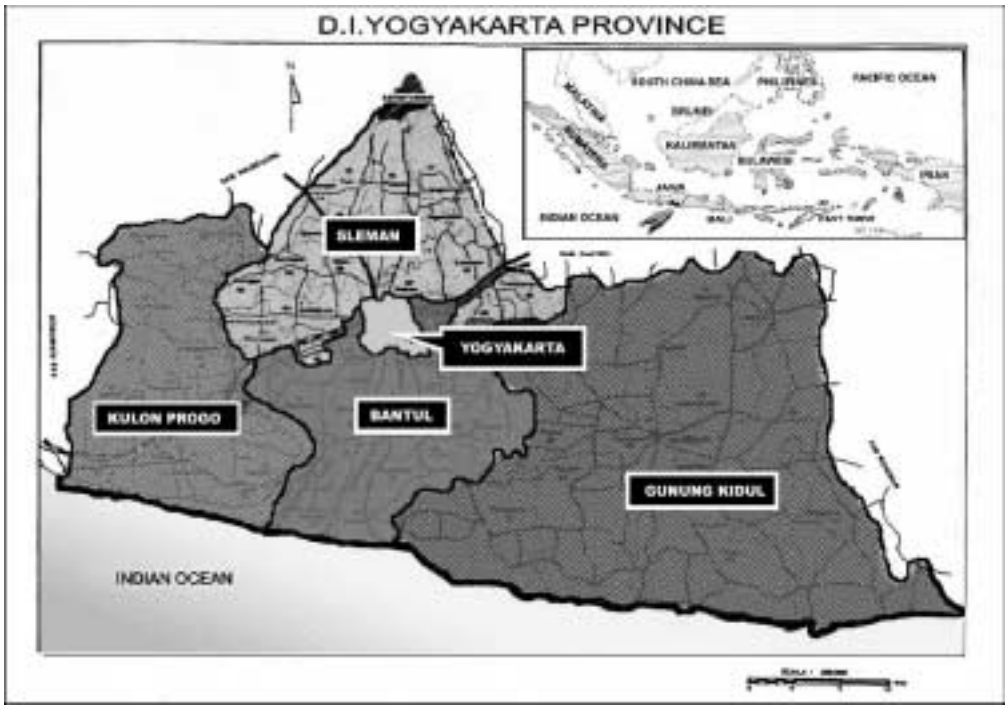

Figure 1. Map of Daerah Istimewa Yogyakarta Province.

3. Government Policy in Dairy Development

Recent livestock development activities of the Indonesia Government's Directorate General of Livestock have attracted the attention of development partners, some institutions, such as banks, cooperatives and private sector. The livestock sub sector has emerged as an important source of gainful employment and income for the vast majority of the rural poor for their poverty alleviation. Important feature of government policies towards the livestock sub sector include: 1) the non involvement of the government in production, processing and marketing activities, 2) support the some institutions in dairy development activities through research, extension, training, credit and the development of appropriate infrastructure, 3) reduction of import tariff on equipment, animals, raw materials and other inputs and 4) reduction and eventual elimination of subsidies on inputs, including veterinary medicine, vaccines and artificial insemination services.

The major activities of the Directorate General of Livestock include 1) conservation of livestock (by providing veterinary health care/ensuring veterinary coverage), 2) development of livestock (development of breeds, productivity and appropriate technology), 3) provision of extension services (training, entrepreneur development, assistance to establish farms, feeds and fodder production, and technology transfer) and 4) employment generation (assistance for credit, input supply and technical support to institutions working with livestock development).

Ministry of Agriculture controls the Directorate General of Livestock with its affiliated research institutions (Agriculture Research Institute, Livestock Development Institute, and universities). Directorate

General of Livestock also provides some funds to the universities for the specific research project under contractual arrangements. The majority of research in some universities in Indonesia is an academic nature. However, in some cases, researchers undertake specific project based research funded by the Ministry of Education and Culture or other aid agencies (e.g. World Bank, United State Agency for International Development/USAID, and International Foundation for Science/IFS).

Bank Rakyat Indonesia (BRI), a government commercial bank, provides loan funds to the smallholder farmers under the micro credit program on 1) general and processing, 2) agriculture and forestry, 3) livestock and fisheries, 4) services, 5) trading, 6) peddling, and 7) shop keeping. *Bank Rakyat Indonesia* (2002) reported that in 2001, BRI had 2,790,192 micro loan clients and the micro account value was $1,710,5776,471.

In addition to credit services, the government supported establishment of some dairy cooperative in some areas of Indonesia. As a part of the rural development, the dairy cooperatives provide some services related with the dairy activities. The activities in collaboration with milk processing industries, bank and private companies.

Expansion of dairy development could benefit from related government policies conducive to dairying (Chantalakhana, 1999). In Indonesia, some changes in government policies have produced major positive impact on dairy production, such as: 1) the establishment of Dairy Technical Team (1982) which consist of Ministry of Industry Affairs, Ministry of Trade and Cooperatives and Ministry of Agriculture that determined the milk price purchasing price agreement between the milk processing industries and the dairy cooperatives and also determined ratio between domestic milk production absorption and the volume of powdered milk which could be imported, 2) a milk drinking campaign sponsored by government to increase milk consumption from about 3.9 kg/capita/year in 1984 to 8 kg/capita/year before 2005, 3) a school milk program launched since 1985 to promote milk drinking among the pupils outside urban areas in order to improve children's health and 4) establishment of dairying project in certain areas in order to increase domestic milk production.

Other government policies which may have a serious impact on dairying include the establishment of some artificial insemination centers since 1985, the establishment of Dairy Board to promote the dairying, continuation of import of good breed of dairy cows from New Zealand and Australia, as well as government support to strengthen the dairy extension and research system (Kartadihardja, 1988 and Kusumadewa et al, 1988). According to De Boer (1999) the use of Farming System Research/Extension (FSR/E) is often suggested as a tool for promoting technological change and technology transfer for smallholder dairying.

4. Dairying in DIY Province

Most of the dairy households do dairy activities as the secondary occupation. **Table 1** indicates that they are engaged in various kinds of occupation. In Yogyakarta, there was a household (20%), which had dairying as main occupation in 2001. Dairying was become secondary occupation for all households in 2003. The main household income was from business, public service and military service. In Bantul, there were 3 households (42.9%), which had dairying as main occupation in 2001 and 2003. Other main occupations in Bantul were business and public service. In Sleman Regency, there were 14 households (18.4%) in 2001 and 17 households (23.7%) in 2003, which had dairying as main occupation. The other main occupations were crop farming, manufacturing and public services in 2001. In

Table 1. Milk producers occupation in the study regions.

Job	Regions											
	Sleman				Bantul				Yogyakarta			
	2001		2003		2001		2003		2001		2003	
	M	S	M	S	M	S	M	S	M	S	M	S
Crop farming	60	2	51	3	0	2	0	1	0	0	0	0
Dairying	14	62	18	56	3	4	3	4	1	4	0	5
Business	0	1	3	6	2	0	2	1	2	1	3	0
Construction	0	3	0	4	0	0	0	0	0	0	0	0
Mining	0	1	0	3	0	0	0	0	0	0	0	0
Manufacturing	1	1	1	4	0	0	0	0	0	0	0	0
Transportation	0	1	2	0	0	0	0	0	0	0	0	0
Public service	1	0	1	0	2	0	2	0	1	1	1	0
Army	0	0	0	0	0	0	0	0	1	0	1	0
Total	76	71	76	76	7	6	7	6	5	5	5	5

Source: Field Survey, 2001 and 2003

Note: M: Main occupation

S: Secondary occupation

2003, the other main occupations were crop farming, business, manufacturing, transportation and public service.

4.1. Dairy cows holding

Dairy cows composition is based on the age of cows, calves, young and adult. Lactating cows, dry cows and bull are categorized as adult. Although Jerseys could better tolerate the average in DIY Province and the Animal Husbandry Service has been promoting the Jerseys since 2000, the milk producers prefer to rear Holstein Friesian crossbreed as they are more used to rearing this breed. There are only 4 Jerseys owned by two milk producers in Sleman.

Table 2 presents the average dairy cows holding by the milk producers in all three regions. In the year 2001, they were 3.2 in Sleman, 6.3 in Bantul and 7.2 in Yogyakarta and were composed of lactating cows, dry cows, heifer that would be lactating in time of 2-12 months, and calves that would be lactating after 24 months with normal rearing. In 2003 the average dairy cows holding by the milk producers increased in Sleman and Bantul but it decreased in Yogyakarta. The dairy cows holding were 4.4 in Sleman, 6.7 in Bantul and 5.6 in Yogyakarta in 2003. Out of five milk producers in Yogyakarta, two of them had a plan to change their dairy activities to other business. They wanted to build student rental rooms on the land, which the dairy activities were done. They think that having a rental room will give more profit and it will also be easier to manage the activities.

In 2001 and 2003, in all study regions the highest percentage of dairy cows composition was lactating cows. The ratio of lactating cows and dry cows was increasing within two years in Yogyakarta, but in Sleman and Bantul the ratio of lactating cows was decreasing. The milk producers in Yogyakarta try to increase the ratio of lactating cows in its herds as a management strategy by replacing the dry cows and

Table 2. Composition and average dairy cows holding per household in the study regions.

Description	Regions					
	Sleman		Bantul		Yogyakarta	
	2001	2003	2001	2003	2001	2003
Average dairy cows holding (heads)	3.2	4.4	6.3	6.7	7.2	5.6
Dairy cow composition						
Lactating	1.2 (37.5)	1.8 (40.9)	3.4 (54.0)	3.9 (58.2)	5.1 (70.8)	4.1 (73.2)
Dry	0.4 (12.5)	0.8 (18.2)	1.2 (19.0)	1.7 (25.4)	1.2 (16.7)	0.6 (10.7)
Heifer	0.7 (21.9)	0.2 (4.5)	1.0 (15.9)	0.1 (1.5)	—	—
Calf	0.9 (28.1)	1.6 (36.4)	0.7 (11.1)	1.0 (14.9)	0.9 (12.5)	0.9 (16.1)
Lactating: dry cows ratio	75:25	69:31	74:26	70:30	81:19	87:13
Milk production/head/year (liters)	2,023.6	2,126.7	2,308.3	2,362.8	2,054.6	2,102.3
Average lactation period (days)	274.7	287.2	289.2	292.7	268.3	286.5
First calving age (months)	28.8	27.2	27.8	25.6	28.4	27.3
Calving number (times)	2.2	2.8	2.4	2.9	3.0	2.9
Calving interval (months)	18.4	18.1	15.8	15.2	19.2	18.7

Source: Filed Survey, 2001 and 2003

Note: Inside ( ), percentage is shown for each of the dairy cows composition.
Lactating cow, a cow which is producing milk.
Dry cow, a cow usually in the latest part of pregnancy, whose lacation has been terminated and who is being prepared for the next lactation. To dry a cow is to stop her milking.
Heifer, a young female bovine from the first heat to the time she gives a first calf.
Calf, a young male or female cow before get the first heat
Bull, a male cow after got the first heat.
Lactation period, the period following calving during which milk is formed in the udder.
First calving age, old of cow (months) at the first parturition.
Calving number, how many time the cow give calves.
Calving interval, time from one parturition to next parturition.

heifers with lactating cow. They have responsibility to fulfill the milk demand of their consumers who buy their milk everyday. Most of the milk producers in Sleman and Bantul do not practice the knowledge of ratio lactating and dry cows in order to maintain continuity of milk production. This is the problem of dairying in DIY Province. The government through the cooperative gives more focus in increasing the dairy cows population to reach the daily milk production target of 8,000 liters per day. Thus, ratio of lactating cows is not given an attention.

An average lactation period in all study regions in 2003 was longer than in 2001. The lactation period and milk production should be increased by improving breed and feed quality. Most of the milk produc-

ers in three regions agreed that cooperative has helped them to improve their milk production through extension, artificial insemination and animal feed supply services. In order to increase number of improved breed, artificial insemination has been implemented using almost 860 doses of imported Holstein Friesian bull semen in 2000 and 986 doses in 2002. However, necessary steps will be taken to raise the efficiency of using artificial insemination and selection emphasis on high milk yield of satisfactory composition and good quality will continue in the future. Selection for high milk production is still the most important factor for assuring high economic returns to milk producers. Therefore, the primary goal of genetic improvement should be directed to increase the annual milk production per cow and to select for desirable milk quality.

Devendra (1988) mentions that improving nutritional management is important factor for increasing economic benefit and milk yield of good quality. According to Malcolm (1999), milk production in the tropical countries (including Indonesia) has been limited by the extreme climates, by low quality tropical feeds that are generally high in fiber and low in digestibility and have a short season to growth. Also limiting milk production are the diseases and parasites associated with hot and wet in climate. Here, to solve the problem of animal feed, cooperative provides feed supply service that it sell concentrate to the members. Cooperative also introduces the fodder cultivation by giving fodder seed to the members.

Ideally, a dairy cow should calve at yearly interval and should have a lactation period of about 300 days, but in practice calving intervals are often longer or lactation period being shorter. The calving interval was becoming shorter in all study regions. According to Chantalakhana (1999), a longer breeding interval will result in a long calving interval, which reduce production efficiency. Hence the aspects of reproductive efficiency and fertility in dairy cows are very much related to milk production efficiency, that is, in terms of milk production per day and calving interval.

In all study regions the first calving age was becoming younger in 2003. The calving number in all regions is between 2 to 3. It means in general, the cows are in the second or third lactation. The milk producers prefer to raise the cow until third lactation because the milk production is in the peak at that lactation number. There are also some milk producers who cull the dairy cows after giving 5 or 6 calves (after 5-6 times of calving). In Yogyakarta, some milk producers do not do the replacement of their dairy cows because they have a plan to close their dairying and change to other business activities.

There are no milk producers who raise Holstein Friesian bull in all three study regions due to the provision of artificial insemination by cooperative and Animal Husbandry Service. The non-necessity of raising bull allows them to raise more number of dairy cows, consequently producing more milk. Whenever a male calf is born, milk producers sell it to the cooperative to pay their credit (Sulastri and Maharjan, 2002).

4.2. Sources of dairy cows

The milk producers raise dairy cows from several sources. **Table 3** shows that more than 61% of the dairy cows in 2001 and 2003, came from the cooperative. On the other hand, they also produce dairy cows in their farm by artificial insemination. Out of 324 cows surveyed in 2001, more than half (199) is provided by cooperative, about one fifth (64) is produced in self farm by artificial insemination and one fifth (61) comes from other sources including cooperative of West Java and Central Java through middle man. The survey conducted in 2003 shows that the sources of 411 dairy cows surveyed is not too much different with 2001.

Table 3 also shows that the role of middleman in supplying dairy cows in all study regions were

Table 3. Sources of dairy cows in the study regions.

Sources of dairy cows	Region						Total	
	Sleman		Bantul		Yogyakarta			
	2001	2003	2001	2003	2001	2003	2001	2003
Farm breed	54 (22.1)	97 (28.9)	6 (13.6)	6 (12.8)	4 (11.1)	2 (7.2)	64 (19.8)	105 (25.5)
Cooperative	139 (57.0)	192 (57.1)	33 (75.0)	39 (83.0)	27 (75.0)	23 (82.1)	199 (61.4)	254 (61.8)
Others	51 (20.9)	47 (14.0)	5 (11.4)	2 (4.2)	5 (13.9)	3 (10.7)	61 (18.8)	52 (12.7)

Source: Field Survey, 2001 and 2003

Note:

Inside ( ) is percentage.

Farm breed, dairy cows are produced in self-farm by artificial insemination

Cooperative, dairy cows are provided by the cooperative.

Others, dairy cows come from the other sources including cooperative of West Java and Central Java through middleman or milk producers raise dairy cows by “gaduh” system (Gaduh is the system in which the milk producer raises others’ animal on profit sharing basis.)

decreasing. Role of cooperative in the provision of dairy cows were increasing in Bantul and Yogyakarta, and it was almost the same in Sleman in 2001 and 2003. In Sleman there is an increasing number of dairy cows which came from farm breed in 2003. Most of milk producers do not sell their calves but they raise them on their own farm. This is a good sign in dairy development in regard to the fact that the milk producers want to raise good dairy cows from their own farm. Actually the milk producers in all regions prefer to raise the cows from calf because they know well the record from the beginning. Due to limitation of land and lack of time, milk producers in two regions of Bantul and Yogyakarta buy heifer from the cooperative. There are some advantages of buying a heifer from the cooperative, these are: 1) the cooperative gives a guarantee of selling pregnant heifers only, 2) the cooperative price is cheaper than the market price and 3) milk producers as the cooperative members can buy the heifer by credit system and they can pay by installment with milk and/or calves.

In the heifers provision service, Warga Mulya Dairy Cooperative has problem that the cooperative were not able to fulfill the demand of heifers among the members. Increasing number of milk producers who raise heifers in their own farm in Sleman does not threaten the heifers provision service by the cooperative. According to the cooperative manager, in 2002, the cooperative could fulfill only 60% of demand. The other 40% were fulfilled by heifers came from the own farm and West Java and Central Java through middleman.

4.3. Feeding practices

According to Shukla and Brahmankar (1999), an efficient system of milk production depends largely on three factors; the productivity of an animal (genetics), the level of feed nutrients and its maintenance. Efficient dairy cows are the result of inheritance and improved breeding. The dairy cooperative aids the members in this aspect by supplying proper semen for artificial insemination. Thus, the most important

aspect of dairy management for increasing milk production is the quantity and quality of feed provided to the cows. The cow feed is divided into two types: concentrate and fodder and their balanced ratio is regarded to be very important to sustain and or increase the production (of milk) and reproduction ability of cow. Since fodder quality, composed of green grass and dry roughages, is variably poor, dairy cows are unable to produce milk unless they are fed with concentrate in addition to fodder. The feeding practices that are followed in three regions have been summarized in **Table 4**. All the milk producers keep the dairy cows at their stall and generally feed fodder and concentrate separately two or three times a day. But in Sleman some milk producers feed their dairy cows only once a day in the morning, giving fodder and concentrate together. The percentage of the milk producers in this category was decreasing from 9.2% in 2001 to 3.9% in 2003. In 2003 all the milk producers in Bantul and Yogyakarta stall feed the dairy cows three times a day. Milk producers in Sleman mostly fed their animal in group in 2001 but in 2003, 72.4% of the them practiced the individual type of feeding. In 2003 more milk producers (85.7%) in Bantul also practiced the individual type of feeding, whereas in Yogyakarta all the milk producers practiced the individual type of feeding. The number of milk producers who practiced individual type of feeding was increasing drastically in Sleman and Bantul because they received a packet of assistance in kind of cement for making of stall feed from Animal Husbandry Services through the cooperative in 2002.

The average daily amount of concentrate given to lactating cow per head is 3 kg, 4,5 kg and 4 kg in Sleman, Bantul, and Yogyakarta, respectively. Currently dry cows are not fed concentrates in Sleman. In Bantul and Yogyakarta currently dry cows feeding on concentrate are given half the amount of lactating cow's allocation. This amount is the same as that given in 2001 and 2003.

According to Ranjhan (1999), during dry period the cow should build up body fat lost in early lactation, which will be required to provide for the growth of the fetus and for the regeneration of mammary tissues. In the practice known as 'steaming up', dry cows are offered quantities of concentrate which

Table 4. Feeding practices in the study regions.

Regions	Frequency/day						Type of feeding			
	2001			2003			2001		2003	
	Once	Twice	Thrice	Once	Twice	Thrice	Individual	Group	Individual	Group
Sleman	7 (9.2)	11 (14.5)	58 (76.3)	3 (3.9)	10 (13.2)	63 (82.9)	13 (13.2)	63 (82.8)	55 (72.4)	21 (27.6)
Bantul	—	1 (14.3)	6 (85.7)	—	—	7 (100)	3 (42.9)	4 (57.1)	6 (85.7)	1 (14.3)
Yogyakarta	—	—	5 (100)	—	—	5 (100)	5 (100)	—	5 (100)	—

Source: Field Survey, 2001 and 2003

Note:

Inside ( ) is percentage.

Once, fodder and concentrate are fed in the morning.

Twice, fodder is fed in the morning and concentrate in the afternoon.

Thrice, fodder is fed twice in the morning and afternoon, and concentrate is fed after morning milking.

increase gradually during the last six weeks of pregnancy. Steaming up is claimed to increase milk production, in part by preparing the cow for high intakes of concentrates that should be fed in early lactation. During the last 60 days of pregnancy live weight increases by about 20 to 30 kg. The response to 'steaming up' probably depends on body condition at the beginning of the dry period. Restoring the reserves of the thin cow will probably have a greater effect on subsequent milk production than increasing the reserves of an already fat cow. Generally, the nutrient of dry cows should contain a minimum 12% crude protein, 22% crude fiber, 50% total digestible nutrient, 0.39% calcium, 0.24% phosphors and 0.16% magnesium (Smith and Guthrie, 1995).

In terms of quantity, it is very difficult to calculate the amount of fodder given to each cow as they are fed in lump sum amount. Milk producers face problems with the availability of fodder; there are problems with quality and quantity and a lack of economical technology for optimum utilization of local feed resources.

One of most common problems facing smallholder dairying in the tropics is the scarcity of good quality fodder during the dry or summer season (Chantalakhana, 1999). Most of milk producers in DIY Province have to use whatever sources of fodder available for dairy feeding, sometimes at very high prices. These sources of fodder consist of: 1) agricultural fibrous residues or by products such as soybean hull, sweet potato leaves, young corn leaves and sugarcane top leaves and 2) forage or fodder leaves either produced on the own farm or collected from outside the farm.

The type of fodder that is available to dairy cows in DIY Province are native grasses, king grass (*Pennisetum purpides*), leucaena (*Leucaena leucephala*), gliricidia (*Gliricia sepium*), sesbania (*Sesbania grandifora*), cassava (*Manihot utilisima*) leaves, sweet potato (*Ipomoea batatas*) leaves, rice (*Oryza sativa*) straw, maize (*Zea mays*) stover and calliandra (*Calliandra sp*). The most common and more frequently fodder fed to dairy cows are native grasses, king grass (*Pennisetum purpuides*), leucaena (*Leucaena leucephala*) and gliricidia (*Gliricidia sepium*).

During the dry season, dairy cows are believed to be increasingly dependent on abundantly available agricultural crop residues, which according to Bakrie (1996), they are high in fiber but low in dietary protein and digestibility. Purwantara et al (2001) mentions that rice straw is by far the most important crop residue, contributing more than 90% of feed energy available to ruminants in Indonesia. However, animal fed on this diet fail to get adequate nutrient for maintenance and production. Efforts are being made by the government through the cooperative and Animal Husbandry Services to examine the possibilities and economic feasibility of improving feeding value of various agricultural and industrial by products, such as bran, oilseed cake and urea molasses block.

To overcome the problem of fodder availability in DIY Province, the cooperative has introduced to the milk producers the integration of fodder and legumes into rice production. In order to get their responses, the cooperative made the pilot project of the integration fodder legume and rice in Maguwoharjo, Sleman. Kusudewa et al (1988) mention that the integration does not have a negative impact on the yield of rice.

4.4. Breeding practices

All the milk producers in the study regions use artificial insemination for breeding of the dairy cows. The breeding of dairy cows by artificial insemination has given the dairy industry the opportunity to make widespread use of superior genes for improving the performance of dairy cows (Etgen and Reaves, 1987). **Table 5** shows that in 2001 the services conception rate was 3.8 in Sleman, 4.1 in

Table 5. Services per conception after artificial insemination in the study regions.

Regions	Services per conception	
	2001	2003
Sleman	3.8	3.6
Bantul	4.1	3.4
Yogyakarta	3.6	3.6
Average	3.8	3.5

Source: Field Survey, 2001 and 2003

Note: Service per conception, the number of services required to obtain a pregnancy.

Bantul and 3.6 in Yogyakarta. It means, the heifer or cow needs almost four times of artificial insemination to obtain a pregnancy. In 2003, the services conception rate was becoming better (decreasing) especially in Bantul because of the establishment of artificial insemination center by the government in the region in 2002. If the milk producers have a difficulty to get the artificial insemination service from the cooperative (need artificial insemination in the night) they use the artificial insemination service from the center. It is very possible that milk producers will leave the cooperative service and use the artificial insemination service from the center because the charge is cheaper and the center gives services in 24 hours. The cooperative's challenge now is on how to provide the better service to the members.

According to Aksi Agraris Kanisius (2000), with the advent and widespread use of artificial insemination, the problem of heat detection has greatly increased because man has replaced the bull as the heat detector. Heat detection is probably the number one reproductive management problem in using artificial insemination. Some of cows may go undetected. A similar or higher percentage of cows suspected of having a retained corpus luteum are probably cycling but are not detected in heat. The major reason of this problem is that many milk producers simply do not give the problem high priority because the effect is not immediately apparent. Etgen and Reaves (1987) describe that if heat is missed, the amount of milk in the bulk tank is not decreased the next day, nor does the cow become ill or die. The economic effects often are nor apparent for months or even a year or more, so the priority assigned to the task of heat detection is low.

4.5. Labor use in dairying

The milk producers and dairy cows are the two most important factors to determine the degree of profitability and personal satisfaction derived from dairying. The milk producers are responsible for doing many things, including a number of little things needed to be done in dairying. Doing these things well and when they need to be done can make dairying a profitable job and an interesting and challenging way of life. Neglecting them can make the dairying a failure or return a little profit. Labor is one of the important inputs in dairy enterprise. The knowledge of dairy management and the requisite skills needed in dairying determine the quality of labor, and quantity of input to enhance the productivity of dairy cows.

Milk production implies a basic and compulsory daily routine of milking, feeding, watering and taking care of the dairy cows. Other major activities related to milk production are the production, harvesting and cutting of fodder crops and the processing, marketing and transport of inputs and outputs.

Seasonal differences in feeding, watering and milking have to be taken into account as well as seasonal changes in the labor input of different household members and their relationship to other farm and non-farm activities. In some cases hired laborers are used incidentally, in others they are used permanently.

In addition to increased investments, many improvements require extra labor. It is essential to verify whether this extra labor is available and whether other activities need to be abandoned as a result. The consequences for the household unit must also be established. It is most important to determine whether the labor input is sufficiently rewarded and whether the additional benefits revert to those who provided the extra labor (Chai et al, 1999).

In Indonesia, like in the study regions, dairy is mostly undertaken by smallholder rearing a few number of cow. They basically use family labor, both male and female, to perform the dairying activities from cleaning cows and their stable, milking, watering, delivering milk to cutting fodder and work related to usage cooperative facilities. When they have to hire labor for such activities they hire local people, all of who are male.

Table 6 shows the data on mandays labor use for various dairying activities in the three study regions in 2001 and 2003. Within that year, the labor use was increasing in Sleman and Bantul. In Sleman, that was caused mainly by increasing of the dairy cows holding. In Bantul increasing of labor use was caused by two factors, that are 1) increasing of dairy cows holding by the milk producers and 2) milk producers in Bantul hire more labor for delivering milk because they sell more milk to consumers directly. In Yogyakarta, the labor use was decreasing in 2003 due to the decreasing of dairy cows holding.

Because of the nature of the dairy work, usually centered in the homestead area, like cleaning cows, milking, feeding, watering and delivering milk, there is a tendency for more female family members to perform them in Sleman and Bantul. In Sleman the trend was the same trend in 2001 and 2003, involving more female family members performing the dairy activities. More than half of the dairying activities are done by female family members in this region. In Bantul the trend was that more female family members performing the dairy activities was changing after the milk producers sell more of their milk to

Table 6. Family labor and hired labor use per cow per household in the study regions.

Labor	Sleman		Bantul		Yogyakarta	
	2001	2003	2001	2003	2001	2003
Man day family labor						
Female	68.2 (54.6)	62.5 (59.6)	70.4 (54.6)	50.3 (37.6)	—	—
Male	51.4 (41.2)	38.7 (36.9)	12.2 (9.5)	19.4 (14.5)	8.1 (6.9)	5.2 (4.1)
Man day hired labor (male)	5.2 (4.2)	3.7 (3.5)	46.2 (35.9)	64.0 (47.9)	109.2 (93.1)	121.2 (95.9)
Total	124.8 (100)	104.9 (100)	128.8 (100)	133.7 (100)	117.3 (100)	126.4 (100)

Source: Field Survey, 2001 and 2003

Note: Inside the ( ) is percentage.

Unit: man day (one man day is 8 hours).

the others except the cooperative.

In 2001 and 2003, in Yogyakarta, almost all the dairying activities were done by hired male labors and most of family members, male and female, were engaged in other jobs, such as, clerical work, business and professional work. In Sleman hired labor used in dairying activities was very low not much different in 2001 and 2003, that 4.2% and 3.5%, respectively and hired only during the peak period of harvesting and cultivating, whereas in Bantul it was rather high, 35.9% in 2001 and 47.9% in 2003. All such hired labors were males in both the regions (**Table 7**). They hire some male labors mainly for delivering the milk to the consumers. In 2001 the milk producers in Bantul sold about 50% of their milk to the cooperative. Since the end of 2002, some some of them sell more milk to the consumers directly (including selling of milk to the private company).

5. Economic Aspect of Dairying

Rearing of dairy cows has been increasingly viewed as a means of alleviating poverty and is believed to improve the livelihoods of landless and small households (Saadullah, 2002). In Indonesia some institutions, such as Department of Agriculture, state and private commercial banks, private bank and private companies, are involved in the promotion of micro credit for small livestock enterprises including dairy cows, poultry and goat production (Directorate General of Livestock, 2001).

According to Saadullah (2002), many smallholders in the developing countries, particularly in mixed farming systems, prefer the flow product (milk, draft power and manure) rather than the end products (meat, hides and skins) since their animals for slaughter entail the permanent loss of flow products. This is also true for the Indonesia dairying, which the incomes from the dairy activities are selling of milk, cows, calves and manure. In the study regions, there was no dairy cow used for draft power. Income from dairying can be used to meet/provide farm household expenses, savings, investment and insurance.

5.1. Profitability of dairying

Cost of dairying is divided into two types: variable cost and fixed cost. Variable cost includes: fodder, concentrate, veterinary services, labor, transportation, interest of credit, energy and others. Fixed cost includes: animal tax, land tax, animal insurance, depreciation of animal, depreciation of equipment, and depreciation of building. The overall cost of production is the summation of these two components.

In this discussion, to compare cost and income value in 2001 and 2003, the nominal value was deflated by an appropriate index in order to determine their real values. The year of 2000 was used as the base year. According to Cramer et al (1997), any time we can see the word real used in an economic context, it means that the values are being expressed in constant currency that have been adjusted to remove the effect of inflation or deflation.

Table 8 shows the details of cost and income of dairying in the study regions. The variable costs are over 84% in all three regions in 2001 and 2003, although the amount in 2001 was only 6.7 million rupiahs in Sleman, just about one-third of the amounts in Bantul (23.5 million rupiahs) and one fourth of the amount in Yogyakarta (27.7 million rupiahs). In 2003, the amount was increasing in Sleman, about 8.8 million rupiahs, but it was decreasing in Bantul and Yogyakarta, 23.4 and 19.8 million rupiahs, respectively. Even though the number of dairy cows in Bantul was increasing, the milk producers minimized the fodder cost through producing own fodder for their dairying. In Yogyakarta, the milk producers also tried to minimize the fodder cost through cultivation of fodder on their own land. The number of dairy

Table 7. dairying labor use per household per annum in the study regions.

Unit: man day

Activities	Sleman						Bantul						Yogyakarta					
	2001			2003			2001			2003			2001			2003		
	FFL	MFL	MHL	FFL	MFL	MHL	FFL	MFL	MHL	FFL	MFL	MHL	FFL	MFL	MHL	FFL	MFL	MHL
1	11.1	35.9	3.4	23.2	45.2	3.9	35.7	9.9	47.4	24.2	21.0	31.1	—	—	82.6	—	—	70.2
2	51.8	5.5	0.6	49.8	9.1	0.8	93.2	3.1	0.4	66.4	10.8	21.8	—	—	111.3	—	—	71.1
3	36.1	2.7	0.7	49.8	3.7	0.6	78.6	1.6	5.1	72.1	4.1	8.1	—	—	129.7	—	—	87.4
4	38.5	26.2	1.1	41.2	25.2	1.4	72.4	10.7	55.1	64.9	16.1	70.3	—	—	118.3	—	—	98.7
5	26.7	10.3	0.9	30.1	9.8	0.8	67.6	3.6	7.2	86.6	3.3	22.8	—	—	97.8	—	—	81.6
6	23.2	1.4	0.2	30.7	1.9	0.6	94.3	5.2	76.6	20.8	6.5	188.3	—	55.6	245.6	—	17.9	188.9
7	28.8	83.2	6.5	48.3	73.1	8.3	—	37.6	99.3	—	63.9	86.4	—	—	—	—	8.1	78.8
8	2.1	2.6	—	1.9	2.3	—	1.6	5.2	—	2.1	4.3	—	—	2.8	0.8	—	3.2	2.0
Subtotal	218.3	167.8	13.4	275.0	170.3	16.4	443.4	76.9	291.1	337.1	130.0	428.8	—	58.4	786.1	—	29.2	678.7
Total labor	399.5			461.7			811.4			895.9			844.5			707.9		
Female labor	218.3			275.0			443.4			337.1			—			—		
Male labor	181.2			186.7			368.0			558.8			844.5			707.9		
Family labor	386.1			445.3			520.3			467.1			58.4			29.2		
Hired labor	13.4			16.4			291.1			428.8			786.1			678.7		

Source: Field Survey 2001 and 2003

Note: Activities: 1) Cleaning animal house, 2) Cleaning cows, 3) Milking, 4) Feeding, 5) Watering, 6) Delivering milk, 7) Cutting fodder, 8) Others (going to cooperative for asking of AI, concentrate and credit)

FFL: Female Family Labor, MFL: Male Family Labor, MHL: Male Hired Labor

One man day: 8 hours

Table 8. Annual cost and income per household in dairying in the study regions.

Description	Sleman				Bantul				Yogyakarta			
	2001		2003		2001		2003		2001		2003	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
1.Variable cost												
Fodder	502,004.5	6.3	778,343.1	7.6	6,154,027.2	24.3	4,127,031.8	16.5	8,578,372.5	28.6	2,727,593.0	12.7
Concentrate	2,389,112.8	30.0	3,243,664.8	31.8	8,407,714.3	33.2	7,375,637.4	29.4	9,432,781.1	31.4	6,096,552.2	28.3
Veterinary cost	151,248.2	1.9	176,214.5	1.7	478,313.1	1.9	577,290.6	2.3	612,641.3	2.0	485,547.8	2.3
Family labor	3,424,400.0	43.1	4,468,829.1	43.8	5,304,500.2	21.0	5,050,716.1	20.1	584,000.0	1.9	369,755.8	1.7
Hired labor	134,000.0	1.7	20,724.6	0.2	2,911,000.8	11.5	5,418,702.9	21.6	7,861,042.1	26.2	8,576,663.9	39.8
Transportation	35,106.2	0.4	40,101.9	0.4	162,142.9	0.6	579,546.2	2.3	293,962.4	1.0	328,359.4	1.5
Interest of credit	88,192.7	1.1	94,157.8	0.9	79,170.9	0.3	179,622.1	0.7	271,450.3	0.9	204,896.2	1.0
Energy	18,734.7	0.2	62,670.4	0.6	45,571.4	0.2	137,143.6	0.5	93,622.6	0.3	1,037,347.5	4.8
Total VC	6,742,799.1	84.8	8,884,706.3	87.1	23,542,440.8	93.0	23,445,690.6	93.5	27,727,872.3	92.4	19,826,715.8	92.1
2. Fixed Cost												
Animal tax	3,216.0	0.0	5,418.8	0.1	6,290.0	0.0	8,466.8	0.0	7,296.7	0.0	7,124.5	0.0
Land tax	28,952.8	0.4	50,231.4	0.5	69,000.0	0.3	60,657.8	0.2	162,620.8	0.5	156,705.3	0.7
Animal insurance	821,768.2	10.3	929,447.9	9.1	754,800.0	3.0	490,854.1	2.0	782,966.1	2.6	541,700.2	2.5
Depreciation of animal	232,167.1	2.9	214,816.8	2.1	610,666.7	2.4	665,419.0	2.7	1,150,666.7	3.8	741,082.0	3.4
Depreciation of equipment	62,518.3	0.8	58,494.4	0.6	171,964.3	0.7	197,707.2	0.8	102,825.3	0.3	158,373.0	0.7
Depreciation of building	59,207.6	0.7	61,680.1	0.6	154,357.1	0.6	201,924.8	0.8	79,897.8	0.3	104,231.4	0.5
Total FC	1,207,830.0	15.2	1,320,089.4	12.9	1,767,078.1	7.0	1,625,029.7	6.5	2,286,273.4	7.6	1,709,216.4	7.9
Total VC+FC	7,950,629.1	100.0	10,204,795.7	100.0	25,309,518.9	100.0	25,070,720.4	100.0	30,014,145.7	100.0	21,535,932.2	100.0
3. Gross Income												
Selling cow	4,218,667.2	39.7	4,411,725.9	32.5	7,229,285.7	23.7	5,691,948.3	19.1	7,498,420.0	20.6	4,070,854.6	15.8
Selling calves	1,468,526.5	13.8	1,537,196.4	11.3	5,987,000.0	19.7	3,697,559.6	12.4	6,572,000.2	18.0	4,784,289.1	18.6
Selling milk	4,078,368.6	38.4	6,335,308.5	46.7	15,582,236.8	51.2	18,673,197.0	62.6	20,065,114.2	55.1	15,700,182.0	61.0
Bonus	112,872.9	1.1	159,869.6	1.2	138,360.0	0.5	276,737.5	0.9	422,566.0	1.2	77,654.6	0.3
Self use manure	368,055.4	3.5	834,729.1	6.2	503,700.2	1.7	905,794.3	3.0	0.0	0.0	434,579.9	1.7
Selling manure	368,055.4	3.5	278,243.0	2.1	1,007,399.8	3.3	603,862.8	2.0	1,858,077.6	5.1	651,869.8	2.5
Total gross income	10,614,546.0	100.0	13,557,072.4	100.0	30,447,982.5	100.0	29,849,099.3	100.0	36,416,178.0	100.0	25,719,430.1	100.0
Net income	2,663,916.9		3,352,276.7		5,138,463.6		4,778,378.9		6,402,032.3		4,183,497.9	
Net return to farm	5,720,261.5		6,986,376.7		9,939,263.6		8,923,300.8		6,986,032.3		4,118,673.7	

Source: Field Survey, 2001 and 2003

Note: Cost and income of 2001 is cost and income calculated from April 2000 to March 2001. Cost and income of 2003 is cost and income calculated from September 2002 to August 2003. The nominal value has deflated by an appropriate index in order to determine the real values. The year of 2000 was used as the base year.

Rupiah is Indonesian currency (11,300 rupiahs = 1 US$ in April 2001 and 8,700 rupiahs = 1US$ in September 2003)

cows in Yogyakarta was decreasing because the milk producers have some limitations and difficulties to develop their dairying. These reasons caused the decreasing of amount of cost in Yogyakarta.

In 2001, the highest amount of variable cost item was, labor cost (44.8%) in Sleman, concentrate in Bantul and Yogyakarta, 33.2% and 31.4%, respectively. This reflects the nature of the dairying in each area. In 2003, labor cost was the highest variable cost in all three regions, Sleman (44.0%), Bantul (41.7%) and Yogyakarta (41.3%). Labor cost includes the actual wage paid to the hired labor and evaluation of the self-labor (**Table 6** and **Table 7**), each separately for female and male, according to the market price. Labor cost increased in Bantul because the milk producers in the region increased selling of milk to consumers directly. They hire some labor for delivering of milk to the consumers. Even though the number of dairy cows decreased in Yogyakarta, the amount of labor cost was still high. This is because milk producers still hire almost the same number of laborers in their dairying. It means the labor efficiency in Yogyakarta was decreasing in 2003.

Fodder is one of the important components of the dairying. In 2001, the highest fodder cost was in Yogyakarta (28.6 %), followed by Bantul (24.3%) and Sleman (6.3%). In that year, all the milk producers in Yogyakarta had no fodder land. They had to buy the fodder. In Sleman it was low because the milk producers had self-produced fodder and or collected free of charge from forest, roadsides and riverbanks. In Bantul milk producers both purchased and self produced the fodder. Thus, the amount of fodder cost shown in 2001 was purchased value for Yogyakarta, production cost in Sleman and summation of both in Bantul.

In 2003, the highest fodder cost was in Bantul (16.5%), followed by Yogyakarta (12.7%) and Sleman (7.6%). Milk producers in Bantul used both self-produced and bought fodder for their dairy cows. Since the end of 2001, the milk producers in Yogyakarta produced fodder on the own land to fulfill the need of fodder. They buy fodder during the peak of dry season because self-produced fodder is not enough for their dairying. In Sleman, the milk producers still use both of self produced fodder and or collected free of charge from forest, roadsides and riverbanks. Thus, the amount of fodder cost shown in 2003 was production cost for Sleman and the summation of purchased value and production cost for Bantul and Yogyakarta.

Concentrate is another key component of the variable cost of milk production. Its share was the highest in Bantul (33.2%) in 2001 and Sleman (31.8%) in 2003. All the milk producers buy the concentrate from the cooperative where the price is cheaper than the outside market and the door delivery is made by the cooperative, which ultimately reduces the transportation cost.

Other variable costs, including veterinary services, transportation, interest of credit, energy, are nominal in all the regions. In 2001, the fixed cost was 15.2 % in Sleman, 7.6% in Yogyakarta and 7.0% in Bantul and mainly consisted of, animal insurance, 10.3% in Sleman, 3.0% in Bantul and 2.6% in Yogyakarta, and the depreciation of animal, 3.8% in Yogyakarta, 2.9% in Sleman and 2.4% in Bantul. In 2003, the share of fixed cost was decreasing Sleman (12.9%) and Bantul (6.5%). It was increasing in Yogyakarta (7.9%). Other components of fixed cost are nominal.

The main source of income is milk in all three regions. The other sources are cows, calves, and manure. Milk producers also receive the bonus on the basis of fat and SNF (solid non fat) content of their milk from the cooperative. The amount of income from these sources varies according to the regions. In 2001, the income from selling of manure was actual income in Yogyakarta. But in Sleman and Bantul, the amount was the evaluated value of actual income from selling and the manure used in the self-farm. In 2003, in all the study regions, the income of manure is divided into selling of manure

and evaluated manure used in the self-farm.

The total amount of gross income sum up to, 10.6 million rupiahs in Sleman, 30.4 million rupiahs in Bantul, and 36.4 million rupiahs in Yogyakarta in 2001. The substraction of total production cost from the gross income gives the net income per household. Thus, the net income from dairying, was 2.6 million rupiahs per household in Sleman and 5.1 and 6.4 million rupiahs in Bantul and Yogyakarta, respectively. This net income is the evaluated profit of the milk producers from the dairying. The return to farm, including the returns to self-resources, like labor, is 5,7 million rupiahs in Sleman, 9.9 million rupiahs in Bantul and 6.9 million rupiahs in Yogyakarta. In 2003, the gross income was increasing in Sleman (13.6 million rupiahs), but it was decreasing in Bantul (29.8 million rupiahs) and Yogyakarta (25.7 million rupiahs). The net income was increasing significantly in Sleman (3.3 million rupiahs) and Bantul (4.7 million rupiahs), but it was decreasing in Yogyakarta (4.1 million rupiahs). The net return to farm in 2003 was 6.9, 8.9 and 4.1 million rupiahs in Sleman, Bantul and Yogyakarta, respectively.

It can be said that in 2001 the returns for what remains in the farm increases doubles the net income in Sleman and nearly doubles in Bantul when the returns to their self-resources are considered. In 2003, it was increasing in Sleman that the return for what remains in the farm increases three time of the net income. This is the extra income gained by the milk producers utilizing their sources in the dairying which otherwise would have been unused and or underused. According to Saadullah (2002), the sustainability of the income from dairying depends largely on the assured supply of accompanying inputs such as feed and veterinary services, and improved milk marketing facilities closer to the doorsteps of the milk producers.

5.2. Contribution of dairy income to the household income

Table 9 presents the total income from agricultural activities (crop, dairy, non dairy livestock and poultry) and non agricultural activities in the study regions. This showed that in 2001 and 2003, the households in Sleman were fully independent of the agricultural work for their income (more than 60% of the income came from the agricultural). In Sleman, dairy contribution in the household income increased from 28.7% in 2001 and became the highest share (35.3%) in 2003. Most of the milk producers in Sleman gave more attention to dairying. They raised more dairy cows. Milk production was also increasing.

In Bantul non agricultural activities gave the highest share in the household income in 2001 (67.6%) and 2003 (69.4%). Among the agricultural activities, dairy contribution in the household income is not much different in 2001 and 2003, which are 20.9% and 22.3%, respectively. A very high share of non agricultural activities in Bantul shows that the households have diversified their income such that they derive income from both agricultural and non agricultural activities undertaken simultaneously. In that sense, agriculture has become a part time activity whose purpose is to secure their household income. It is not infrequent in the case of such households that a small *sawah* is cultivated by an elderly person or by the head of household in the evening after having completed a primary activity. The dairy activities are done by mostly female family labor and also hired labor mainly for delivering of milk to the consumers. This is not surprising as some of the households labor force includes a large share, which is engaged in public services and business.

To sump up, diversification of income and of primary employment, and the level of average household income are higher in communities, which are closer to the city and to transit corridors bordering regional or national road (Rotge, 2000). Nevertheless, it should be mentioned that the study region of

Table 9. Share of dairying in the household income in the study regions.

Income from	Sleman				Bantul				Yogyakarta			
	2001		2003		2001		2003		2001		2003	
	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%	Amount	%
Crop	2,845,274.9	30.7	2,949,051.7	31.1	1,994,623.7	8.0	1,796,541.8	7.7	44,972.3	0.2	2,218,616.8	6.0
Dairy	2,663,916.9	28.7	3,352,276.7	35.3	5,138,463.6	20.9	4,778,378.9	20.4	6,402,032.3	22.0	4,183,497.9	11.2
Non dairy LS and poultry	79,074.4	0.9	751,636.0	7.9	856,750.9	3.5	580,100.6	2.5	120,750.7	0.4	205,535.0	0.6
Non agriculture	3,672,661.3	39.7	2,436,675.0	25.7	16,641,600.0	67.6	16,297,279.9	69.4	22,542,800.1	77.4	30,525,798.3	82.2
Total	9,260,927.5	100.0	9,489,639.3	100.0	24,631,438.2	100.0	23,452,301.2	100.0	29,110,555.4	100.0	37,133,447.9	100.0

Source: Field Survey, 2001 and 2003

Note:

Income of 2001 is the household income calculated from April 2000 to March 2001. Income of 2003 is the household income calculated from September 2002 to August 2003. The nominal value has deflated by an appropriate index in order to determine the real values. The year of 2000 was used as the base year.

LS non dairy and poultry is income from chicken, duck, cows and goat.

Income from non-agriculture activities is income from other job (business, construction, mining, manufacturing, transportation, public service and army).

Rupiah is Indonesian currency (11,300 rupiahs = 1 US$ in April 2001 and 8,700 rupiahs = 1US$ in September 2003)

Bantul had been selected for sugar cane cultivation. This occurs once every five years. During such periods, *sawah* are rented out by the *Madukismo* sugar company, which carries out the cultivation work. As a result, household members probably have to find alternative employment while household income might be below its normal average when rice is cultivated. As an alternative way to solve this problem, some of the households involve in the dairy activities (Sulastri and Maharjan, 2002). There is also a household in Bantul, which shift from agriculture to no farm activities, which is not dependent on land during sugarcane cultivation by undertaking a small *warung* (small grocery shop and/or restaurant).

As seen in **Table 9** non agricultural activities have the largest share in 2001 (77.4%) and 2003 (82.2%) in the household income in Yogyakarta. Agriculture activities contributed less than 25% in2001 and 2003. The dairy contribution in the household income decreased from 22.0% in 2001 and became half (11.2%) in 2003. Most of the milk producers in Yogyakarta have difficulties to develop their dairy. The limitation of land, fodder and expensive wage labor are the main problems.

A further important observation is that, a low share of dairy activities in the household income can be found in Bantul and Yogyakarta. This does not mean that dairy activities have virtually disappeared from the dweller's choice. In reality, all respondents in Yogyakarta and some respondents in Bantul are lacking land, and most of them engage in dairying as a secondary activity. In short the main points need emphasizing:

1. In Bantul and Yogyakarta there are considerable and varied no- farm activities for primary employment. Only in Sleman, which is located in rural and relatively far from Yogyakarta does agriculture remain the dominant sector of primary activity.
2. There is a clear relationship between locational characteristic and the level of development of dairying. Sleman, as a rural area and agriculture as the primary activity among the people, has a better chance to develop dairying than Bantul and Yogyakarta.

According to Indonesia Central Bureau of Statistics (1997), the dairying contributes 30% of the total income of the milk producer in Yogyakarta, 70.9% of the total household income in West Java and 50% of the total household income in East Java. This description is for the general milk producers in Indonesia.

6. Conclusion

Dairying in the study regions is dominated by small scale or smallholder farms under mixed crop livestock farming systems. Dairying has very stable composition of cows at household level with good future prospects and produces about 2,100 liters of milk per head per year. Feeds are one of the major inputs for dairy production that are relatively abundant in DIY Province. Roughage feeds are scarce in the dry season but in the long term, with appropriate methods of collection and preservation, this feed scarcity could be resolved easily. Nonetheless, the feed production techniques have not been used to full capacity due to certain limitations, which could be overcome by research and extension efforts. Currently, major research and extension efforts aim to improve the milk yield of dairy cow from 6-8 liters/day to 10-15 liters/day or up to 4,500 liters/lactation period (300 days).

Dairying in DIY Province is labor intensive. The data reveal a greater use of family labor in rural and sub urban areas compared to that of hired labor in dairy cows care and delivering of milk. In urban areas, there is a greater use of hired male labor in dairy activity. In rural areas hired labors are used only

during the peak period of harvesting and cultivating.

Income from dairying gives different level of contribution to the household income of the milk producers in three study regions. In Yogyakarta (urban) and Bantul (sub urban), non-agriculture activities give the highest share in household income. On other hand, dairying in Sleman (rural) gives highest share in the household income. Hence, it is clear that there is correlation between locational characteristics and the development level of dairying. From the findings, Sleman has been indicated having a better chance to be developed for dairying than Yogyakarta and Bantul.

Endnotes

(1) The first author is a lecturer in Faculty of Animal Science, Gadjah Mada University Yogyakarta, Indonesia.

(2) The term milk producers refer to all households in rural as well as in urban and sub urban areas, which are engaged in milk production although for rural households also produce crops and their occupation is generally farming.

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