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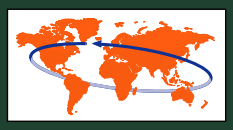

International
Farm Comparison
Network IFCN

The Economics of Milk Production in Orissa, India, with Particular Emphasis on Small-Scale Producers

Amit Saha, Otto Garcia and Torsten Hemme

PPLPI Working Paper No. 16

A Living from Livestock

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PREFACE

This is the 16th of a series of Working Papers prepared for the Pro-Poor Livestock Policy Initiative (PPLPI). The purpose of these papers is to explore issues related to livestock development in the context of poverty alleviation.

Livestock is vital to the economies of many developing countries. Animals are a source of food, more specifically protein for human diets, income, employment and possibly foreign exchange. For low income producers, livestock can serve as a store of wealth, provide draught power and organic fertiliser for crop production and a means of transport. Consumption of livestock and livestock products in developing countries, though starting from a low base, is growing rapidly.

The study applies a method of economic analysis developed by the International Farm Comparison Network (IFCN) which is based on the concept of 'typical farms'. Three broad farm types were selected to represent typical farms in the state: farms stall feeding two dairy animals (buffalo or local cattle), representing the most common farm type found in the state, farms with six dairy animals, located in peri-urban areas benefiting from good market access, and rural farms practicing a form of pastoral production system in areas where communal grazing land is available. Each farm is described in detail with assets, production costs, profits and other economic information presented both graphically and in the text. A comparison with similar farms in the state of Haryana is provided.

We hope this paper will provide useful information to its readers and any feedback is welcome by the authors, PPLPI and the Livestock Information, Sector Analysis and Policy Branch (AGAL) of the Food and Agriculture Organization (FAO).

Disclaimer

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Keywords

Costs of production, India, milk, Orissa, policy, poverty reduction, small-scale dairy, typical farms

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1. EXECUTIVE SUMMARY

Introduction

Orissa is one of the least developed states in India with very high levels of poverty. Mixed crop-livestock farming is the most predominant farming system for over 80 percent of all rural households in the state. Of the total livestock population, bovines account for about 65 percent indicating their importance in livestock production. In the rural economy, milk is one of the most important products of cattle and buffalo enterprises, contributing over 33 percent of the value of all livestock outputs (Government of Orissa, 1998-99). Other products include meat, bones, skins and hides, manure, and draught power. With very small and marginal operational holdings (less than a hectare) accounting for nearly 80 percent of the 3.94 million farms, increasing milk production could be an efficient way to improve rural livelihoods.

The main purpose of this study was to gain insight into the household and farm economics of small-scale dairy farmers in Orissa, and to obtain estimates of their costs per unit of output in milk production so as to gauge their potential for improvement and vulnerability to international competition. In order to ascertain possible developments in the dairy sector and to broadly identify areas of intervention that favour small-scale dairy producers, the study examines the potential to improve milk production of different farm types. A case study approach is used, the aim being to obtain qualitative insights rather than quantitative extrapolation.

Methodology

The methodology applied for the economic analysis was developed by the International Farm Comparison Network (IFCN) and utilises the concept of typical farms. Farm types are determined by regional dairy experts taking into consideration (a) location of the farm, (b) farm size in terms of herd size and (c) the production systems that make important contributions to milk production in the region. The first category of farms (small) was chosen to represent the size that is close to the statistical average. The other farm types defined represent larger farms to allow the exploration of potentials for economies of size in the region, or a different dairy production system. Management levels on the typical farms are average to slightly above average compared to other farms of the same type. Data was collected using a standard questionnaire and a computer simulation model, TIPI-CAL (Technology Impact and Policy Impact Calculations), was used for biological and economic simulations of the typical farms. A farm to farm comparison was carried out to identify differences between farms in Orissa and Haryana.

Results

Milk production in India and Orissa

India is a world leader in milk production, contributing about 15 percent to total world output. In 2002, India produced an estimated 84 million MT, second only to the EU. Milk yields in India, at 694 kg per cow per year, however, are extremely low compared to other large milk producing countries such as the USA, Germany or New Zealand. Average milk yields per animal in the US were 11 times higher than those of India, while for New Zealand the figure is 5 times higher. Farm gate prices received in the US were twice as high, while those received in Germany were 50 percent higher than those received by Indian farmers. Only in New Zealand were farm gate prices found to be slightly lower.

Orissa does not contribute significantly to milk production in India. With only 1.7 percent of the dairy cow population and 0.4 percent of the buffalo population in 2002, milk production in Orissa contributed only 1.1 percent to the milk produced in India. Most of the milk in Orissa is produced on farms with marginal to small landholdings, less than 2 hectares, and with 3 or 4 animals. Even by Indian standards, milk yields in Orissa are extremely low (1/4 of the Indian average). Farm gate prices of milk are only slightly lower than the Indian average, but still a little higher than those received in New Zealand. The per capita milk production in Orissa is very low at 26 kg per capita per year while the annual per capita production in India is 82 kg.

Analysis of 'typical farms' in Ganjam and Gajapati districts of Orissa

Based on the IFCN methodology, six farm types were identified as 'typical' and were subjected to detailed analyses. Two small dairy farms, IN-2CO (2 local cows and less than a hectare land) and IN-2BO (2 buffaloes and 1-2 ha land), represent over 95 percent of the dairy farms in Orissa. The farms IN-6CO (6 crossbred cows in a peri-urban area) and IN-6BO (6 grade buffaloes, also in a peri-urban area) represent the fast growing medium sized commercial farm types in Orissa. These farm types provide a picture of the economies of scale and the effect of location peri-urban and urban areas. Farms IN-15CO (15 local cows) and IN-9BO (9 local buffaloes) represent only 5 percent of the farms in rural areas but have distinctly different production and management characteristics due to their large herd size and access to areas for common grazing.

Dairy production systems

Local, non-descript cows are the main type of dairy animals followed by buffaloes and crossbred cows. The family is in charge of the management of the farm but they use the opportunity to hire very cheap labour. Fallow and forest land can be used for grazing. Feed rations are based on agricultural by-products such as rice bran, rice polish, broken rice, paddy straw and pulses meal. Commercial cattle feed is only used by the medium sized commercial farms such as IN-6CO. Milking is done by hand. In terms of non fat corrected milk (ECM), production per dairy animal ranges from 210 to 1,305 kg/year.

Household comparison

Household incomes range from 420 US-$ to 1,570 US-$ per year. Income structure is quite diverse with non-cash benefits being prominent in the small systems. For example, draught power, manure and fuel from cow dung, and milk used in the household account for 16 percent of the household income in IN-2CO. Off farm income is quite important for all the stall fed systems in Orissa and constitutes 5 to 45 percent of the household income.

Whole farm comparison

The returns from farming range from 460 US-$ to 2,910 US-$ per year. The dairy contributes 25 to 85 percent to the whole farm returns. The returns from cash crops are also important, ranging from 15 to 70 percent, depending on farm type. Net cash farm income closely follows the level of farm returns with the exception of the large commercial cow system (IN-15CO), where net farm income is relatively low, mainly due to comparatively high cash costs and hired labour costs in dairy per 100 litres ECM. The highest net cash farm income was obtained in the commercial buffalo based dairy farming system (IN-6BO), mainly due to lower unit costs of milk production.

The net cash farm income ranges from 190 US-$ to 1,100 US-$ per year. The low net cash income of 190 US-$ per year (IN-2CO) is due to low milk yields, small size of land holding, and slightly lower milk prices paid by the cooperative due to lower fat content and remote location.

Comparison of the dairy enterprise - Costs of milk production

The buffalo-based pastoral dairy farming system (IN-9BO) and the commercial stall-fed crossbred cow based dairy farming system (IN-6CO) have the lowest cost of milk production per 100 litres of ECM at around 12.3 to 12.9 US-$. The commercial buffalo-based dairy farming system with grade buffaloes, IN-6BO, has slightly higher costs at 14.6 US-$ per 100 kg ECM, mainly because of slightly higher purchased feed costs. These farm types have the potential to compete in the long run with imports of dairy products and also to produce milk for export, provided international quality standards can be achieved and the dairy chain being internationally competitive.

In the small farm systems, the buffalo-based rural farm (IN-2BO) produces milk at a significantly lower unit cost (at 19.9 US-$ per 100 kg ECM) than the IN-2CO cattle based farm which could only produce at 31.4 US-$. This can be explained by higher milk yields and higher labour productivity in IN-2BO. It has to be noted, however, that the main purpose of IN-2CO is to produce milk for home consumption (30 percent of the production) by converting locally available feedstuff into milk, livestock, fuel and draught power for its crop activities. Given that IN-15CO can produce milk at comparatively lower costs (15.3 US-$ per 100 kg ECM), there is a potential to lower milk production costs, but this requires the realization of economies of scale in similar cattle-based farms through expansion to larger herd sizes. Another alternative could be a herd of a cow and a buffalo for uniform milk production in the year (see Annex A-6).

As in small dairy farms in most other countries, farm IN2-CO will tend to persist as long as alternative employment opportunities (at 0.14 US-$/hour in this case) are not available. With the existing wage rate for dairy labour at 0.11 US-$/hour, the chances of obtaining available alternative employment seems remote.

Comparison of dairy farms in Orissa and Haryana

A comparison of typical and leading-edge farms in Orissa with corresponding farms in Haryana reveals that milk production in Orissa is relatively cost competitive. Although milk yields in Orissa are much lower than in Haryana, farmers in Orissa produce milk at competitive costs due to lower land costs and lower wage rates. The availability of grazing land in Orissa and cheaper feed also contributes to lowering the costs of milk production. Buffalo milk production was found to be more cost competitive in Orissa than in similar farms in Haryana. However, farm gate milk prices are lower by around 5 percent in Orissa and farm incomes are much lower in Orissa than in Haryana due to low milk yields and lower off-farm income.

Dairy chain in Orissa

Most of the milk marketing is done through the informal sector with milk being sold to the milkman or locally. Farmers are encouraged to sell buffalo milk with higher fat content to co-operatives by milk pricing based on fat content and assurance of seasonal fixed prices throughout the year.

Producer milk prices are 14 percent higher in the informal sector than in formal sector (milk union cooperative). Consumer prices for fluid milk are also lower in the informal sector through the milkmen and farmers selling directly in the rural market. Both the consumer and the producer markets are mostly captured by the informal sector although the quality of milk handled through this channel is poor. Consumers have a high price elasticity of demand for milk products. Without information on milk quality or means to check for adulteration, consumers will continue to prefer the cheaper products and the informal sector will maintain its hold of the major share of milk markets in Orissa.

It is estimated that only about 5 percent of total marketable supply of milk is handled by the formal sector, the cooperatives. Estimates show that the cooperative milk

union selling toned milk with 3 percent fat receives value-added and retail margins of 0.22 US-$ per kg of raw milk used and of 0.06 US-$ for other raw materials used (Skimmed milk powder). In the informal sector, the local milkman selling raw milk in the nearby town or city receives a processing and retailing margin of 0.13 US-$ per kg of milk handled followed by the peri-urban farmer selling milk directly in the town, who receives a margin of 0.12 US-$ per kg milk sold. The costs of value-added in the formal sector, however, are significantly higher than in the informal sector.

Conclusions

The present study analyzed six typical dairy farming systems in Orissa. All the systems cover their cash costs and contribute positively to farm income.

The most common dairy farming system, IN-2CO (2 local cows) produces very low cash farm income and generates negative entrepreneurial profits. The persistence of this system is largely due to the low cash costs of milk production. Moreover, given the scarcity of alternative employment opportunities for family labour, the dairy activity produces a relatively good cash margin of around 10 US-$ per 100 kg ECM. There is potential for improving farm income by improving milk yields and increasing herd size. The other small dairy farming system, IN-2BO (2 buffaloes), has even lower costs of milk production than IN-2CO, mainly due to its higher milk yields. Although the lowest net costs of milk production are incurred by the pastoral, buffalo-based dairy farming systems (IN-6BO), this production system is not very prevalent in the region given the scarcity of common grazing areas.

The share of off-farm income was the highest in the most prevalent small dairy farming system (IN-2CO). Family labour is a relatively important component of cost in small subsistence farm types like IN-2CO and IN-2BO. In the commercial farm types such as IN-6CO and IN-6BO, purchased feed costs are proportionately higher. Other returns from dairy such as cow dung for fuel and draught power are proportionately higher in the small farms. An important component of the dairy farming system that results in significant differences in farm profits are the returns to labour. The returns to labour are very low for the small farms but much above the existing wage level in case of the commercial farms (IN-6CO and IN-6BO). In case of pastoral systems, IN-9BO had comparatively higher returns to labour than IN-15CO mainly due to the higher milk yields of the buffalo-based system.

A comparative analysis of typical dairy farms in Orissa and Haryana revealed differences in cost and productivity of dairy farming in the two states. A large potential to reduce milk production costs of smallholder dairy farming and increase family farm income through milk production exists in Orissa by better breed, feed and herd management. Smallholders using buffalo for milk production in Orissa were found to be more cost competitive than similar farms in Haryana. Hence suitable strategies to promote such buffalo-based systems should have potential for improving the production and competitive position of dairying in Orissa.

2. OVERVIEW – MILK PRODUCTION IN ORISSA

2.1 Orissa - Dairy in the global context

World milk production

In 2002 India continued to be the world leader in milk production with an estimated production volume of 84.4 million tons. The production of Orissa was 0.93 million tons, contributing only 1.1 percent of milk production in India. Of the total milk produced in Orissa in 2001-02, most (45 %t) came from crossbred cows. The rest was produced by local cows (34 %), buffaloes (20 %) and goats from Ganjam district (0.3 %).

Dairy animals

In 2001-02 Orissa had 3.8 million dairy cows and 0.4 million dairy buffaloes, constituting only 1.7 percent of the dairy cow population and 0.4 percent of the buffalo population in India. By comparison, there are 97.3 and 9.6 million cattle cows in the USA and New Zealand respectively, of which a majority are for milk production.

Dairy farm structures

The vast majority (over 80 percent) of dairy animals in Orissa are kept in farms of 1 to 2 animals. In line with the average size of Indian 'dairy' herds, the average dairy farm in Orissa also has 2 animals, mostly local cows. In comparison, dairy herds in the USA average 88 dairy cows while herds in New Zealand hold an average of 236 dairy cows.

Milk yields

At 189 kg per cow per year average milk yields in Orissa are extremely low. Average annual milk yields in the USA and New Zealand are 41 and 18 times as high. This dramatic difference can be explained by various factors, most importantly genetics, feeding, management, technology, etc. as well as the propensity of farmers to adopt modern dairy farming practices.

Milk prices

The average milk price in Orissa (19.1 US-$/100 kg 4% ECM) was slightly lower than the average milk price in India as a whole (20 US-$/100 kg). Prices in New Zealand (17.5 US$/100 kg) are the lowest while the prices in countries such as Germany (30 US$/100 kg) and USA (38 US-$/100 kg), where dairy production is highly subsidized, are almost double.

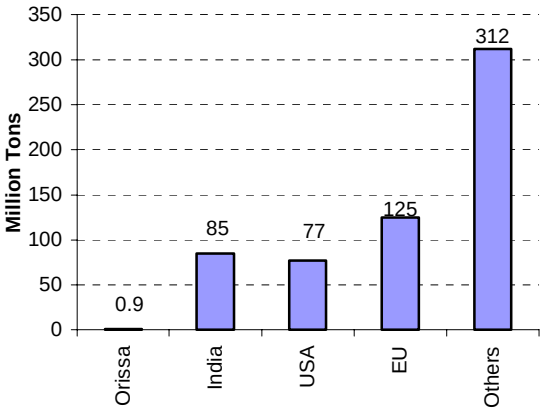
Milk production per capita

At only 26 kg per annum per capita, Orissa has a very low per capita milk production. This is mainly due to its high human population density and the comparatively low milk yield of its dairy animals. At 82 kg per year, the average milk production per capita in India is 3.2 times that of Orissa. In comparison, countries like New Zealand produce as much as 3,060 kg per capita.

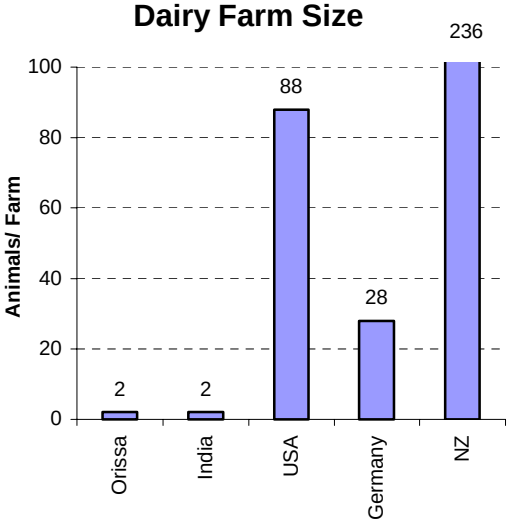
Explanations of variables; year and sources of data:

- Milk Production per Country(2002): FAO (2003)
- Average Farm Size (2002): Hemme et al. (2003)
- Milk Yields per Dairy Animal (2002): Hemme et al. (2003)
- Number of Animals (2002): FAO (2003).
- Farm Gate Milk Prices (2002): Hemme et al. (2003)
- Milk Production per Capita (2002): Hemme et al. (2003)
- Integrated sample survey estimates have been obtained for Orissa State from Government of Orissa, 2002

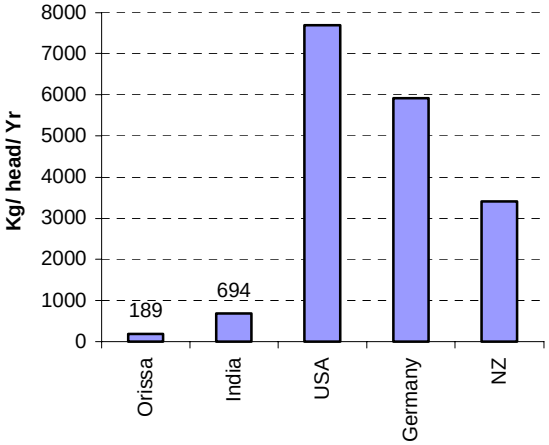
Milk Production per Country



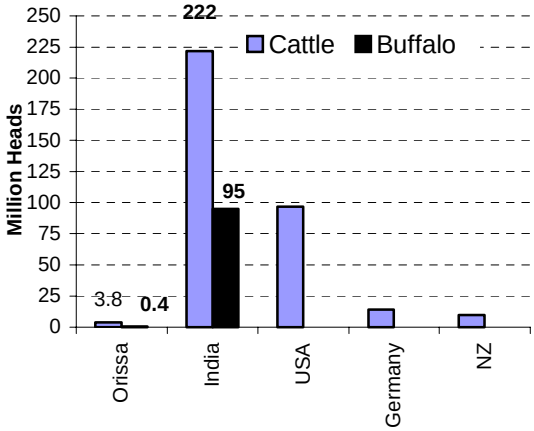
Dairy Farm Size



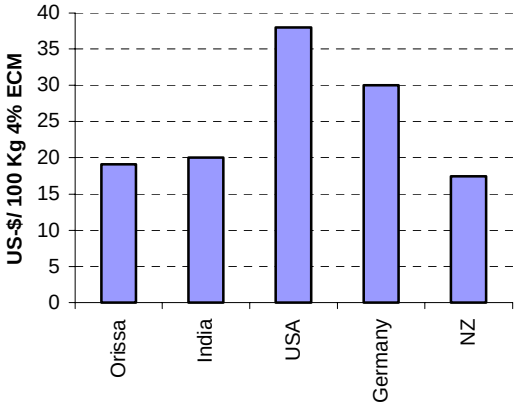
Milk Yields per Dairy Animal



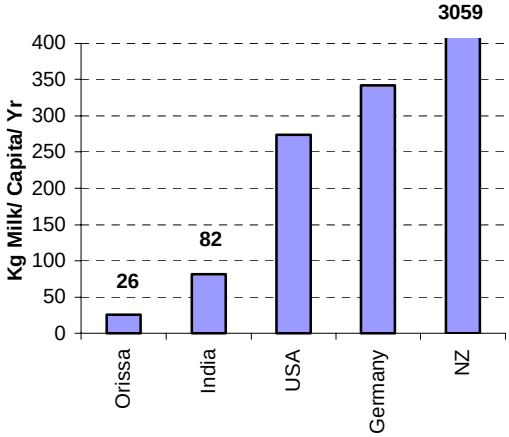
Number of Live Animals



Farm Gate Milk Prices (2001)



Milk Production per Capita



2.2 Recent dairy developments in Orissa

Milk production

Milk production from local cattle increased marginally from 1995 to 1998 , but fell in 1999 owing to the high mortality of local cattle in the 'killer cyclone' in coastal districts of Orissa. However milk production from crossbred cows has shown a significant increase by 91 percent over the same period while buffalo milk production showed a growth of 49 percent.

Development of daily milk yields

Milk yields of most types of dairy animals have increased between 1995 and 2002. The yields of crossbred cows, after an initial decline in 1997, have shown a consistent increase. Buffalo yields, with an increase in 1999, have marginally decreased in 2001. The yields of local cattle have remained more or less stagnant after the cyclone in 1999.

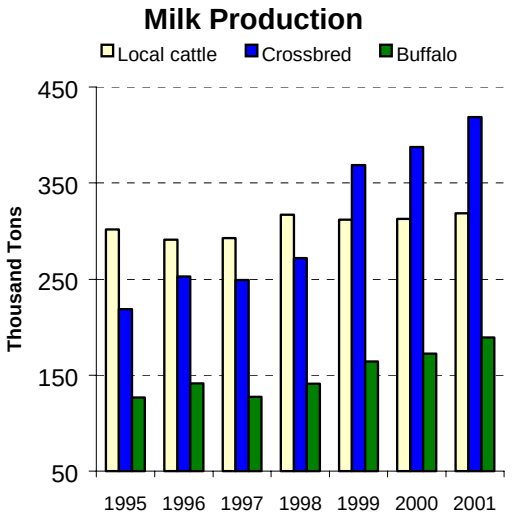
Types of dairy animals

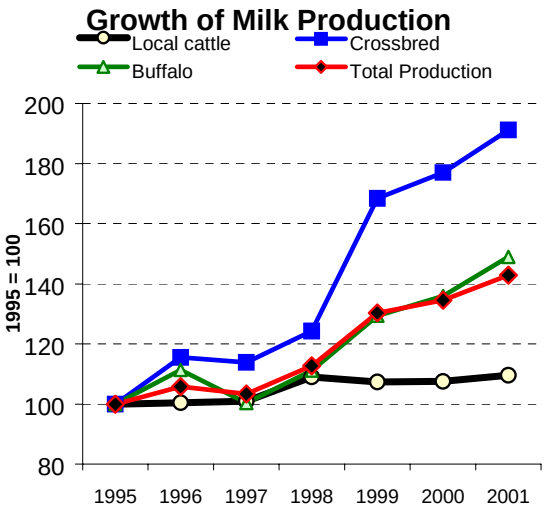
Between 1995 and 2002, the number of local cattle and buffalo declined by 12.3 percent and 14.8 percent respectively. The decline of local cattle and buffalo populations primarily occurred in 1999, and are attributed to the severe effects of the cyclone. The buffalo population is again increasing since 1999 probably because of the higher prices of buffalo milk being paid by the cooperatives due to the higher fat content.

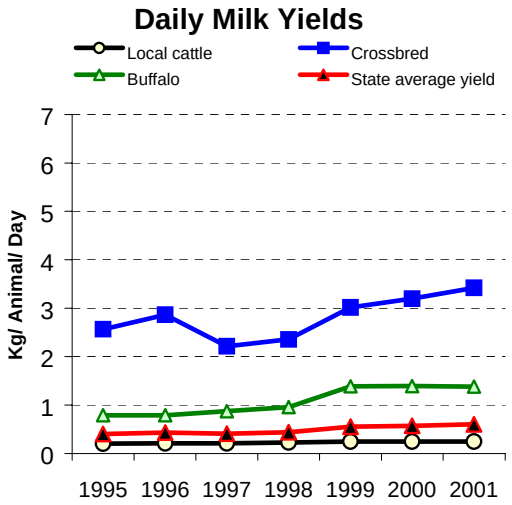
The number of crossbred cattle has increased by 43.4 percent. Interestingly, the number of crossbred cows has increased significantly (by 5.67 percent) even during the cyclone period. This may reflect the importance given to crossbred cows by owners given their higher productivity and hence market value. There may be several reasons for the higher survival rates of crossbred cows during the cyclone period, for instance they may have been kept in sheds providing greater protection than that provided for local cows. Most of the crossbred cows come from states like Andhra Pradesh, Madhya Pradesh and Punjab and are mostly jersey crosses with lower body weights, which may also have offered some advantage.

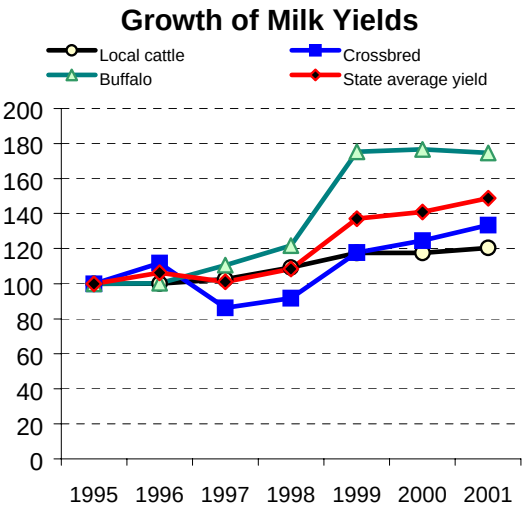
Explanations of variables; year and sources of data:

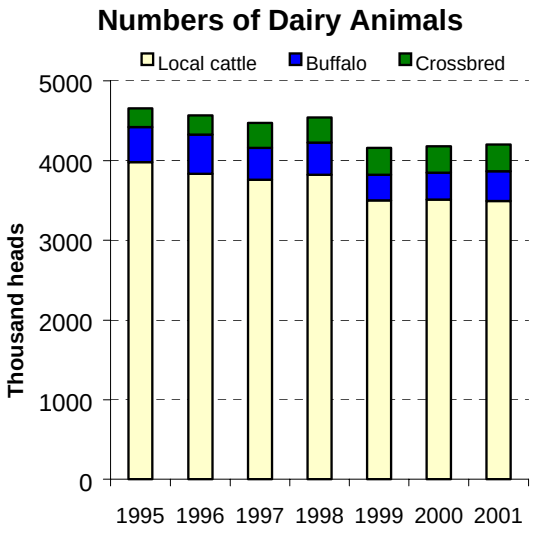
- Local Cattle: Non-descript cows without any specific breed characteristics (mostly *Bos indicus*), which have relatively low milk yields but are well adapted to local conditions.
- Crossbred: Dairy animals with varying degrees of a productive dairy genetics (*Bos taurus*; usually Jersey, crosses with one of the many Indian breeds).
- Milk Production: Government of Orissa,1995-2002.
- Development of Milk Yields: Government of Orissa, 1995-2002.
- Types of Dairy Animals: Government of Orissa, 2001-2002.

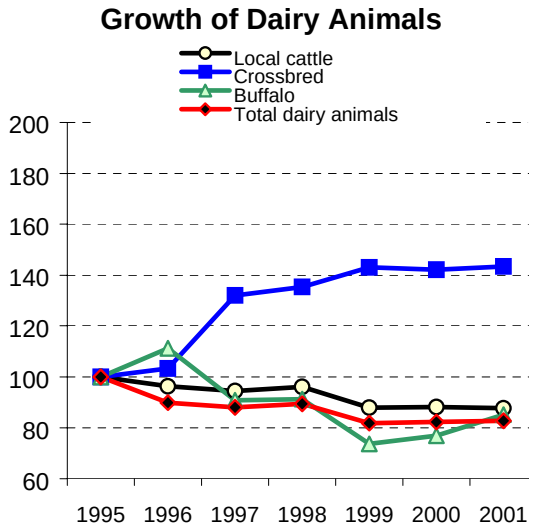

Milk Production
Local cattle
Crossbred
Buffalo
Thousand Tons
450
350
250
150
50
1995 1996 1997 1998 1999 2000 2001


Growth of Milk Production
Local cattle
Crossbred
Buffalo
Total Production
1995 = 100
200
180
160
140
120
100
80
1995 1996 1997 1998 1999 2000 2001


Daily Milk Yields
Local cattle
Crossbred
Buffalo
State average yield
Kg/ Animal/ Day
7
6
5
4
3
2
1
0
1995 1996 1997 1998 1999 2000 2001


Growth of Milk Yields
Local cattle
Crossbred
Buffalo
State average yield
200
180
160
140
120
100
80
60
40
20
0
1995 1996 1997 1998 1999 2000 2001


Numbers of Dairy Animals
Local cattle
Buffalo
Crossbred
Thousand heads
5000
4000
3000
2000
1000
0
1995 1996 1997 1998 1999 2000 2001


Growth of Dairy Animals
Local cattle
Crossbred
Buffalo
Total dairy animals
200
180
160
140
120
100
80
60
1995 1996 1997 1998 1999 2000 2001

2.3 Natural conditions and farm structure in Orissa

Natural conditions (temperature and rainfall)

Orissa, on average, experiences moderate temperatures in the west and central regions throughout the year with only slight variation between seasons. However most of the northern plateau, north east upland and coastal regions have a hot and moist climate while the eastern and south-eastern uplands are warm and humid.

Orissa is endowed with rainfall throughout the year but maximum precipitation occurs between June and September. Although the state has significant potential water resources, it mostly depends on rainfed agriculture. The soil is mostly red loamy to laterite except in coastal regions where alluvial soils predominate.

State farmland structure

With a total land area of about 1.6 million hectares, Orissa only constitutes 4.7 percent of India´s land mass. Only 37.4 percent of the land are used for cultivation of crops, 37.3 percent are under forests while the remaining 25 percent are dedicated to other uses or are waste lands. (In India overall, the area under forests accounts for 19 percent, the area under crop cultivation for 43 percent and while the rest has other uses). Paddy (rice) is the main crop in the state, sown on 77.5 percent of area cultivated in 2000-01 and is mainly grown as winter paddy. The other main crops are pulses (9.7% area sown), and oilseeds (5.9 % of area sown).

Farm structure in Orissa (survey of 6 villages)

A survey of 3 villages and a town in the peri-urban region of Ganjam district and of 3 villages in a rural region from the Ganjam and Gajapati districts of Orissa was undertaken to understand the dairy farming systems existing in the region.

Farms in urban and peri-urban areas

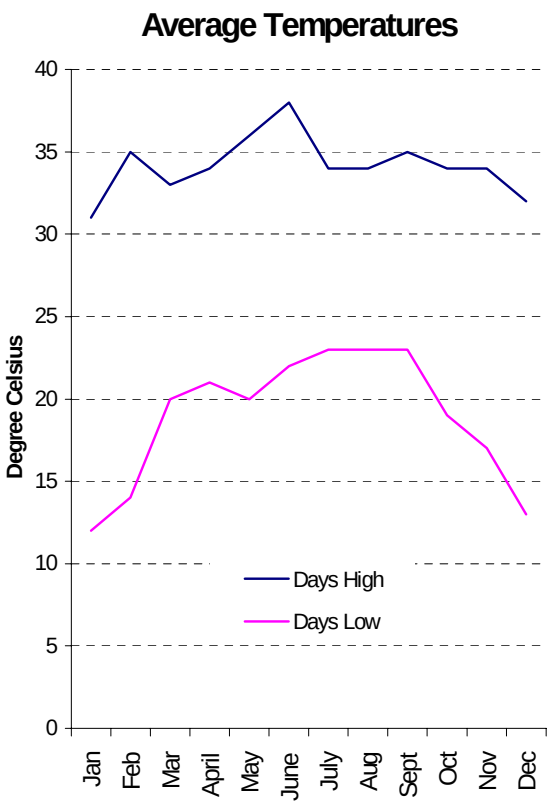
About 79 percent of the dairy farms in the urban and peri-urban areas (within a radius of 50 km from a main town or city) have one or two, usually two, ‘dairy’ animals and own up to one hectare of land. These farms are similar to the farms in rural areas. About 17 percent of farms have an average herd size of 3 dairy animals, mostly crossbred Jersey cows. The remaining 4 percent are farms with grade buffaloes with Murrah genes.

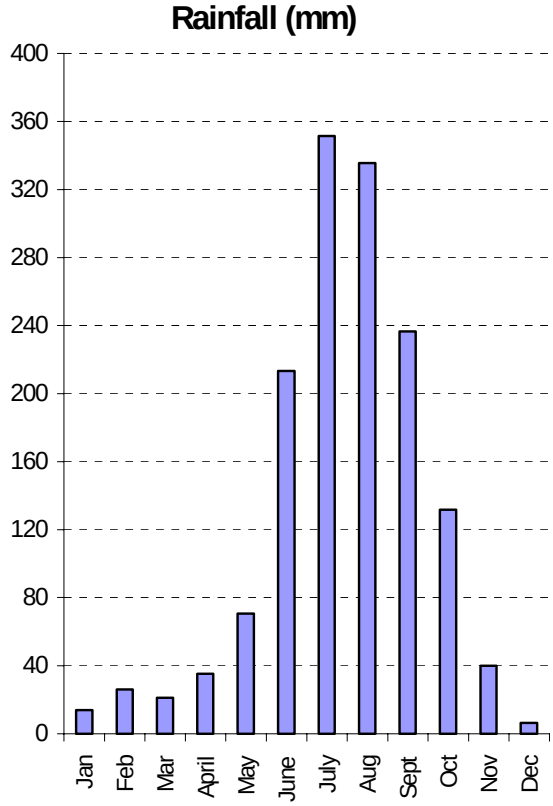
Farms in the rural area

About 80 percent of the farm holdings in rural areas are marginal to small land holdings, with up to 2 hectares of land, and the herds are on average small. Over 95 percent of the farms own between one and two dairy animals while the remaining 5 percent have between 10 and 15 dairy animals. The latter farms practice ‘pastoral’, grazing-based livestock production and are located in less dense, upland and forest areas. They have multiple production objectives including fuel, draught and milk.

Explanations of variables; year and sources of data:

- Temperature: Government of Orissa (2002)
- Rainfall: Government of Orissa (2002)
- States farmland structure: Government of Orissa (2002)
- Land Use Classification and Irrigated Area (1997-98 & 1998-99): Ministry of Agriculture, Government of India
- Farm Structure: Saha(2003a)





Farm Structure in Orissa

	Number of Dairy Animals			Land owned (ha)	% of farms
	Local cattle	Crossbred cattle	Buffaloes		
Farm types in urban and peri-urban region					100%
IN-2CO (Local cattle based)	1-3	0-1	0	0-1	66%
IN-2BO (Buffalo based)	1-2	0	1-2	0-1	13%
IN-6CO (Crossbred cattle based)	0	2-8	0	0-2	17%
IN-6BO (Graded buffalo based)	0	0	3-9	0-2	4%
Farms types in rural region					100%
IN-2CO (Local cattle based)	1-3	0-1	0	0-1	88%
IN-2BO (Buffalo based)	1-2	0	1-2	0-1	7%
IN-9BO (Semi pastoral buffalo)	0	0	8-15	0-1.5	3%
IN-15CO (Pastoral cattle based)	10-20	0	0	0-3	2%

3. IFCN ANALYSIS OF DAIRY FARMS IN ORISSA

3.1 Description of the 'typical' farms in Orissa

The state of Orissa has been classified into high potential, average potential and low potential districts (for details see Annex A9). High potential districts are characterized by higher density of dairy animals, higher populations of crossbred cows, as well as higher milk yields and milk production per year. On the other hand, low potential districts are those with a low density of dairy animals, lower yields and lower veterinary and dairy infrastructure. The districts of Ganjam (high potential) and Gajapati (low potential) were selected for the study. In the following, each typical farm is briefly described. More details on the dairy production system in each farm can be found in the table on the next page.

2-Cow farm (IN-2CO)

Location: Farm with marginal land holding in a rural area of Gajapati district

Activities: This farm represents a household with less than one hectare of farmland and owns two non-descript cows (Annex A6). The household consumes about 30 percent of its milk production while the rest is sold to the local milkman. This farm represents the vast majority of farms and is close to the average farm size in the area.

2-Buffalo farm (IN-2BO)

Location: A farm in a rural area of Gajapati district with 2 hectares of land.

Activities: This farm with two local buffaloes is also located in a rural area with good water supplies (river, tanks, pond, etc.). The farm household owns 1 ha of land and rents another 1 ha, both used mostly for growing paddy. Milk is primarily sold to the local co-operative through its collection centre in the village.

6-Cow farm (IN-6CO)

Location: A farm in a peri-urban (suburban) area in Ganjam district near to the town of Aska.

Activities: This farm owns 1 ha of irrigated land. It has 6 crossbred cows (Jersey crosses). Milk is sold partly to the local market directly and partly to co-operatives. Mostly such farms receive additional income from off-farm sources. The farm however mostly concentrates on dairying rather than crop farming.

6-Buffalo farm (IN-6BO)

Location: A dairy farm that is located within a major urban area in Ganjam district.

Activities: This farm owns 2.5 ha of land while livestock are grazed in the forest or open waste lands along with some stall feeding. The animals are buffaloes (6) of good pedigree, selectively purchased and generally up-graded with Murrah genes. Milk is either sold directly to the end consumer or hotels in the town and partly to the dairy co-operative.

15-Local cow farm (IN-15CO)

Location: A farm located in a rural area at the outskirts of a village in Ganjam district.

Activities: The farm owns 2 ha of land and another 2 ha are rented. Crop cultivation is the main occupation. Livestock are reared through pastoral grazing using mostly hired

labour. The livestock enterprise has the dual purpose of producing good draught bulls with milk as secondary product.

9-Buffalo farm (IN-9BO)

Location: A farm located in a rural region at the outskirts of a village in Ganjam district. It has 1.5 ha of land, lies near to a water source and has access to land for grazing.

Activities: This farm also practices pastoral grazing, the animals being kept in the barren fields or open spaces adjoining the village. Capital use and investment in feed are minimal.

Farm	Units	IN-2CO	IN-2BO	IN-6CO	IN-6BO	IN-15CO	IN-9BO
Region		Gajapati	Gajapati	Ganjam	Ganjam	Ganjam	Ganjam
Land owned	ha	0.4	1	0.4	1.5	2	1
Land rented	ha	0.4	1	0.6	1	2	0.5
Dairy Enterprise							
Cows/ Buffaloes	no.	2	2	6	6	15	9
Breed	description	2 local cows	2 buffaloes	6 crossbred cows (Jersey)	6 grade buffaloes (Murrah)	15 local cattle	9 non-descript buffaloes
Liveweight	kg	190	240	300	350	185	310
Milk yield / year	kg ECM/cow	191	466	1285	1437	197	350
Fat and protein content	%	3.6% / 3.4%	5.0% / 3.4%	4.0% / 3.4%	5.5% / 3.4%	3.5% / 3.4%	5.0% / 3.4%
% milk sold	%	71%	73%	94%	80%	97%	82%
Land use Dairy enterprise							
Land use for dairy	ha	0.06	0.08	0.08	0.15	0.23	0.08
Milk produced per ha	Kg ECM / ha	476	466	7709	3448	739	2099
Stocking rate	LU / ha	2.50	1.00	6.00	2.40	3.75	6.00
Labour							
Part time employees	h/year	234	540	450	1080	3060	0
Share of labour for dairy	% of total labour	57.4	53.7	73.3	57.6	80.5	60
Share of family labour for dairy	% of total dairy labour	70.1	57.5	79.5	55.1	10.4	100
Hours per milking cow	h / cow / year	391	635	367	327	228	266
Buildings							
Housing type	description	Thatched roof open house	Thatched roof open house	Concrete house with asbestos roof	Stone house and floor with thatched roof	Thatched roof with open house	Tied in open or in thatched roof shed
Building(year built)	description	2000	1999	1990	1990	1998	1993
Milking							
Milking times	per day	twice	twice	twice	twice	once	twice
Calves/ Animal/ Year	head	0.6	0.7	1.0	1.1	1.0	1.1
Length of lactation	days	290	220	300	230	270	195
Yield per lactation	Kg ECM /cow	191	466	1285	1580	197	385
Dairy company (distance	km	65	65	5	5	50	55
Herd management							
Seasonality	yes / no	no	yes	no	yes	no	yes
Calving season	months	Jan-Dec	Nov-June	Jan - Dec	Nov-June	Jan-Dec	Nov-June
Dry period	months	10	10	2	4	4	4
Feeding times	per day	2	2	3	2	1	1
Average lactations	lact. per cow	6	6	4	4	6	6
Artificial insemination	yes / no	no	no	yes	yes	no	no
Death rate	% cows	5	5	5	5	5	5
Culling rate	% cows	10	10	30	30	10	10
Feeding							
Feeding system	description	grazing+stallfed	grazing +stallfed	stallfed	grazing + stallfed	grazing	grazing
Roughage feed source	description	grasses+paddy straw	grasses + paddy straw	grasses + paddy straw	grasses + paddy straw	grasses + paddy straw	grasses + paddy straw
Concentrates Fed	description	RB+BGSC+RS	RB +BGSC or RGSC + RS	BR+RP or RB + BGSC or RGSC + RS + CF	BR+RP or RB + BGSC or RGSC + RS + WM	RS	RB + RS + BGSC or RGSC
Concentrate use in total	t per cow	0.24	0.54	1.53	1.81	0.01	0.08
Concentrate input	g / kg ECM	1233	1148	1187	1259	41	219
Calf rearing							
Death rate of calves	% calves	10	15	20	15	10	20

Notes: **BGSC and RGSC mean Black gram seed cull and Red gram seed cull**

****** RB, RP, BR refers to Rice bran, Rice polish, and Broken rice

******* RS, WM and CF refers to Ragi seed (millets), Wheat meal and Concentrate feed (balanced feed commerical ration)

3.2 Farm comparison: Household approach

Size of the household - Labour utilisation

The families on the selected farms have five to seven members, which corresponds well to the average family size in the region (five persons/family). All farms except IN-15CO have off-farm income sources with maximum off-farm income per household being realized by farm IN-6CO, which may indicate that good off-farm income is a prerequisite to run such a kind of farm. All farms except IN-15CO and IN-9BO, both of which practice open grazing, make significant use of family labour in farm activities ranging from 1,183 hours in IN-15CO to 3,990 hours in IN-9BO system (higher due to no hired labour).

Household income levels

The household income includes the net cash farm income, the salary brought home from off-farm work and the combined value of draught power, manure and milk consumed by the household. The annual household incomes range from 420 US$ (IN-2CO) to 1,570 US$ (IN-6CO). The slightly higher income of peri-urban IN-6CO compared with IN-6BO is a result of the higher off-farm income. The 'commercial' farms IN-6CO and IN-6BO produce approximately 7.7 and 8.6 tonnes of ECM milk per year. On the other hand IN-2CO only sells 0.37 tonnes of milk per year. The household income of the 'pastoral' IN-15CO systems mainly stems from crop production and is more than double that of the most common dairy farming system (IN-2CO).

Household income structure

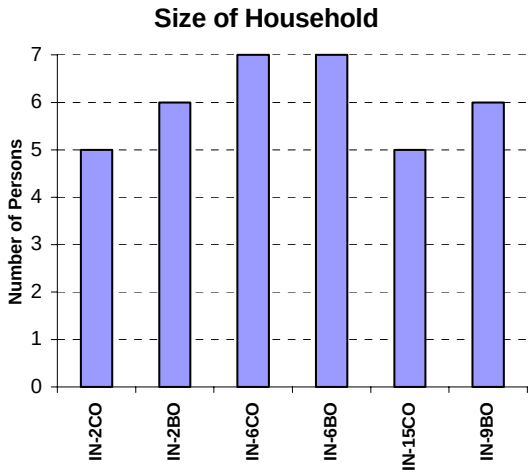
The share of off-farm income is relatively high for the smaller farms (Annex A7), and for the commercial crossbred cow farm in the peri-urban areas (IN-6CO). The share of net cash farm income goes as high as 89 percent in the pastoral system (IN-9BO) and is as low as 42 percent in the typical small cow farm (IN-2CO). Interestingly, IN-6CO has a significant share of off-farm income reaching approximately 40 percent (family members employed in government jobs) of total household income. The share of non-cash farm benefits is comparatively lower in the buffalo based systems (IN-2BO and IN-9BO) mainly due to higher proportion of milk sold.

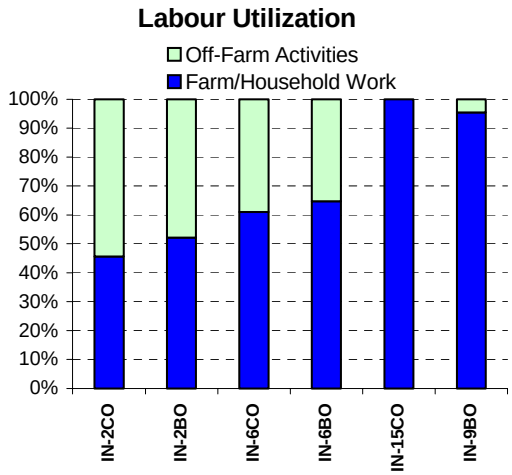
Household living expenses

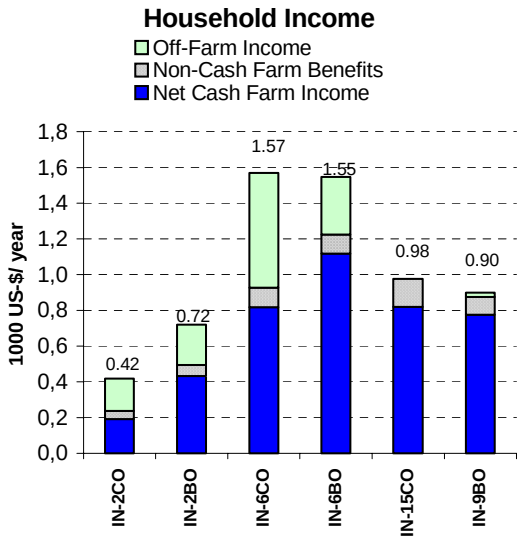
On the whole, all households are able to cover their living expenses from the combined on- and off-farm incomes. Family living expenses are highest in the commercial peri-urban farms, being nearly 4 to 5 times the expenses of the more common rural IN-2CO type farms. These farms also have more family members and are comparatively well off. The IN-2CO type farms are, however, living on an annual income of only 410 US-$, with living expenses being lowest at only 180 US-$ per year. Most of these expenses are for food, indicating the vulnerability of these households in the case they cannot produce their own food or if any natural calamity or disaster strikes. The farm household generally faces high risks in the event of droughts, famines, illness or marriage of their daughter. Hence the balance of cash income and living expenses is generally saved to safeguard for such unpredictable events.

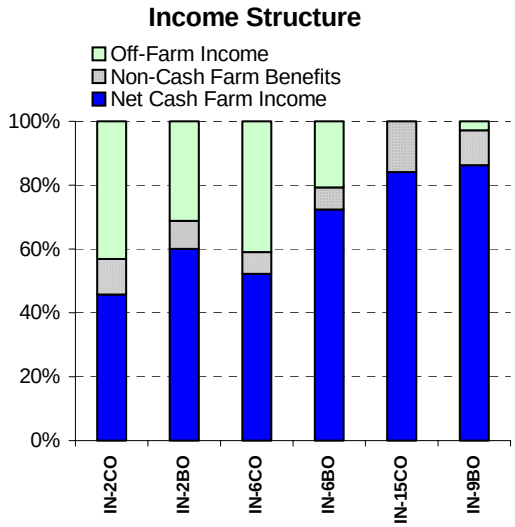
Explanations of variables; year and sources of data:

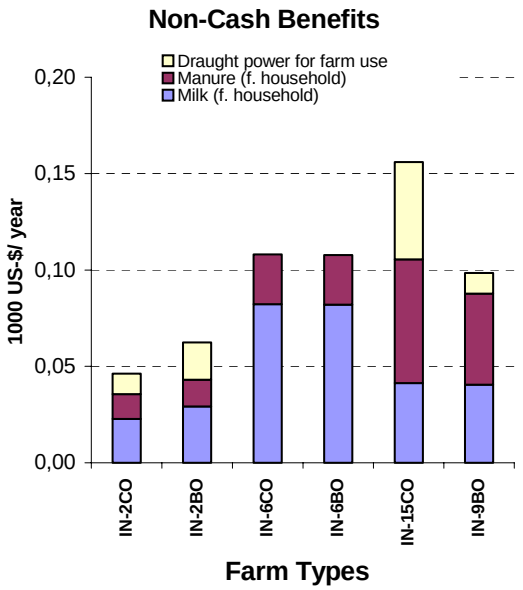
- Size of the household: People living together in one house as a family
- Labour utilisation: Family labour used to generate income
- Household income: Includes cash and non-cash incomes from farm and off-farm activities
- Off-farm incomes: Includes all salaries for all family members
- Non-Cash Benefits: Value of cow dung used as fuel, draught power & milk used by family
- Net cash farm income: Total farm receipts minus total farm expenses
- Household living expenses: Minimum annual cash expenses for the family to maintain the current living conditions.
- Sources of Data: IFCN data collection based on expert estimations and statistics, year 2003.


Size of Household
Number of Persons
0
1
2
3
4
5
6
7
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Labour Utilization
Off-Farm Activities
Farm/Household Work
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Household Income
Off-Farm Income
Non-Cash Farm Benefits
Net Cash Farm Income
1000 US-$/ year
0,0
0,2
0,4
0,6
0,8
1,0
1,2
1,4
1,6
1,8
0.42
0.72
1.57
1.55
0.98
0.90
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Income Structure
Off-Farm Income
Non-Cash Farm Benefits
Net Cash Farm Income
100%
80%
60%
40%
20%
0%
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Non-Cash Benefits
Draught power for farm use
Manure (f. household)
Milk (f. household)
1000 US-$/ year
0,00
0,05
0,10
0,15
0,20
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO
Farm Types


Living Expenses and Savings
Family living expenses
Savings
1000 US-$/ year
0,0
0,1
0,2
0,3
0,4
0,5
0,6
0,7
0,8
0,9
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO
Farm Types

3.3 Farm comparison: Whole farm approach

Farm returns

Farm returns range from 460 to 2,910 US-$ per year. The low returns of 460 US-$/year of farm IN-2CO are due to the very low milk yields of its cows and the small size of landholdings. The buffalo-based small dairy farming system (IN-2BO) has more than double the farm returns of IN-2CO, despite only having 2 dairy buffaloes, mainly because of the higher milk yields with a higher fat content and because of its larger landholdings. The 'commercial' buffalo-based dairy farming system (IN-6BO) has higher returns than the 'commercial' cattle based dairy farming system (IN-6CO) mainly because of better prices received for buffalo milk with more fat, higher labour productivity and larger landholding.

Net cash farm income (NCFI)

The net cash farm income is proportional to the level of farm returns, except for IN-15CO which achieves a similar net cash income (800 US-$/year) to IN-9BO despite its substantially higher farm returns. The lower proportion of net income of IN-15CO compared with IN-9BO is mainly a result of the lower milk and labour productivity.

The very low net cash farm income of IN-2CO (190 US-$/year) can be explained by the poor productivity of dairy animals, very low asset ownership (land, livestock, other forms of wealth) and the lack of suitable agricultural markets in remote areas. This also explains the lower proportion of milk sold in milk markets by such farms in comparison to other typical farms.

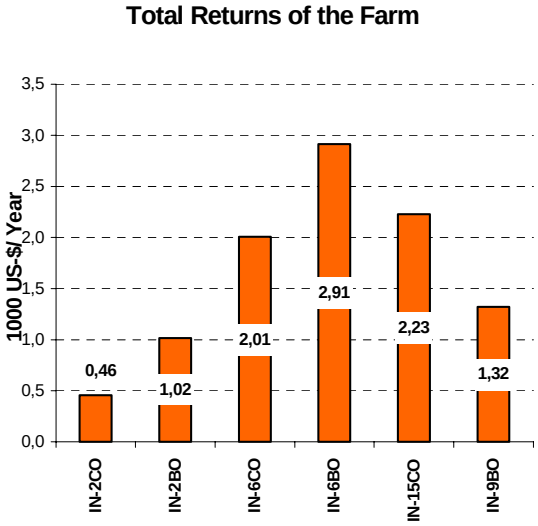
Farm assets

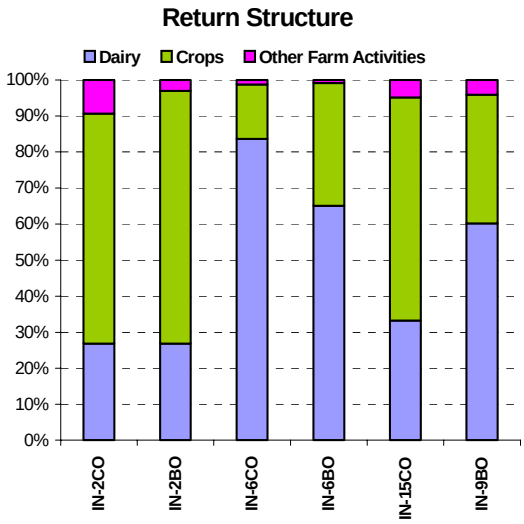
On a whole farm basis, land is the most important asset for all the dairy farming systems, representing between 75 and 90 percent of the total farm assets. (The market value of one hectare land ranges between 10,500 to 11,000 US-$.) Thus, farms IN-6BO and IN-15CO have the highest value of assets since they have comparatively larger landholdings than the other farms.

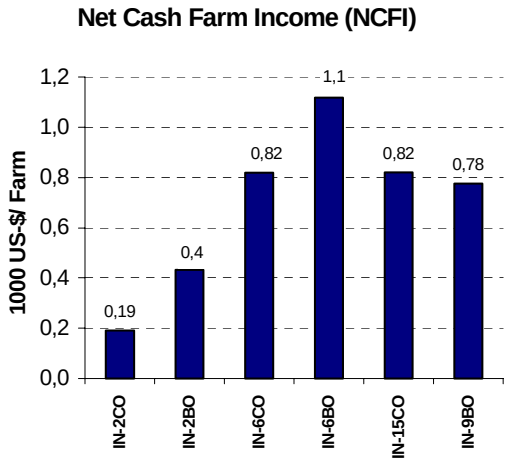
The share of livestock as contribution to the value of farm assets is low ranging from 5 percent of the total farm assets in IN-2BO to 15 percent in IN-6CO, where crossbred cows with higher value are kept.

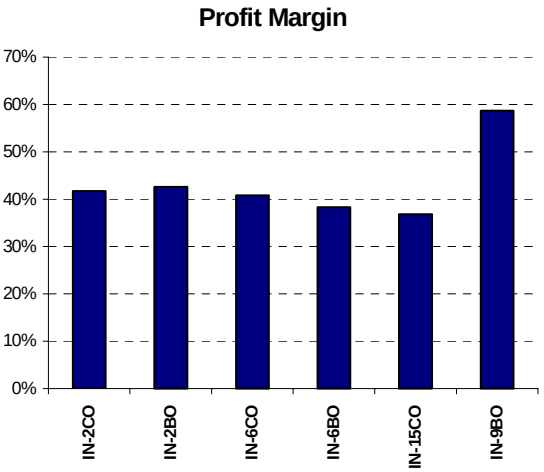
Explanations of variables; year and sources of data:

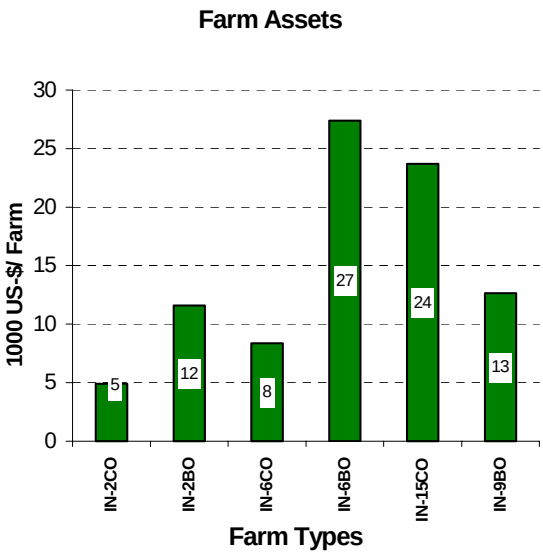
- Total returns: All cash receipts minus the balance of inventory (for example livestock).
- Returns to dairy: Milk, cull cows, heifers, calves, sale and use of manure, draught power, etc.
- Cash crops: Sale of surplus crops like rice, wheat, etc.
- Net cash farm income (NCFI): Cash receipts minus cash expenses of the farm.
- Profit margin: Net cash farm income divided by total farm returns.
- Farm assets: All assets related to the farm (land, cattle, machinery, buildings, etc.)
- IFCN data collection based on expert estimations and statistics, year 2003.

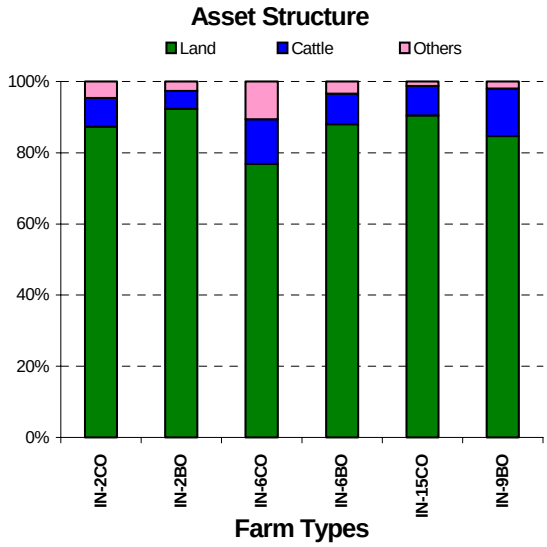

Total Returns of the Farm
1000 US-$/ Year
3,5
3,0
2,5
2,0
1,5
1,0
0,5
0,0
0,46
1,02
2,01
2,91
2,23
1,32
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Return Structure
Dairy
Crops
Other Farm Activities
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Net Cash Farm Income (NCFI)
1000 US-$/ Farm
1,2
1,0
0,8
0,6
0,4
0,2
0,0
0,19
0,4
0,82
1,1
0,82
0,78
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Profit Margin
70%
60%
50%
40%
30%
20%
10%
0%
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Farm Assets
1000 US-$/ Farm
30
25
20
15
10
5
0
5
12
8
27
24
13
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO
Farm Types


Asset Structure
Land
Cattle
Others
100%
80%
60%
40%
20%
0%
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO
Farm Types

3.4 Farm comparison: Dairy enterprise approach

Cost of milk production

The 'pastoral', buffalo-based dairy farming system has the lowest cost of milk production at 12.3 US-$ per 100 kg of ECM followed by the 'commercial' cattle-based peri-urban dairy farming system (IN-6CO) producing at a cost of 12.9 US-$. The highest production cost of 31.4 US-$ per 100 kg is incurred by farm IN-2CO. This is mainly attributable to higher opportunity costs arising from lower labour productivity (with family labour being valued at the existing market wage rate). However, the lack of sufficient alternative employment questions the validity of using existing local wages for valuation of family labour. (If opportunity costs of family labour are considered zero, the costs of milk production are highly competitive in all systems ranging from 2.03 US-$ (in IN-9BO) to 13.5 US-$ per 100 kg ECM in the cattle-based pastoral production system (IN-15CO). The smaller IN-2CO would have cost at 11.6 US-$ per 100 litres ECM leaving a cash margin of 6.9 US-$). The lack of alternative employment opportunities explains the predominance of IN-2CO type farms (more than 80 percent farms) and without any suitable employment for family labour, this dairy farming system will continue to persist as long as the cash costs are met. In the mid-range of cost per unit output, the 'commercial' buffalo-based farming system with grade buffalo (IN-6BO) has higher costs at 14.6 US-$ per 100 kg ECM than the IN-6CO cow based farms mainly because of slightly higher costs for purchased feed and labour.

Return structure

The returns per 100 kg ECM range from 23 US-$ to 36 US-$. The subsistence milk production systems have comparatively higher returns per 100 kg of ECM. This is mainly attributable to the higher share of non-milk returns such as cattle sales, cow dung and draught use.

Cost structure of the dairy enterprise

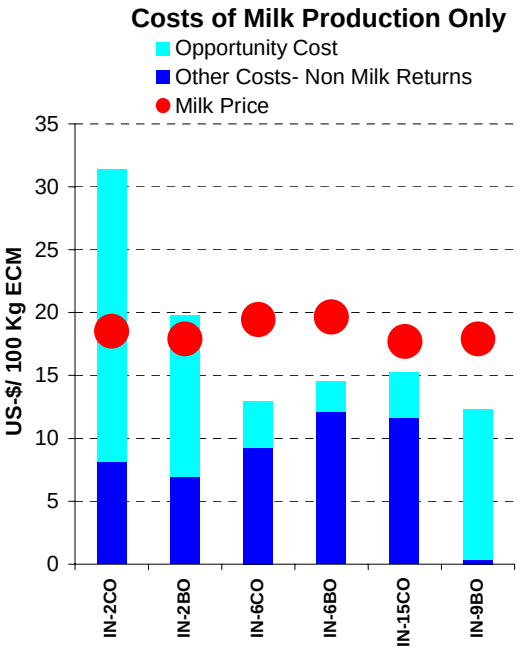
On the smaller subsistence farm IN-2CO, the main component of the production costs are the opportunity costs, which account for more than 50 percent of total cost of the dairy enterprise. For the commercial farms, with increasing use of feeds, better breeds and management, milk yields increase considerably and with efficient use of family labour, the costs are most competitive for the commercial cow based system (IN-6CO) at 16.5 US-$ per 100 kg ECM, closely followed by IN-6BO at 17.8 US$ per 100 kg ECM.

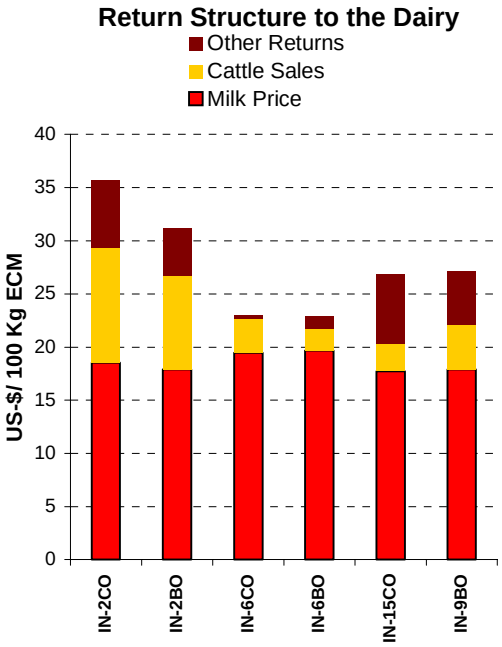
The observed economies of scale are significant and basically driven by labour costs and by better feed management. Farm IN-9BO only has 15 percent of the labour costs per litre of milk compared to IN-2CO. Similarly farm IN-6CO has 18 percent lower feed costs than IN-2CO for the same quantity of milk produced.

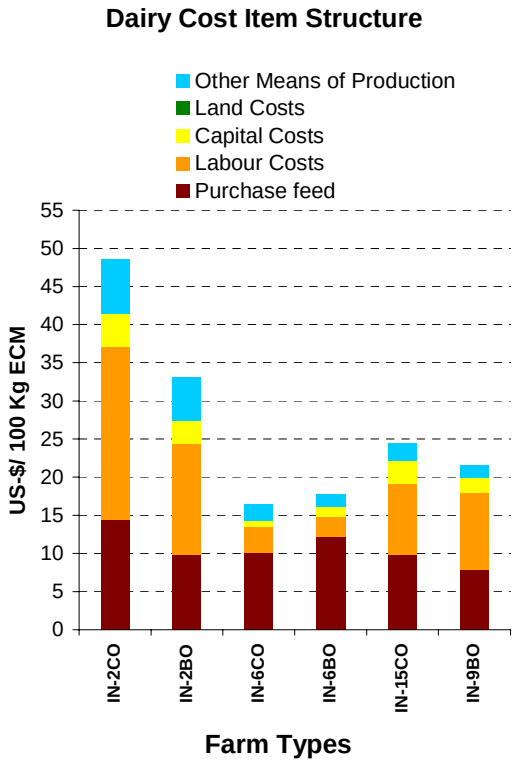
Opportunity costs are lowest in IN-6BO mainly because of lower share of more productive family labour and comparatively higher yields than other systems. Depreciation is largest for IN-2CO because of lower milk yields and higher capital costs per 100 kg ECM.

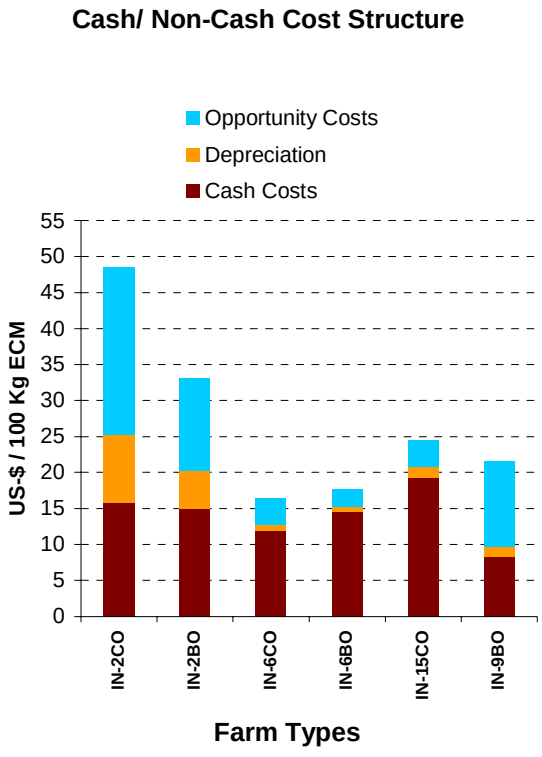
Explanations of variables; year and sources of data:

- Costs of milk production : see Annex A2
- Return structure and cost structure: see Annex A3
- IFCN data collection based on expert estimations and statistics, year 2003.


Costs of Milk Production Only
Opportunity Cost
Other Costs- Non Milk Returns
Milk Price
US-$/ 100 Kg ECM
0
5
10
15
20
25
30
35
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Return Structure to the Dairy
Other Returns
Cattle Sales
Milk Price
US-$/ 100 Kg ECM
0
5
10
15
20
25
30
35
40
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Dairy Cost Item Structure
Other Means of Production
Land Costs
Capital Costs
Labour Costs
Purchase feed
US-$/ 100 Kg ECM
0
5
10
15
20
25
30
35
40
45
50
55
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO
Farm Types


Cash/ Non-Cash Cost Structure
Opportunity Costs
Depreciation
Cash Costs
US-$ / 100 Kg ECM
0
5
10
15
20
25
30
35
40
45
50
55
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO
Farm Types

Dairy farm income

All six farm types cover their production costs from the profit and loss account and generate a positive farm income, indicating the sustainability of the production systems. The dairy farm income is highest in the buffalo-based pastoral system (IN-9BO) at 17.6 US-$ per 100 kg ECM. This is mainly because of lower cash costs and the competitive advantage of free grazing lands, open space to keep the animals and existence of suitable physical conditions for this system. Among the remaining farms, the smaller production systems have comparatively higher family farm income per 100 kg ECM at 10 to 11 US-$. The farm income of the pastoral cattle based system (IN-15CO) is lowest at 6 US-$ per 100 kg ECM mainly due to lower yields and higher cash costs arising from higher use of hired labour.

Dairy profit margin

Opportunity costs for family owned resources, land, labour and capital are excluded from the computation of dairy profit margins. The configuration of profit margins closely follows the pattern of farm income across farming systems. All farms showed a positive dairy profit margin, however with a wide variation ranging from 42 percent in the pastoral cattle based system (IN-15CO) to as high as 92 percent in the pastoral buffalo based system. The high profit margin in the buffalo based pastoral system is due to the higher use of family labour and very low cash costs. The profit margins of the smaller, predominant systems IN-2CO and IN-2BO are also relatively high at 63 to 66 percent. The profit margins of the commercial dairy farming systems range from 46 to 58 percent.

Entrepreneurial profit

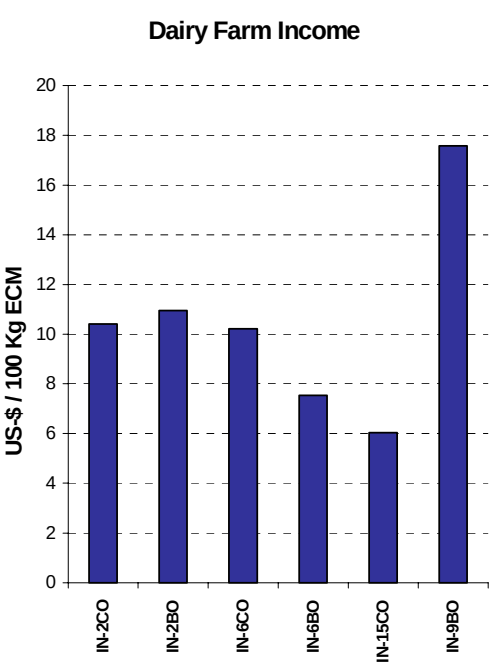
With the exception of the smaller farms IN-2CO and IN-2BO, all farms cover their full economic costs and generate an entrepreneurial profit. The small farms make an entrepreneurial loss of 12.9 (IN-2CO) and 2.0 US-$ per 100 kg ECM (IN-2BO) while the other farms make a profit ranging from 2.4 to 6.5 US-$ per 100 kg ECM. The entrepreneurial profits is exceptionally high in case of the commercial cattle-based IN-6CO and the pastoral buffalo-based production IN-9BO at around 6.5 and 5.6 US-$ per 100 kg ECM. The entrepreneurial profits of the IN-15CO pastoral cattle based dairy farming system is lower at 2.4 US-$.

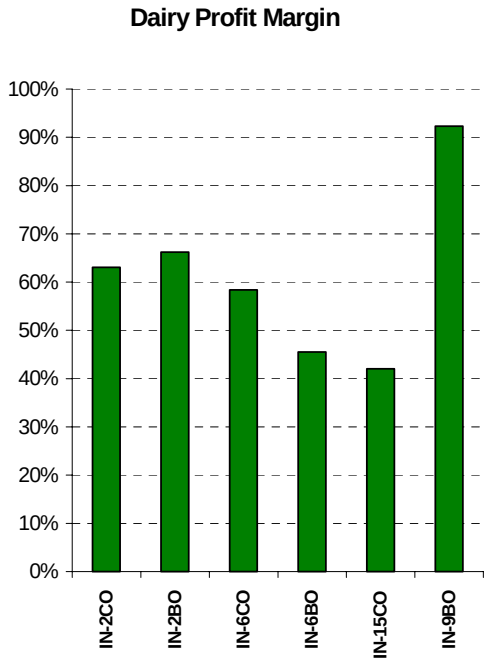
Return to labour

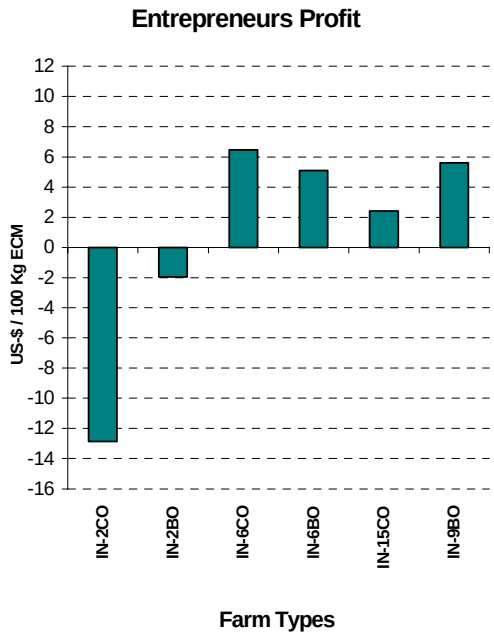
The wage level is lowest in farm IN-15CO because of the greater proportion of use of cheaper hired labour. The return to labour is 7 times higher in farm IN-6CO, and more than 6 times higher in farm IN-BO farm than in IN-2CO, which has the lowest return to labour. This is mainly attributable to the higher milk yields and resultant higher labour productivity of the former two systems. The return to labour is also higher in IN-2BO than in IN-2CO despite the higher amount of labour input per animal. Among the larger farms, the return to labour is higher in IN-9BO than in its cattle-based counterpart, IN-15CO due to higher milk yields (Milk yield is second lowest in IN-15CO).

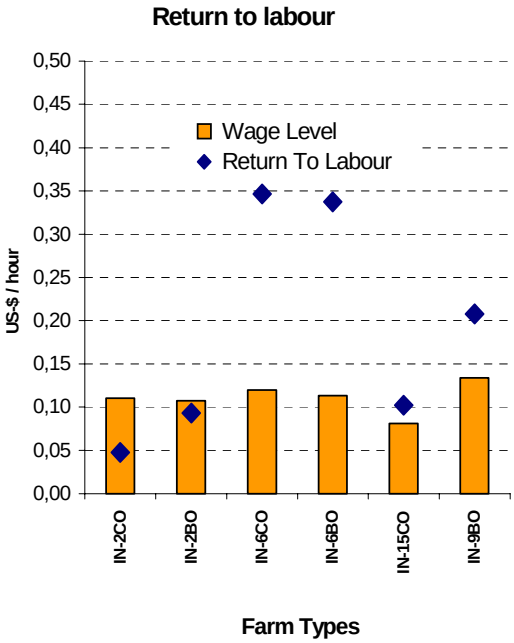
Explanations of variables; year and sources of data:

- Explanations variables and IFCN method: see Annex A2 and A3
- Other returns: Value of manure (sold, home use); draught power use
- IFCN data collection based on expert estimations and statistics, year 2003.


Dairy Farm Income
US-$ / 100 Kg ECM
20
18
16
14
12
10
8
6
4
2
0
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Dairy Profit Margin
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Entrepreneurs Profit
US-$ / 100 Kg ECM
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO
Farm Types


Return to labour
US-$ / hour
0,50
0,45
0,40
0,35
0,30
0,25
0,20
0,15
0,10
0,05
0,00
Wage Level
Return To Labour
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO
Farm Types

Labour costs and inputs per dairy animal

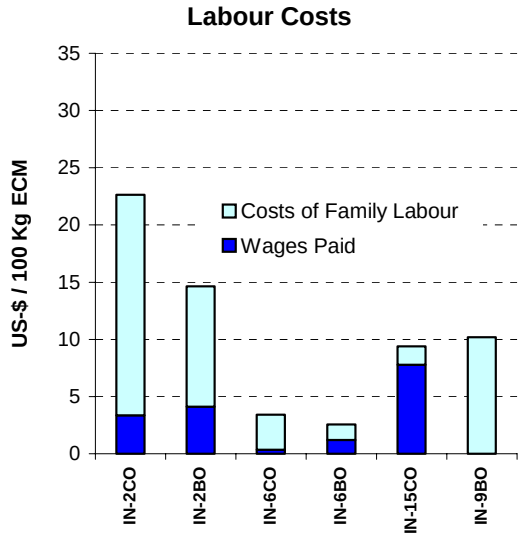
The labour cost per dairy animal is highest in the small farm systems, at 22.6 US-$ per 100 kg ECM in case of farm IN-2CO, followed by 14.6 US$ per 100 kg ECM in IN-2BO. In case of the pastoral systems, IN-15CO and IN-9BO, the labour costs are similar at 9.5 to 10 US-$ per 100 kg ECM. The labour costs is however lowest for the commercial farms, IN-6CO and IN-9BO, due to higher milk yields. The labour input per dairy animal is highest in the case of IN-2BO.

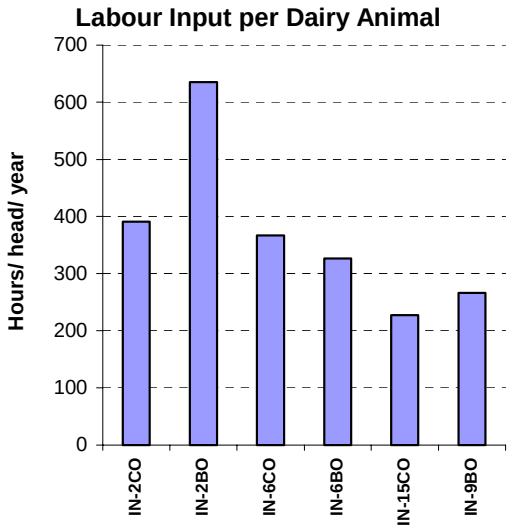
Capital costs and inputs per dairy animal

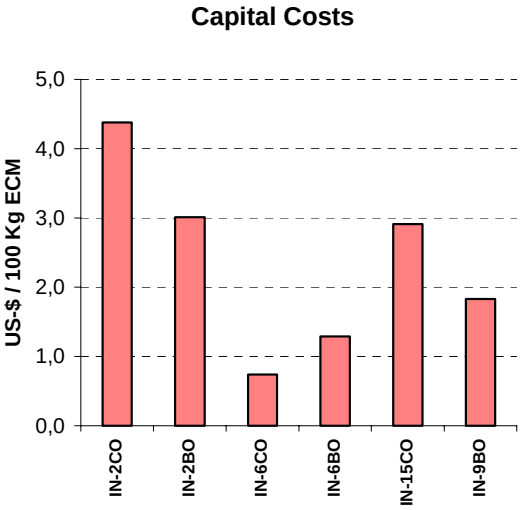
The capital costs per 100 kg ECM produced are highest in the smaller farms, while, in terms of capital costs per dairy animal, capital input is highest in case of buffalo-based commercial farm IN-6BO. In general, the capital input per dairy animal is higher in the buffalo-based systems because of higher investment in buildings and equipment.

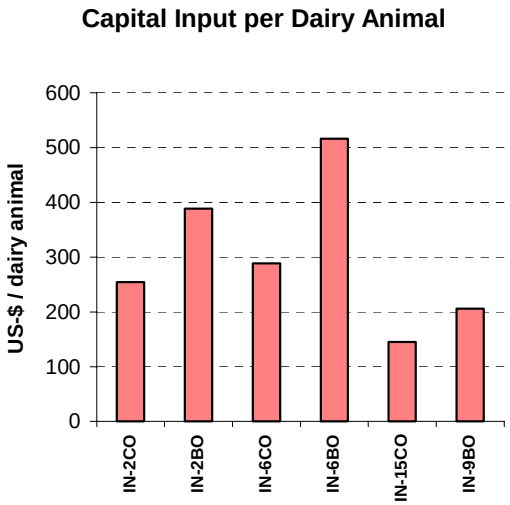
Land costs and 'stocking rates'

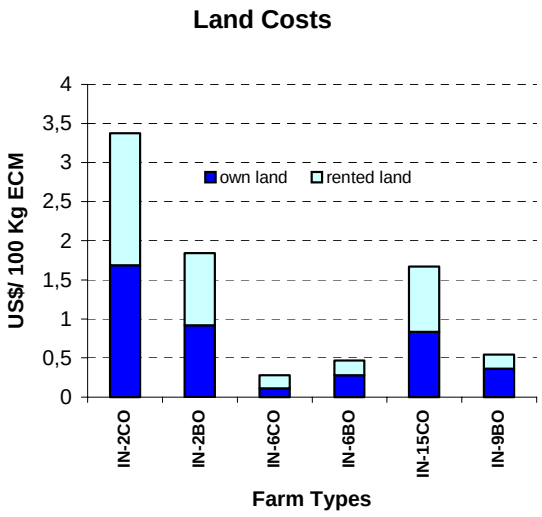
Land costs to produce 100 kg ECM are much higher in the smaller farms than the commercial or pastoral farms due to lower milk yields and lower use of purchased feeds by the small farms. Hence, the 'stocking rates' are also higher in the commercial and pastoral systems. The stocking rate in the small buffalo-based system is lower than in the cattle-based system, as land holdings of the buffalo based farms are higher than the smaller cattle based farms.

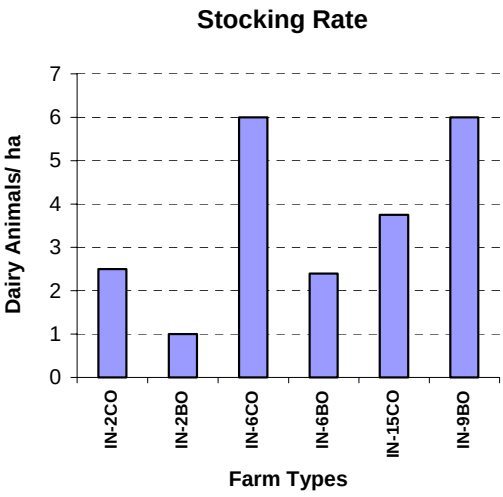

Labour Costs
US-$ / 100 Kg ECM
35
30
25
20
15
10
5
0
Costs of Family Labour
Wages Paid
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Labour Input per Dairy Animal
Hours/ head/ year
700
600
500
400
300
200
100
0
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Capital Costs
US-$ / 100 Kg ECM
5,0
4,0
3,0
2,0
1,0
0,0
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Capital Input per Dairy Animal
US-$ / dairy animal
600
500
400
300
200
100
0
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO


Land Costs
US$/ 100 Kg ECM
4
3,5
3
2,5
2
1,5
1
0,5
0
own land
rented land
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO
Farm Types


Stocking Rate
Dairy Animals/ ha
7
6
5
4
3
2
1
0
IN-2CO
IN-2BO
IN-6CO
IN-6BO
IN-15CO
IN-9BO
Farm Types

3.5 Comparison of typical dairy farms in Orissa and Haryana

The most prevalent dairy farm types in Orissa are IN-2CO and IN-2BO, while IN-6CO is the leading edge farm. Similarly, in Haryana the most common farm types are small IN-2BH and IN-4CBH, and the leading edge farm type is represented by IN-22H. A comparative analysis of these farms will provide insight into reasons for the competitiveness of dairy farming in the two regions.

Cost and returns

The cost of milk production of the two-cow farm in Orissa is much higher than that of its counterpart in Haryana while the two-buffalo farm in Orissa produces milk at a lower cost than the similar two-buffalo farm in Haryana. This could be accounted for by lower opportunity costs in Orissa in buffalo farms in comparison to the situation in Haryana. The commercial farm IN-6CO in Orissa is cost competitive wit farm IN-22H. This signifies a high potential for dairy development in Orissa.

The return structure shows higher other returns such as cattle, draught power and manure in farms in Orissa than in those in Haryana. For the small farms, although returns from milk sales are lower in Orissa than in Haryana, this is more than compensated for by higher returns from other outputs. It is also seen that with intensification of dairying, the share of other returns decreases.

Productivity

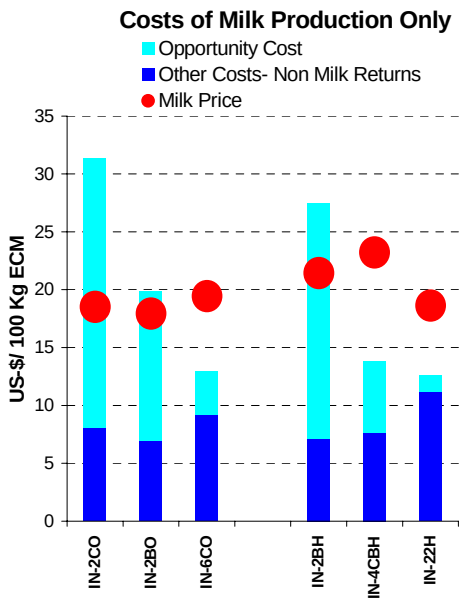
The milk yield of typical farm IN-2BH in Haryana is four times higher than that of farm IN-2CO and twice as high as that of farm IN-2BO. In terms of labour productivity, the number of manhours employed for 100 kg ECM is much higher in Orissa, being nearly double that in the small farms in Haryana. The leading edge farm in Orissa (IN-6CO) has a milk and labour productivity similar to the four-cow farm in Haryana (IN-4CBH). The smaller buffalo farm in Orissa is promising as it has only slightly higher labour input than the two-buffalo farm in Haryana, despite milk yield being much lower. Hired labour is an important component of dairy farming in Orissa but not in Haryana, mainly due to the grazing system still practised in parts of Orissa and availability of cheap hired labour for grazing animals.

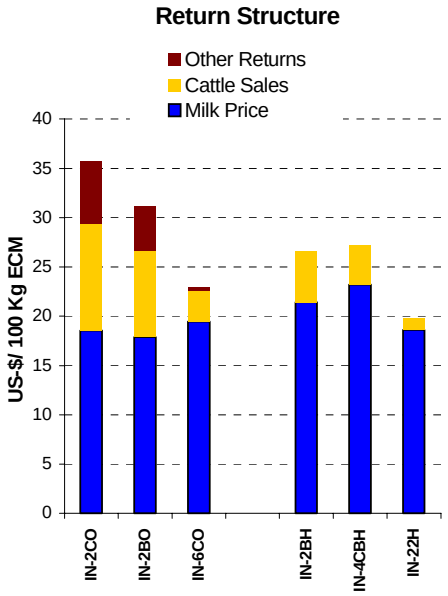
Factor prices

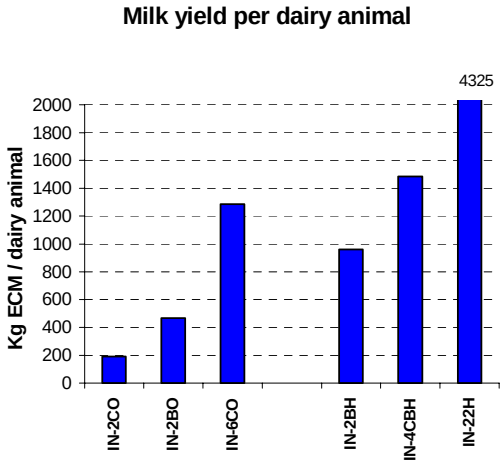
There is a significant difference in factor prices of land and labour in these two regions. The cost of land is more than double in the rural regions of Haryana compared to Orissa. The labour wages are also significantly lower in Orissa, being only 60 percent of the farm wages paid in Haryana. This is a significant source of potential cost competitiveness of milk production in Orissa.

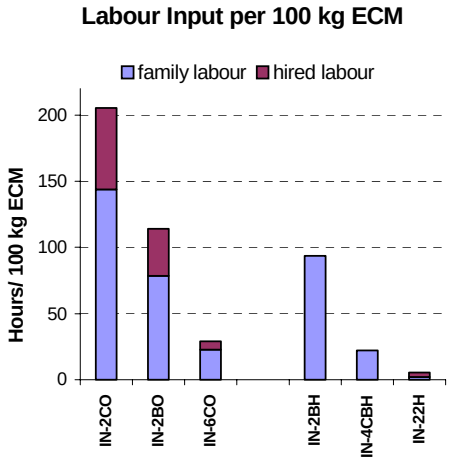
Explanations of variables; year and sources of data:

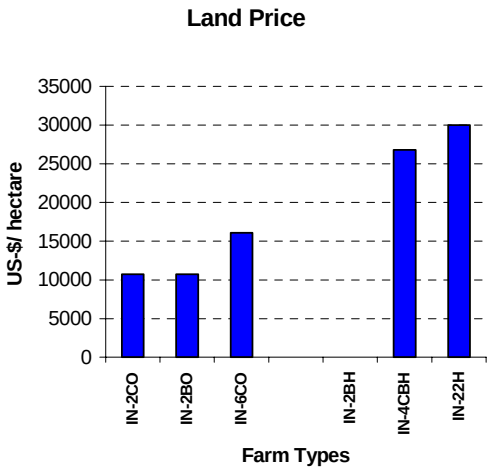
- IN-2BH: A 2 buffalo farm in rural Haryana without any landholdings
- IN-4CBH: A 4 dairy animal (2 cows and 2 buffalo) farm in rural Haryana with 3.7 ha land
- IN-22H: A 22 dairy animal farm (17 crossbred cows and 5 Murrah buffaloes) in rural Haryana with 5.8 ha land and contract marketing of milk to a dairy company.
- Differences in estimates of Haryana farms with respect to PPLPI working Paper No. 2 are due to adjustment to year of data collection and change in methodology
- IFCN data collection based on IFCN methods, year 2003.

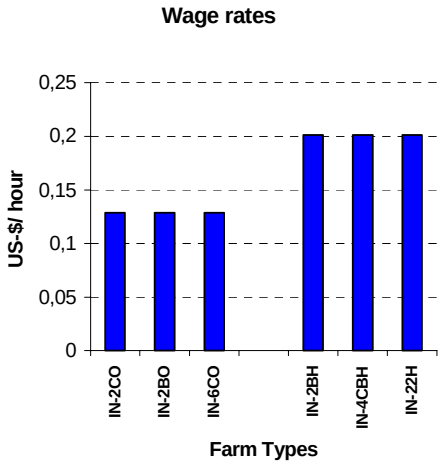

Costs of Milk Production Only
Opportunity Cost
Other Costs- Non Milk Returns
Milk Price
US-$/ 100 Kg ECM
0
5
10
15
20
25
30
35
IN-2CO
IN-2BO
IN-6CO
IN-2BH
IN-4CBH
IN-22H


Return Structure
Other Returns
Cattle Sales
Milk Price
US-$/ 100 Kg ECM
0
5
10
15
20
25
30
35
40
IN-2CO
IN-2BO
IN-6CO
IN-2BH
IN-4CBH
IN-22H


Milk yield per dairy animal
Kg ECM / dairy animal
0
200
400
600
800
1000
1200
1400
1600
1800
2000
4325
IN-2CO
IN-2BO
IN-6CO
IN-2BH
IN-4CBH
IN-22H


Labour Input per 100 kg ECM
family labour
hired labour
Hours/ 100 kg ECM
0
50
100
150
200
IN-2CO
IN-2BO
IN-6CO
IN-2BH
IN-4CBH
IN-22H


Land Price
US-$/ hectare
0
5000
10000
15000
20000
25000
30000
35000
IN-2CO
IN-2BO
IN-6CO
IN-2BH
IN-4CBH
IN-22H
Farm Types


Wage rates
US-$/ hour
0
0,05
0,1
0,15
0,2
0,25
IN-2CO
IN-2BO
IN-6CO
IN-2BH
IN-4CBH
IN-22H
Farm Types

Since the small buffalo-based dairy farming system in Orissa was found to be competitive with that in Haryana, IN-2BO will be compared with IN-2BH. IN-2BO is a typical buffalo-based dairy farming system in Orissa with a hectare or less of land holding while IN-2BH is the typical farm in Haryana with two buffaloes without land holding.

Milk productivity

Milk yield per dairy animal in the Haryana farm is twice that in the Orissa farm. This is mainly on account of better breeds and better feed management. Due to better irrigation facilities in Haryana, there is good availability of cut grasses, and other types of fodder in Haryana, while in Orissa no green fodder crop is grown and cut grasses are available only during rainy season, grazing being the source of green fodder (Annex A6). Mustard seed cake, cotton seed cake, wheat meal and commercial concentrates are used in Haryana, whereas rice bran is the common feed used in the typical farm in Orissa. (The quality of the feed can easily be judged from their average prices which in 2003 were Rs. 6,267 per tonne in Haryana and Rs. 2,000 per tonne in Orissa in 2003.

Labour productivity

The return to labour in terms of ECM per hour is only slightly higher in Haryana while the wage rate in Orissa is lower than in Haryana. In monetary terms, the labour productivity is only 0.04 US-$ per hour higher in Haryana in comparison to Orissa. Thus the potential to harness the lower wage rates in Orissa for buffalo milk production appears quite high.

Returns

Milk returns are higher in Haryana by around 5 US-$ than in Orissa due to better prices. The cattle returns per 100 kg ECM produced, however, are 8 US-$ higher in Orissa due to proportionately lower milk yields in Orissa (in absolute terms, the higher returns to cattle sales in Orissa are difficult to explain directly by lower milk yields and this relationship warrants further analysis). The other returns comprising use/sale of cow dung for fuel and draught power are also higher in Orissa by 4 US-$ per 100 kg ECM produced.

Cost of milk production

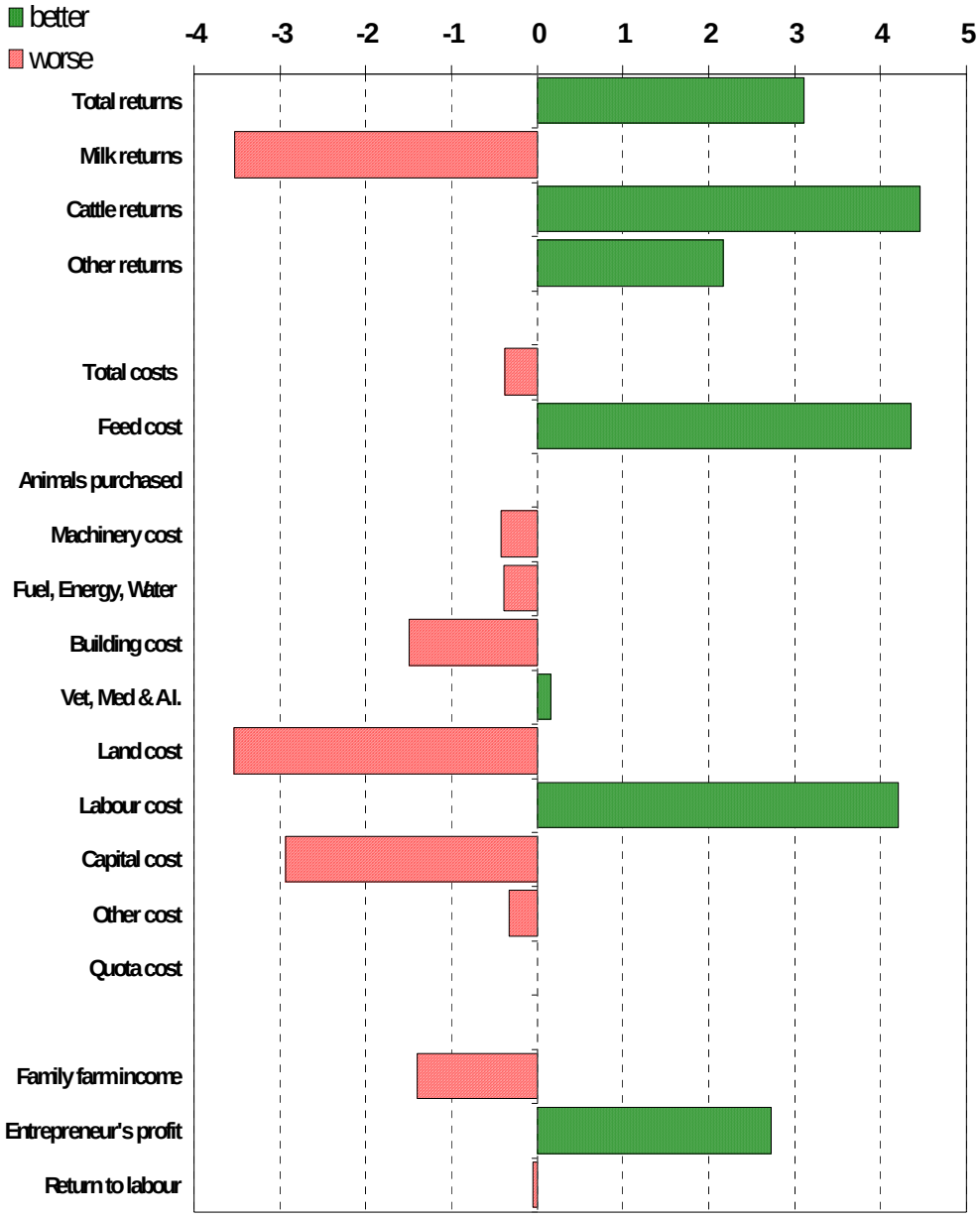
The cost of milk production is lower in the Orissa buffalo farm than in the corresponding farm in Haryana. This is mainly a result of lower labour and feed costs. The availability of pasture land for grazing makes the buffalo farm in Orissa cost-competitive. The improvement in milk yields with existing technology could make the buffalo farms in Orissa even more cost competitive.

Income

In case of IN-2BO the potential to increase family farm income is around 1.4 US-$ per 100 kg of ECM produced. However, the entrepreneurial profits is higher in Orissa farm from dairy farming. This gives a potential signal for buffalo milk production in Orissa.

Comparative farm analysis of typical buffalo-based dairy farming systems in Orissa and Haryana in 2003

Typical farm	Milk yield (ECM in litres)	Weight / animal (kgs.)	Value/ animal (Rs.)	Labour productivity (kgECM/hr)	Percent animals dry
IN-2BO	466	260	6,500	0.7	40%
IN-2BH	960	420	8,000	1.1	40%



In US-$/100 kg ECM	
Weakness	Strength
	3.1
-3.5	
	4.5
	2.2
-0.4	
	4.4
-0.4	
-0.4	
-15	
	0.2
-3.5	
	4.2
-2.9	
-0.3	
-1.4	
	2.7
-0.04	

Strengths: Higher returns (+), lower costs (+), higher profits (+)
Weaknesses: Lower returns (-), higher costs (-), lower profits (-)
* Return to labour in US-$ per hour

4. ANALYSIS OF THE DAIRY CHAIN IN ORISSA

4.1 Processing and marketing channels for dairy products

The per capita availability of milk and milk products was provisionally estimated at 70 grams per day in 2001-02. Estimates of monthly per capita expenditure on milk and milk products show an average outlay of Rs. 24.70 (NSS, 2000-01). Milk is the single most important livestock produce in Orissa and accounts for over 33 percent of the value of all livestock output (Government of Orissa, 2001-02).

It is estimated that of the total milk output in Orissa, 30 percent is retained for home consumption while 65 percent is marketed through the different informal and formal channels (only around 5 percent of the milk produced is marketed through formal channels, see chart). The major share in the informal sector is captured by the 'milkmen' locally called 'dudhias'. The milkman generally sells the fresh raw milk in the local markets in nearby towns and cities, delivers to consumers directly in their houses, or to hotels and restaurants. The raw milk is added to drinks like tea, coffee or used to make indigenous milk products such as curd, cottage cheese, sweets, etc. In the informal sector, the consumer has direct and daily contact with the farmer or milkman and the raw milk is purchased shortly after milking. The milk is delivered by the milkman in traditional small vessels made of aluminium on their bicycles. Cow milk is the preferred milk for home consumption by the family members while buffalo milk is mainly for sale as it fetches a better price due to the higher fat content.

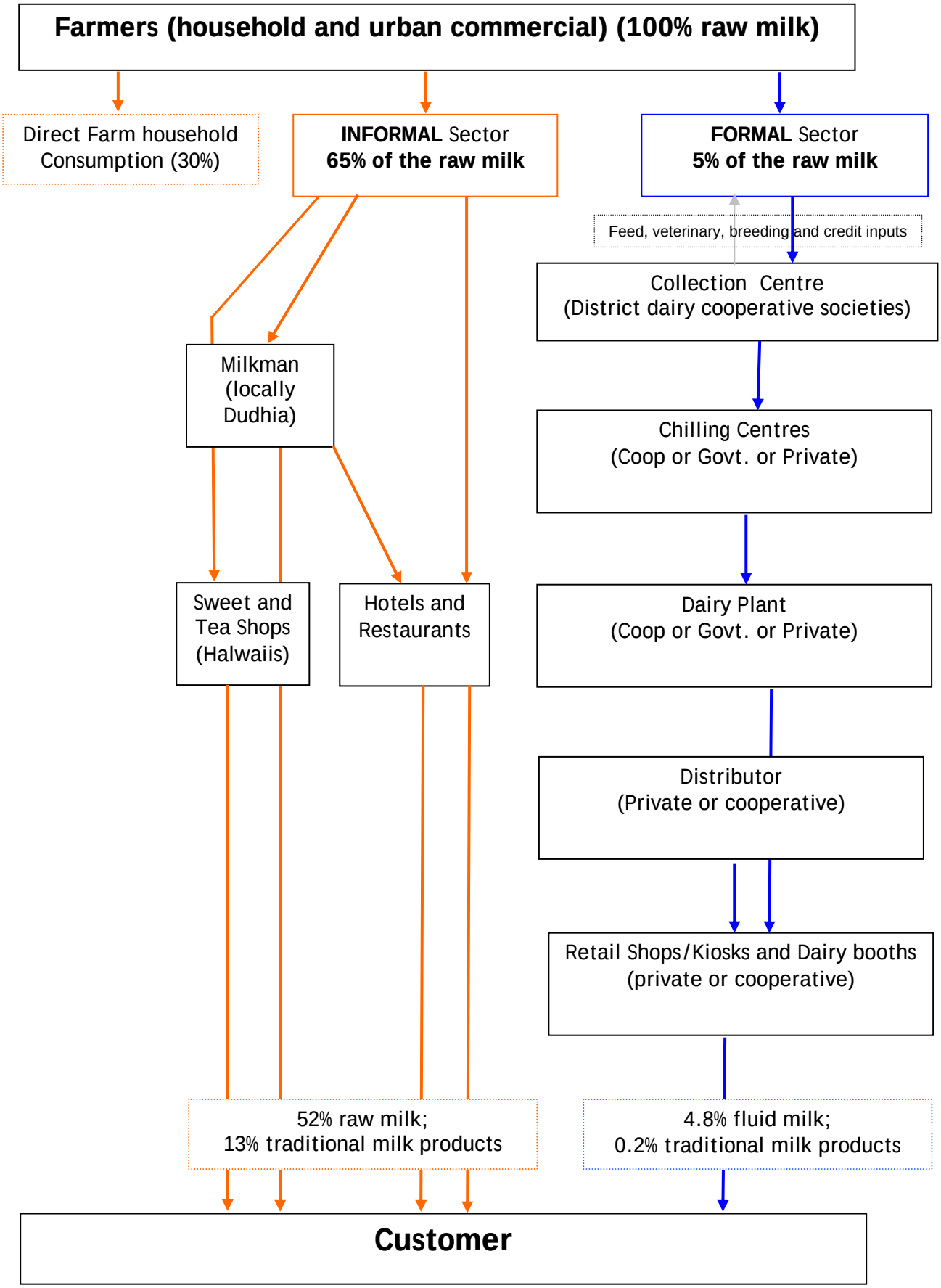
The formal sector has a co-operative network servicing only 3.7 percent of the villages in Orissa state. An overview of the dairy infrastructure of Orissa is given in Annex A9. Milk procurement is done by the dairy co-operative societies promoted by OMFED and the DAH&VS. The collected volume per DCS is often below 100 litres per day making them unviable (see Annex A9). Over 90 to 95 percent of the milk procured by the formal sector is commonly sold in plastic pouches after pasteurisation, homogenisation and standardisation to 3 percent fat and 8.5 percent solid non-fats or 4 percent fat and 9 percent solid non-fats under refrigerated conditions as 'toned' milk or cow milk respectively.

Due to lack of proper mechanisms to check product quality, milk sold in the informal market is mostly adulterated with water and sold at lower prices than the products in plastic sachets produced by the formal sector. With low income and standards of living, consumers are highly price sensitive to food items and tend to purchase the cheaper milk in the informal market which is easily available, despite often being adulterated with water.

The diagram on the next page shows a simplified version of the main milk marketing channels in the formal and informal sectors.

Explanations of abbreviations:

- DAH & VS : Department of Animal Husbandry and Veterinary Services, Govt. of Orissa
- OMFED: Orissa Dairy Cooperative Milk Producers' Federation Limited
- DCS: Dairy Cooperative Societies


Farmers (household and urban commercial) (100% raw milk)
Direct Farm household Consumption (30%)
INFORMAL Sector 65% of the raw milk
FORMAL Sector 5% of the raw milk
Feed, veterinary, breeding and credit inputs
Collection Centre (District dairy cooperative societies)
Milkman (locally Dudhia)
Chilling Centres (Coop or Govt. or Private)
Sweet and Tea Shops (Halwaiis)
Hotels and Restaurants
Dairy Plant (Coop or Govt. or Private)
Distributor (Private or cooperative)
Retail Shops/Kiosks and Dairy booths (private or cooperative)
52% raw milk; 13% traditional milk products
4.8% fluid milk; 0.2% traditional milk products
Customer

4.2 Margins in the dairy chain: Farmer to consumer

The margins from 1 kg of milk brought from the farmer by different channels are analysed in this section. About 90 percent of the milk is marketed in the form of fluid milk in both the formal and informal sector. There are two product profiles in the formal sector namely toned milk and cow milk and three channels exist in the informal sector for the marketing of fluid milk. Each channel is assumed to purchase one kg of milk with 4.2 percent fat from farmers selling cow's milk while buffalo milk has a higher fat content assumed at 6%. This standardisation allows to compare all channels up to a point. Processing of the milk to the end products is standardised only in the formal sector.

The dairy channels

Co-op 3%: Milk union buying milk at 4.2 percent fat and selling at 3 percent fat.

Co-op 4 %: Milk union buying milk at 4.2 percent fat and selling at 4 percent fat.

Direct sale 4.2%: Commercial farmers IN-6CO producing milk at 4.2 percent fat and selling the rural consumers without fat extraction/water addition.

Milkman 2.5%: Local person, collecting milk at 4.2 percent fat and selling at 2.5 percent fat in urban areas.

Direct sale 3.9%: Peri-urban dairy farms, like IN-6BO, producing milk at 6 percent fat and selling directly to the consumer in urban areas with 3.9 percent fat.

The 'milk union' represents the formal co-operative sector while the others represent informal channels.

Farmer milk prices

Milk prices paid by the co-operatives are lower by 13 percent than the prices paid by the local milkman. Hence farmers prefer to sell milk to the milkman who generally operates near the urban and peri-urban regions.

Consumer milk prices

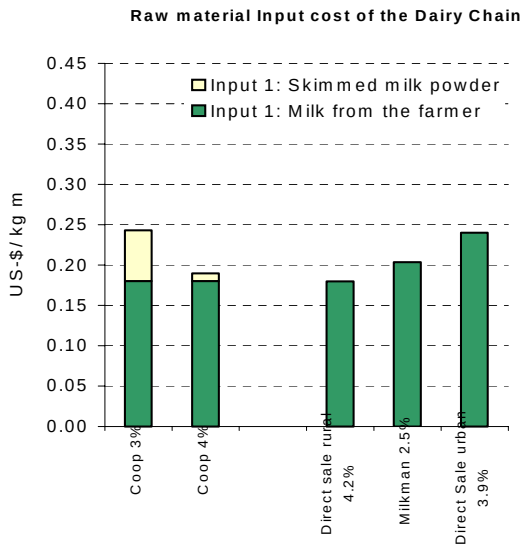
The consumer milk prices for the products depend on the channel of operation and on the fat content. The milk sold in plastic sachets in the form of cow milk with 4 percent fat commands the highest price of 0.32 US-$ per litre, followed by the toned milk with 3 percent fat sold at 0.29 US-$ per litre. Thus the products of the co-operative sector have higher prices than the products of the informal sector. Even though the milk man sells milk with lower fat content, he fetches a higher price than the farmer who sells the milk to the milkman due to lack of adequate measures to check for milk adulteration.

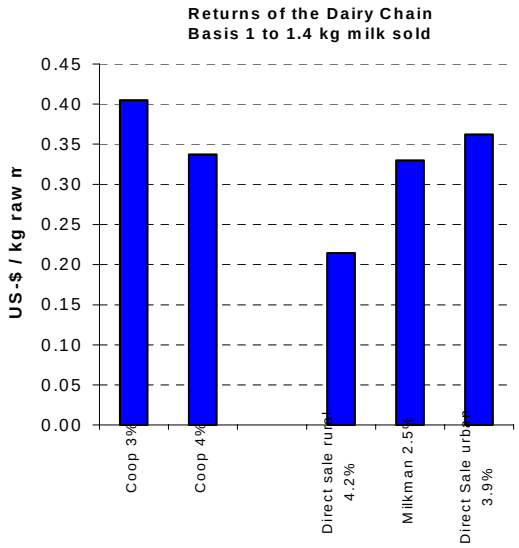
Value-addition margins (returns of dairy chain – input value of raw milk)

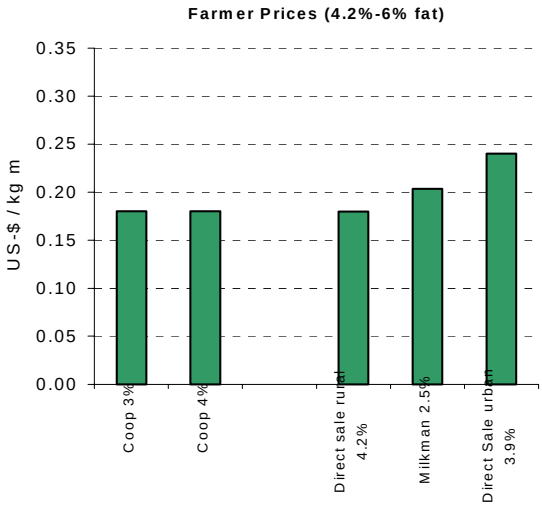
The margins for value-addition vary between 0.03 to 0.22 US-$/kg milk bought from the farmer. The highest value-addition margin is generated in the cooperative manufacturing of toned milk with 3 percent fat. In case of direct sale farmers, the input value of raw milk is taken as the opportunity costs of selling milk to the next best dairy channel (cooperative, in this case). The lowest margin of 0.03 US-$ per kg of raw milk sold is earned by the farmer selling his milk directly to rural consumers. However the farmers' share in terms of value of raw milk is the highest in this case of direct rural sale at the cost of relatively better quality milk than that of milkman or the urban direct sale farmer. The milkman and urban direct sale farmer are making relatively better margins for processing and retailing in the informal channel.

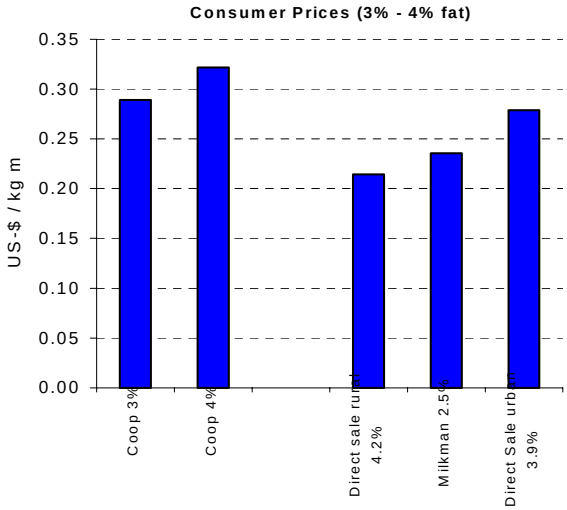
Explanations of variables; year and sources of data:

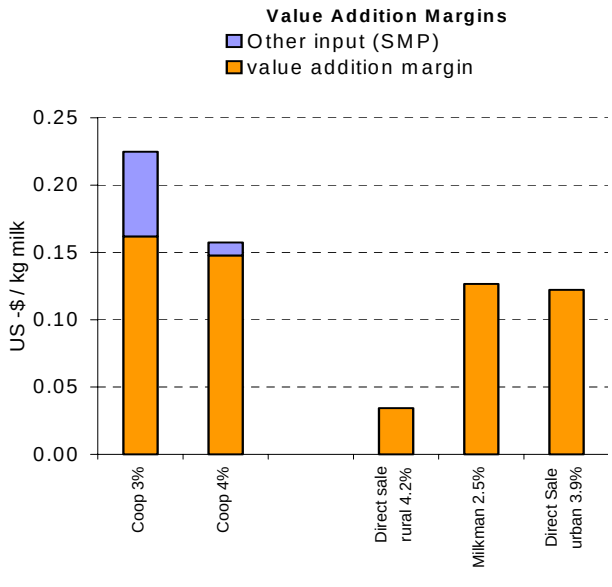
- Value of raw material inputs: Farm gate price of whole milk, for details see Annex 11.
- Value-addition Margin: Represents other inputs, transport, processing and retail costs.
- SMP: Skimmed Milk Powder
- Saha (2003b).

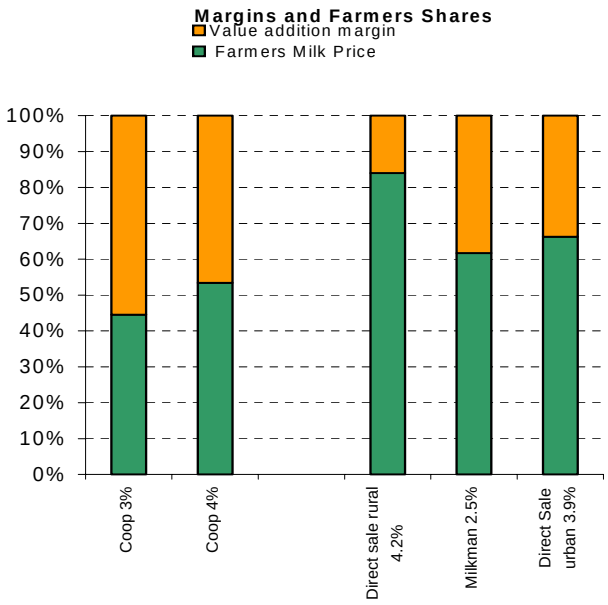

Raw material Input cost of the Dairy Chain
Input 1: Skimmed milk powder
Input 1: Milk from the farmer
US-$/ kg m
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Coop 3%
Coop 4%
Direct sale rural 4.2%
Milkman 2.5%
Direct Sale urban 3.9%


Returns of the Dairy Chain
Basis 1 to 1.4 kg milk sold
US-$ / kg raw m
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Coop 3%
Coop 4%
Direct sale rural 4.2%
Milkman 2.5%
Direct Sale urban 3.9%


Farmer Prices (4.2%-6% fat)
US-$ / kg m
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Coop 3%
Coop 4%
Direct sale rural 4.2%
Milkman 2.5%
Direct Sale urban 3.9%


Consumer Prices (3% - 4% fat)
US-$ / kg m
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Coop 3%
Coop 4%
Direct sale rural 4.2%
Milkman 2.5%
Direct Sale urban 3.9%


Value Addition Margins
Other input (SMP)
value addition margin
US-$ / kg milk
0.25
0.20
0.15
0.10
0.05
0.00
Coop 3%
Coop 4%
Direct sale rural 4.2%
Milkman 2.5%
Direct Sale urban 3.9%


Margins and Farmers Shares
Value addition margin
Farmers Milk Price
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Coop 3%
Coop 4%
Direct sale rural 4.2%
Milkman 2.5%
Direct Sale urban 3.9%

CONCLUSIONS

Dairy Development in Orissa

Over the period 1995-2002, the proportion of crossbred dairy cows in Orissa has increased by 43.4 percent and its contribution to overall milk production by 91 percent. In terms of numbers of dairy animals, the populations of buffalo and local cattle have declined by 14.8 and 12.3 percent respectively. This is attributed mainly to the killer cyclone in 1999. There has, however, been a slow but steady increase in milk yields of buffaloes.

Dairy farming in Orissa

The buffalo-based pastoral dairy farming system is able to produce milk at around 12.3 US-$ per 100 kg. The commercial cattle-based farm (IN-6CO) produces milk at around 12.9 US-$ per 100 kg ECM. These farm types have the potential to compete with imports and also to produce milk for export provided international quality standards can be met and provided the marketing chain is competitive enough to efficiently meet the marketing expenses. The small, buffalo-based IN-2BO has lower costs of milk production than the small, cattle-based farm IN-2CO. Hence, there appears to exist potential to promote such systems in the areas with suitable grazing lands and riverine or other water sources.

The small IN-2CO-type cattle-based dairy farming systems have the highest production costs at 31.4 US-$ per 100 kg ECM. IN-2CO has a very low cash farm income and makes an entrepreneurial loss. This is partly because of the low milk yields, low labour productivity and marginal size of landholdings. However, a closer look at the system shows that this type of production is sustainable due to its low cash costs (only 8.1 US-$ per 100 kg ECM). The major share of the non-cash costs are opportunity costs, due to the use of family labour. With the scarcity of opportunities for employment in rural areas, this leaves a good cash margin of around 10 US-$ per 100 kg ECM. Hence there is a potential to improve the farm income by improving milk yields. Although land resources are scarce, the potential for increasing farm/herd size can be further explored. In this system, the non-milk returns, such as cattle sales and non-cash benefits such as the use of manure for heating, milk for home consumption and draught power for crop cultivation are very significant, accounting for 48 percent of total dairy returns on these farms.

An important component of the dairy farming system, making a significant difference to farm profits, is labour productivity, which is very low for the small farms. However, the opportunity cost of labour in Orissa is still much higher than the existing wage level in case of the commercial farms (IN-6CO and IN-6BO).

Comparison of typical farms in Haryana and Orissa

The farms in Orissa have higher non-milk returns (animal sales, cow dung used as fuel and draught power returns) than those in Haryana. The superior cost competitiveness of milk production in Haryana is mainly due to better milk yield and higher labour productivity. Hence, keeping of animals of improved productive potential and better use of inputs would increase productivity of farm labour and lead to better farm incomes as is the case in Haryana

Dairy chain in Orissa

The consumer retail prices of the most common fluid milk products of the formal sector are slightly higher than that of like-products in the informal market. Milk prices

paid by the co-operatives are lower by 13 percent relative to the prices paid by the milkman.

The highest value-addition margin is received by the formal sector (co-operative) in the case of toned milk. The farmer supplying directly to urban consumers also has a relatively high value-addition margin. There is a significant amount of adulteration of milk by the informal sector due to lack of adequate quality control measures in the state.

ANNEXES

A1 METHODOLOGICAL BACKGROUND

In this chapter, we will present the methods and sources of information used to collect data about the Orissa dairy sector and how the costs of production for the selected typical production systems are calculated.

This project has followed the framework used by the International Farm Comparison Network (IFCN). IFCN is a world-wide association of agricultural researchers, advisors and farmers. These participants select typical agricultural systems in key production regions in their individual countries. In 2003, the number of participating countries extended to 27 countries with 83 farm types that represent more than 75 percent of the world milk production.

Within this scientific Network, FAL-Federal Agricultural Research Centre (Germany) through its Institute of Farm Economics is acting as the co-ordination centre for scientific issues.

The central objectives of IFCN are:

1. To create and maintain a standardised infrastructure through which production data of the major agricultural products (milk, beef, wheat, sugar, etc.) and from major producing regions of the world can be effectively compared and discussed.

2. To analyse the impact of the structure of production, technology applied and country-specific policies on the economic performance of agribusinesses, their costs of production and global competitiveness.

In order to achieve these objectives, IFCN employs the following methods and principles:

Direct contact with the production protagonists. A team of advisors and farmers is put together to set up the typical production models and to revise the final results. This approach brings the results closest to reality.

The principle of 'Total Costs'. IFCN considers both direct costs and margins, and the indirect (fixed) costs (i.e. depreciation and interests of the infrastructure used) and the opportunity costs for owned assets and production factors (i.e. family labour, land, capital).

A single and homogeneous method is utilised to calculate the costs of production for all participating countries. The IFCN standard is not the only truth, but a) it is scientifically correct, b) it includes all the existing production costs, and c) it creates transparency and international comparability in the arena of costs of agricultural production. Each IFCN member and client can reorganise the costs at his convenience and present them in the particular format of his country while he maintains an internationally comparable set of results.

The concept of setting (regional) typical agricultural models. A team of country experts, advisors and producers is formed to identify and set up the typical regional production models for each agricultural product. Typical production models must represent the common production structures in the region or country.

In the case of dairy production, for example, a working team composed of advisors, consultants and producers is formed as a panel. The first working step is to define the typical milk production systems of the major dairy regions in country. This model may be a 4-cow farm, feeding mostly cut grasses to fully confined animals, combine milk production with some other agricultural activities such as wheat and rice production in 3 ha of irrigated owned land, and milking is done by hand twice a day.

The second working step is to collect all the needed information from these typical models. For this, IFCN has developed a standard questionnaire. It is crucial that these

data collected should neither reflect an individual farm (too many particularities may hurt the ability to generalise the results) nor be an arithmetic average (an average does not show much about the technology and the economics involved). The typical model should rather represent real and common situations of the region and show clearly the predominant technology and infrastructure. Such models will be preferred by analysts. The model TIPI-CAL (Technology Impact and Policy Impact Calculations) is utilised for the simulations of these typical models and the calculations of their costs of production. TIPI-CAL can be easily shared with all IFCN members since it is a spreadsheet in MS-Excel. This model is a combination of production (physical data) and accounting (economic data). TIPI-CAL also consists of both a structure of costs of production and a simulation component (without optimisation). The simulations can be done for a period of up to 10 years in order to evaluate the growth, investments, policies or market conditions. For each year, TIPI-CAL produces a 'Profit and Loss Account', a balance and cash flow statement.

Allocation of costs of production. When the typical milk production systems have several agricultural activities besides dairy, fixed costs and expenses (i.e. depreciation) are distributed to each activity according to their use. For example, the depreciation of the machinery, which is used, for the dairy and the crop enterprises is allocated according to the hours worked in each.

Data about farm and off-farm household economics. IFCN takes into account all activities of the typical production systems, plus all the off-farm incomes and expenses realised by the owner and his family. This more complete picture of the typical model is necessary to obtain reliable information about the current economic situation of the model (and the household) and about the future of the farm (simulations).

All the methods and principles above have been applied in this project. Full panels were not set up since these models have already been part of the IFCN activities for the year 2002. The IFCN fieldwork experience supports that the analysis of costs of production shows no significant difference between the participation of one advisor and a 'full panel'. Therefore, it was decided that an IFCN scientist first visit each and every model, talk with the owners to collect project-specific information, analyse the data and then have the results cross-checked by local experts and farmers.

The analysis of costs of production and the competitiveness of the typical models are found in part 4.5. The graphs follow the same structure as those in the 'IFCN Annual Dairy Report'. The main objectives of this report are a) to analyse the main typical milk production systems in the state of Orissa, India and b) to compare the economics of the small-scale-dairy-farm household in Haryana and Orissa. This report shows the comparative world position of the Orissa dairy industry and its potential, margin analysis of dairy chains in Orissa, a comparison of the costs of production for the main milk production systems in Orissa, and a chapter on the comparison of dairy farms in Haryana and Orissa.

For more information about IFCN, visit http://www.ifcnnetwork.org and http://www.ifcndairy.org

A2 IFCN METHOD: COSTS OF PRODUCTION CALCULATIONS

Cost calculation

The cost calculations are based on dairy enterprises that consist of the following elements: Milk production, raising of replacement heifers and forage production and / or feed purchased for dairy cows and replacements.

The analysis results in a comparison of returns and total costs per kilogram of milk. Total costs consist of expenses from the profit and loss account (cash costs, depreciation, etc.), and opportunity costs for farm-owned factors of production (family labour, own land, own capital). The estimation of these opportunity costs must be considered carefully because the potential income of farm owned factors of production in alternative uses is difficult to determine. In the short run, the use of own production factors on a family farm can provide flexibility in the case of low returns when the family can chose to forgo income. However, in the long run opportunity costs must be considered because the potential successors of the farmer will, in most cases, make a decision on the alternative use of own production factors, in particular their own labour input, before taking over the farm. To indicate the effects of opportunity costs we have them separated from the other costs in most of the figures.

For the estimations and calculations the following assumptions were made:

Labour costs

For hired labour, cash labour costs currently incurred were used. For unpaid family labour, the average wage rate per hour for a qualified full-time worker in the respective region was used.

Land costs

For rented land, rents currently paid by the farmers were used. Regional rent prices provided by the farmers were used for owned land. In those countries with limited rental markets (like NZ), the land market value was capitalised at 4 per cent annual interest to obtain a theoretical rent price.

Capital costs

Own capital is defined as assets, without land and quota, plus circulating capital. For borrowed funds, a real interest rate of 6 per cent was used in all countries; for owner's capital, the real interest rate was assumed to be 3 per cent.

Quota costs

Rent values were used for rented or leased quota. Purchased quota values were taken as being the annual depreciation of values from the profit and loss accounts.

Depreciation

Machinery and buildings were depreciated using a straight-line schedule on purchase prices with a residual value of zero.

Adjustments of fat content

All cost components and forage requirements are established to produce FCM (fat corrected milk with 4.0 percent fat).

Adjustment of VAT

All cost components and returns are stated without value added tax (VAT).

Adjustment of milk FCM 4 percent

The milk output per farm is adjusted to 4 percent fat. Formula: FCM milk = (milk production * fat in percent*0.15) + (milk production*0.4)

Farm economic indicators (IFCN method)

+ Total receipts =

\+ Crop (wheat, barley, etc.)

\+ Dairy (milk, cull cows, calves, etc.)

\+ Government payments

- Total expenses =

\+ Variable costs crop

\+ Variable costs dairy

\+ Fixed cash cost

\+ Paid wages

\+ Paid land rent

\+ Paid interest on liabilities

= Net cash farm income

+ Non cash adjustments =

\- Depreciation

+/- Change in inventory

+/- Capital gains / losses

= Farm income (Family farm income in Dairy Report 2001)

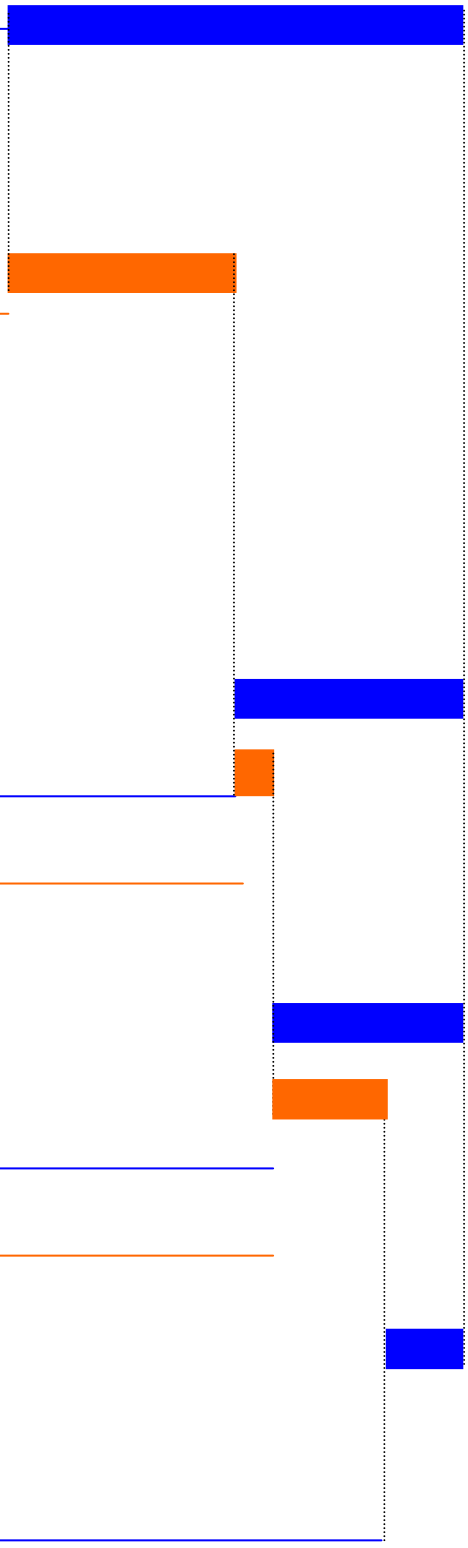
- Opportunity costs =

\+ calc. interest on own capital

\+ calc. rent on land

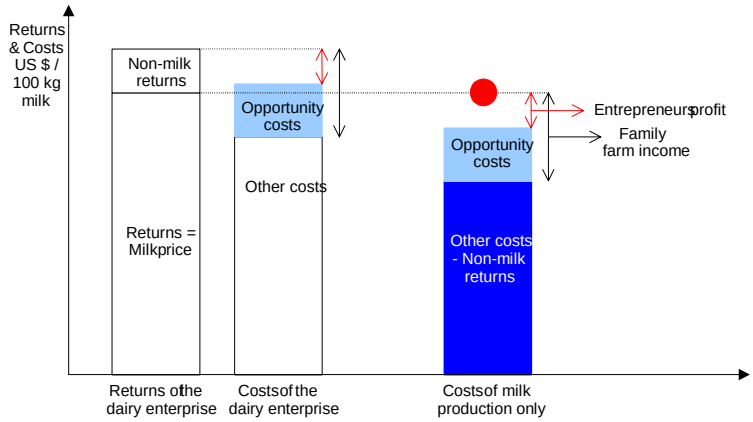
\+ calc. cost for own labour

= Entrepreneurs profit



A3 DESCRIPTION OF IFCN RESULT VARIABLES

Cost of milk production only



Method

The total costs of the dairy enterprise are related to the total returns of the dairy enterprise including milk and non-milk returns (cattle returns and direct payments). Therefore the non-milk returns have been subtracted from the total costs to show a cost bar that can be compared with the milk price. The figure beside explains the method.

Other costs: Costs from the P&L account minus non-milk returns (cattle returns and direct payments, excl. VAT).

Opportunity costs: Costs for using own production factors inside the enterprise (land * regional land rents, family working hours * wage for qualified workers, capital: Own capital * 3 percent).

Returns of the dairy enterprise

Milk price: Average milk prices adjusted to fat corrected milk (4 percent excl. VAT).

Cattle returns: Returns selling cull cows, male calves and surplus heifers + /- livestock inventory (excl. VAT).

Other Returns: Selling/home use of manure

Costs by costs items

Costs for means of production: All cash costs like fuel, fertiliser, concentrate, insurance, maintenance plus non-cash costs like depreciation for machinery and buildings (excl. VAT).

Labour costs: Costs for hired labour + opportunity costs for family labour.

Land costs: Land rents paid + calculated land rents for owned land.

Capital costs: Non-land assets * interest rate (equity * 3 percent, liabilities * 6 percent).

Quota costs: Payments for rented quota and depreciation for quota bought.

Cash and non-cash costs

Cash Costs: Cash costs for purchase feed, fertiliser, seeds, fuel, maintenance, land rents, interest on liabilities, wages paid, vet + medicine, water, insurance, accounting, etc (excl. VAT).

Depreciation: Depreciation of purchase prices for buildings, machinery and quotas (excl. VAT).

Opportunity costs: Costs for using own production factors (land owned, family labour input, equity).

Economic results of the dairy enterprise

Farm income per farm: Returns minus costs from P&L account of the dairy enterprise.

Farm income per kg milk: Farm income per farm (dairy enterprise) / milk production

Profit margin: Share of farm income on the total returns: Farm income divided by the total returns.

Entrepreneurs profit: Returns minus costs from P&L account of the dairy enterprise – opportunity cost allocated to the dairy enterprise.

Net cash farm income: Cash receipts minus cash costs of the dairy enterprise or: Farm income + depreciation

Return to labour: Entrepreneurs profit plus labour costs (wages paid plus opportunity costs) divided by total labour input.

Average wages on the farm: This figure represents the gross salary + social fees (insurance, taxes, etc.) the employer has to cover. Calculation: Total labour costs (wages paid plus opportunity costs) divided by the total hours worked. To calculate this the number of hours worked by the employees and the family has been estimated by experts.

Labour input: The estimation of hours worked and the valuation of these hours is extremely difficult especially in family farms. In the IFCN network this method will be intensively discussed and improved during the next workshops.

Labour costs: Paid wages and opportunity costs for own labour of the dairy enterprise.

Land costs: Paid land rents and opportunity costs for own land (calculated rent) of the dairy enterprise.

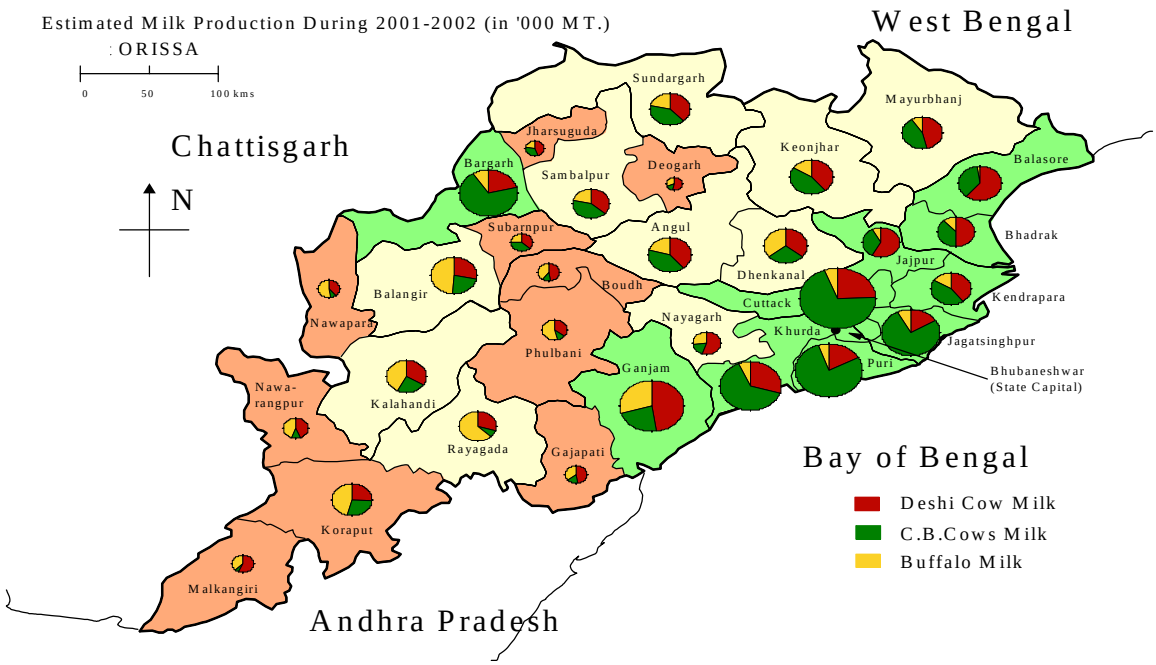
Stocking rate: Number of cows / ha land.

Capital costs: Paid interests and opportunity costs for own capital (excluding land capital and quota capital). For equity 3 percent and for liabilities 6 percent interest rate is used in all countries. This reflects the method of “capital using costs” developed by Isermeyer 1989.

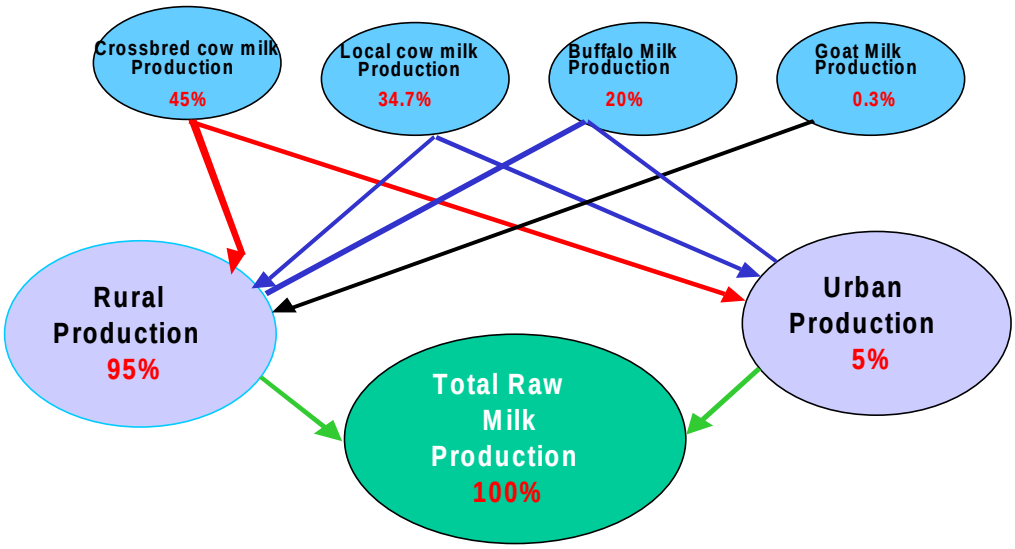
Capital input: Total Assets (land, buildings, machinery, cattle)/ number cows

A4 MILK PRODUCTION IN ORISSA

Milk production by district



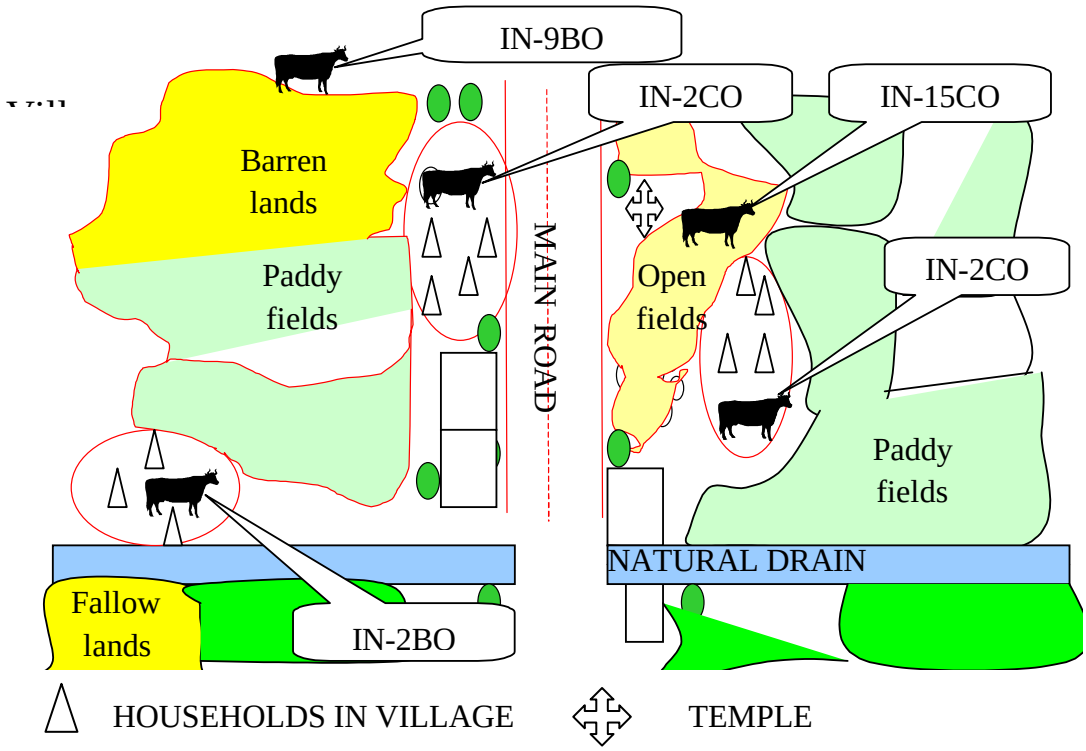
Rural vs. urban milk production in Orissa



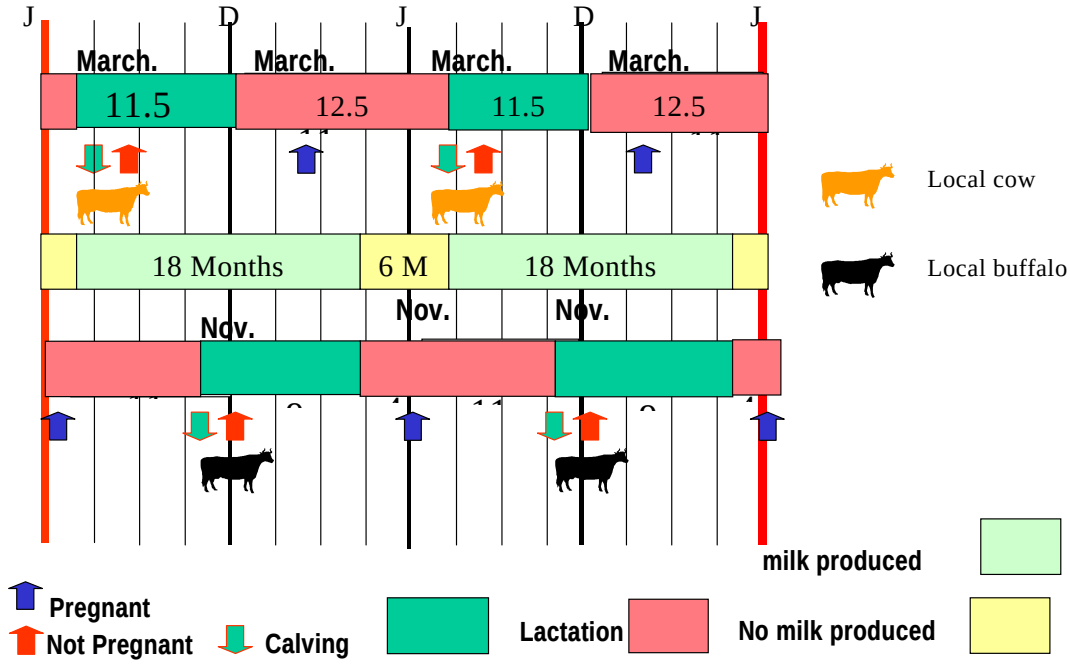
Source: Regio graph maps 1991, Government of Orissa (2001-02)

A5 ILLUSTRATION OF THE DAIRY PRODUCTION SYSTEM FOR A TYPICAL 2 COW FARM (IN-2CO) IN ORISSA

Production surroundings for a typical 2-milch-animal farm



Seasonal issues for a typical 2-dairy-animal farm in Orissa



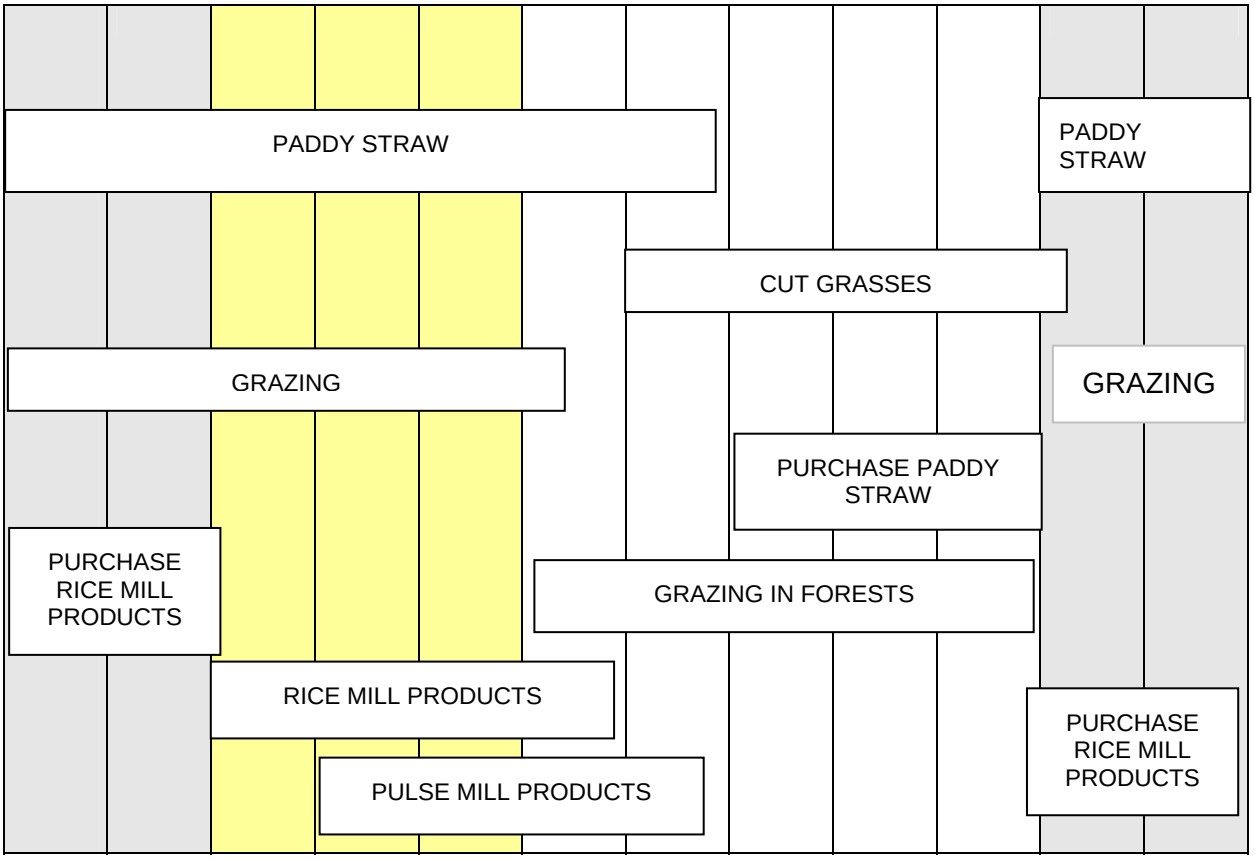
Source: Own illustration

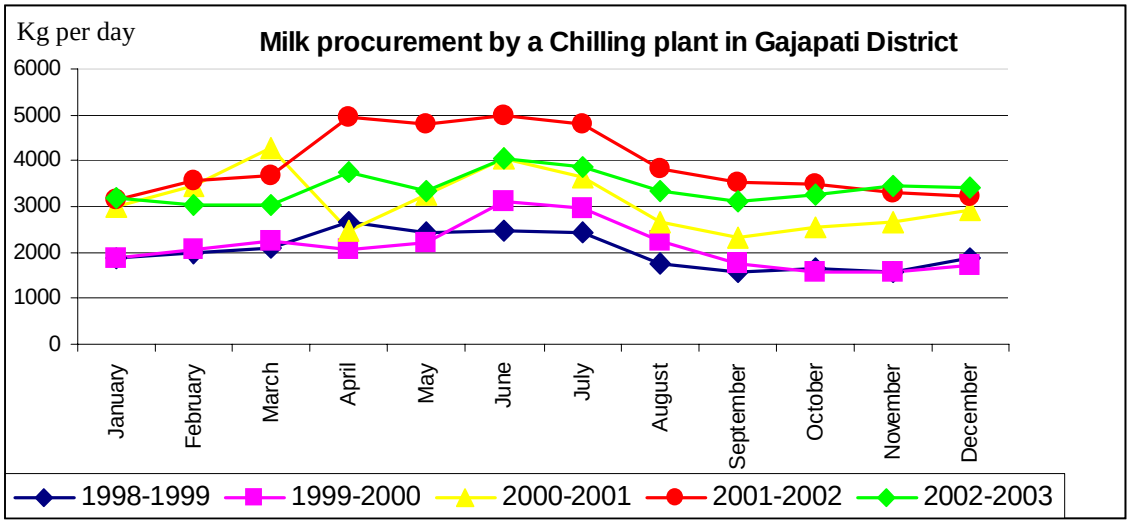
A6 FEED SOURCES AND MILK PRODUCTION CHARACTERISTICS FOR A TYPICAL 2-COW FARM (IN-2CO) IN ORISSA

Feed availability during the year

Jan Feb Mar Apr May June July Aug Sept Oct Nov Dec

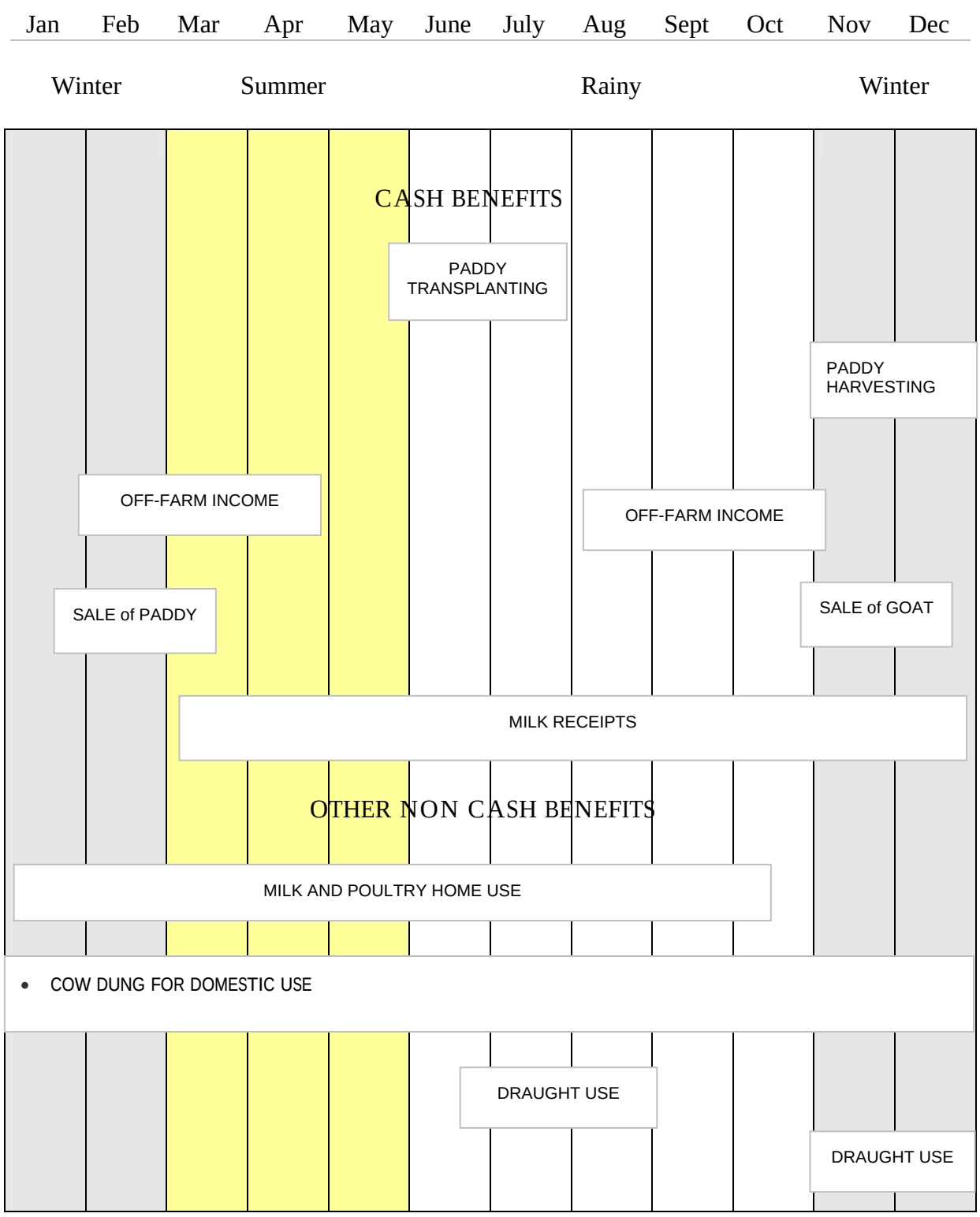
Winter season Summer season Rainy Season Winter





Source: District cooperative milk producers' union limited, Orissa

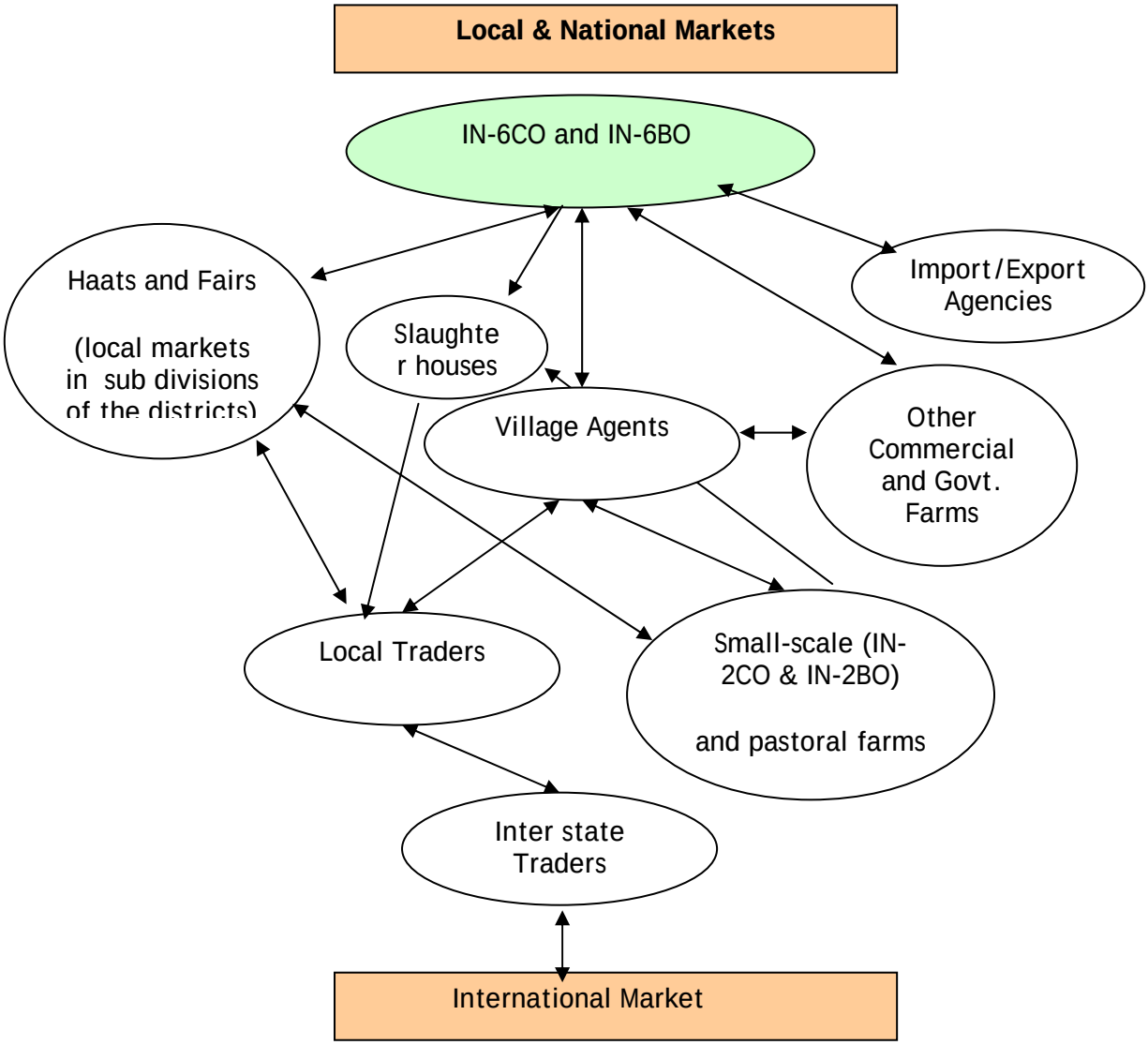
A7 SIMPLIFIED DIAGRAM OF CASH AND NON-CASH RECEIPTS BY A TYPICAL IN-2CO DAIRY FARM IN ORISSA



Source: Own Illustration.

A8 MARKETING OF DAIRY ANIMALS IN ORISSA

Livestock marketing for typical farms in Orissa



Note:

- IN-6CO type farms have a higher rate of selling dry animals and buying lactating animals and normally procure crossbred jersey cows from interstate dealers through the local agents. They generally do not rear their own heifers.
- IN-6BO has extensive knowledge of the pedigree of animals before purchase of animals (buffaloes) of good genetics.

Source: Own Illustration

A9 POTENTIAL FOR DAIRY DEVELOPMENT IN ORISSA

Classification

Based on the development status of the area and the openness to change and adoption of new technology, the 30 districts in the state have been grouped into three economic categories (see map).

Category A: High potential:

These districts lie on the coastal plains (except Bargarh) and are concentrated around the capital city, Bhubaneshwar. Bargarh is included in this group because of the innovativeness of the farmers in this area. They have a higher literacy rate (73.7 percent), higher percentage of villages with electricity (91.4 percent), lower tribal population density and higher road network density.

Category B: Average/Medium potential:

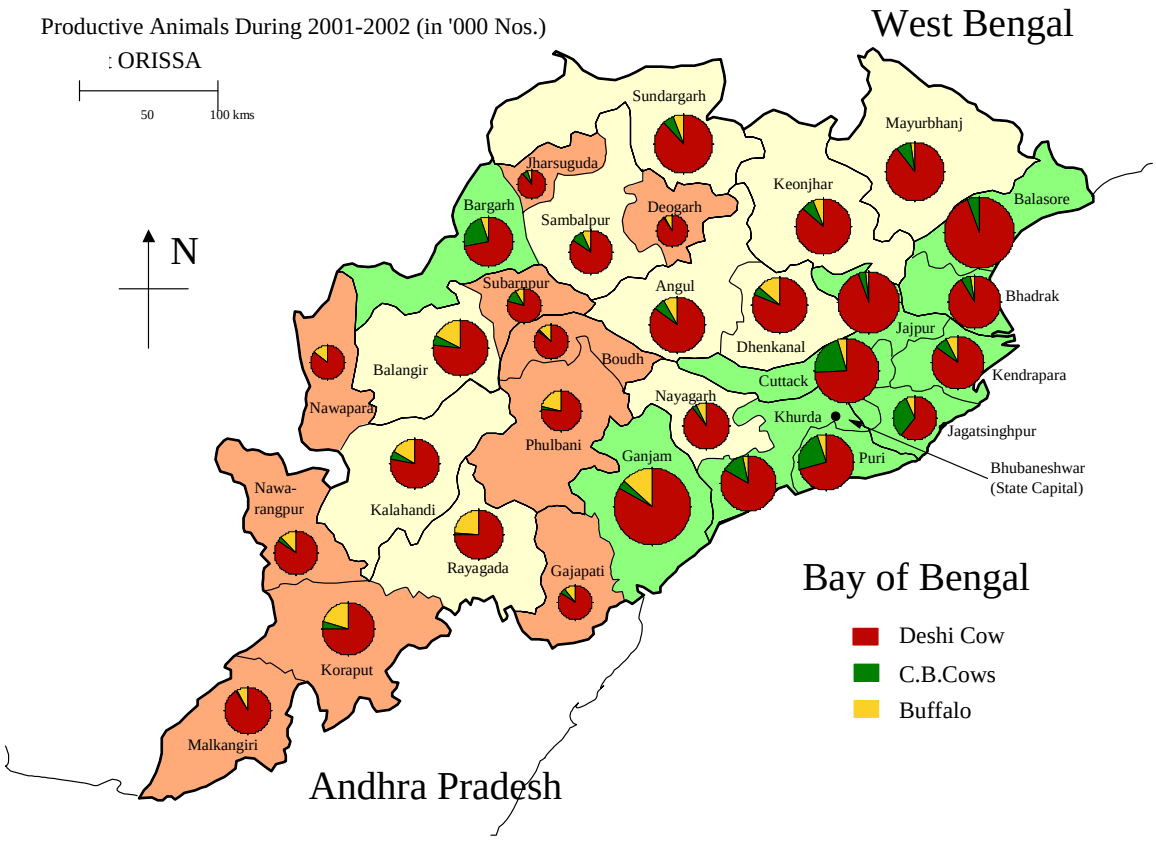
This category includes mainly the ten midland plateau districts. These districts have a dairy infrastructure comparable to that in category A, but due to a larger area under forests and a higher proportion of tribal population, they are not as productive in terms of milk production as category A. These districts have an average literacy rate of 59.2 percent, 71.3 percentage of villages have electricity and the tribal population density lies around 49 persons per square kilometre.

Category C: Low potential:

Category C includes the ten upland and midland central and south districts. These districts lack dairy infrastructure and milk marketing is mostly unorganised. The innovativeness and adoption rate is very low and the population is dominated by tribal populations and a fair proportion of the area is under forests. These districts have a low literacy rate (47 percent), only 59.5 percent of the villages have electricity, and tribal population density is around 45.9 persons per square kilometre.

Sources of data:

- Government of Orissa (2003)
- Kurup (2003)



High potential (green)	Medium potential (yellow)	Low potential (red)
Cuttack	Bolangir	Koraput
Puri	Dhenkanal	Gajpati (68)
Ganjam (315)	Keonjhar	Jharsuguda
Khurda	Angul	Boudh
Jagatsinghpur	Sambalpur	Phulbani
Bargarh	Sundargarh	Nawapara
Balasore	Mayurbhanj	Deogarh
Kendrapara	Rayagada	Nawarangpur
Jajpur	Kalahandi	Malkangiri
Bhadrak	Nayagarh	Sonapur

Dairy animal population

In 2002, the high potential districts had 2.6 times the local cow population per square kilometer than the medium potential districts and 5.8 times the crossbred cow population density. The low potential districts on the other hand had only 34.1 percent of the local cow population per square kilometer and only 20.7 percent of the crossbred cow population in milk per square kilometer. This signifies the importance given to milk production in the high potential districts vis-à-vis in the low potential districts. The population of crossbred cows is most concentrated in Jagatsinghpur, Cuttack, Puri, Khurda and Bargarh districts. On the other hand, the buffalo population density is rather uniform in all the three categories of districts, highlighting the importance of buffalo milk production in the medium and low potential districts.

Average milk yield

There is not much variation in the average milk yield in the case of buffaloes. In case of crossbred cows, however the average yield was 1.8 times higher in high potential districts than in low potential districts. Surprisingly, the average milk yield in the case of local cows was 1.6 times in the high potential districts than the low potential districts, showing the improvement potential in milk productivity of local cows in the low potential districts with the exisitng technology in Orissa.

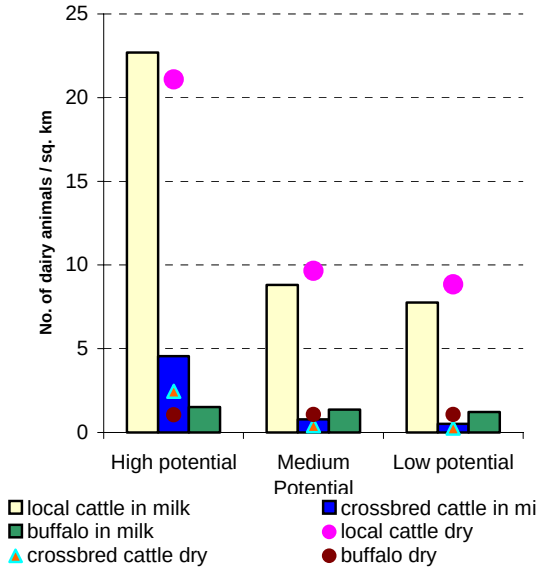
Milk production per year

The high potential districts, having only 24.3 percent of total land area of Orissa, are producing over 56.9 percent of the total milk production in the state, whereas the medium potential districts with 46.7 percent of total land area are contributing around 30.3 percent to the total milk production. The low potential districts with 29 percent of total land area are only producing 12.8 percent of milk production in the state. Lack of milk markets, lower dairy animal density, lower milk yields, more area under forests and lower innovativeness of farmers are some of the factors causing the variation in milk production across districts. The easiest and quickest way to promote dairy development in the state is to develop milk markets in the high and medium potential districts and infrastructure along with awareness in the low potential districts.

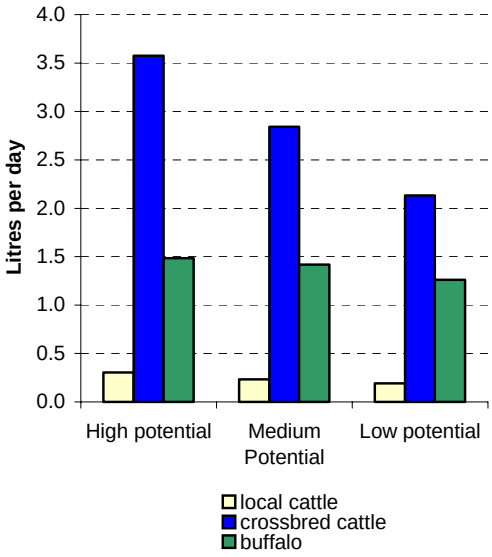
Sources of data:

- Government of Orissa (2001-02)
- Government of Orissa (2003)

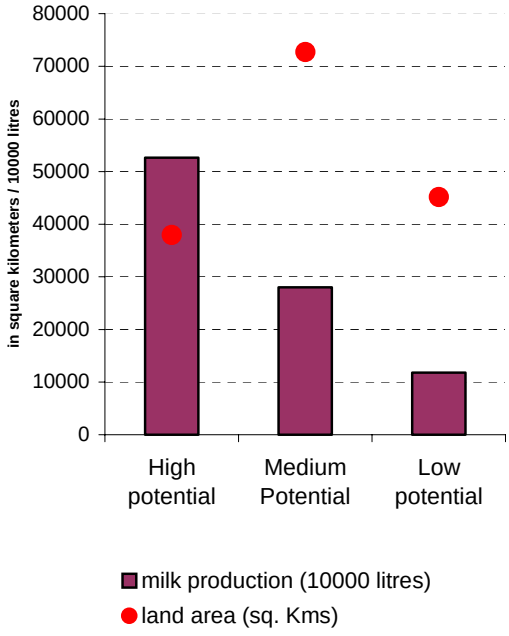
Dairy animal population in the classified districts per sq. Km. Of district area in 2001-02



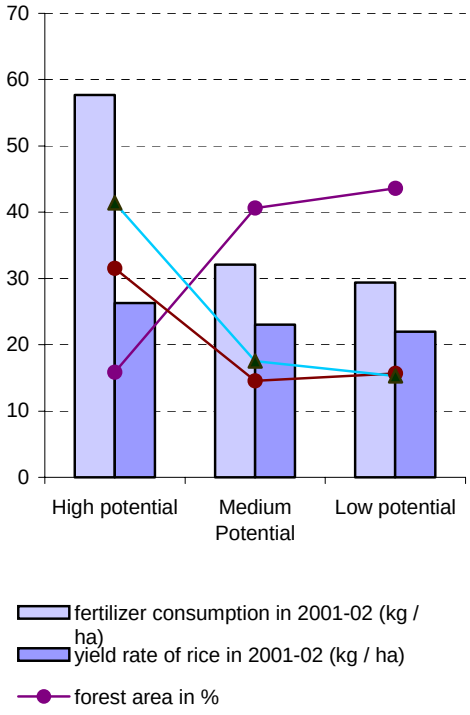
Dairy animal average yield in the clasiffied districts (2001-02)



Total milk production per annum vs. Total land area in the classified districts in 2001-02



Adoption of innovations per district



Veterinary infrastructure

Veterinary infrastructure is highly biased towards the high potential districts concentrated around the coast and around the capital city of Bhubaneshwar with around 6 veterinary hospitals, 39 livestock aid centres, 38 artificial insemination centres, 5 key village units, 4.7 ICDP units, 8 veterinary surgeons and 35 livestock inspectors per 1,000 square km whereas the low potential districts have only 3 hospitals, 13 livestock aid centres, 7 artificial insemination centres, 0.3 key village units, 1 ICDP unit, 3 veterinary surgeons and 12 Livestock inspectors per 1,000 square km. The veterinary infrastructure in the medium potential and low potential districts is similar.

Dairy infrastructure in the state

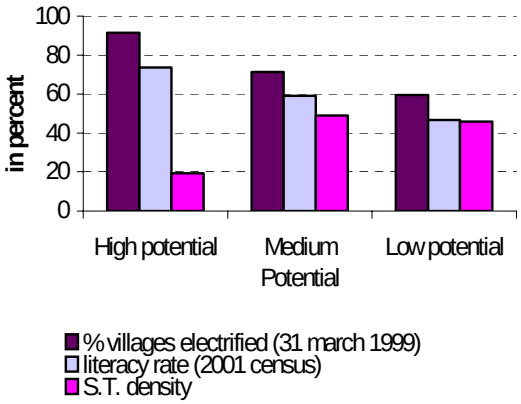
The overall dairy infrastructure in the state is very poor. The proportion of marketable supply of milk procured by the formal sector by year 2008 is estimated to be around 2.6 percent in the high potential districts, 4.1 percent in the medium potential districts and 0.9 percent in the low potential districts (Kurup, 2002). The proportional capacity by 2008 would be however much higher at 8.03 percent, 15.4 and 6.9 percent respectively. The present working capacity of the dairy and chilling plants is estimated to be 34.6, 22.7 and 11.8 percent respectively in the high potential, medium potential and low potential districts. The average number of functional dairy co-operative societies per district varies from 210.3 in the high potential to 64.0 in the medium potential and only 18.7 in the low potential districts. The milk collection per co-operative society per day stands at 68.8, 60.3 and 51.3 litres respectively for the high, medium and low potential districts per society per day.

The total number of cooperative dairy plants in the state is 10, 3 in the high potential districts, 7 in the medium potential districts and none in the low potential districts. The total number of chilling plants in the state is 29, of which 12 plants are in the high potential districts, 11 in the medium potential districts and 6 plants in the low potential districts. The milk handling capacity of the formal cooperative sector was 3.056 lakh litres per day in 2002 of which the share of the high potential districts was 55.2 percent (1.688 lakh litres per day) followed by the medium potential districts with 37.6 percent and the low potential districts with only 7.6 percent of the total handling capacity.

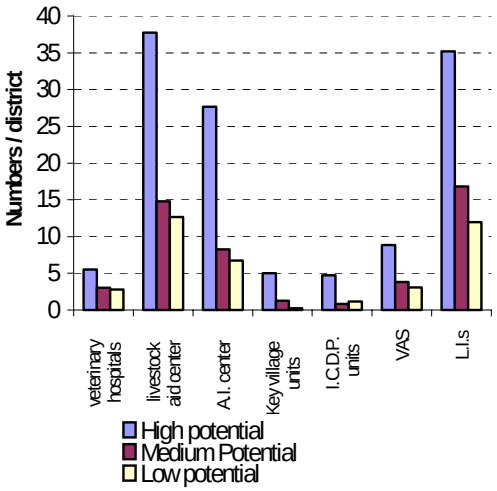
Sources of data:

- Government of Orissa (2001-02)
- Government of Orissa (2003)
- Kurup (2003)

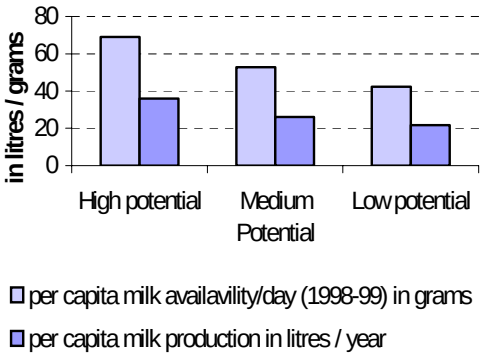
Availability of infrastructure per district

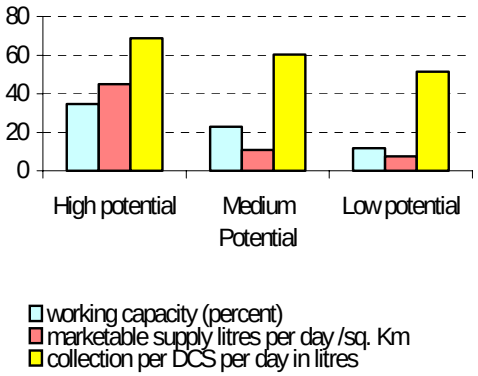


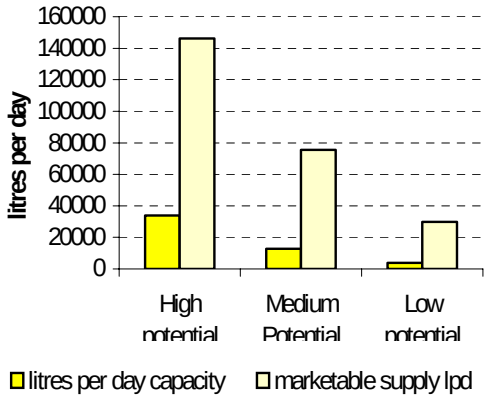
Veterinary infrastructure per 1000 sq.Kms of district area

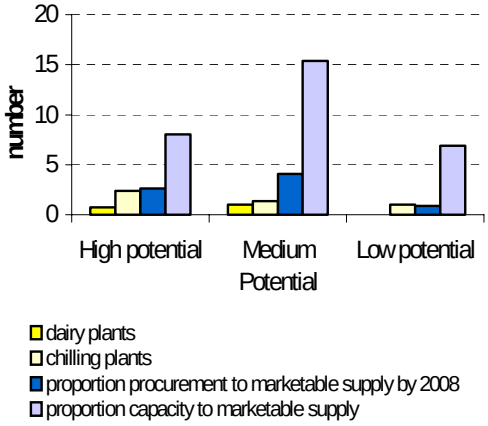


Dairy Infrastructure in the state



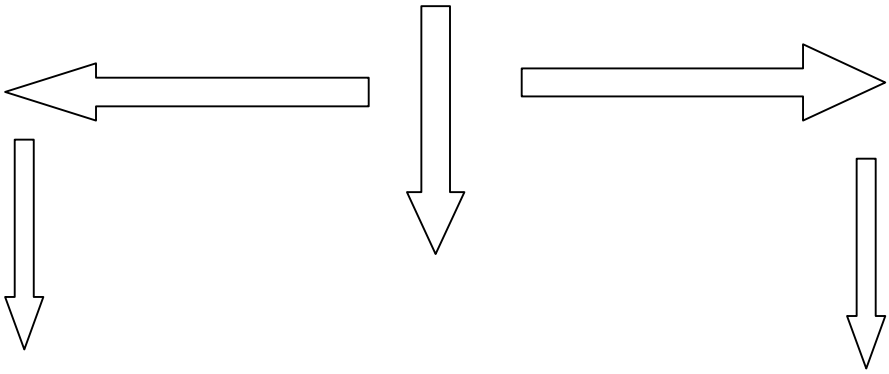




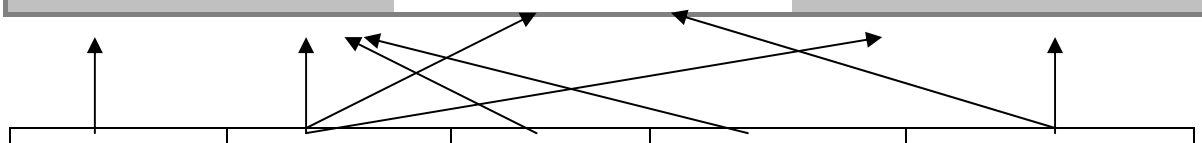


A10 MAJOR STAKEHOLDERS IN THE ORISSA DAIRY INDUSTRY

Orissa Dairy Cooperative Milk Producers' Federation Limited (OMFED)
National Dairy Development Board (NDDB)
Directorate of Veterinary and Health Services of the State Government of Orissa
Indo Swiss Project Orissa



Production Sector	***Processing Sector***	***Marketing Sector***
Milk Producers	Milk Processors	Marketing Channels
1. Smallholders	1. Co-operative Sector	1. Private Companies
2. Large Producers	2. Private Sector	2. State Co-operatives
3. Peri-urban Dairy Farms	3. State Government	3. Milk Marketing Federations
4. Commercial Dairy Farms	4. Bilateral agencies	4. Wholesalers and Retailers
5. Institutional Dairy Farms	5. Informal Sector (Halwaiis)	5. Informal Sectors (Dudhias, Contractors, Milk Producers)



Health Services	**Financial services**	**Feed Services**	**Livestock services**	**Consultancy services**
Government Hospitals Livestock Aid centres Artificial Insemination centres	Nationalized banks District banks Cooperative banks Private banks	Feed plants Fodder markets Distributors Retailers Co-operatives	Slaughter houses Livestock markets	Bilateral agencies Contractors Engineers Consultants

Source: Sharma (2002) and own illustration

A11 DAIRY CHAIN CALCULATIONS

Milk Handling in Ganjam and Gajapati districts, Orissa						
		Formal Milk Channels		Informal Milk Channels		
		Coop 3%	Coop 4%	Direct sale rural 4.2%	Milkman 2.5%	Direct Sale urban 3.9%
Variables	**Units**					
Dairy Processing activities based on 1 kg milk bought from the farmer						
INPUTS						
Input 1: Milk from the farmer						
Quantity	Kg	1	1	1	1	1
Fat Content	% estimation	4.2%	4.2%	4.2%	4.2%	5.5%
Protein Content	% estimation	3.5%	3.5%	3.5%	3.5%	3.5%
Purchase Price*	US-$/ Kg	0.18	0.18	0.18	0.20	0.24
SUM OF ALL INPUTS	**US-$**	**0.18**	**0.18**	0.18	0.20	0.24
OTHER RAW MATERIAL INPUTS						
Input 1: Skimmed milk powder						
Quantity	Kg	0.04	0.01	0	0	0
Fat Content	%	2.5%	3%	0%	0%	0%
Other solids	% estimation	95.0%	95.0%	0.0%	0.0%	0.0%
Price paid by the channel	US-$/ Kg	1.71	1.71	0.00	0.00	0.00
Input 2: Water						
Quantity water	Kg	0.363	0.044	0.000	0.400	0.300
Consumer price for water	US-$/ Kg	0	0	0	0	0
SUM OF ALL INPUTS	**US-$**	**0.24**	**0.19**	**0.18**	**0.20**	**0.24**
OUTPUTS						
Output 1: Liquid milk	Description	Toned milk	Cow milk	Cow milk	Cow milk	Buffalo milk
Quantity	Kg	1.40	1.05	1.00	1.40	1.30
Fat Content	%	3	4	4.2	2.52	3.85
Other solids	% estimation	3.4	3.5	3.5	3.2	3.5
Consumer Price	US-$/ Kg	0.29	0.32	0.21	0.24	0.28
MARGINS						
Sum of all Returns	US-$	0.40	0.34	0.21	0.33	0.36
-Farmers Milk Price / costs incurred	US-$	0.18	0.18	0.18	0.20	0.24
Value addition margins**	US-$	0.22	0.16	0.03	0.13	0.12

Notes:

1- The amount of water and SMP used for milk processing by the Cooperative was provided to us by the milk union. For other channels, water used based on expert views and assumptions form authors and we assume no cost for it.
2- Fat content for (fluid) Milks varies greatly due mainly to poor regulation and quality control and a strong consumer demand for (fluid) milks.

*__3-__ The purchase price refers to raw milk price paid to farmer or opportunity cost in case of direct sale by farmer
4- Value addition margins refers to the margins available to the channel for processing and retailing 1 kg of raw milk after deducting the farmers' milk price at the point of exchange from the farmer to the channel from the gross returns of the final product of that channel.

Source: Accounting information of the Milk Union in the district. Prices and processing channels from personal communication, fat and protein contents based on expert views and assumptions made by the Authors.

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