Evaluation of cost of cow milk production and quality of milk produced by commercial dairy farms located within the radius of 100 km from Guwahati city, Assam (India)

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Executive summary

Assam a North Eastern state of India comprises an area of 78,523 square kilometers (30,318 square miles) with diverged topographical range. The milk production of the state has shown a gradual increase from 1986-87 to 2005-06. During 2005-06, the production of milk was 821 million liters. The same for the year 2004-05 was 812 million liters. The growth rate over the previous year was 1.1% only. While the average cost of production of milk in other parts of India can be assumed at 20US$ per 100 kg, cost of the production of milk in Bangladesh, one of the prominent country sharing boundary with Assam is 22 US$ per 100 kg energy corrected milk against the world average market prices of milk that normally ranges between 15 -18 US$ per 100 kg milk.

Future of processed milk and other products-based industries in the North eastern region of India where Assam is a gate way appears bright in the light of the Look East Policy of government of India; Free Trade Agreement with ASEAN in 2012, Pan Asian Highway etc. These environmental changes will provide a plethora of opportunities for the North Eastern States to interact commercially with international neighbors with whom they share 98% of their borders. The future perceive market changes necessitates need of strategies for safeguarding interest of local producers and augmenting milk product export from the region in near future to neighboring countries like Bangladesh and Myanmar. This assumes significance considering the perishable nature of milk products and the logistics suitability of the state or the region thereof from the targeted countries.

In the background of perceived threat of milk products from neighboring countries to Assam and other North Eastern states of India besides scope of enhancing export competitiveness of local processors, the current study was sponsored by the project to record cost of production of cow milk in commercial units and the quality at the existing cost in an around 100 km radius of Guwahati city- the gate way to N E India. Study was also aimed at identifying intervening notes from the findings, so as to reduce the cost and improve quality of milk at producers' level for enhancing their competitiveness.

For the current study the samples (500 in numbers) for the study were stratified in to three groups in order to minimize variations due to sampling. The strata and their attributes are as under –

A. ***Traditional small holders farmers / farms***: Farmers having herd size of 5 -20 cattle with experience of cattle rearing and milk marketing business for more than 10 years.

B. ***Neo-small holder farmers*** **/ farms** Farmers having the herd size of 5-20 cattle with experience of cattle rearing for not less than 10 years. Farmers in the business for less than one year were excluded from the study.

C. ***Medium farm holder farmers / farms***: Farmers having herd size of more than 20 cattle heads with experience of cattle rearing and milk marketing for more than one year.

The study calculated the cost of production of milk for each of strata's mentioned above which were recorded as Rs.13.24 (~ 29 US$ per 100 kg) for traditional small holder farms, Rs.14.54 (~ 32US$ per 100 kg) for Neo small holder farms and Rs.10.57 (~23 US$ per 100kg) for medium holder farms. The over all average cost for all the strata's together being Rs.12.95/-. (~ 28US$ per 100 kg)

The benefit cost ration (BCR) for traditional small holder farmers, neo small holder farmers and medium small holder farmers were calculated as 1.05, 1.04 and 1.29 respectively with over all benefit cost ratio being 1.09.

The study recorded low per animal productivity as a predominant factor for increased cost of production in commercial operations. The fact that majority of farmers have access to artificial insemination services indicate the possibility of bringing a change in the scenario through appropriate breeding strategies clubbed with scientific record keeping.

The number of producing (milch) animals per farm was much less (around 45%) than the standard of 70%. The study indicated ample scope of cost reduction through appropriate fertility management and by minimizing feeding expenses on un-productive animals.

The study recorded variance in prices of various categories of animals across studied groups indicating need of organized market. Other than milk income was found to be crucial for profitability of enterprises.

Cost of health care was found to be much higher which may be due to higher sickness rates or consultation for fertility failures. The findings also indicate willingness on the part of the farmers / entrepreneurs to pay for veterinary services. In order to reduce the cost of health care farmers may be advised to enter into contract of consultancy for basket of services targeted at enhanced productivity.

Feeding system that depend excessively on concentrate ration than on green grass and practices like cooking of food etc. were recorded as stumbling block towards reducing cost of production.

Structured observation made during the study revealed scope of improvement in farm shed construction and land utilization.

Better management of heifer or opportunity cost of replacement with own heifer was recorded to contribute substantially in reducing cost of production.

Percentage of feed cost to overall cost was recorded at 82.68, 86.07 and 76.07 for traditional small holder farms, neo small holder farms and medium holder farms respectively. This indicates intervention aimed at reducing cost of feeding as crucial for cost reduction and competitiveness thereof.

Cost of feed was highest for less experienced neo small holder farms in comparison to other groups. Understanding of market and ability to test quality of feed ingredient in field condition besides skill of intelligent (time, source) procurement are some of the factors that can enhance competitiveness of the producers.

The structured observation indicated that besides efficient collection system, improvement of environment surrounding farm, more particularly through creation of opportunities for waste disposal and their economic use is crucial for bringing improvement in milk quality.

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1.0. Introduction

The structure of milk production world wide is diverse. The farming system differ in farm size (1-3000 cow per farm), milk yield (< 1000kg to > 10,000 kg / cow per lactation), feed basis, milking technology and the linkage to the dairy chain etc. Small scale farms dominate the South Asia, Switzerland, Australia, Norway, Finland and Poland where as large farm provide most of the milk production in USA, Israel, Argentina, Oceania, Hungry, Czech Republic, Estonia, Denmark, Netherlands and UK.

In India the livestock keeping system is more complex and can be divided into peri-urban dairying and rural dairying. Peri-urban dairies usually keep crossbreds and or buffaloes whereas the rural dairy farming is small holding with average herd size of around 3 animals per household. More than 80% of milk produced in the country in fact comes from small holding and landless farmers. India is rated as the highest milk producer in the world but this is largely due to the number of animals that is 10-times higher than USA. The per animal productivity in Indian dairy animal is one of the lowest in the world around 8-9-times lower than dairy-developed countries. Another interesting feature of the Indian dairy farming is the production system wherein the dairy animals are largely fed on crop residues and high producing animals are supplemented with concentrate feed.

Assam a North Eastern state of India comprises an area of 78,523 square kilometers (30,318 square miles) with diverged topographical range. The Brahmaputra valley has a gradual slope from east to west with a difference of 99m in altitude above mean sea level. The state is divided into six agro-climatic zones based on rainfall, terrain and soil characteristics.

Agro-climatic zones are:

Sl.no.	Zones	No. of district	Area (%)
1	North Bank Plain	4	**18.37**
2	Upper Brahmaputra Valley	5	**20.40**
3	Central Brahmaputra Valley	2	**7.08**
4	Lower Brahmaputra Valley	10	**25.75**
5	Barak valley	3	**8.90**
6	**Hills Zone**	**2**	**5.58**

Table 1

The climate of the state of Assam is a humid type in plains with heavy rainfall while a pleasant sub-alpine climate prevails in the hills. The average maximum temperature during summer and winter are 30^0 and 16^0C respectively, while the rainfall ranges from 1152 mm to 3000 mm.

Assam is characterized by all the problems associated usually with the mountainous environment, i.e., low availability of cultivable land, lack of diversity in economic activities, low accessibility, low productivity, meager infrastructure, inadequate employment opportunities, an alarming rate of out-migration of skilled personnel, and low level of social and political articulation.

Livestock and poultry husbandry is the indispensable subsidiary activity with agriculture and considered as buffer and / or of insurance value for the family. Cattle of indigenous breed, specially bull / bullock reared for draught power and the female animals were kept of livestock multiplication at home.

The milk production of the state has shown a gradual increase from 1986-87 to 2005-06. During 2005-06, the production of milk was 821 million liters. The same for the year 2004-05 was 812 million liters. The growth rate over the previous year was 1.1% only.[1]

Traditional dairy activity has transformed to small and medium scale commercial dairy activity with changing of time and ever increasing demand of milk. Commercial dairy farming plays significant role in generating gainful employment in the rural sector, particularly among the landless, small & marginal farmers and women besides providing cheap and nutritious food to the growing human population.

The commercial dairy farms concentrate mostly in the peri-urban areas due to easy access to market and accessibility to required inputs. Peri urban commercial farming is mostly dominated by traditional dairy farmers of Nepalese community. The farms are small to Medium in size. Most preferred breeds in the region are Holstein Friesian and Jersey crosses. The farmers in general follow management style which is a blend of inherited traditional knowledge and modern scientific understanding. Besides peri-urban farming, good numbers of commercial dairy farms are emerging in the rural areas too with support of some Government and Non-government organization backed capacity building projects and financial assistance schemes.

[1] Department of Animal Husbandry and Veterinary, Government of Assam

2.00 Study Objective

There is no scientific documentation on cost of milk production in the state of Assam till date. Majority of farmers are either not aware or less sensitized to the need of proper record keeping for calculation of cost of production. Inadequate knowledge about the cost of production is making majority of small holder farmers vulnerable to competition.

The present study was undertaken both in peri-urban and rural areas surrounding Guwahati city with the following objectives**:**

1. To evaluate cost of production in different categories of dairy farms.
2. To find out the quality of milk produce by the dairy farmers in the existing cost.
3. To determine different intervening pointers (if needed) to reduce cost of production and improve quality of milk.

2.01. The Study Team:

a. Principal Investigator: Dr. Tapan Kumar Amonge, PhD, Hony.Advisor,FARMER

b. Co-Principal Investigator: Dr. Pranjal Borah, Dairy Consultant, FARMER

c. Field Monitoring Officer: Dr. Monjul Islam, Secy. General, FARMER

d. Microbiologist: Dr. Ratul Sarma, PhD – Hony. Advisor, FARMER

e. Statistical Officer: Dr. Mukul Ch. Borah, PhD – Hony.Adviosr, FARMER

f. Supervisors: Dr. Ajit Bangthai, B.V.Sc & A.H

Dr. Dhurbajyoti Das, B.V.Sc & A.H

g. Enumerators: Mr. Divakar Dhakal

Mr. Binod Timsina

Mr. Diganto Kalita

h. Data Entry Operator: Mr. Jintu Medhi

i. Project Administration:Dr.M.Islam Babaruah,Chief Technical Advisor, FARMER

j. Technical guidance: Prof.Abdul Samad – The Dean, Bombay Veterinary College

k. Managerial Assistance: Ms.Zinher Ahmed

3.00. METHODOLOGY:

Methodology of the study involves area description, Categorization of farmers, respondent selection, interview schedule structuring, milk sample analysis and analytical frame.

3.01. Location of the study:

The study was conducted in peri-urban and adjacent rural areas within a radius of 100 km from Guwahati city. Limiting of study area to100 km radius of Guwahati city is based on secondary knowledge related to usual milk procurement area of city based milk processors. The study area is one of the highest milk producing area of state. Furthermore, neo-entrepreneurs across the state are getting inspiration, management training and cattle stock from the study area only. Five dairy clusters representing both peri urban and rural producers were selected from within the study area based on normal milk aggregation areas (Primary market), observed growth pattern, ethnic composition, and obvious differences pertaining to management practices, available marketing channels and input scenario.

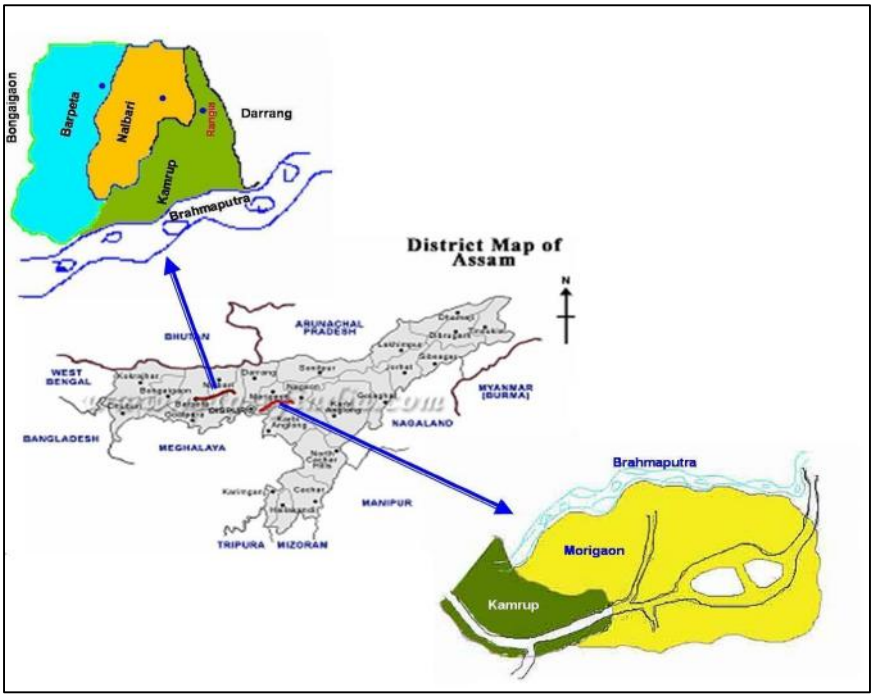


Fig-1. Location of the study

Five selected clusters of the study:

Area	Area code	Name of the area	District	Cluster Characteristics
1.	A1	Amlighat to Jagiroad (Advancing rural area around Rural township e.g. Jagiroad)	Morigaon	Area with highest concentration of high producing animals. Presence of strong cooperative providing better access to resources and market to producers. Mix of Assamese speaking and Nepalese producers.
2.	A2	Khetri to Sonapur (Sandwich area between city and rural township.)	Kamrup Rural	Encouraging growth pattern with private investment (Farm house) Predominantly tribal, Assamese speaking producers.
3.	A3	Khanapara to Sonapur (Peri urban area to Guwahati city)	Kamrup Metro and Rural	Peri urban area with hilly terrain, Predominantly Nepalese and migrant producers. Management practices affected by constraints related to topography of land, water and inadequate drainage etc. Predominance of market intermediaries.
4.	A4	Guwahati urban	Kamrup Metro	Predominantly migrant Urban producers with constraint of land and ownership of assets.
5.	A5	Rangia to Barpeta District (Rural Assam)	Kamrup rural and Barpeta	Assamese speaking rural producers with existence of distinct practices of semi intensive rearing. Limited access to input and market.

3.02. Selection of farmers / Commercial Units:

Knowledge level or experience of farmers and the herd size owned has direct impact on the cost of production of milk. Hence, the farmers were stratified in to three groups in order to minimize variation due to sampling. The strata and their attributes are as under –

A. Traditional small holders farmers / farms: Farmers having herd size of 5 - 20 cattle with experience of cattle rearing and milk marketing business for more than 10 years.

***B.Neo-small holder farmers* / farms** Farmers having the herd size of 5-20 cattle with experience of cattle rearing for not less than 10 years. Farmers in the business for less than one year were excluded from the study.

C. Medium farm holder farmers / farms: Farmers having herd size of more than 20 cattle heads with experience of cattle rearing and milk marketing for more than one year.

In case of group C experience was not considered as confounding variable with an assumption that they have comparatively higher degree of access to information and normally afford professional or skilled managerial assistance.

3.03. Respondent selection:

From the identified clusters, special emphasis was given to generate status information on the commercial producing units within the clusters. Selections of villages / areas with producing units within the clusters were made using simple random sampling method. Number of farms selected from different villages / area depended on estimated data on commercial dairy animal population in the village / area (maximum 10 farms for every 100 commercially reared animals). Within a selected village, a random start up point (commercial dairy unit) was selected using randomization and then next units were selected at an equal household interval alternatively. The interval was worked out on the basis of number of household in the village. From each cluster 100 farmer respondents (farm units) were included in the study. The details of the sampling frame is provided in box -1

Box-1

Sampling Frame: Milk producers of Kamrup (Metro), Kamrup (Rural), Morigoan Barpeta and Nalbari Dist of Assam.

Primary Sampling unit: Production clusters

Secondary Sampling unit: Village / Locality

Final Sampling unit: Commercial dairy farm rearing cows with minimum 5 numbers of animals & household of owner entrepreneur.

Element: Owner entrepreneur

Extent: 100 km radius of Guwahati city

Time: May –June'07

Size: 500

3.04. Interview Schedule structuring:

The interview schedule (Annexure 2) was prepared by P.I and Co-P.I in consultation with different experts. Initial small study was undertaken to evaluate the suitability of schedule and minor alterations based on experience was included in the final schedule. The information gathering was through visit of Supervisors and Enumerators to the farmers door step or in the farm premises itself under strict supervision of PI. The supervisors and enumerators were selected from the cluster groups who knew the geography and had personal rapport with the farmers in the clusters. Before actual start of survey the enumerators and supervisors were trained by PI and Co PI on survey related communication skills. The interviews were conducted during May –June'2007. The period in the study area is characterized by moderate summer temperature, beginning of monsoon with normal fodder availability.

3.05 Record of Observation

Structured observation by qualified professional was also used as a tool to understand feeding practices, farm shed construction, land utilization and hygiene or farm environment. Critical observations were cross verified and documented using electronic means.

3.06. Milk sample analysis:

To evaluate quality (both physical and microbiological) of milk, five (5) random milk samples were collected from amongst the 100 respondents in each cluster. The sample size of 5 for each of the cluster was however fixed irrespective of area and spread of farms within the cluster considering study limitations. The pooled duplicate morning milk samples from each unit were collected in sterilized sample vials (one time collection only). The samples were kept in ice box and transported immediately to the laboratory. The samples were processed in the lab within 2-3 hrs.

Fat, SNF (Solid not fat), Protein, Specific gravity, Added water and Temperature were estimated using LAKTAN – 220 (Sibagrapriber Russia). The instrument was calibrated every day before testing as per the protocol provided by the manufacturer.

To study the microbial quality of the milk samples following tests were conducted.

- Total Viable Count (TVC) – Pour Plate Method was used for the study.
- Methylene Blue Reduction Test (MBRT).
- Coliform Count.
- Spore Count.

3.07. Analytical Frame:

As per the objective of the study effort was made to assess all the input factors affecting milk production and cost under prevailing production system of surveyed areas. The farmers / units were stratified into three categories (as mentioned earlier) and category - wise input factors were critically observed. Average investments for all possible input variables were calculated. An input – output analysis was carried out to calculate average cost of milk production and profitability. An economic analysis was made to understand the sustainability of the production system and practices. Cost-benefit ratios were calculated to examine the farm economy.

4.00. Limitation of the study

1. Time: The period for the study was too short, covering only one session. It is therefore possible that due to seasonal variations in input cost and the production level the cost of milk on the farm may be different for other seasons. .
2. Majority of farmers generally do not keep much records hence, the information collection was based on mental recollection of recent event such as procurement rates. The inputs provided by the farmers therefore could not be checked for authenticity.
3. Perception: Since schedule was prepared for data collection by enumerators, there may be difference between actual and recorded data as perceived by enumerators.
4. The rates related to non milk income e.g. income from cow dung etc. were assumed on the basis that their would be assured market accessible to the farmers.
5. Logistic and other difficulties associated with limited budget study leading to constraints like quality testing of milk samples only from 5% of total respondents ignoring cluster area and spread of farms within the clusters.
6. No concurrent study was conducted to collect data from market / intermediaries regarding input and milk prices for cross verification.
7. Limited focused sensitization program was organized amongst the stakeholders both prior and during the study period. Information related to ownership could not be verified.

4.01: Handling of Response bias:

To reduce response bias special care was taken to select enumerators and supervisors with dairy farming experience from the identified belts only. The co-investigator was also selected based on his long experience in identified belts as a leading practitioner.

5.00. Review of literature on Cost of Production

Cost of production in developed countries range between 79 US$ per 100 kg milk in Switzerland and 9 US$ / 100kg milk in Argentina. The average cost of production of EU is 28 US$ per 100 kg[2]. Cost of the production of milk in developing country like Bangladesh (The country sharing border with North east India) is 22 US$ per 100 kg energy corrected milk[3].The world market prices of milk ranges between 15 -18 US$ per 100 kg milk. The costs of production surveys on milk are not being conducted by majority of the Indian states since long due to resource constraint. The following tables indicate references related to three states viz. Himachal Pradesh, West Bangal and Hariyana across the time line mentioned. The estimated average production cost of milk for India can be assumed at 20US$ per 100 kg. Industry representative in India indicates that large farms in India can achieve a production cost below 15US$ per 100 kg.

Parameter	Himachal Pradesh (1999-2000)	West Bengal (97-98)	Hariyana (1997-98)
Cost of Production of Milk (Rs. / Kg)	11.18	10.08	7.50
Share of Feed cost to gross cost %	74	65	73
Share of labor cost to gross cost %	20	24	24

Table- 2

(Ref. Parliament question hour 12th August'02 answer by Minister of state Agriculture, GOI Sri Hukumdeo Narayan Yadav)

[2] International Farm Comparison Network (IFCN) -2002
[3] Hemme TA , Review of Milk Production in Bangladesh, Pro Poor Livestock Policy initiative, FAO

6.00. RESULTS

6.01. Distribution of respondents:

The A4 (Guwahati Peri-urban) cluster has the highest numbers (80%) of Traditional small holder farms. The Neo-small holder farms were highest in A5 cluster (Rangia to Barpeta Dist.) (63%) Indicating growth of Neo-small holder dairy farms in the rural areas. Out of 500 studied respondents 52.2 per cent were Traditional small holder farms, 32 were percent are Neo-small holder farms and only 15.80 percent were Medium farm holder farms. (Table 3 & Fig 2)

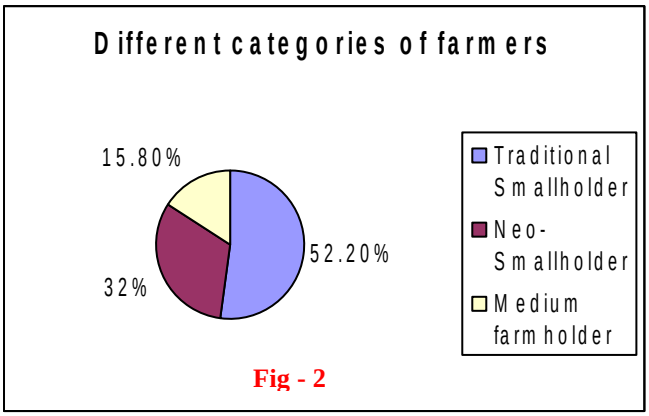


Fig - 2

6.02. Age and sex group of respondent entrepreneurs:

Out of the 500 farm owner respondent majority (48%) were in the age group of 30-50 years. Thirty seven (37%) percent of the respondents were above 50 years where as 15% respondent were young aged bellow 30 years. The results indicate that younger generation farmers (63%) are better inclined to dairy business in Assam than older group. (Table-4)

None of the farm unit surveyed under the study were owned in full or part by women. The majority of the units however, the female members of the owner family were found to contribute around 2-4 hours per day. The cost of labor of women family members was not included in the labor cost.

6.03 Education level of the respondents:

Thirty (30.00%) percent of the respondent's education level was found to be between

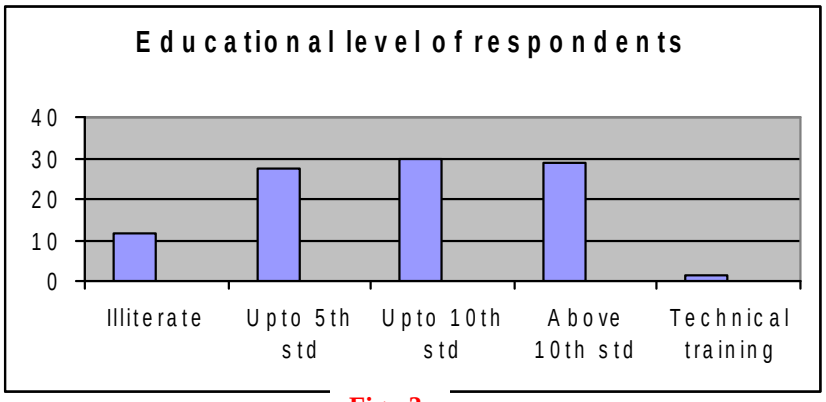


Fig - 3

6th to10th standard. Percentage of respondent's education level between 1 to 5th and above 10th standard was 27.60 and 28.80 respectively. The number of illiterate farmers in each cluster ranged from 6 to 17 with an average of 11.80%. Only 1.40 percent of the respondents had formal technical training on dairy farming indicating either inadequate awareness on need of formal training or limited access to formal training facilities, extension activities within the study area. (Table 5, Fig -3)

6.04 Family structure of the respondents:

Study of family pattern revealed that nuclear family type is more predominant (71.40%) amongst the respondents. Number of family members involved in day to day activities were more in peri-urban cluster of A3 (Average 4.71) than in rural areas. This may be either due to the work culture of predominantly Nepalese ethnic group of peri urban cluster A3 or due to high cost of hired labor in peri urban areas. (Table 6, Fig-4) In all the five clusters the overall average family size varied from 5.76 to 7.28 numbers. The average adult male, female and children in the families were 2.38, 2.08 and 2.72, respectively. (Table 7)

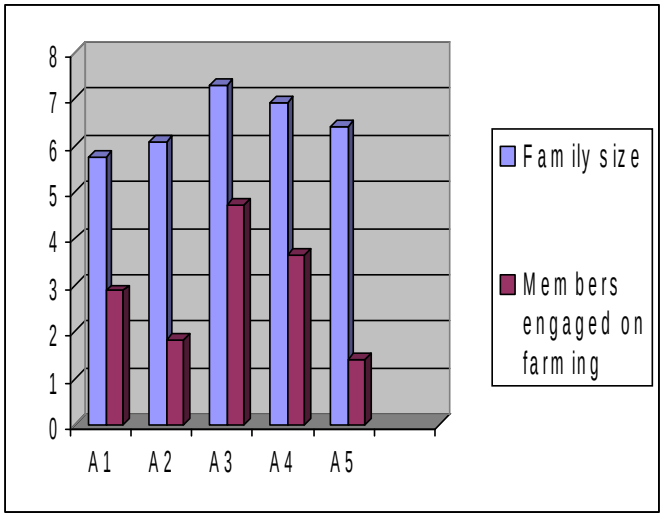


Fig -4 Average family size and members engaged

6.05. Land holding and farm shed area:

Majority of the respondents (92.4%) were found to have the dairy unit on their own land.

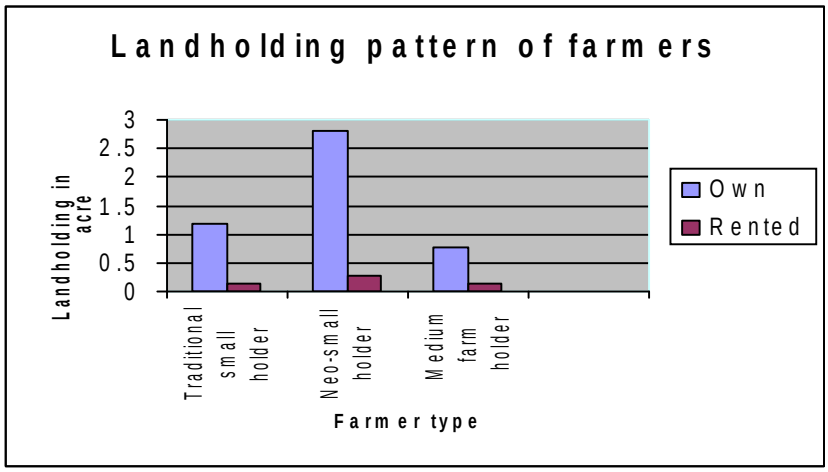
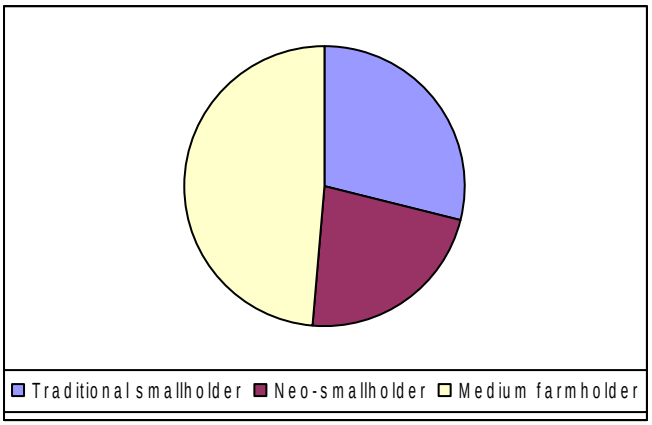


Fig - 5

Average land holding was highest amongst neo small holder farms that are mostly from rural areas (8.54 bighas ~2.81 acre). The average farm shed area is less amongst neo small holder farms which may be either due to relatively small herd size or due to semi-intensive system of farming. (Table 8, Fig. 6)



Only 24.8% of respondents were found to cultivate fodder for feeding their dairy cattle. The practice of cultivating fodder was more prevalent amongst medium holder farmers (36.6%). The practice was found to be less prevalent amongst neo small holder farmers (19.2%) although they have highest farm land holding. This may be due to inadequate awareness regarding importance of green fodder or availability of greens in rural surroundings.

6.06 Farmer's house type

The farmer's housing type was studied to have an idea about the socio-economic status of the farmers in the five studied clusters. Thus considering housing as a criterion, it can be assumed that economic status for farmers belonging to A2 and A1 cluster (viz. Area from

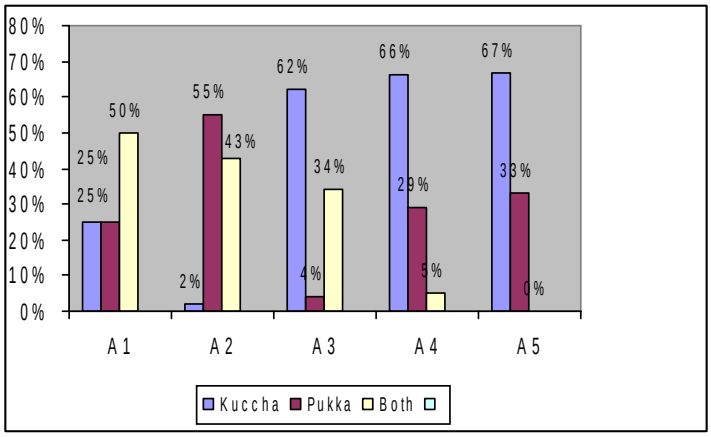


Fig-7 Farmer's house type in different clusters

Sonapur to Amlighat) was better than others. This may be due to the fact that they have better access to resources besides organized marketing system supported by cooperative. However, in case of predominantly hilly terrain of peri urban cluster A3 (Khanapara to Sonapur) people may choose to reside in temporary *kuccha* houses irrespective of economic status. It can be noted that, relatively urban clusters of .A4 (Guwahati metro) and more interior rural cluster of A5 (Rangia to Barpeta) had highest number of "*Kucha*"

houses which may indicates poor economic condition of the farmers of urban areas and interior rural areas. (Table 9, Fig-7)

6.07. Availability of essential amenities:

Irrespective of strata, on an average 81.80 percent of the studied farmer household had the facility of electricity in their house as well as shed. Majority of the farmers (93.00%) had access to nearby school whereas 81.00 percent of the farm households are attached to a motorable road. Availability of medical health care facilities (hospital etc.) was limited to only 77.20 percent farmers and very few farmers (31.80%) had in-house water availability. Around 56.20 percent of the studied farm household had telephone facility (Table 10, Fig-8). Around 68.2% farmers were dependent on external community water supply for their farm activity. Water supply largely being free its cost was not included in the input cost.

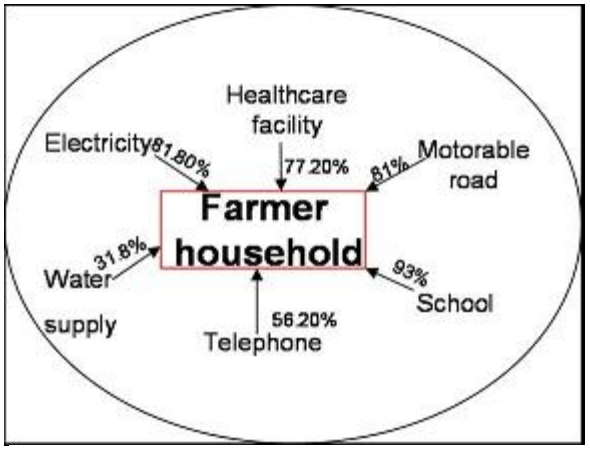


Fig – 8 Availability of basic amenities to

6.08.Herd strength:

Study on herd strength of Traditional smallholder farmers, Neo-smallholder farmers and Medium farm holder farmers revealed that the current average herd strength was 14.07, 10.34 and 24.58, respectively. The respective average initial herd strengths of the three strata of the farmers were 5.31, 4.08 and 5.81 numbers. There was a marked increase in herd strength from the initial herd strength (i.e. at the time of starting the farm) in all three strata of farmers which may indicate propensity for expansion. Different categories of animals holding in a herd by different groups of farmers are presented in Table 11 and represented in figure 9.

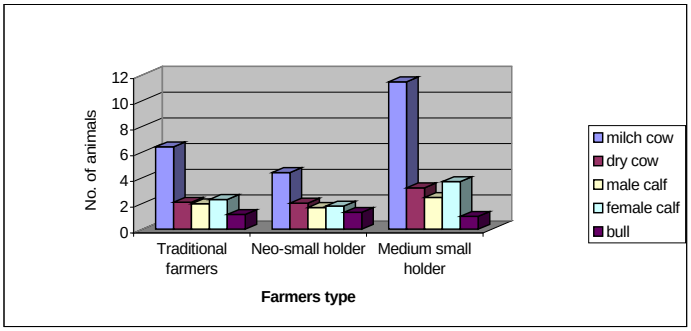


Fig – 9 Average number of animal holding

The average numbers of milch cow in three categories of farmers under study were 6.41, 4.41 and 11.47 respectively, which amounted to 45.56, 42.64 and 46.66 percent of the total herd strength. These values are significantly less than the standard proportion of 70% of animals in milk at all the time. This particular factor could affect the farm profitability and over all cost of milk production significantly. Conversely it can be deduced that strategies of better fertility management would significantly lower the cost of milk production. Comparisons between total herd strength and total milch cow holding in three categories of farmers are represented in fig 10.

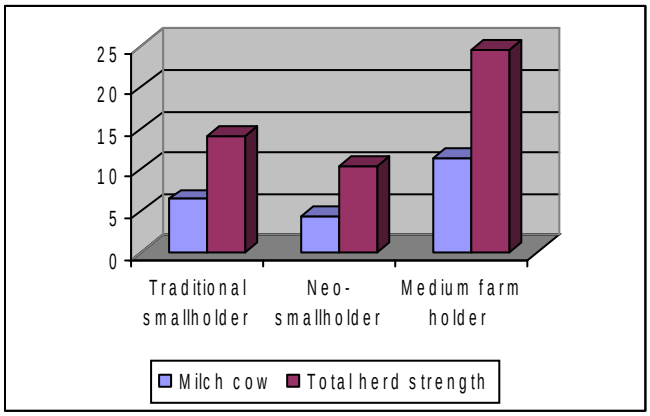


Fig – 10 Total herd strength and milch cow

The average holding of dry cows and heifers were 2.09 (20.8%), 2.03 (7.1%) and 3.22 (13%); 3.39 (24%), 2.82 (27.2%) and 5.50 (22.37%) numbers respectively in three strata of farmers. Considering 10% as the yearly replacement rate, the proportion of heifers in the farms should be around 15-20%, where as the proportion of dry and pregnant cows should be around 25-30%. In most of the farms the proportion of heifers was found to be as per standard norms, which also suggest that the farmers must be following covert culling strategy. The results again indicate problems related with fertility management because of which for extended lactation days the animals are being milked as these were still not pregnant. Therefore the percentage of dry animals in the farms was found to be lower than standard.

The study shows that only 193 (73.95%) numbers of Traditional smallholder farmers, 114 (71.25%) numbers of Neo-smallholder farmers and 66 (83.54%) numbers of Medium farm holder farmers rear female calf with an average respective number of 2.30 (16.34%), 1.80 (17.4%) and 3.69 (15%). This indicates that all the farmers in respective groups are rearing female calf as future replacement stock of their herd.

Only 54 (10.8%) of the total farmers under study were found to rear bull for breeding purpose. This finding is very encouraging and suggest that majority of the farmers are using AI services.

6.09. Breed distribution

Study on breed distribution in different area under study revealed that 57.00 percent farmers rear Jersey cross and rest 43.00 percent rear Holstein Friesian cross as major breed in their herd. Percentage of farmers rearing Jersey was found to be highest in Guwahati peri urban (84.00%) where as the percentage of farmers rearing Holstein Friesian was more in Kamrup rural areas (89.00%) extending from Sonapur to Khetri (89.00%) (Table 12).

The distribution of major breed amongst different group of farmers is presented in Table 13. The study indicates that 131 numbers of Traditional smallholder farmers rear Jersey cross while the rest 130 number of farmer rear Holstein Friesian cross cattle as major breed in their herd indicating almost equal popularity of the concerned breeds amongst the traditional small holders. Amongst the Neo-small holder farmers Jersey crosses were more popular (78%) than the Holstein Friesian cross (22%). Medium farm holder farmers prefer Holstein Friesian cross cattle (63.3%) rather than Jersey crosses (26.7%).

Jersey Cow

Holstein Friesian

6.10. Feeding practices of dairy cattle:

Feed constitutes almost 75% of the total cost in a dairy farm operation. Feeding in cattle comprises of concentrate (feed ingredient with less fiber) and roughage (Green and dry fodder). There is not much variation in feeding practice amongst different group of

respondents. The study recorded that common concentrate ingredients that are fed to the cattle are wheat bran, rice bran, broken rice, mustard oil cake, maize, matikaloi (black gram) and some locally available pulses like hingti, teesee etc. Commercially composed concentrate feed is not much popular amongst farmers. Majority of the farmers prepare concentrate mixture traditionally. The common practice is to mix the different ingredients i.e. wheat bran, mustard oil cake (MOC), Besan (Equal mixture from amongst Maize, broken rice, Hingti, Teesee, Rice polish etc. Parts of composition usually varies depending on the availability and cost in the market) at an approximate ratio (weighing is not done in any of the farm) in a bucket to make a semisolid composition with water and given to the cows individually three times a day (morning, noon and evening).

Structured observation of feeding practices also recorded the fact that the most of the farmers cook broken rice along with the vegetable waste to feed their cattle. There is a general perception that if not cooked it will not be digested properly. This practice assumes significance from the point of view that, scientifically feeding of cooked food is harmful for ruminants (four stomached animal), as they harm the rumen environment by developing acidity and more gas due to high fermentation.

Feeding of a grounded mixture of protein rich feed ingredients traditionally named as “Besan” was recoded in majority of clusters. In number of cases this mixture was found to be grinded to such a finer particle size that technically this could not be digested properly by animals. Majority of respondents were found to be ignorant of losses originating from such practices.

Calves are fed only wheat bran at the rate of 1.02 to 1.35 Kg per day as concentrate ration along with milk, green grasses and straw in the area under study. The average quantity of milk fed to the calves ranged from 0.50 to 0.96 Kg per day until the calf attains 6 months of age. Approximately 2.31 to 5.14 Kg green grass and 1.61 – 2.59 kg of straw was fed to the calves daily. The study showed that feeding of grasses (5.14 Kg) and straws (2.59 Kg) were more in the rural areas of Morigoan district (Amlighat and adjoining areas). The total calf feeding details by different types of farmer is presented in Table 14.

The feeding practice of heifers varies with different types of farmers. Majority of the farmers under study feed only wheat bran with an average of 2.62 Kg per day as major feed ingredient. Besides this, few farmers feed other feed ingredients like maize, rice polish, MOC, Broken rice. *Besan* and *Purabi Dana*. Details presented in Table 15.

Feeding of milch cow is one of the most important aspects in dairy farming. Farm productivity and economics is dependant on feeding of milch cow. The present study revealed that there are not many variations in feeding practices of milch cow amongst different types of farmers.

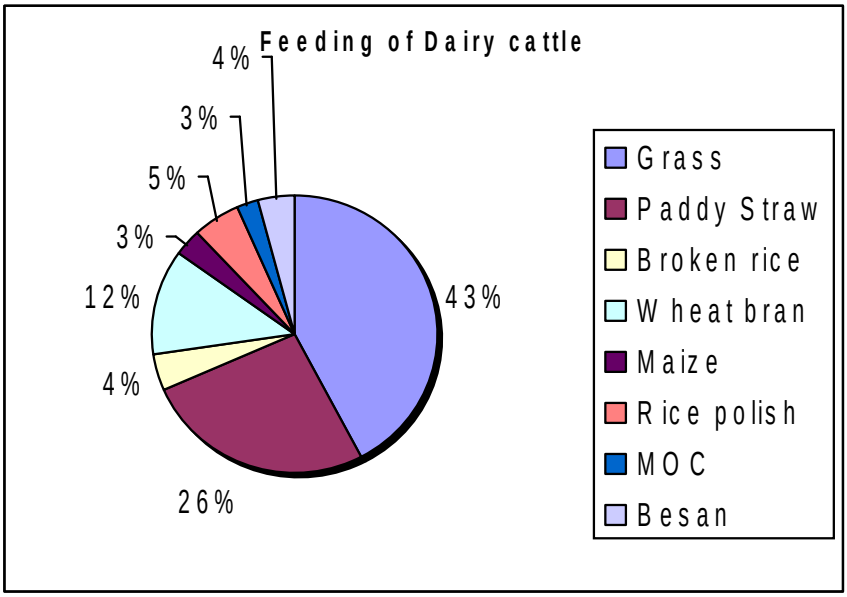


Fig – 11 Feeding of Dairy Cattle

On an average farmers fed around 12.12 Kg grass, 7.55 Kg paddy straw, 3.49 Kg wheat bran, 0.88 Kg Maize, 1.49 Kg Rice polish, 0.74 Kg MOC, 1.29 Kg broken rice and 1.21 Kg Besan daily. Percentage of different feed ingredient fed to milch cow is given in the figure 11. and the details of feeding practices are presented in Table 16.

6.11. Feeding of roughage:

As stated earlier (paragraph 5.05 and table 8) very few farmers (24.8%) cultivate fodder for their livestock. Besides the cultivated fodder, structured observation recorded that respondents used to collects green grass from unprotected forest area, cultivable wasteland, barren and uncultivable land, fallow land and areas under tree plantation and groves and permanent pasture and grazing land. The uncultivated forages are mainly mixed jungle grasses, and certain local grasses like Bahpetia, Katakutura (*Amarantus spinosus*), Kathal Pat (*Artocarpus integrifolia*), Dalgrass, Folic leaf, Dubariban *(Cynodon dactylon*), Meteka pat (*Water hyacinth*), Gameri pat (*Foeniculum ramonchi*), Suba grass, Kayaban, Dimaru pat (*Ficus glomeratus),* Uluban *(Imperata cylindrical*), Jamun leaves, Kanchan, Ghora Neem, Mitha alu leaf (*batatas edulis*), Rice straw, Latagrass, Aligrass, Helochi (*Enhydra fluctuants*), Ahat pat *(Ficus religiosa*), Sugar Cane leaf , banana leaf etc. found abundantly in the state.

Paddy straw is the only source of dry roughage to feed the cattle.


Green grass for cattle


Heap of Paddy straw

The average feed intake per milch cow per day was: concentrate 6.13 Kg, green fodder (mixed grasses from open field or from the nearby jungle) 11.80 Kg and paddy straw 7.79 Kg.

6.12 Prices of different feed ingredients:

Prices of different feed ingredient were found to be dependant with different types of farmer and scale of operation. Price of feed ingredient for farmer who purchases less quantity is more and vice versa. The prices of different concentrate ingredients during the study period at the farmer's doorstep were recorded and presented in Table 17. The respondent farmers reported that the prices of feed ingredients were highly fluctuating. The prices of major feed ingredients are very high because major quantity has to be imported from out side the state. 35.6% of respondent farmers used to purchase commercial branded balanced feed however, majority of them uses the product as one of the ingredient of daily home made concentrate ration instead of considering the same as replacement / substitute of home made concentrate.

6.13. Milk production

The total number of milch cow holding of traditional smallholder farmers, neo-smallholder farmers and medium farm holder farmers were: 1673 (average 6.41), 706 (average 4.41) and 906 (average 11.47) respectively (Table 18). The average daily milk production per animal by different strata of farmers is presented in fig12. The daily average milk production per animal was found to be highest in neo-small holder farmer which may be due to less number of animals and focused management practices.

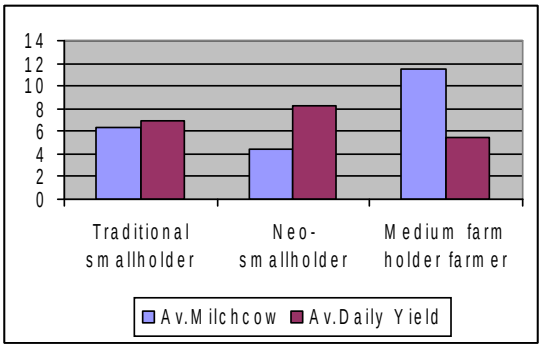


Fig – 12 no of milch cow and avg. daily milk production in different categories of farmers

The average daily yields were 6.88, 8.28 and 5.39 kg per milking animals in three categories of farmers respectively with average lactation length of 303 days.

6.14 Manpower involvement in dairy farming

Major activities in a dairy operation where there is requirement of skilled, semi-skilled and non-skilled labour are milking, feeding, cleaning of cow-shed and animal, cutting and carrying of forages from

outside the farm premise, carrying of feed ingredients from the roadside to the farm premises etc. Besides family labour, the farmers engage labour as permanent, daily and / or contractual basis.

The study showed that the average number of hired labour involved in dairy farming in different strata of farmer were 2.01, 1.33 and 1.61 numbers respectively for traditional small holder , Neo small holder and medium small holder respectively. On an average the involvement of family members in the farming activities were 3.01, 1.82 and 4.78 in the three strata of farmers respectively mentioned above. Details of labour involvement in dairy farm are presented in Table 19.

6.15 Veterinary Cost

Veterinary service is accessible to all the respondents. The per annum average cost of veterinary service (Fee to doctors only) is Rs.1869.16, Rs.1379.53 and Rs.3503.21 respectively in three strata of farmers with an overall average of Rs.1986.37. The other veterinary cost involved in dairy farming are vitamins and supplements, medicines to counteract diseases, vaccines, deworming, artificial insemination, natural service and some emergencies cost. The details of the cost are presented in Table 20.

The average total veterinary costs per annum in three categories of farmers were 10,245.60, 5,931.86 and 18,144.68 respectively with the overall cost of Rs.10, 288.43.

6.16 Farm inventory cost

Findings from structured study and recorded observation revealed that majority of cow sheds of the respondent farmer are of mixed type i.e. Kuccha and / or concrete. The roofing material commonly used is thatch which is considered as one of the good roofing materials to suit the climatic condition of N.E. region. It provides comfort to the animals in extreme hot or cold climate.

Various types of flooring system were observed during the study. They were either made up of wooden planks, concrete or with brick plastered in between. Commonly mangers are made up of wooden planks; very few farmers have concrete mangers at their sheds.

Though all farmer household have drains in their cowshed, but still dung pits are kept very near to the shed. Very few Medium farm holder farmers under study have fully concrete cow shed.

The average construction cost of shed was found to be Rs. 26,616.64, Rs. 22,905.06 and Rs. 37, 288.00 for average herd size of 14.07, 10.34 and 24.58 respectively for three categories of farmers A, B, C respectively. The average cost (all categories together) was Rs. 27, 012.00. The average cost of utensils and instruments used in cowshed are found to Rs.6, 001.63, 5,682.19 and 8,050.00 respectively in three categories of farmers with above mentioned herd size. The average cost of utensils for all categories of farms together is Rs.6577.94. The detail of the farm inventory cost is presented in Table 21.

Annual repairing cost of the shed is Rs.6474.72, Rs.4518.31 and Rs.10598.36 respectively for traditional small holder, neo small holder and medium small holder farmers.

6.17 Marketing of farm produce

6.17.1 Milk Marketing:

Three modes of selling milk were observed in the study:

a. ***Direct selling****:* In this case farmer use to sell their milk to the consumers directly. The amount of milk sold directly by traditional small holder farmers (3.8%) was 843.5 kg with an average price of Rs. 16.83. 6.25% of Neo-small holder farmer sale 1089.50 liters of milk with an average price of Rs.15.95. The direct selling of milk (1933 liters) in case of Medium

farm holder farmer is very less (1.26%), but the average price is higher (Rs.18.17) than the other farmer group (Table 22).

b. ***Co-operative society*:** Those farmers who are the members of the co-operative society use to sale a portion of milk produced to the society. Generally the milk price of co-operative varies from 13.42 to 14.18 rupees (average Rs. 13.91) depending on the two axes basis (fat and SNF basis). The sale of milk to the co-operative society is highest (3037 lts) amongst the Traditional small holder farmers (37.5%) with an average of Rs. 14.13, followed by Neo-small holder farmers (1400.30 liters) with an average price of Rs. 14.18 and the lowest sale (1329 liters) is from Medium farm holder (50.6%) with an average price of Rs. 13.42 (Table 22). This variability indicates that by managing components, quality and volume, producers may have more control over the price.

> A total of 26.29% of total milk produced by the respondents was channelized through cooperative marketing route

c. ***Sale to Middleman*:** Maximum amount of the milk was sold to the middleman. Traditional small holder farmers (138 numbers) transect 5919.50 kg of milk with an average price of Rs.17.07 with middleman. Transaction of Medium and neo-farm holder farmers with middle man was 5555.5 and 826.50 kgs respectively and the respective average prices were Rs 17.32 and Rs. 15.80 (Table 22). Although the respondent farmers got more value of their milk from the middleman, they complained that the

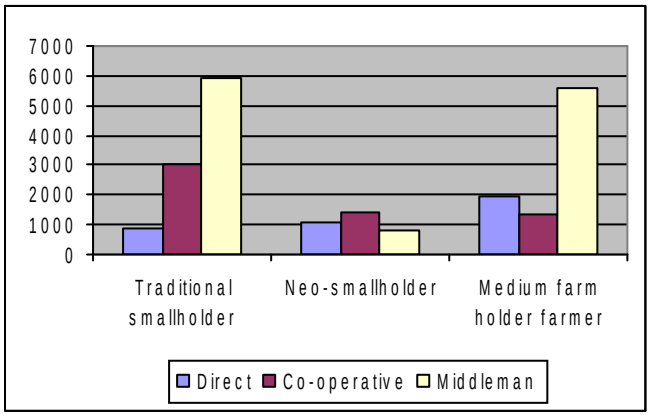


Fig – 13 selling of milk by different categories of farmers

middlemen were not much reliable. Payments were not regular, moreover, in flush season middleman even refused to take all the milk produced by the farmers.

Percentage of total milk produced by respondents that is sold through unorganized (middle man) sector: 56.08%

Variance in milk prices within a limited market (other than where collection is done on two axis basis) is a critical observation. This may be linked to producers' ability to ensure regular supply, personal relations with agents, years in business (influence factor) understanding for previous credit / advances etc.

A total of 216 (43.2%) respondents out of 500 managed to get price 17.5 per lit of milk and above.

Home consumption of milk: On an average 2.52 kg of milk was consumed in the household itself with an average range of 1.78 to 3.45 kg. (Table 22).

6.17.2 Sale of animals:

Sale of animals is one of the major earning sources of dairy farmers. The animal stock provides insurance for the farmer household. Most of the male calves were sold out from farms. The average prices ranged from Rs. 531.43 to Rs. 887.50 depending on the age and health status of the calf. The remaining categories of animal viz. female calf, heifers, milch cow and bull were sold in the event of extreme need of money to the farmer household, or in case of special occasion like marriage etc. There is no standard format amongst farmers for pricing the animals. There is a scope of further investigation to justify critical observations such as:

- In comparison to other categories, less average price of male calves was observed in case of medium holder farmer category (C).
- Prices of heifers for sale were almost twice in case of neo small holder farms than that of other categories.

A trend for high animal prices across class of animals such as calves, heifer etc. was observed in case of neo small holder farms. This may be due to the fact that most of such farms are growing in interior rural areas where availability of quality animal is less. The break up of prices is depicted in Table 23.

6.18 Credit type

The study revealed that farmer's enjoy different credit facilities viz. nationalized banks, private loan (Kabuli) and from their own generated credit system (i.e. group of farmer come together, deposit certain amount of money every month, which is used term by term by each farmer). (Table: 24)

The average maximum amount of money transected by the respondent farmers during the study from bank (33.4%), private loan (6.2%) and others debt (5%) were Rs. 2, 00,000.00, Rs. 5, 00,000.00 and Rs. 17,200.00 respectively (Table24).

An encouraging 33.4 % farmers from among the respondents availed loan from banks.

Another critical observation was that average maximum amount transacted with private lending was more than that of bank transaction.

These observations point out that, although the farmers are in active dairy business, their access to credit from public institutions is considerably less than private lenders.

6.19. Cost of milk production:

Cost of milk production is a highly variable figure depending upon many factors under different areas and condition. The costs of various inputs that go in determining the overall cost of milk production have been presented in Table 25 bellow.

The average cost of milk production was found to be Rs. 13.24 (29 US$ per 100 kg), Rs. 14.54 (32US$ per 100 kg) and Rs. 10.57 (23 US$ per 100 kg) per kg of milk in Traditional small holder farmers, Neo-small holder farmers and Medium farm holder farmers respectively**.** The overall average cost of production being Rs.12.95 (28US$ per 100 kg) per kg of milk.

The highest cost of production of Rs.14.54 per liter was recorded amongst Neo-small holder farmers; this may be due to the less number of milch animals (average 4.41 per household) and higher feed cost (94.63 %) as observed in rural areas where these farms

are predominant. Generally, the cost of feed should be around 70 percent of the total cost in a dairy farm.

The finding of the present study is more or less comparable to farmers in other parts of the country. The cost of per kg milk production however is much higher when compared with dairy developed countries. This may be due to lower herd strength of productive animals, higher cost of feed (it may be due to more reliance on concentrate feed rather than fodder) and comparatively less milk production of the milch animals under the study.

Table 25 : Cost of milk production

Farmers type		A	B	C	overall
1. Capital Investment					
	1.1.Value of milch cow				
	1.1.1.av. No of animal	6.41	4.41	11.47	4.99
	1.1.2.no. of farmers	261	160	79	500
	1.1.3.Av. Price	24940	20616	29518	25841
	total cost of animal	41724869	14546650	26747145	64473295
	1.2.Av.Cost of shed	11457.59	16697.75	16051.26	14355.28
	1.3.Av.Cost of utensil	2968.41	3231.97	3957.43	3211.44
	1.4.Av.Cost of instrument	3033.22	2450.22	4092.57	3016.03
Total		**41742329**	**14569030**	**26771247**	**64493878**
2.Variable cost					
	2.1.Feed cost(daily)	152733.2	86591.55	49957.58	289282.3
	Total annual feed cost	**46278160**	**26237240**	**15137147**	**87652546**
	2.2.Veterinary cost				
	2.2.1.vety fee	1869.16	1379.53	3503.2	1986.37
	2.2.2.Medicine	4684.22	2411.06	9478.87	4731.28
	2.2.3.Deworming	816	382.04	858.15	701.31
	2.2.4.Veccine	725.72	495.04	1551.13	820.22

	2.2.5.AI	1049.12		697.52		1953.47		1096.24
	2.2.6. Natural service	758.71		300		537.86		640.77
	2.2.7.Any other	342.67		266.67		262		312.24
	Total annual Vety. Cost:	**10245.6**		**5931.86**		**18144.68**		**10288.43**
3.Shed repairing cost		**6474.72**		**4518.31**		**10598.36**		**6838.06**
4.Labour cost	av. no. of labour	2.01		1.325		1.607		1.73
	Av. pay(1676.37)							
	Total labour cost	3369.504		2221.19		2693.927		2900.12
	annual labour cost	**33565.8**		**22126.71**		**26835.94**		**28889.96**
5.Depreciation (10% of capital investment)		**4174233**		**1456903**		**2677125**		**6449388**
6. Total cost	**2+3+4+5**	**50502679**		**27726719**		**17869850**		**94147950**
7. **Total milk yield(daily)**		11496.5		5846		4890.5		22233
7.1	**Milk yield of total lactation length**	**3483440**		**1771338**		**1481822**		**6736599**
	Av. dry day=62days							
	lactation length=303							
8. Income other than milk								
i. Value of calf		998951.4		536002.6		384679.6		1848612
ii. Sale of Farm Yard Manure (FMY)[4]		3346020		1411200		1812260		4990000
iii. Sale of gunny bag[5]		37154.88		19437.29		10011.58		66604
	Total	**4382126**		**1966640**		**2206951**		**6905216**
9. Total cost – Income other than milk 6-8		**46120552**		**25760080**		**15662899**		**87242734**
Cost of per liter milk production 9 / 7.1		**13.24**		**14.543**		**10.57**		**12.951**

[4] Estimated @4 ton per cow per year and @ Rs.500.00 per ton.
[5] Estimated @13.3 bags per ton of feed and @Rs.5.00 per bag.

Table 26. Dairy Farm economy

	Farmers' type	A (261)	B (160)	C (79)	
1.Opening stock (Estimated value of Animals)		**53534920.44**	**20838475.49**	**34378116.37**	
2. Fixed Cost	2.1 Av. Cost of shed	11457.59	16697.75	16051.26	
	2.2. Av. Cost of utensil & instrument	6001.63	5682.19	8050	
	Total (Av Cost x Number of Farms)	**4556856.42**	**5841164.34**	**6290428.86**	
3.Variable cost	3.1.Total feed cost Per day Av consumption x No days x No Of animal for each ingredient	**62661242.02**	**35036745.32**	**20084826.86**	
	3.2. Av Veterinary cost	10245.6	5931.86	18144.68	
	Sub Total of 3.2	**2674101.6**	**949097.6**	**1433429.72**	
	3.3. Annual labor cost	33565.8	22126.7	26835.94	
	Sub total 3.3	**8760673.8**	**3540272**	**2120039.26**	
	3.4.Annual shed repairing cost	6474.72	4518.31	10598.36	
	Sub total 3.4	**1689901.92**	**1179278.91**	**2766171.96**	
	Total variable cost	**75785919.34**	**40705393.83**	**26404467.8**	
	Individual investment	290367.507	254408.7115	334233.7696	
4. Return	4.1. Milk				
	Annual milk yield	4196222.5	2133790	1785032.5	
	Return on milk @ Rs.17.5 per lit (Judgmental price estimation Considering 43.2% respondents Getting price of 17.5 and Above)	73433893.75	37341325	31238068.75	

	4.2.Dung (Calculated considering Technical assumption of dung Production by each adult cattle)	5673260	2530540	3066780	
	4.3 Value on gunny bag (Considering 50 Kg gunny bag)	53649.525	2530540	13466.31	
	4.4 Value on calf	1036331.75	545594.06	288314.6	
	Total Return	**80197135.03**	**42947999.06**	**34606629.66**	
5. Depreciation @ 10% of fixed cost		455685.642	584116.434	629042.886	
6. Present worth of benefit (Total Return – Depreciation)		79741449.38	42363882.63	33977586.77	156082919
7.Net return	**4- (3+5)**	**3955530.047**	**1658488.793**	**7573118.977**	
Benefit cost Ratio	**BCR= Present worth of benefit / present worth of cost**	**1.05**	**1.04**	**1.29**	**1.09**
% Of feed cost		82.68	86.07	76.07	82.43
% Of veterinary cost		3.53	2.33	5.43	3.54
% Of labor cost		11.56	8.70	8.03	10.10
% Of shed repairing		2.23	2.90	10.48	3.94

6.20. Dairy farm economy and benefit cost ratio (BCR):

The benefit cost ratio (BCR) for Traditional small holder farmers, Neo-small holder farmers and Medium farm holder farmers were calculated as 1.05, 1.04 and 1.29 respectively. The overall BCR being 1.09.

The Medium farm holder farmers had a higher net return as well as better BCR in comparison to the other two groups. This may be due to the fact that in this group of farmer's the feed cost constitutes less percentage (76.07%) in comparison to the other two groups (82.68% and 86.07% respectively) and also having more average numbers of milch animals.

7.00. Physical and Bacteriological quality of milk produced by the respondent's farmers in the existing cost:

To study the quality of milk produced by the respondent's farmers / farms with current cost, a total of 50 representative samples were tested. (Please refer methodology)

Table 27: Physical and Bacteriological quality of milk:

Area	Fat (Av%)	SNF (Av%)	Protein (Av%)	Specific gravity (Av%)	Added water (Av%)	Total viable count	MBR (%)	Spore count
A1	5.62 (4.89-6.97)	8.40 (7.39-9.04)	2.98 (2.47-3.27)	1.026 (1.022 – 1.029)	0	1,51,200	G=0 F=20 P=80	Nil
A2	4.30 (2.25-8.42)	7.56 (6.61-8.39)	2.54 (2.11-2.99)	1.025 (1.018 – 1.029)	5.20 (0-13)	1,04,400	G=0 F=20 P=80	-do-
A3	3.67 (2.88-5.53)	7.73 (7.30-8.10)	2.72 (2.56-2.87)	1.026 (1.025 -1.027)	3.20 (0-8)	2,19,000	G=100 F=0 P=0	-do-
A4	3.67 (2.88-5.53)	7.16 (4.61-9.06)	2.58 (1.58-3.27)	1.023 (1.014 -1.029)	12.80 (0-42)	1,59,000	G=0 F=80 P=20	-do-
A5	4.95 (2.30-7.85)	8.31 (7.68-9.04)	2.91 (2.53-3.16)	1.027 (1.022 -1.029)	1 (0-4)	2,19,800	G=60 F=0 P=40	-do-
Normal	HF-3.4 Jr-5.37	8.5	HF-3.22 Jr- 3.92	1.027	-	-	-	-

SNF: Solid Not fat; MBR: Methylene Blue Reduction; G: good, F: fair, P: poor

A comparison of the above table with cluster-wise breed distribution revealed that fat percentage was within normal range for cluster A1 and A2 only i.e. covering area

extending from Khetri (Parts of Kamrup rural) to Amlighat (Morigoan Dist). In two samples the fat percentage (8.42 and 7.85%) was found to be abnormally higher, it may be presumed that in these two samples butter oil or ghee might have been used as adulterant besides addition of water. All the five cluster studied showed lower level of SNF and protein content. The specific gravity of milk sample was found to be normal only in A5 group. Different percentage of adulteration with water was noticed in the four groups except the A1 group. Low fat and SNF in milk in general indicated poor price realization by farmers when milk is procured by two axis method. Failure of cooperatives to procure milk locally as observed in the state may be linked to this finding.

The total viable count in the present samples revealed that the milk of A1, A2 and A4 groups were of very good quality (viable count not exceeding 2,00,000), whereas the milk of A3 and A5 groups could be graded as bacteriologically good (viable count ranges from 2,00,000 to 10,00,000).

Based on the de-colorization time in the Methylene Blue Test (MBR), the samples may be graded as follows –

Excellent	-	Nil
Good	-	32%
Fair	-	24%
Poor	-	44%

The positive growth was recorded in all the samples in the multiple tube count done for Coliform bacilli (Mac Conckey's broth) at a dilution of 1:10, 1:100 and 1:1000 indicating possible feacal contamination. Such contamination generally originates from unhygienic handling and farm surroundings.

The finding of the present study, contrary to general believe that in the absence of cold storage chains and sanitary condition under which individual animals are hand milked, the bacteriological quality of milk from all the production system was found to be good an acceptable. This may be because of the fact that the time taken from production to marketing is comparatively less in the clusters under study than in case of interior rural areas.

8.00. Identified intervening notes:

The study revealed following specific intervening notes to reduce cost of production and improve quality of milk.

1. **Ensuring genetic improvement for enhanced per animal productivity:** The study recorded low per animal productivity as a predominant factor for increased cost of production in commercial operations. Fortunately, from our study it appears that farmer acceptability for AI, if made available on their door step is quite high. High genetic quality progeny tested bull semen (Dams milk yield more than 10000kg per lactation) is not available to these farmers. It is therefore necessary that elite dams with the farmers are identified and inseminated with imported high genetic quality semen so that rapid genetic progression could be achieved. For other animals appropriate breeding programs on scientific lines should be implemented. Our study also reiterate that farmers are ready to pay for input cost and hence efforts should be made to deliver AI services to the farmers under appropriate service delivery systems.
2. **Record keeping:** Animal performance recording is accepted core requirement for scientific dairy operations as the veterinary and breeding services can be planned based on dynamic data analysis. From the study it is evident that, farmers are not generally inclined to keep records hence; an alternate system wherein the service providers maintain the performance record should be popularized and implemented. This would also increase market value of animals.
3. **Practice of culling:** Number of producing (milch) animals per farm was much less (around 45%) than the standard of 70% of the entire herd at any point of time. There is ample scope of cost reduction by minimizing feeding expenses on un-productive animals. Keeping appropriate number of quality animals in the assigned shed area will also enhance comfort to animals which can directly be related to improve per animal productivity.
4. **Ensuring Animal availability and income from other than milk**: From the study it is evident that the income generated from sale of animals in the farm under study was around 1% of total return. These suggest that calf mortality is probably very high and those surviving calves are not marketed in an organized

way. It would therefore be beneficial to farmers if efforts are made to reduce calf mortality which in effect is a management problem. Recorded variance in prices of various categories of animals across studied groups which indicate need of organized animal market. Other than milk income e.g. income from sale of male calves, cow dung etc. was found to be crucial for controlling the cost of production

5. **Ensuring availability of continuous veterinary and animal husbandry service:** From the study it is evident that the farmers are ready to pay the cost of health care if provided on farm. The health care cost paid by the farmers under the study was found to be much higher comparison to herd strength. The cost can be reduced and quality can be improved by developing herd health delivery system based on continuity, contract and target oriented basket of services.

6. **Alternative feeding system focused at fodder:** Form the study it is evident that majority of dairy farmers do not own sizable farm land which can be used for fodder cultivation. It is therefore suggested that a platform be created wherein the agriculture farmers having enough land can be encouraged to grow fodder as cash crops which in tern can be contracted to organized dairy farmers. Production cost was found to be much less for medium scale farms feeding higher amount of green fodder.

7. **Ensuring effective land management:** The study recorded a very high ownership of land amongst the respondents. Structured observation made during the study reveled that there is scope of improvement in housing both in terms of land utilization and economic construction of shed. Planned use of surplus land in the farm premises for other agriculture income can enhance unit earning thus reducing cost of production.

8. **Better management of heifer and popularization of the practice of replacement from own stock:** Nearly 74% of the sample indicated that they rear heifer for future replacement. A good market for heifer as observed in the study (refer cost of animals) justifies investment on heifer. The practice is seen more in case of medium holder farms (83.54%) showing relatively less cost of production. Sale of heifer or opportunity cost of replacement with own heifer can contribute

substantially to other than milk income of the units thus reducing cost of production.

9. **Popularization of scientific Feeding practice:** The study observed few traditional feeding practices e.g. cooking feed, feeding of fine grinded feed mixture etc. which is unscientific. There is ample scope for cost reduction by ensuring better utilization of costly feed. This can be achieved by improving feeding system. Improvement of feeding system can also be directly linked to production of quality milk.

10. **Intelligent input procurement:** Cost on feed was highest for less experienced Neo small holder farms in comparison to other groups. Understanding of market and quality of feed ingredients may have supported other groups for intelligent input procurement which has direct relevance to cost of production.

11. **Better management of labor:** The study recorded high family involvement, and less number of hired labors in medium holder farms (producing milk at lower cost) than in other groups through they have more animals. Similarly involvement of family labor was found to be less in case of neo-small holder farms producing milk at high cost. This indicates scope of cost reduction through better labor management and personal involvement.

12. **Focus on farm environment management for quality production:** The study recorded that though majority farmer household have drains alongside their cowshed, they are being forced to keep dung pits near to the shed in absence of facility for waste disposal or their economic use. It can be assumed that environment surrounding farms is the root cause for substandard milk quality with colliform bacilli.

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