International Journal of Engineering Research & Management Technology ISSN: 2348-4039
November-2014 Volume 1, Issue-6
Email: editor@ijermt.org www.ijermt

A Brief Study of Small Dairy Farming in India — Constraints and Development Opportunities

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ABSTRACT:
The Indian dairy industry has been through an evolution right from the British era till today. It has come a long way over the years from a milk production volume of 55.7 million tons in 1991-92 to 157.26 million tons in 2014. Steadily and firmly, it has cruised to become numerouno in the list of milk producing countries and the smallholder milk producers have scripted this success story. Today, the Indian Dairy industry stands at a mammoth size of US$ 70 billion. Given the highest mulch bovine population of 115.487 million in the world, India exhibits tremendous potential to further strengthen its position in the world dairy market. The operation flood program promoted and implemented by the National Dairy Development Board (NDDB) has been instrumental in bringing about a white revolution in India. Changing lifestyle, feeding habits and urban culture has somewhat effected the transition of the Indian dairy Industry into a more of a demand driven, highly diversified and exciting business proposition. The country accounts for more than 15 per cent of world's total milk production and is also the world's largest consumer base of dairy products, consuming almost all of its own milk production. Dairying has been regarded as one of the activities that could contribute to alleviating the poverty and unemployment especially in the drought - prone and rain - fed areas. In India, about three - fourth of the population live in rural areas and about 38 per cent of them are poor. Therefore among these people, as well as the large vegetarian segment of the country's population, dairy products provide a critical source of nutrition and animal protein to millions of people in India. Prior to year 2000, India was not noticed by most international dairy companies, as the country was neither an active importer nor an exporter of dairy products. Currently, the Indian dairy market is growing at an annual rate of 7 per cent. Despite the increase in production, a demand supply gap has become imminent in the dairy industry due to the changing consumption habits, dynamic demographic patterns, and the rapid urbanization of rural India. This means that there is an urgent need for the growth rate of the dairy sector to match the rapidly growing Indian economy.

KEY WORDS: Indian dairy, National Dairy Development Board

STATE OF THE ART:
Management around social and environmental limitations has been the key to success of smallholder dairying industries. Examples include selection of cattle suited to individual environments and management systems, such as the countless generations that produced the stable breeds in India, and cultural behaviours that enhance animal welfare. The use of buffalo for milk production in India may in fact be seen as a broadening of the concept of selection. In that case, 'selecting' a different species and then selecting for genetic characteristics within that species has allowed production from a wider range of physical environments associated with socio-economic demands for other outputs, such as draught and meat. As distinct from the past, the use of new techniques and knowledge in genetic upgrading now allows the production of suitable animals from cross-breeding of local with temperate dairy breeds, cross-breeding of

local with locally improved dairy breeds, and selection within local breeds. Artificial insemination has been widely proven for rapid upgrading of Asian dairy breeds. However, such programmes rely on constant evaluation of milk output and hence require sound herd recording systems (Na Phuket, 1999). Smallholder production systems show low outputs of milk per animal. When analyzed on a cost benefit basis, the use of by-products or other waste as feed, and multiple outputs such as draught and meat production are seen to raise the efficiency of smallholder production systems above those of dairying monocultures. In addition, feeding technologies now allow increases in milk production by matching nutrition to physiological state, age, and management of draught requirements (Zerbini and Wold, 1999). Integration of dairy farming with crop production systems is foreign to western mono-cultural approaches. Models of an integrated farming system indicate incremental benefits from dairying as an adjunct to cropping, draught, meat, pig production, and a range of other farm-based enterprises (Remenyi, 1985). However, models do not facilitate simple economic rate of return analyses that partitioned all inputs between industries. The problem is common to 'alternative' agricultural approaches now seen as synergistic with conventional development technologies (Cornell University, 1999). Many agricultural systems in highly populous areas may prove unsustainable, although they must be tolerated in the short term to overcome peaks in human population growth and the development of new technological innovations (Conway, 1984). Low-input integrated farming systems offer such higher production as they circulate nutrients with high efficiency while incidentally accumulating few toxic products in any one area. Systems developed in integrated dairy production in highly populous areas as Indonesia, China, Viet Nam and India provide an indication of the probable sustainability of these systems (Egan, 1999). Dairy industries based on high cow turnover rates, high veterinary and metabolic enhancing chemical inputs, and concentration of waste in more developed countries appear to be less sustainable (Falvey, 1999). The future for smallholder dairy development will rely on continued education of smallholders and research. Research must acknowledge integrated systems and the role of smallholders, while focusing on such technical parameters as; breeding systems, herd recording, feeding systems, production of breeds, the multiple uses of animals, management of reproduction and health, and milk harvesting systems (Cornell University, 1999). The strong social research requirement of smallholder dairying contrasts with that of dairy research in more developed countries while the technical elements share common scientific bases. The future for individual countries in smallholder dairy production is likely to vary according to the stage of development of a country, the relative levels of market protection, and an understanding of smallholder dairying by international development agencies (Chantalakhana, 1999).

DAIRY PRODUCTION SYSTEMS:

There are two major mixed crop-livestock systems in smallholder farming — sedentary and migratory. In the sedentary system, livestock are kept in a village throughout the year. Almost all the smallholder dairy farms in the sample villages operated sedentary management. Dairy animals, along with all other livestock, play a crucial role in supplying manure to the smallholders' farms, which is one of the most important inputs in mountain farming and critical for sustainability of the farming system. Draught animal power (DAP) is another input that is critical to productivity and sustainability of mountain agriculture (Singh 1998a), and dairy production systems involving cows also supply DAP. Farmers rearing dairy cattle use the bullocks at their own farms and supplement family income through hiring out ploughs and selling bullocks. The system may be referred to as a dairy-manure-draught cattle production system. One noteworthy fact about dairy farming in Uttaranchal is that, unlike in many mountain areas in the Hindu Kush-Himalayan region, it is not associated with meat production, a characteristic shared by many other mountain areas in India. It is also true of cattle-based (but not buffalo-based) dairy farming in Nepal. In India and Nepal, cows are generally considered sacred animals. In order to develop dairy enterprise in areas such as these, the unique cultural setting must be taken into consideration.

SPECIES AND BREEDS OF DAIRY ANIMALS:

Cattle and buffalo are basically the only dairy species throughout the Uttaranchal hills. The use of goats, sheep, and yaks as dairy animals is extremely rare. Overall the bovine population comprised 72% of the total livestock in the sample villages, 63% in the Almora villages and 82% in the Nainital villages, the remainder being goats. Fifty per cent of all livestock in both areas were cattle, with similar proportions of bullocks (20%), cows (18%), and infants (12%). The buffalo proportion in the Almora villages (14%) was, however, just less than half of that in the Nainital villages (33%). Nainital district lies adjacent to the Terai area of the central Himalayas and some of it extends into the plains. Rearing of buffalo in this milkshed is more conducive than in Almora, which is located exclusively in the mountain areas lying towards the inner Himalayas. On average each household had 5.9 head of livestock (of which 3 were cattle). The milkshed herd size in Almora (7.90) was twice that in Nainital, as a result of the substantially higher population of goats in the former.

BREEDS:

All buffalo in the region are indigenous; the dairy species are largely a mixture of improved Murrah and Bhadawari, with a possible mixture of other indigenous (Indian) breeds imported from the plains, but now well adapted to mountain conditions. The presence of pure Murrah, considered to be the highest-yielding breed, or other pure or improved breeds, is rare. Moreover, there have been no systematic institutional efforts to improve or upgrade buffalo breeds in the area. Only cattle have been targeted for improvement. Indigenous breeds constitute about 93% of the cattle population and crossbreeds for about 7%. According to the latest official Livestock Census (1993), there were 115,345 crossbred cattle, or less than 6% of the total cattle population (1,978,331), in Uttaranchal. Amongst the crossbred cattle population, females comprised 62% (Animal Husbandry Department 1998).

CHARACTERISTICS OF DAIRY FARMS:

Dairy farm size can be defined as follows: small: a dairy farm with a maximum dairy animal equivalent of two cow units (CUs); medium: a dairy farm with three to four CUs; large: a dairy farm with five or more CUs. The overwhelming majority of dairy farmers operated on small and medium scales of production (45% and 47%, respectively). Only 8% of farms in the sample villages had were than five CUs (Figure 1).

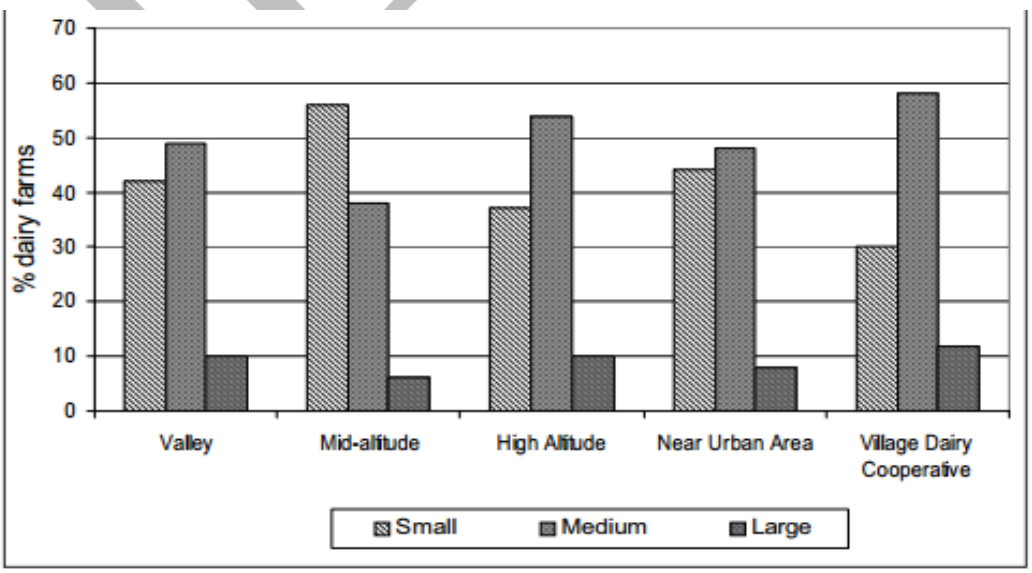

Fig. 1 : Scale of dairy production at different locations

Many of the characteristics relating to a dairy farm depend upon its location. Composition and size of livestock (including the dairy livestock), feeding, disease management, breeding, on-farm processing, marketing of dairy products, and many other aspects relating to the success or failure of a dairy farm also depend on its location. Around two-thirds of the dairy farms at all locations followed a mixed cattle-buffalobased dairy production system. Preference for such a system is remarkably high in the VDCs. In addition to manure production, which is vital for maintaining soil fertility, the cows produce bullocks for draught power, which is essential for mountain agriculture, and supply some milk mainly for family consumption. The buffalo yield more milk for cash income. A relatively high proportion of the farms (15-25%) followed a pure buffalo- based production system, indicating a preference for market-oriented dairy management. If a dairy farm is located near a prominent town or city, its management is likely to be market-oriented. There is a higher chance of these dairy farms being semi-intensive, depending on the cost and availability of inputs, such as concentrate feed and medicines. The overall performance of a dairy farm in the mountains, depends on a complex mix of factors. If a dairy farmer belongs to a milk society, the farm is linked with the market. Institutional programmes based on cooperative dairy development, facilitating the dairy farmers to market their produce, appear to be the most important factor for the success of a dairy farm, often irrespective of its location.

ANIMAL FEED RESOURCES & NATURAL RESOURCE MANAGEMENT:

Due to the availability of common property resources (CPRs) in mountain areas, local inhabitants do not customarily depend on cultivated fodder. Even large landholders find cereals and other cash crops to be far more remunerative than cultivated fodder crops. According to the Animal Husbandry Department (1998), a CU's requirements for green and dry fodder are 24 and 6 kg/day, respectively. In the area of the survey, the requirement in each village was far more than the availability of fodder. The average shortage of green fodder was 26% and of dry fodder 77%. From this fodder balance, it is clear that the whole livestock population in Uttaranchal is underfed. This situation obviously has a major influence on the performance of livestock in the region. The overall paucity of green and dry fodder, according to the Animal Husbandry Department (1998), is about 68% each. The green fodder being provided to the livestock is not 'available' fodder. In fact, the bulk of it is the fodder that is extracted from the CPRs. Its availability, to a great extent, depends on the quantity of the fodder cut from the forest or grazed from grazing land. The bulk of the dry fodder, however, is that grown on cropland, and its availability is equivalent to its production. Livestock farmers have their own ways of responding to the scarcity of fodder. They may feed a large part of the available nutritive fodder to a dairy animal in milk, not provide any fodder to ovine species tied to the stall at night, and may give some cereal and purchased concentrate to dairy animals. In many mountain areas, alternative management systems are evolving, including stall feeding, the planting of fodder trees close to the homestead, and cultivating grasses on private land unsuitable for growing food crops (Tulachan and Neupane 1999). Fodder supplies to livestock in the region could be improved substantially by increasing the productivity of cropland, especially through agroforestry systems, and by efficient management of CPRs. Alterations to feeding management inside the animal shed would save fodder from wastage.

Most of the concentrate feed used for dairy animals is home produced. However, the Milk Unions also supply concentrate animal feed to members of VDCs. The cost of the feed is deducted from the members' share of the remuneration from the sale of the milk. Barnyard millet, barley, black soybeans, wheat bran, and wheat flour constitute the home-grown feed. A dairy farm in the sampled villages provided, on average, only 100 kg concentrate feed to the dairy animals in a year, the bulk of which (77 kg) was produced at home. A dairy farm in a VDC fed much more concentrate, both home produced and purchased, to the dairy animals than other farms. Overall, concentrate feeding per head per day was higher in a VDC village than in other villages, though still far below the standards for dairy animal feeding. The proportion of purchased feed used was much larger in a VDC village – some 32%. Concentrate feed is generally fed to animals in milk, and often monopolised by buffalo in lactation stage. The overall trend is that market-oriented dairy farms are

more aware of concentrate feeding because the cost incurred on feeding is likely to return as household income through increased milk productivity.

LIVESTOCK HEALTH SERVICES:

Health management is one of the most important aspects of dairy development. Healthy animals are capable of producing milk to the extent of their inherent productive capacity. The role of dairy farmers in health management is crucial, for animal health largely depends on housing management, feeding practices, and understanding and dealing with various diseases affecting the livestock. The main diseases of economic importance affecting dairy stock in the region are footand-mouth disease, haemorrhagic scepticaemia (HS), black quarter (BQ), tuberculosis, brucellosis, mastitis, haematuria, bloat, and parasitic diseases. Foot-and-mouth disease, HS, and BQ generally occur in dairy animals in areas at lower altitudes, perhaps due to a favourable environment for the pathogens. Black quarter occurs in summer due to bacterial infection.

Foot-and-mouth, which is a viral disease, affects livestock particularly in the rainy season. Haemorrhagic scepticaemia, which is a bacterial disease, generally occurs in winter. Tuberculosis can occur at any seasonal and animals can be affected without being noticed. Mastitis is common in high-yielding animals. Brucellosis, also a bacterial disease, generally affects the dairy animals at seven months' pregnancy. Haematuria is caused by 3-hydroxy-L-kynurenin in bracken fern found predominantly at high altitudes. Bloat occurs in the rainy season, particularly at high and mid-altitudes, wherever there is a large leguminous component in the vegetation of grazing lands.

MARKETING COST, MARGINS, AND PRICE SPREAD:

Price spread — the difference between the price paid by the ultimate consumer and the price received by the producer — normally reflects the extent of the services given and their costs (labour costs, transportation costs, equipment costs, spoilage, and degree of risks involved in marketing (Singh 1999)). In local markets producers often have no marketing margin or costs.

If the institutions and other intermediaries involved in the marketing of dairy products are to be sustainable, they have to make certain profits after investing in the various activities and functions necessary for milk marketing. Important factors that influence and determine marketing margins are the type of dairy product, marketing channel, agency involved, mode of transportation, distance between a dairy farm and the market place, and ongoing trends in the market.

The data on price spread and marketing margins for milk in the study area show that at 86% the producers' share in the price paid by the consumer was considerably higher for direct sale than in other channels. There was no expenditure on transportation or chilling; the costs were for handling (9%), and such things as depreciation on utensils, a total of 14%. The producer's share in the consumer price was 71% when milk was marketed through traders and 79% when it was marketed through the producer-DMU-consumer channel. Costs incurred on transportation, handling, and other functions in the producer-trader consumer channel accounted for 4% of the consumer's price; the trader's margin was 25%. Costs incurred on the same functions and chilling in milk marketed through DMUs amount to 10%, and the DMU margin was 10%. Overall the marketing costs were highest for direct sale because of the small quantities involved, and next highest for DMUs because of the transportation costs involved in collecting from scattered villages over large distances.

The traders' marketing costs were much lower, but the profit margin higher. Overall the net price received by the farmer from the DMU was the same as for direct sale, reflecting a higher price to the consumer of DMU milk, and lower from tradrs because of the trader profit margin.

ECONOMICS OF MILK PRODUCTION:

Production costs were compared for both the dairy animals (cows and buffalo) and the three main production systems (traditional & semi-urban) averaged over all locations (Table 1).

Table-1
ECONOMIC RETURNS IN SMALLHOLDER DAIRY PRODUCTION SYSTEMS (RS./ANIMAL/YEAR):

	Traditional		Semi-urban	
	Cow	**Buffalo**	**Cow**	**Buffalo**
Variable cost				
Fodder	1000	3560	1040	3560
Concentrate	20	150	20	140
Labour	2020	1450	2760	1450
Miscellaneous	100	200	180	250
Sub-Total	3140	5360	4000	5400
Fixed Costs				
Interest	350	1500	400	1500
Depreciation	250	1000	640	1000
Sub-total	600	2500	1040	2500
Total Maintenance Cost	3740	7860	5040	7900
Economics Gains				
Milk	4590	13360	5900	16030
Farmyard manure	1500	3000	1500	3000
Total grains	6090	16360	7400	19030
Net margin per animal	2350	8500	2360	11130
Net margin per litre	487	764	380	833
Return to family	3020	5010	3800	5010

The greatest cost in the maintenance of a dairy animal, particularly in the plains, is usually the cost of feed. But in mountain areas, like those of the Uttar Pradesh Himalayas, the bulk of the fodder comes from CPRs free of charge. Therefore fresh feed costs were not included in the overall maintenance costs apart from the costs incurred on labour for collecting the fodder from the CPRs. Dry fodder comes mostly from private cropland, and its costs have been included. The greatest part of the total maintenance cost were household labour costs for cows and fodder costs for buffalo. A reduction in these costs through alternative livestock management would significantly improve the economy of milk production. The economic returns for buffalo were higher than for cows, in all situations. Because in rural areas the actual cost of labour used for raising dairy animals is close to zero, the estimated costs of fodder collection and other labour can be considered as an additional economic return to the family, approximately doubling the actual benefit. This suggests that smallholder dairy farmers are in fact receiving considerable economic benefits from dairy farming.

CONSTRAINTS, OPPORTUNITIES, & RESEARCH & DEVELOPMENT ISSUES IN DAIRY PRODUCTION AND MARKETING:

LIVESTOCK AND NATURAL RESOURCE BASE: POTENTIALS:

The evidence from this study suggests an increasing trend in milk production, marketing, and consumption rates. The natural resource base, including vast areas of CPRs, the huge population of dairy animals, including unique and highly adapted breeds, and the diverse animal production systems together hold the key to dairy development in the region. Because farming systems in the region are self-contained, almost all inputs regarded as indispensable for the development of dairy farming grow within the system itself. Smallholder dairy farmers have particularly good prospects for economic development because of the natural resource base they have access to.

The main problem the dairy sector in this region faces is low productivity. The large dairy animal populations, and the natural resources that serve as rich repositories of quality fodder, remain underexploited by the dairy sector. Institutional interventions focus on three aspects of dairy production: crossbreeding, health care, and fodder production. This approach, as discussed in detail in the text, is not perspective based. Smallholders do not participate in the process and therefore, the strategies have had almost no visible impact on the transformation of dairy production systems. They have, however, impacted greatly on the marketing system. Dairy development with a focus on the natural and livestock resource base will be the most appropriate perspective-based strategy for the smallholder-based community of the region. Inadequate supply of feed to dairy animals, as we have noted earlier, is one of the major constraints to dairy production in the region. Milk yields of both cows and buffalo could be increased by feeding them adequate amounts of green fodder obtainable from CPRs, particularly the forests. Smallholders get CPR-based feed free of charge, which results in a reduced cost of dairy maintenance and a consequent increase in the gross returns to the farm.

NATURAL RESOURCE MANAGEMENT:

Uttaranchal has large areas of uncultivated land covered with forests, grasslands, scrub (poor forest cover), or perpetual snow. Common property resources comprise large areas of forests and grasslands. This natural resource base which is endowed with a diversity of fodder-yielding plants holds the most potential for the development of dairy farming in the region. Natural resource management, in fact, is the most important issue relating to dairy development in the UP Hills. Dairy farming is linked with other farming systems through the nutrient cycle. These links are vital for the sustainability of the mountain farming system, and detailed study of them will be very useful for evolving strategies for the efficient management of the natural resource base as well as for realising improvements in the production performance of the mountain farming system.

TECHNOLOGICAL OPTIONS:

The seasonality of fodder supplies, the acute shortage of fodder, and low rates of concentrate feeding impose severe constraints on smallholder dairy production systems and highlight the need to formulate balanced rations incorporating local feed resources and to assess them on farm. Feeding chemically treated dry fodder; supplementing the diet with urea, molasses, and mineral mixtures; designing new feeding systems ensuring little or no wastage, and increased usage of available feed; and the application of fodderpreservation methods could all help increase dairy production in the region. There is a need for long-term testing on farms of the impact and feasibility of these technologies. Tree leaves are used as a bedding material in animal sheds in the hills. Bedding mixed with dung is composted and applied to the soil. Composting techniques in the mountains, however, appear to lose tremendous amounts of energy and nutrients. Improved composting techniques would help enhance soil fertility and fodder output from cropland. Applying breeding techniques aimed at reducing first calving age, increasing lactation length and productivity, and decreasing the dry period, and taking advantage of modern veterinary advances to control some prevailing problems, such as parasite infestation and infertility, are yet other relevant areas for research. Eliminating internal and external parasites in dairy animals through the administration of effective medicines on a regular basis could lead to considerable increases in milk production. This needs to be tested on a large population of dairy animals in the hills.

STUDY IMPLICATIONS:

Institutional intervention must encourage various agencies, including the gram panchayats, non-government organisations, schools, and colleges to be involved in the regeneration and efficient management of CPRs. Management through intensive afforestation and reforestation, protection, preservation, and judicious use will help to create a stable feed resource base for dairy farming. Dry fodder is found in surplus in the neighbouring plains areas and could be supplied to the mountain areas. Subsidies should be given to smallholder dairy farmers for commercial feed, improved dairy species or breeds, mineral mixtures, and

medicines. Adequate animal health care should be developed and extended to the remote villages. Well-proven traditional methods of disease management should also be recognised and integrated. A cooperative system of milk collection, marketing, processing, and distribution is the most effective system for the dairy sector. This, therefore, must be strengthened. An extension system of dairy technology dissemination, on-farm demonstrations, experimentation, training, and quality control, with increased participation of women also needs to be developed.

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