Report on the FAO E-mail Conference on Small-scale Milk Collection and Processing in Developing Countries

29 May to 28 July 2000

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Animal Production Service
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The interventions in this conference are the personal opinions of the participants. Unless otherwise specifically noted, the opinions expressed are not necessarily those of the participants' affiliated organisations.

Preface

The focus of this E-mail conference was small-scale milk collection and processing. A huge information gap and lack of technical sharing of experiences and contacts have greatly slowed down the development of small-scale dairy development in developing countries. This E-mail conference was designed to address this critical gap. It has managed to bring together 571 stakeholders from 97 countries who have actively participated in the conference and provided some very interesting and valuable accounts of experiences in their countries.

The freeflow of information and opinions in addition to technical information have given a clear indication of the current challenges and opportunities in the small-scale sector. The feedback provided by participants will be one of the key reference points for guiding the short- and medium-term plans and activities of the Animal Production and Health Division of the Food and Agriculture Organization of the United Nations (FAO) in dairy development.

Readability and accessibility were the two main design criteria for these proceedings. Hyperlinks to the various chapters and subsections are included in the Table of Contents to increase speed of access to specific areas of interest. The main body of the document comprises around 40 pages only, all other text has been included in the annexes.

I trust that this report will serve as a valuable update for those working from policy to field level in the small-scale dairy sector in developing countries.

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Acknowledgements

The FAO Animal Production Service would like to thank the authors of the discussion papers who have initiated the discussion through their high-quality papers and have been supported by the poster papers which gave accounts of actual situations in the field. Clearly any conference cannot be a success without a significant level of participation by subscribers. The number of comments received clearly reflects the high level of interest and participation by the subscribers.

The conference moderators have done an excellent job of keeping the conference focused and active, which is reflected in this document. Particular thanks are extended to colleagues and collaborators who have provided contact information and promoted the conference through their various media e.g. Dairy Outlook mail list of the Commodities and Trade Division of FAO, the Federación Panamericana de Lechería (FEPALE), the mailing list of the Livestock Research for Rural Development newsletter (LRRD) and many others.

Special thanks also to Mr. John Rowell, Computing Services, FAO for enabling the conference to take place in such a timely and organised manner.

Executive summary

Within FAO the Animal Production and Health Division has a small team working on global dairy development. The current focus of the team is on small-scale milk collection and processing in developing countries. The increase in human population results in an increased demand for livestock products. Small-scale milk processing has the capacity to meet a substantial part of these product requirements. The main driving force to attract smallholders into this supply cycle is to provide increased returns.

The objectives of the conference were to:

- provide an overview of small-scale milk collection and processing in developing countries;
- gather ideas and share information about the subject of the conference;
- establish links and facilitate co-operation between key persons working in dairy production.

The conference was organised as an E-mail conference to have global outreach and facilitate rapid and efficient feedback, 571 participants subscribed from 97 countries. 69 percent of the participants were from or working in developing countries. In total, 29 percent of the participants contributed by either sending in comments and papers, or returning the questionnaire.

The three key topics chosen for the conference were: “From farm to collection point”, “Small-scale milk processing technologies” and “Milk producers’ organisations”. Discussion papers, supporting poster papers and active comments, feedback and interaction combined with ‘trigger statements’ resulted in a lively and interesting conference.

The key findings of the conference were:

1. Poor farmer returns: Individual farmers or farmers groups in developing countries, in many cases, currently receive only a fraction of the retail price of their milk.

2. Technical information and training. A significant gap exists in technical information and skills development in small-scale milk collection and processing.

3. Technologies. There is a lack of low cost small-scale milk cooling and processing technologies.

4. Small-scale milk collection and processing is highly relevant in developing countries. Focused E-mail conferences on small-scale milk collection and processing provide a valuable platform for information exchange and discussion.

5. Legal instruments covering the dairy sector in developing countries are frequently outdated and unsuited to current day market industry needs.

6. Food safety: pasteurisation of milk. Many consumers in developing countries are not aware of the hazards of drinking unpasteurised milk.

7. Opportunities for small-scale dairy sector. Many governments are withdrawing from formal milk collection and processing, which has created an opportunity for small-scale milk processors to enter a lucrative market.

8. Informal milk marketing continues to play an important role in the total milk marketed in developing countries.

Peul woman milking a goat, Senegal (Photo by I. Balderi, 1995)

The main recommendations of the conference are the following:

1. Farmers and farmers groups need to increase their current returns from milk production through effective organisation and small-scale processing.

2. FAO in collaboration with other international and regional partners is in an ideal position to provide technical guidelines and advice for sustainable development of small-scale milk collection and processing.

   Regional dairy training centres should be established where technology and training can be adapted to local needs.

3. Low cost and small-scale milk cooling and processing equipment should be developed and promoted, that can be manufactured in many developing countries and can be adapted to meet market demanded products through simple processes.

4. Follow-up E-mail conferences should be organised. Lessons learned from the E-mail conference should be used to organise focused follow up E-mail conferences.

   Follow-up regional workshops of the E-mail conference should be organised.

5. A regulatory framework needs to be developed and adopted into each country's national legislation to facilitate and encourage the development of a dynamic and vibrant small-scale sector.

6. Governments and the private sector should take the lead in advising consumers on the potential hazards of consuming raw unpasteurised milk and dairy products.

7. National government and legislators need to recognise the changes in the dairy sector in many developing countries.

8. Organised small-scale milk collection and processing should be promoted not only as a sustainable, income-generating and household food security activity, but also as a means to improving the safety, quantity and quality of milk and dairy products available for consumers.

CHAPTER 1

Introduction

1.1 Background

The Food and Agriculture Organization of the United Nations (FAO) was founded in October 1945 with a mandate to raise levels of nutrition and standards of living, to improve agricultural productivity, and to better the condition of rural populations. Within FAO, the Animal Production and Health Division (AGA) has the mandate for livestock products processing. One of the key activities of the division is dairy development and the current focus is on the small-scale sector.

A small but dedicated team is working in the Division on livestock products processing, it currently has the following thematic strategy and focus:

- to promote the introduction of efficient small-scale, market-oriented, low-cost processing technologies and skills;
- to establish the products transformation grouping as an effective, recognisable entity;
- to continue to build pro-active working relationship with regional and national key institutions and projects in collaboration with other FAO Divisions and regional offices.

The milk sector in developing counties was often dominated by a large and often state owned or controlled central dairy industry in the past. An increasing trend towards privatisation has resulted in the deregulation of these inefficient and poorly managed industries and presented a window of opportunity for the entry of private industry into the milk sector.

This unique set of circumstances has led to both a challenge and an opportunity for small-scale farmers and processors in developing countries. Firstly there is an ever-increasing market in the urban centres. The growth in urban populations, increased levels of education and income growth has resulted in a massive increase in demand for dairy products. The International Food Policy Research institute (IFPRI), using its International Model for Policy Analysis of Agricultural Consumption (IMPACT), predicts that the consumption of milk in developing countries will grow by 3.3% each year between the early 1990's and 2020. Translated into real figures this means that an additional 233 million metric tons of milk will be consumed in 2020, as compared with 1993.

The challenge now is to organise the collection of safe, good quality milk and provide a constant supply of quality milk and dairy products to meet market demands. At the same time, the market demand for value added products for a range of income levels should be met. Governments are also looking to find ways to reduce imports of food and food products that are a major burden on national budgets and especially on hard earned foreign currency.

Policies and strategies to promote milk production in developing countries often do not address the key issues of small-scale milk collection and processing and this acts as a limiting factor in the success of many interventions and projects in the sector. Growth and development of the small-scale sector can best be achieved through local level organisation of small-scale producers into working groups,

associations or co-operatives. The main driving force to attract smallholders into this supply cycle is to provide increased returns to stimulate production and encourage uptake of improved technologies.

1.2 Objectives

The E-mail conference was organised to pursue the above foci and also as a result of increasing demands to FAO for assistance from member countries regarding small-scale milk production and processing. The key objectives of the conference were to:

- provide an overview of small-scale milk collection and processing in developing countries
- gather ideas and share information about the subject of the conference
- establish links and facilitate co-operation between key persons working in dairy production

A list of the definitions and rules applied to the conference is outlined in Annex 4.

The following topics were discussed:

1. Topic 1: From Farm to Collection point
2. Topic 2: Small-scale Milk Processing Technologies
3. Topic 3:Milk Producer Organisations (MPOs)

The conference proceedings will be used as the base document for a series of regional technical workshops planned in South America, Africa, and Asia in 2001. A number of other supporting initiatives such as a directory of small and medium scale dairy equipment manufacturers and suppliers are also planned for the near future. It is envisaged that the outcome of these workshops will be incorporated both into future focused activities for the Animal Production and Health Division of FAO and also result in action plans for follow up activities in the regions.

CHAPTER 2

Conference design

Conference planning started in September 1999 and was one of the key activities of the livestock products team of FAO Animal Production Service in the year 2000. The concept of the conference originated from the increasing number of queries and requests for technical information and guidance from small-scale milk processors or groups who were interested in starting up or expanding their businesses. The conference was designed by the livestock products team based at FAO headquarters and operated by a team of moderators.

Initially it was intended to have the conference in three languages, namely English, French and Spanish. However financial limitations restricted the conference to English only. As many of the people interested in small-scale milk collection and processing do not have access to Internet it was decided to base the conference on E-mail communication with the Internet as a backup. E mails included discussion papers, poster papers, trigger statements, issues raised by the moderators and comments from participants (see Box 2.1). In view of the fact that many subscribers have full time and demanding employment in the dairy sector, E-mail distribution was limited to two days per week, usually Tuesday and Thursday afternoons.

Box 2.1: Number of Messages Sent Out

Poster / Discussion Papers	15
"Comments Received"	19
"Your views Please"	4
"Issues Raised by Moderators"	8
Total number of messages:	46

The conference was designed to provide a platform for technical discussion and exchange of information of ideas and improvements in small-scale milk collection and processing. Over 2,000 E-mail invitations to participate were sent out by the conference team. The total number of participants was 571 representing 97 countries (see also Chapter 4).

The conference organisers identified and approached the authors of the discussion papers some months in advance. Author selection criteria included working with smallholders and having proven experience in the dairy sector of a developing country. The discussion paper format and relevant background documents were provided to the authors who were also advised to provide a simple text with a minimum of graphics etc to facilitate downloading and reading in lesser developed E-mail servers (see Box 2.2 for details of the topics and papers).

The objective of the discussion papers was to provide information which would be of use to subscribers and also to stimulate discussion and feedback.

The objective of poster papers was to provide real examples of some of the practical challenges and solutions to problems in small-scale milk collection and processing. Some poster papers were solicited in advance and others were submitted by subscribers during the course of the conference.

Box 2.2: The Topics and Papers

Topic 1: From Farm to Collection point
Discussion Paper 1.1: "Clean Milk Production and Support Services"
Discussion Paper 1.2: "Milk Collection, Preservation and Transport"
Discussion Paper 1.3: "Milk Testing, Quality Control, Hygiene and Safety"
Discussion Paper 1.4: "Milk Payments"
Poster paper 1.1: "The Lactoperoxidase System (LP-s) of Milk Preservation"
Poster paper 1.2: "A Case Study of the Production of Milk by Rural Farmers in the Highlands of South Africa"
Poster paper 1.3: "The System of Milk Payment in Nepal - Experiences from NDDB"

Topic 2: Small-scale milk Processing Technologies
Discussion Paper 2.1: "Small-Scale Processing Technologies: Liquid Milk"
Discussion Paper 2.2: "Small-Scale Milk Processing Technologies: Other Milk Products"
Poster Paper 2.1: "The Village Milk System - an Alternative, Low-Cost Milk Collecting and In-Pouch Pasteurising System"
Poster Paper 2.2: "Traditional Milk Products from India"

Topic 3:Milk Producer Organisations (MPOs)
Discussion Paper 3.1: "Market Opportunities for Milk Producer Organisations"
Discussion Paper 3.2: "Organisation and Management of Milk Producers Organisations"
Discussion Paper 3.3: "Training Programme for the Small-scale Dairy Sector in Kenya (FAO-TCP/KEN/5511 project)"
Poster paper 3.1: "The Story of Milk Vita in Bangladesh"

The trigger questions (see Box 2.3) were based on feedback and suggestions from subscribers, combined with the field experiences of the moderators. The questions generated a good response.

All papers and comments were reviewed by the moderators and forwarded to subscribers in clear and straightforward language which was easily understandable.

Box 2.3: The Trigger Questions

1: "Developing countries cannot afford milk payments according to quality"

2: "Small-scale milk processing is irrelevant as the bulk of milk in developing countries is sold raw through informal markets"

3: "No appropriate legislation exists to effectively regulate small-scale milk processing"

4: "There are few, if any, successful examples of co-operative milk producer organisations in developing countries outside Asia"

Implementation

The E-mail conference was implemented using the FAO tailored list server of the mailserver. This allows the creation of a dedicated list where subscription was easy and rapid. Full subscription details were provided on the invitation E-mail and also through the Internet. Upon subscription each subscriber received a welcome message giving additional background information and the Internet address as a reference point.

E-mails were posted in text only to the mailing list. Some problems were reported in returns of messages to the server but most were due to simple spelling errors in E-mail addresses and easily resolved.

Internet site

An Internet site was set up for the conference under the Animal Production and Health Division of FAO and was updated once a week. The Internet site can be found at: http://www.fao.org/livestock/AGAP/LPS/dairy/econf/intro.htm For a sample of the Internet WebPages, see box 2.4.

Box 2.4: Example of Internet webpage

29 May - 28 July, 2000

E-mail conference on "Small-Scale Milk Collection and Processing in Developing Countries"

Introduction
Definitions/Rules
Subscribe
Contribute
news
Papers/Comments
Pictures
Links
Search FAO
AGAP Home
FAO Home

Welcome to the Homepage of the E-mail conference on small-scale milk collection and processing in developing countries, hosted by the FAO Livestock Products team, Animal Production Service. The conference has started on 29 May 2000 and will end on 28 July 2000. The main focus of the conference will be on small-scale milk collection and processing, in order to define priorities and policies for future activities. The conference will be focused towards market oriented small scale milk collection and processing and the improvement of sustainable livelihoods. The proceedings of the conference will be published both in hardcopy and electronically, and regional workshops are planned in 2001 as a follow up of this workshop. If you have not subscribed yet, you can go to the subscription page. Your subscription to this conference constitutes your acceptance of the rules of this conference.
We invite you to the papers and comments section to read the background documents of this conference, and the comments for the views of participants.
Please read the news section for the latest updates of the conference.

CHAPTER 3

Summary of Proceedings

3.1 Topic 1: From Farm to Collection point

3.1.1 Discussion papers Topic 1

The following discussion papers were sent out to participants (see Annex 1 for full text versions):

"Clean Milk Production and Support Services"
Dr O. P. Sinha. Consultant, Dairy Farmers' Organisation, Management and Training, A/6 Avkar Apartment, Near IRMA. ANAND 388 001, India.

"Milk Collection, Preservation and Transport"
Jose Pedro Urraburu, Manager, Pan American Dairy Information System (INFOLECHE), a service of the Pan American Dairy Federation (FEPALE), Montevideo, Uruguay.

"Milk Testing, Quality Control, Hygiene And Safety"
Roberto Giangiacomo, Istituto Sperimentale Lattiero Caseario, Lodi, Italy.

"Milk Payments; General Considerations"
René Metzger, France.

O.P. Sinha outlined the importance of milk as a part of agricultural production, household food security and nutrition at both the family level and for consumers as a whole. Substantial losses of milk can occur at farm level when hygienic practices are not in place. The importance of clean milk production was highlighted and the key contamination points were highlighted and control measures outlined. The importance of adequate support services e.g., veterinary health and quality feed inputs, and their availability even at village level was highlighted as one of the main prerequisites for the successful development of a sustainable small-scale milk production sector to meet the growing demand for quality milk by consumers.

Sinha identified one of the major driving forces for the improvement of clean milk production to be a payment system based on hygienic quality. Knowledge of hygiene was reported as not being adequate in many developing countries and a concerted "Education-extension" services approach was recommended. The greatest contribution which these services could contribute was identified as the development of awareness amongst milk producers/groups of clean milk production in sanitary conditions and improved animal health care. Service delivery is required at village level and women should play a key role in the organisation and delivery of the services.

The paper from José Pedro Urraburu referred to a South American situation where farm size and hence cow numbers are larger. Milking on the farm is often done by machine, but again the importance of hygienic practices during the milking process was highlighted. When there is a lack

of sufficient dairy infrastructure, groups of producers can share their cooling equipment investment costs or organise the timely collection of milk within two hours of milking. Where a reliable electrical supply is available the importance of rapid milk cooling e.g., by plate heat exchanger, can greatly improve the keeping quality of the milk. A range of milk cooling equipment is currently available at low cost including water spray, immersion and in line heat exchange coolers.

As dairy farm sizes have grown due to scale of economy, the frequency of milk collection has dropped. If long intervals cannot be avoided the milk should be cooled to 2C prior to transportation. Milk collection should be carried by a fair and impartial party to ensure that all milk supplied is correctly and accurately recorded and representative samples taken and properly stored. Milk transport should maintain the temperature during transportation e.g., the use of cooler boxes, insulated containers or in situ chilling units.

Uraburru provided a case study of a Brazilian dairy co-operative where farmers have significantly reduced their milk collection costs through sharing the burden of common milk cooling tank costs. They shortened the milk collection route, reduced the frequency of collections and significantly improved the quality of milk collected. Comprehensive detailed lists and prices of milk tanks, cans and machines in Brazil are also provided.

Giangiacomo outlined the differences in milk composition due to the influence of breed, feeding and environmental factors. The farmer was identified as the key quality controller on the farm. Some of the most common quality control and hygiene tests (increasingly rapid tests) are briefly described and he advises that simple and cheap tests are highly effective even if not as accurate as modern computer based testing.

Developed countries have many regulations and standards established regarding the composition and quality of milk. On of the main challenges which remains for developing countries is the presence of zoonotic diseases which can adversely affect both human and animal health. Some reports indicate that 10- 20% of raw milk sampled may contain harmful organisms such as E Coli, Brucella Melitensis, Listeria etc. However the effect of this level of contamination on a given population requires in depth study to quantify and qualify the negative effects of harmful organisms over a period of time. The adoption of sanitary provisions should take account of the actual incidence of foodborne illnesses, the vector food products and specific and effective control measures.

Metzger details the complexity of milk payment systems and identifies some of the key determining factors which have to be considered. Frequently the cost of milk production is difficult to calculate as it should theoretically include all costs e.g., family labour and time. Estimates of costs are generally used. For the farmer the price of milk includes labour, fodder, cattle foodstuffs, breeding, farm rent, financial expenses etc., for the processor the price depends on the composition of milk, (fat and protein content), on the bacteriological quality, and on the seasonal market etc. To factor in the cost of seasonal pricing of milk the average weighted yearly figure should be used as a reference. Milk payment systems are now generally focused on a combination of physio-chemical and bacteriological criteria. The best results have been shown to occur with a standard price with incentives for higher quality and penalties for lower quality and strict rejection of adulterated unsuitable milk (e.g., antibiotics present) or lack of temperature control. A methodology for calculation of farmgate price is suggested.

Milk collection costs can be quite substantial where the production area is dispersed and producers have only limited quantities of milk. The value of group formation and bulking/setting up of chilling/collection centres is highlighted as being essential to reduce milk collection prices. The use of local transport means is recommended.

3.1.2 Poster papers Topic 1

For full text version see Annex 1. The following poster papers were sent out during this topic:

"The Lactoperoxidase System (LP-s) of Milk Preservation"
Anthony Bennett, Dairy Consultant, FAO Rome.

"A Case Study of the Production of Milk by Rural Farmers in the Highlands of South Africa"
Nellie A. Prinsloo and J.J. Keller, ARC-Animal Nutrition and Animal Products Institute, P/B X2, Irene, 0062, RSA

"The System of Milk Payment In Nepal - Experiences from NDDB"
Ram Milan Upadhayay, Senior Dairy Specialist, Nepal

Bennett outlined the importance of milk both as a regular and constant household income and its contribution to food security. Up to 20% of milk in developing countries is estimated to be lost due to souring/spoilage. In 1991 the Codex Alimentarius Commission approved a guideline on the use of the Lactoperoxidase system of milk preservation.

Lactoperoxidase is an enzyme, which is naturally occurring in milk and can be reactivated to extend the shelf life of raw milk by 7-8 hours at an ambient temperature of 30C. The system is ideal for use in developing countries where there is a lack of cooling facilities. Perhaps the greatest beneficiaries will be the rural women who can use this system to preserve their milk for the hours required to transport the milk to nearby markets. FAO is promoting the system through the Global Lactoperoxidase Programme under which a series of national demonstrations of the use and regulation of the system will be held.

Lactoperoxidase Demonstration in Nepal
(Photo by J. Draaijer, 2001)

Prinsloo and Keller give an account of the effect of a training programme for improved milk quality and hygiene for Thaba Dairies in South Africa. The dairy has a capacity of 14,000l/d and produces fresh milk, yoghurt, drinking yoghurt, fermented dairy products, cheddar and Gouda cheese. Milk is supplied by 40 shareholders living within a 70km radius of the plant.

The vast majority of the shareholders milk by hand and transport milk by light open truck, donkey, horse, tractor and bicycle to the collection points. A detailed training programme for the farmers was organised which focused on the following areas: personal hygiene, improved milking practices and materials, micro-organisms- importance, destruction and control, cleaning and disinfection

The result of the training programme was a 70% reduction in bacterial counts and keeping time increased from 3 to 7 days. The Lactoperoxidase system of milk preservation was identified as having huge potential to improve rural milk collection in South Africa.

Upadhayay describes the development of the milk payment system in Nepal. Historically there is a long tradition of product processing (mainly for preservation due to difficult transport conditions) in Nepal. Traditional products include butters, Ghee and hard cheeses.

In the 1950s the price for milk for processing was linked for fat percentage e.g. if 4-6% fat the milk price was Rs. X per unit of milk, the prices for 6-8 and >8% fat were 1.5X and 2X, respectively. Farmers were quick to identify various means whereby the fat percentage could be artificially inflated and soon most milk tested had >8.5% fat.

A linear fat percentage system was then introduced where Rs X per fat percentage per unit of milk was fixed for all milk deliveries which contained above the minimum fat level fixed at 5%. The current payment system is based on fat and SNF but many adulteration practices are suspected at field level. A proposal for a new system whereby payment will be based on fat and protein content and on microbiological quality (graded) is now being developed.

3.1.3 Comments Topic 1

For full text version refer to annex 1. The following comments on topic 1 were received and replied to by the relevant party.

- P.R. Gupta, India praised the initiative of the conference and the focus on the small-scale where the growth in milk production and processing is expected to take place. He requested the conference to address 'traditional dairy products' and the moderators requested him to submit a poster paper on this topic.
- J. George, India argued that the conference should have included milk production.
- Anton Glaeser, Tanzania sought additional information on Lactoperoxidase, the use of plastic cans, and organisation of milk producers groups.
- Laurie Depiazzi, Australia provided information on an approach in Australia on improved dairy hygiene including dry cleaning of teats in summer, the importance of clean water and HACCP.
- Naranjo, Colombia gave details of a successful dairy development approach in Colombia where a quality based milk payment system, animal health inputs, technical advice, sharing of information and provision of credit resulted in a significant milk quality improvement. Additional detailed information was provided on the payment system applied and milk testing equipment. His views on milk quality and food security were echoed by:
- K. A. Soryal, Egypt who agreed that the quality of milk is a concept closely related to food security, and is important in both developed and developing countries.

- R. Garces-Aviles, Chile commented that hand milking is preferable at small-scale because machine milking increases workload due to the higher level of control and sanitising needed. He reported that poor hygienic milk quality was present in the spring/summer season and asked other dairy development specialists to be aware and take steps to prevent it.
- L. Falvey, Australia advised on the recent publication by ILRI "Smallholder Dairying in the Tropics" as a useful reference for conference subscribers.
- J. Rasambainarivo, Madagascar sought a definition of "clean milk" and advised that dairy legislation in many East African countries is often outdated. He also queried whether the same standards should apply to small-scale and large-scale milk producers.
- Waldhauer, Nepal reported on a study commissioned by the National Dairy Development Board of Nepal which indicated that the alcohol test (using concentration of 68-72%) is not reliable for testing the freshness of buffalo milk. This was replied to by:
- E. Alderson, UK who advised that the acidity problem may be related to breeds and she has had some success in reducing "unstable" milk by implementing a regime of balanced dairy cattle feed rations.
- P. Gupta, India recognised the potential of the Lactoperoxidase system for raw milk preservation in selected areas of India and suggested that some FAO/WHO initiative may lead to a policy change by the Government of India to enable the use of the Codex Alimentarius approved system to replace current illegal "neutralisers".
- Scholten, England praised the poster paper by Prinsloo and Keller and queried whether periodic sterilisation of milk cans is practical and whether stainless steel open surface corrugated "milk coolers" are suitable for use by small-scale producers today.
- K. Lewis, New Zealand commented that milk can cleaning is best effected at the collection centre where hot and cold water with appropriate chemicals and guidance is likely to make a significant contribution to improving milk quality.
- N.S.R. Sastry, India provided an overview comment detailing the current Indian situation on the conference issues. He suggested that that plastic cans are sometimes necessary and advised on cleaning but recommended aluminium due to the long-term quality benefits.
- Codex Alimentarius Commission identified sources of information on clean milk and regulations in response to the query from J. Rasambainarivo, Madagascar.
- G. Veldink, Netherlands reported on experiences from Vietnam where payment of milk quality incentives and accurate random individual sampling in combination with group payments was the best approach for milk quality improvement. Training on production and handling were also essential.
- Lewis, Malawi sought advice on the use of pressurised containers for long term storage of heat treated milk (without refrigeration) as used on a farm in Tanzania in the 80's.
- Escobar, Cuba outlined the widespread use of Lactoperoxidase in Cuba and ongoing research on it by CENSA.
- R. Rodriguez, Cuba provided a brief overview of Cuban dairy production and milk quality control parameters in Cuba. Development efforts are from farm to research level.
- M. Maisaree, FAO, Thailand commented that milk payments must be according to quality e.g., fat content. Poor quality milk should be rejected.
- K.A. Soryal, Egypt reported that summer milk is often of poor hygienic quality due to high ambient temperatures. He suggested the ISAAC ice cooler in desert areas and the current use of cooling pools to cool milk. He reported on the recent reduction of raw milk payment to farmers in Egypt due to powdered milk.
- Kitalyi, Kenya reported on a recent workshop in Kenya in which Lactoperoxidase was the main issue discussed. The Lactoperoxidase system was identified as having the potential to significantly contribute towards improved livelihoods and enhanced food security among small-scale producers.

- J. Havranek/S. Kalit, Croatia gave a brief overview of milk collection in Croatia where improvements in milk quality and quantity are brought about by training and extension in combination with regulatory standards.
- R. Hernandez Rodriguez, Cuba reported on a recent study in which the affect of different feeding regimes on Holstein Friesians and their crosses was measured. It was concluded that the feeding of Leucaena leucocephala has the capacity to improve the composition of milk (fat, lactose and TS respectively).
- Erickson, US sought additional details about rural milk collection systems, especially about what is done where refrigeration is not available and what advantages there would be if refrigeration were available. Would there be an interest in a durable, low cost, solar powered icemaking system? This was positively responded to by;
- M. Bacchus, Guyana who sought additional information.
- NDDP, Nepal commented that 60-70% of the retail price should go to the producer and that low cost milk quality testing can include a simple fat test combined with lactometer testing. Milk payments should be linked to composition, where incentives and penalties should be based on variation from a fixed standard.
- G. Psathas, Cyprus advised on setting up a milk quality payment system based on milk composition and hygienic quality. He identified payment schemes as a tool for improving quality not for applying regulations. This was highly praised by: J. C. Lambert, FAO who outlined a stepped approach to milk testing regimes linked to the development of the milk enterprise.
- Sota, Chile advised on a differential milk price in paid in South America only where milking and milking is done properly and the milk can be tested.

3.2 Topic 2: Small-scale milk Processing Technologies

3.2.1 Discussion Papers Topic 2

The following discussion papers were sent out to participants (see Annex 1 for full text versions)

> "Small-scale processing technologies: Liquid milk"
> Lusato Kurwijila, Department of Animal Science and Production, Sokoine University of Agriculture, Tanzania.
>
> "Small-scale Milk Processing Technologies: Other Milk Products"
> Tek Bahadur Thapa, Dairy Consultant, Animal Production and Health Division, Food and Agriculture Organization of the United Nations, Rome, Italy.

Kurwijila started the discussion with the rationale of small-scale milk processing in developing countries. The paper highlighted the small-scale processor's problems by saying that simple solutions are either not always available or are ignored in favour of more sophisticated processing equipment which may not always be appropriate for specific situations. The paper continued on conceptualisation and developments in small-scale processing, and felt the household level technologies, which are important for food security and traditional processing, are ignored by the definition. Large-scale parastatals were started during sixties, but suffered after milk powder and buttteroil assistance was stopped. The parastatal could not run efficiently due to management and raw milk availability problems. Thus, small-scale milk processing came up both as an option and as a commercially viable alternative.

An entrepreneur must consider following to set up a liquid milk-processing unit; i) Milk Cooling and collection system; ii) Milk separation; iii) Milk Homogenisation; iv) Milk pasteurisation (Batch, H.T.S.T. and In-container pasteurisation); v) Milk packaging; vi) Bulk vending; vii) Milk storage and transportation; viii) Process utilities (Hot water/steam generation, Refrigeration, Renewable energy).

For producing sterilised/UHT milk, older batch methods are not in use or treated as obsolete, but the latest technology if often too expensive for small-scale operations. In the concluding remark, Kurwijilla appealed the conference participants to provide answers to some of the questions raised in the paper and to contribute by providing information on any technology /supplier of dairy equipment that may help in technology transfer.

Thapa opened the paper with the background information and a general review, and identified some of the key problems and constraints faced by small-scale processors. A review of dairy products manufacturing is presented which includes the range of products. It also revealed the present situation of the internationalisation of the market because of WTO agreements and its effect on small-scale production and marketing of locally produced dairy products.

The paper reviewed product manufacturing, and briefly introduced the fermented dairy products like yoghurt, cultured buttermilk, sour cream, acidophilus milk; fat based dairy products like cream, butter, ghee, and ice cream; cheeses; concentrated dairy products like evaporated milks, sweetened condensed milk, condensed buttermilk, condensed whey, Khoa and Kurauni; and dried dairy products like milk powders, whey powder and buttermilk powders, and traditional products like Chhurpi and Dukhoa.

Major challenges faced by the small-scale processors as described are: no easy access to training and skills development; trade barriers requiring policy interventions; high value added local taxes on products, and duties on import of equipment and production inputs; no easy access to the information on the dairy business; poorly developed legal quality standards and weak quality monitoring and enforcement mechanism.

Major avenues for small-scale processing are: increased market opportunities and market freedom due to current wave of privatisation of parastatals; increased market opportunities for value-added dairy products with higher returns; better control on business and flexible management.

The real agenda for future strategies to promote small-scale dairy enterprise must address the training and human resource need, trade barriers requiring policy interventions, local taxes on products, and import duties on equipment, accessibility to the information on the market trend and appropriate technology, legal requirement and standards and other relevant issues affecting the development of small-scale agribusiness.

The paper concluded by giving a call to all the participants to contribute and share their experiences on small-scale processing and its promotion to the cause of alleviating rural poverty. The paper concludes with the agenda for future common strategies on the cause and development of small-scale processing enterprises in the developing countries.

Woman milking cow, Peru (Photo by A. Odoul, 1994)

3.2.2 Poster Papers Topic 2

"The Village Milk System - an alternative, low-cost milk collecting and in-pouch pasteurising system"

Brian Dugdill, Dairy and Meat Officer (Institutions and Training), Animal Production and Health Division, Food and Agriculture Organization of the United Nations, Rome, Italy.

"Traditional milk products from India"

P.R. Gupta, Editor & Publisher, Dairy India Yearbook & Technology of Indian Milk Products (In Print), India

Dugdill describes a low-cost milk collection-pasteurisation system currently being promoted by the Livestock Products Team at FAO. Consumers want good quality pasteurised milk at the most competitive price. Milk that is to be transported longer hours requires cooling. For areas in developing countries where conventional cooling is not currently feasible, FAO is promoting the use of the Lactoperoxidase system of milk preservation (LP-s) to prolong the quality of milk by natural enzyme reactivation. Recent field trials in Bangladesh confirmed that treated milk can be preserved for up 10 hours after milking at an ambient temperature of 30C before cooling or processing.

Conventional processing systems for pasteurising and packaging are also expensive for the small-scale operations. FAO has recently field-tested a low-cost, innovative milk pasteurising unit in Kenya, called the MILKPRO. This is a complete fill, seal, pasteurise and cooling system. The initial investment of US$10 000 can be paid back within 12 months at a daily throughput of 750 litres.

For the first time FAO is combining these two innovative technologies under its Village Milk System - the provisional name for the initiative. The immediate aims are to increase producer returns by up to 50 percent, and to make increased volumes of attractively packaged, safe pasteurised milk available to consumers at competitive prices. The main advantages of the system are; able to handle very small quantities of milk (as little as 50 litres a day) efficiently and safely, low energy and water consumption, reduced waste water and more environment friendly, and so on. The Village Milk System meets many of the key requirements for efficient, low-cost, low-risk milk collection and processing by smallholder marketing groups, and is an efficient tool for rural poverty alleviation.

The preliminary financial analysis indicates the enterprises will breakeven at a throughput of about 210 litres of pasteurised milk daily, one third of targeted sales for each enterprise. At this level, producers will get 70 percent of the ex-factory processed milk price. Further projects are planned for Ghana and Guyana later this year.

Gupta reported that traditional products account for over 90 per cent of all dairy products consumed in the country. Simple processes were developed to preserve milk. In their search for ways to prevent milk spoilage and find uses for surplus milk, a number of products such as curds (yoghurt-like fermented product), Makkhan (butter), Khoa (desiccated milk product), Chhana and Paneer (soft cottage cheese-like cultured product) and Ghee (clarified butter) were developed. A wide range of sweets like Rasogolla, Sandesh, Burfi, Peda, Shrikhand, Gulabjamun, Lassi, Misti Doi and Kheer (rice pudding) are produced.

In the past milk marketing was just between producer to consumer, without processing and middlemen. This was low-cost, appropriate and sustainable because (a) milk and dairy products were consumed fresh and therefore the centres of milk production and consumption are close by; and (b) the shelf life of raw milk was enhanced by boiling, a simple way of sterilisation. Traditionally, the urban consumer buys milk twice a day. Any surplus milk in homes is fermented into curd, an essential item of the Indian meal. At the farm level, the unsold surplus milk is made into long-life products like Khoa, Channa, Paneer and Ghee.

Now the scenario has changed, and the traditional processes are upgraded to commercial ones to cater for mass needs. The National Dairy Development Board (NDDB) and the National Dairy Research Institute (NDRI) have made impressive innovations for the assembly-line production of Burfi, Dahi, Kheer, Shrikhand, Gulabjamun, Rasogolla, Mishti Doi and others. Western technology is adapted to commercialise the production of Shrikhand, Khoa, Chhana, and Gulabjamuns.

The Sugam Dairy in Gujarat uses the traditional grocery/general stores that have a refrigerator to market its products. The product range includes Shrikhand, Gulabjamuns, Pedas and curds, apart from flavoured milk. The dairy has the highest turnover of a single unit, marketing traditional dairy products. In the same way, other dairies in different states, market their products. The major strength is mass appeal, plus much higher profit margins. The increasing demand for traditional products presents a great opportunity for the organised dairy sector in India to strengthen

its base and take a larger share of the expanding milk production which is expected to exceed the 100 million-tonne level by 2005.

3.2.3 Comments Topic 2

For full text version refer to Annex 1. The following comments were received and replied to by the relevant party.

- P. Stewart, N-Ireland wanted to know the most appropriate form of water purification and is there a commercial Treatment Plant available for treating up to 1,000 litres per day?
- C. Erickson, USA provided details on a solar ice maker (ISAAC) which was reported as durable, low cost and with a capacity to produce 50kgs of ice per day for milk cooling.
- G. Haylle Dick, South Africa reiterated and reinforced that MILKPRO is a dependable system for small-scale milk processing and marketing. He added that some applications in South Africa have been running successfully for 8 years. MILKPRO system represents a more-than-viable option for farmers wishing to sell up to 1000 litres per day of pasteurised milk.
- K. Coetzee, South Africa enquired if sterilisation is really a viable option for small-scale enterprises and can the cost of the UHT-process be limited by using a cheaper non-sterile package such as plastic pouches for packaging?
- N. Abeiderrahmane, Mauritania commented that making quality products that can compete with attractively-packaged and cheap imported milk is very difficult and expensive. Their dairy pays over 50 percent of the consumer price for raw milk. Every region has a different set of conditions, and these must be studied very carefully before deciding on the best way to generate income for farmers from milk. She also commented on the acidity problems which processors are facing. A problem which they had with camel cheese was discovered to be feed related (excessive salt intake). She provided a detailed account of the practical challenges and solutions faced by their dairy in Mauritania.
- Abdel-Aziz, Egypt reported on a recent study on the dairy industry in Egypt and provided the major constraints and recommendations for both small and large scale milk processing.
- H. Muriuki, Kenya complimented Thapa on his paper and added that it is not attractive to develop other products for local market due to the low purchasing power. He also recommended that appropriate technology which fit the local situation should be used.
- R. Young, Dominican Republic advised of a cheese making factory in the Dominican Republic where milk pasteurisation is considered too expensive. Milk is treated with Hydrogen Peroxide instead. He requested details on this type of practice and its effect on quality, flavour and safety.
- Faye, France requested advice/accounts of experiences on estimation of total collected milk in smallholder conditions.
- P. Vyasulu, India commented that women are not included in technical dairy training. He called for a gender audit for dairy enterprises and training to ensure the real workers get the benefit. This was responded to by:
- N. Abeiderrahmane, Mauritania who commented on the varying roles of women across different social and cultural divides and also that small-scale village based systems must and will evolve upwards.
- G. Psathas, Cyprus requested additional information on the ISAAC cooling system
- K.A. Soryal, Egypt identified one of the greatest needs for small-scale processors as being equipment design and suppliers contacts.
- T. Borbonet, Uruguay provided information on a training to improve cheese making.
- E. Orskov, UK queried if there is any technology with which herdsmen could make milk powder

in the steppes or mountains with only the sun and wind for drying in Mongolia? Would it be possible to use absorbent cloth and hang up the absorbed milk for drying and shake of the dried milk, which could then be brought to the market with a long shelf life? This was responded to by:

- T. Ali, Egypt reported seeing young scientists talking about drying milk by soaking sponges in milk and exposing it to sunlight in Sudanese TV. He also wanted to hear more about similar simple techniques for preserving milk.
- K. Assad, Egypt reported on goat milk that preservation and marketing of surplus milk are the main challenges in many developing countries. Research on the preservation of goat milk by simple reactivation mechanisms need to be elaborated.

Comments on "Your views Please (2)!!!!"
"Small-scale milk processing is irrelevant as the bulk of milk in developing countries is sold raw through informal markets"

- B. Richard, Denmark identified small-scale processing as relevant to avoid the spread of bovine tuberculosis which is very rampant among certain communities in the developing world and also to avoid the consumption of adulterated milk.
- N. Prinsloo, South Africa agreed with the above statement and emphasised the importance of processing and value addition for small farmers.
- L. Falvey, Australia referred to small-scale milk processing as highly relevant in cultural, nutritional and preservational terms and cited India as the best example and Mongolia as another.
- P. Gupta, India argued that the statement was not true if we agree that modern processing is useful and that informal milk markets in developing countries need to be phased out. This change should also be consumer driven.
- R. Shrestha, Nepal commented that the challenge is how to convert the informal chain of milk marketing to the formal channel. Small-scale processing is more practical and feasible in developing countries and reduces malpractices that affect consumer health.
- J. Rasambainarivo, Madagascar advised that in areas such as the highland zones of Madagascar the lack of milk processing activities leads to huge wastage in the rainy season and requested additional information on the MILKPRO system.
- R. Giangiacomo, Italy disagreed with the above statement and reported that in his personal experience most small-scale milk processors buy most of their milk from the official market.
- C. Arthur da Silva, Brazil reported that in Brazil, small-scale milk processing is a viable alternative for large numbers of dairy farmers and associations. While such enterprises are in principle financially feasible, they do face difficulties in marketing and distribution.
- N. Abeiderrahmane, Mauritania agreed that it is true that a lot of milk is sold raw, but small-scale processing is not irrelevant, it is vital.
- D. Mlay, Tanzania advised that although currently about 95% of milk is supplied raw in Tanzania but that still small-scale processing is very relevant. Processed dairy products are easy to transport and distribute to consumers.
- G. Veldink, Netherlands advised that economic factors will determine whether processing can best be implemented on a small, medium or large scale. He supported the establishment of small-scale milk processing units, as they are often better manageable and more sustainable than large industrial plants. Training in hygiene and quality improvement of the products is important.
- Ghaffar; Pakistan reported that small-scale processing is very essential in countries like Pakistan where the population is very scattered and herds are comprised of 3-4 heads of cattle or buffalo. Local investors can play an important role in this field. The successful example in Pakistan is Idra-e-Kissan who is running three milk plants successfully. The standard of living of member farmers has a substantial improvement.

- T. Acharya, Bhutan advised that the statement holds true in the case of Bhutan. Due to the inaccessible terrain, the bulk of the milk is converted into butter and dried cheese. Suitable mobile technology for milk processing must be explored, and Lactoperoxidase may assist in this sector.
- J. Thornes, UK disagreed strongly and advised that milk may be sold this way presently but in the future it will be processed to meet public demand. i.e. better quality, better health.
- R. Young, Dominican Republic strongly disagreed and advised that milk processing is very relevant in the Third World. The problems should be seen in a context of small-scale and local technical and organisational problems, local storage and energy problems and the lack of local markets. People deserve to consume safe good quality products, especially in the Third World where people are more vulnerable to health risks and disease.
- F. Xolot, México reported that in his region of Mexico more than 50 % of the producers are dual purpose, the production averages 60 litres / day per producer with hand milking. Only 1 % produces between 400 and 600 litres / day. If small-scale milk processing is important, low cost technology and training in dairy development is needed.
- Alvarez, Spain advised that if the above sentence was correct, there would not be a need for the present electronic conference! Small-scale milk processing is important because it affects many small farmers and it is usually the case that small and poor tend to go together. The important issue here is whether production is efficient.
- R. Steinkamp, Yugoslavia reported that in Montenegro milk is processed into cheese, butter or related cream products. Most of these are salted and fermented which makes them relatively safe for consumers. Educating people on both importance of the ageing process and reasonable hygiene is important, as well as the danger of human transmissible diseases.
- R. Shrestha, Nepal reported that small-scale milk processing is needed in developing countries because the bulk of milk is being sold through informal channels. The challenge is how to convert the informal chain of milk marketing to formal channel.

Comments on "*Your views Please (3)!!!!*"
" No appropriate legislation exists to effectively regulate small-scale milk processing"

- J. Thornes, UK commented that self-regulation is well worth thinking about or the milk industry will go from crisis to crisis.
- M. Tyler, UK highlighted the importance of encouraging and enabling new small-scale processing enterprises to produce safe quality milk.
- D.G. Mlay, Tanzania advised that legislation specifically for small-scale processing is now being discussed in Tanzania and should be approved shortly.
- R. Giangiacomo, Italy recommended to provide of a general document specific for small-scale processing units which could stimulate in any country the promotion of programmes aimed as building up a hygienic culture. Without this cultural awareness legislation will remain an unattended piece of paper.
- J. Phelan, Ireland advised that the basic principles of risk management and quality control apply irrespective of the quantity of milk produced by each individual supplier. Neither cooling nor Lactoperoxidase is a substitute of hygiene and technical support is essential in developing the "hygiene culture" referred to by R. Giangiacomo.

3.3 Topic 3: Milk Producer Organisations (MPOs)

3.3.1 Discussion papers Topic 3

The following discussion papers were sent out to participants (see Annex 1 for full text versions)

> "Market Opportunities for Milk Producer Organisations"
> Steven Staal, International Livestock Research Institute, Nairobi, Kenya
>
> "Organisation and Management of Milk Producers Organisations"
> Joe Phelan, International Consultant on Livestock Food Systems and Rural Development.
>
> "Training Programme for the Small-scale Dairy Sector in Kenya (FAO-TCP/KEN/6611 project)"
> Brian Dugdill, Dairy and Meat Officer (Institutions and Training), Animal Production Service, FAO, Rome, Italy, formerly: Team Leader/Dairy Development Adviser, FAO TCP/KEN/6611 project.

In his paper Staal identifies the main determinants in dairy group formation and presents the basic principles that seem to govern market opportunities for milk producer organisations. He argues that the main requirements of smallholders are in bulking and reliability of milk collection and marketing and that farmers are often willing to accept a lower but regular return for their milk when they have this outlet security.

He provides some principles, which are based on experiences from a number of developing countries including:

- "Dairy farmer organisations are most successful where there is large local milk surplus"
- "The nature of traditional local dairy consumption habits largely determines opportunities and constraints"
- "The main competition to dairy farmer groups is usually the informal market"
- "There are other constraints to milk producer organisations besides marketing"

He proceeds to describe four typical types of marketing arrangements used by milk producers' organisations including: from co-operative to co-operative union, from co-operative to private processor, from co-operative to private traders, and co-operative direct sales.

The issue of value added products is an example of the common misconception of acceptance of Western style products and approaches in developing countries. These often fail, as there is no market outlet for these products. The success of small-scale processing which is controlled and owned by smallholders (e.g., such as in selected areas of Ethiopia where milk is processed manually into butter), is highlighted and praised. Targeted value addition can however substantially increased incomes for groups.

The majority of domestically-produced marketed milk (not total production) is shown to be traded in the informal market. Milk producer organisations will in future have to deal with informal milk agents either as competition but potentially as partners. The informal sector can also have a role to play in employment generation. To better address public health concerns and draws all stakeholders together into a regulated market, a proactive regulatory and policy approach is recommended.

Phelan identifies the reasons for formation of milk producers groups as: exchange of experience, training, savings and credit schemes, veterinary and other services delivery and drugs and milk marketing. The initial steps in the formation of a group are critical to establish the necessary trust and cohesion. Many groups form "co-operatives", which has many different meanings but there has been a gradual evolution towards democratic structures in many countries.

During group formalisation the most important thing is that the members agree on the modus operandi and objectives. These should be clearly documented and accessible to members. This can be achieved through meetings, election of a task force and use of planning techniques such as Logical Framework Analysis.

Terms of reference for the task force are listed. One of their key tasks is the formation of a Provisional Committee of Management leading to the first General Meeting of members.
Management structures will depend on the size of enterprise but in a small-scale enterprise business may be carried out by an unpaid elected member. As the enterprise grows a management team must be formed, which includes a Board of Directors. The functions and duties of a Board of Directors are outlined in addition to twelve key agenda items to be included in the annual plan. Salaried professional management staff is recommended.

The status of members working for a group will depend on the form of association chosen with the group and may be as a salaried worker or partners. Group accounting has two basic rules which are responsibility for keeping records must be firmly assigned, and all transactions must have some verification (voucher or signature)

Most MPOs expand into processing beyond fresh milk to improve returns. Farm gate prices should be firmly market linked with a quality base. Good management practices should be designed into every process and as always, quality control and assurance from the farm to the consumer is essential.

Dugdill's paper refers to a short-term technical assistance-training programme, which was based in Kenya in 1996/7. The Kenyan Ministry of Agriculture, Livestock Development and Marketing was the government agency responsible for project implementation and was advised by a stakeholders steering group.

The objective of the project was to "Develop and design the organisation of a short term tailor made training courses at Naivasha Dairy Training Institute (DTI) for persons and organisations involved in milk collection, transport, processing and marketing in the small-scale sector to improve efficiency and quality throughout the milk chain".

A huge consumer market opened up for the small-scale dairy sector when the huge parastatal Kenya Cooperative Creameries ran into difficulties. A training needs assessment clearly identified the greatest needs in the small-scale sector. Beneficiaries were mature trainees who had limited practical processing skills. Training was focused on in-service hands on practical training at DTI for 5 days followed by two days outreach training at the client's premises. Participants of whom there were nearly 500, contributed 50% of the training costs.

The training course was based on the following six modules; Hygienic milk handling and processing; Milk testing and quality control; Dairy Equipment maintenance; Cultured dairy products; Cheese making; Milk and dairy products marketing (including basic business management skills).

Substantial databases on equipment and suppliers were documented by the project and made available to the small-scale processors and potential entrepreneurs from the milk sector. The liberalisation of the milk industry had a beneficial impact on the small-scale dairy sector in Kenya, particularly on prices and markets. Producer welfare was improved through higher real prices and timeliness of payments. This led to shifts in market outlets for producers and the emergence of many small producers and processors. Operation of the training and training plant unit on a commercial basis was recommended, as was a consumer education campaign on the dangers of drinking unpasteurised raw milk and brining informal market intermediaries (milk hawkers) into the training programme.

Village milk collection centre, Uganda (photo by R. Faidutti 1996)

3.3.2 Poster paper Topic 3

For full text version see Annex 1. The following poster paper was sent out during this topic:

"The Story of Milk Vita in Bangladesh"
S. C. Das, Manager (Co-operative Societies), Bangladesh Co-operative Milk Producers Union Ltd, Dhaka

'Milk Vita' is the brand name of the Bangladesh Co-operative Milk Producers Union Ltd, Dhaka. The union is the result of 30 years of Government and donor assisted technical and financial interventions. The union was a loss-making venture (mainly due to mixed social and business objectives) until the early 1990's, when ownership passed to the milk producers themselves and a determined Board of Directors introduced professional management.

The company rapidly turned into a profit making enterprise. In 1998/9, 29.5 million litres of milk were procured from 390 village co-operative societies spread over 15 districts. A net profit representing 10% of turnover was distributed to shareholders and also invested in additional chilling centres and a milk powder plant with a capacity of 100,000 litres per day.

3.3.3 Comments Topic 3

For full text version refer to annex 1. The following comments were received and replied to by the relevant party.

- M. Tyler sought additional info on small-scale dairy processing plant and the development of a one-stop-shop for info and training and guidelines on setting up co-operative ventures.
- T. B. Thapa, Nepal identified marketing as the major challenge for Yak cheese in Nepal. He recommended introduction of quality standards, training and human resource development and improvement of milk collection for cheese processing.

- R. Shrestha, Nepal identifies formal small-scale milk processing as the best way to reduce practices that negatively affect product quality and consumer health.
- N. Abeiderrahmane, Mauritania commented on the difficulties in milk collection between the formal and informal market, sometimes raw milk is preferred. Milk supply varies seasonally and is linked to a mobile national market of urban dwellers buying milk in the countryside. The concept of herders organising is viewed as "unthinkable".
- P. Leperre, Kosovo sought policy advice and techniques from participants to use in reconstructing the shattered dairy sector in Kosovo

Comments on "*Your views please No. 4 !!!!*"
"There are few, if any, successful examples of co-operative milk producer organisations in developing countries outside Asia

- D. Harcourt, South Africa advised that he has also heard of successful co-operative milk producers organisation in Senegal and provided some contact details for additional information.
- R. Steinkamp, Yugoslavia reported on the effect of organisation of farmers in Montenegro on feed price reduction and raising the price of milk. He advised that in order to organise effectively there has to be a felt need and a real solution that only a group can solve.
- N. Sastry, India agreed in general that there are few examples of successful milk producers organisations outside the Asia region
- T. McClunie, New Zealand pointed out the success of the Organicao das Cooperativas Brasilelras in Brazil and advised that a similar organisation exists in Argentina for their co-ops.
- J. Morton, United Kingdom queried the meaning of 'successful' and reported on the case of Kenya where some seemingly open co-operatives had closed and limited membership. He reported that after liberalisation many co-ops were being squeezed between private processors and hawkers or middlemen who could undercut them.
- R. Giangiacomo, Italy reported on the existence of examples of several successful co-operative milk producers organisations in Venezuela and Colombia.
- J. Phelan, Ireland advised that MPOs have been the basis for successful dairy development in developed countries early last century. The conditions at that time are comparable to conditions in many developing countries now. Experiences form these regions may be useful for refining approaches for successful development of MPOs in developing regions.

CHAPTER 4

Summary of Participation and Evaluation

4.1 Participants

Each subscriber was requested to provide basic information from which the following figures were generated. A total of 571 people from 97 (see figure 4.1) countries subscribed to the conference, of whom 69% were from developing countries and remaining 31% from the non-developing world (see figure 4.2).

Figure 4.1: Represented countries in e-conference

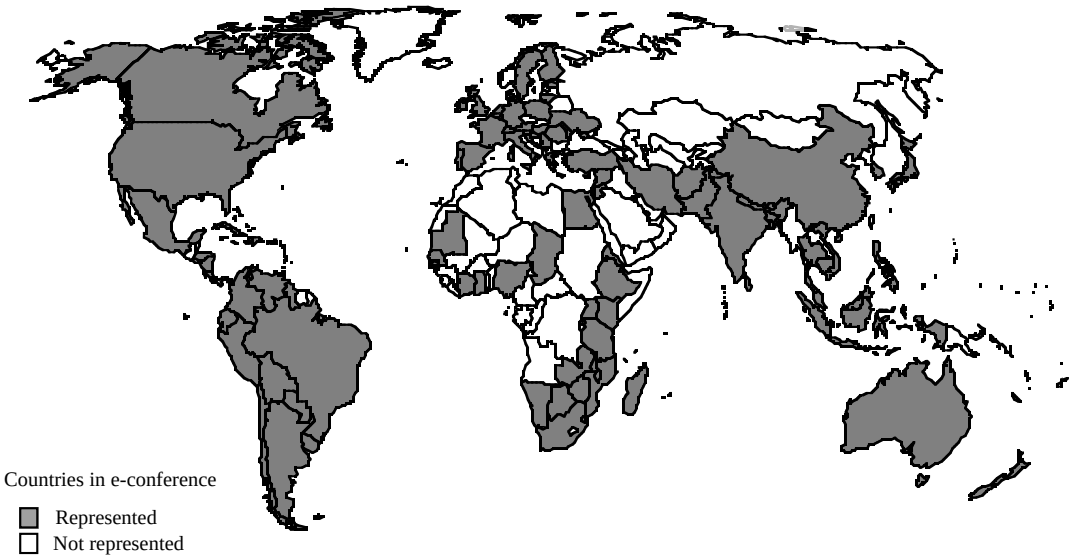
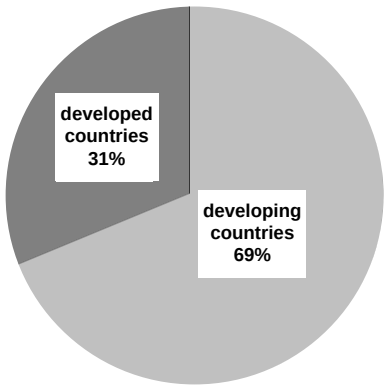
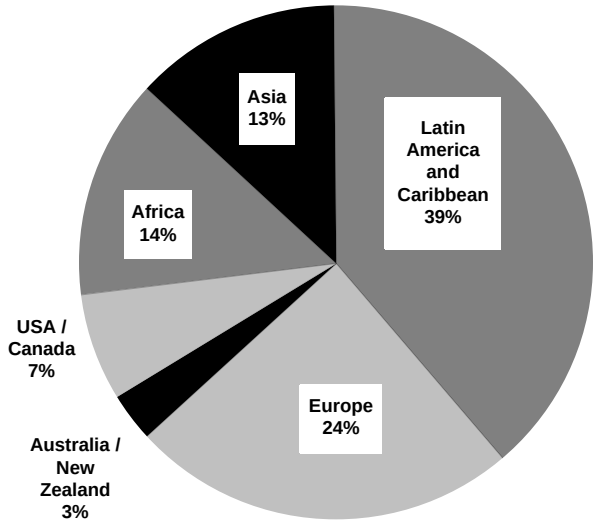


Figure 4.2: Percentage participants from developing / non-developing countries



Latin America and Caribbean ranked highest in participation from the developing countries with 39%, perhaps indicating that this part of the world has better access to e-mail facilities. The participation from Africa and Asia respectively was 14% and 13%. In the non-developing world, Europe was ahead in the list with 24% followed by 7% USA and Canada, and 3% from Australia and New Zealand (see figure 4.3)

Figure 4.3: Percentage participants from different global regions



During the conference, a total of 8 discussion papers and 6 poster papers were posted out to the participants.

4.2 Comments

In total, 28.7 % of the subscribers actively participated and contributed in the conference by sending comments, questions and feedback on the issues raised during the discussion.

In total, 107 comments were received, out of which the maximum comments sent by one participant was 7, followed by 6 comments by 1, 5 comments by 3, 4 comments by 3, 3 comments by 5, 2 comments by 11, and 1 each by 37 conference participants.

4.3 Internet WebPages

The conference used the Internet WebPages as a backup only. The pages can be found at the following address: http://www.fao.org/livestock/AGAP/LPS/dairy/econf/intro.htm

A counter was placed within the first page and people from more than 50 countries visited the Website. A total of 820 visits were made to the WebPages, and this is still increasing. Peak hours of visits were between 8 and 11 am and 1 and 4 p.m. Central European Time.

4.4 Questionnaire

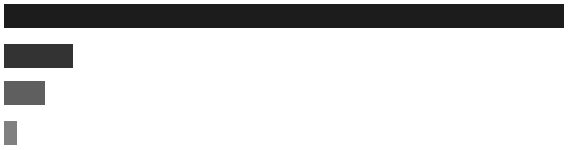
A short questionnaire comprising 17 multiple choice questions and 3 open questions was sent out to the conference participants, and the feedback received was analysed. A total of 128 participants sent back the completed questionnaires (see annex-7), which is 22.6 percent of all subscribers. An analysis of the multiple choice questions is presented below.

Results of Multiple Choice Questions of Questionnaire

********** **Organisation** **********

1
The length of the conference (2 months) was:

1) just OK	81	%
2) too long	10	%
3) too short	6	%
no answer	2	%



2
The E-mails received were sent out:

1) Too frequently	9	%
2) Just right	84	%
3) Not frequently enough	5	%
no answer	2	%

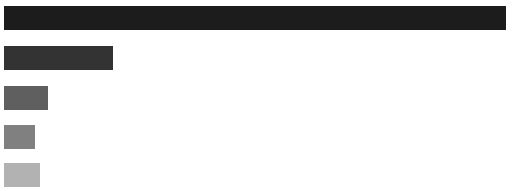
3
The E-mails "your views, please" were:

1) not useful or interesting	4	%
2) stimulating discussion	84	%
3) don't know	5	%
4) Other	5	%
no answer	2	%

********** **Topics** **********

4
I joined the conference:

1) from the beginning	70	%
2) during topic 1: from farm to collection point	15	%
3) during topic 2: milk processing	6	%
4) during topic 3: milk producer' organisations	4	%
no answer	5	%



5
The subject of the conference was:

1) very relevant	44	%
2) relevant	52	%
3) not so relevant	2	%
no answer	2	%

6
How do you rate the quality of the papers that were sent out?

1) very good	29	%
2) good / satisfactory	65	%
3) poor	1	%
no answer	5	%

7

From which topic did you learn the most:

1) topic 1: from farm to collection point	39 %
2) topic 2: milk processing	28 %
3) topic 3: milk producer' organisations	20 %
no answer	13 %

********************** About Yourself **********************

8

How would you describe your profession?

1) Milk Producer/Farmer	7 %
2) Member, Milk Producers Coop. Society	1 %
3) Small-scale Milk Processor	3 %
4) Large-scale Dairy Plant Owner	2 %
5) Extension Officer/ government official	10 %
6) Teacher	3 %
7) University Lecturer/Reader/Professor	23 %
8) Consultant	16 %
9) Development worker	22 %
10) Other	7 %
no answer	5 %

9

I am working in a

1) developing country	53 %
2) country in transition	20 %
3) non-developing country	22 %
no answer	5 %

10

1) I have easy Internet access	76 %
2) I have access, but sometimes/slow/difficult	19 %
3) I don't have Internet access	2 %
no answer	3 %

11

(If you have seen the Internet pages)

How do you rate the quality of the pages?

1) Excellent	26 %
2) Good	30 %
3) Poor	0 %
no answer / not seen the Internet	43 %

12
I followed the conference by reading

1) e-mails only	64	%
2) Internet pages only	2	%
3) both the Internet pages and the e-mails	33	%
no answer	2	%

13

1) I didn't contribute to the conference	71	%
2) I contributed actively (by comments/paper)	25	%
no answer	4	%

********** **About The Future** **********

14
I would be interested in receiving proceedings in:

1) Arabic	0	%
2) Chinese	0	%
3) English	55	%
4) French	5	%
5) Portuguese	4	%
6) Spanish	32	%
7) Other	0	%
no answer	0	%

15
I would like to receive the proceedings

1) by e-mail	53	%
2) I'll read it on the Internet	5	%
3) by post, hardcopy	40	%
no answer	2	%

16
In future, I would prefer an e-mail conference in:

1) Arabic	0	%
2) English	60	%
3) French	3	%
4) Spanish	28	%
5) Other:	2	%
no answer	7	%

17
In future, I prefer

1) a conference by e-mail	81	%
2) a conference only on the Internet	3	%
3) a conventional workshop	11	%
4) other	0	%
no answer	5	%

Comments made by the respondents:

In general, the respondents highly appreciated the e-mail conference, and suggested similar more in-depth conferences on other dairy development issues. The general feeling was that more people could participate through e-conferencing than a conventional workshop. Many wanted more information on small-scale processing. Feedback received suggested the conference materials are used by university teachers and extensionists as teaching material. Some wanted to receive the comments on a daily basis rather than twice weekly. Some felt e-mails were too long, but overall found the information interesting and the discussions useful.

Many found the trigger statements "Your Views Please" very stimulating and useful, and they said, relevant to the situation of the dairy sector in developing countries. Many felt that the views raised were pertinent and valid. They felt it was a good way to stimulate discussion and showed how the subject was taken seriously by participants in so many countries.

Specific reference was also made to the limitation of the conference to English. A number of requests for multi-language future conferencing and regional follow up workshops were also received.

A number of topics were suggested for consideration in the organisation of regional follow-up workshops next year, including;

- Development of concrete steps, strategies and actions to improve primary milk production systems to develop a satisfactory dairy sector.
- Some of the burning issues should form the part of the agenda for the regional workshops.
- More focus and information on the latest innovations in milk collection and storage, with costs e.g. solar power for cooling and Lactoperoxidase.
- Breeds for tropical production of milk.
- Agro-forestry and silvo-pastoral system

Follow up discussions and actions to guide medium or long-term planning activities suggested by the respondents included:

- Well defined technical information as well as useful criteria to choose the most suitable technologies in relation to the conditions prevailing in developing countries.
- Small-scale milk processing resulting in high quality products.
- Role of the government in promoting small-scale dairy industries.
- Policy changes needed to uplift small dairy industries
- Quality issues for small dairy industries
- Methodology to improve milk composition
- Topics from Discussion paper 2.1 and 2.2
- Co-operative milk producer organisations in developing countries
- Simple techniques for preserving milk
- Using HACCP in small-scale milk processing units
- Milk processing and milk producers' organisations
- Milk adulteration
- Farmers organisation and farmers training

- Milk quality related issues, including testing payment schemes
- Economic analysis of small milk processing units in the tropics

For the future e-mail conferences, the respondents proposed discussions of the following topics;

- Role of the government in promoting small-scale dairy industries
- Policy changes needed to uplift small dairy industries
- Quality issues for small dairy industries
- Child health problems due to the ingestion of different milk types
- Does the milk carry allergenic factors due to the production system (feeding strategy)?
- Technical methods to detect antinutritional factors in milk
- Specificity of different milks (cows, buffaloes, goats, sheep) processes
- More technological aspects of different dairy processes
- More about practical risk analysis processes for small-scale dairy units
- Use of the Lactoperoxidase system (LPS) of milk preservation
- Regulations on small-scale dairy processing
- Promotion of milk consumption in developing countries
- Milk production in the tropics
- The use of milk proteins
- On-farm research on milk collection.
- Privatisation of veterinary services in developing and ex-communist countries.
- Organising small groups of farmers on a self help basis
- Feeding strategies in developing countries.

Participants from many countries including Brazil, Tanzania, Nepal indicated they would provide information for the directory of small and medium scale milk processing equipment manufacturers.

CHAPTER 5

Conclusions and Recommendations

5.1 Conclusions

The following are the key conclusions as identified through analysis of the discussions, comments and feedback of the conference.

1. **Poor farmer returns.** Individual farmers or farmers groups in developing countries, in many cases, currently receive only a fraction of the retail price for their milk.

2. **Technical information and training**. A significant gap exists in technical information and skills development in small-scale milk collection and processing, especially in milk hygiene, appropriate milk preservation techniques, milk testing, quality control, HACCP for small-scale farmers, milk payment systems, dairy product diversification and organisation of milk producers.

3. **Technologies.** There is a lack of low cost small-scale milk cooling and processing technologies.

4. **Small-scale milk collection and processing** is highly relevant in developing countries. Focused E-mail conferences on small-scale milk collection and processing provide a valuable platform for information exchange and discussion.

5. **Legal instruments** covering the dairy sector in developing countries are frequently outdated and unsuited to current day market industry needs.

6. **Food Safety: pasteurisation of milk.** Many consumers in developing countries are not aware of the hazards of drinking unpasteurised milk.

7. **Opportunities for small-scale dairy sector.** Many governments are withdrawing from formal milk collection and processing, which has created an opportunity for small-scale milk processors to enter a lucrative market.

8. **Informal milk marketing** continues to play an important role in the total milk marketed in developing countries.

5.2 Recommendations

1. The core strength of small-scale dairy development will be an organisation which is ground up and market driven. Farmers and farmers groups need to **increase their current returns** from milk production. Through effective organisation, small-scale processing is a tool by which they can increase their direct market access and thus gain higher returns for their product(s).

2. FAO in collaboration with other international and regional partners is in an ideal position to provide **technical guidelines and advice** for sustainable development of small-scale milk collection and processing. These experiences could be compiled and prepared in a simple guideline or series of guidelines format to provide advise to both public and private parties on how to approach/initiate small-scale milk processing in their countries. These guidelines should comprise of:
   - a directory of suppliers of low cost small-scale dairy equipment for developing countries;
   - the setting up of Milk Producers' Organisations;
   - Milk payment systems;
   - Low cost milk quality testing procedures and equipment;
   - HACCP guidelines and good manufacturing practices for small scale milk producers.

   Regional dairy training centres should be established where technology and training can be adapted to local needs. This could be an effective and efficient way of promoting the development of a sustainable small-scale processing industry. However to address the greatest need and to maximise impact on the ground a comprehensive training and capacity building program is urgently needed in many countries where consumer demand is exceeding local supply or vice versa. One solution may be the initiation of regional or agro-ecological zone based training centres, which would be operated initially on a pilot basis and progress over a two-year period to a full cost recovery operation with professional management. Ideally then location would be related to the highest potential markets and milk production areas.

3. **Low cost and small-scale milk cooling and processing equipment** should be developed and promoted, that can be manufactured in many developing countries and can be adapted to meet market demanded products through simple processes.

4. **Follow-up regional workshops** of the E-mail conference should be organised. FAO is planning to hold a series of regional conferences on the key issues which have been raised during the conference. The conferences will be organised by FAO in collaboration with one or more regional partners. A number of conference subscribers have already indicated their willingness to be actively involved in the conferences and the locations and conference contents will shortly be finalised. The target beneficiaries will be public and private stakeholders who are actively involved in dairy development, extension activities, farmers groups, women's groups etc. The workshop objectives will be the following:
   - To promote small-scale processing as a sustainable and viable commercial activity
   - To identify the key factors essential to the success of small-scale milk enterprises in developing countries in the regions using a participatory framework
   - To produce practical guidelines on sustainable small-scale dairy processing

   Follow-up E-mail conferences should be organised. Lessons learned from the E-mail conference should be used to organise focused follow up E-mail conferences. The possibilities of an ongoing information exchange on small-scale milk collection and processing should be explored.

5. **A regulatory framework** needs to be developed and adopted into each country's national legislation to facilitate and encourage the development of a dynamic and vibrant small-scale

sector. This should range from group formation and registration as a legally recognised entity (e.g., co-operatives comprising producers or producers groups), to milk and dairy products standards to ensure consumer concerns are safeguarded and facilitate value addition and product diversification to meet consumer demands.

6. Governments and the private sector should take the lead in advising consumers on the **potential hazards of consuming raw unpasteurised milk** and dairy products. Quality milk production starts at farm level. Training in, and provision of basic information are required to support governments in this activity which should include all stakeholders at country level and be tailored to national conditions. Regional dairy training centres could also take a pro-active role in this.

7. National government and legislators need to **recognise the changes in the dairy sector in many developing countries.** Deregulation of large-scale enterprises has created a unique window of opportunity for small-scale processors to supply growing national demands. Governments should promote small-scale processing from policy to field level perhaps with the support of international organisations such as FAO, IDF, WHO, CIRVAL, ILRI..

8. **Organised small-scale milk collection and processing** can contribute to the development of a formalised milk collection, processing and distribution system. It should therefore be promoted not only as a sustainable, income-generating and household food security activity, but also as a means to improving the safety, quantity and quality of milk and dairy products available for consumers.

Annex-1: Conference Time-table

Date	Particulars
	Topic 1: From Farm to Collection Point
June 6, 2000	Discussion paper 1.1: Clean Milk Production and Support Services Dr OP Sinha. Consultant, Dairy Farmers' Organisation, Management and Training, ANAND 388 001 (India)
June 6, 2000	Discussion paper 1.2: Milk Collection, Preservation and Transport Jose Pedro Urraburu, Manager, Pan American Dairy Information System (INFOLECHE), a service of the Pan American Dairy Federation (FEPALE), Montevideo, Uraguay.
June 6, 2000	POSTER PAPER: The Lactoperoxidase System (LP-s) of milk preservation A. Bennett, Dairy Consultant, FAO Rome.
June 6, 2000	Comments received (1) as of 5 June
June 8, 2000	Discussion paper 1.3: Milk Testing, Quality Control, Hygiene And Safety Roberto Giangiacomo - Istituto Sperimentale Lattiero Caseario - Lodi, Italy
June 13, 2000	Discussion paper 1.4: Milk Payments; General considerations René Metzger, France
June 13, 2000	The System of Milk Payment in Nepal - Experiences from NDDB. R.M. Upadhayay, Senior Dairy Specialist, Nepal
June 13, 2000	Comments received (2): 8-9 June
June 15, 2000	Comments received (3) as of 10 to 15, June
June 15, 2000	Your views, please !!!!! (no. 1) - "developing countries cannot afford milk payments according to quality"
	Topic 2: Small-scale Milk Processing Technologies
June 22, 2000	Discussion Paper 2.1: Small-scale processing technologies: Liquid milk Lusato R. Kurwijila, Department of Animal Science and Production, Sokoine University of Agriculture, Tanzania.
June 22, 2000	POSTER PAPER : The Village Milk System - an alternative, low-cost milk collecting and in-pouch pasteurising system B.T. Dugdill, Dairy and Meat Officer (Institutions and Training), FAO, Rome.
June 22, 2000	Comments received (4): 19-22 June
June 27, 2000	Discussion Paper 2.2: Small-Scale Milk Processing Technologies: Other Milk Products. T. B. Thapa, Dairy Consultant, AGAP, FAO, Rome
June 27, 2000	Poster paper: Traditional milk products from India P.R. GUPTA, Editor & Publisher, Dairy India Yearbook & Technology of Indian Milk Products, India
June 27, 2000	Comments received (5): 23-27 June
June 29, 2000	Comments received (6): 22-29 June
July 03, 2000	Comments received (7): 29 June to 3 July
July 03, 2000	Your views, please !!!!! (no. 2) - "Small-scale milk processing is irrelevant as the bulk of milk in developing countries is sold raw through informal markets"
July 06, 2000	Comments received (8) on "Your views, please (no. 2)"

	Topic 3: Milk Producer Organisations (MPO)
July 10, 2000	Discussion Paper 3.1: Market Opportunities for Milk Producers' Organisations Steven J. Staal, International Livestock Research Institute, Nairobi, Kenya
July 10, 2000	Comments Received (9): 06-10 July
July 13, 2000	Discussion Paper 3.2: Organisation and Management of Milk Producers' Organisations. J. Phelan, International Consultant on Livestock Food Systems and Rural Development
July 13, 2000	Comments Received (10): 10-13 July
July 18, 2000	Discussion paper 3.3:Training Programme for the Small-scale Dairy Sector in Kenya (FAO-TCP/KEN/5511 project) B.T.Dugdill, Dairy and Meat Officer (Institutions and Training), AGAP, FAO, Rome, Italy
July 18, 2000	Your views, please !!!!! (no. 3) - "No appropriate legislation exists to effectively regulate small-scale milk processing"
July 20, 2000	Comments Received (11): 18-20 July
July 20, 2000	Your views, please !!!!! (no. 4) - "There are few, if any, successful examples of co-operative milk producer organisations in developing countries outside Asia"
July 20, 2000	Questionnaire on FAO E-mail conference on "Small-scale milk collection and processing in developing countries"
July 24, 2000	Comments Received (12): 20-24 July
July 27, 2000	The End (?!) - FAO E-Mail conference on "Small-scale milk collection and processing in developing countries"
July 27, 2000	Questionnaire on FAO E-mail conference on "Small-scale milk collection and processing in developing countries"
July 27, 2000	Comments Received (13): 24-27 July
July 31, 2000	Comments Received (14): 27-31 July
Aug. 3, 2000	Comments Received (15): 31 July to 3 August

Annex 2: List of Participants

Name	Country	Name	Country	Name	Country
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Andrea Janin	Argentina	Carlos Nagashiro	Bolivia	Devin Hunt	Canada
Andrea Maggio	Argentina	Fernando Cadario	Bolivia	Humberto Monardes	Canada
Cristina Arakaki	Argentina	Gunnar Serrudo Rmírez	Bolivia	Javier F. Burchard	Canada
Eduardo Martinez	Argentina	Ignacio Velasquez	Bolivia	joseph mallia	Canada
Francisco Javier Hurtado	Argentina	Javier Arce	Bolivia	Mark Hall	Canada
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Guillermo Pérez Mazás	Argentina	Nelson Ramos	Bolivia	Pablo E. Colucci	Canada
Gustavo Tito	Argentina	Rijk de Jong	Bolivia	Willy Nayet	Canada
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Héctor Roberto Buffoni	Argentina	Shalaulani James	Botswana	Tite Demba	Chad
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Laura Robert	Argentina	Beatriz Waltrick	Brazil	José Luis Garcia de Siles	Chile
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Omar Daga	Argentina	Ederlon Oliveira	Brazil	Rene Garces-Aviles	Chile
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Francisco Rizzo	Ecuador
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Tor Lundstrom	Finland
André Le Luec	France
Bernard Faye	France
Christian MEYER	France
Denis Sautier	France
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George Kanyama-Phiri	Malawi	Willem van Weperen	Netherlands	Delille Wessels	South Africa
Michael Nyirenda	Malawi	Tom McClunie	New Zealand	Ferdie Mostert	South Africa
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Siamy Wong	Malaysia	Ken Lewis	New Zealand	Greg Haylle-Dick	South Africa
Nancy Abeiderrahmane	Mauritania	Kerry Straight	New Zealand	Joan Berning	South Africa
K.Boodhoo	Mauritius	Robert Franks	New Zealand	Koos Coetzee	South Africa
Naidu	Mauritius	Stephen Lee	New Zealand	Lindela R. Ndlovu	South Africa
Parmessur Toolsee	Mauritius	Juan José Marenco García	Nicaragua	Nellie Prinsloo	South Africa
Alejandrino Bastar Cordero	México	Pascal Elegeert	Nicaragua	Qeda Nyoka	South Africa
Alfonso Velázquez	México	A. C. Obi	Nigeria	Sarel Moore	South Africa
Alfredo Julian Paredes	México	Olusanya Olutogun	Nigeria	Yoh Chang Yoon	South Korea
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Felix Lopez Xolot	México	Dr. Talat N. Pasha	Pakistan	José Luis Muñiz Rodríguez	Spain
Fernando Manzo Ramos	México	Ernst Mill	Pakistan	José M. Ena	Spain
Gustavo Chavez	México	Rashid Ahmed Nizamani	Pakistan	Luis Mata	Spain
Hector Enrigue	México	Syed Hassan Raza	Pakistan	Manuel Martin Rocha	Spain
Jorge Quiroz	México	Tanveer Ahmad	Pakistan	Thakshala Seresinghe	Sri Lanka
José A. Alayón G	México	Lourdes Denis	Paraguay	Elliot Magongo	Swaziland
Jose Espinoza	México	Marco A. Gonzalez	Paraguay	Anders Fagerberg	Sweden
José L. Romano-Munoz	México	Carlos A. Gomez	Peru	Eva Jonsson	Sweden
Juan Carlos Martínez	México	Daniel Sanchez	Peru	Hosein Amini	Sweden
Juan G. Magana M.	México	Jan De Neef	Peru	Magnus Oscarsson	Sweden
Luis Arturo Saucedo P	México	Jorge Manrique	Peru	Olof Claesson	Sweden
Luis Ramírez Avilés	México	Julio San Roman	Peru	Soren Lundin	Sweden
Martha Albarrán Díaz	México	Maria del Carmen	Peru	Hans Joehr	Switzerland
rarjona	México	Michel Millan Montero	Peru	Olivier Flechtner	Switzerland
Ricardo Coutiño Rincón	México	Saul Fernandez-Baca	Peru	Monika Zaklouta	Syria
Ronald Santos-Ricalde	México	Senamhi-Arequipa	Peru	Muhi El-Dine Hilali	Syria
Rutilio Nava-Montero	México	Thomas Bernet	Peru	Anton Glaeser	Tanzania
Tom A Dulisch	México	Tito Morante	Peru	Anton Glaeser	Tanzania
Erik Evans	Moldova	Walter Velasquez	Peru	Birgit van Munster	Tanzania
Andrew Mattick	Mozambique	Arnel N. del Barrio	Philippines	Ernst Lohle	Tanzania

Name	Country
Martin.N.Shem	Tanzania
Paul Stewart	Tanzania
Prof. Kurwijila	Tanzania
Rose Ubwe	Tanzania
Tanga Dairy Dev. Programme	Tanzania
Chaidate Inchaisri	Thailand
Chittra Arjinkit	Thailand
Denis Hoffmann	Thailand
Kritapon Sommart	Thailand
Monchai Maisaree	Thailand
Nurcan Cetinkaya	Turkey
Johnson Nkuuhe	Uganda
Robert Walimbwa	Uganda
Tom Mugisa	Uganda
Abdul Chaudhry	UK
Alan Duncan	UK
Andrew Gartside	UK
Anne Pearson	UK
Bruce Scholten	UK
Caroline Rymer	UK
David Wendover	UK
E R Orskov	UK
Euan F. Thomson	UK
John Chesworth	UK
John Morton	UK
Jon Thornes	UK
Juan Rivera	UK
Liz Alderson	UK
Mike Tyler	UK
Paul CHIY	UK
Sarah Plescia	UK
Stewart Stockdale	UK
Wyn Richards	UK
Andrei Vorobyov	Ukraine
Prof.Glazko V	Ukraine
Thomas Habermann	Ukraine
Tom Rulland	Ukraine
Alcides Fernández	Uruguay
Ana Zorrilla	Uruguay
Armando Gustavo Steneri	Uruguay
Cecilia Carriquiry	Uruguay
Daniela Innamorato	Uruguay
Danilo Bartaburu	Uruguay
Javier Lopez Davyt	Uruguay
José Luis Martinez	Uruguay
Jose Urraburu	Uruguay
Milton Tarca	Uruguay
Milton Tarca	Uruguay
Mónica Larrechart	Uruguay
Oscar González	Uruguay
Sergio Borbonet	Uruguay
Andy Lee	US
Barry L. Workman	US
Brinkley Benson	US
Caitlin Hunter	US
Carl Erickson	US
Carmella Hoffman	US
Cees de Haan	US
Charles Drabkin	US
Dale Anderson	US
David Hall	US
Deborah Wagner	US
Don Lloyd Ranck	US
Donald Trotter	US
James McDonald	US
Jens Spangenberg	US
Jerome Gauthier	US
John Beers	US
Julia Farmer	US
K Nakhai	US
Margret Paty-Petty	US
Marit Arana	US
Michel Wattiaux	US
Moshe Rosenberg	US
Myron Bozell	US
Palika Dias	US
Robin Bowie	US
Terry A. Gipson	US
Vicki Dunaway	US
Virginia Moyer	US
Walt Dennig	US
Alvaro Ojeda	Venezuela
Angel Stehlik	Venezuela
Carlos Alvarado	Venezuela
Carlos_Domínguez	Venezuela
Carmen Ordonez	Venezuela
Enrique Ron	Venezuela
Ivan Martinez	Venezuela
Jenny Urriola	Venezuela
Jesus Reggeti	Venezuela
José Añez	Venezuela
Omar Araujo-Febres	Venezuela
Oscar Lang	Venezuela
Dick Harting	Viet Nam
Paul POZY	Viet Nam
Bui Tuyen	Vietnam
Luc de Bruyne	Vietnam
Roger Steinkamp	Yugoslavia
Chibwe Kaoma	Zambia
Dr. Judith.C.N. Lungu	Zambia
Faith Gandiya	Zimbabwe
Julio de Castro	Zimbabwe
Mubasa Mugwagwa	Zimbabwe
Muhammad Qasim	

Annex-3: Conference Questionnaire

********** Organisation **********

1. The length of the conference (2 months) was:
) just OK
) too long
) too short

** I would prefer the following period:

_____

2. The E-mails received were sent out:
) Too frequently
) Just right
) Not frequently enough

** Remarks:

_____

3. The E-mails “your views, please” were:
) not useful or interesting
) stimulating discussion
) don’t know
) Other, please specify:

** Remarks:

_____

4. Do you have any other remarks regarding organisation?

********** Topics **********

5. I joined the conference:
) from the beginning
) during topic 1: from farm to collection point
) during topic 2: milk processing
) during topic 3: milk producer’ organisations

** Remarks:

_____

6. The subject of the conference was:
) very relevant
) relevant
) not so relevant

** Remarks:

_____

7. How do you rate the quality of the papers that were sent out?
) very good
) good / satisfactory
) poor

** Remarks:

_____

8. From which topic did you learn the most:
) topic 1: from farm to collection point
) topic 2: milk processing
) topic 3: milk producers’ organisations

** Remarks:

_____

9. I missed the following topics in the discussions:

********** About Yourself **********

10. How would you describe your profession?
) Milk Producer/Farmer
) Member, Milk Producers Coop. Society
) Small-scale Milk Processor
) Large-scale Dairy Plant Owner
) Extension Officer/ government official
) Teacher
) University Lecturer/Reader/Professor
) Consultant
) Development worker
) Other (please specify):

** Remarks:

---

11. I am working in a
) developing country
) country in transition
) non-developing country

** Remarks:

---

12. Internet accessibility
) I have easy Internet access
) I have Internet access, but only sometimes / slow / difficult
) I don't have Internet access

** Remarks:

---

13. (If you have seen the Internet pages)
How do you rate the quality of the pages?
) Excellent
) Good
) Poor

** Remarks:

---

14. I followed the conference by reading
) e-mails only
) Internet pages only
) both the Internet pages and the e-mails

** Remarks:

15.) I didn't contribute to the conference
) I contributed actively (by comments / paper)

** Remarks:

********** About The Future **********

15. I would be interested in receiving proceedings in:
) Arabic
) Chinese
) English
) French
) Portuguese

) Spanish
) Other, Please specify:

** Remarks:

_____

16. I would like to receive the proceedings
) by E-mail
) I'll read it on the Internet
) by post, hardcopy. My address is:

** Remarks:

_____

17. We will be organising regional follow-up workshops next year. Do you have any suggestions for this?

_____

18. In future, I would prefer an E-mail conference in:
) Arabic
) English
) French
) Spanish
) Other:

** Remarks:

_____

19. In future, I prefer
) a conference by E-mail
) a conference only on the Internet
) a conventional workshop
) other, please specify:

** Remarks:

_____

20. I think we should have follow up discussions / action on the following topics (this information will be used to guide our medium term planning for activities in small scale milk collection and processing):

_____

21. In any future (E-mail) conference(s), I would like to see the following topics being discussed:

_____

22. We are currently putting together a directory of small and medium scale milk processing equipment manufacturers. If you have any information that we can include in this directory, please provide details below.

_____

23. Do you have any other comments/ suggestions for improvements/ remarks:

Annex-4: Conference Definitions and Rules

Definitions:
For the purpose of this conference, the following definitions will apply:

Small-Scale: Where milk processing units are involved that process less than 5,000 litres per day; very small-scale processing centres are those that process less than 500 litres per day.

Milk: All milk from animals that is collected and processed, including milk from cows, goats, sheep, yaks, chauri's, buffaloes and camels.

Collection: The collection of milk from more than one farmer to a collection point or centre. The collection point could also be a processing centre.

Processing: The processing of raw milk into milk products like pasteurised or sterilised milk, yoghurt, cheese, cream, butter, etc.

Developing Countries: There is some ambiguity regarding the definition of a developing country, but in this conference the list of the Development Assistance Committee (DAC) is used, see e.g.
http://www.oecd.org/dac/htm/daclst2000.htm
The main focus of the conference will be on developing countries, although we do accept that a lot can be learned from small-scale milk collection and processing in developed countries.

Rules
The moderators of the conference will make sure that all messages posted follow the basic rules of the conference and are relevant to the subject of the conference. This is in no way to limit the views expressed by participants. We encourage and welcome a diversity of views, and we want you to speak your mind. As you do, however, we expect that you will follow some very simple rules.

Your participation in the E-mail conference is contingent upon and constitutes your acceptance of the Rules that follow.

For purposes of these Rules, each person participating in the E-mail conference, whether simply reading materials posted, reports generated etc., or posting any material or any link to any material, shall hereinafter be referred to as a "Participant". Similarly, FAO, and any eventual partners, shall hereinafter be referred to as ''Sponsors".

1. Personal Identification: Each Participant should include his/her name and country of residence in any message posted to a discussion. A Participant should never represent him/herself as another person.

2. Conduct: Participants may not post libellous or defamatory messages or materials, or links to such materials. Participants may not post messages or materials, or links to the same, that are obscene, violent, abusive, threatening, or designed to harass or intimidate another person or entity.

3. Liability and Responsibility: Each Participant is legally responsible, and solely responsible, for any materials, or links to any materials, that such Participant posts to the E-mail conference. Participants may only post materials that they have the right or permission to distribute electronically. Each Participant agrees to indemnify and hold harmless the Sponsors of the Conference from any and all liability, damages, costs or expenses, or any claim, action, suit or other proceeding arising out of either any posting that such Participant makes to the E-mail conference or any unauthorised use of material posted to any such conference by such Participant.

4. Accuracy: The FAO and any partners, as Sponsors of the Conference, cannot and do not guarantee the accuracy of any statements made in or materials posted to the E-mail conferences by Participants.

5. Attribution: Regardless of whether they identify the entity by whom they are employed, Participants are assumed to be speaking in their personal capacity unless they explicitly state that their contribution represents the views of their organisation. For this reason, Participants should not quote the postings of other Participants as representing the views of the organisations to which those other Participants belong.

6. Intellectual Property Rights and Fair Use: Each Participant retains the intellectual property rights, including copyrights, over any materials, or links to any materials, of such Participant's own creation that such Participant posts to the Conference. However, each Participant authorises other Participants to make personal and customary use of that work, including creating links to or re-posting such materials to other internet discussion sites but not otherwise to reproduce or disseminate those materials unless such Participant gives permission. Each Participant agrees always to identify the source and author of materials downloaded from the Conference if such Participant re-posts them elsewhere. Any FAO materials downloaded from the Conference will only be used outside the Conference if permission has been obtained from the FAO and the FAO is given credit as the source of the material. Additionally, each Participant expressly authorises the Sponsors of the E-mail conference to reference, summarise, quote and disseminate all or part of such Participant's postings to the E-mail conference in any summary or other document(s) that may be subsequently prepared.

7. Nature of the E-mail Conference: Each Participant recognises and agrees that the E-mail conference constitutes official FAO conferences in accordance with FAO's Constitution and rules and all applicable conventions.

The Moderators of the E-mail conference retain the right to refuse to post any message that they consider to be in violation of the above Rules, to publish the messages posted to the Conference in whole or in part and to modify messages posted to the Conference to ensure compliance with the Rules. The Sponsors may deny access to the conference to any Participant determined, in the sole discretion of the Sponsors, to be in violation of the Rules. The Sponsors also retain the right to make copies of the messages posted to the Conference as part of the normal process of archiving the discussions.

Annex-5: Introductory Paper, Discussion Papers, Poster Papers, and Comments Received on Topic 1: From Farm to Collection Point

Introductory Paper : "Overview of Small-Scale milk Collection and Processing in Developing Countries"

Jean Claude Lambert, Senior Dairy Officer, Brian Dugdill, Dairy and Meat Officer*, Jurjen Draaijer, Animal Production Officer*, Anthony Bennett, Dairy Development Consultant**
**Animal Production and Health Division, Food and Agriculture Organisation of the United Nations*

1. The Role of FAO

The Food and Agriculture Organisation (FAO) of the United Nations (UN) was founded in October 1945 with a mandate to raise levels of nutrition and standards of living, to improve agricultural productivity, and to better the condition of rural populations. Since its inception, FAO has worked to alleviate poverty and hunger by promoting agricultural development, improved nutrition and the pursuit of food security - the access of all people at all times to the food they need for an active and healthy life.

The Organisation offers direct development assistance, collects, analyses and disseminates information, provides policy and planning advice to governments and acts as an international forum for debate on food and agriculture issues. A specific priority of the Organisation is encouraging sustainable agriculture and rural development and to develop a long-term strategy for the conservation and management of natural resources. It aims to meet the needs of both present and future generations through programmes that do not degrade the environment and are technically appropriate, economically viable and socially acceptable. You can find more information on FAO at: http://www.fao.org or you can send an e-mail to info@fao.org with specific enquiries.

2. E-mail conference

The concept of this E-mail conference was developed as a result of increasing demands for assistance from member countries of FAO regarding small-scale milk production and processing. Small-scale milk collection and processing is one of the key potential growth areas in developing countries. Demand for milk and milk products has now almost stagnated in developed nations where industry is seeking innovative ways to market high value and diversified dairy products within a limited market. In developing countries there is a continuing rise in demand for milk, which is an essential dietary and nutritional source of vitamins and minerals for young children and the aged. However, a severe lack of technical knowledge and sharing of information and experiences in the small-scale milk sector is limiting the potential of this sector to meet rising market demands.

The objectives of the conference are to:

- provide an overview of small-scale milk collection and processing in developing countries
- gather ideas and share information about the subject of the conference
- establish links and facilitate co-operation between key persons working in dairy production

The outcome of the conference will be used to define priorities and develop policies for small-scale milk collection and processing in developing countries. The proceedings of this E-mail conference will be distributed both in electronic and printed form to a wide, global audience. Definitions used in the context of this conference, we are considering the following definitions, which you can also find under rules and definitions.

Small-Scale: Where milk processing units are involved that process less than 5,000 litres per day; very small-scale processing centres are those that process less than 500 litres per day.

Milk: All milk from animals that is collected and processed, including milk from e.g. cows, goats, sheep, yaks, chauri's, buffaloes and camels.

Collection: The collection of milk from more than one farmer to a collection point or centre. The collection point could also be a processing centre.

Processing: The processing of raw milk into milk products such as pasteurised or sterilised milk, yoghurt, cheese, cream, butter, etc.

Developing Countries: There is some ambiguity regarding the definition of a developing country, but in this conference the list of the Development Assistance Committee (DAC) is used, see e.g. http://www.oecd.org/dac/htm/daclst2000.htm The main focus of the onference will be on developing countries, although we do accept that a lot can be learned from small scale milk collection and processing in developed countries.

Topics and papers

Apart from the general discussion papers mentioned below, you will receive poster papers on more specific topics, related to the different discussion papers

Topic 1: From Farm to Collection Point:

You will receive soon the first paper in this series, "Clean Milk Production and Support Services". This paper deals with the importance of clean milk production at farm level. Hygiene at farm level is the important first step in improving the quality of milk products. The paper also looks at related support services for improvement of hygiene. "Milk Collection and Preservation" is the next discussion paper. The collection of milk, transport and ways to preserve the milk will be discussed in this paper. This is followed by "Milk Testing, Quality Control, Hygiene and Safety". This paper will deal with milk testing techniques and briefly outline the importance of quality control from the farm to the consumer. The next paper will be on "Milk Payments"; the importance of a milk payment scheme that encourages production of safe quality products will be discussed.

Topic 2: Small-scale milk processing technologies

There will be one paper dealing with the "processing technologies for liquid milk and one discussion paper on "Processing technologies for other milk products"

Topic 3: Milk Producers' Organisations (MPOs):

The first paper in this series is called "Identification of Market Opportunities", dealing with the importance of identifying the right markets for the products. The second paper will be on "Organisation and Management of MPOs", the third paper on "legal aspects of MPOs" and the last paper will be on "education, information training".

3. General Overview of small scale milk collection and processing

Current Situation

The milk sector in developing counties was frequently dominated by a large and often state owned or controlled central dairy industry. An increasing trend towards privatisation has resulted in the deregulation of these inefficient and poorly managed industries and presented a window of opportunity for the entry of private industry into the milk sector.

This unique set of circumstances has led to both a challenge and opportunity for small-scale farmers and processors in developing countries. Firstly there is an ever-increasing market in the urban centres. The growth in urban populations, increased levels of education and income growth has resulted in a massive increase in demand for dairy products. The International Food Policy Research institute (IFPRI), using its International Model for Policy Analysis of Agricultural Consumption (IMPACT), predicts that the consumption of milk in developing countries will grow by 3.3% each year between the early 2020. Translated into real figures this means that an 1990's and additional tons of milk will be consumed in 2020, as compared 233 metric millions with milk consumption in 1993.

The Challenges ahead

The challenge is to organise the collection of safe good quality milk and provide a constant supply of good quality milk and milk products to meet market demands. At the same time, the market demand for value added products for a range of income levels should be met. Governments are also looking to find ways to reduce imports of food and food products that are a major burden on national budgets and especially on hard earned foreign currency.

For example, Ghana currently imports almost half of its milk and dairy products. A recent national study, done by the Ministry of Food and Agriculture in collaboration with FAO, concluded, quoting:

- "Fresh milk consumption in the peri-urban areas is low due to the speculated perception that locally produced milk is not safe for consumption. This can be rectified through hygienic practices and milk handling."
- "The performance of the few milk producing co-operatives operating so far has shown that the quantity of locally produced milk currently available to processors and consumers could be increased significantly if effective collection and marketing systems are put in place".

As a result, at the request of the Ministry of Food and Agriculture, FAO will shortly provide assistance to formulate a project to set up a pilot small scale (1,000 litres a day) producer-owned milk marketing enterprise to demonstrate the innovated low-cost milk collecting, pasteurising and packaging technologies currently being promoted by the Dairy Group at FAO.

Policies and strategies to promote milk production in developing countries often do not address the key issues of small-scale milk collection and processing and this acts as a limiting factor in the success of many interventions and projects in the sector.

Small Scale Milk Production

In developing countries 80-90% of milk production comes from small-scale farming operations. As much as one third of the milk production is based in urban and peri-urban settings. Peri-urban and urban farmers have one key advantage over their rural counterparts: they are located close to the market, so they can supply the market in a shorter time and at lower costs. However, they are dependent to a large degree on expensive inputs such as concentrates and even grass or hay which have to be transported to the urban centres where their animals are based. Associated environmental and public health concerns over urban and peri-urban agriculture is a growing concern for the future. Conversely, milk is more easily and more efficiently produced on grass or agricultural byproducts.

Organisation of Small-Scale Producers

Growth and development of the milk sector can be achieved through the provision of various technical assistance programmes but most importantly through local level organisation of small-scale producers into working groups, associations or co-operatives. Perhaps the most renowned success story in recent years was dairying in India, which is now the largest milk producer in the world. Some 30 years ago the industry was practically non existent. Other more recent success stories include Bangladesh, Nepal, Kenya and Uganda which have seen huge rises in the number and diversity of small-scale processors who used collection and processing on a small-scale for initial entry into the market.

Small-scale producers and processors have the potential to meet the required increased demand in milk and milk products. Production potential may be sufficient but improvements are required in efficiency and particularly in vertically integrating smallholders and smallholder groups in the production chain. The main driving force to attract smallholders into this supply cycle is to provide increased returns to stimulate production and encourage uptake of improved technologies. This applies from farm level where high hygienic quality and safe milk is produced right up to consumer level. Increased return will necessitate the uptake of value addition and other effective and adaptable (preferably low cost and low tech) technologies by organised groups of producers who collectively have increased investment and human resource capacity and can quickly benefit from sharing of resources, costs and experiences.

Participation in the conference

A dedicated team has been assembled to manage and moderate the discussions and I wish them all the best for this challenging and time consuming task. The conference proceedings will be used as the base document for a series of regional technical workshops planned in South America, Africa, Asia and the Near East in 2001. A number of other supporting initiatives such as a directory/database of small and medium scale dairy equipment manufacturers and suppliers are also planned for the near future. It is envisaged that the outcome of these workshops will be incorporated both into future focused activities for the Animal Production and Health Division of FAO and also result in actions plans for follow up activities in the regions. It will however only be through your full and active participation that the objectives of the conference can be achieved and have a concrete outcome.

Discussion paper 1.1: Clean Milk Production and Support Services

Dr OP Sinha. Consultant, Dairy Farmers' Organisation, Management and Training A/6 Avkar Apartment, Near IRMA. ANAND 388 001 (India)

1. Clean Milk Production

Agriculture is the base of India's economy. Agriculture forms 31% of the national GDP (see e.g. http://www.nic.in/agricoop/stats.htm) and approximately 75% of India's population live in villages and depend on crop and livestock farming for their livelihood. Livestock production, including dairying, plays a multipurpose role in the agriculture systems of India. Milk is a cheap but high value source of nutrients for the rural population. If milk is not produced hygienically it can affect the health of many people.

Besides being a health hazard, contamination of milk can lead to huge economical losses. Contamination may occur at different levels: at farm level, during collection and storage, and at processing centres. Milk contains many essential nutrients, such as carbohydrates, proteins, lipids, minerals and vitamins and therefore might act as an ideal medium for rapid proliferation of harmful microorganisms. Milk needs to be protected from all possible sources of microbial contamination and various types of disease organisms. When the milk is secreted from the udder, it is almost sterile. The employment of hygienic practices at the time of milking is therefore one of the first and most important steps in clean milk production.

'Clean Milk' is generally defined as *"milk drawn from the udder of healthy animals, which is collected in clean dry milking pails and free from extraneous matters like dust, dirt, flies, hay, manure etc. Clean milk has a normal composition, possesses a natural milk flavour with low bacterial count and is safe for human consumption"*.

Clean milk production results in milk that:

- is safe for human consumption and free from disease causing microorganisms;
- has a high keeping quality;
- has a high commercial value;
- can be transported over long distances;
- is a high quality base product for processing, resulting in high quality products.

Contamination and Control Measures at Farm Level

Potential sources of contamination of milk are dung, water, utensils, soil, feed, air, milking equipment, the animal and the milker her/himself. Contamination of milk can occur at the following levels:

- Animal shed and environment.
- The Animal
- Milker and milking routine
- Milking equipment
- Storage and transport

Animal shed and environment:

The animal shed is one of the main sources of contamination. At the same time however, a good shed protects against micro-organisms as it keeps out other animals, people, wind, rain and excessive heat, all increasing the danger of contamination. Mud, urine, faeces, and feed residues should regularly be removed from the shed. The shed should have proper drainage, sufficient light and ventilation. In very wet areas, sprinkling slaked lime over the surface will help to dry it out quickly.

The milking area of the shed needs special hygienic attention. The floor of the milkshed should be swept with clean water, and disinfected with one-percent bleaching powder solution. Facilities should be provided for a sufficient supply of safe and potable water for drinking, washing udders and flanks of the animals, utensils and milkers' hands etc.

TheAnimal

The animal itself is one of the most significant sources of contamination, care and management of the animal

and its health is therefore the starting point for clean milk production. Milk from diseased animals should be kept separate and disposed of safely. Animals suffering from any contagious disease, including mastitis, should be segregated from the healthy ones.

The skin of the animal provides a large surface for possible contamination. Long hairs on the flanks, hind legs, tail and udder should be clipped at frequent intervals. If washing of animals is not practised regularly as is observed in most cases, at least grooming of the animals should be done to keep the hair and dust away from milk. The udder is the part of the animal nearest to the milk and needs to be washed before each milking, and dried with a clean cloth or towel.

Milker and Milking Routine

In the case of hand milking, the danger of contamination coming from the milker is higher as compared with machine milking. The milker should therefore be free from contagious diseases. Nails should be well trimmed; she/he should wear clean clothes and should wash her/his hands with soap and water before milking, then dry with a clean towel. A good milking routine prevents contamination of the milk. A consistent milking method at regular intervals, fast but gentle and complete milking, and sanitary methods during milking are all important aspects. Feeding roughage at the time of milking should be avoided. If the calves are suckling, the calf should be allowed to suckle at the beginning of the milking. The udders and teats should be washed and massaged for at least 30 seconds and dried prior to milking. Foremilk should be examined and abnormal milk should be discarded. The foremilk should not be allowed to run on the floor as this increases the danger of contamination. The milk should be drawn directly into the pail as fast as possible. The milker should not wipe their hands on the body of the animals or on their own body. After milking, the teats can be dipped or sprayed with a gentle antiseptic solution. The milking area should be thoroughly cleaned after each milking.

Milking Equipment

Dirty milking equipment is one of the main sources of infection of milk. About 15 minutes before milking, milking equipment should be rinsed with a sanitizing solution. In this way, dust and contaminating agents will be removed. Milking equipment should also be thoroughly cleaned after use because any milk residues in the equipment will allow microorganisms to grow rapidly. The utensils and equipment used during milking should be of standard quality. They should be made up of acceptable, non-absorbent, corrosion-resistant material and should be easy to clean. The utensils and equipment should not have any joints or open seams and should be free from dents, rust etc. The milking utensils and equipment should be thoroughly cleaned and sanitised after each milking. An acceptable, non-toxic and non-corrosive cleaning and bactericidal agent should be used for cleaning and sanitation. After cleaning and sanitation, the utensils and equipment should be stored in such a manner and location to prevent contamination from flies, insects dust, dirt, rodents etc. They should preferably be stored in an inverted position off the ground to facilitate drainage of wash water.

Storage and Transport

Before storage, it is best to filter the milk with a clean cloth in order to remove large particles that might have entered the milk. The cloth should be thoroughly cleaned after use and left to dry in the sun. Heat, light and violent movement can all cause breakdown of certain components in the milk. Milk should therefore be cooled as quickly as possible. In case chilling is not feasible, preservatives like lactoperoxidase can be added to prolong the time before the milk gets spoiled (Discussion Paper 1.2 will deal with this issue). Milk should be stored in clean containers with a lid and kept in a cool and shady place where the danger of contamination is minimal. Milk should be transported in clean containers, transport time should be kept to an absolute minimum and violent movement of the milk should be avoided as milk fat can soon turn rancid in the presence of oxygen.

2. Economics of Clean Milk Production

When setting standards for clean milk production, it is important that the standards reflect the local conditions. If milk is boiled before use and consumed within hours of production, high capital investments to improve hygiene may not be an economic necessity. With an increasing time between milking and consumption, hygienic measures should improve. At the same time, with an increasing scale of farming, there is more room for investments in hygienic practises. The cost of clean milk production should not exceed the benefit of the farmers. Milk payments should be an incentive to improve the hygiene, and clean milk production should be financially rewarded.

3. Support Services Related to Clean Milk Production.

Milk Producers' Organisations (MPOs) should provide "Support-Services" to increase clean milk production. An effective and well trained animal health service should be available at any time to look after the health of animals, arrangements should be made for regular vaccination and checking against contagious diseases by the qualified veterinarians. Veterinary first aid should be readily available around the clock at village level.

To avoid spoilage, milk collection centres should be set up at locations where producers can easily access. Milk producers' organisations should have their own arrangements for milk processing, manufacturing of by-products and marketing to maximise returns to the producer.

In many developing countries, knowledge of hygiene is often not sufficient. One of the most important support-services regarding clean milk production is "Extension-Education". The ultimate aim of this service should be to develop the awareness amongst the milk producers towards cleanliness of milk shed, clean milk production and animal health care. These services should be organised at the village level and main thrust should be given to empower the women members.

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Discussion paper 1.2: Milk Collection, Preservation and Transport (Topic 1: From Farm to Collection Point)

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1. Machine milking

On medium to large dairy farms, the usual practice is to milk cows by a milking machine that sucks the milk out of the teat by vacuum. The milking equipment consists of a vacuum pump, a vacuum vessel which also serves as a milk collecting pail, teat cups connected by hoses to the vacuum vessel, and a pulsator which alternately applies vacuum and atmospheric pressure to the teat cups.

The teat cup unit consists of a rigid outer case containing an inner tube of rubber, called the teat cup liner. The inside of the liner, in contact with the teat, is subjected to a constant vacuum of about 0.5 bar (50% vacuum) during milking. The pressure in the pulsation chamber (between the liner and teat cup) is regularly alternated by the pulsator between 0.5 bar during the suction phase and atmospheric pressure during the massage phase. The result is that milk is sucked from the teat cistern during the suction phase. During the massage phase the teat cup liner is pressed together to stop milk suction, allowing a period of teat massage and for new milk to run down into the teat cistern from the udder cistern. This is followed by another suction phase, and so on.

Relaxation of the teat during the massage phase is necessary to avoid accumulation of blood and fluid in the teat, which is painful to the cow and will cause her to stop letting down. The pulsator alternates between the suction and massage phases 40 to 60 times a minute. The four teat cups, attached to a manifold called the milk claw, are held on the cow's teats by suction. During milking, suction is alternately applied to the left and right teats or, in some instances, to the front teats and rear teats. The milk is drawn from the teats to the vacuum vessel or into a vacuumed transport pipe. An automatic shut-off valve operates to prevent dirt from being drawn into the system if a teat cup should fall off during milking. After the cow has been milked, the milk pail (vacuum vessel) is taken to a milk room where it is emptied into a churn or a special milk tank for chilling.

To eliminate the heavy and time-consuming work of carrying filled pails to the milk room, a pipeline system may be installed for direct transport of the milk to the milk room by vacuum. Such systems are widely employed on medium sized and large farms and allow milk to be conveyed in a closed system straight from the cow to a collecting tank in the milk room. This is a great advantage from the bacteriological point of view. It is however important that the pipeline system is designed to prevent air leakage agitating the milk in a harmful way. The machine milking plant is also provided with cleaning-in-place (CIP) facilities.

2. Chilling milk on the farm

Milk leaves the udder at a temperature of about 37°C. Fresh milk from a healthy cow is practically free from bacteria, but must be protected against infection as soon as it leaves the udder. Micro-organisms capable of spoiling the milk are everywhere - on the udder, on the milker's hands, on air-borne dust particles and water droplets, on straw and chaff, on the cow's hair and in the soil. Milk contaminated in this way must be filtered.

Careful attention must be paid to hygiene in order to produce milk of high bacteriological quality. However, despite all precautions, it is impossible to completely exclude bacteria from milk. Milk is in fact an excellent growth medium for bacteria - it contains all the nutrients they need. So as soon as bacteria get into milk they start to multiply. On the other hand, the milk leaving the teats contains certain original bactericides which protect the milk against the action of micro-organisms during the initial period. It also takes some time for infecting micro-organisms to adapt to the new medium before they can begin to grow.

Unless the milk is chilled it will be quickly spoiled by micro-organisms, which thrive and multiply most vigorously at temperatures around 37°C. Milk should therefore be chilled quickly to about 4°C immediately after it leaves the cow. At this temperature the level of activity of micro-organisms is very low. But the bacteria will start to multiply again if the temperature is allowed to rise during storage. It is therefore important to keep the milk well chilled.

Under certain circumstances, e.g. when water and/or electricity is not available on the farm or when the quantity of milk is too small to justify the investment needed on the farm, co-operative milk collecting centres should be established.

3. Farm cooling equipment

Spray or immersion coolers are used on farms which deliver milk to the dairy in cans. In the spray cooler, circulating chilled water is sprayed on the outsides of the cans to keep the milk cool. The immersion cooler consists of a coil which is lowered into the can. Chilled water is circulated through the coil to keep the milk at the required temperature.

Where milking machines are used, the milk is collected in special farm tanks. These come in a variety of sizes with built-in cooling equipment designed to guarantee chilling to a specified temperature within a specified time. These tanks are also often equipped for automatic cleaning to ensure a uniformly high standard of hygiene.

On very large farms, and in collecting centres where large volumes of milk (more than 5 000 litres) must be chilled quickly from 37°C to 4°C, the cooling equipment in the bulk tanks is inadequate. In these cases the tank is mainly used to maintain the required storage temperature; a major part of the cooling is carried out in in-line heat exchangers in the delivery pipeline.

4. Frequency of delivery to the dairy

In former times milk was delivered to the dairy twice a day, morning and evening. In those days the dairy was close to the farm. But as dairies became larger and fewer, their catchment areas grew wider and the average distance from farm to dairy increased. This meant longer intervals between collections. Collection on alternate days is now common practice, and collection every three or even four days is not entirely unknown.

Milk should preferably be handled in a closed system to minimise the risk of infection. It must be chilled quickly to 4°C as soon as it is produced and then kept at that temperature until processed. All equipment coming into contact with milk must be cleaned and disinfected.

Quality problems may arise if the intervals between collections are too long. Certain types of micro-organisms, known as psychrotrophic, can grow and reproduce below +7°C. They occur mainly in soil and water, so it is important that water used for cleaning is of high bacteriological quality. After an acclimatisation period of 48-72 hours, growth goes into an intense logarithmic phase. This results in breakdown of both fat and protein, giving the milk off-flavours that may jeopardise the quality of products made from it. This phenomenon must be allowed for in planning of collection schedules. If long intervals cannot be avoided, it is advisable to chill the milk to 2-3°C.

5. Milk transportation to the dairy

The tanker driver who comes to the farm or the co-operative milk collecting centre to pick up the milk, should take a representative sample and preserve it properly to maintain the same properties from the time it was taken, until it is received at the dairy. The same principle applies to the collected milk, which should be transported in an insulated tank capable of maintaining a temperature between 4ºC and 9ºC.

Drivers must follow regular routines to transport milk from the farm to the dairy as follows:

* Wear uniform and keep good personal hygiene.
* Agitate the milk before taking the sample.
* Record the temperature of milk to be loaded.
* Carn, out the alcohol test before loading.
* Take the sample.
* Fill out the transport receipt.
* Return to the farmer the dairy plant reports on the test results of his milk.

During transportation, thermographs measure temperature levels of the milk. In advanced dairy countries, the insulated trucks are equipped with automatic sampling devices. Prices for these devices range from US$ 500 to US$ 7,000.

6. Control software

Some available software products allow the dairy to keep record of the complete milk transportation chain: milk samples, driver and tanker tracking, shipment volumes, etc.

7. Case study: a Brazilian dairy co-operative

Contrary to the notion that the small dairy farmer is destined to failure, the Co-operative Agropecuaria de Boa Esperança Ltda. (CAPEBE), located in Minas Gerais, Brazil has successfully developed a milk collection

programme among its farmers, 80% of them producing an average of 100 litres/day. The key of the programme is the common cooling tank. After more than a year of the new collection programme implementation, the region of Esperança where CAPABE operates has nine common cooling tanks working, and four more in the process of installation.

Between April 1999 and February 2000 CAPEBE bulk milk collection, including 55 private cooling tanks, has grown from 28% to 70% of its 55,000 litres/day production. This has allowed CAPEBE to reduce milk rejected at reception from 140,000 litres in 1997 to 16,400 litres in 1999. One of the major impacts of the programme on dairy farmers was the dramatic reduction of transport costs, which in some regions fell up to 80%. For example, in some places, the transport cost per litre went down from US$ 0.022 to US$ 0.007.

Before the use of common cooling tanks, the tanker would travel a distance of 90 kms, loading between 1,000 and 1,200 litres per day. Today, after two common tanks and five private tanks have been installed, the tanker circuit is down to 58 kms., loading 6,500 litres of milk every two days. In addition to the reduced transportation costs, product quality has improved because the time between milking and arrival at the dairy has been significantly reduced.

At a price of US$ 5,155, each cooling tank has a capacity to store 2.500 litres of milk. The farmers use the financing offered by CAPEBE that allows payments in 15 months without interests, five months longer than the market financing. The tank invoice goes to one of the associated farmers, but all of the farmers authorise CAPEBE to discount the payments from their milk cheques.

The most recent purchase of a common cooling tank was made in March of this year, by 16 dairy farmers who together produce 1.200 litres/day.

Appendix 1: Cooling tanks prices

Here are some reference prices for different capacity cooling tanks, available in the Brazilian market (May 2000):

Capacity (Litres)	US$	US$/Litre	Capacity (Litres)	US$	US$/Litre
150	1.988,95	0,0045	1.000	3.059,12	0,0010
200	1.538,67	0,0026	1.200	3.425,41	0,0010
250	2.154,70	0,0029	1.300	4.814,92	0,0013
260	1.743,09	0,0023	1.500	4.342,54	0,0010
300	1.818,78	0,0021	1.550	5.543,65	0,0012
350	1.840,88	0,0018	1.600	3.774,59	0,0008
500	2.070,72	0,0014	2.000	4.411,60	0,0007
520	2.486,19	0,0016	2.050	5.524,86	0,0009
600	3.149,17	0,0018	2.500	4.582,87	0,0006
650	2.261,88	0,0012	3.000	5.054,14	0,0006
750	3.038,67	0,0014	4.000	6.595,03	0,0006
800	2.702,76	0,0011	5.300	7.979,56	0,0005
			6.000	9.113,26	0,0005

Milking machines and milk cans prices

The following are reference prices of milk cans available in the Brazilian market, and milking machines available in Uruguay.

Milk cans and pails - May 2000

	US$	US$ / litre		US$	US$/l		US$	US$/l
Plastic can			Tin can			Tin milking pail		
5 l	3,48	0,70	5 l	7,76	1,55	10 l	7,18	0,72
10 l	5,64	0,56	10 l	11,22	1,12	15 l	9,39	0,63
20 l	14,25	0,71	20 l	19,28	0,96			
40 l	0,00	0,00	30 l	23,12	0,77			
50 l	30,83	0,62	50 l	31,66	0,63			

Milking machines - December 1999

Models direct to can	US$
2 cups	2.500
4 cups	4.500

Models for pipes	US$
4 cups	8.139
6 cups	10.271
8 cups	12.193
12 cups	17.195
16 cups	23.502

Appendix 2: Farm equipment sources

The following are a few examples of farm and testing equipment manufacturers:
http://www.westfalia.com/english/start.htm - Farm Equipment (Germany) www.alfalavalagri.com - Farm Equipment http://www.foss.dk/foss.asp - Testing Devices (Denmark) www.Bosio.com.ar - Milking machines (Argentina) http://www.ordemex.com.mx - Milking machines (Mexico)
Complete lists of companies in Latin America can be purchased at the Pan American Dairy Information System - INFOLECHE: www.fepale.org

Sources:

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Pan American Dairy Information System - INFOLECHE

Discussion paper 1.3: Milk Testing, Quality Control, Hygiene And Safety

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The subjects mentioned in the title suggest two separate approaches for improving milk utilisation. Up to ten years ago, milk testing and quality control mainly addressed chemical composition, in particular fat content, and the suitability for processing milk into cheese. In the last decade, due to the increase in the international milktrade, the interpretation of these terms has been expanded to include hygienic control.

1. Milk composition

Milk composition is a basic requirement for the evaluation of the feed conversion efficiency into milk and determines the suitability of milk to be processed into further products. A large amount of literature is available on this subject, and it continues to be important, due to the numerous factors involved in determining the amount of milk produced by animals, the protein and fat content, and its hygienic quality.

The main factor determining milk composition is the breed of the lactating animals, but also the environment and pastures play an important role. For example in Italy, which is a country with a large variety of geographical environments, milk composition can vary significantly with the season and with the location. On flatlands, such as the Province of Cremona, which has the highest number of lactating cows in the country, the protein content is on average 3.26% and the fat content is 3.56%. In the province of Bolzano, mainly mountainous, the average protein and fat contents are 3.42 and 4.05%, respectively. In southern regions, like Sicily, the averages are 3.24 and 3.44%, respectively. The production par cow also varies significantly: an average of 8.5 t per lactation in Cremona, versus an average 4.2 t in Sicily.

2. Milk testing and quality control

2.1 Milk testing and quality control at farm level

Farmers do not carry out direct measurements on the composition of milk. However, they are able to evaluate the sanitary conditions of animals and should be able to detect the presence of mastitis, the major enemy on the dairy farm. Mastitis results in a reduction in fat and protein contens and the farmer can see and feel a variation of the density of secreted milk. The infection often comes with some secretion of blood, which results in the colour becoming pale pink. Attention should be paid also to changes in normal colour due to the ingestion of particular feeds, plants, or by-products from other food processing which impair anomalous pigmentation. These same substances might lead also to changes in flavour, for example fish odour from fish protein concentrates, with aromatic substances remaining entrapped on the fat globules.

The farmer is the key quality controller on the farm. This will include screening of milk containing residual drugs, for example antibiotics or sulphamides, careful rinsing of the milk tanks to avoid the presence of residual detergents. These residues and additions can easily be detected and reduce the economic value of the milk.

2.2 Milk testing and quality control by collection or processing centres

Centres collecting milk from farms generally carry out the analysis of antibiotics and sulpha compounds on each lorry. The most well known and easily applied method is the colourimetric response to the growth of Bacillus stearothermophilus var. calidolactisina solid agar medium after incubation. At each delivery the freezing point of milk is also measured for detection of added water. Commercial instrumentation is available for this analysis and its cost is generally repaid by the decrease in the amount paid for adulterated milk. Instruments provide values in °H (Hortvet) or in °C (Centigrade). Conversion formulas can switch from one system to the other. Values above -0,520 °C (i.e. closer to 0 °C) are suspect, but the normal interval of freezing points in the region has to be known . Formulas can convert the variation in freezing point, as a consequence of variation in the electrolytes content, into the amount of added water.

Similar information is usually given by the measure of density using a lactometer at 15 or 20 °C, which generally is between 1028 and 1034 g/L at 15 °C. Values lower than 1028 g/L generally indicates presence of

added water, as a consequence of the variation in the fat and protein content by dilution. Formulas can permit to compute from the density value an estimate of the total solids. pH is the measure of the global amount of dissociated H^+ and therefore a rough estimate of the acidity of the milk. pH is a very easy measure, if the instrument is well calibrated, and provides an immediate indication on the condition of the milk. The normal values for milk are 6,6-6,8. Lower values generally mean an acidification process due to development of bacteria; higher values generally mean the presence of mastitis.

A more accurate measure of the degree of acidification is given by the titration of milk. Titration is carried out by adding through a burette a solution of NaOH. Depending on the type of system in use the normality (N) of sodium hydroxide changes: 0.25N for Soxlet Henkel (°SH), N/9 in Dornic (°D). Current values are 7-7,8 °SH. Higher values generally mean an acidification process due to development of lactic acids by bacteria. Two simple and rapid methods can provide an estimate of the suitability of milk to be consumed or processed: the stability of milk to ethanol 68% and the alizarin-alcohol test. The first method is based on the behaviour of milk when mixed to an equal volume of ethanol 68%: if the milk does not form floccules, it is normal; if it does, it means that the milk is generally not suitable to further processing.

The second method is more accurate and is based on the change in colour of the equivolumetric mixture of milk with alizarin-alcohol. According to a colourimetric scale and the eventual presence of floccules it is possible to define the normality, the degree of acidification or the presence of abnormal milk (colostrum, mastitic milk). The above mentioned analyses are carried out at each delivery and do not require specially trained staff.

Determination of protein and fat content require more sophisticated instrumentation and trained staff. Official methods exist, issued by Codex and by IDF. For determination of these milk constituents on a large scale, automatic instruments are available. A mid-infrared radiation is filtered by selected filters permitting the passage of those wavelengths corresponding to the absorption of the chemical bonds characteristic for protein, fat, and lactose. A calibration curve with known samples permits the quantitative determination of the three constituents simultaneously. If such an instrument is available, the milk composition is assessed at each delivery and enables a milk payment system based on quality. If traditional wet chemistry has to be used for these determinations, the analyses are generally carried out every two weeks. Determinations on the Total bacterial count, using a standard plate count are also carried out every two weeks. More information on analytical procedures carried out in collection centres can be found in the FAO small scale dairy farming manual.

2.3 Discussion

In 1992 the EU issued the Directive 92/46 establishing the hygienic requirements for the production and marketing of raw milk, liquid milk for consumption, milk for the preparation of dairy products, and dairy products. In the application of the Directive, cow milk destined for the production of liquid milk for consumption must comply with some chemical and physiochemical parameters, e.g. minimum protein content of 28 g/L, non-fat dry matter minimum 8,50%, weight not less than 1028 g/L, freezing point lower or equal to -0,520°C. The Directive gives great emphasis to the precision of the analytical measurements and to the purpose establishes that member countries designate a central laboratory, co-ordinated by a European Central Laboratory, to provide analytical methods, to organise comparative tests, to promote new methods, to improve personnel skill, etc.

Under the umbrella of these national laboratories farmers' organisation, the performances of the own laboratories of industrial organisations or any other organisation, can be kept under control. After the initial investment costs for equipment, the analyses are quite inexpensive and do not request solvents or any other reagent which must be disposed of in a safe manner. This procedure facilitates the continuous monitoring of milk trade, the payment of milk by quality (see discussion paper 1.4) and result in the improvement of the relationship between sellers and buyers. Moreover, the assurance of the correctness in analytical performance permits the development of specific programs aiming at improving feeding for a higher animal productivity, both qualitatively and quantitatively. The establishment of national networks of laboratories also allows monitoring and control of milk composition in different areas, often with different climatic conditions. In addition it permits easy data collection for statistical purposes, contributing to the basis for national and international legislation.

3. Hygiene and Safety

In the last decade more and more emphasis was put world-wide on foodborne diseases. WHO and FAO are already involved in developing programs aiming at monitoring these diseases and minimising their effects (FAO/WHO Food Standards Program). However, the type of diseases, the agents, the epidemiology, the type of products

involved and the technologies necessary to minimise the risks associated with the consumption of those products, etc. are not well known. The EU has issued provisions concerning hygiene in milk production, milk collection and processing. Raw milk from cows and buffaloes must be produced by animals officially free from tuberculosis and brucellosis, which do not present symptoms of infectious diseases transmissible to humans through milk and in good general sanitary conditions. Cows should produce at least 2 litres of milk per day. Raw milk from sheep and goat must be produced by animals officially free from brucellosis, unless destined for the production of cheese with over 60 days ripening.

Milk must be free from residual substances as veterinary drugs or detergents. The Directive provides also the maximum limit of total bacterial count for the milk of the various species marketed in EU. The combination of hygienic provisions for the animals, of environmental characteristics in the milking areas, in the milk collection points, and during transport, of heat treatment, of hygienic processing and of a self-monitoring programme by the factory minimises the risk of marketing contaminated products potentially transferring diseases to consumers.

Other micro-organisms are emerging, capturing the attention of scientists and analysts. Research in dairy products often shows the detection of bacteria which before were never analysed, but very likely present also in the past. The development of modern analytical tools reveals the presence of an unexpected number of different biotypes of the same species. For several reasons micro-organisms change, become more virulent, more resistant to certain antibiotics, the number of people susceptible to being infected increases, etc. All these can cause, together with the increased capacity of monitoring and keeping record of infections transmitted through dairy products, to an increased number of cases of foodborne diseases.

In developing countries, there are some reports on the presence, with an incidence ranging 10-20% of the samples, of harmful organisms such as E. coli O157: H7, Brucella melitensis, Bacillus cereus, Yersinia enterocolitica, Aeromonas hydrophila, Pseudomonas seudomallei, Lysteria monocytogenes, Staphylococcus aureus, etc. Samples were isolated from products consumed directly and deriving from cow, sheep, goat, camel, buffalo milks. It is also clear that there is a high risk of contracting diseases by consumption of these products. However, we make this statement on the basis of our limited European experiences which were recorded in a totally different environment, on a different population with very different food consumption habits, in very different sanitary conditions, etc. There is no evidence that the same number of a bacterial species can induce disease independently of the biotype, of the product in which it is present, of the characteristics of the population consuming that product. The adoption of sanitary provisions requires an in-depth knowledge in each country, or homogenous geographical area, of the real incidence of foodborne diseases, which diseases are transmitted through dairy products, in which products do the virulent agents persist after processing, and which provisions are necessary to minimise the risk of the presence of these organisms. But this issue would deserve a specific paper. Another issue that would need special attention and discussion is the presence of aflatoxins, in particular aflatoxin M1. These toxins are quite often found in milk and milk products, as consequence of the growth of fungi on feed, a phenomenon facilitated by the environmental conditions in several developing countries. Due to the carcinogenic properties of some toxins the control of aflatoxins is highly advisable for the benefit of consumer health.

Discussion Paper-1.4: Milk Payments; General Considerations

By: René Metzger, France

1 Difficulties associated with prices and costs in milk production

1.1 Farm milk costs and prices

Milk is produced and consumed by the most important animals, i.e. mammals. Milk's nutritive qualities are essential for the young mammal's normal development from birth to a more or less advanced age, according to species, and for humans in particular.

10,000 to 15,000 years ago, man had managed to domesticate some mammals in order to improve his life-style. The animals provided milk, meat, wool, skins, fuel, fertiliser, transport and draught power, etc. This domestication signalled the passage from the custom of picking and hunting to an agricultural and breeding culture.

This universality of milk production and consumption was made possible when climatic and sanitary conditions were sufficient to allow herds to develop. Today, however, the nutritive qualities of milk and dairy products' are recognised everywhere, to the extent that their production and consumption are present in all modern societies. But the universality of milk production has been changed by the local socio-economic and cultural environment to intensive production from herds of very different sizes in industrialised countries, where the selective and rational breeding habits have reached satisfactory production levels or even higher, for most animals.

On the contrary, extensive breeding with only limited access to modern production techniques leads to median productivity levels in many developing countries. Nevertheless, milk production was for a long time linked with economic livelihood, self-consumption of milk by the farming-breeding families using the animal as for draught purposes and for the production of meat. These were the main objectives closely linked to cattle breeding. As a co-product of breeding, the value of milk can only be set by the market. This is still the case in many developing countries where the price of a litre of milk can correspond to several hours of labour.

Rural emigration and improved living standards in developed countries since the beginning of the industrial revolution, were the causes of increased demand from farmers. This demand being at first realised by milk collectors who sold the milk on urban markets.

Supported by technical progress in constant evolution, (selection, rationalised animal feeding), this production ensures the farmers of a regular income. Although milk has always been just one element among others in a subsistence economy, during the XXth century it became more and more important providing farmers with a regular, remunerative income from mixed farming. But, here again, getting money for milk is often confused with family costs and farming costs. No distinction is made between income and deductions with respect to their origin and destination. It is the same for hours worked or deductions in kind for farm products, which are not accounted for. Therefore, production costs can only be estimated.

Further evolution came in the 70s when milk production had become a real specialisation on large sized farms where production costs can be calculated without any ambiguity as to the direct allocation of expenses. In fact, only the industrialised countries have reached this stage for some of their milk production. In other parts of the world, milk production is still largely considered as a subsistence activity, and less often as a cash economy. It is therefore just an approximation to speak of production costs and prices of milk (farm-prices).

1.2 What is milk?

From the farm to the consumer the journey for raw milk is long and complex. At present, milk is the basic raw material of many products available on the market: drinking milk, cheese, butter, yoghurts, evaporated and powder milk etc.

For the farmer, the price of milk represents labour, fodder, cattle foodstuffs, breeding, farm rent, financial expenses etc. For the processor, the price of the raw material depends on the composition of milk (fat and protein content), on the bacteriological quality, and on the seasonal market etc. For the consumer, the price of milk and dairy products represents the possibility of varied food and he/she appreciates the large range of milk products for their nutritive and gastronomic characteristics. Consequently, an exact estimation of the price of milk does not exist and the price can be obtained using several methods:

- Through an arbitrary decision established by professional bodies and/or administrations.
- Based on the value to the local market (drinking milk, yoghurt, cheese...) or on the world market (butter and skimmed milk powder)
- In accordance with the marginal price of one gram of fat and one gram of protein, and in respect to quality.

This value can be based on subsidies given to exports (E.U.), deficiency payments (USA) or otherwise in respect to non-subsidised markets (N.Z., Australia). In the developing countries, the price is essentially based on the local market for dairy products.

2 The price of milk (farmgate price)

At what price is the farmer paid for his/her milk? To this rather simple question, there is no clear and unique answer, even though an annual indication of price may be proposed for one region, one country, or even a group of countries (e.g. the European Union).

2.1 Price per kg or per litre?

Although most countries give prices per kilo and per ton of milk, some still speak about a litre and a hectolitre of milk. The general trend must be retained, i.e. per kilo and ton as measure units for milk even though litres are largely used.

2.2 Seasonal pricing of milk

In all countries, either in temperate zones or in tropical zones, there are strong seasonal variations of the milk volume produced. As needs do not increase at the same pace as production, there are two prices for milk; low and high seasonal prices. Sometimes, a monthly variation can be observed concerning the price of a kilo of milk. The difference between the maximum and the minimum price can reach 30% calculated on the low price (for temperate countries). This can be doubled on the open market in tropical countries.

To calculate costs and margins, the average weighted yearly figure should be used as a reference for the calculation exercise. This simple accounting method must not leave aside the possibility of achieving a monthly cost price that will be compared with the purchase price proposed by the collecting concerns. Optimisation of profit should lead to more regular production during the course of the year. For non-grazing systems, this target is easier to reach.

2.3 Payment in respect to quality

From one season to another, from one cowshed to another, milk can show large quality differences, which milk processors must take into account. Two types of criteria are used for paying by quality:

* Physio-chemical
* Bacteriological

2.3.1 Physio-chemical criteria

Physio-chemical criteria usually relate to the fat content and protein matter, the basic rate of which per kilo of milk varies from one country to another. The basic price will be obtained for fat content generally between 3.8 and 4.2%, and a protein content between 2.9 and 3.4%. Each degree of fat content or protein matter (0.1% or 1 gram/litre) results in a premium being paid above the basic rate and a reduction below this rate.

2.3.2 Bacteriological criteria

In developed countries, there is a question of not collecting unsound milk (e.g. containing over 100,000 bacteria or more than 400,000 somatic cells for E.U. standards). Testing for better bacteriological quality could result in finding specific bacteria such as:

* Coliforms
* Staphylococcus
* Listeria
* Butyric spores

Similarly, the presence of antibiotics and the milk temperature during collecting can be used as quality criteria

and for price reduction. In developing countries, for small scale dairy plants the tests normally carried out for physio-chemical and bacteriological quality are density to determinate possible adulteration by water and acidity to determine suitability for processing.

2.4 Farmgate price

The price paid to the producer by the milk collecting concerns (dairy, collecting co-operative society) includes the basic seasonal figure, increased or reduced by a certain amount, according to the quality criteria found. However, this price never includes a cooling premium, as this operation is catered for and controlled by the collecting concern. The milk-cooling tank is therefore included in the collecting costs (see below). The price of milk from the farmgate should be calculated as follows:

Seasonal basic price
+ Accounted for fat content rate
+ Accounted for protein rate
+ Accounted for quality (total bacteria)
+ Accounted for quality (Leukocytes)
- Accounted for specific quality criteria (Antibiotics, specific bacteria)
± Volume premium
= Farmgate price

Finally, an additional annual price increment can be granted to producers belonging to co-operative systems:

* as a further premium for quality
* as a rebate on supplies
* as a membership bonus.

However, the most important bonus amounts are paid at the end of the year on the volumes delivered during the low season (dry season, winter). These different premiums and rebates can represent 2 to 5% of the farmgate price paid monthly.

3 Milk Collection Costs

For a long time, and even today in many regions of the world, transporting milk from its production site to a transformation unit or a consumption zone was, or remains a considerable obstacle, that sometimes cannot be overcome in order to develop the milk industry. Improved transport requires good road infrastructures to ensure rapid and safe transport of a particularly fragile raw material that deteriorates very quickly.

3.1 Collection

Early on in developed countries, milk was traditionally collected in milk churns (20 - 40 litres) that were put on a vehicle from the dairy, which stopped at each farm to collect the full churns in exchange for empty churns cleaned by factory. As farms had no refrigeration systems, the milk was collected twice a day (morning and evening milking), seven days a week. These heavy and expensive systems for collecting milk still exist in many developing countries or when milk is produced on small more or less isolated farms. In addition to the high cost of this type of milk collection, quality control of the milk did not exist and the churns were just checked to see whether they contained the right amount. In mountain village dairies or in the bush, the milk churns are also brought to the factory by the milk producers. In this case, the purchase price of the milk is increased by a few cents per kilo in respect to the basic price.

In developing countries the milk producers bring their milk to the collecting centre. Once a day, a large capacity tanker comes to collect the milk collected during the day. Therefore, with only a few stops at different centres the tanker can collect the milk coming from many producers. The advantages of this system are numerous:

* reduced collecting costs
* maintained milk quality
* easier control of volumes and quality of the milk.

All these operations can be made by one person alone; furthermore, it is at the collecting centre where documents to pay the producers can be prepared.

The system of primary collecting centres spread over a radius of 20 to 50 kilometres around the factory is the best method of collecting milk produced in dispersed areas (small producers in mountain or remote areas) in good economic and hygienic conditions. This is the solution to be adopted wherever milk is difficult to get out from where it is produced with the assurance of a certain and regular outlet, and is an encouragement for producers to produce more and better milk. The milk collection process stops at the factory when the milk is put into a holding area or storage tank.

Cost of the raw material upon arrival at the factory =
Ex-farm price paid to the producers + Collection Costs

3.2 Collection cost

This is an integral part of the cost of collecting and comprises the following:

* purchase and maintenance of the equipment
* cleaning of the milk churns at the factory
* supply of maintenance and hygiene products for the cooling tanks
* consumption of water and electricity for chilling.

When collection is made in bulk, the milk is kept in cooling tanks with direct expansion. However, concerning milk collecting in churns, these are put in a tank where cold or chilled water circulates.

3.2.1 Sharing of the chilling costs between the producer and the factory

It has been stated in this paper that expenses involved in storage and cooling operations related to milk collection and are therefore the responsibility of the factory.

3.3 Possible Options

Organisation of milk collecting will largely vary depending on the company's size and also in respect to geographical, climatic, seasonal, legal etc., constraints. Two options may be considered, depending on the size of the enterprise.

For small-sized enterprises, milk collecting will often be limited to milk collecting in optimal time conditions in order to conserve the milk's qualities.

For units producing under 2,000 l/per day, in developing countries, several options are possible. In the best case, a four-wheel drive vehicle with a platform will make one or two rounds with churns that must be washed at the factory. Therefore, milk-collecting costs will include the following items:

Fixed expenses, namely:

* amortisation of the vehicle, the churns and small equipment
* insurance and taxes concerning the vehicle
* garage and overhauling costs
* driver's wages
* attribution of building costs

Variable costs

* petrol, oil and tyres
* overhauling of the vehicle
* churn washing costs.

In the event of very dispersed collection areas, two or three primary collecting centres can be organised and managed by one of the producers. Milk brought to these centres will be by the producers themselves. In this case a supply premium will be added to the costs generated by the running of the collection centre.

A CASE STUDY OF THE PRODUCTION OF MILK BY RURAL FARMERS IN THE HIGHLANDS OF SOUTH AFRICA

Topic 1: from farm to collection point, clean milk production

By: Nellie A. Prinsloo and J.J. Keller, ARC-Animal Nutrition and Animal Products Institute, P/B X2, Irene, 0062, RSA

1. Introduction

Although 2.2 million tonnes of commercially produced fresh milk had been recorded during 1999 in South Africa, this figure excludes milk produced by small and rural producers. In the rural areas the milk produced is usually consumed within the household. Yet, some entrepreneurs have already entered the commercial market in this country. Similar to countries in the rest of Africa (especially Southern Africa), long distances, lack of facilities and a harsh climate drastically affects the quality and quantity of the milk produced by the small, South African rural farmer.

2. Background

In the mountainous highlands of South Africa, developing farmers are shareholders in a dairy factory that manufactures fresh milk, yoghurt, drinking yoghurt, maas (a fermented milk product) and a small number of Gouda and Cheddar cheeses. The products are sold to the +/- 600 000 locals living in and around the nearby town. The milk is supplied by the 40 shareholders to the factory, all living within a 70 kilometre radius from the factory. Only two of the farmers have milking parlours and produce about 800 litres and 400 litres of milk, respectively. The other farmers are lacking milking facilities completely. The animals are of mixed breeds, feed on natural grasslands and pastures and despite winter rainfall and snow, no supplementary green feed is given to the animals. The factory needs 13 000 litres of milk per day, but due to a recent draught, only about 6 000 litres of milk are received daily. This is a typical example of the seasonal impact on milk production in rural areas. Poor hygiene practices will have a totally detrimental effect on the viability of the venture.

In South Africa the concept of collection points for receiving raw milk is not regularly used in the rural areas. In this case, milk is transported by light open truck, horse or donkey cart, tractor and bicycle to three collection points. Payment is determined by the volume of milk supplied by the farmer and is only accepted after it complies with the alcohol test. The milk is then being taken to the dairy factory by three tankers. At the factory total counts, coliforms and E.coli counts are determined.

3. Training and recommendations

Training was provided for the group of farmers (including the women), collection point personnel and the factory personnel. A training manual and training material was composed consisting of the following modules:

- Personal hygiene
- Micro-organisms
- Micro-organisms: importance
- Micro-organisms: destruction
- Micro-organisms: control
- Cleaning and disinfection
- General cleaning

Personal hygiene was the first subject on which the farmers were trained. A simple, effective hygiene routine already positively influences the microbiological quality of raw milk. Milking machines are great sources of contamination and hand milking often results in milk of a higher microbiological standard, provided that both animal and handler are healthy. Emphasis was placed on the area being used for milking the cows to be, as far as possible, free from any excreta. It is also preferable not to feed the cow whilst milking is in progress. The farmers were advised to wash the udder after which it has to be dried with a paper towel. If there is no municipal water

available, only pre-boiled water should be used. Almost none of the farmers used antibiotics to treat mastitis. The concept of using a mastitis strip (test) cup for each quarter was well accepted by everyone. The use of cloth aggregates microbial contamination, as micro-organisms are able to colonise the material at an alarming rate. Therefore, substitution with paper towels was advocated. It is also not desirable to use a milk cloth in order to filter out impurities. In this case the use of an in-line filter at the collection tanks was suggested.

The importance of cleaning and sanitising was demonstrated to the farmers. They used to clean their own milking cans, often with an undesired effect. The correct cleaning and sanitising methods and agents were being used by the personnel at the collection points. They were tasked with the responsibility of ensuring the cleaning and sanitising of the farmers' milk cans at the collection points immediately after receiving the milk. The milk cans will then be kept closed while being transported back to the farm. Milking took place during the very early hours, minimising the need for cooling facilities during transportation.

4.Results

Bacterial counts of the raw milked decreased with nearly 70% and the keeping time increased from 3 to 7 days. Although use of the Lactoperoxidase system is not currently allowed in South Africa, according to legislation, the use of this system will be ideal in the above mentioned situation, as for other rural milk producers.

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Poster Paper: THE SYSTEM OF MILK PAYMENT IN NEPAL - EXPERIENCES FROM NDDB;

by R.M. Upadhayay, Senior Dairy Specialist, Nepal

INTRODUCTION

Historically, milk was not supposed to be sold. Probably it was so because every house hold used to produce milk for their own consumption. Milk has, however, been traditionally processed into country butter, Tschurpi, Shergham, etc. and ghee, all indigenous products. Butter milk used to be served to guests in place of water, free of cost. Processed products were bartered or sold for cash within and outside the country. The products from high mountain areas found their market in the north and from plains in the south across Nepalese borders.

Later, as the population started growing and the urbanization process began, milk went into market to serve those who could not afford to keep milking animals. In rural areas milk used to be bartered with rice on one to one basis volume wise. In urban areas milk was sold on cash or credit by producers directly to consumers. Later on middlemen entered into the marketing channel. Milk shops came up in cities like Kathmandu about 100 years ago. It seems that there was no system of price fixation. Prices were bargained between the buyer and the seller and payment was made in cash at the time of purchase or after a week, a fortnight or even a month, as mutually agreed by both parties

EVOLUTION OF MILK PAYMENT SYSTEM:

It was only in early 1950s that a pricing and payment system was introduced in Nepal. It was the time when HMG of Nepal first initiated buying milk from farmers to process it into cheese and other milk products. The Dairy Development Section, under the Department of Agriculture introduced a system of milk payment based on criteria of price determination and frequency of payment.

EXPERIENCES FROM NDDB:

Early stages:

Slab system:

Milk price was determined on the basis of fat content in milk. Different rates were fixed for milk containing different ranges of fat, say 4 to 6, 6 to 8, and above 8 percent of fat, with proportional variation. For example, if 4 to 6 percent milk price was Rs. X per unit of milk, the prices for 6 to 8 and above 8 percent fat milk were fixed at Rs 1.5 X and Rs 2 X per unit, respectively.

During those times, all the milk brought to the collecting centers were from buffalo. During the late lactation period buffalo milk tested up to 13% fat (Personal experience from this author). The payment was made at intervals of 15 days.(Payment is still made at the same frequency).

This system worked fairly well for some time. Later the farmers became clever enough to manipulate the milk in such a way that no milk was received testing more than 8.5%, and almost all the supplies tested nearer to the lower level.

Linear fat percentage system:

Learning lessons from above experiences, a linear fat percentage rate was introduced. For example, Rs X per fat percentage per unit of milk was fixed for all milk deliveries which contained above the minimum fat level fixed at 5%. A penalty rate was fixed for milk testing less than 5% fat. This system worked very well. Farmers realized that they did not gain anything by adulterating the milk. This system was in practice for long time.

Present: Fat + SNF system:

Improved cross bred cows entered into the farming system in 1980s. Farmers selling cow milk got very low rate because of low fat in milk. It was not possible to fix different rates for cow and buffalo milk because it was practically impossible to detect and differentiate between these two types of milk under field conditions. It was even more difficult if the milk was mixed.

Thorough study of this problem was made and a dual axis payment system was introduced. A minimum

level of fat and SNF was fixed. Different rates per kg of fat and per kg of SNF were introduced. Different rates per unit of fat and SNF were fixed on the basis of distance and season of procurement. However, the seasonal differences in price are not sufficient to induce farmers for adjusting their breeding system to bring more animals in milk during the lean season.

This double axis payment system has brought many problems of adulteration with sugar soda ,starch, urea etc. in order to raise SNF. It is very difficult to detect these adulterations at field level, and. NDDB is now preparing a proposal for a new payment system.

Quality Payment System :

The present system is based only on fat and SNF. The new, incentive payment system under preparation in NDDB will be based on fat and protein content and on microbiological quality. Milk will be graded according to quality, and high quality milk will be paid a premium price, whilst low quality milk will be paid a penalty rate.

POSTER PAPER: The Lactoperoxidase System (LP-s) of milk preservation

A. Bennett, Dairy Consultant, FAO Rome.

Background

Milk represents one of the fastest returns for small-scale livestock keepers. It is a key element for household food security. The generation of surplus milk brings income to women and children who are usually in charge of the milk-producing animals such as goats, sheep and cows. Milk can frequently generate the only regular income for rural families and is therefore essential for their survival. In remote areas where there is a huge demand for fresh, good quality milk, small-scale milk producers face a major problem in accessing distant markets. Most of the small farmers have no direct access to the market. Middlemen therefore take the biggest share of the consumer milk price. Milk can usually be transported unrefrigerated for up to 20 km but after a certain period will begin to deteriorate. Souring sets in and the milk quickly becomes useless.

Milk is the last nutritional link between a mammalian mother and her offspring. As well as providing a complete and balanced diet for the newborn calf, kid or human baby, milk also contains antibacterial agents to protect the sucking young from various infectious diseases. The knowledge that milk, and particularly colostrum contains immune factors essential for the survival of offspring is not new, and research in Sweden on colostrum in the 1960's led to the discovery of a naturally occurring enzymatic preservation system in milk. The enzyme is called Lactoperoxidase and through in depth research a system of reactivation was developed using simple activators. The result is a system of milk preservation, which maintains the keeping quality of milk for 7-8 hours at ambient tropical temperatures (30°C).

The system

Lactoperoxidase is an enzyme, which is naturally present in milk. One of its unique biological functions is an antibacterial effect in the presence of hydrogen peroxide and thiocyanate. Both of these substances are naturally present in milk in varying concentrations. The method of activating LP-s in milk to add about 10 PPM of Thiocyanate (preferably in powder form) to the raw milk to increase the overall level to 15 PPM (Parts Per Million, 5 PPM naturally present). The solution is thoroughly mixed for 30 seconds and then an equimolar amount (8.5 PPM) of hydrogen peroxide is added (generally in the form of a granulated sodium carbonate peroxyhydrate). The activation of the Lactoperoxidase has a bacteriostatic effect on the raw milk and effectively extends the shelf-life of the raw milk under tropical conditions for 7-8 hrs. This means that producers can then transport the milk from the collection point to a processing centre and thereby significantly increase the income generated at farm and producer group level.

After 15 years of field experiments in developed and developing countries, a Code of Practice for the use of an alternative milk preservation method based on the activation of the natural enzymatic antibacterial complex in milk (Lactoperoxidase system) was approved by the FAO/WHO Expert Committee on Food Additives in 1989 and by the Codex Alimentarius Commission in 1991. The system is cheap, easy to use and readily applicable in developing countries with a minimum of training requirements.

The World Bank estimates that 20% of all milk produced is wasted in developing countries. The use of LP-s in raw milk means that a larger quantity of milk can be collected and processed from areas where there is a lack of dairy infrastructure. Small scale producers, (often women), will therefore have increased incomes through the sale of surplus production, there is a 'liquid' benefit to the consumer and milk production will be stimulated. They will have an increased opportunity to market their surplus milk to the urban centres and also to reduce milk losses. This will result in a substantial increase in cash income for the household. Up to 40% of an increase in production of milk available for processing can result when the system is adopted. The penultimate beneficiaries will be the consumers who will have fast access to safe, quality milk.

Adoption

In countries with an advanced dairy industry, cooling safeguards the bacterial quality of the raw milk and prevents spoilage. However cooling is rarely an applicable preservation technique for small-scale producers in developing countries due to the absence of reliable electrical supply or economic constraints. An opportunity now exists for the women smallholders, who have the responsibility for marketing of surplus milk, due to the following reasons:

- There is an increasing trend to privatise the dairy industry in developing countries and countries in transition.
- Many small milk processing industries have emerged and are trying to develop their milk collection system
- The demand for fresh milk by the urban population is growing very fast.

One of the limiting factors is the availability of a safe, cheap and easy to use system of milk preservation. With a cheap, flexible method of preservation of milk from farm to the dairy many families can have their household income increase by a minimum of 50% within 6 months.

LP-s does not function as an end product treatment. It is a processing aid, which enhances the naturally occurring antibacterial system in milk. It is therefore essential that the quality of the raw milk is good and thus training in clean milk production is complementary to the demonstration of the Lactoperoxidase system of milk preservation. The system is described by Codex Alimentarius as intended for utilisation in the following situations:

3.1. The method should be used only in situations when technical, economical and/or practical reasons do not allow the use of cooling facilities for maintaining the quality of raw milk. Use of the LP-s system in areas which currently lack an adequate infrastructure for collection of liquid milk, would ensure the production of milk as a safe and wholesome food, which otherwise would be virtually impossible.

3.2. The method should not be used by the individual farmers but at a suitable collection point/centre. These centres must be equipped with proper facilities for cleaning and sanitising the vessels used to hold and transport milk.

3.3. The personnel responsible for the collection of milk should be in charge for the treatment of the milk. They should be given appropriate training including training in general milk hygiene, to enable them fulfil this in a correct way.

3.4. The dairy processing the milk collected by use of the Lactoperoxidase system should be responsible for ensuring that the method is used as intended. This dairy should set up appropriate control methods to monitor usage of the method, raw milk quality and quality of the milk prior to processing.

3.5. The method should be used to prevent undue bacterial multiplication in raw milk during collection and transportation to the dairy processing plant under condition stated in

3.6. The inhibitory effect of the treatment is dependent on the temperature of the stored milk and has been found to act for the following periods of time in laboratory and field experiments carried out in different countries with raw milk of an initial good hygienic standard:

Temperature C	Time (h)
30	7-8
25	11-12
20	16-17
15	24-26”

Source: CAC/GL 13-1991

The use of the Lactoperoxidase system does not exclude the necessity of pasteurisation of the milk before human consumption. Neither does it exclude the normal precautions and handling routines applied to ensure a high hygienic standard of the milk”

Implementation

In recognition of the huge potential and demand for the use of such a safe and cheap system of raw milk preservation, FAO, with the support of the Swedish government prepared to disseminate and advise developing countries on the adoption of the LP-s. A panel of 11 experts drawn from the 5 continents convened in Uppsala in 1998 to launch the Global Lactoperoxidase Programme, which is based at FAO HQ in Rome. The objective of the programme is to facilitate the uptake of the system in developing countries and countries in transition.

The main activities of the programme will include national and regional demonstrations of the application of the system at field level including the provision of training as detailed in the guideline. Participating government will in collaboration with regional and national institutions identify areas or zones in which milk infrastructure is inadequate for collection of milk produced. The programme will invite participation of both

public and private parties to demonstrations but with an emphasis on women who are the main decision-makers regarding milk and milk marketing in the majority of developing countries

A total of 80 countries have to date registered their interest in participating in the FAO Global Lactoperoxidase Programme. FAO, with the support of the Swedish, Irish, Hungarian and Czech Governments is promoting the uptake of Lactoperoxidase as a safe and effective method of milk preservation.

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www.fao.org/WAICENT/FAOINFO/AGRICULT/AGA/AGAP/LPS/dairy/lactoper.htm

Refer to the Codex Alimentarius approved guideline CAC/GL 13-1991 at:
www.fao.org/WAICENT/FAOINFO/ECONOMIC/ESN/codex/STANDARD/volume12/vol_12e.htm l (guideline in English, French and Spanish)

Comments received in topic-1:

01-06: R. Garces-Aviles, Chile: HACCP and small scale milk producers

Reaction to the question: How can modern quality control and assurance systems like HACCP be applied to small scale milk producers in developing countries?

To apply in small scale milk farms the HACCP concepts is not easy but not impossible. We are some experiences concerning modern quality control in farms and always one of the most important control point was WATER QUALITY, and more , usually in all consulted literature is not easy to find a detailed description about the water quality and problems at farm, because all papers and publications are starting with the assumption that the water quality is good.

The water quality control is one of the best ways to achieve that its use in our dairy farms would not be a major source of contamination or spoilage to decrease the milk quality. Now I want to introduce to you a summary of a specific work concerning milk hygiene control based about 70 to 80% in GMP's.

Summary

In order to evaluate and assess the hygiene of milk production in Chilean dairy farms according to Council Directive 92/46 EEC a checklist and handbook were made. The Council Directive 92/46/EEC lays down health rules for the production and placing on market of raw milk, heat-treated drinking milk, milk for the manufacture of milk based products and milk-based products intented for human consumption.

This regulation includes requirements that have to be met by dairy farms and concern the following areas of milk production such as: characteristics of raw milk, animal health, design and condition of buildings, installations and equipment as well as milking, personnel and water hygiene.

The submitted treatise is intended to provide a basis for simple and fast investigation and assessment of milk production hygiene in dairy farms: Therefore all essential directives of Council Directive 92/46/EEC and other legal obligations as well as principles for a good manufacturing practices that have to be complied in order to fulfill the legal standards are grouped as follows: sale milk and milk products, raw milk investigation, milking, livestock, stable, milking parlour, milk room, cluster, milking machine, milk bulk tank, milk buckets and transport vessels, single water supply plants.

For all these subjects a checklist containing between 100 and 150 yes/no-questions depending on the invidual farm situation was drawn up to investigate milk production hygiene in dairy farms. A separate manual was drawn up offering itemized extensive information concerning the pertinent legal regulations and directives, their importance for milk hygiene, the application of the investigation and the economic consequences.

For assessment of milk production hygiene all items are assigned to one of three categories (important, very important and exceedingly important). According to the frequency and the extent of economic expenses that have to be carried by the dairy farm in order to meet the requirements, the items are grouped to six defined expense-categories.

Because of the hygienic and economic importance of water hygiene for milk production, private water supply facilities were given special attention in the checklist and the manual.

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Reaction from the Moderators:

We agree, water (both quality and quantity) is one of the Critical Control Points.

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19-05: P.R. Gupta, India: There should be more focus on traditional products

Thank you for your "Welcome-to-Milk-L" list. I accept to abide by the Rules laid down for this Conference. Meanwhile, I wish to share with the E-mail Conference Moderators of the Livestock Products Team, Animal Production Service of FAO the following comments:

Kindly accept my heartiest congratulations on your initiative in organizing the FAO Electronic Conference on Small-Scale Milk collection and Processing in Developing Countries. My good wishes to you and your team on its success. Possibly, it will be the first of its kind ever held.

It is indeed appropriate that the focus of this conference is on small-scale farmer/processor in developing

countries where the bulk of the growth in milk production and processing is expected to take place in this new millennium. Further, the base of dairying in the Third World countries will continue to rest on the smallholder, and so the challenges before him need to be highlighted in the forthcoming conference. In this connection, your kind attention is invited to a comprehensive monograph brought out by ILRI on this subject, entitled "Smallholder Dairying in the Tropics" edited by Flavey & Chantalakhana (ISBN 07340 1432 5).

Much would be gained from this conference if it can create interest in and put together available information on process technologies under development for the production of traditional milk products in a modern way in the developing countries. Due coverage should also be given to related issues like their packaging, storage and distribution and the scope for cold chain.

It is important to keep in mind that the technology required in the developing countries should not aim to save labour, as is true in the developed countries, but deal with the situation of small-scale operations, high ambient temperatures and unreliable electric power supply that limits the efficacy of the conventional cold chain for storage, transportation and distribution of milk products. These problems require their own unique solutions with appropriate R & D that is sustainable and appropriate. I trust my loud thinking helps to provide a point of view for the forthcoming Conference.

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Reaction from the Moderators:

We have asked Mr. Gupta to write a poster paper on "Traditional Milk Products from the Indian Subcontinent".

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30-05: J. George, India: There should be more focus on the production side

Thanks very much for including my name as a participant for the E-mail conference on "Small-scale milk collection and processing in developing countries". I would like to thankfully acknowledge receipt of all your E-mail since 24 May 2000 on this subject.

Looking at the topics for discussion as mailed on 24 May 2K, I am not sure if it would be proper to ignore the milk production dynamics in developing countries all together. I tend to think you are emphasising too much on market linkages and the medium for this appears to be the "institutional reforms". For a developing country these issues, no doubt, are important but in a sequential pattern based on scientific social engineering inferences, I am afraid FAO is making "heroic assumptions".

Today India has become the world's single largest milk producing country. You may recall that way back in 1969-70 the country ventured into Operation Flood or White Revolution. What was the base of milk production in India at that time and what is it today — is not an academic question. All developing contries without exception inso far as milk production is considered follow a low input-low output model in the tiny stockholdings on small land holdings. Then the milk animals are either dual purpose or multi-purpose breeds. These breeds are not solely for milk production as is practiced in developed countries. The maximum daily milk production may be about 1-3 kgs per animal in a truncated lactation period. The Sanitary and Phytosanitary measures of milk production although essential, are not the immediate concerns of these milk producers. Therefore, I would like to argue for an initial discussion in the "backward linkages" form for a downstream reform in the system. For a detailed discussion you may refer to the lead article by me published in the Oxford Agrarian Studies Vol.17, 1988:1-31 entitled "Dairy Development policy: Instruments and Implications for India".

I am also attaching Two word document files containing my observations as a Discussant on a Paer entitled "Indian Dairy Policy:Times to change". This was submitted at the World Bank sponsored workshop on Agriculture Sector Reform in April 1999 and I understand is going to be published by the World Bank very shortly. The second file contains a paper written recently in early February in view of the Union budget of the contry.

I hope you will consider my suggestion and, if you so desire, I can write a discussion paper for the e-conference.

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Reaction from the Moderators:

A conscious decision has been taken not to focus on the production side in this particular conference, apart from milk hygiene aspects. We would like to hear the opinions of other participants. Please contact Mr. George directly at hipagrg@nde.vsnl.net.in if you are interested in obtaining the above mentioned documents.

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05-06: N.S.R. Sastry, India: General comments on the topics of the conference

Dear Sir,

I wish to provide the following information for general information of our friends in sister developing countries.

Topic 1: From Farm to Collection Point; 1. Clean Milk Production and Support Services

This is a real problem in India as hand milking is practiced by 100% farmers with a wet fist with the knuckle of the thumb pressed against the teat for strength (necessary in case of buffaloes). Wet hand is considered a must, using water, and first streams of milk and even saliva. This is not only unhygienic but also causes mastitis. Dairy Cooperatives, which cover from 40 to 75% of farmers in different provinces carry out training programmes and use literature and A-V aids to educate farmers on clean milk production. Obviously dirty milk is also rejected at village collection points. Unfortunately the bad situation still continues in case of producers not falling under the cooperative network (let us call them private producers).

2. Milk Collection and Preservation

In case of members producers of coops milk is collected daily both the times. The milk so collected (and kept some what cool by local methods and even by keeping the cans in ice) in cans is quickly conveyed to the nearest chilling centre of the coop. From chilling centres the milk goes to the coop's milk plant at the district HQ. In case of private producers, a bigger producer among them may collect from others and take it right away to urban consumers on bicycle, motor bike etc. non-producer traders may collect from them and take it to city. No preservation is normally done. But in summer, especially when taking away is delayed, the trader may add soda-bicarb to prevent curdling. Adulteration with water and flour (to build up density for cheating the lactometer) is added. The Universal method of preservation of milk at home is by boiling; some times the milk is left for hours on hot dung-cake stove.

3. Milk Testing, Quality Control, Hygiene and Safety

In case of coop producers, payment is on the basis of fat content and hence testing is done at collection time using a milk-tester, nowadays. At this juncture, colour, appearance and foreign matter content are examined. A member consistently bringing milk with foreign matter (straw pieces and dried dung particles, animal hair) is taken to task right there. All milk so collected is filtered through a muslin cloth before cooling. Vigilance parties of the coop try to prevent adulteration of milk. Also, in some districts, village coops giving consistently good milk get bonus in the form of services. No such things apply for the milk produced by private producers. Only the trader may reject patently bad milk. No bacteriological check is yet possible universally in the field.

4. Milk Payments

In case of coop producers, milk supplied by individual milk producers daily is maintained in his/her passbook along with the fat test of the respective samples. Then payment is made on the basis of fat content. The coop unions have freedom to decide on the frequency of payment, but payment at the weekend for the whole week is the most pratical frequency. Some coops decide to pay more frequently. Any payments due from the producer to the coop for services and supplies (feed, medicine, fertiliser) as well as a small fraction towards common welfare of the members is deducted from the milk payments. In case of private producers, they are at the mercy of the trader-middleman. Most often the trader extends loan to the producer to purchase a buffalo or crossbred cow and he collects milk from that producer as repayment of principal and interest, leaving a little milk for the producer's family. If this is not the case, the trader may pay at his own convenience and depending on the relationship between them.

Topic 2: Small-Scale Milk Processing Technologies; 1. Liquid Milk

Either the milk is sold away fresh soon after milking or boiled and kept hot, if it has to be stored for home consumption.

2. Other Milk Products

Other common milk products are curd (fermented product), butter, butter milk, ghee (clarified butter oil) and khoa (milk concentrated ton a putty like consistency by evaporation on fire) are products made at home in that order. Curds, butter and buttermilk are for home consumption, though women from roadside villages may sell

them at points along the road for the travelers. They may even go around in small towns hawking buttermilk, especially in summer. Clarification sour cream or butter churns ghee from sour milk. It is the preferred cooking medium and adjuvant to Indian bread and rice dishes. Ghee is mainly is the traditional way of salvaging excess milk. But it can also be sold to middlemen, who collect them and sell to bigger traders for packing and export to metropolitan cities and to Gulf countries even. Khoa is made some times at home as a base for many milk sweetmeats.

****

08-06: A. Naranjo, Colombia; improving milk quality: payments and training
(English Translation of this comment)

In Colombia there are regions with small producers, producing 20 to 500 liters daily. In one of these regions I have the responsibility for milk quality. Seven years ago we began a program on milk quality improvement with excellent results (65% of milk has less than 50000 Ufc/ml). Fundamental pillars of this program have been payment by quality and the training. Most of the farmers milk by hand, there are almost no cooling tanks, milk collection is done once a day by trucks in an area of around 150 km. The steps of the program:

1, A system of payment was introduced involving the concepts of hygienic quality (first we used blue methylene reduction test, now bactoscan), compositional quality (milkoscan) and punishment by antibiotic presence in milk (acidity test with culture of yogurt) and special bonuses for volume and cooling tank, bonuses or punishments up to 20 % of the price of milk in the region.

2, Young Veterinarians became qualified in milk quality and each of them was assigned to 80 farmers. Each Veterinarian is responsible for the milk quality of his or her farmers, and periodic visits are made to the farms in order to make sure milk quality satisfies the criteria set by the company.

3, Two monthly periodic publications are issued, written in a very simple language, so that it can be understood by people with a very low level of education.

4, Conferences, seminars and courses, completely free, were organised for farmers, farm workers, university students and technicians.

5, Other activities were organised, e.g. health days for children of the workers of the property.

6, Agreement with banks were made for credits for the purchase of cooling tanks by farmers. Today we have more of 90% of milk from cooling tanks, with less than 100000 Ucf/ml.

****

Reaction from the moderators:

We would like to congratulate you with the achievements of your integrated program, which shows that milk payment systems based on milk quality, together with training and education in milk hygiene are important factors when trying to improve milk quality.

- Could you describe in detail the system of bonuses and penalties that you are mentioning?
- Could you provide the participants with more information on the 'Milkoscan'? What kind of tests is it used for, what is the price, where is it available, etc.

****

08-06: R. Garces-Aviles, Chile; hand vs machine milking contamination

Reaction to the question: Is there a higher risk of contamination of milk from machine or hand milking?

I think that machine milking always implicates a higher risk of milk contamination respect to hand milking because it is a milking method including multiple factors and more to have a milking machine implicates to consider that milking equipment and utensils must be cleaned, regularly sanitised and maintained. It often requires additional work for small farmers and finally conduce to a poor hygiene of machine, udder health and bad milk quality.

****

09-06: J. Rasambainarivo, Madagascar; clean milk: regulations and transport

I am from Magadascar where the Highland Zones are very active on Small-Scale Dairy production. One point I would like to arise is the national or international regulations of the quality of milk produced and marketed by these small-scale farmers. In Madagascar our regulation on this matter is very old (1964) and when I visit some East african Countries it seems that the regulations is not very clear for the farmers and some scientists. So I think that a clear definition of "clean milk" is needed. Is it the same characterics for the milk to be sold directly to the comsumers and those to the industrial plants? Two years ago we conducted a survey on this

matter on the Highland regions. The results showed that the most important contamination was of microbial origin but physical adulteration was reduced in the peri-urban zones while it supposed to be important in the rural zones. One important problem is the milk transportation from farm to the collecting point or consumers. Most of equipements are 3-5 litres plastic containers and the transport takes more than 3 hours of walk every morning. This duration is one of important factors which allows the proliferation of microorganisms. So I hope that during this E-conference, we can have some informations on what is "a clean milk" in the differents participants countries.

****

Reaction from the moderators:

We have forwarded your question about regulations to the Codex Alimentarius Commission. Would anyone like to have a go at a definition of "Clean Milk"?

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09-06: I. Waldhauer, Nepal; acidity test and bufalo milk: research results

Milk Testing at collecting point level in Nepal

1. Background:

Nepal is predominantly an agricultural country. 81% of the population was in 1998 employed by agricultural work. The sizes of the farms and farmland are small, and each farmer has a piece of land for crop and some livestock, average land size 0,5 ha/family, which mainly provides the family with its daily necessities.

The number of milk cows and buffaloes in Nepal are more or less the same. However the milk yield from buffaloes is significantly larger than from cows. In 1997/98 there were in 826,000 milking cows and 882,000 milk buffaloes. The milk yield was respectively 318,680 liters and 729,360 liters.

After milking the farmers bring the milk in small containers (average 5 liter/farmer) to the milk collection point, where the milk is collected daily. At the collection center, the milk is checked for fat content and solid non fat, which is the base for payment in Nepal. At some collecting points, when suspected, the alcohol test is performed. The recommended strength of the alcohol is 72% to ensure that the milk can be used for production of Skim Milk Powder but in reality the used strength of alcohol is 68% and sometimes even down till 55%.

Shortly after the introduction of the alcohol test in Nepal in 1990 complaints started coming in. Farmers claimed that the test would turn positive even though their milk was fresh and of good quality. It was mainly in the case of buffalo milk that the complaints were made. The response toward the farmers was bad bacteriological quality, adulteration or udder diseases.

Based on the above reaction the National Dairy Development Board, Nepal decided to make a small pre-study to assess if the issue was due to bad quality or due to the different chemical composition between cow milk and buffalo milk. The study included field experiments on purely fresh milk from cows and buffaloes including alcohol test (72% and 68%), acidity test and mastitis test (Mastrip and CMT).

2. The study:

The study was conducted in Nepal by M. B. Kristensen, Royal Veterinary and Agricultural University in Denmark. In Autumn 1999. The conclusion of the study:

The study concluded that the use of alcohol test with the strength of 72% or 68% is unreliable for judging the freshness or quality of buffalo milk. Neither the level of acidity in the milk nor an unhealthy udder was found to cause the positive results of the alcohol test on buffalo milk. The conclusion is therefore that it is difference in the chemical composition of the buffalo milk cause the positive result of the alcohol test when used reported concentrations of alcohol solutions. The use of the alcohol test, with the reported concentrations, does not serve as a reliable indicator to judge the quality of buffalo milk in any stages of the milk chain in Nepal.

****

Reaction from the moderators:

Which difference in chemical composition between cow milk and bufalo milk might be the cause of these test results? Could it be e.g. the fat content? What are other people's experiences (e.g. from India)? If the alcohol content is lowered, do you think the test might work with bufalo milk?

****

09-06: P. Gupta, India; Lactoperoxidase in India

The poster paper on LP-s of milk preservation by Dr A Bannett is indeed all comprehensive. Of interest to the conference participants may be the situation in India where this system has not yet been accepted by the Government of India. It is under study by the Ministry of the Health. In the absence any approved method for non-refrigerated milk preservation from farms to dairy plants, the milk contractors are reported to resort to the use of neutralisers such as sodium bicarbonate, hydrogen peroxide and even soda ash to prevent souring and spoilage of milk during transportation.

Some initiative from FAO-WHO may help to bring about a policy change in the thinking of Govt of India on this subject, eventually leading to the use of LP-System in India and hopefully eliminate the present "abuse" of neutraliser that is also not legally permitted.

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Reaction from the moderators:

We have forwarded the comment made by Mr. Gupta to the LP-s Secretariat, which gave us the following response: The LP-s was originally discovered some 30 years ago in Sweden. When the system had been fully understood and refined by researchers it was submitted to Codex Alimentarius and then on to the Joint FAO/WHO Expert Committee on Food Additives (JECFA) for evaluation. This process of extensive scientific evaluation for no adverse effect to the milk, humans or animals took a total of 15 years and included field trials which were carried out all over the world. The system was approved by JECFA in 1989 and by Codex Alimentarius in 1991.

My understanding of Codex is that each country which is a member of Codex Alimentarius may at their discretion, adopt wholly, partially or not at all, the Codes of Practice, Guidelines etc. as produced by Codex. From Mr. Gupta's communication it appears that the Ministry of Health in India has therefore, for whatever reason, decided to conduct their own additional research.

It is of great concern that we read of the use of "Neutralisers" in India. The only Codex Alimentarius approved system of milk preservation apart from cooling (which is always the first choice) is the Lactoperoxidase system. This was again confirmed in the 23 rd session of Codex Alimentarius Commission which was held in June/July 1999 as part of a response to a question raised by the Delegation of India regarding the use of Hydrogen Peroxide for milk preservation. The response to the query is copied below and constitutes a strong endorsement of the LP-s.

"214. The Commission noted that the direct addition of hydrogen peroxide for preserving milk was included in List C of CAC/FAL 5-1979, which contains those substances the use thereof should be restricted to specific uses and this had caused confusion in the international trade of milk. It further noted that the Commission has adopted at the 19th Session in 1991 the Guidelines for the Preservation of Raw Milk by Use of the Lactoperoxidase System which includes a substance that generates hydrogen peroxide at a much lower level than in the case of direct addition.""215. The Commission agreed that the direct use of hydrogen peroxide was inconsistent with the above Guidelines and was no longer acceptable.

216. The Commission confirmed: (a) that the most preferred system of the preservation of raw milk was refrigeration; (b) its approval of the use of the enzymatic activators of the Lactoperoxidase system in accordance with the Guidelines for the Preservation of Raw Milk by Use of the Lactoperoxidase System and based on the advise of the Joint FAO/WHO Expert Committee on Food Additives, where refrigeration was not possible; and (c) that the Lactoperoxidase system should not be used for products intended for international trade".

Since the approval of the system in 1991, 80 FAO member countries have requested FAO assistance in the application of the system for suitable zones or areas in their respective countries. In 1998 a panel of experts, from research, development and private industry were gathered in Uppsala, Sweden to develop a programme to enable the uptake of the LP-s by developing countries. It was recognised that one of the main limitations to the uptake of the system was the lack of knowledge on the existence of the system especially among small-scale processors/collectors. The result was the Global Lactoperoxidase Programme which has as its objective the development of a practical guideline suitable for use in developing countries and countries in transition on the adoption and implementation of the LP-s.

The first phase of the programme was the preparation and testing of training and information materials and a development suitable methodology/approach for use by participating countries. This has now been

completed. The second phase (implementation) will consist of demonstrations in the participating countries (in areas selected by the government) and the final result will be a practical guideline enabling the full uptake of this safe and effective system of milk preservation so essentially needed in developing countries.
Additional details on the programme are available at:
http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGA/AGAP/LPS/dairy/intro.htm or may also be requested directly from me by E-mail, fax or phone
A. Bennett, Dairy Development Consultant, FAO, Rome
Tel: 0039 06 570553327 ; Fax: 0039 06 57075749 E-mail: anthony.bennett@fao.org
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09-06: B. Scholten, England; clean milk, poster paper by Prinsloo, SA

I was taken with the poster paper by Prinsloo and Keller on small scale collection in the highlands of South Africa - particularly that the processing centre took responsibility for sanitizing milk cans which were returned sealed to the farm. This seems good practice. Also noted as a prime source of microbial contamination were milking machines. Yes, even when made from stainless steel, brush-scrubbed between milkings with soap & water and dipped in sanitising solutions - inspectors often find surprising amounts of contaminants. (Typically harboured in solids/mineral deposits accumulating in awkward corners in the machine, e.g. the lid for the pulsators.)

QUESTION 1: Could the processor routinely (twice annually?) hold something like an "autoclave day" when farmers bring milking machines to the processor for the same thorough cleaning milk cans get?

QUESTION 2: In the 1950s, before advent of refrigerated bulk tanks in the USA, farmers used stainless steel gridded "milk coolers". Pails of raw milk, warm from the cow, were poured into a collector to be cooled by streaming over grids into milk cans below, slowing the increase of any microbes in the milk. Do we see this as a well-founded practice for small-scale producers today? Or is the longer time milk is exposed to environment considered a greater risk of airborne contamination?
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Reaction from the moderators:

Are open surface coolers being used in developing countries? What are your experiences with these type of coolers? Are there any other alternative milk cooling systems that you are using in your area?
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13-06: K. Lewis, New Zealand; washing milk cans at collection centre

Congratulations on your initiative in setting up the conference. I wish to endorse the recommendation made by Prinsloo and Keller relating to the desirability of providing can washing facilities at milk collection centres and also the request by Anton Glaeser, Tanzania, concerning the availability of appropriate plastic cans which are likely to be cheaper than metal cans, at least in the first instance, and easier to clean than recycled soft drink bottles. In my experience - in the Ethiopian Highlands in the '70s - it is quite impractical to expect smallholders to effectively clean a delivery can (which has been emptied an hour or more earlier) at their home. In the dry season especially, water often has to be carried some distance by female members of the family and is of doubtful quality. Milk collection centres are often located near a source of water and the provision of hot and cold water with appropriate chemicals and guidance is likely to make a significant contribution to improving milk quality.
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13-06: N. Sastry, India; Reaction to Glaeser: cleaning of plastic cans

With my experience in Zambia, I can understand the problem with the use of plastic containers for milk. In fact these plastic containers are actually recycled 5 litre cooking oil containers. They are supposed to use food-grade plastic in manufacturing them. Hence there may not be contamination from the plastic material itself. Yes cleaning is difficult. Also villagers consider the plastic containers just the same way as they consider the gourd contaners used for sour milk. That is an attitudinal problem. So the options are -

1. Better cleaning: Rinsing first with cold water for 2-3 minutes, then with warm water (boiled water left to cool for 10 minutes (other wise the plastic will melt) for just 1/2 to 1 minute and then rinsing with lot of clean cold water. This should remove most of the stuff unless curdling took place. After rinsing as above (it should be very vigourous) the containers should be dried in sun by hanging them on bamboos or thin poles, i.e. inverting the container and letting the bamboo passthrough its mouth. A couple of hours of this drying should help in deodourising and reasonable disenfection (cleanliness).

2. In African markets (in cities) one finds 20 litre plastic oil packs. These have a bit larger mouths and an improvised brush can be used to clean it. The problem is that they do not have good grips for carrying when full. Hence one has to contrive a rope halter for each container.
3. Best could be to introduce aluminium containers, which are manufactured now in many developing countries inclduing India. Since a small producer may not be able to bear the cost, the milk collection organisation or government may finance or even subsidise. The cost is worth investing in view of supply of more of better quality milk that it entails.

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13-06: CODEX Commission; Reaction to Rasambainarivo: milk regulations

This is the answer from the CODEX Alimentarius Commission regarding the question of Rasambainarivo on clean milk and regulations:

1. for chemical contamination

(a) veterinary drug residues : List of maximum residue limits for veterinary drugs adopted by the Codex Alimentarius Commission is found at the following URL:

http://apps.fao.org/CodexSystem/vetdrugs/vetd_q-e.htm

<http://apps.fao.org/CodexSystem/vetdrugs/vetd_q-e.htm> (also available in French and Spanish)

You should select “all” for the first and second dialog boxes and “milk” for the third, Then select “by species” for output style and submit to data base.

(b) pesticide residues : List of maximum residue limits for pesticides adopted by the Codex Alimentarius Commission is found at the following URL:

http://apps.fao.org/CodexSystem/pestdes/pest_q-e.htm

<http://apps.fao.org/CodexSystem/pestdes/pest_q-e.htm> (also available in French and Spanish)

You should select “all” in the first dialog box and “MILKS>” (not “MILKS+) in the second, select “by commodity” for output style and submit to data base.

(c) other chemicals such as mycotoxins and heavy metals : Since there has been no standard for milk elaborated by the Codex Alimentarius Commission, there is no specific maximum levels for heavy metals in milk. However, the Codex Alimentarius Commission has been considering the maximum level for aflatoxin M in milk and maximum levels of lead and tin in milk. They have not yet been adopted by the Codex Alimentarius Commission.

2. for microbiological contamination

The Codex Alimentarius Commission has established the Recommended International Code of Practice - General Principles of Food Hygiene (CAC/RCP 1-1969, Rev.3 (1997)). The General Principles apply to all foods. The text is available from: ftp://ftp.fao.org/codex/standard/fh_basic.pdf

<ftp://ftp.fao.org/codex/standard/fh_basic.pdf> The text include the definition of “food suitability”. The Codex Committee on Food Hygiene is developing a code of hygienic practice for milk and milk products. However, it is at very early stage of development.

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13-06: A. Naranjo, Colombia; more info on payment system / testing

(see previous comment of Naranjo of 08-06)

Payment system

The system of bonuses and penalties that we use is the following: (prices approximated in dollars), milk samples are taken 6 times a month and are averaged. Base Price of milk (by law): 20 cents/litre. Bonuses are related to the averages of the region:

Bonus for Total Solids: + 0 to 1,2 cent/litre for every tenth above average.

Bonus for Protein: + 0 to 2 cent/litre for every tenth above average.

Bacteriological: - 2 cent (> 500.000 cfu/ml) to + 2,5 cent (< 20.000 cfu/ml) A geometric average of data over the last 3 months is used.

Bonus for cooling tank: + 1 cent/litre.

Penalty for fat: - 0,5 cent (< 3 % fat)

Bonus for Daily volume: + 0 (< 500 litres) to + 1.5 cent/litre (> 6 500 litre/day).

Antibiotics: penalty of 50 % of payment on first day, the fourth time the milk purchase is suspended. In general the final prices go from 19 cent/litre to 26 cent/litre.

The milkoscan is a high technology electronic equipment made by fosselectric tecnologia with a high price (more than 60 000 US dollars). It measures the fat, protein and lactose content of milk by infrared. Other similar equipment exists but with a lower cost (7 000 US dollars), e.g. LACTOSTAR. This high technology equipment is appropriate for small and medium scale dairy operations, e.g. small Colombian enterprises (companies of less than 30 000lit/day) have already adopted this technology. They use it along with bacteriological counts to establish similar quality payment systems that we recommended.

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14-06: B. Lewis, Malawi; milk preservation: pressurized containers ?

On the topic of milk preservation - does anyone have any information on the use of pressurized containers for long term storage of heat treated milk (without refrigeration)?

Apparently this method was used many years ago to preserve milk on Dutch boats sailing out to the then Dutch East Indies (Indonesia). It was still being used by a farm in Southern Tanzania in the mid 80's - but this it the only case I have heard of in recent times.

I am glad to know more of the actual process, and whether it might still be useful today in similar situations where cooling isn't possible, and the journey to the market is beyond the range of LP treatment.

I would also like to send my appreciation to the organizers for initiating this thoroughly interesting, useful and accessible conference.

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Reaction from the Moderators:

Does anybody have information on pressurized containers for milk storage?

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14-06: A. Escobar, Cuba; the lactoperoxidase system in Cuba: stabilak

First of all I would greatly appreciate the patronizers of the Milk Owner to give me the possibility to participate in "FAO Electronic Conference on Small-scale milk collection and Processing in Developing Countries."With respect to the Lactoperoxidase system I would like to say that Cuba has been pioneer in the investigation from 1984 (Ponce et al, 1987, 1992) and applies this system in an extensive way in all places where refrigeration doesn't exist. The Lactoperoxidase system is recognized in CUBA with the name of STABILAK which is produced by the National Center of Animal Health and Plant Protection (CENSA) and it is marketed by C-Kure. In Cuba more than 60 million liters of milk applying the Stabilak were collected in 1999.

The Lactoperoxidase system can also be applied to refrigerated milk when the time of transportation surpasses the 8 hours, if we consider that the psicrotrofos microorganisms can be developed to low temperature. A considerable effect in the reduction of the metileno blue or another coloring by this microorganism is not always observed because of the lower reducer capacity of these, but the effect is observed when the count of cells for plate or of automatic way is carried out. Our studies have demonstrated that the application of the system against this microorganism type that is developed to low temperature, can be an alternative when the transportation of the refrigerated milk from the collection to the industry surpasses the 8 hours.

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14-06: R. Rodriguez, Cuba; DP 1.3: milk testing and payments in Cuba

This conference is a great idea and at the same time a great opportunity for our countries that are able by means of the FAO exchange so much experience accumulated in our regions with relation to the production

and processing of the milk. In Cuba, dairy production is organised in 3 basic levels:

- Large Dairy State Enterprises
- Different types of cooperative forms of production
- Private producers

Dairy herds population ranges from 50 to 100 dairy cows. Private farmers have a lesser number of animals (10 to 30 cows). Holstein friesian and cross-breeds with high percent of Holstein are the major breeds used in our country to produce milk. In our country the mean production of milk is around 4 liters/cow/day and 1 100 liters/lactancy, but in large Genetic Enterprises with A.I and mechanical milking have a production of 10 liters/cow/day and 3 000 kg/lactancy. It is important to underline these yields are reached using tropical grasses and forages with a little amount of feedstuffs.

There is a system for milk quality control in the farms, its is performed in 55 laboratories of cattle sector and others of the dairy industry. In Cuba milk is paid based on its quality. The main parameters measured are:

- Methylene blue reduction Time (MBRT), it is used to classify the milk, to determine its basic price.
- Fat content (Percent) by Gerber´s method, improvement are given considering the fat percentage over 3,20 g%, so 1 cuban cent is paid by every 0.1 g% increase of fat.
- Control of adulteration by milk watering (It´s determined by the milk density and/or refractometric degree).
- California Mastitis Test (CMT) (Taxes due to low density and mastitis (CMT) are applied to the farmers).
- Acid titration and alcohol test
- Sediments

Milk must be free from residual substances as detergents or veterinary drugs. Specialists and farmers are working in our country in different ways to improve milk production, and it can be done by:

- Improving the milk production systems which combine tropical gramineous such as pastures, forages and sugar cane which are rich in energy with leguminous for protein supporting.
- Reducing bovine mastitis and enhancing the milk quality whose basic aspects is to improve the management practices, hygiene during the milking time, and herd health.
- Offering capacitation services and transfering technologies by research centers.

This it is our reality to large characteristics. We consider that even remains a great deal by doing, but our efforts are directed to satisfy all people needs in regard to this important product. In them we are busy since the farmers until the centers of research and the universities.

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Reaction from the Moderators:

The Cuban Peso is linked to the American Dollar, the official exchange rate therefore is 1.00.

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19-06: A. Kitalyi: Lactoperoxidase

* General remark

This conference has come at an opportune time. Efforts to promote milk production in the smallholder production systems of developing countries are facing new challenges, particularly in marketing. We are told that farmers in the Western part of Uganda do not know what to do with their surplus milk production, which can not reach the areas within the country facing critical milk shortages. The Regional Land Management Unit (RELMA/Sida) based in Nairobi recently Supported a stake holder workshop on use of LP-s in the region. RELMA mandate is to contribute towards improved livelihoods and enhanced food security among small-scale land users in the region. RELMA support in this activity is on the hypothesis that, an alternative method to milk preservation, where refrigeration is no option, will improve the milk marketing opportunities and consequently contribute to food security and livelihood. Workshop participants were drawn from prospective stakeholders on use of LP-s in the region from, Ministry of Agriculture and Ministry of Health, University and National Agricultural Research Services, Smallholder dairy development projects, Cooperatives and Processing agencies, University of Agriculture, Bureau of Standard (Kenya), international Livestock Research Center (ILRI) and RELMA. The workshop had a technical input of Prof. Olof Claesson, President of the GLP.

* Question to Dr. Jean-Claude Lambert
Are the following countries, Kenya, Tanzania, Uganda and Zambia among the 80 countries in GLP? If so what has actually been done on the ground or what are the implementation strategies? Let me share the key issues and concluding remarks of the workshop.

KEY ISSUES AND CONCLUDING REMARKS: RELMA Regional workshop on use of LP-s for milk preservation March 27 - 29, 2000.

1. The workshop has provided a forum for learning and exchange of ideas and information about the technical. Legal, policy and practical aspects of LP-s.

2. This workshop has not been policy-making forum, but rather an opportunity to meet and explore scientific information about a new technology. Also assess whether or not available scientific information as well as legal and institutional setting provide an environment upon which informed policies decisions can be made about use of LPS.

3. What is emerging from the deliberations of the last two days is that the following key issues merit consideration as we move forward a) Do we have conditions in the dairy sector, which warrant application of LP-s in the content of Codex alimentarius guidelines? i.e. use of refrigeration is virtually impossible for technical/economic reasons. Indications are that we have such situations in our respective countries.

b) Does the efficacy of LP-s provide an opportunity for increased market access in our varied ecological environment (Infrastructure temperatures, milk density), YES

c) Does the institutional set up in a liberalized market economy where you have informal milk market fit into the Codex guidelines with regard to application of LP-s and control of its use? The key issues here are the requirement for the method to be applied at milk collection points/centers and application of system be controlled by the processing plants. If the LP-s were to be adopted/adopted for use, this is an area that will require national milk and milk committees to address themselves to very carefully. In doing this national technical committees and policy makers should not be oblivious of the fact. Milk marketing agents may already be using unapproved methods if milk preservation and may continue to do so for along time to come is not deliberate, efforts are made to discuss and adopt valid options.

d) The toxicological and safety issues is the most sensitive aspect of any additive to foods. More local research into naturally occurring levels of thiocynate in milk is well justified and will have to be carried out at a wider scale regionally in order to clear any doubts.

e) The clause that prohibits LP-s treated milk to enter international trade clears deters adoption of the method by developing countries. This issue will have to be further pursued at the national level and at the international level.

4. Finally the strategies and recommendations that we have made need to be followed up pro-actively and RELMA is expected to continue to play a co-ordinating role in this endeavor.
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Reaction from the LP-s Secretariat:
All of the above countries or institutions based in these countries are participating the Global Lactoperoxidase Programme (GLP). To date a demonstration has been carried out in Tanzania by Prof. L. Kurwijila and the secretariat is aware and has provided limited support mainly in the form of background and training materials for demonstration and information awareness activities.

The GLP has progressed to the end of the first phase which entailed preparation of background and training materials materials for full implementation through demonstrations (phase II). A number of donors have indicated their interest in the programme and the implementation is expected to swing into full action soon.
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C. Erickson, US; The ISAAC Solar Icemaker

Solar Ice Company is located in Annapolis, Maryland and it promotes, produces and supports the ISAAC Solar Icemaker. Immersing milk in cans into an ice bath is a good method of cooling milk at small-scale milk collection centers. The problem is that many small-scale collection centers do not have ice because they do not have electricity. Thus milk producers resort to alternative methods of preservation.

It would be a great benefit if an icemaking system could be developed for remote small-scale milk collection centers. The most important requirement for such a system is that the cost is low. More specifically, the amount of income it generates is able to pay for the system in a reasonably short time period. To meet this requirement for the rural off-grid application, the system should 1) not require electricity or fuel supply. 2) be very durable and low maintenance.

One class of refrigeration systems, which are particularly good candidates for remote off-grid icemaking, are the intermittent absorption refrigeration (IAR) systems. IAR systems have a vessel of absorbent and refrigerant that is heated causing liquid refrigerant to be collected in a second vessel. As the vessel cools, the refrigerant is reabsorbed and a refrigeration effect is produced at the second vessel. These systems are composed generally of steel vessels, piping and valves. Since such components are low cost and very durable, part of the requirements of an appropriate system are satisfied. In addition, IAR systems can be powered by solar energy. Thus IAR systems have great potential for rural off-grid icemaker market.

The ISAAC(tm) Solar Icemaker, which was developed by Energy Concepts Company of Annapolis, Maryland, USA, takes full advantage of the features of IAR. This system meets the requirements of low cost and sufficiently high productivity to be cost effective. The solar collector is 12.1 square meters and it produces about 50 kg of ice per sunny day. With minimal low cost maintenance the ISAAC(tm) will function for at least twenty years. A photo of the ISAAC Solar Icemaker and a day's production of ice can be seen at http://members.aol.com/SolarIceCo.

It is interesting to estimate the income that can be generated by 50 kg of ice per day. One kilogram of ice is able to cool nearly two liters of milk to 3 degrees centigrade. If the additional income of selling to a more lucrative market is10 cents per liter of milk, then the annual additional income is $3,000 (based on operating 300 days per year). This amount of money will cover the cost of an ISAAC(tm) in a reasonably short period and then provide money for other village projects.

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Reaction from the Moderators:

We did ask Mr. Erickson for some more details on the Ice Maker, you will find the questions below, including the answers of Mr. Erickson.

1. What is the cost of the unit?

* Price is dependent upon the number of units and volume production. In widespread deployment, the price may be $4,000 to $5,000 per unit.

2. How much does it weigh (for shipping purposes)?

* The unit is shipped in components. The heaviest is about 350-lb. The total weight for the 16-foot unit is about 1000 lb. Smaller units are available.

3. What are maintenance costs? e.g. battery acid (if used)/refrigerant/maintenance/labour and the all important depreciation.

* There are no batteries. No filters or oil need to be replaced regularly. Annual maintenance expenses should average $100 to $150. The system will last twenty years or more.

4. How does the ISAAC work?

* A diagram can be seen at http://members.aol.com/SolarIceCo.

5. How many systems are installed and working? And where?

* Units have been installed in Marshall Islands, Thailand, Colombia, Virgin Islands, The Bahamas and Mexico. We have not been in contact with these installations for a few years. Important modifications to the ISAAC have resulted from the very practical experiences there. It is important that the next installation covers all aspects of introducing a new technology. The current model on display in Annapolis, Maryland is product of considerable development and field trial efforts. It is the best place to learn about the technology.

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15-06: R. Garces, Chile; spring milk is of poorer quality

Frequently, is thought that in spring-summer the milk has the best hygienic conditions respect to autumn-winter time. But in practice there is an inverse situation, particularly with a small farmers. We have investigated this situation during 3 consecutive years and always the results were the same: the bad hygienic milk quality presents in spring-summer season. The causes for it are attributed to:

1. In spring-summer season the water supply, from well, brooks, ponds, etc., is less than that in autumn-winter time and it increases the risk of a poor cleaning during the milking and cleaning and sanitation of milk equipment and utensils will be affected as well.
2. In autumn-winter the appearance of animals and udders is not optimal (dirtiness, clay or mud) and a sufficient cleaning of udders or teats before milking is accomplished because the farmers assume that exists (it is visible but not always in spring-summer time) the hazard, that a contamination of the milk occurs through residues and contaminants of the udders.
3. Weather conditions: high temperature, mainly in summer, makes it complicated to preserve the milk bacteria in low level before the recollection or transporting to the central plant. Until today in Chile it is not allowed to add lactoperoxidase in places where refrigeration doesn't exist.

With these results, we recommend to specialists in rural development (through the courses, conferences, meeting at farms, etc.) to put attention in this topic for preventing a poor milk quality.

23-07: K. Assad, Egypt: Goat milk

Milk production in the small holders exetensive production system of Egypt is facing difficult challenges particularly in preserving and marketing the surplus milk of sheep and goats . What are the alternative methods for milk preservation,where refrigeration is no option, because refrigeration is virtually impossible for technical and economic reasons ? Facing this challenges , I sent a proposal to the USAID/Middle East Regional Cooperation (MERC) program. Also , scientists of Israel, Palestinian National Authority, Jordan, and USA shared . The scientific project, MULTINATIONAL APPROACHES TO ENHANCE GOAT PRODUCTION IN THE MIDDLE EAST was the result of such cooperation and we are waiting for the financial aid to begin the project .One of the important areas of investigations is milk storage . Modes of milk storage would be investigated, considering aspects such as shelflife, cost and convenience. Different chemical preservatives will be tested for long storage of milk before processing without deterioration, such as nicin alone or as a mixture with other bacteriocins. Nicin will be of particular interest, because of activity aganist Gram positive and spore-forming species of Clostridium and Bacillus and previous use in many dairy products. Nicin is also recognized to be non toxic. In addition, research studies have shown that nisin has a different mode of action compared with PLG-1. Therefore, the use of a mixture of the two bacteriocins was shown to have a 20-fold greater killing effect than nicin alone. Concerning LP-s, results of some experiments made in Egypt indicated that the shelf life of control and LP-treated pasteurized Camel milk was 20 and 30 days, respectively . On the other hand, values of Cow, ewe and Goat milk samples were 0 & 17, 0 & 17 and 0 &20 days, respectively.

22-07: C. Erickson, US: more details on milk collection systems

There have been questions relevant ammonia absorption and the ISAAC Solar Icemaker in the conference proceeding. Please refer to the posts in "Comments Received" 5 and 11. I am interested in more details about rural milk collection systems, especially about what is done where refrigeration is not available and what advantages there would be if refrigeration were available. If there were a durable, low cost, solar powered icemaking system available, would you like to introduce it to your milk collection system?

24-07: K.A. Soryal, Egypt: milk payment system

A problem in Egypt concerning milk payment, I invite the contributors to share us : I also, argue that there is a need for payment systems according to quality. It must be applied gradually at the aim of, after a period, reaching the international market level. In Egypt, paying milk is designed according to fat percentage and total solids content (qualitatively). The titratable acidity test and the organoleptic properties might be the reason for refusing the milk.

Some factories refuse the milk when its temp. is over 5-7°C. We need to introduce the bacteriological

quality tests as a part of system for milk payments. We have an arised problem now in our country and I invite all the contributors to give solutions to the problem : The usual price for one kilogram of liquid cow milk is about 1 L.E (1$ is 3.5 L.E.) but now milk factories refuse to pay more than 0.5 L.E and substituted the raw cow milk with reconstituted imported powder milk. This situation resulted in a huge loss for the milk producers and threats to close the lactating farms in Egypt. Although I speak about cow milk but it is a problem of milk payment which is closely related with international markets and globalization.

An imported product (Powder milk) might destroy our local animal wealth. CAN WE DISCUSS AND EXCHANGE VIEWS ?

24-07: K.A. Soryal, Egypt: Summer mik in Egypt

In Egypt, summer milk in both small and large farms, is of bad hygienic quality and the milk reaches milk factories with high content of titratable acidity and bacterial count to the degree of the failure of acidity and alchol tests. Mainly, the high temperature is responsible for such bad hygienic quality of the milk. The situation now has changed after introducing the in place cooling of the milk. The winter milk has the best hygienic quality and the case is middle in spring and autumn milk.

24-07: K.A. Soryal, Egypt: Solar Ice-maker

From Kamal Assad Soryal to C.Erickson us ; The ISAAC solar Ice maker Athough the ISAAC solar ice maker does not require electricity or fuel supply, durable and low maintenance but its price of 4000-5000 $ is still too high for the use by the bedouins in desert areas of Egypt. We need something like that but with low price. I remember a method of milk cooling was applied in Turky as : The producers are supplied with clean plastic 28-30 liters containers to carry milk to the collection unit . The Unit is stationed by a water source under a tint and the full milk churns are replaced by clean ones when the milk is cooled . Milk in the churns is cooled to 15 C in cooling pools filled with water obtained from the water source and having a temperature of 11-12 C. Hydrogen peroxide is added to the milk brought from far distances. To the company producing The ISAAC maker: My Institute have an extension station supplied with small scale dairy processing unit in the desert, can you give us an experimental unit of ISAAC solar ice maker as a gift ?

28-07: M. Bacchus, Guyana: Low cost solar icemaker

I wish to respond positively to Mr. C. Erickson's query on the durable, low cost, solar powered icemaking system in the milk collection system. We look forward to receiving more details.

Your views Please (1)!!!!

" developing countries cannot afford milk payments according to quality"
"El pago de la leche según calidad no es aplicable para los países en vía de desarrollo"
"le paiement du lait selon sa qualité n'est pas applicable pour les pays en voie de developpement"

22-06: G. Psathas, Cyprus; comment on 'Your views please (1)'

My opinion, is that in developing countries, there is ground to apply payments according to quality. There are several steps to follow to improve quality. Before getting in these steps, it should be cleared what we mean quality. Usually we mean two components: Composition and hygienic quality.

Composition

In composition are included fat, protein, lactose, total solids, freezing point and pH/acidity. According to the needs, in a scheme of payment there could be included for example fat, or fat and protein, or fat and total solids, and/or pH/acidity.

Hygienic quality

In hygienics, usually are included total microbial count, somatic cell count, degree of cleaningness, detection of antibiotics and psychrofiles count if the milk is cooled after milking.

Necessary steps

1. Estimation of quantities, kind of milk (sheep, goat, cow, bufallo), number of animals, number of farms, scattering of farms, infrastructure facilities (ground-mountainious, semi mountainious, plain, etc-,roads net, electricity, water supply, communication with farmers etc).
2. Estimation of structure of the farms and animals feeding habits (tentative in house, grassing outside in the fields, nomadic system or mixed).
3. Climatic conditions and milk preservation facilities.
4. Estimation of quality control system, i.e.trained inspectors for the farmers, adopted sampling procedures and samples preservation procedures, laboratory organization (premises, equipment, personell, mechanisation /automization).
5. Organisation of milk collection and milk preservation (cooling in the farms, cooling in portable coolers and delivery to a road tanker at several posts of collection, collection at collecting center and/or use of lactoperoxidase system for milk preservation where the cooling facilities do not exist, etc).
6. Organisation of training department for the producers, with several campaigns to the production areas for Good Milking Practices.
7. Evaluation of existing situation of milk quality, by producing data around composition and hygienic quality.
8. Evaluation of the required cost to improve quality.
9. Evaluation of the needs of the processors (cheese, drinking milk, fermented products, etc).
10. Design of the scheme of payments, according to the conclusions of the previous steps. This could start from elementary parameters, for example, pH/acidity, or water adulteration, or degree of cleaningness, or fat, or fat and protein.
11. The schemes should be in dynamic condition, by means by adopting basic price to the average of a parameter, seasonally or all over the year, and provision of premiums for better quality for this parameter. The next year, we estimate the new average (expected improved) and we remove the scales. After, two or three years of implimentation, we evaluate the average quality. If there was significant improvement, then we apply also penalties for producers with inferior quality.

If the quality is very poor and doesn't meet international requirements, doesn't mean that the schemes cannot start from an existing poor situation. The schemes of payment are tools for improving the quality, not for applying regulations. Of course, issues concerning safety of the product should be accounted. In an area, to apply a scheme of payment, it is required the expert opinion how to proceed, according to the evaluation of the existing situation.

21-06: I. Waldhauer, Nepal; Question to Alderson on alcohol test

In the mail "Comments on "Your views, please (1)"" dated the 19 June I saw some comments made by E. Alderson, UK, consumers are willing to pay for quality, commenting on the alcohol test as a platform test. Mr. Alderson is mentioning some factors which are not the reasons for clotting of milk during alcohol test, are these statements to see in some reports or articles? He is even giving some reason for why it clots - I am very much interested in get some documentation in this matter.

18-6: R. Hernandez Rodriguez, Cuba; (ENG/ESP)

Title: Study of milk quality in Holstein Friesian and their crossings under silvopastoral sytems. By: R. Hernandez Rodriguez y P. Ponce Ceballo. Dpto. de Lactacion. Centro Nacional de Sanidad Agropecuaria (CENSA), Apdo. 10, San Jose de las Lajas, La Habana, Cuba, E. mail robiert@id.censa.edu.cu <mailto:robiert@id.censa.edu.cu>

INTRODUCTION

A common leguminous feed for ruminants in Cuba is Leucaena leucocephala. It has a high nutritious value and a high digestibility. Leucaena has been the subject of several studies in combination with milk production, always associated with protein banks. In the last few years in Cuba work was done on silvopastoral systems, where Leucaena is used directly in pastures. Here Leucaena is used to mainly meet the protein requirements

of the animal, which contributes to the basic nutritional needs of milk operations in Cuba, leading to a substantial increase in the production and quality of milk. The objective of the following work is to establish for the first time in Cuba the levels of composition and the main physio-chemical properties of milk generated from silvopastoral base production systems.

MATERIALS AND METHODS

87 fresh milk samples of morning milk were collected in cooling tanks (29 samples per herd), in perfect state of conservation, originating of cows from the province of Habana between the months of June of 1997 and January of 1998. The study was conducted with Holstein Friesian cows, Siboney of Cuba (5/8 H - 3/8C) and F1 crossings of the Holstein, H-C, ¾ H - ¼ C and ¼ H - ¾ C. Fat, protein, lactose, SNF and total solids, were determined by infrared spectrophotometry, using the MilkoScan 104 S/N Foss Electric Denmark. Crioscopy was carried out using automatic Crioscopo 4D3 Avanced Instruments, density was measured with a lactometer.

RESULTS AND DISCUSSION

The percentages of fat, lactose, SNF and TS (3,78; 4,78; 8.36 and 12.14 g% respectively) from Holstein Friesians fed on Leucaena were higher than the race of Havana, whose values were 3,33, 4,56, 8,26 and 11,58%. The levels of milk protein were low (2.87 g%). The density and crioscopy in our study were above the Cuban minimum limits. The milk fat and lactose (4.28 and 4.79 g% respectively) were higher in the Holstein crosses than the Cuban crosses, TS and SNF were 13.11 and 8.83 g% respectively. The levels of protein of our study (3.33 g%) are within the limits, in which the values studied for these crosses variates. The results of the studied phisico-chemical parameters, oscillate within you limit them established after Cuba. Our work demonstrates better results in the silvopastoral systems with relation to fat, lactose and TS respectively (4,28; 4.77 and 12.87 g%), than what was found in the Siboney crossing of Cuba in previous studies. The rest of the components varied. The density and crioscopy show values falling within the specified Cuban values.

CONCLUSIONS

The new milk exploitation system has the capacity to improve the composition of milk. The general phisico-chemical properties are above the specified minimum.

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01-08: NDDB, Nepal: Discussion Paper 1.4 - Milk Payments

In response to the questions raised by the moderators, I hereby submit my opinions for consideration of moderators.

1. In my opinion 60 to 70% of the retail price should go to the milk producers.

2. Low cost milk quality testing equipment suitable for small-scale operations in developing countries is simple fat test by Gerber method combined with lactometer testing for determining the minimum required reading for rejecting or accepting milk. Example, the average lactometer reading of pure cow/buffalo milk should be around 30C° L.R. at 27C°. If milk tests less than 28C° L.R. should be taken as suspicious and should be rejected. The accepted milk should be subjected to fat test using Gerber method. The Gerber centrifuge, Butarometers, pipettes for milk, fill measures for Amyl alcohol Lactometer and Lactometer jar could be procured from many suppliers form Nepal and India. The prices are about U.S.$50.00 for the whole set.

3. The incentive and penalties should be based on fat content compare to the fixed standardl. For every unit of fat lower and higher than the standard fixed an exact amount should be provided as penalty and incentive respectively at the rate of market cost of fat in terms of Butter of Ghee.

4. Starting point for adopting a milk payment system should be fixing a minimum quality standard based on

standard fat and S.N.F used for market milk, deducting the cost involved in collection, chilling, sterilising, transporting, processing and marketing, Then the bonus payment should be paid for additional fat according to market rate of fat. To induce this, farmers must be educated by actual demonstration of milk test done at their milking animals. They must know what is wholesome milk and how does it affect the price if adulteration convineed they will understand and accept your payment system. After the industry grows and the farmers are properly educated, then quality incentive based on bacteriological test say a M.B.R. reaction time should be introduced.

Annex-6: Discussion Papers, Poster Papers, and comments received on Topic 2: Small-Scale Milk Processing Technologies

Discussion Paper 2.1: Small-scale processing technologies: Liquid milk

Lusato R. Kurwijila, Department of Animal Science and Production, Sokoine University of Agriculture, Tanzania

Introduction

Worldwide, liquid milk occupies a dominant position in milk processing, marketing and consumption. This is because liquid milk is a basic food in many societies where cattle and other milch animals form an important part of the agricultural production system. The form in which the milk is presented for sale, ranges from on-farm and traded raw milk sales in most of the poor developing countries to pasteurised or UHT milk in countries with developed dairy industries. If you review the history of dairying in most of the European and North American countries, one sees the share of liquid milk products in the dairy industry changing over time in proportion to level of economic and technological development in their societies. Consumers in richer societies demand and consume a more diversified mix of milk and milk products. Thirty years ago liquid / market milk constituted more than 70% of the quantity and values of marketed milk and milk products in these countries. To date this has dropped to no more than 50% as more and more milk is directed towards products such as fermented milk, cheese, butter, dried milk products etc. In developing countries, depending on the level of development of the dairy industry, products range from a few indigenous dairy products and raw milk to pasteurised / UHT liquid milk and a small proportion of other "luxury" products. Thus liquid milk is still the most important base for developing the dairy industry in developing countries. This is due to population growth and rapid pace of urbanisation in most developing countries. (See introductory paper of this conference).

The capacity to handle, process and market liquid milk must therefore be expanded to match the growing demand for processed liquid milk by the expanding (urban) populations in developing countries. Given the nature of the dairy industry in most developing countries and the infrastructure, within which the industry must operate, this challenge is by no means an easy one. For the purposes of this E-conference, I intend to introduce the discussions on this subject by highlighting on the conditions which make "Small-scale" processing, with all economic and technological considerations in mind, often the most viable if not the only option available for successful and profitable liquid milk processing in many situations with a poorly developed or emerging dairy industry. I will then follow it up by discussing why, even as inevitable as small-scale processing seems to be, its operations may not always be as easy as one may be tempted to think. I will conclude by highlighting the technical and economic challenges that we, in developing countries face, as we try to promote small-scale processing. This paper will dwell only on liquid milk processing. Other milk products will be discussed in discussion paper 2.2.

RATIONALE FOR SMALL-SCALE PROCESSING IN DEVELOPING COUNTRIES

Conceptualisation of small-scale processing

On the basis of the definition that has been given, small-scale processing units are those units handling more that 500 litres per day but less than 5000 litres per day. Very small scale or micro-dairies are those handling less than 500 litres per day. At the very bottom line we should not forget about "Household level technologies" which are important for household food security and traditional processing of liquid milk. These definitions are important, for what may be small-scale in one country could be medium-scale in another, depending on the level of development. Besides this has a big influence on choice of technology that may be available.

Developments in small-scale processing

In the 60s, dairy processing in developing countries was largely based on the European model of centralised processing with plant capacities ranging from 30,000 to 60,000 litres per day. These plants required electricity,

the pasteurised milk was packed mostly in single use containers which had to be imported; the volumes of locally available milk was too small or too scattered so recombination of imported was used to fill the deficit as long as milk powder and butter oil donations were available. It soon became clear, the mostly state run large dairy plants were unsustainable. In the late 70s and early 80s commercial manufacturers of dairy plants came up with the concept of "Mini dairy" which were essentially "block mounted", turnkey projects of 500 litre per hour capacity (up to 5,000 per 8 hour shift). Although in itself a very smart idea, the operations of these small plants were in most cases I have seen not very successful, mainly because of mismanagement of state run enterprises. In some cases, even these mini dairies were still too large for the small volumes of locally produced milk (often less than 2000 litres) that could be made available. For some one in Europe or America it may sound inconceivable that local milk producers cannot produce enough milk to satisfy the requirements of such a small plant! The reasons are varied, but some of the very common ones are:

1. The plant is located in a town far away from the rural based milk producers where road networks are so bad that is uneconomical for the processor or milk producers to transport the milk to the plant, particularly during the wet season.
2. The milk marketing system is highly unregulated with informal milk traders offering a cheaper product to (mostly poor) consumers in the form of raw milk which they boil at home any way (In countries like Tanzania informal milk marketing of raw milk account for more than 90% of marketed). The majority of the low income, in urban centres cannot afford the added cost of pasteurised milk especially when expensive packaging systems costing more than 20-30% the retail value of raw milk are used.
3. High cost of processing due to inadequate plant capacity utilisation, high electricity tariffs, taxes on processed milk versus no tax on raw milk.

In spite of the big technological advances that have been made in the dairy industry and the subsequent drive for large and more efficient plants in developed countries the concept and need for small-scale milk processing remains as valid and relevant today in most countries with a developing dairy industry as it was 30 years ago when the "mini-dairy" concept came to the fore (in developed countries to serve the needs of the on-farm producer-processors with spin-offs for developing countries).

TECHNOLOGIES FOR SMALL SCALE LIQUID MILK PROCESSING

The subject of small-scale milk processing was one of the topics covered at recent workshops held by FAO at Morogoro in Tanzania in 1995 and by FAO/IDF at Anand in India in 1997. During the former it was noted that a stepwise scaling up of technologies is essential for any dairy or country wishing to grow a successful dairy industry. Unfortunately, simple solutions are either not always available or are ignored in favour of more sophisticated processing equipment which may not always be appropriate for specific situations. For anyone trying to develop or set up a liquid milk-processing unit, one cannot avoid considering the following:

i) Milk Cooling and collection system.

Whether one is dealing with on-farm small-scale processing or small-scale milk processing based on collection of milk from many individual small-scale milk producers one has to think of the most appropriate and efficient method of cooling and/or collecting the milk. In 1990 IDF published a Manual of Milk Collection in Warm Developing Countries. The time tested immersion coolers (ICE BANKS) have now been largely replaced by direct expansion vats. The benefits of the immersion coolers in a developing dairy industry are obvious:

- Milk is cooled in individual milk cans, avoiding the mixing of milk of inferior milk from one supplier into the rest of the milk.
- In the event of electricity breakdown, the ice bank provides a buffer, which can still keep the milk for several more hours
- Armed with a compressor, condenser, copper pipes for an evaporator and other essential standard components of a mechanical refrigeration system, any good refrigeration technician /engineer in a developing country can construct a well insulated ice bank using cement bricks or metal/metal boxes!

In spite of these advantages, people hesitate to use this simple technology in favour of an imported, stainless steel direct expansion vat.

ii) Milk separation

Milk separation is a necessity for anyone trying to optimise product mix and profits by producing butterfat-standardised milk. The excess butterfat may be converted to more highly priced products such as cream, butter or ghee. The centrifugal cream separator remains the equipment of choice. Manually or electric operated Models of 50 litres per hour to 500 litres per hour are available from various manufacturers. During the Anand IDF/FAO conference attempts to develop household level milk separator based on the common household blender/food processor machine was reported by Agrawala (1997). It is not clear whether or not commercial production of the described designs has come into production as of now.

iii) Milk Homogenisation

Homogenisation of milk is standard operation for commercially processed milk. Homogenisation has the effect of breaking down the fat globules to sizes so small that the milk fat can no longer forms a cream layer. While this improves the organoleptic and physical properties of pasteurised milk, the loss of ability to form a cream layer is sometimes viewed negatively by consumers in developing countries, who may erroneously think that such milk may be skimmed milk. This partly contributes to consumer preference for raw milk from which the consumer can still skim off the cream for other household uses. Homogenisers are essentially very expensive, the smallest unit may come in the range of 250 - 300 litres/ hour and they may cost as much as US $ 15,000 even as second hand equipment. Use of homogeniser may not be economical for plants of less than 5,000 litres per day.

iv) Milk pasteurisation

Batch pasteurisation

Milk may be pasteurised by use of the age-old double-jacketed batch pasteurisers. All stainless steel vats of various sizes may be used. Schulthess (1995) described a cheaper version (locally fabricated in Kenya) made of a stainless steel inner surface (which comes in contact with milk) covered in mild steel outer jacket and operating on low-pressure steam. In-can pasteurisation of several hundred litres per day may be done in brick lined charcoal/firewood stoves (See FAO 1998, Schulthess in FAO, 1995).

Agrawala (1997) describes a mini-jacketed kettle with a double jacket filled with water that is heated, I guess, by use of an electric element. The milk is filled and heated to any desired temperature and holding time. The excess steam generated is whistled out from a vent, cautioning the operator on control of the pasteurisation temperature of the milk. Batch pasteurisers may easily be constructed by any mechanical engineering workshop with capability for stainless steel welding and metal sheet work facilities.

H.T.S.T. pasteurisation

Mini H.T.S.T pasteurisers are based on plate heat exchanger technology and much more sophisticated in their design and construction. The smallest units have capacities ranging from 500 litres per hour upwards. Major dairy equipment manufactures have each versions of their own. India is emerging as a strong source of cheaper but good quality versions as was evident at the dairy equipment exposition at Anand, 1997.

In-container pasteurisation

Milk may also be pasteurised after filling in the final container. This may be a plastic sachet or plastic bottle. The milk sachets or bottles are filled, then placed in a hot water bath or spray with or without agitation. The batch method of pasteurisation are usually employed (63 - 65°C for 30 minutes). See, for example, the in-pouch pasteurising system described in the poster paper on the Village Milk System that you will receive together with this paper.

v) Milk packaging

Pasteurised milk, after cooling, has to be packaged immediately. For batch pasteurisation installations of up to 2000 litres per day, manual plastic sachet sealing machines may be used at the rate of up to 300 sachets per hour. Sachets are usually pre-formed and sealed on one end. Semi-automatic versions with mechanised dosing of the milk are available from different manufacturers. Full automatic versions that form and fill various sizes of plastic sachets from a roll are available. Unlike the pre-formed sachets, the automatic form and fill versions provide and opportunity for disinfecting the plastic film before milk is filled in. Batch pasteurised milk may also be filled in

plastic or glass bottles or 3 - 5 litres plastic gallons and capped with aluminium foil, screw or cork cap.

vi) Bulk vending

After batch pasteurisation and cooling milk may be sold in bulk via bulk vending machines. This system is reported to be successfully in use in India. It cuts down the high cost of single use packaging.

vii) Milk storage and transportation

Pasteurised milk has to be kept cold throughout the marketing chain. Hence provision for refrigerated storage is mandatory. Transportation and distribution has to be done in insulated vehicles to avoid excessive temperature increases.

viii) Process utilities

Hot water/steam generation

As described above low-pressure steam boilers or electric hot water generators may be used to provide process heat. A combination of solar water panel for preheating the process water may reduce the cost of electricity in hot water/steam generation by as much as 30 - 40% but this is rarely used!

Refrigeration

Mechanical refrigeration appears to be the only option available. Solar/absorption refrigeration based on ammonia as refrigerant has rarely gone beyond the prototype testing. Am I right ?

Renewable energy

Although small-scale processors in developing countries often claim that the cost of electricity accounts for up to 30% of their operational costs, very little effort has been made to incorporate renewable energy sources of energy (solar, Biogas) in small-scale dairies. Much of what is reported in literature is a pilot/prototype test model. What is hindering commercial application?

ix) Sterilised/UHT milk

While it is possible to use batch retorts to produce sterilised milk in bottles. This technology, to my best knowledge rarely in use today. Reasons may be due to unfavourable economics of milk in-bottle milk sterilisation today and the extensive organoleptic and nutritive changes imparted on the milk. In can sterilisation is definitely uneconomical. UHT milk plants are perhaps too expensive for small-scale operations. I do not know of any commercial UHT plant of less than 5,000 litres per day.

THE CHALLENGES AHEAD

- While small-scale processing remains inevitable in developing countries, complete low-cost modules below 5,000 litres per day appear not to be available. One has to assemble various units from different manufactures to come up with a complete processing plant of one's choice/requirement. Even then most potential users of such equipment have no information on where to source for relevant equipment.
- While the basic technologies are well established at large scale operations, the challenge for developing countries is to miniaturise these technologies to a level that makes them accessible to even the smallest of dairy plants in remotest area of our developing world.
- The possibility to commercially incorporate renewable energy sources in small dairies has to be explored in commercial proportions beyond the research laboratories.
- A number of policy issues that seem to discourage development of milk processing in favour of raw milk marketing may also need to be addressed.

ACKNOWLEDGEMENT AND APPEAL

The author wishes to thank all scientists and dairy plant manufacturers who have worked and continue to work on small-scale milk processing technologies Worldwide. Availability of such information in various publications/brochures has enabled me to make this modest contribution to the conference. I hope that in the course of this conference we shall provide answers to some of the questions raised in this paper. Anybody aware of any technology /supplier of dairy equipment that may contribute towards technology transfer/development of

small scale processing in developing countries may contribute that information to the moderator for incorporation in the Equipment database being developed as part of this conference. Thank you.

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Discussion Paper 2.2: Small-Scale Milk Processing Technologies: Other Milk Products

T. B. Thapa, Dairy Consultant, Animal Production and Health Division, Food and Agriculture Organisation of the United Nations, Rome, Italy.

1. BACKGROUND

Dairying is part and parcel of integrated farming systems, wherein crops are cultivated and few cattle, goats, chickens are kept by the families for their livelihood. This is a typical example of a farming family in developing countries, wherein milk is a part of farm produce that generates cash income on a regular basis. For this reason, dairying has been recognised as an effective tool for rural poverty alleviation and sustainable livelihoods by governments of developing countries. The reasons for this are simple and straightforward. If farmers keep dairy animals, they have, besides milk, dung and urine as organic manure that improves the soil and increases crop productivity. Moreover, dairying promotes the integrated sustainable way of farming. The standard of living has improved in the milkshed areas where farmers have access to the market, for their milk produced on the farm. In small holder operations, farmers are usually able to sell only morning milk; thus evening milk is consumed at home, improving family nutrition.

Milk processing started with the objective of converting perishable milk into concentrated and long shelf life dairy products like butter, cheese, ghee and so on. Thus, the products could be easily transported to a market centre, and also fetch a better price or return. In the present context, this discussion paper overviews the general scenario of processing technologies for milk product in a global context. A general review is made on the problems encountered by small scale processors, in respect of technology and cost effective equipment, market competition with the internal and externally traded products, quality regulations and government policy towards the promotion of small scale value-added processing. The paper also takes a note of the present situation of the internationalisation of the market because of WTO agreements and its effect on small-scale production and marketing of locally produced dairy products.

The paper also discusses how the encountered problems could be overcome to sustain the small scale processing operations, and suggests the possible solutions. The paper attempts to stimulate participation from all corners to dig out unpublished information on small-scale processing technologies. It is hoped that this paper will contribute to the conference objectives of sharing ideas and information about small-scale milk collection and processing, establishing links between people working in dairy development and defining priorities and policies for future activities would be achieved. This paper does not discuss liquid milk processing and marketing in developing countries. This topic has been covered in discussion paper 2.1.

2. OVERVIEW AND CONSTRAINTS

Variations have been observed in small-scale processing technologies used by entrepreneurs across agro-ecological zones. Market demand varies also between different ecological zones. Gradually, traditional technologies are in the process of upgrading to meet the market demand. Demand for safer and more hygienic products is increasing, due to increased consumer awareness. Mostly, small-scale technologies are traditional or semi-traditional, and their products have to compete with the large-scale manufacturers or multi-national giants. In developing countries, these small-scale processors do not have access to training, even if they are ready to pay for learning. Fellowships and external training generally go to the government organisations. With few exceptions, most developing countries do not have dairy training facilities within the country. Small-scale processors are able to receive training only through donor assisted projects, if at all they operate in the areas. Many entrepreneurs start small scale processing through learning by seeing, without formal skills, turning the enterprise into a risky business. This has been the case of small-scale dairy processors in many developing countries.

Small-scale processors often find difficulties in getting the right kind of equipment for the business. They do not have access to information, on types, capacities and prices of equipment and their cost competitive source of buying.

The packaging used by processors is often not attractive. Many have to transport products to the major urban centres for marketing, and a rural producers finds difficulty bargaining with the urban marketers. This product has also to compete with the imported ones' in terms of quality and prices; multinationals are pushing

their products in the developing countries. Could we have solutions to sustain the small-scale processors in the developing world?

Many developing countries are currently in the process of joining or preparing to join the WTO. After this, better quality, better packed and competitively priced products would flood the market. The impact needs to be further assessed.

Gradual movement towards a market type economy by the developing countries has exerted an adverse stress on the small-scale agribusiness including milk processing. Do these countries want their small scale agribusiness to sustain or vanish or be replaced by the imported ones'? If they want to safeguard, these countries should come up with a policy statement on what ways the small scale operations could be sustained, which have played a key role in rural poverty alleviation and rural employment generation.

3. REVIEW ON PRODUCT MANUFACTURING

Small-scale processors produce a wide range of dairy products. They are broadly categorised as fermented milk products, concentrated milk products, acid coagulated milk products, evaporated milk, fat-based milk products and dried milk products. The processes may vary slightly to significantly between the countries and regions depending on the taste, food habits and other considerations.

Fermented milks are the most common products from which other dairy products are also made. In the earlier days, fermentation was used to control the growth of harmful bacteria and some pathogens while making indigenous milk products. The use of natural controlled fermentation is observed in 'Dahi' making in the Indian sub-continent, 'Laban' in Syria, 'Ergo' in Ethiopia and similar sour milk products in other regions. These fermented milk products are used as the base material for making butter, ghee and soft or hard types of traditional cheeses even in semi-commercial operations.

On the Indian sub-continent, organic acids are used to coagulate milk; the resulting product 'Chhanna - a soft cheese type product' is used in sweets making. In Latin American Countries, cheese making is an important sector of dairy industry; traditional cheeses based on rennet coagulation are made in small-scale farms and modern factories.

Heat is widely used to concentrate and preserve milk, and such concentrated milk products are used in making sweets in the Indian sub-continent and Latin America.

Each category of products is briefly discussed below:

3.1 FERMENTED MILK

Fermented milks are products prepared by controlled fermentation of milk to produce acidity and flavour to a desired level. The popular products are Yoghurt, Dahi, Acidophilus milk, Laban, Ergo, cultured buttermilk, kefir, Koumiss; beverages based on bulagaricus or bifidus strains, and so on. Fermented milks are very popular throughout the world.

Yoghurt is one of the most popular brands of fermented milk, and originated centuries ago in Bulgaria. It is now produced and consumed in most parts of the world. Although the consistency, flavour and aroma may vary from one region to another, the basic ingredients and manufacturing are essentially consistent. Yoghurt is made from milk of various animals, but in most cases cow and buffalo milk are used. To make a good quality product, raw milk used must be of low bacterial count, free from antibiotics, sanitising chemicals, mastitis milk and colostrum. The milk also should be free from contamination by bacteriophages.

For yoghurt manufacturing, milk is clarified and separated into cream and skim milk, then standardised to achieve the desired fat content. Then, milk is heated to 85 °C/30 minutes or 95 °C/10 minutes. This higher temperature heat treatment is necessary to produce a relatively sterile and conducive environment for the starter culture; and to denature and coagulate whey proteins to enhance the viscosity and texture of the final product. The mix may then be homogenised using high pressure, to thoroughly mix and prevent creaming and wheying off during incubation and subsequent storage, if facilities exist. Then, the mix is cooled to inoculation temperature, and the starter is added (Str. thermophilus : Lactobacillus bulgaricus 1:1), and mixed well. The inoculated milk is either retail packed or set in bulk at 43-45 °C for 4-6 hours. The packaging before or after setting depends upon whether the product is stirred type or set type. The product is immediately cooled after setting to 5 °C to slow down the physical, chemical and microbiological degradation.

These days, one can see lots of diversification in yoghurt production, there are varieties namely set types, stirred or drinking types, flavoured and so on. The ingredients used in making yoghurt includes whole milk, skim

milk, cream, starter cultures, sweeteners, natural fruit and synthetic flavours.

Cultured Buttermilk was originally the fermented by-product of butter industry, but today it is more common to produce cultured buttermilks from skim or whole milk. S. lactis and S. cremoris are the commonly used starter cultures in the preparation of cultured buttermilk. Milk is usually heated to 95 °C and cooled to 20-25 °C before the addition of starter culture. Starter is added at 1-2% and incubated for 16-20 hours, resulting in an acidity of 0.9% lactic acid. The product is packed and sold in retail packs.

Sour cream is commonly called cultured cream, and the fat content ranges between 12-30% depending on the required properties. The starter is similar to the one used for cultured buttermilk. The cream after standardisation to a desired fat content is usually heated to 75-80 °C, and then homogenised to improve the texture. Inoculation and fermentation conditions are similar to those of cultured buttermilk, but with relatively shorter incubation time (lower acidity level of 0.6% lactic acid).

Acidophilus milk is a traditional milk product fermented with Lactobacillus acidophilus, and may be prepared using whole or skimmed milk depending on the market demand. The product is well known and recognised for its therapeutic benefits in the gastro-intestinal tract. The milk is heated to high temperature like 95 °C for 1 hour or similar temperature-time combinations, basically to reduce the microbial load and also to favour the slow growing starter bacteria. Milk is inoculated at 2-5% level and incubated at 37 °C until it coagulated. Some milk has acidity as high as 1% lactic acid, but for therapeutic purposes, the acidity range of 0.6-0.7% is more common. The acidophilus milk may be sweetened, if demanded by the market.

There are great many others Fermented Milk Products, like Kefir, Koumiss, Bulgarian milks, and others. Many of these have developed in regional areas and, depending on the cultures used. These fermented milks have varying flavours, textures including the by-products of fermentation such as gas or ethanol or both.

3.2 FAT BASED MILK PRODUCTS

Fat based milk products like cream, butter, ghee, and ice cream are also described as fat rich milk products. These products are made after stepwise concentration of fat from whole milk to cream, and cream to butter and then to ghee. Milk is separated to concentrate fat in the form of cream (around 40% fat), and cream is churned for further concentration to butter (around 80% fat). This butter when heated to 110 °C yields Ghee or clarified butterfat (>99.5% fat), which is totally a milk fat.

Butter is usually made from sweet cream and is salted. However, it can also be made from cultured cream, but could be unsalted if it has to be used in other formulations like recombination and so on. The principal constituents of a normal salted butter are fat (80 - 82%), water (15.6 - 17.6%), salt (about 1.2%) as well as protein, calcium and phosphorous (about 1.2%). Butter also contains fat-soluble vitamins A, D and E. The ingredients used in making butter includes cream, with or without starter cultures, with or without butter colours like annatto, with or without table salt.

Ghee or clarified butterfat is also described as anhydrous milk fat. These names are alternatively used in different parts of the world. Ghee is made either from butter or directly from cream. The product is very popular around the world, and especially in the developing countries. The product is very important from a nutritional, religious and commercial point of view. The name itself signifies that it is produced after clarification of butter, and is a product with a long shelflife. Butter or cream are the sole ingredients used in making ghee.

Ice cream has a long history as a popular dairy food item. It has evolved from a manually manufactured household product to a fairly automated industrial product. Ice cream is one of the best forms of diversification in processing and value-addition in milk, with a high profit margin. The basic steps to be followed to manufacture ice cream are selection of the ingredients and their blending, pasteurisation, homogenisation, ageing the mix, freezing, packaging and hardening. Ice cream should have greater than 10% milkfat by legal definition, and usually between 10% and as high as 16% fat in some premium ice creams, 9 to 12% milk solids-not-fat, and this component is also known as the serum solids which contains proteins (casein and whey proteins) and carbohydrates (lactose) found in milk. Ice cream should contain 12 to 16% sweeteners and 0.2 to 0.5% stabilisers and emulsifiers. Varieties of food grade colours and flavours are used depending upon the taste of consumers, but Vanilla is often the most preferred.

3.3 CHEESES

Cheese making started as a way of preserving milk, to a long life product. In a simple definition, cheese is the fresh or ripened product obtained after coagulation and whey separation of milk, cream or partly skimmed milk,

buttermilk or a mixture of these products. Principally, cheese making involves concentration, preservation and ripening. Milk is pasteurised and cooled to inoculation and setting temperature, additives like saltpetre or salt or annatto colour are added, starter culture is inoculated, the milk is coagulated using rennet, the curd is cooked, pressed, and salted, and the cheese is ripened. These three processes are common for all cheese varieties. By controlling these processes in different ways - more or less whey drainage, stronger or weaker acidification, different moulding, different surface treatment, addition of different micro-organisms, storage at different temperatures, etc. - it is possible to manufacture a large number of very different cheese varieties from the same raw material: milk. Broadly, cheeses are classified as soft, semi-hard, hard, and very hard types. The ingredients used in making cheese includes whole milk, skim milk, cream or a combination of two of them, starter cultures, rennet or organic acids like citric acid. Spices like pepper, cumin, black peppers and other may optionally be added in processed and special types of cheeses.

Soft cheeses are the cheeses with high moisture content. The popular cheeses in this category are Cottage Cheeses, Mozzarella, Paneer, Chhanna and so on. Soft cheeses could have moisture content as high as 80 %. Among the soft cheeses, mozzarella, paneer and chhanna are of great importance to the developing countries.

Thousands of varieties of cheeses have evolved that are characteristic of various regions of the world. They are Fresh, unpinned cheeses (Cottage, Cream and Ricotta), Bland and buttery (Edam, Gouda type), Swiss-style cheeses (Emmentaler, Gruyere), Yak Cheese (typical Nepalese hard cheese), Cheddar-style cheeses, Extra-hard cheeses (Parmesan, Saanen), Monastery cheeses (Saint Paulin), Blue- veined Cheeses (Roquefort, Stilton and Gorgonzola), Camembert and Brie types, Goat's milk cheeses, Ewe's milk cheeses (Feta), Spiced or flavoured cheeses, Smoked cheeses, Whey cheeses (Ricotta), Strong-smelling cheeses (Limburger, Maroilles), and Processed cheeses.

3.4 CONCENTRATED DAIRY PRODUCTS

Evaporated milks, sweetened condensed milk, condensed buttermilk, condensed whey, Khoa and Kurauni are classified under the category of concentrated milk products. The ingredients used in making concentrated milk includes whole milk or skim milk or cream or a combination of to standardise to a desired level of composition. Sweeteners are added in sweetened product like sweetened condensed milk, and stabilisers may also be used.

Evaporated milk

After the raw milk is clarified and standardised, it is given a pre-heating treatment of 93-100° C for 10 to 25 min or 115-128° C for 1 to 6 min. Basically, pre-heat treatment is given to increase the concentrated milk stability during sterilisation, to decrease the chance of coagulation taking place during storage, to decrease the initial microbial load, and to modify the viscosity of the final product. Milk is then concentrated at low temperatures by vacuum evaporation. This process is based on the physical law that the boiling point of a liquid is lowered when the liquid is exposed to a pressure below atmospheric pressure. In this case, the boiling point is lowered to approximately 40-45° C. This results in little to no cooked flavour. The milk is concentrated to a 30-40% total solids level.

Sweetened Condensed Milk

In this product, sugar is used to increase the shelf life of condensed milk. Sucrose, in the form of crystals or solution, increases the osmotic pressure of the liquid. This in turn prevents the growth of micro-organisms. Milk is heated to 85-90° C for several seconds after it has been clarified and standardised. This treatment destroys osmophilic and thermophilic micro-organisms, inactivating lipases and proteases, decreases fat separation and inhibits oxidative changes. This product is similar to the evaporated milk, with added sugar in it. Although sugar may be added before evaporation, post evaporation addition is recommended to avoid undesirable viscosity changes during storage. Sugar is added for a final concentration of not less than 45%.

Condensed Buttermilk and Condensed Whey

These products are made to utilise the by-products from butter and cheese industry. Many times, buttermilk and whey are mixed with the skimmed milk during skimmed milk powder manufacturing.

Khoa/Kurauni

Traditionally, heat is used to concentrate and preserve milk. Khoa or Kurauni is also prepared by concentration of

milk to a semi-solid consistency, and is used as base material while making milk based sweets in the Indian sub-continent and Latin America region. The ingredients used in making Khoa or Kurauni is pure whole milk, preferably buffalo milk.

3.5 DRIED MILK PRODUCTS

Milk powders, whey powder and buttermilk powders are described as dried milk products. Traditional products like Chhurpi and Dukhoa from the Indo-china region also fall under the category of dried milks. The ingredients used in making dried milk products include condensed skim milk or condensed whole milk, with or without added sweeteners , stabilisers, and vitamin concentrates.

While making milk powders, milk is first clarified, standardised and then heat-treated. This heat treatment is usually more severe than that required for pasteurisation. This heating destroys all the pathogenic and most of the spoilage micro-organisms, and also inactivates the enzyme lipase, which could cause lipolysis during storage. Milk is then evaporated prior to drying. Spray drying is the most commonly used method for producing milk powders. After drying, the powder must be packaged in containers able to provide protection from moisture, air, light, etc. Milk powders are broadly of two types; Whole milk powder and Skim Milk Powder. For the retail consumer market, Instant milk powder are produced and packed.

Chhurpi/Durukhoa is a traditional dried milk product from Indo-china region. It is the dried hard casein product produced from yak or chauri (crossbred yak Vs cattle) milk traditionally in the Himalayan region of China, India, Bhutan and Nepal. The product is widely consumed by Himalayan people as a source of nutrients, and is chewed to maintain salivation during mountain climbing. The product is known to have started with the aim of conserving the valuable yak milk into a longlife dairy product. These days, Chhurpi is made using buffalo, cow, yak milk, and the product could be made using milk from other species too. Chhurpi is produced in the scattered remote areas, where there is no market for liquid milk, and where no other milk processing facilities exist.

Whey Powder is a by-product of cheese industry, and disposal has been a serious problem. Thus, whey is condensed and dried to use as additives in the food industries. Whey Protein Concentrates are also prepared by ultrafiltration of whey. After ultrafiltration, the retentate is pasteurised, may be evaporated, and then dried. Drying, usually spray drying, is done at lower temperatures than for milk in order that large amounts of protein denaturation may be avoided.

4. CHALLENGES AND OPPORTUNITIES

The following have been identified as some of the key challenges currently faced by the small-scale milk processors in developing countries;

- No easy access to training and skill development
- Trade barriers requiring policy interventions to promote development of national dairy industry within the context of WTO.
- High value added local taxes on products, and duties on import of equipment and production inputs like rennet and starter culture.
- No easy access to the information on the dairy business (for example equipment, inputs availability, markets, and so on).
- Appropriate scale of technology is not available (either traditional or automated modern technology is available, but appropriate to the small-scale is not available. The entrepreneur has to invent by himself.)
- Poorly developed Legal Quality Standards, and Weak Quality monitoring and enforcement mechanism

Despite these challenges, great many opportunities exist for operating small-scale dairy enterprises in developing countries, and the important ones are listed below;

- Privatisation and government withdrawals from the parastals or large scale dairy industry is resulting in an increased market freedom. Now, these avenues are the opportunities for the small-scale processors.
- Market opportunities for value-added milk products are growing due to the increasing trend of urbanisation. Small-scale enterprises can focus on specific tailor made products, using simple and low cost technology, and that generates higher returns.
- Small-scale enterprises could be family owned enterprises, thus the control on the business could be much easier and better. These are good to generate sustainable self employment.
- Management could be more simple and flexible.

Many developing countries are currently in the process of joining or preparing to join the WTO. These countries need to develop policies to safeguard the small-scale processors, which are playing a key role in rural poverty alleviation and rural employment generation in these countries. This should facilitate and promote the initiation and development of a market driven small-scale processing sector.

5. AGENDA FOR FUTURE STRATEGIES

The sections on overview and constraints and the challenges and opportunities, have already highlighted the small-scale milk processing scenario in the developing countries. A very small share of milk produced in these countries is being handled by the organised sector, and almost 80 percent is processed and handled through the traditional and informal channel. Also, in the light of the global trend of privatisation, small-scale enterprises are considered to be very important to the national economy, employment generation at the very local and rural level. Farmers have a secured market for their milk production. These enterprises are contributing to a real extent in reducing the rural-urban migration. It has been realised that they are very important, but many small-scale enterprises are struggling to survive. The Animal Production Service and Health Division in FAO realised this and decided to organise an E-mail conference on this topic.

Thus the real agenda for future strategies must address the training and human resource need, trade barriers requiring policy interventions, local taxes on products, and import duties on equipment, accessibility to the information on the market trend and appropriate technology, legal requirement and standards and other relevant issues affecting the development of small-scale agribusiness.

The participants from all over the world with a majority from developing countries are invited to share their experiences on the problems faced by the small holder dairy processors, and how best could the problems be solved. This would help to formulate common strategies, for promotion and further development.

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Poster Paper: The Village Milk System - an alternative, low-cost milk collecting and in-pouch pasteurising system

By: B.T. Dugdill, Dairy and Meat Officer (Institutions and Training), AGAP, FAO, Rome.

Introduction

The demand for milk and milk products in developing countries is expected to grow by almost 60 percent over the next two decades. Much of the growth will come from increasingly discerning urban dwellers, many with rising disposable incomes wanting attractively packaged, nutritious and value-for-money products. Small milk producers are starting to respond by increasing the productivity of their milch animals and selling their surplus milk. Local markets are soon satisfied, so producers have to look to intermediaries to collect, process and sell their milk further afield. These intermediaries invariably take the lion's share of the consumer price - often up to 80 percent.

Even where groups of producers pool their milk for economic reasons, they face a number of risks and difficulties when setting up small scale dairy enterprises. Not least among these are the high cost and relative complexity of stainless steel milk processing equipment, and the high cost of imported packaging materials. New technologies and systems are required that are not only inexpensive and easy to maintain, but can also get relatively small volumes of milk to consumers safely and efficiently. As stressed in Lusato Kurwijila's discussion paper on Small Scale Processing Technologies for Liquid Milk, the challenge is also to adapt and scale down existing technologies.

Systems for collecting and processing liquid milk in developing countries should ideally have as many of the following features as possible:

- handle up to 1 000 litres of milk daily, but also efficiently handle much smaller volumes;
- low risk and minimal capital investment in expensive (stainless steel) equipment;
- can be used in areas with limited local infrastructure (electricity and roads);
- can be installed in existing buildings;
- easy to operate and maintain;
- environmentally friendly;
- use attractive, locally produced packaging materials;
- optimise milk quality and shelf-life;
- promote rural employment;
- maximise the returns to small milk producers.

This short poster paper describes a low-cost milk collection-pasteurisation system currently being promoted by the Livestock Production Group at FAO.

Milk Collection

Conventional ice-bank or direct expansion milk cooling units are expensive, costing as much as US$10 000 for a 1 000 litre capacity tank with supporting equipment. The systems are expensive to run, especially when fairly small quantities of milk are collected during the lean season. They require a purpose-built building, a reliable three-phase electricity supply, comparatively sophisticated maintenance, and good access roads for heavy milk collection trucks. As a result, they can be difficult to operate efficiently where milk is produced in remote rural areas.

Since the 1980s FAO has been developing a low-cost alternative for collecting milk from these remote areas. Known as the LACTOPEROXIDASE (LP) system, two activators are used to reactivate a natural enzyme preservation mechanism present in milk. Developed in Sweden and extensively field tested, the technology is safe and inexpensive. It is already in use in a number of countries and has received WHO/FAO Codex Alimentarius approval. Recent field trials in Bangladesh (April 2000) confirmed that treated milk can be preserved for up 10 hours after milking at an ambient temperature of 30°C before cooling or processing, whereas untreated milk started to sour within three hours or so of milking.

At present, the activators are produced commercially in Cuba, France and Sweden. Costs work out at just under one US cent per litre of milk treated. More detailed information about the LP system may be found in

Anthony Bennett's earlier poster paper, or on the FAO Global Lactoperoxidase Web-site at
http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGA/AGAP/LPS/dairy/lactoper.htm

Milk Processing

Conventional processing systems for pasteurising and packaging up to 1 000 litres of milk daily are also very expensive requiring an investment of up to US$50 000 for the equipment alone, depending on the system selected. Like conventional milk collecting systems, they require purpose-built facilities and specialised maintenance.

FAO has recently field tested a low-cost, innovative milk pasteurising unit in Kenya. Built in South Africa the unit, called the MILKPRO, first fills raw milk into pre-formed polyethylene pouches. The pouches are immediately sealed, treated at 650C for 30 minutes in a batch pasteuriser, and cooled to 50C in a chiller. The heating process is automatically controlled. The unit can handle up to 100 litres of milk an hour and costs just under US$10 000. At a daily throughput of 750 litres the payback period can be as little as 12 months. The unit is operated simply by plugging into a standard single phase electrical power point, or by using a small diesel or petrol engine. It is especially designed for easy cleaning and maintenance and suitable for installation in existing basic buildings. Because the milk is pasteurised in the pouch, post-pasteurisation contamination - the main cause of spoilage - is virtually eliminated. A refrigerated shelf-life of up to 15 days is possible - a good sales plus in today's highly competitive marketplace. The food grade polyethylene pouches can usually be manufactured in-country and printed with eye-catching designs. Though the MILKPRO system was developed only recently, more than 60 units are now in use across 11 countries in Africa, both with small farmer groups and with individual farmers. One unit is in operation in Europe (in Romania) and great interest has also been shown in the USA where MILKPROs are expected to be in operation later this year. A more detailed, illustrated description of the MILKPRO unit may be found in on the FAO web-site at
http://www.fao.org/WAICENT/FAOINFO/AGRICULT/AGA/AGAP/LPS/dairy/milkpro.htm

The Village Milk System

For the first time FAO is combining these two innovative technologies under its Village Milk System - the provisional name for the initiative. The system is flexible and offers groups of small producers the opportunity to add extra value to their milk. FAO's immediate aims are to increase producer returns by up to 50 percent, and to make increased volumes of attractively packaged, safe pasteurised milk available to consumers at competitive prices. Initial indications are that the investment cost for the system - invariably the main risk for the small scale entrepreneur - can be cut substantially (see annex for indicative costs). Another advantage of the system is its ability to handle very small quantities of milk (as little as 50 litres a day) efficiently and safely while local milk production and markets are being built up.

Yet a further benefit is the potential to reduce energy and water usage. Because the only plant items to come into contact with milk are the milk cans and the filler, the amounts of water and detergents used for rinsing and cleaning equipment are significantly reduced. This reduces the amount of waste water and the effluent loading, which in turn keeps costs down and is environmentally friendly.

The Village Milk System meets many of the key requirements for efficient, low-cost, low-risk milk collection and processing by smallholder marketing groups, whether they be co-operatives or private companies. FAO and UNDP have already started a project with the Grameen Bank in Bangladesh where four small community-owned dairy enterprises will use the system to process small quantities of milk collected from thousands of very poor farmers. Each small enterprise will provide full-time employment for 12 people, including milk collectors and milk distributors who will use insulated cycle rickshaw vans.

The preliminary financial analysis indicates the enterprises will breakeven at a throughput of about 210 litres of pasteurised milk daily, one third of targeted sales for each enterprise. At this level, producers will get 70 percent of the ex-factory processed milk price. Further projects are planned for Ghana and Guyana later this year. The progress of these initiatives may be followed on the FAO Animal Production and Health Division web-site at the above internet address.

Annex

Village Milk System - Estimated Costs (US$) (Based on field trails conducted by the Government of Kenya/FAO Training Programme for the Small Scale Dairy Sector project at the Naivasha Dairy Training Institute in Kenya in 1998)

Basic Equipment

Item	Number	Estimated Cost (US$)	
		Unit	Total
Milk Collection			
milk churns (50 litres)	40	40	1,600
milk collection point kits[a]	4	150	600
Milk Processing			
milk reception/testing kit[b]	1	400	400
milk filling/pasteurising/cooling unit	1	10,000	10,000
miscellaneous furniture/fittings	1	400	400
Sub-total			13,000
Optional Equipment			
generator (8 kva)	1	5,000	5,000
deep freezer (20 cu ft)	1	1,000	1,000
Sub-total			6,000
Contingency (5%)			1,000
Total			20,000

[a] Measuring jugs or spring scale/tray/strainer/lactometer-thermometer/alcohol gun etc
[b] Weigh scale/strainer/lactometer/alcohol gun/thermometer/wash tank/plunger etc

Basic start-up supplies[a]

Item	Quantity	Estimated cost (US$)
LPs chemicals	5,000 sachets[b]	1,000
packaging materials (500ml)	110,000 pouches[c]	3,250
cleaning/sanitising chemicals	125 kg[c]	150
68% alcohol (for milk screening)	50 litres[c]	100
Total		4,500

a Average daily throughput of 600 litres (to allow for seasonal fluctuations in milk deliveries).
b 6 months supplies
c 3 months supplies

Poster paper: Traditional milk products from India

By: P.R. GUPTA, Editor & Publisher, Dairy India Yearbook & Technology of Indian Milk Products (In Print), India

Milk occupies an exalted position in India. Its roots go back to some 6,000 years when milch animals were domesticated. Simple processes were developed to preserve milk's nutritive goodness as a means to protect and promote health. In their search for ways to prevent milk spoilage and find uses for surplus milk, a number of products were developed. They were curds (yoghurt-like fermented product), makkhan (butter), khoa (desiccated milk product), chhana and paneer (soft cottage cheese-like cultured product) and ghee (clarified butter).

A wide range of sweets was produced for consumption on festive occasions. They included rasogolla, sandesh, burfi, peda, shrikhand, gulabjamun, lassi, misti doi and kheer (rice pudding), combining delicious taste and flavour with fitness and health. These ethnic products constitute the world of traditional dairy products.

The milk handling practices, as developed in the olden times, from producer to consumer were based on simple approach and science and were handed down from generation to generation to serve home, smallholders and trade. They are low-cost, appropriate and sustainable. Examples:

1. Milk and its products are consumed fresh and therefore the centres of milk production and consumption are close by. So, the need for expensive refrigerated storage and distribution is not necessary. This insistence on freshness in food has become something of an obsession in the Indian mind and is now an ingrained consumer mind set that is not easily grasped by an outsider.
2. The shelf life of raw milk is enhanced by taking recourse to boiling, a simple way of sterilisation. Thus, its souring or spoilage is extended for a few hours—enough to consume the quantity on hand. Traditionally, the urban consumer buys milk twice a day. Any surplus milk in homes is fermented into curd, an essential item of the Indian meal. At the farm level or in trade, the unsold surplus milk is made into khoa, channa, paneer and ghee.

Traditional products account for over 90 per cent of all dairy products consumed in the country. The organised dairy sector in India, however, focuses on the Western dairy products like milk powder, butter, cheese and ice cream for its product mix. One exception is ghee. Further, it only handles about 10-12 per cent of the total milk produced in the country. To strengthen its viability and increase its share, it must widen its product base. This can best be achieved by going in for traditional milk products for which the technology is available. Their production has the potential of becoming a major profit centre for the organised dairy sector. The process modernisation for making traditional dairy products has taken impressive strides. However, there is no need to reinvent the wheel because some of the food processing methods available in the West can be usefully adapted to mass production of traditional products. Some process modifications may, however, become necessary.

In recent years, some outstanding innovations have been made at the National Dairy Development Board (NDDB) and the National Dairy Research Institute (NDRI) for the assembly-line production of burfi, dahi, kheer, shrikhand, gulabjamun, rasogolla, mishti doi and the like, by adapting the modern tools and technology. An admirable example of Western technology adaptation is the manufacture of shrikhand on a large scale, using basket centrifuges, quarg separators and planetary mixers, used by bakeries. Today, the volume of shrikhand manufactured by the organised sector exceeds that of processed cheese sold in India.

The manufacture of khoa, using roller driers and scraped surface heat exchangers, is another instance of the use of the modern technology. UF/RO technologies can also be used for chhana making and concentration of milk for many indigenous dairy products. The use of meat ball forming machines and potato fryers for manufacturing gulabjamuns on a large scale is a good example of integrating the traditional with the modern.

Packaging of these products can also follow a similar approach. In Italy, Mozzarella cheese balls are being packed in whey in consumer packs. This can be tried to market rasogollas and gulabjamuns. Chocolate and candy packaging lines can be used to pack burfi and peda. Tetrapaks can be used to pack lassi, basundi, kheer and sevian. Japanese Tofu resembles paneer that can be packaged similarly. Modernisation of this sector will also result in energy savings. While manufacturing sweets in traditional ways, much heat energy goes waste which can possibly be recovered in a modern plant. Evaporation of milk in a karahi (resembling the Chinese wok) consumes five times more energy than vacuum evaporators.

Large-scale manufacture of these products will also open the way for trying out newer ingredients. The processed food industry in the United States has emerged as the largest user of corn syrup solids and high fructose corn syrup. These sweeteners add to the moisture retention properties of many foods, apart from adjusting the sweetness to a desired level. The technology of recombining milk constituents can also help in making many traditional products such as khoa and chhana. These exciting possibilities can be explored to the advantage of the processors and consumers.

Manufacture of khoa and chhana as powder is another way of using Western technology to make indigenous products. How far these modifications will be accepted will ultimately be decided by the consumer. The advent of convenience foods and their increased acceptability will further support the modernisation of this sector. India's most modern plant for traditional dairy products is that of the Baroda District Cooperative Milk Producers Union Ltd (Sugam Dairy) at Vadodara in Gujarat. It markets its products through a large network of hundreds of retail outlets in the city. The Sugam Dairy uses the traditional grocery/general stores that have a refrigerator to market its products. The product range includes shrikhand, gulabjamuns, pedas and curds, apart from flavoured milks. The dairy has the highest turnover of a single unit, marketing traditional dairy products.

The Mother Dairy in Calcutta markets mishti doi in a similar fashion. Dairies in Punjab and Haryana market lassi, paneer and kalakand (also, lately, milk cake). Cooperative dairies in Tamil Nadu, Andhra Pradesh and Karnataka also sell makkhan, khoa, peda and kulfi. Gokul, Mahanand and Warana dairies in Maharashtra are also marketing shrikhand through their sales outlets.

The major strength of the traditional dairy product sector is the mass appeal it enjoys. Not only does its market far exceed that for Western dairy products, but its operating margins are also much higher. The Bureau of Indian Standards (BIS) has worked out standard specifications for the quality of khoa, shrikhand, burfi, rasogollas and gulabjamuns, and those for other products are being worked out. The increasing demand for traditional products presents a great opportunity for the organised dairy sector in India to strengthen its base and take a larger share of the expanding milk production which is expected to cross 100 million-tonne level by 2005.

Reading List:

1. IDF Workshop on Small Scale Dairy Processing & Indigenous Milk Products, Proceedings, December 4-6, 1997.
2. The Technology of Traditional Milk Products in Developing Countries, FAO Animal Production & Health, Paper No 85, 1990.
3. Smallholder Dairying in the Tropics, International Livestock Research Institute, 1999.
4. Advances in Traditional Dairy Products, Centre of Advanced Studies in Dairy Technology, National Dairy Research Institute, Karnal, Page 167, 1997.
5. A Historical Dictionary of Indian Food by Dr K T Achaya, 1998.
6. Outlines of Dairy Technology by Sukumar De, 1980.
7. Milk & Milk Products by Harbans Singh, March 1968
8. "Traditional Milk Specialities: A Compendium", Dairy India 1997, pp 369-392.
9. Dairy India 1997, 5th Ed. A mini-encyclopaedia on the Indian dairy industry (pages: 910 + xviii) covering production, processing, distribution, marketing, research and development. A multi-disciplinary volume, it serves as a suppliers of products & services; a Who's Who. Over 7,000 organizations and specialists are listed.
10. "Technology of Indian Milk Products" by Dr R P Aneja, Mr A K Banerjee, Dr R C Chandan, Dr B N Mathur, Dr L K Vaswani (In Print).

Comments received on Small-scale Milk Processing Technologies:

07-07: P. Stewart, N-Ireland; Water Purification

I am currently assisting a small charitable trust in the town of Tabora in western Tanzania to design a small-scale processing unit in that town. In the Discussion Paper 'Small-Scale Processing Technologies: Liquid Milk' the issue of water quality was not discussed. I am told that water which is used to clean milk processing equipment should be fit for human consumption. The water quality in Tabora is very poor and therefore could not be treated using ultra-violet. What is the most appropriate form of water purification and is there a commercial Treatment Plant available for treating up to 1,000 litres per day?

06-07: G. Haylle Dick, South Africa; comments on MILKPRO

In reply to N. Abeiderrahmane in Mauritania, whose sense of humour is easy to get to grips with, his latest comments on the failure of the MILKPRO system in Mauritania are illuminating.

As I recall, the customer involved initially was interested in 6 MILKPRO units in total, which suggests that they were, in fact, too big for the MILKPRO system, and not geared up for small-scale production. The fact that they only took delivery of one unit suggests that they became aware of the error in their thinking.

What should be pointed out here is that a concept like the MILKPRO system, where the milk is packaged prior to pasteurising, is only feasible where there is a maximum of 2000 liters per day to be processed. Each unit can handle up to 1000 liters per day, so that if 2000 liters are to be processed, a second unit can be purchased.

However, the fact that it is a manually-operated batch system, means that it becomes inefficient as the daily volumes progress beyond 2000 liters. It starts to require too much space and labour, and its initial cost is too close to that of an HTST-type system to justify its choice over the HTST equipment. Manufacturing the system with larger tanks which become difficult to work with, only reduces the system's efficiency.

In its class, however, the MILKPRO system represents a more-than-viable option for farmers wishing to sell up to 1000 liters per day of packaged, pasteurised milk.

29-06: G. Haylle-Dick, South Africa; The MILKPRO system

May I take this opportunity to congratulate you on the concept of an email conference, which given the ease with which information is shared and disseminated, I'm certain will be taken up and copied by others in the future.

Being the manufacturer of the MILKPRO Pasteurisation system mentioned in Mr. Brian Dugdill's poster paper on the Village Milk System, I was concerned to read the subsequent comments on the said paper by N. Abeiderrahmane in Mauritania. He questioned whether the Village Sytem would in fact work, and mentioned that a MILKPRO unit had not worked for very long in his country.

Perhaps a brief background to the MILKPRO system would be appropriate at this point. It was designed and developed in South Africa with the smaller dairy farmer in mind, keeping cognisance of the difficulties facing the smaller dairy farmer who wishes to pasteurise, package, and market his own milk. It was deemed important to design a system which would;

- be inexpensive in terms of initial capital outlay;
- produce high-quality pasteurised milk in often difficult circumstances;
- be easy and inexpensive to operate, with low levels of required sophistication;
- be easily maintained and;
- be environmentally-friendly

The only way to satisfy these criteria would be to rethink the whole idea behind pasteurisation of milk. In-container pasteurisation is not a new concept, nor was it at the time the MILKPRO system was developed, but it was a system better-suited to pasteurise goods packed in glass containers, like jams and bottled beer, which could stand the relatively-high temperatures required.

However, at the temperatures required for milk pasteurisation, the ability of the package to withstand temperature obviates the need for a packaging material like glass. At 65 deg C, High and Low Density Polyethylene (HDPE and LDPE), commonly used in the food packaging industry, is unnafected, even in terms of imparting a flavour to the milk. The idea whereby the milk is packaged prior to pasteurising, and then pasteurised in the packaging, began to make sense. Because the milk is packaged during pasteurisation, the requirement for

stainless steel processing equipment falls away, which has a dramatic effect on the intial cost of the system. The system proposed would then;
- package the milk direct from the cow, with no pre-chilling required;
- pasteurise the milk in the packaging, and;
- chill the pasteurised milk to storage temperatures of less than 5 deg. C.

The concept has proved to be a huge success, and has successfully satisfied all the design criteria. Post-pasteurisation contamination is no longer possible as long as the packaging is not damaged prior to use. Plastic sachets or bottles can be used, and the milk pasteurised by the system consistently shows excellent quality-test results. Being manually operated, it is simple to run and maintain, with no moving parts. Keeping the system clean is also made very much easier since the only part which requires daily cleaning is the sachet/bottle filling unit. The water used to heat and chill the milk need only be replaced if a sachet or bottle is not properly sealed and leaks.

The system is flexible to the extent that a standard unit can profitably process between 100 and 1000 liters of milk per day. Its only potential drawback is the fact that it operates on electricity, which is not always available in far-flung rural areas. Work is currently being carried out to determine whether alternative energy sources like solar power and bio-gas are feasible options.

To address the concerns expressed by N. Abeiderrahmane in Mauritania then, where he reports a MILKPRO unit did not last for long in that country, it should be pointed out that a relatively new concept such as this, even though it is largely maintenance-free, still requires a degree of technical know-how to operate successfully. This know-how is easily imparted by the manufacturers, as long as contact is maintained. Unfortunately, for reasons unknown to the manufacturer, the customer who purchased the MILKPRO unit for Mauritania broke off contact soon afterwards, with the result that the manufacturers were not even aware that problems were being experienced at all. Without knowing what went wrong, it is difficult to comment on N. Abeiderrahmane's assertions.

Having said that, there are some applications in South Africa which have been running successfully for 8 years now, with no problems. The system has also been evolving over time, with improvements being added to the system at every opportunity. Manufacturing the system in South Africa has meant that US Dollar prices have remained firm for the last 4 years, while the quality has been consistently improved over that time.

I would appreciate the chance to address the problems which occurred with the unit in Mauritania. The latest developments to the system can be viewed at <http://www.milk-pro.com>

23-06: K. Coetzee, South Africa; sterilising milk

So far a lot of discussion focussed on pasteurisation. Is sterilisation a viable option for small-scale enterprises? Also, can the cost of the UHT-process be limited by using a cheaper non-sterile package such as plastic pouches for packaging? Although the shelf-life will be less, it will still be longer than for ordinary pasteurised milk. The point about consumer resistance to homogenised milk on the basis of perceived "low-fat properties" is very valid in South Africa.

23-06: N. Abeiderrahmane, Mauritanie; village milk system

This is a very interesting way to hold a conference. I agree with most of the poster paper on the village milk system, but also have some comments: The ideal world does not exist. In the real world, making quality products that can compete with attractively-packaged and cheap imported milk is very difficult and expensive.

Intermediaries who take 80 percent of consumer price should of course be banned. But if rural milk producers are small and scattered, and have no technical knowledge, it may be impossible for them to set up any sort of self-sustaining dairy that can produce marketable products all year round. Their families or neighbours will not buy the products, and it may be difficult to sell them in town.

Our dairy pays over 50 percent of consumer price for raw milk. The other 50 percent is not much to cover all the costs involved in collection, chilling, trucking over 200 or 320 km to the dairy, processing, packaging, marketing to 2,000 retail outlets, and managing all this. Although villagers may receive more money if they do their own processing, how much will the processing cost? Will they end up with more income or with more problems? Who does the maintenance? Who procures the pouches? What about unsold milk? How much milk can they market ? Do they trust each other and is their organization self-sustaining? Will the quality of their products be acceptable to available customers?

At first, people who wanted to sell milk to the dairy complained that raw milk was sold at a higher price than what they were paid. But then they realise that only small quantities can be sold at the higher price, and it is better for them to sell a lot of milk at a reasonable price (we pay US$ 0.44 per kg) than very little - or none - at twice that price.

Some technologies that look cheap are expensive to run in the long term. Every country, every region, has a different set of conditions, and these must be studied very carefully before deciding on the best way to generate income for farmers from milk. I would like to know whether the proposed Village Milk System really works. One MILKPRO dairy was tested in our country and did not last long.

03-07: H. Muriuki, Kenya; comments on Thapa's paper: other products

My name is Hezekiah G. Muriuki and I work with the Ministry of Agriculture and Rural Development in Kenya. I am in a Project of an integrated Research and Development project called Smallholder Dairy (R&D) Project. It is funded by both DFID and Kenya govt. and implemented collaboatively by 3 institutions i.e. the Ministry, KARI and ILRI. Below are comments on DISCUSSION PAPER 2 - Small scale milk processing technologies: Other Products by T. B. Thapa.

The paper by T. B. Thapa is well thought, informative and descriptive of the situation as exists in our world. I however find Challenges and Opportunities and the Agenda for Future Strategies not complete. One major challenge is the low purchasing power by majority of the people, preferences and tastes. Unless the products are processed for home consumption, in which case they will be limited to traditional products, or for foreign markets which again is faced with competition from well established multinational giants, it will not be attractive to make or develop other milk products.

I don't seem to grasp the challenge on "Trade barriers requiring policy interventions to promote development of national dairy policy within the context of WTO". The membership with WTO can be visualised as assuming there will be fair play from a soccer match between the likes of Brazillian, French and other well-refined teams and High school teams. >From the negotiation table to implementation of WTO agreement, there can not be fair play starting from the current imbalance in technology, wealth etc. Implementation of WTO agreement will at most only create markets for the developed partners. There is a lot to be said about WTO agreement and this may not be the right forum.

About what must be addressed for future strategies, I agree with the author but I want to emphasise that appropriate technology should be developed from within and/or modified to fit the local situation which should include considerations on the purchasing power of the intended market. Major weaknesses of most development efforts are the assumptions made on transfer of technology, the level of funding and the fixed life-span of programme(s). This has resulted to a lot of wastage in terms of resources, both human and capital. Development of small-scale milk processing technology have to be linked with the overall economic development both at the micro- and macro-level.

03-07: R. Young, Dominican Republic; Use of H2O2 in Cheesemaking

I have recently learnt that in at least one major cheese making factory in the Domincan Republic, the milk is not pasteurized because this is considered too expensive. Instead, the milk is treated with Hydrogen Peroxide to eliminate unwanted bacteria, and then the hydrogen peroxide is supposedly removed using enzymes.

Does anyone have more deatils on this type of practice? How does it effect quality, falvour etc. Is it safe? are there any hazards to health? is it a legitimate alternative to pasteurization?

While I'm here. I am very interested in the MILKPRO equipment and the Village system, it would be great if we could get it to work with small womens groups here in the Dominican Republic. Apart from the layout costs presented in the paper by Brian Dudgill, is there any other information available on the running costs in the practice, like the project in Kenya mentioned.?

I found the concerns viewed by Abeiderrahmane, Mauritane 23-06, very interesting. The "hidden" comercialization costs and real local demand could be a make or break for this kind of project, not forgetting the tecnical side and associative or cooperative level organising.

1) In the Dominican Republic, the competition from Imported milk powder is very strong. It is difficult to compete with European subsidised milk powder.

2) Due to what appears to be an energy crisis, people here have learn't not to rely on their fridge working for many hours during the day, especially in small towns and villages (the very places where we we like to sell our fresh pasteurised milk). So if the customer doesn't like imported milk powder, they will opt for UHT at US$1.00 a litre (which is probably a mixture of fresh milk and powder milk).
3) If people can't afford UHT or powder milk, they will often buy crude untreated milk.

I think there is a possibility that if we could offer fresh pasteurised milk at fair price to the customer, we might get a market.

Reaction from the moderators:
Apart from cooling, Lactoperoxidase is the only recommended way of milk preservation by the CODEX Alimentarius. see: www.fao.org/WAICENT/FAOINFO/ECONOMIC/ESN/codex/STANDARD/volume12/vol_12e.htm

We are putting together some practical operating guidelines for the Village Milk System. As indicated in Brian Dugdill's poster paper, the system is being piloted with villagers (male and female) in Bangladesh through the Grameen Bank with the first community-owned dairy enterprise scheduled to start-up at the end of this year. The system is being tailored to the local situation and market and will incorporate milk raw milk collection by cycle rickshaw vans and pasteurised milk distribution by 'milkshaws' (insulated cycle rickshaw vans). Feedback, including detailed costings, will be posted in due course on our website.

03-07: T. Ali, Egypt; reaction to Orskov (28-06): drying of milk
Not long ago I saw the end of the Livestock Programme on the Sudanese TV satellite from Khartoum. The programme featured young scientists talking about drying milk by soaking sponges in milk and exposing it to sun light. I had it in mind to contact my colleagues in Sudan to inquire about this technique but never got around to doing so. Now E. ORSKOV communication to the network has reawakened my interest on the subject.

Providing milk to the urban population of Sudan during the dry season is a big problem in that country with a population of 28m head of local cattle. I would appreciate to hear about experience of colleagues who dealt or know some of these simple techniques for preserving milk.

29-06: T. Borbonet, Uruguay; Traditional cheesemaking in Uruguay (E/S)
Title: Training to improve cheese making.
Objective: improve cheese making to improve quality of life of rural people.
Development: this work started in 1991 with the following main topics:

- knowledge of the regions in the following subjects: customs, general culture, cheese making, normative culture effective, situation of the cheese sector and the market.

- to train cheese makers

This work was inspired by the words of the first General Director of the FAO, Lord Boyd Orr when he said: " EVERYTHING WHAT RESEARCH HAS TAUGHT TO ME ABOUT CALORIES, AMINO ACIDS, PROTEINS, CARBOHYDRATES, VITAMINS AND ENZYMES IS THAT IF PEOPLE ARE HUNGRY, THEY NEED FOOD. IF PEOPLE HAVE POOR DIETS, THEY NEED GOOD FOOD".

What a vision he had ! Or was he thinking about food safety, since in those years nobody talked about the subject of HACCP. The training was started under the name "I would do it much better if I would now why I would do it ", through different courses it has gone away " breaking " the barriers that are put by own rural means, (or of the city towards rural means?) like trying " to protect the secrets " of processing. In Uruguay two types of cheese makers exist: the permanent cheese maker and the occasional one. The first is the one that had some ancestors that were cheese makers, like Swiss families that arriving as of 1861 and bringing the "cheese culture". They were transmitting the knowledge and experiences to their children and grandchildren. The occasional cheese makers are those that process cheeses depending on the moment or situation in which they are living. The more developed zone in terms of cheese making is in the Southwest of the country, including the departments of Colony and San jose. As of 1861 the Swiss began to process two types of cheeses: one called Sbrinz cheese (cheese seeds) and another called Colonia cheese. Today this one is recognized as being native of Uruguay. It is a cheese processed

from whole milk with addition of lactic ferment or termófilo. If the milk is raw no bacteria are added, if it is sterilised or pasteurised these bacteria are added. After being cooled down, it is warmed up and then again cooled down to be taken to the market.

The cheeses are sold in fairs, supermarkets or to companies that re-process them. Immediate conclusions: - the cheese maker wants and wishes to become qualified to improve their products - Quality Improvement will lead to higher economic returns - They wish to stay in rural areas - The market demand for flavored and aromatic products will increase - training courses can break that "barrier" when all group members are participating and discussing, learning from peoples errors, - One maturing room could for example be set up for the whole group Mediate conclusions: - transform the producer into an producer-industralist, with knowledge of costs, prices and markets.

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28-06: E. Orskov, UK; technology for sun drying of milk powder?

I have visited mongolian and tibetan herdsmen and admired the many milk products they make from camel yak cows sheep and horse milk. In Ulan Baatur in outer mongolia for instance there is a great demand for milk to be added to the tea to give the mongolian milky tea about one third milk.m while many cheese type products and high fat products can be found in city markeds the distance to the marked does not allow the herdsnen to fill that marked so that milk powder has to be imported. My quistion to the audience is therefore, is there any technology with which herdsmen could make milk powder in the steppes or mountains with only the sun and wind for drying? Would it be possible to use absorbant cloth and hang up the absorbed milk for drying and shake of the dried milk which could then be brought to the marked with a long shelflife. I have never got round to trying yet but maybe the technology is already there.

25-06: E. Alderson, UK; Reaction to Walhauer: Acid milk

There is very little reference in the literature to this problem: Huston, R V , (1991) Acid Milk on Bolivian dairy Farms New Brunswick Milk Marketing Board (1991) Causes and Prevention of Milk Off-flavours Sommer, H H and Binney, T H (1923) A study of the factors that influence the coagulation of milk in the alcohol test. J. Dairy Sci. 6, 176 Weimar, A C (1923) The alcohol test as a means of detecting abnormal milk. J. Dairy Sci. 6. 95

Requests to get funding to investigate the causes have been turned down—reason given "too localised a problem"! (But it has also appeared in Brazil. Many theories have been advanced as to the cause but to my knowledge no satisfactory explanation has been discovered. it affected a majority of the dairy herds in the department of Santa Cruz in Bolivia, sometimes the whole herd often causing the farmers to go out of business, but mainly individual cows; it was not breed specific and affected criollo, zebu and Holstein breeds alike; stress conditions such as severe climate change, calving, and nutritional imbalances— especially Ca: P and protein:energy ratios, seemed to exacerbate the problem. It does seem to be a physiological/biochemical problem—weak cell membranes? —- and is definitely not bacteriological. ("unstable" rather than "acid" milk would be a better description)

Although the actual physiological reasons for the problem were not identified I did manage to reduce it significantly over 3 years by implementing a regimen of balanced dairy cattle feed rations. But it would be interesting to know the mechanisms that cause this and if has been experienced in other parts of the world! (By the way—just for the record—I am female!!!)

26-06: L. Falvey, Australia; ILRI publication on Dairying

The recent collation of global information for the first book on "Small-holder Dairying in the Tropics" published by the International Livestovk Research Centre contains much information onf relevance to each topic listed. It is available through ILRI, as a subsidy to selected persons.

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Reaction from Moderators:

ILRI can be contacted at: http://www.cgiar.org/ilri/a.m.nyamu@cgiar.org

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28-06: G. Veldink, Netherlands; Experiences from Vietnam

With the arrival of the first papers of Topic 2, we feel that we should submit to you the following comments regarding milk collection under smallholder situations. Our experience is based on managing smallholder milk collection schemes in among others, Vietnam.

Quality tests

The visual appearance, the temperature of the milk and the alcohol test and the use of a lactodensity meter, are good

milk reception tests at the Collection Points. The quality control system should be based on a good central laboratory where we do the following tests in the bulk samples of the CP's per delivery and randomly in samples of individual suppliers:

- Total Solids % - Fat %
- Resazurin grade - Freeze point
- Antibiotic test (Delvo) - Additive tests (sugar, starch, carbonate)

In bulk samples furthermore:

- Total Plate Counts (norm for smallholder milk collection scheme: <500,000/ml)
- Psychotropic counts (norm for smallholder milk collection scheme: <100,000/ml)
- pH (>6.6)

Payment system

Instead of paying to a group of farmers (co-operative) we have good experience with our payment scheme where the farmers receive an individual milk payment from the processing plant. The kilo price is determined per delivery and per collection point (group of farmers) and is based only on the composition and bacterial contamination of the bulk milk. The farmers receive payment once per two weeks. The group's milk is not screened on adulteration, additives and antibiotic. Instead samples are taken randomly from the individual suppliers and in case their milk is found positive on the mentioned issues they will receive an "individual" price, which is always considerably lower compared to the group price. The individual price is based on a single sample and is applied over the whole quantity supplied during a payment period. During the first two years after implementation of this payment system the quality of the raw milk improved substantially. The farmers are pleased except the odd one who's milk is excluded from the group price. Both parties benefit in this situation. The farmers are paid a good price and the processing plant (Vietnam Foremost Dairy Company) receives good quality raw milk.

It is our experience that the financial incentive is the best incentive available to stimulate the farmers to change their practices, make small investments, participate in training sessions, etc. No milk collection scheme and its associated milk payment system, will be accepted if it is not reliable. Furthermore it is crucial that there is a good exchange of information between the buyers of the milk and the farmers (or the farmers co-operatives). The gradually gained trust makes introduction of new ideas or programmes easier and more successful. The suggestions made (Mr Sastry of India, etc.) that time is required to train t he farmers is fully supportedbut the first and most important aspect, is whether the farmer has "confidence" in what the scheme does. In our experience the instrument of financial incentives can be used for:

- improving the TS% (bonus/penalty for fat % and TS%)
- improving the hygienic quality (bonus for Resazurin test grade)
- penalising adulteration with water (penalty for too high freeze point)
- penalty for antibiotic in the milk etc.

The financial incentive has to be substantial but not distorting the price breakdown and the weighing of the various components (value of the milk based on average total solids % versus bonus/penalty for fat% or TS%). We try to improve the bacteriological quality through an elaborated farm hygiene scoring (including an incentive for clean conditions) and training on milk production and handling.

Seasonal milk quality

Under the humid tropic conditions of Vietnam and Indonesia, as can be expected, the hygienic quality of the fresh milk collected is lowest during the rainy season.

Freeze point determination

It is our experience that a lot of tests have to be made and a large data base should be built, before a correct base freeze point can be identified. The freeze point between individual cow's milk can show considerable variations, which makes it especially in a smallholder (2 to 3 cows per farmer) collection scheme difficult to determine adulteration. To be able to distinguish a true erratic freeze point and adulteration we cross-check (in case of a too high freeze point) the individual sample's freeze point taken at the collection point with a sample that is taken at the milking point by our staff. Still we sometimes find in samples taken direct at milking by our staff, freeze points which are well below the norm. In these cases we refund any deduction made.

Organisation
We have experienced that the persons taking the individual samples can better not be the same person as giving the extension on dairy husbandry, hygiene conditions, etc. We therefore have employed special persons taking only samples.

28-06: N. Abeiderrahmane, Mauritania; Acid Milk
Although I have not yet seen the paper on the alcohol test, I think somebody has a problem with acid milk. We discovered something that may be commonplace knowledge, maybe not : when we were making camel cheese (which is quite tricky) our chemist found that the milk was behaving as if it were very acid whereas it was at 16 degrees Dornic (the minimum for healthy camel milk). He went out at dawn, had the camels milked in front of him, rushed back, and the milk was still acid. He then measured pH and found it quite low.

He thought about this, and came up with an explanation : pH is ++ ions, and the camels were browsing in salty ground with very salty bushes. The milk is full of Mg++, Ca++ I+ and other salts, so it seems that the chemical acidity and Dornic acidity (buffer capacity) entail different effects. Does that make any sense? It fits in with E. Alderson's experience with feeding.

28-06: N. Abeiderrahmane, Mauritania; Reaction to Lambert (27-06)
MILKPRO : I am not sure that I have all the data about it :
The MILKPRO dairy was set up in Kiffa with a special funding within the scope of a project providing funds for unemployed graduates, but it mysteriously turned out to belong to a prominent business family. Kiffa is 640 km from Nouakchott, it has a sizeable population by Mauritanian standards. We heard that there was not enough milk, some people said the flavour was not good, but I do not really know why they stopped. The owners then opened a larger dairy in Aioun (800 km from Nouakchott) but that lasted 12 months and stopped. There were problems. I shall try to get some more information and come back with it.

24-06: N. Abeiderrahmane, Mauritania; experiences of a dairy
In developing countries, there are three ways to set up a dairy (three forms of ownership) :
A) State ownership. This is not fashionable any more, because it has been proven to be inefficient.
B) Collective ownership, e.g. communities or NGOs or co-operatives. This is very fashionable, which is odd because socialism is definitely "out", but does it really work? This is the essential question.
C) Private enterprise. Frowned upon by supporters of option 'B' and by communist countries, but may have some positive aspects.

Our dairy, which definitely is in category 'C', has accumulated some very interesting experience over a period of 11 years. Although privately owned, it is not run on a 'maximum-profit' basis : rather it is governed by a 'maximum quality' philosophy.

The dairy is a private business, set up by a woman with very little money at the time and a loan from the French Development Agency. It is based on small-scale modern equipment on the "mini-dairy" principle, using exclusively fresh milk bought from semi-nomadic herders (no powder, no farm, no supercows). It started with camel milk, the only type available in 1989, then went on to process cow milk and recently goat milk too. For 3 years it was not a success, processing only 200 liters a day, but then it started growing and now averages well over 10,000 liters a day, with a line of 14 different products. Cow milk now accounts for 60 to 70 percent of throughput, but camel milk is holding its ground.

Camel milk is more unusual for Europeans, but to all practical purposes it is equivalent to cow milk from the dairy's point of view : dromedaries and local cows yield the same amount of milk, the owners are similar, processing methods are the same. Camel, cow and goat milk are collected and processed separately, except in one product. Four types of pasteurized milk (camel, cow, semi-skim, and camel+cow mix) are packaged in half-liter cartons ; cocoa-milk and three types of sour milk (camel, cow, goat) in pouches ; cream and butter in plastic pots with lids ; yoghourt, two cottage cheeses in plastic pots with sealed aluminium caps; ghee in recycled glass jars with new lids.

Here are some comments about the practical aspects of this dairy's experience :

- Developing countries are not all the same and are not homogenous with respect to income level and consumer preferences.
- In some countries, people with a pastoral tradition drink lots of milk and like it ; countries with no such tradition first have to overcome lactose intolerance. Although drinking milk is good for people's health and is excellent for

livestock owners' income, it may not always be easy to develop a market for processed milk.

- People who like milk make a difference between good-tasting fresh milk and poor-tasting overcooked milk or badly processed milk.
- If locally processed milk is not good, people will buy imported milk or local non-processed milk. Very few people make consumer choices for humanitarian, patriotic or social reasons.
- Properly processed milk has two major advantages : a) it tastes good, and b) it lasts longer. Milk containing germs turns sour sooner. The advantage of modern processing methods is that they enable more milk to be sold, at a better price, as products keep longer and can go further and
- reach affluent markets.
- People with a nomadic tradition find it very difficult to work together in an organized way, so co-operative type structures (although often set up to comply with "donor" agency requirements, and quite ficticious in real life) have not yet been seen to work in Mauritania.
- Buying milk from poor herdsmen and selling it to middle-class or high-income city-dwellers may not sound OEpolitically/socially correct[1] but it is very efficient in providing an income to herders. They can use the income from milk to feed and care for their livestock, thus increasing the value of their capital assets and their income from meat production, and raise their overall standard of living.
- Besides the dairy[1]s vehicles that collect milk, a number of people with pick-up trucks (or even donkey carts) earn a living by collecting milk around the camps, as far as 80 km, and delivering it to the dairy's collecting centres. They are paid by herders per liter or per can.
- Nowadays over 700 suppliers, not one of whom has a fence or a farm, deliver milk twice a day. Some goat milk suppliers supply as little as 0.5 liter a day. Suppliers are scattered far and wide.
- African cattle does not yield much milk but it is well adjusted to the environment. The first step to increase milk production is to feed the livestock. This can be done with farm by-products, which is good for farmers[1] income, too.
- One of the biggest hurdles that had to be overcome in this country was traditional prejudice against selling milk, considered to be a miserly practice. This has been very difficult, but economic considerations have prevailed very gradually. This prejudice should not be underestimated where it exists.
- The whole collection system involves a lot of work (particularly the administrative followup to make sure everyone gets paid properly) but spreads a lot of money.
- On the consumer side, people with a nomadic tradition do not keep much crockery. They tend to drink straight from the package. For this reason cartons or plastic bottles are preferable to pouches : sucking a pouch is not dignified or practical.
- Milk in our country is a social drink, served together with sodas and juices at receptions, parties, weddings, and in offices and meetings. It needs to look nice.
- Local milk and dairy products compete with a huge variety and quantity of imported products. Consumers do not necessarily prefer domestic production, unless it is better. Quality is important.
- Thanks to a long-term commitment to quality, local milk has gained a very large share of the market, although until recently prices were higher than those of imported products.
- It is important to boost local production by making products that people are proud of, and happy to buy.
- Village production is good if it can be sold. Outside the major towns, most people do not have any money to buy milk, but they also have access to some fresh milk - a cow or a goat or a neighbour[1]s cow or goat. Besides, there are very few refrigerators in the less developed communities.

To conclude, this dairy[1]s experience indicates that wherever there is a market for high-quality dairy products (such as major towns and cities) it is worth setting up a modern unit making up-market products, using only fresh milk collected from the villages. There is a market for quality products in Africa.

Of course, it is important to find ways to help village farmers to start adding some value to their basic produce. Simple technology is attractive, low-price products are needed, but there is a risk of leaving poor countries behind while the rest of the world races forwards if only rudimentary technology is offered.

It is essential that development comes from the people themselves. After the first step of village dairying, the next step up is the modern mini-dairy. Encouraging local entrepreneurs together with local engineers to set up private dairies is one way to help get the milk from the villages to the towns, and money feedback to the villages. What they need is real solid practical industrial know-how, and second-hand equipment to start with.

22-06: J. Lambert, FAO; Reaction to Psathas (22-06) on milk testing

The comments made by G. Psathas are excellent. The paragraph 9 should be underlined because according to me this is the fundamental question. We should start by elementary parameters:

Acidity

- because when the milk is too acid we cannot “pasteurise “it.

Water adulteration

- because you cannot make cheese with water. These 2 tests can be easily done by the Alcohol test and the lactodensimeter test.

The second step should be the fat or the protein content of the milk: what is the most appropriate methode and laboratory equipment for these parameters? The Gerber method was used for centuries but need a minimum laboratory equipment and organisation: we have to collect samples of milk every day or week with preservative and to analyse the montly sample at the laboratory. For protein the old Kjeldal method was usually used but only at the milk plant level. For microbiological test the Resazurin test is the most common test used at the milk collection level. But again this test need a minimum of laboratory equipment and a competant person to do it.

What is the most efficient and economical way for determination of milk composition and milk quality?

30-06: P. Vyasulu, India; non-technical aspects of dairying?

Firstly, thanks for the steady stream of papers and materials from conf. You are doing an admirable job of keeping track of it all and being at the centre of the web, it must be very challenging. I was wondering if we are going to be getting papers, data, research findings etc on some of the non-technical aspects of dairying. For example: - have projects and programmes looked at the economic impact of dairying activity on the family or on the nutritional level of a household ? What does dairying do to the work load of women and children? Do the costs and benefits accrue to the same gender or does dairying add to further widening of gender disparities? Certainly in our country, much of the work related to dairying is done by women and children ; I am talking about small holders and not commercial/large scale dairying enterprises. It has been contended that when these small producers link up with collection centres, they retain very little for their own use and sell almost all the produce for cash. Milk products such as curds, buttermilk, butter, ghee etc is not given to the children or expectant/lactating mothers in any significant quantity even though produced at home! The lucre of cash perhaps is difficult to resist. Reaching milk to the collection point is often done by men and the payment arrangement is also often with them. Interestingly, much of the technical/skill training is given to men and boys in dairying extension activities. It has been found that unless special efforts are made in organising women, they do not get their due share from the activity. In general, when any production activity is taken up on a commercial scale or for external market,(be it food-production, health care, craft work...) there is a tendency to marginalise the role of women. This is not to say that dairying should continue to be a ‘subsistance’ activity! but rather, can we put it through a ‘gender audit’ before we plunge into it? I understand such analysis have been done for NDDB, in India. Any interesting experiences of the participants to share ? Please comment

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Reaction from the moderators:

These aspects are hopefully going to be discussed during the next topic:
“Milk Producer Organisations”.

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06-07: J. Havranek/S. Kalit, Croatia; milk collection in Croatia

In Croatia there are many farmers with small herd size (5-10 cows), but collecting of milk to dairy factory is well organised. In the villages there is one or more milk collecting points with bulk tank cooler. This tanks belong to the dairy factories. Dairy factories organised collecting point on some big farms. All other farmer must bring their milk to the milk collecting point as soon as possible after milking. On farmer is charged to follow evidence and sampling the milk for quality control. Milk payment system is based on the quantity of milk and fat content. But very soon milk will be paid according to new legislation. This legislation take into consideration several milk quality parameters: fat, protein, somatic cell count and total bacterial count. Milk has to be negative on 72% alcohol test, no

added water and no veterinary drugs. Milk will be divided in 4 classes according to its quality. The minimal request for quality of milk is that milk must contain more then 3,2% of fat, more than 3,0% of protein, no more than 100 000 bacteria/ml and no more than 400 000 somatic cell count/ml. To achieve this request we start with farmer education program to prepare the farmer. Education program go very well and we have many farmers with very good milk quality. Education consist of visiting the farmers, sampling the milk, analysis, and extension. Many publications are issued about quality milk production. When the new payment system will be introduced farmers will have enough written material for improving the quality, but also the quantity, of milk.

04-07: A.Abdel-Aziz, Egypt; recommendations for dairy industry in Egypt

Concerning small-scale milk processing, a recent study on the dairy industry in Egypt arrived at the following major constraints and recommendations for both large- and small-scale milk processing.

Constraints

1. The high risk of investment in the dairy processing:

* High investment cost of the dairy processing plants.
* Limited acquaintance of the available GOE legislations.
* Lack of information about the local and foreign market.
* Inconvenient pricing and taxes policies to the dairy processors.

2. Loss in raw milk produced from small and medium dairy farms:
* Small herd sizes.
* Weakness of milk collecting and marketing systems.
* Irregular supply of milk and dairy products.
* Incomplete acquaintance of milk supply legislations.

3. Low export competitiveness ability of dairy products:
* High cost of inputs.
* Lack of information on potential foreign markets.
* The use of low technologies in milk processing.
* Dairy products do not meet export standards.
* Inproper packing of dairy products.
* High the production cost.

4. Asbence of supervision on producing high quality (clean) milk and dairy products:
* Poor traditional milking system.
* Absence of cooling tanks, and cold channel.
* Weakness of milk handling tools and transportation systems.

5. Absence of common entity among different parities in the dairy sub-sector:
* No direct connection between producing processing and marketing units.

Recommendations

1. Stimulate private sector investment in dairy processing:
* Develop financing mechanism for dairy plants.
* Revise legislations and rules, customs and taxes.
* Taxes codification for dairy plants (on the basis of the amount of processed milk).
* Protect local dairy products from unfair competition with imported products.
* Provision of efficient information about local and foreign market.
* Promate export campaigns.

2. Increase the contribution of small and medium farms in milk supply:
* Optimize herd size.

* Develop efficient milk collection, cooling and marketing systems.
* Move from marketing of raw milk to value added products:
* Establish financing mechanism for dairy plants.
* Establish financing mechanism for milk processing units in rural areas.
* Encourage rural women participation.

3. Produce new varieties and attain standards of production for export in view of WTO agreements and local market legislations:
* Strengthen the market information systems.
* Identify potential export products.
* Use better processing technologies.
* Revise tarrifs on inputs.
* Revise taxes and, fees on exports.
* Implement promotion campaigns.

4. Supervision and control on private dairy processing units.
* Improve milking systems and cooling channels.
* Improve milk handling tools and transportation systems.

5. Establishing the Egyptian Dairy Union (EDU).
* Set standards and specifications for dairy products.
* Revise rules, legislations, tarrifs and treaties.
* Promote exports of dairy products.

04-07: N. Abeiderrahmane, Mauritania; several issues

1) How do you get the dried milk - if it is dried - out of the sponge ?

2) Comment on "30-06: P. Vyasulu, India; non-technical aspects of dairying?"

Yes, gender can definitely be an issue, but it varies with custom. In this part of the world, in one community large ruminants (i.e. dromedary and cattle) are milked by men, and small ruminants (goats, ewes) are women's job. In another community, all animals are milked by women, who own the milk even if the animals are not their own (they can own animals, too). Two noticeable consequences :

1) When our dairy started buying goat milk, we only got very little, until we contacted groups of women, and explained that we wanted them to make money, and asked them to send the milk under their own names, and also gave a higher price for women's milk (for some time). It was a great success.
2) As P. Vyasulu remarks, and as has been noticed by researchers in other West African countries, where women used to manage the milk, it and its income has been taken from them by the men who carry the milk off to the dairy. This causes discontent and social problems. In this country women of the same ethnic group are more assertive, so they deliver their own milk - some rather sharp discussions have been reported. The preference for cash vs milk was brought to our attention once when we could not buy the milk, and our driver reported women as saying "Bless so-and-so (i.e. us), this evening we can have milk for dinner".
3) I have been trying to find information on the failure of the MILKPRO unit here, with no success so far. The people who set it up have become our main competitors, and it is a bit difficult to ask them directly ! Maybe the main problem was that the owners were too big for the unit, and were not interested in small-scale operations. It was said at the time that they did not find enough milk, but it all happened in a town located 640 km away from here, so it is not easy to gather first-hand info.
4) It is interesting to note that the integrated farm model including dairy animals and crop farming (Thapa) is not the only model around : In desertic or semi-desertic areas, such as all the Sahelian countries, livestock breeding is the base of the economy. There is practically no farming, particularly by livestock owners : since there is no farmland around, the land is covered by more or less sparse pasture or grazing or browsing vegetation. Milk is also the basic food. In a semi-desertic and random-rain environment, it is necessary to move around to make the most of the pastures available. People who live in tents and often change location cannot process milk. In these conditions, a dairy is the only solution. Besides, people are more individualistic and less 'organizable' than sedentary farmers. As a result, milk has to be collected over longer distances and along variable routes.

5) Maybe it is for these reasons that an entrepreneurial dairy seems more effective than anything based on the hope of organizing anything collective. Some of our suppliers do even trust each other enough to send one of them to the dairy to collect payment for each and all the others, let alone putting their milk in the same can! At a CIRAD conference in 1999 it was noticed that dairies that receive lots of subsidies and help and training and so on do not seem to get off the ground as well as private enterprises. I would like to make the point that at heart I am not an advocate of the private enterprise, but our own experience has shown us that - at least in our circumstances - it is the only one that works so far ; and if the principle of private ownership is basically unsatisfactory, it still can do lots of good by spreading a lot of income. It does need a town with a market, however.
6) There was a question about a system for less than 5,000 litres milk/day : we started with one such system, supplied by Alfa Laval (become Tetra Pak). The pasteurizer is a Microtherm 600 litres per hour continuous plate exchanger, and it is an excellent, reliable machine. Adding a cooling tank, a water chiller, and a plastic sachet filler (if plastic sachets are acceptable on the market) one gets a good little system that can turn a profit at a very low production level and still go quite a way. Breakeven point depends on many factors : cost of milk, sale price, good management, no returned milk, cost of energy, cost of packaging, personnel costs, and so on.
7) I really think that developing countries need several types of milk processing for the different markets, and that small-scale, village based systems must and will evolve upwards.

07-07: C. Erickson, USA; great need for appropriate technologies

According to previous discussion papers and comments, there is great need for innovative and appropriate technologies for milk collection and marketing in developing countries. Preservation is an important aspect of post harvest processing of milk and cooling is one of the best preservation techniques. But cooling at collection centers that do not have electricity has been so costly that less desirable alternatives are frequently accepted. I want to emphasize that milk cooling in small-scale collection centers is now possible due to the development of the ISAAC Solar Icemaker

The ISAAC, which is based on ammonia absorption, will make milk cooling affordable in areas with good solar resource. It is durable, easy to operate, does not need electricity or fuel, and it is low in cost. The advantage of introducing the ISAAC is that it will solve many other food spoilage problems also; it can preserve fish, meat, fruit and vegetables. The ISAAC Solar Icemaker will be beneficial in many ways

11-07: G. Psathas, Cyprus; More details on ISAAC cooling system

Can we have more details about the ISAAC system of cooling from Mr. C. Erickson from USA?

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Reaction from moderators:

For details, see the first comment made by Mr. Erickson on 19-06 (in E-mail called: Comments Received (5))

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24-07: K.A. Soryal, Egypt: need low cost technology

Kamal Assad Soryal; question to L.Kurwijila on the paper Small-Scale Processing Technologies ;Liquid milk

1-I agree with you that the majority of the low income in our developing countries can not afford the added cost of pasteurized milk espicially when expensive packing systems are used and the high cost of processing

2- We need a cheaper Mini HTST pasteurizer from India supplied with filling machine in plastic bottles (not disposable) and capped with aluminium screw cap. Can you give us the Net-adress of Indian companyies which attented the dairy equipement exposition at Anand, 1997 ?

I designed a small-scale dairy processing unit of 2 tons daily with total price of about 8000 $ supplied with milk cooler , batch pasteurizer,separator, butter churner, ice cream maker and tools for making soft cheeses. this unit is located beside a new reclaimed area of small milk producers .

I want to supply this unit with the Indian HTST pasteurizer as described above. I think this would be a mean of using the milk by units like that to solve the problem of decreased the price of raw milk which arised from changing the raw milk with imported powder milk by the dairy makersas I described in a previous comment.

To Prof. J.C.Lambert, FAO

Can we obtain a design for HTST milk pasteurizer of the Indian low price Capacity 0f 3-5 tons daily supplied with filling machine in plastic bottles and capped with aluminium screw cap ?

I think this is a common need for the instruction of small-scale processing units in the developing countries. I hope a diagram of such machine with the price and details about the producing company is published on the FAO Website or in the proceeding of our E-mail Conf.

27-07: M. Tyler, UK: info on small scale equipment

There may well be a correlation between sale of unpasteurized milk and the incidence of milk born diseases - i do not know if this relationship has been explored in those countries which sell mainly raw milk?

Mention is made in the forum of small scale dairy plant from India - if you have any contact details I would very much appreciate copy.

I am planning, with a small group of very experienced aid development people a possibly unique new venture to supply a range of lowest possible cost micro and small scale agrifood plant, sourced globally, plus 'Know How' for sale via a 'Not for Profit 'company, into developing countries, especially where SME credit facilities are being improved.

We plan to start in Romania and to expand to other countries as soon as possible. We hope to attract funding to assist our start up and to enable us to setup a possibly mobile, demonstration centre

We are planning to visit some potential suppliers in India and South Africa - hence my interest in possible small dairy plant contacts

This project may well have very substantial potential and would be a very cost effective of development funds targeting 'bottom up' support to improve food security and sustainable
job creation in deprived regions

An SMME Forum?

It has been an interesting pleasure to make a few small contributions to your Milk processing forum. May I suggest that in view of the growing acceptance of need for more effective 'Bottom up' development, plus the increasing funds being made available for SMME credit ($150millions is reportedly going into Romanian banks for this purpose) - that you consider an on line conference or forum on SMME development in Agrifood

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Comments from the moderators

Would appreciate very much if someone from India could advise
on the small-scale equipment mentioned above.

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28-07: K.A. Soryal, Egypt: Sun drying of milk

Kamal Assad Soryal, Egypt;reaction to T.Ali (3-07) : Technology for sun drying of milk powder !!!

Really it is not a tcchnology to use absorbant cloth or soaking sponges in milk !!! and hang up the absorbed milk for drying by the sun and shake of the dried milk which could then be brought to the market with a long shelflife !!!

I agree with the Ethics mentioned by A.Naranjo(15-06) that quality of milk is a concept closely related to food security, the people who consume milk products in developing countries are neither less important nor less human than consumers of developed countries , and their health is equal important. Thanks to Orstov (28-06) who clreard out this point.

Your views Please (2)!!!!

"Small scale milk processing is irrelevant as the bulk of milk in developing countries is sold raw through informal markets"

11-07: J. Rasambainarivo, Madagascar: processing reduces wastage

I have some comments on the "Irrelevance of small-scale milk processing in developpeing countries". I don't agree with this opinion as mamy villages on the High land zones of Madagascar, are very isolated during the rainy seasons as the roads are so bad and consequently the milk produced cannot be transported to the milk collection point. And for mamy days the milk is wasted. Then even for the use during the rainy season the small scale processing unitis necessary and may increase the quantity of milk produced by the villages. So we are looking for any smallscale processing technologies.I am very glad to read more on the "MILKPRO" technology and will ask to have more details on it.

10-07: R. Shrestha, Nepal; convert informal chain to formal channel

One of the main reasons that small-scale milk processing is needed in developing countries is that bulk of milk is being sold through informal channels. When milk is marketed through informal channels, it is less likely to be regulated thus increasing the chances of adulteration, unhygienic handling and other malpractices that affect consumer health. The challenge in front of us is how to convert the informal chain of milk marketing to formal channel. We have seen that the small-scale processing is more practical and affordable in developing countries and at the same time it helps control the issues mentioned above.

07-07: L. Falvey, Australia; highly relevant in all the terms

Small-scale milk processing is highly relevant in cultural, nutritional and preservational terms. India is the best example, Mongolia another. Refer to Chapter 18 and 20 in
http://www.cgiar.org/ilri/dbtw%2Dwpd/fulldocs/smhdairy/smhdairy.htm

07-07: P. Gupta, India; processing has a definite and positive role

Views on "Irrelevance of small-scale milk processing in developing countries". Not true, if we are convinced that modern processing is useful and that informal milk markets in developing countries need to be eventually phased out. It is true that the road to reach the goal of total milk processing is still far away in developing countries. Quite likely, there would be many paths to reach this destination. The mere awareness of this need is by itself a positive step forward and should help intensify our efforts.

India is a good example of a developing country with an encouraging track record of progress made in the volume of milk processed. In the last 30 years, this volume of milk has gone up by more than five time to exceed 25 million lpd (litres per day). In the same period, the per capita milk availability has almost doubled to over 70 kg/year, when the population has almost doubled to 1,000 million. Further, her annual milk production has risen almost four times to 80 million tonnes. Presently, more than 400 liquid milk plants and product factories of varying capacities – from 5,000 to 500,000 lpd-are located in different parts of the countries.

One thing is certain that the answer to facilitating increased milk processing does not only lie through only legislation. More important is the public awareness and demand from users. One major impediment in this endeavour is the low purchasing power of the masses in developing countries. Fortunately, the traditional wisdom has created its own safety mechanism for people to "safely" consume raw milk after its "processing" in homes through proven practices like boiling. It is also true that certain loss of nutrients does occur during in boiling, but it is a small price to be paid for safety! However, with awareness and increasing purchasing power, the demand for processed and pasteurised milk in plastic pouches is increasing in urban areas. In this scenario, the small-scale processing has a very definite and positive role to play to meet the needs of small towns that number over 4,000. In addition are about 2,000 large villages, with population of over 10,000.

06-07: B. Richard, Denmark; relevant to aviod the spread of bovine TB

Small-scale milk processing is relevant to aviod the spread of bovine tuberculosis which is very rampant among certain communities in the developing world who do consume raw milk and also to avoid the consumption of adulterated milk being sold unhygienically by some unscrupplous traders trying to make easy profits.

06-07: N. Prinsloo, South Africa; Value adding is important

Comments on:"Small-scale milk processing is irrelevant as the bulk of milk in developing countries is sold raw through informal markets" Value adding to milk is very important to the small-scale farmer. For the past eight years our Institute has been involved in the technology transfer of manufacturing of fermented milk to rural communities. Information on manufacturing of especially yoghurt and maas (a full cream fermented milk) with the use of household or kitchen equipment is provided. We use commercially available DVS starter cultures to limit possible contamination.

The following issues can be addressed through value adding to milk: stimulation of milk production in the rural areas (bear in mind that milk is not usually produced on a very large-scale by the South African small-scale dairy farmer) it gives the small scale producer an opportunity to compete in the commercial market, albeit firstly the local market providesa product with a longer shelf life gives an opportunity to address hygiene (e.g. personal, quality) addresses household food safety helps in the fight against malnutrition.

Yes, at present raw milk is usually sold through informal markets but, in my opinion the processing of milk is very relevant to the small-scale dairy farmer.

05-07: C. Arthur da Silva, Brazil; processing enterprises in Brazil

I believe one should not generalize that much, as this certainly varies from country to country.
In Brazil, small-scale milk processing is a viable alternative for large numbers of dairy farmers and farmers' associations. Some of the typical small enterprises are:

- mini pasteurizing plants, processing up to 1000 l /daily. Some of the smallest ones utilize a very simple, slow pasteurization technology. Others rely on conventional pasteurization equipment, specially designed for small-scale use. In both cases, milk is packaged in plastic sachets and distributed at the local level. While such enterprises are in principle financially feasible, they do face difficulties in marketing and distribution.
- informal cheese producers; in some regions of the country there are many of such companies. Fresh cheeses and mozzarella are the most common products. They have serious quality problems but through lower pricing manage to hold their market shares. Of course, these activities are unlawful.
- small scale, diversified dairy plants. These are fully legalized, small companies processing up to 3000 l /day typically. Products are cheeses, yoghurt and pasteurized milk. We have recently finished a general project profile to guide investments in this type of enterprise. Our project indicates an internal rate of return of 22% / year. But the sensitivity analysis reveals a great degree of dependance on stable revenues; reductions of only 10% in revenues over a steady period would make the project unfeasible. This, again calls for rigorous evaluation of markets, before any decision to invest is made.

04-07: N. Abeiderrahmane, Mauritania; small scale processing is vital

It is true that a lot of milk is sold raw, but small-scale processing is not
irrelevant, it is vital, for several reasons :

- it improves the quality of milk and dairy products, thus protecting people's health ;
- it broadens the marketing radius, both socially and geographically.
- Packaged milk and processed dairy products keep longer, and move further into towns and up the social scale ;
- it enables more milk to be sold, therefore providing more income for farmers ;

it gives farmers and entrepreneurs a start on the path towards a bigger modern dairy industry.

04-07: G. Veldink, Netherlands; small scale technologies needed

Although the bulk of the raw milk is being marketed through informal channels -at present- this does not necessarily mean that we should promote and/or sustain this situation. For a variety of reasons, which are all well known to you, processing of milk is beneficial to the consumers and producers. Economic factors will determine whether it can best be implemented on a small, medium or large scale. Where appropriate I therefore strongly support the establishment of small-scale milk processing units. Small-scale units have a number of disadvantages but are often better manageable and more sustainable than large industrial plants.

Small-scale processing can be simple (yoghurt or cheese making) and preserve the milk in a nutritious product. It is our task to train people in hygiene and to improve the quality of the products made. For many producers (or producers groups) simple processing is the only option to preserve the milk and secure a regular income and feed the families a nutritious product.

04-07: D. Mlay; Tanzania; 95% raw, but processing has its advantages

Though currently about 95% of milk is supplied raw in my country Tanzania, but still the relevancy of small-scale processing is worthwhile. Supply system of raw milk to consumers is very delicate and limit to large extend milk consumption in entire population and in particular areas with no milk. Processed milk products are easy to transport and distribute and portability make it easy to access consumers! Though it is hard work to achieve that level but is wothwhile to expand dairy industry!

04-07: A. Ghaffar; Pakistan; succesful examples in Pakistan

In my opinion small-scale processing is very essential for the country like Pakistan where population structutre is very scattered and herd comprises of 3-4 heads of cattle or buffalo. Local investors can play an important role in this field The successful example in Paksiatan is Idra-e-Kissan who is running three milk plants successfully. The standard of living of member farmers has a substantial improvemet.

04-07: T. Acharya, Bhutan; Mobile household technologies needed

The statement holds true in the case of Bhutan. In fact, Bhutan's case is quite different - may be similar to that of Nepal and hilly areas of India. Due to the inaccessible terrain, bulk of the milk is converted into butter and dried cheese which is then brought to the road heads - some of them travel as long as a week. In this connotation, suitable mobile technology for milk processing at the household level, including technology that prolongs the shelf life of both the fluid milk and products must be explored. GLP may assist in this sector to a limited extent.

03-07: J. Thornes, UK; In future there will be more processing

I disagree strongly. Milk may be sold this way presently but in the future it will be processed to meet public demand. i.e. better quality, better health.

03-07: R. Young, Dominican Republic; quality products are needed

According to an article by Frank Tejada, published in Volume 8 of the Magazine of the Dominican Asociation of Milk Producers (APROLECHE), it is estimated that 52.4% of the national production is consumed as raw milk.

I would have thought that Frank is really saying is that 52.4% of the national production is not processed into pasteurized milk or milk products. What percentage is actually consumed or how much is actually wasted is hard to say. However, when one takes into consideration that in the Dominican Republic, 40% of the milk is imported in dried milk powder from Denmark, New Zeland and varios European Community countries, one comes to the conclusion that in the DR, the local production system is very inefficient.

A recent survey conducted by the State Agricultural Department in 1998, (Secretaria de Estado para la Agricultura) revealed that only one third of all farms had over ten animals. This shows that milk production here is still very informal and poorly organised.

I don't believe that milk processing in Developing Countries is irrelevant at all. Milk is generaly consumed raw because there are certain limitations for producing processed milk and milk products. But the need for quality food products in the Third World is just as relevant as in any other part of the world.

1) The problem is that most milk is consumed raw for simply thrown away for lack of local organisation and facilities in the local communities to be able to process the milk or deliver the milk production on to larger processing centres.

Yes there is a percentage of milk production that is consumed in the family, or made into other products for consumption in the home. Another small percentage might find its way to neighbours in the community so long as they don't have their own cows. This milk is a valuable source of nourishment for the family and community. However, if an average daily production per cow gives 6 bottles (1 bottle = 0.72 litres), the family will consume only 3 of these. The other 3 they will try to sell. If they have more than one cow, they will have a much higher percentage of surplus milk. If they can't find a market, it all goes to fatten up the calf or will spoil in the hot tropical climate and get thrown away.

2) We believe that milk consumed in the communites should be tested and heat treated. The minimum sanitary conditions should be observed for milk consumed locally, not just for milk and milk products sold in urban towns and cities. If pasteurizing is not possible, because it works out to expensive, the milk should at least be boiled and then consumed in the same day if possible.

The reality is that in local milk production, and local cheese making, the milk is not treated in any way. There is a lack of training on the ground, and very few government controls or resources to make any significant impact on the problem.

We believe that the Dominican rural population deserve safe good quality food just as anyone else. The milk that is consumed at local level has not been controlled or screened in any way and therefore has no guarantees as to its quality for human consumption.

3) At the end of the day, the sadest part is that apart from the poor quality milk products available on the market, there is in fact a shortage of good quality milk. Instead of investing to the local milk production, the State allows 40% of the consumed milk to be imported as milk powder and mixed with water to sell as liquid milk. To avoid health risks, the school breakfast is normally made up using imported milk powder instead of locally produced fresh milk. Processed milk products are pasteurized using the UHT process, but arrive on the shelves at US$1.00. The poor in the communites can't afford these prices, and will buy raw untreated milk at US$0.25. However, in the Dominican republic there is little alternative between raw milk or UHT milk.

Milk processing is very relevant in the Third World. However, the issue makes no sense if one doesn't examine the problemas in a context of small-scale production problems, local technical problems, local organisational problems, local storage and energy problems and the lack of local markets. If you believe that people deserve to consume safe good quality products, milk processing can't be dimissed as irrelevant, less so in the Third World where people are more vulnerable to health risks and disease. 50% of producers are"

03-07: F. Xolot, México; >50% of producers are small scale in México

Well, in this region of Mexico, well-known as "tuxtlas", with almost 3000 cattle owners, more than 50 % of the producers dual purpose, the production averages 60 liters / day per producer with hand milking, the market is:
a) nestlé
b) cheese makers
c) sale retail.

Only 1 % produces between 400 and 600 liters / day, and 0,5 % have a milking machine. If small scale milk processing is important, low cost technology and training in dairy development is needed.
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03-07: A. Alvarez, Spain; efficient production is important

If the above sentence was correct, there would not be a need for the present electronic conference.
Small-sale milk processing is important because it affects many small farmers and it is usually the case that small and poor tend to go together. The important issue here (and in any other sector) is whether production is efficient (regardless of size). This links directly with the role of extension:
a) to help in achieving efficiency
b) to give advise on how to grow (efficiently)

03-07: R. Steinkamp, Yugoslavia; processed products are safer

In Montenegro and many parts of the Balkans milk is not sold fresh. It is processed into cheese, butter or related cream products. Most of these are salted and fermented which makes them relatively safe for consumers. One could also make the argument that people develop natural tolerance to bacteria that would make an American ill. Educating people on the importance of the aging process and reasonable hygiene is important.

Another important point about fresh milk products is there may be human transmissible diseases present such as brucellosis. In know in some countries, this causes us to recommend extending the aging process from 60 to 90 days to insure proper acid formation. In any case, given the rate of bacteria reproducing in milk, there really is no such thing as "fresh" milk in a developing country unless one is standing beside the cow.

10-07: R. Shrestha, Nepal; convert infovrmal chain to formal channel

One of the main reasons that small-scale milk processing is needed in developing countries is that bulk of milk is being sold through informal channels. When milk is marketed through informal channels, it is less likely to be regulated thus increasing the chances of adulteration, unhygienic handling and other malpractices that affect consumer health. The challenge in front of us is how to convert the informal chain of milk marketing to formal channel. We have seen that the small scale processing is more practical and affordable in developing countries and at the same time it helps control the issues mentioned above

24-07: R. Giangiacomo, Italy: Small-scale relevant.

Even if late, I feel to express my disagreement with the statement "small-scale processing is irrelevant as the bulk of milk in developing countries is sold raw through informal market". It might be that in some areas where milk collection is particularly unfriendly exists an informal market, but my personal experience in areas of South America Colombia, Venezuela) and Middle East Syia, Egypt) says that small enterprises processing milk buy most of their raw milk from official market. On the other hand, also other participants of other countries expressed similar reservations to above statement.

Annex-7: Discussion Papers, Poster Paper and Comments Received on Topic 3: Milk Producer Organisations (MPO)

Discussion Paper 3.1: Market Opportunities for Milk Producer Organisations

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Introduction

The focus of this paper is on milk producer organisations in developing countries, particularly those serving smallholder dairy farmers. The main part of the paper presents some basic principles that seem to govern market opportunities for milk producer organisations. Milk market opportunities and milk producer organisation formation are treated as two aspects of the same issue. Illustrations of these are given from cases in several countries, based on the authors' experiences. A small addendum is presented that addresses the important role of the informal market in most developing countries, again with examples from different countries.

Determinants of milk market opportunities and group formation

Milk producer organisations have typically been formed in response to a fundamental farmer problem: small quantities of milk are sometimes not convenient to market. Milk is perishable and requires special handling to insure quality and shelf life. Unlike grain, which can be purchased in small quantities, and gradually bulked by a market agent over days or weeks before delivery to the next market point, milk must be collected and transported quickly. Holding milk, particularly in rural developing country settings where infrastructure may be lacking, can be costly and risky. On the other hand, the rapid delivery of small quantities of milk to market may not be practical or economic; some smallholder producers may market no more than 1-2 litres of milk on a given day. The practical collection and transport of milk to market therefore usually requires some bulking, and the need for speed and reliability requires good organisation of that bulking.

As a consequence, there is strong incentive for smallholder producers to try to form collective organisations to meet these needs: bulking and reliability. It may be noted that, in the case of milk, bargaining power to improve prices may not be as important a reason for group formation as these others - simply having a reliable market mechanism may be more important, and in many cases farmers are willing to accept lower prices in return. Market opportunities are thus central to dairy farmer group formation and the two issues share some basic underlying features. It may also be noted that market opportunities in most developing countries are not limited to those provided by the market for pasteurised milk or processed products: raw milk markets are generally large everywhere, and play an important role for dairy farmer groups.

Principles

Some apparent principles for dairy farmer organisations and market opportunities can be identified based on observations from developing country settings.

"Dairy farmer organisations operate most successfully where there is large local milk surplus (and large deficit area somewhere nearby)." This may seem like an obvious point, but it is remarkable how often it is overlooked, and it may be the most common reason for failure of dairy farmer group projects. The presence of a significant number of dairy farmers is not in itself adequate for success. A good case in point can be found in parts of Kenya. In the central highlands human population densities are high, but so is density of dairy cattle - more than 70% of rural households keep them. As a result, supply outstrips local demand and so dairy farmer groups serve an important role in moving the surplus to urban markets. In a similar densely populated highland setting in western Kenya, dairy cattle are less numerous, but are still found in many households. Local demand in this case is adequate to absorb all the supply. Farmers are able to simply sell milk to their neighbours or to private traders, both of whom typically offer higher prices than a processor or cooperative. As a result, efforts to establish dairy cooperatives in this area, where there remain many dairy cattle, have systematically failed because farmers just do not need help to market their milk. It is true of course that farmer groups may offer other services: feed supply, credit, AI or veterinary services and even extension advice. However, the available evidence suggests that farmers typically look to groups primarily for milk marketing services - without strong need by farmers for that, other complementary services will not be enough to sustain farmer loyalty.

"*The nature of traditional local dairy consumption habits largely determines opportunities and constraints.*" The types of dairy products that consumers demand varies widely across countries, and remains generally tied to traditional consumption habits. These patterns largely determine the type of market opportunities that dairy farmer organisations face, as well as market constraints. For example, in most of South Asia and East Africa, milk and dairy products are traditionally consumed, and so cooperatives may largely serve markets for liquid milk, including the raw milk market. In South-East Asia, Sri Lanka and coastal West Africa where dairy consumption traditions are weak or absent, the market may consist mainly of serving the demand for processed products such as yoghurt, condensed milk and powder, consumption habits that have only recently been acquired. In the first case, aimed mainly at liquid milk markets, once milk is bulked there may then be constraints to distribution and retailing, unless strong links with an established processor exist. In Uganda, where the demand is mainly for raw milk, cooperatives depend on an association of bicycle vendors to retail the bulked milk, limiting the quantities that they can supply. This constrains market outlet quantities, particularly in the flush season, and also permits increased competition from the informal market. In the second case, where the market is for processed products such as yoghurt and powder, constraints are often felt in the prices received and through competition from imports. Because processing incurs high costs, these are often passed on to the producer. Further, imported powder can compete more directly with these products. In such a setting there are usually few constraints to the quantity of milk offered to the market.

"*The main competition to dairy farmer groups is usually the informal market.*" Building on the points above, this is again related to the nature of local demand. Where there is strong demand for liquid milk or traditional processed products (India is a good example), the informal market will always provide stiff competition for farmers' milk. The informal market is based simply on the fact that in developing countries where most of the population are resource-poor, people are often not willing to pay the extra costs of formal processing and packaging, and prefer to process themselves (boiling, etc). Further, because the informal market often does not incur those costs, the market margins between farmer and consumer are usually smaller. This usually means that the informal market can offer higher prices to farmers, and lower retail prices to consumers. As an example, here are farm-gate prices from a survey of 3,500 farms in Sri Lanka in 1998: while cooperatives and processors paid 11.6 rupees/litre for morning milk, private traders paid 10.8 Rs/l, hotels and restaurants paid 14.7 Rs/l, and private households paid 15.2 Rs/l (U. of Peradeniya/ILRI/MLD&EI, 1999). In Kenya in the same year, the figures were 13.6 Kenya shillings/litre from coops, 14.1/l from private traders, 17.1/l from hotels and restaurants, and 16.9/l from private household buyers (SDP 1999). It is clear that informal retail sales to hotels, restaurants and homes pay the highest prices, a pattern seen in other country cases as well. Cooperatives and traders seem to operate in about the same price range, and differences between them may be related to the types of services provided and the mode of payment. Traders often collect milk directly at the farm-gate, allowing farmers to avoid the often time-consuming task of delivering milk to a collection centre or cooperative. They may value this service enough to accept lower prices. Some traders also offer loans and provide feed delivery. Similarly, cooperatives may (or may not) offer more reliable payment; again, farmers may accept lower prices in return. Retail sales to homes and restaurant may attract high prices, but require extra effort by the farmer in terms of finding buyers and delivery. This combination of prices, effort required to market, and services offered in return, will determine farmer loyalty to a milk producer organisation, compared to choosing to turn instead to an informal milk outlet. Given the dominance of the informal market in most developing countries and the relative small role of cooperatives (see more on this below), the evidence suggests that milk producer organisations main competition will continue to be the informal market for some time to come.

"*There are other constraints to milk producer organisations besides marketing*" These relate to institutional issues, most of which are well documented. One is the fact that public support of some kind may be necessary to establish milk producer groups, if farmers' resources are not enough. Again, the Amul and Operation Flood examples are illustrative of this. A second main constraint relates to management capacity. This is particularly tested when cooperatives choose to go beyond simple milk collection and invest in processing and packaging equipment, or in provision of AI and veterinary services. For this reason, the Operation Flood program, for example, actively discourages small village cooperatives from engaging in any activities besides simple milk collection and basic services. Typical types of marketing arrangements used by milk producer organisations. There are perhaps 4 basic types of marketing arrangements that dairy farmer groups rely on to market milk. Some may employ a combination of these.

Cooperative to cooperative union.

This is where a small local group delivers milk to a larger cooperative organisation (union or federation) that generally processes and markets the milk and dairy products. The membership of the union consists of a number of farmer groups, who generally participate in some way in the management of the union. The classic example of this is the Gujarat state dairy cooperative union (Amul), which collects milk from small village cooperatives, and set the pattern for the Operation Flood efforts in India. This type of structure allows the investment in processing to be shared by a large number of producers, and to be professionally managed.

Cooperative to private processor.

In this case, a cooperative collects milk for a privately owned processor. The arrangement is thus contractual, and may be subject to market changes. It also reduces the management and investment demands on the cooperative, which serves principally as a milk collector. This is common in Sri Lanka, where powder manufacturers buy milk from cooperatives.

Cooperative to private traders

Where the informal market is strong, some cooperatives sell bulked milk principally to private traders, who then market it in raw form to consumers. This is common in Uganda and Tanzania, where the market infrastructure for packaged milk distribution and retailing is limited, and cooperatives do not have the means to retail raw milk themselves.

Cooperative direct sales

Some cooperatives choose to sell milk and dairy products directly. In Ethiopia small farmer groups make butter and market it directly. In Kenya, cooperatives sell raw milk at their own shops, and sell only the excess to processors. In many countries, cooperatives formally process and market liquid milk and other dairy products, such as buffalo curd in Sri Lanka. These arrangements require higher levels of management and investment. Which of the above arrangements that cooperatives choose to pursue, or some combination thereof, seems to depend on the:

A) relative demand locally for raw milk vs. processed products
B) presence of large processors or of a functioning cooperative union
C) density of milk producers locally
D) level and quality of road infrastructure
E) distance to main demand centres
F) nature of regulations on raw milk marketing, and on governance of producer
G) organisations

Poor infrastructure, good local demand for liquid milk, and long distances may tend to favour a marketing approach that targets the informal market, either for raw milk or traditional processed products, and maybe direct sales by the cooperative. The presence of large processors or unions, strict regulations and weak liquid milk consumption traditions may favour targeting of the formal processed dairy product market.

Value added?

Many cooperative managers see “value-adding” through processing as one means of increasing revenue. Amul, for example, apparently generates nearly all their “profits” through the 5% or so of milk throughput that is processed into high-value products. However, value adding through processing generally needs to be approached cautiously by cooperatives. Besides the additional management and investment capacity required, to be successful, processed products must carefully fit consumer demands. Unfortunately, in many developing countries dairy technologists are still trained using approaches and products developed in Europe or North America. This can sometimes result in the creation of products that are not of interest to local consumers. In past years, for example, the Kenya Cooperative Creameries produced a substantial quantity of butter. The fact that Kenyan consumers are not particularly interested in butter led to the accumulations of large mountains of butter in storage, which eventually had to be disposed of at high cost. It should be remembered that “value” exists only in the minds of consumers, and nowhere else. Too often, “cost” is erroneously equated with “value”. Transforming milk into a product that has little consumer demand is more likely to be an exercise in “cost-adding”, rather than “value-adding”.

Nevertheless, if the right products are made using a manageable technology, even very small milk producer organisations can gain revenue from some processing. Small (20-30 farmer) but successful hand-churned butter groups in Ethiopia illustrate that point.

Addendum: How Informal?

In this paper, we have frequently referred to the informal market. This topic sometimes raises a little controversy, simply because public health concerns have led dairy technologists and dairy policy makers to stress pasteurisation. It remains true, nevertheless, that many resource-poor consumers simply refuse to pay the extra costs that incurs. But the role of traditional preferences should not be discounted: in Kenya, we consistently find that high-income consumers express the same preference for raw milk as do lower-income, and often end up buying more of it

As a matter of definition, informal milk markets are sometimes referred to as "unorganised" markets, or we refer to them sometimes as "raw or traditionally processed milk markets", because in many cases agents in such markets have local licenses, pay taxes, etc, and are quite "formal" in a regulatory sense. To better understand the role of the informal milk market across developing countries, and their importance for milk producer organisations, we have made the following estimates of the size of the informal market with help from national scientists.

Percentage of domestically-produced marketed milk, not total production.

	Informal	Co-operatives	Reference
Tanzania:	98%	4%	MAC/SUA/ILRI
Uganda:	90%		MAIF/ILRI
Nicaragua:	86%	4%	CIAT
India	83%	6%	Dairy India
Costa Rica:	44%	54%	CIAT
Sri Lanka:	40%	7%	MLD&EI

The pretty clear picture which begins to emerge is that formal milk markets are not terribly important in most parts of the developing world, and that with some variation, that pattern exists across continents. It should be noted that India is now the world's large milk producer; with 83% of marketed milk handled informally, these informal markets are not small by any standard. There is also not much evidence that these markets will go away naturally any time soon - in both Kenya and Sri Lanka, they have grown as a percentage over the last decade. It should also be recognized that informal markets tend to employ more people per unit milk handled than formal processing. In Sri Lanka every 100 lts of informal milk handled daily generates 1 full-time job at over the national average annual income level; in Kenya, 100 lts per day created 2-3 jobs.

The basic point here is that milk producer organisations will have to deal with informal market agents for the time being either as competition, but also potentially as partners. If employment generation is a public policy concern that is reflected in milk producer organisation strategies, then informal milk marketing can be one avenue.

The issue, of course, is public health concerns. Current dairy market policies throughout the developing world have largely been adopted from the West, and reflect international standards of food safety, etc. However, as the as the percentages above show, they are being systematically ignored, and as a result, most consumers buy milk and dairy products which are completely outside any regulatory environment. It is possible that to better address the public health issues, policies may need to take a more pro-active approach to informal milk trading, and which better address the realities of consumer willingness to pay for higher standards. Hard-line regulatory policies simply force market agents into the unregulated market.

Discussion Paper 3.2: Organisation and Management of Milk Producer Organisations

By: J. Phelan, International Consultant on Livestock Food Systems and Rural Development

Organisational Aspects

Informal collaboration between milk producers in production enhancement, processing and marketing, has been practiced by milk producers for centuries but the emergence of formal milk producers' groups has only happened in the last hundred years in the west and more recently in most developing countries. The type of association varies considerably with country and ranges from informal groups and partnerships, through formal democratic co-operatives structures, to so called national co-operatives, which are controlled by governments. The term co-operative means different things in different regions but there has been a gradual evolution towards democratic structures in most countries. The formation of groups of milk producers has progressed more rapidly in developed economies where governments have limited themselves largely to providing supportive legislation, and selective tax concessions in the fledgling stages, as part of an enabling environment for development of producers' organisations.

In the emerging economic trends towards liberalisation, privatisation, and market orientation, the governments in many developing countries are reducing their direct involvement in assistance to agriculture and people are being given more responsibility for their own development. In future there will be greater emphasis on self-help groups and a participatory approach to development in order to mobilise local resources and knowledge for the benefit of rural communities. This environment will be much more conducive to the formation of bottom up producer organisations but it is important that the institutional and legal frameworks and modus operandi for these groups are based on the successful experiences of similar groups elsewhere in the same country or in other countries.

Dairy farmers experience common problems and have similar interests. They therefore tend to form groups for the purposes of : Exchange of experiences;

Training; Savings and credit schemes; Veterinary and other service delivery and drugs; and Marketing of milk. The basic unit in any form of joint activity is the group and working in groups confers many advantages but it does involve commitment and obligations. The degree of formality needed in the structure of groups, varies with function and stage of development of the joint activity. Informal groups tend to become more formal as the numbers and geographical cover increases.

Milk Producers should be encouraged to build their own groups from the bottom up through a participatory approach and should adopt constitutions which preclude dominance of the group's activities by a few. The initial steps in the formation of a group are critical to establish the necessary trust and cohesion. In the beginning the farmers may prefer to work together in some informal or loose association to solve common problems and become convinced of the benefits of joint activity. In general there is a greater chance of success when an integrated approach is adopted to address production, as well as marketing, processing, management and credit issues. The most important thing is that the members agree on the modus operandi and the objectives and that these are fully explained in a written document to which the members have access. This is achieved through a series of meetings, election of an Advisory Task Force, with responsibility for assembling and analysing all the relevant information through baseline surveys, marketing and feasibility studies. The use of planing techniques such as SWOT(Strengths-Weaknesses-Opportunities-Threats) and Logical Framework(LFA) analysis, and calculation of Break even point can be helpful at this stage.

The Advisory task force should consist of not more than seven people. It is important that they have a complementary range of qualifications and abilities and share a strong commitment and dedication to the task entrusted to them. The task force has the responsibility to fully investigate the proposal to establish an MPO and advise the potential members of the advantages and obligations involved. The following terms of reference are suggested:

(a) Clearly describe the problem to be tackled and quantify its extent
(b) Develop proposals for solving the problem

(c) Recommend the type of organisation,- listing advantages and obligations, government regulations and concessions.
(d) Specify the resources needed to implement the proposals - cost of purchase or hire of buildings, facilities and equipment.
(e) Quantify the human resource requirements and the likely source of personnel - what additional skills can be developed within the group through training, and what staff must he hired ?.
(f) Suggest procedures for management of the MPO in the formative years.
(g) Estimate the minimum number of members and the minimum volume of business needed to make the venture viable. Advise on promotion campaigns to attract the required number of members and expand business.
(h) Develop or commission a 2-3 year financial plan to establish the financing needs of the venture and indicate the likely proportions coming from members, grants, loans from development agencies or financial institutions.

The Task Force should liaise with the appropriate national organisations and development agencies to seek advice and assistance in carrying out these terms of reference. When their task is completed, the report is presented to a public meeting of all stakeholders. This meeting would elect a Provisional Committee of Management with responsibility to set up the MPO and proceed with establishing it as a legal entity. It may or may not include members of the Task Force. It must carry out a final appraisal of the whole proposal and agree on objectives, policies, finances, organisation and management of the MPO. Further studies on particular aspects may be carried out at this stage if deemed necessary. It must also decide on external and internal communications and on member education. The Provisional Management Committee must choose the appropriate form of organisation and adopt appropriate legal statutes. It is the responsibility of the Provisional Management Committee to ensure that the rules adopted are appropriate to the needs of the organisation. The rules must address the aims, objectives and activities, internal regulation of the organisation, and provide for modification or rescinding of any or all the rules.

Once the draft rules are agreed, the formal registration can proceed. The details will vary according to the arrangements in the particular country but there are basic steps, which are common. These involve the submission of a completed application form to a national authority, together with copies of the constitution, registration forms for founder members, evidence of paid up capital and payment of a prescribed fee. This is followed by formal approval, and acknowledgement by the registrar. The national organising bodies usually provide the model rules and a registration assistance package, for a set fee, which also covers registration.

When the Provisional Committee of Management has registered the milk producers' organisation or society and received a number of completed application forms, it should proceed with the first General Meeting of Members to inaugurate the group enterprise. The Provisional committee must report on the tasks entrusted to it by the meeting of prospective members and tender its resignation. The members are then in a position to exercise their rights according to the rules of association, since the members in general meetings are the supreme authority in the affairs of the society. In practice most of the authority is delegated to the Board of Directors, who in turn may devolve that authority to managers and office holders. However, the board is still responsible to the members.

Managing a Milk Producers' Organisation

Management Structures and Organisational Development. The inaugral meeting of members, elected a Board of Directors and delegated to them the responsibility of running the organisation between delegate meetings. Group members of a Milk Producers' Organisation will be positively disposed towards the organisation only if it continues to create benefits for them. An MPO must therefore be structured and managed so as to provide members with the best cost-benefit package of markets and services available in their area and make economic provisions for the future of the organisation. Successful management of group enterprises is linked with promotion of a participatory approach to involve members in the affairs of the organisation. The members need to take an active part in shaping and implementing the policies of the organisation but since many of them may not have the required skills and knowledge to do this effectively, training must be provided to encourage participation and develop leadership qualities within the group.

The management structure will depend on the size and complexity of the enterprise but there are basic elements, which are common to all enterprises. The members elect a Board, which appoints a Manager and agree

on initial Staffing levels. In more complex enterprises there may be a two - tier system, involving a Supervisory Board to safeguard members' interests. The main duties of the Board is to give effect to the proposals, contained in the report of the Provisional Committee of Management, and endorsed by the first General Meeting of members. While delegating management to their elected and appointed leaders, members need to provide clear objectives and take an active part in the shared decision making processes associated with the wider development issues involved in the overall development of the group.

The business management in a very small MPO may be carried out by an unpaid, elected member. As the enterprise grows, a management team must be formed, which includes the Board of Directors and salaried professional management staff. While members retain ultimate governance, most of the work of controlling should be in the hands of the elected leaders, who in turn should rely on appointed managers. The latter are responsible for the day to day business management, specified in the business or operational plan, This plan is essentially a set of guidelines for running the enterprise and its complexity will depend on the range of activities envisaged. The plan consists of a set of targets related to the group's objectives with assigned responsibilities for each activity. It must set out clearly what is to be done, by whom, when and how. In the initial stages of development of an MPO, the responsibility for implementation of the business plan may be in the hands of members and leaders, but as the MPO grows, it will be necessary to engage professional management and technical staff.

A synergistic interaction is needed between the members, the board and the manager in order to shape a suitable management ethos for the group enterprise. The selection of leaders and managers is therefore critical in ensuring success. It is important that the roles of all parties are clearly defined and understood and for this reason it necessary to write down and agree on the job descriptions or function statements of all concerned.

Function of the Board of Directors

The overall function of the Board is to monitor and control the operational plans to ensure conformity with the policies, strategies and interests of members. However, details will vary depending on the form of association as well as the size and complexity of the enterprise. The initial duties will include:

- Appointing a Chairperson for the Group, unless this has appointment has been made by the General Meeting of members. The Chairperson must preside over meetings of the members and of the Board to obtain decisions and must be familiar with every aspect of the groups activities.
- Appointing the Secretary whose duties include understanding and advising on the statutes of the group, keeping records of share transactions, circulating timely notice of meetings and keeping minutes of meetings.
- Translating the objectives and policies of the group into specific goals and developing a system of monitoring progress towards those goals.
- Selecting and appointing a manager and the delegation to him/her of appropriate responsibilities and sufficient authority to function effectively.
- Selecting and purchasing or renting, suitable premises and equipment to carry out the group's activities as planned.
- Adopting a financial policy to provide the fixed asset and working capital, and suitable financial and management accounting systems to monitor and control activities.
- Developing and implementing a communications policy to ensure that members are kept fully informed and involved in the affairs of the group.
- Promoting education and training programmes for members, staff, managers and directors as this is essential for organisational development.
- Promoting co-operation with other groups involved in related activities and exploring the advantages of inter group associations and second- level organisations or federations in improving bargaining power in purchase inputs, marketing, or representations to governments.

In order to carry out these functions effectively, the Board should have a programme of activities at regular intervals and a monitored plan covering specific periods (normally one year). The agenda of the routine monthly meetings of the Board should include an update on membership, and reviews of performance relative to predictions and the financial situation. The following twelve items have been suggested for inclusion in the annual plan for the Board of a Co-operative, but these would equally apply to an MPO, which was not a co-operative.

1.Review of vision statement:. 2. Review of objectives and members' benefits. 3. Update of strategic plan. 4.

Establishment of annual budget. 5. In-depth review of results against budget and the strategic plan. 6. Review of corporate policies. 7. Review of remuneration policy. 8. Review of performance of top management. 9. Review of performance of Board. 10. Visits to operating facilities - familiarisation rather than supervisory. 11. In-depth reviews of key areas of activity - reports by manager and senior staff. 12. Review of human resource development - members, directors and staff.

Staff Recruitment

There are subtle differences in the requirements for general managers or chief executive officers of MPOs because group based organisations are more people oriented than purely commercial companies. However, there are no differences in the essential tasks of entrepreneurial management between the two environments and both recruit from the same labour pool. The relationship between manager and Board is critical to the success of the organisation and the importance of selecting the right candidate cannot be over emphasised. Senior managers must combine management skills, leadership and organisational abilities, with a good understanding of the nature of the business and the priorities of the owner members. The Board must clearly define the functions of the manager relative to their own responsibilities and must give the incumbent sufficient authority to create a working environment which will both challenge and stimulate staff. After selection the manager should be given appropriate induction training to get to know the Board and the business and there should be a probation period and preferably a fixed term contract. Rewards should reflect progress in matching the member objectives.

The senior manager will be responsible for setting up the mechanism to select and appoint all staff below the level of those reporting directly to the Board. Guidelines on staffing levels are usually set by the delegate meeting. The Board may retain control over wage and salary scales, promotion policies and health and safety issues or insist on consultation prior to introduction of significant changes in these areas of employment policy. If members of the MPO work for the group, their status as a worker will depend on the form of association chosen by the group. If they have formed a partnership, then all the workers, who are partners, will be regarded as self-employed for legal and taxation purposes. In a partnership each partner takes weekly or monthly drawings from the partnership bank account which are set against their profits at the end of the financial year. Partners are not protected by employment legislation and will not receive state benefits. The rights of each worker/partner should be set out in the partnership agreement and if they wish to enjoy similar rights to those of the employees, they must make the necessary provisions in their partnership agreement. If the group has registered as an Industrial or Provident Society, or as a Company, then the workers will be employees and the fact that they own or control the employer does not affect their legal status as employees. Each employee should have a written contract of employment setting out the terms and conditions of employment and this helps to balance the rights and duties of a worker against the interests of the milk producers' group. The conditions governing employment are covered by state legislation in most countries but in addition there are conditions governing workers shares in co-operatives in some countries.

There are no special conditions applying to employees in MPOs, so standard procedures and techniques are used to select, appoint, evaluate and reward performance. Each position must be specified through a job description and the appointee must have the necessary technical skills and personal qulities to take on the responsibility. Training on the job must also be provided where needed as part of the overall human resource development programme for the organisation.

Accounting Systems

Up to date and accurate information to support decision making is the key to successful management of any enterprise. The keeping of proper records of all business transactions in an MPO is essential to meet internal needs and external obligations and to overcome problems. The group must have information on cash flow, the amounts they owe and are owed and by whom, what stocks and equipment are on premises, what products or services are making a profit or loss, and any indication of likely emergencies such as cash flow problems. The external factors relate to, legal requirements for keeping adequate records, to provide information to lending institutions and to State agencies and revenue Commissioners. The FAO Trainer's Manual on Agricultural Co-operative Development, states two fundamental rules which apply to all systems of record keeping, even the simplest (FAO,1998). 1. Responsibility for keeping records must be firmly assigned; 2. All transactions must have some verification (voucher or signature)

The basic books which the group should keep are: a) Receipts and Payments Book, b) Sales Ledger, c) Purchases Ledger, d) Petty Cash Book, e). Wages and Salaries Book and f) Fixed Asset Inventory. Other books and records are added as deemed necessary and pre-printed account books can be obtained from stationery shops or the group may wish to have ones printed with the name and logo of the group. The above records relate mostly to financial management and additional records and tools to refine operational management will be included under Milk Plant Management and Quality Control.

Organisation of Milk Collection Routes and Centres

The baseline study will provide the information base for planning the collection routes and deciding on the type of facilities to be provided. A decision will have to be taken on the number of collection points and/or centres that are needed in the area covered by the group. The number will also be influenced by the type of processing, and/or marketing envisaged. Suppliers may be required to transport their milk to intermediate points or to the centres, once or twice per day at agreed times. It may be appropriate to organise group transport of individual supplies in containers provided by the farmer or alternatively the centre may provide and clean standard milk churns to improve hygiene in handling.

The emphasis must be on hygienic production and handling and the movement of the milk as quickly as possible to the point where cooling or processing takes place. The challenge is to cool or process milk during the 3-4 hour period after milking, when the natural bactericidal properties of milk, are preventing growth of micro-organisms. The importance of milk quality cannot be over emphasized as it governs the quality and shelf-life of the dairy products derived from it. The layout of routes must be planned to minimize holding time and temperature rise during transport. The management must stress the collective responsibility of group members in conforming to agreed schedules for collection to avoid undue delays and consequent deterioration of milk quality.

The manner in which milk is used varies with circumstances and location relative to the markets. An effective collection system provides rural milk producers with access to the rapidly growing urban markets for milk and milk products. The distance, from which these markets can be reached, varies with the product, the level of organisation and the transport infrastructure in the country. The basis on which milk is paid for by the group, and the frequency of payment will be influenced by the arrangements for disposal of the milk. The actual price paid to producers, must reflect the reality of the market place and the overall processing and marketing costs incurred by the group enterprise.

Dairy Plant Management

Milk Producers' Organisations may limit their activities at the beginning to collection of milk and wholesaling it to a processor but most MPOs establish a milk processing facility at some stage to improve returns from the market. When a group enterprise such as setting up a milk processing plant is envisaged, it is necessary to analyze the situation in a thorough and professional way to give a clear understanding of the project and to get members to share a common ownership of the project. The same participatory planning, outlined in section 2, must be applied and the techniques such as LFA and SWOT analysis and other planning tools should be used.

Plant Design and Operation

Management of a Dairy Plant involves identifying the right product mix, efficient processing, transport and distribution of milk and products and control of quality from primary production to the final marketing. Since milk processing is the core activity of the group, it is important to explore techniques in planning, monitoring and control which improve efficiency and enhance profitability.

The essential features of an efficient Dairy Plant are: well designed equipment and premises, operated and maintained by well trained and motivated staff, where each task is clearly described and properly monitored. Milk is an excellent food for man and micro-organisms but it is also highly perishable and potentially harmful to man. Because of economic and health reasons, milk and milk products should be handled, transported, processed and packaged under the most hygienic conditions possible. In addition every step in the chain from cow to consumption, should be rigorously controlled to ensure correct processing and prevent post-processing contamination, which is the most frequent cause of problems. The importance of hygiene in dairy processing cannot be over emphasised and special attention should be given to cleaning and sanitation when preparing instructions for process operators.

Milk Plant Hygiene

Milk hygiene implies good quality raw milk being handled by workers observing good personal hygiene, using properly cleaned and sanitised equipment, working in clean premises. It is important for plant operators to appreciate the difference between the cleaning and sanitation processes. Cleaning involves the physical removal of all traces of milk solids from the milk contact surfaces through a cycle of pre-rinsing, scrubbing action with detergent and final rinse with clean water. Sanitation is the final step in the treatment using heat or chemical agents to sterilise the plant immediately preceding the next cycle of use. The two are related because it is difficult, if not impossible, to sanitise or sterilise equipment that is not properly cleaned. The key factors in efficient plant hygiene are:

- Hygienic design of plant and premises
- Selection of suitable staff and providing training,supervision, and recognition
- Selecting the right detergent for the type of deposits, water type, and the equipment
- Balance between chemical agents and heat in the sterilisation cycle
- Effective monitoring of cleaned surfaces and concentration of chemical solutions
- Well designed cleaning and sanitising routines, with clear instructions for staff

The planning of cleaning and sanitising procedures should involve discussion between the plant manager, detergent /sanitiser and equipment suppliers, processing and laboratory staff. Feed back discussion on results by the laboratory control group to cleaning staff is very important. Separate routines should be developed for each processing operation and operators should be thoroughly trained. Particular attention should be paid to safety aspects in relation to high temperatures or steam pressure as well as handling chemicals.

Plant Operation and Maintenance

The efficient functioning of a dairy processing plant is a key factor in the success of an MPO. Staff must have the appropriate level of skills and understanding of the processes to optimise manufacturing procedures and equipment must be properly maintained to minimize downtime. The latter aspect is becoming increasingly important as processing units handle greater quantities of milk and become more mechanised. When new plant is purchased, it is important to make arrangements for the training of the staff who will operate the equipment and to have operating and maintenance manuals for each item of equipment in a secure but accessible place. It is advisable to build in a provision for staff training at commissioning and where possible, arrange training visits to other plants where similar equipment is currently in use.

Manufacturers' Manuals must be supplemented by in-service training and precise operating instructions and maintenance schedules for each item of equipment. These instructions must be in an appropriate format to be understood by all staff responsible for operating the equipment. The staff must also be informed about the key factors, which influence the economic efficiency of the process and the corresponding control points, must be monitored. The main inputs into each processing unit (materials, labour, and energy), must be accurately measured and recorded at regular intervals, and compared with actual and predicted outputs over the same time intervals. In a milk processing unit, this in effect means a mass balance on milk solids purchased and sold on a daily basis, and a comparison between the actual and theoretical amounts of labour, energy and packaging materials used per unit volume of milk or milk product.

The systems necessary for detailed measurement, compositional analysis, calculations and recording at the sub-unit level, must be put in place as part of the planning and management process. The theoretical yields of different dairy products can be calculated from a given quantity of milk of known composition by assuming certain losses at each step of the process and assuming order figures for the amount of labour, energy, cleaning and packaging material per unit of output. However, the target levels must be realistic for the equipment used in the plant and the length of each process cycle.

There are substantial differences between the skimming efficiency of separators resulting in different losses of fat in skim milk. The fat losses in buttermilk during churning of butter vary considerably with the churn type and size. Design of cheese vats significantly affect the amount of fat lost in whey. A new system for pasteurisation of milk in pouches, developed in South Africa and described by B. Dugdill in this E-mail Conference, minimizes losses of milk and allows very small quantities of milk to be processed. Energy requirements for heating milk can be dramatically reduced through use plate heat exchangers with regeneration sections. Short process cycles translate into higher than average milk solids losses in cleaning and a greater

proportion of total energy and labour being used in start up and cleaning cycles. It is important, therefore to select the appropriate size of processing plant for the projected milk supply. All these factors influence the yield of product from a given quantity of raw milk and the amount of energy used in processing and should be taken into account at all stages of planning and implementation of the project. The targets set must be adjusted according to the equipment used in the plant, as setting unrealistic yield targets can demoralize staff. In some cases investment in new equipment may be justified on the basis of improved yields or reduced energy use in addition to labour efficiency considerations.

Equipment malfunction and breakdown can have a significant influence on costs through downtime and product rejection. Preventive maintenance and quality control programmes are essential in a milk plant. Appropriate records must be kept and the staff responsible in both areas must liaise actively with processing and management staff to ensure that recommendations are acted on.

A complete set of record forms should be developed for each process, along the lines of the examples given for accounting systems, and this will facilitate efficient management of the plant operations. The process, accounting and auditing records are supplemented by a well planned and properly recorded inventory and stock control system to provide a comprehensive information base for management decisions.

Discussion paper 3.3: Training Programme for the Small-scale Dairy Sector in Kenya (FAO-TCP/KEN/5511 project)

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1. INTRODUCTION

1.1 Project Background

Before the processing and sale of milk in Kenya was liberalised up in 1992, the dairy industry had been dominated by Kenya Co-operative Creameries (KCC), a huge de-facto para-statal purchasing milk from many of the country's mainly small-scale producers. Since liberalisation, a growing number of small and medium sized producer organisations and individuals have reduced deliveries to KCC and entered the processed milk market.

Many of these new dairy entrepreneurs had little or no experience in the handling and processing of safe milk for the expanding Kenyan market. The Government therefore sought assistance from FAO's Technical Cooperation Programme to provide the knowledge and skills required to process and market longer-keeping wholesome milk and dairy products.

1.2 Outline of Official Arrangements

This assistance was approved by FAO on 25 January 1996 under the Technical Cooperation Programme project TCP/KEN/6611, 'Training Programme for the Small-scale Dairy Sector'. The contribution from FAO was $US 364 000. The project, with a planned duration of 20 months, started in March 1996 and was completed in December 1997. The Ministry of Agriculture, Livestock Development and Marketing (MOA) was designated the government agency responsible for project implementation. The MOA was guided by a Project Steering Group representing the chief stakeholders in the small-scale dairy industry, including producer organisations, the private sector, women, the newly formed Kenya Dairy Processor's Association (KDPA) and the Kenya Dairy Board (KDB) (see annex 1).

1.3 Objective of the Project

The objective of the project was 'to develop and design the organisation of short-term, tailor-made training courses at Naivasha Dairy Training Institute (DTI) for persons and organisations involved in milk collection, transport, processing and marketing in the small-scale sector to improve efficiency and quality throughout the milk chain'. The target was to train 90 trainees and to support dairy sub-sector reform. The project was to work closely with the Danish International Development Agency (DANIDA), which has long been associated with FAO and dairy training in East Africa.

2. RESULTS AND CONCLUSIONS

A participatory approach to project implementation was pursued to promote national ownership of the training programme and to foster sustainability. Special emphasis was placed on team-building at DTI, on ensuring that training reflected dairy industry needs and was financially self-sustaining, on gender balance and on interacting with other ongoing dairy sub-sector initiatives. More detailed information on project implementation and findings may be found in the documents and reports listed in annex 3.

DANIDA has provided assistance for the process of sub-sector reform since 1990. It was agreed the TCP project would play a supporting role in advancing the reform process centred on dairy training.

2.1 Training

2.1.1 Needs assessment and approach

A nation-wide training-needs assessment survey was conducted in 1996. More than 50 milk producer groups, dairy co-operatives and private sector processing units were visited. Practices were observed and owners, management and employees consulted about their requirements. The views of government field staff, retailers and consumers were also obtained. The key findings were as follows.

- Small scale milk processors ranged considerably in size from the "Jua Kali" (backyard or open-air milk

processing) category with throughputs of 50 to 300 litres per day (lpd) and the semi-"Jua Kali" category, with 300 to 2 000 lpd, to larger, purpose built, more capital intensive dairies using imported equipment, with throughputs reaching 15 000 lpd. In addition, many milk dealers and vendors were selling raw milk, often of rather dubious quality, in urban areas.

- Many "Jua Kali" processors were highly innovative adding value to processed whole milk and "maziwa lala" (traditional soured milk) type products sold through their own small shops or kiosks.
- Most smaller operators were using locally-produced polythene pouches to package their products, while larger operators were using paper board cartons or polystyrene cups, often imported.
- The shelf life of most products was relatively short, owing to poor raw milk quality, treatment processes, distribution and point-of-sale handicaps. Fresh pasteurised milk usually had a refrigerated shelf life of two days and cultured products five days.
- Of major concern to small processors was the type of processing equipment to use and where to acquire it. Many had difficulties in raising capital to develop their enterprises.
- While many processors employed staff who had either attended conventional courses for school leavers at DTI or used to work for KCC, all expressed the need for shorter-term training which focussed on providing hands-on, practical knowledge and skills.
- Women's milk producer groups function in a number of areas, although more men than women were employed by processors.
- The very small-scale processors employed one person per 20 to 30 litres of milk collected, processed and marketed.
- The key groups of employees requiring training were milk reception staff, plant operators, quality control staff, maintenance technicians and salesmen. The majority were literate and had received basic education.
- The priority training subjects included the following: a knowledge of clean milk production, hygiene and handling; milk collection and transport; basic milk processing and preservation; the operation and maintenance of key processing equipment such as coolers, heat treatment units, fillers, etc; the operation and maintenance of service equipment, especially boilers and refrigeration units; the production of cultured milk products such as "maziwa lala" and yoghurt, with special emphasis on starters; the processing of other products such as butter, cream, novelty milks, ghee, ice-cream and, particularly, cheese; the distribution and marketing of milk and milk products including advertising, merchandising and sales promotion; business management, finance, planning and bookkeeping.
- Many processors wanted in-house and refresher training for staff at their own processing units, especially in general milk handling and hygiene, as well as in clean milk production for their milk suppliers.
- All the processors consulted indicated their willingness to share the costs of training, though some producer groups indicated this might be difficult initially.
- Since the reformed Kenya Dairy Board will have a mandate to promote dairy training under the new Dairy Industry Bill, it was considered essential to involve the Board and the newly formed Kenya Dairy Processors Association in the training programme.
- DTI was also earmarked by MOA to introduce the dairy training diploma course being phased out by Egerton University.

A milk marketing survey was conducted in Nakuru District to corroborate feedback from the needs assessment exercise. The Nakuru area typified the changes that are transforming the Kenyan dairy industry, including the key finding that liberalisation has brought about increased sales of raw milk in urban areas by itinerant traders (hawkers), along with the attendant health risks. The information gathered was used to develop the training module on milk marketing.

It was clear DTI would have to adapt its training philosophy to the dairy industry's current manpower development needs. The in-service training approach was thus based on providing mature trainees with practical processing skills and knowledge through five-day residential courses at Naivasha and two-day outreach courses at the client's premises. It was felt this type of training would also equip trainees to compete more effectively for jobs and promotion. The training was offered to both medium and small-scale processors.

The courses were conducted from April to September, during the annual DTI recess period, and the administration and accounting system was incorporated into the existing DTI administration system. Owing to legal obstacles (DTI operates under outdated Dairy and Education Acts), it was not possible to open up a bank

account to manage course accounts as a first step in achieving semi-autonomy at DTI and courses were run on a cash basis. For the same reason, the DTI demonstration dairy could not be run on a commercial basis as first planned.

In order to build-in financial sustainability, and in line with recent changes in government policy concerning the involvement of employers in training, it was agreed participants would contribute 50% of course costs during the pilot 1997 period while the courses were being pioneered.

2.1.2 Course preparation

Based on the subjects identified as most needed, six modules were selected for the 1997 pilot programme as follows:

01: Hygienic milk handling and processing
02: Milk testing and quality control
03: Dairy equipment maintenance
04: Cultured milk products
05: Cheese making
06: Milk and milk products marketing (including basic business management skills)

A prospectus for the training programme was developed and distributed to potential dairy industry clients. Curricula, detailed lesson plans and materials, including a set of six basic processing guides, were prepared for each module. The guides were also distributed to milk producer groups and processors through KDB, KDPA and MOA field staff. Audio-visual equipment and a computer system were provided to upgrade DTI's teaching and teaching material preparation facilities and to establish the outreach training unit.

Since the course modules focussed on providing trainees with hands-on skills (practicals comprised almost half the time allocated), the DTI teaching dairy was renovated and a small-scale milk processing demonstration unit established. This comprised a locally-made wood-fuelled pasteuriser, a small milk cooler and, since most "Jua Kali" processors use low-cost flexible plastic packaging for their milk, an innovative in-pouch milk filling/pasteurising/cooling system. Developed in South Africa, this system is easy to install, operate and maintain and improves the hygienic quality and refrigerated shelf life of pasteurised milk to up to two weeks. Motivated by the training, a women's dairy group in Coast Province intends to order one unit.

A study tour for the Project Steering Group was organised to Lesotho, South Africa and Swaziland to visit medium and small-scale dairy enterprises, dairy equipment manufacturers and training institutions. The tour was jointly funded by DANIDA.

To spearhead the training effort during the pilot phase, a trainers' training workshop was held for nine lecturers from DTI, focussing on the adult learning approach to be used for teaching the courses and on building team-based communication skills. Provincial Dairy Officers also attended in order to foster awareness and cooperation at field level. Together, the DTI trainers and Provincial focal points made up the Dairy Training Team. External specialists were also used to provide industrial experience.

2.1.3 Short residential courses

Seven five-day residential courses were held during the 1997 pilot period, with those dealing with hygienic milk handling and processing (Course 01), milk testing and quality control (Course 02) and cultured milk products (Course 04) proving the most popular. A total of 83 trainees, sponsored by 37 client organisations or private dairy companies, participated. Private milk processors and producer co-operatives sent three quarters of the trainees, only 16 per cent were women. Since most came from the small-scale sector, 40 % were at supervisor level or above.

2.1.5 Mobile outreach training

Five private and co-operative sector clients, with milk throughputs ranging from 300 litres up to 50,000 litres a day, used the outreach service during 1997. Each session also provided on-the-job training of the Dairy Training Team. A total of 180 employees participated, 32 % of whom were female. The main operational problem was the poor condition of the vehicle used to support the outreach unit.

2.1.6 Course awareness and administration

To assist with targeting prospective clients for the training courses, a database of potential dairy industry clients was compiled and stored at the DTI, in collaboration with KDB, KDPA and MOA dairy extension field staff.

Almost 150 producer organisations and private sector companies are now registered. As the dairy industry is undergoing rapid change, the database needs to be reviewed and updated annually.

The system designed to attract clients to the residential courses worked moderately well. Of the 128 dairy industry clients who applied to sponsor trainees to the courses, 83 (65%) actually joined - against a target of 90. Although the programme was advertised in the national press and through KDB and KDPA, a number of clients had problems communicating with the DTI about the exact course timing. To improve communications, a facsimile machine and an electronic mail terminal were installed at DTI towards the end of 1997 when a new telephone line was installed.

The delay in publishing the first issue of the Maziwa (Milk) News newsletter, originally scheduled for March 1997, also contributed to poor course publicity. The first issue was only published in November, after completion of the courses. Maziwa News was eventually distributed to all dairy sub-sector stakeholders, including those on the database described above. All DTI Dairy Training Team members have been trained to use the desktop computer-publishing programme.

A video, based on material filmed during the pilot period was produced by the DTI to promote the training programme. Copies are to be distributed to as wide an audience as possible including the two national television companies. The video is to be shown also at agricultural shows and used during the opening session at all DTI in-service courses.

2.1.7 Dairy equipment directory

To help processors obtain information about medium and small-scale dairy equipment manufacturers and suppliers, both domestic and foreign, a Directory of Dairy Equipment Suppliers was compiled in collaboration with the KDB and the KDPA. The directory was distributed with the first edition of Maziwa News to all the companies and organisations listed in the DTI database and is to be updated annually.

2.2 Evaluation

An ongoing monitoring and evaluation system was built into the training programme. The pilot period was reviewed at an evaluation workshop in December 1997. A total of 20 participants attended, drawn from the DTI Dairy Training Team, Dairy Officers from each province and private and co-operative sector milk processors who participated in the training programme. Resource persons were drawn from the DTI, KDB, KDPA and the Project Steering Group. The key points are summarised below.

- The short courses were deemed to be relevant to the dairy industry's needs. They should continue to be run as five-day courses in order to make them affordable to self-financing clients. No new course subjects were proposed, but it was felt that practical work should be further increased. In order to enhance the quality of milk supplied by smallholders, the training module on hygienic milk handling and processing should be expanded to include aspects of clean milk production, public health and good feeding practice for dairy cattle. Contacts with prospective clients need to be improved. A fee structure that reflects the actual cost of running each individual course should be introduced and made known to prospective clients. DTI accommodation facilities should be upgraded. In order not to interfere with regular DTI courses, the short courses should continue to be run during the annual April-to-September recess period.
- The two-day outreach courses should continue in the format evolved during 1997. Costs should be based on actual costs, with travel distances taken into consideration. Transport for the unit should be reliable, with vehicle hire considered for longer journeys. As the number of outreach courses depends on demand, the DTI should actively reach out to clients in the field.

Based on the above conclusions, a course schedule for 1998 was proposed by the workshop. The DTI was requested to hold an annual review workshop to exchange experiences, and to keep contact with clients in the field.

2.3 Dairy Sub-sector Reform

In the Government's Eighth National Development Plan for the period 1997 to 2001, promotion of the dairy industry is given the highest priority as it has potential for creating employment, particularly in processing and distribution. Competition in the industry is to be encouraged by the provision of incentives for private sector investors in milk processing.

The drafting of a new Dairy Industry Bill to ensure a competitive policy framework for the industry and

to strengthen the Kenya Dairy Board has been completed. The Bill includes a mandate for KDB to foster dairy industry training. The Government intends to enact the bill in 1998, following a final review of the sub-sector policy framework.

This review is currently underway. A stakeholder workshop, sponsored by DANIDA, was held in November 1997 at which a draft dairy policy document was discussed. With regard to training, the document recognises that the emergence of many new medium and small-scale processing plants has increased the demand for trained manpower and that the dairy industry, including the private sector, needs to play a more active role in training. The document also states that the DTI will be granted semi-autonomous status to enable its training to be commercialised. The policy document will be submitted to the Cabinet prior to presenting the new Dairy Industry Bill to parliament.

The project team participated in the drafting of both the dairy policy document and Dairy Industry Bill.

2.4 Follow-up

At the end of 1996 the project supported the Government/DANIDA team which carried out a dairy industry manpower study. The team recommended a DANIDA-financed follow-up project aimed mainly at upgrading the DTI to diploma course level and at building on the in-service tailor-made training programme initiated by the current project. A further DANIDA mission visited Kenya in 1997 to draft a project document for the "Support to the Dairy Training Institute, Naivasha Project". The project will have a duration of three years and is provisionally budgeted at DKK 9.02 million (US$ 1.4 million), excluding technical assistance. It was originally scheduled to start at the beginning of 1998, immediately after the completion of the TCP project. As a result of the 1997 December parliamentary elections, however, this was delayed.

2.4 Conclusions

At the time this statement was written, the training action programme for 1998 indicated in annex 2 has been drawn up, with course fees based on full cost recovery. Although the lead-time between advertising and starting the 1997 courses was very short, the number of applications was encouraging, indicating a real need for tailor-made courses for small and medium milk processors. The direct involvement and active support of the dairy industry at large, especially the private sector, boded well for sustaining this type of self-financing, industry-driven training in future. Nevertheless, the DTI and the Dairy Training Team need to increase investment in publicising the programme if the training is to become financially self-sustaining in the longer term.

The time invested in preparing the Dairy Training Team at DTI paid off. The team tackled the first season of short and outreach courses with enthusiasm and responded well to the unique requirements of industry-driven in-service teaching, very different from those involved in teaching longer-term school leavers.

Overall, the liberalisation of the dairy industry in 1992 has had a beneficial impact on the small-scale dairy sector, particularly on milk markets and prices. Producer welfare has improved through higher real prices and timeliness of payments. This had led to shifts in market outlets for producers and the emergence of many new processors. Not surprisingly, consumers have also benefited from a wider range of more competitively priced dairy products.

3. RECOMMENDATIONS

The recommendations have two basic aims: to consolidate the in-service training programme and the activities of the Dairy Training Team and to build on the progress achieved to date at the DTI until the follow-up DANIDA project begins. They therefore focus on the immediate post-project period.

3.1 1998 In-service Training Action Programme

The training action programme agreed for 1998 and shown in appendix 2 should be implemented by DTI. The Project Steering Group should continue to guide implementation of the 1998 programme, at least until the DANIDA follow-up project commences. DTI should also consider coopting private-sector members on to its present Management Council to ensure training is attuned to dairy industry requirements.

Owing to the poor condition of many rural roads, a fully serviceable four-wheel-drive vehicle should be made available by the MOA to support the out-reach training programme. Additional DTI lecturers and staff should be given an opportunity to participate in the Dairy Training Team. Considering the important role played by women in dairying and the relatively small numbers attending some of the five-day residential courses, DTI

should encourage more women to attend. This could be achieved by allocating a fixed number of places on appropriate course modules.

The DTI should also be more active in reaching out to prospective clients and following up enquiries and applications for the training courses. As the Maziwa News newsletter is one of the key tools in the communication process, the publication strategy developed to sustain the newsletter should be closely followed. In this connection, and in collaboration with KDB and KDPA, the DTI should update the dairy processor database annually. The DTI promotional video should be used extensively to promote the training courses. The Dairy Equipment Supplier Directory should also be updated annually and published in Maziwa News.

To improve the keeping quality of milk marketed by small-scale processors, as well as to reduce capital costs, DTI and KDB should collaborate to sponsor "Jua Kali" fabrication of the simple in-pouch milk filling-pasteurising-cooling system demonstrated by the project.

3.2 Dairy Sub-sector Reform

In order to advance the training commercialisation process it is recommended that the MOA should give priority to legislation granting DTI semi-autonomous status. A first step in this process should be to authorise the DTI to open a bank account for its in-service training programme. This would enable income from course fees to be used directly to sustain the programme. In addition, efforts should be increased to obtain consent to operate the DTI dairy plant, including the small-scale demonstration unit, on a commercial basis.

While the change to a liberalised market has stimulated competition, leading to a rise in the number of milk processors and the consequent demand for new types of training, it has also brought about increased sales of raw milk in urban areas by hawkers. The main reason cited for this trend is improved producer welfare brought about by higher milk prices and more timely payment. Reports in 1997 estimate that over half of the milk marketed in urban areas is now sold untreated, compared with a negligibly low figure before liberalisation.

These changes need to be understood and exploited to improve the milk marketing system in Kenya. Meanwhile, it is recommended that the KDB and KDPA mount an advertising campaign to educate consumers about the potential risks of raw milk and the benefits of safe handling and processing. As hawkers are likely to be present as market intermediaries for the foreseeable future, ways and means should also be found by the KDB to educate and train hawkers under the DTI in-service training module on hygienic milk handling and processing (course 01).

Annex 1: Project Team

Project Steering Group

- A.Chabeda, Chief, Training and Staff Development, MOA, Nairobi
- J.Cheruiyot, Head, Dairy and Beef Branch, MOA, Nairobi
- J.Wanyama, Principal, Dairy Training Institute, MOA, Naivasha
- G.Ngambi (Mrs), Chairman, Tetu Dairy Co-operative Society, Nyeri
- J.Karuga, Coordinator, KDPA and Managing Director, Eldoville Dairies, Nairobi
- G.Bor, Director, Eldairy Products Ltd., Eldoret
- J.Makhapila, Manager Technical Services, Kenya Dairy Board, Nairobi
- A.Qvortrup, Senior Agricultural Programme Adviser, DANIDA, MOA, Nairobi
- J.Kiptarus, National Project Coordinator, MOA, Nairobi
- B.T.Dugdill, Consultant Team Leader/Dairy Development Adviser, FAO

Dairy Training Team (from DTI Naivasha)

- P.Mwenze, Head of Dairy Technology Department
- J.A.Magero (Ms), Lecturer (Dairy Technology)
- B.Mukoya, Assistant Lecturer (Animal Nutrition)
- J.O.Kutwa, Assistant Lecturer (Dairy Bacteriology)
- M.Nakeel (Mrs), Assistant Lecturer (Animal Health)
- M.M.Ngaruiya, Assistant Lecturer (Cheese Making)
- D.N.Njuguna, Assistant Lecturer (Milk Processing)
- A.O.Okach, Assistant Lecturer (Dairy Plant)
- C.N.Wangila (Mrs), Assistant Lecturer (Quality Control)

National Project Personnel

- J.Kiptarus, National Project Coordinator
- J.Wanyama, Principal, Dairy Training Institute, Naivasha
- M.Obiero, Deputy Principal

International (FAO)
- B.T.Dugdill, Consultant Team Leader/Dairy Development Adviser (9 months in 3 missions)
- L.R.Kurwijila, Consultant/Milk Quality Control, (3 months in 2 missions)
- O.P.Sinha, Consultant/Dairy Farmers' Organisation (2 months in one mission)
- J.Lambert, Senior Dairy Officer, Rome

Annex 2: In-service Training Action Programme for 1998

Action	Responsible	Target Completion Date
1.Organise reliable transport for outreach unit	PDTI/NPC	Feb 98
2.Design/execute improved training programme awareness/publicity campaign	DTT	Mar 98
3.Upgrade accommodation for 5-day course trainees	PDTI/DTT	Mar 98
4.Follow up commercialisation with MOA	NPC/PDTI	Mar 98
5.Organise DTI Field Day at Naivasha	PDTI/DTT	Jun 98
6.Involve/train other DTI staff for Dairy Training Team	PDTI/DTT	Nov 98
7.Training programme evaluation workshop	DTT	Dec 98
8.Short Residential Course Programme: (Target: 7 courses/90 trainees)		
01 Hygienic Milk Handling and Processing (1st)	DTT	19-24/04/98
01 Hygienic Milk Handling and Processing (2nd)	DTT	20-25/09/98
02 Milk Testing and Quality Control	DTT	03-08/05/98
03 Dairy Equipment Maintenance	DTT	21-26/06/98
04 Cultured Milk Products	DTT	17-22/05/98
05 Cheese Making	DTT	on demand
06 Milk and Milk Products Marketing	DTT	07-12/06/98
9.Outreach Course Training Programme: (Target: 6 sessions/180 trainees)		
Brookside Dairy, Ruiru	NPC/DTT	during Jan 98
Taita Taveta Dairy Cooperative	NPC/DTT	during Feb 98
Mitungu Dairy Group	NPC/DTT	during Mar 98
Other sessions	DTT	on demand
10. DANIDA follow-up project:		
Final clearance from Danish Government	NPC/PDTI	Jul 98
Project start up	NPC/PDTI	Jan 99

Key: PDTI = Principal, DTI; NPC = National Project Coordinator; DTT = Dairy Training Team.

Annex 3: List of Reports and Documents Prepared by the Project Team

Field Documents
1. Preparatory Mission Report (May 1996)
2. Inception Report and Project Work Plan (July 1996)
3. Out-reach Training Programme Guidelines (February 1997)
4. Trainers' Training Programme Guidelines (February 1997)

5. Short Course Training Programme Guidelines (February 1997)
6. Mission Report FAO Consultant/Dairy Farmers' Organisation (February 1997)
7. Mission Report FAO Team Leader/Dairy Development Adviser (February 1997)
8. Mission Report FAO Consultant/Milk Quality, Collection, Processing and Marketing (March 1997)
9. Technical Report on Milk Processing and Marketing in Kenya (March 1997)
10. Milk Marketing in Kenya: A Case Study of Nakuru District (March 1997)
11. Guidelines for Operating DTT Audio-Visual Equipment (March 1997)
12. Lesson Guides for Milk Processing Training Modules (November 1997)
13. Processing Guides (November 1997):
    - 01: Hygienic milk handling and processing
    - 02: Milk testing and quality control
    - 03: Dairy equipment maintenance
    - 04: Cultured milk products
    - 05: Cheese making
    - 06: Milk and milk products marketing (including basic business management skills)
14. Directory of Kenyan Dairy Processors (November 1997)
15. Directory of Dairy Equipment Suppliers (November 1997)
16. Training Evaluation Workshop Report (December 1997)
17. Mission Report. International Consultant/Milk Quality, Collection, Processing and Marketing (December 1997)
18. Mission Report. International Consultant Team Leader/Dairy Development Adviser (January 1998)

Other Reports/Documents:
1. Project Information Note 1 (May 1996)
2. Project Information Note 2 (June 1996)
3 1997 DTI In-service Training Programme Prospectus (December 1996)
3. Project Information Note 3 (February 1997)
4. Report on Study Tour to Southern Africa (July 1997)
5. Project Progress Report: March to September 1997 (October 1997)
6. Short Course Reports: February to September 1997 (October 1997)
7. DTI-Maziwa (Milk) Newsletter: Issue 1 (November 1997)
8. Outreach Training Session Reports: February to November 1997 (December 1997).

Poster paper: The Story of Milk Vita in Bangladesh.

By S. C. Das, Manager (Co-operative Societies), Bangladesh Co-operative Milk Producers Union Ltd, Dhaka. Currently National Livestock Advisor, Grameen Bank/UNDP/FAO Community Livestock and Dairy Development Project, BGD/98/009.

Bangladesh Milk Producers Co-operative Union Ltd. (BMPCUL) is one of the largest national level co-operative organizations in Bangladesh. In the late 1960's, two loss making dairy organisations were amalgamated by the Government to form the Eastern Milk Producers Co-operative Union Ltd (EMPCUL).

The federal union was called 'Milk Union'. It used 'Milk Vita' as a brand name for its products. In the mid 1970's, the Government of Bangladesh initiated a co-operative dairy venture with the financial and technical assistance from UNDP, FAO and DANIDA. Three chilling plants and one pasteurisation/processing plant were commissioned in rural milk pocket areas. One processing and packaging plant was set up in Dhaka city for standardization of liquid milk and marketing of pasteurised milk and milk products to the city dwellers. The main objective of the co-operative dairy complex were:

- Raising family income of small farmers in rural milk pockets by facilitating with a remunerative year round cash market of milk through the co-operative system.
- Assurance of support services for livestock development activities.
- Ensuring an adequate supply of hygienic milk and milk products to the urban population.

In 1977, the name of the organization was changed to Bangladesh Milk Producers Co-operative Union Ltd (BMPCUL). Initially the co-operative started its activities in 110 village primary co-operatives having 4304 nos. of household members in four districts, procured 0.85 million litres of milk and paid Taka 1.85 million to the producers. In spite of gradual increased milk collection, extended support services for cattle development and marketing activities, the co-operative was a losing concern till 1990-91 financial years. Development of management skills and commercial approach in business operation led the co-operative to emerge as a profit making organization since 1991-92 and its ever-increasing business success is continuing year after year.

The developmental activities of 1998-99 financial year revealed that the co-operative procured 29.5 million litres of milk from 390 village milk co-operative societies spread in 15 districts at a cost of Taka 467.42 million. The 1997/ 98 audited accounts of Milk Vita indicated a net profit of Taka 47.8 million (US $ 1.0 million) on a turn over of Taka 490.5 million (US$ 10.0 million)-much of which was distributed as a dividend to the milk producers. Four additional chilling centres were already set up in the milk pocket areas and one instant milk powder plant of 100,000 litres processing capacity per day commissioned at own fund and three more chilling centres are in pipeline for set up. Milk collection target for 1999-2000 financial years is 32.5 million litres. The current daily milk collection quantity is 115,000 litres and sale volume is around 90,000 litres. The direct beneficiaries of this co-operative organization are 40,000 landless, small and marginal household milk producers of 390 village primary milk co-operative societies (VMPCS). Other beneficiaries are- 300,000 family members, 800 employees of VMPCS, 300 rickshaw pullers of Dhaka city engaged in milk transportation to the retail shops and 700 employees of different dairy plants and Head Office. Having pasteurised liquid milk and other milk products at their doorsteps daily also benefits millions of city dwellers. The important factors behind this sustainable development are:

- Empowerment of the Board - since 1991 Milk Vita is governed by an elected Board of Directors, from amongst the VMPCS who are very keen to protect producer's interest in setting fair milk price, timely procurement of required support services to enhance milk production and active role in business development plan of Milk Vita.
- Professional management: in1991, BMPCUL was permitted to employ professional management personnel at senior level and this provided a sound efficient management system resulting in improved business turn over.
- Support services:
  - Fair milk price and milk procuring centres at remote villages facilitate cattle rearing for increased milk production.
  - Up-gradation of local indigenous low yielding cattle to a high yielding variety through massive artificial insemination facilitates increased milk production than that of 90's decade.

  - Assurance of timely healthcare service decreases producer's fear on disease outbreak and encourages more cattle rearing for milk production.
  - Arrangement of pastureland for winter fodder cultivation and grazing scope greatly expedites increased milk production.
  - Distribution of balanced concentrate cattle feed to the producers at cost and repayment through weekly milk bills facilitate feeding practice to increase milk production.
  - Interest free credit facilities for milch cow purchase and repayment through weekly milk bills helpful to smallholders for cattle rearing and milk production.
  - Grant for office construction and furniture procurement.
- Women participation in cattle rearing, milk selling and in co-operative management facilitates cattle rearing for increased milk production.
- Training and study tours of the producers at home and abroad facilitate sharing of knowledge on modern cattle management for increased milk production.
- Distribution of incentive bonus, additional price to the producers and special prize to the co-operatives stimulate competition for increased milk production.
- Accountability of employees to the producers through the Board and requirement of approval of the producers' representative for budget approval stimulate their integrity with the co-operative and thus enhances increased milk supply.
- Strict quality control measures both at producer's level and in processing plants disseminate reputation of quality products to the consumers.
- Timely distribution of quality pasteurised milk and other dairy products to shops and consumers of greater Dhaka and other cities enhance expansion of marketing network.
- Use of locally fabricated Milkshaws, an insulated box, mounted on a traditional three- wheeled cycle rickshaw chassis, to deliver milk and milk products in the narrow, congested streets expedite more sales.
- Since 1992 marketing of standardized fresh milk instead of recombined powder milk created consumers preference for intake of Milk Vita pasteurised milk than any other products available in the market.
- Duty on imported milk powder and Government patronage on dairy industry also helpful for business development of Milk Vita.

All these are the encouraging factors for flourishing of the present Milk Vita in Bangladesh.

Comments received on Topic-3: Milk Producers' Organisations (MPO)

11-07: N. Abeiderrahmane, Mauritania; Comment on Steven J. Staal Paper 3.1

Thank you for an interesting discussion of a complex topic. It highlights the need for a pragmatic approach : different situations call for different responses. On the last point, may I venture a description of our dairy's interaction with the informal market : In Nouakchott, a number of people have a milch herd and sell raw milk, either directly or via retailers, who sit along the main streets on the outskirts and sell milk out of buckets, fresh and sour. Their price has always been roughly the same as the retail price of our high-quality pasteurized milk in cartons. This is due to the high value attached to fresh "natural" milk. Of course we pay half that price for raw milk. In the cool season, sales are slower, so milk producers are very happy to sell the morning milk to the dairy at the lower price, and the evening milk to the informal market. In summer, of course the dairy wants more milk but gets very little. However, some customers have been faithful for 11 years - half time. It is a permanent tug-of-war, as in winter the dairy cannot buy the excess milk and in summer milk is scarce. Another interaction occurs during the summer holidays, when a large number of city families go out of town and live in a traditional tent, with the main aim of drinking fresh (i.e. raw) milk. This became a fashion when dairy supply herds were created for the dairy. As a result, not only wealthy people with their own herds could go to the country, but also middle-class people who contract a specified daily amount of milk. Suppliers sell as much milk as they can to holiday-makers, who pay high prices, and the dairy is deprived of milk - and of customers. Some people prefer to take packaged pasteurized milk out to the bush, and put it in the traditional skin, and are happy not to have to contend with It is a complex interaction, definitely arising from a specific context wherein people are willing to pay more for raw milk than for pasteurized milk. As for milk producer organizations, they have been at the root of major French dairy industries, but in our social context it is unthinkable that herders get organized together. Maybe some time in the future...

11-07: B. Faye, France; Curve of collected milk

We are working on the estimation of the total collected milk in smallholder conditions. Data are collected every 2 weeks. The milk quantity is measured just after or before calf milking according to the different milking practices of the farmers. The data present very high within and between individual variability due to missed data and different milking practices. Under these conditions and for one given lactation, how can we estimate individual milk sampling and overall its variance? Thanks to give your experience on the matter.

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Reaction from the moderators:

Can any of the participants assist?

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18-07: M. Tyler, UK: The Story of Milk Vita in Bangladesh

It is good to learn of successful cooperative ventures in Bangladesh and the guidelines provided could be very helpful in other countries. It would be appreciated if someone could indicate

1. The average yield of milk per cow in summer and winter and
2. What processing plant was installed and its output rate

We are hoping to establish a new venture to supply a range of micro and small scale food processing plant including complete small scale dairy product plant, equipment and know how, into rural areas of Eastern Europe,in partnership with funders and trainers - developing a 'One Stop Shop' concept for new SME start ups - with micro units being available for subsistence use and trial.

Any comments on this approach would be much appreciated.

18-07: M. Tyler, UK: Training Programme for Small-scale Dairies

Thank you very much for enabling us to read this very interesting report. A few observations:

If the seemingly high FAO cost of $364,000 has enabled the development of optimal training programmes for the SME dairy sector - are these courses to be made available for other countries to use and if so what FAO

funding might be provided to implement such training elsewhere? A Directory of Small Scale Dairy Plant and Equipment was reported as developed during this programme - could this please be made available as it may be a very helpful publication? References to demonstration units are interesting - I believe there is real value in demonstration units perhaps mobile, to stimulate interest and give people confidence and enough 'Know how' to start their own enterprise in dairy products.
(We are hoping to provide a mobile demonstration centre for a range of micro and SME food plant in a new venture which we are planning to start in Romania as a private 'Not for profit' enterprise - if we can generate sufficient financial support).

Does anyone else have experience with demonstration units and are they best set up as 'open' commercially viable 'models'

18-07: T. B. Thapa, Nepal: Yak Cheese; a Nepalese Souvenir

Nepal is the first country to produce cheese from Yak/Chauri milk in the high alpine region of Nepal. This product is popularly known by the name of Yak cheese. Nepal produced around 150 metric tons of yak cheese during 1998/99. This activity is focussed in the districts of Mount Everest trekking route and the Rasuwa district, closer to the potential markets.

National Dairy Development Board (NDDB) is an apex policy making body in the dairy sector, in Nepal. FAO/NDDB-Nepal organised a workshop and brought together specially private sector yak cheese makers from different parts of the country, beginning of this year.The workshop discussed the problems and identified priorities.

1. Marketing has been recognised as a top priority area to address the acute problem faced by cheese industry in Nepal. The forum felt the need of organising the cheese producers into co-operative to organise the marketing management. The cooperative should carry out market study, plan to establish cheese coldstores in the capital, arrange cheese transport facility and develop promotional campaigns for increased cheese marketing.
2. Training and Human Resource Development is a second priority area and recommended; establishment of Dairy Training Institute to organise regular and need-based trainings.
3. Standardise the cheese manufacturing process, and modernise the cheese industry
4. Quality Management:
   (a) Formulate mandatory quality standards for all types of cheeses produced in Nepal and enforce them.
   (b) Encourage and enforce timely delivery of milk to cheese plants.
   (c) Discourage milk transport in plastic containers and jerrycans.

28-07: P. Leperre, Belgium: nearing end

The milk collection systems and conditions are varying from country to country and I think it is an error to generalize to "developping countries" north/south, asia africa etc
and even within each group each country has an individuality.

Being at present in charge of Livestock and Veterinary in UNMIK Govt in Kosovo and replacing the dept of Agriculture Head, I did not have time to read all communications, but I have found quite a number of very interesting and instructive ones and save the others. Now if someone can advise on the policy and techniques to use here I would be very interested.

The weather can be very cold but it is around 40 c at the moment. Large industrial dairies are out of order and difficult to restart. Processing is necessary becaus of the incidence of Brucellosis and Tularemia. Nato bombed most of the small dairies and the best attitude I can think of is to resurect small dairies by a system of credit. In isolated villages an minority enclaves must have a micro processing for small quantities and low cost.

What are the best techinques to apply in each case? If I may ask the participants for their advice and opinion in this end of e-conference, just as if we were chatting in the lobby before going?

Many thanks to FAO and the moderators for this conference. I wish to say once again that I find this a very effective and practical way to stay up to date and share information and experience. I really hope these conferences will continue in the future.

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Comments from the moderators

We suggest to go through the FAO publication on MPO which should be printed by the end of 2000.

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Your views Please (3)!!!!
" No appropriate legislation exists to effectively regulate small-scale milk processing"

18-07: J. Thornes, UK; Self regulation is worth thinking
"No appropriate legislation exists to effectively regulate small-scale milk processing". It should do or our industry will go from crisis to crisis. Self regulation is worth thinking about.

18-07: M. Tyler, UK; Clear guidelines for quality and safety
Clearly guidelines are helpful especially for quality and safety in small-scale processing, but legal obligations are presumably covered in most countries, or should be,by more general obligation. It is important that possible new enterprise in small scale milk processing is encouraged and enabled rather than stifled or discouraged by legal obligation.

As much milk is still sold fresh and unpasteurized - with potential health hazards and very short storage life - that may be where any national legislation might be better targeted, to encourage the development of small scale safer processing and longer storage life.

20-07: D. G. Mlay, Tanzania: No legislation exist
Is not an issue of appropriate legislation exists to effectively regulate small-scale milk processing in Tanzania. No such legislation is "on existance". It is only recently where there is a bill submitted to the Authourity which some of proposed appropriate clauses are to discussed and may be approved. Otherwise the survival of small-scale milk processing should be within the legal frame work as large dairy milk factory which is not a realistic or practical at all. Thank now there is an effort to make separate legislation!

20-7: P.R. Gupta, India: voluntary regulations needed
Thank god for that! We in the developing countries have enough laws in the statute book to sink another "Titanic". The tragedy of the developing world is that it has all laws and no order, all rules and no regulations. Something more tangible and interactive is needed to bring the desired results, like voluntary regulations.

24-07: R. Giangiacomo, Italy: build hygienic culture
In my view, it cannot exist an appropriate legislation regulating small-scale milk processing. Legislation is valid in the country issuing the law, or in the case of federal countries for a group of countries mutually recognising their legislation. Organistaions like FAO do not issue legislation but only guidelines, which can promote relevant national legislation. Different is the case of WTO, which adopt Codex alimetarius technical documents as the basis for regulating international trade. In this case, it would be necessary a document internationally recognised describing the procedures necessary to assure the safety of products obtained in small scale milk processing units and subject to international trade.

The subject is very complex and difficult to adopt at international level. As I was addressing in my discussion paper 1.3: Milk testing, Quality control, Hygiene and Safety on June 8, the approach to safety issues deserves particular attention and constant update. The situation is very different in each country and the adoption of provisions common to any world situation is rather difficult to be achieved and it might be wrong to accept compromises.

I feel that it would be greatly important to provide (FAO, WHO, Codex?) a general document specific for small scale processing units which could stimulate in any country the promotion of programmes aiming at buiilding up an hygienic culture in the food operators. If there is'nt a cultural background on the importance of hygiene and food safety, legislation will remain an unattended piece of paper.

21-07: N. Sastry, India: Training and Organisation is important
In India, there may not be very elaborate specific laws for standards and processing of milk by small farmers as such. But there are laws concerning food which also apply to milk.
1. Prevention of Food Adulteration Act - milk quality is covered under this. It gives powers to municipal health staff to take action if milk and products sold in market do not meet the standards (mostly composition), though in times of epidemics milk samples are al;so examined for microbiological quality.
2. AGMARK - This is a quality marks allotted to agricultural products meeting certain standards stipulated under it.

Milk products are included in it. For example there are several brands (and brandless) of ghee (clarified butter oil made from sour cream or curds) in the market. But only some could get AGMARK certificate testifying to their quality.
3. Indian Standards - The Bureau of Indian Standards developed standards for practically all manufactured or prepared items of all branches including food items. These food, including milk, should meet the stipulated standards, lest the manufacturers may lose the license.

The problem is laws specifically for the small-producer-processor. Generally the quantities of milk and products processed by them are very small, are disposed[off quickly before quality starts deteriorating, distributed to consumers very close to the producer and they are, in general, not readily 'approachable' by quality inspectors.

I feel that extension education for production, handling, storage and disposal of clean milk (shed, animal, milkier, utensil etc. hygiene) will go a long way (and there are indication to this) in improving small-farmer milk quality than any legislation. The cooperative or community collection systems will be helpful a lot in carrying out such an education better as they can also use inducements and penalty' also for quality improvement.

I am sure that in many developing countries there can be general food laws which are also applicable to milk. My honest feeling is that improvement, not just in quality, can be achieved by organising farmers in any country, in any social milieu. The organisation should not take away the individual farmers' independence in decision making at farm level and allow them to realise that action in union will be to three common as well as individual good. Legislations can at the most facilitate formation of such organisations and three efficient functioning.

28-07: J. Phelan, Ireland: follow code of practices

Professor Giangiacomo emphasizes the difficulties in implementing legislation and QC programme for small-scale milk processing and he advocates the production of special guidelines by FAO/Codex. These difficulties are well recognized but the solution involves a series of steps to create the awareness through training and dissemination of technical information. The legislation governing food handling applies to those who trade in all types of food and milk is particularly important because of its perishable nature and its potential to transfer disease from animal to man.

The basic principles of risk management and quality control are the same irrespective of quantity of milk produced by each individual supplier. However procedures for monitoring quality and payment schemes will be very much influenced by the scale of operation. Testing procedures which are practised in countries with large consignments per producer cannot be justified in developing countries where individual deliveries may be only a few litres of milk. The latter case, only simple rejection tests may be feasible and codes of practice must be established to minimize the risk to consumer. Where feasible an cost effective, cooling within a few hours of production, helps enormously in reducing spoilage and extending the range of markets whhcan be accessed. In the absence of cooling, the lactoperoxidase system has been shown to improve keeping quality of raw milk. However, neither cooling nor lactoperoxidase are a substitute for hygiene and technical support is essential in developing the "hygiene culture" referred to by Roberto Giangiacomo.

Your views Please (4)!!!!

"There are few, if any, successful examples of co-operative milk producer organisations in developing countries outside Asia"

21-07: D. Harcourt, South Africa: Maybe in Senegal?

I had understood (third hand or so) that there were successes in this area in Senegal where I have done some work, but not in the dairy sector, lately. I know that TPA (tpa@gret.org <mailto:tpa@gret.org>) and Dyna – Enetrprises (cjuliard@dynaentreprises.net <mailto:cjuliard@dynaentreprises.net>) have recently done sector analysis and maybe they have good information on the issue.

21-07: R. Steinkamp, Yugoslavia: examples exist in Montenegro

I'm not sure that eastern Europe should be categorized as developing countries, but there are certainly examples where people have organized successfully in Montenegro to confront real issues of the dairy farmer. Last year farmers organized to raise the price of milk. They staged a strike and stopped shipping milk. It worked. Likewise, this year associations are forming to purchase feed in larger quantities and get discounts on prices. Price of feed to the producer has dropped nearly 30% over the going market rate.

Farmers will organize when there is a good reason. The problem I have seen when folks are mucking about developing other folks is they forget that people need a reason to organize. My favorite poster pictures a flock of

turkeys with the caption, "Now that we're organized, what are we going to do." In order to organize effectively, there has to be a felt need and a real solution that only a group can solve. Otherwise, it is a lot less hassle to go it alone.

21-07: N. Sastry, India: Statement is true

Yes this statement is generally true. nsrsastry@satyasaionline.net.in

24-07: T. McClunie, New Zealand: Look at Brazil

In respect of this question (There are few, if any, successful examples of co-operative milk producer organisations in developing countries outside Asia), success is a variable thing but one could do well to look at Brazil where the OCB (Organizacao das Cooperativas Brasilelras) represents a number of successful co-ops, a similar organisation exists in Argentina for their co-ops.

21-07: J. Morton, UK: examples from Kenya

This begs two questions: what is meant by "successful" , and in what institutional context? NRI/ILRI collaborative research (building on earlier KAR/ILRI work) in the Nairobi milkshed looked at state-sponsored dairy co-operatives in the face of liberalisation. In fact there were three processes of liberalisation: of milk marketing from a state-controlled system with producer co-operatives subordinate to, but also protected by a parastatal which imposed pan-territorial prices; of services such as AI and clinical veterinary services; and of the co-operatives themselves from being operationally controlled by a Ministry of the Government to being something like genuine producer organisations.

Before these liberalisations, some co-operatives were highly "successful": high turnover, high surplus. However, they were successful as virtual organs of government and their producer base was protected by government regulation from competition. As liberalisation progressed (in around 1995), a number of co-operatives close to Nairobi diversified into veterinary services and input supply and appeared to flourish. By 1998, the full effects of all the liberalisations were making themselves felt and it seemed as if nearly all the co-ops were being squeezed between commercial dairies/processors and unlicensed hawkers of raw milk who could undercut them. Possession of major assets such as pasteurisation equipment was a distinctly mixed blessing for co-ops as it encouraged factionalism. Even the few co-ops that were financially "successful" seemed to have underlying problems of lack of commitment or even resentment from members, and would have no cushion against even short-term financial downturns.

Further out from Nairobi, in semi-extensive areas like Nyandarua, we came across less formal self-help groups that were successful in entirely different ways, and principally by adopting very limited objectives of bulking up raw milk for collection by private dairies, plus collective bargaining with those dairies. Interestingly, these groups adopted a policy of limited membership, while the principle of open membership to all meeting basic criteria of residence and occupation is regarded as part of international co-operative principles.

Written in haste. More information and references on request

24-07: R. Giangiacomo, Italy: see Colombia and Venezuela

Yes, there are certainly successful examples, that I know, of co-operatives milk producer organisations in Colombia and Venezuela. However, I think that several participants to this conference could better provide specific information on this matter.

24-07: J. Phelan, Ireland: learn from the developed ones

Comments received to date show many examples of successful cooperation between milk producers in many parts of the world outside of Asia. The type of organisation varies but the important thing is that groups of producers have been shown to do things better collectively than as individuals working alone. This applies in milk production enhancement activities as well as all the marketing arrangements described by Dr Stahl in his paper.

MPOs, mainly in the form of democratic cooperatives, have been the basis of developing successful dairying in Europe, North America, Australia and New Zealand in the early part of the last century. These MPOs played an important role in stimulating the development of rural infrastucture and communications to meet their own commercial needs. It should be remembered that the conditions obtained in those regions at that time were comparable to the challenges being faced by developing countries now. The experiences of those regions are therefore useful in establishing approaches to establishing MPOs in developing regions.