



**Proceedings of the
China-FAO Regional Workshop on
Small-scale Milk Collection and Processing
in Developing Countries**

5-17 May, 2002
Tongshan, Jiangsu, China

Editors-in-chief:

Wang Jiaqi
Jean-Claude Lambert



**Proceedings of the China - FAO Regional Asian workshop on
"Small-scale Milk Collection and Processing in Developing
Countries"**

15 – 17 May 2002

**Tongshan hotel
Tongshan (Xuzhou, Jiangsu province)
the People's Republic of China**

**Editors-in-Chief: Dr Wang Jiaqi
 Dr Jean-Claude Lambert**

**Institute of Animal Science
China Academy of Agricultural Science
China**

**Animal Production Service
Animal Production and Health Division
Food and Agriculture Organisation of the United Nations
Rome, Italy**

The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the United Nations or the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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.

Acknowledgements

The Animal Production and Health Division (AGA) of the Food and Agricultural Organization of the United Nations would like to thank all the participants for their active contribution to this workshop through the background and country papers and enthusiastic discussion during the plenary and group sessions. It would have been impossible to develop the recommendations without such active participation drawing upon the experience and professional points of view of the participants.

AGA also would like to thank all the staff of the laboratory of ruminant nutrition of the Institute of Animal Science (IAS), Chinese Academy of Agricultural Science (CAAS), for their tremendous effort in organising this workshop. Special gratitude is given to Dr Jiaqi Wang, Deputy Director of the IAS for his initiative and support. The coordination provided by the Chinese Ministry of Agriculture and the officials of Tongshan County is also highly appreciated.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	IV
TABLE OF CONTENTS.....	V
EXECUTIVE SUMMARY	VI
CHAPTER 1 INTRODUCTION.....	1
1.1 BACKGROUND	1
1.2 OBJECTIVES AND EXPECTED OUTCOME	1
CHAPTER 2 INTRODUCTORY SESSION	3
2.1 FAO ACTIVITIES IN SMALL-SCALE MILK COLLECTION AND PROCESSING	3
2.2 SUMMARY OF THE FAO E-MAIL CONFERENCE ON SMALL-SCALE MILK COLLECTION AND PROCESSING IN DEVELOPING COUNTRIES, 29 MAY TO 28 JULY 2000	4
CHAPTER 3 GROUP SESSION DISCUSSION	9
3.1 MILK PRODUCER GROUPS.....	9
3.1.1 <i>Background paper on Milk Producer Groups</i>	9
3.1.2 <i>Conclusions from group sessions</i>	14
3.2 MARKETING OF DAIRY PRODUCTS.....	15
3.2.1 <i>Background paper on marketing of dairy products</i>	15
3.2.2 <i>Conclusions from group sessions</i>	19
3.3 MILK PROCESSING AT VILLAGE LEVEL	20
3.3.1 <i>Background paper on milk processing at village level</i>	20
3.3.2 <i>Conclusions from group sessions</i>	23
3.4 MILK TESTING AND PAYMENT SYSTEMS	23
3.4.1 <i>Background paper on milk testing and payment systems</i>	23
3.4.2 <i>Conclusions from group sessions</i>	28
3.5 DAIRY POLICY.....	29
3.5.1 <i>Background paper on dairy policy</i>	29
3.5.2 <i>Conclusions from group sessions</i>	32
3.6 FOOD SAFETY	33
3.6.1 <i>Background paper on food safety</i>	33
3.6.2 <i>Conclusions from group session on food safety</i>	36
CHAPTER 4 COUNTRY PAPERS.....	39
4.1 COUNTRY PAPER CHINA.....	39
4.2 COUNTRY PAPER BANGLADESH	41
4.3 COUNTRY PAPER INDIA.....	45
4.4 COUNTRY PAPER PAKISTAN.....	52
4.5 COUNTRY PAPER THAILAND	56
4.6 COUNTRY PAPER VIETNAM.....	58
CHAPTER 5 CONCLUSIONS AND RECOMMENDATIONS	65
5.1 CONCLUSIONS.....	65
5.2 RECOMMENDATIONS.....	66
ANNEX 1: CONFERENCE TIME TABLE.....	68
ANNEX 2: LIST OF PARTICIPANTS	70
ANNEX 3: SPEECHES	74

Executive Summary

An FAO E-mail conference on small-scale milk collection and processing in developing countries was held from May to July 2000, in which 570 people from 97 countries participated. The aim of the conference was to:

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

This workshop is the first regional technical workshop to follow-up on the E-mail conference and was jointly organised by the Ministry of Agriculture of China, the Institute of Animal Science of the China Academy of Agricultural Science (CAAS) and the Food and Agriculture Organisation of the United Nations (FAO). The objectives of the workshop were:

- to exchange information on small-scale milk collection and processing in the Asian region, and
- to address common regional constraints.

Besides participants from China, 25 participants working in small-scale milk collection and processing were invited from the Asian region including Bangladesh, India, Mongolia, Nepal, Pakistan, Sri Lanka, Thailand and Vietnam.

This workshop consisted of plenary sessions, background papers, country reports and group discussions. The group discussion focused on the following key topics:

- Milk producer groups
- Marketing of dairy products
- Milk processing at village level
- Milk testing and payment systems
- Dairy policy
- Milk product safety

Through this workshop, a platform has been established for future collaboration in this region.

The key findings of the workshop were:

- 1 There is a lack of **appropriate (government) policies** for the small-scale dairy sector.
- 2 In some counties there are few **milk producer groups** based at village level.
- 3 **Milk testing and sampling** systems can improve the existing weak **linkages** between payment and testing systems, the management information system and extension services.
- 4 There is a lack of **low cost field level micro-biological testing methods**.
- 5 **Milk product safety** is a major issue in small-scale milk production, collection and processing. The large **informal milk market** can constitute a health hazard for the consumer.

- 6 There is a **lack of (access to) education, information, training and support services** in small-scale milk collection and processing.
- 7 **Milk traders** take a fair share of the milk price for their service.
- 8 The **seasonality of the milk supply** in some countries makes marketing more difficult, while the collection and processing of milk is challenging because of small milk volumes and long distances.
- 9 **Milk processors** often produce a limited range of products.
- 10 There is a lack of **promotion of the consumption of local milk**, while there often is a consumer misunderstanding regarding the supposed higher quality of imported dairy products.

The main recommendations of the workshop were the following:

1. **Appropriate policies** for small-scale milk collection and processing should be established.
2. Farmers' owned **milk producer organisations** should be introduced.
3. Introduction of **appropriate milk payment systems** based on hygienic and compositional quality with incentives to improve the quality of milk and with regular milk payments.
4. **Training, education and information** for small-scale milk collection and processing should be improved.
5. **Guidelines** should be provided to milk producer groups, milk processors and market agents for good manufacturing practices regarding small-scale milk collection and processing.
6. **Consumption of safe milk and milk products should be promoted** to stimulate milk production through school milk feeding, advertisements, etc.
7. Establishment of **regional Asian information systems** on equipment for small-scale, low cost milk testing; payment systems; processing technology, and market information.
8. A **qualification standard** for laboratory technicians and milk testers should be introduced.
9. Studies should be carried out to develop and improve simple **milk testing procedures**.
10. **Studies** should be carried out to define **consumer preference** regarding dairy products. ILRI's Dairy Programme could take a leading role in this.
11. Many issues regarding small-scale milk collection and processing in Asia require a **national rather than a regional approach** given the diverse nature of milk collection and processing systems.
12. The improvement of small-scale milk collection and processing in developing countries in the Asian region requires a **holistic and integrated approach**.

Executive summary in Chinese

一、研讨会背景简介

中国—FAO 发展中国家小规模奶收集与加工亚洲区域研讨会于 2002 年 5 月 16 日—5 月 17 日在江苏省铜山县成功召开并圆满结束。

在 2000 年 5 月至 7 月，FAO 曾成功地举办了关于发展中国家小规模牛奶收集与加工的电子邮件会议。共有来自世界 97 个国家的 570 名代表成功地参与了该电子会议。该会议主要包括 3 个议题：小农户奶收集；小规模奶加工技术；牛奶生产者组织。在电子会议中还讨论了发展中国家小规模奶业发展中存在的限制因素，并针对这些限制因素来自世界许多国家提出了许多有价值的建议，这些建议的重要性将在本次研讨会中进行了重点阐述。

本次亚洲区域性研讨会是 FAO 第一次电子会议的沿续，会议由中华人民共和国农业部和联合国粮农组织（FAO）共同主办，具体由中国农业科学院畜牧研究所、江苏省农林厅、江苏省铜山县人民政府共同承办本次年会，同时得到了江苏省维维奶业集团的大力支持。研讨会由中国农业科学院畜牧研究所文杰研究员主持并召开，同时来自中国、美国、法国、荷兰、古巴、日本、蒙古、芬兰、叙利亚、斯洛伐克、爱沙尼亚、肯尼亚、尼泊尔、印度、巴基斯坦、泰国、斯里兰卡、孟加拉国、越南 19 个国家从事奶业的专家、学者及官员在内的 52 名代表出席了会议。

二、本次研讨会的目标及研讨会内容

本次研讨会的议题主要包括：发展中国家在小规模奶生产和加工方面的信息交流，提出具有共同代表性的奶业发展限制因素。并通过这次研讨会，将来拟筹建一个示范基地以利于今后发展中国家间进行进一步的合作。上次电子会议的结论及建议是本次研讨会议程中的首要议题。有关这方面的行动落实计划现正在组织撰写，它将有利于 FAO 在今后更好组织和协调其项目计划活动，其中包括来自 FAO 总部和项目地实施地间信息的交流。

来自世界主要发展中不同国家和地区从事小规模牛奶收集和加工方面的 50 多位专家、学者及官员出席了本次研讨会。这些专家在全体会议上通过奶业专题论文报告汇报、国家奶业报告汇报及分组讨论的方式针对本次研讨会的议题进行了细致全面的研讨。

本次研讨会的报告主题及具体议题内容如下：

- （一） FAO 关于奶生产的报告
- （二） FAO 关于奶产品营销策略的报告
- （三） FAO 关于乡村级奶产品加工体系的报告
- （四） FAO 关于奶检测和定价体系的报告
- （五） FAO 关于奶业政策的报告
- （六） FAO 关于食品安全的报告

在分组讨论中，所有的研讨会参加者将被分为 6 组，在各专题报告和国家报告结束后，围绕以上 6 个议题，分 2 天进行进行了讨论，并在讨论会议期间中每个小组针对各自的议题进一步总结了具有共性的奶业发展限制因素、可能的解决办法及各位提出推荐建议。

三、研讨会所取得的主要发现和建议

（一）研讨会所取得的主要发现：

- 1、 在亚洲地区的一些国家很少存在乡村级奶生产者组织
- 2、 针对小规模奶收集和加工方面存在的问题，乡村级奶生产者缺乏教育和培训
- 3、 针对小规模奶收集和加工方面存在的问题，乡村级奶生产者缺乏信息或难以获得信息
- 4、 缺乏奶生产方面的支持服务体系
- 5、 对小规模奶生产方面，缺乏国家缺乏相应的政策引导与支持
- 6、 奶安全问题是存在于小规模奶生产、收集及加工中主要问题
- 7、 中间商介入奶生产从中谋利，导致农民生产奶回报较低
- 8、 在亚洲的许多国家，由于奶生产量较小且运输距离远，导致很难进行小规模奶收集和加工
- 9、 奶非正规营销市场大于正规营销市场，对消费者健康存在安全隐患
- 10、 奶加工者所能够生产的奶产品种类比较有限

- 11、 在一些国家，由于奶生产存在季节性，而导致很难形成稳定的奶市场
- 12、 奶检测和奶取样是能够得到改善的
- 13、 目前还缺乏进行奶实地检测的低成本简易技术
- 14、 奶定价与奶检测体系的联系程度低，管理信息与推广服务间联系不紧密。
- 15、 当地对奶消费需求没有得到促进
- 16、 有许多消费者对进口的被建议为高质量的奶产品存在误解

(二) 本次研讨会中提出的主要推荐建议

- 1、 建议农民成立属于农民们自己的奶生产者组织。
 - 2、 通过教育和培训的方式来改进提高小规模奶收集和加工技术。
 - 3、 要制定一些引导和支持小规模奶生产和加工的相应各级政策。
 - 4、 应该倡导根据奶的卫生和奶成分质量情况进行定位奶的价格，以激励奶生产者提高奶的质量。
 - 5、 针对小规模奶生产和加工方面，为奶生产者、奶加工者、奶经销机构提供良好生产规范的指导方法。
 - 6、 鼓励奶的消费，促进奶的生产和营销，改善奶的食用安全问题（如通过学生奶计划、广告宣传等方式）。
 - 7、 就小规模奶低成本的检测技术、定价体系、加工技术及市场信息方面，建立亚洲区域性信息系统。
 - 8、 为实验室技师和奶检测者建立国家级的针对非规范奶市场的定量监测体系。
 - 9、 积极开展研究，以探索出用于奶检测的一些简易操作方法和技术（如乡村级的抗生素简易实用检测技术）。
 - 10、 开展一些研究来消费者对奶及奶产品的消费偏好，并研究所偏好的这些奶产品的市场信息，ILRI 的奶业项目计划可能会起到领头作用。
 - 11、 针对发展中国家小规模奶收集和加工方面存在的问题，由于一些亚洲国家在奶收集和加工方面存在的多样性，需要采取国家性措施和方法。
- 洲地区的发展中国家的小规模奶收集和加工的改进需要采取整体的和综合的相紧密结合的方法。

Chapter 1 Introduction

1.1 Background

An FAO E-mail conference on small-scale milk collection and processing in developing countries was held from May to July 2000, in which 570 people from 97 countries participated. The aim of the conference was to:

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

The discussion was focused on three key topics:

- getting milk from the farm to collection points;
- small-scale milk processing technologies; and
- milk producers' organisations.

The constraints faced by small-scale dairying in developing countries and possible solutions were discussed. The importance of a follow-up to the conference was emphasised.

This workshop is the first regional technical workshop to follow-up on the E-mail conference and was jointly organised by the Ministry of Agriculture of China, the Institute of Animal Science of the China Academy of Agricultural Science (CAAS) and the Food and Agriculture Organisation of the United Nations (FAO).

1.2 Objectives and Expected Outcome

Based on the findings and recommendations of the E-mail conference, the workshop is focused on region-specific issues regarding small-scale milk collection and processing in Asia. The objectives of the workshop were:

- to exchange information on small-scale milk collection and processing in the Asian region; and
- to address common regional constraints.

The workshop invited 25 participants working in small-scale milk collection and processing including Bangladesh, India, Mongolia, Nepal, Pakistan, Sri Lanka, Thailand and Vietnam. The workshop consisted of a plenary session and group discussions which focused on the following key topics:

- Milk producer groups
- Marketing of dairy products
- Milk processing at village level
- Milk testing and payment systems
- Dairy policy

- Milk product safety

Country papers were presented which included an overview of their small-scale dairy situation, country-specific constraints and possible solutions. One aim of the workshop is to establish a platform for future collaboration in this region. The recommendations of the workshop will assist FAO to fine-tune its programme of activities, including information delivery, both at headquarters and the field.

Chapter 2 Introductory Session

2.1 FAO activities in small-scale milk collection and processing

FAO was founded in 1945 with a mandate to raise levels of nutrition and living standards, to improve agricultural productivity, and 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 - 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 the governments of the developing countries, and acts as an international forum for debate on food and agriculture issues. A priority of the organisation is to encourage 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.

The livestock products team in the Animal Production Service of FAO is responsible for dairy development and the activities are targeted on small-scale household dairy production. The objectives of the team include:

- To contribute to poverty alleviation and food safety;
- To promote the introduction of efficient milk processing technologies and skills; and
- To build pro-active working relationships with key institutions through regional and national projects.

These activities include both normative and field activities, which mutually support each other. Normative activities fall into three major domains:

Contribution of livestock to poverty alleviation

Small-scale, low-input livestock producers in rural areas face various constraints such as a lack of suitable processing technologies for perishable products and lack markets. To address these constraints, and to contribute to poverty alleviation and income generation, the livestock products team provides technical assistance for the adoption of suitable technologies for the preservation and value-added processing of perishable products for better access to markets.

Veterinary Public Health, Food and Feed Safety

Livestock products, although highly nutritious, can cause food-borne diseases unless appropriate hygienic control measures are taken during production and processing. To avoid the risk of food-borne diseases from livestock products, the livestock product team provides information on practical methodologies and guidelines that demonstrate the importance of hygiene.

Technologies and Systems for Efficient Natural Resource Use in Livestock Production

To meet the strong global increase of the demand for livestock products, a new set of research and development is essential, especially focusing on efficient livestock resource use technologies. The livestock products team will provide new livestock products processing technologies tailored to small-scale, low-input livestock producers. Field activities on the other hand, are operated currently many countries and regions aiming to validate and field-test the new technologies, to support small-scale enterprises or to support policy decision by the policy makers. Field projects

in operation can be found in the following countries: North Korea, Kenya, Sri Lanka, Bangladesh, Guyana, Jamaica, Madagascar, Ecuador, South Pacific, the Asian region, Ghana, etcetera.

2.2 Summary of the FAO E-mail Conference on Small-scale Milk Collection and Processing in Developing Countries, 29 May to 28 July 2000

By Jurjen Draaijer

Introduction

The focus of the E-mail conference was small-scale milk collection and processing in developing countries. This E-mail conference was designed to address the critical information gap that has inhibited the development of small-scale dairy development. It has managed to bring together 571 stakeholders who have actively participated in the conference and provided some very interesting and valuable accounts of experiences in their countries.

The free-flow of information and opinions in addition to technical information has given a clear indication of the current challenges and opportunities in the small-scale sector. The feedback provided by participants has provided guidance for the plans and activities of the Animal Production and Health Division of FAO in dairy development.

These were the objectives of the conference:

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

Summary of Participation

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

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.

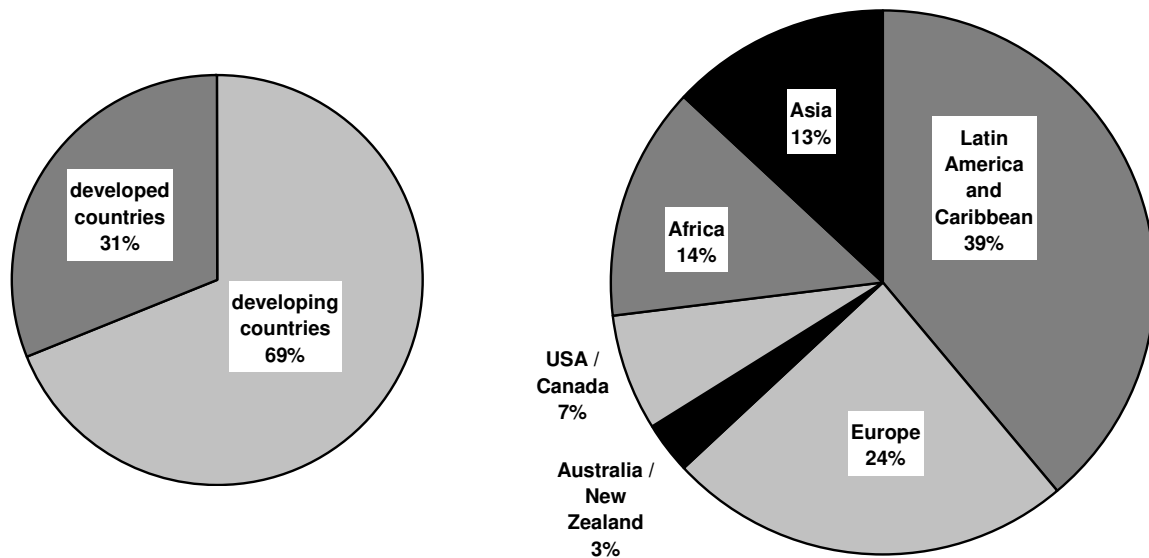


Figure: percentage participants from developed / developing countries and percentage participants from different global regions

Box: The Topics and Papers

Topic 1: From Farm to Collection point

- Clean Milk Production and Support Services
- Milk Collection, Preservation and Transport
- Milk Testing, Quality Control, Hygiene and Safety
- Milk Payments

Topic 2: Small-scale milk Processing Technologies

- Small-Scale Processing Technologies: Liquid Milk
- Small-Scale Milk Processing Technologies: Other Milk Products

Topic 3: Milk Producer Organisations (MPOs)

- Market Opportunities for Milk Producer Organisations
- Organisation and Management of Milk Producers Organisations”

Main Conclusions

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:** 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 part in the total milk marketed in developing countries.

The main **recommendations** of the conference are the following:

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 advice 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; and
 - 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 we will shortly be finalising the locations and conference contents. 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; and
- 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 proactive 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.

Evaluation and follow-up of the Conference

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. 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; and
- Agro-forestry and silvo-pastoral system.

Follow up discussions and actions to guide medium or long-term planning activities suggested 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; and
- 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;
- Technical methods to detect anti-nutritional 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; and
- Organising small groups of farmers on a self help basis.

Chapter 3 Group Session Discussion

3.1 Milk Producer Groups

3.1.1 Background paper on Milk Producer Groups

Milk Producer Groups: Background Constraints and Future Strategies

*Presented by: O.P. Sinha, Consultant
Dairy Farmer's Organization, Management & Training
A/6 Avkar Apartments, Nr IRMA
ANAND- 388 001(India)*

Introduction:

Most of the countries whether developed or developing, share a few things common, like agriculture, animal husbandry, climate, socio-economic structure and most importantly the developing economies of the country. Besides, we are all committed to improve the living standards of smallholders and there by of our country, as they occupy the major part of population in the country, by learning and sharing from each other in terms of experiences, practices and technologies in the field of agriculture, dairying etc.

The milk sector in developing countries was frequently dominated by a large and often state owned or controlled central dairy industry. An increasing trend towards the liberalization, privatization and market orientation, the governments in many developing countries are reducing their direct involvement in assistance to agriculture and allied activities and farmers are given more responsibility for their own development.

In developing countries, 80-90% of milk production comes from small-scale farming operations. Dairying has been cited as a significant means of achieving the “Economic-Socio” development of rural house holds. This is because milk can provide a daily income to the farmer for the most part of the year.

Background:

If we examine the history of dairying, the origin lies in the developing countries in Mesopotamia to be precise, at around 6,000-7,000 BC. And from this region, milk production and milk consumption spread to other regions in Europe, North & East Africa and Asia. The developing countries can be divided into traditional and non traditional milk producers. Traditional milk producing regions are roughly the countries of the Mediterranean and the Middle East, the Indian subcontinent, the Savannah regions Western Africa and the Highlands of Eastern Africa and to some extent South and Central America. In these regions the structure of milk production is characterized by not more than two to four milk animals per farmer. Dairying is often a part of mixed farming system, and dairy cattle are often used as draught animals as well. Livestock is fed principally on agriculture residues and waste and are grazing on natural pasture of non arable land.

In the non-traditional milk producing countries like South East Africa, China, Korea and Japan, the structure of dairying is more varied. Especially in the tropical and subtropical regions, besides small farms there are also large-scale specialized dairy farms, sometimes with more than one hundred cows, most of which were founded in colonial times or after the Second World war.

Milk Production Systems in Developing Countries:

In the developing countries the small mixed farm predominates. In Africa and Asia dairying is nearly always part of a mixed farming system, with, in most cases, no more than three or four dairy cows. By and large the milk production system in developing countries can be broadly classified into three main categories on the following basis:

1. Primary use of animals and consumption of dairy products

- a) Dairying for home consumption - specialised milk production for home consumption, where milk is an essential part of the household diet;
- b) Dual-purpose animal (milk and draught) - where seasonal surpluses of milk are converted into market sales of storable household products;
- c) Small-scale dairy farming – where milk and milk products are converted into market sales;
- d) Commercial dairy farming – where the animal holding is large and milk and milk products are converted into market sales.

2. Ownership of dairy farming

- a) State ownership – as it has been proven to be often inefficient this is rarely found in developing countries;
- b) Collective ownership – e.g. self help groups/milk bulking groups/cooperatives;
- c) Private enterprises – owned and run by an individual / in partnership as private business.

3. Area of operation

- a) Urban Milk Production System - small, medium and large scale dairy farms found near big urban centres with 10 to 50 milk animals, where milk production is the main economic activity with limited level of mechanization;
- b) Peri-urban milk production system - this includes small and commercial dairy farms found near the proximity of urban area;
- c) Rural milk Production system - where the farmer owns 2-5 animals, kept under traditional system and the milk is sold through middleman as they do not have the accessibility to the market.

In developing countries 80-90% of the milk production comes from small-scale dairy farming. As much as one third of the milk production is based in urban and peri-urban settings. Peri-urban and urban producers have one key advantage over their rural counterparts; they are located close to the market and can supply the market in a shorter time and 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.

In the urban and peri-urban areas the land prices continue to escalate faster than general price levels and the value of milk produced. This makes farm expansion or acquisition of farmland to be used for dairying uneconomical or beyond the reach of smallholders. Also the associated environmental and public health concerns over urban and peri-urban agriculture are growing for the future. Conversely, milk is more easily and more efficiently produced on grass or agricultural by-products.

Constraints:

Almost like any other business, the farmer who owns and looks after the livestock is paid low for his contribution in terms of management, breeding and feeding. The producers stay in remote and isolated areas and do not have the links with the urban consumer, which puts them under a pressure to come under the clutches and vicious cycle of middlemen who exploit them. This situation also induces other disadvantages like decreased quality of milk along the distribution

chain, while its price increases significantly; reason being that each middleman adds his commercial margin. This results in very low returns for their milk. Apart from the middlemen the other factors responsible for low returns are:

- Milk production in developing countries takes place in smallholdings, both in terms of land and animals, scattered through out the country. Reaching out to such a scattered smallholder for technology transfer and extension support is, to say the least, a difficult task. Therefore no access to latest and updated technical information and training related to management, breeding, feeding, milk sanitation and hygiene.
- Lack of low cost small-scale milk chilling and processing technologies.
- No platform for sharing and exchange of information on small-scale milk collection and processing.
- Lack of awareness towards the legal and food safety measures.
- Lack of realization of opportunities developed to enter in the market due to withdrawal of many Governments from milk collection and processing.
- Lack of good quality credit; most of the farm level credit for smallholder dairy production comes from the traditional money lenders.
- Non-availability of regular and affordable support services for milk production enhancement.
- No recognition for women involvement in dairying.

In addition, the development of small-scale dairying in developing countries also needs to address the following constraints/challenges:

1. To satisfy the consumer awareness – the consumer is looking for value for money (he/she is spending in buying the milk and milk products) in terms of quantity & quality.
2. Milk being a perishable commodity - Quality preservation is another challenge.
3. Market Competition
4. Distribution and marketing of milk by ‘unorganised-sector’ under most unhygienic condition.
5. No regular and assured market.

A Possible Solution:

To over come all these problems, the solution for milk producers seems to be to come out of the isolation and vicious cycle of middlemen and to establish their own organizations (working groups, associations or cooperatives), which should be owned, controlled and managed by producers themselves. A farmers’ organization can be an effective tool for influencing decision making in the producer’s interest and mobilising resources for development. It can also act as link between farmers and the state in the exercise of policy making and execution. This will help them in getting the remunerative return to their product.

The successful experiences of “Operation –Flood” (OF) in India, which is now the largest milk producer in the world, is perhaps the best possible example of producers’ involvement. This has proved that such producer oriented organization increases the producers’ participation in the business chain leads to face the competitiveness (price and quality) in the open market, also helps in production enhancement and leads to national self sufficiency for dairy products. The other success stories include Bangladesh, Nepal, Kenya and Uganda.

Based on the Indian experience, the following approach may be adopted for establishing the Milk producers’ group/association/cooperative. Although the dairy farmers experience common problems and have similar interests, suitable modifications can be made in the framework and modus operandi as per the need of the respective countries.

Initially, the organizational structure may consist of two tiers – Village Milk producers Group/Cooperative societies (VMPG/VMPCS), and Milk Producers Union/Milk Producers Cooperative Union at the District/Regional level. Later on, if a felt need is there from marketing view point a third tier may be added at National level. All these units/ tiers are will be owned by the producers, controlled by the elected representatives of members and managed by hired professionals and function in accordance to adopted Bylaws. The main functions and responsibilities of **VMPG/VMPCS** are to:

- (a) procure, test and regularly pay for the milk;
- (b) provide Veterinary First Aid and Artificial Insemination facilities;
- (c) arrange other technical support services;
- (d) sale liquid milk locally and to District/Regional level Milk Union i.e. provide a regular market.

The principal functions and responsibilities of the **District /Regional Milk Unions** are:

- (a) Own and operate-Dairy plant, Chilling centres, Cattle feed plant, liquid nitrogen plant and Semen Bank;
- (b) Arrange transport and procure milk from VMPG/VMPS, process milk and manufacture milk products and marketing;
- (c) provide technical support services;
- (d) provide technical guidelines, advice, training and field extension programmes to members and staff of VMPG/VMPS;
- (e) Organise and supervise VMPG/VMPCS.

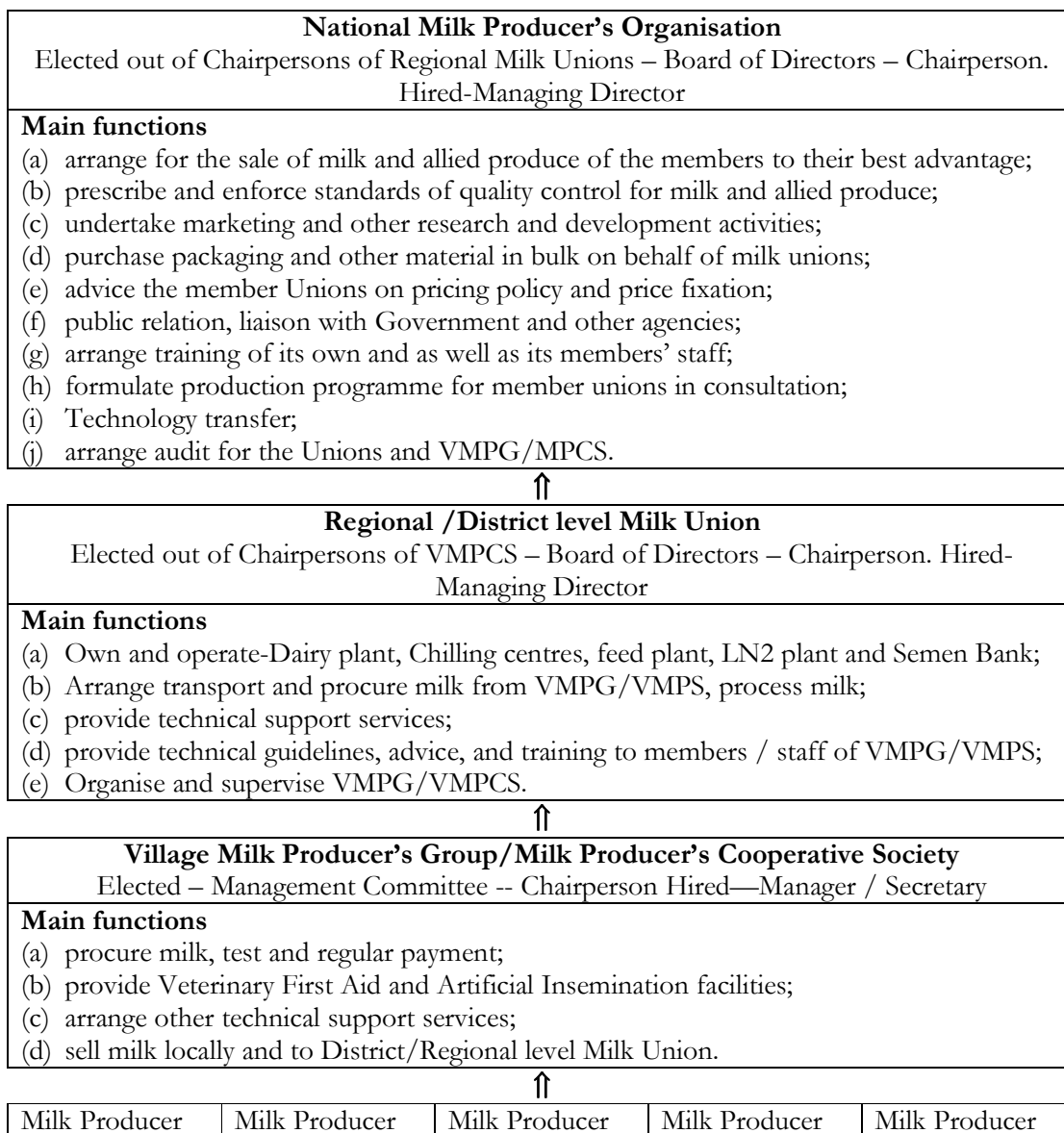
The main functions and responsibilities of the **National level Milk Producers Organisation:**

- (a) arrange for the sale of dairy and allied produce of the members to their best advantage;
- (b) prescribe and enforce standards of quality control for dairy and allied produce;
- (c) undertake market and other research and development activities;
- (d) purchase packing and other material in bulk on behalf of milk unions;
- (e) advice the member Unions on pricing policy and price fixation, public relation, liaison with Government and other agencies;
- (f) arrange training of its own and as well as its members' staff;
- (g) formulate production programme for member unions in consultation with them;
- (h) technology transfer
- (i) arrange audit of the Unions and VMPG/VMPCS.

Conclusion:

Milk Producer organizations can play a vital role in the dairy development process in developing countries. The organization of milk producers in a group will have the potential to meet the required increased demand for milk and milk products in the market. The basic philosophy of this vertically integrated structure is to establish a direct linkage between milk producers and consumers eliminating all the middlemen. These organizations may grow to become centres to provide support services like veterinary aid, artificial insemination, supply of concentrates, extension, training, milk collection, processing and marketing of milk and milk product. This system transfers the largest share of the consumers' price to the producers.

FLOW CHART FOR SUGGESTED MILK PRODUCERS ORGANISATIONS



Questions for Discussion:

As suggested in this paper, do you agree that if dairy farmers come together and organize into a vertical integrated structure which is owned, controlled and managed by themselves, most the constraints identified by the e-mail conference may be easy to over come? If not, what are other possible solutions?

References:

1. Report of the FAO E-mail Conference on Small-scale Milk Collection and Processing in Developing Countries (29 May-28 July 2000) :
 - An Introductory Paper: “overview of small-scale milk collection and processing in developing countries by Jean Claude Lambert, Brian Dugdill, Jurjen Draaijer and Anthony Bennett, Animal Production Services (AGAP) FAO, Rome.

- Conclusions and Recommendations.
 - Discussion Paper – “Market Opportunities for milk Producers Organisations” by Steven J. Staal, International Livestock Research Institute, Nairobi, Kenya.
 - Discussion paper - “Organisation and management of Milk producer Organisations” by J. Phelan, International Consultant on Livestock Food Systems and Rural Development.
2. Papers presented at the NDDDB –ILRI South –South Workshop on Smallholder Dairy Production and Marketing – Constraints and Opportunities. March 2001 at Anand (India)
 3. Papers presented at the “FAO–NDDDB Workshop on Market oriented dairying – Role of Producers Organisations and NGOs. December 1997 at Anand (India).
 4. Understanding Dairy Production in Developing Countries. By: Dr John W. Hibbs and Dr. W.G. Whittlestone. Published by Volunteers In Technical Assistance(VITA), Virginia, USA
 5. ”Smallholder Dairying in the Tropics” By: Falvey L. and Chantalakhana C. (eds), International Livestock Research Institute, (ILRI) Nairobi, Kenya.
 - Chapter 1: The Dairy Industry in a changing world .by; H. Schelhaas
 - Chapter 2: Dairy production System in the Tropics. By P.N. de Leeuw, A. Omere, S. Staal and W. Thorpe
 - Chapter 3: Socio economic aspects of smallholder dairy farmers by A.J. de Boer.
 6. “Innovative business model for dairy development” by Jaswant S Bhandir, International Improvement Mission, Chnadigarh (India).
 7. The group promoter’s resource book. FAO 1994.
 8. Saga of Anand-Pattern Co-operatives- A Proven Model for Rural Development through Cooperatives in India By Singh S.N.1996
 9. Anand Pattern and Operation Flood-An Overview-A report prepared by NDDDB.
 10. Training Mission report –Training Programme for the small-scale dairy sector FAO Project ‘TCP/KEN/6611 by OP Sinha 1997.

3.1.2 Conclusions from group sessions

1. Ranking of constraints:

• 1. No village level Milk Producer Groups (e.g. China, Pakistan)	7 votes
• 1. Lack of Education and Training	7 votes
• 3. Lack of Milk Production Support Services	4 votes
• 4. Lack of appropriate policies	3 votes
• 4. Milk Safety (also due to privatisation)	3 votes
• 6. Middlemen take share of farmers	1 vote
• 6. Neglecting other species (e.g. Yak, buffalo, goat)	1 vote
• 6. Small milk volumes are difficult to collect (Mongolia, Pakistan)	1 vote
• 9. Farmers bypass collection centres and sell milk by themselves	0 vote
2. Solutions:
 - Training and education to show benefits of MPGs at village level
 - FAO pilot projects
 - Training centres: Government / NGOs / Companies
 - Governments to establish favourable policies for formation and functioning of MPGs at all levels
 - Group organisation should start at village level (local farmer leaders, existing groups)
 - Farmers should own their groups (e.g. by shares)
 - Groups first start with collection, followed by marketing and simple milk production

support services

- Provide Marketing support (by MPGs, Companies, shops, etc)
- Training for Milk Safety
- Groups to introduce payment according to quality
- Regular milk payments

3.2 Marketing of dairy products

3.2.1 Background paper on marketing of dairy products

Challenges facing dairy markets in developing countries

A. Omore,
International Livestock Research Institute & Kenya Agricultural Research Institute
Nairobi, Kenya

Introduction

It is widely recognized that small-scale dairying plays a major role in the livelihoods of millions of poor people in developing countries and is a promising avenue out of poverty for millions more. The acknowledged benefits from dairying include good returns (compared to most traditional agricultural commodities) and income generation opportunities for producer households and for rural and urban market intermediaries through their participation in processing and marketing. The 2000 FAO E-conference on “Small-Scale Milk Collection and Processing in Developing Countries” discussed a number of critical constraints that need to be resolved and proposed a number of opportunities that need to be exploited to realize further benefits from small-scale dairying. This paper summarizes the main dairy marketing issues raised at the E-conference and poses questions that need to be resolved to improve small-scale dairy marketing systems. The issues are presented for further discussion in the context of the current and future trends in dairy supply in developing countries.

Current trends in dairy marketing

A major outcome of the FAO E-conference was the widespread recognition of the important role of informal (“raw or traditional”) milk marketing in developing countries, with pasteurized and other milk product markets playing only a minor role. The informal milk markets flourish because they are favoured by current trends in production and consumption of dairy products. In a recent review, de Leeuw *et al.*, (1999) summarize that most milk production in tropical developing countries is concentrated near consumption centres with specialized smallholder (and large scale in some cases) dairy farms generally located close to (peri-urban) or within (intra-urban) major markets, or more distant when there is an efficient market infrastructure (e.g., India and parts of Latin America). The systems of marketing are also heavily influenced by traditional consumption habits. Although there are small market segments that consume processed dairy products, consumption and preferences in many consumption centres are mostly for low-cost liquid raw or soured milk (where the regulatory institutions allow their sale). In addition, the often-poor state of infrastructure favours informal markets. In other parts, non-liquid traditionally processed dairy products form an important part of the diet: in Ethiopia and in west Africa traditional butter and soft cheeses form an important proportion of marketed dairy production. In south Asia, the consumption of fermented and sweetened dairy products is common.

One discussion paper in the E-conference cited figures that capture the reality of the current situation by showing that informal milk sales comprise over half of traded milk in most countries (Table 1). It was also recognized that this situation reflects widespread consumer reluctance to pay for “value-adding”, and that what some people may consider as “value-adding” may actually mean “cost-adding” in the mind of the consumer. It was observed that in some cases where milk is processed, intermediaries take as much as 80% of the consumer price. The high additional costs incurred by poor consumers in such cases are what seem to favour shorter milk market channels and limit the development of processed milk markets. Informal markets on the other hand offer higher prices to farmers and lower retail prices to consumers. Where intermediaries are involved (over half the milk sales in most circumstances pass through intermediaries), they take only 20-50% of the consumer price. Recent data gathered by ILRI and partners in various sub-Saharan Africa countries indicate that common intermediaries in informal liquid milk marketing include mobile (itinerant traders), assemblers, wholesalers, cooperative, self help groups and retailers in milk-bars, shops and kiosks. The market shares of traded raw milk between various types of intermediaries can be quite dynamic in response to risks faced as some evidence from Kenya shows. Indications in 1999 were that many producers who opted for small milk traders to buy their milk after market liberalization in 1992 had returned to traditional dairy cooperatives as the costs and risks of dealing with informal intermediaries were found to be too high (Morton *et al.*, 1999).

Table 1: 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

Source: E-Conference discussion paper on “Market Opportunities for Milk Producer Organizations” by Staal.

A number of issues were raised in the E-conference in relation to the large market share of informal markets including: their efficiency, reliability, waste and spoilage incurred and concerns on the safety of marketed raw milk. It is considered that since informal markets will continue to dominate in the foreseeable future, more attention must be given to resolving the constraints affecting them, bearing future trends in mind. The future trends have been well captured by predictions by Delgado *et al.*, (1999) that indicate high dairy production growth (relative to developed countries), mainly in response to large increases in demand driven by human population growth, urbanization and modest increases in incomes. Future challenges in milk marketing will directly relate to these changes.

Major constraints facing dairy markets in developing countries

How will current dairy market structures in developing countries evolve?

One pertinent issue that was not discussed in much detail in the E-conference is how the impending large increases in demand for dairy products would alter the current dairy marketing structures in developing countries. In this connection, the questions that come in mind are: for how long will the current dairy market structure continue to dominate? What changes in the supply (scale of farms and market supply chains) of milk and dairy products will likely occur? What other driving forces besides the stated changes in population, urbanization and incomes are

likely to be important? What specific interventions are required in specific regions? No attempt is made here to provide specific answers to these questions, but to begin to answer them, the current trends in dairy supply and demand within and between various developing regions must be considered.

Examples from Kenya and India indicate that regional differences in consumer preferences will play a major role in influencing the evolution of dairy markets in different regions. Evidence from Kenya that likely applies to many countries in the region indicates that the current structure of milk marketing will not change fast due to strong traditional preferences. Following milk market liberalization in 1992 and the subsequent collapse of the only dairy processing parastatal, as many as 50 milk processors entered the market most of who hoped to fill the gap in the pasteurized and packaged milk supply and reap huge benefits. To the disappointment of many, this gap was filled quickly and today only half of these processors survive and virtually all who survive operate at below their full capacity. A major reason for the disappointment was failure by the entrepreneurs to recognize that the market for pasteurized and packaged milk market in Kenya has not been growing. Available figures show that pasteurized milk supply has stagnated at 500,000 litres per day over the last decade. This figure represented only 12% of the milk market in 1997.

However, evidence from India provided by P. Gupta in the E-conference (p. 117), and which also must widely apply, suggests that under other circumstances, growth in consumption of “value-added” dairy products can occur very fast as shown by the reported five-fold increase in the volume of processed milk in the last 30 years. Though the Indian report does not provide the specific reasons for the high rate of growth in milk processing, differences in consumer preferences between the two countries has likely played a major role. Kenya and India differ significantly in that regard in that while in Kenya the demand is largely for liquid milk, in India there is a significantly market share for processed products such as fermented products, cheese, and sweets. Further in Kenya, contrary to previous assumptions, survey data gathered in 1999 by ILRI and Kenyan partners showed that high-income consumers express the same preference for raw milk as do those with lower income, and often end up buying more of it. However, depending on location, consumers in Kenya did not always buy what they preferred. For example, in the largest city of Nairobi, the majority (78%) of consumers bought pasteurized milk. This reflects the inability of raw milk markets to satisfy areas of large consumer demand and indicates that milk processing in the region will mainly take root in response to urbanization. The role of public organisations should be to provide relevant information on such trends to guide current and future investments.

Some producers have responded to increasing demand for dairy products in large cities (e.g., Dar-es-Salaam) by moving large numbers of dairy cattle to the urban area and selling milk directly to consumers. It is likely that in other urban areas too, dairy production will initially increase but would quickly reach its limits as urban land is put to alternative more productive uses. As milk demand in urban areas outstrips the ability of informal markets to supply, it can be expected that opportunities for selling processed milk will increase despite any revealed preference for raw milk. The sales will require an increasing number of intermediaries to prolong the shelf life of milk through processing. Practical technology options such as those proposed in the E-conference under the “Village Milk System” to prolong the shelf life of milk will therefore become increasingly necessary. A key question is how best to target such technologies and encourage their adoption in the areas that will need them most. Answers are also required on the specific market opportunities, economic viability and ability to fit within the existing institutional structures in specific countries.

What interventions are needed to encourage collective action and how should they be implemented?

Some form of collective action has always been considered an important mechanism for reducing transactions costs in milk marketing and losses from milk spoilage, especially where small quantities per unit are involved. The role and limitations facing farmer cooperatives, and the principles that seem to govern the performance of such groups were well argued in the discussion paper on “Market opportunities for milk producer organisations (MPOs)”. The principles outlined in the paper included the following considerations: amount of milk surplus in a given location; nature of local dairy consumption habits; nature of competition from the informal market; and, institutional issues. The E-conference contributors admitted to only few successful MPOs outside Asia, indicating that these principles have often been overlooked in the formation of such groups. One of the common driving factors for the formation of such groups is their success in developed countries in the past. It is clear that such successes cannot be easily replicated in many developing countries. Given the small-scale production and small quantities of milk/unit in most developing countries, efforts to act collectively must continue to be encouraged. The paper suggested public support of some kind for MPOs, as was the case with the Amul and Operation Flood in India. The specific types of public support required including clearly defined options for their implementation need to be spelt out for consideration for funding by governments and other development agencies.

What trade-offs between market efficiency and public health will be needed?

In response to the “trigger” question on the relevance of milk processing in developing countries, most contributors were affirmative in their response but there were few suggestions on how to improve the performance of the currently dominant informal raw milk markets, without necessarily pushing them to process their milk. A pro-active regulatory and policy approach to dealing with the informal markets was proposed but participants did not discuss how to go about this. Improvements in current dairy markets need to be considered in conjunction with the needs for the development of appropriate operational health standards and regulations for informal markets since health considerations will increase as more intermediaries get involved in trading milk. Optimal strategies will need to consider trade-offs between efficiency in marketing of informal milk and the operational standards required. When defining the trade-offs, considerations for consumer practices that reduce health risks such as boiling milk prior to consumption, will be critical, and should be encouraged as long as raw milk markets predominate.

What will be the effects of free international trade on milk markets?

References were made in the E-conference to the potential influence of WTO agreements on domestic milk markets. Some arguments were put across that the non-tariff (mainly sanitary) trade barriers that the agreements entail would have adverse effects on the dairy industry in developing countries. It is however more likely that, given the low level of dairy exports from developing countries, many domestic markets will benefit from the prospects for reduction, or even removal, of export subsidies by industrialised countries, thereby curtailing imports and contributing to increased domestic prices that would benefit dairy producers. Developing policies that would spread such benefits to poorer sections of societies should be a preoccupation for governments. In addition, individual countries and regions would need to take care that the international trade regulations in the WTO agreements that they consent to do not force them to limit opportunities for the poor in their domestic markets.

Trigger questions for discussion

1. If informal raw milk markets are going to be dominant in the foreseeable future, what specific general and region-specific policy options need to be encouraged to stimulate the response of the informal markets to the changing market environment?

2. Realising the continued dominance of informal milk markets in developing countries, what trade-offs are required between economics and milk quality to optimize the benefits of small-scale dairying?
3. What institutional mechanisms are needed to generate and disseminate required market information including promoting appropriate technology options?

Main References

1. de Leeuw, P., Omore, A., Staal, S. and Thorpe, W. 1999. Dairy production systems in the tropics. Book Chapter In: Falvey, L. (ed.), Chantalakhana, C. (ed.) Smallholder Dairying in the Tropics, p. 19-44. Nairobi (Kenya): ILRI ACC. No.: IL-990209
2. Delgado C., Rosegrant M., Steinfeld H., Ehui, S. and Courbois C. (1999). Livestock to 2020. The Next Food Revolution. IFPRI/FAO/ILRI. Food, Agriculture, and the Environment Discussion Paper 28.
3. FAO. 2001. Report of the FAO E-mail conference on “Small-Scale Milk Collection and Processing in Developing Countries” 29 May – 28 July 2000. pp146.
4. Morton, J., Coulter, J., Miheso, V., Staal, S., Kenyanjui, M. and Tallontire, A. (1999). Provision of agricultural services through Co-operatives and Self-help Groups in the dairy sector of Kenya. NRI Report OVI 3.1, Natural Resources Institute, Chatham, UK.

3.2.2 Conclusions from group sessions

1. constrains listed:

- Unorganised /Informal Sector
 - A) Quality - Milk is highly perishable/ Standard/ Health.
 - B) Poor market access - Small quantities/ Limited range of products/Lack of infrastructure/ Poor packaging.
 - C) Seasonality- Supply fluctuation, Short shelf life.
 - D) Lack of information.
- Organised/ Formal Sector
 - A) Quality - Milk is highly perishable/ Standard/ Health/ Mixing of milks.
 - B) High competition - local and global - MNCs and other local organised sector (scale of business- financial strength) / Use of imported milk powder & other/ High cost/ Lack of strategic alliances.
 - C) Lack of policy to promote quality - labelling and enforcement of standard.
 - D) Generic milk promotion

2. Solutions

Unorganised /Informal Sector:

- Create infrastructure for marketing to improve market access
- Make products with longer shelf life.
- Collective action.
- Promote low cost system that reduce bacterial growth e.g. LPS, Cooling, Heating
- Make products with longer shelf life for solutions of seasonality
- Improved animal management practises.
- Generate and disseminate appropriate information lack of information/extension material

Organised/ Formal Sector

- A) Competition
 - Policy to promote level playing field
 - Provide market information
 - Promote formation of producer groups.
- B) Lack of policy to promote quality
 - Adopt and enforce appropriate standards
 - Promote consumer information
- C) Generic milk & milk products promotion
 - Campaign for promoting milk by government agencies
 - Media
 - School syllabus
 - School milk programmes
 - Campaign by dairy industry getting together
- D) To help sort out problems various bodies will have to be involved like Local Govts., Dairy industry, Research Institutions, NGOs, FAO, World Bank and other International Regional and National bodies.
- E) Role International bodies like FAO/IDF can play a crucial role in providing forums for sharing of lessons from successes in dairy field across the world.
- F) Apart from information sharing also sharing practical experience through expert exchange programme and on the job learning opportunities could be arranged

3.3 Milk processing at village level

3.3.1 Background paper on milk processing at village level

Milk Processing at Village Level or Small-scale Milk Processing

Tek B. Thapa
FAO Dairy Consultant

Background

The organized dairy sector / large processors handle a small share of milk produced in developing countries. Most milk is marketed through informal channels. To cite a few examples, India, the largest milk producer, markets almost 83 % of its production through informal channels. Similar is the case with other South Asian countries like Pakistan, Bangladesh, Bhutan and Nepal. Published data confirm that informal marketing is also dominant in Kenya, and other East African countries. In West Africa milk is processed traditionally as sour milk, and marketed by household processors. The situation is similar in the developing countries of Caribbean and South America.

Under this situation, village milk processing is a very vital income-generating activity at the producer's level. There is no other farm produce that generates cash income twice a day, except milk. Thus, the processing of milk at village level has been recognized as an effective tool for rural poverty alleviation in the developing countries.

Major constraints identified during the email conference were lack of technical and business skills, lack of appropriate technology and equipment to process on a sustainable basis, poor business and market information and policy shortfalls promoting small-scale processing. This paper intends to initiate the focused discussion on the conclusions and recommendations made specifically in relation to the Asian regional needs, and propose an action plan, to promote milk processing at village.

First, as an example of milk processing at village level, a summary follows of the 'village milk system' which was described by B. Dugdill in his poster paper during the E-mail conference. Then follows a section on traditional milk products with extracts from the poster paper of the E-mail conference by P.R. Gupta (India), titled 'traditional milk products from India'. The challenges and opportunities for small-scale milk processing are then mentioned and some issues to facilitate the discussion during the group sessions conclude the paper.

The village milk system

The village milk system is developed by FAO and is a combination of the Lactoperoxidase (LP) system of milk preservation and an innovative milk pasteurising unit developed in Kenya, called MILKPRO. The unit first fills raw milk into pre-formed polyethylene pouches, the pouches are immediately sealed, treated at 65 °C for 30 minutes in a batch pasteurizer, and cooled to 5 °C in a chiller. 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.

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, compared with the 2 to 5 days for milk processed and packaged on more conventional equipment - 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. The small-scale milk processing project based on village milk system has been successfully launched in Guyana under a FAO technical cooperation project in collaboration with the government.

The village milk system offers groups of small producers the opportunity to add extra value to their milk. FAO's immediate aim is to increase producer returns by 50 percent, and to provide consumers with an increased volume of an attractive quality product at competitive prices. The Village Milk System meets the key requirements for efficient, low cost milk collection and processing for smallholder marketing groups, whether they are co-operatives or private companies.

More information on the village milk system can be found at FAO's Dairy Information Page at <http://www.fao.org/ag/aga/agap/lps/dairy/intro.htm>

Traditional Milk Products

The issue of traditional milk products created a lot of interest during the E-mail conference. The poster paper by Gupta, 'traditional milk products from India' initiated these discussions. It is believed that the increasing demand for traditional products present a great opportunity for small-scale milk processors. FAO published a book in 1990 called 'the technology of traditional milk products in developing countries', which can also be found at the Dairy Information Page on the web.

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:

- Low level of technical skills;
- Limited access to information, training and skill development;
- Lack of appropriate small-scale technology and equipment to process on a sustainable basis;
- Technical guidance and advisory services;
- Food safety and quality requirements.

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 large scale dairy industry are 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 (for example traditional milk products), using simple and low cost technology, and that generates higher returns.

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.

Conclusion

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 the Asian region are invited to share their experiences on the problems faced by the smallholder dairy processors, and how best could the problems be solved. This would help to formulate common strategies, for promotion and further development.

Issues to initiate discussion during the group session

1. Can small-scale Asian milk processors learn from each other regarding the issue of traditional milk products? If so, what would be according to you the best action plan to take in order to facilitate the exchange of information?
2. Repeatedly during the E-mail conference the issue of the lack of small-scale milk processing technologies was mentioned. Which small-scale technologies are available in your country or in other countries that you know of?
3. What would in your country be the steps to be taken in order to increase access to information, training and skill development for small-scale milk processors? Who would be responsible for each step?

3.3.2 Conclusions from group sessions

1. Prioritized Constraints on milk processing at village level are the following:

- Lack of training including technology/marketing, facility
- Low level of technical skills
- Difficulty in access to market-oriented technology, skills, products, knowledge
- Access to information on equipment and related inputs at national/regional/global level
- Availability of high quality
- Poor or lacking regulatory frame-work or regulation
- Poor awareness of consumer/competent authority on Small-scale products
- Lack of capacity of extension in both private and public sector
- Inability to meet the requirement of regulation.

2. Recommendations/suggestions:

- Lack of training including technology/marketing, facility
 - Regional dairy training centre in South Asia and East Asia should be established or rehabilitated.
 - Small mobile training units to be introduced.
 - Training of trainers
 - Planning and coordination requirement
- Low level of technical skills
 - Training of farmers, processors and extension personnel
 - Planning of training programmes (short, medium and long-term)
- Difficulty in access to market-oriented technology, skills, products, knowledge
 - Directory of information at national and regional level (website and hard copy production)
 - Establishment of a resource centre in each country (medium to long-term)
- Access to information on equipment at national and regional level (combined with number three)
- Availability of high quality raw milk
 - training of farmers/processors
 - Framework for ensuring raw milk quality (including legislative aspect and operational aspects)

3.4 Milk testing and payment systems

3.4.1 Background paper on milk testing and payment systems

Milk Testing and Payment Systems in Developing Countries

*by Jurjen Draaijer
FAO consultant*

Introduction

The establishment of good milk testing and payment systems form the basis for a hygienic high quality dairy product. The methods used for milk testing are usually related to the payment system adopted. Below a description is given of a few very simple milk testing procedures, suitable for small-scale milk producer groups in developing countries. There are many other tests, often more complicated and more expensive. In the context of the subject of this workshop, being 'small-scale' the focus will be on simple and const effective tests. After that some examples

follow of very simple milk payment procedures. This article is used as a starting point for this workshop and in the end some questions and discussion points can be found that will be used to initiate discussion.

Milk testing

The testing methods below focus on milk reception tests that can be carried out at collection centres. Milk testing for quality can be divided into testing for hygiene and for composition. Some examples of tests, in order of cost and simplicity are described below:

1. taste, smell, visual observation and temperature

This should always be the first screening of the milk, since it is cheap, quick and does not require any equipment. These tests are also called 'organoleptic tests'. It is also reliable if the person carrying out the tests is experienced. The tester smells the milk, observes the appearance, tastes if necessary, checks the can for cleanliness, looks for sediment, and filters the milk to check its cleanliness. If doubts arise after the examination about the quality of the milk, other tests can be done to determine the quality.

2. density meter or lactometer test

With a lactometer the specific density of milk is measured. At 15 degrees Celsius, the normal density of the milk ranges from 1.028 to 1.033 g/ml, whereas water has a density of 1.0 g/ml. So when you read the lactometer, you can determine whether water has been added to the milk. It is best to combine the lactometer reading with the fat test: if the results of the fat test are low and the density is high (e.g. 1.035), then the milk might have been skimmed. If the results of the fat test are low and the density is low (e.g. 1.027), then water might have been added to the milk. You can use the lactometer reading together with the fat percentage to estimate the Solids Non Fat (SNF) content of the milk.

3. clot-on-boiling

The clot-on-boiling test is simple, quick and cheap. If the milk is sour or if the milk is abnormal (colostrum or mastitis milk) the milk will not pass this test. Place test tubes with 5 ml of milk for up to 4 minutes in boiling water or in a flame. Examine the tubes and reject the milk if you can see the milk clotting. Please note that at high altitude milk boils at a lower temperature. This test is not very sensitive to slightly sour milk and an alternative is the alcohol test.

4. alcohol test

If the milk is sour or if the milk is abnormal (colostrum or mastitis milk) the milk will not pass the alcohol test. You carry out the test by mixing equal amounts (2 ml) of milk and a 68% ethanol solution (made by mixing 68 ml of 96% alcohol with 28 ml distilled water). Milk that contains more than 0.21 % acid will coagulate when alcohol is added.

5. acidity test

This test measures the lactic acid in the milk. If the acidity is higher than 0.19 %, then the milk quality is poor and cannot be processed. If the acidity is lower than normal (e.g. 0.10 % lactic acid) then the milk is of poor bacterial quality or sodium hydroxide / bicarbonate might have been added. For this test you will need a white porcelain dish, a 10 ml pipette, a 1 ml pipette, a burette (0.1 ml graduations), a glass rod for stirring, a phenolphthalein indicator solution (0.5% in 50% alcohol) and a 0.1 N Sodium Hydroxide solution. Measure 9 ml of the milk into the dish, add 1 ml of phenolphthalein and from the burette, slowly add the 0.1 N sodium hydroxide solution while mixing continuously, until a faint pink colour appears. The more Sodium Hydroxide you have to add before it turns pink, the more acid the milk.

6. Gerber test for fat

This test is used to determine the fat content of the milk. 10.94 ml. of milk at 20 degrees Celsius is added to a butyrometer together with sulphuric acid and amyl alcohol. After centrifugation, the sample is put in a 65 degrees Celsius water bath and read after 3 minutes. The fat content from this reading should not be less than 3 %.

Milk payment systems

Milk can be priced according to quantity, composition, hygiene or a combination of these criteria. Any milk payment system should be:

- Fair for both farmer and processing centre;
- discourage unfavourable changes in composition;
- provide opportunities for shifts towards production of more valuable and hygienic milk;
- A payment system should be adjusted to the local situation and local composition of milk.

When a group of farmers is just starting with the collection of milk, milk screening could be restricted to the visual method and pay on a volume or weight basis. This has the disadvantage that milk of a better quality is not rewarded and that there is no incentive to improve milk quality. Since most payment systems are based on solid contents, it is more appropriate to measure the weight of the milk. The yield of milk products will depend on the amount of total solids present. The greater the amount of fat and protein in milk the greater the yield of cheese and milk with a high fat content gives more butter than milk with a low fat content.

In the interests of equity and in order to promote quality improvement, it is desirable that a payment system with bonuses for quality is introduced at an early stage. The cost of such a payment and testing system should not be higher than the advantages gained. There are many other, more complex payment systems based on protein, cell count or other parameters, but in the context of this workshop these will not be described. For the examples below, the following background information is used:

Background information for examples: (@ is a money unit)

Base milk price:	5 @/kg
Milk Producer 1:	20 kg milk with 4.2 % fat, density 1.036
Milk Producer 2:	20 kg milk with 3.5 % fat, density 1.032
Milk Producer 3:	20 kg milk with 2.8 % fat, density 1.028

Payment Method 1. Based on volume or weight

This is the simplest method and it is easy to calculate. A weighing machine can be used or a spring balance.

Example Method 1:

Producer No.	Kg milk	@/kg	Total price
1	20	5	100
2	20	5	100
3	20	5	100
Total	60		300

Advantages of method 1:

- simple to calculate the milk price
- no expensive testing equipment is needed

Disadvantages of method 1:

- has no incentive to improve quality of milk.

To make this method more sophisticated, any milk below a certain density can be refused to deter milk producers from adding water to it. A penalty for low fat could also be introduced (see below):

Penalty for low fat

You could introduce a penalty for milk delivered with a fat percentage below 3.0 %, for example with a 2.8% fat content:

Penalty below 3.0 % fat = $-2.0 @ \times (3.0 - \text{fat } \%) \times \text{kg milk}$

The milk producer number 3 will now get less money for his / her milk:

His / her penalty will be: $-2.0 @ \times (3.0 - 2.8) \times 20 \text{ kg} = -8.0 @$

Price = $20 \text{ kg milk} \times 5 @ = 100 @ - \text{penalty} = 100 - 8 = 92 @$

Payment Method 2. Based on fat amount

This payment method is based on the amount of fat a producer delivers. In this example we use the amount of fat (in kg) rather than fat percentage, because this will discourage farmers from adding water. If you use fat percentages, this means that a farmer would get more money if he or she adds water to the milk. For example:

Milk price for 3.2 % fat is 5.0 @ per kg

Milk price for 4.0 % fat is 5.2 @ per kg

A farmer with 20 kg milk with 4% fat (total amount of fat is 0.8 kg) will get $(20 \times 5.2 @ =) 104 @$. If this farmer adds 5 kg of water to his milk, his fat percentage will go down to 3.2 % (0.8 kg fat / 25 kg), but he will get more money for his milk despite the lower price per kg $(25 \times 5.0 @ =) 125 @!!!$

To prevent this from happening, it is better to use a payment system based on kilograms of fat:

Example Method 2:

Milk price is 142.90 @ per kg of fat

Producer No.	Kg milk	fat %	total kg fat	Total price
1	20	4.2	0.84	120
2	20	3.5	0.70	100
3	20	2.8	0.56	80
Total	60			300

@ is a money unit we use in this book

Advantages of method 2:

- fairly simple to calculate the milk price
- no benefits for milk producers adding water to the milk

Disadvantages of method 2:

- you will need to buy fat testing equipment

Payment Method 3. fat and solids not fat (SNF)

This method is based on the fat and SNF content of milk. The yield of milk products will depend on the amount of total solids (TS) present. The greater the amount of fat and protein in milk the greater the yield of cheese, and milk with a high fat content gives more butter than milk with a low fat content.

Calculation of TS and SNF

Total Solids can be estimated from the corrected lactometer reading (L).

$$TS = \frac{(L-1) \times 1000}{4} + (1.22 \times \text{fat \%}) + 0.72$$

Once you have the TS, you can estimate SNF as follows:

$$SNF = TS - \text{fat \%}$$

Example of SNF calculations:

Producer No.	fat %	density	TS %	SNF %
1	4.2	1.036	14.84	10.64
2	3.5	1.032	12.99	9.49
3	2.8	1.028	11.14	8.34

Payment system

The payment system is based on a price for fat and a price for SNF. The price of the milk can be calculated according to the formula:

$$\text{milk price} = \text{litres of milk} \times \left\{ \frac{(\text{fat \%} \times \text{fat price})}{100} + \frac{(\text{SNF \%} \times \text{SNF price})}{100} \right\}$$

Example Method 3:

Milk price for fat is 50.9 @ and for SNF is 33.9 @ per kg.

Producer No.	Kg milk	fat %	SNF %	Total price
1	20	4.2	10.64	114.9
2	20	3.5	9.49	100.0
3	20	2.8	8.34	85.1
Total	60			300.0

@ is a money unit we use in this book

Advantages of method 3:

- provides an incentive to increase fat and SNF

Disadvantages of method 3:

- complicated to calculate the milk price
- you will need to buy fat testing equipment and a density meter

Frequency of milk payments to members

Frequency of milk payments can be daily, weekly, once every two weeks or on a monthly basis. Where the milk price is based on average composition for a period of two weeks or monthly averages, the interval between payments is normally two weeks (4 to 6 weeks after first delivery). Intervals longer than 6 weeks should be avoided. On the other hand, daily payment for very small quantities of milk increases administration work and raises costs.

Seasonal variations in price

In all countries, whether in temperate or tropical zones, there are strong seasonal variations in the milk volume produced and often there are two prices for milk; low and high seasonal prices.

How to calculate the base producer milk price?

You will first have to calculate all the costs for the group. Consider the following:

- milk transport costs (including vehicle insurance, drivers' wages, petrol, etc)
- milk collection costs
- milk testing costs
- milk preservation costs
- milk processing costs
- milk marketing costs
- stationary, rent of buildings, salaries etc.
- costs of electricity and water

Issues / questions for group sessions

1. What are the main milk testing and payment systems in your area?
2. There always is a balance between the costs and benefits of the tests, because testing regularly can become very expensive! What is according to you the most cost-effective testing system to use for small-scale milk collection in developing countries?
3. FAO is to publish a "Milk Testing and Payment Systems Resource Book" for technical clearance by the livestock products team. The resource book will describe the steps for the development of milk payment systems for milk producers groups in developing countries. What do you think the booklet should focus on?

3.4.2 Conclusions from group sessions

Constraints

- Shortage of knowledge and information
 - Payment systems
 - Milk Quality
 - Methods and Testing and Sampling
 - Access to information
- Incentives and penalties for quality sporadic
- Access to testing equipment and chemicals at village level and towns
- Poor quality of chemicals
- Shortage of skill technicians
- Difficulties sampling and testing in small volume remote areas
- Lack of appropriate field level micro biological testing methodology
- Cost of testing often high
- Lack of models/access testing and payment system
- Payment systems
 - Different production size
 - Commodity/products base
- Extension and payment systems not joined effectively

- Weak linkage between payment systems and management information system
- Standards lacking for payment system (grades)
- Lack of targeted multilevel testing /sampling strategies
- End of year profit distribution linked to quality and output (i.e. dairy coops)

Solutions

- Training
 - Regional training centres (S. Asia & E. Asia)
 - Training of Trainers
 - Mobile training team
 - Scholarships
 - Ministries to write guideline manual for national implementation of training programs
- Guidelines
 - GMP/HACCP
 - Laboratories
 - Groups
- Improve existing training centres /materials
 - Follow up on previous activities
- Introduce qualification system
- Legislate standards into enterprise by-laws
- Information database/website/directory/ training materials
 - International
 - Regional
 - National
 - E-dairy newsletter
- Introduction of quality testing/payment systems
 - Create new sampling guidelines
 - Hygiene
(methylene blue reduction test, resazurin test, alcohol, acidity, and clot on boiling)
 - Composition
 - Bonuses and penalties
 - Regular payments
- Integration of payment systems into management, extension and business planning

3.5 Dairy Policy

3.5.1 Background paper on dairy policy

Discussion Paper on Dairy Sector Policy Framework

By Dr. S.K.R. Amarasekara¹

Introduction and Background

Livestock farming continues to be a characteristic feature of many developing countries. Dairying is a very robust and economical way of generating capital by converting resources such as surplus

¹ Director/Livestock Development, Ministry of Agriculture and Livestock, Govijana Mandiraya, 80/5, Rajamalwatte Road, Battaramulla, Sri Lanka.

household labour, green forage and crop residues and by-products into high value cash products. Dairy farming is also a traditional rural industry in most developing countries and is characterized by several hundred thousands of smallholder farmers who usually operate integrated crop-livestock systems. There is a growing demand for dairy products in most developing countries as a result of economic development, increases in populations and changes in food habits with increasing urbanization.

According to available statistics, the average annual growth rates of cattle populations in developing countries are generally positive while buffalo numbers are generally falling. Average annual growth rates in total milk production vary widely across the developing countries, ranging over an average of almost 20% in Thailand, through stagnation in Sri Lanka to a slightly negative figure in Philippines. Countries like India, Pakistan and Laos are totally or nearly self-sufficient with respect to milk requirements while the majority of the developing countries have to supplement the domestic production with imported milk products to satisfy domestic demand.

It is in this background that the FAO E-mail conference on Small-scale Milk Collection and Processing in Developing Countries conducted in May-July 2000 deliberated on various aspects of small-scale milk production, collection, processing and marketing. The conference has defined the priorities for future action. It may now be observed that it would be necessary for us to consider the policy framework under which the recommended activities are to be undertaken.

Policy Framework for Small-scale Dairy Development

The sectoral policy framework for small-scale dairy development must necessarily be designed and implemented in conformity with the overarching macro-economic policy framework already formulated and promulgated by the respective governments. It is for this reason that the E-mail Conference has made the recommendation:

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 dairy sector. This should range from group formation and registration as a legally recognized 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.

As a first step towards the implementation of this recommendation, it is necessary for the government of each country desirous of implementing it to recognize its importance and relevance and accept it as an area of high priority. Without this recognition and acceptance, it would not be possible to induce the relevant authorities to commit sufficient resources to make a determined effort to give due consideration to the many issues that need to be addressed to fulfil the objectives underpinning the above recommendation.

Policy Objectives

Formulation of policy options, to be effective, should be based on a clear definition of policy objectives. Lack of a clear understanding and an agreement on policy objectives could result in inconsistencies and contradictions in the policy framework and even differences between declared policy and actual practice. In Sri Lanka, for instance, there are inconsistencies and tensions between macro-economic and sectoral policies and a number of policy ambiguities and unresolved issues within the dairy sector itself. This may well be the case in many other countries while those with success stories in the dairy sector may be exceptions. Some examples to illustrate this observation are:

- An objective of (total) self-sufficiency in dairy products may not necessarily be consistent with a macro-economic objective of achieving rapid GDP growth within an open economic system
- Maintaining low consumer prices is not consistent with the objective of providing an incentive price for the producers to encourage production and productivity
- Improving services to dairy producers through government institutions is difficult at a time when there is a demand to contain government expenditure in order to reduce the fiscal deficit

Each country may have its own uncertainties, contradictions, inconsistencies and unresolved issues. The need to review the situation in each country and to establish a well-defined set of policy objectives followed by the formulation of a consistent set of policy options for achieving them cannot be overemphasized.

Some Key Issues to be addressed

A review of the current situation in many of the countries represented here would lead to the identification of the key issues to be addressed by the respective country. Some of the key issues that may need to be addressed are given below. However, it has to be mentioned that the list is not exhaustive and that some of these issues may not be relevant to some countries.

- **Trade Policy.** What should be the position of each country at the WTO negotiations? What are the effects of any bilateral or regional trade arrangements on dairy sector policies? Is it necessary to protect the local industry against international competition? If so, at what level? Should imports of processing equipment and/or other inputs for the dairy sector be exempt from customs duties and other taxes?
- **Fiscal Policy.** Is it necessary/possible to offer special incentives for the dairy sector through concessions in taxes, subsidised credit, other subsidies etc.? Can the government commit additional resources to service the dairy sector through public sector institutions? Is the existing institutional framework suitable for undertaking the proposed developmental plans?
- **Pricing Policy.** Are prices paid to producers based on any quality standards e.g. composition and hygienic standards? Should free market prices prevail or should the government intervene in fixing prices of dairy products? Is there evidence of anti-competitive or collusive behaviour among private players in the dairy sector? If so, what policy interventions can be applied to overcome it? What roles should the government play in product grading and quality control?
- **Privatisation Policy.** Are there any government institutions involved with the dairy sector performing commercial functions? Are their functions clearly defined or are they a combination of service and commercial functions? Is there a possibility to separate the commercial and service functions and privatise those of a commercial nature?
- **Provincial/Regional Policies.** Will the provincial/regional institutions go along with the national policies with regard to dairy development? Should there be a regional/provincial focus in encouraging small-scale dairy development? How can the centre ensure that the regions/provinces adhere to the requirements of the national programme?
- **Industry Organisational Policies.** Are there any existing policies for organising producers' societies? How effective is the co-operative system? Is it properly organized? Do the producers see co-operatives as a suitable vehicle to provide the support required for a sustained development effort? Are there any suitable alternatives to co-operatives? Have any previous experiences in forming producers' organizations been positive or negative?
- **Public Health Policies.** What are the public health requirements that have to be taken into account by the dairy sector? Is their existing legislature? Who is responsible for ensuring that

the stipulated requirements are adhered to? Are the systems working satisfactorily or is it necessary to develop new systems?

- **Education/Training Policy.** Are their sufficient facilities for meeting the education/training needs of the dairy sector? Who are responsible? Is there a need to train farmers? If so, how is this need met? How is the training of trainers carried out? Is there a need for improvement?
- **Research and Development Policy.** What are the research requirements of the dairy sector? Are their trained personnel to undertake this research? Do the research findings get conveyed to the farmers in an effective manner? What are the experiences vis-à-vis the adoption of research recommendations by the small-scale producers? If they are not satisfactory how can it be improved?
- **Animal Breeding Policy.** Is there a policy for the breeding of dairy animals? What should be the role of the government in producing/supplying animals of improved breeds? Who should be responsible for breed improvement schemes including the processing and distribution of semen? Is it necessary to develop a herd recording and bull selection programme to identify AI sires?
- **Animal Nutrition Policy.** Are the animals getting the required feeds of appropriate quality in sufficient quantities to express their true genetic potential? If not, how can this be ensured? Are their options for intensive forage production within smallholder farming systems? If so, how can these be facilitated? Is their legislation to ensure that small-scale producers are protected from any scrupulous animal feed dealers? Who is responsible for implementing same?

Conclusions

From the foregoing it may be concluded that a wide variety of issues have to be addressed in order to lay down appropriate policies for the development of the small-scale dairy sector. As the issues prevailing in the different countries participating in this workshop have necessarily to be showing a great degree of variation, it would not be possible to lay down a general guideline to be addressed by all the countries.

Recommendations

As a first step towards the development of small-scale dairying the respective governments give due consideration to the recommendations made at the initial E-mail conference and accept them as an area of priority. Thereafter, sufficient resources should be committed for the identification of key issues relevant to the respective country as out lined above and formulate appropriate sub sector policies to use small-scale dairying as an instrument rural development.

3.5.2 Conclusions from group sessions

Presentation of group discussion on dairy policy:

Issues

- National domestic policies
 - Lack of consistent and comprehensive policy addressing
 - Enhancement of Demand for milk and milk products
 - Encourage Local production and provide market access
 - Enact and enforce appropriate regulations (quality).
 - Lack of processing and marketing infrastructure
- International Trade policies

- Threats from cheap import
- Balancing producers and consumers interest
- Lack of data on import impact
- International competition with respect to subsidies

Suggestions

- National domestic policies
 - Evolve policies involving all stake holders
 - Support programmes like
 - School milk feeding
 - School education
 - Consumer awareness
 - Training & education
 - Dairy professional
 - Law enforcement bodies
 - Producers and consumers
 - Support creating infrastructure
- International Trade policies
 - Evolve appropriate policies meeting WTO requirements.
 - May be take up some of the anomalies for correction in next round of WTO.

Who all could play a role?

- Dairy Industry, all stakeholders
(producers mainly) to lobby for enabling policies to support growth of dairy industry
- FAO and such other international bodies in developing country specific policy recommendations.
- Govt is the policy maker so the larger role remains with them.
- In awareness creation, training bodies like local training institutes, schools, NGOs, dairy industries' associations etc. Can play active role.

3.6 Food safety

3.6.1 Background paper on food safety

Background Paper for Group Discussion on Food Safety

*By Masatsugu Okita
FAO Rome*

Background

Milk is a highly nutritious and ideal food for both children and adults as an important source for their daily intake of energy, protein and essential minerals. Similar to other regions of the world, the demand for milk and dairy products has kept growing in many Asian developing countries, on one hand due to the expanding demand in urban area combined with the rapid urbanisation, and on the other hand, due to the steady demand for traditional milk and dairy products as a staple food since centuries ago.

One of the key features of milk production in developing countries is its high dependency on small-scale rural producers. The immediate return from their daily surplus milk contributes significantly to improve rural house-hold food security. As improvement of foreign trade deficit is also expected, domestic dairy development is often given the top priority of the national development policy in developing countries.

Potential human health hazard of milk and dairy products

In addition to the quantitative growth, the improvement in quality becomes an urgent matter these days. Recent global trends in human food safety concern have posed additional task on the domestic dairy sector, i.e. ensuring the safety of milk and dairy products in order to prevent human health hazards through it. Due to its prominent nutritional components, milk is an ideal media for microbial growth and unfavourable milk handling may cause food borne disease through milk and dairy products. Major microbial agents causing human health hazard include: *Mycobacterium bovis*; *Brucella abortus* and *Brucella melitensis*; *E. coli* O157: H7; *Staphylococcus aureus*; *Listeria monocytogenes*.

The characteristics of the individual micro organism can be summarised as follows: *Mycobacterium bovis* infection is a classical infectious disease in bovine species. Through unpasteurised milk and close contact to infected animals this micro organism can be transmitted to human and develop human tuberculosis. Though frequency of *Mycobacterium bovis* infection in human is unknown due to the lack of reliable data, unavailability of the effective control measures and significant level of infection in bovine population in many developing countries may pose a high risk of infection in human.

Brucella abortus and *Brucella melitensis*: Brucellosis is another important classical zoonosis transmitted from ruminants through unpasteurised milk. While it causes abortion in animals, major symptom in human is malaise and fever which might complicate the correct diagnosis. While developed countries employ the most effective measures, i.e. test and slaughter to control disease in livestock and to minimise the resulting human risk, even reliable surveillance of the infection in animals is difficult in developing countries.

E. coli O157:H7: This *Escherichia coli* serotype naturally exists in the digestive tract of ruminants without developing any serious symptom. However, it is highly virulent for human causing serious haemorrhagic colitis which is sometimes fatal. Livestock products contaminated with animal faeces and with insufficient heat treatment. It might exist in unpasteurised milk unhygienically handled on farm.

Listeria monocytogenes is extraordinary resistant to refrigeration compared to the other non-spore-forming bacteria and hence, even in the developed countries where reliable cooling system is available listeriosis causes food poisoning through milk. Major symptom is meningoencephalitis.

In addition to microbial contamination, residue of medical treatment administrated to animal might cause human health problem. A wide variety of antibiotics are commonly used worldwide to treat mastitis of milking animals and antibiotic residue in milk is often identified where inappropriate treatment on farm and lack of reliable detecting system in milk collection exist.

Possible Contamination source at farm level

Contamination may take place at various stages from farm to the market. It may occur at the dairy farm, during the collection and transportation, at processing factory and market. Among these stages, prevention of contamination at farm is critical because it may affect the quality control in later stages. At farm level, the potential source of the contamination includes milking

animal, milking person and milk handling, animal shed and environment, milking equipment and storage/ transportation.

Milking animals:

Milking animals are one of the major potential sources of contamination. Some micro organisms can be transmitted from unhealthy animals through milk. Especially when the animal suffers from mastitis, the milk drawn from it needs to be discarded. Moreover, even when the animals look totally healthy they may carry harmful micro organisms.

Milking person and milk handling:

The milking person may cause contamination if she/he carries infectious agents. Also, it may occur that transmission of infectious agents takes place from unhealthy animal to healthy animal through milking. Inappropriate milking routines such as irregular milking interval, unhygienic milking and bad manual milking may damage the udder and milking animal which might result in increased opportunity of contamination.

Animal shed and environment:

The cleanliness of the animal shed is crucial to prevent contamination at dairy farm level. Various factors in animal sheds including faeces and urine, stalls, litter, feed residues etc. can affect the risk of contamination. It is also noted that availability of clean water is an important environmental factor. The area where milking takes place should be kept extremely hygienic.

Milking equipment

Milking equipment needs to be kept clean and disinfected. It needs to be made of the materials, which can easily be washed and are resistant to disinfectant. Milking equipment needs to be washed and disinfected after every single milking.

Storage/transportation

In case milk needs to be kept until milk is picked up by the milk collector, it needs to be cooled down as quickly as possible preferably up to 4 degree Celsius. If a refrigerator is not available, cool it down as much as possible and keep it under shade. Milk collection routes need to be designed carefully to minimise transportation time. If applicable, alternative milk preservation method e.g. Lactoperoxidase-system can be considered.

Constraints

By taking into account above-mentioned factors, contamination at farm level can be avoided significantly. However, it might be difficult to tackle these risks in developing countries due to various constraints, which may include:

1. Lack of resources: Rural small-scale farmers in developing countries are frequently in short of sufficient resources and cannot afford to buy appropriate milking equipment, which is easy to wash and resistant to disinfectant. They cannot install cooling facilities to keep their milk cool until milk collector comes and pick up it. In addition, developing countries often suffer from unstable electricity supply, which complicates the situation. Also at national level, developing countries often encounter difficulties in effective animal disease control due to the lack of resource.
2. Lack of information and weak institutional framework for training: Many of these problems are caused by farmers' ignorance and it seems simple to solve them as long as farmers are able to access appropriate information source and receive sufficient training. However, the extension function in both private and public sector is often weak and immature to work as the effective information disseminating module or training centre.

3. Lack of incentive for hygienic quality: Because hygienic quality is not reflected in farmers' return in many developing countries, farmers tend to neglect the hygienic quality of milk. This may be caused by various factors; lack of established milk payment system; insufficient legislative framework of the competent authority to control food safety; and poor appreciation for the hygienic quality in the market

Possible solutions

To tackle the above-mentioned constraints, the development of a consistent strategy and active involvement of both private sector and public sector from farm to the consumers is essential. More specifically the following components might be considered to be included:

1. Establishment of training centres and provision of training: Enhancing the extension function both in private and public sector may play key role to raise awareness of farmers. In order to implement in a sustainable manner, it is important to build human capacity in national, regional and community level through training of trainees.
2. Development of national legislative framework of controlling food safety: The national competent authority should take responsibility to ensure food safety on milk and dairy products.
3. Establish milk payments systems considering milk hygiene quality: Private sector need to establish reliable milk quality testing and evaluate farmers' milk according to hygienic quality in addition to content quality. This is expected to encourage farmers to improve their milk.

Key question for discussion

In order to ensure food safety in milk and dairy products, raising awareness among consumers is essential. How can we raise consumers' awareness on milk and dairy products' safety?

References

- "Zoonotic Tuberculosis due to Mycobacterium bovis in Developing Countries" by Cosivi, J.M. Grange, C.J. Daborn, M.C. Raviglione, T. Fujikura, D. Cousins, R.A. Robinson, H.F.A.K. Huchzermeyer, I. de Kantor, and F.-X. Meslin, Emerging Infectious Diseases, Vol. 4 No. 1 1998.
- "Clean milk production and support services", OP Sinha, India
- Report of the FAO E-mail Conference on Small-scale Milk Collection and Processing in Developing Countries

3.6.2 Conclusions from group session on food safety

List of the Constraints

1. Producers' level
 - animal husbandry practices/diseases (mastitis)
 - animal shed/environment (ventilation, drainage, etc.)
 - availability of clean water
 - milk handling and equipment
 - adulteration
 - storage (normally without refrigeration in S-S producers)
 - use of the preservative in inappropriate manner (H₂O₂, pesticides, Sodium bicarbonate, etc.

2. Processors' level

- delay in reception at the dairy plant
- checking the quality of the milk before the acceptance (time shortage, seasonal change)
- maintenance of the dairy plant
- short failed labour force
- no regular medical exam for plant staff
- inefficient facilitation of devices
- checking the quality before packaging
- package material/way of the packaging

3. Distributor' level

- manipulating the price (at the retail outlets)
- regulation (on the manufacturing details)
- lack of storage facility
- poor transport condition
- Informal market
- middlemen's behaviour (adulteration, manipulation of the price)
- lack of the regulation/implementation

4. Consumer' level

- value for money
 - good organoleptic quality
 - hygienic quality (safe)
 - nutritional quality
 - natural
 - competitive price
 - ready to use
- requirement/need, convenience
- consumers' awareness to the proper storage at home
- lack of consumer awareness to the necessity of pasteurising milk at home
- lack of consumer awareness to the quality assurance system

Possible solution/recommendation

1. Education/training at all levels

Establishment of the training centres at regional/district level by FAO/NGO/local government to cater:

- training of the trainers for outreach programme in villages
- development of the training materials (multimedia and publication)
- education programme at TV, radio and newspapers on milk hygiene quality
- mobile extension unit
- school education

2. Incentive for the producers

- establishment of the quality based payments system

- additional incentive according to the record of the quality of individual production environment (prerequisite is MPG!)
- penalty system for the poor quality milk

3. Policy

- formation of the advisory committee comprises of officials from FAO, IDF, local government and farmers representatives, consumer representative
- frame the policy by the advisory committee
- approval by the government
- implementation of the policy by the concerned departments.
 - establishment of the lab for the testing
 - inspection, collection of sample and testing
 - medical exam of plant staff

Chapter 4 Country Papers

4.1 Country paper China

Dairy cattle production in China: Technology for efficient milk production and milk quality control

Wang Jiaqi, Ph.D., Professor

Institute of Animal Science, Chinese Academy of Agricultural Sciences, Beijing, China

Email: wang-jia-qi@263.net

1. Background

Livestock production, especially pig and poultry production in China has been developing rapidly since the 1980's. The per capita production of meat and eggs is above the world average and highest of Asia (47kg of meat and 17 kg of eggs, 1999). But milk production is much less than the world average level. The average milk consumption per capita was 100 kg in the world in 2001, while less than 8 kg in China. With the improvement of people's living standard, the consumption of dairy products is increasing after the entry of the new century, which stimulates the development of dairy industry in China. Up to 2001, China had 5.77 million head of dairy cattle and the milk yield was 10.49 million ton, 13.7% and 20% more than that in 2000, respectively.

The dairy industry has a very important meaning for rural development in China. Dairy cattle husbandry is a labour-consuming industry, which can increase farm cash income; its development can also combine the use of natural resources and agro-industry by-products; its long production chain has more profit space when the milk is supplied for processing industry. The Chinese central government has instituted a number of promotional programs to boost the production of milk and milk-based products. Milk production and dairy industry has been put at the priority in The 10th Five-Year Plan (2001-2005) for social economic development.

China will be the largest market for dairy products in the future. Several joint venture firms, including Nestle, Unilever, Kraft, Danone, and China Peregrine, have built plants in big cities. After formal entry of the World Trade Organization (WTO), China is lowering the tariffs, more and more international companies are being expected to invest in dairy industry.

Currently the main limiting factors in milk production in China are low efficiency and lack of quality control systems for milk production (HACCP). The collaboration on technology development for improving dairy production efficiency and milk quality control on an international level will speed up the milk development in China in the future and enhance the sustainability of milk production and consumption.

2. Technology for milk production

The priority for next five years will be to develop the technology for optimizing milk production efficiency and enhancing the milk quality for human health. The perspective research is proposed to focus on dairy cattle feeding and management; using of local feed resources; feeding and management of high yield dairy cattle; and milk safety and quality control (HACCP).

2.1 The nutritional research for different breed of dairy cattle

The research will focus on the stress and adaptation of the different breed of dairy cattle to various areas, feed resources and the change of nutrient requirements.

2.2 Use of local feed resources

In the past, dairy industry in China was dominated by state-owned dairy operations, but now smallholder dairy plays an increasingly important role in milk production. According to a survey over 25 provinces in 2000, smallholder dairy accounted for 76.8% of total number of dairy cattle. With increased dairy cows, supply of high quality feed becomes a limiting factor for smallholder dairy development. Because of the large rural population and limited arable land area, it is not possible for China to adopt widespread use of a high concentrate feed diet, such as in the United States. In the present time, most of smallholder dairy farms use low quality roughages ad lib., plus silages and supplemented with a mixture as the basic feedstuff. Roughages consist of ammoniated or non-ammoniated straws and native grasses cut nearby.

The research will focus on silage and forage processing and storage; grain feed and oilseed meal processing; food by-product; use of biotechnology for news feed resources and feed additives (direct fed micro organisms).

2.3 Fodder production technology

2.3.1 Collection and valuation of fodder crop germplasms and their breeding

Aimed at the collection and valuation of fodder crop germplasms which have good tolerances to low temperatures and drought, mainly including: the germplasms of Medicago genus or alfalfa varieties which have good tolerances to low temperatures, drought and free-bloat characteristic, to low temperatures and early mature characteristic. On the other hand, we need to breed alfalfa varieties which has good tolerance to chilliness, drought and free-bloat characteristic, especially by biotechnology.

2.3.2 Seed production and processing of alfalfa

The aim is to establish a suitable base of alfalfa seed production and processing in China; import the relative techniques and equipments for alfalfa seed production and processing, including alfalfa varieties cultivated techniques for seed production, feeding and administration techniques of alfalfa leaf cutting bee (*Megachile rotundata* Fabricius), techniques and equipments of harvesting, cleaning and processing of alfalfa seed.

2.3.3 Processing technique of forage products

The aim is to study a suitable technology system of forage products' processing for China, including techniques and equipments in this area, such as machines of forage harvesting and processing, silage and semi-hay silage, silage additives of alfalfa and fodder corn, herbage food making (roller, block, granule), extraction of proteins and enzymes from alfalfa and so on. To establish China-state standard of alfalfa hay quality through nutrition value estimation; To develop new diet formulation method based on alfalfa hay diet, through which better milk yield, excellent milk component and greatest profit will attained. It is also necessary for the estimate of proper price of alfalfa hay through technique and economy analysis of relations among alfalfa hay addition in the diet of dairy cow, milk yield and profit.

2.4 New Technology for dairy cattle feeding and management

The aim is to develop a new edition of “nutrition requirement of Chinese dairy cattle” through application of metabolic protein (MP) system or rumen degraded protein-rumen undegraded protein (RDP-RUP) system in feeding trial of high producing cow. The research will also focus on TMR feeding technique; stage feeding technique; equipment for feeding and management; the equipment for cattle house; developing alfalfa hay based diet for dairy cow in different lactation stage; select RUP supplements and nutrition additives based on alfalfa hay diet, which were specially used for high producing dairy cow; developing TMR feeding system used for China high producing cow; developing low-cost dairy cow breeding and improvement system which can be insemination (AI) technique; developing low-pollution nutrition management system and disease control system which can be used to curb common disease such as mastitis, rumen acidosis and laminitis.

2.5 Technology for milk safety and quality control system

The research will focus on fresh milk quality rapid check; quality control during the milk collection, storage and transportation; quality control during milk processing; shelf quality control for dairy products.

3 Personnel training in dairy science and technology

Dairy science and technology training of personnel engaged in China’s dairy industry is in urgent need.

4.2 Country paper Bangladesh

Country Paper: The Co-operative Dairy venture of Bangladesh

*Gobinda Chandra Saha
General Manager, Milk Vita.*

Bangladesh is a low-lying riverine country with a total area of 55,598 square miles (143,998 square kilometres). It stretches latitudinally between 20° 34' and 26° 38' north and longitudinally between 88° 01' and 92° 41' east. The country is almost surrounded by India except for a short (about 120 miles) south eastern frontier with Burma, and a southern irregular coast line that faces the Bay of Bengal. The most significant characteristic feature of Bangladesh's landscape is its extensive network of rivers which contribute a great deal to the socio-economic life of the nation.

The population of Bangladesh was estimated at about 129.50 million in 2001, of which total nos. of female are 64.20 million. Islam is the state religion of Bangladesh practiced by 90% of the population. The rest of the population are from Hindu, Christian, Buddha and other small aboriginal community who enjoy the equal religious independence. More than 98% of the people speak Bengali which is the national language; however, English is still widely used in Bangladesh.

Ninety percent of the people of Bangladesh are agriculturist and live in the villages. Most of the farmer’s families possess cows for draught purposes as well as for producing milk for their own consumption and surplus to sell.

Status of Dairying in the Country:

By way of mechanization, the modern world has adopted technologically advanced methods in agricultural production. But in Bangladesh, 90% of the agro-activities are performed with the draft-power received from cattle heads. Statistical surveys interpret that there are an about 58.90 million domestic cattle-heads with the details:

Number of Cattle heads in the country

Cows	Buffalo	Goat	Lamb
23.50	0.80	33.50	1.10

The proportion of milking cows is 45% with average milk production 200-300 litres per lactation period comprising 180-240 days a year, except in certain milk pocket areas where exist some local crossed comparatively high-breed cattle having milk production of 800-1000 litres in 210-300 days of lactation.

The present milk production of the country is estimated to 1.62 million metric tons of which 73% is from cows and the balance 27% is received from buffaloes and goats. The total milk produced, do not cater the demand of the country, and such to meet up national deficit the Government is to import 18,000 to 20,000 metric tons of powder milk & milk products through investment of the national hard- earned foreign exchange ranging from Tk.1800-2000.00 million. Total import Contributes about 0.15 million metric tons of liquid milk.

In recent years some new ventures in milk and milk product processing and marketing have been initiated in the country. Though most of the organisation caters a very little quantity of milk but the market for the processed milk in the country is being rapidly increased.

Processed Liquid Milk Sale Per Day:

SL. No.	Name of the Enterprise	Milk Sale Litres/ Day (Average)	% of Market Share
1	Milk Vita	1,10,000	62.16
2.	Arong	38,000	21.48
3.	Amomilk	4,000	2.26
4.	Shelaida	4,000	2.26
5.	Bikrampur	3,000	1.69
6.	Savar Dairy	3,000	1.69
7.	Aftab Dairy	5,000	2.82
8.	Safa Dairy	3,000	1.69
9.	Tulip Dairy	7,000	3.95
	Total	1,77,000	100.00

The Dairy Co-operatives:

The Bangladesh Milk Producers' Co-operative Union Ltd. popularly known by its products name 'Milk Vita' has emerged as a vital venture for rural development significantly aiding the rural farmers in terms of business and motivational linkages. The apex union has so far mobilized 60,000 poor, landless and marginal farmers in 10 milk shed areas of the country. The farmers supply milk twice a day to the societies numbering about 500, against fair price with a year-round guaranteed market. City dwellers receive milk and milk products after processing the collected milk in products manufacturing unit. Thereby, through the activities of milk union, the rural produce is being channelled to urban market and in return the urban money is ploughed back to rural areas contributing effectively in the poverty alleviation endeavours. Originally initiated in 1946 with private entrepreneurship, the organization could not attain economic success and as

such it was handed over to co-operative marketing society in 1967. However, the situation was unchanged. In 1973, soon after the liberation of Bangladesh a project title “Co-operative Dairy Complex” was initiated by the Government. The objectives of the project were outlined as:

Objectives and Activities:

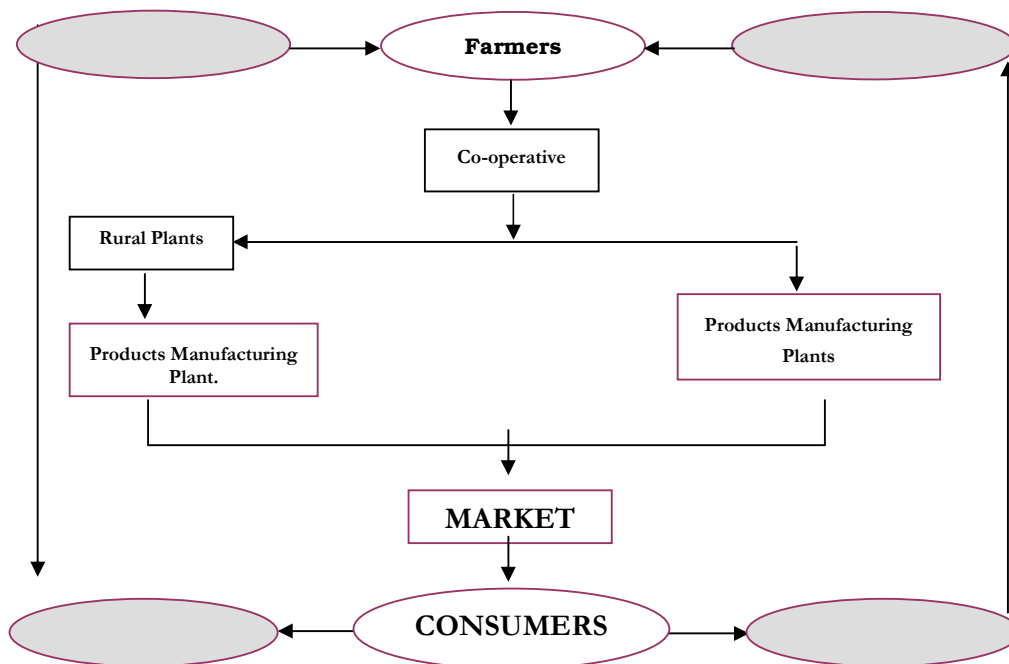
The objectives of the ‘Co-operative Dairy Complex’ project were outlined as:

- Raising subsidiary income of the poor, landless and marginal farmers living in relatively remote rural areas of the country by way of purchasing their produced milk at a reasonable price through guaranteed market under co-operative fold;
- Ensuring the regular supply of safe, hygienic and nutritious milk and milk products to the city dwellers at a fair price.

Under the project 5 (five) plants were established during the period 1974 -77, which has been extended to 11 (eleven) in the recent years by the financial support of the organization. The organizational name of the project was assigned as “Bangladesh Milk producers’ Co-operative Union Limited” with its products name “Milk Vita “. However, it could not earn financial success up to 1990 – 91 and from 1991 – 92 it has started earning net profit which is being continued till to date.

It is experienced from the 27 years of operation that, Milk Vita activities are not only supplementing the organization to grew-up as a long-sustaining profit-making enterprise only; its contribution towards action-oriented mobilization of the farmers has also created enormous effect in rural development perspectives. As a result in every year more and more milk producing poor farmers are bringing themselves under the rural societies of the milk union for their economic upliftment.

Milk vita – an effective graduation process:



In this way, the graduation process has significantly enabled milk vita to cater the need-based benefits to the less fortunate group of the rural society. The beneficiaries are:

- 60,000 poor, landless and marginal milk producing farmers who were earlier exploited by the traditional *ghoses* (middlemen) but at present receiving fair price through sale of milk in a guaranteed market;
- 4,00,000 farmers family members who are directly dependent on the income of the cooperative members for their livelihood;
- A large number of city dwellers receiving continuous supply of pure, safe, hygienic and nutritious milk and milk products at a reasonable price;
- More than 500 Rickshaw pullers cooperative members engaged in the distribution process of milk vita products receiving the daily cash income for maintaining their livelihood along with their dependent family members;
- More than 4000 people who are employed out of the direct and indirect job opportunities created both in rural and urban areas in milk production and transportation process;
- Nearly 750 people are engaged in the different plants and head office of the organisation who earn livelihood for them and their families;
- 100 new co-operative farmers every year who receive interest free credit for cattle purchase.

To further strengthening the activities of milk vita, intensification of the motivational activities through training are underway.

Government Policy:

Although the Government encourages the Co-operative dairy sector, a detail “dairy policy” with special reference to the Small-Scale is yet to be framed. However, through the proportion of the milk vita the activities are on the way for over all dairy development of the Country.

Major Constraints:

Through analysing the overall activities milk vita outlines the following major constraints:

- Lack of an appropriate dairy policy depicting issues like product standardisation, taxation, infra-structure development, price, import rationalisation, product safety measures etc. to aid dairy development process of the country;
- Competition with the imported powder milk and milk products along with domestic production;
- Non-congenial taxation policies and rate for its routine imported items;
- Shortage of quality cattle feed with reasonable price;
- Fund deficit for timely materialisation of its planned activities;
- Lack of supports from the government and national and international donor agencies towards undertaking of a massive dairy development program of the country like Operation Milk Flood I, II & III of India;
- Absence of adequate training facilities and support to adopt new technology.

Rapid removal of these constraints will aid attaining self-sufficiency in milk production sector of the country within a shortest possible time.

Future Plans:

The future plan of milk vita includes:

- Expansion of the prevailing handling capacity of the existing plants;
- Establishment of a number of Chilling Plants;

- Acquisition of Bathan Land from the Government for permanent use as grazing land by the milk producing farmers.
- Establishment of an Ultra High Temperature (UHT) Milk Plant;
- Establishment of a Cattle Feed Plant;
- Expansion of the Chocolate Crunch Making Plant to Candy Plant;
- Establishment of a Water Treatment Plant;
- Replication of the project in other areas of the country especially in the divisional head quarters like – Chittagong, Khulna and Rajshahi.

Conclusions:

Milk Vita has emerged as a successful co-operative endeavour in the country assuring supplementary income for the poor, landless and marginal milk producing farmers along with the women community associated to it, on a regular basis. It has shown the capability to further strengthening of its activities to increase dairy production and thereby contribute effectively in the national economy through a strong and viable organisation of small farmers. Therefore, in the overall tune, Milk Vita believes that rapid implementation of the future plans; the sector will have to momentum to attain self sufficiency in milk production of the country.

e-mail : milkvita@bangla.net

4.3 Country paper India

Dairy Development In India: Operation Flood And Beyond

*Sriram Singh*²*

National Dairy development Board, India

Introduction

Dairying in India is as old as its culture. The seals from Sivikotada in Gujarat and Kalibhanga in Rajasthan show images of domestic animals probably reared by Harappans (2200B.C to 1600 B.C.)ⁱ. Since long dairying has been taken up by the farmers as a complementary occupation to cultivation. It will be rare to find a rural household not having a cow or a buffalo to meet its daily requirement of milk. Milk and milk products are greatly valued in the society as a source of balanced nutrition.

Livestock plays a vital role in the Indian economy. Next to agriculture, animal husbandry is the most important economic activity in rural areas. These two together provide employment and income to the vast majority of the rural population. Indian agriculture is an economic symbiosis of crop and cattle production. Landless, Small (land holding 1-2 hectares) and marginal (land holding below 1 hectares) constitute about 75% of rural households and own almost 35% of the total land holding. “About 67% of the workforce is engaged in agriculture either as cultivators or farm labour. In a normal year, crop production can generate employment for this workforce for only 90 to 120 days. For the remaining period, they are virtually unemployed. In this milieu, dairying sets right this imbalance in employment.”ⁱⁱⁱ Milk, an important contributor to the value of output from livestock has a share of about 4% in the gross domestic product (GDP) of India.

Today India is the topmost milk producer in the world with an estimated total production of 83 Million MT during the year 2001. If we look back into the transformation of the milk production

² Sriram Singh is working with National Dairy Development Board, India as Senior Executive in its Cooperative Services Group. The opinions expressed in this paper are his own, and may not be subscribed in part or whole by the organization he is working with.

in the country over the last four decades there is visible exponential growth trend beyond the 70s, which were stagnant during the 60s and before. The decade of 70s marks the beginning of the Operation Flood, a project promoted by government of India through National Dairy Development Board (NDDB) to enhance the income of the farmers engaged in milk production and there by enhance milk production and improve per capita milk availability. During the decade of 60s the milk production was hovering around 20 million MT and per capita availability of milk was a dismal 127 gram per day. Today with India becoming the largest milk producer in the world per capita availability of milk has almost doubled to 220 grams per day notwithstanding the population explosion by two and half times over the same period.

Milk and milk products market of India is also one of the world's largest and fastest growing market. The growing middle class with increasing disposable income is providing the sustainable growth to the exponential rise in the milk production. The cycle is looking complete and the linkages strongly established between the supply side and the demand side. Fluid milk once rationed in the cities, is now widely available, not only in the metropolitan and other major urban areas, but also in hundreds of smaller cities and towns. The dairy industry is capable of making products of a standard equivalent to the best in the world. And multinationals of the industry are eyeing India as a new supplier to the world's dairy consumersⁱⁱⁱ.

The past

In the sixties and early seventies prior to formation of cooperatives, the milk producers were at the mercy of traditional traders, who would pay remunerative prices in the lean summer months and extremely low prices in the flush months of monsoon and winter. This irrational pricing and exploitation by the trader, discouraged farmers from initiating better management practices as the whole operation was not remunerative enough. Consequent to farmers not adopting scientific practices for better feeding and animal health care milk production was very low. Faced with indifferent and undependable traditional market for milk, farmers normally converted milk into Ghee (Clarified butter), which has much longer shelf life at room temperature and also enjoys a sizable traditional market. Though it did serve to reduce the dependence of farmers on traditional traders but nevertheless, it was extremely un-remunerative.

Emergence of cooperative in the dairy sector was basically an organized attempt to address the situation in farmers favour. The most famous and talked about Anand pattern of cooperatives in Kaira district of Gujarat state of India was started as a determined retaliation against the monopolistic exploitation of farmers by a private trader namely Polson. Farmers did realize that the system under which private traders bought their milk at low prices and sold at a huge profit was just not fair. Sardar Patel a revered leader and freedom fighter hailing from this part of the country advised the local leaders to take up marketing of milk on their own by organizing themselves into a cooperative. He advised that this cooperative should have its own processing plant.

After a brief struggle with the then government (before independence of the country) Kaira District Cooperative Milk Producers' Union Limited was registered on December 14, 1946. The Kaira union began pasteurizing milk for Bombay (a metro market) milk scheme in June 1948 with just a handful of farmers in two village cooperative societies supplying about 250 litre of milk a day. By the end of 1948 more than 400 farmers joined and quantity of milk handled rose to 5,000 Litres a day. As the years passed this cooperative endeavour went on growing bigger and better, achieving many accolades in the process. By mid 1965 it started collecting about .2 million litres of milk a day. It became soon the centre of attraction of the top leadership of the country. Anand the small bloc level town was the hub of all these activities as the plant was situated here. The cooperative structure and the system established as a part people's effort came to be known

as Anand Pattern. “An important reason why the Amul acquired greater significance than the contemporary dairy cooperatives was that it not only organized milk producers but also tuned in with the process of modernization and commercialization. It also dealt with issues of development and change”^{iv}.

Operation Flood: The White revolution

Lal bahadur Shastri the then Prime Minister of the country in 1964 told the charismatic professional General Manager of Kaira Milk union, Dr. V. Kurien to make Anand Pattern a reality all around the country. National Dairy Development Board was established in 1965 with an aim replicating the Anand Pattern all around the country. Anand pattern envisaged a three tier structure at village level a Dairy co-operative society with the main task of collecting milk from members and canalising inputs and services to its members, at District level a union with milk processing facility democratically owned and controlled by the elected representatives of DCSs, and at state level a federation of the district unions with the aim of marketing the milk and milk products in major markets and get the best possible realization for the farmer member while ensuring quality milk and milk products at affordable prices.

A concept of ‘food aid’ in form of dairy products was used as the tool for dairy development. Gifted commodities of skimmed milk powder and butter oil from European Economic Communities were used for the generation of funds. In converting the donated commodities into liquid milk and selling it through metropolitan dairies, the NDDB adopted two strategies:

1. To sell it at prices at par with milk that was locally produced so that the local market would not be depressed;
2. To invest the funds generated by marketing of the gifted commodities in setting up milk sheds in the hinterlands of the metropolitan cities.

This scheme became famous as ‘Operation Flood Programme’s main objective being to establish cooperative in the rural milk sheds and to canalise the milk collected to flood the metro dairies. The operation flood had three phases.

Operation flood I implemented was during June 1970 to March 1981. During this period 39 Milk sheds were covered, 13,270 village dairy cooperative societies (DCS) were organized and it enrolled 1.7 million farmers as members. These milk sheds with its DCSs collected on average 2.5 million litres of milk a day. Processing capacity of 3.58 million litres a day was created which was enough to handle the peak collection of 3.39 million litres per day.

The Operation Flood (OF) II was initiated during October 1979 and went on until March 1985. During this phase coverage increased to 136 milk sheds, DCSs organised to 34,523, average milk collection per day to 5.78 million litres, milk handling capacity to 8.78 million litres per day. It was a phase when the expansion of processing capacities was matched with infrastructure creation like national frozen semen system to support artificial insemination programme to improve the breed of the animals, establishing vaccine production and delivery system to strengthen the animal health care programmes and emphasizing manpower development services to develop professionals with required managerial and technical competence.

The OF III was taken up with major emphasis on promoting measures to consolidate achievements gained during the earlier two phases by improving the productivity and efficiency of the cooperative dairy sector and its institutional base for its long term sustainability. This phase was during 1987 to 1996. By end of OF III coverage of the milk sheds grew to 170, DCS

organized increased to 72,744, average milk collection became 11million litres a day and the processing capacity to 19.4million litres a day.

“Conservatively estimated, operation flood has reached to 40 million rural Indians. Its achievements are well-documented. The programme strategies – creating infrastructure through monetisation of commodity aid and investing in production enhancement while building processing facilities and developing markets – have also been well-researched and widely appreciated. In the 25 years since the launch of Operation Flood, milk production has increased manifold and per capita consumption almost doubled. Most importantly, dairying has emerged as an important income generating activity and source of rural employment. The project adopted novel and innovative measures to boost milk production, train professionals and workers alike to become more competent and educate members of the cooperatives about their rights and responsibilities so that a more informed and democratic cooperative structure emerges. The investments made – which include substantial time, money and effort by milk producers themselves – are by no means small. It is necessary that no effort be spared to ensure that optimal returns are achieved in the future.”

Under operation flood i.e. in post seventies period data shows “a change in national milk production from a growth rate of 0.7% per annum until 1969 to 4.7 percent per annum cumulative, it can best be attributed to the policy changes accompanying the launch of operation flood. By 1996, the higher growth rate associated with the operation flood period was resulting in an extra 43 million metric tons of milk per annum. Even at Rs10 per kg of milk it amounts to a contribution of Rs 430 billion per annum, approximately US\$9 billion. Even if 10% of the positive change could be attributed to operation flood it would be a contribution of Rs 43 billion per annum and that would exceed in one year itself the entire financial investment under the three phases of operation flood. Certainly after the green revolution it was the exponential rise of the milk production that has considerably propelled the rural economy to a high growth rate, and rightly it has been labelled the ‘White Revolution’.

The Present

India has become the world’s largest milk producing country. The economic liberalization and globalisation process in the country is in going on. Many multinationals have entered the milk and milk products market. Cooperatives have also grown big over these years. Several brands have been created and choices of basket for the consumer is increasing day by day. The cooperative together collect about 17.5 million litres of milk a day. This is however only about 16% of the total marketable surplus milk available in the country. Another about 4-5% milk must be collected by private organized sector. Thus majority of milk is still handled by the unorganized traders. However the presence of cooperative plays a psychological barrier in stopping exploitation of farmers by the traders. There are 96,000 DCSs covering about 140,000 villages and with a formidable farmer membership of 11Million. Although most of the dairy related activities are taken care of by women in the villages of India but the participation of women as members of cooperatives or in its governance is not very encouraging. However with constant effort of education and training there have been some successes and the women membership has grown a little over 20% of the total in past few years.

With the rising cost of high yielding cows and buffaloes, the farmer is now willing to invest in professional services for maximizing the productivity of his dairy animals. This opens an array of business opportunities in dairying. Prospect exist right from the point of milk production through its processing and marketing. Nutritionally improved crop residue and dry fodder (UMB, BPF) are in demand and can be thriving small business for the self employed. So also farm veterinary first aid and insemination services are gaining acceptance in major milk sheds.

Cooperatives with plethora of brands are not able to put up a united front to the upcoming competition from big multinationals. By now about 170 milk sheds associated with NDDDB under operation flood programmes sell in over 50 brand names. Together they account for about Rs 90 billion worth of annual turnover but quite fragmented with a few brands having less than Rs100 million of turnover. Advertisement and sales promotion expenditure of approximately Rs 1 billion is incurred by these coops but thinly spread over the localized brands. Today the cooperatives are feeling vulnerable with the multinational's financial power and aggressive marketing strategies. Cooperatives always worked as a balance between the producers and the consumers, and thus they did not feel the need for alluring the consumers. Today the electronic media's pervasive presence and increased educational level the consumers are advertisement savvy and are swayed by them. The cooperatives are at it to figure out before it is too late in the race of reaching the mind of the consumers.

Mainstay of cooperative has been liquid milk sale. Over 80% of the procured milk is sold as pasteurized liquid milk in packed sachets and it is differentiated based on fat contents e.g. standard milk (4.5% Fat), toned milk (3.5% Fat), and double toned milk (1.5% Fat). Lately cooperatives have given emphasis on development of indigenous dairy products having longer shelf-life. The development of process technologies and the manufacture of quality dairy products in the organized sector will benefit both milk producers and consumers. With this objective the technology for manufacturing Shrikahand, Gulabjamun, Peda, Lassi, Mishti doi, Rasogolla, Paneer, Kalakand, Khoa etc. developed by the product and process development group of NDDDB has been progressively transferred to cooperative dairies to enable them diversify their marketing efforts.

Cooperatives work on a thin margin. They price their product moderately and pass on more than 70% of the sales realization to their farmer members as price, bonus and other benefits. Budgeting a large sum for marketing has been seen by the cooperative leadership as somehow deviation from the social goals. But slowly this is changing and the open market system has made it imperative to be aggressive in reaching out to consumers' mind.

It is ironical that the government promoted initially cooperatives as a measure for providing opportunities for people to come together to take lead in their economic development. But the law enacted for the coops were more with a view that coops will need constant coaching and controlling. The patriarchal role of government later became the hindrance for the true growth of cooperative. The legal framework governing the cooperative is still not reformed to the extent that we could label as enabling ones. Some changes have taken place in few states where parallel laws, which are more enabling and have been enacted, providing choices to coops to enjoy the bliss of being a true coop.

The Future

The Anand model of dairy development has laid the foundation for a modern dairy industry. In partnership with Dairy unions and federations, National Dairy Development Board has helped put in place the requisite infrastructure. In recent times a discussion has started as to the cooperatives catering mainly to smallholders will remain so in future or change because of other changes coming in existence. India has essentially been a smallholder's dairying based on crop residue and household labour. However large corporations prefer promoting large commercial farms as has been seen in some parts of northern India where Multinationals operate. This may be taking a step backward as far as the generation of employment is considered by the sector.

Now the winds of economic changes, blowing in the wake of liberalization, are affecting the base of cooperative movement in India. During the year the proverbial last straw of control regime; the Milk and Milk Product Order (MMPO), which regulated milk shed concept thereby giving designated milk shed supply areas to dairy plants, has been practically scrapped. Under this milk shed rules, every dairy plant had its milk shed assigned for milk procurement from farmers. With this scheme gone the supply side is available for poaching by new entrants, and this has certainly anguished the cooperatives and other organized sectors, which have developed their milk sheds over the years by taking productivity enhancement measures.

The government has also put up in the parliament an amendment bill to the existing company act whereby a new chapter is being proposed to be introduced allowing registration of producer company under the company act as private companies working with the cooperative principles philosophy. This step is seen as providing a real level playing field to the coops, which have been complaining of the cooperative acts giving the government agencies substantial power to control coops' business affairs.

Following the Uruguay round of multilateral trade agreements, agriculture has become a part of the international trade regime. Under the agreement on Agriculture all member countries must move to tariff based import protection from non-tariff based protection measures. Although subsidies for domestic production in many developed countries have been reduced in categories subject to reduction commitments, overall levels of subsidies provided by developed countries continue to place developing countries at a disadvantage. In 2005, the world trade regime will begin to shift dramatically, requiring India provide access for up to five percent of domestic consumption to exporting nations, some of whose farmers and commodity firms may continue to enjoy substantial subsidies. If dairy cooperative fail to raise procurement and market shares dramatically, others at home and abroad will fill the gap.

With these changes in the environment the cooperatives are tightening their belt to face the competitive environment where in multi nationals and other domestic big companies are making a foray into the hitherto unheeded milk business. The cooperative together collecting about 16 percent of the marketable surplus of milk available in the country certainly gives them an edge over any organized private operator. As impressive as have been the achievement, the potential is far greater. As income continues to rise, the demand for milk and milk products will grow at a far more rapid pace than in the past. The laudable achievement of past may not be sufficient to safeguard and support the cooperatives' growth in coming years unless they aim high and re-energise themselves towards still higher goals.

With the proactive support of NDDB the cooperative dairy sector has come out with perspective plan 2010 clearly spelling out the focus areas and the time-bound specific key targets. "The dairy cooperative framework is in place. The challenge is to build further on this strong foundation – not just in quantitative terms, but also in terms of institutional strength of every tier in the structure. To set the goals for next decade, the dairy unions have worked with NDDB to evolve Perspective Plans."^{vi} These plans emphasise four thrust areas:

- Strengthening the cooperative Framework
- Productivity Enhancement
- Quality Improvement
- Building a National Information Network"

(The details of the physical targets are presented at table I.)

Perspective 2010 targets increased geographical spread, organization of new cooperatives and strengthening of old ones, expanded services and expanded marketing. Every link in the cooperative chain – from the primary dairy cooperative society to the federation – will be strengthened. Institution building efforts have been initiated to help train society committee members to prepare their value and mission statements, set concrete, attainable objectives and plan future strategies. For unions, business orientation and corporate governance programme for elected leaders are being taken up. Skill up-gradation and shared vision building programmes are being offered to make the professionals take greater initiative in making the goals achievable. Several initiatives are being put in place to encourage women to come forward and join coops and take part in its running and its governance.

Expanding the milk procurement and liquid milk marketing is central to the perspective 2010. Cooperatives have envisaged to procure 48.8 million kg of milk per day, which is presently around 17.5 million kgs per day and to sell on average about 35 million litres per day, a significant jump from present level of 13.5 million litres. To synergise these marketing efforts emphasis is being given to standardized pack designs, sub-branding of milk types and use of a mnemonic cooperative symbol in retail outlet. Also national level campaigns are on various popular TV channels to reach out to consumers to attract to the coops' milk.

Several strategic interventions are planned under the perspective to ensure better nutrition and health of animals to improve productivity. Productivity enhancement thrust area also includes the strategy of upgrading the cattle breed through the integration of artificial insemination, embryo transfer and genetic engineering, DNA finger printing and karyotyping.

High quality standards are critical in a market with intense domestic and international competition. NDDDB has been promoting under perspective plan a comprehensive package for quality improvement. This involves intensive training of from farmers' members to plant personnel, preparation of baseline data on raw milk bacteriological quality, raising awareness of good hygienic Practices, establishment of models for quality assurance, and financing such quality sustaining equipments as bulk coolers and stainless steel vessels.

TABLE I

PERSPECTIVE 2010 TARGETS

Particulars	2000	2010
1. Strengthening The Cooperative Framework		
a. DCS* procurement (Million Kg/day)	15.78	48.80
b. Number of dairy cooperative society	84,289	129,480
c. Farmer members	10.62	15.62
d. Women members (%)	21.19	49.98
e. Milk marketing (Million litres /day)	129.16	365
2. Productivity Enhancement		
a. Inseminations carried out per year (Million)	4.72	16.79
b. Unions with progeny testing programmes	17	49
c. Cattle feed production (tons per day)	4,066	8,628
d. Fodder seed utilized (tons per year)	4,044	24,000
e. DCS* with first aid service	27,000	1,08,000
f. DCS* doing HS and BQ vaccinations	23,000	88,000
3. Quality and plant management		
a. 90% of milk reaching consumers from cooperative will be from ISO certified plants		
b. Clean milk production regimes, managed by farmer members, will be in place in all participating milk unions.		

4. National Information Network
a. All cooperative unions will be linked to and through an internet dairy information system.
b. About three-fourth of the unions will use computerized data processing in all major functional areas.
c. About 75% of unions will use the Geographical Information System (GIS) to monitor field activities.

* DCS – Village Dairy Cooperative Society

The application of information technology to an operation as complex and physically widespread as the dairy cooperatives has brought and will bring enormous benefits. Therefore in perspective 2010 setting up of a National Information Network (NIN) is a thrust area. The NIN will involve collection, analysis and value addition to data for decision makers, enhancing productivity and responsiveness at all levels. The NIN will address data gathering and information providing to village DCSs, district unions and state federations. An ambitious village animal census is underway in all operation flood milk-sheds. Already an internet-based dairy information system (IDIS) is in place linking almost all the milk unions through internet information flow.

Apart from all the direct and indirect support NDDDB has also put multidisciplinary teams at state offices across the countries to work with unions to make them more vibrant. Government of India has taken some positive steps to reform the legislative environment of the cooperatives. The initiatives taken by the NDDDB along with support from the Government of India have set the direction for cooperatives to become strong and self reliant.

The success of Anand pattern cooperative dairying in India has meant a better life for millions of landless, marginal and small Indian farmers. A growing number of African and Asian countries have expressed interest in adopting the Anand pattern, to develop their dairy industry. Indian dairy farmers feel a sense of pride and responsibility to reach out and share their achievements in bringing happiness to farmers of other developing countries.

4.4 Country paper Pakistan

Small-scale milk production, collection and processing in Pakistan

Abdul Ghaffar and I. H. Athar

Animal Sciences Institute, National Agricultural Research Centre, Islamabad, Pakistan.

Email: parv@isb.paknet.com.pk

Introduction

Pakistan is primarily an agricultural country and its foreign exchange is largely dependent on agriculture value added products. The livestock sub-sector of agriculture plays an important role in the economy as it contributes 9% of the Gross Domestic Product (GDP) and 36% of agricultural value added products. The livestock sub-sector earned Rs. 39.5 billion in 1999-2000 that is almost 9% of the total export earnings of the country (GOP 2001). It has been estimated that about 60% of the calories are met from milk and its products. This paper describes livestock population, milk production, collection, processing and marketing while highlighting constraints and opportunities of small-scale milk collection and processing in Pakistan.

Livestock Population and their products

Pakistan has a buffalo and cattle population of 40.7 million heads. Most farmers have 2-5 animals per household scattered throughout the country (ACO, 1998). The trend of total livestock population is shown in Table 1.

Table 1: Livestock population (000 heads) trends in Pakistan.

Species	1986	1996	% Increase
Buffaloes	15704	20272	+29.1
Cattle	17132	20424	+19.2
Sheep	22644	23543	+4.0
Goats	29006	41169	+41.9
Others(Work animals)	5098	3389	-33.5

Among the large ruminants the buffaloes have increased at a higher rate than cattle. Five million farmers own these animals in small numbers, only 2 percent of the households own more than 10 cattle and/or buffaloes. The major livestock products produced in the country are milk 26284, beef 1010, mutton 6660 thousand tones. The per capita availability of animal products is below as compared to recommended level of WHO.

The consumption of milk is unevenly distributed in the rural and urban areas due to lack of infrastructure required for efficient transportation of milk produced in the rural areas. About 80 thousand metric tons powder milk was imported last year to fill the gap between the requirements of the urban consumer and the available. The Government has provided certain incentives for the improvement of dairy industry that include strengthening of research and development activities, import of exotic animals, provision of credit facilities and tax holiday on some items essential for livestock and dairy industry. As a result of concession and incentives provided by the government during last decade there has been resurgence by the private person to invest in dairy sector.

Milk Production

Four types of dairy production systems have been identified in Pakistan (FAO 1987). A brief description is given below:

- i) *Rural subsistence small holdings*. This system operates on almost zero input level and producing milk for the family needs. Farmers keep 2-3 dairy animals including young stock.
- ii) *Rural, market-oriented small holdings*. A typical unit consists of fewer than 6 dairy animals, with 2 or 3 in milk. Milking animals are generally stall fed with seasonal green fodder, straw and concentrate while dry animals are grazed. Female calves are kept for herd replacements. This system is the main source of milk in Pakistan.
- iii) *Rural commercial farms*. In this system more than 40 animals, 90% buffaloes and 10% cattle, on mixed crop-livestock farms or specialized farms, are maintained for breeding and milk production. These farms are well organized and keep some records, but their contribution to the total milk supply is small.
- iv) *Peri-urban commercial dairy farms*. In this system, around all big cities, most herds have 15 to 50 animals and more than 90% are buffaloes. Under this system turnover is very high. The largest peri-urban dairy is at the Landhi Cattle Colony, Karachi, where more than 150,000 milking animals are kept. Since this is a high-cost system, only high-potential animals are kept.

According to estimates (GOP 2000), buffaloes produce 66%, cattle 32% and small ruminants 2% of total milk production. The availability of per capita milk is 82.42 litres in the country. It has

been reported that a good amount of milk is wasted every year. The specific reasons for such wastage are yet to be identified. However, the traditional conversion of milk into other dairy products and inefficient milk collection, transportation and marketing system appear to be the main contributing factors for this wastage of milk.

There are seasonal changes in milk production; December to March is the period of highest production and June to July of lowest. There are huge quantities of surplus milk available in some areas during the peak season, which could be transported to other milk deficient parts of the country. On an average milk production density in Pakistan is about 400 kg / hectare of agricultural area, which is considered high in the developing countries.

Milk Collection

In Pakistan, milk is usually produced in small herds that are scattered over vast areas. Due to highly perishable nature of milk, its safe collection, transportation and distribution to various urban centres is difficult. From production to consumption milk passes through several hands, which deteriorate its hygienic and nutritional quality while price goes up.

The quantity of milk available with the producer is usually small, therefore, the milk collector have to go door to door for its collection and sometimes they can hardly collect 50-100 litres of milk from a village in 2-5 hours. Usually the milk traders handle the milk in an un-organized way and it is sold raw at the consumer's doorstep or to vendors. Currently, some dairy plants like Nestle and Halla have established a network to collect from producers and eliminate the middlemen. These milk collection centres buy the milk on fat percentage basis and transport to dairy plants in refrigerated vans/trucks for further processing.

A report prepared by the World Bank and GTZ revealed that the price of milk is inversely proportional to the distances from urban market in order to compensate for the spoilage and transportation charges. A sound collection and marketing system is therefore, essential to ensure the producer, a quick disposal of his product at a competitive price. This would also benefit the consumers by having an access to clean, safe, unadulterated milk. Long-term implication of such a system would be beneficial in terms of improved nutrition, prevention from various ailments and an increase in the income of rural population. An application of cost effective technology, such as Lactoperoxidase system for preserving fresh raw milk becomes crucial for the success of attaining the dual objectives of ensuring maximum returns to milk producer as well as providing with low cost milk and milk products to common consumers. In developing country like Pakistan such technology has promising potential for economical transport of fluid milk from the remote areas. For this purpose a system of cooperative societies/unions/networks may be established at the gross root level in a village. It can establish a permanent linkage between the individual milk producer and the nearest dairy plant. This system may help selling the milk twice a day on cash basis throughout the year and its transportation to the concerned dairies.

Milk Processing

Processing of milk in dairy plants includes private, public and military/dairy farms. Almost all the military dairy farms are equipped with processing facilities for pasteurized/homogenized milk, fresh cream, preparation of butter and milk powder. In addition, there are six milk drying plants in Pakistan. There were 38 milk processing plants installed in the country over the last three decades, of which 25 plants are completely closed, 7 are operating in low capacity and 6 at satisfactory level. The main causes of failure of pasteurized milk processing plants were poor management, wrong processing technology, inadequate and unhygienic milk supply, lack of research input and trained manpower and lack of refrigerated marketing facilities. Resurgence of interest in dairy development in the private sector, particularly motivated by improved credit

availability and liberal government concessions, was marked by an induction of modern UHT technology in 1979 in the country. The total number of UHT milk plant is 21, out of which 5 are in operation. At present, however, existing operating milk plants with three or four notable exceptions are working at less than 1/3 capacity. The slow down in UHT operation is associated with both production and marketing constraints. The reasons for the failure of a large number of dairy plants are several and may differ slightly from plant to plant. However, the most common reason may be an over estimation of demand for processed milk, too rapid investment in UHT technology, lack of advertisement/consumer education, exorbitant price of UHT processed milk, non-development of sustainable milk collection system, lack of trained manpower and insufficient operational funds.

All plants have large scale milk processing capacity. There are only 3 plants that can be considered as small-scale processing (5000 litres per day). However, there are 2-4 creameries in each of big cities that are operating on cottage scale.

Milk Marketing Systems

The processed milk and milk products are generally sold through commission agents that cause relatively higher prices as compared to raw milk. Consequently, a large quantity of adulterated milk continues to be sold to consumers through the local vendors and urban milk producers. A survey showed that only 21 percent of the milk products in villages is available for sale. The rest of 79 percent is consumed at the homes in the form of fresh milk and milk products. About 51 percent of the milk is sold in urban centres through retail markets and milk vendors. Khoya makers are consuming about 23 percent of the available liquid milk. The 12 percent goes to dairy plant for utilization into various milk products and remaining 9 percent is directly sold to consumers.

A successful milk marketing system should ensure reasonable margin for both the producer and the consumer and ultimately should stimulate the growth and development of an organized milk marketing system. The present system of milk collection, transportation, processing and pricing is one of the major constraints in the development of dairy industry in Pakistan.

Milk Quality and preservation

Milk is a highly perishable commodity and difficult to handle, especially in a country with high ambient summer temperature as in Pakistan. It forms an excellent medium for the growth and metabolic activities of microbial organism, both pathogenic and non-pathogenic and thus retains its nutritional value only for four to six hours. Several studies were conducted to determine the quality of market milk. The quality of this milk was compared with that of the milk produced at dairy farms. The findings of one study are summarized in Table 2.

Table 2. Composition of milk supplied by various sources.

Source	Fat (%)	SNF (%)	T.S. (%)	Water (%)
Rural milk producer	5.81	9.43	15.24	84.76
Milk collector	5.70	8.66	14.36	87.64
Urban milk producer	4.70	7.78	12.48	87.41
Milk vendor	3.68	6.03	9.71	90.29
Processed milk	3.49	9.00	12.49	87.51
NARC Dairy Farm:				
Buffalo milk	6.50	10.15	16.65	83.35
Cow milk	3.81	9.03	12.84	87.15
Dairy Coop.	5.78	8.73	14.51	85.49

Source; Athar, I.H. and Ali, A. (1986), NARC.

To prolong the keeping quality of milk at farm level cooling and/or chilling of milk is recommended. However, use of hydrogen peroxide (H₂O₂) and activation of Lactoperoxidase system could be employed. The life of milk depends on the number of bacteria initially present and the temperature at which it is stored. Bacteria found in milk grow most rapidly at temperatures above 15.5°C while the temperature of about 21.1°C helps speedy souring of milk. The most suitable temperature for temporary preservation of milk is 4°C. Milk leaves the udder at a temperature of about 37°C. Fresh milk from healthy animal is practically free from bacteria, but it must be protected against contamination as soon as it leaves the udder.

REFERENCES

- Agricultural Census Organisation (1998). Livestock Census 1996. Statistics Division, Government of Pakistan, Gulberg, Lahore.
- Athar, I.H. and A. Ali 1986. Study on fat and total solids contents of milk supplied by different dairies in Islamabad. Pak. J. Agri. Sci. 23(2):101-106.
- FAO 1987. Pakistan Livestock Sector Study. Report of the FAO/ADB Cooperative Programme investment centre, Vol. 1&2, FAO Rome.
- Government of Pakistan 2000. Agricultural Statistics 1999-00. Finance division, Economic Advisor's Wing, Islamabad
- Government of Pakistan 2001. Economic Survey 2000-2001. Finance division, Economic Advisor's Wing, Islamabad

4.5 Country paper Thailand

Small-Scale Milk Collection in Thailand

*Mr. Vichai Harnpanichpun, 122/8 huaykaew road
a.mueang Chiangmai 50300, THAILAND*

Introduction

The Kingdom of Thailand covers an area of 513,115 square kilometres with an approximate population of 62 million. Thailand is a tropical country with an average temperature of 28 °C and a yearly rainfall of 1,400-2,400 mm. In most regions there are 3 seasons, the summer, the rainy and the cool season. Agriculture is a predominant occupation of this country.

The livestock sector in Thailand has gone through major changes in the last four decades. Before 1960, almost none of the Thai farmers specialized in livestock production. Most farmers raised animals in their backyards and let the animals graze on their own or fed them with by-products from the farm or even food waste.

According to the Division of Planning, Department of Livestock Development (DLD), Thailand livestock population in 1999 comprised approximately 4.63 million beef cattle, 0.28 million dairy cattle, 1.79 million buffaloes.

Most of the dairy cattle are owned by smallholder farmers with the average of 18 cows per farm, they are intensively taken care of. Most of the cattle in Thailand are crossbred of Holstein-Friesian and other Indicus species for the purpose not only sound performance but also disease resistance and climatic tolerance. Milk production in the country contributes only 30 percent to domestic milk product consumption which does not reach the demand. As a result, about \$

271.43 of milk and milk products was imported into Thailand to compensate the raw milk insufficiency. Therefore, the Government has a policy to encourage the farmers to raise more dairy cattle and to improve milk production in order to reduce milk and milk products importation.

Because the majority of the people in the Kingdom are in the agricultural sector, this sector has naturally received his Majesty's priority attention. In 1960 the Danish government sent experts to study the possibility of dairy cattle fed in Thailand as a present to His Majesty the King. The Thai government has developed this activity from that time to be the Dairy Promotion Organization (DPO) for training on feeding dairy cattle, increasing milk production at farm level, collecting milk from dairy cooperatives, upgrading milk quality from small-scale farmers and dairy cooperatives, and processing dairy products such as pasteurising milk, Ultra Heat-Treated (UHT), drink yoghurt.

The demand for milk and dairy products in Thailand is growing at 14% per year, with almost half of all milk and milk products consumed being imported. School milk programmes are increasingly accepted by policy-makers in Thailand as a cost-effective tool to fight malnutrition among preschool and primary school children. School milk also plays an important role in increasing milk consumption and establishing the habit of milk drinking in adult life. The average per capita consumption is just 10 kg / year, compared with the FAO recommended target of 120 kg. Though livestock are well integrated into the predominantly smallholder agriculture systems in Thailand, very little has been done to tap the milk producing potential of local cows, with milk often being poured away due to spoilage or lack of market access. The Government has begun to address the imbalance between supply and demand and has assigned the highest priority to dairy development. These focus on increasing milk production at farm level, resulting to justifiable public health concerns about the safety of raw milk and traditional products and the lack of affordable and efficient milk collecting, processing and marketing infrastructure.

Type of Milk collection Centres

Type1. MCC Belong to a Dairy Cooperative, which organises milk collection from the farmers. The dairy cooperative will pay the milk price directly to the farmer by the quality of the raw milk.

Type2. MCC Belongs to a Private Dairy plant, the cost to run the milk collection is paid by the private company who owned the milk collection. The company will pay the milk price directly to each farmer

Size of the milk collection centres

1. Small-Scale milk Collecting Centre, Receive raw milk about 1,000 - 5,000 kg/day
2. Medium milk Collecting Centre, Receive raw milk about 5,000 - 10,000 kg/day
3. Large milk Collecting Centre, Receive raw milk more than 10,00 kg/day

Milk collection centre activities

1. Receiving raw milk from individual farmers;
2. Sending the raw milk to the dairy plant which some plant belong to private company and some plant belong to dairy cooperative;
3. When the government official want to contact the farmer to arrange a training course or some disease control, they will come to visit the farmers at the milk collection centre;
4. Some milk collection centres also sell food concentrate or mineral block and some animal drug to the farmers.

Equipment in the milk collection centre

1. Milk receiving, including receiving tank, milk pump
2. Milk testing apparatus, including Alcohol test, milk sampling apparatus, and Lactometer
3. Cooling tank
4. Tanker
5. Electric generator

4.6 Country paper Vietnam

Smallholder dairy goat production and marketing system in Vietnam

Dinh Van Binh, Ngo Tien Dung, Nguyen Thi Mui, Goat and Rabbit Research Centre, Sontay

Introduction

Vietnam is a tropical country located in Southeast Asia with a monsoon climate. The total area of the country is 33.2 million ha, with a population of 78 million; there are 52 million farmers with 70% of total labour working in agriculture. The total cultivated area is small, about 11 million ha. The agriculture is mainly based on rice production, 77% of the cultivated area, supported by other crops such as maize, potato, cassava, groundnut, soybean, sugarcane, fruit trees and other perennial commercial trees as coffee, tea, rubber and coconut. The agriculture output value contributes to 25% of the GDP of which food production contributes to 77% and livestock production to 20% dealing mainly with pigs, cattle, chicken, ducks and goats.

Farmers raise their animals mainly by locally available feed resources such as natural tree leaves or grasses and by-products, residues from vegetables or crops (cassava, sweet potato, bananas, rice, maize, groundnut, bean, etc.). However, the productivity of livestock is low because inputs such as labour, feed and other investments are also low.

The crop-livestock farming system is common in the whole country. While the importance of the crop component is readily recognized, the role of livestock in the system is often less than emphasized, but livestock provide an important contribution to Asian agricultural production by providing food, milk as well as supplying draught power and fertilizer. Incorporation of livestock in the system enables the utilization of marginal lands, which are less suited for crops; livestock also serve as insurance for farm households through additional income generation.

Livestock production

The livestock production forms 25% of the agricultural output value. In this sector, production is almost entirely in the hands of smallholders and deals mainly with pigs, cattle, buffaloes, local goats, fish and poultry. Livestock production is still very far from meeting the people's needs for meat, eggs and milk. Anyway, there is no tradition in Vietnam either for the production or the consumption of fresh milk. The average fresh milk consumption is 5-8 litres/person/year. The domestic milk production forms only 8,6%, the other 91,4% of milk consumption must be imported, in which 70% in the powder form to be processed in to condensed milk, yogurt and can be found on sale in most towns, villages.

According to FAO statistics, import of milk products has increased from US\$ 2.5 million to US\$ 78.8 million during the last decade. It is therefore urgent to rapidly develop local milk production and reduce the cost of imports. On the other hand, creating employment by changing the structure of livestock and protection of the environment is very important and necessary.

In recent years, the people's living standard is increasing. The level of milk consumption has also improved from 0.47 kg/person/year in 1990 to 3.7 kg in 1995, to 6kg in 1999 and to 7.5 kg in 2001. Milk consumption in 1999 is 10 times higher than in 1990, while, poultry 1.2 times. The total milk consumption in Vietnam is estimated at 460,000 tons/year mainly in the cities and industrial zones.

General situation of dairy production in Vietnam

In Vietnam as well as other countries, dairying is recognized as an instrument for social and economic development. The nation's milk supply comes from main source of small producers, dispersed throughout the rural areas. The programmer for development of dairy production is set up with the encouragement of dairy cattle and dairy goat production. Therefore the number of dairy cattle and goat population is increase rapidly during last years (**table 1**).

At the end in 1999 the total of dairy cow herd of the country was 29.400 heads, in June 2000, this number is increased to 30,000 heads, in which about 20,000 heads are reproductive cows consisting of 13,000 milking heads, 85% of dairy cows are concentrated in the South. Most of the dairy cows (94%) are crossbreed Holstein Friesians and 6% are pure Holstein Friesian breed, 92% of total dairy cows are raised at the small householder sectors with the size of herd is 3-5 heads per household. The growth rate of dairy cow is 38.4% per 10 years, while the demand of milk consumption is increased at 20% per year. Therefore the milk import is still increasing at 25%/ year.

Table 1: Dairy cattle and goat population (thousand heads)

Year	Cattle		Goat		Total milk (Thousand tones)
	Total	Dairy	Total	Dairy	
1990	3117	11.0	312.3	18.5	9.300
1991	3136	12.1	312.4	19.6	11.352
1992	3202	13.1	312.3	27.0	13.043
1993	3333	15.0	353.2	30.4	15.073
1994	3467	16.5	427.8	35.9	16.234
1995	3639	18.7	550.5	38.0	20.925
1996	3800	22.5	512.8	45.1	27.856
1997	3905	24.5	515.0	48.2	31.274
1998	3987	26.1	514.3	52.3	32.803
1999	4064	29.4	553.8	55.0	39.000
2000	4180	30.0	555,5	75.5	42.100
2001	4315	31.8	575.5	95.5	49.200
Growth rate/10 year (%)	38.4	189	84.2	416.2	429.0

Opportunities for developing dairy production in Vietnam

The development of dairy production in Vietnam recently has many following advantages:

- Animal feed is predominantly an agricultural by-product. At the same time, the efficiency of converting feed into meat and milk is higher than other animals. Using efficiency of available pastures in the hilly, mountainous areas where occupying three quarters of the country
- The needs of milk consumption of people firstly in cities, industrial areas is increasing rapidly
- The milk production has just covered 10% of that demands. Establishment of systems for milk collection and processing in Vietnam to reduce the import of milk products from outside

- The development of dairy cow and goat production is not only to increase the milk products but also to create the employment and to improved the economic social condition in the rural areas
- The dairy cow and goat raising at households creates high income and get more benefits due to the low cost of feed and high price of milk products with the regular collection systems at their houses
- The technology of dairy production and milk processing is adapted and improved in Vietnam condition. The technologies of effective production is being transferred to the households in private, sustainable and integrated farming system

The constraints for developing dairy production in Vietnam

In the development of dairy production there are the following constraints:

- The dairy production breeding farms in Vietnam have not enough high productive breeds to provide for farmers;
- Lack of suitable technologies in dairy production, breeding management, feed processing, disease prevention, milk collection and processing in the tropical condition;
- Lack of experiences in organization of training and transfer technologies to farmers;
- The milk processing companies do not take attention to developing animal production with milk collection;
- The technology of milk processing and the cost for fresh milk and milk product transportation is not suitable leading high price of milk products for consumers while the traditional consumption of fresh milk and milk products is not popular;
- The farmers lack of fund for increasing their number of breeding animals;
- The taxes for import of milk materials from outside are low (7-10%) and there is no suitable to encourage the farmers to produce domestic milk;
- Some policies are not suitable or their implementation is bad and the existing system of cultural and local managers does not meet current requirements. The policy of market expansion is not considered properly. The rural credit meets only about half of farmers' loan requirement.

Smallholder dairy goat production

The goat production has been established widely in Vietnam under extensive systems. The national goat population is 0.575 million, of which 72.4 % is in the North and 27.6 % is in South of Vietnam. Eighty three percent of these are meat types (Grass goats), which have small size of body, low meat productivity. However, in the recent years, dairy goat production has had more attention of the Government. This is the reason why some achievements have been attained in the field of goat breeding, nutrition, processing. Consequently, goat production is playing an important role in improvement of the incomes for poor farmers in the hilly and mountainous areas where forages, pasture is available and is contributing to poverty alleviation in Vietnam.

The annual amount of goat products is 40,500 tones of meat (75% of providing for consumption in the cities) and 7,640 tones of milk (86% of which are consumed by self-farmers). Recent prices of goat products are higher than the other animals, for instant: 1 kg bodyweight of goat meat is 22,000 VND and for breed is 30,000VND (comparing with the cost of 1 kg beef or pork just is 9,000 VND). 1 litre of goat milk costs 7,000-7,500 VND, while 1 litre of cow milk is 2,800-3,000 VND. The high price of the products gives a higher income for the raisers and promotes goat production in Vietnam.

Goat breeds

The improved dual-purpose goat breed (Bach thao) is having an increasing impact at farmer level on milk and meat production. In the last few years Government of Vietnam has taken a program for the development of goat production. Three breeds of dairy goat were imported from India with this aim in mind, especially for dairy goat production in Vietnam.

Table 2: The performance of dairy goat in Vietnam

	Breeds:			
	Bach thao	Barbary	Jamnapary	Beetal
Body weight				
At birth	2.49-2.84	2.1-2.3	2.9-3.5	3.4-3.9
At 6 months	18.3-22.6	13.5-15.8	17.4-12.9	17.6-19.5
At 12 months	29.2-40.0	19.3-24.3	25.8-35.6	24.2-34.2
Meat production at 9 month				
Carcass rate (%)	42.8	45.1	47.8	46.0
Meat rate (%)	30	29.0	30.6	28.7
Milk production				
Milk yield (l/day)	1.51	1.3	2.1	1.9
Lactation length (days)	148	155	179	186
Reproductive performance				
First kidding age (days)	346	250	401	435
Kidding interval (days)	217	281	316	312
Litter size (kid/litre)	2.09	1.55	1.39	1.36
FCR (kg DM/kg weight gain)(from birth – 9 month age)	4.49	6.07	6.89	6.60

¹ *Dinh Van Binh. (1994, 1998)*

At the Goat & Rabbit Research Centre the studies on the technologies in the development of goat production have been implemented. The initial results of the study are as follows: The Bach thao and Indian goat breeds have been selected to increase their productivity. The bucks of these breeds are used to cross with local breed to improve the reproduction and meat, milk productivity of local goat breeds.

Feeding system for dairy goat production

The farmers raise their animals mainly by locally available feed resources such as natural tree leaves or grasses and by-products, residues from vegetables or crops (cassava, sweet potato, bananas, rice, maize, groundnut, bean, etc.). In 1992-1993 a survey was done in Vietnam using RRA, PRA methods to find out the problems and constraints faced by farmers in the traditional farming system. The main problems and constraints were follows:

- Insufficient supply of feed for animals and lack of protein for animals, especially in the dry season, resulting in the low rate of productivity;
- Lack of technologies for using and processing local feed resources for feeding animals;
- Livestock production was involved with small size of animal herd, with extension system and therefore low income;
- Forest was destroyed and cassava was the main crop so the erosion increased and cultivated land degenerated,

Research activities

Based on that result of investigation, in order to contribute to solving this situation, research activities on station and on farm have been carried out:

- Selection of good goat breeds such as Bach thao breed (dual-purpose) and adaptation three kind of India goats;
- Biomass production and feed quality of multipurpose crops and forage trees such as sugar cane, jackfruit, bananas, *Acacia mangium*, *Flemingia macrophylla*, and *Trichanthera gigantea*, as the feed resources for feeding animals especially ruminants;
- Increasing productivity of ruminants using protein-rich foliages with a basal diet of agricultural by-products such as rice bran, molasses, urea treated rice straw, and sugar cane tops instead of the traditional feeding system of cereal concentrates and grasses.
- Using some leguminous trees such as *Leucaena Leucocephala K636*, *Leucaena Pallida K748*, *Leucaena Hybrid KX2*, *Calliandra*, *Flemingia macrophylla* to improve soil fertility and control soil erosion by installing hedgerows or contour on slopping land.

Setting up goat bank for poor farmers

The Goat and Rabbit Research Centre Sontay, Hatay has been established by the cooperation in raising goat with farmers by the contact. In the contact, Goat and Rabbit Research Centre provided good breeds (borrowing capital) and was suitable to each agro-ecological region and established net-service for insurance to householders such as veterinary service (vaccination, deworming, etc.), training and transferring technology to farmers in raising goats, milk collection. When does give kids 60% the weaning kids are belonging to farmers and 40% are paying for Goat and Rabbit research Centre for the other farmers borrowing to develop. By this way numbers of farmers have dairy goat for raising are increased very quick

Setting up systems for collecting, storing and processing goat milk into cheese

This system is included with establishing a system of goat milk collection in the villages, communes and region. The goat milk was collected from each group collection, which was installed in village or commune. The goat milk was tested in each group collection and then transferred to goat cheese processing factory. Before processing goat milk into cheese and sale of the products in Hanoi, the goat milk was tested density of solid (by lactometer), acidity (by NaOH 0.1N), fat (by Alcohol) and bacteria with simple equipments. The technology was simple, employing a proprietary lactobacilli starter and rennet as coagulant, with prior pasteurization of the milk. The first goat cheese was produced at Goat and Rabbit Research centre Sontay, Hatay, Vietnam.

Otherwise, most important it is estimated that the income of the families receiving the goats has increased by more than 50%. The technology of dairy production and milk processing is adapted and improved in Vietnam conditions. The technologies of effective production are being transferred to the households in private, some provinces such as Tuyenquang, Thainguyen and Binhdin in the sustainable and integrated farming systems.

Marketing fresh goat milk and goat cheese

Fresh milk and goat cheese were introduced in Hanoi, Hochiminh, Laocai and other cities market from 1996 up to now. In the beginning, fresh goat milk and goat cheese are quite special for Vietnamese people. They did not have the habit of using products made from goat milk. But, in recent years, when Vietnam's economy has been opened, living standard of people is improving and demands of milk is increasing in the cities, the customers needed products with high quality. The market for goat products has become bigger. In addition, goat cheese and fresh goat milk are kind special products with high nutrition and favourable especially for foreigners and rich people

Otherwise, it is recommended that an advertising campaign be conducted to highlight the nutritional and health-securing qualities of goat milk and its products, which are produced in rural areas with no chemical inputs and thus qualify for the green “organic” label. Diversification into long-life packs of fresh milk and yogurt will increase market opportunities.

Impact of the dairy goat production for increasing income in householder

The results of technology transfer carried out in Bavi district from 1993-2000, using findings from the work at GRRC, has established the potential of the new feed resources for dual-purpose goat production as a means of improving animal productivity and farmer income. Demonstrations were established with 5 households in 1993. The numbers of participating farmers increased yearly and from the data an economic comparison was made between the new farming system and the traditional one. The results showed major increases in income as a result of introducing the new system (Dinh Van Binh and Nguyen Thi Mui, 1993 and 1997-1998; Table 4 shows the economic efficiency between two farming systems in 1995. The increase in the number of farmers applying the new technologies was taken as a measure of the impact in the area, especially the impact at level of the farm. By 1998, in 35 households where new technologies were introduced, there were marked (54%) increases in income of the livestock-based interventions compared to the conventional system (Table 4). There were 286 participating farmers in 2000 and all reported an improved income, especially those farmers in the villages where goat raising under contract was introduced.

Table 4: Comparison of economic efficiency between two farming systems (means per household)

Production	Traditional system (million VND)					New system (million VND)				
	No.	Exp.	Income	Profit	%	No	Exp.	Income	Profit	%
Pig	3	2.8	3.3	0.5	15	3	2.4	3.3	0.8	30
Local cow	2	1.4	2.6	1.2	86	2	1.3	2.8	1.5	115
Local goat	4	1.2	1.8	0.6	50	4	1.2	2.4	1.2	100
Dairy goat						5	1.8	6.0	4.2	242
From milk								2.8	-	-
Fish pond (m ²)	100	0.1	0.25	0.15	150	200	0.15	0.57	0.42	283
Cassava (m ²)	500	0.19	0.40	0.21	110					
Sugarcane (m ²)						500	0.5	1.6	1.1	220
Garden (m ²)	600	0.22	0.45	0.23	104	600	0.24	0.78	0.54	257
Fuel wood (t)	4.9	0.97				1.1	0.24			
Biogas						1	0.18	0.73	0.55	305
Total		6.93	8.7	2.84	41		8.0	18.2	10.2	129

Source: Dinh Van Binh et al., 1995

Conclusions

- Developing dairy products based on small-scale dairy production is the strategy of Vietnamese Government in recent and future years;
- Dairy goat production is a new branch of agriculture in Vietnam, which is based on applying new technologies of breeding, optimum utilization local feed resources, established milk collection and processing systems with the concept of “small is beautiful” in sustainable integrated livestock farming system that is not only contributed in developing milk production, creating employment, increasing income but also reduced poverty alleviation at households in rural areas;
- These aspects strengthen the cases for the promotion of goat production as an important element in the campaign to assist less-advantaged rural dwellers, especially those in mountain areas;

- The cooperation in developing dairy goat production is very necessary in strategy dairy production at householder which should be established, supported and sponsored by Region, international, FAO, NGO and Government organizations project.

References

- Dinh Van Binh, Chu Dinh Khu, 1997.** Using of Bach Thao Bucks to improve the performance of local Co goat flocks. MsC thesis. Institute of Agricultural Sciences 1998
- Dinh Van Binh, 1994.** Study on some biological characteristics and the performance of Bach Thao goat breed raising in Northern Vietnam. PhD thesis, Institute of agricultural sciences 1995.
- Dinh Van Binh and Nguyen Thi Mui 1997** Impact study of livestock-based interventions in villages of Bavi district in North Vietnam. Proceeding of regional seminar-workshop on better use of locally
- Dinh Van Binh, Nguyen Kim Lin, Chu Dinh Khu, Do Thi Thanh Van and Pham Trong Bao, 1998.** Results on adaptation research of Barbari, Beetal and Jamunapari goat breeds after 4 years in Vietnam condition. Institute of Agricultural Sciences. Proceeding of Workshop of Animal Production Science, Ministry of Agriculture and Rural Development, Vietnam 1999
- . Dinh Van Binh, Nguyen Quang Suc, Nguyen Thi Mui and Le Viet Ly 2000.** Transfer of livestock technologies to farmers in Bavi and mountainous areas of North Vietnam Workshop-seminar "Making better use of local feed resources" SAREC-UAF, January, 2000
- FAO, 2000. FAO org. Database.** Internet: <http://aps.fao.org/lim500>
- Nguyen Thi Mui., Dinh Van Binh., Ngo Tien Dung, 2001.** Farmers' reception on use of forages in Bavi District. Proceeding of Workshop of Animal Production Science, Ministry of Agriculture and rural development, Vietnam 2001-19

Chapter 5 Conclusions and recommendations

5.1 Conclusions

- 1 In some countries in the Asian region there are very few **village level milk producer groups** (e.g. China, Pakistan). In other countries they are existing, but often not owned by farmers themselves.
- 2 There is a **lack of education and training** regarding
 - setting up, functioning and development of milk producer groups
 - small-scale milk processing technologies
 - marketing of dairy products
 - milk testing and payment systems based on hygienic and compositional quality
- 3 There is a **lack of (or access to) information** regarding
 - market prices
 - small-scale processing equipment and related inputs at national/regional/global level
 - suitable milk testing and payment systems at village level
- 4 There is a **lack of support services** (e.g. veterinary services, artificial insemination, feed supply, and marketing outlets) to support the small-scale dairy sector in the development of the milk production, collection, processing and marketing.
- 5 There is a lack of **appropriate policies** for the small-scale dairy sector:
 - to facilitate the existence of small-scale milk producer groups
 - to increase the hygienic and compositional quality of milk
 - to enhance the demand for local milk and milk products and to encourage local production
 - to reduce threats for the local production from cheap imports of dairy products
 - to raise awareness of consumer awareness regarding hygiene of milk
- 6 **Milk safety** is a major issue in small-scale milk production, collection and processing because:
 - payment systems often lack incentives for quality improvement like bonuses or penalties
 - the informal unregulated milk market continues to play the biggest role
 - good manufacturing practices for milk producers, collectors and processors are neither regulated nor implemented
 - milk packaging is often of low quality
 - low level of consumer awareness to the necessity of heat treatment of milk at home
- 7 **Middlemen** take a fair share of the milk price, resulting in lower returns for farmers.
- 8 In many countries in the Asian region, the collection and processing of milk is made difficult by the fact that milk producers produce **small milk volumes**, which milk producers are living in remote areas and that raw milk is often of poor quality (e.g. Vietnam, Mongolia, and Pakistan).

- 9 The **informal milk market** is in terms of volume in almost all countries in the Asian region larger than the formal market. Often the quality of milk marketed through the informal market is of lower hygienic quality which can be a hazard for the consumer health.
- 10 **Milk processors** often produce a limited range of products, the packaging of the dairy products is often of low quality and the processors face high competition by the cheap imports of milk powder and other dairy products.
- 11 The **seasonality of the milk supply** in some countries makes marketing more difficult.
- 12 Regarding **milk testing**, the access to appropriate equipment at village level does often not exist, the quality of the chemicals is often poor, there is a shortage of skilled technicians and the small volumes of milk in remote areas make sampling and testing difficult.
- 13 There is a lack of low cost field level micro-biological **testing methods**.
- 14 There are often weak **linkages** between payment and testing systems, the management information system and extension services.
- 15 There is a lack of **promotion of local milk consumption**
- 16 There is a **consumer misunderstanding** regarding the supposed higher quality of imported dairy products.

5.2 Recommendations

1. Farmers' owned **milk producer organisations** should be introduced and / or developed at village, district and other levels to improve hygienic milk quality in the informal market and to increase farmers' returns
2. **Training and education** for small-scale milk collection and processing should be improved

Topics:

- Setting up, functioning and development of milk producer groups
- Small-scale milk processing techniques
- Marketing of dairy products
- Milk testing and payment systems based on hygienic and compositional quality
- Training of Trainers

Through:

- Establishment of regional training centres at different levels (e.g. mobile training units)
- Pilot projects
- Development of training materials
- Long term training programs

3. **Appropriate policies** for small-scale milk collection and processing should be established at different levels:
 - Establishment of an advisory committee to recommend specific policies, e.g. by the

formation of an advisory committee comprises of officials from FAO, IDF, local government and farmers representatives, consumer representative

- Opportunities for farmers' owned Milk Producer Groups to exist and register
 - International Trade Policies should promote small-scale milk collection and processing
 - A proactive approach should be taken to creating an enabling environment for all stakeholder
4. Introduction of **appropriate milk payment systems** according to hygienic and compositional quality with the inclusion of incentives to improve the quality of milk and with regular milk payments
 5. **Guidelines** should be provided to milk producer groups, milk processors and market agents for Good Manufacturing Practices regarding small-scale milk collection and processing
 6. **Milk consumption should be promoted** to stimulate milk production and marketing (e.g. school milk feeding, advertisements), including the promotion of safe local products.
 7. Establishment of **regional Asian information systems** on equipment for small-scale low cost milk testing, payment systems, processing technology and market information
 8. A **qualification system** for laboratory technicians and milk testers should be introduced starting at national level with a special focus on the informal markets.
 9. Studies should be carried out in order to develop and improve the simple **milk testing procedures** (e.g. an antibiotics test to be used at village level).
 10. **Studies** should be carried out in order to define **consumer preference** regarding dairy products and general market information for these products. ILRI's Dairy Programme could take a leading role in this.
 11. Many issues regarding small-scale milk collection and processing in developing countries require a **national approach** since Asian countries are diverse in their milk collection and processing systems.
 12. The improvement of small-scale milk collection and processing in developing countries in the Asian regions requires **a holistic and integrated approach** since all aspects are strongly interlinked.

Annex 1: Conference time table

**Ministry of Agriculture, People's Republic of China / Institute of Animal Science,
Chinese Academy of Agricultural Science (CAAS) /
Food and Agriculture Organization of the United Nations (FAO)**

**Regional Asian workshop on
"SMALL-SCALE MILK COLLECTION AND PROCESSING IN
DEVELOPING COUNTRIES"**

DAILY SCHEDULE

15-17 May 2002, Tongshan hotel, Tongshan (Xuzhou, Jiangsu province), China

Wednesday 15 May

Time	Activity
07:40 – 08:30	Arrival (by train) and Registration of Participants
08.30 – 09.30	Breakfast
09:30 – 13:00	Visits to: <ul style="list-style-type: none"> • small-scale village milk producers • village milk collection centre • Wei-wei milk processing centre and Wei Wei farm
13.00 – 14.30	Lunch Break
14:30 – 18:00	Further field visits
19.00 – 21.00	Dinner (offered by Tongshan County)

Thursday 16 May

Time	Activity
07.00 – 08.30	Breakfast
08:30 – 09:30	Opening Ceremony
09:30 – 09:50	Objectives of the conference and explanation of the agenda
09:50 – 10:10	FAOs activities in small-scale milk collection and processing
10:10 – 10:30	Report on the FAO E-mail conference on small-scale milk collection and processing in developing countries
10.30 – 11.00	Break
11.00 – 11.15	Presentation of paper on milk producer groups
11.15 – 11.30	Presentation of paper on marketing of dairy products
11:30 – 11:45	Presentation of paper on milk processing at village level
11:45 – 11:55	Introduction to group sessions
11:55 – 12:45	Group session: constraints in small-scale milk collection and processing <ol style="list-style-type: none"> 1. Milk producer groups 2. Marketing of dairy products 3. Milk processing at village level
12.45 – 14.00	Lunch Break
14.00 – 14.10	Country paper (Bangladesh)
14:10 – 14:20	Country paper (Cambodia)

14.20 – 14.30	Country paper (India)
14.30 – 15.30	group session: designing an action plan to overcome constraints
15.30 – 16.00	Break
16.00 – 17:00	continuation of group work
17:00 – 18:30	Plenary session: presentation of group findings and discussion on findings
18.30 – 20.00	Dinner
20:00 – 21:00	Evening session

Friday 17 May

Time	Activity
07:00 – 08:30	Breakfast
08.30 – 08.45	Presentation of paper on milk testing and payment systems
08:45 – 09:00	Presentation of paper on dairy policy
09:00 – 09:15	Presentation of paper on food safety
09:15 – 09:25	Introduction to group work
09:25 – 10:30	Group work: main constraints in small-scale milk collection and processing 1. Milk Testing and Payment Systems 2. Dairy Policy 3. Food Safety
10.30 – 11.00	Break
11.00 – 12.45	group work: designing action plan to overcome constraints
12.45 – 14.00	Lunch Break
14:00 – 14:10	Country paper (Pakistan)
14.10 – 14.20	Country paper (Bhutan)
14.20 – 14.30	Country paper (Vietnam)
14.30 – 15.30	Presentation of group work and discussion on findings
15.30 – 16.00	Break
16.00 – 17:00	Main conclusions and recommendations
17:00 – 17:30	Closure of workshop
17:30 – 18:30	Free for packing
18.30 – 20.00	Dinner
20:00 –	Departure of Participants (by train)

Annex 2: List of participants

Sri Kamal Ranjith Amarasekara

Nationality: Sri Lanka
Profession: Director
Ministry of Agriculture and Livestock
C/O FAO Representative
202 Bauddhaloka Mawatha
Colombo 7, Sri Lanka
Tel: +94 1 580798 / 588537/00 94 1 871518
Email: FAO-LKA@field.fao.org

Jan Barabas

Nationality: Slovak Republic
Profession: Consultant, Dairy technologist
Berlinska 7/96, Zilina 01008,
SLOVAKIA
Email: jan.barabas@bb.telecom.sk

Dinh van Binh

Nationality: Vietnam
Profession: PhD of Animal husbandry
Goat and Rabbit Research Centre
Xuan Khanh, Son Tay,
Hatay, Vietnam
Fax: 08434838889
Tel: 08434838341,
Email: binhbavi@netnam.vn

Bingwang Du

Nationality: Chinese
Profession: Professor
Department of Animal Science,
ZhanJiang Ocean university,
Zhanjiang 524088, Guangdong, P. R. China
Tel: +86 25 13828265228
Email: dubingwang@sina.com

Jurjen Draaijer

Nationality: Netherlands
Profession: FAO Consultant
Hoogstraat 37A, 6701 BM Wageningen
The Netherlands
Email: Jurjen.draayer@12move.nl
Tel: +31 6 20362903

Sanjid Enkhtuya

Nationality: Mongolia
Profession: Senior officer
Responsible for milk and dairy processing.
Policy Implementation and Coordination
Department,
Ministry of Food and Agriculture, Mongolia.
Tel: 976-11-56877 (O), 976-99184168 (mobile)
Tel/Fax: 976-11-454096 (home)
Email: esanjid@hotmail.com

Luis A. Clerge Fabra

Nationality: Cuba
Profession: Centro Nacional de Sanidad Agropecuaria
(CENSA)
Mail box 10,
San Jose de las Lajas,
Provincia Habana, Cuba,
Tel: +53 7 64 6-3897(o), +53 7 64-209-4641(h)
Email: lucler@censa.edu.cu

Antonella Falcone

Nationality: Italia
Profession: FAO General Staff
Animal Production and Health Division of FAO
Viale delle Terme di Caracalla
Rome 00100 Italy
Fax: +39-0657055749
Email: antonella.falcone@fao.org

Yousheng Fang

Nationality: Chinese
Profession: Senior Engineer of Animal Husbandry
Beijing Dairy centre,
No. 56 Xisi zhuanta Hutong
Beijing 100810, P. R. China.
Tel: +86 10 66172067, 62948051
Fax: +86 10 66172067/62943084

Yao Fu

Nationality: Chinese
Profession: trade manager
Beijing Shinejo Shineyeah Science & Technology Co.,
Ltd.
Beijing 100094, P. R. China
Tel: +86 10 62819092
Fax: +86 10 62811619
Email: fy2218@163.com

Bin Gao

Nationality: Chinese
Profession: Vice governor
People's Government of Tongshan County
Tongshan Economic development district,
Tongshan 221116, Jiangsu province, P. R. China
Tel: +86 516 2735135/3503666
Fax: +86 516 3405025

Tengyun Gao

Nationality: Chinese
Profession: Professor
Henan Agricultural University,
No.95 Wenhua road, Zhengzhou 450002,
Henan province, P. R. China
Tel: +86 371 3960196
Email: tygaoty@yahoo.com

Abdul Ghaffar

Nationality: Pakistan
Profession: Research Scientist
Senior Scientific Officer (ABG)
Animal Sciences Institute
NARC, Park Road
Islamabad Pakistan
Fax: +92-51-9255221
Tel: +92-51 9255040
Email: parc@isb.paknet.com.pk

Runxia Gu

Nationality: Chinese
Profession: Director
Dairy products research Institute,
Yangzhou University,
Yangzhou 225009, Jiangsu, P. R. China
Tel: +86 514 7979053
Fax: +86 514 7369499
Email: rxgu@yzu.edu.cn

Vichai Harnpanichpun

Nationality: Thailand
Profession: Dairy technologist
122/8 huaykaew road
a.mueang Chiangmai 50300
THAILAND
Fax: +66-53-213162
Tel: +66-53-222474
Email: products_extension@dld.go.th
rg05_cmi@dld.go.th

Chenghao He

Nationality: Chinese
Profession: Professor
Institute of Animal Science,
Chinese Academy of Agricultural Science
Beijing 100094, P. R. China
Fax: +86 10 62895853
Tel: +86 10 62895862

Richard Owen Kellems

Nationality: USA
Profession: PhD
Brigham Young University
Plant and Animal Sciences Department
353 WIDB, Provo,
Utah 84602, USA
Fax: 01-801-378-4211
Email: richard_kellems@byu.edu

Christopher La Due

Nationality: USA
Profession: program officer
Peak enterprise program
Economic Liaison department,
Tibet Industrial and Commercial Federation
No.12 linkuo North road
Lasa 850000, Tibet, P. R. China
Tel: +86 891 13908985173
Fax: +86 891 6334110
Email: cladue@mountain.org

Jean-Claude Lambert

Nationality: French
Profession: FAO Senior Professional Officer
Animal Production and Health Division of FAO
Viale delle Terme di Caracalla
Rome 00100 Italy
Fax: +39-0657055749
Email: jeanclaude.lambert@fao.org

Tseden Lhundrop (Cidan Lunzhu)

Nationality: Chinese
Profession: vice director
Economic Liaison department,
Tibet Industrial and Commercial Federation
No.12 linkuo North road
Lasa 850000, Tibet, P. R. China
Tel: +86 891 6330965, or +86 89113989093809
Fax: +86 891 6334110

Chang Liu

Nationality: Chinese
Profession: Secretary of Jiangsu provincial dairy
industry association
Floor No.9 of Nonglin Mansion
District of Longjiang,
Nanjing 6228036, Jiangsu, P. R. China
Tel: +86 25 6228036

Jinxiang Liu

Nationality: Chinese
Profession: director
Department of animal husbandry,
No.256 Jiangkang road,
Anqiu 262100, Shangdong, P. R. China
Tel: +86 536 4262974
Fax: +86 536 4261637

Zhaoqin Liu

Nationality: Chinese
Profession: governor
People's Government of Tongshan County
Tongshan Economic development district,
Tongshan 221116, Jiangsu province, P. R. China
Tel: +86 516 2735135/3503666
Fax: +86 516 3405025

Zhenyu Liu

Nationality: Chinese
Profession: vice manager
Xu Zhou VV dairy Co. Ltd,
No.1 Tianjin road,
Tongshan New district 221100, Jiangsu province
P. R. China
Tel: +86 516 3507326
Fax: +86 516 3507325

Elias el Mayda

Nationality: Syria
Profession: Professor, Univ. Aleppo
Aleppo University Faculty of Agriculture Food
Science Department, Aleppo-Syria
Fax: +963-212229184
Tel: +963-215723558
Email: e_elmayda@yahoo.com

Masatsugu Okita

Nationality: Japanese
Profession: FAO Associate Professional Officer
Animal Production and Health Division of FAO,
Viale delle Terme di Caracalla
Rome 00100, Italy
Fax: +39-0657055749
Tel: +39-0657056214
Email: masatsugu.okita@fao.org

Arvi Olkonen

Nationality: Estonia
Profession: Professor
Institute of Animal Science
Estonian Agricultural University
Kreutzwaldi 1, Tartu 51014, Estonia
Tel. +372 7 313 471, +372-7-313472,
Mobile phone: +372-52-31722
Fax: 372 7 313 429
Email: henno@eau.ee

Amos Omoro

Nationality: Kenya
Profession: Veterinary Surgeon
Market-oriented Smallholder Dairy,
International Livestock Research Institute
P.O. Box 30709, Nairobi, Kenya
Email: A.OMORO@CGIAR.ORG

Jean Paul Ramet

Nationality: France
Profession: Professor of Dairy Technology
ENSAIA 2, avenue de la Foret de Haye
F-54 505 VANDOEUVRE-LES-NANCY
Fax: +33383595804
Tel: +33383595959, +33383595849
Email: Jean-Paul.Ramet@ensaia.inpl-nancy.fr

Tek Bahadur Thapa

Nationality: Nepal
Profession: FAO Dairy Consultant
Director, Yeti Dairy Products International Inc. Ltd,
GPO Box-7445, Kathmandu, Nepal.
TEL: +977-1-493125 and 474225
E-mail: tbthapa@enet.com.np
tekthapa@yahoo.com

Gobinda Chandra Saha

Nationality: Bangladesh
Profession: General Manager of MilkVita
Dugdha Bhaban 139-140,
Tejgaon Industrial Area, Dhaka 1208
Fax: +880-2-8826888
Email: milkvita@bangla.net

Qinghai Sheng

Nationality: Chinese
Profession: PhD
Sanlu Group,
No. 539 Heping west road,
Shijiangzhuang 050071, Hebei, P. R. China
Tel: +86 311 8615440
Email: shengjia99@yahoo.com

Teuvo Voitto Antero Siirtola

Nationality: Finland
Profession: Dairy Development Consultant
Tupakkiaho, Haimoo 03400 Vihti, Finland
Tel: +35892234725
Fax: +35892227325
Gsm: +358405959273
Email: teuvo.siirtola@pp.inet.fi

Sriram Singh

Nationality: India
Profession: Service
Sr. Executive
Cooperative Services
National Dairy Development Board (NDDB)
Anand - 388001 Gujarat, India
Fax: (91-2692) 60157 and 60165
Email: srirams@nddb.coop

Om Pal Sinha

Nationality: India
Profession: Free Lance Consultant
A/6 Avkar Apartments,
Near IRMA, ANAND- 388 001 (Gujarat State),
India
Email: opsinha@hotmail.com

Zhenhuan Su

Nationality: Chinese
Profession: Professor
Institute of Animal Science,
Chinese Academy of Agricultural Science
Beijing 100094, P. R. China
Fax: +86 10 62895853
Tel: +86 10 62895862

RongXin Sun

Nationality: Chinese
Profession: President
Changfu Group,
No.168 Changfu road, NanPing 353000,
Fujian province, P. R. China
Tel: +86 599 8614821
Fax: +86 599 8614721

Issara Suwanabol

Nationality: Thailand
Profession: Professor
National Milk Drinking Campaign Board
c/o National Youth Bureau
618/1 Nikkom Makkasan Road, Rajthevee
Bangkok 10400, Thailand
Fax: 662 6516959 or 662 2772474
Email: issaras@mozart.inet.co.th

Fenglan Wang

Nationality: Chinese
Profession: vice manager
Xu Zhou VV dairy Co. Ltd,
No.1 Tianjin road,
Tongshan New district 221100, Jiangsu province
P. R. China
Tel: +86 516 3927113
Fax: +86 516 3507325
Mobile phone: +86 516 13852138938

Jiaqi Wang

Nationality: Chinese
Profession: Professor, PhD in ruminant nutrition,
vice director of Institute
Institute of Animal Science,
Chinese Academy of Agricultural Science
Beijing 100094, P. R. China
Fax: +86 10 62897587
Tel: +86 10 62890458
Email: Wang-jia-qi@263.net

Jie Wen

Nationality: Chinese
Profession: Professor
Institute of Animal Science,
Chinese Academy of Agricultural Science
Beijing 100094, P. R. China
Fax: +86 10 62895853
Tel: +86 10 62895862

Meiyan Yu

Nationality: Chinese
National research centre of Dairy Engineering and
Technology
Heilongjiang Dairy Training centre
No.337 Xuefu road
Harbin 150086, P. R. China
Tel/fax: +86 451 6661498
Email: meiyanyu@mail.hl.cn

Annex 3: Speeches

Speech 1

Ladies and Gentleman,

Good evening. I wish to welcome all the participants to the FAO Regional Workshop for Asian countries. Without the assistance of the Ministry of Agriculture, and in particular of the Institute of Animal Sciences, this important event could not have been organized. In this regard, I wish to thank all the staff of the institute for the active contribution in the organization of the workshop.

I am convinced that no other place would have been more appropriate than China for hosting the workshop. China, like many other countries in Asia, has a modern developed dairy industry, particularly in the coast, and has a huge potential for milk production in the central part of the country. Unfortunately, the dairy infrastructure is not well established; for this reason, there is a need to start with low investment capital for milk collection and processing at a small-scale level.

This workshop represents the follow-up to the very successful electronic conference on small-scale milk collection and processing organized in July 2000 by FAO that brought together over 570 participants from 97 countries.

The objectives of this workshop are to exchange information on small-scale milk production and processing in developing countries or dairy areas, and to address common regional constraints.

The Ministry of Agriculture of China has collaborated closely with FAO in various occasions for the improvement of the dairy sector; I mention as an example the establishment of the Reference National Dairy Laboratory in Harbin. This workshop will permit FAO to prepare a regional programme of activities based on the most critical constraints for dairy development in Asia.

The dairy development for smallholders is among the priorities of the Special Programme for Food Security, which has been initiated by the Director-General of FAO five years ago in order to reduce the malnutrition in the world.

FAO is more oriented towards the South - South assistance through the organization of regional networks for exchange of information, experience and bilateral assistance in the region.

I wish this workshop a big success and hope that with your important contribution the small-scale dairy sector will continue to develop for the benefit of the small farmers.

Speech 2

Mr Chairman,
Distinguished Participants,
Ladies and Gentlemen,

It is an honour and indeed a privilege for me to be here with you today in this beautiful and dynamic city of Xuzhou on the occasion of the Asian Regional Workshop on Small-scale Milk Collection and Processing in Developing Countries. First of all, please allow me to congratulate, on behalf of the FAO's Director-General Dr Jacques Diouf, the Government of China for the

successful organization of such an important event. It is with the collaboration of the Ministry of Agriculture and Jiangsu Provincial People's Government, and with the assistance provided by the Institute of Animal Science of the Chinese Academy of Agricultural Science and Xuzhou City and Tongshan County Government, that the FAO regional workshop is successfully organized. I would like to thank all the official and scientists for their active contribution for the organization of this workshop.

The Ministry of Agriculture of China has collaborated closely with FAO in various occasions for the improvement of the dairy sector; I mention as an example the establishment of the Reference National Dairy Laboratory in Harbin. This workshop will permit FAO to prepare a regional programme of activities based on the most critical constraints for dairy development in Asia.

The dairy development for smallholders is among the priorities of the Special Programme for Food Security, which has been initiated by the Director-General of FAO five years ago in order to reduce the malnutrition in the world. FAO is more oriented towards the South-South assistance through the organization of regional networks for exchange of information, experience and bilateral assistance in the region.

I wish this workshop a big success. I also wish all the participants a nice stay in this beautiful city of Xuzhou.

Thank you all.
