# Traditional Cheesemaking

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# Preface

In the nineteenth century Swiss cheesemaking was an important factor in promoting rural development. Before the expansion of tourism, cattle grazing was the most appropriate method of land use in the higher valleys and the Alps; in many regions, for the peasants, it was the only alternative to emigration. However, milk production could only be increased where there was a market for this nutritious but highly perishable product. For the peasants of isolated valleys and Alps, cheesemaking was the only way to overcome this bottleneck. Thus, the peasants formed co-operatives which they initially ran themselves and, later on, rented out to specialized workmen who improved techniques and turned cheesemaking into a highly respected trade.

The better the cheese, the higher was the price it commanded in local and regional markets. As the demand for high quality cheese rose and export markets were opened, the dairies became able to pay more for the milk they used, and soon the peasants began to increase production by improving the quality of their livestock, pastures and stock farming techniques. By the beginning of the twentieth century, Emmentaler, Tilsiter, Gruyère, Appenzeller, and the cheeses from other relatively isolated valleys had become highly valued export products. This profitable trade was — and still is — a reliable source of income for thousands of cheesemakers and dairy farmers in Switzerland.

Similar strategies to achieve rural development have been adopted by French, Dutch, Danish, English and Italian farmers and cheesemakers, to mention only a few of the nations which have become famous for the quality of their cheese.

Based on this model of rural development, which, at home, proved to be a successful way of integrating isolated peasants into national and international markets and thereby stimulating their production and raising their incomes, the Swiss Development Corporation (SDC), a public agency for the promotion of social and economic development in the Third World, began to transfer cheesemaking techniques in order to generate similar processes of change in the peasant community of those poor countries which have a potential for dairy farming. The first project

of this programme was set up in Langtang, Nepal, as early as 1954.

The production of cheese and yoghurt, mainly for the tourist market, soon became an important source of income for some small dairy farmers in the valleys of the Himalayas. In 1977 a similar project was set up in Afghanistan.

In Latin America, the programme was started in Peru in 1970. Initially, its main objective was to offer a productive alternative to the peasants of the Sheque valley near Lima, the capital of Peru. Later, in 1972, the Programme, in close collaboration with the Instituto de Investigaciones Agroindustrial now the Instituto Nacional de Desarrollo Agroindustrial (INDA) expanded its activities to many other regions of the Peruvian highlands. In 1981 the Instituto Nacional de Investigación y Promoción Agropecuaria (INIPA) became the most important national partner institution and the project soon became integrated into the Programa Nacional de Queserías, which still receives some limited follow-up assistance by SDC.

In Peru, the programme trained some 30 technicians and extension workers, who were specializing in small-scale cheesemaking, as well as about 200 peasants and workers from co-operatives and other forms of collective enterprises. Altogether it advised and promoted the establishment of more than 80 small rural cheese factories.

Based on a recommendation made by FAO, the programme initiated its activities in Ecuador in 1978. As suggested by the evaluation of the Peruvian experience, it co-operates not only with the Ministerio de Agricultura y Ganaderia, the official counterpart institution, but also with the Fondo Ecuatoriano Populorum Progressio (FEPP) and other non-governmental organizations interested in promoting rural development.

This joint effort allows for the application of a more integrated approach, according to which cheese manufacturing, as the main stimulant of change, should be accompanied by the promotion of peasant organizations, credit programmes, extension services for pasture, genetic and stock-farming improvements, as well as by the establishment of an association of peasant-owned cheese factories with its own marketing network and retail outlets. Also, the programme has given more importance to local demand and preferences. By adapting traditional techniques to produce suitably hygienic fresh cheese, which may be easily subsidized by profits from other types of dairy products, it is possible to improve the peasants' own diet and thus their conditions of health. Finally, cheesemaking should be complemented by other activities such as meat processing, as well as by biogas or solar energy programmes.

In such a strategy of integrated rural development the promotion of small-scale cheesemaking may become a key element in generating a

series of positive spin-off effects. This concept cannot be adopted by all groups of peasants, but in general, at least the following conditions and arguments should be considered:

- the peasants must be organized, well motivated and have some previous experience in stock-raising;
- there must be enough land to expand and increase pastures without generating ecological problems;
- the producers need access to credit and extension services to establish a small cheese factory and improve their livestock, pastures and farming techniques;
- cheese production by small-holders should only be encouraged in isolated areas where climate and ecological conditions do not permit the production of food crops and where there is no alternative market for milk: to increase the consumption of freshly pasteurized milk is always a better way of improving the diet of the poor;
- in the case of co-operative cheesemaking, additional assistance in management, accountancy and organization of self-help groups is indispensable;
- in most developing countries, well-matured cheese is mainly consumed by the middle and upper classes who live in the major cities, markets to which the peasants usually have no direct access; unless they manage to establish their own marketing network, most of the value added by cheese production is therefore lost to the middlemen;
- the general economic policies (milk price, import restrictions, credit availability to small farmers) and technical extension systems should encourage dairy production, and actively assist the peasants in their efforts to raise their output.

The present handbook summarizes the author's experience gained during the 30 years which he and other experts of SDC have spent in different developing countries promoting appropriate techniques for cheesemaking as a means of improving peasant livelihood. The book is now published in English to assist organized groups of small producers as well as governmental and non-governmental institutions which promote rural development in Third World countries.

F.R. Staehelin
Director
Swiss Development Co-operation

# Contents

# Introduction

### *Why make cheese?*

There are many remote areas scattered throughout the world where dairy farming is a well-established occupation. Large quantities of high-grade milk can be produced in such areas but the local market cannot always absorb them, especially during peak periods. Converting milk to cheese is one method of dealing with the surplus. Cheesemaking provides an incentive for improving dairying as well as creating new jobs. It also improves the local diet and raises the standard of living generally, through a better understanding of hygiene, scientific techniques and community spirit. In a Third World setting, the local cheese plant often serves as a centre for community activities.

Nutritionally, cheese resembles meat but it is a more concentrated food. It contains large quantities of protein, fat and minerals and is rich in phosphorus and calcium which are both beneficial to growing children.

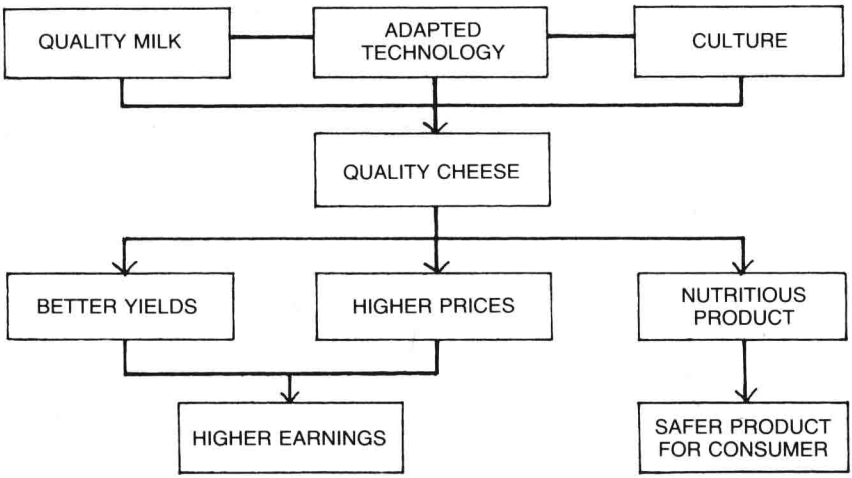



**Figure 1. The 'knock-on' effects of cheesemaking.**

If rural cheese factories are organized as co-operatives or associations then the entire community will benefit. As members of a co-operative, dairy farmers who send their milk to the plant will have a stake in its development and future success. With a higher income, farmers can improve their herds, pastures, and dairy practices, and high quality cheese and butter will contribute towards a healthier national diet. But whatever structure the rural cheese factory adopts — whether as a co-operative or as a private concern — there is a 'knock on' effect which will be to everyone's advantage (see Figure 1).

Hygiene in both the cheese factory and the milking parlour is clearly vital. Cheesemakers must be trained to make products of the highest quality, so as never to put the consumer's health at risk. They must be able to solve the many problems which may arise during processing, and personnel must be trained to work conscientiously in constructing, equipping, organizing and administering the enterprise.

### *Location*

There are several factors to be considered before deciding on the best location for a cheese factory. Due to production costs, cheese protein is more expensive than meat protein. It is advisable, therefore, to locate cheese factories in remote areas where milk distribution costs are high and demands are low. Siting cheese factories in heavily populated urban areas is less important, as fresh milk can be transported easily and cheaply and is always in demand, especially by children for whom it is a better source of nutrition than cheese.

In remote areas, cheesemaking can be the best way to overcome the problem of milk overproduction. By converting milk into cheese during periods of peak production, its nutritional value can be conserved and stored until needed, although it should be remembered that cheese cannot be kept forever, under normal circumstances. Economically, rural rather than urban locations are more suitable for cheese factories.

Traditional cheesemaking has a definite role to play throughout the world. In the Third World, many rural cheese factories are already in full operation and are producing a whole range of high-quality products. The fine cheeses of Europe are the result of hundreds of years of labour and research. Good cheesemakers must be willing to experiment and innovate to achieve the best results. Although cheese is usually made from cows' milk, every kind of milk can be employed. Excellent cheeses are made from goats' and ewes' milk. In Asia, yak and buffalo milk are used. Cheesemakers will often strive to imitate a well-known European cheese such as Gouda or Cheddar, but local conditions and national preferences will soon exert their influences and new types of cheese will emerge to suit local preferences.

### *International cheeses and cheesemaking*

In the Himalayan area of Central Asia cheese is made from skimmed milk curds which are first acidified then stretched into thin strips by hand and left to dry on the roof until sufficiently hard. This type of cheese lasts for months and provides a reserve of food in winter.

In the Near East, the Bedouins make cheese from whole milk heated to approximately 80°C, then acidified with lemon juice to coagulate it. The whey is drained off and the curd pressed in straw baskets. When stored in brine, this type of cheese keeps for many months and will not be damaged by the desert heat.

France produces many soft variety names, the most famous of which are Camembert and Brie. Switzerland and Germany have produced Emmental and Gruyère for several hundred years, often in co-operatives. Renowned for their great size, they can weigh up to 110kg. They have a hard consistency and an elastic texture with typical eyes of 1 to 2 cm diameter. Cheese is one of Switzerland's principal exports.

The UK, Australia, New Zealand, Canada and the United States all make cheese in large dairies, of which cheddar is the best-known variety. Holland produces Edam and Gouda and Denmark's main cheese is Danbo. Italy is famous for Parmesan, a cheese which requires prolonged storage for full maturation to produce its characteristic flavour.

### *A word of warning*

For those deciding to establish a rural cheese production facility, patience and perseverance must be the key factors. Good hygiene both on a personal level and in the work environment is essential. Flexibility and good working relationships are desirable if top-quality products are to be obtained. Cheeses which are suspect or of inferior quality must not be released for sale to the public. These downgraded products can often be sold to large cheese factories for processing. Cheesemaking requires a balance of skill and technology, theory and good business practice which all combine to create top-quality speciality products that are highly desirable to the consumer.

The cheesemaking process described later in this book has been developed without the use of preservatives — neither in the milk nor in the cheese. For this reason, cheese produced in this way will have a shorter shelf-life than other cheeses containing preservatives.

## ***Basic cheesemaking principles***

Cheese is milk curd — a substance formed from the coagulation of milk by rennet and acid — separated from the whey and pressed or moulded into a solid mass. It contains concentrated milk solids, water, rennet (to

coagulate the milk), bacterial cultures (to acidify the milk and curds and produce desirable characteristics), salt, and, sometimes, calcium chloride. The calcium chloride is necessary in order to compensate for the loss of the free calcium in the milk resulting from the pasteurization process.

Cheesemaking equipment and methods vary but the basic principles have remained unchanged for thousands of years:

1. Milking
2. Coagulation
3. Separation of curds and whey
4. Forming the curd into a cheese mould
5. Salting for conservation and flavour
6. Maturation and conservation.

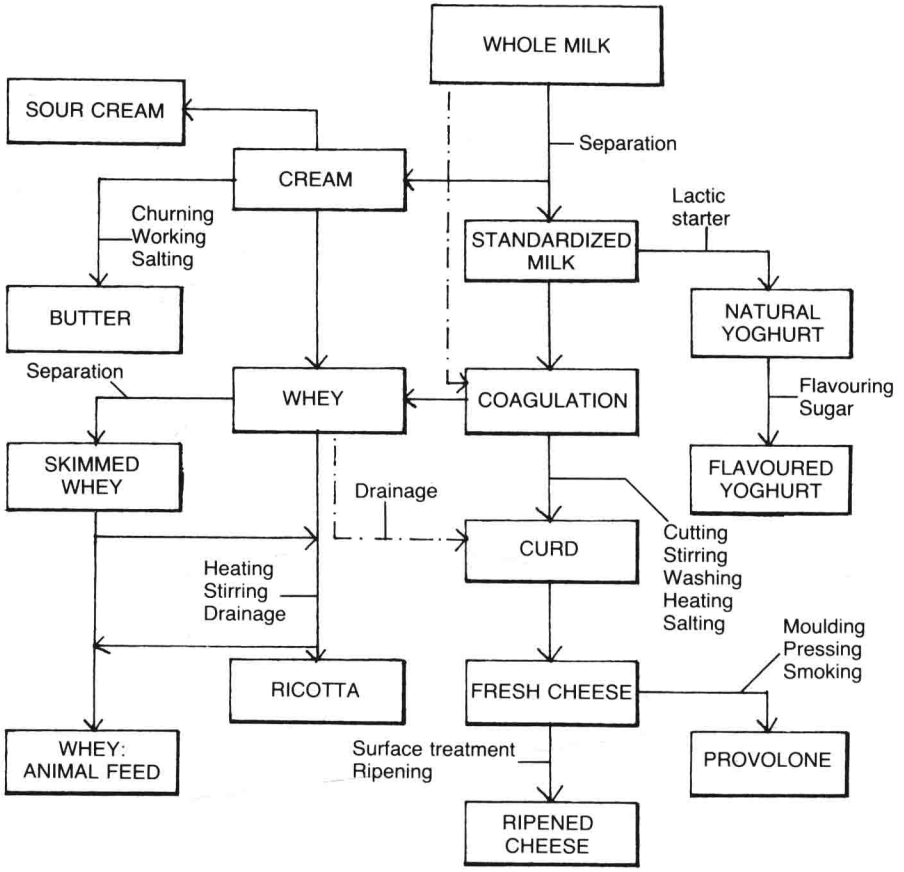



**Figure 2. Flow chart of the transformation of milk into cheese and its by-products.**

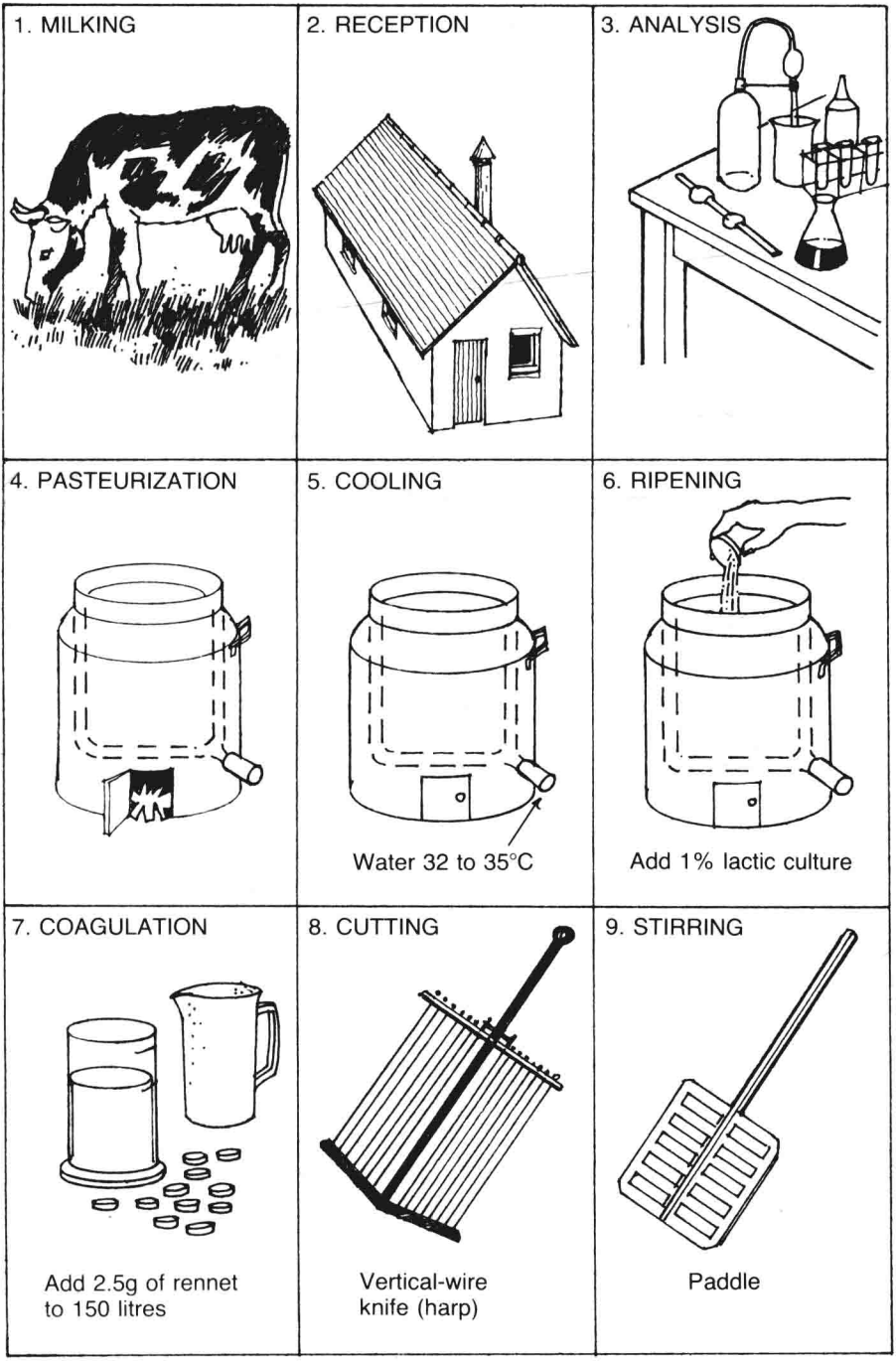
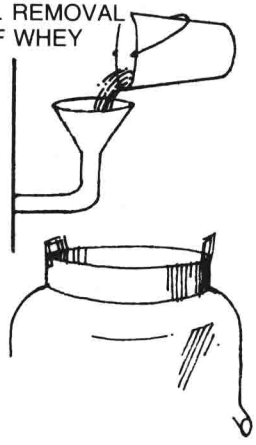
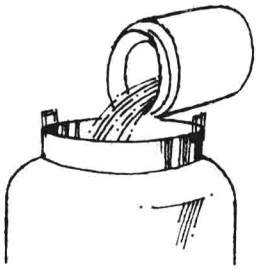



**Figure 3. The cheesemaking process.**

10. REMOVAL OF WHEY

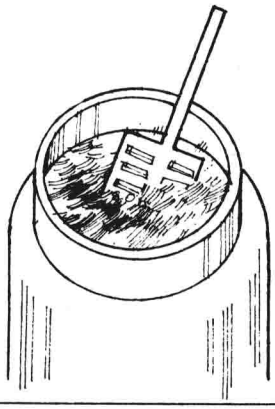


11. WASHING THE CURD

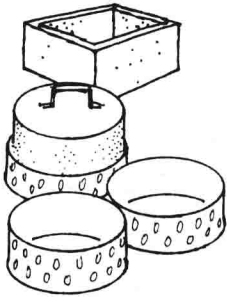


Raise temperature

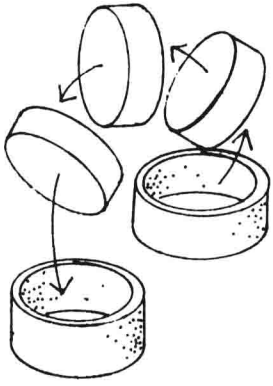
12. STIRRING



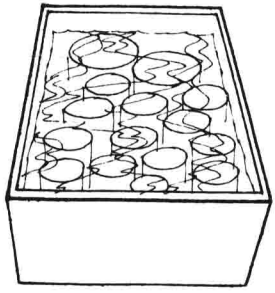
13. MOULDING



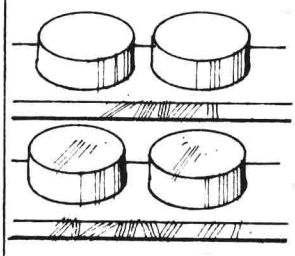
14. TURNING



15. BRINE



16. MATURING

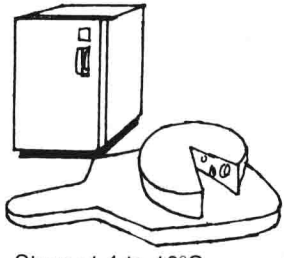


12 to 15°C

17. DISTRIBUTION

4 to 10°C

18. STORING AND EATING



Store at 4 to 10°C. Consume after 2 hours at room temperature for the best flavour.

Traditionally salt was used in cheesemaking in order to preserve the product for a longer period. However, today conservation can be achieved by the use of lactic cultures, so that over-salting is no longer necessary.

The stages involved in the modern preparation of cheese are illustrated in Figure 3.

The various stages of cheesemaking are described in detail in Part II of this book. Part I covers aspects of hygiene and basic microbiology, an elementary knowledge of which is required in order to appreciate the biochemical processes involved during processing. Part III deals with other products that may be produced from milk, and includes a section describing the construction of and equipment requirements for the preparation of cheese.

# Part I
# Bacteria

Bacteria are microscopic one-cell organisms. Each cell is surrounded by a wall which characterizes the shape of the bacterium. Bacterial shape is an important aid to classification which may be done under the microscope. The cell may be spherical (coccus) or rod-shaped (bacillus) and of varying lengths and diameter.

Bacteria multiply by the simple method of binary division: each cell grows to a critical size and then divides to produce two cells with identical properties. Each cell will subsequently grow and divide at about the same rate as the parent cell. This chain of events will continue until limited by the exhaustion of required nutrients or by accumulation of toxic substances.

Bacteria may be found everywhere — on land, in the air, in water, and most bacteria are non-pathogenic. Bacteria are therefore commonly found on the surface of, or in, various food products, such as milk. Even if the milk is obtained under reasonably hygienic conditions and from healthy cows, it always contains some bacteria which, under certain conditions, can multiply within a few hours so that the milk can become unfit for either cheesemaking or drinking. Adequate milk pasteurization (or other heat treatments) will ensure adequate destruction of known pathogens without destroying or affecting to any significant extent the valuable components of milk. The surviving heat-resistant organisms are not of any danger. Pasteurized milk can however be contaminated with all types of micro-organisms.

However, some bacteria such as *streptococcus lactis*, when growing in milk, convert the milk sugar (lactose) into lactic acid, an essential ingredient in traditional cheesemaking. Other types of bacteria found in milk and cheese include monococcus, diplococcus, tetracoccus, streptococcus, staphilococcus, lactobacillus and bacterias propionicas.

### *Factors affecting the survival of bacteria*

#### *Temperature*

For each kind of bacteria there is an ideal temperature for maximum growth and reproduction. Some prefer a relatively cool environment