

Stimulating milk production in milk-deficit countries of Africa and Asia*

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Summary

MOST DEVELOPING countries have a growing trade deficit in dairy products and Africa now accounts for about 25% of the world's annual dairy imports. Strikingly contrasting situations exist among continents and countries in the growth of livestock and food grain production, and an association between the two commodity groups is apparent.

Three main approaches to dairy development have been used in the developing world: large parastatal dairy farms, medium-sized dairy farms in the commercial sector, and organised milk collection from large numbers of subsistence farmers.

Five interrelated issues need attention in any dairy development strategy: the supply of dairy stock, animal health, fodder systems, marketing arrangements and training of farmers.

Dairy development must be supported by adequate research. It is emphasised that the research problems presented by the different organisational forms of milk production are very different, and that there is a need to predict what future production patterns are likely to be. Traditional smallholder farming seems likely to continue to predominate in both Asia and Africa, and a cooperative association of smallholder milk producers is probable.

The importance of asking the right questions, of building a research structure appropriate to current farming patterns, and of being able to put new technology into practice will largely determine the future food production and prosperity of Africa and Asia.

Introduction

In 1980 developing countries were responsible for one third of the world imports of dairy products (Table 1), and almost all of them have a large and growing deficit in these products.

Table 1. *World trade in dairy products, 1980.*

Region/economy	Trade (US\$ million)		
	Exports ^a	Imports ^b	Balance
Developing market economies	167	4713	-4546
Africa	3	1133	-1130
Far East	87	796	-709
Latin America	59	1112	-1053
Near East	18	1615	-1597
Asian centrally planned economies	136	101	+35
Developed market economies	12 891	8 516	+ 4 375
Eastern Europe and USSR	427	647	-220
World total	13 587	14 001	-414

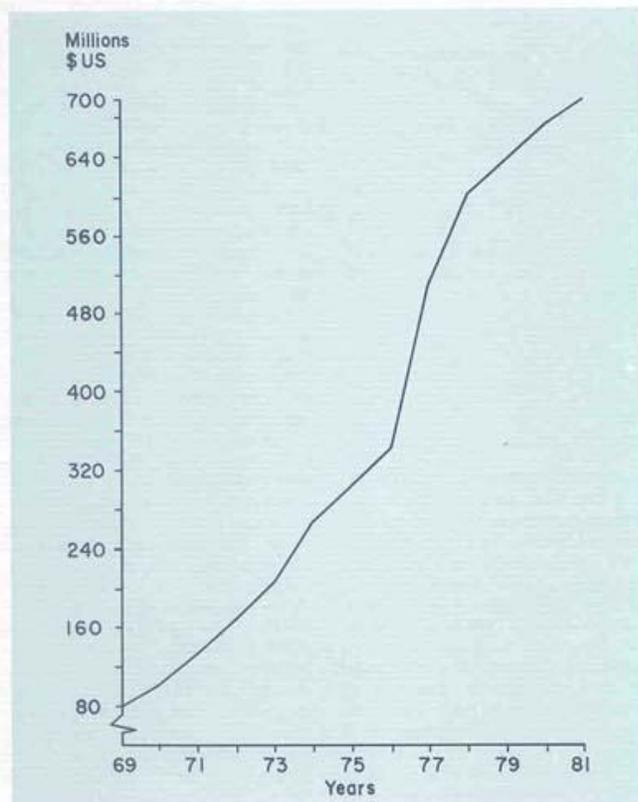
^a FOB values

^b CIF values

Source: FAO, 1983.

The dependence of sub-Saharan Africa on imports to satisfy the increasing demand for dairy products has been growing rapidly (Figure 1).

Figure 1. *Imports of dairy products by the countries of sub-Saharan Africa, 1969–1981.*



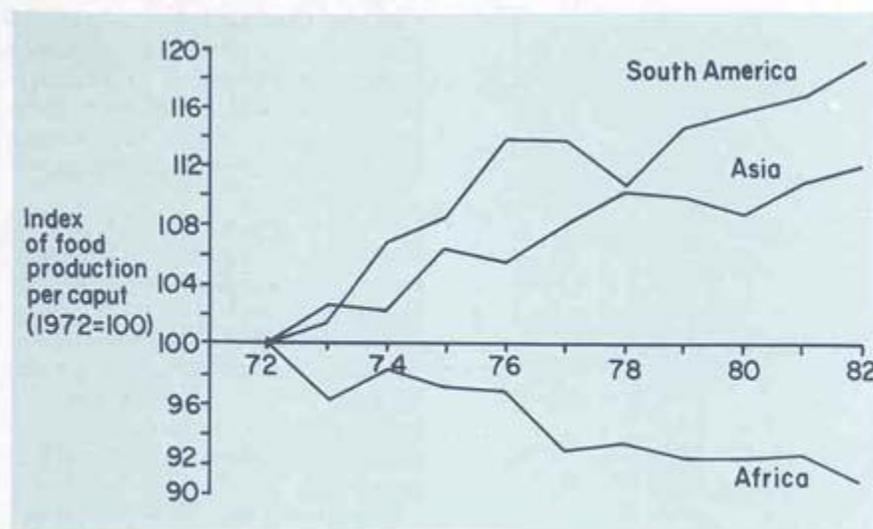
Source: FAO trade yearbooks 1970, 1973, 1976, 1979 and 1982.

Government policies in milk-deficit countries are frequently oriented towards maintaining low milk prices for urban consumers, thereby discouraging domestic production and encouraging an increasing reliance on imports in order to stabilise prices. Given the oversupply of dairy products, on the international market and the policy of subsidising exports by developed countries, these imports have been relatively cheap. However, the decrease in foreign exchange reserves, the need to improve nutritional standards and the wish to diversify and intensify agricultural production are now inducing some governments to consider domestic dairy production as a substitute for imports (Frankel, 1982). Nevertheless, with a few outstanding exceptions, progress in dairy development has been slow.

Dairy development and food grain production

In 1983 India experienced a record-breaking harvest of 145 million tonnes of cereal grain and an all-time high in milk production of 35 million tonnes. By contrast, Africa's food and livestock production appears to be moving towards a crisis; official estimates of the rates of increase in annual production average less than half the rate of the increase in population, and imports of livestock products alone now cost about US\$ 2500 million each year. Changes in per caput production of food in Asia, South America and Africa are summarised in Figure 2.

Figure 2. Index of food production per caput in Africa, South America and Asia, 1972–1982.



Source: *FAO production yearbooks* 1973, 1976, 1979 and 1982.

Is there any lesson to be learnt from these contrasting situations? In India's case it is clear, that the large increases in milk production in recent years, far from hampering increases in cereal production, may in fact have been a stimulating and contributory factor. In the case of Africa it is also clear that those countries which have shown the highest increases in output of livestock products are the same countries that have the fastest rates of increase in food grain production (ILCA, 1983).

The issue of whether or not livestock compete for scarce food production resources in Africa and India is now less contentious as the available evidence shows a complementarity between livestock production and food grain production, generated in a major part by the additional cash that smallholder milk production so frequently provides.

Historical precedents for this causality abound in the agricultural history of Europe, North America and Australia. The reasons behind it relate to the impact that small increments in the cash income of subsistence farmers have on fertilizer use, the role of cattle in land cultivation, the high income elasticities for meat and milk, and the importance of crop residues in livestock feeding.

In both Asia and Africa farmers and pastoralists keep cattle for many reasons, including milk, manure, draught power, meat and capital savings. Attempts to increase milk production must take account of these multiple functions; they must also take account of the use of livestock as the catalyst in generating increased cash income, enabling greater expenditure on improved crop seeds, fertilizer, pest control measures and a greater variety and quantity of foodstuffs for the household.

This paper attempts to give an overview of some of the issues and options for dairy development in the milk-deficit countries of Africa and Asia, and discusses organisational issues, production incentives, technical constraints and the need for various support services. The paper concludes with a critical evaluation of the role of research in stimulating dairy development.

Organisational issues

Three main approaches have characterised schemes for dairy development in the developing world:

- large parastatal dairy farms with high-yielding dairy cattle;
- medium-sized dairy farms in the commercial sector located near major urban centres; and
- organised milk collection from large numbers of traditional subsistence farmers, usually associated with some upgrading of cattle breeds.

Large parastatal farms offer, in principle, considerable opportunities for maximizing the impact of specialised management skills, minimising transport and input-supply problems, and for effecting substantial economies of scale. In practice, however, parastatal farms usually have very high costs of milk production and require subsidies to ensure continued operation (Brumby, 1983).

The problems such farms face are often associated with high labour costs, reliance on purchased feedstuffs rather than pastures and fodder crops, and their capital intensity and poor management. Parastatal farms can, however, play a valuable role in a dairy development strategy by guaranteeing minimal milk supplies, by acting as focal points for the collection and processing of more widespread milk supplies, as service centres and cooperatives for artificial insemination (AI), and by producing female stock for distribution to smallholders.

The smaller dairy units of the private sector are usually more efficient and may generate a rapid increase in a country's milk production if the market incentives are sufficiently attractive. These commercial dairy farms are often located on the edge of major towns, thereby minimising transport costs. However, they have relatively high production costs due to their capital intensity, and they incur many of the purchased feed costs that traditional smallholder farmers are able to avoid.

The organisation of dairy development on the basis of milk collection from a large number of small farms is a third alternative. The most successful experience of dairy development to date in a developing country is found in India and is based on the so-called Anand model, a concept that began 30 years ago with the establishment of a small dairy producers' cooperative in the town of Anand, 480 km north of Bombay. The success of this small cooperative quickly led to the establishment of similar groups at the grass-roots level in many other Indian states. Now more than 10 000 Indian village dairy cooperatives with 2 million members collect and process some 2.5 million litres of milk daily (Brumby, 1983). The Anand pattern of cooperation is a three tier structure. It consists of a large number of small village milk producers' cooperatives aggregated into district unions (each of about 400 village dairy societies) and a federation of the several unions in each state. The whole system is owned by the primary milk producers who are peasant farmers of small areas of land and landless labourers owning one or two cows. Two semi-autonomous government agencies – the National Dairy Development Board and the Indian Dairy Corporation provide technical and financial assistance to the system.

This cooperative structure provides an integrated system for marketing and processing milk. The basic unit is the village milk producers' cooperative. Each cooperative has as its area of operation the village in which it was formed (Halse, 1980). The village cooperative buys milk twice a day from its 100 to 200 members on a commission basis at its village collection centre. The milk is immediately tested for fat content and quality and taken by truck, without cooling, to the union dairy where it is pasteurised, cooled and either transported to distant urban markets or processed into dried milk and butter. The union dairies are relatively large modern plants with capacities of 100 000 to 400 000 litres per day. The entire supply of each union dairy comes from the large number of smallholder farmers making up the basic village societies (Brumby, 1983).

Members of village cooperatives have access to an AI service, to veterinary services, concentrate feed supplements and forage crop seeds. The essence of the success of the movement is a reliable and profitable outlet for all milk produced, immediate cash payment based on milk quality which is determined by individual fat tests, technical assistance and economies of scale at critical points in the marketing system.

Another example of a successful smallholder dairy development programme, also based on an integrated approach, is found in Kenya. This programme is built on the land reform policy implemented at the end of the colonial era, when about 50 000 smallholdings were formed from 700 000 ha of farmland previously owned by expatriates. Various factors have contributed to the success of the Kenyan dairy development programme, including an effective marketing system based on a cooperative structure, the provision of technical services, a national AI scheme emphasising smallholder services, a reform in the pricing policy that abolished supply quotas (which discriminated against smallholders), the presence of large high-grade herds, a national tick control/dip construction programme, and an agricultural infrastructure which was relatively well developed. Average annual per caput milk consumption in Kenya is 75 litres compared with less than 30 litres for sub-Saharan Africa as a whole, and about 75% of the country's total market supply comes from smallholder mixed farms.

Production aspects

In the technical production aspects of a dairy development strategy, five interrelated issues need attention. These are: the supply of dairy stock, animal health, fodder systems, marketing arrangements, and training of farmers. It is important to stress the interrelated nature of these

issues. For example, the introduction of upgraded stock without improving the management or the feed regime may leave the farmer worse off than before.

Supply of dairy stock

Although some of the developing world's indigenous breeds of cattle, such as the Sahiwal, combine adaptability to a tropical environment with an ability to produce substantial amounts of milk, genetic improvement of local stock is usually essential if returns comparable to those of food crops are to be obtained from dairying. Selection for improved milk yields within indigenous breeds is possible, but it is an expensive and long-term process. As a result, crossbreeding is the most common method of genetic improvement. Large farms are generally able to organise their own genetic upgrading systems, using either improved bulls or AI systems. AI for smallholders requires an efficient field operation and good management skills from both the farmer and the operating agency. A decision to establish an AI system should recognize the need for a reliable communication system and for an all-weather road network in the area (Frankel, 1982). An incentive scheme for the inseminators increases substantially the efficiency of the AI service, and liquid rather than frozen semen services are much easier to implement. Where the reliability of the AI service is in question, bull camps are likely to be a better proposition for small-scale dairy systems.

Animal health

Intensive vaccination campaigns have been effective in freeing much of the developing world from the major epidemic diseases of livestock. However, disease control remains a major concern, especially for dairy cattle. Upgraded cows are usually much more susceptible to disease than indigenous animals. A competent veterinary service is essential to control disease problems in improved dairy animals, but a major constraint in developing countries is the shortage of veterinary staff and the lack of cheap animal health treatments. Some countries, such as India and Ethiopia, have tried to overcome the shortage of trained manpower by using lower level staff such as animal health assistants, and this has proved to be an effective and low-cost approach to providing animal health services when supported by competent professional advice.

Veterinary assistance should be provided under a system of cost recovery or by the service cooperative of which the farmer is a member. In Africa the dairy industry continues to experience heavy losses from tick-borne diseases, East coast fever (ECF) and babesiosis in particular. In Kenya, ECF accounts for the deaths of between 50 000 and 80 000 head of cattle annually (FAO, 1981). A disease which is commonly overlooked in Africa but which has serious economic consequences is mastitis. In Kenya its incidence has been reported to be as high as 50% in some areas, while for Ethiopia it has been estimated that milk production from exotic cattle in the state farms would increase by 20% if an effective mastitis treatment campaign was launched.

More than 40% of Africa's land area is infested with tsetse flies which transmit trypanosomes; livestock production based on temperate breeds has therefore not been possible in tsetse-infested areas. An important development option for these areas appears to be the use of trypanotolerant livestock. ILCA's studies with trypanotolerant livestock in 10 African countries have indicated that the growth and reproduction of these animals under conditions of low to

medium trypanosomiasis risk are much higher than has hitherto been acknowledged. Little work on their potential contribution to milk production has been carried out to date.

Feeding systems

Most of the feed energy for milk production under traditional management in developing countries is provided by natural grazing of rangelands and pastures, crop residues and grasses along roadsides. Although such rations are usually sufficient for maintenance, increasing milk production beyond subsistence levels requires the provision of higher quality feedstuffs or supplementation with concentrate feeds. If available, concentrates are the easiest option for the farmer in order to meet the high protein needs of dairy cattle; but concentrates are often in limited supply, costly and their distribution system is rarely efficient.

The scope for increasing pasture production is substantial, but the constraint is usually inadequate research support at the national level. The introduction of special-purpose fodder crops at the smallholder level is constrained by the priority that smallholder farmers give to growing subsistence food crops, the unavailability of forage seeds, and seasonal labour shortages. In some areas fodder trees and shrubs are often an attractive alternative.

The role of research in developing appropriate feeding systems is particularly important. Research at the International Agricultural Research Centres (IARCs) needs to be complemented with adaptive and applied research by national organisations. Few experimental results are available on the optimal integration of crops and livestock in smallholder mixed farming systems.

Marketing systems

The success of any dairy development scheme depends to a large extent on marketing and pricing arrangements. The prices received by farmers for certain products largely determine which activities are undertaken on the farm. An efficient milk collection and distribution system to bring milk from the farmer to the consumer is a critical factor in dairy development. In a review of dairy development projects financed by the World Bank, Frankel (1982) found that where milk collection and cooling centres had been established to cater for groups of consumers, smallholder participation in dairy development had flourished. The Indian and Kenyan experiences serve as outstanding examples in this respect.

Milk processing and packaging plants require capital investments of at least US\$ 10 per litre of daily capacity. Because of large seasonal variations in supply and in production costs, efficient plants require both a manufacturing capacity, usually for butter and skim milk powder, as well as the capability of processing liquid milk for urban markets.

An important aspect of pricing is the margin available between the purchase and sales prices. This margin is often squeezed by the conflict between policies which try to provide milk at low prices to urban consumers, and those which seek to maintain attractive producer prices. Pricing policies need not only to encourage increased sales, but also to ensure regular supplies to processing centres. In Africa only a minor fraction of milk production enters the official commercial sector and many processing plants operate well below their designed capacity. Even in Kenya, a country with an efficient marketing system, only an estimated 10 to 15% of the total milk production, or just over half the amount available for marketing, is sold through KCC

(Owiro, 1980). For smallholders in more remote areas, local processing of milk into storable products such as ghee or boiled curd cheese is required, a subject on which very little research has been undertaken.

Training of farmers

In most countries of Africa and Asia where the environment is suitable for dairy production, there are large numbers of smallholder farmers and landless labourers who have the potential to engage in dairy production. Many of these farmers already operate mixed crop–livestock farms in which cattle are used mainly to provide draught power and manure. The development of dairy production at the smallholder level requires some change in the management methods of the farmer, which calls for training in new techniques. Higher yielding cows require higher standards of management, the provision of adequate feeding and watering regimes, disease control, profitable calf rearing, simple housing and the maintenance of an acceptable breeding cycle. Husbandry standards adequate for local stock usually lead to failure if applied to improved stock. Any dairy development strategy must therefore involve improvements in the knowledge and management skills of smallholder producers. Simple and low-cost training techniques can be readily established, as the Indian experience amply demonstrates.

Institutional support

Advisory and extension services

A shift towards dairy development requires more support from advisory services. These services are essential to provide on-farm advice on animal husbandry and fodder crops, to organise field days and demonstrations, provide courses in farmer training centres, and act as an effective link with research services. Training must be low-cost, and group extension activities have often been shown to be effective ways of improving animal husbandry practices. The main constraint in providing good advisory services in animal husbandry has been the limited knowledge of advisory officers in farm management. Farmers are reluctant to follow advice on good husbandry practices unless they are convinced first that taking the advice will lead to significant increases, in productivity and income.

Provision of credit

The development of dairy production activities usually requires substantial additional investment, principally for constructing processing and marketing facilities. Credit for smallholder farmers is not an essential part of dairy development. In Kenya only about 10% of the national dairy herd has been financed through credit, yet the country has made substantial advances in dairy production. In India, provision of credit to encourage small farmers to move to increased milk production is unusual. Relatively large investments and high risks are involved when smallholders buy improved stock on credit. It is therefore essential to have a professional link between lenders and borrowers to appraise loan applications, and to supervise loan disbursement and the progress of borrowers after disbursement. The institution of a cow insurance system also reduces the risk for the borrower.

In Malawi the provision of credit for smallholder dairy development proved very successful when it was integrated with the milk collection system, and credit repayments were automatically

deducted from payments for milk delivery. But the Indian experience is the reverse; tied credit can easily lead to a diversion of the supply of individual producers to other market outlets.

The role of research in stimulating milk production

Dairy development must be supported by adequate research, whose role is to develop cheaper and better methods of increasing agricultural productivity.

Many problems of dairy production are location-specific and require adaptive research at the local level. Among common problems encountered at the smallholder level are dry season feed strategies, profitable calf-rearing methods, practical breeding policies, small-scale processing techniques, socio-economic adoption issues and animal health factors.

In considering livestock research priorities it is important to establish what type of organisation of livestock production is likely to prevail in the next 20 to 30 years. The research problems presented by the alternative forms of milk production outlined earlier in this paper are very different, and it makes little sense to embark on specific research programmes without having a clear concept of what future production patterns are likely to be. Traditional smallholder farming is likely to continue to predominate in both Asia and Africa and it seems probable that a structure of service cooperatives will emerge. Based on this assumption, let us consider what type of milk production research is likely to be the most efficient in terms of cost, and how it might best be organised.

In all African and Asian countries calving patterns show marked seasonal variation; peak calving periods are influenced greatly by seasonal patterns of rainfall and feed supplies. Milk supplies and, more importantly, production costs show similar seasonal variations. Do we accept this situation, do we try to modify it by supplementary feeding and new forage crops, or do we produce milk only for that part of the year when feed is plentiful, conserving the seasonally surplus milk, as is done in New Zealand?

Cheap milk production can be achieved by feeding cows low energy diets based on crop residues and byproducts, supplemented with leguminous fodder and a small quantity of feed concentrate. The optimal milk yield per cow depends on its breed type, the overall stress of the environment, and the relative prices of cattle, inputs and outputs. The optimal feeding level and balance of feed types in these varying circumstances is largely unexplored, while for crossbred animals little is known about the relationship between incremental feeding and incremental milk yields.

The much discussed question of what degree of crossbreeding is desirable now seems to have been answered for a number of systems. On smallholder farms, animals with about 50% of exotic blood usually outperform higher level crosses, but how this level can best be maintained is an unresolved practical issue. Should F_1 (50%) bulls be used for each generation? Should a new breed be fashioned by intermating of the crossbreds? Would 'crisscrossing' be practical? And how do we maintain a draught capability? Genetic interactions and maternal effects also complicate the analysis of crossbreeding data, as does the small size of the herds for which field records are obtained. Rarely are 'within herd' comparisons possible in small herds and the use of records across farms adds many other possible sources of variation. ILCA's results show that milk records from small herds in Africa have coefficients of variation of about 30%. This high variability makes selection methods largely impractical and necessitates large numbers of animals in any field experimentation.

In both Asia and Africa we know that, in the better environments, crossbred cows outperform and are more efficient than most local stock; we know that livestock can catalyse agricultural growth; we know that smallholders make up the bulk of all producers; and we know that certain ways of organising milk production have a much better success record than others. We also know that a careful analysis of farm production systems is essential to identify those constraints, both technical and nontechnical, that limit present output and whose identification is essential to the most cost-effective use of research funds.

Unattractive prices and inappropriate policy directives frustrate production increases in many situations. Important as these are, the increase in food output so badly needed depends greatly on the development and adoption of new and simple technology. It also depends on whether or not research workers are promoting and supporting the organisational and entrepreneurial systems needed to put better technology into productive effect. The importance of asking the right research questions, of building a research structure appropriate to the farming patterns currently in use, and of being able to put better technology into practice on a widespread scale will largely determine the future food production and prosperity of both Africa and Asia.

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