Recording systems for breed improvement and production management in transition and developing countries. A dairy industry perspective

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Summary

This paper describes the situation of meat and milk production in developing and developed countries in relation with either the future population trend or the different production systems. The need of increasing the production levels are briefly detailed in the light of the projections made at IFPRI.

Different milk production systems are briefly described comparing various countries: South American countries (characterised by a system in which cows graze privately owned natural and planted pastures) and other areas like Sub-Saharan Africa, where three quarters of the milk is produced by cattle, with common property natural pastures, providing most of the feed. In Asia, cattle and buffaloes produce equal shares of the total milk supply. The tight relations existing between crops and livestock are briefly summarised, providing a production system that offers more control over feed inputs than in pastoralist and agro-pastoralist systems and give a better base to facilitate recording and management.

The necessity of an effective and efficient milk recording system is stressed because monetary reward provides effective motivation for change. Examples of successful milk recording are recalled since this is the first step for a significant contribution to genetic improvement. At the same time the need of an adequate pricing and marketing policy is required since the interdependence of meat and milk have an important bearing on breeding policies.

Introduction

At present about 23% of the world population, living in developed countries, have a per capita milk consumption five to six times higher than in developing countries. However due to population growth, urbanization and rising incomes, there have been rapid increases in

aggregate consumption of livestock food products in developing countries between 1971 and 1995. Projections by IFPRI in 1999, suggest that 62% of the world's meat and 60% of the milk consumption will be in developing countries by 2020 (Delgado *et al*., 1999). This contrasts with the situation in the early nineties when the corresponding figures for 48% for meat and 41% for milk.

These changes in demand for animal products in developing countries, are placing unprecedented pressure on existing resources used in livestock production. The changes in milk production in developing countries over the period 1984 to 1998 were reviewed by Nicholson *et al*., (2001). In two developing regions, Latin America and the Caribbean (LAC) and Sub-Saharan Africa (SSA), increases in production were influenced more by increases in animal numbers and changes in herd composition towards increased milking cows, than by productivity increases. In the other regions increases in productivity were more important. In developing countries as a whole, overall production increased by 4.0% per annum, 2.0% from increases in animal numbers and 2.0% increase in milk per cow. Since significant proportions of milk production increases to date, have been achieved through increases in animal numbers, future emphasis will have to concentrate on greater efficiency in terms of output per animal and per unit of land and more efficient links between production units and marketing channels (Phelan and Henriksen, 1995).

The theme of the seminar is therefore both timely and challenging, since recording, monitoring and evaluation of information is the key to increased efficiency. Animal recording has a catalytic role in enhancing production and productivity. My former colleagues from FAO have described the livestock development setting in the first two papers and my task is to give a dairy industry perspective. Most of the participants have strong links with recording and animal breeding but this paper will approach the subject from a broader viewpoint of dairy development.

Breed improvement has been to the forefront of dairy development all over the globe and in many countries, animal recording is synonymous with milk recording. Milk production enhancement, through genetic improvement and feeding, has been an important component of dairy development projects, which the author has been associated with over several decades. There have been a number of examples where the choice of breed was inappropriate for the level of management and disease challenge in the recipient country but these have invariably involved inter government cooperation programmes and some have been spectacular failures. On the other hand, all the more widely known successful dairy development projects, like NDDB's Operation flood in India and the Milk Vita project in Bangladesh, owe much of their success to improved breeding and management in addition to market links.

This paper will first examine the milk production systems in developing countries, then review the recording systems used and finally look at the influence of pricing and marketing policies on the relative value of milk components, which in turn dictates breeding and management priorities.

Milk production systems

The location and type of milk production systems in developing regions is dictated more by market access than by other factors, but there are however characteristics which are region specific. With the exception of India and Pakistan, where buffaloes account for more than half the total milk production, cow's are the dominant source of supply.

In Latin America, most milk comes from cows grazing privately owned natural and planted pastures (de Leeuw *et al*., 1999). In Sub-Saharan Africa, three quarters of the milk is produced by cattle, with common property natural pastures, providing most of the feed. In Asia, cattle and buffaloes produce equal shares of total milk supply. Throughout most of the developing regions, small holders and medium/large-scale market-oriented dairy farms, tend to concentrate near or even within urban conglomerations to get better access to markets and efficient support services. Milk production may be moved to more distant locations only when the marketing infrastructure is efficient but such conditions are limited to India and part of Latin America and the Caribbean (LAC). Unit costs of milk collection and transport determine the potential for milk production in these locations.

There are wide variations within regions and the type and level of intensity of production. These reflect the wide variations in agro-ecological zones, availability of feed resources and culture and tradition in animal keeping (Nicholson *et al*., 2001).

Sudan, Kenya, Ethiopia, Somalia and Tanzania account for two thirds of cow milk production in Sub-Saharan Africa. In the arid and semi arid zones and in the highlands, there is a long tradition in cattle keeping and milk consumption (de Leeuw *et al*., 1999). In the more humid zones cattle keeping has been constrained by tick borne diseases and trypanosomiasis and sheep and goats predominate with minimal amount of dairy production. The highlands are the most productive in terms of milk production per unit area. In the densely populated highlands of Kenya and to a lesser extant in Tanzania, milk production has risen rapidly due to widespread adoption of intensive dairy production with cross breed and high grade dairy cows. The Kenyan dairy herd probably accounts for over 75% of all specialized dairy cattle in Eastern and & Southern Africa. (Muriuki, 2001.)

In Asia, the extensive agro-pastoral system, covers over 70% the total grazing land but produces only 15% meat and very low levels of milk production. Milk production in tropical Asia is concentrated in the

rain-fed and irrigated crop-livestock systems of India, which account for most of the dairy cows and buffaloes. India and Pakistan account for over 90% of milk produced in tropical Asia. In India milk is produced mainly from crop residues. Singh *et al*., (1997), show that two thirds of available feed originated from cropped land, 25% of which is irrigated. Forage crops provide another 12% and grazing accounts for only 14% of total feed. Dairy production systems in other parts of Asia, range from indigenous cattle communally grazed in relatively dry lowlands, to intensive zero-grazing enterprises with cross-bred cows producing 1500kg of milk per year and up to 11 tonnes of milk per hectare of farmland (de Leeuw *et al*., 1999)

In LAC the livestock systems can be grouped by eco-zone for the semi arid and highland regions and by production system in the humid zone. There are two systems, pasture-based and crop-livestock. The latter is more important accounting for 70% of cattle and 50% of land. Livestock are kept in the pasture-based production systems at high altitudes in the Andes and in crop-livestock systems at lower altitudes and in the valleys. Arable land in the pasture-based and crop-livestock systems in the semi-arid zones of NE Brazil, constitutes only 5.0% of total land but supports 15% of the cattle and 17% of the milk in the region (de Leeuw *et al*., 1999).

In all continents, crop-livestock farmers are able to benefit from the complementarities in feed resources and nutrient cycling, which increase overall farm efficiency. These systems provide more control over feed inputs than in pastoralist and agro-pastoralist systems and give a better base to facilitate recording and management. These crop-livestock systems generally support high rural population densities and the consequent pressures on intensification result in declining farm sizes and increasing reliance on purchased fodders and concentrates. Lactation yields have increased fivefold in some smallholder milk production units (de Jong, 1996). These more intensive systems are likely to account for the bulk of milk production in developing countries but they need more refined management to minimize environmental impact and achieve sustainable development.

The changes that have taken place in many of the countries in transition from centralized economies, have been dramatic and painful in many cases. Under the Soviet system, milk production was largely confined to state and cooperative farms with centralised processing and state marketing systems for dairy products, which took little account of actual collection, processing and distribution costs. There were only limited opportunities for farm workers to develop independent milk production systems. The collapse of the Soviet System and the associated political and economic changes, led to profound structural changes in the agricultural sector, a drastic reduction in livestock numbers and reduced availability of livestock food products. The management and reporting systems that were applied within the large units, with varying degrees of success, had little relevance

to the smallholder units resulting from the sharing out of land and animals. The distribution was arbitrary with senior officials getting larger shares and there was inadequate training to prepare recipients for their new role and as a consequence, the management levels were very low. While some countries in Eastern Europe managed to adapt, the processing and market infrastructure collapsed in many countries. The author was a member of an IFAD mission to study the livestock situation in Azerbijan and Georgia in 1999, where many producers were forced to sell productive animals to generate income in a downward spiral of economic activity. There is an urgent need to develop appropriate training, extension and marketing services to meet the needs of these livestock keepers and halt the decline.

Milk recording

An international workshop on Animal Recording for Smallholders in Developing countries was organized by ICAR in India in 1998, with assistance from FAO, NDDB and donors. The workshop attracted 45 participants from 25 countries and the proceedings of the workshop provide a valuable insight into the constraints and challenges to be overcome, when implementing animal recording programmes in developing countries (ICAR, 1998).

It was interesting to note that all eight recommendations of the workshop were directed at FAO/ICAR, rather than the participating countries but there were implications for the these countries. The first recommendation stated that FAO/ICAR should initiate pilot projects to demonstrate the economic benefits of animal recording. I wonder if any progress has been made towards this goal because monetary reward provides effective motivation for change. It was suggested that guidelines be developed based on principles of farmer participation, cost sharing and integration into local service/extension packages. The system should include all measures necessary for economic evaluation of animals, should be no more complex than necessary to achieve programme goals, and training should be provided.

Three different programmes were reported from India, each with distinctive features but all dealt with smallholders with 1 to 5 dairy cows. While the recording systems in Zimbabwe and Kenya, included special schemes for smallholders, they were essentially for larger herds as were other systems in Brazil. The reports on Malaysia, Sri Lanka, Vietnam and The Philipines, describe national efforts to provide smallholders with breeding services, including AI to improve genetic potential of animals. Availability of sources of dairy genotypes was cited by Walshe *et al.* (1991), as an important factor in establishing market oriented dairying. This service could be regarded as a public good and as such warrants Government support.

All participating countries reported dairy herd improvement programmes for cattle or buffaloes. The associated recording schemes to evaluate sires, dams and progeny are mainly at government, institution or donor project level. However, there was considerable variation in detail and quality of information gathered and in the rigour of data analysis. Recording at individual producer level was very limited. Most country reports at the workshop highlighted the difficulties in motivation of livestock owners , with one or two cows, to take even rudimentary records because of lack of appreciation of potential benefits. Some success has been achieved in places where marketing is organized as it is relatively easy to obtain data on the amount of milk delivered to collection centres, or sold. However every effort should be made to collect estimates of amounts used for home consumption, and amount fed to calves in order to establish total annual production per animal. Once this basic information is quantified, more detailed data can be added on calving intervals, age at first calving and cost of feed, which are the most important determinants of profitability. The more comprehensive the record keeping the more precise the management and this invariably leads to better margins.

The promotion of organized recording by Breed Societies and Farmer's Organisations, has made a significant contribution to genetic improvement, increased productivity and profitability in dairying in all regions of the developed world. The impact of milk recording in large herds in developing countries has made similar contributions in countries like Zimbabwe, Kenya and South Africa. Earlier this month the author saw an example of how the very sophisticated recording and management ALPRO system, supplied by Alfa Laval in Kenya, contributed to lowering milk production costs. The system identified each animal and dispensed feed in relation to yield and monitored amount eaten and signaled alarms when action needed to be taken. The reported production cost was considerably lower than any of the ten farms visited in the area.

The impact of milk recording in developing countries has been limited, particularly in smallholder dairying, due to shortage of organizations with the necessary know-how and financial resources to develop and sustain recording systems. There have been some success stories but these were invariably associated with projects that received donor support over a prolonged period. Operation Flood in India and Milk Vita in Bangladesh, mentioned earlier, are typical examples and are perhaps the two most successful dairy development projects over the last four decades. An FAO/UNDP dairy development project in Uganda, from the mid 1980s to the early 1990s, dramatically increased the amount of milk marketed in the country. The project promoted AI and recording as part of a substantial milk production enhancement component. FAO dairy development projects in Tanzania, Ecuador and Vietnam all demonstrated the potential of AI in upgrading dairy animals and increasing milk production.

Pricing and marketing policies

The requirements of the milk and meat processing sectors and the interdependence of meat and milk have an important bearing on breeding policies. Conditions of production and availability of land will naturally influence the choice of specialized or dual purpose animals. Government support schemes can also influence the trends in the industry but international trends towards liberalization have diminished the impact of Government policies. In Ireland, for example, government policies promoted beef and milk at different times and dual purpose animals predominated up to the 1970s when Ireland joined the EEC. The dairy sector supplied the majority of the calves to the beef industry in Ireland and Ayrshires, Shorthorns and Herefords figured prominently. The dairy exports were almost exclusively butter and milk was paid for on the basis of fat only. Entry to the EEC, opened up markets for milk powder, cheese and other dairy products and new markets for lean meat. The Irish Dairy Industry became much more specialized in order to exploit the market opportunities presented by the EEC price guarantees.

Friesian cows of Dutch, American, New Zealand and Canadian origin, predominate in the dairy sector and there is less interdependence between dairy and meat sectors. In parallel the beef sector also became more responsive to the needs of the export markets for lean meat. There has been a rapid growth in beef breeds such as Charolais, Simmenthal to supplement the traditional Aberdeen Angus and Hereford breeds. The shift towards specialisation has been accompanied by more intensive management and a greater emphasis on management information systems. The introduction of milk quotas by the EEC in the mid eighties, has put even greater stress on management to maximize profitability within the quota restriction. Despite these pressures, less than 25% of the dairy herd is subjected to organized recording. This contrasts with the Netherlands, where 75% of dairy animals are recorded and where genetic merit is also important in the context of semen export. New Zealand, another export oriented dairying country, has levels of recording intermediate between the two. Breeding patterns are also managed to ensure that the majority of the dairy herd is calving down when feed (grass), is most abundant. The concomitant seasonal pattern of production increases the cost of processing due to sub-optimal use of processing equipment and a shift in the product mix to shelf stable products like milk powder. Because most of the cost is incurred pre farm gate, the total cost of the seasonally produced dairy products is marginally lower and this can be critical in some export markets. However the relative profitability of short shelf life products may justify higher input milk production in the winter. Adjustment of seasonal production patterns may also be justified in developing countries to balance supplies in flush and lean periods.

The product mix will also influence the choice of breed or even species. Consumer preference for high fat content in milk in India, provides a premium demand for buffalo milk. Similarly in Italy, there is a large price differential between mozzarella cheese made from buffalo milk. Total

yield is the primary consideration when supplying the liquid milk market but milk composition determines the yield of dairy products and protein based products like cheese and milk powder are more expensive than fat based products. Selection criteria in breeding will therefore be influenced by the predominant product produced.

The success of selection programmes and changes in all aspects of husbandry and management has raised yields in dairy animals where health and other issues assume greater importance and breeding indices may have to be reassessed. A recent publication involving former colleagues in Moorepark Research Centre, Wageningen Institute of Animal Science and the Irish Cattle Breeding Federation, reviewed dairy cattle breeding objectives in Ireland under different milk quota scenarios (Veerkamp *et al*., 2002). The relative breeding index (RBI) used in Ireland, combines predicted difference for milk, fat and protein yields and protein content. The study suggests that under the prevailing quota conditions in Ireland, the economic values in terms of profit per cow per year, were high for % survival, kg butterfat, kg protein and negative for Kg of milk and per day calving interval. These economic values will be used in a selection index to select bulls for profitability in milk production in Ireland.

The microbiological quality of milk and the health status of animals is an over riding consideration for the processing sector and this is the most challenging aspect of milk production in developing countries. High ambient temperatures, poor hygienic conditions on farms and poor road infrastructure, make it very difficult to deliver high quality milk to processing plants or reach informal markets. Failure to address this aspect of milk production, will seriously undermine returns to milk producers. This could negate the undoubted potential of recording and breeding to enhance milk production in developing countries.

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