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Smallholder Milk Production in the Tropics

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ABSTRACT: Smallholder dairying (SHD) involves increasing numbers of persons who are able to provide a regular cash flow income to support their families. In some cases, continued participation in the industry has been shown to be possible even without ownership or tenure over land. The importance of milk as a dietary contribution in rural communities provides benefits above cash flow and income production and these nutritional benefits also flow into urban communities. The importance of dairying to small farmers in developing countries has been overlooked by scientists and development agencies. Its integral role as a component of farming systems which uses by-products and waste products to yield a daily cash income and family nutritional benefit has been confused with large intensive specialised dairies of developed countries. For these and other technical and developmental reasons, we have joined the resources of the International Livestock Research Institute, The Thai Research Institute and the University of Melbourne to produce a comprehensive analysis of smallholder dairying in the tropics. The papers presented in this contract reflect part of that analysis.

Key Words: Dairying, Tropics, Smallholder Farms

INTRODUCTION

Today's concerns over the grazing of ruminants in environmentally sensitive landscapes contributing methane to greenhouse gas emissions, highlights the need for increased efficiencies in production for critical human feedstuffs. Feeding the continuing rise in global population represents a major challenge for those engaged in international agricultural development. Within the need for absolute quantities of food, is an often lost requirement for highly nutritious foods to be available when other human dietary components are of low quality. Milk represents the key balance in many marginal diets. This continues to be a clear role for SHD with its efficient use of wastes and by-products. Centuries of development have produced small scale systems to preserve milk, systems for smallholders to share facilities, and improvements in feeding, breeding and management.

The following three papers summarise important aspects of SHD, namely production systems, feed resources, and future possibilities. Other aspects of the dairy subject of SHD will be mentioned in my closing remarks.

DAIRY PRODUCTION SYSTEMS IN THE TROPICS

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Dairy production is a biologically efficient system that converts large quantities of the most abundant feed in the tropics to milk, the most nutritious human food. About two thirds of the world's cattle, almost all buffalo (97 percent) and half of all sheep and goats are found in the tropical zones of Africa, Asia and America, regions which support 70 per cent of the world human population. Three quarters of the 3.9 billion people in the tropics live in Asia. In 1993-94, the tropics produced 150 million tons of milk or 36 per cent of the global output (Seth et al., 1996). In Africa, three quarters of the milk is produced by cattle, the remainder coming from camels and goats (Walsh et al., 1991). In Asia, cattle account for 47 per cent of all milk, with most of the remainder produced by buffalo. In Central and South America (CSA), almost all milk is produced by cattle.

The interplay between people, livestock and land has resulted in variable availability of milk. In Africa and Asia, there is about 30 kg per person, one third as much as in CSA. Milk yields averaged about 60 kg per 100 kg of livestock mass maintained, ranging from 36 kg in SSA to 95 kg in Asia. The latter is one tenth of the efficiency in the OECD countries (930 kg /AU), where the average dairy cow produces 500 kg milk per year, compared to 340, 900 and 1,100 kg per cow milked in Sub-Saharan Africa (SSA), Asia and CSA, respectively.

In Sub-Saharan Africa, milk output per AU and per person is lower than in Asia and America, despite a stocking rate of only 0.1 AU/ha of agricultural land. Milk output is lowest in the subhumid/humid zone because livestock wealth per person is low, fewer cows and goats are milked and off-take per cow is lower than in the other zones. The highlands of SSA are the most productive in terms of milk per ha, but production per head of cattle is lower than in the dry zone (70 vs 58 kg); this is because the majority of cattle are found in the Ethiopian highlands, where male stock used for traction comprise a high fraction of the herd. However, in the densely populated highlands of Kenya, and to a lesser extent in Tanzania, milk production has risen rapidly due to the widespread adoption of intensive dairy production with crossbred or high grade cows.

Milk production in SSA amounted to 1.27 million tons in 1988, of which three quarters were produced in East Africa. Cow milk accounted for 80 per cent overall; varying from only half of the milk produced in East and West Africa to nearly 100 per cent in Central and Southern Africa. Output per TLU (250 kg LW)
and continues to increase in area, and remains as an important forage in Southeast Asia in its early stages of growth (Falvey, 1981).

Forage and fodder on critical land

Critical land is no longer capable of playing a role in production, hydrology, or ecology functions as a result of overgrazing, continuous cultivation, bushfires, and deforestation of marginal land. Such forage is dominated by annuals, which grow fast and produce plenty of seeds during the wet season. Perennials consist of shrubs and trees, which grow during the wet season and mid-dry season.

Sustainable yield

The aim of improved forage and fodder production is year-round production. Species which produce well during the wet season can be complemented by those that produce during the dry season. Seasonal variation in forage and fodder production can be reduced by growing a range of species and by judicious use of fertiliser, grass-legume mixtures, browse shrub and trees, and fast growing grasses under intensive management.

Pastures and intensive systems

The sloping agricultural land technology system consists of alternative strips of annual food crop and strips of fodder shrub or tree legumes along the contour line of steep lands. In the Philippines, where the system originated, the land used is divided into 40 per cent for agriculture, 20 per cent for forestry and 40 per cent for livestock, particularly goats in a cut and carry system. The intensive feed gardens use fodder shrub and trees in pure stands or combined with grasses and managed intensively to provide fodder for livestock.

The Savannah system is an integration of shrubs and/or trees either singly or in clusters among the natural grass in an extensive dryland area in the dry tropics. The natural pasture can be sown with improved grass-legume pasture and the native trees can be replaced with timber trees (savannah timberland) or the native trees can be replaced with fodder shrubs and trees (savannah fodderland).

The home plot system integrates farm house with shrubs and trees, pasture, food crop and livestock in a small (0.25 ha at least) area of land. In this system the border of the farm compound is totally planted with shrubs and trees, with a strip of grass inside the border. The area inside the border is used for housing the farmer’s family, livestock shed, fodder shed, for growing food crops and forage and fodder. SHD benefits through the feeding systems of the integrated and intensive farms to an extent that may be easily under-estimated from other production systems.

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A FUTURE FOR SMALL-HOLDER DAIRYING

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The largest milk producing and consuming country India, provides production, processing and preservation techniques which may well spread to other regions of the world with the projected rapid expansion in demand for livestock products of the next twenty years (Delgado, 1999). Past assumptions that such small-holders will evolve into western-style large producers in free market environments now appear to be subsumed into wider understandings of sustainable agriculture as it embraces the field of so-called ‘alternative’ agriculture approaches (Conway, 1997). Re-evaluation of the utilisation of by-products in a more efficient manner than could be common place in more developed countries and consideration of the externalities of integrated farming systems (Alten, 1995) indicate a viable and understated livestock industry. SHD may well represent a field to which we will allocate increasing human and development resources.

Small-holder production systems show low outputs of milk per animal. However, when analysed on a cost-benefit basis, the use of by-products or other waste as feed, and multiple outputs such as draught and meat production, the continued efficiency of small-holder production systems can outweigh the apparent efficiencies of dairying mono-cultures. Application of current technologies will allow increases in milk production by recognising the differences in feeding requirements, in particular nitrogen balance, according to physiological state, work needs, and age of an animal.

The future for small-holder dairy development will rely on continued research and education of small-holders themselves. Research must acknowledge integrated systems and the role of small-holders while focusing on such technical parameters as; breeding systems, herd recording, feeding systems, production of breeds, the multiple uses of animals, management of reproduction and health, and milk harvesting systems. The strong social research requirement of small-holder dairying contrasts with that of dairy research in more developed countries while technical elements share common scientific bases. The future for individual countries in small-holder dairy production is likely to
varies according to the stage of development of a country, the relative levels of market protection, and an understanding of small-holder dairying by international development agencies.

Economic modelling of small-holder dairying is complex because of the integration of milk production with the very lives of small-holders and would include variables common to many small-holder integrated systems including:

**Feeding systems:** crop residues; pastures; communal pastures; concentrates; preserved pasture; supplements

**Breeding systems:** local breeds; local breeds crossed with temperate dairy breeds; local breeds crossed with local dairy breeds; near pure bred and pure bred temperate dairy species

**Production systems for fodder:** specialist fodder production; production of own fodder; roadside harvesting; communal management

**Stimulus for development:** development banks; local banks; government programs; aid organisations; local initiatives; non-government organisations

**Physical environment:** wet tropics; dry tropics; high altitude; low altitude; rainfall distribution; temperature variations

**Management:** epidemic disease management; herd and individual animal management; housing; feeding for production; private services for animal health; production systems; milkers as specialist service providers

**Applicable technologies:** herd recording; by-pass protein feeding; urea and alkaline straw treatments; vaccination programs

**Milk market:** local fresh milk; local pasteurised milk; export from local area; processing for local boutique markets; selling to large factories; domestic use; mixing with imported milk powder

**Processing:** village level; area collection and processing; factory-based; multinational factory-based

**Integrity of dairy system:** specific dairy enterprise; mixed farming enterprises; adjacent to other farming activities; adjacent to other wage earning activities; fully integrated with farming system

**Multiple animal outputs:** draught; meat; asset management; religion; status

**Sustainability:** short term; medium term; long term; comparison with other food production enterprises; comparison with dairy sustainability in other countries

**Animal species:** cattle; buffalo; goats; sheep; camel; horse; other

**External environment:** implications of GATT; policies of financing and funding agencies; involvement of multinational processing facilities; local ability to collectivise

**Land ownership:** landless; own land; own dairy-shed land; utilisation of farming in conjunction with communal land; communal grazing; family assets; migratory production

**Outputs:** raw milk; family security; income; infant and family nutrition; marginal incremental output to an integrated system; benefits from animal manure for cropping; maintaining additional animals for work; meat consumption; additional animals for sale.

Incorporating all of the above non-exhaustive factors into a single model would be primarily of academic interest. Dairying development differs from general agricultural development. The oft-observed relationship between increased agricultural production and economic development begins with agriculture producing surplus wealth for industrial development, often initially through agro-industry, which creates further wealth and economic activity and leads to an increase in demand. While the dairy industry can create a part of the initial surplus, expansion of a dairy industry may also be a response to economic development itself. Demand for luxury products may include milk as a safe and nutritious food for children, thereby creating a reliable market for further dairy development, consistent with observed increases in demand for animal products in less developed countries.

The relationship between small and large-holders in many countries has developed into one where a small-holder supplies milk to processing facilities linked with larger producers, or one where small-holders cooperatively share a milk collection and processing plant. Cooperatives are usually seen to provide greater security and be more socially equitable than private large-holder plants accepting small-holder milk.

Applied research oriented to small-holders needs which are not met by simple importing of technology is linked to wider understanding of national planners and analysts of the benefits that have accrued from small-holder dairying. These may be grouped as: year round engagement of rural and peri-urban labour; utilisation of agricultural and other by-products; integration with cropping systems management; conversion of by-products to organic manure for application to crops; provision of nutritious and hygienic food for children; production of meat from male calves and older cows; reducing the cost of production of meat for traditional markets in circumstances of rising costs as draught power declines as the primary bovine product; a basis for rural and peri-urban industrial development through milk factories; the development of new products for niche exports; reducing rural to urban population drift; draught and traction as a dairy industry by-product or adjunct; and landless persons making a reasonable living from dairying.

Small-holder dairying has not been popular among development agencies such as the World Bank and the Asian Development, or even for most bilateral aid agencies. Much of this unpopularity has been related to assumptions that tropical industries may not survive without protection. Funders of development prefer large and familiar projects and analyses of dairying in tropical countries have commonly assumed industries similar to those of more developed countries. The exceptional Operation Flood in India illustrates one exception in successful collectivisation based on local socio-cultural values.
Imminent changes in the international dairy market as a result of Uruguay Round Agreements are expected to control dumping of milk powder in less developed countries, which with rising demand should allow dairying to expand rapidly in parallel with other intensive livestock industries (Delgado, 1999). Thus the indigenous developed techniques and selectively innovative small-holding dairy industries of the tropics present an opportunity to development agencies and policy makers as they consider the social efficiencies of highly integrated systems, and the centrality of small-holders themselves.

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CONCLUSION

In spite of several decades, or centuries for some cases, of dairy farming in developing countries the productivity of SHD has remained at a relatively low level due to a lack of appropriate dairy research (Chantalakhan, 1995). Furthermore the science and technology available in developed countries cannot be readily adopted by small farmers due to their socio-economic and agro-ecological conditions being greatly different from those in industrialised countries. Some dairy technology developed in advanced countries may be appropriate for adoption by smallholder dairy farmers but most of these dairy technologies or dairy practices have never been transferred to smallholder farms due to a lack of effective services.

It is obvious that not all problems related to low productivity of SHD can be solved solely by research solutions. They are also influenced by other factors such as unfavorable government policies, lack of market outlets, and inefficient dairy extension services. To understand the relationship of research and development activities for SHD improvement, which will systematically lead to more effective identification of research priorities, it is important to analyse related factors which influence the SHD systems.

Examples of the institutional support required to facilitate dairy industry growth include credit institutions, farmer training facilities, milk collection centers, processing and marketing facilities, dairy farmer cooperatives or groups, and research and extension services. Prerequisite technical factors consist of; (1) suitable dairy breeds for hot and humid tropics, (2) availability of good quality feeds especially roughages, as well as clean water, (3) good farm management practices and herd husbandry, and (4) appropriate control and prevention of tropical animal diseases and parasites. Expansion of dairy development could benefit from related government policies conducive to dairy farming. For example in Thailand, some changes in government policies produced major positive impacts on dairy production, such as; (1) the Regulation of the Ministry of Commerce (1985) on Dairy Products Manufacturing, which required producers of recombined milk to use fresh milk to recombine milk at the ratio of 1:1 or 1:2 of skimmed powdered milk to fresh milk, (2) a milk drinking campaign sponsored by government to increase fresh milk consumption from about two kg per capita to 15 before the year 2000, (3) a school milk program launched during 1994-95 to promote milk drinking among pupils outside urban areas in order to improve children’s health, (4) diversification of rice production to dairy farming in order to reduce paddy farming in certain areas. Socio-economic factors, such as, income from off-farm jobs, availability of capital, milk prices, price of land, farmer education and training, and availability of family labor, influence a dairy farmers’ decision on whether to expand and improve dairy operations.

SHD has been a major field of animal production for centuries. In our opinion it has not received the attention it deserves from scientists probably because the field has been conceived as a primitive form of capital intensive western systems. With international attention now beginning to come to SHD in the tropics, we expect an increased research interest in the field.

REFERENCES
