

Strategies for Sustainable Management of Livestock in Mixed-Crop Livestock Farming Systems

In this chapter, strategies are set out that have been formulated on the discussions so far (see Annex 8 for a summary of trends and implications). Research has shown that problems prevail on several levels, hindering the smooth progress of sustainable and remunerative livestock systems in mountain areas. At the production level, the smallholder faces problems of acute fodder shortage and is still largely isolated from appropriate and beneficial technological options. At the market level, pricing policies and market institutions need to be improved. Policies have so far been somewhat removed from reality as faced by mountain farmers whose needs, capabilities, and achievements must be recognised and strengthened.

Key thrust areas, strategies, and potential options/approaches for sustainable livestock management are discussed below, along with current constraints and strategies for overcoming them.

Improvement in the Feed Resource Base

Reiteration of the Problem

Feed shortage is a major problem for livestock farmers throughout the HKH. In Uttarakhand in the Central Indian Himalayas, the present shortage of feed and fodder is estimated to be 65 per cent (Dhar 1997). The magnitude of the problem varies from zone to zone. Similarly, in Nepal, scarcity of fodder (especially during winter) is a crucial problem in raising livestock. The shortage of animal feed is acute during the dry period and winter and livestock are generally underfed by one-third of the amount required. Nepal faces a 20–36 per cent feed shortage. The situation

is much worse in the mountains because of small landholdings and the limited support land for grazing. The fact that ruminants are underfed has resulted in late maturity, high calf and adult mortality, poor lifetime performance, and infertility in cattle and buffaloes (Sherchand and Pradhan 1997).

The primary reasons for the shortage of fodder are the shrinking per capita landholdings and loss of forest land which have reduced the resource base per head of livestock. Animal numbers per household have decreased while the total livestock units have gradually increased. Many CPRs, where farmers used to graze their livestock unimpeded, are also becoming protected areas.

Community sanctions are in place in intense pressure areas, with penalties for those who encroach on community forest areas to graze livestock. Such restrictions contributed to the farmers' problem with fodder collection, at least during the early phase of community forestry. Even in well-managed community forests, fodder species and grasses are still scarce. Attempts were made to introduce exotic fodder species in community forests, but these species did not perform as hoped. Attention should be directed to local species that adapt well.

Strategies

- Increase production of fodder trees and fodder grasses in community controlled areas
- Enhance the productivity of fodder grasses and fodder trees from private farms
- Improve access to quality feed (feed concentrates)

Potential Options/Approaches for Land-Based Feed Resources

- Increase planting of fodder species (trees, grasses and shrubs) on uncultivated community and private land (marginal land, terrace risers)

Significant research has been carried out in agroforestry and related technologies that can help to generate fodder all year round to cope with the winter shortage. These need to be promoted through better extension services. The government could support

research to identify fast-growing fodder trees and improved grasses for specific agro-climatic zones and arrange for multiplying and distributing seeds and seedlings. Incentives such as short training courses, in-country tours, and prizes for taking care of planted trees would be useful. Trees and grasses would not only supply livestock fodder but would also supply much-needed fuelwood, as well as conserving soil and preventing erosion. Potential areas where these could be grown are community land that is not fully utilised and private land.

- Assist private farmers in multiplying, distributing/selling fodder trees and forage grass seeds

Given the opportunity, local farmers can take the lead in raising nurseries of fodder trees and growing seeds of forage grasses for their own use as well as for profit.

- Promotion of efficient use of agricultural residues

Given the limitation of small landholdings, technologies that enable maximum fodder/feed output with minimum land resources should be promoted.

Many farmers in the high pressure areas of the HKH have partially adopted these solutions: their experiences need to be built upon and replicated.

- Encourage better management of common resources for fodder supply

Community planting and sharing of fodder can be encouraged. Communities can be organized in groups to grow fodder grasses on CPRs and in forests. On-farm adaptive research has proven that fodder grasses can be grown on very marginal lands in pine forests.

- Promote entrepreneurship in supply of quality concentrate feeds

For a smallholder dairy, a timely supply of quality concentrate feed is critical, especially in periods of fodder scarcity. Private, local suppliers should be encouraged.

Improvement in Animal Productivity

Reiteration of the Problem

Low productivity in terms of milk is a major constraint. Poor feeding practices, local breeds and their sub-optimal nutrition, and low milk prices (resulting in less incentive to keep productive animals) are the primary reasons behind poor milk production. High-yielding animals are expensive. Quality animals have been promoted in the past, but the improved cattle were an inappropriate choice, especially in the Nepalese hills and mountains (see Box 7.1). Affordable and adaptable options for quality animals, such as improved buffaloes, have not been given priority by the government sector, so that, even when mountain

Box 7.1

INAPPROPRIATE CHOICE OF QUALITY ANIMALS

In recognition that the productivity of livestock presently owned by the large majority of smallholders in high pressure areas is very low, government institutions have in the past promoted the adoption of high-yielding animals (mainly cattle) through distribution and credit arrangements. Improved cattle were vigorously promoted in some parts of Nepal, including the hills of Kaski and Parbat (the sites for the present study). Similarly, in the Indian hills too, exotic and/or exotic cross-breeds were introduced many years ago. However, there were several problems that hindered the optimal performance of such animals in mountain farming systems. These included sub-optimal nutrition and management, greater susceptibility to prevailing diseases and pests, and thinly spread veterinary services. High-yielding breeds (especially cattle) require quality fodder. There are two constraints involved in growing improved forage for improved cattle. Firstly, farm sizes are small and fragmented and farmers need to keep most of the available land for food crops. Secondly, cultivation of improved fodder grasses requires irrigation, which is not available to most farmers. Mountain conditions of inaccessibility and the resulting lack of access to inputs and services, even if affordable, also presents a challenge to rearing such improved cattle breeds, because they are dependent on both quality feed (concentrates and quality fodder) and on a good veterinary network.

farmers desire to replace their local buffaloes, they cannot overcome the inaccessibility and isolation of their mountain farms to acquire and raise the improved breed. Inadequate extension and promotion/demonstration are also constraints. Farmers from remote villages indicated that they were not well informed about opportunities for raising improved buffaloes. At present, improved buffaloes are sold mainly by private traders from the lowlands and have not reached the smaller market towns of the hills. The relevant government institutions should play a part in helping to ensure that improved buffaloes reach these small market towns.

On the other hand, to curb the increasing livestock pressure in HP, Ranveer (1995) suggests that the livestock population in HP should be reduced by 34.4 per cent. To some extent, this has occurred through the introduction of quality dairy animals such as Jersey crosses. Cross-bred cows only account for 14 per cent of the total cow population in HP, and there is plenty of scope for increasing their proportion while decreasing the number of unproductive cows of local breed.

Strategies

- Promote appropriate,manageable productive animals
- Improve the productivity of the animals that are adopted
- Promote the trade in improved buffaloes

Potential Options/Approaches

- Reassess policy regarding cross-bred cattle promotion; focus on appropriate, manageable productive animals

Box 7.1 describes the case of an inappropriate choice for productive animals; a lesson that is important. Research and development should focus on building on the successes of people's choices. Development policy should be more participatory in order to reflect the ground realities. Wherever feasible, encouragement for adoption of cross-bred cattle is needed. Nevertheless, its introduction as a blanket solution should be avoided.

- Encourage local people in improved buffalo trading

Make farmers aware of the areas in which they are sold. Facilitate

market arrangements whereby buffalo traders and the farmer willing to buy them can come together. This might include organizing ‘market days’ in villages for the sale of improved buffaloes.

- Increase price incentives

If the commodity derived from livestock, e.g., milk, fetches a price that covers the cost of production and leaves a profit, there is an increased incentive to feed the animal well and increase the productivity of otherwise unproductive animals. The price of milk set by parastatal government organizations is low and is not set according to the cost of production. Price policies should be reassessed and a market for value-added products, such as *khuwa* (milk concentrate) , ghee, and, in urban areas, ice cream, should be increased. Price incentives through diversification of milk products will encourage households to improve the productivity of animals

- Improve market infrastructure and market scope

The possibility of selling milk encourages farmers to keep productive animals. Examples from Dolakha demonstrate that animals kept within the vicinity of road networks were productive animals (in this case buffaloes as opposed to local cattle). With this increase in access the quality of animals kept and, therefore, the total milk collected also increase. In most of the chilling centres visited, it was found that milk arriving from villages more than two hours’ walk away were from local buffaloes. A greater proportion of the milk was arriving from villages closer by and was from both improved buffaloes and cows. There is considerable scope for increasing the demand for pasteurised milk. The majority of school-going children do not have access to milk. A milk-feeding programme for all school going children during their ‘tiffin’ hours at school can increase milk consumption significantly.

- Encourage farmers’ groups

Several factors make membership of producer associations, such as farmers’ cooperatives, conducive to keeping productive animals. In certain cooperatives, compulsory quotas for milk supply must be adhered to, and this means that farmers will have

to keep/buy productive animals. Risk factors, such as disease and unavailability of credit, are lessened in a group situation compared to individual ventures. Farmers' groups are often linked with credit schemes and are capable of organizing animal health services.

Improvement in Livestock Support Services

Reiteration of the Problem

There is a significant shortage of livestock support services. One of the reasons for farmers' reluctance to adopt improved animals is the insecurity of their investment. Animals, particularly improved breeds, are prone to diseases and cannot be sustained without readily available drugs and vaccines and regular monitoring of their health. Veterinary services in Nepal are largely confined to the government sector.

The number of skilled livestock technicians is also very small and extension and line agencies are understaffed. Shrestha and Sherchan (1988) calculate that the ratio of veterinarians to livestock in Nepal is such that each veterinary doctor has to provide services for 42,000 livestock units in the hill region. Lack of trained human resources in livestock health services is of great concern. Private sector involvement in livestock support services (dispensaries for drugs and vaccines) is limited and needs to be encouraged.

Strategies

- Improve human resource base in livestock support services sector
- Promote private sector participation in livestock health services

Potential Options/Approaches

- Training and building local people's capacity

Experiences from the Indian Himalayas (HP) should be extended to the hills of Nepal. Training of 'paravets' able to provide privately-owned mobile services could work well.

- Involve the private sector

Private enterprises should be more actively encouraged to establish veterinary dispensaries.

- NGOs should be encouraged

NGOs can be involved in the provision of veterinary services and in carrying out training for local human resources capable of providing such services.

Reassess the Price Policy for Milk

Reiteration of the Problem

The present price policy for fresh milk favours urban consumers. Farmers often state that the cost of production would exceed the price they get for their milk if they were to only feed their livestock on purchased feed. Lower milk prices and increasing feed costs could jeopardise the economic viability of raising livestock. Presently, the National Dairy Development Corporation (DDC) sets the milk price. It has the largest processing facilities with milk collection and chilling centres and is the farmers' major customer.

Farmers complain that the DDC fixes the price that provides just enough margin to cover their production costs. Although private dairies pay an approximately ten per cent higher price per litre of milk than DDC, because of their limited collections centres, the majority of farmers cannot sell milk to the private dairies.

The other reason cited by farmers for the stagnant price of milk has been the excess use of imported powdered milk by the DDC (Dairy Development Corporation), as well as by private dairies.

Strategies

- Set prices realistically to reflect the cost of production
- Lift subsidies to enable fair competition

Potential Options/Approaches

- Implement fair price policies

Analysis of the cost of production must be taken into account before the price of milk is determined. When such prices are determined there should be an adequate margin of benefit for milk producers.

- Facilitate fair competition so that private dairies can play a greater role in the market

The government should facilitate these changes, monitor quality, enforce standards, and enact suitable policies from time to time.

- Discourage excessive use of powdered milk for processing

Excess use of imported powdered milk should be discouraged, especially if it is subsidised.

- Enforce quality control

There is a need to control the quality of the pasteurised milk sold. It has been reported that there is a common practice of using low quality powdered milk and buttermilk for sale in the market.

Promotion of Manufactured Livestock Feed

Reiteration of the Problem

Reliance on non-land based, external sources of feed is bound to increase in future, as the villages transform from subsistence to semi-commercial economies. Maintaining a productive herd of livestock will require more and more inputs of livestock feed from outside.

However, one of the biggest problems faced by a smallholder dairy household is the increasing price of manufactured feed in the face of stagnating milk prices. Interviews with farmers indicated that, if they were to depend entirely on purchased feed, the cost of feed would exceed the benefits derived from the sale of milk. The

small farmers, without enough land of their own to supply land-based feed, bear the full brunt of the high cost of feed. Dependence on land-based fodder resources is becoming increasingly difficult for smallholder dairy farmers.

Strategies

- Monitor prices and quality of livestock feed in the market
- Set milk prices realistically (as discussed above)

Potential Option/Approaches

- Promote competition and monitor quality

There is involvement of the private sector in production of livestock feed in Nepal, but there is very little competition. Prices and quality are not monitored. Farmers at the field study sites expressed dissatisfaction over the quality of feed. Relevant bodies to monitor the quality and price of livestock feed should be instituted.

- Increase availability of feed concentrates

Encourage more private sector involvement and competition.

- Train local entrepreneurs

Enforce production of quality feed and provide support/training for development of micro-enterprises for feed production in rural areas.

Fostering Credit and Savings' Institutions / Minimisation of the Risk in Livestock Raising

Reiteration of the Problem

Credit facilities are essential for encouraging the adoption of productive animals, since it is an expensive investment for the smallholder. Despite continuing efforts, official credit for smallholders is not easily available through government institutions. A large number of farmers willing to invest in livestock still have to resort to unofficial credit at high interest rates. Unavailability of

credit is therefore another constraint to livestock sector development for small-holders.

Delivery of government credit services mainly occurs in the cities and administrative centres, away from the villages. There is a paucity of field-based government credit institutions in remote areas. Community credit and savings' organizations have been relatively successful and need to be replicated in different areas. Concessional loans should be provided to local credit/savings' organizations.

Investment in productive livestock has a lot of risk and uncertainty. As mentioned previously, availability of risk neutralising factors, such as veterinary services, encourages farmers to adopt improved breeds. Insurance of livestock against death and natural hazards is lacking. Farmers also face uncertainties at the market level. Lack of guaranteed marketing prospects for livestock products and unfair prices add to the uncertainty.

Strategies

- Improve credit access, especially for disadvantaged groups, women and marginal farmers
- Promote insurance policies for livestock and foster local institutions
- Enhance local savings' and credit organizations

Potential Options/ Approaches

- Improve linkages between farmers and bank/financing agencies for credit

Promote field-based government credit institutions. Encourage and mobilise community organizations for savings and credit. Provide concessional loans to community credit and savings' organizations.

- Encourage and foster farmers' organizations

Experience from successful transformed areas has proven that the formation of farmers' groups greatly helps cushion the individual farmer from the risks associated with livestock raising.

Community-level institutions, such as milk producer associations (MPAs), community credit and savings' organizations, and cooperatives, need to be promoted more, and successful experiences should be replicated.

- Promote insurance policies for animal against death and disease

The private sector should be encouraged to enter the business of insuring livestock, although initially some assistance should be given by the government.

- Widen markets

Increase market network linkages, including domestic and regional markets.

Promotion of Appropriate Technologies for Inaccessible Areas

Reiteration of the Problem

Lack of accessibility has greatly hindered prospects for improving the livelihood of smallholders through a remunerative, cash-oriented livestock sector. Access in terms of proximity to the roadhead and milk collection centres usually correlates to increased incentives for the small-holder to commercialise. However, small-scale chilling centres (usually at the roadheads) are still few and far between and are largely inaccessible to remote farmers. There are numerous households practising mixed crop-livestock farming systems in the inaccessible areas where raising of cattle and buffaloes is common.

Presently, farmers are carrying their milk a distance of five to six hours' to milk collection centres (Annex 4). In most inaccessible areas, local buffaloes are the prime milk producers. There are hinterlands further afield that require eight to 12 hours of walking to get to milk collection centres at the roadheads.

Appropriate milk processing technologies for such inaccessible areas has not so far received any attention. In order to promote milk collection and benefit poor farmers, appropriate technologies and facilities need to be developed for these remote

areas. The quality of milk and milk products has suffered because of the long distances that have to be covered to reach the chilling centres.

Strategies

- Institute policies for appropriate technologies for remote areas
- Build capacity of private small-scale (cottage) industries

Potential Options/Approaches

- Direct efforts towards developing /designing small-scale, intermediate raw milk chilling/processing facilities appropriate to inaccessible areas

Chilling facilities with a capacity of 100 to 600 litres have already proved successful in some areas, e.g., Ilam in Nepal. They need to be promoted and further developed. Existing technologies must be upgraded. Means of increasing the shelf life of milk is an important issue for farmers in remote areas. Appropriate technologies are necessary for this purpose.

- Promote cottage and micro-enterprises for high-value products (*khuwa*, ghee etc)

Private entrepreneurship in milk processing and milk product diversification has not been encouraged so far. Policies and the operating environment should be made more conducive for small dairies. Efforts should be made to:

- institute specific financing schemes;
- enable fairer price policy/ fairer competition; and
- make inputs like starter culture and rennet easily available.
- Promote environmentally-friendly processing technologies

Processing plants of any scale require a lot of fuel. So far, fuelwood has been meeting the energy demands of these plants.

Factories that run on diesel fuel have already proven successful (e.g., in Ilam, Nepal). Such technologies should be encouraged and subsidised like the biogas plants. Subsidies are well justified in

cases like this, since they contribute to alleviating the pressure on the environment.

Promotion of Diversification through Value-adding to Increase Returns

Reiteration of the Problem

Diversification of milk products has not been fully undertaken to maximise returns from the sale of different value-added milk products. Presently, milk sold by the smallholder is usually raw, unprocessed milk. There is plenty of scope for diversifying milk into different products, both traditional and modern. The traditional products include the butter, *ghee* (clarified butter), *khuwa* (condensed milk), and *chuurpi* (hardened cheese) that have always been marketed by smallholders. Modern products include ice cream and flavoured milk. Disadvantages resulting from ‘milk holidays’ for fresh milk could be compensated for by profitably channelling milk into new products.

Strategies

- Promote milk product diversification
- Increase the market share of traditional and modern value-added milk products

Potential Options/Approaches

- Facilitate marketing for traditional products like *khuwa*

Khuwa is an essential ingredient in local sweets. It has a large market and is widely consumed in urban areas. The producer-client link for traditional milk products such as these is very weak and is not as well established as that of raw milk. Experiences from Baroda in India have shown that *khuwa* production and distribution on a large scale can be operated quite successfully. An outlet for value-added products is especially important since it maintains a cash-flow for rural households in glut periods. This would be most desirable in accessible areas.

- Improve technologies for existing traditional products

Khuwa and unique products such as yak cheese require improved production technology. For urban-based dairies, skill

development programmes for products such as ice cream need to be extended to private sector enterprises. Nepal's dairy skills are still limited to public sector technicians.

- Promote programmes for skill development

There are very few technicians with the knowledge and skill to run a dairy. Furthermore, whatever skill and knowledge there is remains limited to public sector technicians. Private entrepreneurs who have started dairy/milk processing businesses of their own have largely relied on knowledge by 'word of mouth' and observation. Shortage of technicians in urban-based factories (for ice cream production for example) is such that they have to pay heavily to hire a limited number of qualified technicians, and smaller businesses cannot even afford them. Present small-scale businesses serving the inaccessible areas produce products of inconsistent and/or poor quality due to lack of training. There is not a single training facility in milk processing and product development in Nepal. The National Dairy Development Board (NDDB) (Nepal) should take the initiative for establishing a National Dairy Training Facility in the country.

- Increase processing capacity to match milk supply

Milk holidays are affecting hill and mountain regions, while production is increasing year by year. Only milk that can be handled is being collected. The number of processing plants has to be increased to absorb the surplus.

- Encourage milk product diversification for urban markets

Diversification can be extended to different varieties of ice cream, yogurt, and flavoured milk drinks (like milkshakes).

Integration of Gender Concerns

Reiteration of the Problem

In Nepal, women contribute 70 per cent of the work in raising livestock and are more knowledgeable than men about treating sick animals (Sharma and Awasthi 1993; Tulachan 1994). In spite of this, women are excluded from extension, marketing, credit, and

other activities critical to increasing livestock productivity and income (HMG/ADB 1993).

Women's needs (for time-saving technology, for example) are not considered when conducting research, nor is the extension education system tailored to women farmers. Despite the fact that women farmers contribute an equal share of the work in raising livestock, their knowledge and ideas on problems have hardly entered mainstream perception; it is only men who have a say.

Use of child labour is common in livestock feed/fodder collection as well as in grazing. It is mostly female children ranging from seven to 13 years, who are engaged in taking animals to graze in nearby forests and on support land. During the rainy season, the boys and girls of this age group are involved in cutting and carrying green grasses and field weeds from crop fields. Children are also engaged in collecting dung from open common property land. In spite of the wide recognition of the role of women in livestock economy, gender insensitivity in planning and in activities related to livestock development still prevails.

Strategies

- Internalise gender concerns in livestock planning
- Develop and promote drudgery-reducing technologies for women and children
- Increase contribution of livestock to women; enhance gender equity

Potential Options/Approaches

- Formulate policies with women and children farmers in mind

Sensitisation of local institutions regarding gender needs and the active involvement of women staff/knowledgeable women farmers are essential if useful programme activities are to be formulated. Participatory approaches should be taken, with explicit emphasis on the problems and potential of women and children.

- Develop and promote drudgery-reducing technologies for women and children

Out-migration and seasonal migration from the hills have resulted in a shortage of farm labour. Able-bodied men, particularly, have been migrating to cities and towns for off-farm

employment. This is due to the increases in wages for labour outside the farm. Women, children, and senior citizens are left behind to tend livestock; and rearing these livestock using the stall feeding option demands labour. Approaches to overcoming labour constraints at the household level should consider labour-saving, time-saving, and drudgery reducing technologies. Indeed, research and development in the livestock sector should focus on this area.

- Improve livestock contribution to gender equity

Micro-livestock (small ruminants and poultry) have been contributing to direct income for women. The option of small ruminants offers more autonomy in decision-making, and thus empowerment to women. Women are more easily involved in the sale and purchase of goats and chickens. They make decisions and have more control over financial transactions with these classes of livestock than with large ruminants.

Promotion of Micro-Livestock for Marginal and Disadvantaged Farmers

The 'visible' classes of livestock, namely, buffaloes and cattle, are the most talked about components of the livestock sector in the middle hills. Little attention, however, is given to micro-livestock such as goats and poultry. They have been an important source of immediate cash income for every household in the hills. In the mid-hill/mountain areas, the number of households raising stall-fed goats is increasing. In the field survey areas, almost 80 per cent of the households were found to be raising two to six goats. Restrictions on open grazing has led to stall-feeding becoming a common practice. Fodder trees are lopped and fed to these animals.

While milk provides regular cash flow (on a daily basis), goats and chickens are 'liquidate-in-need' assets. Poultry provides a quick source of cash income. Women take them to market towns where they sell them easily and return home with the required household items bought from the cash. Small ruminants, in comparison to large ruminants, e.g., buffaloes, are a less risky investment for resource-poor farmers since they require a smaller amount of capital.

Credit schemes for raising goats are operating very well in most parts of the middle hills of Nepal, mostly run by various NGOs. The default rate for small loans for micro-livestock (especially in the case of women's groups) is also very low, indicating its success.

Presently, there are no marketing problems for goats. Petty goat traders roam around villages looking for goats to buy. They then walk them to the markets for sale. On the other hand, rural areas in the hills and mountains do not raise poultry on a commercial scale. Rural households raise local poultry as scavenging birds, and their size is small. On average, a farm household raises four to ten chickens. The marketing of local chickens has not been a problem. Petty traders in poultry travel around villages, buy poultry, and carry them to market centres. The problem is that farmers are not getting as much return as they could had they organized their markets. Thus in order to make micro-livestock a remunerative enterprise, the focus should be on organized marketing in farmers' groups.

Thus, there is considerable scope for developing micro-livestock to help improve the income levels of resource-poor farmers. In inaccessible areas, priority should be given to goat raising as goats can walk to markets. Also, with urban consumers' increased levels of disposable income, demand for goat meat has been increasing steadily. Small-scale poultry production with 200–500 birds, that can be managed using family labour, can be promoted in areas that have access to roads and wider markets. However, food supplies and veterinary services must be assured. Such programmes can be developed and implemented to target resource-poor farm households in particular.

Strategies

- Allow wider inclusion of micro-livestock in policy agenda
- Encourage government and non-government organizations to introduce schemes that provide credit support for disadvantaged groups
- Enhance the productivity of goats

Potential Options/Approaches

- Promote micro-enterprises for women based on goat and poultry raising

Credit provision for such enterprises is necessary. Micro-enterprises can be encouraged through formation of savings' and credit groups for women.

- Provide training for women for small-scale poultry raising

Such programmes should equip women entrepreneurs with the skills and knowledge needed to manage health and feed requirements for poultry. They also have to be linked to the necessary support services such as veterinary support and easy provision of feed concentrate.

- Organize farmers in marketing their live animals and products

Formation of women's groups to market goats and poultry can be encouraged. These groups can be associated with savings' and credit associations for women and marginalised farmers.

- Establish a regular and reliable marketing network

Links between producers and markets should be better facilitated. A proper market information system is essential to guarantee regular sales. In addition, community savings' and credit systems should be strengthened to expand goat production at the household level and disadvantaged groups and marginalised farmers should be organized for the production and marketing of poultry and eggs

Improvement of Soil Fertility through Better Management of Livestock and Forage Crops

Reiteration of the Problem

Livestock contributes to the maintenance of soil fertility. However, there is still a lot of scope for contributing to the sustainable management of soil through better management of livestock. In a semi-stall-fed system, about 46 per cent of manure produced during the daytime is lost while animals are grazing in the forest or on community fallow land (Bajracharya 1998). Even in an entirely stall-fed system, potential fertilizer is lost due to poor housing structure, inefficient FYM preparation and inappropriate application methods.

Strategies

- Improve the efficiency of the nutrient cycling of the crop-forest-livestock system
- Integrate new components into the system of ‘win-win’ technologies (nitrogen-fixing fodder trees and leguminous forage) for fodder, fertility, and conservation

Potential Options/Approaches

- Disseminate knowledge and technologies for efficient nutrient recycling

Effective dissemination of information on nutrient loss in the stall-fed system and ways to prevent loss is necessary. The importance of N-rich legume feed and N-content of animal excreta for quality FYM production needs to be emphasised.

- Promote legume integration in mixed crop-livestock farming systems

Legume integration directly contributes to soil fertility maintenance. Approaches for increasing legume integration can include the following steps:

- dissemination of information on N-fixing activities of legumes and their importance in soil fertility improvement;

- identification of promising legumes for specific farming systems;
 - incorporation of indigenous knowledge on locally available legume species and exploration of suitable new legume crops and trees; and
 - provision of support in getting the required inputs and services.
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- Promote farm agroforestry

Agroforestry systems for soil conservation and sustainable livestock production have to be promoted. Agroforestry also allows a reduction in the farmers' work burden and avoids over-exploitation of common forest and grassland.

