

# Traditional Livestock Production and Growth Opportunities in India

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**ABSTRACT**

Livestock and animal health development projects need to be based on an understanding of livestock production systems because different systems need different approaches particularly in view of degradation of environment combined with population pressure. In India, the livestock production system is primarily traditional, consisting of mixed-farming and pastoral systems, therefore, development of marginal and smallholder mixed farms must aim at intensification of the total production system. Resource-poor farming systems may aim at the improved management of the various livestock species in backyards. Pastoral systems must focus on effective management of grazing pressure. Community pasture management involves application of technologies, land tenure policies, institutional development, economic return and a reduction in the number of people depending upon livestock. The challenge is to reverse the current degradation of the environment, and arrive at sustainable increases in crop and livestock production to secure present and future food supplies.

**Key words:** Environment, Integrated farming system, Traditional livestock production

## Introduction

The sustainability of many crop and livestock production systems in many countries is threatened by population growth and changes in consumption patterns. Increased cropping, changes in cropping pattern and intensity and overgrazing of pasturelands lead to soil degradation and these endanger food production. Especially the livestock sector is often blamed. Strategies for sustainable agricultural and livestock development are needed to meet the increasing demand for food and employment, and to reduce the degradation of the environment.

***Description of livestock production systems:*** Livestock production systems may be classified according to a number of criteria, the main ones being integration with crop production, the animal-land relationship, intensity of production, and type of product. A livestock production system can be considered either as a component of a mixed crop-livestock farming system or may constitute the whole farming system. Seré and Steinfeld (1996) broadly classified livestock production systems into four types:

i) Grassland-based systems, based solely on livestock, in which more than 90 percent of the dry matter fed to animals comes from rangelands, pastures or home-grown forages.

ii) Rain-fed mixed farming systems, in which more than 10 percent of the dry matter fed to animals comes from crop by-products.

iii) Irrigated mixed farming systems.

iv) Landless livestock production systems, which are solely livestock-based with 10 percent or less of the dry matter fed to animals being farm produced.

Modern and traditional livestock production systems have been distinguished on the basis of factors of production. Modern

systems have large capital requirements and employ substantial amounts of hired labour, while traditional systems mainly rely on family labour and the extensive use of land. In general, traditional livestock systems are far more prevalent in India than modern systems.

The traditional livestock production systems can be subdivided into two broad categories: *Grassland-based Systems* and Mixed or *Integrated Farming System*.

The grassland-based systems again have been subdivided into:

i) Traditional pastoral systems, found in arid areas receiving less rainfall per annum and where cropping is not practised.

ii) Traditional agro-pastoral systems, which occur in arid and semi-arid areas with medium annual rainfall and whose main crops are millet and sorghum.

***Pastoral and agro-pastoral systems:*** Pastoral systems are associated with zones that are too dry for cropping to provide a basis for subsistence and are defined as land-based systems, where the grazing of ruminants is the predominant form of land use. Based on the degree of economic dependency on livestock, a pastoral production system has been defined as one in which 50 percent or more of household gross revenue comes from livestock or livestock-related activities, or where more than 20 percent of household food energy is directly derived from livestock or livestock-related activities (Swift, 1984). Pastoral systems are mainly found in the arid and semi-arid zones of Rajasthan, Gujrat, Haryana and Ladakh region of India. Pastoral systems are also prevalent in the humid and sub-humid zones of Himalayas, including North Eastern hills of India. Approximately 4% of agricultural land is used under this system (Birthal *et al*., 2006), however, livelihood of marginal communities are dependent on it.

The major factor in pastoral systems is the mean rainfall, its reliability and distribution. Three types of pastoral system can be identified (Jahnke, 1982):

1. *Nomadic pastoralism*, which is a pure pastoral system, characterized by little or no agriculture and by high mobility of people and animals in search of grazing and water. Livestock species reared under this system are primarily sheep and goat.

2. *Transhumant pastoralism*, which is based on more or less regular seasonal migrations from a permanent home. The sheep, yak and mithun rearing are categorized under this system.

3. *Agro-pastoralism*, in which livestock production is associated with dryland or rainfed cropping and animals range over short distances. They are village-based herders, who make a substantial commitment to farming, although this remains subsidiary to pastoralism for the purposes of household income. The commonest species kept in agro-pastoral systems are cattle, buffaloes, camel, sheep and goats.

***Mixed or Integrated Farming System*:** Livestock in India are raised as a part of mixed farming systems. Mixed farming systems are considered environmentally most benign and sustainable because of complementarities between crop and livestock production. Animals derive most of their feed–fodder requirement from agricultural residues and by-products, and in turn provide draught power and dung manure for cropping activities.

In India mixed rainfed system is practised on 46% of land and mixed irrigated system on 37% land. The mixed crop–livestock systems

are characterized by considerable heterogeneity in terms of species, production efficiency, management practices and commercialization (Birthal *et al*., 2006). This heterogeneity was captured by Rao *et al*. (2004) who delineated 15 crop–livestock systems, and found cattle or buffalo as the second or third largest economic activity in most of these systems.

Mixed farming systems, however, are undergoing a steady transformation due to increasing pressure on livestock to produce more to meet the growing food demand. The non-food functions of livestock, that is draught services and manure production, are declining in importance because of increasing use of bio-mechanical inputs in crop production and declining size of land holding. Thus the interactions between crop and livestock production are likely to weaken, giving way to emergence of commercial production systems based on high-producing animals and external inputs. For instance, poultry production in India has largely been transformed from a backyard activity to a commercial activity. The commercialization trends are also visible in the case of dairy (Birthal *et al*., 2006).

## Issues related to traditional livestock production

***Livestock resources and land holding*:** India has huge population of different livestock species. The total livestock population consisting of cattle, buffalo, sheep, goat, pig, equines, camels, mithun and yak in the country is 512.05 million numbers as per 19$^{th}$ livestock census. However, on the one hand the productivity is very low because of poor genetic resources of indigenous livestock, which constitutes 135.2 million goats, 61.3 million sheep, 152.2 million cattle, 7.8 million pigs, 0.3 million mithun, 0.08 million yaks and non-descriptive buffaloes. On the other hand the land holding size of the farmers is low, average 0f 1.16 hectares. The marginal (> 1 ha) and small farmers (1-2 ha) constitutes more than 80% of the farming community. Additionally, about 43% of the rural household does not possess agricultural lands (Agricultural Census, 2010-11). The situation increases the cost of livestock feeding, which constitute major part of the livestock husbandry. However, livestock have remained an integral part of the socio-economic fabric of rural India as a source of livelihood and a provider of draught energy, manure and fuel. Therefore, in rural India a growing livestock sector, which is mostly traditional livestock production system, augurs well for the low income households to augment their income and escape poverty.

***Livestock in the livelihoods of the poor*:** Livestock are integral to the livelihood strategies of hundreds of millions of resource-poor crop–livestock farmers and pastoralists and of many millions of the rural landless. While the way livestock contribute to livelihoods varies considerably between households and regions according to the different types and attributes of livestock, the level of household resources, and the degree of market integration. The herd size of livestock reared by landless and marginal farmers in majority part of India is less than five. Several nomadic tribes (e.g. *Gujjars, Bakarwals, Gaddis* and *Changpas, Brokpas, Drokpas* etc.) rear buffaloes, sheep, goat, *mithun*, yaks, pigs on traditional production system.

Millions of poor people in the drylands of western India, the Deccan Plateau, and in the mountainous reaches of the Himalayas, depend only on livestock for their livelihoods. Rainfed and arid agriculture alone supports 60% of the livestock population (Prasad, 2010). In view of low productivity and high uncertainty in crop production, majority of the people in rain-fed regions depend on livestock.

It contributes to the livelihood of the poor in many ways – income from products, insurance against drought, emergency cash requirements, household nutrition, fuel for cooking, manure for crops, draught power for farming etc. Evidence shows that smallholders obtain nearly half of their income from livestock that may contribute up to 62 per cent of their livelihood requirements (Ramesha and Bhattacharya, 2008).

The smallholders and landless farmers together control over 75% of country's livestock resources. Since the livestock wealth is largely concentrated among the marginal and small landholders in India, it is expected that any growth in the livestock sector would bring prosperity and livelihood security to the small holders.

***Feed resources*:** Inadequate feed quality and quantity impedes increased animal production under traditional production system. Most of the available feed energy supply for livestock originates from commons, pastures and crop residues. The rearing of livestock on a variety of grazing lands is and age-old practice. True pastures and grasslands are spread over an area of about 12.04 M ha in India in form of the subtropical, temperate and alpine pastures. Other grazing lands are available under tree crops and groves (3.70 M ha), on wastelands (1.50 M ha) and on fallow lands (2.33 M ha). The availability of the herbage, its growth stage and nutritive values largely influence the production performance of the animals, as the supply of supplementary feeding is limited for the animals raised on free ranges. Therefore, production of milch animals is highest when grass is at its best in terms of quality and quantity during rainy season.

***Animal genetic resources***: Though many indigenous breeds have special adaptive traits like disease resistance, climatic tolerance, ability to use poor quality feed and to survive with reduced and/or irregular supplies of feed and water, yet they are low producer. Selection for milk production or higher growth rate in indigenous livestock breeds is constrained due to small and fragmented livestock holding. There is an urgent need for conservation of the indigenous breeds along with rapid improvement in productivity of livestock to meet the higher demands for animal products in future. Sustained economic and income growth, and urbanization are causing significant changes in food consumption pattern in India. Consumers are including more of high-value commodities like animal products in their food baskets. Breeding policy for livestock for augmenting production, thus, should be developed keeping in view the existing or potential feed supplies and management practices.

***Animal health:*** The control of animal diseases still has a high priority in livestock production, mainly because infectious diseases can cause heavy losses. Some of these diseases can be controlled with relatively cheap vaccines. However, the control of infectious diseases with vaccines cannot be seen in isolation from other technical inputs better housing and hygiene, nutrition and scientific management practices. Obtaining veterinary services under traditional livestock production system is far from satisfactory and farmers practice traditional herbal treatment. Therefore, the Governmental approach to improving animal health should follow the pathway of reducing disease occurrence by identifying and controlling the risk factors which contribute to the occurrence in a given region. It may be noted that the failure of some international eradication campaigns was due not to a lack of a suitable vaccine, but to the poor veterinary infrastructure.

***Environmental considerations*:** Livestock particularly yak, yak-cattle hybrids, hill cattle, mithun, sheep, goat, buffalo, camel and horse are reared by around 20 pastoral communities living in these difficult hilly terrains of the western and eastern Indian Himalayas. This eco-friendly system of animal rearing plays a very important role in the food security, economy and culture of these transhumant pastoral communities. These pastoral communities rely on natural pasturelands for their livelihood. They move along with their herds from one pasture to another for utilizing the available major feed resources. Hence, grasslands are the major feed reservoirs for their animals, whereas, the forage cultivation remained almost neglected in these high altitude areas. Beside, grazing in temperate/ alpine pastures, fodder trees and shrubs are also fed to the livestock. Due to overgrazing, coupled with poor management and care, these grazing lands have deteriorated to a large extent and need amelioration or rehabilitation for sustained animal production.

***Livestock and pastoralists***: Pastoralists, who derive more than 50 per cent of their incomes from livestock and livestock products, are people who live mostly in arid, semi-arid and remote hilly areas. Their livelihoods depend on their intimate knowledge of the surrounding ecosystem and on the well-being of their livestock. Pastoral systems take many forms and are adapted to particular natural, political and economic environments. The types of livestock kept by pastoralists vary according to climate, environment, water and other natural resources, and geographical area, and may include camels, goats, sheep, yaks, mithun and horses.

Pastoralists inhabit zones where the potential for crop cultivation is limited due to low and highly variable rainfall conditions, steep terrain or extreme temperatures. Within this unpredictable, vulnerable and dynamic environment, they have developed successful mechanisms of adaptation to maintain an ecological balance between themselves and the natural environment. It is, therefore, an economic and social system well adapted to dryland and hilly conditions and characterized by a complex set of practices and knowledge that has permitted the maintenance of a sustainable equilibrium among pastures, livestock and people. The pastoral communities are marginalized and generally not given due consideration in wider socio-political analysis and their livelihoods are vulnerable to climate change, shifting global markets, population growth and increased competition for land and other natural resources (Rota, 2009).

The pastoralists used the following strategies to manage the environment in a sustainable way while also (a) assuring a continuous food supply, (b) minimizing risks to people and livestock, (c) avoiding disease outbreaks and (d) containing social and political instability:

i. *Livestock adaptation*: Pastoralists own any of a wide range of indigenous livestock selected on the basis of survival and productivity, and are well adapted to the prevailing climatic conditions. Their pasturelands are also characterized by species diversity to optimize different pasture resources and conserve the ecosystem.

ii. *Mobility*: Economically logical and environmentally essential, mobility is the only way to make sustainable use of pasture lands. The pastoral system is moved to fit the environment in order to make the best use of the available resources. Mobility enables pastoralists to take advantage of pasture resources that are

only seasonally accessible, and allows access to other resources and services. Moreover, thanks to mobility, pastoralists can obtain sufficient supplies of food, forage and water, or avoid disease outbreaks.

iii. *Diversification of livestock species*: By keeping more than one species of livestock, pastoralists can generate a wider variety of livestock products and make better use of the available forage in different seasons, even in times of crisis.

iv. *Maximization of stock numbers*: Such accumulation helps ensure survival of herds despite losses incurred during droughts or disease outbreaks. It also represents a method to accumulate food stock and marketable assets that they can eventually sell at the risk absorption stage, when all efforts are directed to sustaining the most valuable animals while the less valuable are used to buy food.

v. *Splitting of herds*: This is a coping strategy aiming at reducing competition among herds for forage and water resources and optimizing pasture use.

vi. *Redistribution of assets*: Mutually supportive relationships among pastoral communities assure that food, cash and labour are redistributed on a reciprocal basis when required. The pastoralists have strong traditional institutions that play a significant role in periods of stress to regulate natural resource use and conservation, manage risks, protect resources and promote collective actions for mutual safety.

***Major constraints in livestock development*:** Livestock development programmes up to now were hardly based on the understanding of the livestock production systems, multipurpose production and its complex relationships between the biological, technical and social components of these systems. There has been an over-emphasis on large farms and rather than towards smallholder farms which possess majority of the livestock populations. Therefore, livestock development projects have not always led to substantial or sustainable long-term increases in productivity or farmers' welfare. Milk and meat yield per cow tend to remain low, although total production has increased, mainly due to increased animal numbers. The increase in the number of animals has not always been accompanied by an improved availability of feed resources, resulting in overgrazing and erosion, or reduced health and performance.

Feed quality and quantity, combined with low producers prices often force farmers to accept low levels of production, compensated by large numbers of animals. Improving milk production though crossbreeding have often failed, particularly when applied to small mixed-farming systems. The commitment to stimulate the development of the rural livestock sector has been lacking, resulting in inadequate producers organisations, limited access of small and marginal farmers to markets and credit, high risk technologies, underdeveloped infrastructure, low and fluctuating producers prices and weak marketing infrastructure.

## Opportunities for traditional production

The focus for the growth of the traditional livestock production system in India is the sustainability, which is also the integral part of the management of natural resources. Use of biotechnology, selective breeding, scientific management and nutrition are some of the technological options for sustainable livestock production, however, the options have to be limited to the natural resource base: animal feed

and genetic resources (Kaasschieter et al, 1992).

***Feed resources***: Technological options for quantitative and qualitative improvements in feed supply are available but must be placed in the broader context of livestock development. Sustainable livestock systems, which depend on the degraded communal pasturelands (including commons, wastelands etc.) for their feed supply, require a balance between stocking rates and the carrying capacity of the pasture. In pastoral societies, communal control of grazing pressure, together with measures to increase the offtake of stock by marketing, are essential before technical measures and investments to improve the pasture (e.g. rotational grazing, fodder banks) can be successful. The development of watershed management can be undertaken.

The pressure on communal pasturelands in the arid and semi-arid areas can be reduced, particularly in the dry season, by providing supplementary feeding of existing fodder trees and shrubs, fodder banks, mineral blocks or by access to cultivated lands (stubble grazing and crop residues). Even feed storage at the end of the rainy season can be considered.

The feasibility of improving communal grazed rangelands in the arid, semi-arid or hilly areas through the introduction of improved grasses, pasture and tree legumes, and shrubs is doubtful. Improved pasture and fodder production has a role to play on mixed crop-livestock farms, although land is the limiting factor. Technologies for pasture and fodder production are available, and include legume fodder banks and/or the inclusion of a forage legume, cultivation of short-duration fodder or improved pasture in the crop rotation or on fallow land. They provide a feed reserve in the dry season, when the quantity and quality of the natural pasture is at minimum.

Pasture and forage conservation through hay or silage-making, although common on large commercial farms, is not generally practised by small and marginal farmers. Ensiling is limited by the small quantities involved and high investment costs, however, pooling resources by marginal and small farmers enables silage pits to be filled quickly.

Burning of crop-residues should be limited to increase the feed base and to avoid biomass and nitrogen losses from the system. However, crop residues have low nutritional value and digestibility. Chopping and/or chemical treatment of straw with urea, supplementation of straw rations with green forages/legumes and molasses-urea blocks are some of the technological options to improve intake and sometimes digestibility, and therefore animal performance.

***Animal genetic resources:*** The two main technological options available for the preservation of animal genetic resources are *in-situ* preservation of live animals and *ex-situ* preservation of germplasm in cryogenic storage. Live animal preservation has the advantage that the breed can gradually respond to changing external influences, but the high costs, the number of animals required and disease risks make this method less attractive. Cryogenic preservation of semen and embryos generally implies an initial investment in storage equipment and, although semen is cheap, relatively high collection costs, which are largely compensated by subsequent low annual storage costs.

The best way to conserve indigenous breeds will be by management and selective breeding and upgradation programmes. The most appropriate breeding option will be the use of nucleus breeding herds, which supplies farmers with male breeding stock or semen. In indigenous cattle and small ruminants, nucleus breeding plans might be the only way

to supply small farmers with performance-tested males.

***Strategies and policies*:** Strategies for sustainable livestock production systems must be part of a broader strategy of rural development, including generating off-farm employment where possible. Priority must be given to livestock systems which make the largest contribution to the nation i.e. pastoralism and the mixed-farming system of the resource-poor small holder. Strategies for livestock development must incorporate the role women play in livestock activities, such as small livestock rearing, on-farm processing and marketing of livestock products. Women should have equal access to education, credit schemes and extension. The training of female farmers and extension staff should have priority.

*Pastoral systems:* Strategies for pastoral societies must focus on controlling grazing pressure on pasturelands, and slowing or even reversing desertification and degradation. Strong commitment, community awareness and involvement to keep stocking rates under control depend on the creation or strengthening of pastoral groups. The main strategy is to regulate grazing pressure to the seasonal feed availability, integrated with the land-use systems, marketing and animal health programmes. Drought risks can be reduced by improving marketing facilities, early warning systems, stable prices of animal products and by building-up emergency stocks of feed.

Improved veterinary facilities at strategic points can increase the efficiency of pasture utilisation. The veterinary services should aim at the prevention and control of diseases, with active participation of pastoralist groups in the planning and implementation of animal health campaigns (FMD, HS, parasitic diseases etc.). Communal pastureland (including commons, wasteland etc.) management, coupled with animal health programmes and institutional development for higher economic returns are required besides the application of technologies for improving the productivity livestock and livelihood of the resource-poor pastoralist.

***Small mixed-farming systems*:** The development strategy for the resource-poor subsistence farmer should emphasise the improvement of farm management, and in the long run the incorporation of these groups into the market system. Livestock development plans must take into account the diversity of livestock species and, therefore, appropriate packages for cattle, buffaloes, sheep, goat, yaks, mithun, camels, pigs etc. must be developed. These packages include aspects of feeding, health and hygiene, housing and breeding and should be relatively small scale. The income of these subsistent farmers is too low to justify large investments.

The challenge of intensification of livestock production of smallholder mixed farms is to improve the efficiency of the production system, by reducing the losses from the system, by improving soil and by making better use and management of locally available resources, through low-cost technological interventions. Matching the feed availability with the requirements of the livestock population is important for marginal and small farmers. This can be achieved through a better use of feeds, treatment or supplementation of crop residues, and by making more effort to benefit from agro-industrial by-products, forage production and feed conservation. Increased production per animal is to be achieved by better feed, animal health, genetic improvements, management and remunerative producer prices. The emphasis must shift to disease-causing risk factors, such as under-nutrition, poor hygiene

and management that affect the productivity of the herd and animal health.

Extension programmes must concentrate on guidance in animal nutrition, including forage conservation, reproduction, animal health and breeding.

Dairy systems may offer the greatest scope for social and economic development. In order to generate rural employment and added value in the rural area, the emphasis may be given on small scale processing for the rural population.

***Policy considerations:*** Technological options to improve sustainability are available and increasingly developed, but their application depends on the economic attractiveness to the marginal and small farmers. Sustainable rural livestock development generally needs the parallel development of private technical support services, not only in the animal health field but also in the field of artificial insemination, breed improvement, animal feed, marketing, processing and finance. However, one should realise that the goal of the private sector in maximising profits, despite generating off-farm employment and income, may be in conflict with the need and costs of protecting the environment. Moreover, it is doubtful whether the private sector will focus its attention on the resource-poor smallholder. Systematic monitoring and critical evaluation of extension, research, development work, services and group activities is essential.

## Conclusions

Some of the livestock and animal health development projects resulted in unsustainable systems without substantial increases in animal productivity, when they were not based on an understanding of livestock production systems. Different systems need different approaches. The increased degradation of the environment, combined with the increased population pressure, requires that livestock development programmes reconsider priorities and options. In India the livestock production system is primarily traditional, consisting of mixed-farming and pastoral systems, and more than 80% of the resource-poor farmers are involved in it. Therefore, development of marginal and smallholder mixed farms must aim at intensification of the total production system, in which external inputs are indispensable, but with the emphasis on optimum input-output relationships by reducing resource losses due to poor management. Resource-poor farming systems must aim at the improved management of the various livestock species in backyards and very small farms, and proper packages for cattle, buffaloes, sheep, goats, rabbits and poultry should be developed.

The multipurpose functions of livestock and complex relationships between the biological, technical and social components require a systems approach, whereby nutrition, animal health, breeding, biotechnology knowhow, inputs and technologies are used to optimise resource use.

Pastoral systems must focus on effective management of grazing pressure of the pasturelands. Communal pasturelands management involves not only the development and application of technologies, but also land tenure policies, institutional development, economic return and a reduction in the number of people depending upon livestock. The challenge is to reverse the current degradation of the environment, and arrive at sustainable increases in crop and livestock production to secure present and future food supplies.

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