

ANIMAL PRODUCTION IN THE TROPICS

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Summary

Animals are an integral part of agriculture, filling an important economic and ecological niche. The justification for accelerating animal production is the awesome need for more animal proteins, currently in short supplies, to meet projected future human requirements. The rationale for improved animal production is associated with the following demand-led factors: rapid human population growth, urbanization, income growth, efficiencies in natural resource management (NRM), and changing consumer preferences. The role and functions of animals in farming systems, and the diversity of

animal genetic resources, are briefly described. Animal production systems are discussed with reference to types, trends, opportunities for productivity enhancement, and the implications for natural resource management. The systems can be grouped broadly into four high order systems: landless, crop-based, agro-pastoralism, and rangeland-based. The landless production systems are of two types: (i) the highly industrialized, modern and capital-intensive pig and poultry production sector, and (ii) extensive, labour-intensive systems involving goats, sheep, buffaloes, cattle and camels and resource-poor nomads, transhumance or agricultural laborers and seasonal migrations. The first (mainly non-ruminant) sector is dominant, growing, and supplies the major share of animal proteins. The second (mainly ruminant) sector is lagging, but has the potential to be more fully developed to enhance protein supplies. The disparity in their relative importance and outputs questions efficiencies of prevailing animal production systems and natural resource management (NRM). Within crop-based systems, the genesis of which is illustrated, animals are found integrated in both irrigated and rainfed areas mainly with annual cropping and even aquaculture. Integrated ruminant-tree crops systems are neglected and underestimated. Agro-pastoralism is specific to sub-Saharan Africa, and range-based systems which are found in arid and semi-arid regions are common throughout Central Asia, West Asia, North Africa and Latin America. Two possible scenarios have been reported for the future of crop-animal systems. One is increased size and specialization, and the other is disintegration due to population pressure. These systems will see more intensification and growth in the future, especially in small farms which are predominant in Asia. Major issues to be addressed across systems include, *inter alia*, focus on rainfed areas; beneficial management of natural resources and crop-animal interactions; strategic use of available feeds; nutrient flows; waste disposal; improved marketing systems to link rural, urban and international markets; zoonosis ; interdisciplinary research and development; and policy issues. These issues together pose major challenges for the future of animal production, but the resultant benefits include improved NRM, productivity enhancement, sustained agricultural growth, reduced poverty, sustainable livelihoods for the resource-poor, and environmental integrity.

1. Introduction

Animal production is an integral part of agriculture, and aims at producing useful products and services of value to humanity. In view of their multi-functional role, animals are often reared together with crops in farming systems for economic, ecological, social and cultural reasons that directly benefit farmers, the poor and their livelihoods. Together with other natural resources such as land, crops and water, animal production is also concerned with issues of sustainability and protection of the environment. Agricultural sustainability not only involves environmental aspects, but includes socio-economic and political aspects.

Figure 1 illustrates a conceptual framework for sustainable ruminant production systems in Asia. Given the agro-ecological zones, small farm systems, bio-physical and socio-economic environment, the major targets for development are efficiency in the management of natural resources, income growth, poverty alleviation, food security, economic viability, minimum dependence on external non-renewable inputs, response to changing consumer preferences, rural growth, and self-reliance. The key

sustainability issues are environmental protection, knowledge of traditional systems, preservation of biodiversity, maintenance of soil fertility, increased access to markets, socially acceptable improvements, wide adoption of improved technologies, farmers' organizations and cooperatives, and replicability.

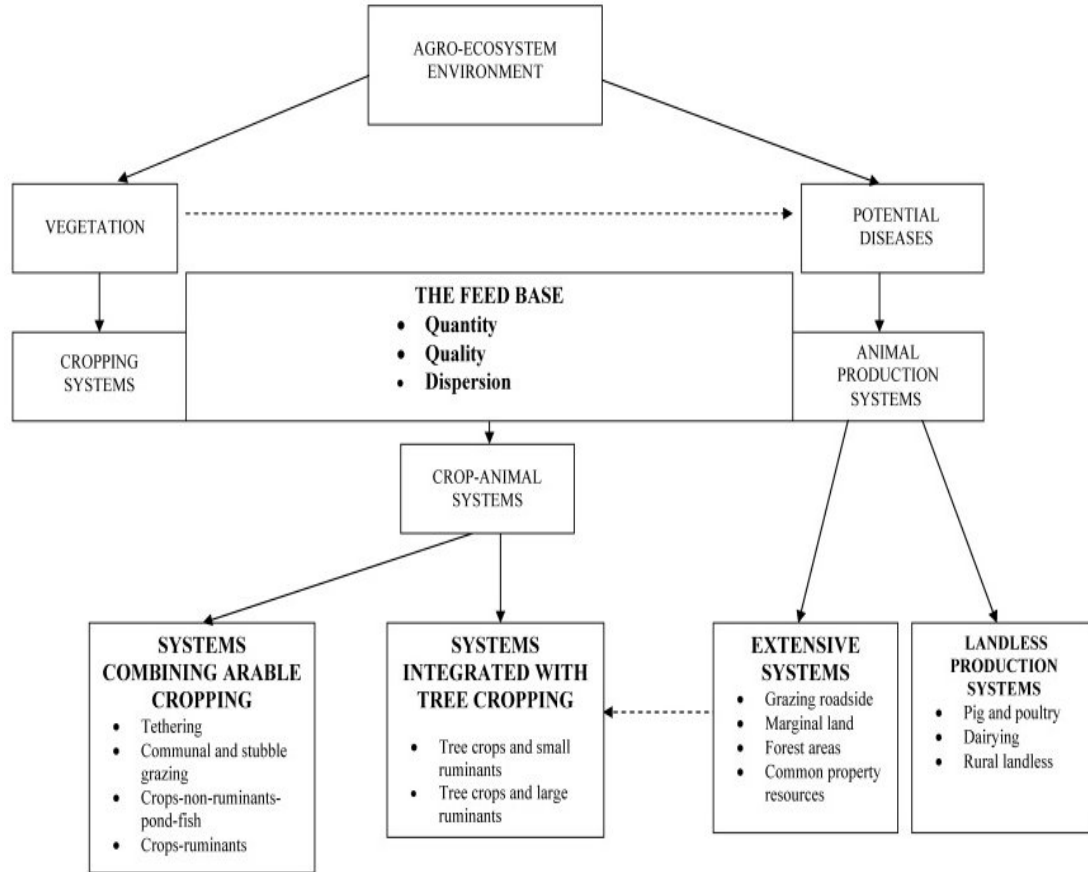


Figure 1. Genesis and types of animal production systems in Asia.

Animal production today must compete with other components of agriculture for the use of diminishing and scarce production resources, as well as financial inputs for funding research and development. It needs to demonstrate that it can be an efficient and sustainable venture, in the face of changing consumer demands and variable external forces, such as rising transportation costs.

The justification for increasing animal production is the burgeoning demand for more animal protein due to human population growth and rising incomes. Animal production today has to cope with this primary function, in circumstances where current production and available supplies are unable to meet present and projected future requirements. It also has to contend with new challenges such as changing consumer preferences, intensification of production systems, emergence of enzootic diseases, and externalities such as rising transportation costs. At the heart of the issue is the capacity and capability of the animal industries to ensure cost-effective production, efficiency of use of production resources, and maximizing outputs to meet the rising demands. Questions are therefore being asked about the nature and contribution of individual animal species,

efficiency of their use, efficiency of the production systems, and the opportunities for maximizing and sustaining potential contributions from the totality of the animal genetic resources.

This chapter is concerned with a comprehensive description of the rationale for accelerating animal production, role and functions of animals, the diversity of the animal genetic resources, demand for animal products, types of animal production systems and trends, opportunities for productivity enhancement, evolving scenarios, emerging issues and future challenges.

2. Rationale for accelerating animal production

The rationale for accelerating the contribution from animals is associated with several factors and also the millennium development goals (MDGs). Most developed country governments and international agencies have now focused attention to pursue these MDGs by 2015, in which Sub-Saharan Africa and Asia are priority regions. Addressing poverty and issues related to these are a major component of this thrust, and it is pertinent in this context to draw attention to the fact that two-thirds of the several millions of rural poor in developing countries are livestock keepers. It is relevant in this context to note the following concerns:-

- 1.2 billion people live on less than US\$1 per day, and 800 million persons go to bed hungry every day.
- In the developing countries, there are 150 million children who are underweight, 175 million whose growth is stunted, and 44 million who are wasting.
- There are between 100 and 140 million children with vitamin A deficiency;
- An estimated 55% of about 12 million deaths each year among children under five years of age in the developing world are associated with malnutrition. Malnourished children also have lifetime disabilities and weakened immune systems, and,
- There are two million women who are iron deficient, many of whom are pregnant.

These facts confirm the well known view that protein-calorie nutrition and deficiencies of key nutrients are very prevalent among the poor throughout the developing countries. Their effects are especially pronounced in children, adolescents, pregnant and lactating women. Children are particularly vulnerable, and malnutrition contributes to poor growth, mental development and ill health.

Animal products such as meats, eggs and milk are important sources of concentrated and digestible sources of high quality proteins and energy, and their consumption significantly contributes to good health. These sources supply micro nutrients such as calcium, iron, zinc and vitamins A, B6 and B12, which are often deficient in cereal-based diets.

Among the red meats, goat meat has a higher lean content than beef or mutton because fat tends to be more concentrated in the viscera rather than sub-cutaneously. Goat milk also has two advantages over cow milk. One is the anti-allergy properties, and the other is the presence of higher levels of six of the ten essential amino acids, and also monounsaturated, polyunsaturated, and medium chain triglycerides, all of which are

known to benefit human health.

3. Role and functions of animals

Animals are valued for more than just meat, milk and eggs, and are intimately involved with farming systems and the way of life of farmers. Given the considerable diversity in the types of animals in global terms, it is not surprising that there also exists diversity in the number of products from the animal genetic resources and their contribution to mankind in the developed and developing countries. It is stressed however, that due to socio- economic and cultural reasons, these contributions are much more infinite in the developing countries compared to the developed countries. Table 1 shows that the contributions are not only in terms of food (meat, milk and eggs), but also in a variety of non-food products. These include for example, traction and haulage activities, fiber (wool and hair), skins and hides, wealth accumulation, insurance against failure of crops, prestige in ownership, as well as sport and recreation. In many ways therefore, animals in the developing countries have multi-purpose functions.

	Species	Products	Contribution
1.	Buffalo	Meat, milk	Human nutrition
2.	Cattle	Meat, milk	Human nutrition
3.	Goats	Meat, milk	Human nutrition
4.	Sheep	Meat, milk	Human nutrition
5.	Chickens	Meat, eggs	Human nutrition
6.	Ducks	Meat, eggs	Human nutrition
7.	Pigs	Meat	Human nutrition
8.	Goats, sheep, camels, yak	Fibre	Wool , hair
9.	All ruminants, camels	Skins	Skins, hides
10.	All ruminants, camels, yak	Traction	Traction, haulage, threshing, packing
11.	All animals	Fertiliser	Dung, urine
12.	All animals	Capital	Wealth accumulation, insurance
13.	All ruminants	Conservation	Grazing, ecology
14.	All animals	Sport, recreation	Prestige, pets, fighting, religion, racing, shows.
15.	All animals	Horns, bones, fats, tankage	Handicraft

NB. Concerning meats, various offals from animals are also used for human consumption

Table 1. Animal diversity, types of products and their contribution

Animals occupy an important economic and ecological niche, and their functions and contribution are numerous. They are consistently and widely owned by farmers for a variety of advantageous reasons:

- Diversification in the use of production resources and reduction of socio-economic risks;

- Promotion of linkages between system components (land, crops and water);
- Generation of value-added products (e.g. meat, milk, eggs and skins);
- Income generation, investment, insurance and economic security;
- Supply of draught power for crop cultivation, transportation and haulage operations;
- Contribution to soil fertility through nutrient cycling (dung and urine);
- Contribution to sustainable agriculture, and environmental protection;
- Prestige, social and recreational values, and
- Development of stable farm households.

In the developing countries, small animals such as chickens, ducks, goats, sheep, rabbits, quail, turkeys and geese are especially important in meeting the daily and immediate household needs for precious animal proteins. These animals therefore make a most important contribution to food security. It is also relevant to note that small stock are often managed by women and children, and are valuable for the stability of farm households.

4. Demand for animal foods

It is projected that over the next 20 years, there will be a massive demand for animal foods, almost all of which are expected to come from the developing countries. The demand for major animal foods (meat, milk and eggs), and trends are influenced by a strong demand-led process. The problem is essentially one of inadequate animal protein supplies in which the demand is dictated by a rapidly changing external environment, which is associated with the following factors:

- Population growth;
- Urbanization;
- Income growth;
- Efficiencies in natural resource management (NRM);
- Animal protein supplies being unable to meet the demand, and
- Changing consumer preferences

Increased human population growth estimated at an extra 2.5 billion people by 2020, together with increasing urbanization, will significantly drive the demand for animal foods. At projected human population growth rates of 0.7%, 1.6% and 1.4% per year up to year 2010, in China, India and Asia, the population increases by 2010 will be 33%, 18% and 12% respectively. It is significant to also note that of these, between 47 and 57% of the population will be economically active in agriculture.

The demand for, and increased consumption of animal foods, is also directly related to increased affluence and increased disposable income. At higher levels of income *per capita* consumption of meat levels off because of saturation. China and India fall out of this trend because of the very high consumption of pork in the former and religious preferences against meat in the latter. It is also known that either pork or mutton is the main substitute for beef and the preference increased with increasing income.

The rising and changing demand for meats, fueled in part by inadequate supply, have

also influenced shifts in the types of meat that are eaten. Increased poultry meat consumption has been particularly noteworthy in all regions, with annual increases of between 6.0 and 6.5% in South Asia and Latin America over the last 10 years. By comparison, the consumption of bovine meat, goat meat and mutton have stagnated in the same regions. The *per capita* consumption of animal products is higher in developed countries than in developing countries. Nevertheless, there have been increased rates of consumption of animal foods in the latter by between 2 and 6% annually.

The demand growth for meat and milk will be greatest in Asia and Sub-Saharan Africa. Although all types of meat are consumed, the *per capita* consumption of non-ruminant meats, notably from pigs and poultry is the greatest, with increased annual rates of 4 and 7% respectively. Two thirds of the increased demand will be pig and poultry meats. The demand for these two meats will exceed that for all other meats, and this demand will mainly come from Asia. In addition, the demand for dairy products will also increase throughout the developing countries, and on account of shortfalls in supply, much of the demand for milk will be met by increasing imports.

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Biographical Sketch

Canagasaby Devendra was previously Senior Associate with the International Livestock Research Institute (ILRI) in Kenya, and is now an independent consultant in tropical animal production. He graduated from the University of New Zealand with a B.Agric.Sci., M.Agric. Sci. from Malaysia, and PhD and DSc from the University of Nottingham, UK. He has worked at the University of the West Indies in Trinidad, the Malaysian Agricultural Research and Development Institute (MARDI) in Malaysia, the International Development Research Centre (IDRC) in Canada, and ILRI. His interest in development and international cooperation spans over 25 years of working experience with national agricultural research systems and international agencies in Asia, Africa and Latin America. His specialized fields of interest are animal nutrition and feed resources, animal production systems and integrated natural resource management.

He has published extensively, and his books include: *Goat and Sheep Production in the Tropics* in 1982 (co-authored), *Goat Production in the Tropics* in 1983 (co-authored), *Pig Production in the Tropics* (co-authored) in 1979, *Non-conventional Feed Resources in Asia and the Pacific* in 1993, and *Tropical Legumes in Animal Nutrition* (co-editor) in 1995. There have also been numerous publications in international journals, and contributions in books, and the more recent of these include six chapters in Elsevier's special issue on *Crop-Livestock Systems in Asia in Agricultural Systems* (2002), four chapters in DFID's publication on *Livestock and Wealth Creation* (2005), and two chapter contributions (Food and Cultivated Systems) in IFPRI's *Millenium Ecosystem Assessment* (2005). He is also the author of a forthcoming book entitled '*Goats: Biology, Production and Development in Asia*' to be published by the Academy of Sciences Malaysia in early 2007.

He was the recipient of the International Dairy Production award from the USA in 1989. In 2004 he was recognized by Lincoln University, New Zealand, with the International Alumni Medal for "outstanding contribution to agricultural science", and also in 2004 by the Han's Animal Life Sciences Foundation in Korea with the Asian Animal award "in recognition of outstanding contribution to animal production of international significance". He is a Fellow of the Academy of Sciences, Malaysia.