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GOAT PRODUCTION IN SMALL FARM SYSTEMS

C DEVENDRA
DIVISION OF AGRICULTURE, FOOD AND NUTRITION SCIENCES
INTERNATIONAL DEVELOPMENT RESEARCH CENTRE
TANGLIN P O BOX 101
SINGAPORE 9124



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ABSTRACT

The paper discusses the importance of goats in small farms within the prevailing production systems (system combining arable cropping and systems integrated with tree cropping). Reference is made to the definition of small farms and small farmers and their characteristics. The significance of ownership is associated with economic, managerial and biological advantages which are reflected in such advantages inter alia as : income, food production, security, employment, fertiliser, by-product utilisation, bush control, leather trade and handicraft, fibre, social values, recreation and transportation. Case studies on the extent of the economic contribution from goats are cited in Indonesia, Pakistan, India, China and Africa. The value of the economic contribution is especially important in arid and semi-arid regions where goat rearing is often the main vocation, and means of survival for nomadic and transhumant people, compared to the humid tropics where its production is usually a sub-system within the main crop-based farming system. Particular focus is made on the role and contribution of women and children in the management of goats. The opportunities for overcoming the constraints, especially management problems, and the significance of these on increased productivity from the species, sustainability and improved human welfare of small farmers are emphasised.

I. INTRODUCTION

Goats constitute important animals in small farm systems in the developing countries. This importance is related to their varied role and size of the herd, relative proportion to other animals if any, scale and intensity of production. These aspects are closely associated with distinct socio-economic contribution to several millions of poor farmers, landless peasants and labourers to whom ownership of goats provides a definite means of livelihood and its sustainability (Devendra, 1980).

In situations where the land is of poor quality and is marginal, crop cultivation is often difficult, rarely intensive and constrained by several environmental factors such as rainfall, very high temperatures and poor soil fertility. Diversification of the farming system is difficult, but under these circumstances, goats and often sheep rearing together make significant contribution to poor farmers and the stability of small farm systems. This importance and contribution by goats increases with decreasing quality of the land, sustainability of the extensive type of farming system, and is typical of the arid and semi-arid regions of the world. Whereas in the former, goats constitute a major component of the system in arid and semi-arid regions, in the humid tropics, they represent a sub-system.

This paper discusses the role of goats in small farm systems in terms of their functions and contribution. In particular, it will focus on

the significance and socio-economic relevance of their ownership to small farmers and poor peasants to whom their ownership is especially important.

II. SMALL FARMS AND SMALL FARMERS

The small size of the holdings is one of the characteristics of small farm systems. The actual size varies between regions and between countries. Table 1 sets out the distribution of ruminants in selected developing countries in relation to the size of holding. About 64% of the goats in Asia are kept on 5 ha of land or less compared to 48% in Africa and 39% in North, Central and South America. The distribution of goats parallels that for sheep. These figures emphasise that the concentration of ruminants is highest in small holdings and is particularly so in Asia.

Small farmers, including landless labourers and low income tenants are peasants who are usually crop-oriented. They are essentially poor people who face geographic isolation. They continuously experience hunger and rural poverty, and probably because of this, have the capacity to adapt and survive hardship. There is resistance to change because of inadequate access and inability to use new technology. Being illiterate, the majority are not interested in extension materials. They provide the family labour depending on the scale and magnitude of the farm operations and live-stock production. They shepherd or tether their animals. Children are often used for herding small ruminants. Landless agricultural labourers provide surplus labour which is of added value to the more progressive farms (Devendra, 1983a).

The village is the focal point of all forms of activities, mainly agricultural, economic and cultural. It is variable in size with respect to the number of households, ranging from a few hundred such as in parts of South East Asia, to several thousands in a cluster in West Africa. The village economy is based on crop production, primarily to meet the subsistence needs of the peasants but also to provide some cash. The crops grown are varied, but cereals (maize, rice and wheat), and root crops (cassava, sweet potatoes and yams) are important staple foods in most developing countries.

Small ruminants are often preferred over large ruminants. However, the real importance of individual species is dependent on the total population of individual species and also the extent of their development. Goats and sheep are conveniently cared for by unpaid family labour (women and children), occupy little housing space and supply both meat and milk in quantities suitable for immediate family consumption. Their potential value in less developed countries has been emphasised (Devendra, 1980). In Latin America, the importance of small animals over large animals in small farms is being advocated in order to alleviate the serious economic and nutritional predicament of small farmers and their families (Huss, 1982).

In mixed crop-animal systems typical of the humid tropics in several countries in South East Asia, East and West Africa, Central America and the Caribbean, one or more species of animals are reared on the farms. There usually exists several species of animal within prevailing mixed farming operations in small farms: buffaloes, cattle, goats, sheep, poultry, pigs, ducks, quails and rabbits but, seldom are all these animals maintained together.

III. SIGNIFICANCE OF OWNERSHIP

Ownership of goats in small farm systems has considerable significance. It is associated with several objectives to serve the

material, cultural and recreational needs of the farmers as follows :

- (i) Income - important means of earning supplementary income.
- (ii) Food - provide animal proteins (milk and meat) that are important for the nutritional well-being of peasants.
- (iii) Security - sources of investment, security and stability.
- (iv) Employment - creation of employment including effective utilisation of unpaid family labour.
- (v) Fertiliser - contribution to farm fertility by the return of dung and urine.
- (vi) By-product utilisation - they enable economic utilisation of non-marketable crop residues.
- (vii) Bush control and clearance - in many parts of Africa, goats are used to control and clear the bush. The task is also facilitated by many goat breeds being trypanotolerant.
- (viii) Leather trade and handicraft - skins are used extensively to produce various leather goods and handicraft.
- (ix) Fibre - Mohair and cashmere are very important fibres in the textile trade and are highly sought after. Ordinary goat hair also has commercial value.
- (x) Social values - the ownership of animals has been shown to increase cohesiveness in village activities.
- (xi) Recreation - socio-economic impact of animal ownership also includes a recreational contribution to small farmers.
- (xii) Transportation - in highland areas such as in the Himalayas, goats provide a means of transporting small loads.

The significance of ownership becomes much more important in arid and semi-arid environments. Goats have particular ability to resist dehydration and adapt to drought conditions (Devendra, 1987a; 1987b). In addition, they reproduce more efficiently. These attributes result in their increased ownership by nomads and transhumant families especially in harsh environments.

The relatively small size of goats is a distinct advantage in the complexity of small farm systems. There are definite economic, managerial and biological advantages as follows :

- (a) Economic - low individual values means a small initial investment and correspondingly small risk of loss by individual deaths. This makes goats and other sheep an attractive proposition for household use and subsistence farming, especially for poor families.

- (b) Managerial - goats can conveniently be cared for by women and children, occupy little housing space, and supply both meat and milk in quantities suitable for immediate family consumption, which is important in view of the difficulties of storage in the tropics.
- (c) Biological - one or two goats can be kept when nutrition is inadequate for even one cow.

The milk producing ability of dairy goats represents a most important function especially in comparison to sheep. Lactating goats have a high persistency in milk production, and this is significant to the daily nutrition of especially pregnant and nursing mothers and children. One litre of milk produces approximately 32 g of proteins which provides about 46 g (70%) of the daily requirements of a lactating or pregnant mother, but is adequate for the daily needs of a child up to 11 years of age. The supply of 1.7 g/litre of Ca is adequate to meet daily requirements.

IV. ECONOMIC IMPORTANCE

Rearing goats and often sheep together offers a very important means to generate income as well as sustain both the rural households and farming operations. Some examples from individual country situations serve to demonstrate this point.

- (i) Indonesia
A study by Knipscheer et al. (1983) indicated that the involvement of rural households in West Java in raising small ruminants is large. One out of every five farmers kept sheep or goats, and participation by farmers was as high as 30%. The contribution of goats and sheep to the total farming income is substantial and was about 14, 17 and 26% for the lowland, upland and rubber plantation situations, respectively. The report also indicated that the income share of the small ruminant enterprise increased as the farmer's resource base, especially land, decreased.
- (ii) Pakistan
The second study concerns the income to be derived from the transhumant system of rearing goats and sheep by a landless family utilising crop residues. Sale of wool plus sheep accounted for 51.4% whereas the sale of goats plus milk accounted for 43.9% of the annual income. About 56% of the value of family consumption was in the form of milk. The net family income was 2620 PRS. equivalent to about US \$291, about half of which was cash income (McDowell, 1976). This study confirms the results of an earlier study (Wahid, 1965), which reported that goats contributed about 20-40% to the total cash income, and in the more remote parts the contribution was as much as 50%. The income from goats contributes significantly to their livelihood.
- (iii) India
In Andhra Pradesh, for example, calculations on the returns from keeping goats suggest that this is very profitable (Sriramaimurthy, 1977). In Rajasthan, Jodha (1966) has reported that based on a 5-year analysis, the net annual income from keeping goats and sheep of a semi-nomadic family was 1600 Rs. The main component of this income was the sale of wool and animals. Results of a survey on the economics of feeding and rearing practices of goats and sheep in the hilly regions of Himachal Pradesh indicated that for the migratory and stationary systems, incomes generated as a percentage of total

cost of production were 11.8-72.7% and 23.5- 32.4%. The corresponding values of sheep were 9.4-25.6% and 10.0-16.9% (Raut and Nadkarni, 1974). Labour was the main cost component in all systems and this was much higher in the stationary system compared to the migratory system.

More recently, Singh and Ram (1987) have reported data on the economic analyses of rearing goats in the submontane and plains of Punjab. The contribution of income from milk to total income increased with herd size from 66.64 to 73.63% and from 72.97 to 80.46% in the two areas, with total income per goat decreasing from Rs. 414.75 to 354.39 and from Rs. 685.89 to 400.56 respectively. Annual income per household, taking all factors into account except interest on capital and costs of family labour, averaged Rs. 2275.2, 3796.3 and 9327.0 for small, medium and large herds in the submontane area and Rs. 4460.5, 6773.3 and 9922.9 in the plains.

(iv) China

In intensively cultivated upland areas in the Sichuan province involving wheat-barley-rape-rice cropping systems where also pigs and goats are often reared by farmers, it has been estimated that the total income generated from these animals together was 29%, of which pigs contributed 19% and goats 10%. Goats in particular, were associated with poor people.

(v) Africa

Wilson (1986) has reported that almost all the small ruminants and in which goats were predominant, were found in the agro-pastoral systems. Within the systems and in those associated with subsistence rainfed agriculture, irrigation or cash crop rainfed agriculture, the contribution by small ruminants to the total revenue were 25, 15 and 10% respectively.

V. THE ROLE OF WOMEN AND CHILDREN

The role of women and children in the management of goats in integrated village systems represents one of the unique features of the systems. This is often an under-estimated issue, but their contribution to goat rearing, and the benefits of this to the stability of small farm systems and the household is very much more than is realised.

The management of goats and sheep, especially small flocks in village systems is more the purview of women than that of men. This is the case in the altiplano regions of Latin America, most sub-Saharan countries, the Indian sub-continent and South East Asia. In South and South East Asia, women take care of goats and or sheep and often own them. In Upper Volta, Mossi, Fulani and Rimalbe women own goats and consider them an investment; Mossi women in particular view them as an insurance against famine (Safilios-Rothschild, 1983). In Mali, a survey of five villages among the Marka, Peulh Rimaibe and Cuerga ethnic groups showed that goats and sheep were mostly owned by women either through inheritance from their mothers, through purchase with income from selling agricultural produce. Ownership represents prestige and security to the women in case of divorce or seasonal immigration of the husband and allows them to meet family and social obligations such as in the purchase of clothes, care of sick children and ceremonial costs (Safilios-Rothschild, 1983). Although women often own the goats, husbands participate in the decision to sell, and among the poor farmers of the Peruvian altiplano, only men can sell the animals (Deere and Leon de Leal, 1982).

Survey results in West Java, Indonesia, indicate that participation by family members was quite significant. Although there were locational differences, women and children had an important influence on the management of goats (Muljadi, Knipscheer and Mathius, 1984). The women's share of involvement in rearing small ruminants increased with increasing number of animals reared. Additionally, literate women were more involved in the physical activities of management (herding, grass cutting, feeding, watering and health control) than in decision making (planning and marketing) probably because of their perception for the animal's needs. Illiterate women by comparison, involved their husbands in all activities (Wahyuni, Suradisastira and Juarni, 1983; Wahyuni, Gaylord and Knipscheer, 1985).

In East Africa in many pastoral systems such as in Kenya and Ethiopia, women have the disposal rights of milk. Women make the decision concerning the timing and quantity of the milk sold, the revenue from which are then available to them for appropriate use in a variety of ways to meet especially the needs of the family. In intensively cropped mixed farm situations in China such as Xian, improved Saanen goats are managed by women and children. In one particular village situation which had 40 families, 29 of these reared goats. The goats were milked three times daily and most of the milk produced was used for home consumption and also sold as yoghurt.

VI. MANAGEMENT OF GOATS

The management of goats in small farm systems are closely associated with the type of production system. These are broadly of two categories and have been described (Devendra, 1986a) :

I. Systems combining arable cropping

- (i) Roadside, communal and arable grazing systems
- (ii) Tethering, and
- (iii) Cut-and-carry feeding

II. Systems integrated with tree cropping

The feeding management consists mainly of grazing, feeding of any cut fodder and the occasional use of crop residues and agro-industrial by-products produced in the farm. Very seldom are purchased concentrates fed. These are in any case not really necessary for meat production, which is the main production objective throughout the tropics. Kitchen wastes and remnants, including salt and water are however, extensively fed to goats in the village system. Probably because of this and especially with systems involved with arable cropping the goats tend to congregate near the homesteads in the villages.

A variety of tree leaves are usually fed to goats, and the more common ones are banyan (Ficus bengalensis) cassava (Manihot esculenta Crantz), jackfruit (Artocarpus heterophyllus), gliricida (Gliricidia maculata), leucaena (Leucaena leucocephala), pigeon pea (Cajanus cajan) and sesbania (Sesbania grandiflora). These proteinaceous forages supply a valuable source of dietary protein, minerals and vitamins; provide variety in the diet and have a significant effect on performance. Their value especially for goats has been emphasised (Devendra, 1983b), and their efficient utilisation represents an important feeding strategy in the developing countries (Devendra, 1986b).

VII. MANAGEMENT PROBLEMS

There are a variety of management problems on small farms. A number of these are major ones and refer especially to breeding methods, feeding systems and animal health measures. With breeding, the ownership of small number of goats precludes the availability of a buck so that mating does at the right time becomes a major problem, especially also if the farmer is busy with crop cultivation. With larger flocks, bucks are usually part of the herd.

Problems of annual feed shortages and consequent low productivity are normal in many parts of the developing countries, and the basic issue is how to improve this deficit situation. Where land is limiting, increased fodder production becomes a problem. The basic strategy is to ensure a feed supply that can be sustained on a year round basis, which means complete use of the total feed resource base. This includes use of available grazing (native and cultivated), cultivated forages including legumes, crop residues, agro-industrial by-products and non-conventional feeds. Conservation measures are important especially if there are chronic drought periods, including the use of strategic supplements of energy, protein, minerals and vitamins in feeding systems that are cost effective.

In integrated systems, the wider use of agro-forestry systems with complementary advantages of forage production, supply of fuelwood, improvement of soil fertility and permanent soil cover and economic land use are worthy of consideration. A very good example in this context concerns the use of L. leucocephala.

Poor husbandry practices drastically reduce the response from goats and therefore their productivity. Conversely, the effects of improved feeding and management on performance are spectacular and is seen in the results reported for goats in Malaysia (Devendra, 1979) and in India (Sachdeva et al., 1979; Parthasarathy, Singh and Rawat, 1983). In Fiji, improved husbandry, feeding, disease control and breeding has been shown to increase the annual rate of reproduction from 120 to 180% and well fed does to produce their first kid in 12-13 months age (Hussain et al., 1983).

Goats appear to be more susceptible to gastrointestinal parasitism than sheep. In Bangladesh, for example, 82.2% of 214 kids born died within six months of age, of which respiratory disorders, gastrointestinal parasitism and contagious ecthyma were the main causes. In adults, 47.8% mortality was recorded for gastrointestinal parasitism and respiratory disorders (Abdur Rahman, Ahmad and Mia, 1976). Likewise in Sri Lanka, kid mortality from 2340 pregnancies was reported to be 28% (Ranatunga, 1971).

VIII. OVERCOMING THE CONSTRAINTS

Overcoming the constraints necessitate better understanding of the attributes of goats, their role within the farming system and opportunities for increased productivity and contribution from them. The major constraints that affect current productivity need to be given priority, and once identified, thoroughly investigated in terms of how potential improvements are likely to influence greater performance. The final step in this effort is to extend the technology so developed gradually and in a manner that it will be acceptable to small farmers. Acceptable technologies are those that are simple, practical, within the farmers' resource capacity, convincing and consistently reproducible.

In many situations, the non-genetic factors require urgent attention. Among these, particular emphasis needs to be given to feeding and management as these are generally very inefficient in all developing countries

without exception, and result in immediate improved performance. In the Near East region likewise, similar opportunities exist in cognisance of a generally low level of flock performance in extensive systems (Table 2). These average figures suggest that with improved and more intensive systems of management, it is feasible to substantially improve the level of performance of goats.

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TABLE 1

DISTRIBUTION OF ANIMALS BY SIZE OF HOLDING IN THE
DEVELOPING COUNTRIES BY REGION (FAO, 1981)

Region (No. of reporting countries is given animals in parenthesis)	Total No. of animals (10 ⁶)	Holdings without land*(10 ⁶)	% distribution					
			Under 1 ha	1-5 ha	5-20 ha	20-100 ha	100-500 ha	500 ha
I. Goats								
<u>Africa</u> (4)	1.8	309.7	9.9	38.5	38.6	11.9	0.8	0.3
N & C America (2)	2.3	0.3	0.0	0.3	1.3	15.3	32.4	50.7
South America (4)	8.9	309.3	10.4	28.3	21.1	21.6	12.6	6.0
Asia (5)	12.6	140.5	33.6	30.7	27.8	7.5	0.3	0.1
II. Sheep								
<u>Africa</u> (4)	4.7	1,194.9	4.4	20.9	43.5	26.7	4.1	0.4
N & C America (3)	20.6	0.1	0.0	0.1	1.2	16.0	32.9	49.7
South America (5)	50.5	4.5	5.6	9.5	7.0	9.9	17.9	50.1
Asia (5)	13.9	662.8	19.9	26.4	37.2	13.8	2.0	0.7

*Establishments with no agricultural land which raise livestock and livestock products

TABLE 2

ESTIMATED AVERAGE FLOCK PERFORMANCE UNDER
EXTENSIVE SYSTEMS IN THE NEAR EAST REGION
(Devendra, 1985)

Trait	Performance	Remarks
Kidding percentage	80-180%)	Depending on rainfall and the availability of feeds
Kid mortality rate	5-40%)	
Adult mortality rate	3-15%)	
Average carcass weight	22 kg	Range 20-24 kg
Average milk production	50-70kg	Per lactation
Estimated flock offtake	30-40%	Mainly male kids