IDRC-268e

Goat Meat Production in Asia

Proceedings of a workshop held in Tando Jam, Pakistan, 13–18 March 1988

Proceedings

INTERNATIONAL DEVELOPMENT RESEARCH CENTRE · CENTRE DE RECHERCHES POUR LE DÉVELOPPEMENT INTERNATIONAL ·
CANADA

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in six sectors: agriculture, food and nutrition sciences; health sciences; information sciences; social sciences; engineering and earth sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are in Ottawa, Canada. Regional offices are located in Africa, Asia, Latin America, and the Middle East.

IDRC-268e

Goat Meat Production in Asia

Proceedings of a workshop held in Tando Jam, Pakistan, 13–18 March 1988

Editor: C. Devendra

P.O. Box 8500, Ottawa, Ont., Canada K1G 3H9

Devendra, C.

Sind Agriculture University, Tando Jam, Hyderabad PK
IDRC. Regional Office for Southeast Asia, Singapore SG

IDRC-268e

Goat meat production in Asia : proceedings of a workshop held in Tando Jam, Pakistan, 13–18 March 1988. Ottawa, Ont. IDRC, 1988. xi + 262 pp. : ill. (Proceedings series / IDRC)

/Goats/, /meat/, /animal production/, /Asia/ – /animal breeding/, /reproduction/, /animal nutrition/, /animal health/, /agricultural management/, /meat processing/, /marketing/, /international trade/, /export potential/, /production functions/, /case studies/, /conference reports/, /lists of participants/.

UDC: 636.39(5) ISBN: 0-88936-525-3

Technical editor: W.M. Carman

A microfiche edition is available.

Abstract/Résumé/Resumen

Abstract: This publication presents the results of a workshop held in Tando Jam, Pakistan, 13–18 March 1988, that focused specifically on all aspects of goat meat production in Asia. The workshop addressed the factors affecting meat production (breeding, nutrition, reproduction, sex, management, animal health, and diseases), the nutritional value of goat meat, methods of slaughter, processing techniques, consumer preferences, and the national and international marketing of goats. The detailed discussions on these aspects were further highlighted by country case studies, prevailing situations, issues and policies, and potential for improving the prevailing patterns of production. An important session covered broader issues concerned with research and development, strategies for increasing production, and export potential, especially in Near East markets. These discussions enabled a definition of research and development priorities and the scope for increasing goat meat production.

Résumé: Cette publication fait le compte rendu d'un atelier tenu à Tando Jam, au Pakistan, du 13 au 18 mars 1988 et qui a porté sur tous les aspects de la production de la viande de chèvre en Asie. Il y a été question notamment des facteurs influant sur la production de la viande (sélection des espèces, nutrition, reproduction, sexe, gestion, santé animale et maladies), de la valeur nutritive de la viande de chèvre, des méthodes d'abattage, des techniques de transformation, des préférences des consommateurs et du marketing national et international des chèvres. En plus de discuter de ces questions en profondeur, les participants ont aussi abordé les points suivants : études de cas de certains pays, situations actuelles, enjeux et politiques, et possibilités d'améliorer les tendances actuelles de la production. Lors d'une séance importante, les participants se sont penchés sur des questions plus vastes concernant la recherche et le développement, les stratégies qui permettraient d'augmenter la production et les possibilités d'exportation, particulièrement vers les marchés du Proche-Orient. Ces discussions ont permis de définir des priorités en matière de recherche et de développement et de déterminer le potentiel de croissance de la production de la viande de chèvre.

Resumen: Esta publicación contiene los resultados de un taller celebrado en Tando Jam, Paquistán, del 13 al 18 de marzo de 1988, dedicado específicamente a todos los aspectos de la producción de carne de cabra en Asia. El taller estudió los factores que afectan la producción de carne de cabra (cruce, nutrición, reproducción, sexo, manejo, salud y enfermedades), el valor nutricional de la carne caprina, los métodos de sacrificio, las técnicas de procesamiento, las preferencias del consumidor y el mercado caprino nacional e internacional. Las discusiones detalladas sobre estos aspectos se vieron además enriquecidas con el potencial para mejorar los patrones prevalecientes de producción. Una de las sesiones importantes cubrió los aspectos más amplios de investigación y desarrollo, estrategias para el aumento de la producción, potencial de exportación, especialmente en los mercados del cercano oriente. Las discusiones permitieron determinar las prioridades de investigación y desarrollo así como las posibilidades para aumentar la producción de carne caprina.

Contents

Goat meat production in Malaysia

M.K. Vidyadaran, M.A. Rajion, and A.A. Tuen

Department of Animal Sciences, Faculty of Veterinary Medicine and Animal Science, Universiti Pertanian Malaysia, 43400 Serdang, Selangor Darul Ehsan, Malaysia

Abstract: *Although about 35% of the working population of Malaysia is involved in agriculture, and self-sufficiency in pigs, poultry, and eggs has been achieved, the ruminant sector, and particularly goats, has been neglected. Goats are almost entirely raised by the rural community in small farms where subsistence production systems with mixed farming are practiced. Inbreeding depression, poor husbandry, and poor nutrition have resulted in low productivity. These factors, coupled with kid mortality and high slaughter rates have resulted in a steady decline in the goat population over the last few years. The major constraints to increased goat production are the meat preferences of the population, government policies, and competition from sheep. Other constraints are common to the ruminant sector. Increasing goat meat production in smallholdings is discussed; the aim is to increase the number of animals by improved husbandry and nutrition. Crossbred goats should only be introduced in farms receptive to new technology.*

Résumé: *Même si environ 35 % de la population active de la Malaisie s'adonne à l'agriculture et est autosuffisante dans la production de porc, de volaille et d'oeuf, les ruminants, et plus particulièrement la chèvre, y ont été négligés. L'élevage de cet animal est le fait, presque exclusivement, des petites fermes des collectivités rurales, où l'on pratique une économie de subsistance axée sur la polyculture. Le dépérissement des troupeaux dû aux accouplements entre consanguins de même que la mauvaise qualité de l'élevage et de la nutrition ont baissé la productivité. Ces facteurs, outre le taux de mortalité des chevreaux et le taux d'abattage élevé, sont responsables de la diminution constante du cheptel caprin ces dernières années. Les préférences alimentaires de la population, les politiques du gouvernement et la concurrence offerte par le mouton sont les principaux obstacles à l'augmentation de la production caprine. L'élevage de la chèvre fait face aussi à d'autres obstacles, communs à tout le secteur des ruminants. On étudie la possibilité d'augmenter la production de viande caprine par les petits cultivateurs; le but est d'accroître le cheptel par l'amélioration de l'élevage et de la nutrition. On ne devrait toutefois introduire les croisements de chèvres que dans les fermes ouvertes à la nouvelle technologie.*

Resumen: *Aun cuando cerca del 35% de la población laboral en Malasia se ocupa de la agricultura y se ha alacanzado allí el autoabastecimiento con respecto a cerdos aves y huevos, se ha relegado el sector de los rumiantes, particularmente los caprinos. Las cabras son criadas en su mayor parte por la comunidad rural en pequeñas granjas donde se ponen en práctica sistemas productivos de subsistencia con agricultura mixta. Una crisis endogámica, baja calidad en las crías y una pobre nutrición han traído como consecuencia una baja productividad. Estos factores, unidos a la mortalidad de cabritos y altos índices de sacrificio han creado un continuo descenso en el número de cabras durante los últimos años. Las principales limitaciones para un aumento en la producción de cabras son las preferencias que tiene la población acerca del tipo de carne, las políticas del gobierno y la competencia que representa la carne de obeja. Otras limitaciones son comunes al sector de los rumiantes. Se discute el incremento de la producción de la carne de cabra en pequeñas propiedades; el objectivo es el de aumentar el número de animales a través de técnicas de crianza y nutrición mejoradas. Las cabras cruzadas se deberían introducir solamente en granjas que sean receptoras de la nueva technología.*

Agriculture plays an important role in the socioeconomic development of Malaysia. It provides employment for about 35% of the working population

(Malaysia 1985) and accounts for about 60% of the foreign exchange earnings. National agriculture policies have, therefore, been directed to sustain exports, increase productivity for farmers, increase employment, and attain food self-sufficiency. Unlike other developing countries, only 20% of the working population involved in agriculture grows food crops; the remaining 80% is involved in the production of export crops.

The livestock sector of Malaysia has been less important to the economy and accounts for only 10% of the gross value of agriculture production and 3.3% of the gross domestic products. About 50% of the beef and 25% of the mutton requirements are produced locally. Of the total animal output, pork, poultry, and eggs account for 92% and the remaining 8% is provided by ruminants in the form of milk, beef, goat meat (chevon), mutton, hides, and skin (Devendra 1983).

The nonruminant sector is well developed and rapid modernization has resulted in efficient pig and poultry production systems. The development of the ruminant sector, however, is less impressive, with most animals being raised in small farms under poor management conditions. Cattle production has recently received greater attention with the importation of many animals such as Droughtmaster and Australian Commercial Cattle for beef production and the Friesan-Sahiwal for milk production.

The goat industry is a neglected sector. Goats are almost entirely raised on smallholdings under poor management systems. Government policies toward increasing goat production in the past have been of low priority and it is envisaged that the development of the goat industry will be slow compared with other livestock industries.

Goat industry

Goats are almost entirely raised in rural communities by smallholders (Fig. 1), landless peasants, and estate workers. A small-scale subsistence production system with mixed farming on 0.1–0.3 ha of land is characteristic throughout Malaysia. Herds are small, typically 1–11 head (Devendra 1966; Peters et al. 1981). Devendra (1983) reported that herd sizes in Perak were larger and ranged from 11 to 63 head. Generally, estate workers keep larger herds because of the greater grazing area, particularly under rubber and oil-palm plantations.

The Malaysian farmer's main concern is crop production; goat rearing is pursued without additional demand on labour or ancillary inputs (Devendra 1983). The animals are of generally poor genetic material and are subject to poor husbandry and nutrition. Goat rearing is considered a sideline business and, because of the small herd size, no effort is made to improve the quality of the herd.

In recent years, several institutions, like the Malaysian Agricultural Research and Development Institute (MARDI), have initiated goat-breeding programs in an effort to conserve and upgrade local breeds as well as to produce superior crossbreeds. These efforts, however, have produced no significant improvements. Almost all the goat meat produced comes from smallholdings, and this trend is likely to persist for many years.

Goats account for 25.6% of the total ruminant population (Table 1). The goat population has declined in Peninsular Malaysia from 312,100 in 1980 to 274,000 in 1985. Of the 274,000 goats, about 110,000 (40%) are indigenous (Katjang); the remaining 164,000 (60%) are various crossbreeds (Wahid 1986/87). Although

Fig. 1. Improved goat housing in a typical Malaysian smallholding.

Table 1. Ruminant livestock population in Malaysia for 1985.

Species	Number	Contribution (%)
Swamp buffalo	160803	15.1
Murrah buffalo	2556	0.2
Beef cattle	454428	42.6
Dairy cattle	98247	9.2
Goats	273586	25.6
Sheep	78305	7.3
Total	1067925	100.0

Source: Division of Veterinary Services, Ministry of Agriculture, Kuala Lumpur, Malaysia.

goats are generally widely distributed, the major concentrations are found in the north and on the west coast of Peninsular Malaysia. Of the total goat population, 89% is found in Peninsular Malaysia; the remaining 11% is distributed in east Malaysia (Devendra 1983). The annual growth rate of the goat population between 1950 and 1980 was 1.2% (Devendra 1983). Since 1980, the condition of the goat population has worsened. High kid mortality, inbreeding, low-quality animals, poor management, and inadequate nutrition have reduced the goat population by about 10% from 1979 to 1982 (Mukherjee 1983). It is estimated that a goat population of 600,000 is needed for the country to achieve 25% self-sufficiency by the year 1990. This value was estimated using an annual extraction rate of 12% (80,000 heads) (Wahid 1981).

Meat production

Goat contribution

The total goat meat production in 1985 was estimated at 350 t (Table 2). This estimate does not include the approximately 20,000 goats that were slaughtered

Table 2. Goat population and goat meat production in Peninsular Malaysia (1985).

State	Goat population ($x10^3$)	Known slaughter[a]	Meat production[b]
Perlis	8.49	449	3.91
Kedah	42.44	3061	26.63
Pulau Pinang	16.70	15271	132.86
Perak	34.17	8968	78.02
Selangor	14.60	3128	27.21
Negri Sembilan	31.16	1812	15.76
Melaka	21.21	1125	9.79
Johor	26.96	343	2.98
Pahang	13.15	1604	13.96
Terengganu	20.01	568	4.94
Kelatan	44.24	3900	33.93
Wilayah Persekutuan	0.46	-	-
Total	273.59	40229	349.98

[a]Unrecorded slaughter accounts for about 50% of known slaughter.
[b]Meat production = number of animals known slaughtered x average carcass weight (8.7 kg) (Mahendranathan and Leong 1974; Vidyadaran et al. 1984).

illegally. Local goat meat accounted for 60% of total production (valued at MYR 3.72 million) (in February 1988, 2.4 Malaysian ringgits [MYR] = 1 United States dollar [USD]). The contribution of goat meat relative to the meat of other ruminants like buffalo, ox, and sheep is low and estimated to be only 4.6% (Devendra 1983). The supply of goat meat is declining and, in 1985, it accounted for only 3.8% of all meats produced by ruminants.

Carcass yield and consumption

Live weight is a useful measurement for assessing growth; however, it does not accurately predict the amount of meat on the carcass (Vidyadaran et al. 1984). Dressing percentage, although considered to be more reliable, is also influenced by variables such as age, sex, diet, stress, amount of noncarcass parts, and method of dissection. This accounts for the wide ranges for dressing percentages reported in goats. The goat has a lower dressing percentage than ox or sheep. The average empty live weight, hot carcass weight, and dressing percentage of Katjang goats were found to be 20.8 kg, 8.2 kg, and 39.6%, respectively. Devendra (1981) reported higher values for Katjang goats under better management. Goats also have a high proportion of muscle and a low proportion of fat (Vidyadaran et al. 1984). The dressing percentages of different breeds of goat found in Peninsular Malaysia differ (Table 3). Vidyadaran et al. (1984) observed that the percentage of expensive muscle in goat was similar to that of ox. Goats have proportionately more muscles along the spinal cord and proximal thoracic limb, and less in the proximal pelvic limb (Table 4).

Performance of different breeds

Generally, crossbred Katjang goats achieved higher average daily gain (ADG) than purebred Katjang (Table 5). Substantial growth occurred between 0 and 3 months and, subsequently, there was much less growth. The preliminary studies of Mustapha and Kamal (1982) indicate that grazing is more favourable for growth than is a semi-intensive system.

Table 3. Dressing percentage of different breeds of goats in Malaysia.

Breed	Sex	Dressing %	Source
Katjang	Male	51.3	Devendra (1981)
	Female	39.6	Vidyadaran et al.(1984)
Saanen x Anglo-Nubian x local	Male	40.14	Wahid et al.(1985)
Anglo-Nubian x local	Male	39.75	Wahid et al. (1985)
Saanen x Jamunapari x local	Male	39.34	Wahid et al. (1985)
Jamunapari x local	Male	39.57	Wahid et al. (1985)
Local	Male	44.0	Noraida (1986)
Local x German Fawn (F_1)	Male	44.0	Noraida (1986)
F_1 male x local (BC_1)	Male	46.0	Noraida (1986)

Table 4. The muscle weight distribution (% of total weight) of kambing katjang does and *Bos taurus* heifers.

Muscle group	Heifers[a] (H)	Does[b] (D)	D - H	Index[c]
Proximal pelvic limb	31.5	27.06	-4.44	85.9
Distal pelvic limb	4.3	4.95	0.65	115.0
Around spinal column	12.1	14.80	0.65	122.3
Abdominal wall	11.5	11.69	0.19	101.7
Proximal thoracic limb	12.4	13.22	0.82	106.6
Distal thoracic limb	2.3	3.15	0.85	137.0
Thorax-thoracic limb	10.3	8.26	-2.04	80.2
Neck-thoracic limb	5.2	5.70	0.50	109.6
Neck-thorax	9.0	11.14	-2.14	124.0

[a]Mean total side muscle weight, 77.6 kg; N = 63 (Berg and Butterfield 1978).
[b]Mean total side muscle weight, 2.70 kg; N = 12.
[c]Goat value relative to cattle = 100.

Protein consumption

The daily per capita consumption of protein of the population in Malaysia is 49.9 g. The main source of protein is from vegetables (36 g), followed by animal sources (8.9 g) and fish (5 g) (Devendra 1973). Thus, unlike Western diets, the predominant protein source of the Malaysian diet is vegetables. It is likely that the daily intake of animal protein will increase in the diet of Malaysians, but it is doubtful that the animal protein intake will ever reach the levels of Western diets. The ruminant contribution of daily protein intake was only 12%, compared with the nonruminant contribution of 87% (Devendra 1983). Goat meat only contributed 0.3% to the protein intake of an individual and, therefore, does not constitute a major component of the diet of Malaysians.

Meat preferences

It is relevant to consider the meat preferences of the major communities in Malaysia. Fish, poultry, and eggs are consumed by all races and probably constitute the main source of animal protein. The demand for beef is mainly by the Malay community, which form the majority of the population. Pork is forbidden to the Malays, who embrace the Islamic religion. The Chinese, which constitute the second-largest group in Malaysia, prefer pork and seldom eat beef or mutton. The

Table 5. Performance of different breeds of goats in Malaysia.

Breed	Condition[a]	Average daily weight gain (g)	Source[b]
Katjang x Jamunapari	SI	51 (0-3) 16 (3-9)	Tuen, unpublished
Katjang x Jamunapari	SI	19 (>12)	Tuen and Dahan (1987)
Katjang x Jamunapari	SI	75 (0-3) 25 (3-9) 10 (9-15)	
Katjang x Jamunapari	GR	88 (0-3) 55 (3-9) 44 (9-15)	Mustapha and Kamal (1982)
Katjang (75% cross)	I	52-63 (3-9)	Abdul Rahman et al. (1987)
Katjang x Katjang	SI	54 (0-3)	Wahid, Kamal, et al. (1987)
Katjang x Saanen	SI	71 (0-3) 33 (3-12)	
Katjang x Anglo-Nubian	SI	69 (0-3) 37 (3-12)	
(Saanen x Katjang) x Katjang	SI	60 (0-3) 39 (3-12)	
(Anglo-Nubian x Katjang) x Katjang	SI	64 (0-3) 37 (3-12)	
Anglo-Nubian x Anglo-Nubian	SI	86 (0-3) 41 (3-10)	
British Alpine x British Alpine	SI	83 (0-3) 34 (3-12)	
Saanen x Saanen	SI	84 (0-3) 21 (3-12)	

[a]SI, semi-intensive; GR, grazing; I, intensive.
[b]Values in parentheses indicate the age range (months) to which the daily weight gain applies.

Indians, who form about 10% of the population, are traditionally vegetarians but eat some poultry and mutton. Malays also consume a certain amount of goat meat that is available as a result of the slaughter of goats for religious purposes.

It is, therefore, a paradox that, on the one hand, there appears to be no great preference for goat meat and, on the other hand, there is a shortage of goat meat. This situation has arisen as a result of a declining goat population coupled with an increasing human population. Recently, Devendra (1983) reported in a study in Perak that all races expressed a desire to consume more mutton. Nevertheless, it is our belief that fish, poultry, eggs, pork, and beef will continue to form the major animal protein source of the diet of the various communities in Malaysia. Two other factors may contribute to a lesser demand for goat meat in the future. One is the belief that the saturated fat of goat meat is a predisposing factor for heart diseases and the other is that, except for a few, there is no greater preference for goat meat to mutton by the younger generation. It is envisaged that people will increasingly consume mutton because of the price differential. Mutton now costs, on average, MYR 7.36/kg; goat meat costs MYR 10.56/kg. Therefore, it is imperative that policies formulated to increase meat production should take into account the cultural, religious, and social factors of the various communities of Malaysia.

Marketing patterns

The demand and supply of various types of meat largely depend on the religious customs of the various communities of Malaysia. Because goat meat is mainly consumed by Indians and Malays, the slaughtering and marketing are predominantly controlled by these two races. There is no efficient marketing system because production is on a small scale and is scattered throughout the country. Moreover, there is no processing industry and almost all goat meat is sold fresh in the market.

There are basically two types of meat marketing (Devendra 1983). First, the animals are sold directly to the purchaser in exchange for goods, produce or kind, or, sometimes, cash. This type of deal is usually carried out with a neighbour or friend, and, therefore, live weight and other factors are not considered. Second, the farmer sells the animal directly to a middleman. The animals are sold on a live-weight basis or on an appraisal of the live weight and the physical condition of the animal. This system of sale favours the middleman, with the farmer getting a much lower price. At the moment, there are no farmers' organizations to coordinate the marketing and sale of goat meat.

Meat inspection is carried out in the abattoirs. As a rule, meat for human consumption must be inspected; however, this rule is often violated. The middleman transports the animals by lorry to a yard where the animals may be held for a day or two before being sent to the abattoir. In some cases, the animals are kept for some time, during which better nutrition is provided. After slaughter, the chilled meat is collected from the abattoir and the meat is either immediately sold in the market or frozen for future use.

There is considerable demand for goat meat during festive and religious occasions. The demand is sporadic and individuals may approach the middleman or the farmer. The animal is slaughtered in the neighbourhood and the meat is shared among members of the family.

There is no organized marketing system to handle large-scale distribution of meat for local or export markets. Efficient packing and marketing systems must be created if goat meat production is to increase.

Limitations to increased production

There are several constraints to increasing goat production. It is necessary to identify these constraints because, unless concerted efforts are taken to overcome them, it may be difficult to achieve production targets.

Meat preferences

The present demand and shortage of goat meat has arisen because the goat population has not increased at the same rate as the human population. Goat meat is not the preferred meat of any community. Furthermore, the younger generation is less discriminating toward goat meat and mutton. The high cost of goat meat also acts as a deterrent. However, a certain demand for goat will always exist because of religious slaughter. It is our view that the demand for goat meat will not increase and that an in-depth study on the future demand for goat meat is necessary.

Government policies

Present government policies on ruminants are largely directed toward increasing beef, milk, and mutton production. Incentives for commercial goat farming are limited or nonexistent. Large-scale commercial goat farming is, therefore, unlikely. For the immediate future, the smallholder is destined to continue to play the role of the producer and supplier. This dependence on the small-scale farmer is likely to be a serious constraint to increasing goat production, mainly because herd sizes are small and goat rearing is only considered a sideline enterprise. Farmers also have little knowledge of basic animal husbandry. The implementation of programs for improvement, therefore, will be difficult.

Competition from sheep

The sheep population of the country has been steadily increasing. They have adapted quite well to forage under rubber and oil palm plantations, causing little damage to the primary crop. The greater availability of cheaper mutton in the market will affect plans to increase goat production. The high price and inadequate preference for goat meat are also likely to affect goat production.

Suitability of breeds

The goats in smallholdings generally have poor genotype, inbreeding, poor nutrition, and other factors contributing to low weight gains. The Katjang breed is prolific and resistant to disease. Although crossbreeds (local × exotic) have better growth rates, their adaptability to small-farm conditions has not been evaluated. Rajendran and Pillai (1976) observed that although body weights of crossbreeds have improved over the years, the reproductive capacity was less than that of Katjang. Furthermore, the economics of production on smallholdings has not been studied. It must be determined whether rearing of crossbreeds is economical after additional inputs like better management and feeds are provided. The lack of information on economic goat rearing in rural areas is a serious constraint to increasing goat production.

Skilled labour

For economic goat production, farmers must acquire the knowledge and skills associated with goat husbandry. The younger generation are believed to be more innovative and to adapt better to new technology (Abidin 1984). In this context, the large migration of youths to urban areas is a matter of much concern. Unless this migration is checked, the task of increasing goat meat production will belong to the older generation, who are unlikely to face the challenges required for economic production.

High kid mortality

Various studies have shown that high kid mortality is an important constraint to increasing goat production. Kid losses range from 1.5 to 50% (Devendra 1962; Syed Mohna 1976; Lee et al. 1978; Mustapha and Kamal 1982; Diechert 1986). The problem with crossbreeds is even more serious. Little information is available regarding kid mortality among crossbreeds in smallholdings. Unless kid mortality is drastically reduced, the prospect of rapidly increasing goat populations remains dim.

Extension services

Present extension services are inadequate. Unless the smallholder has easy access to information and other services such as credit facilities, marketing outlets, etc., it is unlikely that the smallholder will make much progress.

Increasing goat production

The following factors must be considered to increase goat meat production:

- Government policies toward goat production,
- Dynamics of the rural population,
- Economic trends within the country,
- Meat produced for local or export markets, and
- Meat preferences of the population.

Once the overall objectives are identified, concerted efforts must be made toward identifying the production system that is most likely to succeed.

Small farms use production systems that utilize locally available resources. Often, these production systems are inefficient. Improvements are necessary to management, nutrition, and the reduction of the losses as a result of disease. It should be remembered that although technological advances like agronomy, veterinary, and genetic programs are available, the socioeconomic factor may be more complex and difficult to implement (Guss 1983).

Smallholdings

Commercial goat farming is unlikely to succeed because of scarcity of available land, uncertainties about the most appropriate production system, and low economic returns. Smallholdings are, therefore, likely to continue to be the main base for goat production. To increase production, the first step is to identify farms suitable for implementing the management program. Small farms can be categorized into three groups:

- Existing farms where there is little likelihood of improvement (group 1),
- Farms where some improvement can be achieved (group 2), and
- Farms receptive to new technology (group 3).

The overall plan should include factors like number of farms that are likely to be involved in the program, the number of farms involved in the 1st year and succeeding years, and the output after about 5 years.

The primary aim of the program should be to increase goat production through better management, nutrition, and decreased losses as a result of disease. The emphasis is on increasing goat numbers rather than on increasing body weight gains. It is unlikely that the farmer will immediately replace indigenous Katjang goats with improved crossbred goats. This is unlikely to occur in farm groups 1 and 2 because of the extra demand on labour and skill. Several reports of crossbred animals under various management conditions suggesting better performance than Katjang goats for birth weights, weaning weights, and live weights (Lee et al. 1978; Khushary et al. 1980; Wahid 1986/87; Wahid, Jemalos et al.

1987); however, little is known about the performance of crossbreeds on smallholdings. Indigenous animals that have evolved under poor nutritional environments have a lower nutrient requirement and, therefore, are less sensitive to changes in nutrient supply (Fricsh and Vercoe 1977). In contrast, genetically improved breeds are more responsive to nutritional inadequacy or stress. An evaluation of the feed resources of the farm is important so that there is no need for purchased feeds.

In farm group 3, the use of improved breeds, improved husbandry, and improved nutrition can be attempted. Ancillary services should be provided to support intensification.

Marketing

Marketing of farm products is a major problem in the developing world. The farmer is often unable to cope with surplus animals. Effective marketing systems including cooperatives and an assured stable price are essential.

Extension services

A comprehensive extension service providing multidisciplinary support is essential for the success of the goat meat production program. The services provided should include agriculture, veterinary medicine, and marketing training programs as well as credit facilities.

Research

Continuing research on all aspects of goat production, with particular emphasis on small farms is a prerequisite for improved goat meat production. In this respect, research into survivability, reproduction, and the economics of rearing crossbreeds on smallholdings are urgently needed.

References

Abdul Rahman, M.H., Mohd. Jafar, D., Sharif, H., Faizah, M. 1987. Feedlot performance of goat and sheep fed oil palm and rice by-products. In Hutagalung, R.I., Chen, C.P., Wan Mohamed, W.E., Law, A.T., Sivarajasingam, S., ed., Advances in animal feeds and feeding in the tropics. Malaysia Society of Animal Production, Universiti Pertanian Malaysia, Kuala Lumpur, Malaysia.

Abidin, Z.I. 1984. Extension problems associated with small farms. In Jainudeen, M.R., Omar, A.R., ed., Pasture development and production in the high rainfall tropics of South East Asia. Universiti Pertanian Malaysia, Kuala Lumpur, Malaysia.

Berg, R.T., Butterfield, R.M. 1978. New concepts of cattle growth. Sydney University Press, Sydney, Australia.

Deichert, G. 1986. Impact of crossbreeding and extension activities on productivity of goats in smallholder systems: investigation on kid mortality. In Third biennial report on the joint goat breeding program. Universiti Malaya, Kuala Lumpur, Malaysia, and Technische Universitat, Berlin, FRG. pp. 69–78.

Devendra, C. 1962. Upgrading local goats by the Anglo-Nubian at the Federal Experiment Station, Serdang. Malayan Agricultural Journal, 43, 265–280.

_____ 1966. The importance of goats in Malaysia. Zeitschrift fuer Tierzuechtung and Zuechtungsbiologie, 83, 72–79.

_____1973. Animal production in relation to human nutritional requirement in Peninsular Malaysia. Kajian Veterinar, 5, 52–65.

_____ 1981. Prospects for increasing food production from goats in the tropics. Malaysian Veterinary Journal, 7, 1–18.

_____ 1983. Goats: husbandry and potential in Malaysia. Ministry of Agriculture, Kuala Lumpur, Malaysia. 178 pp.

Fricsh, J.E., Vercoe, J.E. 1977. Food intake, eating rate, weight gains, metabolic rate and efficiency of feed utilisation in *Bos taurus* and *Bos indicus* crossbred cattle. Animal Production, 25, 343–358.

Guss, S.B. 1983. Strategies for improving goat production in the tropics. Philippine Journal of Veterinary and Animal Sciences, 14, 74–77.

Khushary, M., Yusuf, M., Wahid, A., Shukri, O.A. 1980. Comparative pre-weaning growth performance of crossbred kids. Paper presented at the Malaysian Veterinary Association Conference, 22–24 November 1980, Kuala Lumpur, Malaysia. 17 pp.

Lee, K.A., Wan Mohamed, W.E., Ng, L.H., Ng, F.C., Phang, A.K. 1978. Performance of sheep and goats under rubber – preliminary results. In Abraham, P.D., Devendra, C., Hutagalung, R.I., Rajarao, J.C., Venugopal, K., Zainal Abdul Ghani, Zainal Thamby, ed., Integration of animals with plantation crops. Rubber Research Institute, Kuala Lumpur, Malaysia.

Mahendranathan, T., Leong, E.S.L. 1974. Handbook of livestock and veterinary statistics. Ministry of Agriculture and Rural Development, Kuala Lumpur, Malaysia. Bulletin 136, 55 pp.

Malaysia, Department of Statistics. 1985. Yearbook of statistics. Department of Statistics, Kuala Lumpur, Malaysia.

Mukherjee, T.K. 1983. Crossbreeding for improvement of local goats using a multidisciplinary approach. Paper presented at the Symposium on Technology, Culture, and Development, 12–15 December 1983, Kuala Lumpur, Malaysia. 39 pp.

Mustapha, M., Kamal, H. 1982. A study of goat production under two systems of management. In Jainudeen, M.R., Omar, A.R., ed., Animal production and health in the tropics. Universiti Pertanian Malaysia, Kuala Lumpur, Malaysia. pp. 329–332.

Noraida, I. 1986. Growth curves and carcass yields of purebreds and crossbred goats. In Third biennial report on the joint goat breeding program. Universiti Malaya, Kuala Lumpur, Malaysia, and Technische Universitat, Berlin, FRG. pp. 59–68.

Peters, K., Deichert, G., Drewes, E., Fichtner, G., Moll, S. 1981. Goat production in low income economic groups of selected areas in west Malaysia. Animal Research and Development, 13, 88–113.

Rajendran, S., Pillai, A. 1976. Observation on the goat industry in Selangor. Paper presented at the Malaysian Veterinary Association Conference, 4–6 December 1976, Kuala Lumpur, Malaysia. 9 pp.

Syed Mohna, S.S. 1976. Goat mortality in Institute Haiwan. Malaysian Veterinary Journal, 6, 72–79.

Tuen, A.A., Dahan, M. 1987. Body weight changes and blood mineral profiles in crossbred goats supplemented with minerals or fed grass and concentrate only. Malaysian Applied Biology, 16, 397–403.

Vidyadaran, M.K., Razak, A., Ganesamurthy. 1984. Carcass composition and muscle distribution of kambing katjang does. Malaysian Applied Biology, 13, 45–52.

Wahid, A. 1981. Goat and sheep development in Malaysia. Livestock Advisory Committee, Malaysian Agricultural Research and Development Institute, Serdang, Malaysia.

_____1986/87. Breeding of goats to increase meat production in Malaysia. Malaysian Veterinary Journal, 8, 229–235.

Wahid, A., Jemalos, M., Shukri, A. 1987. Growth performance of Katjang, Saanen × Katjang, and Anglo-Nubian × Katjang goats. In Proceedings of the 4th International Conference on Goats, 8–13 March 1987. Brasilia, Brazil. Empresa Brailcira de Tequisa Agropecuaria, Brasilia, Brazil.

Wahid, A., Kamal, A.H., Ariff, O.M. 1987. The growth performance of purebred and crossbred goats under open pasture conditions. Malaysian Applied Biology, 16, 219–223.

Wahid, A., Rozimah Hamzah, Cheah, P.F. 1985. Introduction of Saanen to Anglo-Nubian × Local and Jamunapari × Local crossbred goats: observations on their growth performance. In Sivarajasingan, S., Hutagalung, R.I., Kassim Hamid, ed., Proceedings: 9th Annual Conference of the Malaysian Society of Animal Production. Universiti Pertanian Malaysia, Kuala Lumpur, Malaysia. pp. 8–13.