7-10

The Black Bengal Goat as a Tool to Promote Sustainable Livelihoods in Rural West Bengal

By:
Subhasish Biswas

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Edited by:
Per Pinstrup-Andersen (globalfoodsystem@cornell.edu)
Cornell University

In collaboration with:
Søren E. Frandsen, FOI, University of Copenhagen
Arie Kuyvenhoven, Wageningen University
Joachim von Braun, International Food Policy Research Institute

Executive Summary

Goats are an integral part of rural India's symbiotic system of crop and livestock production and make up a significant part of the livestock wealth of the country. Over the past 25 years or so, the Indian livestock industry has progressed from a situation of scarcity to one of plenty. Although the share of agriculture in India's gross domestic product had been declining since the country's independence in 1947, there was an increasing trend in the value of output from livestock as a share of GDP (GOI 1998). Goats are among the main meat-producing animals in India, and goat meat (chevon) faces huge domestic demand, with no social, cultural, and religious restrictions. Despite the popularity of goat meat, goat rearing has not been conducted as either a large- or a small-scale industry in the state of West Bengal or in India as a whole. Among the 20 well-defined breeds of goats in India, the black Bengal is a dwarf breed, highly prolific, and famous for its superior-quality meat and skin. In West Bengal, it is commonly known as the "poor man's cow."

India has more than 124 million goats, which account for more than 25 percent of the country's total livestock and contribute more than Rs. 106 billion annually to the national economy, providing food and nutritional security to millions of marginal and small farmers and agricultural laborers (Kumar 2007). A number of factors make the rearing of black Bengal goats a preferred option among marginal and small farmers (those having less than one hectare of land) and even landless farmers, who depend on common grazing and forest lands for fodder. These factors include low capital intensity, prolific breeding, superior chevon quality, early sexual maturity, high-quality skin, low kidding intervals, good adaptability, no religious taboo against consumption, and steady returns (Dixit and Shukla 1995).

Under the prevailing traditional production system, however, the productivity of goats is very low (Singh and Kumar 2007). Mortality and morbidity losses due to disease in goats have been high in traditional flocks (Kumar 2007). Unfortunately, little attention has been paid to improving the genetics and productivity of black Bengal goats. Proper marketing and the application of modern technology and advanced management systems in goat rearing could bring about a significant change in the market for goat meat.

A coordinated approach might be initiated to increase the productivity of goat production by improving management practices, enhancing nutritional inputs, and minimizing morbidity and mortality from traditional and emerging diseases (such as goat pox, pneumonia, and *peste des petits ruminants* [PPR]). To achieve this new approach, national policy makers could transmit scientific guidelines to implementing agencies, preferably at the level of local self-government (*panchayats*). Bridging the national and local efforts, the state veterinary department, research organizations, and state government should play major roles. Veterinary education institutions can also be consulted on the training of the primary stakeholders—that is, livestock raisers and farmers—in scientific rearing, slaughtering, and processing of goat.

Your assignment is to advise national policy makers and state animal resources development departments to formulate a strategy to improve the livelihoods of small and marginal farmers in West Bengal through improved productivity and use of the black Bengal goat and to conserve the related germplasm.

Background

The Indian Perspective

From the Indian perspective, livestock and dairying are closely intertwined with agriculture and have been sources of income generation and means of sustenance for rural communities during natural calamities that result in crop damage. Because goats have higher fecundity and are more productive than other livestock reared by Indian farmers and offer assured income to farmers with low input costs in diverse agroclimatic conditions, they play a pivotal role in human subsistence. According to the 17th Livestock Census 2003, India has 181.88 million small ruminants, consisting of 61.78 million sheep and 120.10 million goats. In terms of population, India ranks second in the world in goats and third in sheep.

More than 70 percent of these two species are reared by small or marginal farmers and landless laborers. The contribution of these species to India's rural economy is estimated at Rs. 24 billion a year (GOI 2004). Together, they produce about 0.7 million tons of meat. In 2003 goats produced 3.7 million tons of milk, about 4 percent of total milk produced in the country. It is estimated that about 5 million families are engaged in various activities related to the rearing of sheep and goats and use their products (GOI 2004).

West Bengal in Context

West Bengal has a goat population of 19.43 million, which is about one-eighth of its human population (GOWB 2004–05). It ranks first in goat meat production among Indian states, accounting for 30.5 percent of total goat meat produced in the country. In 2004–05 West Bengal produced 148,260 metric tons (MT) of goat meat from 24.71 million goats (GOWB 2004–05). To produce this meat, West Bengal provides only 7.5–8 million goats for slaughter every year, and the remaining 15–16 million goats are procured from other states. Repeated outbreaks of bird flu and the increasing popularity of goat meat in this region have increased the demand for chevon severalfold in recent years.

One of the most serious challenges that the state of West Bengal faces today is reconciling the need to reduce poverty with the need to meet increased market demand for products. The areas that poor people occupy are usually the most marginal for agricultural development and far from transportation networks or urban centers. Sustained low-input agricultural production by these poor farmers has made agriculture a self-defeating activity. These farmers cannot compete with costly modern agricultural practices, and they are often compelled to become landless laborers. They are forced to depend on their own labor and the minimum available natural resources. Whole families, including children, are commonly involved in a variety of activities because no single activity—agricultural wage labor or agricultural production—can meet their daily domestic needs for sus-tenance. This situation generates not only economic deprivation, but also illiteracy and deforestation.

Improved goat husbandry could help overcome this challenge. This poor subpopulation has long engaged in rudimentary animal husbandry. Better animal husbandry—such as selection of better breeds, use of better feeds, and adoption of more scientific rearing practices—could make goat farming a profitable business, ultimately leading to increased incomes and better nutritional status in this section of society.

Goat: The "Poor Man's Cow"

Livestock-based poverty alleviation programs are heavily tilted toward dairying, which requires more water than goat rearing and depends on irrigated fodder production. Goat rearing is considered one of the best options in water-deficient areas in tropical climates. Goats can efficiently survive on available shrubs and trees in harsh environments and on low-fertility lands where no crop can be grown. Called the "poor man's cow," goat is cheap to procure and easy to rear, especially by women, who often rear small livestock during their leisure time. With the potential to provide high-quality meat and milk, goat is regarded as an important source of nutrients for people in the developing countries of the tropics (Birthal and Taneja 2006). Goat rearing has been practiced by a large segment of the poor population in rural India, as well as in West Bengal. Goats are also used in ceremonial feasts and for the payment of social dues.

About 90 percent of the world's goats are reared primarily for meat. In India about 42 percent of the total population of goats is slaughtered for meat every year. In 1999–2000, the per capita annual availability of goat meat and mutton in India was 1.0 kilogram (Birthal and Taneja 2006). Goats provide not only livelihoods for much of the rural population, but also valuable animal protein to both rural and urban populations. They play an important role in income generation, capital storage, employment generation, and household nutrition. West Bengal ranks first among Indian states in goat meat production, accounting for 30.5 percent of total goat meat production in India. West Bengal produced 148,260 MT of goat meat in 2004–05 (GOWB 2004–05). In addition, the skin of the black Bengal goat is prized on the world market for leather production for its exceptionally fine grain (Sastry and Thomas 2005).

In spite of West Bengal's large livestock population, per capita protein availability there is only about 10 grams a day, compared with the world average of 25 grams. The recommended minimum protein requirement is 20 grams of animal protein per

capita per day, of which 4 grams are expected to come from meat and 16 grams from fish and other animal products (Kondaiah 2008). The estimated demand for meat for the present population of India would be 7.7 million tons compared with present production of 5.7 million tons (GOI 2004–05). The 148,260 MT of chevon produced in West Bengal in 2004–05 probably came from 24.71 million live goats, considering that one black Bengal goat produces an average of 6 kilograms of meat (ICAR 2002; Sastry and Thomas 2005). But the census report recorded only 19.43 million live goats in the state in 2004–05, including kids and does. Therefore shortfalls are continuously met by goats marketed from other states (GOWB 2004–05).

The diet of an average Indian is cereal-based and lacks nutrient-rich foods such as pulses, fruits, vegetables, and animal products. Low intake of these products results in nutritional deficiencies. About 30 percent of the population suffers from malnutrition (Kumar and Joshi 1999). Goat meat can play a large role in combating malnutrition. It is an excellent source of high-biological-value protein, vitamin B12, niacin, and vitamin B6. It is also a source of long-chain omega-3 polyunsaturated fats, riboflavin, pantothenic acid, selenium, and possibly vitamin D, and it contains a range of endogenous antioxidants and other bioactive substances, including taurine, carnitine, carnosine, ubiquinone, glutathione, and creatine. Goat meat, including liver, is an important source of several micronutrients given that some of them are exclusively present in meat or they are much more bioavailable in meat than in plant sources. Intake of livestock products, however, is low in India compared with that in many developing and developed countries.

As shown in Table 1, the goats and their products contribute about Rs. 142 billion annually to the national economy, accounting for around 9 percent of the gross domestic product (GDP) of the livestock sector, which contributes more than 30 percent of agricultural GDP (FAO 2007).

Table 1: Contribution of Goat to the Indian Economy, 2007 (at current prices)

Goat product	Quantity produced (thousand metric tons)	Value (million Rs.)
Meat[1]	543	81,450
Milk[2]	4,000	36,000
Skin[3]	130	6,498
Offal[4]	379	7,388
Manure[5]	17,211	10,327
Blood[6]	54	246
Pashmina[7]	0.041	62
Total		**141,970**

Source: The estimates are based on data from FAO (2007).
[1]Value is estimated at Rs. 150/kg.
[2]Value is estimated at Rs. 9/kg.
[3]Value is estimated at Rs. 50/kg.
[4]Offal is estimated as 35 percent of live weight and valued at Rs. 200/animal slaughtered.
[5]Because information on manure produced is not available, the average yield of manure has been estimated at 500g/adult and 200g/young/day and valued at Rs. 600/ton. The ratio of the adult to kid population is 60:40.
[6]Value is estimated at 5 percent of live weight and valued at Rs. 5/goat slaughtered.
[7] Pashmina refers to a type of fine cashmere wool and the textiles made from that wool, which come from a breed of goat indigenous to the Himalayas. Value is estimated at Rs. 2,000/kg.

Goats are also considered "walking refrigerators" for storage of milk because they can be milked as required, several times a day. Yet goat's milk accounts for only 3.5 percent of total available milk from all sources in India (Agnihotri and Pal 1996). This low demand for goat's milk is due to consumers' lack of awareness about its nutritive value and the lack of an established infrastructure for marketing goat milk in India. Goat's milk thus does not reach the market and remains with the farmers themselves, who ultimately consume it. The World Health Organization has reported that more than 70 percent of the world's population has some allergy to cow's milk, with symptoms that include stomachache, gas, skin rash, and ear infection, whereas no such allergy was reported for goat's milk. Goat's milk is preferred to cow's milk for patients suffering from liver dysfunction, jaundice, biliary disorders, acidosis, and insomnia (BAIF 2008).

The Black Bengal Goat

Among the various meat-producing indigenous breeds of goats in India owned by small farmers, peasants, and landless laborers, the black Bengal goat (*Capra hircus bengalensis*) is the most common. This breed is an important contributor to a sustainable agricultural system, particularly in the eastern region of the Indian subcontinent. But the breed has not received scientific attention for its contribution to humankind, especially the poor. Bengal goats are highly prolific, are resistant to common diseases, thrive on meager feeding conditions, and can produce excellent-quality meat. These factors have led to the realization of the need to pay more attention to this goat breed, whose genetic material has been used since time immemorial, but without any attention to the need to conserve it.

Black Bengal goat rearing has a number of advantages:

- The initial investment needed for goat farming is low.
- Because of the breed's small size, docile nature, and modest housing requirements, it raises few management problems.
- Goats are prolific breeders and achieve sexual maturity at the age of 10–12 months. The gestation period in goats is short, and at the age of 16–17 months they start giving milk.
- In drought-prone areas, goat rearing is much less risky than other livestock husbandry.
- Unlike large animals on commercial farms, both male and female goats have equal value.
- India has no religious taboo against goat slaughter and meat consumption.
- Goat meat is relatively lean (low in cholesterol) and good for people who prefer a low-calorie diet, especially during India's intense summers, when many people prefer to avoid rich, high-calorie foods. Sometimes goat meat is preferred over mutton because of its "chewability."
- Goat's milk is easier to digest than cow's milk because of its small fat globules, and it is naturally homogenized. Goat's milk is said to play a role in improving appetite and digestive efficiency. Goat's milk does not pose the allergy problems that cow's milk does. It has antifungal and antibacterial properties and can be used for treating urogenital diseases of fungal origin.
- Goat rearing creates employment for the rural poor and effectively uses unpaid family labor.

Policy Issues

Despite making significant progress in various fields, the state of West Bengal still faces poverty, unemployment, ignorance, and socioeconomic inequality. New economic forces in the post-liberalization period are bringing with them new opportunities for development and nation building. It is, however, important to ensure that growth is inclusive and that the benefits of development reach everyone, particularly the rural masses who have not been effectively touched by the efforts since independence. Agriculture is the backbone of the Indian, as well as West Bengal, economy. In recent years, agricultural growth has fallen both in India and in West Bengal. Although the share of agriculture in GDP has steadily declined, more than half of the population of West Bengal (40 million people) still relies on agriculture (Khan 2008). The livestock sector provides livelihood support to millions of people who have little access to land. About one-third of the population—mainly landless people and marginal and small farmers—lives below the poverty line. Because livestock is

distributed more equitably than land, growth in the livestock sector is considered anti-poverty and equity-oriented (Adams and He 1995; Birthal and Singh 1995). The fact that agricultural growth lags behind growth in the non-agriculture sectors explains the plight of rural people.

Poverty, hunger, and health care represent some of the major challenges before rural India as well as in West Bengal. The Green Revolution provided food security to the people, the "white revolution" made India the world's top milk producer, and the "blue revolution" created new opportunities in backyard and marine fisheries. Now the Government of India dreams of launching a "pink revolution" in which meat from the black Bengal goat would play an important part (GOI 2004–05). Rising per capita income, growing urbanization, and widening globalization are boosting the demand for high-value commodities including meat (Birthal and Joshi 2006). A rapid shift in the dietary habits of non-vegetarians is increasing demand for sheep and goat meat (Kondaiah 2008). Moreover, a huge expected increase in the demand for meat in developing countries (by 100 percent) presents an excellent opportunity for India to enhance its exports of live goats and sheep and their meat (Delgado et al. 1999). Black Bengal goats have good carcass and production traits, and the dressing percentage has remained unchanged, at about 45–50 percent.[1] Changes in nutrition and breeding practices to slightly increase the dressing percentage could translate into substantial increases in meat production. Steady demand for this meat in India could help generate income for rural Bengal.

In spite of organized efforts by agricultural universities, private institutions, and international organizations, commercial goat farming is not yet well developed in West Bengal, for several possible reasons. First, the majority of goats are reared on a zero-input basis, with farmers selling their goats at any price, making this a highly attractive sector for middlemen. Second, there is a lack of skilled labor to manage goats under an intensive management system. Third, when these goats are brought from free range into an intensive system of management, they tend to suffer from contagious and communicable diseases. Studies also show that there is little awareness in West Bengal or in India about how to improve livestock productivity to enhance livelihoods—a consequence of weak public extension support for livestock (Rangenekar 1998).

There are other factors in the sluggish improvement of this valuable animal. Because of indiscriminate breeding and the absence of high-quality bucks, black Bengal goats have suffered from severe genetic erosion, resulting in low weight at birth, poor growth, and high susceptibility to disease (Yadav and Yadav 2008). In the absence of timely vaccination, 45–50 percent of the goats die from diseases such as PPR (BAIF 2008), enterotoxaemia, and goat pox. Poor infrastructure for disease diagnosis and other facilities affect the survival of these goats. With the depletion of natural resources, particularly community pastures, there is a severe shortage of fodder and feed, leading to poor growth. Goat rearing on free grazing land is an age-old practice, so owners do not feed goats with cultivated fodder, concentrated feed, or mineral mixtures. Lack of deworming further stunts their growth. Proper marketing channels are absent. Goat farmers are exploited at the market because they often sell their animals to middlemen in times of distress. In the absence of organized marketing in West Bengal, owners lack information about the weight of the animals and the price of the products and consequently receive very low returns (Mathialagan 2007). To enhance their incomes, owners tend to increase their herd size but then face shortages of fodder, posing a serious threat to biodiversity.

In the 1970s, before it lost its primacy to Tamil Nadu and Uttar Pradesh, West Bengal was considered the tannery center of the country. In 2003, it had 523 tanneries and 2,000 leather goods producers (Chattopadhyay 2003), and its goat skins were high in quality. West Bengal is one of the country's leading states for export of finished leather goods and accounts for almost 25 percent of the country's leather exports. The state now (2010) has 538 tanneries producing leather. The West Bengal Industrial Development Corporation provides market facilities for the leather products manufactured by small-scale industries located in the state. From August 1991 to December 2005, 24 approvals were obtained for foreign direct investment in leather and leather goods production units,

[1] Dressing percentage denotes the percentage of carcass with respect to the live weight of the animal. Here "carcass" means the part of the animal used for production of meat (including bone) excluding the skin, internal organs, horns, hooves, and head. This is for goat carcass only.

with investments totaling US$56 million (WBIDC 2005). Significant depreciation over time in the value of goatskin leather has been observed due to pox marks, malnutrition, scratches, and other skin lesions.

Stakeholders

Smallholders and Landless People

In West Bengal, goat rearing is an important component of agriculture and central to the livelihoods of many poor. It is considered a subsidiary source of income accompanying other agricultural activities, particularly for women in smallholder and landless households. Heavy market demand and high prices for chevon have created opportunities to employ a large number of rural people, including unemployed youth, women, aged persons, widows, socially backward (tribal) people, and poor people. Goat rearing enhances livelihoods by providing more income and new or alternative employment; improving food security and nutrition, especially by supplying protein; and contributing to the development of rural areas, which can help slow urban migration (Tiwari and Sharma 2009). Goat rearing benefits not only individuals who engage in this activity, but also other sectors of the community. At the same time, poultry rearing faces a number of problems, including continual outbreaks of bird flu in West Bengal and foreign investment that increases competition with small-scale household producers. Thus goat rearing, especially with the black Bengal goat, may be an attractive option for meeting requirements for meat in West Bengal and in India as a whole, as well as for generating income for smallholders and landless people in West Bengal.

Unemployed Youth

Livestock are also an important source of employment for rural people in West Bengal (GOWB 2004–05). In 2004–05 primary livestock production employed about 4 million rural persons, equivalent to 5 percent of total rural workers in West Bengal (ICAR 2006). Birthal et al. (2003) found small ruminants (that is, goats) contributing 25–75 percent to the income of the smallholders who possessed them. The huge population of India, and of West Bengal, is an impediment to the development of many kinds of infrastructure and to the ecological aspects of any development program. Agriculture's scope for employing all of the available labor is limited. Government and the private sector are also too limited to meet the demands of this huge population for jobs and safety nets. Goatery with black Bengal goat, either individually or on a cooperative basis, can generate income for unemployed (in spite of being highly qualified) youth in West Bengal.

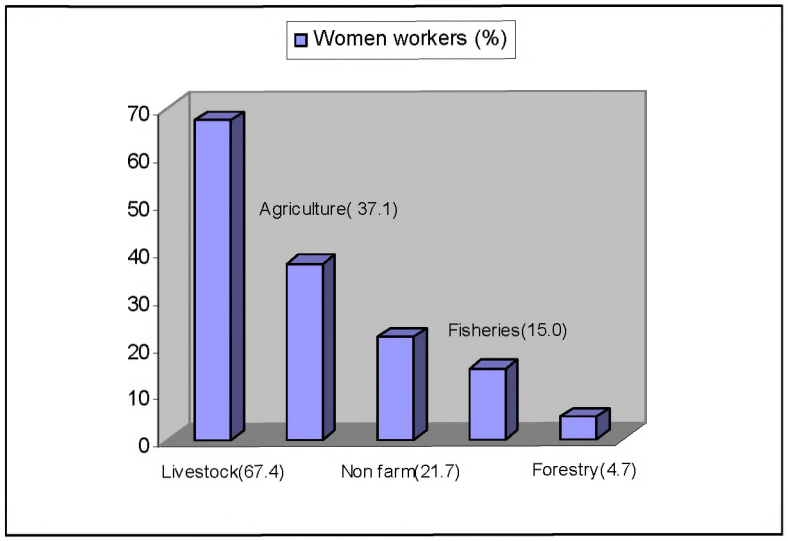
Women

As shown in Table 1, women are important in livestock production. Women are one of the driving forces in rural Bengal because of their round-the-clock management of domestic activities (Hoque and Itohara 2008), but they are mostly dependent on male members of the family to supply their needs and to improve the lives of their children. Goat rearing, especially with black Bengal goat, may give them relief from this disparity. They can easily rear and maintain black Bengal goats on a small scale and better than males, who are often engaged in activities outside the household, and thereby generate income year-round (Deshpande and Sabapara 2010). For example, in one project, goat-keeping women were organized into groups of 5–7 members, which maintained 35–40 does each. One superior-quality black Bengal buck was provided to each group. Vaccination of one-month-old kids provided protection against PPR and reduced mortality from 50 percent to less than 5 percent. Regular deworming and supplementary feed of a mineral mixture increased the goats' body weight. Systematic culling increased the population of this breed. A field guide who brought a spring balance scale assessed the value of goats. The income of participating households increased by 200 percent even in the absence of larger herd size (Hegde 2008).

Widows

Widows, neglected in society, generally do not eat any meat, including chevon, because of social customs and barriers. But they have a keen interest in rearing this species of animal, which provides an opportunity for increasing their incomes and improving their livelihoods (Saadullah, Hossain, and Akhter 1997).

Figure 1: Female Participation in Agricultural Labor in India



Source: Birthal and Taneja (2006), based on data the electronic database "Employment and unemployment situation in India," National Sample Survey Office, India.

Older People

Older people are also neglected by their families. They have little or no income, but they do have time. The black Bengal goat, one of humans' oldest companions, can supply nutrition, protection, support, and above all company to their keepers. Older people may be the ideal caretakers of this particular breed, which can generate income for their day-to-day expenditures.

Socially Backward People (Tribal) and Poor People

This category of people has long reared goats, partly because of scarcity of jobs. Goat rearing, especially of the black Bengal goat, requires little space, few inputs, and cheap and locally available resources, making it a suitable income-generating activity for this group. In addition, generations of experience with goat rearing have given them indigenous technological knowledge about how to treat animal diseases at low cost.

Nongovernmental Organizations (NGOs)

NGOs can effectively promote neglected species of goat and disseminate technologies "from lab to land." They can provide useful information about the black Bengal goat to policy makers. Some NGOs have already initiated goat development projects. For example, the Bharatiya Agro-Industries Foundation (BAIF), along with the JRD Tata Trust, started a project in West Bengal aimed at encouraging goat keepers to practice sustainable goat husbandry; promoting improved breeding through superior breeding bucks; promoting best practices for feeding, health care, and housing; and establishing links with markets to earn better prices. Other NGOs, like the Nature, Environment, and Wildlife Society (NEWS) and the Tagore Society for Rural Development (TSRD), have used this valuable livestock resource as an activity for women's self-help groups. Still, much work remains to be done by the NGOs, as well as the government and private entrepreneurs, to make this valuable resource a tool for sustainable livelihoods for poor people in West Bengal.

The Meat Industry

West Bengal ranks first in goat meat production, accounting for 30.5 percent of total goat meat produced in India. In 2004–05 148,260 MT of goat meat was produced (GOWB 2004–05) from 24.71 million goats, but the state still has no established commercial slaughterhouses, and most goats are slaughtered by households. As a result, the other valuable goat by-product—the skin—loses its value because it is mutilated during slaughter.

Consumers

Consumers are the beneficiaries who ultimately purchase or receive commercially sold food items, consume them, and maintain demand for them. Given that meat is a highly perishable item, they could also play a role in monitoring and evaluating the quality of the product. Where public health is concerned, the consumers can act as "watchdogs" by providing feedback and pressuring regulators to take timely action.

Local Governments including Municipal Corporations

In West Bengal the three-tiered system of local government (*panchayat*), from the district level to the village level, works in a consolidated way and has a separate section dealing with animal husbandry. This local government should help identify potential beneficiaries of goat-rearing projects, recognize their difficulties in rearing goats, and engage in disease surveillance, offering prophylactic and curative care. *Panchayat* livelihood development projects should motivate interested goat raisers and offer them regular training to improve goat husbandry and in turn enable sustainable development.

National and State Governments

Panchayats (local governments) could plan goat husbandry programs drawing on technical guidance from national and state animal husbandry departments. The national and state governments could extend enough technical and financial support to make *panchayats* capable of implementing such programs. These higher-level governments could also establish laboratories for diagnosing and controlling disease, as well as model farms in different areas (some of these already exist). People intending to rear goats could visit these farms to gather information on and experience in goat husbandry.

Policy Options

Over the past three decades, West Bengal has made tremendous progress in food production. Agricultural growth, however, has hardly ever exceeded 3 percent a year. Given the pro-poor nature of agricultural growth, the National Agricultural Policy (GOI 2000) set a target of 4 percent annual growth in the agricultural sector by 2020 and emphasized livestock as an important driver of growth. The policy statement focused on the need to (1) formulate a livestock-breeding policy to increase livestock production and enhance the use of draft animals as a source of energy; (2) generate and disseminate livestock-related technologies to improve animal productivity; (3) improve marketing, processing, and transportation facilities for value addition, (4) manage grazing lands and rejuvenate pastures; (5) establish disease-free zones; and (6) involve cooperatives and the private sector in development efforts. The statement also emphasized raising incentives for livestock production on a par with those for crop production (Birthal and Taneja 2006).

The Government of India, state governments, and research organizations have analyzed the possibilities for improving and conserving the black Bengal goat (IAEA 2007). Some policy options are as follows:

1. *Use low-cost, unconventional feeding practices.* The geography of West Bengal varies considerably, with elevation differences and six agroclimatic zones (the hill zone, the terai zone, the old alluvial zone, the new alluvial zone, the laterite and red soil zone, and the coastal saline zone). Livestock feed differs by zone. For various reasons, little green fodder is produced. Widespread research was initiated in the different agroclimatic zones of West Bengal to increase milk production in cattle through the use of low-cost and unconventional feeding. The use of locally available, low-cost, unconventional feed resources, such as jackfruit leaves and bamboo leaves, can increase the growth rate of black Bengal goats and cost-effectively promote high-quality meat and skin. Animal nutritionists must create low-cost feeds that provide the necessary macro- and micronutritional elements.
2. *Improve access to inputs.* Smallholder goat producers need to have access to inputs such as feed, grazing land, animal health services, credit, and risk-mitigating mechanisms (such as insurance). Feed is scarce in arid and rainfed regions, and in some irrigated regions, roughages (mainly rice and wheat straw) are surplus and often burnt after harvest instead of being fed to livestock. Policies are needed to procure,

store, and transfer surplus fodder to fodder-scarce regions (Birthal and Taneja 2006).

3. *Establish preventive animal health services.* Despite considerable expansion of veterinary infrastructure and manpower, delivery of livestock services and information remains poor in West Bengal and in India. Animal health services have focused largely on curative measures and neglected preventive measures. Given that infra-structure and manpower are not significant constraints, marginal investments in prophylactic measures can yield higher dividends. As an initial step, policy makers could create some disease-free zones, using regular monitoring and surveillance, emphasizing both prophylactic and curative measures, and creating ideal conditions for animal rearing (Birthal and Taneja 2006).

4. *Conduct research to optimize the survival of goats.* A well-managed goat is less likely to succumb to disease than a poorly managed one. Diseases such as PPR, foot-and-mouth disease, brucellosis, and pustular dermatitis are widely prevalent in different regions. Research on goat health is required to reduce the mortality rates of these valuable goats.

5. *Conserve high-quality black Bengal goat germplasm.* Conservation is the management of human use of the biosphere so that it may yield the greatest sustainable benefits to the present generation while maintaining its potential to meet the needs and ambition of future generations. In recent years, the black Bengal goat has been subject to cross-breeding with other breeds of goat and inbreeding because of the paucity of suitable black Bengal bucks. These practices have led to several complications in the offspring, such as reduced disease resistance, high morbidity rates, and low growth rates. Conservation of high-quality and native pure black Bengal goat germplasm is crucial to overcoming these problems. Goat owners should be informed about the utility of this important breed and advised to breed goats within the same breed, which will help maintain the world-famous, high-quality meat and skin (Sastry and Thomas 2005). Government agencies and research institutions, especially extension services, may play pivotal roles here.

6. *Increase the productivity of meat production.* From 2004 to 2007, India's total meat production increased from 5.9 million tons to 6.5 million tons, but the share of chevon in total meat production fell from 8.6 percent to 8.34 percent, even though the number of goats slaughtered increased every year (FAO 2007). Thus, although demand for chevon increased, the productivity of goat production remained unchanged or even declined. This finding has raised a challenge for animal scientists, who need to orient their research activities to increase productivity. The state of West Bengal has a huge population of goats, especially black Bengal, but the dressing percentage is low, at nearly 50 percent. Although there is a strong market for chevon (partly because there is no religious taboo against consumption of goat, as there is for beef and pork), the low dressing percentage of the black Bengal goat has been an impediment to rural goat farmers. New technologies, including biotechnology, have the potential to revolutionize animal production. Administration of a growth hormone known as exogenous somatotropin (ST) is one biotechnological tool that can increase food output (meat or milk) per unit of feed input. In addition to raising the efficiency of food production, ST can result in environmental benefits through reduction of animal waste and decreased expenditures for feed production, including fertilizer and other inputs associated with growing, harvesting, processing, and storing animal feed. Biotechnology can also help reduce the fat content of fresh meat and its products. Many studies have shown that ST effectively alters nutrient use in growing animals in a manner that markedly reduces the amount of carcass fat. This fat, when consumed by humans, contributes to their low-density lipoprotein cholesterol levels, a major risk factor for coronary heart disease. Researchers could also increase per capita goat meat production by introducing good animal breeding practices, like selecting high-quality animals for

breeding and developing careful cross-breeding programs.

7. *Increase value added.* Another important related issue is improving value addition to goat products. At present, only about 2 percent of all meat output undergoes value addition. The prices of processed goat meat products are high because of a lack of economies of scale in processing, as well as high packaging and storage costs. Improvements in value added are necessary to sustain expanding markets, strengthen exports, and counteract the threat of cheap imports. Public action is required not only to invest in infrastructure, but also to encourage the private sector to invest in meat processing and cold chains (Birthal and Taneja 2006).

Assignment

Your assignment is to advise national policy makers and state animal resources development departments to formulate a strategy to improve the livelihoods of small and marginal farmers in West Bengal through improved productivity and use of the black Bengal goat and to conserve the related germplasm.

Additional Readings

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