

LIVESTOCK REVOLUTION AND ITS IMPACTS ON THE SUSTAINABILITY OF MARGINAL AND SMALL FARMERS IN INDIA: A CASE STUDY

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Abstract

Livestock Revolution and Its Impacts on the Sustainability of Marginal and Small Farmers in India: A Case Study

Livestock husbandry is an important segment of Indian agriculture. Its share of contribution to agricultural gross products has increased since the implementation of the globalization of agricultural trade. Livestock revolution has occurred not only in India, but in all tropical developing countries, owing to recently increasing demand for animal-derived products in national and international markets. We selected Aligarh, a micro geographical unit from the Upper Ganga plain of Uttar Pradesh for this study. 600 households from 12 villages in the area were surveyed for collection of data. The study revealed that the region witnessed growth in livestock husbandry with selected species during 1993-1994 to 2003-2004. Buffalo and goats showed a positive change due to enhancement in the demand of milk and meat on account of increasing urban consumers, liberalization of agri-business and the changing of food habits over the decades. Cattle numbers have contracted owing to the mechanization of agriculture and the prohibition of cow slaughter in the country. Two thirds of livestock keepers, workers and beneficiaries are poor farmers with less than 3 hectares of land holding. The majority of them follow the livestock-cropping integrated farming system, which is highly beneficial rather than rearing livestock exclusively. Livestock husbandry is an economically viable, socially acceptable and environmentally sustainable farming system in the study area of the Aligarh district.

Keywords

sustainable, economic viability, livestock revolution

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1. Introduction

Livestock husbandry emerged as an important diversified form of farming systems in developing countries, especially in tropical monsoon Asian countries recently (Khan et al 2008). It is an allied and complementary activity to existing cropping systems. A large segment of workforce of these various countries has been employed in this sector of agricultural economy. Livestock husbandry is looked at as having a latent potential and boon for employment generation and poverty alleviation in poor resource regions (Picca 2008; Leonard 2006). The generation of income through various operations i.e. rearing, milking, marketing and processing, and the cultivation of crops should also improve the economic viability of poor farmers i.e. landless, marginal and small land-holders in the developing world (Taneja 2008; Rama et al 2005). Healthy nutrition and food security is also expected to be improved through increasing animal derived food availability and accessibility after development of the livestock sector. Soil fertility is maintained through the use of animal wastes such as manure used as natural fertilizer. Soil ecology must also be balanced (Alan 2007; Fakoya 2007).

The livestock sector developed tremendously over the last two decades in tropical developing countries of Latin America, Africa and Asia. Demand for animal derived products grew at international and national levels in most of these nations. The liberalization of agri-business, an increase in the number of urban consumers, changing eating habits from vegetarian to animal derived food as well as increasing health consciousness are the driving forces of the accelerating demand for livestock products like milk and meat. This kind of abrupt and fast growth of this sector has characterized this livestock growth as a livestock revolution (Delgado et al 1999, 83).

The revolution also has much challenge in the way of achieving successful targets. Intensification and scaling up of livestock and allied industries usually managed by corporate sectors present a threat to the survival of small farmers, enterprises and the ecological balance in the concerned areas (Steinfeld 2006, 407). Increasing pressure of livestock per unit area of pastureland in arid, semi arid and mountainous regions has accelerated the degree of soil degradation and desertification through over grazing (Alan 2007). A high demand for feed grains as well fodder has resulted in more hectares of land needed for these crops and, consequently, excess amounts of water are drawn from underground for irrigation with a view to keep up the regular supply of animal feed throughout the year. This pattern of demand for land and water presented a grim situation in food security and water crises during the post economic reform period at a global level. Mismanagement of livestock waste, both solid and liquid, caused soil and water pollution. Global warming is also encouraged through the addition of green house gases produced by livestock and decomposing animal waste (The World Bank 2006, 63). An animal and human epidemic has also been spreading due to the increase of livestock rearing (Hoffman 1999).

Livestock husbandry has been well rooted in the Indian agricultural system since ancient times, but the scale of production has been subsistent in nature and the method of rearing, traditional in nature. Commercial or market oriented production systems developed to a minimum level, on a small scale, and usually in peri-urban areas. Animals like cows are considered to be religiously sacred by the majority of the population. The country ranked first in cattle and buffalo numbers in the world.

In the case of small rudiments i.e. goat and sheep, India also occupied the third and fourth positions at a global level. The poultry sector of livestock husbandry also showed a higher level of contribution in the world with a share of 4.25%.

1.1 Objectives of the study

In this study, the researchers aim to understand the following issues and objectives at a micro level in the geographical unit known as Aligarh district, which is located in the Upper Ganga plain in western Uttar Pradesh. The study area covers an area of 3,700 km² with a population of 2.90 million. 74% of the population resides in rural areas and 65% of the workforce is engaged in agriculture, including livestock husbandry. The objectives of the study are as follows:

- The pattern and growth of livestock and their products in the study area.
- Socio-economic structures of livestock farmers or farmers and levels of employment generation.
- Economic viability and sustainability of livestock husbandry and cropping system.

1.2 Geographical Outlook of Study Area

Aligarh district is an important district located in the western part of Uttar Pradesh at a distance of 130 kilometres from Delhi, in the central part of Ganga–Yamuna doab. It is bounded by the district of Bulandshahr in the north, Hathras in the south, Etah in the east and Mathura in the west and south-west. Aligarh is separated from Badaun district by the extreme north-eastern boundary of the Ganga River, whereas the extreme north-western boundary, formed by the river Yamuna, separates Aligarh from the Gurgaon district of Haryana state.

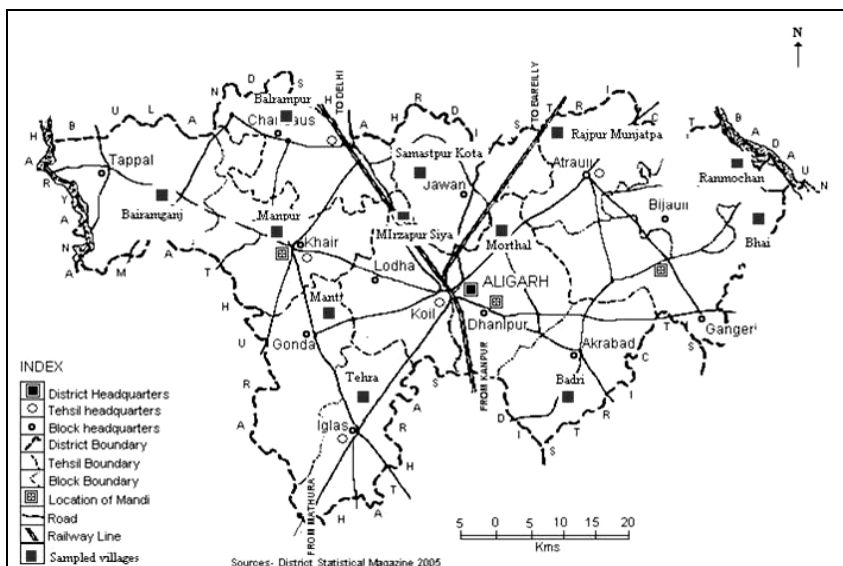


Fig. 1: Aligarh District research area.

The total area of the district is 3,700 km² with a population of 2,992,286 as of 2001. The maximum extent of the district from east to west is 116 km and the maximum

extent from north to south is about 62 km. The shape of Aligarh district is dominated by an east-west protrusion. The district has been divided into 5 tehsils namely, Atrauli, Gabhana, Khair, Koil and Iglas. These tehsils are further subdivided into 12 development blocks, namely, Atrauli, Gangiri, Bijauli, Jawan, Chandaus, Khair, Tappal, Dhanipur, Lodha, Akrabad, Iglas and Gonda, which include 1180 villages. Information regarding sampled villages is given in Tab. 1.

All the villages are dominated by poor farmers. Most of them practice the mixed livestock-cropping integrated farming system. These villages are served by pucca road (metalled road). The houses in the area consist mostly of thatched roofs except those belonging to large farms. Bairamganj in Tappal block is dominated by Brahmn (high caste), Mirzapur Siya in Lodh block and Morthal in Dhanipur are dominated by a Muslim population, Tehra in Iglas block is dominated by Hindu Rajput, and the rest of the sampled villages have mixed populations.

Tab. 1: Basic data of the sampled villages in Aligarh district.

Blocks	Villages	Total household	Total population	Total male population	Total Female population
Khair	Manpur Kalan	103	588	316	272
Tappal	Bairamganj	116	637	317	320
Atrauli	Raipur Munzapta	369	2408	1302	1106
Bijauli	Ranmochna	217	1389	778	611
Gangiri	Bhay	104	637	362	275
Iglas	Tehara	274	1655	895	760
Gonda	Mati	233	1474	783	691
Lodha	Mirzapur Siya	113	921	513	408
Dhanipur	Morthal	334	2125	1130	995
Akrabad	Badri	79	465	230	235
Jawan	Samastpurkota	190	1279	709	570
Chandaus	Balrampur	78	623	330	293
Total		2210	14201	7665	6536

Source: Field survey 2007-2008

1.3 Research Methodology and Data Collection

This, a micro level study, is based mainly on a primary source of data. The information regarding economic aspects of livestock and livestock farmers is not available in published form. 12 villages, one from each development block, were selected for a detailed survey. 50% of the total households of each selected village were questioned regarding various issues of livestock husbandry. The livestock farmers were classified as landless, marginal (0-1 hectare), small (1-2 hectares), medium (2-3 hectares) and large (more than 3 hectares) on the basis of the size of holdings.

In total, 600 households were surveyed. Secondary data was also collected from agricultural statistics published from district headquarters. Collected data was processed and presented in tabular form and analyzed for the purposes of deriving concrete and precise results.

2. Results and Discussion

2.1 Pattern and Growth of Livestock

Livestock husbandry is an important segment of the agricultural system in study area. All kinds of bovines i.e. cattle, buffalo, goat and sheep are reared along with the cropping of various crops. The district of Aligarh exhibited a domination of buffalo rearing followed by goats, cattle and sheep. Buffalo shared 67.78% (715,774 heads) of the total livestock reared in 2003-2004. Goats, with 187,111 heads, ranked second, and cattle, with 143,620 heads, stood at third position as is evident from the data (Tab. 2). The ratio between individual livestock species and area and population also showed the same pattern of buffalo domination in the composition of the livestock in the area under study.

Tab. 2: Present scenario and growth of livestock in Aligarh district.

Livestock Species	Livestock Number		Growth in percent	% to total livestock	Livestock /000 persons (2003-04)	Livestock /hectare (2003-04)
	2003-04	1993-94				
Buffalo	715774	550551	+30	67.78	239.20	2.39
Cattle	143620	192593	-25.42	13.59	58.63	0.48
Goat	187111	185259	+1.00	17.72	187.51	0.70
Sheep	9587	18532	-48.26	0.90	03.20	0.03
Total	1056092	946935	11.53	100		

Source: District Statistical Magazine, 2006.

The livestock sector has witnessed upward dynamism in terms of their number and their products (e.g. milk and meat) during the last three decades on account of technological change, government incentives and changes in the world economic order. A positive trend of 11.53% for livestock as a whole has been observed through the data analysis of two points of time i.e. 1993-1994 and 2003-2004. The analysis of growth of individual species showed very disappointing results. Cattle and sheep declined at the rate of 25.42% and 48.26% respectively from 1993-1994 to 2003-2004. Mechanization of agriculture reduced the demand of oxen (male cattle) in agriculture, as they had been used for ploughing the land and transporting the agricultural products from the farmhouse to the markets. Prohibition of slaughtering of cattle, especially cows, due to religious reasons, has also discouraged the rearing of cattle in the study area. The production of milk per cow is also rather low when compared to buffalo.

Sheep rearing is a caste specific occupation. Gadadia (shepherd), a backward community, reared sheep, which became uneconomical due to their inferior quality of wool and meat. Squeezing of common or public grassland is one of the serious problems suffered by farmers in this small ruminant in Aligarh district. The number of buffalo jumped up from 550,551 heads to 715,774 heads recording an exceptional positive change to the tune of 30% in the decade between 1993-1994 and 2003-2004. This kind of abnormal growth of buffalo in comparison to other species is attributed to the scheme of Flood Operation to enhance milk production, the increasing demand of meat in national and international markets due to increasing urbanization, the improvement in purchasing power among middle income households, the changing food habits from vegetarian to animal-derived foods and the

liberalization of agricultural trade under the auspices of the WTO. Aligarh Muslim University, with an enrolment of 30,000 students, is a good market for buffalo meat. The newly established four-meat industry near the town of Aligarh has accelerated the demand for 3,000 buffalo every day for the production of meat, which is exclusively exported to 22 countries in middle-east, south-east, central and west Asia (Allana 2005).

The goat, a small ruminant, also showed amelioration during the discussed period, but at a rather slow rate compared to buffalo. The rearing of this species became very popular recently in households of poor families with a larger interest from females. Goat rearing emerged as a new option for enhancing the economic power of women irrespective of any social class in rural areas of the district. Goats require low capital and can be fed on grasses and straw from growing crops. The demand for goat meat (mutton) is increasing day by day, as it is widely acceptable in all-ethnic groups of the Indian population in the country, unlike beef.

2.2 Economic Stratification and Livestock Husbandry

Livestock husbandry is rooted in the agricultural structure of the study area. Data revealed that 90% of total households of the selected villages are involved in various processes of livestock rearing (Tab. 3). The households of livestock husbandry belong mainly to poor farmers. Landless, marginal and small farmers with less than one hectare and one to two hectares of land-holding, respectively, belong to 75% of livestock rearing households in the study area.

Tab. 3: Economic stratification of livestock farmers in Aligarh district.

	Number of households surveyed	% of the total households and rearing households surveyed
Livestock Rearing Households	500	83.33%
Landless	75	15%
Marginal Farmer (less than 1 hectare)	100	20%
Small Farmer (1-2 hectares)	200	40%
Medium Farmer (2-3 hectare)	75	15%
Large Farmer (> 3 hectares)	50	10%

Source: Field Survey, 2007-2008.

These groups of farmers, with the exception of a few landless farmers, follow mixed farming practices with integration of livestock and crops. All adult family members are involved in this system and harness the maximum possible potential of livestock and cultivated crops. One fourth of livestock farmers are from larger-sized farms i.e. more than 3 hectares of land. They also follow the same system of livestock-crop integration as the former group of poor, but the involvement of household members is rather low. Hired workers are employed for livestock husbandry.

2.3 Economics of Livestock Husbandry

Livestock husbandry is a capital-intensive activity. It needs investment for the purchasing of animals, fodder, feed grains, oil cakes and some other concentrates and labourers to care for the livestock for feeding, grazing and milking. The cost of rearing varies with the nature and kinds of livestock. The assessment of the cost

incurred for various species of livestock is given in Tab. 4 and Tab. 5.

Tab. 4: Input assessment incurred for rearing of livestock per annum.

Source: Field Survey, 2007-2008.

Livestock Species	Input cost/head/year (in 1000s of Rs.)					
	Purchase	Fodder	Feed grain	Oil cake	Labour	Total
Buffalo	25	9	14.32	5.66	6	49.98
Cattle	10	8	14.32	5.00	6	43.32
Goat	25	1	20	-	1	6.50
Sheep	25	-	-	-	1	3.50

Tab. 5: Output assessment incurred for rearing of livestock per annum.

Source: Field Survey, 2007-2008.

Livestock Species	Output/head/annum (in 1000s of Rs.)				
	Milk	Dung cake	Manures	Offspring	Total
Buffalo	53	13.44	2	2.50	70.95
Cattle	36	10	2	2	50
Goat	1.50	-	1	7	9.50
Sheep	-	-	1	5	6

Note - 1 U.S. dollar is equivalent to 58 rupees.

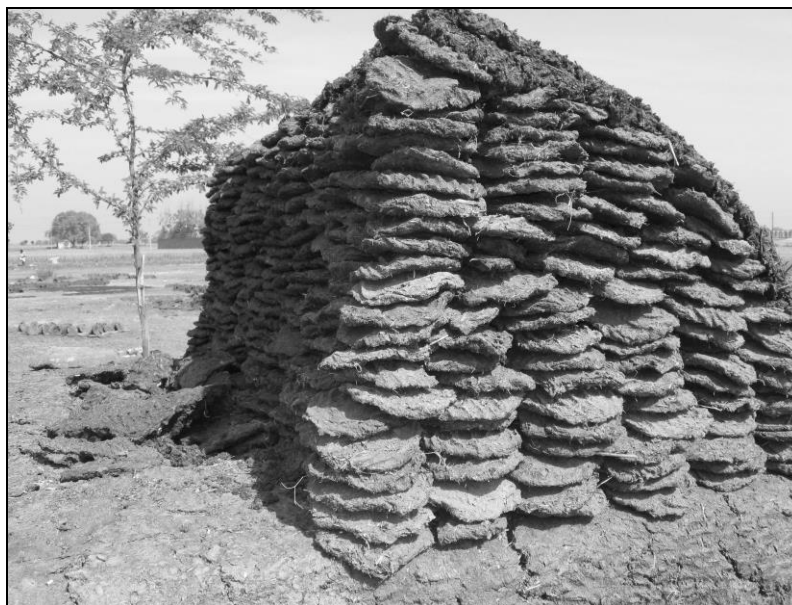


Fig. 2: Heap of Dry Dung Cake for Marketing.

Source: Author

The estimated costs of rearing for buffalo and cattle are very high due to initial high capital: Rs. 25,000 for buffalo and Rs. 10,000 for cattle is required for purchase.

Contrary to this, goats and sheep require low capital, or less than Rs. 3,000 per head, so they are known as the poor and women’s resource. The cost incurred for fodder, feed grain and concentrate is also higher for big ruminants rather than smaller ones.

Tab. 6: Input - output cost/head/annum difference (Rupees) for Various Species of livestock.

Livestock species	Input minus purchase cost	Output Price	Difference	Livestock	Input minus purchase cost	Output Price	Difference
Buffalo	34,320	70,948	36,628	Goat	4,000	9,500	5,500
Cattle	33,320	50,000	16,680	Sheep	1,000	6,000	5,000

Source: Field Survey, 2007-2008.

The production cost per head of cattle and buffalo also varies with the livestock specific and livestock-cropping integrated system adopted by livestock farmers (Tab. 7). In the exclusive livestock rearing system, the cost of rearing is rather high because all kinds of fodders, feed grains and other materials required for animal feeding need to be purchased from markets or external sources. In the latter case, the same materials are recycled or obtained from crop’s products or from products like straw or residues.

The benefit or out-input ratio is higher in the livestock crop integrated system in comparison to the livestock specific system owing to the adjustment of mutual by-products, which reduces the production cost per unit of livestock and land. Analysis of cost and price with reference to the size of holdings/categories of farmers showed a variation in benefits achieved per unit head of livestock.

Tab. 7: Cost-benefit analysis for buffalo or cattle rearing/head/annum based on size of land-holdings.

Source: Field Survey, 2007-2008.

Input items	Landless Livestock farmers (only)	Livestock-Cropping integrated (Mixed farmers) Farmers				
		Landless	Marginal (Less than 1 hectare)	Small (1-2 hectares)	Medium (2-3 hectares)	Large (>3 hectares)
Labour	-	-	-	-	3000	6000
Feed grain	14320	13000	13000	10000	-	-
Fodder	-	-	-	-	-	-
Concentrate	5660	3600	3600	3600	-	-
Crop Residues	9000	4000	4000	3000	-	-
Other	1000	1000	1000	1500	2000	2000
Total (Input)	29980	21600	21600	18100	5000	8000
Total (Output)	70948	70948	70948	70948	70948	70948
Benefit	40968	49348	49348	52848	65948	64948

Medium sized landholders received the highest benefit per head. Large holders, small, marginal and landless farmers who practice the livestock-cropping integrated system follow. The return for livestock rearing is directly proportional to the size of holding of the farmer. Medium sized landholders receiving the highest profits can be

attributed to the availability of all kinds of livestock feeds from crops and free labourers from household members. Contrary to this, for large farmers, the input cost is rather high due to the use of hired labour for all kinds of operations performed for livestock husbandry, though feed, fodder, concentrates, etc. are fully available from the cropping system. The poor farmers cost of inputs is higher due to the purchase of feed grain, fodder, concentrates and so on from outside the farm. A partial amount of all forms of animal feed is obtained from crop products on poor farms, but the labour is free, as household members employ themselves in this form of agricultural system.

Goats appeared to be more beneficial for the poor because they do not require much initial capital for purchase. The rearing cost incurred is also very low, as their survival is based on grazing rather than feeding at home. Goats are considered to be the poor and women's cows and a latent economic resource. Above all, poor farmers with less than 3 hectares of land controlled 90% of livestock husbandry.

2.4 Employment through Livestock Husbandry

Livestock husbandry employs a great share of the workforce available in the study area. 83% of the workforce of households surveyed in the rural areas was found to be involved directly or indirectly in livestock husbandry. The proportion of livestock workforce to total workforce is directly related to the size of land-holdings, up to medium farmers, which range from 50-90%, while large land-holders absorb only 20% of their workforce in the livestock sector (Tab. 8).

The share for various categories of farmers in the total livestock workforce varies with the size of holding. Marginal and small farmers showed a higher share of employment (20% and 40%) in this sector of the agricultural economy. Medium and landless holders contributed 15% each. Large farmers shared only 10% of total livestock workers in the selected villages. The study revealed that rearing employs the largest proportion (71.81%) of livestock workers in the study area; it varies between 66% and 86% among different categories of farmers. In rearing, the size of landholding is directly proportional to the share of livestock workers, with the exception of medium farmers.

The marketing of livestock and their products engaged only 14.40% of the total livestock workforce. Marginal and medium farmers employed 21 and 22% of their livestock workers in the marketing process. Contrary to this, large farmers showed very low participation in the same activity. Similarly, collection and processing also exhibited variation in involvement of livestock workers with the categories of livestock keepers. 13% of livestock workers in the study area are engaged in the processing of livestock products. Landless livestock workers represented the highest proportion (17%) in this operation (Tab. 8); small, marginal, medium and large farmers follow in descending order, as shown in the table.

The highest share of livestock workers involved in processing activities on landless farms is attributed to the absence of employment in any other sector of economy. Part time engagement in agriculture as seasonal labour also urged landless farmers to adopt a permanent secured economic activity. The least amount of participation by the large farmers is caused by availability of sufficient jobs in agriculture and their social status discouraging them to process milk or meat.



Fig. 3: Women from Marginal Farms Milking Buffalo.
Source: Author.

Tab. 8: Proportion of workers in various operations of livestock husbandry.

Farmers	% of livestock workers to total workforce	% of livestock workers	% of Workers in Various Operations of Livestock husbandry to the total livestock workforce.			
			Rearing Producers	Marketing	Collecting and processing	Total
Landless	50%	15%	50 (66.66)	12 (16)	13 (17.00)	75 (100)
Marginal	70%	20%	68 (68)	21 (21)	11 (11)	100 (100)
Small	75%	40%	146 (73)	22 (11)	32 (16)	200 (100)
Medium	90%	15%	52 (69.33)	15 (20)	8 (10.66)	75 (100)
Large	20%	10%	43 (86)	2 (4)	5 (10)	50 (100)
Total	83.33%	100%	359 (71.18)	72 (14.4)	69 (13.80)	500 (100)

Source: Field Survey, 2007-2008.

2.5 Livestock–Cropping Integrated System and Sustainability

Livestock husbandry in the study area is practiced mainly in two forms: the exclusive livestock and livestock–cropping integrated systems. 90% of farmers have been following the second system traditionally since ancient times. It is a well-integrated system for the most efficient management of livestock and crop-derived products utilization through the recycling process. The study revealed that this system proved to be more economically viable than the exclusive livestock system in which all feed and fodder are purchased and obtained from outside the farm. 93.40% of respondents during the survey period replied that the integrated system is practiced for the generation of extra income. Meat and milk production, forage linkage, and sustainable food production were preferred second, third and fourth, respectively. Soil fertility enhancement along with the reducing of crop risk are also very important benefits of mixed farming, but were placed at fifth and sixth place.

The use of livestock as draft power in transportation and cultivation of crops declined on account of intensive mechanization of agriculture. In this way, in the integrated system of livestock husbandry, sustainability is maintained through the continuous cycle of resources, energy and nutrients. Livestock rearing supports crop production in the form of provision of draft power and manures. It also diversifies the source of income through the sale and purchase of livestock and livestock products like milk and meat, which improve the capital asset to invest in agriculture. In return, the crop residues, fodder and feed grains are used for feeding livestock in either managed enclosures (cattle pan) or through post-harvest grazing. Farmers, however, maximize the production from limited land and capital, enhance income through diversification of employment opportunities, minimize the crop risk and improve food and health security. The crop-livestock farming system is a highly economically viable, environmentally sustainable and socially acceptable form of agriculture in the study area as revealed from analysis of the data.

Tab. 9: Operational features of the crop-livestock production system for sustainable development.

Utilization of crop-livestock Production systems for:	Landless	Marginal Farmers	Small Farmers	Medium Farmers	Large Farmers	Average	Rank
1-Extra income	99	99	99	90	80	93.4	I
2-Sustainable food production	90	85	80	80	50	77	IV
3-Enhance soil fertility	50	50	80	90	90	72	V
4-Meat and milk production	100	100	90	85	80	91	II
5-Transportation	30	40	50	40	20	36	IX
6-Draught power	90	90	30	10	5	45	VIII
7-Reduce risk	45	45	79	85	90	68.8	VI
8-Forage linkage	90	90	90	85	70	81	III
9-Waste disposal	50	50	60	70	90	64	VII

Source: Field Survey, 2007-2008.

Note: Figure shows percentage of respondents who answered the queries.

3. Conclusions

Livestock husbandry is practiced as an integral and complementary system to agriculture in the area. The mechanization and modernization of the cropping sector and increasing demand for livestock products, especially meat and milk, brought a dramatic change in the composition of bovine species of livestock. Buffalo stand highest in the ranks, pushing back cattle in recent years. Cattle's rearing has been continuously discouraged on account of the mechanization of agriculture and prohibition of meat production for religious reasons. Small ruminants like goats showed improvement in their numbers at a very slight rate, though demand for meat is high. For this reason, they are reared by poor and female workers in very traditional ways. No commercial or intensive farming is done in the study region. Similarly, buffalo have recorded the highest growth in their numbers over the last decade in response to the growth of demand for milk and meat at national and international levels.

The study area follows exclusive livestock as well as integrated livestock-cropping or mixed farming systems. 83% of farmers follow the second system, mainly landless livestock keepers. Poor farmers with less than 3 hectares of holdings control live-

stock husbandry. Livestock husbandry is a diversified source of income and employment for them to enhance their income during the agricultural off-season. More than 70% of the workforce under these categories is employed in this sector.

The comparative cost and benefit analysis of livestock rearing in the district revealed that the integrated livestock-cropping system is more profitable than the exclusive livestock system on account of lower input costs adjusted through the use of livestock feed and fodder from residues of crops from their own fields. Medium sized landholders achieved the highest amount of benefit per buffalo/cattle/year due to the availability of animal feeds free of cost from their own crops and through the use of maximum amount of labourers from household members. Large farmers are found to be less involved in livestock husbandry directly and depend upon hired labourers for rearing livestock. The availability of sufficient full-time employment in the cultivation of crops as well as in other sectors of the economy are the main factors for low participation by large farmers in the rearing of livestock.

The livestock-cropping integrated farming system is well rooted in rural areas. Optimal utilization of animal products/by-products in the cultivation of various crops and the use of crop residues and by-products for rearing animals have resulted in the improvement of economic viability of agriculture and sustainability for poor farmers who follow the system. Soil fertility is also maintained through the use of cow manure as fertilizer directly. The production of biogas is also used for cooking food and other work, which can save energy. Proper management of livestock and crop-derived wastes could reduce environmental pollution and increase the level of sustainability of the environment. Moreover, livestock rearing undertaken by poor farmers, with the cultivation of distinct crops, is the key and boon for poverty alleviation at the national level. Integrated crop-livestock farming is an economically viable, environmentally sustainable and socially acceptable farming system in the study area.

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Summary

Livestock husbandry is an important segment of Indian agriculture. Its share of contribution to agricultural gross products has increased since the implementation of the globalization of agricultural trade. Livestock revolution has occurred not only in India, but in all tropical developing countries, owing to recently increasing demand for animal-derived products in national and international markets.

The mechanization and modernization of the cropping sector and increasing demand for livestock products, especially meat and milk, brought a dramatic change in the composition of bovine species of livestock. Buffalo stand highest in the ranks, pushing back cattle in recent years. A cattle rearing has been continuously discouraged on account of the mechanization of agriculture and prohibition of meat production for religious reasons. Small ruminants like goats showed improvement in their numbers at a very slight rate, though demand for meat is high. For this reason, they are reared by poor and female workers in very traditional ways. No commercial or intensive farming is done in the study region. Similarly, buffalo have recorded the highest growth in their numbers over the last decade in response to the growth of demand for milk and meat at national and international levels.

Livestock husbandry is a diversified source of income and employment for them to enhance their income during the agricultural off-season. The comparative cost and benefit analysis of livestock rearing in the district revealed that the integrated livestock-cropping system is more profitable than the exclusive livestock system on account of lower input costs adjusted through the use of livestock feed and fodder from residues of crops from their own fields. Optimal utilization of animal products/by-products in the cultivation of various crops and the use of crop residues and by-products for rearing animals have resulted in the improvement of economic viability of agriculture and sustainability for poor farmers who follow the system. Soil fertility is also maintained through the use of cow manure as fertilizer directly. The production of biogas is also used for cooking food and other work, which can save energy. Proper management of livestock and crop-derived wastes could reduce environmental pollution and increase the level of sustainability of the environment. Moreover, livestock rearing undertaken by poor farmers, with the cultivation of distinct crops, is the key and boon for poverty alleviation at the national level. Integrated crop-livestock farming is an economically viable, environmentally sustainable and socially acceptable farming system in the study area.