LIVESTOCK IN DIFFERENT FARMING SYSTEMS

Compiled by

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Livestock in the Household Economy
Livestock in the Household Economy

U.K. Pandey
CCS Haryana Agricultural University, Hisar

1. Introduction

Animal husbandry in India is closely interwoven with agriculture since ages and plays an important role in the rural household economy. It is the principal source of draught power in rural areas possesses the vast employment potential and provides milk, meat and eggs, and thereby improves the nutritional security. It is, besides, an important source of manure and domestic fuel. A special feature of Indian animal husbandry is that it is predominantly rural, an integral adjunct to crop husbandry and this contributed towards the sustainability of rural countryside. Recent decades have witnessed major changes in this sector and a significant expansion in the output of some of its components. Yet the transformation of livestock sector varies across regions and farming systems due to changes in social and economic forces on the one hand, and systems of livestock production, their efficiency and profitability on the other. Accordingly, an attempt has been made in this paper to assess the temporal spatial changes in livestock wealth and also their contributions. More specifically, the objectives of this study are: (i) to examine the region wise inter-census growth, compositional changes and density of livestock and poultry together with their contributions, and (ii) to understand the lessons emanating from the various cross-section rural households studies on livestock.

2. Data and Methodology

The study is based on secondary data published in the Livestock Censuses of India (Government of India, 1987 and 1992). Besides tabular analysis, per annum compound growth rates were computed to indicate an increase or decrease in the livestock and poultry population during the inter-census periods (1972-82 and 1982-92). Based on the compound growth rates for 1982-92 inter-census period, changes in population of draught animals, small ruminants, poultry and piggery enterprises are presented in sections II to V, while the last section outlines the issues for in depth studies.

3. Structural Changes in Population and Contribution

3.1. Bovine and draught animals

3.1.1. Compound growth rates: At the all-India level the indigenous cattle in milk though have increased at the annual rate of 1.31% during 1972-82 inter-census period yet it declined at the annual rate of 0.15% during 1982-92 inter-census period. The growth of buffalo population in milk was at an annual rate of 1.79 and 3.21% during 1972-82 and 1982-92 inter-census periods, respectively. The cross-bred cattle in milk have, however, increased at an annual rate of 6.22 percent during 1982-92 (Table 1). Across regions, though the indigenous cattle in milk have increased in various inter-census periods (except during 1972-
82 in the northern and during 1982-92 in the southern and eastern regions), yet the eastern region accounted for the highest increase during 1972-82 inter-census period followed by the western region. Except for the southern region, though the crossbred cattle in milk have positively increased during 1982-92 inter-census period, the western region accounted for the highest increase, followed by the northern and eastern regions.

Except for the eastern region in 1982-92, the buffalo population in milk increased across regions in both the inter-census periods with the highest increase in the northern region followed by western region in 1982-92 inter-census period and in southern region in 1972-82 inter-census period. As compared to the indigenous cattle in milk, buffalo population in milk has increased at a faster rate (except for the eastern region in 1972-82), the cross bred cattle in milk have increased relatively at a much faster rate across regions (except for southern region). The higher growth rates in the case of buffaloes and cross bred cattle reflect that the households take more care of these milch stocks because of heavy investments, consumer’s preference for buffalo milk as well as their high milk yields as compared to the indigenous cows, and greater milk production potential of cross bred cattle as compared to buffaloes. The northern region has accounted for the highest increase in buffaloes while the western region for crossbred cattle in milk, the eastern region for indigenous cattle. On the whole, there appears to be a general tendency for maintaining buffaloes for milk production in all the regions, the northern region has tremendous potential for milk production, followed by the western region (Pandey, 1995). Furthermore, the households of eastern region seem to have shifted for the rearing of crossbred cattle over buffaloes and indigenous cattle in 1982-92 inter-census period.

Negative growth is observed for indigenous dry cattle across regions in both the inter-census periods (except for the eastern region and all India in 1972-82). This shows that the number of dry cattle has tended to decrease in those periods. Contrarily, but for the southern region, there has been positive growth in the case of dry crossbred cattle in all the regions and at the all India level. Likewise, dry buffaloes have shown positive growth in all the regions and at the all-India level (except for the northern region in 1972-82, as well as southern and eastern regions in 1982-92). This reflects the fact that, by and large, the number of both dry crossbred cattle and buffaloes have tended to increase over the period. Indeed, it seems that the households have shifted for rearing crossbred cows and/or buffaloes over the indigenous cattle for milk production.

The compound growth rates for youngstock show that; (a) except for the northern and southern regions in 1972-82 while eastern region in 1982-92, the male cattle calves (below 3 years) have mostly increased across regions and at the all-India level, thereby reflecting positive replacement for bullocks, (b) female cattle calves (below 3 years) have also shown a positive trend mostly across regions (except for southern region in 1972-82 and eastern region in 1982-92) showing the replacement rate for breedable cows, (c) youngstock buffaloes (below 3 years) of both the categories have, by and large, observed an increasing trend across regions and at the all-India level during both the inter-census periods, reflecting positive replacement rates, (d) the relatively higher positive growth rates of young stock buffaloes as compared to cattle show the better survival and/or replacement rates of youngstock buffaloes, and (e) the positive growth rates of both cattle and buffaloes (more particularly heifers and young calves) also indicate the farmer’s behaviour of rearing these offspring either for replacement or for sale.

The compound growth rates for draught animals show; (a) camels which occupy a place as draught animals only in the northern and western regions, showed a declining trend in both the inter-census periods (except for northern region in 1982-92), (b) except for eastern region, he-buffaloes showed an increasing trend during 1982-92 inter-census period in northern, western and southern regions including all India, and (c) bullocks, though declined across regions including at all-India level in 1972-82 yet showed a positive trend across-regions and
all-India in 1982-92 inter-census period. The increasing trend of bullocks in post green revolution era might be due to the partial replacement of tractorization, as it requires greater foreign exchange obligations for petroleum products, reduction in the employment of human labour and the increase in air and noise pollution, thereby adding to the social cost of tractorization (Panday, et al, 1983).

3.1.2. Compositional changes: Among indigenous cattle both the absolute and percentage shares of adult males were, by and large, the highest during all the census years across regions, including India as a whole (Table 2). Adult females ranked first in eastern region including India during 1982 census while youngstock ranked first in eastern region during the latest census. Among cross bred cattle, adult females ranked first followed by the young stock and adult males in both the censuses across regions including India, with exception for the northern region wherein adult males and youngstock, respectively, ranked first in 1982 and 1992 censuses followed by the adult females. Likewise, in case of buffaloes both the absolute and percentage shares of adult females were the highest among all the three categories in all the censuses both across regions and at all-India, followed by youngstock (except for the eastern region in 1972 and 1992). A significant number of adult females were also dry among cattle and buffaloes in all the censuses both across regions and at the all-India level.

The percentage shares of females in milk were relatively greater among buffaloes and cross bred cattle than among the indigenous cattle in all the censuses both across regions and at the all-India level. Thus the prominence of buffaloes and crossbred cattle among rural households would continue. Therefore, our efforts should be to concentrate on increasing the number of crossbred cattle and buffaloes in milk to reduce the cost of milk production (by reducing intercalving period) and also to have the better returns from them. Likewise, the percentage shares of indigenous adult male cattle were the highest as compared to buffaloes and crossbred cattle both across regions and at all-India level (Table2). These results confirm the fact that; (a) the indigenous cattle are mainly reared by the households to sustain the draught animal power and indigenous cow’s milk is considered as by-product; (b) buffaloes are considered as the main milch animal, followed by the crossbred cattle to sustain the milk production needs; (c) households try to rear the offspring of these species for replacement and/or sales; and (d) this pattern of rearing animals is primarily based on economic logic rather than on religious grounds.

Although the available cross-sectional information in respect of the distribution of bovines among the individual farm sizes and among the landless rural households for the country as a whole is inadequate yet studies do exist for the individual regions. The distribution of milch animals in rural households is less skewed as compared to land and the productivity of milch animals kept by small farmers does not compare unfavourably with that of large farmers (Patel, 1993). The National Commission on Agriculture had estimated that 70 to 75 percent of the households possessing milch cattle belong to the vulnerable category of small farmers, marginal farmers and landless agricultural labourers (Government of India, 1971, p.13). Dairying, by and large, is a small man’s business. A village enumeration survey conducted by the NDDB in 1984 (Khanna, 1989, p.539 reveals that about 60% of the total rural households own milch animals, generally two or three. Some 72 percent of the families owning milch animals are landless, and small and marginal farmers. The vulnerable group of families accounted for about 61% of total buffaloes and cows in the survey area. Only the large farmers having 4 hectares or more of land holdings kept more than 4 milch animals.

Another study by the National Council of Applied Economic Research, 1991 reveals the fact that 43 % of the member households of milk producer co-operative societies in Operation Flood areas had only one milch animal and almost 75% of the members belonged to the category of landless, marginal and small farmers. Thus, the overall distribution of milch
cattle is much more uniform and less skewed than the distribution of land. The small and
marginal farmers and the landless labourers together with village artisans, rear 1-2 milch
animals mainly on crop residues and by-products with the help of under-employed and
unemployed family labour, especially the female workforce. A recent study conducted in
Haryana observed that the rural households rear on an average one milch cattle while 4-6

Indigenous adult male cattle outnumbered the adult male buffaloes in all the censuses both
across regions and at all-India level, but the adult male buffaloes outnumbered cross bred
cattle adult males in the latest censuses (Table 3). Likewise, indigenous adult-female cattle
outnumbered adult female buffaloes across regions and at the all-India level in all the
censuses (except for the northern region in 1982 and 1992 censuses but the adult female
buffaloes outnumbered crossbred female cattle in the latest censuses. Similarly, except for
the northern region in 1992 census, the indigenous cattle youngstock outnumbered buffalo
youngstock; on the other hand, buffalo youngstock outnumbered crossbred cattle youngstock
in all the censuses across regions and at the all-India level.

On the whole, indigenous cattle outnumbered buffaloes while buffaloes outnumbered
crossbred cattle across regions and at the all-India level during various censuses. Indigenous
cattle population was observed to be the highest in the eastern region in all the censuses while
cross bred cattle were concentrated in the eastern and southern regions followed by the
western region. Furthermore, northern, southern and western regions were observed to be
important from the point of view of rearing buffaloes for milk production. Among these
milch animals, the crossbred cattle had the highest lactating efficiency, followed by buffaloes
in all the censuses and regions.

3.1.3. Density: The stocking rates of bovines show significantly regional disparities (Table 4).
The eastern region has the highest cattle density while in northern region density was the
highest for buffaloes. On an average, every 100 hectares of cropped area in the country
sustained 55 indigenous cattle, 6 crossbreds and 40 buffaloes including their youngstock. The
eastern region sustained 71 indigenous cattle while the northern region sustained 59 buffaloes
including young stock per hundred hectares of cropped area. The density of crossbred cattle
including their youngstock though predominates in the southern region, both the northern and
eastern regions occupy the second place.

Among draught animals every 100 hectares of cropped area in the country sustained 43
indigenous and one crossbred cattle adult males, 5 he-buffaloes and one camel. Among
regions, southern region sustained the highest number of draught animals per 100 hectares of
cropped land, followed by western, eastern, and northern, regions, respectively. Camels,
however, were concentrated only in the northern region.

3.1.4. Contributions:
Milk production and exports: The total milk production in India has increased from 22.5
million tonnes in 1970-71 to 31.6 million tonnes in 1980-81 and 66.30 million tonnes in 1995
which has been estimated to 81.3 million tonnes in 1999-2000. Likewise, the production of
cattle and buffalo hides in India has also increased from 0.80 million metric tonnes in 1981 to
0.92 million metric tonnes in 1990 which has also been estimated to 0.95 million metric tonnes
in 1999. India ranks first in the world in milk production, with an estimated production of
81.3 million tonnes in 1999-2000, about 5 percent higher than in 1998-99. Buffaloes
dominated the milk production scene contributing about 52 percent of the total, followed by
cows (about 45%) and goats (about 3%). Furthermore, the share of northern region in the total
milk production was the highest, followed by the western region.

In spite of achieving success in raising the milk production, the per capita per day availability
of milk in India was 199 gms based on 1995 actual milk production. The northern region
showed higher availability (308g), followed by the southern region (189g), western region (174g) and eastern region (109g). There also existed significant inter-state variations within the region. Indeed, none of the States in the country other than Punjab (794g), Haryana (592g), Himachal Pradesh (339g), Rajasthan (319g) and Gujarat (256g) could meet the minimum nutritional requirement of milk (250g). Furthermore, the southern (189g), western (174g) and eastern region (109g) continued to be the deficit regions with regard to milk availability in 1995. Again the per capita per day milk availability for year 2005 in northern, southern and India as a whole would be though 406g, 260g and 248g, respectively. Yet the western including central (187g) and eastern (127g) regions would be still the deficit regions. Obviously the requirement of milk in the country as a whole can not be met with the present growth rate. However, with nutritional awareness, rise in per capita income and growing urbanisation, the demand for milk may increase further, thereby widening the gap between milk production and demand. In this context, it is essential to bridge the gap between the potential yields of bovines at organised farms and in those of rural households.

According to FAO estimates, India exported 773 metric tonnes of dried milk worth 1507 thousand U.S. dollars, 143 metric tonnes of butter worth 4.32 million US dollars in 1996, which may further increase in foreseeable future. In this context, the researcher's viewpoint are that; (a) India has a vast potential to export dairy products especially to African and Middle East countries, provided we improve the quality of our milk products (Patel, 1993), and (b) the export of high valued agricultural products like dairying is desirable rather than that of foodgrains (Bhalla, 1995). But by exporting dairy products without looking into the domestic demand for milk, the nutritional status of the Indian people may deteriorate across regions.

**Employment and income generation through dairying:** The rural households survey conducted in the western zone of Haryana (Panday, et al 1993) revealed that on an average the crop farming contributed 54% of the total income earned by a household followed by dairy (23%). Furthermore, the contribution of dairying in the total income of household was 32,28,24 and 19% in case of landless, small, medium and large farm respondents, respectively. A cow unit maintained generated 103 man days as against 144 days by a buffalo unit. The landless and small farmers, however, used more labour while maintaining milch animals.

The quantity of milk produced by a cow and buffalo was 1183 and 1755 kg, respectively, in lactation. The returns over feed cost were Rs. 374 from a cow and Rs. 2564 from the buffalo. Thus at household farm the buffaloes are still performing better than cows. Overtime, the situation may improve if the indigenous dual purpose cow breed is replaced by milch purpose high yielding cows or cross bred cows. To sustain maintenance of a cow and buffalo profitably at household farm of the study area, the cow’s existing milk needs to be increased by 61% while that of buffaloes by 35% per annum. Thus, vigorous efforts in terms of breeding, feeding and management of these animals coupled with extension services (which presently lacks as compared to crop farming) are extremely essential for enhancing the productivity of milch animals at the household farms.

The farming system research study conducted at the Haryana Agricultural University, Hisar organised farm revealed that 3 buffaloes+1 ha land unit generated annual employment of 630 days followed by 559 days by 3 cross bred cows+1 ha land unit. Whereas only one cross bred cow maintained on 1 ha farm could generate 168 days of employment. Milk produced on these units was 5300, 9419 and 2388 Kg, respectively. However, net income was maximum from the 3 cross bred cows unit (Rs. 21,312) followed by buffaloes unit (Rs. 9,426). The situation would be quite different on the rural household farms due to the gap in transfer of technology and adoption by the households (Singh, et al 1994).

**Dung/fuel and draft energy:** The milch animals also provide dung, which augments soil
fertility and thereby enhances the crop productivity. Yet of the total dung produced by the bovines, about 70% is being used for the fuel purpose by the rural households. As per 1992 census, the cattle population of India including male, female and youngstock produces 693.51 thousand metric tonnes of dry dung as compared to buffaloes of 607.33 thousand metric tonnes. Across regions, for cattle population the dry dung estimates of western region ranked first followed by northern, eastern and southern zones, respectively. Similarly, for buffaloes population these estimates for northern zone ranked first followed by western, southern and eastern zone. Other draft animals (including camels, horses, ponies, mules and donkeys) contributed 9.89 thousand metric tonnes of dry dung with the highest being in northern region (Table 5).

The bullocks, he buffaloes, camels, horses, ponies, mules and donkeys also provide draft power energy both for tillage as well as post harvest operations of crop farming. Accordingly, the region wise draft power energy generated through the livestock population has also been estimated in Table 6.

The availability of animal power/energy in India as per 1992 and 1997 censuses together with, the projected population for 2002 have been estimated to be 35.21, 31.57 and 30.52 lakh h.p, respectively. Although the energy available from bullocks and camels can be used both for tillage and post harvest operations yet energy generated from the work animals other than bullocks and camels can only be used for the post harvest operations.

3.2. Small Ruminants

3.2.1. Compound growth rates: Except for southern region, the growth rates for sheep population were mostly positive across regions and at the all-India level during 1972-82 inter-census period. But sheep population declined at the annual rate of 3.26 percent in eastern region during 1982-92 inter census period, with a marginal decline in the western region (Table 7).

For goats, these growth rates were most positive across regions and at all-India level during 1972-82 inter-census period, with a highest growth being in the eastern region. Contrarily, the goat population declined at the annual rate of 2.71 percent in eastern region during 1982-92 inter census period, with a marginal decline in the southern region.

On the whole, the goat and sheep population though increased at the respective annual growth rates of 3.50 and 2.0 per cent in 1972-82 inter census period, yet these species increased only marginally during 1982-92 inter census period with a greatest set back of being in the eastern region. Further more, the regional growth rates are related to the regional resource base on the one hand, and the market demand, on the other.

3.2.2. Compositional changes: Except for southern and eastern region both goat and sheep population, by and large, increased across regions and at all-India level in various censuses (Table 8). On the whole, the female population of sheep and goats outnumbered male population across regions and at the all-India level in all the censuses. Further more, regional disparities do exist in the sheep and goat farming which may be due to varying resource endowments.

The null hypothesis about a general belief that small ruminants are being reared by the people with little or no access to cultivated land has been rejected for Karnataka State (Birthal and Ravishankar, 1999 and Pasha 1991) on account of the deterioration of common property resources, supply of quality manure for crop production and ample availability of fodder from owned land. Situation in other regions will not be different due to deterioration of common property resources. However, it is essential to probe further across regions/states so that the
planners and policy makers may develop suitable strategies for their upliftment.

3.2.3 Density:- The density of sheep and goats varies widely across the regions. On an average one hectare of culturable wasteland in India during 1992-93, commanded 7 goats and 3 sheep (Table 9). Across regions, goat density is the highest in the eastern region (about 13), followed by the southern (about 11) and western/northern regions (about 5). Sheep density is the highest in southern region (about 12), followed by the northern (about 3) and eastern region (about 2). Further more, among the regions there are certain states like Punjab, Haryana, Tamil Nadu, West Bengal, etc., where the density of sheep and goats is quite high, thereby showing the saturation point for sheep and goats development. Contrarily, there are some states like Rajasthan, Gujarat, Madhya Pradesh, Maharashtra, Himachal Pradesh, Jammu & Kashmir, etc., where there is still scope for improving the density by proper planning and development of vegetation on waste land. In fact, there exist potentialities for sheep and goat farming across regions. In such cases, one can go even for commercial sheep and goat production thereby making the use of vast wasteland resources (Pandey, 1992).

3.2.4. Contributions: Sheep and goats also contribute to the national economy of India. Accordingly, it is imperative to make some estimates about their contributions in terms of production of milk, meat, skin, dung etc. It has been estimated that goats contribute only about 3 per cent to the total milk production in the country. Further more, a major portion of sheep and goat milk production is being used by the sheep and goat rearers themselves and there is no marketable surplus. An attempt, based on certain assumptions, has been made about meat and skin production and the data are presented in Table 10.

As per our estimates, about 57.32 million and 14.69 million of goat and sheep pieces contributed 0.52 and 0.13 million tonnes of meat, respectively, in 1992. Moreover, the estimates for years 1997 and 2002 about goat and sheep meat production are also contained in Table 10. Regional differences, however, existed both in sheep and goat meat production. India exported about eight thousand metric tonnes of sheep and goat meat during 1996 (FAO, 1997). But there is a vast scope for improving the meat export market, particularly in the Middle East, which could be achieved only by expanding the total number of sheep and goats on commercial farming basis.

The production of skin from sheep and goats has been estimated at about 59 million and 229 million sq.feet, respectively, in 1992 and the same has also been projected for year 2002 as 60 and 238 million sq.feet, respectively.

Angora breed of goat gives fine silky fibre which has great demand in fibre industry and pashmina goats are the world famous for their very fine pashmina fibre out of which Kashmiri Shawls are prepared. Due to lack of breedwise published data on sheep and goat population in the different regions of India, we could not work out the estimates for wool production and goat’s fibre production.

The regionwise estimates for dung through small ruminants has been presented in Table 11. As per 1992 and 1997 census, these estimates at all India level for small ruminants population are 21.01 and 26.31 thousand metric tonnes respectively.

Sheep and goats also posses income and employment potentials. Kumar et al 1986, observed positive return to labour, being Rs.84 per goat per annum. Similarly, sheep units generated the adequate returns for repaying the loan and also qualified other tests of credit, particularly when financed at the concessional lower interest rates (Sharma and Pandey, 1984). Similarly, Chowdhry et al, 1995, observed that the flock size made the highest contributions to gross returns in sheep farming.

The share of sheep and goats to total ruminants livestock is higher in draught prone areas of
Karnataka than in the non-drought prone ones. Furthermore, small ruminants contribute substantially to total gross returns of rural households, particularly in poor peasants and landless (Pasha, 1995). It has also been observed that in terms of biomass consumption bovines are more reducers of environment ecology than sheep and goats in hilly areas (Thakur et al 1995).

The farming systems of study for sheep and goats was conducted at organised dry land farm of Bawal research station in Haryana by maintaining each of sheep and goat units for grazing on community land, the general practice being adopted in the area by the landless farmers of the state. Rearing of sheep and goats provided per annum 168 and 171 man days of employment, respectively (Singh, et al, 1990).

3.3. Poultry
As the poultry enterprise is of land saving but labour and capital intensive in nature, it suits very well even to those households who do not possess adequate landbase. Further, this enterprise is though s lightly risky, it generates quick returns and ranks relatively high in profitability as compared to other livestock enterprises.

3.3.1. Compound growth rates: The poultry enterprise observed the respective annual growth rates of 4.80 and 1.39 per cent during the 1972-82 and 1982-92 inter census periods. Across regions, the northern region recorded the highest annual growth rate in 1972-82 inter census period followed by the eastern region but western region observed the highest growth in 1982-92 inter census period followed by the southern region (Table 12). The disparity in the prices of poultry products and the production of coarse grains in a region was found to be mainly responsible for imbalanced growth of poultry in India (Bhardwaj, et al, 1995).

3.3.2. Compositional changes: Except for eastern region, the number of poultry birds increased across regions and at all-India level in various censuses (Table 12). The diversity in compositional structure across regions seems to be due to varying resource endowments, aptitude/adaptability of households towards poultry farming. By and large, the poultry farming has become popular amongst households of different social groups/strata.

3.3.3. Density: Region wise density of poultry birds reveal the fact that there existed, 77 and 84 poultry birds at per kilo meter distance, as per 1992 and 1997 censuses, respectively which has also been projected for 2002. The southern and eastern regions, however, ranked first and second respectively (Table 12).

3.3.4. Contributions: The egg production in India has increased from 10.88 thousand million in 1981-82 to 34.77 thousand million in 1998-99, which has been projected for 2002 as 42.82 thousand million. Similarly, the poultry meat has increased from 3.62 lakh metric tonnes in 1991 to 4.59 lakh metric tonnes in 1998. Further more, India has exported eggs worth 13.04 million US$ in 1997 while that of poultry meat 0.07 million US$ in 1996. Rajput et al (1995) estimated on an average the net returns per layer as Rs.31. The poultry manure has also been estimated as 7.64 and 8.26 thousand metric tonnes as per 1992 and 1997 censuses, respectively. Across regions, the southern region contributed the highest poultry manure followed by western region (Table 13).

3.4. Pigs
Traditionally, pigs are being reared by socially and economically backward section of the society. Its adoption is becoming popular amongst other sections of the society as well (Pandey, et al. 1997, Jain & Pandey, 1998). Yet, the major factors which affect the adoption of pig farming in Haryana include; family and farming (26%), socio-economic status (15%), social and literacy status (14%), technical infrastructure (10%) and marketing infrastructure
3.4.1 Compound growth rates: The region wise compound growth rates for pig population are presented in Table 14. The pig population at all-India level increased at the annual rates of 3.80 and 1.07 per cent during 1972-82 and 1982-92 inter-census periods. Across regions, eastern region had the highest growth rate in 1972-82 inter census period while northern region in 1982-92 inter census period.

3.4.2 Compositional changes: The compositional structure of pigs not only observed an increasing trend at all-India level in various censuses but also across regions. Amongst regions, the eastern region had highest pig population in all censuses due to socio-economic and environmental factors related to adoption of this enterprise. Both northern and southern regions also had a good compositional structure of pigs in different censuses (Table 14). Thus, of late, pig farming is also gaining importance not only across regions but also amongst different social groups in a region.

3.4.3 Density: Table 14 shows the pig density across regions at per kilometre distance. As per 1992 and 1997 censuses, there existed about 4 pigs at per kilo metre distance and also same for 2002 projected population. Across regions, eastern region (about 6 pigs/km) ranked first followed by the northern (about 4 pigs/km) and southern (about 3 pigs/km) regions. Further more across regions there are certain states/union territories like Chandigarh (about 35/km), Nagaland (about 32/km), Goa (about 24/km), Tripura (about 18/km), Manipur (about 17/km), Meghalaya (about 13/km) each Haryana and West Bengal (about 12/km), Assam (about 11/km), Uttar Pradesh (about 10/km), where pig density is quite high thereby showing the saturated point. Contrarily, there are certain States like Rajasthan, Gujarat, Himachal Pradesh, Maharashtra, Madhya Pradesh, Karnataka, Andhra Pradesh, Arunachal Pradesh, etc where there is still scope for improving the density by proper planning and development of infrastructures.

3.4.4 Contributions: The feeding pattern has significant influence in the net returns from the pig farming. The annual net returns/pig ranged between Rs.908 and Rs.1136 on farms rearing pigs with hotel waste while on pig farms without hotel waste it ranged between Rs.713 and Rs.920 (Pandey et al 1997 opt cit). The net return per pig under different systems of feeding was the highest in medium farmer’s category, followed by large and small farmers. In fact of the different systems of feeding patterns, the net return/pig under exclusively hotel waste category was the highest in medium and large size groups, while cereal-vegetable-fodder-hotel waste groups in small size categories (Jain & Pandey, 1998, opt cit).

Based on survey data in Haryana, it has also been estimated that a 100 adults pig unit generates annual employment of 1277 man days while that of mixed herd strength (both adult and young ones) about 707 man days per annum (Pandey, et al, 1997, op cit). The production of pig meat has increased from 3664 lakh metric tonnes in 1991 to 4.69 lakh metric tonnes in 1998. India exported 350 metric tonnes of pig meat worth 383 thousand US$ in 1997.

The pig manure has also been estimated as 10.07 and 10.69 thousand metric tonnes as per 1992 and 1997 censuses, respectively. Across regions, the eastern region contributed the highest pig manure followed by the northern region (Table 15).

4. Issues for In-Depth Study

From the above, the following issues emerge for further in-depth study: To meet the demand for milk and milk products of the growing population, how can we improve the production efficiency of our milch stock under the existing conditions of feed and fodder availability, increasing number of not caivered milch animals, inadequate health cover and breeding...
infrastructures, etc., across regions?

Small ruminants require less out of pocket expenses and also form the backbone of the rural poor. Likewise, the poultry enterprise is land saving as well as labour and capital intensive in nature, even suits well to the landless. Piggery enterprise specifically attracts a social class of people who are the major producer-cum-customers. Are there some ways and means for enhancing the production efficiencies of these enterprises through vertical and horizontal integration?

How to allocate the total output of milk and milk products, small ruminants, poultry and piggery products, between the domestic consumption and exports? How can we improve the quality of livestock products so as to meet the international standards?

Livestock enterprises not only possess income and employment potentials but stabilizes the household income besides meeting the equity considerations? Whether the existing extension education and other infrastructures are adequate or need strengthening/streamlining?

How to reorient/revitalise our existing livestock policy framework so as to strengthen our rural households in attaining growth with social justice on the one hand and livestock sector across regions on the other?

Notes

1. Northern Region: Punjab, Rajasthan, Uttar Pradesh, Haryana, Himachal Pradesh, Jammu & Kashmir, Chandigarh, Delhi; Southern Region: Andhra Pradesh, Karnataka, Kerala, N. Tamil Nadu and Pondicherry; Eastern Region: Bihar, Assam, Orissa, West Bengal, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Arunachal Pradesh, Andaman & Nicobar Islands; Western Region: Gujarat, Madhya Pradesh, Maharashtra, Goa, Dadra & Nagar Haveli, Daman & Diu.

2. Compound growth rates of bovines, small ruminants, poultry and pig population between two inter census periods were calculated using the following formula:

\[ Pt = \left(1 + \frac{r}{100}\right)^t \]

Where, \( Pt \) is bovine/small ruminant/poultry/pig population in the \( t \)-th period, \( Po \) is bovine/small ruminant/poultry/pig population in the base year, \( r \) is the compound growth rate and \( t \) is the time in years.

3. The estimates for dung (dry matter) has been computed as per following table. For such computations also see Maynard, et al. 1981 and Prasad, D. 2000.

<table>
<thead>
<tr>
<th>Animals</th>
<th>Average Body weight (In kg.)</th>
<th>Feed intake (kg)</th>
<th>Digestibility (per cent)</th>
<th>Faeces (dry matter/day in kg.)</th>
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<tbody>
<tr>
<td>Buffalo</td>
<td>500</td>
<td>15</td>
<td>50</td>
<td>7.50</td>
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<tr>
<td>Cattle</td>
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<td>Mule/horses &amp; ponies</td>
<td>500</td>
<td>15</td>
<td>60</td>
<td>6.00</td>
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<td>Pig</td>
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<td>70</td>
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<td>Sheep, Goat</td>
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<td>0.900</td>
<td>80</td>
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<td>Poultry (adult layer)</td>
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References


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<tr>
<th>Year</th>
<th>Bullocks</th>
<th>Cows</th>
<th>Bulls</th>
<th>Total</th>
<th>Male</th>
<th>Females</th>
<th>Crossbred</th>
<th>Indigoons</th>
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<td>1992</td>
<td>1,982</td>
<td>1,912</td>
<td>390</td>
<td>4,284</td>
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<td>2,790</td>
<td>1,982</td>
<td>1,912</td>
<td>390</td>
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<td>2002(p)</td>
<td>2,002</td>
<td>1,982</td>
<td>390</td>
<td>4,374</td>
<td>1,500</td>
<td>2,874</td>
<td>2,002</td>
<td>1,982</td>
<td>390</td>
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Table 2: Compositional change in bovine population across Indian regions.
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<td>I.</td>
<td>Milk animals</td>
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<td>Indigenous cattle</td>
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<td>Crossbred cattle</td>
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<td>Buffaloes</td>
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<td>Draught animals</td>
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<td>Bullocks</td>
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<td>(iii)</td>
<td>Camels</td>
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<td>III.</td>
<td>Cattle young-stock(below 3 years)</td>
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<td>IV.</td>
<td>Buffalo young-stock(below 3 years)</td>
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<td>Youngstock (below 3 years)</td>
<td>11.66 (26.14)</td>
<td>16.49 (25.89)</td>
<td>14.46 (35.50)</td>
<td>12.67 (39.63)</td>
<td>0.51 (33.12)</td>
<td>1.07 (45.34)</td>
<td>2.27 (47.59)</td>
<td>1.64 (26.58)</td>
<td>2.48 (26.61)</td>
<td>1.28 (33.51)</td>
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<td>Grand Total</td>
<td>44.61 (100.0)</td>
<td>63.69 (100.0)</td>
<td>40.73 (100.0)</td>
<td>31.97 (100.0)</td>
<td>1.54 (100.0)</td>
<td>2.36 (100.0)</td>
<td>4.77 (100.0)</td>
<td>6.17 (100.0)</td>
<td>9.32 (100.0)</td>
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<td></td>
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<td>(i) In milk</td>
<td>22.03 (41.25)</td>
<td>25.09 (27.17)</td>
<td>24.72 (48.60)</td>
<td>24.37 (53.83)</td>
<td>1.76 (36.59)</td>
<td>3.44 (61.85)</td>
<td>6.35 (48.36)</td>
<td>15.07 (52.71)</td>
<td>17.99 (33.41)</td>
<td>24.68 (59.64)</td>
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<td>(ii) Dry</td>
<td>26.33 (49.31)</td>
<td>26.40 (28.59)</td>
<td>21.08 (41.45)</td>
<td>16.83 (37.18)</td>
<td>0.91 (18.92)</td>
<td>1.53 (28.33)</td>
<td>2.55 (19.42)</td>
<td>11.30 (39.52)</td>
<td>12.05 (22.51)</td>
<td>12.05 (31.15)</td>
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<td>(iii) Not calved</td>
<td>5.04 (9.44)</td>
<td>4.66 (5.05)</td>
<td>3.84 (7.55)</td>
<td>3.16 (6.98)</td>
<td>0.29 (6.03)</td>
<td>0.54 (10.00)</td>
<td>1.00 (7.62)</td>
<td>2.24 (7.83)</td>
<td>2.33 (4.35)</td>
<td>2.75 (4.65)</td>
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<tr>
<td>Total</td>
<td>53.40 (30.57)</td>
<td>92.35 (40.10)</td>
<td>50.86 (32.12)</td>
<td>45.27 (31.60)</td>
<td>4.81 (45.77)</td>
<td>5.40 (41.10)</td>
<td>13.13 (47.76)</td>
<td>28.59 (50.70)</td>
<td>53.54 (62.18)</td>
<td>41.38 (52.41)</td>
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<tr>
<td>3. Youngstock (below 3 years)</td>
<td>46.82 (26.81)</td>
<td>50.12 (21.77)</td>
<td>51.06 (32.24)</td>
<td>52.92 (36.94)</td>
<td>2.94 (27.97)</td>
<td>5.16 (39.27)</td>
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<td>Grand Total</td>
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<td>230.26 (100.0)</td>
<td>158.37 (100.0)</td>
<td>143.25 (100.0)</td>
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<td>56.39 (100.0)</td>
<td>86.11 (100.0)</td>
<td>78.95 (100.0)</td>
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Note: 1. Adult females total does not tally as undefined "others" category has been excluded.
2. Figures in parentheses are the percentages to the grand total.
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<td>26.7</td>
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<td>30.1</td>
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<td>24.5</td>
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<td>WW (C)</td>
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<td>26.7</td>
<td>29.0</td>
<td>29.8</td>
<td>30.5</td>
<td>30.1</td>
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Table 3: Ratio of Cattle to buffaloes and their lactating efficiency across regions of India

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<tr>
<th>Particulars</th>
<th>Ratio of Indigenous cattle to buffaloes</th>
<th>Ratio of Crossbred cattle to buffaloes</th>
<th>Lactating efficiency*</th>
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<tbody>
<tr>
<td></td>
<td>Adult Male</td>
<td>Adult females</td>
<td>Young stock</td>
</tr>
<tr>
<td>I. 1972</td>
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<tr>
<td>(a) Northern</td>
<td>9.96</td>
<td>1.11</td>
<td>1.31</td>
</tr>
<tr>
<td>(b) Western</td>
<td>12.54</td>
<td>2.22</td>
<td>3.09</td>
</tr>
<tr>
<td>(c) Southern</td>
<td>6.32</td>
<td>1.70</td>
<td>1.99</td>
</tr>
<tr>
<td>(d) Eastern</td>
<td>10.04</td>
<td>5.20</td>
<td>7.09</td>
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<td>All India</td>
<td>9.43</td>
<td>1.86</td>
<td>2.35</td>
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<td>II. 1982</td>
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<tr>
<td>(a) Northern</td>
<td>6.10</td>
<td>0.84</td>
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<tr>
<td>(b) Western</td>
<td>31.49</td>
<td>2.32</td>
<td>2.64</td>
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<tr>
<td>(c) Southern</td>
<td>16.73</td>
<td>1.41</td>
<td>1.08</td>
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<tr>
<td>(d) Eastern</td>
<td>9.41</td>
<td>5.73</td>
<td>6.66</td>
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<tr>
<td>All India</td>
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<td>1.72</td>
<td>1.99</td>
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<td>III. 1992</td>
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<tr>
<td>(a) Northern</td>
<td>5.92</td>
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<td>0.83</td>
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<td>(b) Western</td>
<td>10.95</td>
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<td>2.13</td>
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<tr>
<td>(c) Southern</td>
<td>6.64</td>
<td>1.06</td>
<td>1.33</td>
</tr>
<tr>
<td>(d) Eastern</td>
<td>8.97</td>
<td>12.38</td>
<td>11.50</td>
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<tr>
<td>All India</td>
<td>8.03</td>
<td>1.23</td>
<td>1.67</td>
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<td>IV. 2002 (Projected)</td>
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<tr>
<td>(a) Northern</td>
<td>5.75</td>
<td>0.43</td>
<td>0.62</td>
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<td>(c) Southern</td>
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<td>0.79</td>
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<td>(d) Eastern</td>
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<td>All India</td>
<td>4.71</td>
<td>0.80</td>
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*Lactating efficiency = Ratio of female numbers in milk to total adult females.
Table 4: Density of Milch, Youngstock and drought Animals Across Regions of India during 1992 (Per hundred hectares of cropped area)

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<th>Particulars</th>
<th>Regions</th>
<th>All India</th>
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<td><strong>Milch Animals</strong></td>
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<td>2</td>
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<tr>
<td>(iii) Buffaloes</td>
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<td>15</td>
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<tr>
<td><strong>Youngstock</strong></td>
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<td>39</td>
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<td>(ii) Crossbred cattle</td>
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<td>(iii) Buffaloes</td>
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<td><strong>Draught Animals</strong></td>
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<td>51</td>
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<td>(ii) Crossbred cattle</td>
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<td>1</td>
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<td>(iii) He Buffaloes</td>
<td>5</td>
<td>4</td>
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<tr>
<td>(iv) Camels</td>
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</table>
Table 5: The Dry Dung Production by Bovines and Draught Animals
(In 000, metric tonnes)

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<th>All India</th>
</tr>
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<td>Southern</td>
<td>Eastern</td>
<td>Western</td>
</tr>
<tr>
<td>I. 1992</td>
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<tr>
<td>(a) Cattle*</td>
<td>183.18</td>
<td>134.24</td>
<td>163.72</td>
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<tr>
<td>(b) Buffaloes*</td>
<td>388.00</td>
<td>01.03</td>
<td>22.27</td>
<td>106.03</td>
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<tr>
<td>(c) Other draft animals**</td>
<td>7.82</td>
<td>0.38</td>
<td>0.21</td>
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<td>216.54</td>
<td>79.16</td>
<td>15.51</td>
<td>92.43</td>
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<td>(c) Others draft animals</td>
<td>8.24</td>
<td>0.31</td>
<td>0.14</td>
<td>1.20</td>
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<td>III. 2002</td>
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<tr>
<td>(a) Cattle</td>
<td>130.81</td>
<td>52.89</td>
<td>90.71</td>
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<td>(b) Buffaloes</td>
<td>215.13</td>
<td>69.35</td>
<td>11.45</td>
<td>126.86</td>
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<tr>
<td>(c) Others draft animals</td>
<td>8.72</td>
<td>0.25</td>
<td>0.09</td>
<td>1.13</td>
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</table>

* Includes adult male, females and young stock  
** Includes camels, horses, ponies, mules and donkeys.
Table 6: Availability of animal power/energy in India during 1992 to 2002
(Animal number & H.P. in 000)

<table>
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<tr>
<th>Sr. No.</th>
<th>Particulars</th>
<th>Horse power per animal</th>
<th>1992</th>
<th>1997</th>
<th>2002**</th>
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</thead>
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<td></td>
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<td></td>
<td>No.</td>
<td>Total Horse power</td>
<td>No.</td>
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<td>1.</td>
<td>Bullocks (above 3 years)</td>
<td>0.5</td>
<td>61155</td>
<td>30577.5</td>
<td>52305</td>
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<tr>
<td>2.</td>
<td>Male Buffaloes (above 3 years)</td>
<td>0.5</td>
<td>6228</td>
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<td>7761</td>
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<td>3.</td>
<td>Camel (above 4 years)</td>
<td>1.0</td>
<td>717</td>
<td>717</td>
<td>727</td>
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<tr>
<td>4.</td>
<td>Horses &amp; Ponies (above 3 years)</td>
<td>0.5</td>
<td>498</td>
<td>249.0</td>
<td>488</td>
</tr>
<tr>
<td>5.</td>
<td>Mules (above 3 years)</td>
<td>0.5</td>
<td>150</td>
<td>75.0</td>
<td>195</td>
</tr>
<tr>
<td>6.</td>
<td>Donkeys (above 3 years)</td>
<td>0.5</td>
<td>955</td>
<td>477.5</td>
<td>932</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>35210.0</td>
<td>31567.5</td>
<td></td>
</tr>
</tbody>
</table>

*Also see Pandey et al. 1983. Opt-cit:

**For year 2002 the livestock population has been projected as per compound growth rate for 1982-92 inter-census period.
Table 7: Compound Growth Rates for Small Ruminants during Different Inter-Census Periods Across Regions of India.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Goat</th>
<th>Sheep</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(Per cent per annum)</td>
<td></td>
</tr>
<tr>
<td>Northern Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1972-82</td>
<td>2.86</td>
<td>4.08</td>
</tr>
<tr>
<td>(b) 1982-92</td>
<td>1.35</td>
<td>0.20</td>
</tr>
<tr>
<td>Western Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1972-82</td>
<td>1.97</td>
<td>2.11</td>
</tr>
<tr>
<td>(b) 1982-92</td>
<td>1.95</td>
<td>-0.09</td>
</tr>
<tr>
<td>Southern Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1972-82</td>
<td>2.52</td>
<td>-0.30</td>
</tr>
<tr>
<td>(b) 1982-92</td>
<td>-0.24</td>
<td>0.66</td>
</tr>
<tr>
<td>Eastern Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1972-82</td>
<td>6.04</td>
<td>4.00</td>
</tr>
<tr>
<td>(b) 1982-92</td>
<td>-2.71</td>
<td>-3.26</td>
</tr>
<tr>
<td>All India</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1972-82</td>
<td>3.50</td>
<td>2.00</td>
</tr>
<tr>
<td>(b) 1982-92</td>
<td>0.03</td>
<td>0.04</td>
</tr>
</tbody>
</table>
Table 8: Compositional changes in Goat and Sheep, population during various Censuses in India.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Goat</th>
<th>Sheep</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1972</td>
<td>21.54</td>
<td>13.48</td>
</tr>
<tr>
<td>(b) 1982</td>
<td>28.55</td>
<td>20.11</td>
</tr>
<tr>
<td>(c) 1992</td>
<td>32.66</td>
<td>20.52</td>
</tr>
<tr>
<td>(d) 2002 (p)</td>
<td>37.36</td>
<td>20.94</td>
</tr>
<tr>
<td>Western</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1972</td>
<td>15.32</td>
<td>4.86</td>
</tr>
<tr>
<td>(b) 1982</td>
<td>18.62</td>
<td>5.99</td>
</tr>
<tr>
<td>(c) 1992</td>
<td>22.59</td>
<td>5.94</td>
</tr>
<tr>
<td>(d) 2002 (p)</td>
<td>27.39</td>
<td>5.88</td>
</tr>
<tr>
<td>Southern</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1972</td>
<td>13.57</td>
<td>18.42</td>
</tr>
<tr>
<td>(b) 1982</td>
<td>17.40</td>
<td>17.86</td>
</tr>
<tr>
<td>(c) 1992</td>
<td>17.00</td>
<td>19.07</td>
</tr>
<tr>
<td>(d) 2002 (p)</td>
<td>16.00</td>
<td>20.36</td>
</tr>
<tr>
<td>Eastern</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1972</td>
<td>17.06</td>
<td>3.24</td>
</tr>
<tr>
<td>(b) 1982</td>
<td>30.66</td>
<td>40.80</td>
</tr>
<tr>
<td>(c) 1992</td>
<td>23.29</td>
<td>3.45</td>
</tr>
<tr>
<td>(d) 2002 (p)</td>
<td>17.69</td>
<td>2.45</td>
</tr>
<tr>
<td>All India</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1972</td>
<td>67.49</td>
<td>40.00</td>
</tr>
<tr>
<td>(b) 1982</td>
<td>95.25</td>
<td>48.77</td>
</tr>
<tr>
<td>(c) 1992</td>
<td>95.54</td>
<td>48.98</td>
</tr>
<tr>
<td>(d) 2002 (p)</td>
<td>95.83</td>
<td>49.19</td>
</tr>
</tbody>
</table>
Table 9: Goat and Sheep farming densities and potentialities across regions of India.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td>6.70</td>
<td>4.87</td>
<td>3.06</td>
<td>100.50</td>
</tr>
<tr>
<td>Southern</td>
<td>1.61</td>
<td>10.56</td>
<td>11.84</td>
<td>24.15</td>
</tr>
<tr>
<td>Eastern</td>
<td>1.76</td>
<td>13.23</td>
<td>1.96</td>
<td>26.40</td>
</tr>
<tr>
<td>Western</td>
<td>4.52</td>
<td>5.0</td>
<td>1.31</td>
<td>67.80</td>
</tr>
<tr>
<td>All India</td>
<td>14.59</td>
<td>6.55</td>
<td>3.36</td>
<td>218.85</td>
</tr>
</tbody>
</table>

*Culturable wasteland includes the permanent pastures, other grazing lands and the culturable wasteland.
+Estimated goat and sheep population is arrived at by assuming the goat sheep density of 15/ha of culturable wasteland by proper planning and development of vegetation (i.e. by raising grasses and shrubs, where in shrubs would be used by the small ruminants while grasses partly by them and remaining by large ruminants).
Assuming the average size of skin as 49 sq ft per animal.
Assuming body weight 70 kgs and mean recovery rate 45 per cent for both the species.
Further, the slaughtered percentage of goats

<table>
<thead>
<tr>
<th>Year</th>
<th>Sheep (Million)</th>
<th>Goat (Million)</th>
<th>Total (Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>2.06</td>
<td>2.03</td>
<td>4.09</td>
</tr>
<tr>
<td>2001</td>
<td>1.98</td>
<td>1.92</td>
<td>3.90</td>
</tr>
<tr>
<td>2000</td>
<td>1.94</td>
<td>1.88</td>
<td>3.82</td>
</tr>
<tr>
<td>1999</td>
<td>1.90</td>
<td>1.84</td>
<td>3.74</td>
</tr>
<tr>
<td>1998</td>
<td>1.86</td>
<td>1.80</td>
<td>3.66</td>
</tr>
</tbody>
</table>

Notes: Sheep and goat population has been projected for 1997 and 2002 based on 1992-93 compound growth rates. Further, the slaughtered percentage of goats.

**Table 10**: Estimates of Goat and Sheep meat and Skin Production across Regions of India
Table 11: Region wise estimates for dung through small ruminants in India
(In, 000 Metric tonnes)

<table>
<thead>
<tr>
<th>Years</th>
<th>Northern</th>
<th>Western</th>
<th>Southern</th>
<th>Eastern</th>
<th>All India</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>4.57</td>
<td>6.49</td>
<td>4.81</td>
<td>5.14</td>
<td>21.01</td>
</tr>
<tr>
<td>1997</td>
<td>10.02</td>
<td>6.57</td>
<td>4.18</td>
<td>5.54</td>
<td>26.31</td>
</tr>
<tr>
<td>2002</td>
<td>10.50</td>
<td>6.65</td>
<td>3.36</td>
<td>5.99</td>
<td>26.77</td>
</tr>
</tbody>
</table>

Table 12: Region wise compound growth rates, compositional changes and density of Poultry enterprise in India.

<table>
<thead>
<tr>
<th>Regions</th>
<th>Northern</th>
<th>Western</th>
<th>Southern</th>
<th>Eastern</th>
<th>All India</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Compound Growth rates. (per cent/annum)</td>
<td>7.71</td>
<td>3.97</td>
<td>3.46</td>
<td>5.74</td>
<td>4.80</td>
</tr>
<tr>
<td>(a) 1972-82</td>
<td>1.55</td>
<td>4.50</td>
<td>1.65</td>
<td>-0.31</td>
<td>1.39</td>
</tr>
<tr>
<td>(b) 1982-92</td>
<td>2.25</td>
<td>5.02</td>
<td>2.34</td>
<td>0.01</td>
<td>2.00</td>
</tr>
</tbody>
</table>

| 2. Compositional Changes (In thousands) | 11.41 | 22.04 | 54.58 | 50.49 | 138.52 |
| (a) 1972        | 24.00 | 32.53 | 76.71 | 88.23 | 221.47 |
| (b) 1982        | 27.99 | 50.52 | 90.32 | 85.54 | 254.36 |
| (c) 1992        | 32.64 | 78.46 | 106.34 | 82.93 | 292.14 |
| (d) 2002 (p)    | 32.64 | 78.46 | 106.34 | 82.93 | 292.14 |

| 3. Density (per sq. km) | 28 | 142 | 124 | 53 | 77 |
| (a) 1992     | 30 | 154 | 122 | 66 | 84 |
| (b) 1997     | 32 | 167 | 120 | 82 | 91 |
| (c) 2002 (p) | 32 | 167 | 120 | 82 | 91 |

Table 13: Region wise estimates for the poultry manure (ooo, metric tonnes)

<table>
<thead>
<tr>
<th>Years</th>
<th>Northern</th>
<th>Western</th>
<th>Southern</th>
<th>Eastern</th>
<th>All India</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>0.84</td>
<td>2.71</td>
<td>2.57</td>
<td>1.52</td>
<td>7.64</td>
</tr>
<tr>
<td>1997</td>
<td>0.90</td>
<td>2.94</td>
<td>2.53</td>
<td>2.89</td>
<td>8.26</td>
</tr>
<tr>
<td>2002 (p)</td>
<td>0.98</td>
<td>3.19</td>
<td>2.49</td>
<td>2.35</td>
<td>9.01</td>
</tr>
</tbody>
</table>
Table 14: Region wise compound growth rates, Compositional changes and density of Pigs.

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Northern</th>
<th>Western</th>
<th>Southern</th>
<th>Eastern</th>
<th>All India</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. Compound Growth rates</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(per cent/annum)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(b) 1972-82</td>
<td>4.68</td>
<td>1.60</td>
<td>4.74</td>
<td>3.80</td>
<td></td>
</tr>
<tr>
<td>(b) 1982-92</td>
<td>2.41</td>
<td>-0.43</td>
<td>0.19</td>
<td>1.07</td>
<td></td>
</tr>
<tr>
<td><strong>II. Compositional Changes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(In thousands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(c) 1972</td>
<td>20.34</td>
<td>6.46</td>
<td>16.45</td>
<td>26.11</td>
<td>69.36</td>
</tr>
<tr>
<td>(f) 1982</td>
<td>29.73</td>
<td>10.21</td>
<td>19.29</td>
<td>41.49</td>
<td>100.71</td>
</tr>
<tr>
<td>(g) 1992</td>
<td>38.28</td>
<td>12.96</td>
<td>18.48</td>
<td>42.28</td>
<td>112.00</td>
</tr>
<tr>
<td>(h) 2002 (p)</td>
<td>49.29</td>
<td>16.45</td>
<td>17.70</td>
<td>43.08</td>
<td>124.55</td>
</tr>
<tr>
<td><strong>III. Density</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(per sq. km)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) 1992</td>
<td>49.29</td>
<td>2.86</td>
<td>6.14</td>
<td>1.36</td>
<td>3.41</td>
</tr>
<tr>
<td>(c) 1997</td>
<td>4.30</td>
<td>2.84</td>
<td>6.20</td>
<td>1.53</td>
<td>3.62</td>
</tr>
<tr>
<td>(c) 2002 (p)</td>
<td>4.87</td>
<td>2.78</td>
<td>6.25</td>
<td>1.73</td>
<td>3.85</td>
</tr>
</tbody>
</table>

Table 15: Region wise estimates for dung through pigs. (In 000 metric tonnes)

<table>
<thead>
<tr>
<th>Years</th>
<th>Region</th>
<th>Northern</th>
<th>Western</th>
<th>Southern</th>
<th>Eastern</th>
<th>All India</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td></td>
<td>3.44</td>
<td>1.16</td>
<td>1.66</td>
<td>3.81</td>
<td>10.07</td>
</tr>
<tr>
<td>1997</td>
<td></td>
<td>3.91</td>
<td>1.31</td>
<td>1.63</td>
<td>3.84</td>
<td>10.69</td>
</tr>
<tr>
<td>2002</td>
<td></td>
<td>4.43</td>
<td>1.48</td>
<td>1.59</td>
<td>3.88</td>
<td>11.38</td>
</tr>
</tbody>
</table>
Summaries of Selected Papers

Economics of Milk Production in Mohanpur, Nadia District - A Case Study

A.K. Maiti, K. Chakravarty and B. N. Banerjee

Bidhan Chandra Krishi Viswa Vidyalaya, Mohanpur

India is one of the largest milk producers but, the productivity is low in comparison to other leading countries of the world. Milk production can be conceived as a function of several variables. Cost of production varies greatly with the change in these variables. The present investigation was conducted in Mohanpur village, Haringhata Block, Nadia district, West Bengal in 1998-99. Forty milk producers were selected randomly and the data on prices of milk, feeds and fodder's were also collected. Results of the study indicate that cost of milk production per liter is higher for pure breed cows than the crossbred cows. Highest milk production is noticed in the large size group for both the breeds. Pure breed cow is a poor yielder and average lactation length is also shorter than crossbred cow. Inclusion of a few crossbred cows can increase the income of a dairy entrepreneur and provide gainful and round the year employment.

Smallholder Livestock Production in the Home Gardens of South Kerala: An Economic Analysis.

S. Regeena

Farming Systems Research Station, Sadanandapuram, Kottarakkara

Existence of smallholdings of size less than 50 cents is a peculiar feature of the agricultural scenario of Kerala. These micro farms, also referred to as home gardens are put to rigorous use by the owners by integrating crop, poultry, livestock, fish and several other activities suited to the locality. Small livestock production units of one or two milch animals and their calves are common in such farming systems. The present study was based on data generated from 30 small holders of Kollam district. All the animals reared were crossbred cows. The average daily milk yield per animal was 6.37 liters, which at Rs.13 per liter fetched an annual income of Rs. 24,843. The annual maintenance cost per animal, inclusive of the imputed value of family labour was Rs. 30,935 and the farmers incurred a loss of Rs.6092 However at cost excluding the imputed value of family labour they could earn a profit of Rs. 6885. The activity was found to generate 141 mandays of gainful employment to the family members. It also had a complementary relationship with the crop activities on the farm, providing for waste minimization and nutrient recycling. The staggered pattern of income flow was an added attraction. However, lack of awareness of the proper management practices was a major constraint. It would be appropriate to carry out more awareness campaigns and also to take the considered opinion of the farmers before planning future breeding and cattle improvement programmes.
Resource Use Efficiency in Milk Production in Farrukhabad District of Uttar Pradesh

Atul Chandra and S.B. Agarwal

National Dairy Research Institute, Karnal
The present study was conducted in Farrukhabad district of Uttar Pradesh. Linear and Cobb Douglas type of milk production functions using daily milk yield as dependent and expenditure on green fodder, dry fodder, concentrate and labour as explanatory variables were tried. Linear regression model was preferred over log linear to examine resource use efficiency. The feed and labour inputs together explained 77 and 78 percent of total variation in milk production for crossbred cows and buffaloes, respectively. The positive and highly significant regression coefficients of expenditure on green fodder and concentrate both in crossbred cows and buffaloes indicated further scope of increasing milk production. It was also evident from the positive and significant higher marginal value products of expenditure on green fodder and concentrate than acquisition cost both for cows and buffaloes.

Economic Appraisal of Dairying: A Case Study of Shimoga District

R.S. Ramesh

Vaikunth Mehta National Institute of Co-operative Management, Pune
This paper makes an attempt to study the financial viability of dairying in Shimoga district of Karnataka. The study employs the multistage sampling technique for identification of the respondents. The data were analysed with the help of Net Cash Flow approach to arrive at logical but unorthodoxical conclusions. The analysis of the data reveals that the landless dairy owners were realizing better income by maintaining milch goats compared to cow and buffalo on small and large farm categories. The Benefit-Cost Ratio was found to be the highest for the small dairy category because of relatively less expenditure incurred on labour and fodder components than the other two categories. The large farm category was found to be owning more number of crossbred milch animals because of their strong economic base. It is thus implied that the financing agencies should never shy away from extending the advances to the dairy sector in India.

Employment and Income Generation through Draught Animals - A Regionwise Analysis

D.S. Nawadkar, K.S. Birari, V.G. Pokharkar and S.B. Lande

Mahatma Phule Krishi Vidyapeeth, Rahuri
Maharashtra State is characterized by varied types of soils, topography and climatic conditions. These factors mostly influence land use and cropping pattern, which have direct impact on labour use structure. In the present investigation an attempt has been made to examine the regional employment and income generation through draught animals. The exercise was based on the data
collected from 300 farm families spread over three regions of the state viz.; Western Maharashtra, Marathwada and Vidarbha for the year 1997-98 under the Comprehensive Scheme for Studying the Cost of Cultivation of Principal Crops in Maharashtra. The results indicated that the per hectare use of bullock labour was the highest (14.15 pair days) in Marathwada region. However, per farm bullock labour use for special activities such as hiring out of labour, procurement of inputs, preparation of farm yard, transportation, social work, etc; was noticed to be the highest (17.16 pair days) in Western Maharashtra region. The larger quantities of bullock labour were required during the months of May to July in all the regions. The annual income from the bullock labour was maximum (Rs. 1682.67) in Vidarbha region and least in Marathwada (Rs. 459.80) region. In view of the employment and income generated from the bullock labour use, maintenance of bullock labour becomes an uneconomic proposition.

Economic Significance of Cattle and Buffaloes on Typical Farms in Haryana

R.N.Pandey, A.C.Gangwar and S.K.Goyal

Chaudhary Charan Singh Haryana Agricultural University, Hisar

In this paper an attempt has been made to examine the present status of cattle and buffaloes on typical farms in Haryana. The primary data from a sample of 250 respondents from four randomly selected blocks from Hisar, Sirsa, Fatehabad and Bhiwani districts were collected for two years by visiting the sample households at least once in a month in a specifically structured schedule. It was found that in case of cows the average milk yield per day during the first month of calving was 6.52 kg, which increased to 7.27 kg during the second month and thereafter, it started declining and was only 0.02 kg in the 11th month. Similarly, in case of milch buffaloes, the average yield during the first month of lactation was 8.17 kg and it increased to 9.18 kg, per day during the second month and thereafter it started declining. During the 15th month, the average yield was only 0.02 kg. It was found that there was no definite trend in feeding pattern of the growing stock. At various stages of the age of cattle as well as buffalo calves/heifers, the total feed cost incurred on them substantially exceeded their average market value. However, after becoming pregnant, this gap between the total feed costs and their market value had substantially narrowed down mainly due to considerable rise in the market value of the pregnant heifers. There was a substantial net loss in raising of cattle and buffalo heifers. Similar to female cattle and buffalo calves, the average market value of male calves was also substantially less than the imputed value of feed and fodder fed to them. When the average costs and returns were taken into account for cattle and buffalo, the returns to labour and management and returns over feed cost were substantially higher in case of milch buffaloes than that of the cattle. Relatively higher milk yield as well as higher price of milk was responsible for economic superiority of the milch buffaloes.

Impact of Dairy Enterprise on Income and Employment in Madurai District, Tamil Nadu

T. Alagumani and M. Anjugam

Tamil Nadu Agricultural University, Madurai

A study was conducted in Madurai district to assess the impact of dairy enterprise on income, employment and asset position, and consumption expenditure. Multiple linear regression was
used to assess the determinants of household income. The results of the study revealed that about 57 percent of the farm households were engaged in dairy enterprise and 43 percent of them were having both crop and dairy activities. Additional income and employment generated per household were Rs.4990 and 365 mandays, respectively. Increased income has resulted in increased consumption expenditure to the tune of Rs.3213 and acquisition of new assets worth of Rs.10152 per household. According to the sample respondents increase in milk price is not in accordance with increase in cost of feeds. Hence it is suggested that for improvement of income and employment of rural people engaged in dairy milk price should be remunerative.

Livestock as a Tool of Diversification and Risk Management

R.K. Khatar, V.K. Singh, and B.S. Tomar

Choudhary Charan Singh Haryana Agricultural University, Hisar

Based on the primary data pertaining to the year 1994-95 collected from 90 respondents randomly selected from six villages from two blocks of Hisar district, it was observed that livestock played a vital role in diversification of agriculture. Dairy enterprise contributed about 18 percent of the total earnings of the farm households. Share of dairying in total earnings was found highest on medium farms (24.5 percent) followed by small farms (23.70 percent) and large farms (13.40 percent). On an average the livestock sector provided employment to the tune of 22.57 percent to the total mandays employment provided by different enterprises on the farm households. Since livestock sector provides regular income and employment and helps in minimization of risk in farming it should be given due emphasis through herd improvement, liberal financing and development of marketing infrastructure, processing and cheaper feed and fodder.

Sustainable Employment Generation through Livestock Enterprise-A Case Study of Bhind District (M.P.)

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The present study examine (i) employment opportunities and (ii) labor engaged in dairy enterprise on different size of land holdings in Bhind district of M.P. Two villages were selected randomly. Thirty farmers from each village and 10 from each group (i.e. small, medium and large group) were selected for the study purpose. The data relates to 1998-99. Both primary and secondary data have been collected. Keeping in consideration, the operation-wise distribution of employment days, it was found that large size farmers engaged comparatively more labour i.e. hired labour than other groups. Out of various operations, grazing required maximum number of days per year per milch animal. The percentage of labour in grazing decreased as the size group increased. Female labour was utilized in arranging grass, cleaning the cattle shed and milking. Grazing, feeding, milking and cleaning were operations where utilization of labour requirement was more. It was also found in the study that employment provided by milch animals was throughout the year. Rainy season gave maximum employment opportunities followed by winter and summer. The differences in the use of labour employment in different seasons varied due to the grazing and milking operations.
The Economics of Livestock Farming in Rural Areas of Tamil Nadu

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The present study is aimed to find out the expenditure pattern, investment and income level in livestock farming in the rural areas of the Tamil Nadu. Face to face interview was conducted with 300 livestock farmers randomly selected in the five regions. The amount of investment on livestock and farm buildings varied widely between regions and farm size groups. Increased farm size increased income ($P < 0.01$) even though the increase in income was disproportionate to the increase in herd size which was due to larger herds maintaining more unproductive animals. The land holding livestock farmers’ annual income in north, west, south, high rainfall and Cauvery delta regions was Rs. 45,082, 56,790, 54,816, 95,000 and 75,058, respectively.

Economic Viability of Draught Animals in Tribal Area of Dharni Tahsil of Vidarbha Region.

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The study was undertaken in 1999-2000. The results were based on data collected through personal interview with randomly selected 150 farmers. The average size of holding of tribal farms was 1.37, 4.33 and 10.60 ha for small, medium and large groups, respectively. Cropped area commanded per bullock pair was 1.63, 3.85 and 6.26 ha for small, medium and large farmers, respectively. Farmers of small, medium and large size holdings owned 1.10, 1.52 and 2.30 bullock pairs, respectively with an overall average of 1.51. Employment of bullock pair during the year or different farm and non-farm operations worked out to 186 and 227 days for small, medium and large groups, respectively. The net maintenance cost of bullock pair estimated to Rs. 10,270, 10,363 and 12,468 for small, medium and large size groups, respectively. By considering the number of working days the maintenance cost per day worked out to Rs. 38.68 and Rs. 39.71 at Cost III (A) and Cost III (B), respectively at overall level. The overall cost per day including working and non-working days in a year worked out to Rs. 22.66 and Rs. 23.27, respectively. Additional pressure of maintaining non-working days (per day) worked out to Rs. 16.02 and Rs. 16.44, respectively at overall level. The viable level of maintaining bullock pair was 179.11 days at overall level and viability of maintenance in small, medium and large groups was 171.16, 172.72 and 207.80 days, respectively.

Structural Changes in Livestock and Livestock Products in Maharashtra

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The present investigation is an attempt to examine the structural changes taking place in the livestock and livestock products in Maharashtra. The result based on time series data on livestock production and livestock products indicated that the proportionate increase in the population of milch cows, buffaloes and goat was 58.49, 110.41 and 94.12 percent, respectively during the year.
1992 over the base year 1966. This increase was 152.75 and 1005.05 per cent in the case of local and improved poultry birds. The total milk production increased from 8.79 lakh tonnes to 49.91 lakhs tonnes during the period of 30 years. Significant increase in the production of egg, wool and meat was also noticed.

The cross sectional analysis of 1995-96 data revealed that the Western Maharashtra region of the State alone shared 45, 54, 60 and 68 percent of the population of cows, buffaloes, sheep and goat and poultry, respectively. The region also contributed highest in the production of livestock products. It has contributed 62.51 percent of the cow milk, 64.41 percent buffalo milk, 55.48 percent goat milk, 73.73 percent wool production in the state. The regions are characterized by cooperative dairy development activities and sheep, goat and poultry farming on large scale, thereby providing a good subsidiary occupation to the crop enterprises. The annual compound growth rates estimated with the help of the exponential function for milk, egg, wool and meat production were positive and highly significant in both the periods i.e. 1970-71 to 1979-80 and 1980-81 to 1995-96 as well as for the entire period, with an exception of goat milk during period 1980-81 to 1995-96.

Comparative Economics of Buffalo Milk Production: Study of Gir Maldharis in Saurashtra

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Maldharis are an integral part of the Gir ecosystem. The word “Maladharis” covers various communities viz., Rabaris, Charsans, Bharwars, Ahirs, etc. Maldharis derive their livelihood mainly from livestock raising. Their domestic livestock comprised mainly of buffaloes. In order to achieve better understanding of the economies of Gir Maldharis and resettled Maldharis, the present study was undertaken. The important findings emerging from the study are: (i) on an average, per day maintenance cost of buffalo in respect of Maldharis and resettled Maldharis was Rs.32.99 and Rs.55.66, respectively. This indicates that the Gir Maldharis enjoyed the benefits of Gir forest for grazing purpose. (ii) feed and fodder contributed the most in total cost of milk production in all the cases. (iii) the average daily milk yield of buffalo in case of Gir Maldharis and resettled Maldharis was 5.47 liters and 7.01 liters, respectively. (iv) in general, relatively higher buffalo milk yield was observed in winter season for both the groups under study. (v) the average milk price realized by the resettled Maldharis was relatively higher than that of the Gir Maldharis indicating better marketing facilities to the resettled Maldharis. (vi) the results of profitability revealed that relatively higher net profit was earned by the Gir Maldharis. (vii) relatively higher lactation length and shorter dry period was found in respect of milch buffaloes maintained by the resettled Maldharis. (viii) the regression coefficients of dry fodder, concentrates and labour charges in case of buffalo milk production for Maldharis turned out to be positive and highly significant in all the seasons. On the other hand, all the inputs, except miscellaneous cost had positive and significant influence on buffalo milk production in respect of resettled Maldhari households.
Energy and Cost Requirements for Milk Production in Different Locations of Jabalpur, Madhya Pradesh

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Energy and cost requirement for milk production in different locations of Jabalpur, Madhya Pradesh are discussed in this paper. A survey was carried out in the year 1996-97 in four different locations of district Jabalpur, Madhya Pradesh. The locations were Maharajpur, Imaliya, Pariyat and Mohaniya. The maximum human energy / cost was used in the Mohaniya area, the value being 4.20 MJ (Rs.14.21). Energy/cost use for fodder (dry and green) and different types of concentrate was estimated to be the highest in the Pariyat area. In the Pariyat area, more amounts of concentrates (37.5%) were fed to the animals as compared to other areas. In the Mohaniya area more amounts of fodder was fed to the animals as compared to other areas. Energy/ cost used from machinery and housing was also estimated to be the highest in the Pariyat area (7.12 MJ/Rs.3.19 /day /animal). The sources like fuel, electricity, minerals and medicines required comparatively less energy and cost. From the percentage source-wise cost composition, it was found that in all the four areas the costliest source was feed concentrate (above 35%) followed by fodder (above 30%), human (above 25%), machinery and housing (above 5%) and least costly source of energy was fuel and electricity (less than 5%). The output - input energy /cost ratio of main product (milk) was highest in the Pariyat area (0.11/1.66) and lowest in Mohaniya area (0.09/0.60). The values of specific energy and output-input energy cost ratios indicate that the performance of dairies in Pariyat area was the best among other surveyed dairies. Livestock enterprises differ greatly in the rate at which capital turns over. The poultry enterprise has low initial investment and rapid turnover. In normal period poultry gives a complete turn over within a year. Milch cattle, on the other hand, call for heavy initial capital investment and give turnover in two to four years. Our common grazing lands are also over stocked.

Cost and Returns of Sheep Farming under Intensive and Semi-Intensive Systems

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A total of 200 lambs (100 males and 100 females) belonging to two genetic groups viz. Nilagiri and Nilagiri-synthetic breed were selected and randomly allotted to intensive and semi-intensive systems. The group under intensive system had, on an average, gained a body weight of 4.48 per animal over the semi-intensive system. The cost on feed and labour was significantly higher for the group under intensive system. However, the increase in the body weight in intensive system was large enough to offset the higher cost incurred through feed and labour.
Economic Status of Small Ruminant Rearers in Tribal Areas of Himachal Pradesh

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Small ruminant rearing has a special importance in the tribal economy of Himachal Pradesh. These tribal areas, being most inaccessible, offer few livelihood options for the inhabitants. The present study aimed at examining the trends in population of small ruminants (sheep and goat) in general and economic status of selected nomadic shepherds of the tribal areas in particular. A two-stage stratified random sampling design was adopted to select a sample of 150 small ruminant rearers (73 small, 45 medium and 32 large) from ten per cent of villages (thirteen) in Bharmaur sub-division of Chamba district, HP.

Tribal areas of Himachal Pradesh, commanding over 42.5 per cent of the geographical area of the state, accounted for 7.0 per cent of the state livestock population in 1992. Taken together, sheep and goat constituted a major segment (80 %) of total livestock in these areas, signifying their importance in such areas. Sheep outnumbered goat population in Bharmaur and Spiti tribal pockets. On the whole, goat population witnessed a decline in both tribal and non-tribal areas of Himachal Pradesh despite a heavy demand for their meat and being more economical than sheep. This decline may be attributed to the faulty grazing policies of the state whereupon grazing on the earmarked areas is discouraged due to destructive grazing habits of the goat to the growing/ fresh forest plantations. The average flock size of small ruminants on sample farms was 128, comprising of 72 sheep and 56 goats. The average wool yield per annum from three shearing was 1.281 kg, which was much higher than the national average of less than 1.0 kg. Besides, this enterprise provided more employment to the males because of its being migratory in nature. On an average, 511 mandays per farm per annum were generated through this enterprise. Regarding income, an average household could realize Rs.34, 988 comprising around 67 per cent of the total household income.

Economics of Goat Farming in Ratnagiri District of Maharashtra

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The present study attempts to examine the profitability in goat farming in Ratnagiri district of Maharashtra. The study is based on primary data collected from 190 selected goat keepers for the year 1998-99. Selected goat keepers were grouped according to their flock size as small (upto 15 goats), medium (16 to 30 goats) and large (above 30 goats). Per flock annual maintenance cost worked out to Rs. 13294 in small group, Rs. 16320 in medium group and Rs.22823 in large group with over all cost of Rs.15483. Net income was Rs. 3947 per adult goat. Whereas per adult goat cost of maintenance decreased with increase in flock size. Considering cost incurred and returns obtained from goat farming it can be concluded that the business of goat farming is profitable in study area. Again results of the study showed that to maintain a flock of 30 and above is the most profitable.
An Economic Study on Poultry Enterprise in Malwa Region of Madhya Pradesh

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The rising trend of poultry farming in Madhya Pradesh is quite encouraging. This study intends to highlight the salient economic features associated with poultry enterprise of Malwa region of Madhya Pradesh, and pertains to the year 1998-99. The objectives of the study were: (1) determining the cost and returns of layers, (2) estimating net returns and benefit - cost ratio of layers, (3) and identifying constraints to commercial poultry. The study was conducted in Indore district of Malwa region where concentration of poultry farms is very high. The sample poultry farms numbering 21 were categorised into small, medium and large. The average cost of rearing per layer per cycle was Rs. 418.65, and revealed an inverse relationship with increasing farm size. This was due to higher maintenance cost on smaller farms. The feed cost accounted for over 47% of the total cost of rearing. The expenditure on feed and medicine was higher on small farms. The gross return varied depending on number of layers, average egg production per bird per cycle and prices received. Total returns included sale of eggs, poultry manure and gunny bags. The average gross return per layer was estimated Rs. 481.25, and revealed inverse relationship with farm size. In layers, eggs were the major source of income with about 85 per cent of gross returns. The average net return per layer amounted to Rs.42.60, the average benefit -cost ratio being 1:1.1. The poultry entrepreneurs indicated difficulty in acquisition of capital and non-availability of improved chicks as the most important constraints in establishing commercial layer units.

Participation of Women in Commercial Poultry Farming A Case Study in Andhra Pradesh.

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A study has been conducted to analyse the participation rate and problems being experienced by farm women, in different activities of commercial poultry farming. The major activities include, housing, feeding, production management, litter management, medical care and marketing. The study was conducted in two Mandals of Guntur district viz., Narasaraopet and Medicinour. Again in each Mandal, two villages having more than 3 poultry farms were selected based on the number of poultry farmers. Further, farmers numbering 60 were selected randomly and stratified 30 each, into small farmers (owning < 500 chicks) and 30 big farmers (owning > 500 chicks). Owned women labourer participation was more in the small poultry farms, compared to the hired laborers of the same group. In small poultry farms, the activities viz., collection (81.7%), grading (26.7%) and storage(90%)of eggs; providing feed (88.3%)and watering(88.3%) were mostly performed by women. In big poultry farms, women (hired) participation was confined to managing the activities only and even in some operations, it was negligible. With the size of poultry farms, the participation of women was decreasing. Significant problems experienced by poultry farm women were lack of awareness about improved practices and disease control measures, higher feed cost and low egg prices, lack of storage facilities, excessive involvement of middlemen, high transportation cost and lack of export facilities.
Economics of Egg Production – A Case Study in Dharwad District of Karnataka State

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The present study estimated the cost of establishment of different sized poultry farms and cost and returns in egg production. This study was conducted in three major egg-producing talukas of erstwhile Dharwad district of Karnataka during 1997-98. The primary data required for the study was collected from 50 randomly selected poultry farms by adopting personal interview method. The results of the study revealed that the capital investment required for small farms was Rs.3.66 lakh and Rs.16.39 lakh for large farm and Rs.8.75 lakh on an average farm. Among the various components of investment, the proportion of investment on shed including land was about 52 per cent in both size of farms. The other items of establishment costs were on battery cage and equipment. The total cost incurred in egg production amounted to Rs. 8.16 lakh on small farms, Rs.37.29 lakh on large farm and Rs.35.04 lakh on an average farm. In the total cost, the proportion of variable cost was 93 per cent irrespective of the size of farm. The expenditure on feed alone accounted for 82 percent. The returns from sale of eggs constituted the major share (88%) followed by sale of culled birds (10%). The net returns from egg production were Rs.89,465 on small farms, Rs.3,73,626 on large farms and Rs. 2,03,529 on an average.

Employment, Income and Problems in Broiler Farming: A Case Study in Kamrup District of Assam

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The study was conducted in Kamrup district of Assam to examine pattern of employment and income from broiler farming. Employment of permanently hired labour was more in all size groups of farms. The benefit cost ratio was found to be 1.23. Break even analysis revealed that the sample farmers were economically viable in the area under study. Lack of hatcheries and quality poultry feeds were the major problems faced by the farmers.

Traditional Poultry Farming in Hilly Areas: A Need for Fresh Look from Rural Development perspective

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Backyard poultry farming is common in rural and many periurban areas. There is hardly any published report based on comprehensive study of traditional poultry farming in hilly areas of the country, although it has received much attention in many Asian and African countries. Traditional poultry farming in hilly areas has multiple objectives and is a good example of
internalized low external input system. Contrary to general belief, it has a role in family economy; it is well knit with rural system and way of life. The products are sold at a premium through an interesting market system. There is a good case to study the system critically from rural development perspective. Backyard poultry farming in hilly areas can be one of the most promising dimensions for agricultural diversification in the mountains and it can assure employment to women farmers, unemployed youth and retired persons.


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Poultry keeping is as old as human civilization since the livestock component became an integral part of subsistence farming. Poultry enterprise has now become India’s most innovative industry. It developed from backyard to frontline production unit and also has achieved the highly mechanized and vertical integrated form commanding global markets. Interplay of production and consumption sectors, accessibility to technical know how, financial supports and political decisions have paved the path for unprecedented growth phenomenon of poultry sector. In view of these disparities and differential growth rates of poultry sector, an attempt have been made to explore the contribution of commercial poultry units in terms of employment and income generation along with horizontal and vertical linkages of poultry sector with other industries to diversify the economic activities.

Contribution of Livestock and Crop Enterprises to the Economy of Tribal Farmers.

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The primary data were collected from 400 tribal households consisting of landless (23), marginal farmers (159), small farmers (158), medium farmers (38) and large farmers (22) in Kanke block of Ranchi district, Bihar during 1996-98. The analysis reveals that average annual income from livestock activities was Rs. 3384 per farm. Among livestock activities, milch animals contributed about 53 percent to gross annual income. The next important activities were goats and pigs contributing about 31 percent and 16 percent to total livestock income, respectively. It was found that goats and pigs were primary source of income for the landless and marginal farmers. It was further observed that livestock activities created an annual employment opportunity of 559 mandays, varying from 441 days to 725 days on different farms. Among livestock, draught animals generated average employment of 168 mandays, goats and sheep 145 mandays, milch animals 137 mandays and pigs 126 mandays. The analysis further indicated that livestock and crop enterprises were the main source of on farm employment. The average annual employment per farm was observed to be 987 mandays, which varied from 414 to 1347 mandays on the sample farms. The number of employment mandays was positively associated with size of agricultural holding. Crops, livestock and farm forestry were prime sources of on farm income.
The average annual gross income from these enterprises was found to be Rs. 26,414 per farm. The contribution of crop husbandry, livestock and farm forestry was 76 percent, 14.7 percent and 7.3 per cent, respectively.

Livestock Status of Assam and Findings of a Study Conducted in Jorhat District

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In the rural based economy of Assam, livestock is the most important source of draft power, supplier of various livestock products and by-products and also source of supplementary farm income and employment. Assam had 119.78 lakh livestock and 131.41 lakh poultry during 1994 and the growth rate was positive except in 1971. The availability of livestock per thousand population has declined from 834 in 1961 to 451 in 1996. The livestock density per 100 ha of net sown area declined from 424 in 1961 to 400 in 1996. The findings of the study conducted in Chakial, Baruagaon and Sensoah villages of Jorhat district indicated that availability of livestock and poultry per household increased but the availability of draught animal per household decreased with increase in the size of holding. Total labour days of livestock use was 116.53 and out of it 55.84 days was for crop production and 60.69 days for transportation and other purposes. Livestock and poultry contributed 22 percent to cash income and the proportion was higher on smaller farms.

Contribution of Dairy Enterprise in the Economy of Rural Families in Maharashtra

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Mahatma Phule Krishi Vidyapeeth, Rahuri

The advantages of dairy enterprise along with the crop production are manifold. Farmers depend on livestock for milk, draft power and organic manure. The present investigation was carried out to know the contribution of dairy enterprise in the income and employment of rural families. The study was based on information obtained from 30 landless labour and 90 farm families from Malshiras tahsil of Solapur district in Maharashtra State. The results of the study revealed that the cropping pattern of the sample families was dominated by cereals (56 %) followed by sugarcane (23 %) which were helpful in providing fodder needs of the milch animals of sample families. The number of milch animals possessed by sample families was two. Per hectare cost of cultivation of sample farms worked out to Rs.14643 and per hectare net income was Rs.8725. The costs and returns from crop production activity increased as the size of farm increased. The per farm total cost incurred on dairy enterprise was Rs.31074 and the income received from it was Rs.38722. The value of milk was having maximum share (90 per cent) in the total income of the dairy enterprise. The net returns received from the dairy enterprise was Rs.7674. The share of income from dairy enterprise in the total income of sample families was next to the income from crop production activity. While in case of employment of sample families, dairy enterprise provided maximum employment of 147 mandays (30 %) and followed by crop production activity 134 mandays (27%).
Contribution of Livestock in the Generation of Employment and Income on Sample Farms in Western Maharashtra.

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Mahatma Phule Krishi Vidyapeeth, Rahuri

In Maharashtra, livestock has become popular in rural areas, as the activity is much more supportive to agriculture than any other subsidiary. The Government is also making efforts in this regard. The study was undertaken to assess the livestock position, feeding expenses and income and employment generated through the activity. The village, Pimpalgaon Wagha from Nagar tahsil in Ahmednagar district was selected for the study. In all, 105 sample cultivators were selected. The data for the year 1998-99 were collected. Simple tabular analysis was carried out. The study revealed that the sample cultivators were having 0.62 ha area under irrigation. The cereals and pulses were dominant in the cropping pattern. The increase in area under pulses and fodder crops was prominent over a period of nine years. The sample farms possessed 4.12 livestock units. The milch cattle constituted 36.65 per cent in the total livestock. The annual employment for male was 238 and 230 days for a female worker. The livestock was the major source of employment both for male and female workers with 30.28 and 41.92 per cent share in the total employment, respectively. The value of owned fodder was 58 per cent and 40 per cent that of purchased feeds etc. in the total expenditure of feed and fodder. The sale of milk was the prime source of income from livestock i.e. 83 per cent contribution in the total income from livestock. The income from livestock was having the highest contribution of 53 per cent in the total income.

Livestock in the Production Systems of Small Farms: Experience from Tamilnadu

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The livestock sector has emerged as an important segment of an expanding and diversified agricultural sector in the Indian economy. The small and marginal farmers, landless laborers and other vulnerable segments of the rural community own milch animals. The complementary relationship between the agriculture and livestock sectors has been often highlighted in the literature. But, the optimal combination of crop and livestock activities on the small farms has to be arrived at as to maximize the net returns. Present study was carried out with the objectives of (a) to study the production plans practiced by the small farmers in order to assess the viability and their contributions to farm business income, (b) to assess the contribution of livestock in terms of capital formation, employment generation and as a source of income on small farms, (c) to develop alternative production plans for small farms with a view to increasing farm viability and household income, and (d) to suggest the ways and means for augmenting the income on small farms to improve their levels of living. Dindigul district of Tamil Nadu was purposively selected for the study. The sample farmers were post stratified into six groups representing six production systems as follows: (a) crop alone (system I), (b) crop + draught animal (system II), (c) crop + milch animal (system III), (d) crop + draught + milch animal (system IV), (e) crop + sheep
(system V) and (f) crop + milch animal + sheep (system VI). To develop alternative production plans that will be feasible with the constraints on resource availability and the existing technology, a linear programming model that incorporates production activities, purchase activities and hiring activities was constructed. This basic framework was used to develop production plans for the typical farm selected on the basis of the mean farm size. Data collected were analyzed with reference to the objectives specified and the results were discussed. The study concluded that (i) production plans practiced in small farms of the study area in all the systems were viable and generated positive net income, (ii) except the farms where systems II (Crop + Drought animal) and system V (Crop + Sheep) were followed, the net farm income was sufficient to meet the household expenses of the small farm household, (iii) small farms in the study area have the potential to generate additional income by diversifying the farm enterprise with milch animals and sheep, (iv) optimizing the farm resources offers scope for increasing production, income and employment.

Performance of Livestock Sector and its Linkage with Crop Production Husbandry: Evidences from Agro-Climatic Regions of Tamil Nadu

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The present paper analyses the development of livestock sector in various agro-climatic regions of Tamil Nadu and extent of use of bullock power in crop production, taking into account the regional endowment factors. The state registered a fall in livestock population to the tune of 2.6 per cent between 1989 and 1994 census. The decline in livestock population has implications on the production of crops and the economy. The pattern of bullock labour utilisation and its relationship with farm size were analysed using the time series cross sectional data (Cost of Cultivation of Principal Crops Scheme) gathered for 3 different decadal points of time namely 1972-73, 1981-82 and 1992-93. The proposition that use of labour saving technologies like tractors had expanded rapidly and they were substituted for human and bullock labour was partially supported by statistical evidences from the study. There was a steady growth in use of animal labour for crop production in some of the agro-climatic zones, though the share of cost declined. Few agro-climatic zones exhibited negative trend in use of bullock labour. There was a positive association between bullock labour and farm size in both the size groups during first period. The small farms mostly depended on hired bullock, whereas large farms used owned bullock power. The elasticities, which were significant during first period, turned to be negative during later period indicating that bullock labour was replaced in both the size groups.

The elasticities of machine labour were found to be not significant in small farms during first period in all zones. But elasticity in Zone I was found to be significant in large farms during the same period. Similarly, during second and third periods, Zone III and IV exhibited positive and significant elasticities on large farms. On the whole, the complementarity between machine labour use and farm size was not a universal phenomenon. The magnitude and the nature of elasticities to some extent proved the positive association between labour saving technologies and farm size.
The temporal variation in tractors revealed that due to the larger availability of tractor services, the substitution effect of tractorization was noticed in less developed districts in terms of livestock sector. The districts which are less developed in terms of livestock sector are endowed with better resources and spread of modern varieties in those districts induced labour saving technologies like tractors, trashers, etc. In the less developed districts in terms of livestock sector, there is larger availability of tractor for custom hiring and the technology become divisible, which facilitated the farmers to hire tractor services as labour saving technique. The competitive market structure for tractor services kept the tractor rent also competitive and the districts are more tractorised due to development in crop husbandry.

It was observed that the less endowed districts are found to be highly developed in terms of livestock sector due to uncertainties associated with crop husbandry. On the other hand, less developed regions in terms of livestock sector are found to be ecologically highly endowed regions and witnessed tractorisation and such tractorisation substitutes bullock labour. The dairy farming activities could be tapped on scientific lines in dry farm situations by providing adequate support in terms of animal health care, marketing infrastructure, remunerative price, fodder development and other services.

Livestock as a Tool of Diversification and Risk Management

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The present study was conducted to examine the role played by livestock particularly milch animals towards generation of income when adopted as a subsidiary occupation by the farmers. The study is based on 45 farmers who had income from milch animals and crop production were randomly selected from Panagar block of Jabalpur district, Madhya Pradesh and pertains to the year 1998-99. The study reveals that crop- cum- livestock farming was the most suited strategy for the diversification of farms operated by risk aveters. Sample farmers had small number of milch animals varying from 3.7 to 10.2. Most efficient group has the largest herd of milch cattle and made best use of resources. As the number of milch animals increased, better amenities and economies of scale could be obtained with respect to fixed assets. Major portion of income was received by sale of milk irrespective of size group. It was found that units could earn more if milk as such is sold rather than converting it into products. Income from dung and manure was another source of income. Percentage share of farm net income from milch animals increased with the unit’s size. The share was highest in large group (18.63%) and lowest (16.41%) in small group. Crop - livestock farming system being a profitable enterprise must be encouraged so as to diversify the farm business and to have more and stable income. The results obtained indicated the urgent need for research efforts in animal breeding, feeding and management for augmenting the productivity.
Study on Income and Employment Generation in Agriculture Based Livestock Farming Systems

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Acharya N.G. Ranga Agricultural University, Hyderabad.

A study on agriculture-based livestock farming systems has been carried out with an objective to estimate the income and employment generation among the existing farming systems and to suggest the profitable system in Northern Telengana Zone of Andhra Pradesh. Karimnagar district was purposively selected for the study with a sample of 96 farmers, constituting 44 from dairy, 32 from poultry and 20 of sheep rearing as their subsidiary occupations in addition to agriculture. Further, 15 farmers having agriculture alone were also selected for comparison. The differences between different farming systems with respect to income and employment generation were tested by ANOVA.

The results revealed that all the three agriculture-based livestock farming systems viz., dairy, poultry and sheep rearing generated more than 200 percent additional employment over agriculture alone. The difference in number of days of employment between different farming systems was statistically significant and all the three systems under study were found to be at par with each other in creating employment potential in the study area. The net returns were higher in agriculture + dairy, compared to agriculture + poultry and agriculture + sheep rearing. The mean difference in incomes of agriculture + dairy with other systems were significantly higher indicating the superiority of the system for higher income generation in the zone.

Economic Evaluation of Dairy Units in Different Seasons in Prakasam District of Andhra Pradesh

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Department of Agricultural Economics, Agriculture College, Bapatla.

Dairying is a living bank for farmers, which provides flexible financial reserves during economic stress and buffer against crop failure. Multiple regression analysis was employed to know the contribution of various factors like dry fodder, green fodder, concentrates and labour towards gross milk yields in different seasons for rural, semi urban and urban areas. Diversion of expenditure from concentrates to dry fodder will increase milk yield in urban areas during summer season. Expenditure on labour for maintenance of hygiene in rainy season should be increased. Excessive use of concentrates in semi urban areas during winter season should be avoided. The results indicated that farmers should be educated about the optimum use of various inputs for improving the milk yield.
Livestock in Different Farming Systems: Its Importance in Farm Diversification, Profitability and Employment in Household Economy of Assam

B.C. Bhowmick and A.K. Sarma
Assam Agricultural University, Jorhat

Livestock is one of the important components of farming systems in the developing countries. It has strong social and religious significance in the rural farm economy. Besides supplying nutritious food and supplementing farm income it also generates employment opportunities to farm family labour. Nevertheless, livestock in this part of the country is reared and managed mostly by traditional ways and as a way of life. Commercialization is yet to take place. The complementary relationship between crops and livestock enables the farm families to effectively utilize the scarce resources. Scientific management of livestock with proper enterprise mix not only enhances production but also substantially improves farm income. Although degree of diversification towards livestock in most of the agro climatic zones of Assam seems to be high yet the income generated from it is far from satisfactory mainly owing to less productive stock and relatively lower working capital investment. Nevertheless, it is important to switch from the less productive and unremunerative stock of livestock to improved and quality breed of animals which will enhance farm income substantially especially on small and marginal farms that have comparatively lower size of holding.

An Economic Analysis of Contribution of Livestock and Crop Production in Wheat Zone of Madhya Pradesh

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In the present study an attempt has been made to examine contribution of livestock to crop production in relation to the size of holding and to find out the level and extent of income and employment generated on selected households through livestock. The wheat zone of Madhya Pradesh was selected purposively for the present study, which comprises of eight districts namely Sagar, Damoh, Hoshangabad, Raisen, Narsinghpur, Vidhish, Bhopal and Sehore. Out of the eight districts, three districts namely Hoshangabad, Sagar and Damoh were selected randomly. From the selected districts primary data for the year 1997-98 were borrowed from Cost of Cultivation Scheme. The secondary data on livestock population has been collected from agricultural statistics for a decade (1989-1998). It was observed that bullock population has declined in all three districts during the study period and the growth rate was negative and highly significant. It indicates that the use of bullock power in the crop enterprise has decreased due to increase in the mechanical power viz. tractor etc. The strength of bullock pair increased with the increase in size of holding but it shows an inverse relationship with respect to bullock labour hired out. The maximum return from hiring bullock was found on marginal and small farms i.e. Rs. 1913 and Rs. 1476, respectively. The average return from bullock hired out on the sample farms was Rs. 1059 per hectare. The income from milk of cattle and buffalo was lower on marginal farms and it increased as the size of farm increased. The income from milk was higher than the income received from bullock hiring. The average return from milch cattle and buffalo on sample farms was Rs.8912 and Rs. 3741, respectively. The gross return inclusive of bullock hired out and from the production of milk was higher on large farm than that of marginal and small farms, indicating inverse relationship with the size of farm. It is evident from the results
that the income from production of crops was higher on large farms and it was lowest on marginal farms. Out of the crop and livestock enterprises, income generated through crop was higher on all the farms of different categories as compared to livestock enterprises.

**A Study on Economics and Viability of Different Farming Systems in Scarcity Zone of Western Maharashtra**

*V.R. Shete, P.M. Kapase, and P.N. Shendage*

*Mahatma Phule Krishi Vidyapeeth, Rahuri*

The present investigation is an attempt to examine the economics and viability of different farming systems in respect of sustainability. The results are based on the information of research project of farming systems carried out at Jeur Research Station district Solapur at five different locations for the year 1999-2000. The crop and animal components were studied under three sets of farming systems. The set I consists of mixed farming system i.e. irrigated and rainfed farming set II consists of rainfed farming system and set III rainfed farming system (totally rainfed). In general the crop production in all the three sets was profitable. The detailed analysis indicated that the kharif crops in Set-I viz., Soybean and Urd were in loss and the remaining crops were in profit. The per hectare highest profit of Rs. 50,932 was obtained from onion for seed. In set-II all the kharif crops were in loss and the rabi crops were in profit. In set III all the kharif crops were in loss and the rabi crops were in profit. In set III horse gram was in loss to the extent of Rs.2383/ha. And the highest profit of Rs.6765 was obtained from the sorghum crop. The maintenance cost exceeded the receipts obtained from the livestock during the year mainly due to under utilization of bullock pair and inadequacy in feeding of concentrates to the crossbred cows. The cost of cultivation of crops indicated that all the three sets were in profit indicating economic viability of farming systems. The per hectare profit obtained was highest in Set-I followed by set-III and II.

**Economic Analysis of Dairy-Crop Enterprise in Ghazipur Distt. (U.P.)**


*Udai Pratap Autonomous College, Varanasi*

For the present study sixty farmers were interviewed from eight villages of Jakahnia block of Ghazipur district. It was found that on smaller size group of farms, farmers having poor breed of cows and buffaloes and proportion of cows are more than the buffaloes as compared to large sized farms. Dairy and crop enterprises have complementary relationship. Dairy enterprise contributes significantly (19.1 to 25.36 percent) to the income of the farmers and accounting 31.03 to 41.18 percent of employment generated. Small and marginal farmers properly manage their crops and get better returns over the cost (163 to 171 percent). These farmers may also get better returns from dairy enterprise by maintaining good breed of the milch animals and proper care on their farms.
Role of Dairying in the Household Income of DWCRA Beneficiaries of Guntur District of Andhra Pradesh

S.K. Apsarjahan and Y. Eswara Prasad

Agricultural College, Bapatla.

Dairying is the subsidiary enterprise to most of the Indian farmers. Women play a major role in keeping livestock. As they lack productive and useful skills, they are preferring dairying as economic activity under Development of Women and Children in Rural Areas (DWCRA) programme. The present paper examines the impact of dairying on the income of DWCRA beneficiaries. Multi stage random sampling technique was used for the selection of mandals, villages and milk producing DWCRA beneficiaries. A sample of 60 dairying households of DWCRA programme were selected for the present study. The annual household income of beneficiaries increased after taking up the dairying activity. The range of annual incomes after the DWCRA programme was from Rs.8900 to Rs.20500. Statistical tests had shown that dairying could contribute to the additional income significantly. Additional days of employment generated and number of milk animals could contribute significantly to the household income.

Management of Reservoir Fisheries – A Supplementary Activity to Agriculture

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Central Inland Capture Fisheries Research Institute, Barrackpore

Dr. Y.S. Paramour University of Horticulture and Forestry, Solan

Reservoir fishery is recognized as a supplementary activity to agriculture. The present paper is directed towards efficient fisheries management of reservoirs leading to better socio-economic status for the local fishers. The two reservoirs, namely, Gobind Sagar and Pong Dam in the state of Himachal Pradesh are among the most fertile biomes of our country, and contribute a major share in fish production of the state. Therefore, these were selected for detailed investigations relating to i) existing level of fish production; ii) carrying capacity or potential fish production; and iii) maximum sustainable fish harvest. The observations pertain to period 1976-77 to 1997-98.

Average annual fish production of Gobind Sagar and Pong Dam was 757 and 459 tonnes with fish yield of 47 and 19 kg per ha. The fish yield observed significant growth for Gobind Sagar (3.24% per annum), while for Pong Dam; it was non-significant due to wide fluctuations. The fish seed-stocking rate was in concurrence to the fish productivity. Its growth rate was 8.95 and 5.92% for Gobind Sagar and Pong reservoirs. The fish production potential for both the reservoirs was nearly three times the existing level, offering immense scope for enhancing fish production. But depending upon catch per unit effort data both the reservoirs have already surpassed the maximum sustainable yield. Therefore, the management practice should be to increase the existing level of fish stock through increased artificial recruitment and generous exploitation. It would result in i) exploitation of untapped production potential; ii) enhancement of maximum sustainable yield (MSY); and iii) increment in fishing effort at MSY, thereby providing opportunities for higher production and better employment.
1. Introduction

The contribution of science and technology to growth and development of India’s agricultural sector is self-evident since at least mid-1960s. The technology driven growth in agriculture helped country achieve self-sufficiency in foodgrains and many other commodities. Developments in research and production infrastructure and encouraging government policies acted as catalysts in this. Considerable technical progress has been made in other sub-sectors of agriculture such as horticulture, livestock and fisheries, its impacts have been slow and sporadic.

Livestock is next to crops in terms of its contribution to income and employment generation. However, its productivity is low, compared to the world average. Cattle milk yield is about half of the world average of 2072 kg/cattle annum. Similar is the case with beef and pork production. The situation becomes more depressing when compared with the developed countries. Average milk yield of cattle is 13 percent of that in the USA and 16 percent in Canada. Sheep and pig meat yield is about 60 percent less. 

Nonetheless, in recent years certain outputs of livestock such as milk, meat and eggs have been growing at an annual rate of 5 percent or more. But, the sustainability of these trends in the long run is ambiguous, as the current production environment has several constraints. Feed fodder has been a real limiting constraint to livestock production and is unlikely to be relaxed in the near future, considering the huge dimensions of livestock population. Common grazing lands have been deteriorating quantitatively as well qualitatively (Jodha, 1991). Animals are fed on crop byproducts and forages from roadsides and other marginal lands. Feeding of grains and other concentrates is inadequate and the competition for grains would intensify with increasing human and livestock populations. Thus, technology would be a key factor in improving productivity of India’s livestock.

2. Status of Technological Change

In the livestock sector significant research advances have been made in areas of animal breeding, nutrition and health. And, many of the research products (technologies) have been found to be viable technically as well as economically under controlled experimental conditions. Their application in the field has rather been weak. Examples of such technologies include improved animal breeds and chemical and biological treatment of feed and fodder. A brief review of the existing as well potential technologies that could influence the growth of livestock sector is presented below.
2.1. Breed Improvement

Crossbreeding of low yielding indigenous breeds with high yielding exotic breeds has been widely acknowledged as a valuable strategy to improving animal productivity. Systematic crossbreeding research and development programmes in India were initiated during 1950s. The focus of crossbreeding research has, however, been mainly on cattle because of its dual role of milk production and provision of draught services to the crop sector. Since then, a number of crossbreeds with improved production potentials have been evolved. Some important crossbreeds include Haryana X Friesian, Haryana X Jersey, Haryana X Brown Swiss, Rathi X Jersey, Gir X Jersey, Gir X Friesian and Sahiwal X Jersey.

Adoption of crossbreeding technology, however, has been slow. Only 7.5 percent of the cattle population is of crossbreds (Table 1). In case of other animal species too the status of crossbreeding is not much different. Hardly about 5 percent of the sheep and 15 percent of pigs represent crossbreds. The probable reasons could be non-acclimitisation and high incidence of morbidity and mortality in crossbred animals. The success in the poultry sector, however, is notable. The share of improved poultry in total poultry population is about 34 percent. Crossbreeding is also practised in other species statistical information, however, is lacking.

| Table 1: Species-wise share of crossbred population (percent) |
|-----------------|-----------------|-----------------|-----------------|------------------|-----------------|-----------------|
| Cattle          |               |               |               |               |           |           |
| Total           | 4.31          | 6.87          | 15.61         | 20.16         | 4.67      | 7.44      |
| Male            | 3.92          | 4.35          | 11.91         | 11.45         | 4.09      | 4.58      |
| Female          | 4.73          | 9.41          | 17.45         | 25.58         | 5.30      | 10.25     |
| Sheep           | 3.12          | 4.73          | 8.83          | 7.52          | 3.27      | 4.98      |
| Pig             | 8.75          | 14.23         | 15.73         | 16.14         | 9.50      | 14.46     |
| Poultry         | 20.10         | 31.86         | 42.09         | 44.37         | 21.69     | 32.86     |

Source: Computed using data from Livestock Censuses.

Population of crossbred animals, however, is increasing. Between 1982 and 1992, population of crossbred cattle increased at a rate of 5.6 percent a year (Table 2). Female population, however, increased faster. On the other hand, the indigenous stock seems to be approaching towards stabilisation. Annual rate of growth in indigenous cattle stock was 0.52 percent, though female population witnessed a slightly higher growth. Low milk yield and deciling demand for animal draught services are the main factors for slow growth in indigenous stock. These trends, however, indicate a gradual substitution of indigenous cattle by crossbred ones.

Buffalo is another important milk species. But, it has not received much attention in breed improvement research. Development efforts have focussed on upgradation of low yielding breeds through artificial insemination. However, buffalo population between 1982 and 1992 increased at a rate of 1.9 percent a year. Female population witnessed faster growth than the male population. The phenomenon of increasing buffalo population is witnessed in most parts of the country. Its adaptability to wide range of climatic conditions, higher milk yield compared to indigenous cattle and price premium on milk for higher fat content have favoured faster growth in buffalo.
population. Further, salvage value of buffalo is higher; unlike cattle there are fewer restrictions on buffalo slaughtering.

Table 2: Growth in crossbred vis-a-vis indigenous livestock population, 1982-1992

<table>
<thead>
<tr>
<th></th>
<th>Rural</th>
<th>Urban</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cattle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crossbred</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>5.53</td>
<td>6.40</td>
<td>5.62</td>
</tr>
<tr>
<td>Male</td>
<td>1.32</td>
<td>4.83</td>
<td>1.56</td>
</tr>
<tr>
<td>Female</td>
<td>8.38</td>
<td>6.88</td>
<td>8.17</td>
</tr>
<tr>
<td>Indigenous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>0.44</td>
<td>3.14</td>
<td>0.52</td>
</tr>
<tr>
<td>Male</td>
<td>0.22</td>
<td>5.30</td>
<td>0.34</td>
</tr>
<tr>
<td>Female</td>
<td>0.67</td>
<td>1.81</td>
<td>0.72</td>
</tr>
<tr>
<td>All cattle</td>
<td>0.71</td>
<td>3.71</td>
<td>0.82</td>
</tr>
<tr>
<td>Male</td>
<td>0.27</td>
<td>5.24</td>
<td>0.40</td>
</tr>
<tr>
<td>Female</td>
<td>1.18</td>
<td>2.87</td>
<td>1.26</td>
</tr>
<tr>
<td>Buffalo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1.85</td>
<td>2.79</td>
<td>1.90</td>
</tr>
<tr>
<td>Male</td>
<td>0.68</td>
<td>0.30</td>
<td>0.66</td>
</tr>
<tr>
<td>Female</td>
<td>2.19</td>
<td>3.24</td>
<td>2.25</td>
</tr>
<tr>
<td>Sheep</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crossbred</td>
<td>4.84</td>
<td>2.67</td>
<td>4.71</td>
</tr>
<tr>
<td>Indigenous</td>
<td>0.25</td>
<td>4.34</td>
<td>0.38</td>
</tr>
<tr>
<td>All</td>
<td>0.42</td>
<td>4.21</td>
<td>0.54</td>
</tr>
<tr>
<td>Goat</td>
<td>1.78</td>
<td>5.11</td>
<td>1.93</td>
</tr>
<tr>
<td>Pig</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crossbred</td>
<td>8.43</td>
<td>4.88</td>
<td>7.87</td>
</tr>
<tr>
<td>Indigenous</td>
<td>2.64</td>
<td>4.56</td>
<td>2.85</td>
</tr>
<tr>
<td>All</td>
<td>3.28</td>
<td>4.61</td>
<td>3.43</td>
</tr>
<tr>
<td>Poultry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved</td>
<td>9.37</td>
<td>6.08</td>
<td>8.96</td>
</tr>
<tr>
<td>Indigenous</td>
<td>3.85</td>
<td>5.10</td>
<td>3.92</td>
</tr>
<tr>
<td>All</td>
<td>4.44</td>
<td>5.52</td>
<td>4.52</td>
</tr>
</tbody>
</table>

Source: As in Table 1.

Population of improved poultry grew at a rate of about 9 percent a year, more than double the growth rate in population of indigenous poultry (Table 2). Technological transformation of the poultry sector seems to be market driven as the demand for poultry meat and eggs is income elastic and has been rising continuously. The populations of crossbred sheep and pigs too grew faster than their indigenous counterparts.

Empirical evidences from the field prove the scientific claims of better economic performance of crossbred animals (Dhaka, et al 1998; Gaddi and Kunal, 1996; Sharma, et al, 1995; Lalwani, 1989). Despite this, crossbreeding technology has not been able to take off. One of the probable
reasons could be non-acclimitisation of crossbred animals to widely varying climatic conditions in the country. In this context, Stein (1999) mentions that 'in using exotic breeds as a strategy for improvement it seems to have been assumed that genotype environmental interactions do not exist or the optimal economic and sustainable crossing structure would automatically be developed. Indeed in much of the Asia, there appears to be a history of introducing breeds without proper evaluation and with little or no thought given to the breeding structure which will best use the available material.' Non-acclimitisation causes a number of health and physiology related problems.

Higher initial investment and maintenance costs could be other limitations to widespread adoption of crossbreeds. The first cross animals perform tremendously. The performance of animals from subsequent crosses declines significantly. And therefore, crossbred animals need to be replaced frequently in order to sustain the flow of benefits. Thus, frequent acquisition of first cross breeds without realising appropriate salvage value of the subsequently crossed animals renders crossbreeding technology capital-intensive. In this context, Alderman (1987) observed that more than 50 percent of the farmers in Karnataka maintaining crossbreeds depend on market for replacement of first cross animals as to avoid the risk of getting unwanted male calf and problems of breeding and feeding to the calf, if bred on own farm.

Another frequently cited reason for slow replacement of indigenous cattle by crossbred one is former's dual role as a source of milk and draught power for agriculture. Crossbred male is considered to be inefficient for draught purposes, compared to indigenous male. This argument however does not seem to be much convincing. Animal physiology research has shown that there is only marginal difference in the draughtability of the two. Further, with the intensification of agriculture, machines have emerged as a major source of draught power in Indian agriculture. However, mechanisation does not appear to have affected the population of working animals much. Number of tractors per thousand hectares increased from 0.6 in 1972 to 10.9 in 1992, while the working bovine stock declined marginally from 65 per hundred hectares to 59 per hundred hectare (Table 3). Mechanisation has affected working bovine stock mainly on medium and large farms. Number of working bovines declined from 41 in 1972 to 18 per 100 hectares in 1992 on medium farms and 21 to 5 on large farms. On small and marginal farms, working animals provided most of the draught power requirement in 1972 as there was hardly any incidence of tractor ownership on these farms. In 1992 the number of tractors on these farms increased to 4.1 and 7.8 per thousand hectares, respectively but without concomittant decline in number of working animals.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Marginal</td>
<td>0.0</td>
<td>4.1</td>
<td>160</td>
<td>154</td>
</tr>
<tr>
<td>Small</td>
<td>0.0</td>
<td>7.8</td>
<td>106</td>
<td>81</td>
</tr>
<tr>
<td>Semi-medium</td>
<td>0.1</td>
<td>10.5</td>
<td>70</td>
<td>42</td>
</tr>
<tr>
<td>Medium</td>
<td>0.7</td>
<td>15.4</td>
<td>41</td>
<td>18</td>
</tr>
<tr>
<td>Large</td>
<td>1.2</td>
<td>14.7</td>
<td>21</td>
<td>5</td>
</tr>
<tr>
<td>All</td>
<td>0.6</td>
<td>10.9</td>
<td>65</td>
<td>59</td>
</tr>
</tbody>
</table>

Nonetheless crossbreeding strategy has been successful under certain environments and economic conditions as in Kerala and Punjab. In Kerala, milk production system is cattle based. Indigenous breeds are good neither as milk yielders nor draught power (Rajapurohit, 1979). Cropping pattern is largely plantation oriented, requiring less of draught power. Further, unlike in many other states cattle slaughtering is not prohibited by law in Kerala, thus making it easier to cull out the low yielding and unwanted animals. In Punjab, on the other hand, increasing intensification of agriculture needed more and more power to perform the agricultural operations in time, which the indigenous cattle was not capable of. Moreover, feed fodder has never been a problem in Punjab.

2.2. Feed and Nutrition

Adequate provision of feed and fodder is essential to livestock production. Feed and fodder scarcity has been one of the most limiting factors in improving livestock productivity in India. Crop residues and byproducts comprise the main feed stuff accounting for 40 percent of the total feed and fodder consumption (World Bank, 1996). Green fodder contributes 26 percent, while concentrate feed contributes only 3 percent to the total feed consumption. The rest comes from grazing. The stall feeding is largely confined to buffalo, crossbred cattle and draught animals. Small ruminants largely feed on forages from village commons, roadsides and harvested fields, and supplementary feeding is lacking except in large commercial herds.

There exists a large gap between requirement and availability of feed and fodder at national level. Recent estimates indicate that India is short in dry fodder by 31 percent, green fodder by 23 percent and concentrate feed by 47 percent (Table 4). Regional deficits, however, more important than the national deficit. Out of 55 micro agro-ecoregions 43 are deficit in feed and fodder (Singh and Mazumdar, 1992). Most of the deficit regions lie in the arid and semi-arid tracts. The feed and fodder deficiency is because of heavy population pressure, quantitative and qualitative deterioration in common grazing lands resulting in low biomass production for animal feed and lack of adoption of fodder production technologies.

<table>
<thead>
<tr>
<th>Feed stuff</th>
<th>Availability (million tonnes)</th>
<th>Requirement (million tonnes)</th>
<th>Deficiency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straws</td>
<td>399</td>
<td>584</td>
<td>31</td>
</tr>
<tr>
<td>Green fodder</td>
<td>574</td>
<td>745</td>
<td>23</td>
</tr>
<tr>
<td>Concentrate</td>
<td>42</td>
<td>79</td>
<td>47</td>
</tr>
</tbody>
</table>

Source: Ministry of Environment and Forests, Govt. of India (1993)

The problem of underfeeding can partly be overcome through technological interventions such as biological and chemical treatment of feed and fodders. Techniques such as urea treatment of straws, urea molasses mineral blocks and bypass protein improve nutritional value of feed, its palatability and digestibility. Application of urea treatment has been reported to reduce green fodder requirement by about 20-40 percent and increase cattle milk yield by 10-20 percent (Patil, et al, 1994; Rai, et al, 1994; Saha and Singh, 1994). Under experimental conditions bypass protein technology has been found to reduce concentrate requirement by 40 percent and reduction in dry matter requirement by 24 percent (Chatterjee and Acharya, 1992; Tripathi, 1997). Despite such benefits, their applicability is limited because of supply side constraints and lack of
concerted efforts to transfer these technologies and to demonstrate their cost-benefit ratios for
their wider adoption.

Area under fodder crops in the country has hardly ever exceeded 5 percent of the gross cropped
area. And, it is uncertain whether this will increase or not. Increasing demand for livestock
products calls for more allocation of land to fodder crops, but current priorities for foodgrains,
pulses and oilseeds seem to constrain fodder area expansion. Yet, availability of byproducts of
food crops as animal feed is expected to increase with increase in area under food crops.

Plant breeding research too has largely focussed on increasing grain yield with little consideration
to byproduct yield, both in terms of quantity and quality. In an *ex ante* framework Kristjanson et
al. (1998) have estimated that one percent improvement in digestibility of coarse cereals fodder
through genetic manipulations would enhance production of different livestock outputs and
services in the range of 3 to 10 percent.

### 2.3. Animal Health

Diseases reduce the production potential of the livestock. There are a number of diseases such as
rinderpest, foot-and-mouth, haemorrhagic septicaemia, mastitis, brucellosis, tuberculosis, black
quarter, etc. that affect livestock production and cause enormous economic loss. According to
some estimates, livestock output worth Rs 50 billion is lost due to diseases. With this in view, the
National Commission on Agriculture (1976) observed that livestock development programme
cannot possibly succeed unless and until a well organised animal health service is built up and
protection of livestock against diseases and pests, particularly the deadly infectious ones, is
assured. Thus, to provide an effective protection against diseases, animal health infrastructure
has been strengthened. Since 1984-85 number of veterinary polyclinics, hospitals and
dispensaries has increased from 14500 to 23303 in 1998 (Table 5). Also, there are 27543 first aid
centres and mobile dispensaries. Apart from these, there are 250 diagnostic laboratories and 21
veterinary vaccine production units. Now, 21 viral vaccines, 14 bacterial vaccines and 13
diagnostic reagents are produced in the country. About 36000 veterinary professionals and 70000
auxiliaries manage these institutions.

<table>
<thead>
<tr>
<th>Table 5: Growth in infrastructure for animal health</th>
</tr>
</thead>
<tbody>
<tr>
<td>1984-85</td>
</tr>
<tr>
<td>No. of veterinary polyclinics, hospitals and dispensaries</td>
</tr>
<tr>
<td>Number of veterinary aid centres, stockman centres and mobile dispensaries</td>
</tr>
<tr>
<td>Number of professional veterinarians</td>
</tr>
<tr>
<td>Number of veterinary auxiliaries</td>
</tr>
</tbody>
</table>

Source: 1. Deptt. of Animal Husbandry and Dairying, GOI.
3. Impact of Technological Change

3.1 Contribution of Technology

The contribution of research and development efforts to the growth of livestock sector is beyond doubt. Share of livestock sector in agricultural gross domestic product has increased from 17 percent in 1980-81 to 23 percent in 1998-99 at 1980-81 prices. Since 1970-71 livestock sector has been growing at a rate of about 3.6 percent a year. And, technology has contributed substantially to this (Table 6). Total factor productivity (TFP) index, a measure of contribution of technology, has been growing at an annual rate of 1.4 percent since 1970, while in the pre-1970s growth in TFP index was marginally negative. This implies that gradually technology is becoming a driving force in the growth of livestock sector.

Table 6: Compound growth rates of output, input and total factor productivity indices

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Output index</td>
<td>1.28</td>
<td>3.59</td>
<td>2.59</td>
</tr>
<tr>
<td>Input index</td>
<td>1.32</td>
<td>2.23</td>
<td>1.79</td>
</tr>
<tr>
<td>TFP index</td>
<td>-0.04</td>
<td>1.36</td>
<td>0.81</td>
</tr>
</tbody>
</table>


3.2 Production and Productivity

From the point of research and development priorities, it is rather more important to assess the contribution of technology at the commodity or species level. The data limitations particularly on the inputs side, however, make it difficult to generate commodity specific estimates of TFP. Nonetheless, productivity trends provide a fair assessment of the impact of technological change (Table 7).

3.2.1 Milk

Between 1972 and 1997 cow and buffalo milk production grew at a rate of 5.2 and 4.4 percent a year, respectively (Table 7). While the productivity of cow and buffalo increased at a rate of 3.2 and 1.9 percent, respectively and thus contributed about 61 percent and 44 percent to their respective output growths. Over time, the growth in production as well as in productivity has accelerated. But, productivity has increased faster than the production indicating that milk production growth is gradually becoming productivity centered. In case of cattle, acceleration in productivity growth is partly because of increase in the population of high milk yielding crossbreeds.
Table 7: Annual growth rates (percent) in production and yield of livestock products, 1972-1997

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Production</td>
<td>Yield</td>
<td>Production</td>
</tr>
<tr>
<td>Milk</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cow milk</td>
<td>5.19</td>
<td>3.03(58.4)</td>
<td>4.88</td>
</tr>
<tr>
<td>Buffalo milk</td>
<td>4.36</td>
<td>1.66(38.1)</td>
<td>4.73</td>
</tr>
<tr>
<td>Meat</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beef and veal</td>
<td>7.50</td>
<td>-0.13(-1.7)</td>
<td>4.21</td>
</tr>
<tr>
<td>Buffalo meat</td>
<td>4.04</td>
<td>-0.07(-1.7)</td>
<td>4.57</td>
</tr>
<tr>
<td>Mutton and lamb</td>
<td>1.98</td>
<td>0.33(16.7)</td>
<td>3.86</td>
</tr>
<tr>
<td>Goat meat</td>
<td>2.46</td>
<td>0.62(25.2)</td>
<td>1.68</td>
</tr>
<tr>
<td>Pig meat</td>
<td>6.44</td>
<td>0.13(2.0)</td>
<td>5.07</td>
</tr>
<tr>
<td>Poultry meat</td>
<td>5.11</td>
<td>9.31</td>
<td>5.65</td>
</tr>
<tr>
<td>Total meat</td>
<td>4.17</td>
<td>4.61</td>
<td>4.22</td>
</tr>
<tr>
<td>Eggs</td>
<td>6.15</td>
<td>3.92</td>
<td>5.58</td>
</tr>
</tbody>
</table>

Figures in parentheses indicate percent share of yield growth in output growth.
Source: Computed from data in FAO Production Year Book, various issues.

Average milk yield of a crossbred in-milk cow in 1993-94 was 5.8 kg/day, which was about 3.5 times more than that of an in-milk indigenous cow (Table 8). In-milk crossbred cows comprised 14.2 percent of the total in-milk cows and contributed 36.3 percent to total cow milk production. Buffalo accounted for 45 percent of total in-milk bovines and contributed 57 percent to total milk production.

Table 8: Contribution of crossbred cows to milk production, 1993-94

<table>
<thead>
<tr>
<th></th>
<th>Indigenous cow</th>
<th>Crossbred cow</th>
<th>Buffalo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share in milk stock (%)</td>
<td>47.4</td>
<td>7.9</td>
<td>44.7</td>
</tr>
<tr>
<td>Share in milk production (%)</td>
<td>27.7</td>
<td>15.8</td>
<td>56.5</td>
</tr>
<tr>
<td>Milk yield (kg/animal/day)</td>
<td>1.69</td>
<td>5.81</td>
<td>3.65</td>
</tr>
</tbody>
</table>


Despite substantial growth in productivity, there remains a large gap between obtainable and realised yield (Table 9). In 1993-94, mean annual yield of an indigenous cattle was 618 kgs, while the lactation yield on research farms for some of the important milch breeds varies from 1137 kgs to 1931 kgs. In case of crossbred cow and buffalo the yield gap, however, is not as large as for indigenous cow. Average milk yield of crossbred cows was 2127 kgs a year, as against the obtainable lactation yield range of 2326 kgs to 3196 kgs. Similarly in case of buffalo, the annual milk yield was 1333 kgs, while the obtainable yield varies 1111 kgs to 1855 kgs per lactation depending on the breed.
Table 9: Obtainable milk yield of some important breeds of cattle and buffalo

<table>
<thead>
<tr>
<th>Species/Breed</th>
<th>Lactation Yield (kg)</th>
<th>Lactation Length (days)</th>
<th>Realised Yield, 1993-94 (kg/annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indigenous cattle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gir</td>
<td>1403</td>
<td>257</td>
<td></td>
</tr>
<tr>
<td>Haryana</td>
<td>1137</td>
<td>232</td>
<td></td>
</tr>
<tr>
<td>Kankrej</td>
<td>1850</td>
<td>351</td>
<td></td>
</tr>
<tr>
<td>Rathi</td>
<td>1931</td>
<td>331</td>
<td></td>
</tr>
<tr>
<td>Red Sindhi</td>
<td>1605</td>
<td>284</td>
<td></td>
</tr>
<tr>
<td>Sahiwal</td>
<td>1719</td>
<td>284</td>
<td></td>
</tr>
<tr>
<td>Tharparkar</td>
<td>1659</td>
<td>280</td>
<td></td>
</tr>
<tr>
<td>Crossbred cattle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Haryana X Friesian</td>
<td>3196</td>
<td>340</td>
<td>2127</td>
</tr>
<tr>
<td>Haryana X Brown Swiss</td>
<td>2785</td>
<td>336</td>
<td></td>
</tr>
<tr>
<td>Haryana X Jersey</td>
<td>2868</td>
<td>308</td>
<td></td>
</tr>
<tr>
<td>Gir X Jersey</td>
<td>2713</td>
<td>324</td>
<td></td>
</tr>
<tr>
<td>Gir X Friesian</td>
<td>2713</td>
<td>324</td>
<td></td>
</tr>
<tr>
<td>Red Sindhi X Friesian</td>
<td>2326</td>
<td>284</td>
<td></td>
</tr>
<tr>
<td>Rathi X Jersey</td>
<td>2802</td>
<td>321</td>
<td></td>
</tr>
<tr>
<td>Tharparkar X Friesian</td>
<td>2600</td>
<td>311</td>
<td></td>
</tr>
<tr>
<td>Sahiwal X Friesian</td>
<td>2357</td>
<td>294</td>
<td></td>
</tr>
<tr>
<td>Sahiwal X Jersey</td>
<td>2660</td>
<td>314</td>
<td></td>
</tr>
<tr>
<td>Buffalo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bhadwari</td>
<td>1111</td>
<td>276</td>
<td>1333</td>
</tr>
<tr>
<td>Mahsana</td>
<td>1744</td>
<td>279</td>
<td></td>
</tr>
<tr>
<td>Murrah</td>
<td>1597</td>
<td>296</td>
<td></td>
</tr>
<tr>
<td>Nili-Ravi</td>
<td>1855</td>
<td>316</td>
<td></td>
</tr>
<tr>
<td>Surti</td>
<td>1772</td>
<td>350</td>
<td></td>
</tr>
</tbody>
</table>

2. Realised yield is based on source as in Table 8.

Regional gaps, however, merit more attention. In eastern and north-eastern states yield is abysmally low. In Orissa, Nagaland, Mizoram, Meghalaya and Assam average milk yield of an indigenous cattle ranges between one-fourth to one-half of the national average. Buffalo milk yield too is much less than the national average. These figures indicate both opportunities and severity of constraints in raising milk production in such areas.

3.2.2. Meat

Total meat production in the country between 1972 and 1997 grew at a rate of 4.2 percent a year. The growth in contributions from different species, however, varied widely. Maximum growth occurred in beef and veal output (7.1 percent), followed by pork (6.3 percent), poultry meat (5.6 percent), buffalo meat (4.1 percent), goat meat (2.4 percent) and mutton and lamb (2.2 percent). Growth in total meat production has improved slightly in recent years mainly because of acceleration in growth in contributions from buffalo, sheep and poultry.

Growth in meat production is largely due to growth in number of animals slaughtered as yield growth is negligible in case of almost all the species. Recent trends, however, indicate improvements in meat yield of cattle, buffalo and sheep, and a decline in meat yield of goat and pig. A number of factors are responsible for poor meat productivity and growth therein. Large animals that is, cattle and buffalo are raised mainly for milk and provide meat as an adjunct.
Animals slaughtered are of poor quality. It is only surplus buffalo males and unproductive stock of both cattle and buffalo often old, infertile and malnourished find way to slaughter houses. Stagnation in yields of small ruminants is a matter of concern. The prominent reasons include deterioration of common grazing lands (Jodha, 1991; Pasha, 1991) that meet most of the consumption requirements of small ruminants and lack of supplementary feeding. Improved nutrition and veterinary care would help raise meat yields in the short run. However, in the long run genetic improvement would be a key factor in sustaining the output growth of these animals.

3.2.3. Eggs
During 1972-97, egg and poultry meat production increased at rate of 5.6 percent a year. However, in recent years poultry meat production increased at an increasing rate, while egg production growth witnessed substantial deceleration. Genetic improvement efforts contributed substantially to faster growth of the poultry sector. About two-third of the total egg production in the country in 1993-94 came from improved layers that comprised 48 percent of the total egg laying population (Table 10). Average egg yield of an improved layer is 232 eggs/annum, which is more than double the yield of a indigenous layer. Clearly, there is considerable scope for increasing egg production through substitution of indigenous layers with the improved layers.

| Table 10 : Share of improved poultry in total egg production, 1993-94 |
|-------------------|-------------------|
| **Unit** | **Fowls** | **Ducks** |
| Population Thousand |
| Improved layers | 65077 (48.1) | 539 (5.1) |
| Indigenous layers | 70225 (51.9) | 9967 (94.9) |
| Total | 135302 (100.0) | 10506 (100.0) |
| Egg production Lakh Nos. |
| Improved layers | 150953 (66.3) | 1039 (8.4) |
| Indigenous layers | 76719 (33.7) | 11395 (91.6) |
| Total | 227672 (100.0) | 12434 (100.0) |
| Egg yield No./annum |
| Improved layers | 232 | 193 |
| Indigenous layers | 109 | 114 |

Figures in parentheses are percent of total.
Source: As in Table 8.

![Figure 1: Trend in incidence of rinderpest in bovines in India](image1.png)

![Figure 2: Trend in incidence of FMD in bovine in India](image2.png)
3.3. Disease Incidence

Many deadly diseases like FMD, black quarter, haemorrhagic septicaemia, anthrax, etc. still prevail in varying intensities despite substantial growth in animal health infrastructure. However, notable success has been achieved in alleviating incidence of rinderpest (Figure 1). This has been possible mainly because of concerted efforts under rinderpest eradication programme. The incidence of FMD, black quarter and haemorrhagic septicaemia in recent years has increased (Figures 2, 3, 4). What this implies is the lack of focus on preventive disease management.
3.4. Prices of Livestock Products

Technological change influences commodity price via supply shift. An upward shift in supply of a commodity is expected to bring down its price, ceteris paribus. Figures 5 to 10 show behaviour of real wholesale prices\(^1\) of some major livestock products since 1970.

Milk price did not exhibit any definite trend during 1970s (Figure 5). It showed some stability during 1980s and thereafter it started declining. Almost a similar trend is observed in case of butter (Figure 6) except during late 1980s when its price showed an upward trend. It may be noted that there has been significant growth in milk production in the country since the initiation of Operation Flood programme under which concerted efforts have been made to create production and marketing infrastructure. Besides, raising domestic production, it also helped reduce dependence on imports as about 99 percent of the milk demand in the country is met through domestic production.

Real wholesale price of mutton has been on a rising trend though with slight year to year fluctuations (Figure 7). This is expected because of slow growth in mutton production. On the other hand, beef price showed a declining trend from 1974-75 to 1985-86, and started increasing thereafter due to rise in export demand (Figure 8). The general trend in price of pork is declining but with wide fluctuations (Figure 9). The real price of eggs has been declining steadily (Figure 10).

\(^1\) The prices are averages of prices in different markets. Agricultural GDP deflator was used to convert the current prices into real prices.
Putting together price and productivity trends gives an idea of the impact of technological change in the livestock sector. In general, a negative relationship exists between productivity and real price trends in case of milk, egg and pork, supplies of which have partially increased due to technological change (breed improvement).

3.5. Equity

Improving efficiency of livestock production through technological interventions is considered to be equity oriented on the premise that the livestock wealth is more equitably distributed than land (Adams Jr. and He, 1995; Birthal and Singh, 1995). The relationship between adoption rate of crossbred cattle and size of land holding shows higher proportions of crossbreds in total cattle stock in the landless and the marginal farm categories, though the size of cattle holding there is smaller (Table 11). It is, thus, conjectured that technological change would generate more income.
generating opportunities for the landless and marginal farmers. But, larger farmers would be benefited more from it by virtue of having more number of crossbreds and better access to feed and fodder resources. This, however, is a contentious issue and needs further probe.

Table 11: Distribution of adult female crossbred cattle by size of land holding (Nos. per household), 1992.

<table>
<thead>
<tr>
<th>Size class of land holding</th>
<th>Indigenous</th>
<th>Crossbred</th>
<th>Total</th>
<th>% crossbreds</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>0.04</td>
<td>0.01</td>
<td>0.05</td>
<td>20.1</td>
</tr>
<tr>
<td>&lt; 1.0 ha</td>
<td>0.35</td>
<td>0.08</td>
<td>0.43</td>
<td>18.2</td>
</tr>
<tr>
<td>1.0-2.0 ha</td>
<td>0.59</td>
<td>0.08</td>
<td>0.67</td>
<td>11.9</td>
</tr>
<tr>
<td>2.0-4.0 ha</td>
<td>0.61</td>
<td>0.09</td>
<td>0.70</td>
<td>12.9</td>
</tr>
<tr>
<td>4.0-10.0 ha</td>
<td>0.64</td>
<td>0.10</td>
<td>0.74</td>
<td>13.5</td>
</tr>
<tr>
<td>&gt;10.0 ha</td>
<td>0.75</td>
<td>0.07</td>
<td>0.82</td>
<td>8.5</td>
</tr>
<tr>
<td>All</td>
<td>0.36</td>
<td>0.07</td>
<td>0.43</td>
<td>15.4</td>
</tr>
</tbody>
</table>

Source: As in Table 3.

3.6. Rural-Urban Disparities

Urbanisation is causing faster expansion in demand for livestock products. As a result, peri-urban livestock systems have been emerging fast. Higher growth in urban livestock populations is an indicator of this (see, Table 2). Unlike rural livestock systems, peri-urban systems are commercially oriented and intensive in nature, depending mainly on purchased inputs. Technical coefficients of crossbred animals are better under peri-urban systems (Birthal, et al, 1999) and therefore adoption of technology is also expected to be higher under peri-urban systems (see, Table 1). For instance, in 1992 about 20 percent of the cattle and 44 percent of the poultry population in urban areas was that of crossbred/improved species. Corresponding figures for rural areas stood at 7 and 32 percent. Adoption of technologies related to health, nutrition and management is also expected to be higher in peri-urban areas. Thus, we may expect increasing technological dualism between rural and urban areas with the rising demand for livestock products.

4. Future Perspectives

India’s livestock sector is at crossroads. On the one hand, India has enormous and diverse livestock population, the production potential of which remains untapped due to feed fodder scarcity and poor application of technologies. On the other hand, sustained economic growth, market oriented policies and trade liberalisation are opening up opportunities for the growth and development of this sector. Demand for livestock products is income elastic and is expected to grow faster (Kumar, 1998). India can also derive substantial benefits from emerging international economic order under WTO through exports of livestock products. At present, livestock products export is constrained by low productivity of livestock, lack of value addition and inadequate phytosanitary standards. How best the emerging opportunities can be capitalised for the benefit of producers as well as consumers would largely be determined by the pace of development and diffusion of yield improving technologies and development of processing infrastructure.
Despite substantial research and development efforts over the last few decades, crossbreeding technology has not been able to take off. What this suggests is the need to review the crossbreeding programmes at regional level for their success as well as failure and rethink the strategy of introducing exotic breeds to improve the local breeds.

Further, animal science research and development efforts have remained biased towards cattle. The buffalo, which holds promises of increasing milk production considering its adaptability to a wide range of climatic conditions and better feed conversion efficiency, has received proportionately less attention. Unlike cattle, fewer restrictions on its slaughtering is an added advantage. Thus, a breakthrough in buffalo crossbreeding would provide a big push to the livestock economy. Other animal species, such as sheep, goat, mithun, camel, donkey, pony, mule, etc., that are of minor importance to the sector but are important to the poor, have also not received adequate attention in research and development efforts.

An animal is not high yielding in itself; it requires quantitatively and qualitatively better feed, health care and management. Feed and fodder scarcity has been one the main limiting factors to raising livestock productivity. Optimisation of livestock population and qualitative improvements of the feed fodder appear to be the main options to improving livestock productivity at the existing feed and fodder scenario. The optimisation option, which involves culling out of surplus population albeit unproductive and unwanted, does not seem to be feasible because of restrictions on cattle slaughtering in most of the states and socio-cultural and religious taboos on meat consumption. However, possibilities of exporting live cattle to countries where demand for beef is high can be explored (Mishra, 1995). This strategy besides earning foreign exchange, would also help relieve pressure on feed fodder resources and would improve productivity of the remaining stock. The option of improving quality of the available feed and fodder resources is technology dependent and needs to be accorded high priority in the research agenda. This is both for crops and animal science research.

These efforts need to be complemented by quality disease prevention and control efforts. Quality of the veterinary services is poor and often the veterinary institutions lack necessary medicines and equipment. The emphasis should shift from curative to preventive disease management and from quantitative expansion of infrastructure to its quality improvement.

Developments in biotechnology are expected to provide solutions to many problems constraining production potential of livestock. Role of biotechnology in improving fodder quality is well established. Similarly in the areas of animal breeding, biotechnologies such as embryo transfer and gene cloning are in the offing and could help improve animal productivity.

The choice, however, has to be made amongst research strategies considering their urgency, gestation period, probability of success and adoption, availability of research resources and economic outcomes. In the short run, research strategies that are less capital intensive, have low gestation period, have higher probability of success as well acceptability by the clientele and yield a good rate of return need to be emphasised. Animal nutrition and health fall in this category. In the long run, however, the genetic research would be a key factor in growth and development of the livestock sector.

Finally, socio-economic research in the livestock sector remains a grey area. Current livestock economics research is inadequate to have a proper understanding of the livestock sector in a system’s perspective. It has focussed mainly on assessment of micro level production efficiency in the bovine sub-sector that is, crossbred cattle vis-à-vis other dairy animals. Aspects related to
nutrition, health and processing technologies have largely remained unattended. Similarly, there is a lack of socio-economic studies on ovine, caprine, equine and poultry production systems. Social sciences particularly economics should, therefore, need to be integrated into biological research process in a significant way right from the initiation of process of technology generation to its diffusion and impact assessment.

Other issues of economic importance, which are often debated but have not been addressed to properly, include estimation of feed and fodder consumption and economic losses due to diseases. Our estimates of feed and fodder consumption are based on feeding norms and with rare exceptions no efforts have been made to estimate actual feed fodder consumption. On the supply side too, little efforts have been made to estimate the contributions from grazing lands and forests. Similarly, whatsoever information available on economic loss due to diseases is based on guesses rather than on sound economic principles. These issues need to be addressed in a multidisciplinary mode for proper planning for development of livestock sector. Related issues of sustainability of livestock production systems, their environmental and role of technology in addressing these too merit attention for an indepth empiricism in a resource economics perspective.

References


Steane, D.E. "Introduction to the Objectives of the Workshop", In the proceedings the Workshop on *Implications of the Asian Economic Crisis for the Livestock Industry* organised by the FAO at Bangkok, July 6-9.


Summaries of Selected Papers

Impact of Technical Change in Milk Production and Some Implications to Returns to Research

L.B. Kunnal, G.M.Gaddi, S.D.Dabali, P.V.Sripad and J.N.Olekhar

University of Agricultural Sciences, Dharwad

The crossbred cows yielded 280 per cent of more milk output over local breeds of cows per lactation. Among the different inputs, feeds, green fodder, dry fodder and herd size contributions to the increased yield level were significant. The technology (breed) alone contributed more than 100 per cent. In actual terms, herd size, dry fodder and green fodder stood to gain under New Milk Production Technology (NMPT) as their proportionate rate of change in factor share was more than zero. However, in absolute terms, all the factors stood to gain but the percentage gain varied from one input to another. The NMPT generated about 146 per cent of additional employment opportunities in the study area. The replacement of all the local breeds of cows in the state would result in 20.31 lakh tonnes of additional milk in the state at the existing level of resource use. Similarly replacement of local breeds of cows would generate an additional employment of 143.3 million mandays per year. Thus there is a tremendous scope to increase milk output and create employment opportunities through implementation of the crossbreeding program in the state.

Impact of Technological Change in Milk Production

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Veterinary College and Research Institute, Namakkal
¹ Veterinary College, Chennai
² Madras Veterinary College, Chennai

A study was undertaken with the objective of decomposing the output gain in milk yield as a result of crossbreeding technology into its causative factors and to work out the cost and returns from different dairy animals from the data collected in the year 1995-96 from 120 dairy farmers selected randomly from twelve villages in Coimbatore district of Tamil Nadu. The calculated overall annual total cost was found to be highest in crossbred cows (Rs.12011) followed by buffaloes (Rs.9779) and desi cows (Rs.6009). While calculating the net returns per milch animal per lactation, crossbred cow ranked first with annual net return of Rs.4408 per animal, followed by buffalo (Rs.3460) and desi cow (Rs.2169). The decomposition of total change in milk yield between crossbred and desi cow was carried out by using the Bisaliahia’s output decomposition model. Decomposition analysis showed that the crossbred animals produce 72.90 per cent more milk than desi cow. Out of this the contribution of cross breeding technology alone was estimated to be 33.46 per cent. The remaining share was due to increased use of inputs. The total input level effect was found to be 38.77 per cent in which the contributions of concentrate, fodder, labour, and health care were found to be 28.13, 10.64, 1.76 and 0.04 per cent, respectively. The decomposition analysis of this study clearly indicated the advantage of rearing crossbred milch animals than buffalo and desi cows.
Impact of Technological Change on Factor Shares in Milk Production

Vinod Kumar

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The present study was conducted during 1990-91 to determine and compare the relative and absolute factor shares and to determine the nature of technical change in milk production in Meerut district of Uttar Pradesh. The data on milk yield, quantity of green fodder, dry fodder, concentrate, miscellaneous expenses and labour utilisation in respect of individual animal along with their prevailing market prices were collected by survey method. The study revealed that the new milk production technology (crossbred cows) was biased in favour of concentrate and management and against green fodder and dry fodder. There were gains in all the factors of production, but the per milch animal gain to concentrate was the highest, followed by labour, green fodder, dry fodder and miscellaneous cost in both the groups except miscellaneous cost in group II (crossbred vs. buffalo). The results also revealed that under the new milk production technology, the relative share of labour in the output declined although the absolute share has shown tendency to increase. It was also observed that distribution of factor shares on different categories (size) of milk producers under new milk production technology (crossbred cows) was found uniform in both the groups

Milk Production in Tamilnadu: Impact of Technology

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Technological changes are recommended in breeding and feeding for increasing milk production. The high yielding bovines are introduced and the existing stock of bovines is improved by cross breeding using the artificial insemination technology. Along with the improvements in the breed quality, efforts are also made in bringing qualitative changes in feeding and feeding practices so that the increased productive potentiality could be realized to its maximum. It is expected that the breeding and feeding technology would positively contribute for the improvements in the productivity of milch animals and production of milk. Keeping the aspect in mind, an attempt is made to examine the changes in milk production, its sources of growth and the contribution of technology in the milk economy of Tamilnadu. According to the official estimates, the growth of milk production was at the higher order lip to the mid-eighties and thereafter it has slowed down, and, the composition of milk is changing in favor of cow milk. The revised estimates revealed that the growth rate of milk production has been at a much faster rate from the mid-seventies than in the earlier period. It can be seen that about 70 per cent of the increase in the total milk production was accounted by cow milk and the remaining 30 per cent by buffalo milk between 1966 and 1994. The dominant factor contributing to the growth in milk production is the productivity of the milch animals. On the technological side, a boom in the spread of artificial inseminations in the eighties, and a reduction in the dependence on grazing and a shift in the feeding practice from grazing to stall feeding are observed. In addition, there is a steady increase in the per head availability of green fodder and concentrates and a marginal decline in the dry fodder availability during the nineties. These trends when related with the trends in the productivity of milch animals reflected the positive contributions of technological changes in breeding and feeding towards increasing the productivity of milch animals and total milk production in the state. In short, the increasing trend in the growth of milk production and the
changes in the relative contribution of the components/factors to the growth in milk production could be largely attributed to the structural changes in the breeding and feeding technologies and their impact in Tamilnadu.

**Impact of Crossbreeding Programme on Cattle Improvement in Himachal Pradesh**

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The implementation of cattle improvement programmes led to gradual replacement of non-descript cattle with graded up and crossbreeds with variable Jersey inheritance. To assess the performance of these cattle under field conditions of Himachal Pradesh, Indian Agricultural Statistics Research Institute (IASRI), New Delhi, conducted a survey in some selected areas of Kangra district during the period 1981-83. The present survey observed significant improvement of economic traits in graded up cattle as compared to non-descript native cattle. With the passage of time the number of graded-up/crossbred cattle increased with continuous implementation of crossbreeding policy. The present study was conducted with the objectives of evaluating the further improvement and changes that have taken place during the period 1983-1995 in the original project area selected by IASRI. The present study was undertaken in the areas covered by four artificial insemination centers viz., Palampur, Paprol, Darang and Nagrota-Bhagwan in Kangra district of Himachal Pradesh, where crossbreeding programme is in progress since 1955. In order to compare the results of two studies, the present study was also conducted in the same areas as covered by the IASRI survey previously. However, only 50% of the villages selected in the survey by the IASRI were retained while 50% were selected afresh to assess the temporal changes that have taken place due to factors other than the impact of crossbreeding programme. The findings of the study have clearly brought about a definite and positive impact of crossbreeding programme in the study area. This was corroborated by the fact that a quantum improvement in the average calving interval over time was observed when compared to 532 days and 598 days in crossbred and non-descript cattle, respectively in the earlier survey conducted by the IASRI in 1981-83. Similarly, a definite improvement in milk yield over the IASRI survey was discernible. For instance, there was nearly 36 percent increase in milk yield over the period of 15 Years. Again, a significant increase of 70 percent in milk yield per day of calving interval was noticed over the earlier survey. The overall lactation length was estimated to be 361 days, 361 days and 290 days in crossbred, graded-up and non-descript cows, respectively. These estimates were lower than the lactation length of 452 days and 384 days observed in graded-up and non-descript cattle in the earlier survey. The present findings revealed that dry period has been considerably reduced to nearly optimum levels. The policy implications of these findings are quite obvious. Since the crossbreeding policy of the State Department of Animal Husbandry has produced tangible results in the field, there is a need to gear up and strengthen the programme more vigorously to bring about improvement in cattle wealth of the state. Simultaneously, people need to be educated and made aware of the benefits accruing from crossbreeding programme so that it could be accepted on a wider scale by the dairy farmers. Extension efforts of the State Department of Animal Husbandry need to be stepped up for this purpose.
Factors Affecting Adoption of Crossbreeding Technology in India

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The study was conducted in the three selected zones of the country, having high, medium and low milk production potential using multistage random sampling technique. One state from each zone was selected purposively. The selected states are Punjab in North from high milk production potential zone, Karnataka in South from medium and West Bengal in East from low potential zone. One district from each state and one block from each district having adequate infrastructure for crossbreeding programme were selected randomly. A cluster of 5 villages from each block having relatively higher concentration of crossbred population was purposively selected. In all, 150 sample households were randomly selected from each cluster of five villages in the selected district on the basis of probability proportion to the total number of adult female bovine holdings in the selected villages. Further, selection of adopters and non-adopters of adult female bovine holdings was done on the basis of probability proportion to number of bovine holdings in different categories.

The estimated Probit and Tobit models revealed that mass media exposure, credit facility and attitude of farmers towards crossbreeding affect the adoption of crossbreeding technology directly, though not significantly. However, level of knowledge about crossbreeding technology and quantity of milk produced per animal were found to be positive and highly significant indicating thereby a positive impact on adoption of crossbreeding technology, while the location of artificial insemination (AI) centre and price of milk turned out to be negative and significant. All these lead to conclude that in order to increase the adoption of crossbreeding technology, efforts should be made to (i) increase the knowledge of farmers about crossbreeding technology (ii) increase the milk productivity of crossbred cows (iii) pay remunerative price for crossbred cow milk and (iv) provide AI facilities to the farmers at the nearest distance.

Genetic Enhancement of Sorghum and Millet Residues Fed to Ruminants: An Ex Ante Assessment

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Inadequate nutrition is the most serious constraint to the efficient performance of animals in the developing countries. In India, straws and stoves contribute 66.2% of the total dry matter fed to the animals. The technologies to improve the nutritive value of the straws and stoves by biological, physical and chemical treatments did not gain the acceptance of the farmers. Plant breeders and animal nutritionists are together trying to improve the digestibility of sorghum and millet stoves through genetic enhancement of these crops. This study tries to assess the potential benefits of this effort vis-à-vis the costs. The feed simulation model is used to measure the potential productivity gains from higher quality crop residues of sorghum and millet in terms of milk and meat (beef) production. Primary survey data and Geographical Information System (GIS) analysis of secondary data are used to assess where these gains are likely to be made. An economic surplus model is used to value the potential benefits versus the costs of the research. At
5% rate of discount, the net present value of the research project amounted to $23.17 million and the net benefit cost ratio of the project worked out to 8.62. At 15% rate of discount, the net present value was $1.26 million and the net benefit cost ratio was 0.64. The internal rate of return was calculated as 18.71 per cent. As the internal rate of return exceeded the opportunity cost of funds even under very conservative assumption about benefits, this research project was found to be worth funding in the *ex ante* evaluation.

**Economic Growth Performance of Rathi Calves Managed under Different Feeding Systems in Arid Zone of Rajasthan**

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Growth rate in Rathi female calves under two feeding systems at the age of about 15 months was estimated in the present study. Eight Rathi calves of almost similar initial body weight (mean body weight 88.13 ± 4.26 kg) were randomly divided into two groups of four calves each. The calves in group 1 were offered ad libitum groundnut haulm and group 2 on ad libitum sewan grass. All the calves irrespective of groups were fed 0.5 kg commercial concentrate mixtures. The data generated during experimental period was processed and analysed for growth rate in terms of live body weight gain with economic significance. The calves in group 1 gained 42.00 ± 2.68 kg live body weight change over initial body weight where as calves in group 2 the live body weight increase over initial weight was only 22.50 ± 3.50 kg. The feed requirement per kg gain was 8.97 ±0.56 kg and 10.70 ± 1.68 kg for group 1 and group 2, respectively. The overall mean values of average daily DM intake per 100 kg body weight were 2.73 kg and 1.92 kg for calves in group 1 and group 2 respectively. Furthermore, the results revealed the superiority of groundnut haulm in economic feasibility. The feed cost per kg live weight gain was Rs. 28.10 ± 1.76 and Rs. 38.78 ± 6.10 in group 1 and group 2, respectively which showed economic viability of groundnut haulm over sewan grass based feeding. From the study it was concluded that a farmer could save 38 percent feed cost by using groundnut fodder.

**Cost of Calf Rearing under Different Management Systems**

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The estimation of cost of calf rearing is of strategic significance since it forms a major capital investment for starting a dairy enterprise. The present study was conducted on 20 crossbred female calves maintained at NDRI. A 2x2 factorial experiment in RBD was used with respect to housing and feeding systems. Having treatment combination i.e. H1F1, H1F2, H2F1 and H2F2, the total cost of rearing calves up to 9 months of age was Rs.5830, 4268, 6016 and 4760 in treatment groups, respectively. The rearing cost was much higher for NDRI feeding (F1) groups as compared to alternative feeding (F2) groups. Feed cost accounted for more than 85 per cent of the total rearing cost. Labour was the second largest component of calf rearing accounting between 8.49 to 11.67 per cent of total cost. Veterinary treatment and miscellaneous expenditure together shared 2.0 to 2.50 per cent.
Resource Use Efficiency in Crossbred Herd of Dairy Farm

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The study was initiated keeping in view the importance of milk in human diet, its scarcity and inquisitiveness to analyze the basic factors associated with milk production through crossbred animals. Since the milk production is a function of genetic potential, feed and management, the herd of crossbred animals was purposively selected from J.N.K.V.V. dairy unit to analyze the different parameters related to milk production and the productivity of the resources that were used for maintaining the herd as dairy unit. The factors responsible for milk production were the feed cost, length of the lactation and lactating number of the cows. Age of the animals affected the production of milk adversely, although insignificantly. The volume of milk production was further analyzed for its seasonal behavior and it was found that the highest quantity of milk was produced by crossbred animals during winter, summer and rainy seasons in succession. Each cow followed the seasonal impact revealed by the herd in totality, the highest milk production during winter may be attributed to the abundance of green fodder during the season as crossbred animals are highly sensitive to dry and hot weather during summer.

A Study on the Economic Efficiency of Milk Production in Kolar District Of Karnataka

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The study attempts to examine the factors influencing milk production and technical efficiency of milk production in Kolar district of Karnataka for the period 1997-98. The primary data was collected from the 100 farmers of Bagepalli and Chintamani talukas of Kolar district. The results obtained by using Cobb-Douglas and stochastic frontier production function shows that the variables like fodder, concentrates, veterinary expenses and labour are significantly contributing towards milk production and especially the labour productivity in dairy farming is high and offers considerable scope for the increased use of labour. The average efficiency in milk production was 92.30 per cent and all the exogenous variables were found to be significantly affecting the production.

Rearing of Low Yielding Lactating Crossbred Cows on Green Legumes

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Eighteen Sahiwal x Jersey crossbred lactating cows yielding five kg milk were divided in three groups. The feeding treatments consisted of 100 per cent nutrient requirements (DCP and TDN) through concentrate (T1), 50 per cent through concentrate + 50 per cent through green berseem feeding (T2) and 100 per cent through green berseem feeding (T3). Dry jowar kadbi was fed ad libitum to all the animals. The proximate principles in concentrate mixture, green berseem and
dry jowar kadbi were found to be OM 90.58, 23.27 and 90.33; CP 17.02, 19.78 and 2.98; CF 11.92, 20.86 and 35.19; EE 2.92, 2.45 and 1.39; NFE 64.09, 42.70 and 52.11 respectively. Average DMI was found to be 7.27, 8.04 and 8.79 kg in T1, T2 and T3 respectively, and differed significantly with the treatments. The FCM yield was found to be 4.74, 5.03 and 5.83 kg milk per day differing significantly between treatments. Non-significant differences were observed in average Fat, TS and SNF of milk of three groups. Average cost of production was Rs. 19.03, 14.29 and 9.23 in T1, T2 and T3, respectively and was significant between three groups. Thus, it is concluded that low yielding crossbred cows can be reared on green barseem alone without concentrate feeding.

**Economics of Dairy Enterprise with Crossbred Cows: A Case Study of Marginal Farmers of Ranjani Village (Pune)**

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Ranjani village of Ambegaon tehsil in Pune district about 60 Kms away from Pune on Pune-Nasik Highway was purposively selected for this study. The annual rainfall is about 2000 to 3000 mms. A milk cooperative namely “Sri Narsinha Dvdh Vyavasayik Sahakari Sanstha Maryadit, Ranjani” was registered in February 1978. The dairy co-operative has a total membership of 275 in 1994-1995. For the purpose of this study, 20 marginal farmers were selected. The selected marginal farmers possessed 34 crossbred cows, 28 crossbred female calves and 12 bullocks in the reference year. Efforts are made in this paper for analysing reason of under which dairying with crossbred cows becomes profitable. Dairy was reported subsidiary occupation by 80 percent of the farmers. On an average 2 persons per family worked in the dairy enterprise. The average number of days-worked in dairying was 70 and 90 male and female days, respectively.

The average expenditure on green and dry fodder and concentrates per crossbred cow was Rs. 4437 and 1215, respectively. The dairy farmers received on an average about 11 cart-loads of dung in a year. About 82 percent of it was used on own farms. During the reference year 95 percent of milk production was sold, 2 percent was consumed at home and the remaining 3 percent was fed to calves. The total surplus by dairy farmers during reference year came to Rs. 163015 on an average per dairy farmer Rs. 8151 or about Rs. 679 per month. Further, if imputed wages of family labour are also excluded from the total expenditure, then all such dairy farmers show a large surplus. The data also show that the dairy enterprise is profitable, if the dairy farmers have some irrigated land under green fodder cultivation round the year.

**Spatio-Temporal Economic Analysis and Potential of Milch Animals in Maharashtra**

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Role of various milch animals in different regions over a period of time (1982-1992) has been examined in the present paper. Similarly, potentials for the specific type of milch animals have also been worked out based on results of the supportive farm level study. It was observed that the
proportion of crossbred milch animals in the total milch livestock in the state was very negligible (2.76%) during the year 1982, which has increased to 10 percent in the year 1992. Next in order is buffalo sharing 36% of the total milch livestock. The indigenous cows shared 67 percent during the year 1982 and have slightly reduced to 54 percent of the state total. As regards the quinquennial growth in number of crossbred it was observed that during 1982-87 increase was more in all the four regions, viz., Konkan, Western Maharashtra, Marathwada and Vidarbha. In the subsequent period, the growth of crossbred was still faster. The share of crossbred is highest in Western Maharashtra though it has declined in recent years. The Vidarbha region ranks first in having the indigenous milch animals with the a share of 35 percent. The growth indices in the number of indigenous milch animals indicated stable situation. Buffaloes share the second position among the milch animals. Western Maharashtra alone shared 50 percent of the total buffaloes in the state. As regards the proportion of milch animals in rural and urban area, it was observed that crossbred and buffaloes are in proportion of 90 and 10, respectively, while the strength of indigenous milch cows in urban areas is to the tune of 3 to 4 percent only. Supportive farm level study indicated that the dairy enterprise gains substantial employment and net profit from the maintenance of crossbred and buffaloes.

Economic Rationale of Raising Crossbred Calves under Cottonseed Extraction Based Concentrate Feed and Chaffy Paddy Hay.

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Eighteen crossbred female calves aged between 4 to 16 months and weighing 60 to 210 kg were divided into three groups of six each and allocated to dietary treatments namely control (T0) – Feed containing GNE & SFE Plus chaffy paddy hay; Treatment 1 (T1)-Feed containing 15% CSE replacing GNE or SFE plus chaffy paddy hay and Treatment 2 (T2) – Feed containing 30% CSE replacing GNE or SFE plus Chaffy paddy hay. All the three groups of calves were fed diets based on NRC standard for 600g average daily gain. The concentrate mixture contained 19% CP and 67% TDN and chaffy paddy hay was fed adlibitum as basal roughage. The study lasted for a period of four months. The dry matter intake the average daily gain during this period in T0, T1 and T2 groups were 4.88 ±0.16, 4.75±0.36 and 4.93±0.17 Kg : 396.7±41.56,386.7±15.94 and 488.0±24.06 g, respectively and the variations among groups for these Parameters were non-significant. The average cost of total ration (concentrate feed and chaffy paddy hay), average cost of feed per Kg weight gain and feed to gain ratio in groups T0, T1 and T2 were Rs. 17.65, 17.43 and 17.55 per day; Rs. 46.95, 45.47 & 36.74 and 12.47±1.38, 12.47 ± 1.07 and 10.30+0.84, respectively, the variations among groups of these Parameters were not statistically significant. This saved Rs. 10.21 for 0.488 ± 0.02 Kg gain in T2 group by replacing GNE & SFE in the concentrate feed when compared to 0.387±0.02 or 0.397 ±0.04 Kg gain per day in T1 or T0, respectively on iso-caloric and iso-nitrogenous diets. Thus, incorporation of CSE in the concentrate feed at 30% level was not only safe but also economical in the feeding of calves for higher gains per day with an object of achieving early puberty in the crossbred female calves.
Role and Performance of Dairy Enterprise in Income and Employment of Rural Families in Western Maharashtra

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The paper attempts to estimate maintenance cost of different milch animals, their comparative economics and assessment of the employment and income from dairy enterprise in irrigated and rainfed areas of Western Maharashtra region using information from 320 families. The data were collected for three consecutive agricultural years (1995-1996, 1996-1997 and 1997-1998) by cost accounting method. The study revealed that the share of feeding cost for all types of animals was between 57 and 74 percent. H.F. cows had highest maintenance cost during lactation and intercalving period followed by Jersey cow, buffaloes and local cow. Per day milk yield during lactation was 10 to 11 liters in H.F. Cow; 8 liters in Jersey, 4.50 liters in buffalo and 3.45 liters in local cow. Per liter cost of milk production was lower in crossbreed cow as compared to the buffaloes and local cows. The share of dairy enterprise in employment pattern of farm families was about 50 per cent. The major source of income to the landless households was the dairy enterprise, which accounted 59 to 68 per cent of their total earnings.

Effect of Birth Weight and Weaning on Calf Mortality: A Study in Andhra Pradesh

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An attempt has been made to study the effect of birth weight and time of weaning on calf mortality in calves from their birth to 12 months of age in cattle and buffaloes of different genetic groups maintained at various livestock farms in Andhra Pradesh. The overall mortality was found to be the highest (8.87%) in 31 to 35 kg birth weight group followed by 36 kg and above (7.37%), 26 to 30 Kg (7.27%), 16 to 20 kg (6.27%), below 15 kg (5.48%) birth weight groups and it was lowest in 21 to 25 kg (5.02%). The birth weight had a significant effect on calf mortality in ¼ IF x ¼ O group only. The mortality was high in weaned calves in all age groups than in unweaned except 6-12 months.

Study on Displacement of Bullock Labour in Thanjavur District, Tamil Nadu

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The study was undertaken in Thanjavur district during 1999-2000. Data were collected from a sample of 90 farms viz., 30 tractor farms, 30 power tiller farms and 30 non-mechanized farms in this district. A multistage stratified random sampling method using district as a universe and
The results indicated that there were 7.02 and 5.85 bullocks per farm in the tractor and power tiller farms respectively, whereas it was only 0.69 and 0.47 per farm bullocks in the above two types of farms after the introduction of machines. Hence, the displacement of bullocks due to the mechanization was $-6.36$ per farm (90.56 per cent) and $-5.38$ (91.97 percent) in tractor and power tiller farms, respectively. Thus the per hectare availability of bullocks decreased from 0.97 to 0.09 in tractor farms and from 0.72 to 0.06 in power tiller farms due to the introduction of tractors and power tillers for performing various agricultural operations. The high percentage of displacement of bullocks (90.56 and 91.97 per cent) due to the introduction of tractors and power tiller clearly indicates the impact of mechanization on the sample farms, the major operations like, preparatory tillage like puddling, threshing, transportation of farm produce etc., were done by these machines. At present, the animals were maintained for transportation of farmyard manure to inaccessible areas in the field, levelling operations and small scale transportation of farm produce. Increase in the wages for labour was identified as prime constraint in maintaining bullocks in both the groups of sample farms. Non-availability of sufficient labour for maintenance and escalation of price of cattle feed was recorded as second constraint in tractor and power tiller farms respectively. Simultaneous operations by large number of farms during peak season and coincidence of harvest and threshing operations of first season and preparatory tillage operations of second season demand introduction of machinery for performing these operations and naturally this was ranked as prime reason for preference of machinery by both the sample farms. Timely availability of machinery and reduction of labour availability for performing the labour intensive preparatory tillage operations were the second and third reasons put forth by the both groups of the sample farms. While better land preparation was ranked as fifth reason for adoption of tractors in the tractor farms it was ranked as fourth reason in the power tiller farms.

Response of Buffalo Owners about Symptoms of Heat in Breeding Tract of Pandharpuri Buffalo of Maharashtra

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The knowledge of heat in buffalo helps in timely insemination / service and better conception rate. In order to know the symptoms of heat in Pandharpuri buffalo in its breeding tract of Maharashtra, 5632 Pandharpuri buffalo owners from 60 villages, spread over 12 talukas and 3 districts were interviewed through informal survey method. Following symptoms of heat in Pandharpuri buffalo were noticed by the buffalo owners; bellowing (33.82 %), discharge of mucus (29.53%), restlessness (8.01%), frequent urination (7.30%), reduced feed intake (6.33%), drop in milk production (4.30%), untimely letdown of milk (3.43%), mounting (3.27%), swelling and redness of external genitalia (3.10%) and raising of tail (1.01%).
Performance of Small Ruminants in Tree Based Feeding Systems

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The performance of small ruminants on tree based feeding system was assessed through a series of experiments. The leaves of NFTs had significantly high protein than OTS in all the four seasons. The leaves of NFTs contained significantly higher total tannins than OTS. The NFTs and OTS leaves had 54.83 and 55.25 percent in sacco DM degradability. The values for in sacco protein degradability 70.37 and 48.84 percent wilting of Glyricidia sepium leaves for 8 hours in shade improved significantly its palatability in goats. It was observed that the leaves of NFTs had significantly more digestibility for protein, either extract or NFE. In two separate long-term feeding trials, each in sheep and goat tree leaf mixture (TLM) was prepared and its optimal level in the roughage was assessed. The growth rate and feed efficiency were significantly high when the TLM and green grass formed equal proportion. In a short term feeding trial with sheep, the effect of feeding sheep with grass or tree leaves with or without concentrate supplementation was assessed. Supplementing grass with concentrate improved the performance. Results of this study indicated that TLM with grasses at 1:1 ratio resulted in better performance of small ruminants.
Marketing and Processing
Summaries of Selected Papers

An Economic Analysis of Milk Availability and Nutrition Security

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Food and nutritional security continues to be the main plank of India’s food policy despite tremendous achievements on food production front during the last three decades. Extra income generated due to green revolution has increased the access of rural population to a wide variety of foods like milk, meat, eggs, fish, fruits and vegetables, which perhaps could offset the protein deficiency due to decline in per capita availability of pulses. In a vegetarian society, milk and milk products could be the major source of supply of these components for nutrition security. Good nutrition depends not only on getting enough food grain and food materials but also staying healthy. In the present paper, however, an attempt has been made to analyze the nutrition security with special reference to milk availability, demand and supply.

A Study on Marketing of Milch Cattle in Coimbatore District, Tamil Nadu

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A study on marketing cost of milch animals and problems in cattle marketing was conducted in the cattle markets of Coimbatore district in Tamil Nadu. Two cattle markets with maximum number of transactions per year were selected and from each market 20 sellers, 20 buyers and 10 market intermediaries were randomly chosen for the study. Among the three channels observed, marketing cost was the highest in channel-I (farmer/seller-village trader-broker-farmer/buyer) due to more number of intermediaries involved in moving the animal from seller to buyer. Breed-wise analysis revealed that, in general, the cost of marketing for crossbred cattle was higher than that of local breeds in all the identified channels. Among the various components of marketing cost, transportation cost and the cost of preparation were the major items of cost in all channels for the sellers. For the buyers, transportation cost and brokerage charges formed the bulk of the total marketing cost. Majority of the sellers ranked unremunerative prices for animals as the most limiting constraints in cattle marketing. Amongst the various problems faced, buyers considered the problem of maf-practices adopted by sellers and traders as the most disturbing one. The study suggested for the regulation of cattle markets and improvements in infrastructure facilities.

Livestock Marketing Scenario in Hills

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In integrated sustainable agriculture, it is necessary to generate income through various activities of which livestock sector is one. The draft animal power is still contributing substantially to agriculture and transport. Himachal Pradesh is a small hilly state where 91 per cent of total 9.69
lakh families keep livestock on their farms. Livestock sector contributes about 13 per cent to the state domestic product. In the state the livestock fairs are held at village level where producers/sellers and buyers meet for a few hours in a day or days. The official policy is not very clear about these fairs and hence, traditions and customs rule these markets. The present study focuses on periodic livestock markets along with channels and problems. The multi-stage random sampling technique was used for the selection of sample. The study revealed that majority of the livestock markets are held at village level and once in a year. However, a few markets like Lavi fair in district Shimla is a regional level market lasts for 4 days, occurs once in a year and is famous for transaction of horses, mules and woolen products. Nalagarh in district Solan is a state level fair, which is held every month and is famous for transaction of good quality bullocks. The size of the market is determined by the volume of arrival of animals. The markets in which less than 100 animals transacted was considered as small markets. Most of the markets like Bilaspur, Jahu, Gasota, Bhikhashah, Dussehra, Gohar, Sandhole, Bhangrotu and Sundernagar are big markets. The two main marketing channels identified are producer/breeder-buyers and producer/breeder-brokers-buyers. The producer’s share was observed to be maximum in these channels. The lowest sale was observed in Sundernagar market, where 10 per cent of the animals were sold. Sundernagar is a big market and has its own goodwill among potential buyers but during the year under investigation unusual rains prevented potential buyers to visit the market. The rent paid to the owners of private land was Rs.80 per kanal in Jahu and Bhikhashah markets. Arrangement for feed and fodder were lacking in all markets barring Bhangrotu and Sundernagar markets of Mandi district. The major malpractice prevalent in livestock marketing are non-milking of the milch cattle for a day to increase the size of the udder, giving jaggery for temporarily increasing the milk yield, false information about number of lactation, shortening of horn adjusting calves of other mother animals and pretending dry animals as pregnant ones. The major problems revealed by the farmers were lack of transportation facilities, non-availability of finance, non-availability of sheds and space in the market yard, no provision of feeding stalls, non-availability of boarding and lodging facilities to sellers, non-availability of water, non-availability of medical care, no provision of vaccination at entry points. These problems were prevalent in all the livestock markets with varying magnitude.

Production, Consumption and Disposal Pattern of Milk in Prakasm District of Andhra Pradesh

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The milk production, consumption and disposal pattern among 120 dairy farmers were examined using an interview schedule having a series of questions. There exists a significant (P<0.01 and P>0.05) difference in the milk production and consumption pattern, between the farmer groups based on land holding whereas significant (P<0.05) difference was observed in the milk consumption and disposal pattern between the farmer groups based on land holding and social status. The per capita consumption of milk in comparison with the ICMR (1997) recommendation was far lower in the farmer groups having less agricultural land, animals and belonging to backward caste. The APDDCF was the main marketing channel for milk in both lean and flush seasons though the local market paid higher price for milk.
Performance of Livestock Processing and Marketing of Milk in Bihar

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Livestock has emerged as the major constituent of agriculture in Bihar accounting for nearly 35 percent of gross domestic product generated through agricultural activities in the state. Keeping this in view, the study was undertaken to examine the performance of livestock, processing of milk and its marketing activities in Bihar. The study is based mainly on secondary data obtained from various publications and reports. The results of the study show that it has come out as a major component of the state economy by contributing nearly 19 percent to gross domestic product of the state. It was found that cattle and buffalo are the major components of livestock in Bihar and constituted about 68 percent of total livestock population in Bihar. Study shows that productivity of milch animal was very low in the state but increasing trend was observed. It was revealed that Bihar State Co-operative Milk producers Federation Ltd. (COMPEED) was set up in 1983 as the apex agency in the state and engaged in managing milk processing plants with total capacity of 1,3,500 liters per day. It was observed that the number of Dairy Co-operative Societies (DSC) increased more than 2 times and its membership increased more than 6 times in 1994-95. The result of the study indicated that daily average marketing of milk in major cities of Bihar increased 1½ times more in 1994-95. Milk and milk products are being marketed under the brand name of ‘SUDHA’ in Bihar.

An Economic Analysis of Production and Marketing of Milk in Orissa

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Orissa has a livestock population of 243 lakhs, of which cattle constitutes 148 lakhs (as in 1995). The contribution of livestock to the total value of agricultural production in India is lowest in Orissa (10.66 %) as compared to more than 30 per cent in states like Rajasthan, Punjab, Himachal Pradesh and Haryana. According to 1995 data, Orissa’s milch cattle number 42 lakhs (35.2 per cent of the total population) and yield only 6.25 lakh tonnes of milk against the requirement of more than 35 lakh tonnes. Seventy per cent of the State’s farm holdings are small and marginal. Increase in milk yield can be sustained only with a dependable market system. The objectives of the study were, to examine the milk yield and its variability in different districts of Orissa with varied types of cattle, to examine the structure as well as the factors involved and their relative contribution to milk yield among different categories of dairy farms, to identify the marketing channels and to estimate the marketing costs and margins in the milk trade for selected market channels, to examine price fluctuation of milk, if any, over the year and to study the remunerativeness of the milk prices. The milk production environment in the state is traditional, unsophisticated and sub-optimal. Low yielding local breeds are dominant across the three size
classes. This is further associated with high percentage of dry cows (41.17 to 48.32) among different categories of dairy owners. The percentage of exotic breeds in rural areas is as low as 21.17 (class-II), 26.96 (Class-III) and 32.35(Class-I). Since exotic breeds are high yields, upgradation of local breeds through ‘Artificial Insemination’, castration of scrub bulls and introduction of exotic breeds are essential.

**Determinants of Milk Marketed Surplus in Bihar: An Empirical Evidence**

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This study examines milk production, consumption and marketed surplus of milk and the factors associated with milk marketed surplus in remote villages in South Central Bihar. Samples of 90 milk producers covering 6 villages constitute the basis of study during year 1996-97. Cobb-Douglas production function was used to estimate coefficients of explanatory variables for milk marketed surplus. The study revealed that percentage marketed surplus was very high (80.20%) in smaller farms than in the large farms. Only 20 percent milk was retained by weaker section for family consumption. Thus, poor having physical access of milk but lack economic access. By and large, marketed surplus was found to be 57 percent of total milk production produced by sampled farmers. Total milk production and size of holding significantly affected milk marketed surplus while milk price had no significant role. Further, emphasis needed to exploit the potential of smaller farmers, having capability and obligatory commitment for promising results, by strengthening and promoting input delivery system to augment production and marketed surplus in the study area.

**Economics of Milk Production and Marketing of Different Buffalo Farms in Mumbai**

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The study was carried out in 54 dairy farms of Mumbai area. Per farm total cost of milk production was Rs. 3480908 with major expenditure on feeds and fodder (46.87 per cent). The dairy farmers send their animals on salvage farm during dry period, the cost of salvage accounted for 3.58% of total cost of milk production. The cost of milk production and marketing together amounted to Rs. 3572631 with benefit cost ratio of 1.50. On an average 177.37 buffaloes were maintained with average lactation period of 248 days with 6.59 liters of milk production per day. Out of the total production of milk 99.83 per cent quantity of milk produced was sold. Out of the total marketed surplus 71 per cent was sold through wholesalers. Non availability of land for fodder cultivation and problem in disposing farm waste coupled with drainage were the major problems in dairy business in Mumbai.
Processing and Marketing of Milk in Karnataka – An Economic Analysis

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The quantity of milk chilled was more during flush season compared to lean season. Hudagi chilling center chilled more milk (40.6 lakh kgs.) compared to Bidar (29.8 lakh kgs.) and (Shahpur 4.8 lakh kgs). The milk sold in Gulbarga district to the total milk sales of Milk Union varied between 94.02 percent to 96.67 percent over the period, averaging to 95.97 percent for the same period. The average price of milk sold had increased from Rs. 8.00 per liter in 1992-93 to Rs.10.5 in 1996-97. The increase in the average price of milk along with a decrease in the fat percentage may have also contributed to the decrease in sales.

The Gulbarga Milk Union realised 93.22 percent sale proceeds by sale of milk alone and the remaining share was realised by milk product sales. Higher share or liquid milk sales in total sales for the union was due to faster rate of turnover in liquidity form. The market share of Union declined from 37.13 to 28.67 percent during the period 1993-94 to 1996-97 because of intrusion of private milk brands in Gulbarga City from Maharashtra State. These vendors paid higher commissions to the milk agents than the Union to build up strong sale network by private milk units in the area. Consequently, the Union was unable to procure the required supply of milk to meet the demand in the city. The Union supplied the milk by purchasing milk from other dairies and as supplementation reconstituted its powder (8.6%) to meet the seasonal surge in demand of the liquid milk in Bidar and Gulbarga districts.

Components of Poultry Production and Consumption in India

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The trend in the growth rate of eggs and poultry meat production over time shows the relative importance attached to this industry. A comparison of the growth rate of egg production and poultry meat production over the last decade shows that poultry meat production increased faster than egg production. The rate of poultry meat and egg production was 10.6 per cent and 6.63 per cent, respectively. The results obtained from the study show that the egg production in India could be improved by increasing the budget outlay for poultry and by formulating the suitable producer price policy to encourage poultry farming. Similarly, enlarging the broiler stock position and the budget outlay for the poultry meat production could enhance poultry meat production. The consumption of egg and poultry meat are also governed by the variables such as price, human population, consumer price index and per capita gross national income.
Analysis of Production and Marketing of Poultry Farms-A Case Study

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As poultry is an emerging as the most important sector of livestock, focus is made to work out costs and returns in poultry farming, to estimate the price spread and efficiency in poultry egg and broiler meat marketing under the identified channels of distribution and to find out the marketing problems in poultry farming. Guntur district of Andhra Pradesh was selected purposively and four villages from two mandals were chosen based on the highest number of poultry farms. From these villages, 60 poultry farmers, 30 each from broilers and layers were selected randomly and stratified into small, medium and large farms based on the number of birds. The comparative analysis of economics of poultry farming i.e. production of both layers and broilers indicated, the average feed cost was more in layer than in broiler production. The rate of return per rupee of investment was 0.25 in case of broiler and 0.21 in case of layer production. Two channels were identified in the marketing of poultry eggs in the study area. In the channel-I (producer-local commission agent-distant wholesaler-retailer-consumer), the producer’s share in consumer’s price (71.25%) was lower compared to the channel-II, where the Poultry Marketing Centre (PMC) is the only agency involved between producer and consumer. Marketing efficiency was higher (25.18%) in channel-II, than in channel-I(9.23%). In the marketing of poultry meat, two channels were identified and the price spread was found to be less, (11.5%) and marketing efficiency (7.5) was more in channel-I (producer-retailer-consumer), as these values for the channel -II (producer-wholesaler-retailer-consumer) were 16.00 and 6.06 respectively. The producer’s share in consumer’s rupee was also more (74.44%) in channel-I, than in channel-II(65.96%). Price flexibility, excess involvement of intermediaries, high transportation cost and breakage and spoilage of eggs were the main constraints identified in the marketing of poultry products. In order to reduce feed cost, least feed cost rations should be developed and poultry farms should be given the status of agricultural farming, to reduce input costs. Poultry Marketing centers. (PMCs) have to be strengthened and DWCRA (Development of Women and Children in Rural Areas) bazaars should also be given priority in the marketing of eggs.

Problem in Production and Marketing of Eggs in Indore District of Madhya Pradesh

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The present investigation has revealed many problems in the production and marketing of eggs encountered by the producers during the course of the study in the 1992-93. These problems are not only the problems faced by the producers of study area, but also the problems of whole country. The main problem in the study area listed in order of their importance are: (i) rising price of feed and other inputs (ii) high seasonal fluctuations in demand (iii) poultry farms are small in size and scattered over wide area which makes collection of eggs costly (iv) the production centres are generally far from consumption centres hence the transport cost increases (v) perishable nature of poultry products and lack of cold storage facilities at reasonable cost (vi) credit facilities are not easily available in the study area and even if they are available it is beyond the reach of farmers. The high interest rate of bank discourages the farmers in poultry units(vii) due to lack of producers' organization, they are forced to sell their products at a lower cost to the
market functionaries (viii) lack of marketing infrastructure in terms of collection, processing 
storage and marketing of eggs (ix) low production due to lack of technical know-how and 
transportation stress (x) lack of processing plants, and (xi) weak rural distribution links.

Economic Analysis of Production and Marketing of Broilers in Maharashtra

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Poultry farming occupies an important place among the livestock enterprises. Poultry farming in 
Maharashtra grew faster than in other states in the country. The study was conducted to estimate 
the cost of production, marketing cost and marketing margin in broiler production. The deep 
litter system proved to be benefited over cage system. The selected broiler producers have 
marketed the produce throughout the year in Pune and Mumbai markets. The price received by 
the producer in Pune market, per bird was Rs. 38.91 from wholesaler and Rs. 40.38 from retailer. 
In producer wholesaler/retailer/consumer marketing channel (channel I) the total marketing cost 
of the wholesaler and retailer was Rs.1.33 and Rs.1.94, respectively. The net profit of the 
producer, wholesaler, and retailer was Rs.6.01, Rs.1.92 and Rs.2.81 respectively, while in the 
case of producer-retailer-consumer marketing channel (channel II) the total marketing cost 
incurred by the retailer was Rs. 7.48 and Rs.3.49 for the producer and retailer, respectively. In 
channel I the producer and middlemen have the share of 83 and 17 percent, respectively while in 
channel II, it was 90 and 10 percent, respectively in consumer’s rupees.

Price Spread of Broiler in Different Marketing Channels in Madhya Pradesh: A 
Case Study

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With the increasing production of eggs and broiler, poultry marketing calls for top priority. 
Despite the general awareness, marketing constraints are being faced by the industry. No 
effective efforts have been made in this direction. There is no organized network for marketing 
of eggs and broiler. In the poultry marketing, agents are operating in various metropolitan cities 
and other leading towns. They fix the wholesale price of eggs and table birds on the day to day 
basis taking into account the supply and demand position. An attempt has been made in this 
study to estimate the price spread under different marketing channels of broiler in Gwalior district 
of Madhya Pradesh. The study covers. 15 sample farms from different categories viz. small (upto 
5000), medium (5001-15000) and large (above 15000). Average number of broiler on sample 
farms was 11367. As for marketing channel is concerned the small broiler farms sold about 30, 32 
and 38 percent of their produce through I (producer-consumer) II (producer-wholesaler-retailer-
consumer) and III (producer-retailer-consumer) marketing channels, respectively. Regarding 
medium and large size farms they also adopted same pattern for marketing, but they sold more 
then 80 percent through channel II and III. The marketing cost accounted 2.15 per cent in channel I 
and 3.87 percent in channel III. It was also observed that the producer’s share in consumer’s
rupee was 100 percent in channel I, followed by channel II 76.73 percent and 75.30 percent in channel III. It may be due to intervention of intermediaries for broiler marketing.

Performance of Goa Dairy Co-operative Union: A Management Appraisal

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A detailed study of the marketing of milk and milk products by Goa Milk Union Limited (GMU) as well as its overall performance has been taken up. GMU spread over both the districts of Goa, having facilities of processing of milk with an installed capacity to process 75,000 liters of milk a day. Primary data was collected for the year 1998-99 using pre-tested questionnaire, on the aspect of consumer preference for milk and milk products, product promotion measures and competitors in the market for their products. While the secondary data collected for ten years from 1988-89 to 1997-98, was collected with respect to milk procurement, distribution, production of milk products, turn over, assets, liabilities, profits, total investment in the business from various publication and records of the milk union. The data so collected was analysed through using financial ratio analysis, Linear Programming Model, Autoregressive Integrated Moving Average (ARIMA) Model and simple tabular analysis. The aggregate business performance of GMU was judged by examining the trend in different financial indicators. The share capital of the Union grew from Rs. 22.97 lakh in 1988-89 to Rs.54.27 lakh during 1997-98. In the corresponding period the investments also increased from Rs.86.05 lakh to Rs.244.01 lakhs. The total sales of the union increased over the year and reached Rs.3581 lakhs at the end of 1997-98, which was possibly the result of better sales effort. The profit earned during 1997-98 amounted to Rs.10.10 lakhs. The fixed assets of the union showed an increasing trend because of increased trend in investment in the fixed assets. The current assets and current liability ratio showed an increasing trend, due to increased investment. To determine the solvency position of GMU, two ratios viz., total debt to share holders equity and total debt to total assets ratio were worked out. The debt to equity ratio was reduced significantly at the end of the study period indicating that GMU has paid more attention on reducing the total debt over the period of time. The ratio of debt to total assets was less than unity indicating that GMU had fair share of its own money against the borrowings. The GMU has an ability to pay off its short-term obligations, which can be seen from liquidity ratios such as current assets to current liabilities, (current ratio) and acid test ratios were found out to be more than unity. Similarly the quick ratio was found to be unity indicating sound liquidity position. The test of profitability as indicated by the profitability ratios revealed that GMU earned reasonable profits through total assets to turnover and fixed assets to turnover ratio, which indicated higher efficiency in terms of sales. Linear Programming Technique was employed to arrive at an optimum product mix for GMU. The results obtained indicate that Model I (Rs. 2.95 crores as working capital) gave 8.01 per cent rate of return on working capital and found out to be more efficient plan for production compared to the existing production programme. Box-Jenkins models were fitted to quantity series of milk and milk products for eight years to forecast the demand for milk and milk products. ARIMA model with seasonality was found to be most suitable for all quantity series. The results indicated that except cream and ghee, these series were linearly related to the previous error term while cream and ghee were linearly related both to previous values and previous error term. With regard to seasonality, only seasonal Moving Average was observed in all the quantity series. Hence it could be concluded that the value in a particular month does not get influenced by corresponding month’s the previous year. Further,
results indicated that except flavoured milk production, all other products production namely milk procurement, standard milk, high fat milk and butter were predicted to be at an increasing trend. Forecasting of results also suggested to increase milk procurement by 3.31 per cent over the existing level in order to meet the demand by 2000 AD. Further it also indicated a decline in the production of flavoured milk which may be due to slackening in demand because of fall in sales.

**Role of Private and Co-operative Sectors in Livestock Production and Processing of Livestock Products**

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The focus of this paper is to examine the role of private and co-operative sectors in livestock and poultry production and processing of livestock products like milk, meat and egg into ready-to-eat, ready-to-cook food products. A detailed review of the performance of the dairy, poultry, sheep, goat and the meat industries have been made with available information, statistics and macro and micro level studies. Conclusion and suggestions have been made for the future strategy for their development.

**Dairy Development in Uttar Pradesh through Pradeshiik Co-operative Dairy Federation**

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In this paper an attempt has been made to present the progress of work done by Pradeshiik Co-operative Dairy Federation Limited (PCDF) in dairy development in Uttar Pradesh. In this study secondary data have been used, which were obtained from the head office of PCDF, Lucknow. The study revealed that the number of cooperative societies increased from 6124 in 1991-92 to 10,580 in 1998-99. The members of the societies were 342.80 (in 000) in 1991-92 increased 557.29 (in 000) in 1998-99. Per day procurement of milk was 443.51 (kg in 000) in 1991-92 increased 700.44 (kg in 000) in 1998-99. The milk sales (in 000 Kg/day) of federation were 298.56 in 1991-92 and increased to 417.07 in 1998-99. It came to know that except the year 1992-93 and 1993-94, the business of federation was found in profit which was maximum (Rs. 499.41 lakh) in 1995-96 and minimum (Rs. 139.70 lakh) in 1997-98. The procurement and marketing of milk of the different state of North India were collected for the year 1996-97 and found that Punjab show maximum procurement 6.92 lakh Kg/day and sell was 3.56 lakh Kg/day.

The production and marketing of milk product like ghee, table butter, SMP, WMP, dairy whitener and baby food of federation for the year 1996-97 shows that the ghee production was 3375 m. tonne and sold 335.13 m. tonne, whereas table butter production was 1795 m. tonnes and sold 1180.05 m. tonnes. Besides procurement and supply of milk, cooperative is an important means of providing various technical input to the farmers. The federation provided 1,86,378 AI services in 1992-93 which increased 2,37295 in 1996-97. In the same way embryo transplantation cases increased from 137 in 1992-93 to 293 in 1996-97. Semen doses distribution from the federation to the farmers increased satisfactorily.
Demand Forecasting for Milk and Milk Products of Goa Milk Union—An Auto Regressive Integrated Moving Average Approach.

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India is the largest producer of milk in the world and it is open to foreign investment in this sector since liberalization. In the process the co-operatives which have made dent in the sector have to equip with better management in planning and monitoring of their activities in order to face the multinationals. In this direction an attempt is made to forecast the demand for milk and milk products of Goa Milk Union (GMU) in the state. The time series data from 1990 to 1998 has been considered for the purpose to forecast the demand with the help of Auto Regressive Integrated Moving Average (AROMA) model. It is found that the milk procurement in 1990-2000 has to be increased 3.31 percent over existing level. Similarly ARIMA indicated that cream and ghee production series are linearly related to both the previous values and previous error term, while other products were only linearly related to both the previous values and previous error term. With regard to seasonality only seasonal Moving Average (MA) was observed by the corresponding months values in the previous year.

Supply Projections for Livestock Products in India by 2020 AD

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This study aims to quantify the production performance of India’s livestock sector and makes projections up to 2020 AD. The required data was collected from published sources for the period 1981 to 1995 and sub-divided in four sub-periods viz.: period I (1981-85), period II (1986-90), period III (1991-95) and analyzed with the help of exponential function. The growth rate for milk, wool, eggs and meat was highest in period I i.e. 6.912, 4.392, 10.99 and 37.935 per cent per annum, respectively. On an average, the growth rate for meat, eggs, milk, and wool was 15.72, 6.6, 4.89 and 1.40 per cent per annum, respectively. On an average, the growth rate for meat, eggs, milk and wool was 15.72, 6.6, 4.89 and 1.40 per cent per annum, respectively. The projections for 2020 D for milk are estimated to be 113.6 million tonnes, 56.88 million Kg for wool, 6608 thousand tonnes meat and for eggs 54626 millions. This can be achieved by various production improvement technologies.
Demand for Livestock Products in India: Current Status and Projections for 2020

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In low-income countries, demand for livestock products is income elastic, compared with that of cereals. This implies that with rising per capita income, the demand for these products would rise faster in the third world countries. This study estimates the effects of income and price change on demand for livestock products and makes demand projections for selected livestock products in 2020. It uses consumer expenditure data from NSSO 50th round which covers urban and rural households in the states. The data pertain to 1993-94. Both Cobb-Douglas and Trans-log models were employed to estimate the complete systems of demand equations. The commodity groups for which demand equations were estimated include milk, mutton and goat meat, beef, buffalo meat, chicken, egg, fish, other-foods and non-foods.

Livestock products being high valued commodities exhibit high elasticities. The consumption pattern revealed that rural population on an average consumes lesser quantities of livestock products than urban population. Livestock products strongly substituted each other. The expenditure elasticities for livestock products are high with tilt in favor of rural area compared to urban areas. It implies that increase in per capita income of rural population would lead to acceleration in demand for livestock products. Further, the expenditure elasticities of live stock products are higher. This implies that there is shift in consumption pattern towards livestock products and diversification of agriculture. The growth rates of live stock products demanded in 2020 are as follows. Milk required 4.77%, mutton and goat meat 13.25%, beef and buffalo meat 3.39%, chicken 4.67%, egg 7.01%, and fish -0.64%. High-income elasticities suggest favorable environment for the growth of livestock sector and diversification of Indian agriculture. Further growth in per capita income, urbanization and shift in consumption pattern towards livestock products would lead to acceleration in demand for livestock products and in turn to give a boost to this sector.

India’s Export Performance in Meat

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The present paper is aimed to assess India’s export performance in meat. This paper is based on secondary time series data complied for the period from 1983-84 to 1996-97 from various published and unpublished sources. Trend analysis was used to predict the growth rates of meat export from India. Compound growth rates of volume, value and unit value realization in export of meat were computed separately. The time series was divided into two sub-periods viz.: (i) period I pre-liberalization period of economy i.e. 1983-84 to 1989-90 and (ii) period II- post-liberalization period i.e. 1990-91 to 1996-97. Analysis of the data revealed that volume of export of sheep and goat meat from India increased significantly in period I @ 5.21 per cent per annum. While in period II export of sheep and goat meat significantly declined @ 12.14 per cent per annum. Export of frozen buffalo beef registered positive and significant growth of 12.70 and 1.88 per cent per annum in the period I and II, respectively. Value of export of sheep and goat meat increased significantly @ 17.09 per cent in period I. Export of buffalo meat in value terms
recorded significant positive growth at 17.05 and 17.36 per cent per annum in the period I and II, respectively. Unit value realization in export of sheep, goat and buffalo meat from India registered significantly increasing trend in both the periods. Export prices of sheep and goat meat recorded higher increase than that of buffalo.

Factors Influencing Market Prices of Bullocks in Maharashtra State

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In all agricultural operations, cattle are indispensable to Indian farmers, as these are the principal sources of farm power. The prices of draft animals depend on age of animals as quantitative characters, breeds, health, activeness, etc. In this paper an attempt has been made to quantify these price determinants. The sample consisted of sellers and buyers, 195 each, traders and brokers 25 each. Thus, the final sample size was 440 marketing functionaries. The data were collected by survey method with the help of specially designed pre-tested schedules. For an analysis of the data both tabular and functional analyses were performed to arrive at meaningful conclusions. The study revealed that amongst sample breeds, Red Kandhari bullocks fetched the highest price in all age categories. In different age groups, animals belonged to 5-7 years age fetched premium price. The average market price fetched for Deoni, Red Kandhari and local breeds of bullocks worked out to be Rs. 4449, 5376 and 4206, respectively. The functional analysis revealed that health index exerted highly significant and positive effect on the price fetched in sale of Deoni and Red Kandhari bullocks. This indicated that healthiness and activeness of bullocks fetches premium price. With increase in the health index by one degree, price fetched by a healthier bullock increases by Rs. 748 and Rs. 532 for Deoni and Red Kandhari bullocks, respectively.

Seasonality Effect on Prices of Beef and Meat Animals

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The paper is aimed at to verify seasonality effect on the prices of beef and meat animals in the Marathwada region. Analysis revealed that arrival and disposal of cattle and buffalo was maximum in winter season owing to seasonal and festival demand. Whereas, in case of sheep and goat, maximum arrival and disposal was recorded in summer season on account of attaining age of culling during this period. Because sheep and goats are conceived in rainy season and at the fag end of kharif season when ample quantity of feed and fodder is available, kids and lambs so obtained during this period are ready for sale by summer for slaughter. The seasonal variation indices for slaughter cattle and buffalo was maximum in the month of January (119.64%) and minimum in the month of June (80.64%). Whereas for sheep and goats, it is highest in the month of May (108.70%) and the lowest in the month of June (84.37%)
The Implications of Agricultural Trade Liberalization for Indian Dairy Industry

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Under the emerging environment of trade liberalization and globalization, doubts are raised about the competitiveness of the Indian dairy industry. However, very little effort has been made so far to find out the international competitiveness of Indian dairy industry in terms of its capability to face the competition in the open and liberal framework. This study is an attempt in this direction. The results of competitiveness analysis reveal that protection to SMP was lower than WMP and butter in all the years. The NPC values for SMP were less than unity during all the years except 1999, while the value of NPC for WMP and butter was above unity in all the years. The estimates of nominal protection coefficients at distortion free world market prices (if all export subsidies are abolished) show that SMP, WMP and butter are efficient import substitutes. The main reasons for the high level of protection to major dairy products in India were (i) the international prices for most dairy products declined significantly since the 1995 and (ii) export subsidies on these products increased substantially. International price of dairy products and exchange rate are the two important international level parameters which have a major influence on the competitiveness, which is the only factor that is within the control of industry and nation. The findings of this study are important and have some implications for the policy making in the dairy sector. The world dairy prices are highly distorted with large export subsidies, which create unhealthy and unfair competition for domestic industry and also has an adverse impact on the incomes of the millions of rural producers. Therefore, some protection should be provided to domestic industry in order to safeguard the interests of milk producers and processors. Export subsidies, resulting in their eventual elimination in dairy sector, and restriction on carry forward and roll-over export provisions. Since the access to the provision of SSG is not universal, Indian dairy industry would expect to see either the removal of special safeguard duty provisions of the agreement or make it available to all member countries. The government should also evolve a mechanism to monitor the international prices and other developments in the world market and take corrective actions such as anti-dumping measures and appropriate tariffs, to protect dairy industry from unfair competition. Indian dairy industry particularly organizations like NDDB, and Indian Dairy Association (IDA), should take a lead role in studying the trends in the global market and provide relevant information to help government during the negotiation process.

Livestock Sector Trade in India: Trends, Performance and Competitiveness

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The market oriented economic policies have brought into focus new issues, which were not very important or relevant in the past. It is argued that the liberalized trade regime has created a favourable climate for livestock products to record large increases in exports. With the reduction in the heavy subsidies that support livestock producers in the developed countries, India’s livestock products may become price competitive in the international market. The present study examines the magnitude of growth and instability in livestock trade, temporal changes in the commodity complex of exports and imports of the livestock sector and changes in the indicators of agricultural trade especially after liberalization. The present study is based on time-series secondary data pertaining to the period 1974 to 1998. The data were compiled from various
published sources. The trends of livestock export and import indicate that the policy of trade liberalization has provided impetus to agricultural trade in the recent years. The study showed that there is potential to increase exports from livestock sector in the coming years. Among different livestock products, exports of meat and meat preparations showed most stable and promising performance. To give a further boost to it, the various sanitary and phytosanitary measures should be taken up vigorously to ensure the international hygienic standards of our livestock exports particularly to developed countries which is lacking now. It has emerged from the analysis that both opportunities and challenges emerge from the liberal and global trade atmosphere for livestock trade of India.

**Marketing of Wool in Scarcity Area of Pune District**

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An attempt was made in this investigation to study the aspect of marketing of wool. The study is exclusively based upon the primary data collected from the sample flock owners by survey method for the Calendar Year 1997. Baramati tahsil of Pune district having relatively higher sheep population was selected for the study. The sampling design adopted for the present study was a stratified two stage random sampling with village as primary unit and sheep flock owner as a secondary sampling unit. Of the total sample shepherds, 54.54 per cent shepherds sold their 53 percent of wool in the village itself, while the rest was sold in the nearby markets. At the overall level, on an average per flock and per sheep sale of wool was 38.40 kg and 0.647 kg, respectively. The gross return per flock was maximum in large size group. Marketing cost of one kilogram of wool worked out to Rs.1.40. Of the total cost, the labour charges alone shared 71.43 per cent followed by transportation cost (19.28 percent), packing charges (5.00 percent) and other expenses such as weighment charges, market fee, etc. (4.29 percent). The marketing cost per kilogram of wool declined with an increase in the size of sheep flock.

**Marketing of Barbari Goats: A Study in Uttar Pradesh**

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An efficient marketing system can ensure a reasonable price to the producer and minimize unnecessary costs and margins. However, marketing of goats is one of the most neglected areas. As a result, it suffers. From many drawbacks such as involvement of middlemen, avoidable marketing cost, unnecessary transportation, mortality of animals during transit and leading to exploitation of both producer and the ultimate consumer. The present study is an attempt to examine the system of marketing and price spread in two selected goat markets (Jaleshar and Ganjundwara) in Etah district of Uttar Pradesh. 137 goat farmers operated in goat market were selected in two markets. The goat farmers were categorized into small (1-5 goats), medium (6-10 goats) and large (above 10 goats) categories on the basis of flock-size. The study indicates that goat farmers periodically sell goats mostly for slaughter and few for rearing. However more sales are affected before some of the major festivals to meet the heavy demand for meat. Goat farmers transport most of their goats for sale in market where goats were sold through Commission agents. The major buyers in market were big traders and city wholesale meat dealers. The marketing cost per goat was highest in small category and found to be Rs. 53.29 followed by
medium category (48.76) and the lowest marketing cost per goat was observed in large category (Rs. 46.26). In fixing the price, three units of sale were commonly followed. They were per head, per pair and per group. The most popular units of sale were ‘per head’ and ‘per pair’ in the area. The average prices ‘per head’, per pair’ and ‘per group’ were fixed through bargain and open sale system. Sometimes the prices were also decided through under cover system. The price spread was much higher in cases where more middlemen and distance were involved. Primary producer were getting 72.9% share for their produce whereas petty traders, big traders and wholesale meat dealers keeping 10.2, 7.5 and 9.4 share, respectively.

Marketing of Live Sheep in and around Hyderabad

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A study was undertaken to identify the marketing channels in marketing live sheep in and around Hyderabad and to work out the producer’s share in the consumer’s price under each marketing channel. The study was conducted in the districts of Hyderabad and Ranga Reddy of Andhra Pradesh. The important marketing channels for live sheep in and around Hyderabad identified are as follows. Channel I : Producer- Butcher (rural)- Consumer, Channel II : Producer- commission Agent - Butcher (urban) –Consumer, Channel III : Producer - Commission Agent-Wholesale Meat Dealer-Butcher-Consumer, Channel IV : Producer-Village Trader-Commission Agent-Butcher-Consumer, Channel V : Producer-Village Trader-Commission Agent- Wholesale Meat Dealer- Butcher- Consumer. It was found that the marketing costs were minimum with Rs. 12.75 in marketing channel I and maximum with Rs. 100.75 in channel V for adult male sheep weighing 12 Kgs carcass yield. The marketing costs increased with the increase in the number of intermediaries. In the entire marketing system the major items of costs were broker’s commission and labour charges followed by transportation. The producer’s share in consumer’s rupee was highest in channel I and lowest in channel V. As the number of intermediaries increased, the marketing efficiency has decreased.
Conditions for Growth of Livestock Sector
A Note on Relations Between Environment and Livestock Production System in India

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1. Introductory Remarks

Research in the economics of livestock in India has hardly paid any attention to environment's determining influence on the livestock production system, or for that matter, on the reproductive characteristics of the livestock. Nor was any attention paid to livestock production system's feedback to environment. W. Burns was perhaps the first to point out to an inverse relationship between bovine milk-yield and intensity of rainfall such that as one moved from drier regions of north-west to wet regions of south-east, milk yield declined (Burns, 1944). Taking cue from Burns I myself formulated a regional planning model in which the country was divided into six regions according to rainfall intensity, topography and territorial continuity (Mishra, 1978, Chapter 7). In our attempts we were explicitly recognising that environmental differences, no matter how simple the criteria of regionalization, played an important role in the livestock production system. Yet looking back from the vantage point of today I was not conscious, nor perhaps Burns was, that we were giving environment the importance it deserved.

As for the feedbacks, the environmentalists and scientists concerned with the global climatic change took the lead in the 1980s, and carried it through the 1990s. They focused, however, only on the negative feedbacks, i.e. on the environment damaging effects of the livestock production systems. I am reminded of environmentalists raising hue and cry against small ruminants as culprits causing environmental damages in the frangible zones of the country; Prime Minister Rajiv Gandhi (1984-87) ordering stoppage of financial support and distribution of goat and sheep under the anti-poverty programme, a Task Force of experts, set up under the counter pressure of local politician examining the issue and coming to the conclusion that the environmentalist's claims were unfounded (GOI, 1987). Be that as it may, the point remains that overstocking and over-grazing does damage pastures and wasteland ecology.

At the international level scientific research in greenhouse gases emission, their warming potentials and their source-wise and nation-wise quantification become a matter of priority agenda for the western governments, specially the U.S. administration as they prepared to meet at the Earth Summit in 1992 and negotiate on emission reduction levels. Since then developing countries have been at the receiving end, being told how much of emission of different greenhouse gases each one causes and from which source. The World Resources Institute (WRI) based in Washington brings out an annual directory giving the details. India’s livestock holding being largest in the world, she figures at the top of the list in respect of methane (CH4) emission from livestock sources around the world (12mt in 1995). In order to impart a sense of neutrality, the United-Nations’ Intergovernmental Committee on Climate Change (IPCC) now brings out Guidelines (IPCC, 1995) which countries can use for preparing their own inventory of greenhouse gases emission. For countries which do not have their own estimates of emission related parameters, the IPCC recommends what it calls ‘default rates’, these countries can use for...
purposes of inventory building. The most problematic are the default rates for methane emission from agriculture including livestock, since these are based on measurements and experiments largely carried out in the developed Western Countries. A group of Indian scientists, who made attempts to build the national inventory of greenhouse gases, opted for the IPCC default rates for estimating methane emission from our livestock. They did so because we do not as yet have our own rates based upon measurements carried out within the country. In saying all this my purpose is to draw attention to a great measure of uncertainty surrounding the measurement of this negative feedback from our livestock to the environment. Secondly, so long as we depend upon the default rates, we shall not be able to keep our head high in the international forums on greenhouse gases emission. It is high time that the ICAR with its vast agricultural scientific resources rises to the occasion.

In addition to the negative feedbacks, there are a number of positive feedbacks from India’s livestock production system to the environment, which are either not recognised or raised at national or international discussions. The proverbial ‘cow dung’ used either as manure or as domestic fuel by millions of rural households has high environmental value. Similarly, India’s livestock function as a gigantic recycling mechanism of agricultural byproducts and thereby contribute to saving of land, a natural resource. I have more to say on the positive feedbacks in the sections that follow. But let us begin with the environments’ determining influence on our livestock resources.

2. Livestock Biodiversity due to Environmental Diversity

India’s sub-continental size, her geographical spread from near equator to sub-temperate latitudes (about 8° to 37° N) and from 67° to 98° E longitude; her physiography, a veritable mosaic of cold and warm deserts, snow-clad mountains, great river valleys, the Dacca plateau skirted by the eastern and western Ghats and the Nilgiris, the mountainous tracts of the North-East and many more at lower gradients; her climatic variation as evidenced by ambient temperature, rainfall intensity and distribution, and the diverse ecological niches this vast land mass supports; all of this has made home for a biodiversity of livestock that is perhaps incomparable to any other country in the world. Consider cattle only, for example. Some of those light weight black cows of the trans-Himalaya Spiti region are reported to have lactation length lip to 5-6 years; so also their crossbreds with yaks, called dzomo. At the other end, there is Kerala’s “dwarf cow,” the vechur, about to be extinct, now revived, which is a high-fat milk yielder (Sosamma lype, Dairy India, 1997). A cow in Brahmaputra valley is a very, very different animal than a cow in Harayana. It is a common saying that India has 25 well defined breeds of cattle, and most of the cattle population is non-descript. But this common saying is based upon lack of complete knowledge. Only now the National Bureau of Animal Genetic Resources at Karnal has started genetic mapping of animals. Genetic wealth is a function of livestock biodiversity. One can not put an economic value on this wealth. With revolutionary changes in biotechnology of breeding and genetic engineering, today's genetic wealth, if preserved, has tremendous possibility for generating economic wealth in future.

3. Positive Environmental Contribution of the Livestock Production System

Though pastoral practices still exist and there are pastoral communities in the country, predominant production mode is one of mixed farming in which agriculture and livestock production are interdependent. Agriculture provides energy to livestock in the form of by-products feed, and the livestock return a part of that energy in the form of draught power and manure, besides producing milk, meat and other animal products. Not more than 5 per cent of the area under cultivation is allocated to fodder crop production to supplement the by-product feed with green fodder.
The positive environmental contributions are due to: (1) recycling of agricultural by products as animal feed, (2) use of dung as manure, (3) use of dry dung-cake as domestic fuel and (4) use of working animals in agricultural operations and also for rural transport. In the first case major land saving occurs because the alternative is to produce equivalent amount of green fodder (in terms of DCP and TDN) by allocating required land area. In the Second case since manure substitutes for chemical fertilizers, besides providing plant nutrients (NPK), it protects soil-born micro organisms, prevent and greenhouse gases emission that would otherwise occur in the manufacture of the equivalent amounts of chemical fertilizers. In the third case land savings occurs because the alternative is to plant firewood trees harvest and supply equivalent amount of dry firewood (in terms of thermal energy). Since there is gestation lag between planting and harvesting of firewood, it requires much more land than the area required to be harvested each year.

In the fourth case the working animals substitute for tractors and other agricultural machinery run on fossil fuel. This way the working animal stock prevents greenhouse gases emission in particular CO2 emission that would otherwise occur due to burning of fossil fuel in running the substitute number of tractors. Incidentally, whereas as fossil fuel is a non-renewable resource, the working animal stock is renewable.

To quantify the above environmental contributions of our livestock production system is not easy. At the Society for Economic and Social Research we are engaged in a major study on this subject with the financial support of the National Dairy Development Board (NDDB). The major difficulty we are faced with is the lack of reliable, up-to-date statistics on the large number of parameters that are involved in the estimation. Livestock statistics of the country even otherwise are in a poor state (Mishra, 1999). I may, for instance mention that representative, up-to-date feed(s) consumption rates for different age-groups and functional categories of animals, so very crucial for estimation of land saving due to recycling of agricultural by-products, are just not available.

4. Negative Environmental Effects

In section-1 I have already mentioned that overstocking and overgrazing is damaging of environment. However, if area under permanent pastures in the country is declining, animals are not to be blamed for this. Given the increasing human population pressure on land, the decline in pastures could be due to slicing away of land for other uses.

The major negative effect of the livestock production system is in form of methane emission, a greenhouse gas with high warming potential compared with carbon dioxide. There are two ways in which methane emission occurs: (1) through enteric fermentation of feed in the animals' rumen, and (2) the way dung-manure is managed. Since in our country manure is managed in open, dispersed conditions, emission on this account is understandably small. Methane emission from enteric fermentation depends upon a host of factors, the chief being the quantity and quality of feed fed to animals. Experimental research in the west has shown that methane emission as a percentage of digestible energy (DE) intake varies from 3 to 8 per cent, as grain feed is reduced and forage is increased in the diet. In most normal feeding situations methane emission bovine works out to about 6 per cent of the digestible energy intake (Johnson & Johnson, 1995). As I noted in section-1 we do not have such measurements in our field conditions. One could apply 6 to 8 per cent of DE to our stock and make an estimate of total methane emission from enteric fermentation. Again, however, one must have data on DE intake of animals in different age-group and functional categories. In the absence of feed(s) consumption rates one can not derive DF intake or, for that matter, the nutrients intake (DCP, TDN).
5. Concluding Remarks

In the preceding sections I have touched upon the various dimensions of the relationship between the country's environment and the livestock production system. I have pointed out to the difficulties researcher faces in quantifying the relationships. I should, however, add that the subject is new as well as challenging. It is not only satisfying to face this challenge. More than that it is of national importance, indeed of international importance.

References


Summaries of Selected Papers

India's Livestock Sector: A Perspective on Performance

Anjani Kumar and Jabir Ali

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The present study examines growth pattern and compositional changes in livestock population and its output in India. The sources of change in output, change in consumption of livestock output were also examined. The analysis showed that in recent decades significant growth has occurred in livestock sector. The growth in this sector was productivity driven since 1960s, which imparts strength to this sector. The higher growth of this sector has also played a role in meeting the nutritional and food security of the country. In view of rising productivity of this sector and to mitigate the growing population pressure on land, this sector can be promoted as a viable diversification alternative. However, the increased production or availability does not appear to have been translated into corresponding consumption of these items. This is a puzzling trend. Improvement in the status of official statistics is highly desirable not only for research but also for official purposes. The study further examined the discrepancies in livestock statistics.

Growth Performance of Livestock and Their Products in India

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The secondary data on livestock population and their products at all India level were collected from various annual reports and integrated sample survey of state governments. The study revealed that population growth in pig (4.5%) was the highest followed by poultry (3.83%) and buffalo (2.27%). The percentage change in 1998-99 over 1987-1988 also supported the high growth in pigs followed by poultry and buffalo. It was evident that milk production was higher and significant in important states and the highest growth was recorded in Maharashtra (8.59%) followed by Kerala (6.29%). The growth in production of eggs was the highest in Kerala (42.95%) followed by Karnataka (39.81%) and Rajasthan (10.16%), but there was a decline in production of eggs by 2 percent in Bihar State. In the production of wool Karnataka stood first in 1998 and followed by Kerala. Whereas in the production of meat, Bihar stood first (40.35%) in 1998 over 1997 and followed by Uttar Pradesh.
Growth Performance of Milk Production-An Inter-Regional Analysis

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The study examines the inter-regional variation in milk production in relation to supply of feeds from existing cropping systems with respect to northern and western and central regions of India. The analysis revealed that states having either wheat or sugarcane or both crops in the system contributed significantly to the milk production. Besides feeds, the increase in crossbred cattle population also contributed to milk production. The results indicated 325 per cent and 672 per cent growth in crossbred cattle population during 1982-92 in Maharashtra and Gujarat states representing western and central region. In the other parts viz. U.P. and Haryana the increase was only 24 per cent and 79.6 per cent, respectively which showed an existence of regional variation in adoption of modern technology for milk production. This has again caused disparity in relative share of milk production in both the regions. A declining trend in per cent share of contribution to the overall milk production was noticed in all the states of northern region proposed for the present study. In contrary to it, the relative share of contribution marked overall increase in the later part. In order to maintain the tempo of growth of country's milk production, modern technology of milk production needs to be disseminated and strengthened in the states/regions where it is comparatively less and lacking.

Changing Structure of Livestock in Himachal Pradesh- A District-wise Analysis

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The present study attempts (i) to examine the trend of composition of livestock population (ii) to study the trend in milk production and (iii) to analyse the factors affecting milk production in Himachal Pradesh. The study is based on secondary data. Interpolation of the data was done wherever necessary. The growth rates were calculated by using annual compound growth rate formula. The study shows that the local cattle population has shown a declining trend whereas there was an increase in the number of improved cattle. This is true in almost all the districts. The highest growth rate for improved cattle was observed in Mandi district followed by Bilaspur and Chamba. It is important to note that improved female cattle increased at a much faster rate than improved male cattle in all the districts of the state except Sirmaur. The results further show that buffalo population increased at a compound growth rate of 1.29 per cent for the state as a whole. In Kinnaur and Kullu districts buffalo population declined over the period of ten years, while in Lahaul and Spiti it was found to be stagnant. The adult females were found to be much higher than adult males during 1982 as well as during 1992. There was marginal improvement in population of the young stock. The results further indicate that in case of goat and sheep no specific trend (both male and female) was observed in different districts of the state. The local sheep declined at a compound growth rate of 0.34 per cent. The decline was more pronounced in female than male. The total improved sheep increased at a compound growth rate of 3.12 per cent, whereas male and female sheep increased by 3.48 per cent and 2.92 per cent, respectively. The increase was found to be highest in Lahaul & Spiti. How ever it was negative in Chamba, Hamirpur, Kullu, Shimla and Sirmaur districts. The rural population density was 4.76 per hectare.
of gross cropped area for the state as a whole. It was found to be highest in Lahaul & Spiti because of low-cropped area and minimum in Sirmaur. The bovine density was highest in Chamba (4.27 per hectare of gross cropped area) and minimum in Hamirpur (2.10 per hectare of gross cropped area). The results have further shown that buffalo contributed higher in total milk production than cattle but its contribution declined over the period. This is mainly because of improvement in milk yield from 1161 grams per day in 1981-82 to 1941 grams per day in 1995-96. The milk yield in case of buffalo increased till 1990-91 and then it started declining. The veterinary services in terms of number of hospitals and dispensaries and crossbred female cattle population were found to be significantly affecting the milk yield of cattle, whereas area under pasture land had no effect on milk yield of cattle. This may be because of stall feeding of the animal. The study suggests that with adequate nutrition and veterinary services the milk yield can be substantially increased.

**Goat Population and Performance Trend in West Bengal: An Economic Analysis**

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West Bengal has the largest goat population in India. The most common breed of goat in West Bengal is Black Bengal. The quality of meat of this breed is regarded as excellent and the skin is of superior quality, and is in great demand both in India and abroad in leather industry. It was found that the goat population was more concentrated in the coastal and alluvial regions of West Bengal. The trends in population of goat show that the density of goat population has undergone a change during the last two decades (1972-82 and 1982-1992) while their growth rates have decelerated sharply. However, the relative importance of goat in the livestock population had been on the increase. Furthermore, it is evident that the area under total grazing land has declined sharply in West Bengal during the period under study. If this trend continues along with the high growth in goat population/livestock, the problem of feed availability would accentuate in the future. Analyses of factors affecting growth indicate that out of the five selected determinants, the association of density of agricultural laborers with goat density is only significant. The economics of goat rearing enterprise in terms of benefit-cost ratio is low.

**Growth and Composition of Bovine Livestock in Himachal Pradesh**

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Himalayan economy is basically agriculture based, wherein livestock is an integral part. Livestock not only helps in supplementing the household income but also provides draught power to agriculture sector. Cattle and buffaloes are major bovine animals, which constitute about 56 per cent of total livestock. This study examines the growth of bovines, their composition and productivity along with pressure of total livestock on land. The growth of livestock was not very high during three decades (1972 to 1992) in all the categories of livestock. Male to female composition had favourably changed during this period in buffaloes, which are reared, mainly for milk. In buffaloes different critical ratios like male to female ratio, in milk to dry period ratio, he buffaloes for breeding to work ratio etc were better than that of cattle. Since cattle constitute a major part of bovine the overall picture seemed to be very dismal. The pressure on pasture land
was very high during this period. The land could produce only between 11-12 per cent of green fodder requirement. This analysis suggest a macro level planning to reduce uneconomical and unnecessary livestock (mostly male cattle population which is unproductive) in long run so that pressure on land is reduced and livestock productivity will increase to benefit the farmers of the state.

Emerging Inter-Regional and Inter Temporal Dimensions of Livestock Sector in Rajasthan

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The livestock development programme in the state of Rajasthan is required to be taken up by assessing the farm level resource base, the basic goals of livestock sector as applicable to various categories of rural households and also the competition for resources for crop production at farm level. The macro level programmes and policies for livestock development must take into account the ground realities at micro level in terms of income-employment opportunities and also the resource base. The declining preference for the farmers in using animal power for farm purposes is crucial to the selection of species and breeds for milk purposes. The existing regional concentration of species and breeds is the resultant of generations of adaptability and the same may not be disturbed through developmental interventions. The lack of infrastructure facilities and the large burden for health care of existing population warrants the need to develop more and more infrastructure facilities for ensured health care of animals. The positive impact of extension services for increased milk production should be given top most priority while devising the plans and programmes for livestock development in the state. Either the cattle fairs are to be made more attractive and effective means for animal marketing or alternatives are to be devised to strengthen the marketing network for animals. The fodder shortage even in good agricultural year in large number of districts is indicative of implementing "herd planning" programmes and fodder production and management programme on war-footing. The employment prospects for the rural work force in general and female workers in particular add to the importance of promoting livestock sector.

Growth of Livestock and Livestock Products in Maharashtra

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An attempt has been made in the present paper to study the progress, regional variability and instability in the estimated production of livestock in the Maharashtra state. The secondary data for the period 1970-71 to 1995-96 of estimated milk, eggs, wool and meat production was collected. The data were further divided into three periods I: 1970-71 to 1979-80, II: 1980-81 to 1989-90, III: 1990-91 to 1995-96 for knowing the decadal changes. Coefficient of variation was estimated for each period and for each product to know the average variability in the milk, eggs, wool and meat production in the state. Simple and compound growth rates were also estimated.
for each product and for each period to know the growth in the production. As compared to period 1970-71 to 1979-80, milk production increased about three and half times, egg production by three times, wool production by one and half time, meat production just doubled during the period 1990-91 to 1995-96. Amongst the regions of Maharashtra milk (35%), eggs (57%), and wool (46%) production was maximum in Pune region and followed by Nashik region. The increase in the production of milk, eggs and wool was stable in the state during the period 1990-91 to 1995-96 except the meat production. The per annum rate of growth of milk, eggs, wool and meat was more during the period 1990-91 to 1995-96. However, it was minimum during 1970-71 to 1980-81. The rate of increase adjusted for trend was more stable for the period 1990-91 to 1995-96 followed by 1980-81 to 1989-90 and 1970-71 to 1979-80.

Livestock Economy of Arunachal Pradesh

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Arunachal Pradesh is situated in eastern most part of India. It is surrounded by an international border in east, west, north and inter state boundary in south. Topography of the state is mountainous and can be divided into upper, middle, and lower zones. Due to its unique feature in terms of climate and altitude, different animals can be reared in the state. Vast forest area (67% of the total geographical area) provides ample opportunities for keeping animals. Of all the animals, mithun has special significance in the socio-economic and religious status of Arunachalis. Livestock Census, for the first time, were conducted in the state in 1978-79. According to 1997-98 census, there were 4.49 lakhs cattle, 1.24 lakhs mithun, 1.83 lakhs goats, 2.75 lakhs pigs, and 11.57 lakhs poultry in the state. Across districts, cattle is concentrated in East Siang, Lohit, Changlang, and West Siang. Lower Subansiri has the highest number of mithuns followed by Upper Siang, and West Siang. Department of Animal Husbandry and Veterinary, through its institutions, has been emphasizing on (a) livestock development and production, (b) animal health coverage, (c) dairy development, and (d) training and education. To promote dairy development on Anand pattern, a centrally sponsored Integrated Dairy Development Project is also under implementation in the state since 1993-94. Few sporadic attempts were also made to organize dairy cooperatives at village level. However on the basis of standard performance indicators, progress of these societies is less than desirable. It is hoped that due to cumulative efforts of centre, state, other departments and hard working and sincere Aurnachalis, livestock sector is going to play a vital role in the state’s economy. With a view to achieve above results, efforts should be made to conduct a study to assess production potential of animal husbandry products and simultaneously to increase consumption of milk and milk products in the state. There is also a need to improve productivity of animals through better feeding and health care and purchasing power of locals. Thus, a holistic approach is required for overall development of livestock sector in the state.
Livestock under the Frequent Drought Situation in Gujarat: Evidence and Issues

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Generally migration with livestock is a seasonal phenomenon, which gets accentuated during the drought period. But the experiences in Gujarat of late suggest that frequent draughts, especially since the mid-eighties, have induced long term or permanent migration rather than seasonal or short term. While this kind of trend as such, is not quite new it nevertheless poses serious concern with respect to (a) the regional imbalance in terms of density of human as well as livestock population; and (b) neglect of the CPLs as well as other marginal lands which could work as an important source of fodder even under the stress situation when crops do not grow. It is in this context, the present paper tries to examine the changing profile of livestock economy in Gujarat. The specific focus is on (a) to discern the shift in livestock population across districts with different levels of CPLs as well as drought proneness; and (b) to discuss policy implications for improving the potential of the livestock sector as an effective mechanism of coping up under the frequent drought situations. The analysis indicates that while livestock sector is an important segment, having a stabilizing impact on the farming economy of the state, the frequent drought in Gujarat since the mid-eighties have indicated that the sector is losing its effectiveness as a coping up mechanism for the poor. This is despite the fact that the state has made significant strides in terms of development of dairies and related activities. To an extent, this may imply that the developmental efforts have overlooked the basic instability in the conditions of agricultural production, which has significant bearing on the sustenance of the livestock economy. The future policy therefore, may need to focus on improving these basic conditions through improved management of land and water resources in the drought prone regions. This would imply a shift from techno-managerial approach towards dairy development to a more holistic approach which simultaneously helps regeneration of land and water resources and at the same time improves the poor’s share in the livestock sector especially in the drought prone regions where it is needed the most.

Livestock and Sustainable Development

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Civilisation began when man domesticated livestock for food, work, transportation, companionship, etc. For the one billion poor people in the world, livestock and associated system (LAS) are the instruments of production for earning their livelihood. Livestock in India consists of 200 million cattle, 70m buffaloes, 100 m goats, 50 m sheep, 20 m pigs and 400 m poultry birds. Associated systems consist of agricultural implements, carts and machinery used in agricultural operations. Asset value of LAS as well as the market value of their outputs are the order of Rs. 900 b, which forms almost 10% of the GNP. Draught animal power (DAP) provides 50b units of energy, valued at Rs. 135b. DAP cultivates 100 m hectares, that is 60% of area sown and also hauls 20b tonne kms of freight in 14 m animal drawn carts. 70 percent of India’s small farms will continue to depend upon DAP for many years. India produces 50m tonnes of milk, valued at Rs. 450 b. Market value of meat and slaughter by-products is estimated at Rs. 180m. Most of the 700m rural people are dependent on livestock for their livelihood.

In spite of their magnificent contribution to India’s economy, LAS is neglected. One major reason of poverty, covering 300m people, is the low level of productivity of LAS. Not even Rs.
9000 m are being spent annually towards improved breeds of animals and their health care, food and nutrition, implements and carts, etc. Management and delivery systems are also poor. Consequently, all segments of society now lose. Animals undergo unnecessary suffering. Environment is terribly polluted in the meat sector. Productivity of DAP can be trebled by improving implements, carts and slaughter houses. By shifting slaughter to rural areas (whereas livestock becomes available for meat), outputs can be increased and wastage reduced, which will double the value-added in rural areas. An upgraded LAS would lead to INCREASED: out of foodgrain and other agricultural products, transport facility connecting India's half a million villages, income of farmers and cart operators, rural industries providing employment, yield from the meat sector and corresponding gain to those in the meat trade, wasteland recovery etc. Also, modernization will lead to REDUCED: production of the environment, wastage and losses animal suffering, poverty in rural areas, etc. Thus an upgraded LAS will help to reduce poverty and improve the living standards of all those depending on livestock directly and indirectly.

Status and Growth of Livestock Sector in Western Maharashtra

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The livestock economy is the major subsidiary activity in Maharashtra. The Western Maharashtra region is on forefront in the livestock maintenance. Various livestock improvement programmes relating to health, breeding and extension work in this regard have resulted into the progress of the livestock in Western Maharashtra. The present exercise was taken up with a view to study the various livestock facilities regarding the health and breeding programme and extension work being carried out in this region. The data for the year 1996-97 were collected from various Government publications and reports relating to livestock. The simple tabular analysis was attempted. The study revealed that of the total veterinary dispensaries, more than 41 percent are in the region. More than 39 per cent of the total veterinary aid centres, are operating in the region. The polyclinics established in the region are to the extent of 29 percent. The treatments and operations carried out in the region were 38.20 and 33.72 percent, respectively. The total artificial inseminations carried out were 68.64 percent of the total in the region, and of the total calves born, 72 percent were in Western Maharashtra. Of the total campaigns organized, 43 per cent were in Western Maharashtra. The fodder seed distributed in the region was to the extent of 57.37 percent. The share of milk, eggs, wool and meat production was 59.24, 73.38, 75 and 52.44 percent, respectively. The compound growth rates regarding breeding, health and production parameters/aspects were found to be positive and highly significant for the overall period and each period. The prominent among them were calves born (14.09), artificial inseminations (10.58 percent), operations carried out (8.02 per cent) and milk production (6.51 percent).

Diversity of Livestock in Hill Farming Systems: A Study in Himachal Pradesh

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The present paper analyses (i) the transformation process of livestock sector in different agro-climatic zones of Himachal Pradesh; (ii) the relationship between livestock number and
composition with land holdings; (iii) the role of livestock in diversification, income and farm risk aversion and in reduction of income inequality; and (iv) the input-output transactions of livestock sector to other sub-sectors of farming systems in Himachal Pradesh.

Livestock supplies meat, milk, wool, draft power, etc. and are an important means of transport for goods in hills. Livestock production and use are influenced by location, climatic seasons and availability and quality of feed. Some of the inputs in livestock rearing are internally mobilized and some are externally. Therefore, livestock production systems should be analyzed with a holistic point of view, linking them with all components of farming systems and local specific situations. As commercialization of crops and consequently the surplus production to be marketed outside the village increased the requirement of market-oriented farm inputs (e.g. fertilizers, pesticides etc.) and import of food grains to the villages also increased. And, the need for transportation facilities also increased. Since in the hills many villages are physically inaccessible due to lack of link roads, the increased demand for transportation facilities increased the demand for pack animals (mules/horses/donkeys) resulting in the change in the livestock composition. In the process of production and marketing of commercial crops these farmers have more exposure to the market and the world around them and thus have also been more receptive to the adoption of new livestock technologies. Thus, the commercialization of crop production has induced reduction in number and improvement in the quality (breed) of livestock reared on stall-fed system. There is a dynamic relationship between cropping pattern and the type and number of livestock possessed by hill farmers. There is an increasing trend towards feeding with purchased concentrate-fed, especially among those farmers who possess improved crossbred cows or buffaloes. The dependence of livestock possessed by commercial crop farmers on the CPRs is decreasing. The linkage between crops, livestock and forests have weakened and the use of organic manure has declined in the crop-nutrient management system and that of chemical fertilizers has increased. In low hill regions the population of cattle is declining and that of stall-fed buffaloes is increasing due to economic reasons and decrease in land available for open grazing sheep population in high hill region is declining whereas the number of goats is increasing. Improved breeds of cows and buffaloes have helped raise household incomes and have contributed to improving the local environment since their dependence on CPR and forests for fodder collection and for grazing has declined and consequently the work load and drudgery of hill rural women in livestock sector has declined and in the commercial crops (fruits and vegetables) cultivation has increased. High paying alternative avenues in crop production and in non-farm rural activities due to liberalization, has compelled farmers to reduce labour use in less paying livestock activities and shift it to other new avenues available to them.

**Livestock Development in Hilly Areas: A Case of Himachal Pradesh**

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Majority of the population lives in rural areas and earns their livelihood from agriculture, horticulture and animal husbandry. Livestock rearing is practiced generally as part of a mixed farming system. Livestock provide milk, mutton, hides and skins, manure, draft power in agriculture, transport etc. It also provides self-employment, particularly socially disadvantaged including rural women. Livestock plays an important role in supplementing rural incomes. Different types of livestock perform these roles. The composition and growth of livestock depend on the agro-climatic, social status, economic condition of the household, market forces and natural resource endowments. From the analysis following can be concluded:
1. Livestock composition is changing in favour of buffaloes and small ruminants. In spite of all governmental efforts in development of cattle, there was no significant achievement rather in sub-tropical zone it is being replaced by buffaloes. This is also because of increasing mechanization and use of fertilizers.

2. In dry temperate and alpine zone livestock rearing is a major occupation because of horticultural and other developments the survival mechanism/strategy of the people is gradually being shifting away.

3. In the humid/sub-tropical zone there seems to be overstocking of cattle, mostly of local breed with low productivity and mostly to provide draught power and manure to agriculture in the area. So far policymakers failed to address the problem of number of livestock directly.

4. The efforts were mostly partial to improve productivity in terms of higher milk yields; other dimensions of livestock development were missing. Emergence of buffaloes for milk in the sub-tropical zone raises the hope for milk based commercial activity.

5. Small ruminants i.e. sheep and goats have mixed growth. Number of sheep is declining while goats are becoming important in all districts of Himachal Pradesh. The market forces mainly guide this growth of goats; i.e. the meat demand is increasing.

6. Presently overstocking of animals is for two reasons; firstly, livestock rearing is based on grazing, involving virtually little private cost it is mostly social cost. Secondly, the concern is to get more manure to maintain the health of soil for agricultural activities. The substitution of manure by fertilizers in hills is difficult because of the hill soils are light shallow and low in humus contents. Thus without organic manure crops cannot be grown profitably. Also the availability of draught animal at right time to use soil moisture is very critical in farming, in the absence of lease and exchange market for bullocks, farmer prefer to own bullocks.

7. Lastly, the problem of increasing number of small ruminants, particularly goats, are considered as greatest source of damage to forest and other vegetation of the ecological fragile areas of the state. In fact, the contribution of sheep and goats to this fragility could have been only marginal. The more important factors such as the extension of cultivation to marginal lands, indiscriminate grazing by large numbers of unproductive cattle, growing pressure on account of demand for fuel wood, commercial timber, raw material for industry etc. are responsible for degradation of these areas. To stop further ecological degradation and for eco-restoration there is need for several positive measures, such as, eco-development approach, pasture development and regulated grazing of animals. The most significant positive measure can be the approach to restrict the number of animals by way of negative action i.e. through administrative actions, all bound to fail or will not bring desired results in the face of strong economic logic favouring small ruminants.

**Evolution of Crop-Livestock Systems: Some Hypotheses**

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The present study analyzes temporal changes in the relationships among households, livestock and crop enterprises. The changing relationships of household, crop enterprises, and livestock have been studied, both at macro and micro level. The overall growth in ovine sector has marginally decreased by about 5 per cent during 1972-97, while during the same period growth in
sheep and goats was 24 per cent and -25 per cent, respectively. Despite the negative growth in ovine population in Sri Ganganagar district, growth in ovine sector in Jaisalmer district was higher. The per cent growth in overall ovine sector was recorded 315 per cent during 1972-97, and separately for sheep and goats during the same period found to be 286 and 363 per cent, respectively.

The per cent share of milk income in total family income was about 14 per cent in 1954/57, which reduced to about 8 per cent in 1967/68 and again it went up to about 30 per cent in 1999/00. This increasing income from milk shows the importance of livestock in household income. It is clear that investment on livestock per farm and per hectare has phenomenally increased during the study period. It is also clear that share of livestock income in total household's income has increased considerably. The study clearly shows the increasing interdependence among household, livestock and crop production. It can also be inferred from the study that with increasing importance of stall-feeding, there is a good opportunity for suitably introducing modern veterinary technology at farm levels. Generally, any policy in crop or livestock sectors is implemented uniformly either at the state level or at the country as well. Such policy implementation may not be much effective, keeping in view the study as well. Therefore, study suggests that for effective implementation of any policy programme, all the aspects need to be taken care of and local conditions must be taken into consideration.

Equine Husbandry in India: A Socio-Economic Perspective

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Equine husbandry has been small but integral part of the livestock economy in this part of the sub-continent since time immemorial. Apart from its unmatched contribution to the sectors like construction, transportation, tourism and sport, equine rearing has been a life support system for several of socially dejected and economically poor sections of our society in traditional parlance. Despite their significant role in our economy, equines in India are subject to negligence, both socially as well as in our livestock research efforts. This paper tries to bring forth some key socio-economic issues in equine husbandry in India based on census data and information on brick-kiln workers and sedentary equine owners of Delhi and Haryana.

Census data indicate a near stagnant equine population in the country over the last two decades except that of mules, who have more than doubled their number during the same period. This decline had been registered mainly in the southern states. Uttar Pradesh with a share of over 30 percent of equine population is on top while Haryana tops the list with highest density of 3.39 per Sq.Km. The equines are reared under two different systems namely migratory and sedentary. Kumhar (potters.), scavengers (Bhangi), Snake charmers (Sapera), Muslim Sheikh, Chamar, Washer man (Dhobi) and Jogi are the main keepers. of these animals with Khmers. topping the list. The migratory households prefer male equines to female equines due to pregnancy related losses. However, female equines are equally placed with male equines in the sedentary system. The equine-man ratio is found to vary considerably in the range of 0.38 to 2.75. The ratio is larger in cases where donkeys are the major lots. Number of equines per household, literacy rate and alternative sources of income was found higher in the sedentary system. On a brick kiln, an equine owner gets near full employment for a period of 6-8 months with an average day of 6-7...
hours. The number of working days varies from 18 to 23 days in a month. With a mean wage rate of Rs. 40.01 per 1000 bricks delivered, the average daily income of an equine owner ranges from Rs. 104 to Rs. 138, however, the income tends to go down as the herd size increases beyond four, probably due to inefficiency in equine use.

This paper also identifies some important constraint to equine husbandry in India. The institutional credit facilities and insurance cover are the two important bottlenecks for this sub-sector. Absence of distinct breeds of equines except that of Horses, unhygienic working environment, depleting traditional occupation base, increasing feed cost and unsatisfactory animal health care are the other constraints identified by the study. In all, this paper the authors hope, would instigate new flush of policy endeavors and research investigation thus triggering off development of this very vital sub-sector of our economy.

**Economic Perspective of Goat Rearing in India**

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This paper examines the role and prospects of goat rearing in India. Goat population in India during last two decades has increased at the fastest rate among all major livestock species in spite of the fact that nearly 41 percent of goats are slaughtered with about 15.5 percent natural death in rural areas. This clearly reflects the economic importance and wide adaptability of goats in India. An attempt has been made in this paper to ascertain the growth and contribution of goats in the economy at national level and their role at micro level in the economy of goat keepers in the villages under extensive system of management. Economic viability of goat rearing on commercial scale was also evaluated. Functional relationship of goat density with several relevant factors viz., size of holding, area under pasture/wasteland, net irrigated area, people below poverty line and bovine density was examined. It was observed that average size of holding and percent net irrigated area in different states was negatively associated with the density of goats. Higher net irrigated area provides suitable environment for higher crop intensity and consequently less area under common pasture which are the major source of feed for the goats. The association between goat density and area under pasture/wastelands was positive and highly significant, which highlights the role of common property resources in goat production system.

For economic analysis at micro level a study was conducted in Mathura district of Uttar Pradesh which falls under southwestern semi-arid zone. A sample of 61 goat-keeping households was selected from the villages of the Farah block. It was observed that more than 50 percent of the goat keepers were landless. The average investment per household was estimated to be Rs.3806 in small category for flock size of 2.2 breedable goats, Rs.8954 in medium flock of 5.25 goats and Rs.22608 in large flock of 16 goats. The grazing contributed to more than 85 percent share of total feed resources fed to the goats. Imputed value of the family labour (mainly, women, children and family old men) was found to be the major component of total expenditure, which accounted for more than 70 percent of the total cost of goat rearing. The family of goat-keepers had access to milk for a period of 60 to 150 days. In addition to milk, the goats enabled the farmers to generate income of Rs. 1972, Rs.7978 and Rs. 17,500 on small, medium and large categories, respectively.
Performance of Dairy Industry in Diara Lands of Bihar

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Diara land is a special type of land where visit of flood, mono cropping and migration of farmers along with livestock is a common feature and therefore performance of dairy industry was judged because it differs with other dairy farms in many respects. The objectives of the study were primarily to assess the socio-economic conditions of the dairy farmers, herd composition, economics of milk production and disposal of the milk and milk products.

For this study among various Diara lands Bhagalpur Diara land which is at the juncture of Kosi and Ganga river was purposively chosen. Out of the various blocks Gopalpur block having the maximum number of milch animals was chosen. Input output data were collected from three-size group of farms viz. large, small and marginal. The findings of the study revealed that socio-economic condition of the dairy farmers in Diara lands of Bhagalpur region was inferior to that of other areas of the Bihar. Cows, buffaloes, bullocks and heifers are maintained at the farm and their number varies from 6 to 9. Among the milch animals, buffaloes predominate because of their eco-friendly nature. However, there were no new breeds of cows on any of the farms in the area of study. The annual total cost of maintenance was observed to be Rs. 17860 that varied from 17120 to Rs. 19070 among the various class of the farm and per day maintenance cost was Rs. 49 per day which varied from 47 to Rs. 52. The gross and net return was observed to be Rs. 17856 and Rs. 1656, respectively. Unorganized system of marketing prevailed in the area and large number of middle men were involved due to which both producers and consumers were not getting desired price of the milk and milk products as paid by the dairy cooperative society. However, some of the producers were getting advances to meet their day to day work.

A simulation exercise for economic evaluation of goat rearing on commercial scale under intensive system of management was carried out first year of the project was assumed to be 1999 for the purpose of calculation of costs and returns. Commercial goat rearing on large scale with 100 breedable goats was also found quite profitable. The net return of a goat farm with 100 breedable goats over the period of 5 years was estimated to be around Rs.5,00,000 after repayment of the loan. The paper also suggests several measures/strategies for the development of goat enterprise in India.

Problems of Livestock Enterprise in Namakkal District

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Although dairy enterprise provides regular and stable income to the farmers., there are several problems encountered by the farmers, in taking up the enterprise. The main objective of the study was to identify problems associated with different enterprises mainly dairy and poultry. Opinion survey was conducted with the respondents of different categories namely Agriculture+Dairy+Poultry, Agriculture+Dairy, Agriculture alone and Dairy alone. The survey was carried out during May 2000 in Namakkal taluk. Garrett’s Ranking Technique was used for prioritising and identifying the most binding and important constraints. The results revealed that
the major problems in milk production were more distance to milk society, high input costs and inadequate credit facilities and in case of poultry production higher feed cost and establishment cost. The sample respondents were also asked to give their suggestions for improvement of milk and poultry production, reasons for not taking up other enterprises and also about their future plans. The results envisaged that the adoption of improved technology coupled with adequate credit facility would help farmers tackling the problems encountered by them.

Farmers’ Perception and Prioritizing Research towards Livestock Problems in Uttar Pradesh.

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A survey of 150 farmers from three development blocks of districts namely, Auraiya, Sitapur and Hardoi was conducted in year 1999-2000 to study animal health problems. Commonly prevalent diseases among buffaloes and cows are Foot and Mouth Disease, Pneumonia, Typanitis, Hemorrhage Septicemia (H.S.), Mastitis, Milk Fever, Rinderpest, Contagious Abortion, Anthrax, Cox pox, Eczema, Diarrhea, Black Quarter, Coccidiosis, Tick Fever, Nutritional Scour, Calf Diphtheria, Inflammation of Uterus. While for goats and sheep these are Pneumonia, Rinderpest, Anthrax, Typanitis, Black Quarter, Diarrhea, Tick Fever, John’s Disease, Eczema and Diarrhea, Black Quarter and Coccidiosis, Tick Fever, Nutritional scour and Calf Diphtheria were seen in order of 1 to 10 for buffaloes. More or less similar ranks were found in case of cows. But in case of goats main diseases are Pneumonia, Typanitis, Rinderpest, Black Quarter, Diarrhea, John’s Disease and Tick Fever, Cow Pox and Eczema, Anthrax and Milk Fever. In case of sheep, these were in the order of Rinderpest, Anthrax, Pneumonia, Black Quarter, John’s Disease, Tick Fever and Cowpox. It emerged that the research projects undertaken by various institutions have not compatibility with problems and they are doing work in light of, academic pursuit. However, the research projects of basic and strategic nature would be of paramount importance for perspective use, but perennial and short term nature problems faced by farmers are inviting attention for R&D supports at regional/national level.

Status and Constraints of Livestock Production in Rice Based Farming Systems in Orissa

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A study was undertaken during 1999-99 to find out the status and constraints of cattle farming in predominant rice based farming system. The data were collected from 500 adopted farmers in 10 KVK villages of Dhenkanal district in Orissa. The study shows that farmers are facing several problems related to technology. Most important 10 problems in adoption of dairying are lack of availability of proper extension/motivation facilities, high risk, non availability of animal health facilities at door step, non availability of green fodder, problem in getting institutional credit, capital intensive vocation, low conception of A.I., male domination in decision making, competition in milk and crop production and cattle insurance. A vast untapped potential exists in adoption of dairying in Orissa. There are several problems in its adoption but those can be easily
tackled by proper motivation and extension work. Women need to be included in decision making for better success of dairying enterprise. The above constraints need to be attended by producers, scientists, and administrators and development workers of the state to enhance the production and productivity of cattle and make the dairying profit making and employment generating enterprise.

Dairy Milk Production: Potentials and Constraints in Sorghum Based Production System

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Dairying is an important and integral farm activity in Sorghum Based Production System (SPS) under rainfed agroecoregion in India. An annual production of 3754.6 thousand tonnes of milk from cows and buffaloes worth Rs. 20642.64 million in SPS provides a good stimulus to the economy of India in general and SPS in particular. However, dairying in SPS is fettered by several technical and socioeconomic constraints, which impose considerable restrictions on dairy milk production. Based on cross-sectional primary data obtained from 160 farms in the districts of Mehboobnagar and Solapur of Andhra Pradesh and Maharashtra representing kharif and rabi sorghum based systems respectively, this study attempts to identify and prioritize the constraints of dairy milk production in SPS in accordance with their economic importance.

It was observed that irrespective of the breeds and the species dairying in SPS was more or less a subsistence household activity. As a result, an ambit of gaps (II) to the tune of 37 to 88 per cent depending on breeds and species of the milch animals was a matter of trepidation. The huge yield gaps (II) of 88 per cent in case of indigenous cows followed by buffaloes (55%), considering their compositions, drag due attention and require wholesome approach to combat the yield reducing technical and socioeconomic constraints. The technical constraints reduced yield of a crossbred cow by more than 0.58 ton in a year and contributed 67.75 per cent to the yield gap (II). Chronic nutrient deficiencies coupled with scarce fodder and inferior feed quality were some of the factors responsible for such wide gap. Lower conception rates followed by failure of artificial insemination and fierce diseases like Foot and mouth disease (FMD), anthrax, mastitis, thilerosis and Hemorrhagge septicemia (HS) were the other critical constraints of crossbred cows which were also common in indigenous breeds. Among indigenous breeds of cattle extensive nutrient deficiency was the prime reason for wide extent debility and reduced yield. Besides, failure of artificial insemination bore a negative persuasion on milk production and cross breeding programs. Stall-feeding followed by weary artificial insemination, FMD, mastitis, frequent miscarriage, prolapse and HS were some of the common and recurring constraints of buffaloes, which put embargo on their milk yield. It was observed that some of the constraints like failure of artificial insemination, FMD and HS were common in a majority of cows and buffaloes. Though losses caused by the different constraints significantly differ in the extent and quantities, the summation of their values totalled to the sum of rupees 2234.41 million, 1296.33 million and 680.45 million respectively. Thus, considering their importance the projects could be put forth for the partial prioritization and funding. Nutrient deficiency, failure of artificial insemination, stall feeding, FMD etc. were some of the other common constraints which could be accorded with top priorities. Among socioeconomic constraints like infrastructure facilities, institutional arrangements, cost of production and product prices are some of the crucial determinants, which affect the nature and extent of dairying and livestock and thus need appropriate socioeconomic and political endeavor.
Constraints Faced by Buffalo Owners in Breeding Tract of Pandharpuri Buffaloes of Maharashtra

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In order to find out the constraints faced by buffalo owners in breeding tract of Pandharpuri buffaloes i.e. Kolhapur, Sangli, and Sopur districts of Maharashtra, 17838 farmers were interviewed through informal survey method. About 11239 (63%) buffalo owners responded to questions. The analysis of information collected revealed that amongst the different groups of constraints, intensity of financial constraints was very high followed by shortage of resources, technical problems and rate of milk.

Dairying in Rainfed Groundnut Base Production System: Prioritizing Production Constraints and Implication for Future Research

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Dairying in rainfed agriculture, as elsewhere in the country, is integrated into the cropping system. Dairy animals, especially indigenous cattle and buffalo, have remained the most underrated and perhaps the least appreciated activities in rainfed agriculture. Their performance is very poor as compared to dairying activities in irrigated agriculture. However, because of the frequent crop failure in rainfed groundnut based production system (GNPS), dairying provides the major food and incomes to the rural people. There is a dual increase in milk production over last three decades in GNPS. Total milk production is around 3.61 million tonnes but milk yield in terms of per breedable animal per year is 724 kg, which is very low as compared to the national-average of 987 kg/ha. Thus enhancement in productivity is very crucial as the sustained economic growth and attendant increases in per capita incomes are expected to boost milk product demand substantially. However, concerns are now being raised on stagnating milk yield even at a low base in GNPS. It shows some inherent problems in milk production in GNPS. On the other hand, if experiment station yields or on farm trials are any indication then available statistics indicate that there exists a vast untapped reservoir in dairy system in GNPS at current level of technology, exploitation of which can help in accelerating growth rates. What is of utmost importance is that to study the constraints operating and removal thereof, thus efforts have been made in this study to identify constraints in dairying that cause significant production losses, and to rank these constraints in terms of their impact on milk production losses. The study also explores researchable issues on the basis of constraint prioritization. The results illustrate considerable yield gaps. The total value loss due to technical constraints in dairying amounted to Rs.17676 million. Mineral deficiency, FMD, parasitic diseases, failure of artificial insemination and high rate of mortality are the problem areas in dairying which are to be carefully addressed through research and development efforts. The study also explores researchable issues on the basis of constraint prioritization.
Annual Fodder Budget for Rearing Livestock in the Bundelkhand Region of Uttar Pradesh

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The study conducted in two blocks falling in the milk-shed areas of Jhansi district of Uttar Pradesh covering 91 farmers in 4 villages revealed that small and medium farmers had deficit, whereas large farmers had surplus fodder (dry + green) availability on per adult cattle unit (ACU) basis. The surplus fodder left by the large farmers in the fields was collected and stored by small and medium farmers to overcome the shortfall in the fodder availability. Some of the large farmers sold out the surplus fodder to the fellow villagers during lean season. Weeding operations provided green fodder to the casual laborers. Apart from stall feeding, about 80% of the farmers allowed free range grazing for their animals during April-October. Small, medium and large farmers also provided 98, 88 and 90 kg of oil cakes and 134, 113 and 93 kg of concentrate mix annually to their livestock herds.

Impact of Integrated Watershed Development Project (Hills) on the Status of Livestock in Shiwalik Foothills of Haryana

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The Shiwalik foothill area of Haryana State is ecologically one of the most fragile agro-economic zones. It was observed that cattle rearing is the major source of livelihood of the people of this area but productivity and the health of animals kept by them was very poor. The present study was aimed to assess the impact of the activities carried out by the Integrated watershed Development Project (Hills) for livestock improvement. To achieve the aims of the study, a random sample of 12 villages was drawn from the project area and 3 villages from adjoining non-project area. Out of these sampled villages 150 animal owners were selected randomly and proportionately representing different socio-economic groups of the people. The required primary data pertaining to the year 1998-99 was collected through survey method using suitably designed and pre-tested schedules. Simple tabular analysis was done to achieve the results and these results were compared on the basis of within and outside the project to assess the impact of project activities.

Number of cows decreased drastically from 2.65 cows per family to 0.87 cows per family. It can be attributed to the breed improvement programme through artificial insemination and the ban imposed on grazing in the project area and replacement of unproductive/low yielding cows with smaller number of high yields. It was observed during the survey that on an average 4.32 liters milk per day per household was being produced outside the project area. It was found that about 35 per cent animals of outside project area were being kept on grazing while corresponding figures for the same households of the project area was about 22 per cent due to the increased availability of grasses and farm produced fodder. On an average, about 66 quintals of green fodder and about 29 quintals of dry fodder was consumed per annum per family by the animals showing an increase of more than 6 quintals in terms of dry matter. It was also observed during
survey that people of project area have become more animal health conscious and adoption of latest technologies of animal treatment and Artificial Insemination etc. has considerably increased. About 20 and 12 per cent farmers of the project area have reported giving balanced feed to buffaloes, cows and bullocks, respectively. Adoption of artificial insemination was to the tune of 36 and 52 per cent in case of buffaloes and cows, respectively.

**Efficient Farming Systems Modeling: An Application of Multiple Objective Compromise Programming Approach**

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The study was undertaken to assess the potential for increasing farm income and employment through an efficient farming system. The study was conducted in Bangalore rural district of Karnataka. An efficient farming system is one with the minimum income variability commensurate with high incomes. The data was analysed using linear programming and its complements MOTAD, multiple objective and compromise programming techniques. An efficient farm plan has the potential to increase farm income by 124% for crop + poultry system of marginal farms, 53% for crop + sericulture system of small farms and 85% for crop + dairy + sericulture system of medium farms. The efficient farm plan generated the highest employment for crop + sericulture system in all the categories of farms. Traditional linear programming (LP) approach to the modeling of agricultural decisions rests on certain basic assumptions about the situation being modeled and the decision-maker (DM) seeks to optimise a well-defined single objective. In reality this is not the case, as the DM is usually seeking an efficient comprising amongst several objectives, many of which can be in conflict, or trying to achieve satisfying levels of his goals. Despite, the recognition given to the existence of multiple objectives in agricultural decision making, very little seems to have been done by agricultural economists to develop and use methodologies that model the decision situations.

**Present Status of Animal Wealth and Dairy Development in Vidarbha Region**

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Milch animals play a crucial role in shaping rural economy by providing gainful employment and regular flow of income to the farmers, agricultural laborers, farm women and other deprived groups. The present status of animal wealth and dairy development in the Vidarbha region could be a cumulative effect of livestock improvement programme introduced during Eighth Five-Year Plan. The study is based on secondary data obtained from District Statistical Abstracts pertaining to 1981-1996. The present study suggests that there is a scope for dairy development and helps to improve standard of living and to stabilize the income of the farmers. in Vidarbha region provided the deficit in fodder met out through establishment of grass bank and rotational grazing along with establishment of a pilot project particularly in fodder scarcity area. An improvement in the efficiency of dairy industry will definitely lead to sustainable fodder production to boost up income and employment in the rural sector of Vidarbha region.
Growth and Instability of Sorghum Production in Karnataka

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The study examines the growth and instability of sorghum production in Karnataka for the period 1961-62 to 1996-97. The period was divided into two: period I (1961-62 to 1976-77) and period II (1977-78 to 1996-97). In the first period, the growth rate of yield was substantially higher which offset the decline in area, while both area and yield showed a modest increase in the second period. The increase in average production in the State as a whole was predominantly due to the change in mean yield. The changes in yield variance and area variance were the two main components of total change in the variance of sorghum production in the state in which the former contributed to instability while the latter was a component for stability.

Crop Productivity Potentials and Constraints in Northern Transitional Zone of Karnataka

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The study revealed that the technologies developed for crops could not be replicated to exploit fully their maximum potential. As much as 40 percent of the farm potential has not been exploited in Jowar and groundnut, while in cotton the farmers have been successful in exploiting about 83 percent of the farm potential. The levels of inputs used on the Demonstration Plots were conspicuously higher than those used on the farmers' fields for most of the crops. The faulty cultural practices followed by the farmers contributed significantly to the unexploited potential in wheat and groundnut. Further, a major portion of the yield gap could be reduced by using more plant nutrients, particularly nitrogenous fertilizers in cereals and phosphatic and potassic fertilizers in oilseeds and pulses.

Crop Diversification in Western Plateau and Hill Regions of Maharashtra: An Economic Analysis

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Project Directorate for Cropping System Research, Modipuram

The paper examines farm size wise socio economic characteristics, cropping pattern, level of diversification, factors affecting net return and crop diversification in western plateau and hill regions of Maharashtra. Entropy index was used to measure diversification. Regression analysis was carried out to quantify the factors affecting diversification and its impact on net return. The highest cropping intensity was estimated for marginal farmers in crops like vegetables and fruits. Indices of diversification revealed that marginal farmers of Pune district were less diversified than others diversification towards high value crops was found to be more profitable in all cases except large farms in Pune district and it was found profitable in case of large farms in Akola.
As per expectations, cropping intensity was found significant and positive to influence net return. It is to be pointed out that elasticity coefficient in respect of percentage area under HYVs on large farms remained insignificant. Family labour was found to be significant except on marginal farms in Pune district and marginal and small farms in Akola district. By and large labour availability, farm size and gross irrigated area appeared to be the strong variable affecting the level of diversification. It is suggested that effective implementation of land ceiling policy may encourage to some extent crop diversification. Secondly, cooperative farming is to be encouraged so that soil testing, irrigation, storage, transportation, standardization and grading, yield and price risk could be handled on cooperative basis. Farm benefit programs may be tied to the growers of the high value crops. The crop insurance scheme should be extended to the fruits and vegetable crops. Location specific strategy of diversification towards high value crops is the necessary task. Emphasis must be placed on the development of the micro irrigation-cum-water saving, and water harvesting technologies and watershed development through in situ rain conservation without hurting the ecosystem.

Livestock, Agriculture and Environment Symbiosis in Western Ghats Region of Karnataka- A Natural Resource Economics Study

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The study makes an overview of livestock sector in Karnataka followed by analysis of various forms of linkages and interactions among livestock, agriculture, forestry and Common Property Resources (CPRs.) in Western Ghats region. The results highlight the predominant role of family labour in animal husbandry and the animal population in Karnataka. There is an unachieved gap of 55 percent in the production of fodder for livestock. The pressure on CPRs. has been increasing and hence there is a large-scale encroachment of CPR in Karnataka. As a result, our livestock population is forced to cover a distance of 61 percent (1.42 kms) more with an additional time of 35 percent (3.06hRs./day) for grazing compared to ten years back. The mechanical power on the other hand, is gradually replacing animal power. The pressure of animal population in the ecologically sensitive region of Western Ghats as the number of animals/100 acres of CPRs. (11 animals/100 acres) is less than the state average (35animal/100 acres). The use of gobar gas as an alternative source of energy is picking up especially in the forestry regions thus helping the conservation of forestry.

Prospects of Livestock Farming in Vegetable-Horticulture Farming System in District Kullu

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The present study was conducted in district Kullu during 1999-2000. A sample of 150 farm households was selected and classified into four categories viz. landless, marginal, small and large. The study was undertaken with the objectives: (a) to examine the distribution of bovine population on different farm categories, and (b) to study the input-output relationship. Results
indicated that the bovine population increased with the increase in farm size. Again, the percentage of crossbred cattle was highest on large farms and lowest on landless farms. The factors like green fodder, dry fodder, concentrates, health expenditure and human labour showed positive and significant relationship with milk yield. Increasing infertility among cattle, scarcity of green fodder, poor quality of feed and concentrates available in the market were the major problems.


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The present study was conducted in Tehri Garhwal district of Uttar Pradesh with the aim to examine role of women in milk production and work out participation of women in the decision making process related to management of livestock. The results indicated that most of the livestock operations were performed by women. For upkeep of milch animals women contribute 134 days/animal/year (90.0%) and men contributed just 15 days/animal/year (10.0%). The lion’s share of labour was on fodder collection being 57.65% of the total labour followed by cleaning of cattle shed (13.55%). Out of 83.74 days spent for fodder collection by the women, about 96 percent was on green fodder and 4 percent on dry fodder collection. The marketing of milk and milk products was almost entirely in the hands of male (90%) the decision making analysis revealed that 29 per cent decisions were taken by women and 33 per cent by male whereas 38% decisions were taken jointly by men and women in valley situation. In mid hills, 29 per cent decisions were taken by female alone and 42 percent by male without consulting the housewife. In high hills, 33 per cent cases were decided by women and 23 per cent by men family members. The contribution of female in milk production was statistically significant whereas impact of women in decision making on dairy enterprises was significant only on high hill situations.

Carrying Capacity of Farmers in Watershed Environment

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Livestock production and maintenance has become one of the most important and economically viable occupations of rural families. Carrying capacity of the land has its own impact on the living conditions of the farmers with respect to number of livestock and the number of adult family members in the rural area. To know the carrying capacity of the land of the watershed farmers a study has been undertaken in Kalyanakere and Mavathurkere watersheds in Karnataka. Majority of watershed farmers belonged to medium level of carrying capacity category followed by a little extent at high and low carrying capacity level. The similar results of medium level of carrying capacity was noticed in marginal, small and big farmers category too. However, the high carrying capacity was observed largely in big farmers followed by small and marginal farmers.
Resources Use Efficiency and Economic Efficiency of Different Rice Based Cropping Systems in Karnataka

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In order to determine the appropriate level of use of resources in cultivation of rice based cropping systems in Southern Transition Zone (to represent irrigated area) and Coastal Zone (to represent rainfed area), the present study was undertaken. To study the resource productivity, Cobb-Douglas type production function was employed. Frontier production function analysis was done to estimate the economic efficiency. The results indicated that there is scope to increase use of seed and inputs like organic manure, soil amendments, and plant protection chemicals and FYM in both the zones. However, expenditure on bullock labour in Southern Transition Zone and human labour in Coastal Zone needs to be reduced to enhance profitability. Economic efficiency was higher in Southern Transition Zone because of assured irrigation facilities in the former case.

Relationship Between Milk Production and Farm Size: An Economic Analysis

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The milk production which was purely an enterprise confined to home, took a different view with different degrees of commercialization. An examination was made to know the relationship between farm size and milk profitability. Duggirala Mandal of Guntur district was selected purposefully and twenty-five farmers each from three categories i.e small, medium and large who were milk producers were identified and primary data were collected with the help of specially designed schedules. The data were analysed for investment, input use and returns pattern. The input use pattern indicated that family labour utilization was more in small farm category compared to medium and large category. Concentrates were used more by large farmers for milk production where as green fodder was key input on small farms. The returns pattern indicated that there was huge difference in physical yield of milk production. It was further observed that higher is the capital investment, more is the dividend and the same phenomenon was notified in Duggirala Mandal of Guntur district. The benefit-cost ratio analysis indicated that small farmers also realized more than a rupee for their investment and the realisation of per rupee was increased with the size of the farm.
Social Status of Farmers Keeping Pandharpuri Buffalo in the Breeding Tract of Maharashtra

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Five hundred forty eight household keeping Pandharpuri Buffaloes from Solapur (200), Sangli (148) and Kolhapur (200) districts of Maharashtra state were randomly selected for the present investigation. The farmers were spread over 60 villages, 12 strata and 3 districts. The traits of household considered for the present study included age, literacy, education, and family members (male and female) and their participation in Pandharpuri buffalo rearing. The results revealed that the average age of farmer was 46.0 ± 1.07 years, the proportion of literate farmers was 67.07, out of these 59.64 per cent farmers have completed their education up to high school level. The average number of male and female family members in households were 3.04 ± 0.03 and 2.6± 0.19 respectively, while the average family size was 5.72 out of which 3.69 family members were literate. Family members of the household mostly did the management of Pandharpuri buffalo.

Role of Milk Producers' Co-operative Societies in Tribal Area of Dharni Tahsil

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The paper examines role of milk producers’ co-operative societies in the tribal area of Dharni Tahsil. Out of 237 milk producer members, 150 milk producers were randomly selected. There are ten milk co-operative societies in Dharni Tahsil consisting 248 members which shared 44.76, 16.53 and 38.71 per cent belongs to Korkuy, Gond tribals and other categories respectively. The highest (21.10) and the lowest member (7.59) per cent were observed. Total 828510 liters milk production from 9 milk co-operative societies was obtained from 300 cows, 354 buffaloes and only one crossbred cow. Marketable surplus and self utilization of milk by members worked out to 94.27 and 5.73 per cent respectively. Out of total milk supplied to Govt. Milk Scheme, Amravati by the milk co-operatives in Dharni tahsil shared 30.44 per cent comprising 54.82 and 45.18 per cent during flush and lean season respectively. Milk prices were observed more during lean season as compared to flush season. A wide disparity between prices by milk scheme and private agencies was observed. The important constraint included supply of milch animals, loans for purchases of milch animals, construction of shed, purchases of feeds and fodder and other recurring expenses.

Role of Co-operatives in Milk Production in Bihar

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The present study aims at examining the role of co-operatives in milk production and creating supporting services like, animal health, artificial insemination, supply of feeds and fodder's seeds
and training facilities to dairy farmers in the State of Bihar. The study is based on primary data collected from 1440 sample dairy farmers that is 720 members and 720 non-members who were selected from 60 dairy co-operatives of the two largest milk unions of Bihar, that is Khagaria-Begusarai-Barauni Dugh Utpadak Sahkari Sangh Ltd. and Vaishali-Patliputra Dugdh Utpadak Sahkari Sangh Ltd.

Analysis of data revealed that there was 7.61 percent higher number of milch animals on member households than that of non-member households. The lactation periods of Deshi cows and she buffaloes were comparatively higher on member households (244 days and 275 days) than non-member households (242 days and 269 days). Lactation period of crossbred cows was found comparatively higher on non member households (301 days) than that of member households (297 days). However, member and non-member dairy farmers did not differ significantly with respect to lactation period of their milch animals.

Per milch animal annual milk production was comparatively higher on member households (866 liters) than that of non-member households (831 liters) of both the categories of dairy farmers (member and non-member) in milk production. Per household annual quantity of marketed milk was 1103 liters on member households and 958 liters on non-member households. The similar trend was observed on different size of households but the quantity of marketed milk declined with the decline in the size of land holdings. On the other hand, per household annual milk consumption was comparatively higher on non-member households (249 litresRs.) than member households (231 litres). Moreover, the consumption of milk was found comparatively higher on member and non-member big households which declined with the decline in size of land holdings in both the categories.

Caste wise analysis of milk production, consumption and marketing revealed that per household annual milk production was comparatively higher on upper caste member and non-member households (1577 liters and 1328 liters) than the intermediate (1219 liters and 1226 liters) and low caste households (1108 liters and 786 liters). The consumption of milk was also higher on member households of upper caste than their non-member counterparts whereas non-member of intermediate and lower caste households consumed comparatively large quantity of milk than their member counterparts.

Analysis of data of supporting services indicated that only 36.37 percent of Co-operative villages had availed the services of veterinary doctors almost once in a month. Among the different types of milch animals, the majority of crossbred cows (89.29 per cent) and more than half of Deshi Cows (58.24 percent) of member farmers were artificially inseminated. However, they could avail this facility for only 27.39 percent of their she buffaloes. Only 55 percent of co-operative villages had artificial insemination centres and about 44.16 per cent of member farmers had availed this facility for their bovines. About 26.39 percent of dairy farmers under study purchased feeds from dairy co-operatives and only 4.58 percent utilised the supply facility of fodder seed from co-operatives during the period under study. Annual per milch animal supply of feeds was worked out to be 156 kg however, it was comparatively higher on small households (183 kg) than big and marginal households (152 kg each and landless households (67 kg). An inquiry on training facility indicated that about 10 percent of sample farmers availed this facility however, the participation of big farmers in training program was comparatively higher in the project area.

Hence it may be inferred that the dairy co-operatives failed to play a significant role in increasing milk production in Bihar. Dairy co-operatives no doubt, made a sincere effort in creating infrastructure for artificial insemination of milch animals but failed in motivating dairy farmers for