Ind. Jn. of Agri. Econ.
Vol. 50, No. 3, July-Sept. 1995

The Livestock Economy of India: A Profile*

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I

INTRODUCTION

Animal husbandry in India is closely interwoven with agriculture since ages and plays an important role in the rural economy. Besides having vast employment potential, this sector provides not only milk, egg, meat, wool, hides and skins, dung, bones, hooves and draught power but also stabilises the farm incomes. The gross value of output from this sector is estimated at Rs. 51,600 crores in 1991-92 compared to Rs. 43,659 crores in 1990-91, accounting for 25.5 per cent of the value of total agricultural output, excluding the contribution of animal draught output (Government of India, 1994). For designing appropriate policies of livestock development and thereby giving a further boost to their contributions, it is extremely essential to focus on the nature and significance of changes taking place in the animal husbandry sector across regions of India.[1] Accordingly, an attempt has been made in this paper to assess the temporal and spatial changes in livestock wealth and also to identify the major constraints inhibiting the growth of animal husbandry sector. More specifically, the objectives of the paper are (i) to study the regionwise inter-census growth, compositional changes and density of bovines and small ruminants together with their contributions to the national economy of India, and (ii) to assess the major constraints inhibiting the growth of livestock enterprises across the regions of India.

Data and Methodology

The study is based on secondary data published in the *Livestock Censuses of India, Statistical Abstracts of India* (Government of India, 1987, 1992) and the *FAO Year Books*. Besides tabular analysis, per annum compound growth rates[2] were computed to indicate an increase or decrease in livestock population during the inter-census periods (1966-77, 1977-87 and 1982-87). The contributions of livestock enterprises are presented in Section II and the major constraints inhibiting their growth in Section III. The last section outlines the issues for in-depth study.

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* Keynote paper.

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The author is grateful to I.J. Singh, Director, Academy of Agricultural Research and Educational Management, A.C. Gangwar, Senior Scientist (Evaluation Cell) and R.N. Pandey, Professor and Head, Department of Agricultural Economics, for going through the manuscript and providing valuable suggestions. He had also fruitful discussions with G.P. Lodhi, Senior Sorghum Breeder and Head, Department of Plant Breeding and his senior colleagues as well as M.P. Singh and R.S. Yadav, Associate Professors, Department of Livestock Production and Management, Ch. Charan Singh Haryana Agricultural University, Hisar.

II

LIVESTOCK POPULATION AND ITS CONTRIBUTION TO THE NATIONAL ECONOMY OF INDIA

A. *Bovines and Draught Animals*

(*i*) *Compound growth rates:-* At the all-India level the indigenous cattle in milk have increased at the annual rate of 0.32, 2.18 and 1.64 per cent during 1966-77, 1977-87 and 1982-87 inter-census periods respectively while the growth of buffalo population in milk was at the annual rate of 2.50, 3.17 and 5.15 per cent during the corresponding periods. The crossbred cattle in milk have, however, increased at an annual rate of 10.23 per cent during 1982-87 (Table I). Across regions, though the indigenous cattle in milk have positively increased in various inter-census periods (except during 1977-87 in the northern, during 1982-87 in the southern and during 1966-77 in the eastern region), yet the eastern region accounted for the highest increase during 1977-87 and 1982-87 inter-census periods, followed by the western region. Except for the western region, though the crossbred cattle in milk have positively increased during 1982-87 inter-census period, the northern region accounted for the highest increase, followed by the eastern and southern regions.

Except for the eastern region in 1977-87, the buffalo population in milk increased across regions in all the inter-census periods with the highest increase in the northern region, followed by the western and southern regions. As compared to the indigenous cattle in milk, the buffalo population in milk has increased at a faster rate, the crossbred cattle in milk have increased relatively at a much faster rate across regions. The higher growth rates in the case of buffaloes and crossbred cattle reflect that the farmers 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 indigenous cows, and greater milk production potential of crossbred cattle as compared to buffaloes. Furthermore, the northern region has accounted for the highest increase in both buffaloes and crossbred cattle in milk, followed by the western region (only for buffaloes), the eastern region for indigenous cattle (together with crossbred cattle next to the northern region). On the whole, though 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.

Negative growth is observed for indigenous dry cattle in both the northern and southern regions in all the inter-census periods while in a few inter-census periods in other regions and at the all-India level. This shows that the number of dry cattle has tended to decrease in those periods. Contrarily, except for the western 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 southern region in 1977-87 and 1982-87). This reflects the fact that, by and large, the number of both dry crossbred cattle and buffaloes has tended to increase over the period. Indeed, people seem to have shifted for rearing crossbred cows and buffaloes over indigenous cattle for milk production. Furthermore, the higher growth rates of indigenous and crossbred cattle as well as buffaloes in milk as compared to their counterpart of dry milch animals are indicative of better feeding, breeding and management practices adopted by the farmers.

TABLE I. COMPOUND GROWTH RATES OF BOVINES AND DRAUGHT ANIMALS DURING DIFFERENT INTER-CENSUS PERIODS ACROSS REGIONS OF INDIA

(per cent per annum)

Sr. No.	Particulars		Northern			Western			Southern			Eastern			All-India		
			1966-77	1977-87	1982-87	1966-77	1977-87	1982-87	1966-77	1977-87	1982-87	1966-77	1977-87	1982-87	1966-77	1977-87	1982-87
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
I.	Milch animals																
	(i) Indigenous cattle	(a) In milk	1.33	-0.56	0.93	0.96	2.99	2.18	1.22	0.21	-0.28	-2.28	5.95	2.98	0.32	2.18	1.64
		(b) Dry	-0.10	-2.62	-2.44	0.66	-0.28	-0.20	-0.03	-3.40	-6.66	-2.73	6.35	2.91	0.40	0.14	0.95
	(ii) Crossbred cattle	(a) In milk	-	-	19.55	-	-	-8.97	-	-	7.10	-	-	10.31	-	-	10.23
		(b) Dry	-	-	9.95	-	-	-15.59	-	-	1.72	-	-	11.38	-	-	5.18
	(iii) Buffaloes	(a) In milk	2.99	3.50	7.91	2.06	3.60	3.61	1.77	3.39	2.55	2.88	-0.98	1.39	2.49	3.17	5.15
		(b) Dry	1.64	0.64	3.60	0.91	0.81	0.13	1.09	-0.98	-2.60	0.39	3.53	0.93	1.21	0.67	1.09
II.	Draught animals																
	(i) Bullocks		1.54	-4.42	-0.33	0.14	0.10	1.73	0.08	-1.83	2.51	-3.68	0.94	5.03	-0.27	1.58	-0.46
	(ii) He-buffaloes		2.12	0.30	3.45	-0.57	-7.85	26.57	-1.06	-4.13	12.37	0.87	0.53	2.54	0.40	-1.73	5.94
	(iii) Camels		-	-2.36	-2.08	-	-8.02	-14.53	-	-	-	-	-	-	-	-2.71	-2.88
III.	Cattle young stock (below 3 years)																
	(i) Male calves		-0.64	-0.53	-0.03	0.25	1.04	0.84	-0.23	-1.46	-3.72	-3.47	6.91	2.72	-0.98	1.72	0.51
	(ii) Female calves		-0.50	0.82	0.15	0.42	1.04	0.86	0.45	1.71	-0.63	-3.00	10.92	7.18	0.62	3.87	2.59
IV.	Buffalo young stock (below 3 years)																
	(i) Male calves		2.71	1.69	4.98	0.94	2.55	2.96	0.49	-2.24	-2.79	0.64	0.98	1.74	1.57	1.00	2.65
	(ii) Female calves		1.48	4.07	5.97	1.26	2.52	1.92	3.21	3.77	2.56	1.59	2.62	1.59	1.80	3.53	3.86

The compound growth rates for young stocks show that (a) except for the northern region 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 showing the replacement rate for breedable cows, (c) young stock buffaloes (below 3 years) of both the categories have observed an increasing trend across regions and at the all-India level during all 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 young stock buffaloes and (e) the positive growth rates of both cattle and buffaloes (more particularly hiefers and young calves) also indicate the farmers' behaviour of rearing these offsprings either for replacement or for sale.

The compound growth rates for draught animals show that (a) camels which occupy a place as draught animals only in the northern and western regions, showed a declining trend in various inter-census periods; (b) he-buffaloes showed an increasing trend in all the inter-census periods both in the northern and eastern regions while a mixed situation prevailed across the western and southern regions and at the all-India level; and (c) bullocks, though declined in various inter-census periods at the all-India level, showed a positive trend in the western region in all the periods and a mixed situation in the remaining regions. The declining rates of draught animals across the regions of India and during the inter-census periods may be due to the rapid mechanisation of Indian agriculture.

(*ii*) *Compositional changes*:- Among indigenous cattle both the absolute and percentage shares of adult males were the highest during all the census years in three regions, viz., northern, western and southern, including India as a whole (Table II). In the eastern region, though the adult males ranked first in all the censuses, young stock ranked second in the latest two censuses. Among crossbred cattle, there existed differing pattern of compositional structure across the regions during 1982-87. In the northern region, the adult males ranked the highest, followed by young stock and adult females in both the censuses (1982 and 1987). In the southern and eastern regions, the adult females ranked the highest, followed by young stock and adult males in both the censuses. A similar pattern existed in the western region and at the all-India level during the 1987 census. Likewise, in the 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 young stock (except for the eastern region in 1977). A significant number of adult females was also dry among cattle and buffaloes in all the censuses both across regions and at the all-India level. Furthermore, the percentage shares of females in milk were relatively greater among buffaloes and crossbred cattle than among the indigenous cattle in all the censuses both across regions and at the all-India level. 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 (Table II). These results confirm the fact that (a) the indigenous cattle are mainly reared by the farmers to sustain draught animal power and indigenous cow's milk is considered as by-product; (b) buffaloes are considered as the main milch animal, followed by crossbred cattle to sustain the milk production needs; (c) farmers trry to rear the offsprings of these species for replacement and/or sales; and (d) this pattern of rearing animals is based on economic logic rather than on religious grounds.

TABLE II. COMPOSITIONAL CHANGES IN BOVINE POPULATION ACROSS INDIAN REGIONS

(million)

Particulars	Cattle						Buffaloes			
	Indigenous				Crossbred					
(1)	1966 (2)	1977 (3)	1982 (4)	1987 (5)	1982 (6)	1987 (7)	1966 (8)	1977 (9)	1982 (10)	1987 (11)
I. Northern region										
1. Adult males	20.80	21.55	16.87	16.39	2.15	1.76	1.93	2.43	2.32	2.76
	(42.98)	(44.23)	(39.50)	(38.88)	(55.70)	(34.11)	(8.97)	(8.93)	(8.73)	(7.74)
2. Adult females										
(i) In milk	5.84	6.75	6.09	6.38	0.43	1.05	5.80	8.02	7.73	11.31
	(12.07)	(13.85)	(14.26)	(15.13)	(11.14)	(20.35)	(26.94)	(29.46)	(29.08)	(31.73)
(ii) Dry	7.11	6.63	6.10	5.39	0.28	0.45	4.45	5.32	4.75	5.67
	(14.69)	(13.61)	(14.28)	(12.78)	(7.25)	(8.72)	(20.67)	(19.54)	(17.87)	(15.90)
(iii) Not calved	1.26	1.14	0.98	1.17	0.08	0.18	0.92	1.05	1.01	1.55
	(2.60)	(2.34)	(2.29)	(2.77)	(2.07)	(3.49)	(4.27)	(3.86)	(3.80)	(4.35)
(iv) Total	14.29	14.68	13.17	13.06	0.79	1.68	11.25	14.53	13.49	18.70
	(29.53)	(30.13)	(30.84)	(30.98)	(20.47)	(32.56)	(52.25)	(53.38)	(50.75)	(52.46)
3. Young stock below 3 years	13.30	12.49	12.67	12.71	0.92	1.72	8.35	10.26	10.77	14.19
	(27.49)	(25.64)	(29.66)	(30.14)	(23.83)	(33.33)	(38.78)	(37.69)	(40.52)	(39.80)
Grand total	48.39	48.72	42.71	42.16	3.86	5.16	21.53	27.22	26.38	35.65
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
II. Western region										
1. Adult males	18.87	18.96	19.69	20.01	0.10	0.03	1.62	1.52	0.62	0.81
	(41.03)	(39.80)	(37.29)	(38.73)	(15.87)	(11.11)	(13.72)	(11.47)	(4.47)	(5.17)
2. Adult females										
(i) In milk	5.05	5.61	6.76	7.53	0.16	0.10	2.90	3.63	4.33	5.17
	(10.98)	(11.78)	(12.80)	(14.58)	(25.40)	(37.04)	(24.58)	(27.40)	(31.22)	(33.01)
(ii) Dry	7.43	7.99	7.85	7.77	0.07	0.02	2.49	2.75	2.96	2.98
	(16.16)	(16.77)	(14.87)	(15.04)	(11.11)	(7.41)	(21.08)	(20.75)	(21.34)	(19.03)
(iii) Not calved	0.92	0.86	0.70	0.74	0.02	0.01	0.43	0.43	0.37	0.40
	(2.00)	(1.80)	(1.33)	(1.43)	(3.17)	(3.70)	(3.64)	(3.25)	(2.67)	(2.55)
(iv) Total	13.72	14.77	18.32	16.22	0.26	0.13	5.91	6.87	7.66	8.61
	(29.83)	(31.00)	(34.70)	(31.40)	(41.27)	(48.15)	(50.04)	(51.85)	(55.23)	(54.98)
3. Young stock below 3 years	13.40	13.91	14.79	15.43	0.27	0.11	4.28	4.86	5.59	6.24
	(29.14)	(29.20)	(28.01)	(29.87)	(42.86)	(40.74)	(36.24)	(36.68)	(40.30)	(39.85)
Grand total	45.99	47.64	52.80	51.66	0.63	0.27	11.81	13.25	13.87	15.66
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
III. Southern region										
1. Adult males	14.56	14.31	13.10	12.03	0.34	0.41	2.51	2.18	1.86	1.46
	(40.66)	(39.57)	(37.96)	(38.32)	(10.93)	(10.33)	(19.40)	(14.86)	(11.63)	(8.99)
2. Adult females										
(i) In milk	4.20	4.80	4.97	4.90	0.88	1.24	3.14	3.81	4.69	5.32
	(11.73)	(13.27)	(14.40)	(15.61)	(28.30)	(31.23)	(24.27)	(25.97)	(29.33)	(32.74)
(ii) Dry	5.28	5.26	5.25	3.72	0.45	0.49	2.36	2.66	2.75	2.41
	(14.74)	(14.55)	(15.21)	(11.85)	(14.47)	(12.34)	(18.24)	(18.13)	(17.20)	(14.83)
(iii) Not calved	1.56	1.39	1.26	0.98	0.12	0.14	0.65	0.67	0.71	0.56
	(4.36)	(3.84)	(3.65)	(3.12)	(3.86)	(3.53)	(5.02)	(4.57)	(4.44)	(3.45)
(iv) Total	12.68	13.15	11.48	10.32	1.46	1.92	6.41	7.39	8.24	8.53
	(35.41)	(36.37)	(33.27)	(32.88)	(46.95)	(48.36)	(49.54)	(50.37)	(51.53)	(52.49)
3. Young stock below 3 years	8.57	8.70	9.93	9.04	1.31	1.64	4.02	5.10	5.89	6.26
	(23.93)	(24.06)	(28.77)	(28.80)	(42.12)	(41.31)	(31.06)	(34.77)	(36.84)	(38.52)
Grand total	35.81	36.16	34.51	31.39	3.11	3.97	12.94	14.67	15.99	16.25
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	100.0)	(100.0)	(100.0)

(Contd.)

TABLE II *(Concld.)*

Particulars	Cattle						Buffaloes			
	Indigenous				Crossbred					
(1)	1966 (2)	1977 (3)	1982 (4)	1987 (5)	1982 (6)	1987 (7)	1966 (8)	1977 (9)	1982 (10)	1987 (11)
IV. Eastern region										
1. Adult males	19.10	12.75	20.36	23.78	0.18	0.26	2.15	2.25	2.16	2.44
	(41.65)	(39.50)	(38.69)	(37.73)	(14.29)	(13.20)	(32.28)	(29.92)	(25.32)	(29.08)
2. Adult females										
(i) In milk	5.88	4.56	7.02	8.13	0.30	0.49	1.09	1.49	1.26	1.35
	(12.82)	(14.13)	(13.34)	(12.90)	(23.81)	(24.87)	(16.37)	(19.81)	(14.77)	(16.09)
(ii) Dry	5.98	4.41	7.07	8.16	0.14	0.24	1.13	1.18	1.60	1.67
	(13.04)	(13.66)	(13.43)	(12.95)	(11.11)	(12.18)	(16.97)	(15.69)	(18.76)	(19.90)
(iii) Not calved	1.26	1.16	1.68	1.53	0.07	0.09	0.15	0.24	0.08	0.25
	(2.75)	(3.59)	(3.19)	(2.43)	(5.56)	(4.57)	(2.25)	(3.19)	(0.93)	(2.98)
(iv) Total	14.01	10.64	15.77	17.86	0.51	0.83	2.58	3.07	3.90	3.27
	(30.55)	(32.96)	(29.96)	(28.34)	(40.48)	(42.13)	(38.74)	(40.82)	(45.72)	(38.98)
3. Young stock below 3 years	12.75	8.89	16.50	21.38	0.57	0.88	1.93	2.20	2.47	2.68
	(27.80)	(27.54)	(31.35)	(33.93)	(45.23)	(44.67)	(28.98)	(29.26)	(28.96)	(31.94)
Grand total	45.86	32.28	52.63	63.02	1.26	1.97	6.66	7.52	8.53	8.39
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
V. All-India										
1. Adult males	73.33	67.57	70.02	72.21	2.77	2.46	8.21	8.38	6.96	7.47
	(41.69)	(41.00)	(38.34)	(38.36)	(31.26)	(21.64)	(15.51)	(13.37)	(10.71)	(9.84)
2. Adult females										
(i) In milk	20.97	21.72	24.84	26.94	1.77	2.88	12.93	16.95	18.01	23.75
	(11.92)	(13.18)	(13.60)	(14.31)	(19.98)	(25.35)	(24.42)	(27.05)	(27.72)	(30.48)
(ii) Dry	25.80	24.70	26.27	25.04	0.94	1.21	10.43	11.91	12.06	12.53
	(14.67)	(14.99)	(14.38)	(13.30)	(10.61)	(10.65)	(19.70)	(19.01)	(18.56)	(16.50)
(iii) Not calved	5.00	4.55	4.62	4.42	0.29	0.42	2.15	2.39	2.17	2.76
	(2.84)	(2.76)	(2.53)	(2.35)	(3.27)	(3.70)	(4.06)	(3.81)	(3.34)	(3.63)
(iv) Total	54.70	53.24	58.74	57.46	3.02	4.56	26.15	31.86	33.29	39.11
	(31.10)	(32.30)	(32.16)	(30.53)	(34.09)	(40.10)	(49.39)	(50.85)	(51.24)	(51.49)
3. Young stock below 3 years	48.02	44.00	53.89	58.56	3.07	4.35	18.58	22.42	24.72	29.37
	(27.28)	(26.70)	(29.50)	(31.11)	(34.65)	(38.26)	(35.10)	(35.78)	(38.05)	(38.67)
Grand total	176.05	164.81	182.65	188.23	8.86	11.37	52.94	62.66	64.97	75.95
	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)

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.

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 crossbred cattle adult males in the latest two censuses (Table III). 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 the latest two censuses) but the adult female buffaloes outnumbered crossbred female cattle in the latest two censuses. Again, except for the northern region in the latest census, the indigenous cattle young stock outnumbered buffalo young stock; on the other hand, buffalo young stock outnumbered crossbred cattle young stock 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 crossbred cattle

were concentrated in the eastern and southern regions. Both the northern and southern regions were observed to be important from the point of view of rearing buffaloes for milk production. Among these milch animals, crossbred cattle had the highest lactating efficiency, followed by buffaloes in all the censuses and regions.

TABLE III. RATIO OF CATTLE TO BUFFALOES AND THEIR LACTATING EFFICIENCY ACROSS REGIONS OF INDIA

Census years and regions	Ratio of indigenous cattle to buffaloes				Ratio of crossbred cattle to buffaloes				Lactating efficiency		
	Adult males	Adult females	Young stock	Total	Adult males	Adult females	Young stock	Total	Cattle		
									Indigenous	Crossbred	Buffaloes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
I. 1966											
(a) Northern	10.78	1.27	1.59	2.25	-	-	-	-	0.41	-	0.52
(b) Western	11.65	2.32	3.13	3.88	-	-	-	-	0.37	-	0.49
(c) Southern	5.80	1.98	2.13	2.77	-	-	-	-	0.33	-	0.49
(d) Eastern	8.89	5.43	6.60	6.89	-	-	-	-	0.42	-	0.42
All-India	8.93	2.09	2.58	3.32	-	-	-	-	0.38	-	0.49
II. 1977											
(a) Northern	8.87	1.01	1.22	1.79	-	-	-	-	0.46	-	0.55
(b) Western	12.47	2.15	2.86	3.60	-	-	-	-	0.38	-	0.53
(c) Southern	6.56	1.78	1.71	2.46	-	-	-	-	0.37	-	0.52
(d) Eastern	5.67	3.47	4.04	4.29	-	-	-	-	0.41	-	0.49
All-India	8.06	1.67	1.96	2.63	-	-	-	-	0.41	-	0.53
III. 1982											
(a) Northern	7.27	0.98	1.18	1.61	0.93	0.06	0.09	0.14	0.46	0.54	0.57
(b) Western	31.76	2.39	2.65	3.80	0.16	0.03	0.05	0.05	0.37	0.61	0.57
(c) Southern	7.04	1.39	1.69	2.16	0.18	0.18	0.22	0.19	0.43	0.60	0.57
(d) Eastern	9.43	4.04	6.68	6.17	0.08	0.13	0.23	0.15	0.45	0.59	0.32
All-India	10.06	1.76	2.18	2.81	0.40	0.09	0.12	0.14	0.42	0.59	0.54
IV. 1987											
(a) Northern	5.94	0.70	0.90	1.18	0.64	0.09	0.12	0.14	0.49	0.63	0.61
(b) Western	24.70	1.88	2.47	3.30	0.04	0.02	0.02	0.02	0.46	0.77	0.60
(c) Southern	8.24	1.21	1.44	1.93	0.28	0.23	0.26	0.24	0.48	0.65	0.62
(d) Eastern	9.75	5.47	7.98	7.51	0.11	0.25	0.33	0.23	0.46	0.59	0.41
All-India	9.67	1.47	1.99	2.48	0.33	0.12	0.15	0.15	0.47	0.63	0.59

* Lactating efficiency = Ratio of female numbers in milk to total adult females.

(*iii*) *Density*:- The stocking rates of bovines show significant regional disparities (Table IV). The eastern region has the highest cattle density while in the northern region the density was the highest for buffaloes. On an average, every 100 hectares of cropped area in the country sustained 55 adult indigenous cattle, 6 crossbreds and 32 buffaloes including their young stock. The eastern region sustained 119 indigenous cattle while the northern region sustained 56 buffaloes including young stock per hundred hectares of cropped area. The density of crossbred cattle including their young stock though predominates in the southern region, both the northern and eastern regions occupy the second place.

TABLE IV. DENSITY OF MILCH, YOUNG STOCK AND DRAUGHT ANIMALS ACROSS REGIONS OF INDIA DURING 1987

(per hundred hectares of cropped area)

Particulars	Regions				All-India
	Northern	Western	Southern	Eastern	
(1)	(2)	(3)	(4)	(5)	(6)
I. Milch animals					
(i) Indigenous cattle	18	24	31	54	33
(ii) Crossbred cattle	3	1	6	3	3
(iii) Buffaloes	32	16	26	10	22
II. Young stock					
(i) Indigenous cattle	22	29	27	65	22
(ii) Crossbred cattle	3	1	5	3	3
(iii) Buffaloes	24	12	19	9	10
III. Draught animals					
(i) Indigenous cattle	28	38	37	72	41
(ii) Crossbred cattle	3	-	1	1	2
(iii) Buffaloes	5	2	4	7	4
(iv) Camels	1	1	-	-	1

Among draught animals, every 100 hectares of cropped area in the country sustained 41 indigenous and 2 crossbred cattle adult males, 4 he-buffaloes and one camel. Among regions, the eastern region sustained the highest number of draught animals per 100 hectares of cropped land, followed by the southern, western and northern regions respectively. Camels, however, were concentrated only in the northern and western regions.

(*iv*) *Bovines contribution 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 54.9 million tonnes in 1990-91. Likewise, 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. India ranks second in the world in milk production, with an estimated production of 58.6 million tonnes in 1992-93, about 3.5 per cent higher than in 1991-92. Buffaloes dominated the milk production scene contributing 52.8 per cent of the total, followed by cows (43.7 per cent) and goats (3.5 per cent). Furthermore, the share of the 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 174 grams (g) based on 1989-90 actual milk production. The northern region showed higher availability (278 g), followed by the western region (174 g), southern region (148 g) and eastern region (93 g). There also existed significant inter-state variations within the region. Indeed, none of the states in the country other than Punjab, Haryana and Himachal Pradesh could meet the minimum nutritional requirement of milk. Furthermore, the eastern region continued to be a deficient region with regard to milk availability; it would remain so even in 2001 A.D. The southern and western regions could meet the minimum nutritional requirement only in 2001 A.D., whereas in earlier years, they were categorised as deficient regions. Obviously, the requirement of milk in the country as a whole cannot 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 (Patel, 1993).

According to FAO estimates, India exported 300 metric tonnes of dried milk worth 0.38 million US dollars and 230 metric tonnes of butter worth 0.75 million US dollars in 1991. It is expected that under the present policy of globalisation of Indian agriculture, the export of dairy products may grow at a faster rate. In this context, the researchers' viewpoints 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.

B. *Small Ruminants*

(*i*) *Compound growth rates*:- These growth rates for sheep population were mostly positive across regions and at the all-India level during 1977-87 inter-census period (Table V), thereby reflecting the positive growth of sheep rearing activity. Across regions, the eastern region has the highest positive growth rates for sheep in all the inter-census periods but the northern region ranked second.

TABLE V. COMPOUND GROWTH RATES FOR SMALL RUMINANTS DURING DIFFERENT INTER-CENSUS PERIODS ACROSS REGIONS OF INDIA

(per cent per annum)

Particulars (1)	Goat (2)	Sheep (3)
I. Northern region		
(a) 1966-77	1.11	0.69
(b) 1977-87	1.53	0.25
(c) 1982-87	-0.15	-3.41
II. Western region		
(a) 1966-77	-0.33	0.59
(b) 1977-87	1.68	0.03
(c) 1982-87	2.01	-2.53
III. Southern region		
(a) 1966-77	1.56	-1.24
(b) 1977-87	1.77	0.14
(c) 1982-87	-1.31	-0.26
IV. Eastern region		
(a) 1966-77	1.60	0.94
(b) 1977-87	8.21	4.99
(c) 1982-87	8.43	4.24
V. All-India		
(a) 1966-77	1.45	-0.16
(b) 1977-87	3.77	0.58
(c) 1982-87	3.02	-1.43

For goats, the eastern region recorded the highest positive growth rates in all the inter-census periods, thereby showing the greatest growth across regions. Both the southern and western regions also had positive growth rates for goat population in most of the inter-census periods, thereby occupying second and third places respectively (except for the western region during 1966-77 and southern region during 1982-87). On the whole, goat

population in India has increased at an annual rate of 1.45, 3.77 and 3.02 per cent in 1966-77, 1977-87 and 1982-87 respectively. Indeed, the regional growth rates are related to the regional resources base, on the one hand, and the market demand, on the other.

(*ii*) *Compositional changes*:- Except for the northern and southern regions in 1987, though the goat population increased across regions and at the all-India level in various censuses, the sheep population did not follow a definite pattern (Table VI). On the whole, the female population of sheep and goats outnumbered males across regions and at the all-India level in all the censuses. Furthermore, regional disparities do exist in the sheep and goat farming which may be due to varying resource endowments.

TABLE VI. COMPOSITIONAL CHANGES IN GOAT AND SHEEP POPULATION DURING VARIOUS CENSUSES IN INDIA

(million)

Particulars (1)	Goat (2)	Sheep (3)
I. Northern region		
(a) 1966	21.04	14.20
(b) 1977	23.77	15.32
(c) 1982	27.86	19.50
(d) 1987	27.11	16.61
II. Western region		
(a) 1966	14.50	4.87
(b) 1977	17.41	5.19
(c) 1982	18.63	5.99
(d) 1987	20.58	5.26
III. Southern region		
(a) 1966	11.53	19.39
(b) 1977	13.68	16.89
(c) 1982	17.21	17.87
(d) 1987	16.30	17.51
IV. Eastern region		
(a) 1966	17.43	3.15
(b) 1977	20.75	3.49
(c) 1982	30.48	4.75
(d) 1987	45.49	5.80
V. All-India		
(a) 1966	64.50	41.61
(b) 1977	75.61	40.89
(c) 1982	94.18	48.11
(d) 1987	109.48	49.74

(*iii*) *Density*:- The density of sheep and goats varies widely across the regions. On an average, one hectare of culturable wasteland in India commanded 4 goats and 2 sheep (Table VII). Across regions, goat density is the highest in the eastern region (about 15), followed by the southern (about 4) and northern (about 3) regions. Sheep density is the highest in the southern region (about 5), followed by the eastern (about 2) and northern regions (about 2). Furthermore, among the regions there are certain states like Punjab, Haryana, Bihar (for goats only), 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, Karnataka, Andhra Pradesh, etc., where there is still scope for improving the density by proper planning and development of vegetation on wasteland. In such cases, one can go even for commercial sheep and goat production, thereby making the use of vast wasteland resources (Pandey, 1992).

TABLE VII. GOAT AND SHEEP FARMING DENSITIES AND POTENTIALITIES ACROSS REGIONS OF INDIA

Regions	Culturable wasteland* (million ha) during 1986-87	Density/ha of culturable wasteland in 1986-87		Potentialities† for goat and/or sheep farming (million)
		Goat	Sheep	
(1)	(2)	(3)	(4)	(5)
Northern region	10.74	2.57	1.59	161.10
Western region	9.95	2.07	0.53	149.25
Southern region	3.94	4.14	4.44	59.10
Eastern region	2.97	15.37	1.95	44.55
All-India	27.60	3.99	1.66	414.00

* Culturable wasteland includes the permanent pastures, other grazing lands and the culturable wasteland.

† Expected goat and sheep population is arrived at by assuming goat and sheep density of 15/ha of culturable wasteland.

TABLE VIII. ESTIMATES OF GOAT AND SHEEP MEAT AND SKIN PRODUCTION ACROSS REGIONS OF INDIA

Particulars	Goat			Sheep		
	Population* (million)	Meat Quantity** (million tonnes)	Skin*** (million sq.ft.)	Population* (million)	Meat Quantity** (million tonnes)	Skin*** (million sq.ft.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
I. Northern region						
1987	27.11	0.15	65.08	16.61	0.04	19.92
1992	29.35	0.16	70.44	17.35	0.05	20.84
1997	32.03	0.17	76.88	18.16	0.05	21.80
2002	35.32	0.19	84.76	19.05	0.05	22.88
II. Western region						
1987	20.58	0.11	49.40	5.26	0.01	6.32
1992	22.51	0.12	54.04	5.34	0.01	6.40
1997	24.75	0.13	59.40	5.45	0.01	6.56
2002	27.36	0.15	65.68	5.59	0.02	6.72
III. Southern region						
1987	16.30	0.09	39.12	17.51	0.05	21.00
1992	17.84	0.10	42.80	17.90	0.05	21.56
1997	19.57	0.11	46.96	18.51	0.05	22.20
2002	21.52	0.12	51.64	19.15	0.05	23.00
IV. Eastern region						
1987	45.49	0.25	109.16	5.80	0.02	6.96
1992	67.39	0.36	161.72	7.46	0.02	8.96
1997	98.89	0.53	237.32	9.62	0.03	11.56
2002	146.69	0.79	352.04	12.41	0.03	14.88
All-India						
1987	109.48	0.59	262.76	45.18	0.12	54.20
1992	137.09	0.74	329.00	48.11	0.13	57.72
1997	175.24	0.95	420.56	51.74	0.14	62.08
2002	230.89	1.25	554.12	56.20	0.15	67.44

* Sheep and goat population has been projected for 1992, 1997 and 2002, based on 1977-87 compound growth rates. Further, the slaughtering percentage of goats is 60 and that for sheep is 30.

** Assuming body weight 20 kg and meat recovery rate 45 per cent for both the species.

*** Assuming the average size of skin as 4 sq. ft. per animal.

(*iv*) *Contributions*:- Sheep and goats also contribute to the national economy of India. Accordingly, it is imperative to make some estimates about their contribution in terms of production of meat, milk, skin, etc. Such an attempt based on certain assumptions has been made and the data are presented in Table VIII. As per our estimates, about 65.69 million and 13.55 million of goat and sheep pieces contributed 0.59 and 0.12 million tonnes of meat respectively in 1987. Moreover, it has been projected that about 105 and 139 million goat pieces would contribute about 0.95 and 1.25 million tonnes of meat in 1997 and 2002 respectively. Likewise, about 16 and 17 million sheep pieces would contribute about 0.14 and 0.15 million tonnes of meat in 1997 and 2002 respectively. Regional differences, however, existed both in sheep and goat meat production. India exported about eight thousand metric tonnes of sheep and goat meat during 1991 (FAO, 1992). But there is a vast scope for improving the export market in meat, particularly to the Middle East, which could be achieved 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 54 million and 263 million sq. ft. respectively in 1987 and it is projected to increase to about 62 and 67 million sq. ft. from sheep and to about 421 and 554 million sq. ft. from goats in 1997 and 2002 respectively. It is estimated that goats contribute only about 3 per cent to the total milk production in the country. Furthermore, a major part of sheep and goat milk production is being used by the sheep and goat keepers themselves and there is no marketable surplus.

Angora breed of goat gives fine silky fibre which has great demand in fibre industry and pashmina goats are 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 estimates for wool production and goat's fibre production.

C. *Poultry Enterprise*

As the poultry enterprise is of land-saving and labour and capital intensive in nature, it suits very well even to those households who do not possess adequate land base. Further, though this enterprise is slightly risky, it generates quick returns and ranks relatively high in profitability as compared to other livestock enterprises. India exported about 125 metric tonnes of fresh poultry meat worth 206 thousand US dollars and 5,794 metric tonnes shell eggs worth 4,003 thousand US dollars in 1991. Taking into consideration these facts and with the changed scenario of world trade due to globalisation and existence of sufficient stock of foodgrains/feed ingredients in the world market, there exists a vast scope for increasing the production of poultry and poultry products such as pasteurised liquid egg, egg powder, poultry meat, etc., both for domestic consumption as well as export purposes which will substantially increase the income and employment.

III

MAJOR CONSTRAINTS INHIBITING THE GROWTH OF LIVESTOCK ENTERPRISES

A. *Feed and Fodder Shortages Constraining Livestock Wealth*

Chronic shortages of feed and fodder together with poor nutritive value of such feeds available have lowered the productive capacity and fertility of India's livestock. As much as 10 to 15 per cent of the existing milk production can appreciably be increased through

adequate feeding of present bovine population (Chatterjee and Acharya, 1992). However, the difficulty arises in finding ways and means to achieve maximum milk output in view of inadequate availability of feed and fodder resources. The important sources of fodder are (a) fodder from forest, (b) open grazing grounds, (c) fodder from the fallow lands and areas sown once, (d) fodder from weeding of major crops, (e) fodder from forage crops, and (f) fodder from semi-forage crop residues.

The grazing of livestock in forests is insignificant due to the fact that forest areas (in India it was about 21 per cent of the total reported area during 1991-92, the highest being in the eastern region about 29 per cent and the lowest in the northern region being about 15 per cent) are often prohibited for grazing as it would destroy the forest cover. Likewise, open grazing facilities are quite limited since permanent pastures and fallow lands are continuously declining. For instance, it has declined by 0.41 per cent between 1986-87 and 1991-92 at the all-India level, the highest decline being in the western region (0.99 per cent), followed by the southern region (0.35 per cent), eastern region (0.18 per cent) and northern region (0.07 per cent). The village panchayat land has also considerably been reduced which was in use for grazing in the past. Due to inadequate open grazing facilities, the livestock rearers mostly do stall feeding to their milch and draught animals and consequently depend upon agriculture.

There is very little scope for increasing the area under green fodder production, keeping in view the priority for foodgrains, pulses and oilseeds. For the past two decades there has been no change in the cultivated area devoted to fodder production in India, being 4.4 per cent of the total cropped area (Singh and Majumdar, 1992). Quite often, shortages of green fodder, especially in May-June and October-November (Pandey and Ram, 1991) also occur due to which both young and dry stock have to suffer most. Therefore, the conservation of surplus fodder and grasses available during the period of flush growth, in the form of silage and hay, is essential to provide an ideal feed during lean period for sustained livestock production.

The livestock population mostly depends upon dry fodder from fodder crops and crop residues. With these dry fodders, the livestock rearers serve concentrates/cakes. But there is need to explore the possibilities of cheap and balanced ration from time to time across regions and dissemination of such technologies to the farmers. Though the production of compound feed in India has been multiplying steadily, the total production is not only far below the tonnage of developed countries, but in some cases the quality is also incredible. In 1964, 0.15 million tonnes of feed was produced which rose to over four million tonnes in 1990 (Yamdagai, 1991), the bulk of it being accounted for by the western and southern regions.

The estimates for green fodder, dry fodder and cakes availability[3] as well as requirements[4] in different regions of India are presented in Table IX. These estimates reveal the fact that (a) in India including the different regions there was deficit stock of dry fodder, green fodder and cakes even in 1986-87 and 1991-92; (b) the deficit position would further aggravate in 1996-97 and 2001-02 due to increase in livestock population; (c) among regions, the northern region had the highest availability of dry and green fodders and cakes while the eastern region had the lowest; and (d) the feed and fodder requirement in the northern region was the highest while it was the lowest in the southern region. Thus both quantitatively and qualitatively there exists a large gap in demand and availability of feed and fodder resources.

In this context, new technologies are being developed to upgrade the crop residues which include (a) the enrichment of straws through ammonia treatment and (b) urea-molasses blocks being developed by the ICAR institutes, agricultural universities and National Dairy Development Board but its adoption level by the farmers is still quite low.

TABLE IX. ESTIMATES FOR FEED AND FODDER AVAILABILITY AND REQUIREMENTS IN INDIA

(million tonnes)

Particulars	1986-87		1991-92		1996-97		2001-02	
(1)	Availability (2)	Requirements (3)	Availability (4)	Requirements (5)	Availability (6)	Requirements (7)	Availability (8)	Requirements (9)
I. Northern region								
(i) Cakes	3.80	115.16	5.77	120.87	7.27	132.14	8.77	154.40
(ii) Green fodder								
(a) *Kharif*	79.26	217.52	71.59	228.31	69.14	249.60	66.69	291.64
(b) *Rabi*	107.78	255.90	109.36	268.60	112.26	293.64	115.16	343.10
(iii) Dry fodder	84.00	179.13	104.85	188.02	120.30	205.55	135.75	240.17
II. Western region								
(i) Cakes	3.35	90.34	4.91	95.10	5.31	100.59	5.71	106.81
(ii) Green fodder								
(a) *Kharif*	39.49	170.64	36.79	179.63	34.34	190.00	31.89	201.75
(b) *Rabi*	33.58	200.75	28.22	211.33	29.32	223.53	30.42	237.36
(iii) Dry fodder	58.47	140.52	85.35	147.93	91.35	156.47	97.35	166.15
III. Southern region								
(i) Cakes	3.75	71.10	4.58	70.79	5.28	71.66	5.98	73.85
(ii) Green fodder								
(a) *Kharif*	31.18	134.31	29.98	133.72	28.98	135.36	27.98	139.49
(b) *Rabi*	27.25	158.01	20.14	157.32	22.09	159.25	24.04	164.10
(iii) Dry fodder	49.34	110.61	49.71	110.12	50.90	111.47	52.15	114.87
IV. Eastern region								
(i) Cakes	1.87	101.05	2.38	138.27	2.88	192.19	3.38	272.15
(ii) Green fodder								
(a) *Kharif*	2.81	190.87	2.64	261.17	2.49	363.02	2.34	514.05
(b) *Rabi*	5.42	224.55	4.75	307.26	5.05	427.09	5.35	604.77
(iii) Dry fodder	34.55	157.18	40.85	215.08	46.95	298.96	53.05	423.34
All-India								
(i) Cakes	12.77	377.64	17.64	425.03	20.74	496.58	23.84	607.20
(ii) Green fodder								
(a) *Kharif*	152.74	713.33	141.00	802.83	134.95	937.98	128.90	1,146.93
(b) *Rabi*	174.23	839.21	162.47	944.51	168.12	1,103.50	174.97	1,349.33
(iii) Dry fodder	226.36	587.44	280.76	661.16	309.50	772.45	338.30	944.53

B. *Carrying Capacity of Common Property Resources (CPRs)*

The common property resources (CPRs) of land consist of village forest, village common and pasture land, wasteland, community threshing grounds, ponds, tanks, etc. Through the supply of fodder and grazing space the CPRs help the individuals in saving their lands for fodder crops. These resources help in sustaining a number of animals for draft and livestock production which would not have been permitted by the individual's own land, especially

for small farmers (Jodha, 1986).

An effort has been made to work out the carrying capacity of CPRs (or the estimates of surplus cattle population[5]) in terms of rainfall (grazing practices) in the different regions of India. The average rainfall data for the period 1983-86 across the regions are given in Table X along with per Adult Cattle Unit (ACU) area required for grazing under the respective rainfall conditions (Government of India, 1976). The actual area available as CPRs for 1986-87 across the regions is also indicated in the table. We have compared the optimum ACU with that of actual ACU to know the surplus or deficit position across the regions.

TABLE X. CARRYING CAPACITY OF COMMON PROPERTY RESOURCES ACROSS REGIONS OF INDIA

Region	Average rainfall during 1983-86 (mm)	Area required per ACU (ha)	Area available as CPRs in 1986-87 (million ha)	Optimum ACU (million)	Actual ACU in 1987 (million)	Surplus or deficit cattle (million)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1. Northern	911.04	0.9	32.78	36.42	73.13	+36.71
2. Western	1185.26	0.8	42.85	53.56	55.00	+1.44
3. Southern	1413.30	0.5	26.05	52.10	43.30	-8.80
4. Eastern	2214.25	0.3	37.31	124.37	61.76	-62.61
All-India	1430.96	0.5	138.99	277.98	233.19	-44.79

The data contained in Table X reveal the fact that (a) both the northern and western regions possess surplus cattle population; (b) both the southern and eastern regions have deficit cattle population; and (c) at the all-India level the cattle population is not in surplus. In case we also convert horses and ponies, mules, donkeys, pigs, etc., into the ACUs, then (a) both the southern and eastern regions including India would also fall under the surplus cattle population category; and (b) in the northern and western regions the position of surplus cattle population would further aggravate. Since the overstocking of livestock creates ecological imbalances across regions, it becomes important to maintain the ecological balance by reducing livestock pressure.

C. *Other Constraints*

(*a*) *Not calved bovines*:- A large majority of indigenous and crossbred cattle as well as that of buffalo population included not calved adult females across regions during various censuses (Table II), thereby posing threats to the Indian dairy industry. Though the indigenous not calved cattle population has increased during 1982-87 in the northern and western regions, it has declined in other regions and in India as a whole. Contrarily, except in the western region, the not calved crossbred cattle have increased in all the regions including India as a whole. Likewise, except in the southern region, the not calved buffaloes have increased in all other regions and India. Thus the concern is that animal scientists have to disseminate their technologies to convert these unproductive milch animals, on the one hand, while the planners and policy makers have to orient their policies to strengthen field infrastructures, on the other.

(*b*) *Health care and reproduction infrastructures*:- Though the growth in veterinary infrastructures (i.e., 40,000 veterinary hospitals/dispensaries/first aid centres and 250

disease diagnostic laboratories) has brought about a sharp decline in mortality, their number per thousand animals is quite inadequate and varies across regions. India has a large network of 34,000 artificial insemination (AI) centres carrying out about 15 million inseminations, but the number of calves born is less than 15 per cent of the AI carried out (Kurup, 1991). While India has invested quite a huge amount in AI network, the quality of the service is quite unsatisfactory. The poor insemination also accounted for about 300 litres of milk loss per animal per lactation (Pandey and Ram, 1991). Again, the conception rate through AI in buffaloes is far lower than in cows under field conditions, which means the protocols for buffalo AI may have to be standardised. Further, the number of breedable animals covered under AI is not more than 10 per cent of the total breedable population.

(*c*) *Inadequate data base*:- Availability of relevant information is very essential for sophisticated, empirical and rigorous economic analysis to arrive at the conclusions for policy formulation. For instance, the information on area and production of individual forage crops, estimates of dry fodders, agro-industrial by-products and non-conventional feed resources that could be used as livestock feed, are not available either at the state or at the central level. Similarly, the availability of livestock census data is not only untimely but it lacks specieswise production, productivity and some other information. Again, the National Sample Survey conducts round the year surveys on different aspects, but the information on various aspects of the livestock economy is not available on time. Further, creation of data base on the data collected in different rounds will be of great help to the economists and statisticians for further sophisticated analysis. Nevertheless, we cannot over-do this lament on lack of data (Vaidyanathan, 1992). Let us hope the Technical Committee of Direction for Improvement of Animal Husbandry and Dairying Statistics in the country, being set up in the Ministry of Agriculture, looks into the entire gamut of data base requirements and streamlines the availability of data on time.

(*d*) *Market infrastructures*:- Inadequate market infrastructures, more particularly unregulated/unorganised markets for livestock and its products, inhibit the growth of this enterprise. For instance, though the existing organisational structure of cattle fairs in Haryana is adequate and earns income for its own organisation, these fairs lack in infrastructural facilities and also suffer from various malpractices. Likewise, the marketing of livestock products is still in the unorganised sector and the share of the producer in the consumer rupee is very small. Due to unorganised livestock and its product markets together with the lack of appropriate price policies for them, the livestock rearers have to incur loss (Mondal and Pandey, 1995). Accordingly, a comprehensive scheme for livestock and its products may be started across Indian states by the Ministry of Agriculture so as to provide the policy supports for the animal husbandry sector.

IV

ISSUES FOR IN-DEPTH STUDY

From the above, the following issues emerge for further in-depth study:

1. To meet the demand for milk and milk products of the growing population, how to improve the production efficiency of our milch animals under the existing conditions of feed and fodder availabilities, increasing number of not-calved milch animals, inadequate

health cover and breeding infrastructures, etc., across regions?

2. 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. What are the ways of increasing production efficiencies of these enterprises through vertical and horizontal integration?

3. How to allocate the total output of milk and milk products, poultry products, etc., between the domestic consumption and exports?

4. What steps are needed to attain the quantitative and qualitative improvements in the availability of feed and fodders for the farm animals? Whether the existing extension education infrastructures are adequate or whether they need strengthening/streamlining?

5. In view of the prevailing inefficiency in the marketing of livestock and livestock products, what steps are needed to improve the technical as well as economic efficiencies in the marketing of livestock and livestock products?

NOTES

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

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

$$\frac{P_t}{P_o} = \left(1 + \frac{r}{100}\right)^t$$

where P_t is bovine/small ruminant population in the t-th period, P_o is bovine/small ruminant population in the base year, r is the compound growth rate and t is the time in years.

3. The regionwise estimates for cakes/concentrates, dry fodder and green fodder availability were worked out as under:

(*i*) The regionwise availability of cakes/concentrates was worked out from the statewise production data. From cotton production data the ratio of cotton seed was estimated as 55 per cent and the cotton seed cake content was 75 kg per quintal of cotton seed. Similarly, the cake content in one quintal each of rapeseed and mustard, linseed, sesamum, groundnut and castorseed was 62, 70, 52, 53 and 52 kilograms respectively. The flour content in one quintal of wheat was 98 kg and wheat brawn content was about 2 per cent in the total quantity of wheat flour. One-fifth of barley production was considered as concentrate while that of gram, *tur* and other pulses as one-tenth. Similarly, the rice content in one quintal of paddy was 66 per cent and rice bran content was one-third of the total quantity of rice. These estimates were generated from statewise production data for the period 1980-81 to 1990-91 and then growth trends were estimated for future projections. Based on these growth rates, the regionwise data were projected for the years 1991-92, 1996-97 and 2001-02. Again, all these cakes and brawns were converted into mustard cake equivalents based on their respective crude protein contents (Ray and Ranjhan, 1978).

(*ii*) The regionwise dry fodder data were estimated based on crop-residues using grain to straw rations (Nirman *et al.*, 1982). These cropwise ratios were: jowar 1:6, bajra 1:5, maize/gram/lentil 1:2, paddy/wheat/barley 1:1, *tur* 1:0.4, peas 1:1.5, *urad* and *moong* 1:2.3. The statewise dry fodder estimates were worked out for the period 1980-81 to 1990-91 and then growth trends were estimated for future projections. Later on, based on regionwise growth trends, the cropwise dry fodder production was projected for the years 1991-92, 1996-97 and 2001-02.

(*iii*) The regionwise estimates for green fodder were separately computed for *kharif* and *rabi* fodders, by multiplying the area estimates with that of yield estimates. The statewise and cropwise data were computed for the period 1980-81 to 1990-91 and then the growth trends were estimated. These growth trends were used for future projections of data for the years 1990-91, 1996-97 and 2001-02.

The regionwise and cropwise area estimates were as under:

(*a*) *Northern Region:*- The entire area under jowar was considered for the fodder production in Punjab, Haryana, Jammu and Kashmir and Himachal Pradesh while only three-fourths in Uttar Pradesh and one-half in Rajasthan. Likewise, one-fifth of the area under bajra while one-third of the area under maize was considered for the fodder production in all the northern states. Of the total area so worked out for *kharif* fodder, only one-third of it was considered for barseem crop. Likewise, one-twentieth, one-half, one-fifth and one-tenth area of barley, other cereals, (oats), other pulses (peas) and rapeseed and mustard were respectively considered for these *rabi* fodder crops.

(*b*) *Western Region:*- In Gujarat state half of the area under each of jowar, bajra and maize was considered under the respective fodder crops. But in Madhya Pradesh and Maharashtra one-twentieth area under these crops was considered under the respective fodder crops. Only one-tenth of *kharif* fodder area was though considered under *rabi* fodder crop lucern, one-fifth of other cereals (oats) and one-fifth of other pulses (peas) under the respective *rabi* fodder crops. The area under cow-pea was one-twentieth of the total *kharif* fodder area.

(*c*) *Southern Region:*- For Kerala the entire area under jowar crop was considered as fodder area while only one-sixth of the area in Andhra Pradesh, Tamil Nadu and Karnataka States. Moreover, one-sixth of the area under each of bajra and maize has been considered for fodder production in all these states. Of the total *kharif* fodder area so worked out, one-fifth area was considered for lucern crop. Likewise, of the total area under other cereals, one-seventh was for oats while from that of other pulses one half in cow-pea.

(*d*) *Eastern Region:*- The entire area under jowar crop was considered for fodder production in the eastern states of Bihar, Orissa, Assam and West Bengal but only one-eighth of total maize area as fodder crop in these states. Of the total area under bajra crop though only three-fourths was considered for fodder production in Bihar, its entire area in the remaining states. Although one-tenth of *kharif* fodder area so worked out was considered under cow-pea crop yet one-tenth each of other cereals (oats) and other pulses (pea) under respective fodder crops.

The regionwise per hectare yield estimates in quintals for various crops were as under:
(a) Northern:- jowar 225, bajra 250, cow-pea 150, peas 180, maize/oats/rapeseed and mustard 200, berseem 600 and lucern 500. (b) Western:- jowar 200, bajra 250, maize 180, oats 200, peas 160, lucern 600 and cow-pea 150. (c) Southern:- jowar 150, bajra 200, maize/oats 180, cow-pea 100 and lucern 450. (d) Eastern: jowar 100, bajra/maize/oats 150, and cow-pea/peas 100.

4. To estimate the feed and fodder requirements, the animals have been converted into standard livestock units/Adult Cattle Units (ACUs). To do so, five cows over three years of age were considered equal to four ACUs while each of she- and he-buffalo, bullock/bull over three years of age has been considered as one ACU. Likewise, a camel over four years of age as two ACUs but that below four years of age has been considered equal to one ACU. Two young stocks of one to three years of age pertaining to cattle and buffaloes are considered as equal to one ACU while three heads below one year of age as one ACU. Seven heads of sheep and goats over one year are equal to one ACU but fourteen heads of sheep and goats young stocks upto one year of age are considered equal to one ACU (Pandey and Yadav, 1982).

Based on compound growth rates for the various categories of above-mentioned animals pertaining to 1977-87 inter-census period, the respective livestock population projections across Indian states were made for the years 1991-92, 1996-97 and 2001-02. Again, these projected livestock populations were converted into standard livestock units/Adult Cattle Units (ACUs) for the years 1991-92, 1996-97 and 2001-02. Later on, the amount of green and dry fodder and cakes/concentrates were worked out on the basis of dry matter requirement, i.e., 2.5 to 3 per cent of body weight (Gill and Gupta, 1976, p. 132) for an ACU of average body weight (500 kg). Accordingly, these requirements were: (a) *kharif* mustard cake 4.5 kg, green fodder 17 kg and dry fodder 7 kg; (b) *rabi* mustard cake 4.5 kg, green fodder 20 kg and dry fodder 7 kg. The respective per ACU requirements were multiplied with that of total ACUs for the years 1987, 1991-92, 1996-97 and 2001-02 so as to work out the total green fodder, dry fodder and cake/concentrate requirements across regions.

5. The following formula (Singh, 1989) was used to estimate the carrying capacity of CPRs:

$$\text{Optimum livestock population for CPRs} = \frac{\text{Required number of Adult Cattle Unit (ACU) per hectare}}{\text{Required area (ha) per Adult Cattle Unit for grazing}} \times \text{Area (ha) available as CPRs}$$

Surplus Cattle = Actual ACUs - Optimum ACUs.

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