

# **Assessment of Livestock Feed and Fodder An All India study**

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The study was undertaken to assess the demand and supply of livestock feed and fodder in all states/UT's by estimating area, production and productivity of major green and dry fodder crops, growth pattern of major livestock population, feed and fodder availability in the states, along with an estimation of deficit/surplus in the states, to improve livestock productivity with a view to improving the efficiency using farm household survey in the sample districts of selected states of Gujarat, Haryana, Karnataka, Kerala, Rajasthan, Uttar Pradesh and West Bengal. The reference period for the study was 2019-20. The crops covered included fodder crops, paddy, wheat, ragi, jowar, maize, sugarcane, Napier grass and other dry fodder crops. Along with the above said objectives, the major constraints faced by the farmers and economics of livestock management methods were also documented.

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## LIST OF ABBREVIATIONS USED IN THE REPORT

<b>Sl. No.</b>	<b>Abbreviations</b>	<b>Full form of the Abbreviations</b>
1	HI	Harvest indices
2	ER	Extraction Rate
3	DM	Dry Matter
4	LP	Livestock Products
5	TE	Triennium Ending
6	TGF	Total Green fodder availability
7	DCP	Digestible crude protein
8	GCA	Gross Cropped Area
9	FAO	Food and Agriculture Organization
10	KVK	Krishi Vigyan Kendra
11	GAP	Good Agriculture Practices
12	MLP	Major Livestock Products
13	NLM	National Livestock Mission
14	GDP	Gross Domestic Product
15	ACU	Adult Cattle Unit
16	NPV	Net Present Value
17	WAD	West African Dwarf
18	IRR	Internal Rate of Return
19	PBP	Pay Back Period
20	ROI	Return on Investment
21	ROE	Return on equity
22	TDN	Total Digestible Nutrients
23	RLU	Ruminant Livestock Units
24	CAGR	Compound Annual Growth Rate
25	KSDA	Karnataka State Department Of Agriculture
26	NATP	National Agriculture Technology Programme
27	ATMS	Any Time Money and Any time Milk
28	ICMR	Indian Council of Medical Research
29	DAHD	Department of Animal Husbandry and Dairying

## EXECUTIVE SUMMARY

This report provides a prospective analysis of the current requirements and availability of feed and fodder, particularly in the selected states and the country in general. The direct estimation of feed and fodder is seldom available; hence, conversion factors were used as recommended by the Food and Agriculture Organization (FAO), the National Agriculture Technology Project (NATP) and the National Dairy Development Board (NDDB) as primary data for the study. The livestock sector contributes sustainability to the agricultural GDP, employment and livelihood in all the states of the country. Animal husbandry is one of the most important secondary occupations for the farmers in rural areas, providing supplementary income along with agriculture farming. In livestock management, non-availability of feed and fodder is the most prevailing problem. The research studies, that identify the gaps in the supply of and demand for feed and fodder across the regions, are quite few. This study has made a systematic analysis of the availability of feed and fodder at the country level and at the regional level by considering major states.

The MoA & FW entrusted the study to the Agricultural Development and Rural Transformation Centre (ADRTC), Institute for Social and Economic Change (ISEC), Bengaluru. The specific objectives of the study are:

1. To estimate the area, production and productivity of major green and dry fodder crops.
2. To study the growth pattern of major livestock population.
3. To assess feed and fodder availability, requirement, the deficit/surplus to improve livestock productivity.

To meet the objectives of the present study, both the primary and secondary data were collected. The primary data was collected at the field level through a sample survey method for the reference period 2018-19. The study was conducted in the following states viz., Haryana, Gujarat, Karnataka, Kerala, Rajasthan, Uttar Pradesh and West Bengal involving the respective Agro-Economic Research Centres (AERCs). In each selected state, a total of 120 cattle-rearing farmers, 120 buffalo-rearing farmers and 120 sheep and goat-rearing farmers were targeted for the survey with a pre-tested questionnaire. The final sample comprised 291 households from Gujarat, 246 from Haryana, 269 from Karnataka, 217 from Kerala, 186 from Rajasthan, 247 from Uttar Pradesh and 150 households from West Bengal.

Thus, a total of 1,606 households across the states were surveyed for the study. The collected data was scrutinised, tabulated and analysed by employing various analytical tools. For estimating the demand and supply of feed and fodder resources (deficit /surplus) for the livestock in different states, the availability of dry fodder, green fodders and concentrates was also worked out using a well-accepted conversion ratio. The estimation of demand for feed and fodder was undertaken through different standards adopted by the FAO and NATP and compared with the nutritional requirement of livestock as developed by NDDB. The primary data collected by our team and secondary data on livestock population and per day consumption in different stages of life, species, age and sex of animals were extensively used for the estimation.

## Our Major Findings

The major findings of the study are as follows

- As per the available data for 2014-15, the area under fodder crops was 91,37,000 hectares implying India has 4.61 per cent of the area under fodder crops to the total gross cropped area. The highest area under fodder crops to gross cropped area is recorded in Rajasthan (20.33%).
- The area under fodder crops in the country has increased at the rate of 1.68 per cent annually for the period 2005-06 to 2014-15. Among the selected states, the highest positive growth is noticed in Rajasthan (6.72%).
- The area under foodgrains recorded a growth of 0.20 per cent per annum while the production growth was 1.92 per cent and productivity growth was 1.60 per cent per annum in the country. Pulses registered an area growth rate of 2.10 per cent with a production growth of 3.61 per cent and a productivity growth of 1.57 per cent per annum. At the same time, oil seeds registered a negative growth (-0.60%), with a low production (0.31%) and productivity growth (0.90%) rates.
- The Compound Annual Growth Rate (CAGR) for the total livestock population in the country for the period 1951-2019 worked to 0.90 per cent. It is interesting to note that the growth rate for buffalo was higher (1.38%) as compared to cattle (0.32%). The small ruminants, particularly the goat population, recorded the highest annual growth rate (1.70%) as compared to cattle and buffalo. The sheep population growth rate at 0.95 per cent was higher as compared to cattle population growth.
- Overall, the livestock population is increasing at a higher pace, as compared to the growth in the area under food grains, pulses and oil seeds.
- Percentage changeover is found to be the highest for goat and buffalo populations at 215.42 and 153.11 per cent for the period 1951 to 2018-19, followed by sheep (89.92%), cattle (23.95%), and overall livestock (83.32%).
- As per the 2019 Livestock Census, the population of various categories of animals such as cattle, buffalo, sheep, goat, and other animals were 192.49 million, 109.85 million, 74.26 million, 148.88 million, and 10.29 million, respectively, which, all together constitutes a total population to 535.77 millions.
- The states with the highest cattle population were West Bengal, Uttar Pradesh and Madhya Pradesh. The states with the highest number of indigenous cattle were Madhya Pradesh, West Bengal and Rajasthan, while the states with the highest number of exotic cattle were Tamil Nadu, Uttar Pradesh and Maharashtra. The country supports 109.85 million of buffalo population of which Uttar Pradesh accounts for 30.06 per cent, followed by Rajasthan (12.47%), Gujarat (9.60%), Madhya Pradesh (9.38%) and Assam (7.08%). The country accounts for 148.84 and 74.26 million of goat and sheep populations, respectively. The states with the highest number of goat population were West Bengal (10.93%), Uttar Pradesh (9.73%), Bihar (8.61%), Madhya Pradesh (7.43%) and Maharashtra (7.12%). The states with highest number of sheep population were Telangana (25.67%), Andhra Pradesh (23.74%), Karnataka (14.88%) and Rajasthan (10.64%).

- The livestock products constitute an average 146.74 mt, 44.19 m kgs and 6.39 mt of milk, wool and meat respectively, for the period of 1980-81 to 2018-19.
- The CAGR of milk and meat has increased at the rate of 4.41 and 9.83 per cent, respectively, as against that of wool which has decreased at the rate of 1.13 per cent.
- The highest CAGR for milk production is found for the recent period (2010-11 to 2018-19) at the rate of 5.58 per cent and 3.04 per cent for wool production for 1980-81 to 1989-90 and at 10.75 per cent for meat production for the period 2000-01 to 2009-10.
- The value of output amounts to Rs. 6.80 lakh crore from livestock in the country. Of which, the highest share is accounted by Uttar Pradesh (13.20%) and Rajasthan (11.88%), followed by Tamil Nadu (9.50%) and Maharashtra (7.24%). The country produces 187.74 million tonnes of milk annually; Uttar Pradesh stands first in terms of milk production with a share of 16.26 per cent, followed by Rajasthan (12.61%) and Madhya Pradesh (8.47%).
- The overall total number of households surveyed stands at 1,606, of which, 291 (Gujarat), 246 (Haryana), 269 (Karnataka), 217 (Kerala), 186 (Rajasthan), 247 (Uttar Pradesh) and 150 from West Bengal were selected respectively, for the study.
- Farmers hold an average land holding of 1.12 hectare, of which, 0.92 hectare was under irrigation and the remaining 0.18 hectare under rainfed however, the area under fodder crops constitutes 0.22 hectare.
- The green fodder requirement ranges from 8.39 kgs to 18.20 kgs per animal per day, whereas the dry fodder requirement ranges from 5.46 kgs to 9.89 kgs per animal per day and concentrate requirement ranges from 0.72 to 2.58 kgs per animal for male buffalo and milching buffalo, respectively.
- Green fodder fed per cattle per day ranges from 8.27 kgs to 15.18 kgs, while dry fodder fed ranges from 4.43 to 9.27 and the concentrate fed ranges from 1.17 to 2.97 kgs.
- Green fodder fed to indigenous cattle ranges from 7.01 to 10.31 kgs per day per cattle, whereas dry fodder from 4.80 kgs to 9.80 kgs and the concentrates from 0.36 kgs to 2.46 kgs.
- In the case of sheep, green fodder fed ranges from 2 kgs to 4.49 kgs per day and dry fodder from 0.18 kgs to 2.86 kgs per day, whereas, the concentrates requirement range from 0.27 kgs to 0.41 kgs per day.
- In the case of goat, green fodder requirement ranges from 1.54 to 3.39 kgs per day, whereas dry fodder ranges from 0.78 kgs to 1.14 kgs per day and the concentrates range from 0.42 to 1.81 kgs per day.
- As per the primary data (feeding pattern of the households), per year requirement of green fodder amounts to 1491.04 million tonnes for the country. Across the states, it ranges from 10.04 million tonnes in Kerala to 116.93 million tonnes in Rajasthan; the requirement of dry fodder accounts for 1,356.18 million tonnes, which varies from 8.20 million tonnes in Kerala to 114.96 million tonnes in Rajasthan; and the requirement of concentrates per day per animal at the household level amounts to 274.39 million tonnes and state-wise, it ranges from 0.94 million tonnes in Kerala to 27.35 million tonnes in Rajasthan.
- There were 51.98, 28.97, 33.91 and 77.67 million milch, dry, adult male and young stocks, respectively, comprising a total of 192.52 million cattle in the country, as per

the latest Livestock Census of 2019.

- There were 38.16, 16.92, 3.39 and 51.19 million of milch, dry, adult male and young stocks respectively, accounting for a total of 109.85 million buffaloes in the country.
- The sheep and goat population stands at 148.88 and 74.26 million, respectively.
- Across the states, the cattle population ranges from 1.33 million in Kerala to 19.02 million in West Bengal, whereas, the buffalo population ranges from 0.10 million in Kerala to 33.02 million in Uttar Pradesh. The goat and sheep population ranges from 0.33 million in Haryana to 20.84 million in Rajasthan and 0.001 million in Kerala and 11.05 million in Karnataka.
- Annual green fodder required is 488.69 million tonnes in the country. The green fodder requirement across the selected states is at 77.05, 48.39, 30.79, 29.67, 21.96, 8.88 and 2.26 million tonnes for Uttar Pradesh, Rajasthan, Gujarat, West Bengal, Karnataka, Haryana and Kerala, respectively.
- The dry fodder requirement per annum is at 468.29 million tonnes for the country. Across the states, dry fodder requirement ranges from 76.74 to 2.03 million tonnes in Uttar Pradesh (highest), followed by Rajasthan, Gujarat, Karnataka, Haryana and Kerala at 76.74, 42.45, 31.18, 28.06, 18.90, 9.17 and 2.03 million tonnes, respectively.
- The requirement of concentrates for cattle, buffalo, sheep and goats is at 50.74 million tonnes in the country. The concentrates required by selected states range from 0.23 million tonnes in Kerala to 9.31 million tonnes in Uttar Pradesh.
- There is an availability of 5,751 lakh tonnes of green fodder from different sources of production and is found to be highest for the area under fodder crops at 3,739.77 lakh tonnes, followed by forest area with an assumption of 50 per cent of area being accessible for grazing (1,077.99 lakh tonnes). Availability of green fodder across the states ranges from 22.99 lakh tonnes in Kerala to 2,216.70 lakh tonnes in Uttar Pradesh.
- The production of paddy, wheat, sorghum, bajra, barley, maize, ragi, small millets, pulses, ground nut, oil seeds and sugarcane was at 1,164.78, 1,035.96, 34.75, 86.64, 16.33, 277.15, 12.29, 3.33, 220.76, 67.27, 315.22, 4054.16 lakh tonnes, respectively.
- The production data of crops were used for estimating crop residues in terms of dry fodder by using harvest indices and extraction ratios. The estimated dry fodder availability was at 5,124.24 lakh tonnes in the country. The highest dry fodder production was observed for paddy at 1,514.21 lakh tonnes, followed by wheat (1,035.96 lakh tonnes), sugarcane (1,013.54 lakh tonnes), Maize (692.88 lakh tonnes), pulses (375.29 lakh tonnes), groundnut (134.54 lakh tonnes), bajra (216.60 lakh tonnes), ragi (24.77 lakh tonnes) and other small millets (8.33 lakh tonnes).
- Across the states, dry fodder production ranges from 7.84 lakh tonnes in Kerala to 1114.99 lakh tonnes in Uttar Pradesh.
- The availability of concentrates was estimated based on extraction and conversion ratios. There is an availability of 524.19 lakh tonnes of concentrates from different sources of production. The highest availability of concentrates is observed for Oilseeds (267.74 lakh tonnes), followed by Brans and Chunnies (176.06 lakh tonnes), and grains (80.39 lakh tonnes).
- Paddy and wheat were the major contributors of Brans and Chunnies. As for grains, a major contribution is made by maize followed by paddy and wheat.



- There is a need for 486.69, 468.29 and 50.74 million tonnes of green fodder, dry fodder and concentrates, whereas the availability/supply of green fodder, dry fodder and concentrates is at 575.18, 512.42 and 52.42 million tonnes, respectively.
- As per the NATP calculations, there is a surplus availability of fodder, which is at 88.49, 44.13 and 1.68 million tonnes of green fodder, dry fodder and concentrates with a gap of 15.38%, 8.61% and 3.20%, respectively. Accordingly, the requirement of green fodder, dry fodder and concentrates in terms of dry matter is at 121.67, 421.46 and 45.67 million tonnes, with a total of 588.80 million tonnes. While, the availability / production of green fodder, dry fodder and concentrates in terms of dry matter is found to be at 143.79, 461.18 and 47.18 million tonnes, respectively, with a total availability of 652.15 million tonnes.
- The difference in availability and requirement of green fodder, dry fodder and concentrates in the form of dry matter is excess at 22.12, 39.72, and 1.51 million tonnes, with a total of 63.55 million tonnes and the percentage of gap at 15.38, 861 and 3.20, respectively, with a total excess of 9.71 per cent to dry matter.
- Similarly, as per the FAO estimates, the livestock population under different categories, as per age, is 114.86 (over 2.5 years), 42.09 (1 to 2.5 years), 35.58 million (less than 1 year) of cattle, which together constitute 192.52 million; the total population of buffaloes constitutes 109.85 million, comprised of 58.66 million belong to above 2.5 years, 26.71 million belong to one to 2.5 years, and 24.48 million belong to less than one year categories; The goat population of the country is at 148.88 million of which, 57.67 million were aged less than one year and 91.22 million were aged above 1 year; The sheep population of the country is at 74.26 million, of which 26.13 million are aged less than 1 year and 48.13 million belong to the category of above one year;
- Accordingly, there is a requirement of 597.67 million tonnes of feed and fodder in terms of dry matter, which ranges from 2.53 million tonnes in Kerala to 96.66 million tonnes in Uttar Pradesh. Correspondingly, the availability of feed and fodder in terms of dry matter is at 652.15 million tonnes and requirement at 597.67 million tonnes and hence, there is a positive difference (excess) in the production at about 54.49 (9.12%) million tonnes. The excess feed and fodder are found in Rajasthan, Uttar Pradesh, Haryana, Karnataka and Gujarat. However, the deficit in production is found in West Bengal (7.27 million tonnes) and Kerala (1.25 million tonnes).
- As per the nutritional requirement of livestock as worked out by the NDDDB, overall, there is a significant deficiency/short-fall of 160.4 kg/animal/day in terms of green fodder in the country and a slight surplus in respect of dry fodder to an extent of 10.97 kg/animal/day and concentrates to the level of 4.94 kg/animal/day.
- According to the livestock population of 2019 and nutritional requirement as estimated by NDDDB, the gap in green fodder, dry fodder and concentrates per year for cattle was - 7,200.13, 1,703.38 and 1,187.59 million tonnes; for buffalo, it was -1,698.84, 447.86 and 112.27 million tonnes; -12.74, -54.21 and 18.97 million tonnes for sheep; 11.96, - 82.60 and 16.30 for goats; -57.46, -78.61 and -5.75 for other categories of livestock, respectively. The cumulative gap for all livestock categories reveals that there is an overall deficit in green fodder to the extent of 31,367.19 million tonnes/year, whereas, in terms of dry fodder & concentrates, the gap is found to be in surplus to the tune of

- 2,145.25 and 966.05 million tonnes/year.
- According to the projection, the livestock population during 2030 going to be 573.27 million consisting of 205.96 million cattle, 117.54 million buffalo, 79.46 million of sheep, 159.30 million goat and 11.01 million other animals.
  - Keeping this population and the nutritional requirement as per NDDDB, there will be an overall deficit in green fodder to the extent of 33,562.9 million tonnes and a surplus of dry fodder at the level of 2,295.42 million tonnes and concentrates of 1,033.67 million tonnes. Proportionately, the gap in green fodder is -7,704.14 million tonnes, dry fodder is 1,823.04 million tonnes and the concentrates is 200.72 million tonnes for cattle; -1,817.75 million tonnes, 479.21 million tonnes and 120.13 million tonnes for buffalo; -13.63 million tonnes, -58.00 million tonnes and 20.30 million tonnes for sheep; 12.79 million tonnes, -88.38 million tonnes and 17.44 million tonnes for goats; and -61.487 million tonnes, -84.11 million tonnes and -6.15 million tonnes for other livestock, respectively.
  - In terms of maintenance cost per animal per annum, the veterinary cost was highest for crossbred cattle (Rs. 2,040) followed by buffalo (Rs. 1,721) and indigenous cattle (Rs. 1,458). The other maintenance cost was also highest for the crossbred cattle (Rs. 2,231), followed by buffalo (Rs. 1,001), indigenous cattle (Rs. 985), goat (Rs.775) and sheep (Rs.684).
  - Average milk yield per day ranges from 8.91 litres to 0.57 litres per day. The milk yield is highest for Crossbreed cattle, followed by buffalo and indigenous cattle. On average, the sheep and goat milk yield amounts to 0.57 and 0.92 litre per day.
  - In the case of crossbred cattle, Uttar Pradesh state accounts for the highest milk yield (10 litres/day), followed by Karnataka (9.90 litres/day), whereas indigenous cattle milk yield was highest in Haryana (6 litre/day), followed by Rajasthan (5.83 litre/day). Buffalo milk yield was highest in Haryana (8.30 litres/day), followed by Rajasthan (7.15 litres/day). The sheep and goat milk yield is highest in Haryana (2.40 litres/day).
  - The highest price of milk for crossbreed (Rs. 36.20/litre) and indigenous cattle (Rs. 38.00/litre) was found in Kerala. The buffalo milk price was highest in West Bengal (Rs. 45.10/litre), followed by Gujarat (Rs. 43.44/litre). The goat milk price was highest in Kerala (Rs. 40/litre) and sheep milk in Gujarat (Rs. 31.11/litre).
  - On average, dung yield per animal per year ranges from 4.22 tonnes in the case of crossbred cattle to 0.27 tonnes in respect of sheep.
  - The major sources of livestock feed were crop residue (64.32%), followed by household leftovers (59.49%), grazing land (53.99%) and tree legumes grown as a hedge or any other forest trees (50.49%). The other sources were improved forage and pasture (36.12%) and feed preserved and stored (21.55%).
  - A majority of farmers (86.92%) expressed that the land was a major constraint for the production of fodder crops, as they belong to small and marginal categories (less land holding). Hence, they were not in a position to grow fodder crops separately. The second major constraint was the lack of awareness regarding government programmes on subsidy on fodder seeds (77.83%), followed by poor livestock extension services (75.03%), high cost of cultivation/production and low return on fodder production (70.36%) etc.

- On average, only 3.15 per cent of the farmers have adopted post-harvest management techniques of feed and fodder and the remaining 96.85 per cent of farmers have not adopted any such techniques.
- The major reasons for non-adoption of post-harvest management were the lack of awareness (61.86%), followed by highly expensive (47.47%), considered inferior in comparison to fresh one (42.27%) and more laborious (29.27%).
- As far as the benefits received from the government related to livestock production across the states, cent per cent of Uttar Pradesh households have mentioned that they have not received any benefits related to livestock production. The other selected states farmers said that they received benefits from the veterinary department, animal vaccination, free treatment, incentives for milk price and subsidised fodder seeds, cattle facilities, mineral mixture, and fodder seeds as major ones.
- The major suggestions made by sample households include the need for distributing hybrid fodder seeds, market information, training programme for post-harvest management, financial assistance for shed construction, and distribution of high-yielding varieties of fodder, making available fodder seeds on time, need for increasing the market price of milk, reduction in market price of feed and fodders, and need for credit support.

## **Summary & Conclusions**

The availability and efficient use of feed resources are the primary drivers for maximising livestock production and productivity. There is a sub-optimal use of feed and fodder across categories of livestock in comparison to the nutritional recommendations by the NDDB. The study found that there is an excess availability of dry fodder and concentrates but the deficiency in green fodder, as per the present feeding pattern of the sample households. There is an excess of dry fodder and concentrates which is unevenly distributed across the livestock production areas across states. Further, the estimation of feed and fodder production according to the production of major crops (cereals, pulses, oilseeds and millets) have their limitations such as harvesting method (manual/ mechanical), harvest season, varieties (dwarf/ tall) grown, climatic conditions etc. Due to decreasing forest and grazing land, farmers should adopt stall feeding of livestock to feed optimally. As indicated by the farmers, there is a need for creating awareness on post-harvest management of feed and fodders with additional incentivisation support by the government. Farmers should be encouraged to grow green fodder for feeding animals and undertake silage preparation so that the feeding can be continued all round the year. Agricultural Universities should be encouraged to develop technologies for improving the yield potential of fodder crops. The Agricultural and Animal Husbandry Department and extension should create awareness and train farmers in fodder production, silage preparation and use of crop residues in proper form to feed the animals.

## Policy Suggestions

1. The livestock sector forms a major secondary agriculture component for most farmers contributing to employment and better livelihood in rural areas. As such, policy focus on this sector is essential.
2. There is a wide gap in the supply of green fodder, dry fodder and concentrates in most states; hence, there is a need to encourage the farmers towards the production of green fodder crops by providing appropriate technologies, particularly high-yielding seeds/ planting materials.
3. Crop residue is the major source of livestock feed, most of which is obtained from field crops and pulses. Farmers should be trained to use the crop residues appropriately to meet their fodder requirements.
4. There is a lack of adequate and authentic data on the production and availability of various types of fodder and feed grains. Therefore, concerned agencies should be encouraged to generate real-time data at periodic intervals as done for other crops.
5. There is a serious lack of awareness regarding fodder cultivation and post-harvest management practices (silage making) among livestock farmers, so training on fodder cultivation and post-harvest management is important. Hence, the extension departments, KVKs and Agricultural Universities should develop need-based extension programmes for fodder crop cultivation, preparation of silage and utilisation of crop residues as fodder.
6. The overall picture reveals that there is a surplus of green and dry fodder production (as per the feeding pattern of sample farmers). But in the field, often farmers express shortage and non-availability of fodder, which might be because though there is overproduction, the farmers don't know where it is produced or available and how to transport it. On the other hand, the farmers in the rural areas where production is happening are not interested in increasing the production (though they can do it very well), as they are afraid that there will be no buyers for the fodder. Hence, a market mechanism like E-NAM exclusively for livestock products may be created which would bridge the buyers and sellers and this would certainly help in improving the production, productivity and profitability of livestock farming.
7. The study revealed that the milk price was ranging between Rs. 26 to 40. Similar studies also indicate that the cost of milk production is higher than the market price of milk. Hence, farmers are not interested in purchasing the inputs (feed and fodder) for cattle, though this could increase the milk production, the profit would be reduced. Most of the cattle are being reared on zero input costs and they are underfed and the optimal production is not happening. Hence, a mechanism like the Competition and Consumer Protection Commission (CCPC) or MSP may be sorted out to fix the procurement price of milk by the Cooperative Unions based on the cost of production. This would attract more and more farmers towards the business and also would increase the milk production, productivity and profitability of dairy farming.

# 1. INTRODUCTION

## 1.1 Background of the Study

Traditionally, India has been a mixed farming economy with agriculture and livestock playing complementary roles. Therefore, it has been acknowledged that the livestock sector makes an important contribution to food security and poverty reduction. The livestock sector in India contributes nearly 29.63 per cent of the total agricultural output and 4.11 per cent of the Gross Domestic Product (GDP). The country accounts for the world's largest livestock population (about 535.78 million), which is 20 per cent of the world's livestock population (1.468 billion). However, the country's share in the world's geographical area under this sector is just about 2.3 per cent. India ranks first in buffalo population (57%) and second in cattle (12%) and goat (20%) population among the world nations. The desired annual growth of the agricultural sector (4%) of the country can also be accomplished by enhancing the productivity of the livestock sector. However, it requires a steady supply of fodder to support the livestock population.

Animal husbandry in India is closely interwoven with agriculture. It plays an important role in the socio-economic development of millions of rural households, thereby contributing significantly to the national economy (Mishra, 1995; Chawla, *et al.*, 2004; Sharma, 2004; BIRTHAL, 2016). Livestock rearing is one of the most important economic activities in the rural areas providing supplementary as well as stable income around the year. This sector has also emerged as a vital sector in terms of ensuring a more inclusive and sustainable agricultural system. Evidence from the National Sample Survey Office's (NSSO) 70<sup>th</sup> round survey (2014 & 2014a) shows that for more than one-fifth (23%) of the agricultural households with very small land holdings (less than 0.01 hectare), livestock is their principal source of income. More than 70 million of the reported 147 million rural households depend on dairy, in varying degrees, for their livelihoods. Marginal, small and semi-medium farmers with average operational holdings of less than 4 ha own about 87.7 per cent of the livestock in India. By controlling 64 per cent of the bovine, 70 per cent of ovine, 73 per cent of caprine and 70 per cent of the poultry population, the smallholders contribute substantially to livestock production (NSSO, 2014). Dairying has become an important secondary source of income for millions of poor and rural households besides assuming an important role in providing employment and income-generating opportunities, particularly to marginal and women farmers. This sector also has a significant impact on equity in terms of employment and poverty alleviation as well. It cannot be merely a coincidence that the level of rural poverty is significantly higher in states where the livestock sector is underdeveloped (Singh and Meena, 2012). This is the sector where the poor contribute to growth directly instead of deriving benefits from growth generated in other sectors of the economy.

In many cases, livestock is also a central component of risk management strategies for smallholders (Randolph *et al.*, 2007). Livestock is a natural asset for the poor that can be liquidated when required or during times of crisis (Singh and Meena, 2012). It also helps

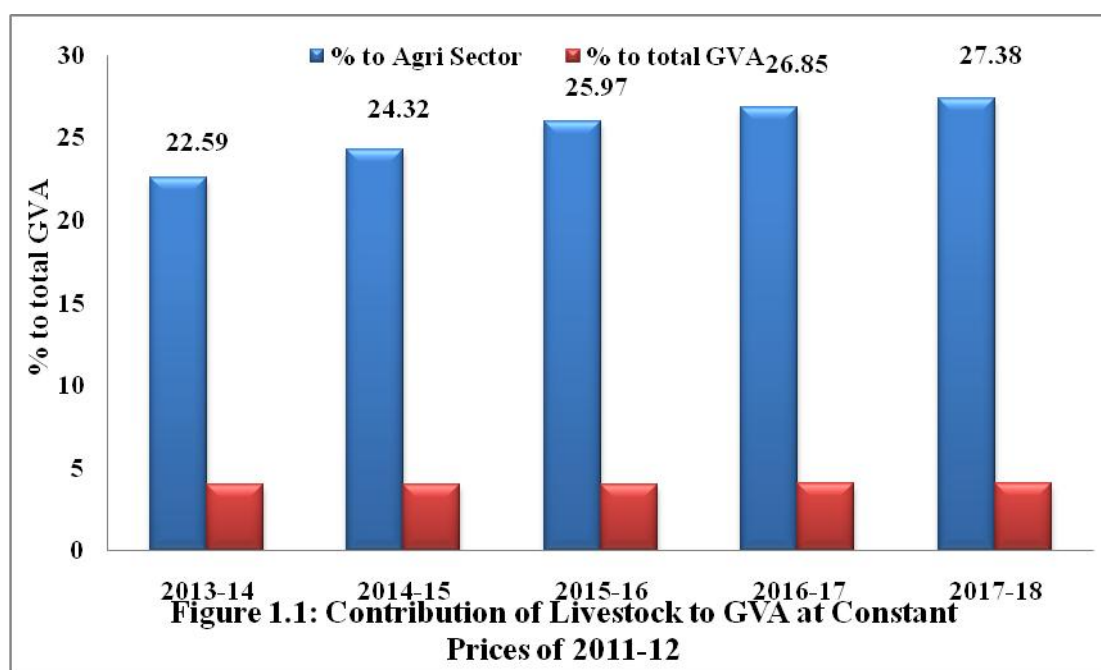
control migration as well as suicides. It is estimated that this sector generates 5-6 per cent of the total rural employment (Shah, 2019), and provides regular employment to 9.8 million people as a principal occupation and 8.6 million people as a subsidiary occupation. More importantly, women constitute 71 per cent of the labour force in livestock farming (GOI, 2002). Apart from providing subsidiary income (about 12% of rural household income, while 26% in the case of the poorest households), rearing of livestock is a source of nutrition for rural households in the form of milk, eggs and meat. Milk has always played a critical role in addressing hunger and malnutrition (Kumar, 2016).

The livestock sector is the second-most important contributor to the agricultural economy of India, next only to staple crops. The animal husbandry and dairying sector contributes about 27.38 per cent to the Gross Value Added (GVA) from total agriculture, forestry and fishing sectors. Its overall contribution to the total GVA of India amounts to about 4.08 per cent for 2017-18, at constant prices. The share of GVA of the livestock sector to total agriculture (crops & livestock) has increased from 22.59 per cent in 2011-12 to 27.38 per cent in 2017-18 at constant prices, as depicted in **Table 1.1** and **Figure 1.1**.

**Table 1.1: Contribution of Livestock to GVA at Constant Prices of 2011-12**  
(in crores)

Year	Livestock	Agriculture	Total GVA	% to Agri Sector	% to total GVA
2013-14	363558	1609198	9063649	22.59	4.01
2014-15	390449	1605715	9712133	24.32	4.02
2015-16	419637	1616146	10491870	25.97	4.00
2016-17	461171	1717467	11318972	26.85	4.07
2017-18	493676	1803039	12104165	27.38	4.08

Source: <https://www.indiastat.com>



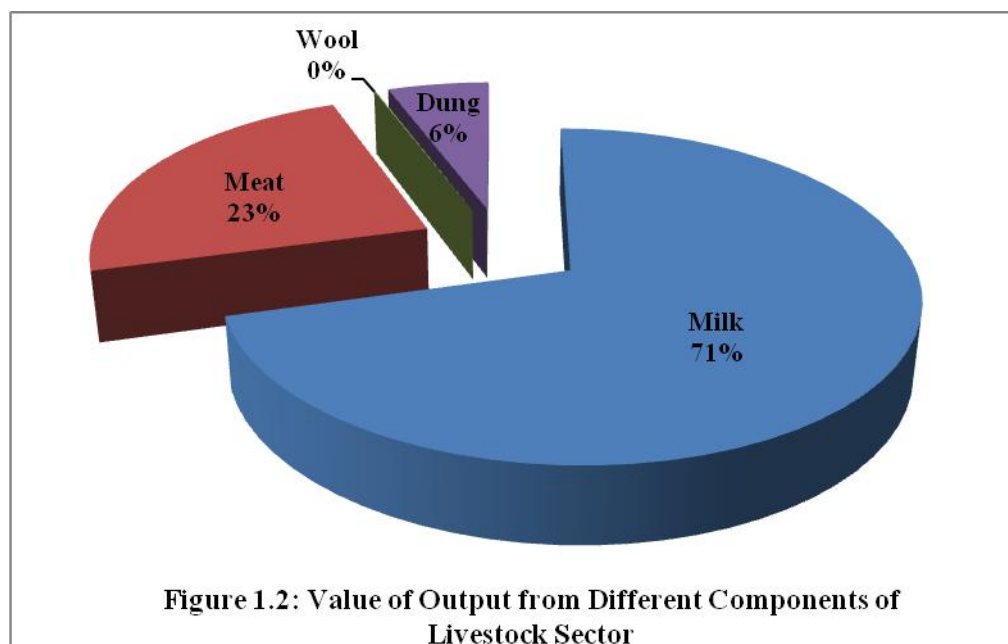
The dairy sub-sector occupies an important place in the livestock sector and the agricultural economy of India since milk is the second-largest agricultural commodity contributing to Gross National Product (GNP), next only to rice. While about two-thirds (66.22%) of the total value of output from the livestock sector during 2017-18 is accounted for by the milk group, followed by about one-fifth share by the meat group (22.03), the use of dung as fuel with a contribution of 5.36 per cent also has significantly contributed to the total value derived from livestock sector at constant prices, as shown in **Table 1.2 and Figure 1.2.**

**Table 1.2: Value of Output from Different Components of Livestock Sector at Constant Prices of 2011-12**

(in crores)

Year	Different components of livestock				Total output Value of livestock	GVA of Livestock
	Milk	Meat	Wool	Dung		
2011-12	327767	96219	496	32599	487751	327334
2012-13	339240	102623	508	33468	508074	344375
2013-14	352247	110744	522	33311	530953	363558
2014-15	374267	117264	518	34177	562026	390449
2015-16	396662	125631	468	34870	595242	419637
2016-17	421495	143744	477	35566	640811	461171
2017-18	448970	149352	447	36359	677960	493676
Per cent (2017-18)	66.22	22.03	0.07	5.36	100.00	

*Source:* <https://www.indiastat.com>



India is endowed with a significant proportion of the world's livestock population (Prabaharan, 2002; Sharma and Sharma, 2002). India ranks first in terms of cattle and buffalo population in the world. The population of cattle and buffalo in India was 218 million and 115 million in 2012 respectively, accounting for 14.7 per cent and 58 per cent of the world

cattle and buffalo population. Most of these are milch cows and milch buffaloes. However, the milk productivity of these animals is very low which might be due to malnutrition. Poor quality of fodder and the scarcity of feed are the impending constraints in improving livestock productivity (Birthal and Jha, 2005).

India is inhabited by about 17.79 per cent of the world's human population with 15 per cent of the world livestock population in over 2.4 per cent of the geographical area. With only 4.2 per cent of the the world water resources, the natural resources of India are under considerable stress. Due to the ever increasing pressure of the human population, arable land is mainly used for food and cash crops, leaving a lesser proportion of good quality arable land for fodder production. Despite the fact that there is a scarcity of total feed and fodder, land available for fodder production has been decreasing. Land allocation to cultivation of free fodder crops is limited and has hardly ever exceeded 5 per cent of the gross cropped area resulting in a severe deficit of green fodder, dry fodder and concentrates. Availability of an adequate quantity of feed and fodder for livestock is essential for improving the livestock productivity. Thus, feed availability needs to be ensured, if livestock is to be sustained at the farm level (Biradar and Kumar, 2013).

## **1.2 Status of Availability of Feed and Fodder in India**

Shortage of fodder and feed has been a major constraint in the development of the livestock economy of India (Seetharaman, et al., 1997). Feed accounts for 65-70 per cent of the total cost of production and maintenance of animals. There is a direct relation between the nutritional status of animals and the type of feed fed. One of the prominent characteristics of Indian livestock is that almost its entire feed requirement is met from crop residues and by-products like grasses, weeds and tree leaves gathered from cultivated and uncultivated lands, grazing on common lands and harvested fields.

To improve the yield of milch animals, feeding animals needs a planned, scientific, practical as well as economic approach. Livestock feeds are generally classified as roughages and concentrates. Roughages are further classified into green fodder and dry fodder. Green fodder is cultivated and harvested to be fed to animals in the form of forage (cut green and fed fresh), silage (preserved under anaerobic conditions) and hay (dehydrated green fodder). Cereal crop residues contribute about 71 per cent of the overall feed resources used for animal feeding, while green fodder accounts for 23 per cent and concentrated feeds for 6 per cent (GOI, 2017).

The major sources of fodder supply include crop residues, cultivated fodder and fodder from common property resources like forests, permanent pastures and grazing lands. The total area under cultivated fodders amounts to 9.13 million hectares for 2014-15; accounting for barely 4.6 per cent of the gross cropped area, while the area under permanent pastures and other grazing lands to 10.26 mha for 2014-15 (accounting for barely 5.2 per cent of the gross cropped area). The share of permanent pastures and other grazing lands in the gross cropped area shows a decline from 4.68 per cent for 1960-61 to 3.33 per cent for 2014-15 (GOI, 2018).



The pasture lands available in the different states are overgrazed and not properly managed, leading to lower productivity. In different states, grazing pressure on such pasture lands is very high compared to their carrying capacity.

The estimates suggest that there is a wide variation in fodder production in the country. Fodder production and its utilisation depend on various factors like cropping patterns followed, climatic conditions of the area as well as the socio-economic conditions of households and the type of livestock reared. Cattle and buffaloes are normally fed fodder available from cultivated areas, supplemented, to a small extent, by harvested grasses. Thus, major sources of fodder for feeding the livestock in India are crop residues (54%), fodder from grasslands (18%) and cultivated fodder crops (28%) (Hegde, 2006).

Prominent among the crop residues are paddy straw, wheat straw, stalks of sorghum, maize, pearl millet, groundnut, beans and grams. Although these crop residues are considered very valuable by the livestock keepers, there is a lot of wastage observed in different parts of the country.

In animal feed supply, coarse cereals have a major role and these account for about 17 per cent of the total cereals production. Traditionally crop and livestock sectors are interrelated to each other. The interactions between these two sectors are so complex that it would be difficult to estimate the contribution of one to the progress of another. The availability of concentrates and crop residues is directly linked to agricultural production. However, agricultural production in India for the last five decades has grown by around 2.2 per cent. The availability of crop residues has further declined due to the adoption of high-yielding dwarf varieties/hybrids and field wastage due to the extensive use of grain pickers/mechanical harvesters in cereal crops (Garg, 2018). The crop sector mainly supplies fodder to livestock, while livestock provides manure and resilience against drought to the crop sector. Production of cereals is around 47 million tonnes of which maize accounts for around 60 per cent of the total coarse cereals produced in India. Most of the coarse cereals in the developed countries are mainly used as feed for cattle while some of the cereals like barley are used in breweries. However, in India, their use is mainly for direct consumption mostly by the poor in the villages.

Compound feed plays an important role in improving the milk yields of cattle and buffaloes as a balanced diet. Driven by a strong growth in the dairy industry, compound feed volumes have increased at an average rate of 6 per cent over the period from 2007-08 to 2012-13. Based on the number of productive dairy animals and the current requirement (0.5 kg), the current estimated compound feed requirement is 65-70 million tonnes while current production is sufficient to feed only about 7 per cent of the total breed-able animals in India. Current consumption volumes are approximately 7.5 million tonnes. The actual market is much smaller because a large portion of this market is serviced by the unorganised (grazing) sector. The three key types of cattle-feed producers are (a) Home-mixers, (b) Dairy cooperatives; and (c) Private sector manufacturers of compound cattle feed. There would still be a significant gap between market potential and supply. Many cooperatives have also set up

their own modern computerised feed plants. They have modern milk processing plants through which they produce and market pasteurized milk, butter, butter oil, chocolate, and other value-added products. The feed production by cooperatives is about 2.5 million tonnes per year, while a deficit of feed and fodder resources has resulted in exorbitant prices of concentrates and crop residues in many parts of the country. Thus, while the higher cost of feed and fodder makes dairy farming a challenging enterprise for landless, marginal and small dairy farmers, their livelihood is at stake in rural areas. Due to a deficiency of green fodder, farmers feed inadequate quantities of green fodder to livestock that affect their health, breeding and milk yield. RBP data related to a few productive animals indicate that average dry matter intake from green fodder by indigenous cattle, buffalo and crossbred animals is in the range of 23-27 per cent, while in the developed countries, it is about 60 per cent, including conserved fodder (silage and hay) (Garg, 2018). Therefore, to meet the growing nutrient requirement of dairy animals economically, there is an urgent need to focus on programmes to enhance green fodder production.

In the sector, there are a variety of feeds and fodders used for livestock feeding purposes, which are broadly classified as roughages, concentrates, feed supplements and feed additives. The stagnated areas under fodder production and a decline in pasture lands are the major challenges faced by the feed and fodder production sector. In addition, the replacement of coarse cereal crops, one of the main sources of crop residues, with commercial crops is also posing a threat to the feed and fodder production sector. In India, a mere four per cent of the total cropping area is under fodder cultivation which has resulted in a severe deficit of green fodder (36%), dry fodder (40%) and concentrates (57%). Therefore, the need of the hour is to fulfill this shortfall in fodder (which accounts for more than 55%), through crop residues and agricultural by-products.

In the milk production sector, feed as an input constitutes 60 to 70 per cent of the total cost. Hence, there is an urgent need for an assessment of feed and fodder availability to reduce the cost and to ensure quality livestock products. Also, any attempt towards enhancing feed availability and economising the feed cost would result in an increased margin of profits for livestock farmers. Meeting the requirements of the current level of livestock production and its annual population growth is a growing concern that has to be resolved by increasing productivity, utilising untapped feed resources, increasing land area or through imports.

It's a matter of fact that the accessibility of crop residues and concentrates is directly connected to food crop production. The food crop sector has shown positive growth in recent years, and, therefore, crop residue and concentrate feed ingredients availability has also shown a commensurate increase. However, crop diversification in recent years, especially with commercial and perennial crops, as a replacement for traditional cereal crops, especially coarse cereals, is likely to have an impact on the availability of crop residues. This situation is alarming because in animal feed supply, coarse cereals have a major role with four major portions of cereal viz., maize, barley, sorghum, and pearl millet accounting for about 44 per cent of the total cereals. Production of these cereals remains stagnant at around 30 million tonnes per year.

To assess the demand and supply of feed and fodder resources (deficit /surplus) for the livestock in different states, the availability of dry fodder, greens and concentrates was calculated using a suitable extraction ratio, also called Residues to Product Ratio (RPR). The quantum of green fodder, dry fodder, and concentrate feed was converted into dry matter (DM) by applying a factor of 0.25 for green fodder, and 0.90 for dry fodder and concentrate feed (Suresh *et al.*, 2012). Crop residues and concentrates from various cereals, pulses and oilseeds were estimated based on their conversion factors (Meena *et al.*, 2018). The factors for conversion of DM from each source into total digestible nutrients (TDN) were taken as 0.534 for green fodder, 0.476 for dry fodder, and 0.780 for concentrate feed. The factors for the conversion of DM from each source into crude protein (CP) were 0.073, 0.016 and 0.180 for green fodder, dry fodder and concentrate feed, respectively (Dikshit and Birthal, 2010). The major fodder crops like maize, sorghum, pearl millet, Egyptian clover, Lucerne, cluster bean, etc., were considered. The area under fodder crops was calculated to be 8.9 million ha, and the fodder productivity was estimated by using the weighted average of 40.93 tonnes/ha, considering the minimum yield of each fodder crop (*Handbook of Agriculture*, 2005).

Fodder production and its utilisation depend on the cropping pattern, climate, socio-economic conditions and type of livestock. The three major sources of fodder supply include crop residues, cultivated fodder and fodder from common property resources like forests, permanent pastures and grazing lands. At present, the country is faced with a severe deficit in respect of almost all the major feed components (green, dry and concentrate). The situation is further aggravated due to the increasing growth of livestock, particularly that of genetically upgraded animals. The available forages are poor in quality, being deficient in available energy, protein and minerals. To compensate for the low productivity of the livestock, farmers maintain a large herd of animals, which adds to the pressure on land and fodder resources. Due to an ever-increasing population pressure of human beings, arable land is mainly used for food and cash crops, thus, there is hardly any chance of having good quality arable land available for fodder production, unless milk production becomes remunerative to the farmer, as compared to other crops. To meet the current level of livestock production and its annual population growth, the deficit with respect to all the components of fodder, dry crop residues and feed has to be met by either increasing productivity, utilising untapped feed resources, increasing land area (not possible due to human pressure for food crops) or through imports. The regional deficits are more important than the national deficit, especially fodder, which is not economical to transport over long distances. The pattern of deficit varies across different parts of the country.

### **1. 3. Need for the Study**

The contribution of the agricultural sector to the total GDP shows a significant downtrend over the years, whereas, the contribution of the livestock sector to the agricultural sector shows a marked uptrend. As the population of livestock increases remarkably farmers are not able to meet the feed and fodder requirements due to the heavy pressure of growing commercial crops. The area under fodder crops has been squeezed in addition to the decreasing productivity. The increasing consumer nutritional awareness, preferences and

changing lifestyle warrant an increased demand for quality value-added milk and other livestock products. Concomitantly, there is a demand for high-quality feed and fodder to sustain high production and produce quality products.

The availability and an efficient use of feed resources are the primary drivers of maximising the productivity of livestock and feed security, its management, the extent of use, conservation are vital to livestock and productivity enhancement. Assessment and forecasting of livestock feed resources are very important in effective planning and policy making. The literature review amply demonstrates that there exists an overall shortage of all types of feed resources and that the existing resources are not sufficient to meet even half of the requirements of bovine stock in certain districts. There is also an inter-district variation in the requirement and availability of feed resources.

It is expected that the population in India would increase and to fulfill the dietary recommended levels of the livestock products as stated by ICMR assumes greater importance. From the current level of production, milk and other livestock products have to increase. Considering the demand for milk and milk products, land under fodder production needs to be doubled or else India will have to import milk from other countries. Keeping this background in view, the study examined the demand, supply, and deficit of feed and fodder production in the country.

#### **1.4 Objectives of the Study**

1. To estimate the area, production and productivity of major green and dry fodder crops.
2. To study the growth pattern of major livestock population.
3. To assess feed and fodder availability, requirement, deficit/surplus to improve livestock productivity.

#### **1.5 Limitations of the Study**

There is no availability of proper standards of feed and fodder required for livestock and ruminants. The study includes major livestock such as buffalo, cattle, sheep and goat. The data on area and production of particular fodder crops is not available with the states. The study is also based on primary data collected through a personal interview method. As farmers did not maintain records of animal husbandry details, feeding and related information, they had to provide the information by memory recall and past experience, thus there is a possibility of recall bias. However, efforts were made to minimize such bias through cross-checking of the data on the field and close observations. This is purely a micro-economic study and the findings of the study are more relevant to the issues under consideration, thus limiting a broader generalization. However, the results can be emulated in other areas under similar agro-ecological-economic conditions through a careful examination.

## 1.6 Review of Literature

This section of Chapter-II mainly deals with the findings of the research studies conducted in the past on livestock/bovines economy, characteristics of livestock rearing as well as supply and demand estimation of livestock feed and fodder and constraints involved in livestock rearing across the states in India and various other countries of the world. It is observed that very few studies were conducted and published by the researchers on the estimation of feed and fodder though they account for a major share in the cost of milk production. Also, the availability of an adequate quantity of feed and fodder for livestock is essential for improving the productivity of livestock. As mentioned earlier, one of the major constraints faced by the dairy production sector in India, particularly in resource-poor rural areas, is the lack of feed and fodder for livestock.

**Naresh (1981)** points out that the main thrust of dairy development is to provide employment opportunities and to generate more income for the betterment and improvement of weaker sections of the society in particular and to improve the nutritional standard of human beings by providing milk to women consumers in general. Dairy development helps stimulate the development of the weaker sections. While studying the crucial role of dairy development in the Indian economy, it would be worthwhile to study the actual impact of dairy development on the beneficiary groups, viz. marginal, small, medium, big farmers and landless labourers.

A study conducted by **Paruthi (1986)** on the estimation of the contribution of the livestock enterprise to the agricultural economy of Haryana state reveals that its contribution to the gross income of small, medium, large and overall average farms was about 33, 27, 20 and 20 per cent, respectively.

**Bhogal and Sharma (1987)** view that milk production requires less land to generate a given level of income as compared to crops, which are labour intensive in nature. Owing to these characteristics of milk production, the Government has given a major emphasis to dairying in its rural development programmes with a view to improving the economic conditions of rural poor, who are small and marginal farmers and landless agricultural labourers. To achieve the desired success in the above mentioned area, it is essential to generate some basic information regarding the contribution of milch animals to the income and employment of the rural poor. Since this information varies from area to area, area-based studies are needed on these economic aspects of milch animals. Keeping these facts in view, the study was conducted with regard to small and marginal farmers and landless agricultural labourers in Meerut district of Uttar Pradesh.

**Moran (1987)** analysed the role of cattle and buffalo in agriculture of South East Asia, in terms of providing both milk and meat and also traction for ploughing and transport. The native breeds vary considerably in their characteristics, not only in their inherent qualities, but also in their response to varying systems of management, and some of them are very primitive. Improvement is possible by crossbreeding but it appears that this is more likely to be achieved with the existing native breeds than by introducing exotic ones.

**Bhanja (1989)** states that the most significant positive point in favour of animal husbandry programme is its employment potential for illiterate rural poor. Animal husbandry does not demand complex skill and is well-suited to our landless rural agricultural labourers. The employment opportunity in crop cultivation being increasingly low due to modernisation and pressure on land, the alternate source of providing employment in rural areas is animal husbandry for which the base resource is already available with the people.

**Uma (1989)** points out that sheep and goat rearing is traditionally a common practice with farmers. Goats and cattle graze in the hillocks where there is some grass available for sheep and cattle for most of the year in the croplands, since, cultivation being largely rain-fed and restricted to the wastelands and gardens.

**Pandey (1995)** states that animal husbandry in India remains closely interwoven with agriculture since ages and plays an important role in the rural economy. Besides having a vast employment potential, this sector provides milk, egg, meat, wool, hides and skins, dung, bones, hooves and draught power and also stabilises farm incomes.

**An Ajit (1997) point out that animal husbandry is** an important component of the rural economy next only to agriculture. In Uttar Pradesh, income from animal husbandry contributes about one-fourth of agricultural income and one- sixth of total income of the state. The importance of animal husbandry is not likely to be any less in Madhya Pradesh, as compared to Uttar Pradesh.

**Francis (1997)** points out that the ownership of livestock (cattle, goats and sheep) is an important social factor in the rural areas of South Africa. Reference to the so-called 'traditional attitude' of livestock owners abounds the state planning documents and attempts to limit stock ownership have always been intensely resisted by rural households. In particular, this refers to the use of livestock as a measure of wealth and security rather than as a production resource to be sold. It is, however, not clear how strongly this attitude still applies to rural areas of South Africa.

**Jabbar (1998)** conducted a study on buyer preferences for sheep and goats in southern Nigeria. The results of the study reveal that supplies, sales and prices of sheep and goats varied widely during the Muslim festival of Eid-el-Kabir with a smaller peak during the Christmas-New Year period. Local West African Dwarf (WAD) sheep and goats and northern Y'ankasa sheep and Red Sokoto goats were traded in the markets and animals purchased for rearing, trading, ceremonies, butchering/ catering, sacrifice, and festivals. There were significant differences between species purchased for various purposes.

**Shelander and Khem (1999)** in their study observed that goat is unique among other ruminants by virtue of its small size, sustenance on low-grade, high-cellulose and top feed, which is usually left unutilised by the other livestock species and for converting such roughages into high quality protein food (milk and meat). Forty per cent of rural population, especially the economically and socially backward classes, maintains goats for an assured

income. Therefore, it provides security to the weaker sections of the rural population. The goat enterprise is primarily in the hands of weaker sections of the rural population. This system of goat production is carried on by the illiterate and poor. There are a very few regulated markets for livestock, and hence, a major portion of profit is taken away by middlemen and marketers.

**Ghaffar *et al.* (1999)** estimated the growth of livestock production in Pakistan. The results of the study reveal that, the contribution of the livestock sector to the Gross Domestic Product (GDP) had risen from 27.30 per cent in 1969-70 to 36.2 per cent in 1997-98.

**Hemalatha and Reddy (2001)**, in their study, point out that unlike the agricultural activities which are strenuous in nature and riddled with uncertainties, dairy enterprise provides a constant and assured income to the poor farmer. It provides gainful employment and thus, prevents migration of rural youth to cities. If maintained on sound scientific lines, it can be an effective medium to generate regular employment for the millions of rural poor.

**Kannan (2002)** studied the economics of fodder cultivation, processing of forages and its marketing aspects across districts in Karnataka. The study results show that the total return from Napier grass was higher than the variable cost of production, indicating that its cultivation was relatively profitable for farmers. However, the estimated green fodder yield was very low at 65 quintal/acre. Since fodder jowar is cultivated in marginal lands, total variable cost of cultivation was low at Rs. 556/acre. The sample farmers used the harvested green fodders for feeding their livestock only and there was no organised market for it. However, a few farmers sold dry fodders within the village. Hay making was the only processing method followed by the farmers in the study area. Among fodder types, farmers stored relatively a large quantity of hay made from paddy straw for a maximum period of 220 days. (x) Availability of quality inputs and extension service delivery were reported to be major problems in the cultivation of fodder crops.

**Mansur (2002)** made an attempt to study the progress of cattle feed manufacturing units as the main strategy of promoting animal husbandry development, more particularly through generating employment opportunities and income to sustain the levels of development of people engaged in dairying activities, and thereby bringing about a transition in the development and growth of feed market and infrastructural facilities.

**Visweswara (2002)** in his study observes that the livestock, though very important to the rural economy of India, is unfortunately a neglected sector and that there can be no agriculture without livestock, as they are interdependent. There is a growing concern among the planners about a decline in the livestock sector, which obviously is the result of a negligent attitude. Livestock is the backbone of economic strength of poor and marginal farmers, who form the majority in the rural community. Maintaining livestock health is important from the national perspective as it contributes considerable revenue to the national exchequer.

**Datta (2013)** in his study also reveals that India faces a net deficit of 61.1 per cent of green fodder, 21.9 per cent of dry crop residues and 64 per cent of concentrate feeds. The study also finds that the quality of fodder is not healthy and does not meet the feeding standards. The author suggests that to maintain a proper balance, India has to fulfill the fodder deficit from all corners of fodder including dry crop residues and feed after utilising uncultivated lands, unexploited feed reserves and increasing fodder productivity on a large scale.

The wide gap existing between the requirement and the actual availability of feed and fodder at the national level has a replica in Karnataka as well. (**Bhende *et al* 2004**). He observes that the deficiency in feed and fodder is more conspicuous in arid and semi-arid regions and forecasts that Karnataka may face a shortage of fodder in the coming years. A gradual decline of livestock at farms is expected owing to lack of resources and manpower to make use of unused land under farms and failure of the government intervention in seed development and distribution in the state. These are certainly problems in all the major states of India, including Kerala. The only difference with respect to Kerala is that there is no such regional dimension to the problem.

**Nirmala (2004)** in her study observes that the livestock industry has the ability to improve the income levels of the poor and can be used during crisis to improve the economic status of women, and consequently the poor families. The rural women constitute 71 per cent of the labour force in livestock farming. In dairying, 75 million women are engaged as against 15 million men, while in the case of small ruminants, the sharing of work with men is almost equal. Livestock products are high sources of proteins and micronutrients such as vitamin A and iron which are essential in preventing malnutrition.

**Christopher (2004)** carried out a study on small ruminant livestock marketing in Gambia. The results of the study show that rams consistently fetched higher prices than other small ruminants. The female Djallonke sheep and female West African Dwarf (WAD) goats attracted better prices, while West African Dwarf bucks were least priced. The prices of these ruminants were not determined by weight but by the general appearance of the animal, market site and season of the year. The grading was not done and sale was by head count. Similarly, the study also reveals that the prices of livestock were lowest around June and highest between October and January. A price differential existed between markets across different sites; prices were higher at sites located along the highway and closer to urban and peri-urban settlements.

**Birthal and Jha (2005)** observe that feed scarcity is the most important constraint in the dairy industry, and accounts for nearly half of all the losses in Indian dairy production. Dikshit and Birthal (2010) estimated the feed consumption rates for different livestock species by age-group, sex, and function at the national level, and based on that the paper has generated demand for different types of feed by the year 2020. According to this study, by 2020, India would require a total of 526 million tonnes (Mt) of dry matter, 855 Mt of green fodder, and 56 Mt of concentrate feed (comprising 27.4 Mt of cereals, 4.0 Mt of pulses, 20.6 Mt of oil seeds, oil cakes and meals, and 3.6 Mt of manufactured feed). In terms of nutrients,



this translates into 738 Mt of dry matter, 379 Mt of total digestible nutrients and 32 Mt of digestible crude protein. The estimates of demand for different feeds are intended to help the policymakers of the country in designing trade strategy to maximise benefits from livestock production.

**Handbook of Agriculture (2005)** considered the major fodder crops like maize, sorghum, pearl millet, Egyptian clover, Lucerne, cluster bean, etc. The area under fodder crops was calculated to be 8.9 million ha, and fodder productivity was estimated by using the weighted average of 40.93 tonnes/ha, considering the minimum yield of each fodder crop.

**Bhuyan and Baruah (2006)** conducted a study on the locally available feed resources, feeding pattern, socio-economic status and the problems of the 100 selected farmers of the hill zone of Assam comprising Karbi Anglong and North Cachar districts. The study found that paddy straw formed the main source of dry roughage. It is concluded that feed and fodder resources available in the region should be fed scientifically and judiciously, to improve the productivity of animals which may in turn improve the socio-economic status of farmers in the hill zone of Assam.

**Singh *et al.* (2006)** conducted a study on migratory sheep and goat production system in Himachal Pradesh. The results of the study revealed a direct relationship between flock-size and resource endowments. Human labour was found to be a major cost component of the maintenance of migratory sheep and goat production system. The flock business and family labour income were observed to be impressive and net income rated meagre for small flock-owners and nominal for large-flock owners. The study also identified that the existing breeds were found good in terms of quality and quantity of meat production, disease resistance and reproduction. The disease management technologies were reported satisfactory; however, medical facilities were not available at higher altitudes. The fodder availability at foothills and in the plains during the winter season was perceived as a major constraint, while the other constraints were lack of marketing and processing infrastructure, low prices of output, high morbidity rate and wild animal attack.

**Misra *et.al.* (2006)** explain that small ruminants are an essential component of rainfed farming systems in semi-arid India. Two models of sheep rearing, lamb fattening and breed multiplication were promoted as a source of income generation and self-employment for the poor and landless households in clusters of two/three selected villages in Mahabubnagar and Anantapur districts of Andhra Pradesh and Tumkur district of Karnataka, India. The Salaha Samithi facilitated the implementation and monitoring of intervention. The core principle of the process was an active decision-making involvement of people at all stages of technological development with technical input and facilitation by project staff.

**Khalache (2007)** estimated the returns from goat farming in Ahmednagar district of Maharashtra state. The results of the study indicated maximum returns (Rs.30,690/annum) earned in the case of large flock size, followed by medium (Rs.14,230/annum) and small (Rs. 11,520/annum) flock size goat farming. This indicated economies of scale under goat farming

in Ahmadabad district.

**Mohammad (2007)** estimated the growth trend in livestock population in Sindh province of Pakistan. The results of the study reveal that the population of cattle, buffaloes, sheep, goats, and camels had become steadily more important in the livestock economy of Sindh province during the last two livestock census periods, as compared to other provinces. Goats and sheep showed a relatively high growth rate over the four decades (1960 to 2000), however, cattle, camels and buffaloes recorded a relatively low growth rate.

**Singwanes and Salam (2007)** analysed the socio-economic constraints involved in goat farming in the Lowveld of Swaziland. The findings of the study reveal that lack of formal market opportunities for selling goats was one of the major hindrances to goat farming. Similarly, a high socio-economic and cultural status accorded to cattle by livestock farmers made the livestock industry to be continuously monopolised by beef production.

**Pathak *et al.*, (2008)** analysed post-harvest management of surplus fodder is the best mitigating strategy for abating regular phenomenon of seasonal and regional deficit of forage and during natural calamities like drought and flood. Major dependence of livestock on crop residues calls for its effective post-harvest processing, value addition, densification, storage and transport, bailing and enrichment of crop residues, particularly paddy straw and other leguminous crop residues for proper storage, balanced feeding with green fodder and minimising wastage and storage loss.

**Suresh *et al.* (2008)** worked out the economic efficiency of sheep farming in semi-arid regions of Rajasthan. The study indicates an annual net return of Rs.25,000 per average flock of 54. The sheep-farming activity attracts labour employment of 581 mandays per annum and more than three-fourths of which is engaged in grazing. Female labour accounts for 12 per cent of the total labour requirement. The major items of expenditure include feed and fodder, veterinary care, hired labour charges and interest on borrowed money. The major sources of return are sale of live animals, wool, milk and manure. The overall average economic efficiency is found to be 75 per cent, implying that the returns could be improved by another 25 per cent with the present resource use level.

**Suresh *et al* (2012)** In the study, the conversion factors used for estimating fodder crop yields by using the weighted average method, taking into consideration of yield and area under fodder crops, with an average yield of 40.93 t/ha and estimated the greens availability from fodder crops by assuming that 4% of the gross cropped area was under fodder crops.

**Sarkar and Ghosh (2008)** estimated the variable cost constituting about 85 per cent of the total cost of all categories of cooperative and non-cooperative dairy farms. Out of the total variable cost of all the categories of cooperative and non-cooperative dairy farms, feed cost was the major cost component (54%), in which concentrate feed had a share of 55 per cent. Labour cost was the second highest with a share of 28 per cent in the total variable cost. Similarly, fixed cost component had a share of 14-15 per cent in the gross cost, and interest

on capital with a major contribution to all types of farms.

**Ghulam *et al.* (2009)** estimated costs, returns and factor productivity of livestock enterprise in northern region of Pakistan. The study reveals that, on an average, livestock owners earned Rs.2,44,601 as gross income per annum with a major share of milk and young stock to the tune of Rs.1,64,235 and Rs.78,155, respectively and the study also indicates that size of the family, number of livestock, quantity of feed and labour days engaged were the major contributory factors to household income. The livestock enterprise in Pakistan indicated increasing return to scale, with investment potentials for future time period. Further, availability of quality breed, veterinary services and milk processing equipment were necessary for the development of livestock enterprise in northern region of Pakistan.

**Hailemariam *et al.* (2009)** identified the determinants of livestock prices in Ethiopian pastoral livestock markets. Hedonic price formation model was used for analysing the survey data. The study identified important occasions viz. Christian fasting, Muslim fasting, holidays and other times, time of a situation whether that specific month fell during ban time or not and season described as wet or dry as important determinants of livestock price formation. Age, group and body condition of the traded animals, buyer and seller types were also important observable attributes influencing the formation of livestock prices.

**Dikshit and Birthal (2010)** conducted a study on India's livestock feed demand: estimates and projections. The study shows that by 2020, India would require a total of 526 million tonnes (mt) of dry matter, 855 mt of green fodder, and 56 mt of concentrate feed (comprising 27.4 mt of cereals, 4.0 mt of pulses, 20.6 mt of oil seeds, oil cakes and meals, and 3.6 mt of manufactured feed). In terms of nutrients, this translated into 738 mt of dry matter, 379 mt of total digestible nutrients and 32 mt of digestible crude protein.

**Halim *et al.* (2010)** conducted a study on the economics of Red Chittagong Cattle farming system in some selected areas of Chittagong district. The results of the study show that about 39 per cent of RCC farm owners were landless, 31 per cent were small and marginal farmers, 17 per cent were medium and 13 per cent were large farmers as per their landholding sizes.

**Mahmoud (2010)** studied the present status of the world goat population and productivity. The total goats and sheep numbered 861.9 and 1078.2 million, respectively. The largest number of goats was observed in Asia, followed by Africa, representing about 59.7 per cent and 33.8 per cent respectively, summing up to 93.5 per cent of the world livestock population. The study also revealed that the total number of goat population in the world being at 590 million during 1990 with an average growth rate of 3.4 per cent per annum. Similarly, growth in cattle population was five per cent per annum, and on the contrary, sheep population decreased by 10 per cent.

**Ogunniyi and Laudia (2010)** assessed the factors influencing the economic efficiency of goat production in Ogbomoso agricultural zone, Oyo state, Nigeria. The results of the study indicate that the mean economic efficiency was 0.595. The major factors affecting the

economic efficiency of goat production were age, education, feeding and herd size.

**Adinya *et al.* (2011)** analysed the costs and returns of small sheep production in Nigeria. The data were analysed using descriptive statistics and cost-returns analysis. The results of the study reveal that a net return of Naira (N) 1,942,400 was realised with N 33.72 made on every Naira invested, indicating sheep production was a profitable farming business, with attractive net returns on investment. The study also reported that sheep farmers were faced with several problems in their production activities. These constraints negatively affected the efficiency of sheep production in the study area. The major constraints included high cost of transportation, lack of capital, inaccessibility of formal credit sources, lack of extension agents, lack of price information, poor market infrastructures, inaccessibility of formal credit sources, high interest rate and lack of road maintenance.

**Cehla *et al.* (2011)** identified the factors influencing the gross value added in the sheep production chain in East Europe. The results show that, gross value added in the processing module was mostly influenced by the number of lambs sold per ewe per year.

**Lukuyu *et al.* (2011)** assessed the feeds and feeding practices and identified feed resource availability in respect of four study sites of Kenya. It was found that farmers in almost all study sites commonly fed crop residues such as dry maize stover, bean haulms, sorghum and finger millet stovers and wheat straw. A concentrate feeds use was reported in all the study sites. In all the sites surveyed, farmers reported low milk production and high milk prices during the dry season due to feed scarcity and low-quality feeds. The authors recommended simple feed processing strategies and methods for feed storage that would help enhance the utilization of crop residues and thereby help alleviate feed shortages. Introduction of small-scale feed conservation strategies such as tube silage and box baling of hay would also help ease feed shortages.

**Gupta *et al.* (2011)** carried out a study on economics of sheep and goat rearing in semi-arid region of Rajasthan. The results of the study indicate that the literacy rate of the small ruminant household head was 40 per cent and the average land holding size was 2.77 hectare, with less than one-fifth of the area under irrigation. The average sheep and goat flock size was 52 and 16, respectively. The gross income from sheep farming was constituted by sale of animals (69.3%), manure (16.6%), milk (7.1%) and wool (7.0%). The major return to goat breeder was from the sale of milk (59.7%), followed by the sale of animals (33.5%) and manure (6.8%). It was also observed that the rearing cost per unit of sheep and goat was around Rr.260 and Rs.344, respectively. The corresponding net return per sheep amounted to Rs.130 with a benefit-cost ratio of 1.5. However, in the case of goat rearing, it was Rs.606 with a benefit-cost ratio of 2.8, respectively. The net returns generally decreased with an increase in the size of land holding, more visibly in the case of sheep rearing farmers.

**Pandey (2011)** estimated the forestry's contribution to livestock feed in Uttarakhand by using contingent valuation approach to estimating the value of tree leaves/fodder. It was found that fodder comprised mostly of grasses and tree fodder. The average proportion of feed quantity

consumed by livestock was found to be 58 per cent from forests, 39 per cent from other than forests and 3 per cent from markets for the hilly region. For the hilly region, the proportion of economic value varied from 40-41 per cent for forest; 40-41 per cent for agriculture and 18-20 per cent for market. The authors recommended that community forestland be used for fuel and fodder needs and that the natural forest land is kept as protected and reserved forest so that the stability of the terrain could be maintained.

**Satyendra *et al.* (2011)** worked out the economics of goat farming in Agra district of Uttar Pradesh. The study reveals that net income derived from different herd size groups of goats was much higher among *barbari* breed group as compared to the local breed group. The study also indicated that large herd size group of goat keepers achieved higher profits than small and medium herd size groups in respect of both the breeds of goat. The overall net annual income per goat was worked out to be Rs.1,183.66 for *barbari* breed and Rs.894.06 for local breed of goats. The improved breed of *barbari* goats had a positive impact on the income of goat keepers, as compared to the local breed, as indicated by its profitability.

**A World Bank study (2011 )** assessed the demand-led transformation of the Livestock Sector in India. This study also reveals that the feed deficit problem persisted. Dry fodder shortage at the national level, was estimated at 11%, and followed by dry fodder at 28% and concentrates at 35%. Crop residues represented the largest feed component but tended to be low in nutritive value, while the supply of roughages was inadequate and the use of concentrates remained low. The quality of Common Property Resources (CPRs) had also degraded due to overgrazing. Between 1960-61 and 2004-05 permanent pastures and grazing lands had shrunk by 25% and barren and cultivable waste lands by 51%. The area under fodder crops in India stagnated at about 8.5-9.0 million hectares during the last 25 years, accounting for only about 4.6 per cent of the total cultivated area. The report suggested that there was a need for addressing feed problems and giving more attention to improving the welfare of poor livestock keepers.

**Thirunavukkarasu, *et al.* (2011)** estimated the dry fodder availability and requirement of bovines for Tamil Nadu State. A survey was conducted to ascertain the grain-to-straw ratios with respect to various cereals and pulses crops across 580 farms, randomly selected from across the 7 agro-climatic zones of the State. Secondary data on area and production of various agricultural commodities in the State (2007-08) were also collected from the government and non-government agencies. The requirement of dry fodder for bovines was estimated (i) taking the dry matter requirement of 2.50% per Adult Cattle Unit (ACU) (350 kg body weight); and (ii) taking the requirement of dry fodder as 1 kg of dry fodder/100 kg of body weight. The dry fodder produced from cereals was estimated at 5.08 million tonnes (66.84% to the total dry fodder), with half of it coming from paddy. Total dry fodder requirement of bovines in the State, was estimated at 11.77 million tonnes as per procedure 1, and at 9.36 million tonnes, as per procedure 2, indicating a deficit of 4.17 million tonnes and 1.76 million tonnes, respectively. Dry fodder status also showed a deficit of 0.57 and 0.24 tonne/ACU in the State, as per procedure 1 and procedure 2, respectively.

**Tsedeke Kocho *et al.* (2011)** investigated the marketing value-chain of smallholder sheep and goats in Alaba, Southern Ethiopia. The results of the study reveal that mode of marketing was mainly on ‘eye-ball’ basis with one-on-one price negotiation. Farmers sold animals of different age, sex and weight either at the farm gate or local markets, while a range of traders was involved at various stages of markets until the animals reached the final consumers. The supply, demand and price of animals displayed clear seasonal variations. Lack of price information, access to incentive markets, poor market infrastructure and seasonality of markets were the major challenges in improving benefit and livelihood of smallholder sheep and goat producers.

**Erlangga and Uke (2012)** employed an investment analysis with regard to goat and sheep fattening project in Indonesia. The study employed project evaluation techniques viz. NPV, IRR, PBP, ROI and ROE for evaluating the feasibility of the project. The results of the study reveal that only Camp Hulucai was suitable for the sheep and goat fattening project as compared to Cihanjuang farm, as indicated by NPV and IRR. The NPV value was found to be greater than zero and IRR greater than weighted average cost of capital. The Camp Hulucai was the most feasible place to implement the goat and sheep fattening project technically as well as financially.

**Grover and Kumar (2012)** study was based on the experiences of 600 fodder growers, 150 from each state, scattered over different clusters, along with a few associated with fodder processing. The primary data pertaining to the year 2008-09 was collected through a personal interview method. The study observed that there was a need to adopt price mechanism which ensured higher or equal net returns at least to the one from competing cereal crops to divert more and more area to fodder crops and that in Karnataka, concerted efforts should be made to encourage farmers to cultivate green fodder crops by providing subsidised seed material and fertilizers coupled with technical training to groups of potential farmers. In respect of Punjab, there was a need for improving the availability of quality seedlings, high yielding varieties of various fodder crops, adequate short-term credit facilities to cover the operational cost, along with required technical training, that could go a long way in augmenting the fodder area, the study observed.

**Prabu *et al.* (2012)** studied the dynamics of livestock population in India vis-a-vis Tamil Nadu state. The annual compound growth rates of livestock population were calculated for various inter-census periods by using a point-to-point approach. The results of the study reveal that livestock and poultry population in India showed a positive trend over the years, excepting cattle, sheep and pig population.

**Gerald (2012)** examined the population and harvest trends in mountain sheep and goats in British Columbia. The estimation showed that the number of Dall’s sheep was 400 to 600 in the extreme northwest of the province and total bighorn sheep numbers peaked in the early to mid-1990s with estimates of 2,750 to 3,250 Rocky Mountain bighorn sheep and 3,100 to 3,900 California bighorn sheep. The estimated number of mountain goats appeared stable over time.

**Ramesh *et al.* (2012)** analysed the small ruminant marketing system across different agro-climatic zones of Southern India. The results of the study reveal that the price of small ruminants was established based on the body confirmation of a given animal.

**Balamurugan and Manoharan (2013)** estimated the cost and benefit of investment in integrated broiler farming in Theni district of Tamil Nadu. The results of the study reveal that the total fixed investment per bird was highest for small farms, followed by medium and large farms. The total cost of meat production per bird, and returns per bird over the variable costs were found highest for small broiler farms, followed by medium and large farms. The study observed on the basis of net present value (NPV) and internal rate of return (IRR), that investment in broiler farming was profitable for all farm-sizes and most profitable for large farms, followed by medium and small farms. The small broiler farms were observed to be highly sensitive to fluctuations in costs and net returns.

**Biradar and Kumar (2013)** made an assessment based on the availability and requirement of fodder as dry matter (DM) in each district of Karnataka. Secondary data of crop production, land utilisation and livestock census data were used along with the primary data collected through a pre-tested interview schedule. Out of 29 districts of Karnataka, 6 districts belonged to an adequate DM available category with a mean availability of 87.51 per cent. Five districts belonged to moderately adequate and 10 districts to deficient DM available categories. However, 1 in every 4 districts belonged to severely DM deficient category. The mean DM availability for the state constituted 56.46 per cent, while the total contribution of crop residues to DM for the state to 72.59 per cent with coarse straw contribution being one third of it. Gross cropped area contributed more among the sources of green fodder and contribution of concentrates to the total DM availability in the state was 3.81 per cent.

**Baruwa (2013)** worked out the cost and returns of goat production under tropical conditions of Nigeria during 2010. The study used a structural questionnaire administered to 60 goat farmers selected during 2010 production season, using a multistage random sampling procedure. The results of the study reveal that the gross margin was N324,668 and net profit N315,818, indicating goat production was most profitable in Nigeria.

**Chetroiu *et al.* (2013)** estimated the goat population trend in the world. The results of the study reveal that goats generally showed an ascending trend, both in terms of stocks and production. The total estimated goat population was 875.5 million heads during 2011. The largest number of goats were found in Asia (over 539 million heads), representing 61.6 per cent, followed by Africa with (over 276 million heads), a share of 31.6 per cent of the total world goat population.

A rapidly developing peri urban livestock farming, emerging fodder markets, vibrant cooperative dairy sector and livestock product- based super markets were indicators of a fast changing economic scenario of livestock sector (**Ghosh *et al.*, 2013**).

**Kakar *et al.* (2013)** studied production pattern of sheep and goats in the Qila Abdullah

district of Balochistan. The findings of the study reveal that the average capital cost on animal was Rs.450, while feeding cost was Rs.3,079, medication and vaccination charges were Rs. 26, labour charges Rs. 135, marketing charges Rs. 16 and miscellaneous charges Rs. 9 and an accumulated overall per animal recurring cost was Rs. Rs.3 264.65 per animal per year. Producers received gross revenue of Rs.5,252 from the sale of animals, manure and wool as against an expenditure of Rs.3,824. The overall net returns worked out to be Rs.1,428 per animal per annum. The farmer earned Rs. 1.38 (1:1.38) on one rupee investment. A breakdown of consumer's rupee reveals that the producer shared 68 paise from the consumer's rupee and pocketed ₹0.38 against the cost of one rupee.

**Khalil *et al.* (2013)** conducted a technical evaluation of sheep and goat farms in North West coast of Egypt. The results reveal that the average cultivated area was 58.66, 96.36 and 116.63 feddan for small, medium and large farm sizes, respectively. Average per annum gross margin for a sheep was L.E. 478, 676 and 722 for small, medium and large size farms, respectively. While in the case of goat, it was L.E. 388, 452 and 403 for small, medium and large farm size farms, indicating economies of scale.

**Naveen Kumar *et al.* (2013)** investigated Kenguri breed of sheep as mutton breed in southern Karnataka, India. The study indicates that male lambs of about two months of age from their home track were traded at shandies of South Karnataka with market price of lamb ranging from ₹2,000 to ₹2,600 based on the season of sale and prevailing demand. Local farmers reared animals for about 12 months before selling them in the market with the period of rearing depending on season, crop harvesting and future festivals.

**Pandian *et al.* (2013)** found the concentrates, green fodder and labour having a significant influence on milk production in the study area. Dry fodder and veterinary charges did not have a significant influence on milk production in the study area. The study shows that concentrates, labour and veterinary charges were being under-utilised in the region. More of these resources might further increase milk production in the area. On the other hand, green fodder and dry fodder were being over-utilised and hence, there was need for rationalising the use of these resources. They study called for an optimal utilisation of labour in the milk production system, as it was a relatively scarce resource in urban areas.

**Prasad *et al.* (2013)** studied the economics of goat farming under the traditional low input production system in Uttar Pradesh. The results of the study reveal that small flock size (<15) was most profitable, followed by flock size of 16-30, 31-45 and >45. The net return worked out to be ₹1,348, ₹1,148, ₹974 and ₹865 per goat per annum, respectively. The net profit per goat per annum decreased linearly with an increase in flock size due to inadequate nutrition and management practices followed by larger goat keepers. Sale of goats was the major source of income (69.90%), followed by sale of milk (31.90%) and manure (8.20%). The net return per goat per annum worked out to be ₹1,207, ₹1,022, ₹966 and ₹916, respectively and the study points out that the shrinkage of grazing resources and the presence of a large population of non-descriptive goats (79.20%) were the major constraints in making the goat farming more remunerative, as opined by the respondent farmers.



**Raju (2013)** assessed the feed requirement and its impact on livestock output in India. The body size and dry matter requirement of cattle, buffalo, sheep and goats were worked out based on standard Ruminant Livestock Units (RLU) for assessing demand side requirement of feed and fodder. The feed resources were assessed based on the secondary data on crop production, land utilisation pattern for the last three years. The results showed a decline in the availability of feed resources. The overall dry matter availability from different sources had increased over the years from 341 million tonnes to 574 million tonnes for the period 1980-81 to 2011-12. The increased availability of feed resources was mainly due to an increase in the crop residues and, to a limited extent, the concentrates. The availability of greens remained more or less static over the years, the study observed.

**Seemi (2013)** estimated the returns on investment from livestock micro-enterprise in rural areas of Punjab province of Pakistan. The net present worth (NPW) technique was used for estimating returns on investment for livestock micro enterprise. The results of the study reveal that during a nine year period of lactation in the buffalo life cycle, five calves were produced, indicating that a single buffalo, with given moderate veterinary services, provided sustainable livelihood with a positive net present worth (NPW).

**Singh, et al., (2013)** observed a deficit of 65 per cent of green fodder and 25 per cent of dry fodder in the Indian livestock sector by 2025 (Additionally, increased pressure on land for production of human food crops from the increasing human population left little available land for further forage cultivation or feed production to nourish the livestock. As a result, livestock predominantly depended on crop residues as their main source of feed (>44%) in much of India (**Singh, et al., 2013**), which was notoriously low in nutritional quality, high in fiber and low in crude protein. These issues coupled with a rise in the demand for dairy products due to urbanisation and human population growth warranted research on a better utilisation of crop residues and improvement in diets for ruminants in India for increasing milk production.

**Dixit and Singh (2014)** conducted an economic analysis of goat rearing under the field conditions of Bundelkhand region. The analysis of the study shows that goats were maintained under mixed farming system by more than 73 per cent of the households belonging to small and marginal farmers and landless labourers. The average land holding size of goat keepers was 1.64 hectare, while small, medium and large categories of goat farmers constituted 12.4%, 73.0% and 14.6% of the total goat farmers, respectively. The average flock per household was 2, 8 and 23 for small, medium and large goat farmers, respectively, with an overall average of 9 goats. Major investment was made on goat purchase (92.7%) followed by construction of shed (5.72%) and purchase of equipment (1.58%). Hired grazing and feed were major items of expenditure accounting for 74.21% and 20.59% of the overall variable cost. The major source of income was sale of goats (83.28%) followed by sale of milk (13.42%). The overall net return per Rs.100 of investment over the variable cost, variable cost plus interest on fixed capital and imputed value of family labour was 75, 64% and 45 per cent, respectively.

The livestock sector, with a growth of about 4.9 per cent per annum (in value terms) during the last decade, has an excellent potential for higher growth. The global trend in animal production indicates a rapid and massive increase in the consumption of livestock products. Urbanisation has brought about a marked shift in the lifestyle of people towards the consumption of milk products, meat and eggs with a resultant increase in the demand for livestock products (**Ghosh and Palsaniya, 2014b**).

**Ramachandra et al. (2014)** estimated the growth trend in cattle and buffalo population of Karnataka using annual compound growth rate technique. The results of the study indicate that the cattle population decreased marginally at the rate of 0.45 per cent during the livestock census period of 1990-03 to 2003-07, while, the growth rate of buffalo population was positive at the rate of 0.41 per cent during same period.

**Samson and Frehiwot (2014)** carried out a spatial analysis of cattle and goat population in Ethiopia. The results of the study indicate that the livestock population viz. cattle, sheep and goat grew from 54.5 million to 103.5 million with an average annual increment of 3.40 million during the period 1996 to 2014. The current average national cattle, sheep and goat population per km<sup>2</sup> were estimated at 71, 33 and 29, respectively. The study also reveals that of the total livestock population, the country owned about 46 per cent of cattle, 43 per cent of sheep and 40 per cent of goats, reared within a 10 km radius from major livestock market centres and all-weather roads. However, 75 per cent of the country's land mass comprising 15 per cent of cattle, 20 per cent of sheep and 21 per cent of goat population was not accessible to market (greater than 30 km from major livestock market centres).

**Vijay et al., (2014)** examined production and supply of forage crop seeds and planting material with respect to the last five years. The study noted that even though there was a huge demand for fodder and fodder seeds, it was not being transformed into breeder seed indent and that the main reason for this low turnout was the absence of organised market. The prevalence of niche markets for fodder seed had resulted in a low turnout of big companies; otherwise, it is a highly potential seed sector. The intrinsic problems in forage seed production ensued non-inclination of both the public and private sectors, resulting in reduced quality and competition. The absence of seed chain in range grasses and legumes hampered their multiplication. Only a few public sector agencies like IGFR and SAUs were producing grass seeds, that too under truthful label (TL) category. Even though there was a huge demand from the forest department, difficulties in improving production and harvesting procedures deterred the seed sector's growth. The fodder seed production was complicated is compared to the regular field crops because the commercial product of fodder crops was vegetative part instead of seed and also the forage crops include grasses and legumes which are not domesticated and not under regular cultivation. Thus, the seed production from fodder crops faced multifaceted challenges at different levels. Indian Grassland and Fodder Research Institute being a pivotal Institute working on fodder, was involved in fodder seed production and supply at different levels.

**Birhan and Adugna (2015)** conducted a theoretical review to understand the availability of feed resources and associated risks in Ethiopia. Natural pastures, crop residues and agro-industrial by-products were found to be the major sources of animal feed in Ethiopia. The authors found that natural grazing land had reduced due to the faster growth of the country's population. On the other hand, the remaining uncultivated pasture land also had declined in terms of forage production due to overgrazing and a reduction in soil fertility.

**Prem, et al (2015)** estimated the district level availability and requirement of livestock feed and fodder in Rajasthan, using secondary data of triennium ending 2008-09. Availability of dry fodder and concentrates was estimated using appropriate conversion ratios to different field crop production, while green fodder was estimated by applying per hectare yield to different fodder sources. The requirement was worked out by converting livestock into adult cattle units and multiplying by per unit consumption capacity. The annual availability of feed and fodder in the state was estimated at 51.54 million tonnes as against the requirement of 68.61 million tonnes and thereby a deficit of around 25% per annum. The feed deficiency was estimated almost in all the districts, excepting the districts of Hanumangarh, Bikaner, Jaisalmer, Churu and Ganganagar. The eastern and south eastern districts were deficient in green fodder, whereas western and southern hill districts were deficient in dry fodder. Other critical dimensions were low roughage: concentration ration (1:0.06) and high population pressure on pasture and grazing lands. The policies towards the development of silvi-pastoral model, creation of fodder banks/storage facilities, strengthening of extension system, developing of drought resistant and high-yielding varieties, crop varieties with an emphasis on fodder component need priority attention.

**Roop and Surendar (2015)** worked out the relative share of livestock population using Compound Annual Growth Rate (CAGR) in Haryana. The results of the study reveal that the number of livestock had undergone substantial changes in terms of composition over the years. An exponential trend was used to calculate the compound growth rate. The population of buffaloes, sheep, goats, horses and ponies and total livestock increased at the compound annual growth rate of 2.92 per cent, 1.99 per cent, 0.69 per cent, 1.32 per cent and 1.87 per cent, respectively. On the contrary, the population of cattle and camels exhibited a negative growth rate of -0.72 and -1.92 per cent, respectively.

A study on the present demand and supply of fodder production was also undertaken in different districts of Karnataka (**Kamardi et. al., 2017**). The results reveal that most of the districts (12 out of total 29) were less vulnerable to fodder deficit and besides acting as surplus districts to fulfill the fodder requirements of other deficit districts of Karnataka, while 8 and 9 districts out of 29 were under highly vulnerable and moderately vulnerable categories, respectively. The authors recommended that the government improve the fodder production status in Karnataka through proper procurement, transportation, conservation and distribution of excess fodder to the deficit districts, and organise fodder banks for supplying seeds and root slips at reasonable rates in adequate quantities to the farmers.

A USDA report by **Landes et al. (2017)** also found a shortfall in the actual feed use at about 11% for dry fodders, 33% for green fodders, and 35% for feed concentrates. According to the study, the use of concentrate feeds for dairy production was relatively less in India, with most concentrates fed to dairy animals consisting of mixes produced on farm using locally available ingredients. The study observed that future production prospects would depend heavily on productivity gains, primarily through improved breeding and feeding practices, and demand for feeds.

**Earagariyanna et al., (2017)** assessed the production and requirement of fodder in India using secondary data from NATP and 19<sup>th</sup> livestock census. The study reveals that fodder requirement in India was at 883.95 Mt of green fodder and 583.66 Mt of dry fodder, whereas the estimated fodder production was at 664.73 Mt of green fodder and 355.93 Mt of dry fodder. Hence, the study emphasised the need for undertaking adequate policy and research initiatives to minimise the existing gap of 218.22 Mt of green fodder and 227.73 Mt of dry fodder, besides strengthening the existing fodder resources. The findings of the study were expected to help policymakers of the country in designing trade strategies to maximise benefits from livestock production.

**Kumar et al (2018)** while studying the constraints faced by livestock feed and fodder traders in Gujarat, observed that feed and fodder were the key pillars of livestock sector and that the concentrate feed business was somewhat organised, but trading was highly unorganised for all feed as well as green and dry fodder business. An exploratory study was conducted to find out the constraints faced by the traders and the retailers of the livestock feed and fodder. The study was conducted in Gujarat during 2017 and 50 traders from 10 taluks (2 taluks from five selected districts) were interviewed using a pre-structured survey schedule. The findings reveal that the biggest constraint perceived by the traders is less remunerative business of feed and fodder, followed by the presence of many competitors in the trading and retailing.

**Niti Aayog (2018)** in its latest report estimated the deficit of dry fodder (10%), concentrates (33%) and green fodder (35%). It reported that the deficit was likely to widen by 2020-21 due to crop diversification from cereals to commercial crops, affecting the availability of crop residues. Insecurity over 'feed and fodder' was observed for the livestock population in the country due to limited land under fodder crops remains and stagnated for the last 25 years. The report proposed providing fodder seeds to dairy farmers and ensuring the availability of green fodder locally in plenty and strengthening of farms in fodder seeds & fodder production.

**Meena et al. (2018)** conducted a study related to demand and supply of livestock feed and fodder resources in Rajasthan using secondary data of triennium ending (TE) 2013-14 on land utilisation pattern, crop production and livestock population. The annual supply of feeds and fodders in the state were estimated at 60.11 m tonnes on DM basis as against the demand of 76.27 m tonnes showing a net deficit of 16.15 m tonnes. The state had a potential dry matter supply of 60.11 m tonnes, of which crop residues, green roughages and concentrates accounted for 60.91%, 27.99% and 11.10% respectively.

**Raju *et al* (2018)** assessed the availability of livestock and poultry feed resources based on the extrapolation of secondary data from livestock census (2012) and land utilisation and crop production patterns in Telangana. The study shows that, overall, dry matter (DM) availability in the state was at about 19.47 million tonnes (Mt) from various feed resources, while availability of green forage, dry forage and concentrate feed resources was at 2.38, 15.0 and 2.1 million tonnes, respectively. Crop residues contributed 77 per cent of the total DM supply for livestock in Telangana. Paddy straw and maize crop were the major crop residues available in the state. Total DM availability, including livestock and poultry, was estimated at 84 per cent and the deficit at around 16 per cent. The study concluded that there was a severe shortage of green forages and concentrates to meet the requirements of livestock and poultry.

**Reddy *et al* (2018)** assessed the feed resources availability for livestock in the Semi-Arid Region of Andhra Pradesh. The results show an overall DM availability of 8.4 million tonnes (Mt) from various feed resources. With regard to green forage DM availability, the main portion of greens was contributed by the public secondary grazing area. The availability of DM as dry fodder or crop residues was estimated at 6.18 mt with crop residues contributing 76.2 per cent of the total DM supply for livestock in the region. Major crop residues included cereal straws (54%), followed by legume straws (32%) and sugarcane residues (14%). The total availability of concentrate ingredients for livestock (including poultry) in the region was estimated at 0.84 Mt. Although the concentrates contributed significantly in terms of nutrients, the total contribution towards the overall DM availability was quite less (9%).

The shortage was identified by (**Samanta *et al*, 2019**) in their study on Livestock feed and feeding practices in South Asia. According to them, the livestock of South Asia primarily relied on agricultural crop residues (straw and stovers), shrubs and tree leaves, roadside grasses, pastureland, kitchen wastes to meet the roughage requirement. It was found that very limited land was allocated to fodder production which, in turn, led to a huge shortage of green fodder in most of the South Asian countries against the requirement.

## **1.7 Data and Methodology**

The present study was conducted using both primary and secondary data collected from the selected states of country. The secondary data on livestock population of all selected states were compiled from different Quinquennial Livestock Censuses. The Census provides livestock population by region, species, sex, age, and purpose. For the present study, state-wise data on livestock population was collected from the Department of Animal Husbandry and Dairying, Government India, for different species viz., cattle, buffalo, sheep and goat for the recent census periods 2012 and 2019. Further, the secondary data on the area under fodder was collected from various issues of Land Use Statistics and also from the Departments of concerned Animal Husbandry, Dairy and Fishery for the study.

The study was conducted in the following states viz., West Bengal, Haryana, Gujarat, Rajasthan, Karnataka, Kerala and Uttar Pradesh by respective Agro-Economic Research Centres. The selection of states for conducting the study was carried out as suggested by

Ministry of Animal Husbandry, Dairy and Fishery, Government of India. For the study, districts were selected based on the livestock population from the available secondary data. A proportionate sampling technique was applied to the sample size of districts across selected states. To select districts for the study from every state, first we collected district-wise livestock population. Based on the population size of Cattle, Buffalo Sheep and Goats ranks were given to individual districts, and later, we took average of the obtained ranks of individual districts. The districts with top three ranks were selected representing different regions of every state for the study. From every selected state, a total of 120 Cattle rearing farmers, 120 Buffalo rearing farmers and 120 Sheep & Goat rearing farmers with a net sample households of 291 from Gujarat, 246 from Haryana, 269 from Karnataka, 217 from Kerala, 186 from Rajasthan, 247 from Uttar Pradesh and 150 sample households from West Bengal, totally 1,606 households across the states were surveyed with a pre-prepared questionnaire (**Table 1.3**). The number of farmers surveyed mainly based the population proportion of cattle, Buffalo and Sheep & Goat in the districts was the basis for the number of farmers to be surveyed i.e. from the selected districts of every state, based on the proportion of population, the sample size was determined. Villages were selected based on the density of animal population details available with respective district animal husbandry department. The cattle rearing farmers included both cross-breed and indigenous cows, bulls and oxen or calves, a farmer rearing all kinds of animals was considered as more than one sample.

Agricultural Development and Rural Transformation Centre (ADRTC), Institute for Social and Economic Change (ISEC), Bengaluru, co-ordinate the project and also conducted the study in Karnataka, followed by AERC- Visva-Bharati in West Bengal, AERC-Delhi in Haryana, AERC- VV Nagar in Gujarat and Rajasthan, AERC- Chennai in Kerala and AERC- Allahabad in Uttar Pradesh.

To understand and analyse the demand and supply of feed and fodder, primary data was collected at the field level through a sample survey method. The reference period of the study was 2019-20 agricultural year. The household survey covered the socio-economic characteristics of livestock farmers i.e., availability, production and recommended practices of feed and fodder resources for their livestock. To meet the objectives of the present study, the collected primary and secondary data were scrutinised, tabulated and analysed by employing various analytical tools. Further, various conversion factors developed by the NATP, FAO and NDDDB were used to estimate the feed and fodder requirement and nutritional requirement of various categories of livestock, while estimating and forecasting feed and fodder requirement in this study.

## **1.8 Organisation of the Report**

For expositional convenience, the present study report has been organised in nine chapters in a logical sequence. The introductory chapter presents the introductory notes, need and scope of the study and sets out the main objectives of the study. It also outlines the data and methodology used for selection of states/ districts/ blocks/ sample households, sample size, analytical and conceptual framework and concepts used in the study. In Chapter II, the status

of area, production and productivity of major green and dry fodder crops in the states is presented. Chapter III, covers the growth pattern of major livestock population in the states and also an analysis of major trends in dairy sector, livestock production and milk productivity across the selected states using secondary data. The socio-economic characteristics of sample household are presented in Chapter IV. Chapters V and VI cover feed and fodder availability (supply) and requirement (demand). Chapter VII deals with the economics of livestock management and constraints faced by the sample households. Chapter VIII dwells on the post-harvest management techniques and benefits received from the government for livestock production, followed by summary, conclusions and policy suggestions in Chapter IX.

**Table 1.3: Sample States based on Willingness of AERCs Participation**

AERCs	States	Districts	Cattle	Buffalo	Goat & Sheep	Total	HH
AERC, VV Nagar	Gujarat	Banas Kantha (north)	60	64	42	166	291
		Panch Mahals (central)	42	40	62	144	
		Surat (south)	18	16	16	50	
		Subtotal	120	120	120	360	
	Rajasthan	Barmer (western)	44	73	77	194	186
		Ajmer (Eastern)	22	19	20	61	
		Udaipur (southern)	54	28	23	105	
		Subtotal	120	120	120	360	
AERC, Delhi	Haryana	Bhiwani (south)	31	46	47	124	246
		Hisar (north)	38	44	33	115	
		Sirsa (central)	51	30	39	120	
		Subtotal	120	120	120	360	
ADRTC, ISEC, Bengaluru	Karnataka	Chitradurga (central)	23	16	51	90	269
		Belgaum (north)	48	89	57	194	
		Hassan (south)	49	15	12	76	
		Subtotal	120	120	120	360	
AERC, Chennai	Kerala	Ernakulam (central)	44	40	40	124	217
		Mallapuram (north)	34	62	44	140	
		Kollam (south)	42	18	36	96	
		Subtotal	120	120	120	360	
AERC, Allahabad	Uttar Pradesh	Bahraich (Eastren)	46	47	46	139	247
		Kheri (Central)	56	44	43	143	
		Agra (western)	18	29	31	78	
		Subtotal	120	120	120	360	
AERC, Visvabharthi	West Bengal	Murshidabad (South)	28	40	41	109	150
		Maldah (North)	23	28	33	84	
		Paschim Medinipur (western)	69	52	46	167	
		Subtotal	120	120	120	360	
<b>Grand Total</b>			<b>840</b>	<b>840</b>	<b>840</b>	<b>2520</b>	<b>1606</b>

\*\*\*\*\*

## 2. TRENDS IN AREA, PRODUCTION AND PRODUCTIVITY OF MAJOR GREEN AND DRY FODDER CROPS IN INDIA

The results obtained were put through a statistical analysis and are presented in the following chapters. In this second Chapter, the area, production and productivity of major green fodder and dry fodder crops and their growth pattern, green fodder yields from land use classification, and also with respect to all the states of the country and conversion factors used from calculation of feed resources (dry and concentrates), feed and fodder requirement of different species are presented in **Tables 2.1 to 2.18**.

### 2.1 Present Status of Area under Fodder Cultivation, Permanent Pastures and Other Grazing Lands in India

The area under fodder cultivation and pasture land is presented in **Table 2.1, Figure 2.1 and Appendix-1**. As can be observed from the table, the country holds 9137 thousand hectares under fodder crops as of 2014-15. Rajasthan (53.93%) accounts for the highest area under fodder crops, followed by Gujarat (9.36%), Uttar Pradesh (8.39%) and Haryana (4.60%). The overall share of selected states comes to 77 per cent of the total fodder area in the country. The country possesses 10,258 hectares of pasture and grazing land, of which highest share is accounted for by Rajasthan (16.32%), Karnataka (8.81%) and Gujarat (8.30%). In total share of selected states in pasture & other grazing land accounted to 34.32 per cent.

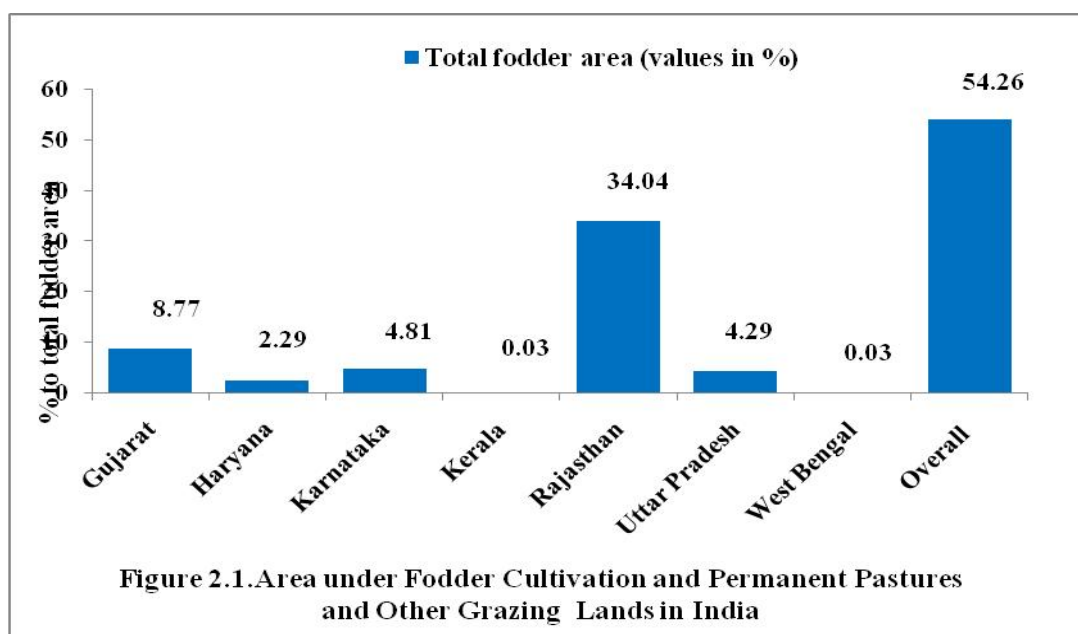
**Table 2.1: Area under Fodder Cultivation and Permanent Pastures and Other Grazing Lands in India**

(Area in 000 ha, as on 2014-15)

States	Fodder Crops	Percentage to Total	Pasture & Other Grazing	Percentage to Total	Total Fodder Area	Percentage
Gujarat	850	9.30	851	8.3	1,701	8.77
Haryana	420	4.60	25	0.24	445	2.29
Karnataka	28	0.31	904	8.81	932	4.81
Kerala	6	0.07	0	0	6	0.03
Rajasthan	4,928	53.93	1674	16.32	6,602	34.04
Uttar Pradesh	767	8.39	65	0.63	832	4.29
West Bengal	3	0.03	2	0.02	5	0.03
<b>Overall</b>	<b>7002</b>	<b>76.63</b>	<b>3,521</b>	<b>34.32</b>	<b>10,523</b>	<b>54.26</b>
<b>India</b>	<b>9137</b>	<b>100</b>	<b>10,258</b>	<b>100</b>	<b>19,395</b>	<b>100.00</b>

*Source: <https://www.indiastat.com>*





The results also show that the country accounts for 4.61 per cent of area under fodder crops of the total gross cropped area. The highest area under fodder crops is found in Rajasthan (20.33 % of GCA).

## 2.2 Trends in the Area under Major Green Fodder Crops across the States

The growth rate of area under fodder crops across the selected states for the period 2005-06 to 2015-16 has been estimated and presented, along with their area in **Table 2.2 and Appendix-2**. The results show a growth rate of area under fodder crops has increased at the rate of 1.68 per cent annually for the period 2005-06 to 2014-15 in the country and significant at one per cent level. Among the selected states, the highest positive growth rate is found in the case of Rajasthan (6.79%), followed by Kerala (1.82%) and significant at one and five per cent, respectively.

**Table 2.2: Area under Fodder Crops across the States (2005-06 to 2015-16)**

Sl. No.	States	Growth rates
1	Gujarat	-0.90***
2	Haryana	-5.79**
3	Karnataka	-2.45***
4	Kerala	1.82**
5	Rajasthan	6.79***
6	Uttar Pradesh	-1.48**
7	West Bengal	-2.06**
	<b>India</b>	1.68***

*Source:* Author estimates the growth rate using. <https://www.indiastat.com>

*Note:* \*\*\* Significant at one per cent, \*\* Significant at Five per cent. NS Non-Significant

While other states show a negative growth rates, the highest negative growth was found in Haryana (5.79%), followed by Karnataka (2.45%), West Bengal (2.06%), Uttar Pradesh (1.48%) and Gujarat (0.90%) and significant at one per cent and five per cent levels. The actual area under fodder crops ranges from 74.19 lakh hectares (2009-10) to 98.31 lakh hectares (2013-14).

### 2.3 Area and Productivity of Major Fodder Crops in the Country

The average yields of major fodder crops in the country are presented in **Table 2.3**. As per the data provided by NITI Aayog, (2018), fodder crops account for 7,965 thousand hectares of which sorghum accounts to highest area of 32.64 per cent (2,600 thousand hectares), followed by berseem (23.85%), Lucerne (12.55%), bajra and maize accounts to (11.30% each). Coming to the productivity of green fodder crops, berseem and lucerne grasses account for highest about 60 to 110 and 60-130 tonnes per hectare, respectively followed by fodder maize and fodder sorghum (30-35 tonnes per hectare). Similarly, the average yield of fodder pearl millet and fodder oats amounts to 35-50 tonnes per hectare respectively.

**Table 2.3: Area and Productivity of Major Green Fodder Crops**

Sl. No.	Crop	Area (000' ha)	Percentage Share in Total Area	Green Fodder Yield (t/ha)
1	Berseem (Egyptian clover)	1900	23.85	60-110
2	Lucerne (Alfalfa)	1000	12.55	60-130
3	Senji (Sweet clover)	5	0.06	20-30
4	Shaftal (Persian clover)	5	0.06	50-75
5	Metha (Fenugreek)	5	0.06	20-35
6	Lobia (Cowpea)	300	3.77	25-45
7	Guar (Cluster bean)	200	2.51	15-30
8	Rice bean	20	0.25	15-30
9	Jai (Oat)	100	1.26	35-50
10	Jau (Barley)	10	0.13	25-40
11	Jowar/Chari (Sorghum)	2600	32.64	35-70
12	Bajra (Pearl millet)	900	11.30	20-35
13	Makka (Maize)	900	11.30	30-55
14	Makchari (Teosinte)	10	0.13	30-50
15	Chara sarson and (Chinese cabbage)	10	0.13	15-35
	Total	7965	100.00	

*Sources: NITI Aayog (2018, p.59), <http://agropedia.iitk.ac.in/content/area-under-fodder-production-india>;*

### 2.4 Green Fodder Yields from Land Use Classification across the States

Green fodder yields based on land use classification are presented in **Table 2.4**. The green fodder availability was estimated through a potential production per unit hectare based on the

land use classification data **FAO (2012) and Ramachandra et al, (2007)**. The land utilisation pattern are classified into gross cropped area (GCA), forest area, cultivable wasteland, permanent pasture, other fallows and area under trees from which green fodder is extracted for livestock feeding. The fodder availability based on land use classification was calculated by using the following formula:

**Fodder availability from land Use:**

$$= \text{Respective land Use} \times \text{Green fodder production} \left( \frac{\text{tonnes}}{\text{ha year}} \right) \dots \dots \dots (1)$$

Similarly, the total fodder availability from all the categories of classification was calculated using the following formula:

**TGF**  
 $= (A * 40.93) + (B * 1.50) + (C * 5.00) + (D * 1.00) + (E * 1.00) + (F * 1.00) + (G * 1.00) \dots \dots \dots (2)$

**TGF= Total Green Fodder Availability**

It is revealed from the above Table that, fodder crop, account for a yield of 40.93 tonnes per hectare, followed by permanent pastures and other grazing lands yield (five tonnes per hectare), and forest area (three tonnes per hectare) on the assumption that only 50% of area is accessible for grazing. The rest of the indicators viz., cultivable wastelands, current fallows, other fallows and misc. tree crops and groves, not included in the net area sown, account for one tonne per hectare.

**Table 2.4: Green Fodder Yields based on Land Use classification**

Sl. No.	Land Use Category	Green Fodder (tonnes/ha/year)
1	Area under fodder crop	40.93
2	Forest area and on assumption that only 50% area was accessible for grazing	3.00*
3	Permanent pastures and other grazing lands	5.00
4	Cultivable wastelands	1.00
5	Current fallows	1.00
6	Other fallows	1.00
7	Misc. Tree Crops and Groves not Included in Net Area Sown	1.00

**Source:** *FAO (2012), Ramachandra et al, 2007* \* Indicates, 1.50 if the whole forest is considered.

## **2.5 Reported Geographical Area and Land Use Classification across the Selected States**

The details of geographical area (reported area) of the selected states of the country are presented in **Table 2.5**. The reported total geographical area of the country is at 3,077.52 million hectares of which the total area under forest is at 23.35 per cent of the total geographical area of the country. The area not available for cultivation is at 14.3 per cent of the total reported area, of which 8.8 per cent of area is under non-agricultural uses and 5.51 per cent of area is under barren and uncultivated lands. The total fallow land amounts to 8.68 per cent. The area available for cultivation amounts to 45.35 per cent of the reported area, and the total gross cropped area to 64.03 per cent of which 18.7 per cent is cultivated more than once. Area not available for cultivation is found highest in West Bengal (21.42%), followed by Gujarat (19.52%). Other uncultivated land other than fallow land is highest in Rajasthan (16.31%) followed by Gujarat (14.76%). Karnataka accounts for (11.07%) highest fallow land, followed by Rajasthan (10.4%) and Uttar Pradesh (7.05%). Haryana is at the top in terms of net area sown (80.58%) and gross cropped area (148.94%).

## **2.6 Trends of Area, Production and Productivity of Major Dry Fodder Crops**

As noted from the earlier reviews, cereals, pulses and oilseeds are the major dry fodder crops (crop residues) and concentrates sources for the livestock. Therefore growth rate of area, production and productivity of major dry fodder crops of the across the states and country are presented in the below section.

**Table 2.5: Reported Geographical Area and its Classification across the Selected States**

(Million hectare)

Particulars	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
Reporting area	190.69	43.71	190.5	38.86	342.67	241.7	86.84	3077.52
Forests	18.34 (9.62)	0.41 (0.94)	30.73 (16.13)	10.82 (27.84)	27.52 (8.03)	16.66 (6.89)	11.74 (13.52)	718.66 (23.35)
<b>Not available for cultivation</b>								
Area under non agricultural uses	11.71 (6.14)	3.95 (9.04)	14.76 (7.75)	5.41 (13.92)	19.45 (5.68)	31.23 (12.92)	18.5 (21.3)	270.77 (8.8)
Barren and Unculturable land	25.52 (13.38)	1.13 (2.59)	7.93 (4.16)	0.13 (0.33)	23.95 (6.99)	4.53 (1.87)	0.1 (0.12)	169.45 (5.51)
Total	37.23 (19.52)	5.08 (11.62)	22.69 (11.91)	5.54 (14.26)	43.4 (12.67)	35.76 (14.8)	18.6 (21.42)	440.22 (14.3)
<b>Other uncultivated land excluding fallow</b>								
Permanent pasture and other grazing land	8.51 (4.46)	0.25 (0.57)	9.07 (4.76)	(0)	16.72 (4.88)	0.65 (0.27)	0.02 (0.02)	102.61 (3.33)
Land under miscellaneous tree crops and groves	0.04 (0.02)	0.08 (0.18)	2.76 (1.45)	0.03 (0.08)	0.21 (0.06)	2.91 (1.2)	0.5 (0.58)	30.93 (1.01)
Culturable waste land	19.6 (10.28)	0.44 (1.01)	4.09 (2.15)	0.99 (2.55)	38.95 (11.37)	3.95 (1.63)	0.16 (0.18)	122.86 (3.99)
Total	28.15 (14.76)	0.78 (1.78)	15.92 (8.36)	1.02 (2.62)	55.88 (16.31)	7.51 (3.11)	0.68 (0.78)	256.39 (8.33)
<b>Fallow land</b>								
Fallow land other than current fallow	0.16 (0.08)	1.3 (2.97)	6.56 (3.44)	0.55 (1.42)	19.66 (5.74)	5.47 (2.26)	0.11 (0.13)	113.08 (3.67)
Current fallows	3.79 (1.99)	0.93 (2.13)	14.53 (7.63)	0.7 (1.8)	15.97 (4.66)	11.61 (4.8)	3.28 (3.78)	154.1 (5.01)
Total	3.95 (2.07)	2.23 (5.1)	21.09 (11.07)	1.25 (3.22)	35.63 (10.4)	17.08 (7.07)	3.39 (3.9)	267.18 (8.68)
Net area sown	103.02 (54.02)	35.22 (80.58)	100.06 (52.52)	20.23 (52.06)	180.24 (52.6)	164.69 (68.14)	52.43 (60.38)	1395.06 (45.33)
Total cropped area	115.22 (60.42)	65.1 (148.94)	120.09 (63.04)	26.28 (67.63)	250.14 (73)	262.03 (108.41)	98.81 (113.78)	1970.54 (64.03)
Area sown more than once	12.2 (6.4)	29.88 (68.36)	20.02 (10.51)	6.05 (15.57)	69.89 (20.4)	97.34 (40.27)	46.38 (53.41)	575.48 (18.7)

**Source:** [http:// www.indiastat.co](http://www.indiastat.co); **Note:** Values in parentheses indicate percentage share to the reported geographical area

### 2.6.1. Selected State-Wise Trends in Area, Production and Productivity of Paddy, Wheat, Ragi and Maize

The details of selected state-wise trends in area, production and yield of paddy, wheat, ragi and maize are presented in **Table 2.6**. In the case of paddy, growth rate of area accounts for (0.20%), with a production growth of 1.89 per cent and a yield growth rate of 1.70 per cent in the country and all are significant at one per cent level. Among the selected states, Rajasthan accounts for the highest area growth of 6.30 per cent, followed by Haryana (2.20%), Gujarat (1.33%), Kerala and Uttar Pradesh one per cent each and the least in West Bengal (0.50%), while negative growth rate found in the case of Karnataka. Similarly, highest production growth rate states are Rajasthan (8.57%), Haryana (3.21%), Gujarat (2.71%) and West Bengal (1.61%) and all are significant at one per cent level. The states which are statistically not significant in growth are: Karnataka, (1.24%), Uttar Pradesh (2.50%) and Kerala (-2.50%).

The highest yield growth rate is found in the case of Rajasthan (2.20%), followed by Kerala (1.51%), Gujarat (1.37%), Haryana, Karnataka and West Bengal all together contributing about one per cent with a significance at various levels. The lowest yield growth rate found in the case of Uttar Pradesh (0.50%). In the case of wheat, the country accounts for an area production and yield growth rate of 0.29 per cent, 1.85 per cent and 1.55 per cent, respectively and significant at various levels. States with the highest negative growth rate in area under wheat include West Bengal (-9.83%), Karnataka (-5.40%), Gujarat (-4.15%) with a significance at various levels and rest of the states are not significant. The major states which contribute significantly to the production growth rate of wheat are Rajasthan (2.72%) followed by Uttar Pradesh (1.23%) and a negative growth rate are West Bengal (-9.77%) followed by Gujarat (-4.15%), Karnataka (-2.90%) and Haryana (-0.04%), while the highest productivity growth is accounted for Karnataka (2.55%), followed by Rajasthan (1.82%), Uttar Pradesh (1.23%) and West Bengal (0.05%), while a negative growth rate found in the case of Gujarat and Haryana. It is interesting to note that excepting Rajasthan, the rest of the states statistically not significant.

The growth rate of area production and yield of ragi in the country for the period of 2010-11 to 2019-20 reflected a negative growth rate of (-2.70%), (-3.12%) and (-0.42%), respectively. In the case of ragi area, all the selected states show negative growth. West Bengal account for the highest negative growth of (-11.39%) followed by Gujarat (-4.10%) and the lowest in the case of Karnataka (1.82%). A similar trend is noticed in the case of ragi production. Again, West Bengal accounts for the highest negative growth of (-10.69%) followed by Karnataka (-4.13%) and the least in the case of Kerala (-1.26%). Excepting West Bengal, the rest of the selected states are statistically not significant. It is interesting to note that the yield growth rate of Kerala state accounts for the highest significant growth of (4.41%) and the rest of the states reflected a meagre growth that is not statistically significant. Area production and productivity of maize at an all India level account for a growth rate of area (1.00%), with a production growth of (3.41%) and yield growth of (2.41%) and all are significant at one per cent level. Among the selected states, West Bengal accounts for the highest growth of area

(14.80%), production (19.52%), yield (4.73%) followed by Kerala state's growth rate of area (5.32%), production (10.49%), yield (5.17%) and all are significant at various levels. Excepting Uttar Pradesh, production and productivity growth rate of about four per cent, the rest of the states show a meagre growth rate that is not statistically significant.

### **2.6.2. Selected State-Wise Trends in Area, Production and Productivity of Bajra, Jowar, Small Millets and Barley**

The details of area, production and productivity growth of bajra, jowar, small millets and barley is presented in **Table 2.7**. In the case of bajra, the country accounts for an area growth of (-2.20%), production (0.50%) and productivity (1.70%). The state with the highest negative growth of area under bajra includes Gujarat (-9.41%) followed by Karnataka with Haryana and Rajasthan accounting about two per cent and the rest of the states accounting for a meagre growth. Similarly, Gujarat, Uttar Pradesh and West Bengal are the top three states in the case of bajra production. The major states which contribute significantly to the yield of bajra are Gujarat (6.41%) followed by Uttar Pradesh (1.50%) and all are significant at one per cent level. The rest of states contribute a meager growth that is statistically not significant.

The growth rate area production and yield of jowar at all India level reflected a negative growth rate of (-4.81%), production (-5.21%) and productivity (-0.44%). The states with the highest area growth include West Bengal (23.00%) followed by Rajasthan (10.23%), Haryana (-7.51%), Gujarat (-7.41%), Karnataka (-3.84%) and Uttar Pradesh (-2.27%). In the case of jowar production, again West Bengal occupies top position (25.60%) followed by Rajasthan (11.40%), Haryana (-7.00%), Gujarat (-5.50%) and Karnataka (-4.72%) and all are significant at various levels. On the contrary, West Bengal state reflects a negative growth of yield (about -15.80%). The rest of the states show a positive growth of jowar yield but their contribution is meagre (**Table.2.7**).

**Table 2.7** depicts, that the country area, production and productivity growth of small millets of (-6.52%), (-2.20%) and (4.30%), respectively. Small millets are grown majorly in West Bengal with an area growth of (26.01%) followed by Karnataka (4.00%), Gujarat (-48.00%), Kerala (-10.89%), Rajasthan (-5.40%) and Uttar Pradesh (-2.46%). In terms of production growth, West Bengal (26.69%) and Karnataka (9.81%) are in the forefront, while Rajasthan and Karnataka are at the top in respect of productivity. The rest of the states reflect a negative growth rate in respect of production and yield.

The details of area, production and productivity of Barley for the country are presented in **Table 2.7**. The table shows that the country has an area growth of (-1.83%) with a production growth of (0.11%) and a productivity growth of (1.94%). The major states with the highest growth of area and production under barley include West Bengal (15.21% & 12.93%), Rajasthan (2.13% & 3.29%) and Gujarat (-14.40% & 13.00%), while Uttar Pradesh, Rajasthan, Gujarat and West Bengal are the major states in terms of highest productivity.

### **2.6.3. Selected State-Wise Trends in Area, Production and Productivity of Groundnut, Food Grains, Pulses and Oilseeds**

The details of area, production and productivity of groundnut, food grains, pulses and oilseeds for the period of 2010-11 to 2019-20 are presented in **Tables 2.8**. In the case of groundnut, the table shows that the country area growth of (-1.53%), production (2.41%) and productivity (3.95%). The major states with more area under groundnut include Rajasthan (7.90%), Haryana (2.51%), West Bengal (1.80%), West Bengal and Gujarat (less than one%) and a negative growth is reflected in the case of Karnataka and Kerala. In terms of production, Rajasthan (9.72%), Gujarat (4.80%), West Bengal (4.31%) Haryana (2.91%) and Uttar Pradesh (0.40%) are the major contributors, while the highest productivity is accounted for by Gujarat, Rajasthan and West Bengal.



**Table 2.6: Selected State-Wise Trends in Area, Production and Productivity of Major Dry Fodder Crops (Paddy, Wheat, Ragi and Maize)**

Crops	Paddy			Wheat			Ragi			Maize		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
Gujarat	1.33**	2.70***	1.37**	- 4.10***	- 4.15**	- 0.04NS	-4.10***	-2.70NS	1.40NS	-2.21***	-0.41NS	1.80**
Haryana	2.20***	3.21***	1.10**	0.05NS	-0.04NS	- 0.06NS	-	-		-7.10***	-3.91***	3.21**
Karnataka	- 0.20NS	1.24NS	1.04**	- 5.40***	-2.90NS	2.55NS	-1.82NS	-4.13NS	- 2.31NS	0.40NS	-0.80NS	- 1.20NS
Kerala	1.00NS	-2.50NS	1.51**	-	-	-	-3.15NS	-1.26NS	4.41***	5.32**	10.49**	5.17***
Rajasthan	6.30***	8.51***	2.21***	0.80NS	2.72***	1.82***	-	-	-	-2.71***	-2.63NS	0.08NS
Uttar Pradesh	1.00NS	2.50NS	1.50NS	- 0.04NS	1.23NS	1.23NS	-	-	-	-0.60NS	4.00***	4.61***
West Bengal	0.50NS	1.61***	1.11***	- 9.83***	-9.77***	0.05NS	- 11.39***	-10.69**	0.70NS	14.80***	19.52***	4.73***
All India	<b>0.20NS</b>	<b>1.89***</b>	<b>1.70***</b>	<b>0.29NS</b>	<b>1.85***</b>	<b>1.55**</b>	<b>-2.70***</b>	<b>-3.12NS</b>	- <b>0.42NS</b>	<b>1.00***</b>	<b>3.41***</b>	<b>2.41***</b>

*Source:* Author estimates the growth rate using the data of <http://www.indiastat.com>

*Note:* \*\*\* Significant at one per cent, \*\* Significant at five per cent and NS Non Significant

**Table 2.7: Selected State-Wise Trends in Area, Production and Yield of Major Dry Fodder Crops**

**(2010-11 to 2019-20)**

Crops	Bajra			Jowar			Small Millets			Barley		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
Gujarat	- 9.41****	-3.00**	6.41***	-7.40***	-5.55NS	1.80**	- 48.00***	-50.91***	- 3.12NS	- 14.40***	-13.00***	1.40NS
Haryana	-2.33NS	-2.10NS	0.31NS	-7.51***	-7.00**	0.50NS	-	-	-	-	-	-
Karnataka	-2.60NS	-2.23NS	0.42NS	-3.84***	-4.72***	- 0.90NS	4.00NS	9.81**	6.00***	-	-	-
Kerala	-	-	-	-	-	-	- 10.89***	-16.52***	- 5.62NS	-	-	-
Rajasthan	-2.10**	-0.60NS	1.50NS	10.23NS	11.40NS	0.92NS	-5.40***	1.22NS	6.61NS	2.13NS	3.29NS	1.13***
Uttar Pradesh	0.01NS	1.51***	1.50***	-2.27***	-0.70NS	1.53NS	-2.46NS	-4.21**	- 1.76NS	-0.50NS	2.55***	3.10NS
West Bengal	-1.02NS	-1.34***	- 0.31NS	23.00***	25.60***	- 15.80**	26.01***	26.69***	1.00NS	15.21***	12.93***	-2.30**
All India	<b>-2.20***</b>	<b>0.50NS</b>	<b>1.70***</b>	<b>-4.81***</b>	<b>-5.21***</b>	- <b>0.44NS</b>	<b>-6.52***</b>	<b>-2.20***</b>	<b>4.30**</b>	<b>-1.83**</b>	<b>0.11NS</b>	<b>1.94**</b>

*Source:* Author estimates the growth rate using the data of <http://www.indiastat.com>

*Note:* \*\*\* Significant at one per cent, \*\* Significant at five per cent and NS Non Significant

**Table 2.8: Selected State-Wise Trends in Area, Production and Productivity of Major Dry Fodder Crops**

**(2010-11 to 2019-20)**

Crops	Groundnut			Total Foodgrains			Total Pulses			Total Oilseeds		
	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield	Area	Production	Yield
Gujarat	0.10NS	4.80NS	5.00NS	-3.00***	-2.00NS	1.04***	-0.33NS	3.20**	3.60***	0.77NS	2.77NS	2.07NS
Haryana	2.51NS	2.91NS	0.70NS	0.10NS	0.72NS	0.60NS	- 12.40***	-9.23***	2.93NS	1.61**	3.81**	2.20NS
Karnataka	-4.20**	-2.23NS	2.00NS	-6.00NS	-4.60NS	1.40NS	3.55***	5.23***	1.50NS	-5.23**	-2.50NS	2.70NS
Kerala	- 27.63***	-27.70***	0.10NS	-2.96**	-1.18NS	1.80***	-4.00NS	-1.93NS	1.98NS	-14.50**	-23.00***	- 8.62NS
Rajasthan	7.90***	9.72***	1.60NS	0.90NS	1.90NS	1.00NS	4.80***	6.01***	1.20NS	1.00NS	1.90NS	1.92**
Uttar Pradesh	0.70NS	0.40NS	- 0.30NS	-0.70NS	0.66NS	1.50NS	-0.50NS	1.56NS	1.98NS	1.20**	3.41**	2.23NS
West Bengal	1.80NS	4.31NS	2.70NS	-1.03***	0.33NS	1.39***	11.30***	11.70***	0.42NS	4.12***	5.20***	1.10NS
All India	<b>-1.53**</b>	<b>2.41NS</b>	<b>3.95**</b>	<b>0.20NS</b>	<b>1.92***</b>	<b>1.60***</b>	<b>2.10***</b>	<b>3.61***</b>	<b>1.57**</b>	<b>-0.60NS</b>	<b>0.31NS</b>	<b>0.90NS</b>

*Source:* Author estimates the growth rate using the data of <http://www.indiastat.com>

*Note:* \*\*\* Significant at one per cent, \*\* Significant at five per cent and NS Non Significant

The growth rate of area, production and productivity of total foodgrains in the country for the period of 2010-11 to 2019-20 are presented in **Table 2.8**. The total food grains account for an area growth of (0.20%) with a production growth of (1.92%) and a productivity growth of (1.60%) in the country and all are significant at various levels. In the case of production growth, a majority of the selected states show a negative growth rate excepting Haryana, Rajasthan, Uttar Pradesh and West Bengal. The highest productivity growth states are Kerala (1.80%) followed by West Bengal (1.39%), Gujarat (1.04%) and the rest of the states are statistically not significant.

The details of the area, production and productivity of Total Pulses for India are presented in Table 2.7. The table shows that the country has registered a total pulses area growth of (2.10%) with a production growth of (3.61%) and a productivity growth of (1.57%). The states with the highest area growth under pulses include West Bengal (11.30%) followed by Rajasthan (4.80%), Karnataka (3.55%), while negative growth is shown in the case of Haryana, Gujarat, Uttar Pradesh and Kerala. In terms of production growth, West Bengal is (11.70%), followed by Rajasthan (6.01%), Karnataka (5.23%), Gujarat (3.20%) and Uttar Pradesh (1.52%) and the rest of the states reflect negative growth rates. Gujarat and Haryana are at the top for productivity of pulses in the country and the rest of the states are below two per cent of growth rate. The country shows negative growth in the oilseed area (-0.60%), with a production growth of (0.31%) and productivity growth of (0.90%). The major states with a positive larger area growth under oilseeds include West Bengal, Uttar Pradesh, Rajasthan and Gujarat, while Kerala and Karnataka show a negative growth. Whereas, West Bengal (5.20%), Haryana (3.81%) and Uttar Pradesh (3.41%) are the major oilseed producing states and the highest productivity is accounted for by Karnataka, Haryana, Gujarat and Uttar Pradesh.

## **2.7 Conversion Factors for Feed Resources (Dry Fodder & Concentrates)**

**Table 2.9** presents the crop residues of various crops that form a portion of dry fodder consumed by livestock though the quantum of available crop residues is often difficult to estimate directly, as it is seldom quantified. The crop residues were considered as dry fodder whereas oil cakes, grains, brans and chunnies of major crops were considered as concentrates. The availability of dry fodder and concentrates from different crops was assessed from production data for recent years by using the following harvest and extraction conversion ratios.

It is clear from the table that the highest crop residues are constituted by sorghum, bajra/pearl millet, maize, ragi, small millets, other cereals, groundnut that range from 2 to 2.50, followed by paddy, wheat, barley, pulses that exhibited less than two harvest indices and the lowest crop residues is found in the case of sugarcane i.e., 0.25 harvest index. Next oil cake harvest indices of both crops show a 0.70 harvest index. Similarly, the grain extraction rate ranges from 0.02 to 0.10 for all the major crops. Brans and chunnies display 0.08 extraction rate for both paddy and wheat, whereas, only 0.03 in the case of pulses.

**Table 2.9: Conversion Factors for Calculation of Feed Resources  
(Dry Fodder & Concentrates)**

Crop	Harvest indices (HI)*		Extraction Rate (ER)	
	Crop residues	Oil Cakes	Grains	Brans and Chunnies
Paddy	1.30		0.02	0.08
Wheat	1.00		0.02	0.08
Sorghum	2.50		0.05	
Bajra/Pearl millet	2.50		0.05	
Barley	1.30		0.10	
Maize	2.50		0.10	
Ragi	2.00		0.05	
Small Millets	2.50		0.10	
Other cereals	2.00		0.10	
Pulses	1.70			0.03
Groundnut	2.00	0.70		
Oilseeds		0.70		
Sugarcane	0.25			

*Source: FAO (2012), Ramachandra et al., (2007)*

*Note: \*Harvest index is the ratio of a tonne of by-product to a tonne of primary crop harvested*

## 2.8 Feed Requirement by Different Species

The details of the total feed requirement of different species of livestock based on the NATP recommendation are presented in **Table 2.10**. Category-wise livestock data was collected from the Animal Husbandry Department and the requirement of feed and fodder was calculated individually, while the aggregate demand was estimated by summing up all the categories. It is evident from the table that the quantity of feed consumption for milch period is more as compared to the dry period. For milch period, the green fodder requirement of Cattle was estimated at 4.75 kg/animal/day, dry fodder at 5.50 kg/animal/day, concentrates at 0.64 kg/animal/day, Dry matter (DM) at 6.71 kg/animal/day, total digestible nutrients at 3.44 kg/animal/day and DCP at 0.27 kg/animal/day. Similarly, feed and fodder requirement of other animals was estimated and the details are given in **Table 2.10**.

**Table 2.10: Feed Fed to Different Species within the Household Premises**

(kg/ animal/ day)

Animal Category	Feed types			Nutrients		
	Green Fodder*	Dry Fodder	Concentrates	Dry Matter (DM)	Total Digestible Nutrients (TDN)	Digestible Crude Protein (DCP)
<b>Cattle</b>						
In-milk	4.75	5.50	0.64	6.71	3.44	0.27
Dry	3.40	4.02	0.40	4.83	2.46	0.18
Adult male	4.06	6.03	0.33	6.74	3.36	0.21
Young stock	2.18	2.13	0.18	2.62	1.33	0.10
<b>Buffalo</b>						
In-milk	5.96	6.34	1.05	8.14	4.25	0.37
Dry	5.44	4.95	0.52	6.28	3.21	0.25
Adult male	4.04	7.47	0.36	8.06	3.99	0.24
Young stock	2.29	2.22	0.19	2.74	1.39	0.10
Goat	1.04	0.20	0.06	0.49	0.27	0.03
Sheep	1.01	0.20	0.04	0.46	0.24	0.03
Others**	2.35	6.72	0.49	7.08	3.54	0.22

*Source: NATP project database*

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### 3. GROWTH PATTERN OF MAJOR LIVESTOCK POPULATION IN INDIA

This chapter presents the details of livestock population, growth pattern of livestock and their main products and conversion factor for ruminant livestock units.

#### 3.1 State-Wise and Species-Wise Livestock Population of India

The state-wise livestock population of the country is presented in **Table 3.1**. The table shows that the country is home to a population of 536.76 million of livestock. Among the selected states, Uttar Pradesh accounts for the highest livestock population at 68.01 million (about 12.67 per cent of the total livestock population), followed by Rajasthan at 56.80 million (10.58%), West Bengal at 37.48 million (6.98%), Karnataka 29.01 million (5.41%), Gujarat 26.89 million (5.01%), Haryana 7.05 million (1.31%) and only 0.54 per cent (2.91 million of livestock population) in Kerala by reflecting the lowest livestock population in the selected states. The overall selected states account for a livestock population of 228.16 million (about 42.50 per cent of the total livestock population). The rest of the states' livestock population details are presented in **Appendix-3.1**. Similarly, the state-wise bovine population is presented in **Table 3.1**. The table shows that the country's bovine population stands at 303.75 million, of which the highest share is accounted for by Uttar Pradesh (17.13%), followed by Rajasthan (9.10%), Gujarat (6.64%), West Bengal (6.49%), Karnataka (3.77%), Haryana (2.07%) and the lowest bovine population found in the case Kerala (0.48%). The overall selected states account for the bovine population of 138.75 million (about 45.67 per cent of the total bovine population). The rest of the states' bovine population details are presented in **Appendix-3.2**.

The state-wise indigenous and exogenous cattle population is presented in **Table 3.1**. The table shows that the country accounts for 142.10 million indigenous cattle and 50.41 million crossbreed cattle which together come to 193.46 million. The states with the highest indigenous cattle population include West Bengal (11.04%), followed by Uttar Pradesh (9.08%), Rajasthan (8.17%), Gujarat (4.38%), Karnataka (3.21%), Haryana (0.67%) and the lowest indigenous cattle population is found in the case of Kerala (0.06%). The overall selected states account for the indigenous cattle population of 52.02 million (about 36.60 per cent of the total bovine population).

The rest of the states' indigenous cattle population details are presented in **Appendix-3.3**, whereas, the states with the highest number of Exotic Cattle are Uttar Pradesh (11.69%), followed by Karnataka (7.73%), Gujarat (6.71%), West Bengal (6.62%), Rajasthan (4.56%) and the least exotic cattle population found is in the case of Kerala (2.48%). The overall selected states account for the exotic cattle population of 20.93 million (about 50.42 per cent of the total exotic cattle population). The rest of the states' exotic cattle population details are presented in **Appendix-3.4**.

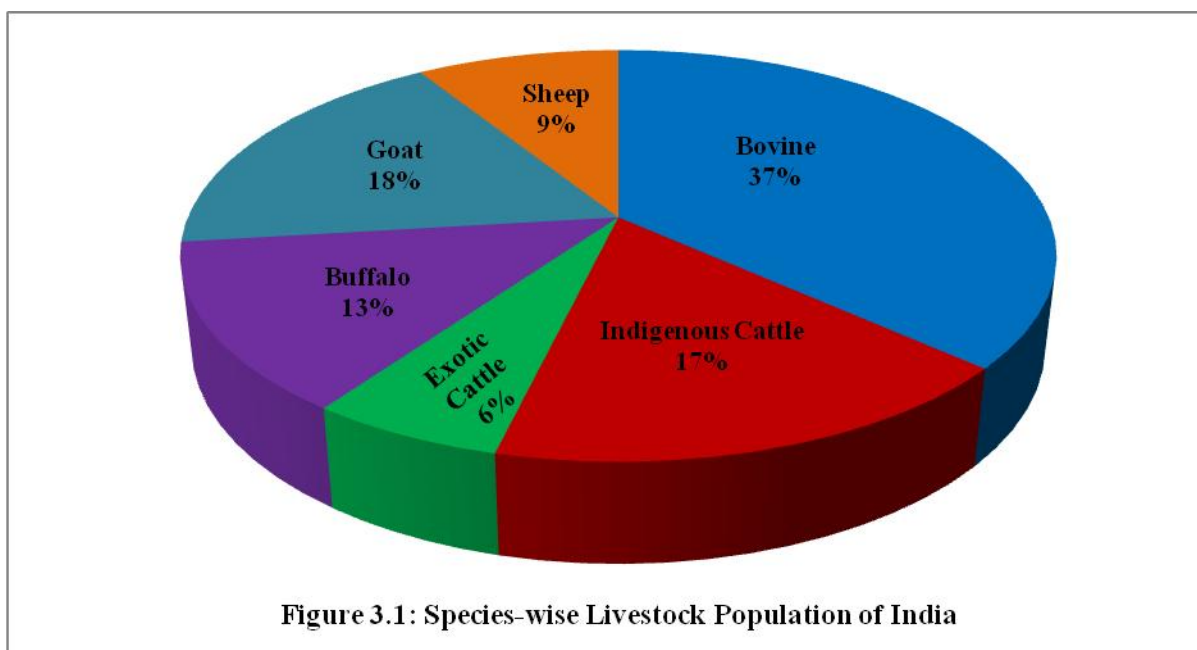
**Table 3.1: State-Wise and Species-Wise Livestock Population of India****(Millions)**

States	Bovine	Indigenous Cattle	Exotic Cattle	Buffalo	Goat	Sheep	Total Livestock
Gujarat	20.18 (6.64)	6.23 (4.38)	3.38 (6.71)	10.54 (9.60)	4.87 (3.27)	1.79 (2.41)	26.89 (5.01)
Haryana	6.30 (2.07)	0.95 (0.67)	0.87 (1.73)	4.37 (3.98)	0.33 (0.22)	0.29 (0.39)	7.05 (1.31)
Karnataka	11.45 (3.77)	4.56 (3.21)	3.90 (7.73)	2.98 (2.72)	6.17 (4.14)	11.05 (14.88)	29.01 (5.41)
Kerala	1.44 (0.48)	0.08 (0.06)	1.25 (2.48)	0.10 (0.09)	1.36 (0.91)	0.00 (0.00)	2.91 (0.54)
Rajasthan	27.63 (9.10)	11.61 (8.17)	2.30 (4.56)	13.69 (12.47)	20.84 (14.00)	7.90 (10.64)	56.80 (10.58)
Uttar Pradesh	52.04 (17.13)	12.90 (9.08)	5.89 (11.69)	33.02 (30.06)	14.48 (9.73)	0.98 (1.33)	68.01 (10.67)
West Bengal	19.71 (6.49)	15.68 (11.04)	3.34 (6.62)	0.63 (0.57)	16.28 (10.93)	0.95 (1.28)	37.48 (6.98)
<b>Overall</b>	<b>138.75</b> <b>(45.67)</b>	<b>52.02</b> <b>(36.60)</b>	<b>20.93</b> <b>(41.51)</b>	<b>65.34</b> <b>(59.48)</b>	<b>64.33</b> <b>(43.21)</b>	<b>22.97</b> <b>(30.93)</b>	<b>228.16</b> <b>(42.50)</b>
<b>India</b>	<b>303.76</b> <b>(100.00)</b>	<b>142.11</b> <b>(100.00)</b>	<b>50.42</b> <b>(100.00)</b>	<b>109.85</b> <b>(100.00)</b>	<b>148.88</b> <b>(100.00)</b>	<b>74.26</b> <b>(100.00)</b>	<b>536.76</b> <b>(100.00)</b>

*Source:* <https://www.indiastat.com>, *Note:* Values in parentheses indicate percentage share to total population

The buffalo population is presented in **Table 3.1** and **Figure 3.1**. The table shows that the country's buffalo population stands at 109.85 million. The states with the highest buffalo population include Uttar Pradesh (30.06%), Rajasthan (12.47%), Gujarat (9.60%), Haryana (3.98%), Karnataka (2.72%), West Bengal (0.57%) and the least buffalo population found in the case of Kerala (0.09%). The overall selected states account for the buffalo population of 65.34 million (about 59.48 per cent of the total buffalo population). The rest of the states' buffalo population details are presented in **Appendix-3.5**. The state-wise goat and sheep population is presented in **Table 3.1**. The table shows that the country is home to 148.84 and 74.26 million of goat and sheep population, respectively. The states with the highest number of goat population are Rajasthan (14.00%), followed by West Bengal (10.93%), Uttar Pradesh (9.73%), Karnataka (4.14%), Gujarat (3.27%), Kerala (0.91%) and the least goat population is in the case of Haryana. The overall selected states account for the goat population of 64.33 million (about 43.21 per cent of the total goat population). For the rest of the states, goat population details are presented in **Appendix-3.6**. The states with the highest number of sheep population are Karnataka (14.88%), Rajasthan (10.64%), Gujarat (2.41%), West Bengal (1.28%) and the lowest is in the case of Haryana (0.39%). The overall selected states account for a sheep population of 22.97 million (about 30.93 per cent of the total sheep population). For the rest of the states, sheep population details are presented in **Appendix-3.6**.





### 3.2 Growth Pattern of Major Livestock Population

The estimated growth rates of major livestock such as cattle, buffalo, sheep and goats are depicted in **Table 3.2**. The results show that the compound annual growth rate of cattle, buffalo, sheep and goats for the period of 1951-2019 was at 0.32, 1.38, 0.95, and 1.70 respectively, while the overall CAGR of the livestock population was at 0.90 per cent. In the case of cattle and buffalo populations, the CAGR for the period 1956-61 was the highest at 2.04 and 2.66 per cent, respectively, whereas, in the case of sheep and goats, the CAGR for 2003-07 (3.87%) and 1977-82 (4.73%), was the highest. The overall livestock population, CAGR for 1977-82 was the highest at 2.6 per cent. We also estimated the percentage change over cattle, buffalo, sheep, goat and total livestock populations for different census periods. The result shows that the percentage change over the period from 1951 to 2018-19 is the highest for goat and buffalo at 215.42 and 153.11, followed by sheep and cattle for 89.92 and 23.95 per cent, respectively. The percentage change in the total livestock population is 83.32 for the period from 1951 to 2018-19. The highest per cent change is observed for 1956-61 in the case of cattle (10.65%) and buffalo (14.03%), but for 1977-82 it is 18.93 per cent in the case of sheep and 26.99 per cent for goats (**Table 3.3**).

**Table 3.2: Livestock Population Growth Rates in India**

Compound Annual Growth Rate					
Year	Cattle	Buffalo	Sheep	Goat	Total Livestock
1951-56	0.43	0.68	0.1	3.26	0.93
1956-61	2.04	2.66	0.45	1.91	1.81
1961-66	0.07	0.69	1.07	1.19	0.51
1966-72	0.24	1.61	-1.16	0.88	0.55
1972-77	0.19	1.55	0.5	2.29	0.86
1977-82	1.35	2.39	3.53	4.73	2.6
1982-87	0.74	1.71	-1.29	2.96	1.2
1987-92	0.49	2.08	2.13	0.9	1.12
1992-97	-0.56	1.32	2.51	1.26	0.61
1997-03	-1.18	1.43	1.12	0.22	-0.01
2003-07	1.83	1.84	3.87	3.1	2.23
2007-12	-0.84	0.63	-1.88	-0.78	-0.68
2012-19	0.27	0.21	2.68	1.95	0.95
1951-19	<b>0.32</b>	<b>1.38</b>	<b>0.95</b>	<b>1.70</b>	<b>0.90</b>

*Note: Author calculation based on Source: <http://www.indiastat.com>*

**Table 3.3: Per Cent Changeover in the Livestock Population in India**

% Change in the Livestock population					
Year	Cattle	Buffalo	Sheep	Goats	Total Livestock
1951-56	2.19	3.46	0.51	17.37	4.71
1956-61	10.65	14.03	2.29	9.93	9.39
1961-66	0.34	3.52	5.47	6.08	2.59
1966-72	1.19	8.30	-5.66	4.49	2.76
1972-77	0.95	8.01	2.50	12.00	4.36
1977-82	6.92	12.55	18.93	25.99	13.71
1982-87	3.76	8.87	-6.28	15.71	6.13
1987-92	2.45	10.85	11.12	4.60	5.74
1992-97	-2.79	6.78	13.21	6.45	3.09
1997-03	-6.89	8.90	6.92	1.34	-0.08
2003-07	7.51	7.58	16.41	13.01	9.22
2007-12	-4.11	3.19	-9.07	-3.82	-3.33
2012-19	0.83	1.06	14.12	10.14	4.82
1951-19	23.95	153.11	89.92	215.42	83.32

*Note: Author calculation based on Source: <http://www.indiastat.com>*

### 3.3 Growth Pattern of Major Livestock Products

The compound annual growth rates of milk, wool and meat produced with their mean values are presented for the period 1980-81 to 2018-19 in **Table 3.4**. The average total production has increased for all the livestock products over the year at 146.74 mt, 44.19 mkg and 6.39

mt of milk, wool and meat production, respectively for the periods 1980-81 to 2018-19. The compound annual growth rate of milk and meat has increased at the rate of 4.41 and 9.83 per cent, respectively in contrast to wool production which has decreased at the rate of 1.13 per cent. The highest CAGR is found concerning milk production in recent years, that is, for the period 2010-11 to 2018-19 at 5.58 per cent and in the case of wool production at 3.04 per cent for 1980-81 to 1989-90 and in the case of meat production at 10.75 per cent for 2000-01 to 2009-10.

**Table 3.4: Growth Rates of Livestock Products in India**

Year	Milk		Wool		Meat	
	Average (Mt)	CAGR (%)	Average (m. kgs)	CAGR (%)	Average (Mt)	CAGR (%)
1980-81 to 1989-90	41.86	5.41	37.54	3.04	—	—
1990-91 to 1999-00	65.31	4.33	42.93	2.06	—	—
2000-01 to 2009-10	96.80	4.29	46.30	-1.79	2.75	10.75
2010-11 to 2018-19	150.11	5.58	44.31	-1.13	6.60	6.17
1980-81 to 2018-19	146.74	4.41	44.19	-1.13	6.39	9.83

*Note: Author calculation based on Source: <http://www.indiastat.com>*

### 3.4 State-Wise Value of Output from Livestock in India

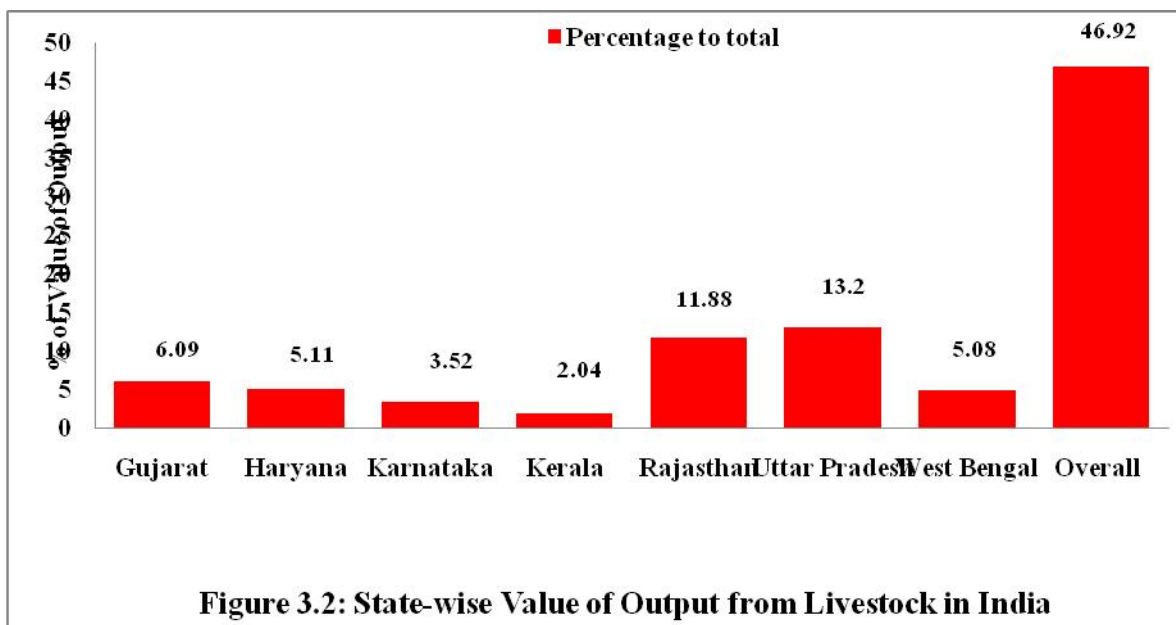
The state-wise value of output from livestock in India is presented in **Table 3.5** and **Figure 3.2**. The table shows the value of livestock output at about 6.80 lakh crore in the country during 2017-18, of which Rs.3.19 lakh crore comes from selected states (about 47 per cent of the total values). Among the selected states, the highest share is accounted for by Uttar Pradesh (13.20%), followed by Rajasthan (11.88%), Gujarat (6.09%), Haryana (5.11%), West Bengal (5.08%), Karnataka (3.52%) and the least contribution is found to Kerala (2.04%). For the rest of the states, details of output from livestock in India are presented in **Appendix 3.7**.

**Table 3.5: State-Wise Value of Output from Livestock in India**

(At Constant Prices, 2011-12)

States	2017-2018 (in lakh crores)	Percentage to total
Gujarat	0.41	6.09
Haryana	0.35	5.11
Karnataka	0.24	3.52
Kerala	0.14	2.04
Rajasthan	0.81	11.88
Uttar Pradesh	0.90	13.20
West Bengal	0.35	5.08
<b>Overall</b>	<b>3.19</b>	<b>46.92</b>
<b>India</b>	<b>6.80</b>	<b>100</b>

*Source: <https://www.indiastat.com>*



### 3.4.1 State-Wise Average Milk Yield of Cattle, Buffalo and Goat in India

The state-wise average milk yield per animal of different species for 2018-19 is presented in **Table 3.6**. The results show that at the all-India level, the average milk yield of crossbred and indigenous and non-descript cattle at 7.61, 3.85 and 2.5 kg/day respectively. The overall average milk yield from selected states of crossbred and indigenous and non-descript cattle at 8.10, 4.12, 3.44 indicating a higher yield level than all India level milk yield. In the case of indigenous and non-descript buffalo milk yield at 6.34 and 4.35 kg/day, Whereas, overall average milk yield of indigenous and non-descript buffalo at 5.97 and 4.72 kg/day from selected states, while the average milk yield of goats in the country at 0.45 kg per day and it is at 0.58 kg per day from selected states.

The average milk yield of crossbred cattle is highest in the states of Kerala (10.17 kg/day) and lowest in the state of West Bengal (6.28 kg/day), whereas Haryana and Rajasthan come under the category of indigenous cattle. Haryana and Rajasthan accounted for the highest average milk yield per animal per day in the case of indigenous buffaloes. Whereas, the highest milk yield of goat is found in Haryana (1.01 kg/day). In the rest of the states, details of the average milk yield of cattle, buffalo and goats in India are presented in **Appendix 3.8**.

**Table 3.6: State-Wise Average Milk Yield of Cattle, Buffalo and Goat in India (2018-19)**

States	Cattle			Buffalo		Goat
	Crossbred	Indigenous	Non-descript	Indigenous	Non-Descript	
Gujarat	9.32	4.65	3.84	5.39	4.44	0.48
Haryana	8.69	6.15	5.31	9.34	7.88	1.01
Karnataka	6.67	2.36	2.38	3.46	3.08	0.14
Kerala	10.17	2.02	3.1	5.35	4.23	0.69
Rajasthan	8.39	5.69	4.68	7.79	5.92	0.79
Uttar Pradesh	7.21	3.51	2.24	4.87	3.33	0.78
West Bengal	6.28	4.43	2.51	5.6	4.17	0.15
<b>Overall</b>	<b>8.10</b>	<b>4.12</b>	<b>3.44</b>	<b>5.97</b>	<b>4.72</b>	<b>0.58</b>
<b>India</b>	<b>7.61</b>	<b>3.85</b>	<b>2.5</b>	<b>6.34</b>	<b>4.35</b>	<b>0.45</b>

Source: -<https://www.indiastat.com>

### 3.4.2 State-Wise Contribution of Milk Production in India (2018-19)

The state-wise milk production in India during the period 2018-19 is presented in **Table 3.7**. The table shows that the country produces 187.74 million tonnes of milk annually. Out of which 95.46 million tonnes of milk production contributed by selected states. The states which account for the highest milk production in the country include Uttar Pradesh (16.26%), Rajasthan (12.61%), Gujarat (7.72%), Haryana (5.71%) and Karnataka (4.21%) occupying the top five positions among the selected states and the rest of the contribution is meagre. In the other states, details of average milk production in India are presented in **Appendix 3.9**.

**Table 3.7: State-Wise Contribution of Milk Production in India (2018-19)**

States	Milk Production (in million tonnes)	Per cent to all India Total 2018-19
Gujarat	14.49	7.72
Haryana	10.72	5.71
Karnataka	7.90	4.21
Kerala	2.54	1.36
Rajasthan	23.66	12.61
Uttar Pradesh	30.51	16.26
West Bengal	5.60	2.99
<b>Overall</b>	<b>95.46</b>	<b>50.85</b>
<b>India</b>	<b>187.74</b>	<b>100.00</b>

Source: <https://www.indiastat.com>

### 3.4.3 State-Wise Meat Production in India

The state-wise meat production from different categories of animals is presented in **Table 3.8**. The species-wise contribution to the total meat production in the country is the highest for

buffaloes (1545.83 thousand tonnes), followed by goat (1097.91 thousand tonnes), sheep (677.99 thousand tonnes) and the lowest meat production in the case of cattle (326.48 thousand tonnes). At the aggregate level, selected state contribution comes to 185.88 thousand tonnes of cattle meat, 862.13 thousand tonnes of buffalo meat, 151.18 thousand tonnes of sheep meat and 497.31 thousand tonnes of goat meat production. Across the selected states, Kerala contributes the highest cattle meat production (46.73%), followed by Karnataka (5.18%) and West Bengal (5.02%), respectively. Similarly, the highest buffalo meat production was found in the case of Uttar Pradesh (44.56%) and the lowest meat production was found in the case of Gujarat (0.06%). With respect to sheep and goats, the highest meat production comes from Rajasthan (7.59% and 7.16%) and the least meat production is found in the case of Gujarat. The details of meat production in n other states are presented in **Appendix 3.10**.

### 3.4.4 State-Wise Wool Production in India

The state-wise wool production in the country during 2018-19 is presented in **Table 3.9**. The table shows that the country produces about 40.42 thousand tonnes of wool annually. The highest wool-producing states in the country include Rajasthan (35.93%), followed by Karnataka (7.57%) and Gujarat (5.62%) which occupied the top three wool-producing states in the country while the rest of the states produce a meagre quantity. For the other states, details of wool production in India are presented in **Appendix 3.11**.

**Table 3.8 State-Wise Meat Production in India (2018-19)**

(in '000 tonnes)

States	Cattle	Buffalo	Sheep	Goat
Gujarat	0 (0)	0.87 (0.06)	0.43 (0.06)	0.78 (0.07)
Haryana	0 (0)	7.32 (0.47)	12.52 (1.85)	6.5 (0.59)
Karnataka	16.91 (5.18)	11.59 (0.75)	47.42 (6.99)	32.4 (2.95)
Kerala	152.57 (46.73)	97.51 (6.31)	0 (0)	22.18 (2.02)
Rajasthan	0 (0)	41.52 (2.69)	51.47 (7.59)	78.66 (7.16)
Uttar Pradesh	0 (0)	688.86 (44.56)	18.78 (2.77)	86.7 (7.9)
West Bengal	16.4 (5.02)	14.46 (0.94)	20.56 (3.03)	270.09 (24.6)
<b>Overall</b>	<b>185.88</b> <b>(56.93)</b>	<b>862.13</b> <b>(55.77)</b>	<b>151.18</b> <b>(22.30)</b>	<b>497.31</b> <b>(45.30)</b>
<b>India</b>	<b>326.48</b> <b>(100)</b>	<b>1545.83</b> <b>(100)</b>	<b>677.99</b> <b>(100)</b>	<b>1097.91</b> <b>(100)</b>

*Source:* <https://www.indiastat.com>

*Note:* Figures in parentheses indicate percentage to total

**Table 3.9: State-Wise Estimates of Wool Production in India (2018-19)**

States	Wool Production (in '000 tonnes)	Per cent to all India Total 2018-19
Gujarat	2.27	5.62
Haryana	0.72	1.78
Karnataka	3.06	7.57
Kerala	0.00	0.00
Rajasthan	14.52	35.93
Uttar Pradesh	1.32	3.26
West Bengal	0.76	1.88
<b>Overall</b>	<b>22.65</b>	<b>56.04</b>
<b>India</b>	<b>40.42</b>	<b>100</b>

*Source: <https://www.indiastat.com>*

### 3.5 Conversion Factors for Ruminant Livestock Units (RLUs)

An estimation of the feed requirement of the livestock has been done only for major ruminant species such as cattle, buffalo, sheep and goats as they consume a major share of feed resources. The body size and the dry matter requirement of cattle, buffalo, sheep, and goats have been worked out based on standard RLUs to minimize the variations. A cattle weighing 350 kg is assumed to represent one standard RLU and the feed and fodder requirement for ruminants (cattle, buffaloes, sheep and goats) has been calculated based on the RLU by assuming two per cent of dry matter intake per day by every Ruminant Livestock Unit (i.e., 7 kg dry matter for 350 kg body weight) which is in line with **Devendra (1997), FAO (2012), and Ramachandra et al., (2007)**. The details of conversion factors used for calculating the RLUs are presented in **Table 3.10**.

**Table 3.10: Conversion Factors for Calculating Ruminant Livestock Units (RLUs)**

Sl. No.	Species	Age (Years)	Conversion factor
A	Buffalo	>2.5	1.14
		1.0-2.5	0.50
		< 1.0	0.17
B	Cattle	>2.5	1.00
		1.0-2.5	0.34
		<1.0	0.11
C	Sheep/goat	>1.0	0.10
		<1.0	0.03

*Source: FAO (2012) and Ramachandra et al, (2007)*

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## 4. SOCIO-ECONOMIC CHARACTERISTICS OF THE SAMPLE HOUSEHOLDS

In this section, socio-economic characteristics, land use patterns, sources of irrigation, cropping patterns, classifications of animals and their values related to the sample households of selected states are presented.

### 4.1. Socio-Economic Characteristics of the Sample Households

The animal husbandry and livestock sector plays an important role in the rural economy of India. Animal husbandry plays a vital role in terms of providing an additional source of income to the farmers of the state. Animal products, for long, have also played an important role in the socio-economic life of the state. As per the sampling framework, Gujarat, Haryana, Karnataka, Kerala, Rajasthan, Uttar Pradesh and West Bengal were selected from among the states of India based on their willingness to participate. Out of a total of 1606 households- 291 from Gujarat, 246 from Haryana, 269 from Karnataka, 217 from Kerala, 186 from Rajasthan, 247 from Uttar Pradesh and 150 from West Bengal were selected for the study. The information about various socio-economic factors such as the size of family, education, age, income, experience in agriculture, dairy, sheep and goat rearing, etc., was collected from the sample households of the selected states. The obtained results are presented in **Tables 4.1 to 4.7**.

**Table 4.1: State-Wise Details of the Number of Households Surveyed, Age, Caste and Gender**

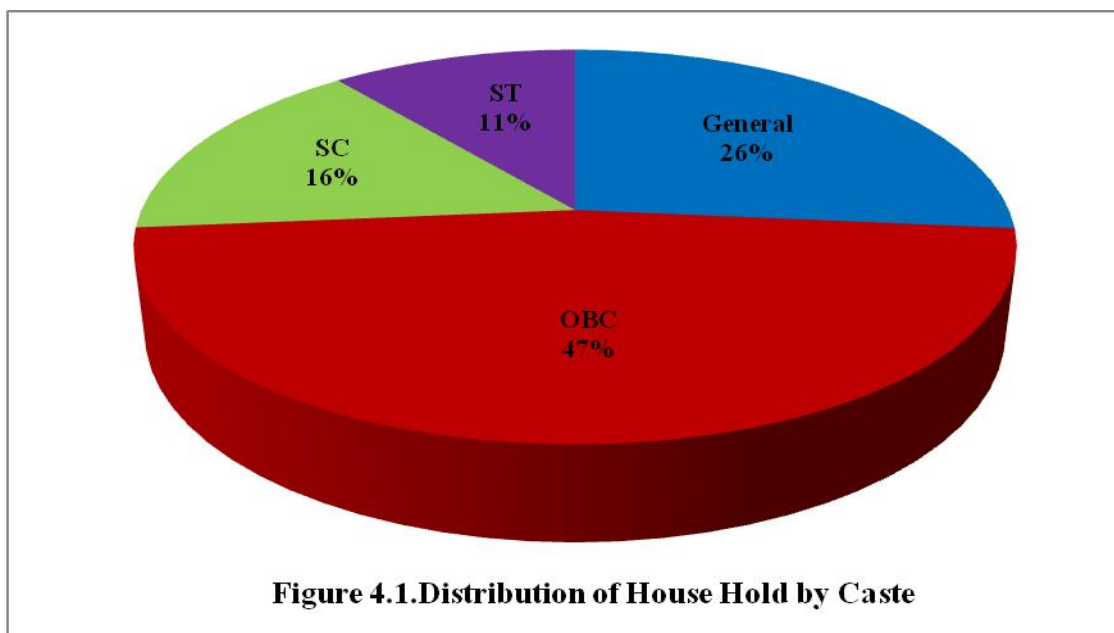
States	Number of HHs	Age (yrs.)	Caste (%)				Gender (%)	
			General	OBC	SC	ST	Male	Female
Gujarat	291	48.00	12.71	45.36	13.75	28.18	92.44	7.56
Haryana	246	43.57	32.50	25.20	42.30	—	93.09	6.91
Karnataka	269	48.00	18.96	60.59	7.81	12.64	93.68	6.32
Kerala	217	53.25	48.38	43.31	5.52	1.84	76.49	23.50
Rajasthan	186	47.10	18.28	61.83	4.84	15.05	93.01	6.99
Uttar Pradesh	247	48.00	19.43	61.54	18.22	0.81	90.69	9.31
West Bengal	150	48.00	46.67	24.67	13.33	15.33	96.00	4.00
<b>Total</b>	<b>1606</b>	<b>47.93</b>	<b>26.46</b>	<b>47.01</b>	<b>15.63</b>	<b>10.77</b>	<b>90.72</b>	<b>9.28</b>

*Source: Field survey data 2019*

The total number of households surveyed, age, caste and gender of the sample respondents are presented in **Table 4.1 and Figure 4.1**. The results show that the average age of the sample household heads is about 48 years, of which the highest age is found in Kerala (53.25.) and the least (44 yrs.) in the case of Haryana. The caste groups of the sample households of selected states are presented in the same Table. Most of the sample households belong to



OBC (46.67%) followed by General Category (26.46%), SC (15.63%) and ST (10.77%). Most of the households belong to the SC category in Haryana (42.30%) and Uttar Pradesh (18.22%) and ST in Gujarat (28.18%) and West Bengal (15.33%). The percentage of households headed by males is 90.72 and the least by females (9.28). The female-headed households are found highest in Kerala (23.50%).



*Source: Field Survey data 2019*

The educational status of households from the selected states is presented in **Table 4.2**. The results show that nearly 63 per cent of the household respondents are educated up to higher secondary, 32 per cent are illiterates and 17 per cent are educated up to primary level. Only 3.37 per cent of the household respondents are graduates and postgraduates and above about 1.24 per cent. A smaller number of illiterate farmers are found in Kerala and more in Gujarat, Haryana and Uttar Pradesh.

**Table 4.2: Educational Status of the Sample Households**

State	Education level (%)				
	Illiterate	Primary	Higher Secondary	Graduate	Post Graduate & above
Gujarat	48.50	17.90	31.60	1.40	0.70
Haryana	43.90	8.90	42.70	3.70	0.80
Karnataka	25.28	15.99	53.90	4.46	0.37
Kerala	3.22	13.36	77.85	4.60	0.92
Rajasthan	31.18	25.81	36.56	0.54	5.91
Uttar Pradesh	41.70	15.39	38.05	4.05	0.81
West Bengal	14.67	28.00	52.00	5.33	-
<b>Total</b>	<b>31.58</b>	<b>17.06</b>	<b>46.76</b>	<b>3.37</b>	<b>1.24</b>

*Source: Field survey data 2019*

The years of experience in crop farming, dairying and sheep and goat rearing are presented in **Table 4.3**. The results show that the sample households on average, 21.85 years of experience in crop farming is the highest, followed by dairying (19.92 yrs.) and sheep and goat farming (13.37 yrs).

**Table 4.3: Experience in Crop Farming, Dairying and Sheep and Goat Rearing**  
(in Percentage)

States	Average Experience (Yrs)		
	Crop Farming	Dairying	Sheep & Goat Rearing
Gujarat	17.71	19.62	10.03
Haryana	24.80	22.96	18.61
Karnataka	25.00	16.00	10.00
Kerala	11.01	18.07	11.02
Rajasthan	22.71	21.72	10.50
Uttar Pradesh	27.10	16.79	10.55
West Bengal	25.32	28.13	28.88
<b>Total</b>	<b>21.85</b>	<b>19.92</b>	<b>13.37</b>

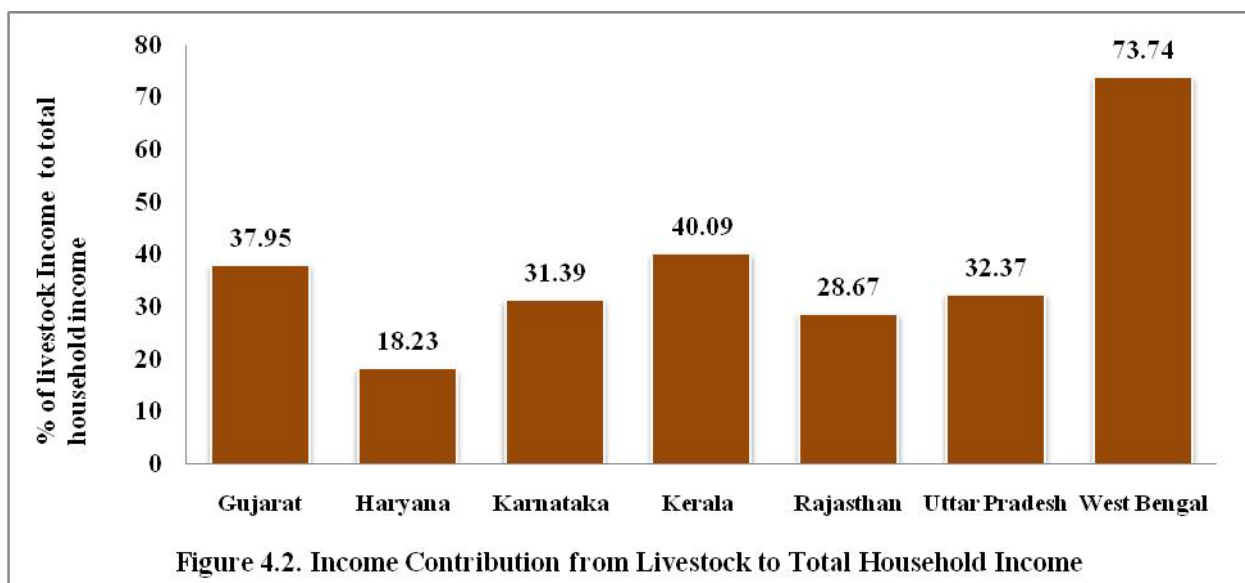
*Source: Field survey data 2019*

The average annual income from different sources of occupation of the selected states is presented in **Table 4.4 and Figure 4.2**. The results show that the highest income is obtained from the sources of crop farming (Rs.184617), followed by dairying (Rs.83683), other sources (Rs.57602) and sheep and goat farming (Rs.19904). Kerala state earns more income from crop farming, while Karnataka State earns the least. West Bengal earns more income from dairying, while Haryana state, the least. In the case of sheep and goat rearing, Haryana state stands first in income earning, while Gujarat the last. In respect of income from other sources, Haryana stands first followed by Uttar Pradesh. The overall income from livestock, West Bengal earns more income (73.74%) and Haryana state, the least (18.23%).

**Table 4.4: Average Income from Different Occupations**

States	Average Annual Income (Rs)						
	Agriculture	Dairy	Sheep & Goat farming	Others	Total	Livestock*	Per cent
Gujarat	105756	78705	6610	33753	224824	85315	37.95
Haryana	160984	21068	42743	125281	350076	63811	18.23
Karnataka	44580	27292	25892	71666	169430	53184	31.39
Kerala	116237	65142	13497	1267	196143	78639	40.09
Rajasthan	135559	48640	10102	10589	204890	58742	28.67
Uttar Pradesh	145143	103149	13640	98826	360758	116789	32.37
West Bengal	90256	335380	29237	39570	494443	364617	73.74
<b>Total</b>	<b>184617</b>	<b>83683</b>	<b>19904</b>	<b>57602</b>	<b>345806</b>	<b>103587</b>	<b>29.96</b>

*Source: Field Survey data 2019 \* indicates (Dairy+ Sheep & Goat farming)*



*Source: Field Survey data 2019*

The family size and the number of family members engaged in crop farming, dairying and sheep and goat rearing are presented in **Table 4.5**. The results show that, on average, a household has six members, of which two persons are engaged in crop farming, dairying and sheep and goat farming. As evident from the literature review, socio and cooperative organizations significantly influence the socioeconomic progress of members as compared to non-members. The percentage of households registered and those non-registered with social and cooperative organisations is presented in **Table 4.6**. The number of persons having membership with social and cooperative organizations is low (about 39%) as compared to non-members (61%).

**Table 4.5: Family Size and the Number of Family Persons Engaged in Crop Farming, Dairying and Sheep and Goat Rearing**

States	Average Family Size (No.)	Average No. of Family Members Engaged in		
		Farming	Dairying	Sheep & Goat Rearing
Gujarat	6.66	2.64	2.19	1.91
Haryana	5.89	2.18	2.58	1.69
Karnataka	6.00	2.00	2.00	2.00
Kerala	4.79	2.12	1.97	2.48
Rajasthan	6.71	1.90	1.56	1.47
Uttar Pradesh	5.01	1.44	1.92	1.26
West Bengal	4.77	1.37	2.65	2.65
<b>Total</b>	<b>5.75</b>	<b>2.00</b>	<b>2.12</b>	<b>1.89</b>

*Source: Field survey data 2019*

**Table 4.6: Membership with Social and Cooperative Organizations**

States	Member of Social & Cooperative Organization (%)	
	Yes	No
Gujarat	72.51	27.49
Haryana	9.76	90.24
Karnataka	38.66	61.34
Kerala	89.40	10.60
Rajasthan	29.03	70.97
Uttar Pradesh	4.05	95.95
West Bengal	35.33	64.67
<b>Total</b>	<b>38.60</b>	<b>61.40</b>

*Source: Field survey data 2019*

The main and subsidiary occupations of the sample households across the states are presented in **Table 4.7**. The results show that Agriculture is the main occupation and Animal husbandry and dairy, is the secondary occupation in Karnataka, Gujarat and Uttar Pradesh whereas, in respect of Haryana, Kerala, West Bengal, the main occupation is animal husbandry and dairy and secondary occupation is crop production.

**Table 4.7: Main and Subsidiary Occupations of the Sample Households across the states (Values in Percentage)**

Occupation	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
<b>Primary</b>								
Agriculture	54.98	38.21	89.59	13.83	82.26	54.25	6.00	51.31
Animal Husbandry & dairy	21.65	45.93	5.20	82.48	12.9	8.91	92.00	34.56
Agri Labour	12.37	3.66	2.60	0.92	0.54	24.10		6.88
Non- Farm labour	10.99	9.35	1.49	2.01	1.61	12.96	2.00	6.43
Employee		2.85	1.12	0.92	2.69	0.40		1.00
<b>Secondary</b>								
Agriculture	9.97	15.69	4.83	14.19	10.75	9.31	79.33	17.02
Animal Husbandry & dairy	70.45	63.90	88.48	76.58	87.1	54.39	7.33	66.86
Agri Labour	6.53	3.03	1.49	5.76	1.61	22.67	5.33	6.85
Non- Farm labour	13.06	15.54	4.83	2.43	0.54	12.96	8.00	8.69
Employee		1.81	0.37	1.05		1.62		0.73

*Source: Field survey data 2019*

## 4.2 Details of Operational Landholdings

The average land-holding details of the sample households are presented in **Table 4.8**. The results show that an average person owns land of 1.12 hectares, of which 0.92 hectares is under irrigation and the remaining 0.18 hectares is under rainfed. The total leased-in land constitutes 0.18 ha and leased-out land about 0.07 hectares. The uncultivated land amounts to about 0.05 ha and net operated land to 1.18 hectares. The area under fodder crops constitutes 0.22 hectares, while the area under fodder cultivation is the highest for Rajasthan.

### 4.3 Sources of Irrigation

The source-wise irrigation details of the sample households across the selected states are presented in **Table 4.9**. The results show that nearly 51 per cent of the households are dependent on borewells as the main source of irrigation, followed by dug wells (24.87%) and canals (19.84%). Irrigation by other sources and tanks is the least. Canal is a rich source of irrigation in Haryana, whereas, in Uttar Pradesh, Karnataka and Gujarat borewells are the main source of irrigation but, in the case of Kerala, dug wells are the main source of irrigation.

**Table 4.8: Landholding Details of the Sample Households**

(in ha)

Particulars		Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
Owned Land	Irrigated	0.79	0.91	1.06	0.44	1.66	0.83	0.91	0.92
	Rainfed	0.07	0.01	0.7	0	0.37	0	0.07	0.18
	<b>Total</b>	<b>0.86</b>	<b>0.92</b>	<b>1.76</b>	<b>0.44</b>	<b>2.03</b>	<b>0.83</b>	<b>1.1</b>	<b>1.12</b>
Leased in Land	Irrigated	0.04	0.29	0	0.04	0.09	0.63	0.07	0.17
	Rainfed	0.1		0.01		-	-	-	0.02
	<b>Total</b>	<b>0.06</b>	<b>0.29</b>	<b>0.01</b>	<b>0.04</b>	<b>0.09</b>	<b>0.63</b>	<b>0.07</b>	<b>0.18</b>
Leased out Land	Irrigated	-	0.01	-	0.01	-	0.4	0.09	0.07
	Rainfed	-	-	-	-	-	-	-	-
	<b>Total</b>	<b>-</b>	<b>0.01</b>	<b>0</b>	<b>0.01</b>	<b>-</b>	<b>0.4</b>	<b>0.09</b>	<b>0.07</b>
Uncultivated land	Irrigated	-	0.02	0.03	0.2	-	-	-	0.03
	Rainfed	-	0.01	0.09	-	-	-	0.05	0.02
	<b>Total</b>	<b>-</b>	<b>0.02</b>	<b>0.12</b>	<b>0.2</b>	<b>-</b>	<b>-</b>	<b>0.05</b>	<b>0.05</b>
Net operated area	Irrigated	0.84	1.18	1.04	0.3	1.75	1.18	0.89	1.01
	Rainfed	0.07	-	0.61	-	0.37	-	0.14	0.17
	<b>Total</b>	<b>0.91</b>	<b>1.18</b>	<b>1.64</b>	<b>0.3</b>	<b>2.12</b>	<b>1.18</b>	<b>1.03</b>	<b>1.18</b>
Area under Fodder crop	Irrigated	0.35	0.34	0.13	0.02	0.32	0.13	0.04	0.2
	Rainfed	0.05	-	0.01	-	0.07	-	-	0.02
	<b>Total</b>	<b>0.4</b>	<b>0.34</b>	<b>0.15</b>	<b>0.02</b>	<b>0.4</b>	<b>0.13</b>	<b>0.04</b>	<b>0.22</b>

Source: Field survey data 2019

**Table 4.9: Sources of Irrigation in the Selected States of India**

(Value in %)

States	Canal	Bore well	Dug well	Tank	Other
Gujarat	26.90	56.73	5.85	5.26	5.26
Haryana	53.39	46.61			
Karnataka	15.43	62.29	22.29		
Kerala	3.29	2.35	93.43		0.94
Rajasthan	24.00	30.70	39.30	0.70	5.30
Uttar Pradesh	12.57	87.43			
West Bengal		50.46	30.09	0.46	18.98
<b>Total</b>	<b>19.84</b>	<b>50.75</b>	<b>24.87</b>	<b>1.08</b>	<b>3.47</b>

Source: Field survey data 2019

#### 4.4 Cropping Pattern Followed by the Sample Households

The cropping patterns followed by the sample households in the selected states are presented in **Table 4.10**. The results show the total gross cropped area at about 2.312 hectares, with the gross cropped being the highest in Kerala at 4.34 hectares, followed by Rajasthan (2.98 ha.), Uttar Pradesh (2.86 ha) and Karnataka (1.882 ha). In the kharif season, the area under paddy (0.216 ha.) and sugarcane (0.211 ha) are the highest, while in the rabi season, wheat (0.266 ha) is the main crop, followed by paddy, and in summer, bajra (0.045 ha.) is the main crop.

**Table 4.10: Cropping Pattern Followed by the Sample Households across the Selected States**

(in ha)								
Crops	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
<b>Kharif</b>								
Maize	0.072		0.323		0.240	0.380	0.009	0.154
Paddy	0.073	0.312	0.056	0.429		0.421	0.245	0.216
Sorghum		0.112	0.026		0.248			0.050
Bajra	0.149	0.089	0.002		0.688	0.457		0.191
Ragi			0.219					0.037
Small millets			0.071					0.012
Pulses	0.005		0.214		0.086			0.047
Ground nut	0.140		0.059					0.035
Oilseeds	0.063		0.005		0.126			0.027
Sugarcane			0.425			0.911		0.211
Cotton	0.061		0.026		0.004			0.016
Others	0.057	0.087	0.188	0.219	0.260			0.115
Fodder	0.230			0.356	0.187	0.142	0.005	0.134
<b>Rabi</b>								
Wheat	0.105	0.791			0.502	0.441		0.266
Maize	0.063		0.104					0.029
Paddy			0.002	0.429				0.058
Barley		0.006			0.077			0.010
Sorghum			0.001		0.012			0.001
Ragi			0.002					0.000
Small millets	0.004	0.011	0.006					0.003
Pulses	0.002		0.017		0.048			0.009
Groundnut			0.006					0.001
Oilseeds	0.207	0.180	0.000		0.098		0.095	0.085
Cotton			0.006					0.001
Others	0.116	0.002	0.035	0.275	0.165		0.169	0.099
Fodder	0.100	0.064	0.002	0.356	0.130	0.113	0.027	0.111
<b>Summer</b>								
Maize			0.013					0.002
Sorghum			0.001		0.004			0.001
Bajra	0.206				0.068			0.045
Groundnut	0.002							0.0004
Sugarcane		0.021						0.003
Others			0.004					0.001
Fodder	0.080		0.009		0.030			0.019
<b>Perennials</b>								
Coconut			0.027	0.271				0.041
Arecanut			0.013					0.002
Banana			0.015	0.388				0.055
Others		0.012	0.008	1.623	0.007			0.223
<b>Total</b>	<b>1.735</b>	<b>1.687</b>	<b>1.882</b>	<b>4.346</b>	<b>2.980</b>	<b>2.865</b>	<b>0.550</b>	<b>2.312</b>

Source: Field survey data 2019

The perennial crops grown include banana (0.055 ha) and coconut (0.041 ha), accounting for a major share. In Gujarat, bajra and oilseeds are the major crops, whereas, in Karnataka, the major crops are sugarcane and maize. Paddy in Kerala, wheat in Haryana, bajra in Rajasthan, sugarcane in Uttar Pradesh, and paddy in West Bengal are the main crops.

#### 4.5 Livestock Inventory of the Sample Households

The total number of animals reared by the sample households and the average number of animals per household have been calculated and presented in **Tables 4.11 and 4.12**. The results show that totally 2,429 buffaloes, 1,946 crossbred cattle, 941 indigenous cattle, 4,779 sheep and 6,861 goats are reared by 1,606 sample households across the selected states of India. On average, a household rears 2 buffaloes, 1 crossbred, 1 indigenous cattle, 3 sheep and 4 goats. The number of buffaloes reared by households is more in West Bengal, followed by Gujarat, Rajasthan and Haryana. More number of crossbred are reared in Kerala state, followed by West Bengal. Indigenous cattle are the highest in the case of West Bengal, while more sheep per household are reared in Karnataka and Haryana. The number of goats reared per household is higher in Gujarat and Rajasthan.

**Table 4.11: Number of Animals Reared by the Sample Households across the Selected States**

States	Number of HH	Number animals				
		Buffalo	Crossbred Cattle	Indigenous Cattle	Sheep	Goat
Gujarat	217	497	266	175	742	1399
Haryana	291	429	114	128	1847	1579
Karnataka	269	255	158	87	1996	1139
Kerala	246	227	787	9		603
Rajasthan	186	336	172	207	194	1164
Uttar Pradesh	247	237	180	31	-	530
West Bengal	150	448	269	304	-	447
<b>Total</b>	<b>1606</b>	<b>2429</b>	<b>1946</b>	<b>941</b>	<b>4779</b>	<b>6861</b>

*Source: Field survey data 2019*

**Table 4.12: Number of Animals Reared Per Households across the Selected States**

States	Number of HH	Number of animals per household				
		Buffalo	Crossbred Cattle	Indigenous Cattle	Sheep	Goat
Gujarat	217	2.29	1.23	0.81	3.42	6.45
Haryana	291	1.47	0.39	0.44	6.35	5.43
Karnataka	269	0.95	0.59	0.32	7.42	4.23
Kerala	246	0.92	3.20	0.04	-	2.45
Rajasthan	186	1.81	0.92	1.11	1.04	6.26
Uttar Pradesh	247	0.96	0.73	0.13	-	2.15
West Bengal	150	2.99	1.79	2.03	-	2.98
<b>Total</b>	<b>1606</b>	<b>1.51</b>	<b>1.21</b>	<b>0.59</b>	<b>2.98</b>	<b>4.27</b>

*Source: Field survey data 2019*

#### 4.6 Economic Values of Livestock Reared by Households

The average value of buffalo, crossbred and indigenous cattle across the states has been presented in **Tables 4.13 to 4.14**. The results show that on average, the value per buffalo ranges from Rs.14181 for less than 1 year to Rs.52,050 for a milch animals. Coming to the states the value ranges from Rs.4,791 to Rs.31206 in Karnataka, Rs.5,849 to Rs.62,868 in Haryana, Rs.2,500 to Rs.55,053 in Rajasthan for less than one year and milching animal respectively, Rs. 15,645 to Rs.50,624 in Gujarat, Rs. 17,004 to Rs.54,028 in West Bengal for less than one year and dry buffalo (**Table4.13**).

**Table 4.13: Average Value of Buffalo across the States (Values in Rs)**

Particulars	Gujarat	Haryana	Karnataka	Kerala	Uttar Pradesh	Rajasthan	West Bengal	Total
Milching	50416	62868	31206	77500	41916	55053	53493	52050
Dry	50624	51250	23638	11929	22240	49740	54028	36044
Male	-	18877	7250	101666	-	-	29072	20558
Heifer pregnant	42056	44000	30537	60000	44194	38050	49006	43422
Heifer non-pregnant	27500	18508	14135	-	40984	34000	23195	22962
<1 year	15645	5849	4791	53181	2500	7333	17004	14181
1-2 Year	28333	24397	12977	103850	8947	22533	22500	30633

*Source: Field survey data 2019*

The average value per crossbred cattle ranges from Rs.5,166 for male crossbred to Rs.39,700 for milch animal. State-wise, the value ranges from Rs.4,791 to Rs.42,112 in Karnataka, Rs 5,320 to Rs.34,071 in Haryana, Rs.11,244 to Rs. 53,963 in Kerala for male and milch animals, respectively, and the value ranges from Rs. 12163 to Rs.47,141 for 1-2 years and Heifer pregnant, respectively. Similarly, the value ranges from Rs. 22,500 to Rs.50,987 for less than one year and dry cow. In the case of Gujarat, the value ranges from Rs.8,000 for non-pregnant to Rs.41,961 for milch cattle and from Rs.15,147 to Rs.60,403 for less than one year of milching animals (**Table 4.14**).

The average value per indigenous cattle ranges from Rs.7,960 for male cattle to Rs.31,373 for milch animals, whereas, it ranges from Rs.7,125 for less than one year to Rs.33,108 for male cattle in Karnataka, Rs 2,469 for male cattle to Rs.31,083 for dry cow in Haryana, Rs. 3,625 for dry less than and 1-2 years to Rs. 47,000 for milch animal in Kerala, whereas, it ranges from Rs. 9,750 to Rs30,000 for less than one year and dry cattle, respectively. Similarly, the value ranges from Rs. 5,808 to Rs.34,600 for less than one year and milch cow. In the case of Gujarat, the value ranges from Rs.14,000 for Heifer non-pregnant to Rs.34,513 for dry cattle and from Rs.7,960 for male cattle to Rs.31,373 for milch indigenous cattle (**Table 4.15**).



**Table: 4.14: Average Value of Crossbred Cattle across the States (Values in Rs)**

Particulars	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
Milching	41961	34071	42112	53963	22533	29975	60403	39700
Dry	39112	22857	28545	21417	50987	31522	54429	33892
Male		5320	2464	11244			25904	5166
Heifer pregnant	34000	19000	34833	49011		47141	58300	34583
Heifer non-pregnant	8000	10559	32607	41000	44942	33115	15454	26498
<1 year	12250	2246	12000	12297	22500	12350	15147	12158
1-2 Year	19000	14080	13333	50062		12163	15500	17728

*Source: Field survey data 2019*

The average value per animal reared by the sample households across the states is been presented in **Table 4.16**. The results show the value at Rs. 4364, Rs. 7740 and Rs.10149 per sheep for less than one year, 1-2 years and more than 2 years, respectively, whereas, at Rs. 5637, Rs.10594, Rs.13492 per goat for less than one year, 1-2 years and more than two years. The market value of goat is the highest in Kerala, ranging from Rs.15737 to Rs.32175, whereas, the value of sheep is the highest in Karnataka, ranging from Rs.6624 to Rs.1457.

**Table 4.15: Average Value of Indigenous Cattle across the States (Values in Rs)**

Particulars	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
Milching	31760	26529	28303	47000	34600	24842	30250	31373
Dry	27810	31083	24315	3625	20000	30000	34513	24577
Male		2469	33108	3625			16560	7960
Heifer pregnant	26077	17666	28666	35000		21846	24625	22506
Heifer non-pregnant	14000	9406	24045		22500	25864	14140	16234
<1 year	28857	3360	7125	3625	5808	9750	13337	10321
1-2 Year	22750	10544.8	10333		9192	13676		10387

*Source: Field survey data 2019*

**Table: 4.16 Average Values of Sheep and Goat across the States (Values in Rs)**

States	Animal Type	Average Value per animal		
		<1 year	1-2 Year	>2 Years
Gujarat	Sheep	3031	5203	6491
	Goat	1928	3931	5011
Haryana	Sheep	4998	7115	12756
	Goat	5241	10823	13312
Karnataka	Sheep	6624	11438	14571
	Goat	8064	14764	20255
Kerala	Goat	15737	23183	32175
Rajasthan	Sheep	3000	6875	7500
	Goat	4003	4656	6489
Uttar Pradesh	Goat	5280	7041	7608
West Bengal	Goat	2643	20005	18017
<b>Total</b>	<b>Sheep</b>	<b>4364</b>	<b>7740</b>	<b>10149</b>
	<b>Goat</b>	<b>5637</b>	<b>10594</b>	<b>13492</b>

*Source: Field survey data 2019*

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## 5. SUPPLY-DEMAND OF FEED AND FODDER

An attempt has been made in this Chapter to work out the demand and supply of feed and fodders in the country based on various methodologies by NATP, FAO and NDDDB. In addition, the study also collected primary data to see the feeding pattern of the livestock in major states across the country. The results are discussed in the following heads.

### 5.1 Quantities of Feed Fed to Buffalo as Per Primary Data

The average feed and fodder fed to buffalo are presented in **Table 5.1**. The results show that on average green fodder fed for buffalo across sample states ranged from 8.39 kg to 18.20 kg per animal per day, whereas, dry fodder fed ranges from 5.46 kg to 9.89 kg per animal per day, and the concentrate fed ranges from 0.86 to 3.01 kg per animal for various age categories of buffalo. The highest green fodder fed was noticed in Kerala, ranging from 20.33 to 41.88 kg and the least was seen in respect of Uttar Pradesh which ranged from 0.65 to 3.33 kg. In the case of Karnataka, farmers fed ranged from 5.60 kg to 19.00 kg, whereas in Haryana, the range varied from 5.10 kg to 18.90 kg, in respect of Gujarat, it ranged from 12 kg to 15.80 kg and in West Bengal, it ranged from 0.85 to 5.05 kg per animal. The dry fodder fed in kg/day/animal was found to be the highest in the case of Gujarat, which ranged between 10.10 kg and 14.50 kg and the least was in the case of Kerala (1.79 kg and 5.19 kg). Similarly, the concentrate fed by the Haryana farmers was the highest to the tune of 0.70 kg to 5.90 kg and the least was noticed in the case of West Bengal, which was less than 1.12 kg/day/animal.

### 5.2 Quantities of Feed Fed to Crossbred Cattle as Per Primary Data

The details of average feed and fodder fed to crossbred cows are presented in **Table 5.2**. The results show that green fodder fed per cattle per day ranges from 8.27 kg to 1518 kg. The dry fodder fed to animals ranges from 4.43 to 9.27 and concentrates from 1.17 to 2.97 kg per cattle per day. The result clearly shows that milch animal heifer pregnant and non-pregnant animals are fed with more quantities of green fodder and concentrates, while male animals are fed with more quantities of dry fodder, as compared to milching and heifer animals. Animals under less than 2 years are fed with less quantity of green fodder, dry fodder and concentrate.

### 5.3 Quantities of Feed Fed to Indigenous Cattle as Per Primary Data

The average feed and fodder fed to indigenous cattle are presented in **Table 5.3**. The results show that green fodder fed to animals ranges from 7.01 to 10.31 kg per day per cattle, whereas, dry fodder ranges from 4.80 kg to 9.80 kg and concentrates from 0.36 kg to 2.46 kg per animal per day. As seen earlier, the highest green fodder was fed by the Kerala farmers and less in Uttar Pradesh. The dry fodder fed was less in Uttar Pradesh and the highest in Gujarat.

**Table 5.1: Quantities of Feed Fed to Buffalo as Per Primary Data****(kg per day /animal)**

Particulars	Guj	Har	KA	KL	Raj	UP	WB	Avg
<b>Green fodder</b>								
Milching	15.80	18.90	19.00	41.36	9.92	2.7	5.05	17.11
Dry	15.80	16.40	8.75	22.86	10.70	0.65	4.57	11.84
Male			8.00	26.61			4.50	18.20
Heifer pregnant	15.40	15.20	13.68	41.88	9.29	3.33	3.79	15.48
Heifer non-pregnant	15.50	9.40	10.29		6.86	2.86	3.74	8.39
<1 year	14.30	5.10	5.60	20.33	9.89		0.85	9.61
1-2 Year	12.00	11.90	6.12	28.71	9.33		1.15	12.28
<b>Dry fodder</b>								
Milching	14.50	14.10	9.14	5.19	12.52	6.25	6.83	9.89
Dry	14.00	11.30	12.60	1.79	10.66	4.33	5.53	8.74
Male			12.10	3.97			5.60	9.85
Heifer pregnant	14.20	13.00	12.17	4.13		7.78	5.87	8.69
Heifer non-pregnant	10.90	7.10	11.85		11.29	6.55	5.21	8.91
<1 year	10.10	2.80	5.23	2.06	12.45		1.20	5.46
1-2 Year	13.70	9.30	4.79	4.47	9.00		2.58	7.45
<b>Concentrates</b>								
Milching	2.80	5.90	1.90	3.38		1.25	1.12	2.58
Dry	2.00	4.10	1.01	1.50	2.74	0.73	0.51	1.89
Male			1.70	1.74	2.37		0.34	1.96
Heifer pregnant	2.80	3.60	1.75	3.50	1.92	1.66	0.32	2.37
Heifer non-pregnant		2.10	1.38		2.00	1.21	0.27	3.01
<1 year		0.70	0.75	1.10	1.45		0.21	0.86
1-2 Year		2.80	0.80	1.93	1.00		0.23	1.51

#### 5.4 Quantities of Feed Fed to Sheep as Per Primary Data

The average feed and fodder fed to sheep are presented in **Table 5.4**. The results show that green fodder fed to sheep ranges from 2 kg to 4.49 kg per day per animal and dry fodder fed to the sheep ranges from 0.18 kg to 2.86 kg per day. Whereas, concentrate fed to them ranges from 0.27 kg to 0.41 kg. In Karnataka, green fodder fed to the sheep ranges from 2.10 to 6.10 kg per animal per day, whereas, in Haryana from 1.50 to 4.54 kg per day per animal. In Haryana, dry fodder fed to the sheep ranges from 1.25 kg to 3.37 kg per animal per day. The concentrate fed for sheep ranges from 0.30 kg to 0.50 kg in Karnataka, whereas, 0.25 kg in the state of Haryana.

#### 5.5 Quantities of Feed Fed to Goats as Per Primary Data

In the case of goats, the average feed and fodder fed are presented in **Table 5.5**. The results show that green fodder fed to the goats ranges from 1.54 to 3.39 kg/goat/day. Similarly, dry fodder fed to goats' ranges from 0.78 kg to 1.14 kg/animal and concentrates fed to the range of 0.42 to 1.81 kg/goat/day.

**Table 5.2: Quantities of Feed Fed to Crossbred Cattle as Per Primary Data**  
(kg per day per animal)

Particulars	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
<b>Green fodder</b>								
Milching	15.19	16.70	19.38	29.24	11.30	1.35	4.12	14.70
Dry	14.74	17.60	15.23	13.57	11.18	1.17	3.61	11.62
Male			11.00	16.65			4.30	11.58
Heifer pregnant	15.91	14.00	16.81	27.75	10.80	1.96	4.02	13.68
Heifer non-pregnant	10.00	9.40	13.90	36.00	30.00	1.31		14.57
<1 year	15.82	5.40	5.00	13.87	7.50		0.51	8.27
1-2 Year	15.80	12.70	13.10	28.61			0.78	15.18
<b>Dry fodder</b>								
Milching	13.79	13.00	10.90	3.99	9.97	4.82	5.53	9.07
Dry	12.91	11.20	15.07	2.18	10.03	5.91	6.19	9.28
Male			12.15	1.78			5.35	6.78
Heifer pregnant	14.36	12.40	8.70	3.24	9.80	8.21	5.48	9.05
Heifer non-pregnant	15.00	7.90	10.86	3.30	10.00	5.28		7.75
<1 year	11.11	5.00		1.03	10.50		1.45	4.63
1-2 Year	10.00	10.40	8.60	1.66			1.87	6.99
<b>Concentrates</b>								
Milching	2.95	5.50	3.09	3.27	3.07	0.80	0.80	2.97
Dry	4.50	5.10	1.60	1.65	5.00	0.82	0.50	2.80
Male			1.70	1.10			0.33	1.17
Heifer pregnant	2.00	4.10	1.60	2.27	2.13	1.17	0.87	2.14
Heifer non-pregnant	3.00	2.50	3.28	4.00		0.86		2.15
<1 year	4.00	0.70		1.05	2.75		0.19	1.38
1-2 Year		3.60	1.60	1.28			0.20	1.55

*Source: Field survey data 2019*

**Table 5.3: Quantities of Feed Fed to Indigenous Cattle as Per Primary Data**  
(kg per day per animal)

Particulars	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
<b>Green fodder</b>								
Milching	13.79	16.14	13.06	8.00	12.04	1.84	4.60	10.31
Dry	13.57	13.25	8.78	1.50	8.73	1.20	4.53	7.55
Male			10.90	1.50			4.38	5.95
Heifer pregnant	14.46	14.67	12.06	2.00	5.00	1.25	4.51	8.13
Heifer non-pregnant	15.00	9.30	12.50	0.00	13.50	0.93	4.17	7.90
<1 year	14.86	5.44	10.00	1.50	8.00		1.19	7.01
1-2 Year	14.50	10.45	10.00	0.00	10.00			7.38
<b>Dry fodder</b>								
Milching	11.86	11.08	16.51		12.09	7.50	5.74	9.47
Dry	13.48	11.08	18.44		11.36	5.48	6.47	9.68
Male			11.30				6.88	6.12
Heifer pregnant	14.23	10.67	15.33		13.57	8.00	6.19	9.80
Heifer non-pregnant	11.60	6.43	14.42		12.70	5.02	5.67	7.92
<1 year	10.00	3.84	6.67		6.15		1.99	4.80
1-2 Year	11.25	6.81	8.00		11.92			6.04
<b>Concentrates</b>								
Milching	3.37	5.70	2.14		2.77	1.47	0.69	2.46
Dry	2.43	5.00	1.03		2.50	0.67	0.50	1.85
Male			0.60				0.50	0.36
Heifer pregnant	3.00	3.70	1.75		3.00	0.99	0.56	1.92
Heifer non-pregnant	2.33	3.40	1.57		1.63	0.63	0.35	1.51
<1 year	2.00	1.34	1.00		2.67		0.15	1.19
1-2 Year		3.57	1.00		4.63			1.49

*Source: Field survey data 2019*

**Table 5.4: Quantities of Feed Fed to Sheep within as Per Primary Data**  
(kg/ day/ animal)

Particulars		Gujarat	Haryana	Karnataka	Rajasthan	Total
<b>Green fodder</b>						
<1 year	Male		1.50	3.32		2.37
	Female		1.90	2.10		2.00
1-2 Year	Male		3.00	5.00		3.96
	Female		2.64	3.50		3.05
>2 Years	Male		4.54	6.10		5.29
	Female		4.53	6.00	2.25	4.49
<b>Dry fodder</b>						
<1 year	Male		1.48			1.48
	Female	1.00	1.25		2.00	1.37
1-2 Year	Male		2.86			2.86
	Female		1.89			0.18
>2 Years	Male	1.00	3.37			2.36
	Female		3.34		1.00	2.43
<b>Concentrates</b>						
<1 year	Male			0.30		0.30
	Female		0.25	0.30		0.27
1-2 Year	Male			0.50		0.50
	Female	0.50	0.25	0.50		0.41
>2 Years	Male		0.25	0.50		0.37
	Female		0.25	0.50	0.50	0.40

Source: Field survey data 2019

**Table 5.5: Quantities of Feed Fed to Goats within as Per Primary Data**  
(kg/ day/ animal)

Particulars		Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
<b>Green fodder</b>									
<1 year	Male	0.60	1.51	3.00	3.32		0.58	0.86	1.54
	Female	0.50	1.46	2.00	4.82	1.50	1.04	0.78	1.81
1-2 Year	Male		3.45	5.00	4.85		0.71	1.27	3.25
	Female	0.40	2.97	3.50	4.48	1.50	0.89	1.16	2.28
> 2 Years	Male	0.60	2.40	8.00	5.50		1.05	1.50	3.39
	Female		2.43	7.00	5.50	1.47	1.09		3.23
<b>Dry fodder</b>									
<1 year	Male		0.70		1.00	1.57	0.31	0.37	0.78
	Female	0.40	0.98		2.33	1.80	0.46	0.33	1.08
1-2 Year	Male	0.30	1.21		1.50	1.50	0.29	0.54	0.91
	Female		1.52		1.44	1.57	0.46	0.52	1.14
> 2 Years	Male		2.23		0.00	1.00	0.44	0.63	0.93
	Female	0.40	2.38		0.00	1.66	0.38		1.00
<b>Concentrates</b>									
<1 year	Male	0.20	0.55	0.30	0.61	1.00	0.13	0.10	0.42
	Female	0.20	0.58	0.30	0.58	1.03	0.16	0.10	0.42
1-2 Year	Male		1.10	0.50	0.60	0.50	0.29	0.15	0.57
	Female		0.70	0.50	0.60	0.71	0.18	0.15	0.49
> 2 Years	Male	0.20	4.80	0.50	0.80	0.50	0.27	0.19	1.22
	Female		5.48	0.50	0.74	1.25	0.38		1.81

Source: Field survey data 2019

## 5.6 Requirement of Feed and Fodder (Demand) in the States as Per Primary Data

The requirement of feed and fodder has been estimated based on the feed fed to animals, considered as a standard. The requirement of green fodder in the selected states, along with the country, is presented in **Table 5.6 and Figure 5.1**. The results show that per year requirement amounts to 1491.04 million tonnes in the country. Across the states, it ranges from 10.04 million tonnes in Kerala and 116.93 million tonnes in Rajasthan. The per day requirement of green fodder for the cattle population in the country has been estimated at 195.97 thousand tonnes (highest), followed by buffalo (147.88 thousand tonnes), goats (38.47 thousand tonnes) and sheep 926.20 thousand tonnes).

**Table 5.6: Requirement of Green Fodder in the States as per Primary Data**

(Million tonnes)

Particulars	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
In milch	4.31	0.93	4.52	1.04	4.93	0.98	2.00	65.00
Dry	2.13	0.50	1.53	0.10	2.57	0.35	1.08	27.77
Adult male	2.11	0.29	1.56	0.01	1.31	0.14	1.00	29.72
Young stock	5.54	0.63	2.84	0.70	4.78	0.90	0.87	73.47
Total cattle	14.10	2.35	10.44	1.85	13.59	2.37	4.95	195.97
In milch	6.04	2.93	2.18	0.02	4.71	3.06	0.07	65.31
Dry	2.92	0.90	0.46	0.01	2.42	0.29	0.02	20.03
Adult male	0.22	0.08	0.03	0.02	0.11	0.05	0.12	6.53
Young stock	6.23	1.88	0.75	0.21	6.32	0.82	0.02	56.02
Total buffalo	15.40	5.80	3.41	0.26	13.56	4.22	0.23	147.88
Sheep	0.63	0.09	4.79	0.00	1.78	0.35	0.34	26.20
Goat	0.26	0.08	2.93	0.64	3.11	1.29	1.81	38.47
Total per day	30.39	8.32	21.58	2.75	32.03	8.23	7.33	408.52
<b>Per year (mt)</b>	<b>110.92</b>	<b>30.36</b>	<b>78.76</b>	<b>10.04</b>	<b>116.93</b>	<b>30.03</b>	<b>26.74</b>	<b>1491.08</b>

*Source: Field survey data 2019*

The requirement of dry fodder in the selected states, along with the country, is presented in **Table 5.7 and Figure 5.1**. The results show that a totally of 1356.18 million tonnes of dry fodder per year is required by the country to feed cattle, buffalo, sheep and goats. The dry fodder requirement per year ranges from 8.20 million tonnes in Kerala to 114.96 million tonnes in Rajasthan. The results also show that 195.97, 147.88, 13.22 and 14.48 thousand tonnes of dry fodder are required by cattle, buffalo, sheep and goats per day in the country.

**Table 5.7: Requirement of Dry Fodder in the States as Per Primary Data**

(‘000 tonnes)

Particulars	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
In milch	4.31	0.93	4.52	1.04	4.93	0.98	2.00	65.00
Dry	2.13	0.50	1.53	0.10	2.57	0.35	1.08	27.77
Adult male	2.11	0.29	1.56	0.01	1.31	0.14	1.00	29.72
Young stock	5.54	0.63	2.84	0.70	4.78	0.90	0.87	73.47
Total cattle	14.10	2.35	10.44	1.85	13.59	2.37	4.95	195.97
In milch	6.04	2.93	2.18	0.02	4.71	3.06	0.07	65.31
Dry	2.92	0.90	0.46	0.01	2.42	0.29	0.02	20.03
Adult male	0.22	0.08	0.03	0.02	0.11	0.05	0.12	6.53
Young stock	6.23	1.88	0.75	0.21	6.32	0.82	0.02	56.02
Total buffalo	15.40	5.80	3.41	0.26	13.56	4.22	0.23	147.88
Sheep	0.18	0.07	1.97	0.00	1.19	0.18	0.17	13.22
Goat	0.18	0.05	0.60	0.14	3.16	0.56	0.78	14.48
Total per day	29.86	8.27	16.42	2.25	31.50	7.33	6.13	371.56
<b>Per year (mt)</b>	<b>108.99</b>	<b>30.18</b>	<b>59.94</b>	<b>8.20</b>	<b>114.96</b>	<b>26.74</b>	<b>22.36</b>	<b>1356.18</b>

Source: Field survey data 2019

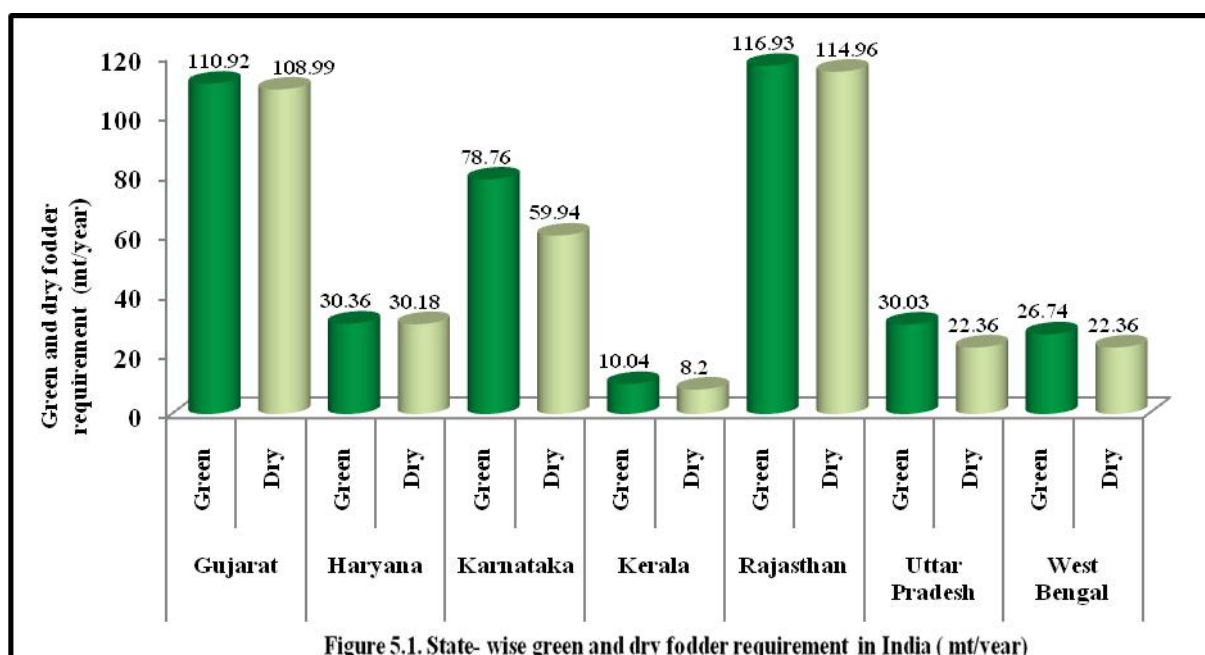


Figure 5.1. State-wise green and dry fodder requirement in India (mt/year)

Source: Field survey data 2019

The estimated requirement of concentrates based on the feed fed at the household level is presented in **Table 5.8**. The results show that the concentrates required by the county amount to 274.39 million tonnes and state-wise, it ranges from 0.94 million tonnes in Kerala to 27.35 million tonnes in Rajasthan. The concentrates required by cattle, buffalo, sheep and goat per day amounts to 34.31, 25.85, 2.79 and 75.18 thousand tonnes, respectively.



**Table 5.8: Requirement of Concentrates in the States as Per Primary Data**  
(‘000 tonnes)

Particulars	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
In milch	0.94	0.32	0.73	0.09	1.23	0.70	0.34	14.10
Dry	0.52	0.16	0.17	0.01	0.97	0.22	0.13	6.74
Adult male	0.52	0.10	0.16	0.00	0.49	0.09	0.10	2.58
Young stock	1.09	0.17	0.39	0.04	1.85	0.42	0.16	10.89
Total cattle	3.07	0.75	1.45	0.14	4.55	1.43	0.73	34.31
In milch	1.07	0.91	0.22	0.002	1.30	1.41	0.02	9.85
Dry	0.37	0.23	0.05	0.0003	0.62	0.32	0.003	3.20
Adult male	0.03	0.02	0.01	0.001	0.02	0.06	0.01	0.70
Young stock	1.12	0.78	0.20	0.03	1.61	0.82	0.01	12.11
Total buffalo	2.58	1.94	0.47	0.03	3.56	2.62	0.04	25.85
Sheep	0.09	0.01	0.48	0.0001	0.40	0.04	0.04	2.79
Goat	0.10	0.07	0.27	0.09	1.73	0.34	0.22	12.23
Total per day	5.84	2.76	2.67	0.26	10.23	4.43	1.03	75.18
<b>Per year (mt)</b>	<b>21.32</b>	<b>10.09</b>	<b>9.74</b>	<b>0.94</b>	<b>37.35</b>	<b>16.16</b>	<b>3.76</b>	<b>274.39</b>

*Source: Field Survey data 2019*

### 5.7 Supply-Demand Gap in Feed and Fodder as Per Primary Data and the Nutritional Requirements (Kg/animal/day) Estimated by NDDB

**Table 5.9** provides a detailed overview of the supply and demand gap for feed and fodder for different categories of livestock (cattle indigenous, crossbred, buffalo, goat, sheep and others), measured in kilograms per animal per day. The three types of feed considered are green fodder, dry fodder, and concentrates. The categories of cattle include In-Milk, Dry, Adult Male, Young Stock, and the total for each category.

According to the nutritional requirements for In-Milk indigenous cattle, the demand for green fodder is 25 kg/animal/day, for dry fodder is 6 kg/animal/day, and for concentrates is 2.25 kg/animal/day. The corresponding supply is 10.31 kg/animal/day for green fodder, 9.47 kg/animal/day for dry fodder, and 2.46 kg/animal/day for concentrate. The gap between supply and demand is calculated, resulting in negative values for green fodder (-14.69 kg/animal/day), indicating a deficit, while dry fodder and concentrates show a positive gap. Similar calculations are made for Dry, Adult Male, and Young Stock categories of indigenous cattle. The Total row represents the sum of the individual categories. The gaps in supply and demand are then calculated for each type of feed. For instance, the total (indigenous cattle) gap for green fodder is -64.06 kg/animal/day, indicating a significant deficit in the supply of green fodder compared to the demand. In contrast, the gap for concentrates is 1.09 kg/animal/day, suggesting a slight surplus.

In the case of In-Milk crossbred animals, the demand for green fodder is 30 kg/animal/day, for dry fodder is 7 kg/animal/day, and for concentrates is 4.5 kg/animal/day. The corresponding supply is 14.7 kg/animal/day for green fodder, 9.07 kg/animal/day for dry fodder, and 2.97 kg/animal/day for concentrate. The gap between supply and demand is calculated, resulting in negative values for green fodder (-15.3 kg/animal/day) and

concentrates (-1.53 kg/animal/day), indicating deficits. Similar calculations are made for Dry, Adult Male, and Young Stock categories of crossbred animals. The Total row represents the sum of the individual categories. The gaps in supply and demand are then calculated for each type of feed. For instance, the total (Crossbred) gap for green fodder is -38.42 kg/animal/day, indicating an overall deficit in the supply of green fodder, suggesting deficits compared to the demand for all crossbred categories. The gaps for dry fodder and concentrates are positive. The negative gaps underscore a general shortage in the supply of feed and fodder for crossbred animals, particularly in green fodder.

With regard to buffalo, the demand for green fodder, dry fodder, and concentrates varies across In-Milk, Dry, Adult Male, and Young Stock categories. The gaps between supply and demand are calculated for each type of feed, and the Total row summarizes the overall deficit or surplus. In general, Buffalo shows a deficit in green fodder (-42.37 kg/animal/day), with negative gaps indicating insufficiency in supply compared to demand. Dry fodder and concentrates are positive. The Goat and Others categories also exhibit negative gaps, indicating deficits in green fodder, and concentrates. The Grand Total provides an aggregate view of the entire table, showing a substantial overall deficit in the supply of green fodder (-160.4 kg/animal/day) for all animal categories combined. Notably, the other category reveals a deficit in dry fodder, green fodder and concentrates. The negative gaps in the Grand Total emphasize the need for increased efforts to address the overall shortage of feed resources for these animals. This information is valuable for farmers, policymakers, and stakeholders in the livestock industry, highlighting the areas that require attention and intervention to ensure the nutritional needs of the animals are met. Strategies may need to be implemented to enhance the availability of feed resources, especially green fodder and concentrates, to address the existing gaps and improve the overall health and productivity of the livestock.

## **5.8 Gap in Supply and Demand of Feed and Fodder as Per the Nutritional Requirement**

**Table 5.10** provides a detailed overview of the gap in supply and demand for feed and fodder, measured in million tonnes per year, across different animal categories, including cattle, buffalo, sheep, goat, and others. The livestock population for each category is also given based on the data from 2019. The columns represent the three types of feed: Green Fodder, Dry Fodder, and Concentrates.

For Cattle, there is a substantial deficit in the supply of Green Fodder (-7200.13 million tonnes/year), while there are surpluses in Dry Fodder (1703.78 million tonnes/year) and Concentrates (187.59 million tonnes/year). Buffalo shows a similar trend with a deficit in Green Fodder (-1698.84 million tonnes/year) and surpluses in Dry Fodder (447.86 million tonnes/year) and Concentrates (112.27 million tonnes/year). Sheep, on the other hand, experiences deficits in Green Fodder (-12.74 million tonnes/year) and Dry Fodder (-54.21 million tonnes/year) but has a surplus in Concentrates (18.97 million tonnes/year). Goat shows a surplus in Green Fodder (11.96 million tonnes/year) but deficits in Dry Fodder (-82.60 million tonnes/year) and a smaller surplus in Concentrates (16.30 million tonnes/year).

**Table 5.9: Supply-Demand Gap in Feed and Fodder**

(Kg/animal/day)

Sl.No	Animal Category	Demand (Kg/animal/day)*			Supplied (Kg/animal/day)**			Gap (Supply-Demand) (Kg/animal/day)		
		Green fodder	Dry Fodder	Concentrates	Green fodder	Dry Fodder	Concentrates	Green fodder	Dry Fodder	Concentrates
I	<b>Cattle Indigenous</b>									
	In-Milk	25	6	2.25	10.31	9.47	2.46	-14.69	3.47	0.21
	Dry	20	5	1.25	7.55	9.68	1.85	-12.45	4.68	0.6
	Adult male	26	5	1	5.95	6.12	0.36	-20.05	1.12	-0.64
	Young Stock	25	5	1	8.13	9.8	1.92	-16.87	4.8	0.92
	<b>Total</b>	<b>96</b>	<b>21</b>	<b>5.5</b>	<b>31.94</b>	<b>35.07</b>	<b>6.59</b>	<b>-64.06</b>	<b>14.07</b>	<b>1.09</b>
II	<b>Crossbred</b>									
	In-Milk	30	7	4.5	14.7	9.07	2.97	-15.3	2.07	-1.53
	Dry	25	6	1	11.62	9.28	2.8	-13.38	3.28	1.8
	Adult male	20	6	1	11.58	6.78	1.17	-8.42	0.78	0.17
	Young Stock	15	5	1	13.68	9.05	2.14	-1.32	4.05	1.14
	<b>Total</b>	<b>90</b>	<b>24</b>	<b>7.5</b>	<b>51.58</b>	<b>34.18</b>	<b>9.08</b>	<b>-38.42</b>	<b>10.18</b>	<b>1.58</b>
III	<b>Buffalo</b>									
	In-Milk	28	7	3	17.11	9.89	2.58	-10.89	2.89	-0.42
	Dry	26	6	1	11.84	8.74	1.89	-14.16	2.74	0.89
	Adult male	26	7	1	18.2	9.85	1.96	-7.8	2.85	0.96
	Young Stock	25	6	1	15.48	8.69	2.37	-9.52	2.69	1.37
	<b>Total</b>	<b>105</b>	<b>26</b>	<b>6</b>	<b>62.63</b>	<b>37.17</b>	<b>8.8</b>	<b>-42.37</b>	<b>11.17</b>	<b>2.8</b>
IV	Goat	3	0.5	0.12	2.53	1	0.82	-0.47	-2	0.7
V	Sheep	3.3	0.38	0.08	3.52	1.78	0.38	0.22	-1.52	0.3
VI	Others	30	7	4.5	14.7	9.07	2.97	-15.3	-20.93	-1.53
	<b>Grand Total</b>	<b>327.3</b>	<b>78.88</b>	<b>23.7</b>	<b>166.9</b>	<b>118.27</b>	<b>28.64</b>	<b>-160.4</b>	<b>10.97</b>	<b>4.94</b>

**Note:** \* indicates Demand as per NDDB. \*\* indicates supply as per quantity of feed and fodder fed to animals within household premises

The other category faces deficits in all three types of feed, with the largest deficit in Green Fodder (-57.46 million tonnes/year). The Total row summarizes the cumulative gap for all animal categories, revealing an overall deficit in Green Fodder (-31367.19 million tonnes/year), a surplus in Dry Fodder (2145.25 million tonnes/year), and a surplus in Concentrates (966.05 million tonnes/year).

This table underscores significant challenges in meeting the demand for Green Fodder, particularly for Cattle, and emphasizes the need for strategies to bridge this gap. The surpluses in Dry Fodder and Concentrates, especially in the Total column, suggest potential areas for resource reallocation or redistribution to address imbalances in the overall feed and fodder supply for the livestock population in the given regions. Policymakers and stakeholders can use this information to formulate targeted interventions to ensure a more balanced and sustainable supply of feed resources for livestock.

**Table 5.10: Gap in Supply and Demand of Feed and Fodder**

Animal Category	Livestock Population (Million) as per 2019	Green Fodder	Dry Fodder	Concentrates
Cattle	192.49	-7200.13	1703.78	187.59
Buffalo	109.85	-1698.84	447.86	112.27
Sheep	74.26	-12.74	-54.21	18.97
Goat	148.88	11.96	-82.60	16.30
Others	10.29	-57.46	-78.61	-5.75
<b>Total</b>	<b>535.77</b>	<b>-31367.19</b>	<b>2145.25</b>	<b>966.05</b>

(Million Tonnes/year)

## 5.9 Projected Livestock Population and Gap (Supply-Demand) of Feed and Fodder

**Table 5.11** presents projected livestock population estimates up to the year 2030 and the corresponding gap between the projected supply and demand for feed and fodder, measured in million tonnes per year. The animal categories included are Cattle, Buffalo, Sheep, Goat, and Others. The estimates are based on data from past Livestock censuses published by the Directorate of Economic & Statistics and the Department of Animal Husbandry & Dairying. For Cattle, the projected population is 205.96 million, and there are substantial deficits in Green Fodder (-7704.14 million tonnes/year) and Concentrates (200.72 million tonnes/year), while there is a surplus in Dry Fodder (1823.04 million tonnes/year). Buffalo, with a projected population of 117.54 million, also faces deficits in Green Fodder (-1817.75 million tonnes/year). Concentrates (120.13 million tonnes/year) and Dry Fodder (479.21 million tonnes/year) are having surplus values.

Sheep, with a projected population of 79.46 million, experiences deficits in Green Fodder (-13.6311 million tonnes/year) and Dry Fodder (-58.00 million tonnes/year), but there is a surplus in Concentrates (20.30 million tonnes/year). Goat, with a projected population of

159.30 million, has a surplus in Green Fodder (12.79192 million tonnes/year), while facing deficits in Dry Fodder (-88.38 million tonnes/year) and a smaller surplus in Concentrates (17.44 million tonnes/year). In the Others category, which has a projected population of 11.01 million, there are deficits in all three types of feed: Green fodder (-61.487 million tonnes/year), Dry Fodder (-84.11 million tonnes/year), and Concentrates (-6.15 million tonnes/year). The Total row summarizes the cumulative gap for all animal categories, indicating an overall deficit in Green Fodder (-33562.9 million tonnes/year), a surplus in Dry Fodder (2295.42 million tonnes/year), and a surplus in Concentrates (1033.67 million tonnes/year).

This table underscores the anticipated challenges in meeting the future demand for Green Fodder, particularly for Cattle and Buffalo. The surpluses in Dry Fodder and Concentrates, especially in the Total column, suggest potential areas for resource reallocation or redistribution to address imbalances in the overall feed and fodder supply for the projected livestock population. Policymakers can use this information to develop strategic plans and interventions to ensure a sustainable and balanced supply of feed resources for the growing livestock population up to 2030.

**Table 5.11: Projected Livestock Population and Gap (Supply-Demand) of Feed and Fodder**

**(Million tonnes/year)**

<b>Animal Category</b>	<b>Projected livestock population estimates* up to 2030</b>	<b>Green Fodder</b>	<b>Dry Fodder</b>	<b>Concentrates</b>
Cattle	205.96	-7704.14	1823.04	200.72
Buffalo	117.54	-1817.75	479.21	120.13
Sheep	79.46	-13.6311	-58.00	20.30
Goat	159.30	12.79192	-88.38	17.44
Others	11.01	-61.487	-84.11	-6.15
<b>Total</b>	<b>573.27</b>	<b>-33562.9</b>	<b>2295.42</b>	<b>1033.67</b>

*Note: \* Estimates based on past Livestock censuses published by the Directorate of Economic & Statistics and Department of Animal Husbandry & Dairying*

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## 6. ESTIMATION OF GAPS IN FEED AND FODDER REQUIREMENT AS PER NATP AND FAO

### 6.1 Background

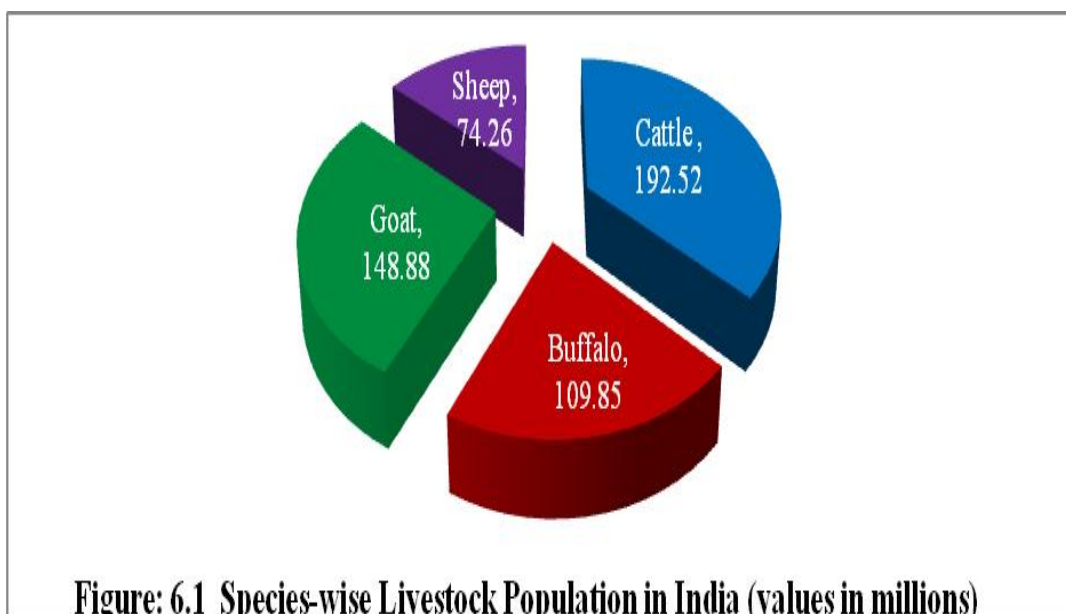
The livestock population of the selected states, based on the latest census 2019, used for estimating the feed and fodder requirement is presented in **Table 6.1 and Figure 6.1**. The results show that the country is home to 51.98, 28.97, 33.91 and 77.67 million milch, dry, adult male and young cattle respectively, which together constitute a total of 192.52 million cattle population in the country. Similarly, the country accounts for 38.16, 16.92, 3.39 and 51.19 million milch, dry, adult male and young buffaloes, respectively, which together constitute a total of 109.85 million Buffalo population. The sheep and goat population stands at 148.88 and 74.26 million respectively. Across the states, the cattle population ranges from 1.33 million in Kerala to 19.02 million in West Bengal, whereas, the buffalo population ranges from 0.10 million in Kerala to 33.02 million in Uttar Pradesh. The goat and sheep population across the states ranges from 0.33 million in Haryana to 20.84 million in Rajasthan and from 0.001 million in Kerala to 11.05 million in Karnataka.

**Table 6.1: Species-Wise Livestock Population across Selected States**

(Numbers in millions)

Particulars	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
<b>Cattle</b>								
In milch	2.98	0.57	2.79	0.56	4.22	6.12	4.59	51.98
Dry	1.51	0.32	1.27	0.13	2.58	2.97	2.65	28.97
Adult male	1.49	0.19	1.42	0.01	1.32	1.21	2.30	33.91
Young stock	3.63	0.74	2.98	0.64	5.79	8.49	9.48	77.67
Total	9.61	1.82	8.46	1.33	13.91	18.79	19.02	192.52
<b>Buffalo</b>								
In milch	3.82	1.55	1.15	0.01	4.75	11.32	0.14	38.16
Dry	1.85	0.55	0.52	0.002	2.26	4.41	0.05	16.92
Adult male	0.14	0.05	0.04	0.01	0.10	0.80	0.26	3.59
Young stock	4.74	2.22	1.28	0.09	6.58	16.49	0.18	51.19
Total	10.54	4.37	2.98	0.10	13.69	33.02	0.63	109.85
<b>Goat</b>	4.87	0.33	6.17	1.36	20.84	14.48	16.28	148.88
<b>Sheep</b>	1.79	0.29	11.05	0.001	7.90	0.98	0.95	74.26

*Source: livestock census, MoFAHD, DAHD-GOI-2019*



*Source: Livestock census, MoFAHD, DAHD-GOI-2019*

## 6.2 Feed and Fodder Requirement as Per NATP Standards

Based on the livestock population (livestock census 2019) and feeding pattern of NATP (correction factors) different categories of livestock the fodder (green, dry and concentrate) requirements are worked out and presented in **Table 6.2**, **Table 6.3** and **Table 6.4**.

### 6.2.1 Green Fodder Requirement

The green fodder required for the respective category was estimated based on the feed conversion factor, as mentioned in the methodological part recommended by NATP. The annual green fodder required amounts to 486.69 million tonnes for the country. The green fodder requirement across the selected states amounts to 77.05, 48.39, 30.79, 29.67, 21.96, 8.88 and 2.26 million tonnes the highest for Uttar Pradesh followed by Rajasthan, Gujarat, West Bengal, Karnataka, Haryana and Kerala respectively (**Table 6.2**).

### 6.2.2 Dry Fodder Requirement

The dry fodder required by the different categories of animals across the states is presented in **Table 6.3**. The table shows the dry fodder requirement per annum at 468.29 million tonnes for the country. Across the states, it ranges from 76.74 to 2.03 million tonnes and is the highest in respect of Uttar Pradesh followed by Rajasthan, Gujarat, Karnataka, Haryana and Kerala at 76.74, 42.45, 31.18, 28.06, 18.90, 9.17 and 2.03 million tonnes per annum, respectively.

**Table 6.2: Green Fodder Requirement across the Selected States**

(\*million tonnes)

Particulars	CF	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
<b>Cattle</b>									
In milch	4.75	14.14	2.70	13.24	2.65	20.05	29.09	21.81	246.90
Dry	3.4	5.12	1.10	4.32	0.43	8.79	10.10	9.03	98.49
Adult male	4.06	6.07	0.77	5.77	0.05	5.34	4.90	9.32	137.67
Young stock	2.18	7.92	1.61	6.49	1.39	12.62	18.51	20.66	169.32
Total		33.25	6.18	29.83	4.52	46.81	62.59	60.82	652.37
<b>Buffalo</b>									
In milch	5.96	22.79	9.24	6.83	0.03	28.32	67.46	0.84	227.44
Dry	5.44	10.05	2.99	2.85	0.01	12.32	24.00	0.28	92.02
Adult male	4.04	0.55	0.21	0.15	0.03	0.40	3.22	1.03	14.50
Young stock	2.29	10.84	5.08	2.93	0.20	15.07	37.76	0.42	117.22
Total		44.24	17.51	12.76	0.27	56.10	132.44	2.57	451.17
<b>Goat</b>	1.04	5.06	0.35	6.42	1.41	21.67	15.06	16.93	154.84
<b>Sheep</b>	1.01	1.81	0.29	11.16	0.00	7.98	0.99	0.96	75.00
<b>Per day (*000 tonne)</b>		<b>84.35</b>	<b>24.33</b>	<b>60.16</b>	<b>6.20</b>	<b>132.56</b>	<b>211.09</b>	<b>81.29</b>	<b>1333.39</b>
<b>Per year (million tonnes)</b>		<b>30.79</b>	<b>8.88</b>	<b>21.96</b>	<b>2.26</b>	<b>48.39</b>	<b>77.05</b>	<b>29.67</b>	<b>486.69</b>

*Note: Authors estimation based on CF\*livestock population***Table 6.3: Requirement of Dry Fodder across the States**

(\*Million tonnes)

Particulars	CF	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
<b>Cattle</b>									
In milch	5.5	16.37	3.13	15.33	3.07	23.22	33.68	25.26	285.88
Dry	4.02	6.05	1.29	5.11	0.51	10.39	11.94	10.67	116.45
Adult male	6.03	9.01	1.14	8.57	0.07	7.93	7.27	13.84	204.47
Young stock	2.13	7.74	1.58	6.34	1.35	12.33	18.08	20.19	165.43
Total		39.17	7.14	35.36	5	53.88	70.98	69.96	772.24
<b>Buffalo</b>									
In milch	6.34	24.24	9.83	7.27	0.03	30.12	71.76	0.9	241.94
Dry	4.95	9.15	2.72	2.6	0.01	11.21	21.84	0.26	83.73
Adult male	7.47	1.02	0.38	0.27	0.05	0.74	5.96	1.91	26.8
Young stock	2.22	10.51	4.92	2.84	0.19	14.61	36.6	0.4	113.63
Total		44.92	17.85	12.97	0.29	56.68	136.17	3.47	466.11
<b>Goat</b>	0.2	0.97	0.07	1.23	0.27	4.17	2.9	3.26	29.78
<b>Sheep</b>	0.2	0.36	0.06	2.21	0.0003	1.58	0.2	0.19	14.85
<b>Per day (000 tonne)</b>		<b>85.43</b>	<b>25.12</b>	<b>51.77</b>	<b>5.56</b>	<b>116.3</b>	<b>210.24</b>	<b>76.88</b>	<b>1282.98</b>
<b>Per year (million tonnes)</b>		<b>31.18</b>	<b>9.17</b>	<b>18.9</b>	<b>2.03</b>	<b>42.45</b>	<b>76.74</b>	<b>28.06</b>	<b>468.29</b>

*Note: Authors estimation based on CF\*livestock population*



### 6.2.3 Concentrates Feed Requirement

The requirement of concentrates for different species of animals in the country and selected states is presented in **Table 6.4**. The table shows a concentrate requirement of 50.74 million tonnes per country to feed cattle, buffalo, sheep and goats. The concentrates required by the selected states range from 0.23 million tonnes in Kerala to 9.31 million tonnes in Uttar Pradesh.

**Table 6.4: Requirement of Concentrates across the States**

('million tonnes)									
Particulars	CF	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
<b>Cattle</b>									
In milch	0.64	1.90	0.36	1.78	0.36	2.70	3.92	2.94	33.27
Dry	0.40	0.60	0.13	0.51	0.05	1.03	1.19	1.06	11.59
Adult male	0.33	0.49	0.06	0.47	0.00	0.43	0.40	0.76	11.19
Young stock	0.18	0.65	0.13	0.54	0.11	1.04	1.53	1.71	13.98
Total		3.65	0.69	3.30	0.53	5.21	7.03	6.46	70.02
<b>Buffalo</b>									
In milch	1.05	4.01	1.63	1.20	0.01	4.99	11.89	0.15	40.07
Dry	0.52	0.96	0.29	0.27	0.00	1.18	2.29	0.03	8.80
Adult male	0.36	0.05	0.02	0.01	0.00	0.04	0.29	0.09	1.29
Young stock	0.19	0.90	0.42	0.24	0.02	1.25	3.13	0.03	9.73
Total		5.92	2.35	1.73	0.03	7.45	17.60	0.30	59.88
<b>Goat</b>	0.06	0.29	0.02	0.37	0.08	1.25	0.87	0.98	8.93
<b>Sheep</b>	0.04	0.07	0.02	0.23	0.00	0.003	0.003	0.003	0.19
<b>Per day (000 tonne)</b>		<b>9.94</b>	<b>3.08</b>	<b>5.63</b>	<b>0.63</b>	<b>13.92</b>	<b>25.50</b>	<b>7.75</b>	<b>139.02</b>
<b>Per year (mt)</b>		<b>3.63</b>	<b>1.13</b>	<b>2.05</b>	<b>0.23</b>	<b>5.08</b>	<b>9.31</b>	<b>2.83</b>	<b>50.74</b>

*Note: Authors estimation based on CF\*livestock population*

### 6.3 Availability of Feed and Fodder in the States

Based on the land use pattern, major crop production and fodder conversion factor, the availability of fodder (green, dry and concentrate) was estimated across the states and for the country, and presented in **Table 6.5**, **Table 6.6** and **Table 6.7**.

#### 6.3.1 Green Fodder Availability

The availability or production/ supply of green fodder in the states and the country is presented in **Table 6.5**. The results show that 5751 lakh tonnes of green fodder is available from the different sources of production, with the highest green fodder source being fodder crops (3739.77 lakh tonnes), followed by forest area on the assumption of 50 per cent of the area being accessible for grazing (1077.99 lakh tonnes) and permanent pastures and other grazing lands. The other source of green fodder includes current fallows, cultivable wasteland, fallow land, etc. The availability of green fodder across the states ranges from 22.99 lakh tonnes in Kerala to 2216.70 lakh tonnes in Uttar Pradesh.

**Table 6.5: Availability of Green Fodder across the States of India**

Land Use Category		Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
<b>Area in lakh hectares (2018)</b>									
Area under fodder crops		8.5	4.2	0.28	0.06	49.28	7.67	0.03	91.37
Forest area and on the assumption that only 50% area is accessible for grazing		18.34	0.41	30.73	10.82	27.52	16.66	11.74	718.66
Permanent pasture and other grazing land		8.51	0.25	9.07		16.72	0.65	0.02	102.61
Cultivable waste land		19.6	0.44	4.09	0.99	38.95	3.95	0.16	122.86
Current fallows		3.79	0.93	14.53	0.7	15.97	11.61	3.28	154.1
Fallow land other than current fallow		0.16	1.3	6.56	0.55	19.66	5.47	0.11	113.08
Land under miscellaneous tree crops and groves		0.04	0.08	2.76	0.03	0.21	2.91	0.5	30.93
<b>CF Availability in lakh tonnes</b>									
Area under fodder crops	40.93	347.91	171.91	11.46	2.46	2017.03	313.93	1.23	3739.77
Forest area and on the assumption that only 50% of the area is accessible for grazing	1.5	27.51	0.62	46.10	16.23	41.28	24.99	17.61	1077.99
Permanent pastures and other grazing land	5	42.55	1.25	45.35	0.00	83.60	3.25	0.10	513.05
Cultivable waste land	1	19.60	0.44	4.09	0.99	38.95	3.95	0.16	122.86
Current fallows	1	3.79	0.93	14.53	0.70	15.97	11.61	3.28	154.10
Fallow lands other than current fallow	1	0.16	1.30	6.56	0.55	19.66	5.47	0.11	113.08
Land under miscellaneous tree crops and groves	1	0.04	0.08	2.76	0.03	0.21	2.91	0.50	30.93
		441.56	176.52	130.85	20.96	2216.70	366.11	22.99	5751.78

*Source: MoA&FW-2018 and Authors estimation based on CF\*Area*

### 6.3.2 Dry Fodder Availability

Major crops that provide fodder were used for estimating dry fodder and concentrates availability. The production of paddy, wheat, sorghum, bajra, barley, maize, ragi, small millets, pulses, groundnut, oilseeds and sugarcane amounts to 1164.78, 1035.96, 34.75, 86.64, 16.33, 277.15, 12.29, 3.33, 220.76, 67.27, 315.22, 4054.16 lakh tonnes respectively. The paddy production across the selected states ranges from 4.53 lakh tonnes in Rajasthan to 162.42 lakh tonnes in West Bengal. Wheat production across the states ranges from 1.64 lakhs in Karnataka to 327.41 lakh tonnes in Uttar Pradesh. Similarly, Bajra production is the highest in Gujarat and the lowest in West Bengal. The oilseed production is the highest in Gujarat and the lowest in Kerala, while the sugarcane production is the highest in Uttar Pradesh (1797.15 lakh tonnes) and the lowest in Kerala (1.06 lakh tonnes) (Table 6.6).

**Table 6.6: Production of Crops****(in lakh tonnes)**

Crops	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
Paddy	19.12	45.16	34.31	5.78	4.53	155.45	162.42	1164.78
Wheat	24.07	125.74	1.64		100.83	327.41	3.38	1035.96
Sorghum	0.96	0.21	8.92	0.002	4.70	1.83	0.0003	34.75
Bajra	8.93	8.78	1.76		38.08	17.79	0.0003	86.64
Barley		0.58			8.13	4.55	0.01	16.33
Maize	8.03	0.16	37.58	0.001	18.92	15.26	17.33	277.15
Ragi	0.10		6.78	0.003			0.03	12.39
Small millets	0.01		0.17		0.11	0.05	0.05	3.33
Pulses	6.81	0.82	17.74	0.023	37.59	24.08	3.68	220.76
Groundnut	22.03	0.03	3.91	0.002	13.82	1.00	1.88	67.27
Oil seeds	37.34	12.77	7.83	0.004	68.99	13.31	11.64	315.22
Sugar cane	113.26	85.05	424.08	1.06	4.48	1797.15	13.35	4054.16

*Note: MoA&FW-2018-19*

The crop production data was used for estimating crop residues in terms of dry fodder by using harvest indices and extraction ratios. The estimated dry fodder availability amounts to 5124.24 lakh tonnes in the country. The highest dry fodder production is observed for paddy (1514.21 lakh tonnes) followed by wheat (1035.96 lakh tonnes), sugarcane (1013.54 lakh tonnes), maize, pulses, groundnut, bajra, ragi and other small millets. Across the states, the dry fodder production ranges from 7.84 lakh tonnes in Kerala to 1114.99 lakh tonnes in Uttar Pradesh (Table 6.7).

**Table 6.7: Availability of Dry Fodder in the Selected States of India****(in lakh tonnes)**

Crop Residues	CF	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
Paddy	1.3	24.86	58.71	44.60	7.52	5.89	202.09	211.15	1514.21
Wheat	1	24.07	125.74	1.64	0.00	100.83	327.41	3.38	1035.96
Sorghum	2.5	2.41	0.53	22.29	0.004	11.74	4.58	0.001	86.89
Bajra/Pearl millet	2.5	22.32	21.96	4.41	-	95.20	44.49	0.001	216.60
Barley	1.3		0.75	0.00	-	10.56	5.92	0.01	21.23
Maize	2.5	20.07	0.39	93.94	0.004	47.31	38.15	43.32	692.88
Ragi	2	0.19	0.00	13.55	0.005			0.06	24.77
Small Millets	2.5	0.03	0.00	0.41	0.001	0.27	0.11	0.12	8.33
Pulses	1.7	11.58	1.40	30.16	0.039	63.91	40.94	6.26	375.29
Groundnut	2	44.06	0.07	7.82	0.005	27.65	2.01	3.76	134.54
Oilseeds									
Sugarcane	0.25	28.32	21.26	106.02	0.27	1.12	449.29	3.34	1013.54
Total		177.91	230.80	324.84	7.84	364.48	1114.99	271.40	5124.24

*Note: Author's estimation based on CF\*Crop Production*

### 6.3.3 Availability of Concentrate Feed

The availability of concentrates was estimated based on extraction and conversion ratios (Table 6.8). The table shows an availability of 525.19 lakh tonnes of concentrates from different sources. The highest availability of concentrates is observed for Oilseeds (267.74 lakh tonnes), followed by Brans and chunnies (176.06 lakh tonnes), and grains (80.39 lakh tonnes). Brans and chunnies account for a major contribution from paddy and wheat. As for grains, a major contribution is made by maize, followed by paddy and wheat.

**Table 6.8: Availability of Concentrates in the Selected States of India**

(in lakh tonnes)

Particulars	CF	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
<b>Oil cakes</b>									
Groundnut	0.7	15.42	0.02	2.74	0.002	9.68	0.70	1.32	47.09
Oilseeds	0.7	26.14	8.94	5.48	0.003	48.29	9.32	8.14	220.65
Total		41.56	8.96	8.22	0.004	57.97	10.02	9.46	267.74
<b>Grains</b>									
Paddy	0.02	0.38	0.90	0.69	0.12	0.09	3.11	3.25	23.30
Wheat	0.02	0.48	2.51	0.03		2.02	6.55	0.07	20.72
Sorghum	0.05	0.05	0.01	0.45	0.0001	0.23	0.09	0.00	1.74
Bajra/Pearl millet	0.05	0.45	0.44	0.09		1.90	0.89	0.00	4.33
Barley	0.1		0.06			0.81	0.46	0.001	1.63
Maize	0.1	0.80	0.02	3.76	0.0001	1.89	1.53	1.73	27.72
Ragi	0.05	0.005		0.34	0.0001			0.001	0.62
Small Millets	0.1	0.001		0.02	0.00003	0.01	0.00	0.005	0.33
Total		2.17	3.94	5.37	0.12	6.96	12.62	5.06	80.39
<b>Brans and chunnies</b>									
Paddy	0.08	1.53	3.61	2.74	0.46	0.36	12.44	12.99	93.18
Wheat	0.08	1.93	10.06	0.13	0.00	8.07	26.19	0.27	82.88
Total		3.46	13.67	2.88	0.46	8.43	38.63	13.26	176.06
Total concentrates		47.18	26.58	16.46	0.58	73.36	61.27	27.78	524.19

*Note: Author's estimation based on CF\*Crop Production*

### 6.4 Feed and Fodder Gap Estimation

The gap in the feed and fodder supply was estimated by using the requirement and availability of green fodder, dry fodder and concentrates. The results show that, there is a requirement of 486.69, 468.29, 50.74 million tonnes of green fodder, dry fodder and concentrates, while the availability /supply of green fodder, dry fodder and concentrates amounts to 575.18, 512.42 and 52.42 million tonnes, respectively. The excess in availability amounts to 88.49, 44.14 and 1.67 million tonnes of green fodder, dry fodder and concentrates with a gap of 15.38, 8.61 and 3.20 per cent, respectively (Table 6.9).

## **6.5 Requirement of Feed and Fodder Nutrients in Terms of Dry Matter, Total Digestible Units and Crude Proteins**

The requirement of feed and fodder in terms of dry matter is presented in **Table 6.10**. The requirement of green fodder, dry fodder and concentrates in terms of dry matter works out to 121.67, 421.46, 45.67 million tonnes and a totally 588.80 million tonnes of dry matter for feeding cattle, buffalo, goats and sheep. The availability / production of green fodder, dry fodder and concentrate in terms of dry matter amounts to 143.79, 461.18 and 47.18 million tonnes, respectively, and total availability to 652.12 million tonnes. The difference in the excess is at 22.12, 39.72, 1.51 million tonnes of which a total of 63.55 million tonnes of dry matter. The percentage gap amounts to 15.38, 8.61 and 3.20 for green fodder, dry fodder and concentrates, respectively and the total gap to 9.71 per dry matter.

**Table 6.9: Feed and Fodder Gap across the States, as per NATP**

(in million tonnes)

States	Requirement			Availability			Difference			Gap (%)		
	GF	DF	Con	GF	DF	Con	GF	DF	Con	GF	DF	Con
Gujarat	30.79	31.18	3.63	44.16	17.79	4.72	13.37	-13.39	1.09	30.28	-75.27	23.09
Haryana	8.88	9.17	1.13	17.65	23.08	2.66	8.77	13.91	1.53	49.69	60.27	57.52
Karnataka	21.96	18.9	2.05	13.08	32.48	1.65	-8.88	13.58	-0.4	-67.89	41.81	-24.24
Kerala	2.26	2.03	0.23	2.1	0.78	0.06	-0.16	-1.25	-0.17	-7.62	-160.26	-283.33
Rajasthan	48.39	42.45	5.08	221.67	36.45	7.34	173.28	-6	2.26	78.17	-16.46	30.79
Uttar Pradesh	77.05	76.74	9.31	36.61	111.5	6.13	-40.44	34.76	-3.18	-110.46	31.17	-51.88
West Bengal	29.67	28.06	2.83	2.3	27.14	2.78	-27.37	-0.92	-0.05	-1190.00	-3.39	-1.80
<b>India</b>	<b>486.69</b>	<b>468.29</b>	<b>50.74</b>	<b>575.18</b>	<b>512.42</b>	<b>52.42</b>	<b>88.49</b>	<b>44.13</b>	<b>1.68</b>	<b>15.38</b>	<b>8.61</b>	<b>3.20</b>

*Note: Author's estimation based on primary and secondary sources, GF: Green fodder, DF: Dry fodder, Con: Concentrates*

**Table 6.10: Feed and Fodder Gap in terms of Dry Matter as per NATP**

(million tonnes)

States	Requirement				Availability				Difference				GAP			
	GFD	DFD	COND	Total	GFD	DFD	COND	Total	GFD	DFD	COND	Total	GFD	DFD	COND	Total
Gujarat	7.7	28.06	3.27	39.03	11.04	16.01	4.25	31.3	3.34	-12.05	0.98	-7.73	30.25	-75.27	23.06	-24.70
Haryana	2.22	8.25	1.01	11.48	4.41	20.77	2.39	27.58	2.19	12.52	1.38	16.1	49.66	60.28	57.74	58.38
Karnataka	5.49	17.01	1.85	24.34	3.27	29.24	1.48	33.99	-2.22	12.23	-0.37	9.65	-67.89	41.83	-25.00	28.39
Kerala	0.57	1.83	0.21	2.6	0.52	0.71	0.05	1.28	-0.05	-1.12	-0.16	-1.32	-9.62	-157.75	-320.00	-103.13
Rajasthan	12.1	38.21	4.57	54.87	55.42	32.8	6.6	94.82	43.32	-5.41	2.03	39.95	78.17	-16.49	30.76	42.13
Uttar Pradesh	19.26	69.06	8.38	96.7	9.15	100.35	5.51	115.02	-10.11	31.29	-2.87	18.32	-110.49	31.18	-52.09	15.93
West Bengal	7.42	25.25	2.54	35.22	0.57	24.43	2.5	27.5	-6.85	-0.82	-0.04	-7.72	-1201.75	-3.36	-1.60	-28.07
<b>India</b>	<b>121.67</b>	<b>421.46</b>	<b>45.67</b>	<b>588.8</b>	<b>143.79</b>	<b>461.18</b>	<b>47.18</b>	<b>652.15</b>	<b>22.12</b>	<b>39.72</b>	<b>1.51</b>	<b>63.35</b>	<b>15.38</b>	<b>8.61</b>	<b>3.20</b>	<b>9.71</b>

*Note: Author's estimation based on primary and secondary sources, GFD: Green fodder in terms of dry matter, DFD: dry fodder in terms of dry matter, COND: concentrates in terms of dry matter*

## 6.6 Requirement of Feed and Fodder in Terms of Ruminant Livestock Units as Per FAO

The livestock population of different categories as per age is presented in **Table 6.11**. The table shows that there are 114.86, 42.09 and 35.58 million of over 2.5 years old cattle, 1 to 2.5 years old cattle and less than 1 year old cattle that together constitute a total of 192.52 million cattle population, whereas there are 109.85 million buffaloes of which 58.66 million belong to above 2.5 years, 26.71 million belong to 1 to 2.5 years and 24.48 million belong to less than 1 year categories of animals. The goat population of the country stands at 148.88 million of which 57.67 million are aged less than 1 year and 91.22 million are aged above 1 year. The sheep population of the country stands at 74.26 million, of which 26.13 million are aged less than 1 year and 48.13 million belong to above one year.

**Table 6.11: Livestock Population as Per Age in the States of India, as Per FAO Standards**

Particulars	(Numbers in millions)							
	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
<b>Cattle</b>								
Over 2.5 year	5.98	1.08	5.48	0.70	8.12	10.30	9.54	114.86
1.0-2.5 years	2.05	0.41	1.54	0.33	2.94	4.26	5.43	42.09
Less than 1 year	1.58	0.33	1.44	0.30	2.85	4.23	4.04	35.58
Total	9.61	1.82	8.46	1.33	13.91	18.79	19.02	192.52
<b>Buffalo</b>								
Over 2.5 year	5.81	2.15	1.71	0.01	7.11	16.53	0.45	58.66
1.0-2.5 years	2.63	1.28	0.59	0.08	3.30	8.69	0.12	26.71
Less than 1 year	2.10	0.94	0.68	0.00	3.28	7.80	0.06	24.48
Total	10.54	4.37	2.98	0.10	13.69	33.02	0.63	109.85
<b>Goat</b>								
Less than 1 year	1.58	0.12	2.19	0.69	7.26	5.95	7.16	57.67
Above 1 year	3.28	0.21	3.97	0.67	13.58	8.53	9.11	91.22
Total	4.87	0.33	6.17	1.36	20.84	14.48	16.28	148.88
<b>Sheep</b>								
Up to 1 year	0.56	0.09	3.69	0.00	2.81	0.40	0.43	26.13
Above 1 year	1.22	0.20	7.36	0.00	5.09	0.58	0.53	48.13
	1.79	0.29	11.05	0.00	7.90	0.98	0.95	74.26

*Note: Livestock Census, FAO report- 2019*

## 6.7 Availability, Requirement and GAP of Feed and Fodder in Terms of Dry Matter as Per FAOs

The difference was calculated by subtracting the availability from requirement. The availability of feed and fodder in terms of dry matter amounts to 652.15 million tonnes and the requirement to 597.67 million tonnes and hence, there is a positive difference in the production at about 54 million tonnes. The access to feed and fodder is found in Rajasthan,

Uttar Pradesh, Haryana, Karnataka and Gujarat. The deficit in the production of feed and fodder in terms of dry matter is found in West Bengal (7.27 million tonnes) and Kerala (1.25 million tonnes). The percentage gap was estimated for the country and across the states at 9.12 per cent. Similarly, this is more than 24.38 per cent to 136.93 per cent across the states with a deficit of 49.28 and 20.91 per cent in respect of Kerala and West Bengal respectively (Table 6.12).

**Table 6.12: Gap in Feed and Fodder in Terms of Dry Matter as Per FAO**

(in million tonnes)

States	Requirement in Terms of Dry Matter	Dry Matter Availability	Difference	GAP (%0
Gujarat	25.16	31.30	-6.13	-24.38
Haryana	11.64	27.58	-15.94	-136.93
Karnataka	25.11	33.99	-8.87	-35.33
Kerala	2.53	1.28	1.25	49.28
Rajasthan	56.01	94.82	-38.81	-69.29
Uttar Pradesh	96.66	115.02	-18.36	-18.99
West Bengal	34.77	27.50	7.27	20.91
India	597.67	652.15	-54.49	-9.12

*Note: Author's estimation.*

The feed and fodder required by cattle, buffalo, sheep and goats was estimated in terms of dry matter. Per day requirement ranges from 0.21 kg of dry matter for sheep belonging to less than one year and 7.98 kg belonging to above 2.5 years, for buffalo. The results show that there is a feed and fodder requirement of 597.67 million tonnes in terms of dry matter which ranges from 2.53 million tonnes in Kerala to 96.66 million tonnes in Uttar Pradesh (Table 6.13).



**Table 6.13: Estimation of Feed and Fodder Required in Terms of Dry Matter, as Per  
FAO**

**(in million tonnes)**

Particulars	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India	
<b>Cattle</b>									
Over 2.5 years	7	1.17	7.56	38.36	4.87	56.86	72.11	66.80	803.99
1.0-2.5 years	2.38	4.88	0.98	3.66	0.80	7.01	10.14	12.93	100.17
Less than 1 year	0.77	1.22	0.25	1.11	0.23	2.19	3.26	3.11	27.40
Total		7.27	8.79	43.13	5.90	66.05	85.50	82.85	931.55
<b>Buffalo</b>									
Over 2.5 year	7.98	46.35	17.17	13.62	0.11	56.77	131.90	3.58	468.15
1.0-2.5 years	3.5	9.21	4.49	2.07	0.29	11.54	30.42	0.41	93.47
Less than 1 year	1.19	2.50	1.11	0.82	0.01	3.91	9.28	0.08	29.13
Total		58.06	22.76	16.51	0.41	72.22	171.60	4.07	590.75
<b>Goat</b>									
Less than 1 year	0.21	0.33	0.03	0.46	0.14	1.52	1.25	1.50	12.11
Above 1 year	0.7	2.30	0.15	2.78	0.47	9.51	5.97	6.38	63.85
Total		2.63	0.17	3.24	0.61	11.03	7.22	7.88	75.96
<b>Sheep</b>									
Up to 1 year	0.21	0.12	0.02	0.78	0.00	0.59	0.08	0.09	5.49
Above 1 year	0.7	0.86	0.14	5.15	0.00	3.57	0.41	0.37	33.69
Total		0.97	0.16	5.93	0.00	4.16	0.49	0.46	39.18
Per day in mn tonnes		68.94	31.89	68.81	6.92	153.46	264.82	95.26	1637.44
Per year mt		25.16	11.64	25.11	2.53	56.01	96.66	34.77	597.67

*Note: Author's estimation based on primary and secondary sources*

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## 7. ECONOMICS OF LIVESTOCK MANAGEMENT AND CONSTRAINTS FACED BY SAMPLE HOUSEHOLDS

The economics of livestock production across the states has been explained in the following tables. The cost of animal shed, labour cost, veterinary and other maintenance cost, milk production and its price and the cost of milk and dung of cattle, buffalo, sheep and goats were estimated based on the sample data collected from selected states.

### 7.1 Rearing Space (Sheds) and Fodder Storage Structures for Livestock

The number of pucca, kutcha and mixed cattle sheds of the sample households from the selected states is presented in **Table 7.1**. In total, 1113 cattle sheds have been constructed by 1606 sample households, which account for nearly 69 per cent. The number of kutcha and pucca cattle sheds is more which accounts for 43.13 and 38.27 per cent and the least by mixed cattle sheds out of 1113 cattle sheds across the states. Karnataka and Haryana have more mixed cattle sheds. The kutcha cattle sheds are more in Gujarat, Rajasthan, Uttar Pradesh and West Bengal, while pucca sheds are more in number in Kerala state.

**Table 7.1: Details of Cattle Sheds of the Sample Households**

(Number of Sheds)

States	Pucca	Kutcha	Mixed	Total
	In number and per cent			
Gujarat	74(42.53)	90(51.72)	10(5.75)	174
Haryana	58(37.66)	34(22.08)	62(40.26)	154
Karnataka	28(24.56)	6(5.26)	80(70.18)	114
Kerala	189(93.56)	11(5.45)	2(0.99)	202
Rajasthan	61(36.53)	84(50.3)	22(13.17)	167
Uttar Pradesh	1(0.65)	123(79.35)	31(20)	155
West Bengal	15(10.2)	132(89.8)	(0)	147
Total	426(38.27)	480(43.13)	207(18.6)	1113
	Market Value (in Rs)			
Gujarat	68781	10547	24750	34693
Haryana	105929	23469	56500	61966
Karnataka	57928	4500	28418	30282
Kerala	107911	30455	15000	51122
Rajasthan	103910	34923	32205	57013
Uttar Pradesh	20000	20787	14970	18586
West Bengal	148000	13008		80504
Total	83653	19553	26671	43292

*Source: Field survey data 2019*

The details of the market value of pucca, kutcha and mixed cattle sheds are presented in **Table 7.2**. The results show that the market value of pucca cattle sheds amounts to Rs. 83,653, followed by mixed cattle sheds (Rs.26,671) and kutcha cattle sheds (Rs.19,553). In all the states, the value of pucca cattle sheds is more compared to kutcha and mixed cattle

sheds, which is the highest in West Bengal, followed by Rajasthan and Kerala. The value of kutcha cattle sheds is higher in Rajasthan, followed by Kerala and the least in Karnataka. The market value of mixed cattle sheds is found higher in Haryana, followed by Rajasthan.

The details of the sheep and goat sheds of the sample households are presented in **Table 7.2**. The results show that totally, 484 sheep and goat sheds have been constructed by 1,606 sample households, which account for about 30 per cent. Out of 486 sheep and goat sheds, 256 (52.89%) are kutcha in nature, followed by 160 (33.06%) sheds which are pucca and the remaining 68 sheds (14.05%) are mixed in nature. Kerala state accounts for more number of pucca cattle sheds, whereas kutcha sheds are more in Haryana, Rajasthan and Gujarat and mixed sheds are more in Karnataka and even in Haryana state.

**Table 7.2: Details of Sheep and Goat Sheds of the Sample Households**  
(Number of Sheds)

States	Pucca	Kutcha	Mixed	Total
Gujarat	4(8.33)	39(81.25)	5(10.42)	48
Haryana	7(5.74)	83(68.03)	32(26.23)	122
Karnataka	11(26.83)	3(7.32)	27(65.85)	41
Kerala	133(92.36)	10(6.94)	1(0.69)	144
Rajasthan	4(4.88)	77(93.9)	1(1.22)	82
Uttar Pradesh	1(5.26)	16(84.21)	2(10.53)	19
West Bengal	(0)	28(100)	(0)	28
Total	160(33.06)	256(52.89)	68(14.05)	484
Market Value (in Rs)				
Gujarat	16250	2540	11500	10097
Haryana	25000	6279	81177	37485
Karnataka	106181	6000	65000	176227
Kerala	37438	13700	20000	23713
Rajasthan	135000	22019	20000	59006
Uttar Pradesh	18000	13456	7000	12819
West Bengal		2029		2029
Total	115647	9394	25483	50175

*Source: Field survey data 2019*

The market value of sheep and goat sheds is presented in **Table 7.2**. The results show that the average market value of pucca sheds amounts to about Rs. 115647 (which is the highest), followed by mixed (Rs.25483) and kutcha (Rs. 9394) sheds, respectively. The value of pucca sheds is found highest in Rajasthan, followed by Karnataka, whereas kutcha sheds are more in Rajasthan and the value of mixed sheds is higher in Haryana, followed by Karnataka.

## 7.2 Labour Requirement and Maintenance Charges of Livestock Rearing

The requirement and labour cost per day is presented in **Table 7.3**. The results show that the labour requirement per day per animal ranges from 0.68 hours to 2.06 hours for buffaloes from 0.40 to 2.06 hours for indigenous cattle, 0.63 to 2.74 hours for crossbred cattle from

0.19 to 3.50 hours for sheep and from 0.11 to 3.28 hours for goats. An average labour requirement per animal per day ranges from 0.88 to 1.45 hours. Among the bovines, crossbred cattle require more per day i.e., 1.26 hours followed by 1.15 hours for buffalo and 0.88 hours for indigenous cattle. The requirement of labour for goat and sheep works out to 1.45 and 1.39 hours, respectively. The per day labour cost for buffalo ranges from Rs. 26.05 to Rs.59.42 for buffalo, Rs. 15.20 to Rs.78.28 for indigenous cattle and Rs.21.50 to Rs.89.37 for crossbred cattle and for goat and sheep Rs. 6.82 to 117.21 and Rs. 4.54 to 118.25, respectively. An average labour cost per day per animal works out to Rs. 46.12 for crossbred, Rs.41.58 for buffalo, Rs. 32.20 for indigenous cattle and Rs.49.69 and Rs.56.81 for sheep and goat, respectively.

**Table 7.3: Details of Labour, Veterinary and Other Maintenance Costs**

States	Labour Requirement (per day)				
	Buffalo	Indigenous Cattle	Crossbred Cattle	Sheep	Goat
Gujarat	1.89	1.55	1.88	2.93	2.64
Haryana	1.07		0.71		2.13
Karnataka	1.01	0.84	1.20	0.19	0.16
Kerala	2.00		1.08		
Rajasthan	2.06	2.06	2.74	3.50	3.28
Uttar Pradesh	0.68	0.40	0.63		0.45
West Bengal	0.93	1.03	1.03		0.11
Total	1.15	0.88	1.26	1.39	1.45
Labour cost per day (Rs/day)					
Gujarat	59.42	52.06	57.45	109.99	84.36
Haryana	39.95		28.10		118.25
Karnataka	35.02	29.03	38.57	6.82	4.95
Kerala	-	-	70.59		
Rajasthan	76.68	78.28	89.37	117.21	108.14
Uttar Pradesh	26.35	15.20	21.50		17.33
West Bengal	35.97	41.11	40.07		4.54
Total	41.58	32.20	46.12	49.69	56.81

*Source: Field Survey data 2019*

The average veterinary and maintenance cost per animal is presented in **Table 7.4**. The veterinary cost is the highest for crossbred cattle i.e., Rs. 2040 per animal per annum, followed by buffalo and indigenous cattle (Rs.1721 and Rs. 2040). The highest veterinary cost for buffalo is found in Haryana, followed by Karnataka. For indigenous cattle, the veterinary cost is the highest in Rajasthan, followed by Haryana and Karnataka. In the case of sheep and goats, the veterinary cost is the highest in Haryana state. The other maintenance cost is also the highest for cross-bred cattle i.e., Rs.2231/annum per animal, followed by buffalo (Rs.1001), indigenous cattle (Rs.985), goat (Rs.775) and sheep (Rs.684).

**Table 7.4: Veterinary and Other Maintenance Cost (Rs/annum)**

Particulars		Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
Veterinary Cost/annum (Rs.)	Buffalo	1799	4216	1884	1675	1799	355	1306	1721
	Indigenous Cattle	1501	2749	2326	1000	2790	79	881	1458
	Crossbred Cattle	3532	1917	3897	2586	2206	1615	1501	2040
	Sheep	860	1742	343		1429			539
	Goat	860	1804	438	667	549	89	76	587
Maintenance Cost/annum	Buffalo	1246	1810	803	1609	1246	624	554	1001
	Indigenous Cattle	508	1671	826		4194	112	445	985
	Crossbred Cattle	467	899	928	3232	9555	1643	625	2231
	Sheep		1167	302		3575		81	684
	Goat		2378	469	1288	434	115		775

Source: Field survey data 2019

### 7.3 Returns from Livestock Rearing

Average milk yields of different species of animals across the states are presented in **Table 7.5**. The results show that the average milk yield per day ranges from 8.91 litres to 0.57 litres. The milk yield is the highest for crossbred cattle (8.91 litre /day), followed by buffalo and indigenous cattle, and for sheep and goats (0.57 and 0.92 litre per day). In the case of crossbred cattle, Uttar Pradesh state accounts for the highest milk yield, followed by Karnataka (9.90 litres), whereas, indigenous cattle milk yield is the highest in Haryana, followed by Rajasthan and Gujarat.

**Table 7.5: Returns from Livestock Rearing (Milk)**

States	Average milk yield per day in ltr					Sale price of milk (Rs/ltr)				
	Crossbred cattle	Indigenous cattle	Buffalo	Sheep	Goat	Crossbred cattle	Indigenous cattle	Buffalo	Sheep	Goat
Gujarat	9.22	5.17	5.82	0.57	0.70	29.68	30.22	43.44	31.11	13.04
Haryana	7.10	6.00	8.30	2.40	2.90	27.10	28.90	39.10		30.00
Karnataka	9.80	2.50	3.92			29.75	30.77	36.03		
Kerala	8.15	2.03	3.28		0.81	36.20	38.00	40.55		40.00
Rajasthan	9.52	5.83	7.15	0.54	0.61	26.28	26.10	38.26	22.57	21.79
Uttar Pradesh	10.00	3.00	8.00		0.35	22.00	26.00	36.00		20.00
West Bengal	9.06	4.43	6.57		0.51	31.45	30.96	45.10		30.88
Average	8.91	4.07	6.12	0.57	0.92	28.81	30.21	39.38	27.78	26.20

Source: Field survey data 2019

Buffalo milk yield is the highest in Haryana state (8.30 litres per day), followed by Rajasthan. The sheep and goat milk yield is the highest in Haryana state. The sale price of milk is presented in **Table 7.5** which shows that on average, the price of milk ranges from Rs.38.38 to Rs.26.20 per litre. Per litre milk price is the highest for buffalo, followed by indigenous cattle and cross bred cattle. The milk price of sheep and goats is Rs.27.78 and Rs.26.20 per litre. The highest price for crossbred and indigenous cattle milk is found in Kerala. The buffalo milk price is the highest in West Bengal, followed by Gujarat. The goat milk price is the highest in Kerala and sheep milk in Gujarat.

Dung yield per animal per year is presented in **Table 7.6**. The results show that, on average dung yield per animal per year ranges from 4.22 tonnes to 0.27 tonnes and are more for crossbred cattle followed by buffalo and indigenous cattle. The sheep and goat yields on an average amount to 0.27 and 0.48 tonnes per animal per year. The respective sale price of dung given in the same table shows that the price obtained amounts to Rs. 3,512, Rs.2,920, Rs.4,344 and Rs. 216 and Rs.339 by sale of 4.22 tonnes, 3.72 tonnes, 4.06 tonnes and 0.27 tonnes and 0.48 tonnes of dung for crossbred cattle, indigenous cattle, buffalo, sheep and goat, respectively.

#### 7.4. Major Sources of Livestock Feed in the States

The major sources of livestock feed reported by the sample households are presented in **Table 7.7**. As per the opinion of respondents, crop residues (64.32%) are the major source of livestock feed, followed by household leftovers (59.49%), grazing land (53.99%) and tree legumes grown as hedges (50.49%). The other sources are improved forage and pasture (36.12%) and food reserve and storage (21.55%). Coming to the states, the major sources of feed are crop residues and household leftovers in Karnataka, household leftovers and crop residues in Haryana, crop residues and improved forage and pasture in Gujarat, grazing land and household leftovers in Kerala, Crop residues and tree legumes grown as a hedge in Uttar Pradesh.

**Table 7.6: Returns from Livestock Dung**

States	Average dung yield per day in kg					Sale price of dung (Rs/kg)				
	Crossbred cattle	Indigenous cattle	Buffalo	Sheep	Goat	Crossbred cattle	Indigenous cattle	Buffalo	Sheep	Goat
Gujarat	6.22	4.27	6.54	0.67	0.96	6111	4393	7338	254	995
Haryana	6.00	8.80	3.40	0.61	0.14	3150	4620	7035	805	177
Karnataka	2.77	1.21	1.43	0.07	0.15	4396	2871	3009	141	321
Kerala	2.34		2.69		0.14	2175		1122		172
Rajasthan	2.81	2.81	3.37	0.47	0.92	3853	4222	4977	106	159
Uttar Pradesh	3.90	3.60	4.80		0.80	1560	1440	1920		400
West Bengal	5.85	5.01	8.39		0.55	3850	3188	5680		130
Average	4.22	3.72	4.06	0.27	0.48	3512	2920	4344	216	339

*Source: Field survey data 2019*

**Table 7.7: Major Sources of Livestock Feed**

(Values in %)

Source of Livestock Feed	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
	Households Reported (%)							
Grazing land	50.90	46.75	60.59	89.86	3.76	80.97	26.00	53.99
Crop residues	86.60	59.35	72.86	46.08	93.01	6.48	100.00	64.32
Improved forage and pasture	58.10	1.63	42.75	25.35	52.69	11.34	74.00	36.12
Household left over	56.00	82.11	68.77	77.88	56.99	2.02	83.33	59.46
Tree legumes grown as hedge or any	56.00	45.93	54.64	27.19	69.35	40.49	66.67	50.49
Feed preservation and storage	10.70	34.15	17.84	8.29	10.75	57.49	2.00	21.55

*Source: Field survey data 2019*

### 7.5 Constraints Faced by Sample Households in Livestock Rearing and Fodder Cultivation

Constraints faced by the sample households in livestock rearing and fodder cultivation across the states are presented in **Table 7.8**. The results show that land is very little, therefore, households cannot afford to put more land under fodder production, lack of awareness regarding government programmes on subsidies related to seeds (77.83%). Poor livestock extension services (75.03%) and high cost of cultivation/production and low returns on fodder production (70.36%) are the major constraints faced by the sample households. The other constraints are the non-availability of adequate irrigation water, non-availability of labour, land not suitable for fodder production, low price for green fodder in the market, no provision of quality seed by society on credit, non-availability of grazing lands, lack of training facilities, more laborious, lack of awareness regarding production and post-harvest techniques. In Karnataka state, lack of awareness regarding government programmes on subsidy on seeds and more laborious and poor livestock extension services are the major constraints faced by the households. Land is very less, therefore, cannot afford to put more land under fodder seed/crop production is the main constraint as indicated by 84.15 per cent of the farmers. In Gujarat state, poor livestock extension service is the most important constraint. In Kerala state, land is very little, therefore, putting more land under fodder is the main constraint. In Rajasthan, excepting the first constraint other constraints have been reported by 100 per cent of the households. In Uttar Pradesh, less land availability, high cost of cultivation, poor livestock services, lack of awareness and more labour are the main constraints, whereas, in West Bengal, very less land availability and high cost of cultivation are the major constraints.

**Table: 7.8 Constraints Faced by the Sample Households in Fodder Cultivation**

Constraints		Gujarat	Haryana	Karnataka	Kerala	Rajasthan	UP	WB	Total
		Number of Households Reported							
		291	246	269	217	186	247	150	1606
1	Land is very scarce, therefore, cannot afford to put more land under fodder seed/crop production	92.10	84.15	81.78	66.82	85.48	100.00	100.00	86.92
2	Non-availability of adequate irrigation water	81.10	54.07	55.76	35.02	100.00	36.44		54.23
3	Non-availability of labour	74.23	18.70	54.65	20.28	100.00	36.44	42.67	49.38
4	Land is not suitable for fodder production	69.42	33.74	52.04	29.03	100.00	100.00		57.35
5	High cost of cultivation/production and low return on fodder production	74.57	43.90	52.42	37.33	100.00	100.00	100.00	70.36
6	Low price prevails for green fodder in market	69.76	25.61	76.21	42.40	100.00	100.00	70.00	68.56
7	High cost of fodder seed	70.45	19.11	68.77	35.94	100.00	100.00	73.33	65.88
8	No provision of quality seed by society on credit & non-availability of quality fodder seed in market	69.42	19.92	71.38	15.67	100.00	100.00	73.33	63.51
9	Non-availability of grazing lands	70.45	30.89	71.38	48.39	100.00	63.56	26.67	59.84
10	Lack of training facilities	93.81	21.54	83.27	46.08	100.00	36.44	91.33	66.19
11	Poor livestock extension services	97.25	15.04	91.08	32.72	100.00	100.00	90.67	75.03
12	Lack of awareness regarding government programmes on subsidy on seeds	96.22	35.77	94.42	37.33	100.00	100.00	76.00	77.83
13	More laborious	79.38	9.76	92.57	37.33	100.00	100.00	36.00	66.75
14	Lack of awareness regarding production and post-harvest techniques	94.85	13.82	85.13	29.03	100.00	63.56	74.67	65.82

*Source: Field survey data 2019*

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## 8. POST-HARVEST MANAGEMENT AND BENEFITS FROM THE GOVERNMENT FOR LIVESTOCK PRODUCTION

### 8.1 Adoption of Post-Harvest Management Techniques in Livestock Rearing

The proportion of farmers adopting post-harvest technology of feed and fodder is presented in **Table 8.1**. The results show that, on average, only 3.15 per cent of the farmers have adopted post-harvest techniques of feed and fodder and the remaining 96.85 per cent of the farmers have not adopted which in turn, apart from significantly influencing the post-harvest management of feed and fodder, has led to the deterioration in their quantities and quality. The results also show that no one has adopted post-harvest techniques of feed and fodder in Kerala, Rajasthan and Uttar Pradesh. In West Bengal and Haryana states, 15.33 and 6.50 per cent of the farmers have adopted post-harvest techniques, while this proportion is insignificant in Karnataka and Gujarat.

**Table 8.1: Total Number of Farmers Adopting Post-Harvest Techniques**

States	Number of Households (%)	
	Yes	No
Gujarat	0.34	99.66
Haryana	6.5	93.5
Karnataka	2.98	97.02
Kerala	0	100
Rajasthan	0	100
Uttar Pradesh	0	100
West Bengal	15.33	84.67
Total	3.15	96.85

*Source: Field Survey data 2019*

### 8.2 Reasons for Not Adopting Post-Harvest Management Techniques in Livestock Rearing

The major reasons for non-adoption of post-harvest management techniques are presented in **Table 8.2**. The table shows that the lack of awareness regarding production and post-harvest management is the most prominent reason (about 61.86%), followed by highly expensive (47.47%), considered inferior in comparison to fresh one (42.27%), lastly more laborious (29.27%). Among the states, lack of awareness regarding production and post-harvest management ranges from 5.92 per cent in Karnataka to 100 per cent in Uttar Pradesh. Similarly, the other reason is the highly expensive ranges from 3.94 per cent in West Bengal and 100 per cent in Uttar Pradesh.

**Table 8.2: Major Reasons for Not Adopting Post-Harvest Techniques**

Particulars	Number of Households Reported (%)							
	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	Total
Considered inferior in comparison to a fresh one	14.14	44.00	45.72	39.89	27.60	100	7.87	42.27
Highly expensive	54.48	56.00	18.26	43.46	28.10	100	3.94	47.47
Lack of awareness of production and post-harvest management	29.31	121.00	5.92	69.29	26.30	100	88.19	61.86
More laborious	2.07	26.00	13.01	27.12	17.90	100	3.94	29.27

*Source: Field Survey data 2019*

### 8.3 Benefits Received from the Government Program for Livestock Production

The benefits received from the government related to livestock production across the states are presented in **Table 8.3**. The results show that Uttar Pradesh households have not received any benefits related to livestock production. For the other selected states that have received benefits, seed obtained from the veterinary department is the major benefit in Gujarat and Karnataka. Animal vaccination and free treatment are the major benefits received by Haryana state farm households. In Kerala state, incentives for milk price and subsidized fodder seeds are the benefits received. Rajasthan households have received cattle facilities, mineral mixture and fodder seeds. West Bengal households obtained free advice from the veterinary surgeon at the block office and free chaff-cutting machine.

### 8.4 Suggestions to Improve Fodder Production in the States

**Table 8.4** reveals the major suggestions made by the respondents to improve the fodder-related crops. In the case of Gujarat, the major suggestion is to make available fodder seeds on time, whereas, in the case of Kerala state, households have suggested that there is a need to increase the market price of milk and reduce the market price of feed and fodder and the need for credit support. The households of Haryana state have reported that subsidies should be provided for fencing the field, stray animals should be controlled, availability of water, and free seed for fodder crops, provide free and subsidised seeds and irrigation facilities to grow fodder crops. The major suggestions given by Karnataka households relate to training programmes for post-harvest management and the need for financial assistance for shed construction and high-yielding varieties of fodder. Rajasthan households have suggested that fodder banks be provided by the Government. In Uttar Pradesh, households have suggested that the Government provide high-yielding seeds and Extension and training services. Finally, households of West Bengal expect timely availability of fodder seeds, subsidised seeds and training for fodder cultivation and its post-harvest management.

**Table 8.3: Benefits Received from the Government for Livestock Production**

Sl. No.	List of Benefits	Households Benefitted (%)
	<b>Gujarat</b>	
1	Cattle shed, subsidy received	2.01
2	Fodder seed, livestock purchasing loan	5.99
	<b>Haryana</b>	
1	Veterinary service	8.13
2	Vaccination	22.76
3	Free treatment, medicine	24.39
	<b>Karnataka</b>	
1	Seeds from the veterinary department	42.76
2	Subsidy for shed construction	1.26
	<b>Kerala</b>	
1	Fodder subsidy	3.69
2	Milk subsidies (incentives)	10.60
3	Feed subsidies	1.84
4	Cattle shed maintenance support	1.38
5	Subsidy for fodder cultivation and milching machine	2.30
	<b>Rajasthan</b>	
1	Cattle facilities, mineral mixture, fodder seed	5.02
2	Seed distribution kit by government	0.93
3	Cattle shed	0.93
	<b>Uttar Pradesh</b>	
1	No benefits received from the Govt.	100.00
	<b>West Bengal</b>	
1	Free advice from veterinary surgeon at the block office	44.00
2	Free chaff-cutting machine from the office of BLDO	13.33
3	Training received on livestock rearing	8.00
4	Free medicine and vaccination	8.00

*Source: Field Survey data 2019*

**Table 8.4: Major Suggestions to Improve Production of Fodder-Related Crops**

Sl. No.	List of Suggestions	Households Benefited (%)
<b>Gujarat</b>		
1	Make available quality fodder seed in time	43.64
2	Make available fodder seed at subsidised rate	11
3	Government should purchase wool from farmers	2.06
<b>Haryana</b>		
1	Subsidy should be provided for fencing the field, stray animals should be controlled, availability of water, and free seed for fodder crop	4.88
2	Free seeds or seed on subsidy should be provided to all, Water quality is also a big problem in growing crops	2.44
3	Irrigation facility on time should be provided, installation of bio plants, provide subsidised seed to all	2.85
<b>Karnataka</b>		
1	Training programme for post-harvest management of fodder	27.31
2	Financial assistance for shed construction	18.66
3	High-yielding varieties of fodder	11.42
4	Free insurance for cattle	8.16
<b>Kerala</b>		
1	Need to increase the market price of milk	15.21
2	Need to reduce the market price of feed (mainly) and fodder	17.05
3	Need for credit support	5.07
4	Need for financial aid for feed (mainly) and fodder costs (including cultivation)	12.90
6	Need for financial aid for cattle shed construction and maintenance	7.37
<b>Rajasthan</b>		
4	Green Fodder banks should be provided by government	10.22
5	Need irrigation facility	1.08
<b>Uttar Pradesh</b>		
1	HYB Seed and Market	63.56
2	Extensions, Services, Training	36.44
<b>West Bengal</b>		
1	Timely availability of improved fodder seed	36.67
2	Provision for subsidy on fodder seed	34.67
3	Provision of training for fodder cultivation	31.33
4	Provision of training for post-harvest management of fodder crops	34.00

*Source: Field Survey data 2019*

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## 9. SUMMARY, CONCLUSIONS AND POLICY SUGGESTIONS

### 9.1 Background

India has traditionally been a mixed farming economy with agriculture and livestock playing complementary roles. Therefore, it has been acknowledged that the livestock sector makes an important contribution to food security and poverty reduction. The livestock sector in India contributes nearly 29.63 per cent of the total agricultural output and 4.11 per cent to the Gross Domestic Product (GDP). The country accounts for the world's largest livestock population, which is roughly 535.78 million, which is 20 per cent of the world's livestock population (1.468 billion). However, the country has only about a 2.3 per cent share of the world's geographical area in the sector. India is number one in buffalo population (57%) and second in cattle (12%) and goat (20%) population among the world nations. The desired annual growth of the agriculture sector (four %) in the country can also be accomplished by enhancing productivity from the livestock sector.

The livestock sector is the second most important contributor to the agricultural economy of India, next only to staple crops. Animal husbandry and dairying sectors contribute about 27.38 per cent of the Gross Value Added (GVA) from total agriculture, forestry and fishing sectors. Its overall contribution to the total GVA of India amounts to about 4.08 per cent for 2017-18, at constant prices. The share of GVA of the livestock sector in the total agriculture (crops & livestock) has increased from 22.59 per cent in 2011-12 to 27.38 per cent in 2017-18 at constant prices. The dairy sub-sector occupies an important place in the livestock sector and in the agricultural economy of India since milk is the second largest agricultural commodity contributing to Gross National Product (GNP), next only to Rice. While about two third (66.22%) of the total value of output from the livestock sector during 2017-18 is accounted for by the milk group, followed by about one-fifth share by the meat group (22.03), the use of dung as fuel with a contribution of 5.36 per cent also has significantly contributed to the total value derived from the livestock sector, at constant prices.

In the milk production sector, feed as an input constitutes 60 to 70 per cent of the total cost. Henceforth, there is a crucial need for assessment of feed and fodder availability, to reduce the cost and to ensure quality livestock products. Also, any attempt towards enhancing feed availability and economizing the feed cost would result in an increased margin of profits for livestock farmers. Meeting the requirements of the current level of livestock production and its annual population growth is a growing concern and has to be resolved by increasing productivity, utilizing untapped feed resources, increasing land area or through imports.

In the sector, there is a variety of feeds and fodders used for livestock feeding purposes, which are broadly classified as roughages, concentrates, feed supplements and feed additives. Stagnated

areas under fodder production and a decline in pasture lands are the major challenges faced by the feed and fodder production sector. In addition, the replacement of coarse cereal crops, which is one of the main sources of crop residues, with commercial crops is also posing a threat to the feed and fodder production sector. In India, a mere four per cent of the total cropping area falls under fodder cultivation, which has resulted in a severe deficit of green fodder (36%), dry fodder (40%) and concentrates (57%). Therefore, the need of the hour is to fulfil this shortfall in fodder (which accounts for more than about 55%), through crop residues and agricultural by-products. To estimate the demand and supply of feed and fodder resources (deficit /surplus) for the livestock in different states, the availability of dry fodder, greens and concentrates has been calculated using a suitable extraction ratio, also called Residues to Product Ratio (RPR). The quantum of green fodder, dry fodder, and concentrate feed was converted into dry matter (DM) by applying a factor of 0.25 for green fodder, and 0.90 for dry fodder and concentrate feed (*Suresh et al 2012*). Crop residues and concentrates from various cereals, pulses and oilseeds were estimated based on their conversion factors (*Meena et al. 2018*). The factors for conversion of DM from each source into total digestible nutrients (TDN) were taken as 0.534 for green fodder, 0.476 for dry fodder, and 0.780 for concentrate feed. The factors for the conversion of DM from each source into crude protein (CP) were 0.073, 0.016 and 0.180 for green fodder, dry fodder and concentrate feed, respectively (*Dikshit and Birthal, 2010*). The major fodder crops like maize, sorghum, pearl millet, Egyptian clover, Lucerne, cluster bean, etc., were considered. The area under fodder crops was calculated at 8.9 million ha, and the fodder productivity was estimated by using the weighted average of 40.93 tonnes/ha, considering the minimum yield of each fodder crop (*Handbook of Agriculture, 2005*).

Fodder production and its utilization depend on the cropping pattern, climate, socioeconomic conditions and type of livestock. The three major sources of fodder supply are crop residues, cultivated fodder and fodder from common property resources like forests, permanent pastures and grazing lands. At present, the country faces a severe deficit of almost all the major feed components (green, dry and concentrate). The situation is further aggravated due to the increasing growth of livestock, particularly that of genetically upgraded animals. The available forages are poor in quality being deficient in available energy, protein and minerals. To compensate for the low productivity of the livestock, farmers maintain a large herd of animals, which adds to the pressure on land and fodder resources. Due to ever-increasing population pressure of human beings, arable land is mainly used for food and cash crops, thus there is little chance of having good-quality arable land available for fodder production, unless milk production becomes remunerative to the farmer, as compared to other crops. The regional deficits are more important than the national deficit, especially for fodder, which is not economical to transport over long distances. The pattern of deficit varies across different parts of the country. The availability and efficient use of feed resources are the primary drivers of maximising the productivity of livestock and feed security. The area under fodder is squeezing in addition to the decreasing productivity. There is a huge gap in dry fodder and concentrates

availability and their requirement. So, there is a need for assessing livestock feed resources and requirements for effective planning and policy making. Keeping this background in view, the study examines the demand; supply and deficit of feed and fodder production in the country by considering the following objectives. They are a) To estimate the area, production and productivity of major green and dry fodder crops; b) To study the growth pattern of major livestock population, and c) To assess feed and fodder availability requirement, deficit/surplus to improve livestock productivity.

To meet the objectives of the present study, primary and secondary data were collected. The primary data was collected at the field level through a sample survey method for the reference period 2018-19. The study was conducted in the following states viz., Haryana, Gujarat, Karnataka, Kerala, Rajasthan, Uttar Pradesh and West Bengal by respective Agro-Economic Research Centres. The selection of states for conducting the study was done as suggested by the Ministry of Animal Husbandry, Dairy and Fishery, Government of India. For the study, districts were selected based on the Livestock population from the available secondary data. A proportionate sampling technique was applied for selecting the sample size of districts from the selected states. The districts having the top three ranks were selected representing different regions of every state for the study. In every selected state a total of 120 Cattle rearing farmers, 120 Buffalo-rearing farmers and 120 Sheep & Goat rearing farmers with a net sample household of 291 from Gujarat, 246 from Haryana, 269 from Karnataka, 217 from Kerala, 186 from Rajasthan, 247 from Uttar Pradesh and 150 sample households from West Bengal, totally 1,606 households across the states were surveyed with a pre-prepared questionnaire (Table 1.3). The collected data was scrutinised, tabulated and analysed by employing various analytical tools. To estimate the demand and supply of feed and fodder resources (deficit /surplus) for the livestock in different states, the availability of dry fodder, greens and concentrates was calculated using a suitable conversion ratio. The estimation of demand for feed and fodder was worked out using different standards as estimated by the FAO, NATP and NDDDB, including the primary data from the study with the help of livestock population data and their per-day consumption in different stages of life, species, age and sex of animals.

## 9.2 Summary of Findings

### 9.2.1 Status of Area, Production and Productivity of Major Green and Dry Fodder Crops in India.

- As per the data provided for 2014-15, the country accounts for 9137 thousand hectares of area under fodder crops. Rajasthan state (53.93%) stands first with the highest area under fodder crops, followed by Maharashtra (10.61%) and Gujarat (9.36%).
- The country has 10258 thousand hectares of pasture and grazing land, of which the highest share is accounted for by Rajasthan (16.32%) and Himachal Pradesh (14.72%).
- India has 4.61 per cent of the area under fodder crops to the total gross cropped area. The highest area under fodder crops to gross cropped area is found in Rajasthan (20.33%).
- The area under fodder crops in the country has increased at the rate of 1.68 per cent annually for the period of 2005-06 to 2014-15. Among the selected states, the highest positive growth is noticed in Rajasthan (6.72%).
- Geographical area (reported area) of the country constitutes about 3077.52 million hectares of which the total area under forest is 23.35 per cent and the area which is not available for cultivation 14.3 per cent.
- Paddy area growth rate accounts for (0.20%), with a production growth of 1.89 per cent and a yield growth rate of 1.70 per cent in the country and all are significant at one per cent level.
- Wheat, the country accounts for an area production and yield growth rate of 0.29 per cent, 1.85 per cent and 1.55 per cent, respectively and significant at various levels. The major states which contribute significantly to the production growth rate of wheat are Rajasthan (2.72%) and Uttar Pradesh (1.23%).
- The growth rate of area production and yield of ragi in the country for the period of 2010-11 to 2019-20 reflected a negative growth rate of (-2.70%), (-3.12%) and (-0.42%), respectively.
- Area production and productivity of maize at all India account for a growth rate of area (1.00%), with a production growth of (3.41%) and yield growth of (2.41%) and all are significant at one per cent level.
- In the case of bajra, the country accounts for area growth of (-2.20%), production (0.50%) and productivity (1.70%).
- The growth rate area production and yield of jowar at the all-India level reflected a negative growth rate of (-4.81%), production (-5.21%) and productivity (-0.44%).
- Area, production and productivity growth of small millets of (-6.52%), (-2.20%) and (4.30%), respectively. Small millets are grown majorly in West Bengal with an area growth of (26.01%) and Karnataka (4.00%).
- The country has an area growth of (-1.83%) with a production growth of (0.11%) and a productivity growth of (1.94%).



- In the case of groundnut, the table shows that the country area growth of (-1.53%), production (2.41%) and productivity (3.95%).
- The total food grains account for an area growth of (0.20%) with a production growth of (1.92%) and a productivity growth of (1.60%) in the country and all are significant at various levels.
- The country has registered a total pulses area growth of (2.10%) with a production growth of (3.61%) and a productivity growth of (1.57%).
- The country shows negative growth of the oilseeds area (-0.60%), with a production growth of (0.31%) and productivity growth of (0.90%).

### **9.2.2 Growth Pattern of Major Livestock Population in the States**

- Compound annual growth rate of cattle, buffalo, sheep and goats and the total livestock population for the period of 1951-2019 amounts to 0.32, 1.38, 0.95, 1.70 and 0.90 per cent, respectively.
- Percentage change over is the highest with respect to goat and buffalo at 215.42 and 153.11 per cent for the period 1951 to 2018-19, followed by sheep (89.92%) and cattle (23.95%), and an overall livestock at 83.32 per cent.
- The country has 536.76 million of livestock population, as per the latest census in 2019. Uttar Pradesh stands first at about 12.67 per cent, followed by Rajasthan (10.58%) and Madhya Pradesh (7.07%).
- The country has 303.75 million bovine population, and is the highest in Uttar Pradesh (17.13%), followed by Madhya Pradesh (9.57%) and Rajasthan (9.10%).
- The country has 142.10 million indigenous and 50.41 million crossbred cattle. The total cattle population stands at 193.46 million. The states having the highest cattle population are West Bengal, Uttar Pradesh and Madhya Pradesh.
- The states having the highest number of indigenous cattle are Madhya Pradesh, West Bengal and Rajasthan. The states having the highest number of exotic cattle are Tamil Nadu, Uttar Pradesh and Maharashtra.
- The country has a buffalo population of 109.85 million, of which Uttar Pradesh accounts for 30.06 per cent, followed by Rajasthan (12.47%), Gujarat (9.60%), Madhya Pradesh (9.38%) and Assam (7.08%).
- The country has 148.84 and 74.26 million of goats and sheep population, respectively. The states having the highest number of goat population are West Bengal (10.93%), Uttar Pradesh (9.73%), Bihar (8.61%), Madhya Pradesh (7.43%) and Maharashtra (7.12%). The states having the highest number of sheep population are Telangana (25.67%), Andhra Pradesh (23.74%), Karnataka (14.88%) and Rajasthan (10.64%).
- The country produces livestock products with an average of 146.74 mt, 44.19 mkg and 6.39 mt of milk, wool and meat, respectively for the period 1980-81 to 2018-19.
- The compound annual growth rate of milk and meat has increased at the rate of 4.41 and

9.83 per cent, respectively as against wool production that has decreased at the rate of 1.13 per cent.

- The highest CAGR for milk production is found for recent period (2010-11 to 2018-19) at 5.58 per cent and 3.04 per cent for wool production (1980-81 to 1989-90) and 10.75 per cent for meat production for the period of 2000-01 to 2009-10.
- The value of the output amounts to 6.80 lakh crore from livestock in the country of which the highest share is accounted for by Uttar Pradesh (13.20%) and Rajasthan (11.88%), followed by Tamil Nadu (9.50%) and Maharashtra (7.24%).
- The average milk yield of crossbred and indigenous and non-descript cattle is at 7.61, 3.85 and 2.5 kg/day, respectively. As for indigenous and non-descript buffalo, it is 6.34 and 4.35 kg/day. The average milk yield of goats is at 0.45 kg per day. The average milk yield of crossbred cattle is found the highest in Punjab, Kerala and Chandigarh. Whereas, for indigenous cattle, Punjab, Haryana, Rajasthan and Andhra Pradesh account for the highest share. Andhra Pradesh, Chandigarh, Haryana and Punjab account for the highest yield of indigenous buffalo. The average highest milk yield of goats is found in Punjab, Chandigarh and Haryana.
- The country produces 187.74 million tonnes of milk annually, Uttar Pradesh stands first accounting for 16.26 per cent, followed by Rajasthan (12.61%) and Madhya Pradesh (8.47%).
- The total meat production comes to 8.1 million tonnes. The highest meat-producing states are Uttar Pradesh (15.12%), Maharashtra (12.58%), West Bengal (10.24%).
- The species-wise contribution to the total meat production in the country is the highest for poultry, which accounts for half of the total meat production (50.06%), followed by buffalo (19.05%) and goat (13.55%). The other species such as cattle, sheep and pigs contribute about 4.02, 8.36 and 4.98 per cent, respectively.
- The country produces 41,462 tonnes of wool annually. The highest wool-producing states in the country are Rajasthan (35.93%), Telangana (10.55%), Karnataka (7.57%) and Gujarat (5.62%).

### **9.2.3 Socio-Economic Characteristics of Sample Households**

- The total number of households surveyed stands at 1606. Of which 291 from Gujarat, 246 from Haryana, 269 from Karnataka, 217 from Kerala, 186 from Rajasthan, 247 from Uttar Pradesh and 150 from West Bengal were selected for the study.
- The average age of the sample household heads is about 48 years old and the highest in Kerala households (53.25.) and the least in Haryana (44 yrs.)
- Most of the sample households belong to OBC category (46.67%) followed by General Category (26.46%), SC (15.63%) and ST (10.77%). More number of households belonging to SC categories are found in Haryana (42.30%) and Uttar Pradesh (18.22%) and ST in Gujarat (28.18%) and West Bengal (15.33%).

- The percentage of households headed by male is 90.72 per cent and the least in respect of households headed by females (9.28%). The female-headed households are the highest in Kerala (23.50%).
- Nearly 63 per cent of the households are educated up to higher secondary, followed by 17 per cent who are educated up to primary level. The percentage of illiterates is found at 32 per cent. More number of illiterate farmers is found in Kerala state.
- The sample households have an average of 21.85 years of experience in crop farming, followed in dairying (19.92 yrs.) and Sheep and Goat farming (13.37 yrs).
- The highest average income is obtained from crop farming (Rs.184,617), followed by dairying (Rs. 83,683), other sources (Rs.57,602) and Sheep and Goat farming (Rs.19,904).
- The number of persons having membership with social and cooperative organizations amounts to 39 per cent.
- Agriculture is the main occupation and animal husbandry and dairy are the secondary occupations in Gujarat, Karnataka and Uttar Pradesh, whereas, in the case of Haryana, Kerala, West Bengal states, the main occupation is animal husbandry and dairy.
- Farmers have an average land holding of 1.12 hectares, of which 0.92 hectare is under irrigation and the remaining 0.18 hectare under rainfed conditions. The area under fodder crops constitutes 0.22 hectare.
- The land holding is the highest in Rajasthan (2.03 hectares), followed by Karnataka (1.76 hectares) and West Bengal (1.10 hectares). The area under fodder cultivation is the highest in Rajasthan and Gujarat
- Nearly 51 per cent of the households have borewells as the main source of irrigation, followed by dug well and canal (24.87 and 19.84%), respectively.
- Canal is a rich source of irrigation in Haryana, whereas in Uttar Pradesh and Karnataka and Gujarat bore well is the main source of irrigation, but in the case of Kerala, dug well is the main source of irrigation.
- Total gross cropped area amounts to 2.312 hectares. The gross cropped area is the highest in Kerala (4.34 hectares), followed by Rajasthan (2.98 ha.), Uttar Pradesh (2.86 ha.) and Karnataka (1.882 ha).
- In the kharif season, the area under paddy (0.216 ha.) and sugarcane (0.211 ha) is the highest. In the case of rabi season, wheat (0.266 ha) is the main crop, followed by paddy.
- In the case of summer, Bajra (0.045 ha.) is the main crop. The perennial crops are banana (0.055 ha) and coconut (0.041 ha) that account for major perennial crops.
- In Karnataka, the major crops are sugarcane and maize, whereas, paddy in Kerala, wheat in Haryana, bajra in Rajasthan, sugarcane in Uttar Pradesh, and paddy in West Bengal.
- Totally 2,429 buffaloes, 1,946 crossbred cattle, 941 indigenous cattle, 4,779 sheep and 6,861 goats are reared by 1,606 sample households across the selected states of India.
- The number buffalo reared by household is more in West Bengal, followed by Gujarat, Rajasthan and Haryana.
- More number of crossbred are reared in Kerala state, followed by West Bengal. The

indigenous cattle are more in West Bengal. The more number of sheep per household are found in Karnataka and Haryana, whereas, more goats per household in Gujarat and Rajasthan.

- The average value per buffalo ranges from Rs.14,181 for less than 1 year to Rs.52,050 for milch animals. The average value per crossbred cattle ranges from Rs.5,166 for Male crossbred to Rs.39,700 for milch animal. The average value per indigenous cattle ranges from Rs.7,960 for Male cattle to Rs.31,373 for milch animals.
- The average value is Rs. 4,364, Rs. 7,740 and Rs.10,149 per sheep for less than one year, 1-2 years and more than 2 years, respectively, whereas Rs. 5,637, Rs.10,594, Rs.13,492 per goat for less than one year, 1-2 years and more than two years.

#### **9.2.4 Feed and Fodder Availability (Supply) and Requirement (Demand) as per Primary Data**

- The green fodder requirement ranges from 8.39 kg to 18.20 kg per animal per day, whereas, dry fodder requirement ranges from 5.46 kg to 9.89 kg per animal per day and concentrate requirement ranges from 0.72 to 2.58 kg per animal for Male buffalo and Milching buffalo animals respectively.
- Green fodder fed per cattle per day ranges from 8.27 kg to 1518 kg. Dry fodder fed to animals ranges from 4.43 to 9.27 kg and concentrates fed ranges from 1.17 to 2.97 kg per cattle per day.
- For indigenous cattle, green fodder fed ranges from 7.01 to 10.31 kg per day, whereas dry fodder ranges from 4.80 kg to 9.80 kg and concentrate fed ranges from 0.36 kg to 2.46 kg per animal per day.
- In the case of sheep, green fodder fed ranges from 2 kg to 4.49 kg per day per animal and dry fodder fed ranges from 0.18 kg to 2.86 kg per day, whereas, concentrate requirement ranges from 0.27 kg to 0.41 kg.
- In the case of goats, green fodder requirement ranges from 1.54 to 3.39 kg per goat per day, whereas dry fodder fed ranges from 0.78 kg to 1.14 kg per animal. The concentrate fed ranges from 0.42 to 1.81 kg per goat per day.
- Per year requirement of green fodder as per the household premises is 1491.04 million tonnes in the country. Across the states, it ranges from 10.04 million tonnes in Kerala and 116.93 million tonnes in Rajasthan.
- Per day requirement of green fodder is 408.52 thousand tonnes and is the highest for cattle (195.97 thousand tonnes), followed by buffalo (147.88 thousand tonnes), goats (38.47 thousand tonnes) and sheep (26.20 thousand tonnes).
- The requirement of dry fodder as per household premises is 1356.18 million tonnes. The per year requirement of dry fodder ranges from 8.20 m tonnes in Kerala to 114.96 million tonnes in Rajasthan.

- The results also show that 195.97, 147.88, 13.22 and 14.48 thousand tonnes of dry fodder are required by cattle, buffalo, sheep and goats per day in the country.
- The requirement of concentrates per day per animal as per household premises is 274.39 million tonnes and it ranges from 0.94 million tonnes in Kerala to 27.35 million tonnes in Rajasthan.

### **9.2.5 Feed and Fodder Recommended as Per NATP, FAO AND GAP**

- There are 51.98, 28.97, 33.91 and 77.67 million of milch, dry cattle, adult male and young stock, respectively comprise a total of 192.52 million cattle in the country, as per the latest livestock census of 2019.
- Of the total buffaloes, there are 38.16, 16.92, 3.39 and 51.19 million of milch, dry, adult male and young stock, respectively, constituting a total of 109.85 million of the buffalo population.
- The sheep and goat population is 148.88 and 74.26 million, respectively.
- Across the states, the cattle population ranges from 1.33 million in Kerala to 19.02 million in West Bengal, whereas the buffalo population ranges from 0.10 million in Kerala to 33.02 million in Uttar Pradesh. The goat and sheep population ranges from 0.33 million in Haryana to 20.84 million in Rajasthan and 0.001 million in Kerala and 11.05 million in Karnataka.
- The annual green fodder requirement is 488.69 million tonnes in the country. The green fodder required across the selected states is 77.05, 48.39, 30.79, 29.67, 21.96, 8.88 and 2.26 million tonnes by Uttar Pradesh, Rajasthan, Gujarat, West Bengal Karnataka, Haryana and Kerala, respectively.
- The dry fodder required per annum is 468.29 million tonnes in the country. Across the states, it ranges from 76.74 to 2.03 million tonnes and is the highest in Uttar Pradesh followed by Rajasthan, Gujarat, Karnataka, Haryana and Kerala at 76.74, 42.45, 31.18, 28.06, 18.90, 9.17 and 2.03 million tonnes per annum, respectively.
- The requirement of concentrates to feed cattle, buffalo, sheep and goats is 50.74 million tonnes in the country. The concentrates required by the selected states range from 0.23 million tonnes in Kerala to 9.31 million tonnes in Uttar Pradesh.
- As much as 5751 lakh tonnes of green fodder is available from different sources of production and is the highest from area under fodder crops (3739.77 lakh tonnes), followed by forest area on the assumption that 50 per cent area is accessible for grazing (1077.99 lakh tonnes). The availability of green fodder across the states ranges from 22.99 lakh tonnes in Kerala to 2216.70 lakh tonnes in Uttar Pradesh.
- The production of paddy, wheat, sorghum, bajra, barley, maize, ragi, small millets, pulses, groundnut, oil seeds and sugarcane amounts to 1164.78, 1035.96, 34.75, 86.64, 16.33, 277.15, 12.29, 3.33, 220.76, 67.27, 315.22, 4054.16 lakh tonnes, respectively.
- The production data of crops was used for estimating crop residues in terms of dry fodder

by using harvest indices and extraction ratios. The estimated dry fodder availability constitutes 5124.24 lakh tonnes in the country. The highest dry fodder production from paddy amounts to 1514.21 lakh tonnes, followed by Wheat (1035.96 lakh tonnes), Sugarcane (1013.54 lakh tonnes), Maize, Pulses Groundnut, Bajra, Ragi and other small millets.

- Across the states, dry fodder production ranges from 7.84 lakh tonnes in Kerala to 1114.99 lakh tonnes in Uttar Pradesh.
- The availability of concentrates was estimated based on extraction and conversion ratios, at 525.19 lakh tonnes from the different sources. The highest availability of concentrates is observed for Oilseeds (267.74 lakh tonnes), followed by Brans and chunnies (176.06 lakh tonnes), and grains (80.39 lakh tonnes).
- Paddy and Wheat are the major contributors from Brans and Chunnies. As for grains, the major contribution is accounted for by maize, followed by paddy and wheat.
- There is a need for 486.69, 468.29 and 50.74 million tonnes of green fodder, dry fodder and concentrates. While the availability /supply of green fodder, dry fodder and concentrates work out to 575.18, 512.42 and 52.42 million tonnes respectively.
- The excess availability is estimated at 88.49, 44.14, 1.67 million tonnes of green fodder, dry fodder and concentrates with a gap of 18.18, 9.43 and 3.30 per cent, respectively.
- The requirement of green fodder, dry fodder and concentrates in terms of dry matter have been estimated at 121.67, 421.46 and 45.67 million tonnes, with a total of 588.80 million tonnes of dry matter.
- The availability / production of green fodder, dry fodder and concentrates in terms of dry matter has been estimated at 143.79, 461.18 and 47.18 million tonnes, respectively, with a total availability of 652.12 million tonnes.
- The difference in excess is 122.12, 39.72, 1.51 million tonnes of which a total of 63.55 million tonnes of dry matter is deficient. The per cent gap amounts to 18.18, 9.43, 3.30 of green fodder, dry fodder and concentrates, respectively and a total of 10.76 per dry matter.
- The livestock population under different categories as per age stands at 114.86, 42.09, 35.58 million for over 2.5 year cattle, 1 to 2.5 year-old of cattle and less than 1 year old cattle which together constitute a total of 192.52 million cattle, whereas there are 109.85 million buffaloes, of which 58.66 million belong to above 2.5 year old, 26.71 million belong to 1 to 2.5 year-old and 24.48 million belong to less than 1 year-old categories. The goat population of the country stands at 148.88 million of which 57.67 million are aged less than 1 year and 91.22 million are aged above 1 year. The sheep population of the country stands at 74.26 million, of which 26.13 million are aged less than 1 year and 48.13 million belong to the category of above one year.
- As much as 597.67 million tonnes of feed and fodder is required in terms of dry matter, ranging from 2.53 million tonnes in Kerala to 96.66 million tonnes in Uttar Pradesh.
- The availability of feed and fodder in terms of dry matter is at 652.15 million tonnes and requirement at 597.67 million tonnes and hence there is a positive difference in the

production at about 54 million tonnes.

- The access to feed and fodder is found in Rajasthan, Uttar Pradesh, Haryana, Karnataka and Gujarat. Deficit in the production of feed and fodder in terms of dry matter is found in West Bengal (7.27 million tonnes) and in Kerala (1.25 million tonnes).
- The percentage gap was estimated for the country and across the states excess at 9.12 per cent in the country, and at 24.38 per cent to 136.93 per cent, across the states and with a deficit of 49.28 and 20.91 per cent in Kerala and West Bengal, respectively.

### **9.2.6 Economics of Livestock Management and Constraints**

- Totally, 1113 cattle sheds have been constructed by 1606 sample households, which account for 69 per cent. The number of kutcha and pucca cattle sheds is more (43.13 and 38.27%) and the least of mixed cattle sheds.
- Karnataka and Haryana states account for more number of mixed cattle sheds. The kutcha cattle sheds are more in Gujarat, Rajasthan, Uttar Pradesh and West Bengal, while Pucca sheds are more in Kerala state.
- Totally, 484 sheep and goat sheds have been constructed by 1606 sample households, which account for 30 per cent of which 52.89 per cent are in kutcha in nature, followed by pucca (33.06%) and mixed (14.05%) nature.
- Labour requirement per day per animal ranges from 0.68 hours to 2.06 hours for buffalo, from 0.40 to 2.06 hours for indigenous cattle, from 0.63 to 2.74 hours for crossbred cattle, from 0.19 to 3.50 hours for sheep and from 0.11 to 3.28 hours for goat.
- For goats and sheep, the value ranges from Rs. 6.82 to 117.21 and Rs. 4.54 to 118.25 respectively. On an average, labour cost per day per animal amounts to Rs. 46.12 for crossbred, Rs.41.58 for buffalo and Rs. 32.20 for indigenous cattle and Rs.49.69 and Rs.56.81 for sheep and goats, respectively.
- The veterinary cost is the highest for crossbred cattle (Rs.2040 per animal per annum), followed by buffalo and indigenous cattle (Rs.1721 and Rs.2040).
- The other maintenance cost is the highest for crossbred cattle (Rs.2231 per annum per animal), followed by buffalo (Rs.1001), indigenous cattle (Rs. 985), goat (Rs.775) and sheep (Rs.684).
- Average milk yield per day ranges from 8.91 litres to 0.57 litres. The milk yield is the highest for crossbred cattle (8.91 litre /day), followed by buffalo and indigenous cattle. The sheep and goat milk yield constitutes an average of 0.57 and 0.92 litre per day
- In the case of crossbred cattle, Uttar Pradesh state accounts for the highest milk yield, followed by Karnataka (9.90 litres), whereas, indigenous cattle milk yield is the highest in Haryana, followed by Rajasthan and Gujarat. Buffalo milk yield is the highest in Haryana state (8.30 litres per day) followed by Rajasthan. The sheep and goats milk yield is the highest in Haryana state.
- The sale price of milk ranges from Rs.38.38 to Rs.26.20 per litre. Per litre milk price is the

highest for buffalo, followed by indigenous cattle and crossbred cattle. The milk price of sheep and goats amounts to Rs.27.78 and Rs.26.20 per litre.

- The highest price for crossbred and indigenous cattle milk is found in Kerala. The buffalo milk price is the highest in West Bengal, followed by Gujarat. The goat milk price is the highest in Kerala and sheep milk in Gujarat.
- An average dung yield per animal per year ranges from 4.22 tonnes to 0.27 tonnes and is more for crossbred cattle, followed by buffalo and indigenous cattle.
- The major source of livestock feed is crop residues, followed by household leftovers (59.49%), grazing land (53.99%) and tree legumes grown as hedges (50.49%). The other sources are improved forage and pasture (36.12%) and food reserved and storage (21.55%).
- Land is very limited and therefore the households cannot afford to put more land under fodder production, lack of awareness regarding government programmes on subsidy on seeds (77.83%), Poor livestock extension services (75.03%) and high cost of cultivation/production and low return on fodder production (70.36%) are the major constraints of livestock rearing and fodder cultivation.

### **9.2.7 Post-Harvest Management and Benefits from the Government for Livestock Production**

- On an average, only 3.15 per cent of farmers have adopted post-harvest techniques of feed and fodder and the remaining 96.85 per cent of farmers have not adopted it.
- The major reasons for non-adoption of post-harvest management includes the lack of awareness regarding production and post-harvest management (61.86%), followed by highly expensive (47.47%), considered inferior in comparison to fresh ones (42.27%), and lastly more laborious (29.27%).
- Among the states, a lack of awareness regarding production and post-harvest management ranges from 5.92 per cent in Karnataka to 100 per cent in Uttar Pradesh. Similarly, the other reason highly expensive ranges from 3.94 per cent in West Bengal to 100 per cent in Uttar Pradesh.
- As for benefits received from the government related to livestock production across the states, Uttar Pradesh households have mentioned that they have not received any benefits related to livestock production. The other selected states have received benefits of which, seed obtained from the veterinary department is the major benefit received in Gujarat and Karnataka. Animal vaccination and free treatment are the major benefits received by Haryana state. Kerala state has received incentives for milk prices and subsidised fodder seeds. Rajasthan households have received cattle facilities, mineral mixture and fodder seeds. As per West Bengal households, they have obtained free advice from the veterinary surgeon at the block office and a free chaff-cutting machine.
- The major suggestion given by Gujarat relates to the availability of fodder seeds in time,



whereas, in the case of Karnataka, it is training programme for post-harvest management and the need for financial assistance for shed construction and high-yielding varieties of fodder. In the case of Kerala state, the households' suggestion is that there is a need for increasing the market price of milk and reducing the market price of feed and fodder and the need for credit support. The households of Haryana state have opined that subsidies should be provided for fencing the field, stray animals should be controlled, availability of water, and free seed for fodder crop, providing free and subsidised seeds and irrigation facilities to grow fodder crops. Rajasthan households have suggested that green fodder banks be provided by the Government. In Uttar Pradesh, households expect high-yielding seeds, extension and training services. Finally, households of West Bengal have suggested timely availability of fodder seeds, subsidized seeds and training for fodder cultivation and its post-harvest management.

### **9.3. Conclusion**

The availability and efficient use of feed resources are the primary drivers of maximising livestock production and productivity. There is a sub-optimal use of feed and fodder across categories of livestock in comparison to the nutritional recommendations by the NDDB. The study found that there is an excess availability of dry fodder and concentrates but, deficient in green fodder, as per the present feeding pattern of the sample households. However, there is an excess of dry fodder and concentrates, which is unevenly distributed across the livestock production areas across states. Further, the estimation of feed and fodder production according to the production of major crops (cereals, pulses, oilseeds and millets) have their own limitations such as harvesting method (manual/ mechanical), harvest season, varieties (dwarf/tall) grown, climatic conditions, etc. Due to decreasing forest and grazing land, farmers should adopt stall feeding of livestock to feed optimally. As indicated by the farmers, there is a need for creating awareness on post-harvest management of feed and fodders with additional incentivisation support by the government. Farmers should be encouraged to grow green fodder for feeding animals and undertake silage preparation so that the feeding can be continued throughout the year. Agricultural universities should be encouraged to develop technologies for improving the yield potential of fodder crops. The Agricultural and Animal Husbandry departments should create awareness and train farmers in fodder production, silage preparation and use of crop residues in proper form to feed the animals.

## 9.4 Policy Suggestions

1. The livestock sector forms the major secondary agriculture component for most farmers, contributing both employment and better livelihood in rural areas. As such, policy focus on this sector is essential.
2. There is a wide gap in supply of green fodder, dry fodder and concentrates in most states; hence, there is a need to encourage farmers to produce green fodder crops by providing appropriate technologies particularly, high-yielding seed/planting material.
3. Crop residue is the major source of livestock feed, most of which is obtained from field crops and pulses. Farmers should be trained to use crop residues appropriately to meet their fodder requirements.
4. There is a lack of adequate and authentic data on the production and availability of various types of fodder and feed grains. Therefore, concerned agencies should be encouraged to generate real-time data at periodic intervals as done for other crops.
5. There is a serious lack of awareness regarding fodder cultivation and post-harvest management practices (silage making) among the livestock farmers, so training in fodder cultivation and post-harvest management is important. Hence, the extension departments, KVKs and Agricultural Universities should develop a need-based extension programmes for fodder crop cultivation, preparation of silage and utilisation of crop residues as fodder.
6. The overall picture reveals that there is a surplus of green and dry fodder production (as per the feeding pattern of sample farmers). But in the field, often farmers express shortage and non-availability of the fodder, which might be because of the fact that though there is overproduction, the farmers don't know where it is produced or available and how to transport it. On the other hand, the farmers in the rural areas where production is happening are not interested in increasing the production (though they can do it very well), as they are afraid that there will not be buyers for the fodder. Hence, a market mechanism like E-NAM exclusively for livestock products may be created which would bridge the buyers and sellers and this would certainly help in improving production, productivity and profitability of livestock farming.
7. The study reveals that the milk price was ranging between Rs. 26 and 40. Similar studies also indicate that the cost of milk production is higher than the market price of milk. Hence, the farmers are not interested in purchasing the inputs (feed and fodder) for cattle, though this could increase the milk production, the profit would be reduced. Most of the cattle are being reared on zero input costs and they are underfed and the optimal production is not happening. Hence, a mechanism like the Competition and Consumer Protection Commission (CCPC) or MSP may be sorted out to fix the procurement price of milk by the Cooperative Unions based on the cost of production. This would attract more and more farmers towards the business and also would increase the milk production, productivity and profitability of dairy farming.

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## 11. APPENDICES

### Appendix 2.1: Area under Fodder Cultivation and Permanent Pastures and Other Grazing Lands in India

(Thousand hectares)

States	Fodder crops	Per cent to total	Per cent to GAC	Pasture & other grazing	Per cent to total
Andaman and Nicobar		0.00	0.00	4	0.04
Andhra Pradesh	64	0.70	0.83	214	2.09
Arunachal Pradesh		0.00	0.00	18	0.18
Assam	4	0.04	0.10	167	1.63
Bihar	20	0.22	0.26	15	0.15
Chandigarh	-			-	
Chhattisgarh	0	0.00	0.00	887	8.65
Dadra and Nagar Haveli	1	0.01	4.35	1	0.01
Daman and Diu	-			-	
Delhi	1	0.01	2.86	-	
Goa	-			1	0.01
Gujarat	850	9.30	6.65	851	8.30
Haryana	420	4.60	6.43	25	0.24
Himachal Pradesh	9	0.10	0.98	1510	14.72
Jammu and Kashmir	53	0.58	4.50	112	1.09
Jharkhand	-			114	1.11
Karnataka	28	0.31	0.23	904	8.81
Kerala	6	0.07	0.23	0	0.00
Lakshadweep	-			-	
Madhya Pradesh	367	4.02	1.54	1303	12.70
Maharashtra	969	10.61	4.13	1249	12.18
Manipur	-			1	0.01
Meghalaya	-			-	
Mizoram	-			11	0.11
Nagaland	-			-	
Odisha	-			524	5.11
Puducherry	-			-	
Punjab	498	5.45	6.34	5	0.05
Rajasthan	4928	53.93	20.33	1674	16.32
Sikkim	-			-	
Tamil Nadu	91	1.00	1.52	108	1.05
Telangana	27	0.30	0.51	299	2.91
Tripura	-			1	0.01
Uttar Pradesh	767	8.39	2.93	65	0.63
Uttarakhand	32	0.35	2.92	192	1.87
West Bengal	3	0.03	0.03	2	0.02
<b>India</b>	<b>9137</b>	<b>100.00</b>	<b>4.61</b>	<b>10258</b>	<b>100.00</b>

Source: <https://www.indiastat.com>

**Appendix 2.2: Area under Fodder Crops across the States**

(in lakh hectare)

Year	Gujarat	Haryana	Karnataka	Kerala	Rajasthan	Uttar Pradesh	West Bengal	India
2005-06	9.59	6.58	0.35	0.04	27.68	8.71	0.02	80.66
2006-07	9.01	6.84	0.47	0.05	31.72	8.72	0.07	82.12
2007-08	8.50	7.55	0.35	0.05	32.29	8.59	0.04	81.44
2008-09	8.50	6.20	0.31	0.05	36.27	8.38	0.03	84.77
2009-10	8.50	4.20	0.39	0.05	28.75	8.31	0.03	74.19
2010-11	8.50	4.08	0.35	0.05	32.87	8.24	0.04	77.22
2011-12	8.50	3.34	0.33	0.04	33.86	8.06	0.03	78.06
2012-13	8.50	4.32	0.33	0.05	48.53	8.00	0.03	92.49
2013-14	8.50	5.83	0.36	0.05	53.70	7.74	0.03	98.31
2014-15	8.50	4.20	0.28	0.06	49.28	7.67	0.03	91.37
CAGR	-0.90	-5.79	-2.45	1.82	6.79	-1.48	-2.06	1.68

*Source: <https://www.indiastat.com> and Author's estimation*

### Appendix 3.1: State-Wise Livestock Population of India

(Numbers)

State/ UTs	Total	%
Andaman and Nicobar Islands	145394	0.03
Andhra Pradesh	34067616	6.35
Arunachal Pradesh	1161428	0.22
Assam	18092201	3.37
Bihar	36540820	6.81
Chandigarh	26990	0.01
Chhattisgarh	15872302	2.96
Dadra and Nagar Haveli	48404	0.01
Daman and Diu	3284	0
Delhi	360397	0.07
Goa	132406	0.02
Gujarat	26893274	5.01
Haryana	7046091	1.31
Himachal Pradesh	4412846	0.82
Jammu and Kashmir	8325324	1.55
Jharkhand	23614545	4.4
Karnataka	29013412	5.41
Kerala	2908657	0.54
Lakshadweep	45697	0.01
Madhya Pradesh	40637375	7.57
Maharashtra	33079818	6.16
Manipur	550719	0.1
Meghalaya	2039103	0.38
Mizoram	359704	0.07
Nagaland	553803	0.1
Odisha	18170309	3.39
Puducherry	151368	0.03
Punjab	7050355	1.31
Rajasthan	56800945	10.58
Sikkim	274332	0.05
Tamil Nadu	24500621	4.56
Telangana	32640639	6.08
Tripura	1317892	0.25
Uttar Pradesh	68012945	12.67
Uttarakhand	4427089	0.82
West Bengal	37483238	6.98
<b>India</b>	<b>536761343</b>	<b>100</b>

Source: <https://www.indiastat.com>

### Appendix 3.2: State-Wise Bovine Population of India

(Numbers)

States/ UTs	Total	%
Andaman and Nicobar Islands	40138	0.01
Andhra Pradesh	10819586	3.56
Arunachal Pradesh	719829	0.24
Assam	11330954	3.73
Bihar	23117774	7.61
Chandigarh	25617	0.01
Chhattisgarh	11158676	3.67
Dadra and Nagar Haveli	40733	0.01
Daman and Diu	2214	0.00
Delhi	248575	0.08
Goa	87454	0.03
Gujarat	20176887	6.64
Haryana	6296705	2.07
Himachal Pradesh	2476522	0.82
Jammu and Kashmir	3256302	1.07
Jharkhand	12573365	4.14
Karnataka	11453564	3.77
Kerala	1443500	0.48
Lakshadweep	2509	0.00
Madhya Pradesh	29057959	9.57
Maharashtra	19595996	6.45
Manipur	269761	0.09
Meghalaya	919284	0.30
Mizoram	51767	0.02
Nagaland	117073	0.04
Odisha	10362294	3.41
Puducherry	74379	0.02
Punjab	6547407	2.16
Rajasthan	27630946	9.10
Sikkim	154373	0.05
Tamil Nadu	10037455	3.30
Telangana	8458845	2.78
Tripura	746162	0.25
Uttar Pradesh	52036426	17.13
Uttarakhand	2718495	0.89
West Bengal	19708898	6.49
<b>India</b>	<b>303758424</b>	<b>100.00</b>

Source: <https://www.indiastat.com>

### Appendix 3.3: State-Wise Indigenous Cattle Population of India

(Numbers)

States/ UTs	Total Indigenous		Total cattle		% of Indigenous to total cattle
Andaman and Nicobar Islands	20919	0.01	36438	0.02	57.41
Andhra Pradesh	2337858	1.65	4600087	2.38	50.82
Arunachal Pradesh	332234	0.23	339221	0.18	97.94
Assam	10140290	7.14	10909239	5.64	92.95
Bihar	11297513	7.95	15397980	7.96	73.37
Chandigarh	4438	0.00	13440	0.01	33.02
Chhattisgarh	9716929	6.84	9983954	5.16	97.33
Dadra and Nagar Haveli	38566	0.03	39736	0.02	97.06
Daman and Diu	1596	0.00	1840	0.00	86.74
Delhi	25446	0.02	86433	0.04	29.44
Goa	32718	0.02	60247	0.03	54.31
Gujarat	6226448	4.38	9633637	4.98	64.63
Haryana	949541	0.67	1928682	1.00	49.23
Himachal Pradesh	759082	0.53	1828017	0.94	41.52
Jammu and Kashmir	1096013	0.77	2539240	1.31	43.16
Jharkhand	10596859	7.46	11223052	5.80	94.42
Karnataka	4560842	3.21	8469004	4.38	53.85
Kerala	82692	0.06	1341996	0.69	6.16
Lakshadweep	1297	0.00	2493	0.00	52.03
Madhya Pradesh	17055853	12.00	18750828	9.69	90.96
Maharashtra	9384574	6.60	13992304	7.23	67.07
Manipur	206546	0.15	224472	0.12	92.01
Meghalaya	870165	0.61	903570	0.47	96.30
Mizoram	24246	0.02	45701	0.02	53.05
Nagaland	59895	0.04	78296	0.04	76.50
Odisha	8323590	5.86	9903970	5.12	84.04
Puducherry	5745	0.00	71984	0.04	7.98
Punjab	425873	0.30	2531460	1.31	16.82
Rajasthan	11614597	8.17	13937630	7.20	83.33
Sikkim	31160	0.02	148010	0.08	21.05
Tamil Nadu	1793941	1.26	9518660	4.92	18.85
Telangana	3621726	2.55	4232539	2.19	85.57
Tripura	610194	0.43	739031	0.38	82.57
Uttar Pradesh	12897013	9.08	19019641	9.83	67.81
Uttarakhand	1275303	0.90	1852123	0.96	68.86
West Bengal	15684764	11.04	19077916	9.86	82.21
<b>India</b>	<b>142106466</b>	<b>100.00</b>	<b>193462871</b>	<b>100.00</b>	<b>73.45</b>

Source: <https://www.indiastat.com>



### Appendix 3.4: State-Wise Exotic Cattle Population of India

(Numbers)

States/ UTs	Total	%
Andaman and Nicobar Islands	14260	0.03
Andhra Pradesh	2239885	4.44
Arunachal Pradesh	6462	0.01
Assam	712974	1.41
Bihar	4013660	7.96
Chandigarh	8940	0.02
Chhattisgarh	257895	0.51
Dadra and Nagar Haveli	1165	0.00
Daman and Diu	224	0.00
Delhi	60987	0.12
Goa	27502	0.05
Gujarat	3384417	6.71
Haryana	870989	1.73
Himachal Pradesh	1067211	2.12
Jammu and Kashmir	1436602	2.85
Jharkhand	591911	1.17
Karnataka	3898075	7.73
Kerala	1249821	2.48
Lakshadweep	1158	0.00
Madhya Pradesh	1679338	3.33
Maharashtra	4540352	9.01
Manipur	17663	0.04
Meghalaya	31860	0.06
Mizoram	19682	0.04
Nagaland	16970	0.03
Odisha	1553347	3.08
Puducherry	66067	0.13
Punjab	2047458	4.06
Rajasthan	2297860	4.56
Sikkim	115748	0.23
Tamil Nadu	7675558	15.22
Telangana	596260	1.18
Tripura	114248	0.23
Uttar Pradesh	5892293	11.69
Uttarakhand	571316	1.13
West Bengal	3336735	6.62
<b>India</b>	<b>50416893</b>	<b>100.00</b>

Source: <https://www.indiastat.com>

### Appendix 3.5: State-Wise Buffalo Population of India

(Numbers)

States/ UTs	Total	%
Andaman and Nicobar Islands	3700	0.00
Andhra Pradesh	6219499	5.66
Arunachal Pradesh	6379	0.01
Assam	421715	0.38
Bihar	7719794	7.03
Chandigarh	12177	0.01
Chhattisgarh	1174722	1.07
Dadra and Nagar	997	0.00
Haveli		0.00
Daman and Diu	374	0.00
Delhi	162142	0.15
Goa	27207	0.02
Gujarat	10543250	9.60
Haryana	4368023	3.98
Himachal Pradesh	646565	0.59
Jammu and Kashmir	690829	0.63
Jharkhand	1350313	1.23
Karnataka	2984560	2.72
Kerala	101504	0.09
Lakshadweep	16	0.00
Madhya Pradesh	10307131	9.38
Maharashtra	5603692	5.10
Manipur	36230	0.03
Meghalaya	15714	0.01
Mizoram	2109	0.00
Nagaland	15654	0.01
Odisha	458324	0.42
Puducherry	2395	0.00
Punjab	4015947	3.66
Rajasthan	13693316	12.47
Sikkim	1144	0.00
Tamil Nadu	518795	0.47
Telangana	4226306	3.85
Tripura	7131	0.01
Uttar Pradesh	33016785	30.06
Uttarakhand	866318	0.79
West Bengal	630921	0.57
<b>India</b>	<b>109851678</b>	<b>100.00</b>

Source: <https://www.indiastat.com>

### Appendix 3.6: State-Wise Goat and Sheep Population of India

(Numbers)

States/ UTs	Goat		Sheep	
	Total	%	Total	%
Andaman and Nicobar	64761	0.04	5	0.00
Andhra Pradesh	5522133	3.71	17626971	23.74
Arunachal Pradesh	159740	0.11	7345	0.01
Assam	4315173	2.9	332100	0.45
Bihar	12821216	8.61	213377	0.29
Chandigarh	998	0	0	0.00
Chhattisgarh	4005657	2.69	180229	0.24
Dadra and Nagar Haveli	7548	0.01	84	0.00
Daman and Diu	987	0	68	0.00
Delhi	30470	0.02	932	0.00
Goa	9446	0.01	8	0.00
Gujarat	4867744	3.27	1787263	2.41
Haryana	334640	0.22	288370	0.39
Himachal Pradesh	1108413	0.74	791345	1.07
Jammu and Kashmir	1730218	1.16	3247503	4.37
Jharkhand	9121173	6.13	641183	0.86
Karnataka	6169392	4.14	11050728	14.88
Kerala	1359161	0.91	1482	0.00
Lakshadweep	43188	0.03	0	0.00
Madhya Pradesh	11064524	7.43	324585	0.44
Maharashtra	10604883	7.12	2680329	3.61
Manipur	38697	0.03	5921	0.01
Meghalaya	397503	0.27	15679	0.02
Mizoram	14820	0.01	485	0.00
Nagaland	31602	0.02	361	0.00
Odisha	6393452	4.29	1279149	1.72
Puducherry	73630	0.05	2445	0.00
Punjab	347949	0.23	85560	0.12
Rajasthan	20840203	14	7903857	10.64
Sikkim	90506	0.06	2016	0.00
Tamil Nadu	9888746	6.64	4500491	6.06
Telangana	4934673	3.31	19063058	25.67
Tripura	360204	0.24	5460	0.01
Uttar Pradesh	14480025	9.73	984725	1.33
Uttarakhand	1371971	0.92	284615	0.38
West Bengal	16279340	10.93	952886	1.28
<b>India</b>	<b>148884786</b>	<b>100</b>	<b>74260615</b>	<b>100.00</b>

Source: <https://www.indiastat.com>

**Appendix 3.7: State-Wise Value of Output from Livestock in India  
(At Constant Prices, 2011-12)**

States/ UTs	2017-2018	%(INR crores)
Andaman and Nicobar Islands	204.84	0.03
Andhra Pradesh	54127.96	7.96
Arunachal Pradesh	771.04	0.11
Assam	6222.96	0.91
Bihar	31200.48	4.59
Chandigarh	142.42	0.02
Chhattisgarh	6420.36	0.94
Dadra and Nagar Haveli	299.2	0.04
Daman and Diu	47.42	0.01
Delhi	1621.85	0.24
Goa	233.11	0.03
Gujarat	41397.38	6.09
Haryana	34788.73	5.11
Himachal Pradesh	3914.15	0.58
Jammu and Kashmir	7509.88	1.10
Jharkhand	8462.16	1.24
Karnataka	23909.25	3.52
Kerala	13905.38	2.04
Lakshadweep	12.71	0.00
Madhya Pradesh	37693.47	5.54
Maharashtra	49248.25	7.24
Manipur	774.71	0.11
Meghalaya	744.05	0.11
Mizoram	904.5	0.13
Nagaland	638.21	0.09
Odisha	10650.26	1.57
Puducherry	396.27	0.06
Punjab	33793.28	4.97
Rajasthan	80807.62	11.88
Sikkim	215.69	0.03
Tamil Nadu	64609.72	9.50
Telangana	33894.89	4.98
Tripura	1179.93	0.17
Uttar Pradesh	89756.05	13.20
Uttarakhand	5081.87	0.75
West Bengal	34568.1	5.08
<b>India</b>	<b>680148.2</b>	<b>100.00</b>

*Source: <https://www.indiastat.com>*

### Appendix 3.8: State-Wise Average Milk Yield of Cattle, Buffalo and Goat in India

(in Kg/Day)

States/ UTs	Cattle			Buffalo		Goat
	Crossbred	Indigenous	Non-descript	Indigenous	Non-Descript	
Andaman and Nicobar Islands	5.71	-	3.24		3.84	0.33
Andhra Pradesh	9.59	5.54	3.28	9.55	4	0.13
Arunachal Pradesh	6.53	1.39	-	2.55	-	-
Assam	4.5	-	1.02	3.43	-	0.14
Bihar	6.57	3.35	-	4.39	-	0.17
Chandigarh	10.62	5.45	5.47	9.56	8.65	1.29
Chhattisgarh	6.21	3.69	1.29	5.92	4.48	0.23
Dadra and Nagar Haveli	-	-	-	-	-	-
Daman and Diu	6.35	4.86	4.3	8.04	4.6	0.33
Delhi	-	-	-	-	-	-
Goa	8.33	-	2.27	-	4.38	0.46
Gujarat	9.32	4.65	3.84	5.39	4.44	0.48
Haryana	8.69	6.15	5.31	9.34	7.88	1.01
Himachal Pradesh	5	3.58	1.96	4.43	3.26	0.56
Jammu and Kashmir	7.91	-	3.68	6.2	4.94	0.41
Jharkhand	7.07	3.05	1.29	5.22	2.4	0.21
Karnataka	6.67	2.36	2.38	3.46	3.08	0.14
Kerala	10.17	2.02	3.1	5.35	4.23	0.69
Lakshadweep	5	-	3		-	0.5
Madhya Pradesh	8.48	3.27	2.96	4.98	4.47	0.6
Maharashtra	9.56	3.48	1.98	6.42	4.16	0.24
Manipur	8.34	-	1.45	-	3.28	-
Meghalaya	8.99	0.78	-	1.84	-	-
Mizoram	7.53	-	1.6	-	-	-
Nagaland	5.48	-	1.77		3.5	0.15
Odisha	6.52	2.56	1.33	4.53	3.84	0.13
Puducherry	5.89	-	2.55		5.29	-
Punjab	12.79	7.29	5.32	9.62	5.38	1.46
Rajasthan	8.39	5.69	4.68	7.79	5.92	0.79
Sikkim	5.18	0	-	-	-	-
Tamil Nadu	7.08	3.35	2.93	4.67	3.03	0.09
Telangana	7.42	5.49	2.08	7.48	3.01	0.11
Tripura	5.86	-	1.8		2.59	0.35
Uttar Pradesh	7.21	3.51	2.24	4.87	3.33	0.78
Uttarakhand	7.13	4.76	1.85	5.33	4.01	0.4
West Bengal	6.28	4.43	2.51	5.6	4.17	0.15
<b>India</b>	<b>7.61</b>	<b>3.85</b>	<b>2.5</b>	<b>6.34</b>	<b>4.35</b>	<b>0.45</b>

Source: <https://www.indiastat.com>

**Appendix 3.9: State-Wise Contribution of Milk Production in India (in '000 tonnes)**

States/ UTs	2001-02	2005-06	2010-11	2015-16	2018-19	Per cent to all India Total 2018-19
Andhra Pradesh	5814	7624	11203	10817	15044	8.01
Arunachal Pradesh	42	48	28	50	55	0.03
Assam	682	747	790	843	882	0.47
Bihar	2664	5060	6517	8288	9818	5.23
Chhattisgarh	795	839	1029	1277	1567	0.83
Goa	45	56	60	54	57	0.03
Gujarat	5862	6960	9321	12262	14493	7.72
Haryana	4978	5299	6267	8381	10726	5.71
Himachal Pradesh	756	869	1102	1283	1460	0.78
J & K	1360	1400	1609	2273	2540	1.35
Jharkhand	940	1335	1555	1812	2183	1.16
Karnataka	4797	4022	5114	6344	7901	4.21
Kerala	2718	2063	2645	2650	2548	1.36
Madhya Pradesh	5283	6283	7514	12148	15911	8.47
Maharashtra	6094	6769	8044	10153	11655	6.21
Manipur	68	77	78	79	86	0.05
Meghalaya	66	73	79	84	87	0.05
Mizoram	14	15	11	22	26	0.01
Nagaland	57	74	76	77	73	0.04
Orissa	929	1342	1671	1903	2311	1.23
Punjab	7932	8909	9423	10774	12599	6.71
Rajasthan	7758	8713	13234	18500	23668	12.61
Sikkim	37	48	43	67	61	0.03
Tamil Nadu	4988	5474	6831	7244	8362	4.45
Telangana	-	-	-	4442	5416	2.88
Tripura	90	87	104	152	185	0.10
Uttar Pradesh	14648	17356	21031	26387	30519	16.26
Uttarakhand	1066	1206	1383	1656	1792	0.95
West Bengal	3515	3891	4471	5038	5607	2.99
A&N Islands	23	20	25	15	18	0.01
Chandigarh	43	46	45	43	45	0.02
D&N Haveli	8	5	11	9		
Daman & Diu	1	1	1	1	1	0.001
Delhi	294	310	480	281		0.000
Lakshadweep	2	2	2	3	4	0.002
Pondicherry	37	43	47	48	49	0.03
<b>All India</b>	<b>84406</b>	<b>97066</b>	<b>121848</b>	<b>155491</b>	<b>187749</b>	

Source: <https://www.indiastat.com>

### Appendix 3.10: State-Wise Estimates of Meat Production in India

(in '000 tonnes)

States/ UTs	Cattle	Buffalo	Sheep	Goat	Pig	Poultry	Total
Andhra Pradesh	0(0)	126.82 (8.2)	161.55 (23.83)	46.2 (4.21)	2.68 (0.66)	443.35 (10.92)	780.6 (9.62)
Arunachal Pradesh	11.23(3.44)	1.72(0.11)	0.19(0.03)	2.65(0.24)	5.48(1.35)	0.6(0.01)	21.87(0.27)
Assam	3.26(1)	0.15(0.01)	1.68(0.25)	15.18(1.38)	19.4(4.8)	10.73(0.26)	50.4(0.62)
Bihar	27.42(8.4)	101.05(6.54)	1.72(0.25)	94.48(8.61)	75.74(18.73)	64.43(1.59)	364.84(4.5)
Chandigarh	0(0)	0(0)	0.27(0.04)	0.37(0.03)	0.23(0.06)	0.08(0)	0.95(0.01)
Chhattisgarh	0(0)	0(0)	2.19(0.32)	15.52(1.41)	2.88(0.71)	40.29(0.99)	60.88(0.75)
Goa	0.24(0.07)	0(0)	0(0)	3.19(0.29)	0.8(0.2)	3.69(0.09)	7.92(0.1)
Gujarat	0(0)	0.87(0.06)	0.43(0.06)	0.78(0.07)	0.12(0.03)	31.13(0.77)	33.33(0.41)
Haryana	0(0)	7.32(0.47)	12.52(1.85)	6.5(0.59)	7.02(1.74)	478.63(11.78)	511.99(6.31)
Himachal Pradesh	0(0)	0(0)	0.92(0.14)	2.32(0.21)	0.11(0.03)	1.25(0.03)	4.6(0.06)
Jammu and Kashmir	0(0)	5.4(0.35)	21.37(3.15)	12.33(1.12)	0(0)	52.5(1.29)	91.6(1.13)
Jharkhand	0(0)	0.22(0.01)	1.03(0.15)	21.68(1.97)	23.05(5.7)	16.41(0.4)	62.39(0.77)
Karnataka	16.91(5.18)	11.59(0.75)	47.42(6.99)	32.4(2.95)	6.1(1.51)	139.18(3.43)	253.6(3.13)
Kerala	152.57(46.73)	97.51(6.31)	0(0)	22.18(2.02)	7.11(1.76)	178.03(4.38)	457.4(5.64)
Madhya Pradesh	0(0)	29.02(1.88)	1.12(0.17)	27.91(2.54)	2.24(0.55)	37.07(0.91)	97.36(1.2)
Maharashtra	0(0)	197.75(12.79)	12.73(1.88)	124.78(11.37)	53.02(13.11)	632.32(15.57)	1020.6(12.58)
Manipur	7.91(2.42)	4.94(0.32)	0.11(0.02)	0.4(0.04)	6.62(1.64)	8.07(0.2)	28.05(0.35)
Meghalaya	23.77(7.28)	0.66(0.04)	0(0)	1.25(0.11)	14.93(3.69)	4.64(0.11)	45.25(0.56)
Mizoram	5.61(1.72)	0.19(0.01)	0(0)	0.19(0.02)	7.95(1.97)	2.18(0.05)	16.12(0.2)
Nagaland	9.67(2.96)	4.35(0.28)	0(0)	0.66(0.06)	15.77(3.9)	1.83(0.05)	32.28(0.4)
Odisha	0(0)	0(0)	17.55(2.59)	77.01(7.01)	9.02(2.23)	98.25(2.42)	201.83(2.49)
Puducherry	1.15(0.35)	0.09(0.01)	1.02(0.15)	4.98(0.45)	0.02(0)	7.37(0.18)	14.63(0.18)
Punjab	0(0)	92.58(5.99)	3.79(0.56)	8.84(0.81)	1.09(0.27)	125.03(3.08)	231.33(2.85)
Rajasthan	0(0)	41.52(2.69)	51.47(7.59)	78.66(7.16)	9.17(2.27)	10.85(0.27)	191.67(2.36)
Sikkim	1.56(0.48)	0.29(0.02)	0(0)	0.1(0.01)	1.06(0.26)	0.7(0.02)	3.71(0.05)
Tamil Nadu	48.63(14.9)	2.97(0.19)	60.64(8.94)	62.33(5.68)	3.72(0.92)	455.51(11.21)	633.8(7.81)
Telangana	0(0)	112.4(7.27)	236.59(34.9)	64.99(5.92)	3.75(0.93)	336.33(8.28)	754.06(9.29)
Tripura	0(0)	0(0)	0(0)	1.85(0.17)	13.89(3.43)	32.08(0.79)	47.82(0.59)
Uttar Pradesh	0(0)	688.86(44.56)	18.78(2.77)	86.7(7.9)	73.29(18.12)	359.44(8.85)	1227.07(15.12)
Uttarakhand	0(0)	3.03(0.2)	2.32(0.34)	11.02(1)	3.31(0.82)	9.5(0.23)	29.18(0.36)
West Bengal	16.4(5.02)	14.46(0.94)	20.56(3.03)	270.09(24.6)	34.35(8.49)	475.42(11.7)	831.28(10.24)
<b>India</b>	<b>326.48(100)</b>	<b>1545.83(100)</b>	<b>677.99(100)</b>	<b>1097.91(100)</b>	<b>404.46(100)</b>	<b>4061.79(100)</b>	<b>8114.46(100)</b>
Species- wise contribution	4.02	19.05	8.36	13.55	4.98	50.06	100

Source: <https://www.indiastat.com>

### Appendix 3.11: State-Wise Estimates of Wool Production in India

(in '000 Kg)

States/UTs	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	Per cent to total (2018-19)
Andhra Pradesh#	4900	5031	5037	778	790	791.62	794.39	797.12	1.97
Arunachal Pradesh	0	18	22	24	26	58.25	60.4	42.63	0.11
Bihar	300	267	271	278	301	280.87	298.1	312.38	0.77
Chhattisgarh	100	107	106	116	119	87.29	81.77	81.95	0.20
Gujarat	2800	2664	2578	2577	2578	2267.32	2294.96	2270.51	5.62
Haryana	1300	1370	1390	1429	1400	691.22	693.39	718.5	1.78
Himachal Pradesh	1600	1649	1655	1663	1680	1475	1481.87	1503.14	3.72
Jammu and Kashmir	7500	7681	8710	8371	8371	7265.51	7489.43	7629.28	18.88
Jharkhand	200	159	156	161	168	177.65	186.59	198.59	0.49
Karnataka	7800	8020	7755	8821	9100	6588.25	4305	3057.92	7.57
Madhya Pradesh	400	442	466	484	500	406.22	408.16	410.17	1.01
Maharashtra	1500	1503	1539	1386	1393	1406.65	1436.77	1456.93	3.60
Punjab	500	558	558	461	470	489.64	514.7	524.85	1.30
Rajasthan	13200	14007	15027	14463	14900	14321.3	14287.4	14521.8	35.93
Sikkim	0	1	1	0	2	0	0	0	0.00
Tamil Nadu	0	1	2	1	2	2.08	1.96	2.28	0.01
Telangana		-	0	4423	4556	4658.11	4506.02	4263.51	10.55
Uttar Pradesh	1400	1456	1473	1494	2572	1286.1	1299.62	1315.97	3.26
Uttarakhand	400	400	440	469	503	538.24	564.07	551.98	1.37
West Bengal	700	722	725	740	746	753.07	758.1	760.43	1.88
<b>India</b>	<b>44700</b>	<b>46055</b>	<b>47909</b>	<b>48140</b>	<b>50176</b>	<b>43544.4</b>	<b>41462.7</b>	<b>40420</b>	<b>100.00</b>

*Source: <https://www.indiastat.com>*



**Centre for Management in Agriculture (CMA)  
Indian Institute of Management Ahmedabad (IIMA)**

**Review Report**

**(I) Title of the Draft Study Report Examined:**  
Assessment of Livestock Feed and Fodder: An All India Study

**(II) Date of Receipt of the Draft Report**  
July 27, 2021

**(III) Date of Despatch of Comments**  
September 20, 2021

**(IV) Comments on the Objectives of the Study**

The topic of the study is of high relevance in the Indian agricultural context. There is an immense need to address the problems pertaining to the availability of feed and fodder for livestock in India. The amount of contribution livestock sector makes towards different states and country's agricultural GDP, employment, and livelihood is something that cannot be ignored. Therefore, the study aims to analyze the area, production, and productivity of major green and dry fodder crops. It also studies the growth patten of major livestock population as well as assessing the feed and fodder availability, requirements, deficit/surplus to improve livestock productivity. Through the primary research conducted the authors have been able to propose relevant policy measure that can not only strengthen the availability of feed and fodder requirements for the increasing population of livestock but also improve and safeguard the livelihood of people dependent on their livestock. In addition, the report makes assessment of the National Agricultural Technology Programme (NATP), Food and Agriculture Organization (FAO) as well as Good Agricultural Practices (GAP) recommendation for feed and fodder needed for livestock along with constraints of livestock management and post-harvest management. While these are some very relevant and useful objectives and the authors have produced very vital primary knowledge on the subject matter, the study has also scrutinized and performed analysis of information obtained using tabular format along with usage of various analytical tools as well. This has tremendously benefited the study although inclusion of more analytical tools in the objective would have benefited the study more. Thus, due to this absence the major output by the report is mainly descriptive in nature. The study could have also included aspects of procuring material which are available in scarcity from other states whilst trading the surplus ones

**(V) Comments on the Methodology**

The methodology is quite consistent with the objective of the study: the primary data is collected through sample survey method conducted in seven states namely West Bengal, Haryana, Gujarat, Rajasthan, Karnataka, Kerala and Uttar Pradesh during the period of 2019-20. These states were selected based on suggestions from Ministry of Animal Husbandry, Dairy and Fishery, Government of India. The districts however were selected based on livestock population using proportionate sampling technique. The top three districts from each state ranked using the technique were included in the study. The secondary data on the other hand was collected through the Quinquennial Livestock censuses along with this data was retrieved from Department of Animal Husbandry and Dairying, Government of India for different species of cattle, buffalo, sheep, and goat from the period of 2012-19. Moreover, Land Use Statistics and Department of Animal Husbandry, Dairy and Fishery were assessed in collating data on area under fodder. The component of socio-economic characteristics of livestock farmers was also considered. The sample size is quite reasonable, and household were selected based on certain inclusion criterions.

**(VI) Comments on the Presentation, Get up etc.**

In general, the report is very well structured and presented. Chapters and sub-sections are very clearly delineated, and tables are nicely done. However, there are numerous formatting errors which can be corrected through another round of proof-reading by a professional editor. One strong advice would be to add an Abbreviations table at the beginning of the report. Since the work involves many contexts specific terms and maintains abbreviations throughout, it may make it easy for the readers to have a list at one place. In case of literature review thematic analysis could have been followed to give readers a better understanding on the subject matter. There are several instances in the reports where tables are not mentioned right next to the section they are related to and are usually presented towards the end of more than three to four section along with many other tables and figure which makes it difficult for the reader to understand the selected section thoroughly. E.g., table 2.5 to 2.7; table 6.5 to 6.8. In various figures the X and Y axis are not defined e.g., Fig.2.1, 3.2 etc. In some cases, units are not defined, along with percentage is depicted within the table but its symbol is not used which makes it confusing, e.g., Table 3.8, 7.1 etc. These are a few irregularities in the study that needs to be worked upon.

**(VII) Overall View on Acceptability of the Report**

Although, there are few anomalies which are present in the study, the assessment towards the end of the study have come out excellent. The micro-level data has portrayed a unique blend of information that one could rarely find on standard information sources. The study also presents various policy implication that can be carried out to address the issues pertaining to the subject matter. These policy implications are an output of firsthand interaction and data collection from the people who are facing the problem themselves. Moreover, state specific solutions are provided which a good way to resolve the issues pertaining to the subject matter. In the end, the report will add significant value to the Indian agriculture and welfare of farmers.

## **Action Taken Report**

### **Assessment of Feed and Fodder an All India Study**

**Referee:** Centre for Management in Agriculture, IIM, Ahmadabad

**Title:** Assessment of Feed and Fodder an All India Study

**Date of Receipt of Draft Report:** July 27 2021

**Date of Comments Received:** September 20 2021

**Comments on the Methodology:** No comments on Methodology

**Comments on the presentation, Get up etc:**

1. Table 2.5 to 2.7 and table 6.5 to 6.8 inserted in respective section in the body of text in the main report as per reviewer comments.
2. In figure 2.1 and 3.2 X and Y axis are defined as per reviewer comments
3. Table 3.8 and 7.1 units are defined as per reviewer comments.