

Research Report: IX/ADRTC/142

ECONOMICS OF PRODUCTION, PROCESSING AND MARKETING OF FODDER CROPS IN KARNATAKA

ELUMALAI KANNAN



**Agricultural Development and Rural Transformation Centre
Institute for Social and Economic Change
Bangalore- 560 072**

March 2012

CONTENTS

	List of Tables	iv-v
	Preface	vi
Chapter I	Introduction	1-4
	1.1 Background	1
	1.2 Objectives of the Study	4
Chapter II	Data and Methodology	5-8
	2.1 Data Sources and Methodology	5
Chapter III	Status of Livestock Population and Fodder Crops Cultivated in Karnataka	9-20
	3.1 Background	9
	3.2 Livestock Population	9
	3.3 Fodder Cultivation	16
Chapter IV	Socio-Economic Characteristics of Fodder Growers	21-51
	4.1 Background	21
	4.2 Demographic Characteristics	21
	4.3 Land Resources	23
	4.4 Farm Power and Machinery	25
	4.5 Livestock Resources	27
	4.6 Cropping Pattern	32
	4.7 Production Status of Fodder Crops	33
	4.8 Status of Livestock Population and Production of Livestock Products	34
	4.9 Feeding Practices	36
Chapter V	Economics of Production of Fodder Crops	52-57
	5.1 Background	52
	5.2 Returns and Variable Cost of Cultivation of Napier	53
	5.3 Returns and Variable Cost of Cultivation of Jowar	55

Chapter VI	Processing and Marketing System for Fodder Crops	58-63
6.1	Background	58
6.2	Disposal Pattern of Fodder Crops	58
6.3	Methods of Processing of Fodders and Cost of Processing	60
Chapter VII	Problems Faced by Growers of Fodder Crops	64-66
7.1	Background	64
7.2	Production Problems	65
Chapter VIII	Summary and Conclusions	67-79
8.1	Introduction	67
8.2	Summary of Findings	69
8.3	Conclusions	77
8.4	Policy Recommendations	78
	References	80

LIST OF TABLES

Table 2.1	Details of Sampling	7
Table 3.1	Number of Livestock in Karnataka: 1992 to 2007	10
Table 3.2	Districtwise Number of Cattle: 1992 to 2007	11
Table 3.3	Districtwise Number of Buffalo: 1992 to 2007	13
Table 3.4	Districtwise Number of Sheep: 1992 to 2007	14
Table 3.5	Districtwise Number of Goat: 1992 to 2007	16
Table 3.6	Districtwise Total Live Stock: 1992 to 2007	18
Table 3.7	Area under Fodder Crops in Karnataka and India	19
Table 3.8	Area under Fodder Crops in Karnataka	20
Table 4.1	General Characteristics of Sample Households	22
Table 4.2	Distribution of Land Holding of Sample Households	23
Table 4.3	Average Size of Land holdings	24
Table 4.4	Distribution of Farm Power Machinery and Buildings of Sample Households	25
Table 4.5	Average Present Value of Farm Power Machinery and Buildings of Sample Households	26
Table 4.6	Distribution of Livestock and Poultry by Farm Size Groups	28
Table 4.7	Average Size of Livestock Holdings	29
Table 4.8	Average Value of Livestock and Poultry by Farm Size Groups	31
Table 4.9	Cropping Pattern of Sample Households	32
Table 4.10	Status of Area, Production and Yield of Fodder Crops during last 10 years	34
Table 4.11	Status of Livestock Population during the last 10 years	35
Table 4.12	Status of Milk and Meat Yield during Last 10 years	35
Table 4.13	Status of Feeding Practices to Bovine	37
Table 4.14	Status of Feeding Practices to Sheep and Goat	38
Table 4.15	Livestock feeding Practices by Sample Households	39
Table 4.16	Seasonwise Quantity of Feed Given to Different Livestock Types	41
Table 4.17	Consumption of Different Type of Fodder	43
Table 4.18	Seasonwise Feeding Practices for Livestock	44-45
Table 5.1	Establishment Cost of Napier	54
Table 5.2	Cost of Cultivation of Napier	55
Table 5.3	Cost of Cultivation of Jowar	56
Table 5.4	Economics of Jowar Fodder vis-à-vis its competing Crop Paddy for the sample households	57
Table 6.1	Disposal Pattern of Fodder Crops	59
Table 6.2	Disposal Pattern of Fodder Crops by Place of Sale	59
Table 6.3	Marketing Cost Incurred by the Farmers	60
Table 6.4	Farmers Adopted Hay Making as a Processing Method	60
Table 6.5	Farmers Adopted Hay Making for Different Type of Fodder	61
Table 6.6	Details of Hay making for Different Forage Types	62

Table 7.1	Overall Farmers Reported Production Problem	65
Table 7.2	Details of Production Problem	65
Annex Table 2.1	Livestock Density by Districts in Karnataka: 2003	8
Annex Table 4.1	Net Cropping Pattern	48
Annex Table 4.2	Seasonwise Feeding Pattern for Overall Sample	49-51

PREFACE

Although crop sector continues to dominate the overall agricultural economy of Karnataka, the importance of livestock has gained momentum during recent years. Animal husbandry and dairying activities, hitherto considered as supplementary to crop production, are being transformed into organised and industrialised production. Interestingly, value of output from livestock sector has registered annual growth rate of about 3 per cent during 2004-05 to 2008-09. However, a sustained growth in the sector requires year round availability of green fodder for feeding to livestock. But, the practice of cultivation of green fodder crops on exclusive land is very much limited due to competition for the resources utilised for the production of food crops. Further, there are no evidences of organised fodder markets operating in the in the study areas. The present study discusses some of the issues related to the cultivation of green fodders, livestock feeding practices and marketing of fodders by farmers.

During the course of the study, we received support from several experts working in this field. We would like to express sincere gratitude to Dr. Sanjay Kumar and Dr. D. K. Grover, Coordinators of the study, PAU, Ludhiana for providing study design and survey schedule. Sincere thanks are also due to experts present at the Workshop on Methodology of the Studies held at IEG, Delhi. We express sincere thanks to the official of the AER Division, Ministry of Agriculture for their kind co-operation in the completion of the study.

Sincere thanks are also due to Prof. R.S. Deshpande, Director, ISEC and Prof. Parmod Kumar, Head, ADRTC for their constructive suggestions and guidance for the completion of the work. We also thank Ms. Soumya Bhat for her research assistance. Special thanks are to all ADRTC faculty and staff particularly Mr. Arun Kumar and Mr. V. Devaraj for their secretarial assistance.

Elumalai Kannan

CHAPTER I

INTRODUCTION

1.1. Background

India's agricultural sector has witnessed different phases of growth trajectory since independence. During 1950s and early 1960s, agricultural sector was characterised by low productivity and stagnant output. New agricultural technology introduced in the form of improved seed and fertilisers combined with irrigation has brought significant changes in the sector during 1970s and 1980s. The level of crop production and input uses has increased tremendously. This has helped India to move from the state of food deficit to food secure country. The 1980s have also witnessed special focus on augmenting the production of commodities like oilseeds, milk and fisheries. Among remarkable changes that have taken place during these periods were that India had reached a mature green revolution stage registering a respectable growth in crop production across regions and achieved white revolution by recording a significant growth in milk production. However, during 1990s and early 2000s, agricultural sector has suffered stagnation/decline in productivity. The drift in policy focus on this sector seems to have brought a lower growth. Till 1980s, much emphasis was given on technology and its spread among farmers. But, in 1990s much importance was placed on price factors and the role of technology had taken backseat of the policy makers. Fortunately with appropriate interventions to increase the public investment in agriculture, rural credit and to disseminate technologies effectively, the decline in productivity has been reversed since mid-2000s.

Crop economy continues to be a dominant sector contributing about three-fourth of total agricultural income. Although animal husbandry and dairying are considered supplementary to crop production, they play important roles in the agricultural economy. It is argued that the recent high growth in agricultural sector is mainly contributed by a respectable growth from the

livestock sector. In fact, share of livestock in value of agricultural output has increased substantially from 18.0 per cent in 1970-71 to 20.0 per cent in 1980-81, 24.0 per cent in 1990-91 and then to 27.0 per cent in 2007-08.

In fact, traditionally India's crop and livestock sectors are interrelated to each other. The interactions between these two sectors are so complex that it would be difficult to separate out the contributions from each sector. The crop sector mainly provides fodder to livestock, while livestock supplies manure and draught power to crop sector. However, the interactions between crop and livestock sector has been weakening over time with the advent of new technologies, which has prompted mechanisation of most of the agricultural operations. Change in cropping pattern from cereal to non-cereals based crops has affected the availability of fodder. A few studies have attempted to analyse these relationships under the changing context of crop and animal management practices, and its implications for rural livelihood (Erenstein et al, 2007).

With the increase in per capita income and urbanisation, the consumption of livestock products will continue to rise in the foreseeable future. Consequently, the demand for feed and fodder for feeding and fattening of livestock will also increase. There are already evidences of intensification of livestock production taking place although at varied pace across different regions in India. Among others, human population density, urbanisation, small size farms have positive and significant effect on the intensification of livestock production (Birthal and Rao, 2004). Rise in intensification of livestock production may put pressure on the existing resource base. According to Dikshit and Birthal (2010), India's livestock sector requires 855 Mt of green fodder, 526 Mt of dry fodder and 56 Mt of concentrates by the year 2020. They predict that these requirements will be met from a basket comprising 27 Mt of cereals, 4 Mt of pulses, 21 Mt of oilseed based items and 4 Mt of manufactured feed.

As observed at the macro level, in Karnataka too, animal husbandry and dairying play a significant role in the growth of overall agricultural sector. Livestock has contributed about 18 per cent of total value of output from agricultural and allied sector in 2008-09. Interestingly, annual growth in livestock sector was over 3 per cent during 2004-05 to 2008-09 as compared to fluctuating and negative growth in the crop sector. Among livestock products, growth in milk production was relatively high.

Nevertheless a sustained growth in livestock sector warrants adequate availability of fodder, quality veterinary services, access to output market and proper care and management of animals. Generally, in Karnataka farmers feed livestock with the commonly available crop residues, wasted grains and gruel. The availability of crop residues particularly paddy straw has increasingly become scarce due to harvesting by combines. The use of combine harvester is a recent phenomenon. The combines leaves huge amount of straw in the field and they become unusable for feeding to livestock. Further, in Karnataka there is shift from traditional cropping pattern to high value agriculture, which among others includes cotton. The crop residues from non-foodgrains cannot be used as dry fodder for feeding livestock.

Further, the practice of growing green fodders by the farmers is also very much limited in the state due to competition for the resources to be used for the production of food crops. However, with changes in crops and crop management practices that are driven by market forces, there is increasing realisation among farmers on exclusive cultivation of green fodder in the farm for better feeding to livestock. However, there are no systematic studies available on economics of production of fodder crops and problems faced by the farmers in Karnataka. Surprisingly, there is scarce literature on issues related to Karnataka livestock economy, livestock and rural livelihoods,

livestock feeding practices, role of livestock in dry land regions, and marketing of livestock and livestock products.

The present study focuses on economics of fodder cultivation, processing of forages and its marketing aspects. The study also sketches growth in livestock population across districts in Karnataka. More specifically, the study focuses on the following the objectives.

1.2. Objectives of the Study

1. To estimate the costs of production and returns associated with the cultivation of important fodder crops
2. To identify the processing and marketing system and to estimate the costs and returns at each link for these fodder crops
3. To study the problems faced by the producers in production, marketing and processing of these fodder crops.

CHAPTER II

DATA AND METHODOLOGY

Feed and fodder account for significant proportion of cost of production of livestock products. Fodders are bulky and difficult to transport from one place to another due to high cost of transportation. Generally, they are treated as non-tradable commodity in any economic analysis. However, there are evidences to show that fodder markets are emerging in an organised way particularly in peri-urban areas to meet the demand for fodder. But, no significant efforts have been made by any agency to systematically collect data on different type of fodders in various states including Karnataka. The past studies have used field survey data to analyse fodder production and feeding pattern of livestock at farm household level.

2.1. Data Sources and Methodology

The present study uses both the secondary and primary data. The secondary data were collected for various published sources. To collect farm level data, a field survey was conducted in the select districts in Karnataka. The details of the data sources and methodology are provided in this section.

Secondary data

The secondary data on livestock population in Karnataka were compiled from different Quinquennial Livestock Censuses. The Census provides livestock population by region, species, sex, age and purpose. For the purpose of the present study, districtwise data on livestock population were collected for different species viz., cattle, buffalo, sheep, goat, pig and poultry for the census periods 1992, 1997, 2003 and 2007. Data on value of output from the livestock sector was compiled from the Directorate of Economics and Statistics, Government of Karnataka.

The compound annual growth rate (CAGR) was estimated to analyse the growth pattern between the inter-census periods. Formula for calculating CAGR can be specified as follows.

$$\frac{P_t}{P_0} = (1 + r)^n$$

Where, P_t the current period population, P_0 the base period population, n the number of years and r growth rate.

Further, secondary data on area under fodder was compiled from various issues of Land Use Statistics and also from the Department of Animal Husbandry and Veterinary Services, Government of Karnataka.

Primary Survey

To understand and analyse the practices of cultivation, processing and marketing of fodder crops, a field survey of fodder growing farmer households was conducted in 2008-09. The survey covered three districts viz., Mandya, Chitradurga and Belgaum and a sample of 201 farmer households. The districts were selected based on the criteria of livestock density estimated as per the Livestock Census 2003. The number of livestock per thousand hectare of geographical area was the highest for Mandya (1973) followed by Belgaum (1970) and Chitradurga (1855) (**Annex Table 2.1**). Incidentally, these districts also fall under different geographical locations in the state: Mandya in south, Belgaum in north and Chitradurga in central region. For the state as whole, the livestock density defined as the number of livestock per thousand hectare of geographical area was 1329.

Two villages were selected from each district in such a way that one village was located nearby the district head quarters and another farthest. This was done especially to take into account the effect of urbanisation or proximity to urban market on cropping pattern including the cultivation of fodder crops. A purposive sampling technique was adopted to select the farmers

growing any type of fodder crops in the selected villages. Since, the focus of the study was on the analysis of economics of fodder cultivation, only farmers who had access to land for the cultivation of fodder crops was considered. These farmers also owned different type of livestock. The landless people, who own livestock, but depend on common land for grazing and purchased inputs were not considered in the study.

Before conducting the survey, a list of farmers growing any fodder crops in a village was prepared based on the informal group discussion of the farmers. Then, a proportionate random sampling method was adopted to select different categories of farmer viz., marginal, small, medium and large. The categories of the farmers were prepared based on the operational holding as: marginal (<2.5 acre), small (2.5-5.0 acre), medium (5.0-10.0 acre) and large (>10.0 acre). A structured household interview schedule was used to collect information from the selected households. The schedule was pre-tested before using it in the field.

Details of the sampling are given in **Table 2.1**. Interestingly, the sample was dominated by marginal and small farmers in Mandya, while small and medium farmers in Chitradurga and Belgaum. Manya has small size farms and highly irrigated agricultural land. Chitradurga and Belgaum fall in dry land zones.

Table 2.1. Details of Sampling

Particulars	Mandya	Chitradurga	Belgaum	All
Marginal	28	12	15	55 (27.4)
Small	31	18	20	69 (34.3)
Medium	16	22	18	56 (27.9)
Large	3	7	11	21 (10.4)
Overall	78	59	64	201 (100.0)

Note: Figures in parenthesis are percent to the total

In addition to the cost of cultivation, information on different methods of processing of fodder and storage period was collected. Details on marketing

of fodders by farmers through different channels were also solicited. Since there were no established feed/fodder processing units in the study area, a separate survey of these units could not be conducted. Similarly, marketing of fodders was not so prevalent among the farmers in the study area. As a result an exclusive survey of traders also could not be undertaken.

Annex Table 2.1. Livestock Density by Districts in Karnataka

District	Geographical Area (000' ha)	Livestock/000' ha Geographical Area in 2003	Livestock/000' ha Geographical Area in 2007
Bagalkote	659	1738	2564
Bangalore Rural	585	1553	1932
Bangalore Urban	217	1303	1219
Belgaum	1344	1970	2231
Bellary	813	1457	1896
Bidar	542	1189	1384
Bijapur	1053	948	1222
Chamarajanagar	570	909	968
Chikmagalore	722	801	911
Chithradurga	771	1855	2397
Davanagere	598	1482	1862
Dhakshina Kannada	477	803	930
Dharwad	427	892	1059
Gadag	466	1098	1567
Gulbarga	1610	1299	1573
Hassan	663	1454	1752
Haveri	485	1554	1761
Kodagu	411	434	439
Kolar	779	1847	2088
Koppal	552	1293	1886
Mandya	498	1973	2314
Mysore	676	1382	1686
Raichur	836	1430	1868
Shiomaga	848	936	1017
Tumkur	1065	1798	2286
Udupi	356	1064	980
Uttara Kannada	1025	460	490
Karnataka	19050	1329	1620

Source: Livestock Census, 2003 and 2007, and Directorate of Economics and Statistics, Government of Karnataka

CHAPTER III

STATUS OF LIVESTOCK POPULATION AND FODDER CROPS CULTIVATED IN KARNATAKA

3.1. Background

India has large livestock population in the world. The livestock population has been expanding and changing in response to changes in technological, economic and institutional spheres. The livestock population has increased significantly from 353.6 million in 1972 to 470.86 million in 1992 and then to 529.7 million in 2007. However, the broader compositional structure has not undergone considerable changes over time. Bovine (cattle and buffalo) continued to dominate the livestock population with about 57 per cent followed by sheep and goats together with 40 per cent. The population of goats has increased dramatically over time when compared to that of sheep. This has huge implications for maintaining ecological balance in different parts of the country. Further, consequent rise in demand for fodder and feed competes with land allocated for growing food crops. Nevertheless, increase in livestock population is an indication that the asset holdings of rural households has been strengthening and they act as insurance at the time of crisis.

The present section analyses the status of livestock population and fodder crops cultivated in Karnataka. The details of livestock population provided in different rounds of Livestock Censuses have been utilised to analyse the trends and compositional changes at the state and district level. The compound annual growth rates were estimated by species type.

3.2. Livestock Population

The trend in livestock population in the state of Karnataka is presented for the period 1992 to 2007 in **Table 3.1**. The total livestock population has increased from 29.57 million in 1992 to 30.86 million in 2007 with

compound annual growth rate (CAGR) of 0.29 per cent. But, livestock population has marginally declined during the inter-census periods of 1997 and 2003. Cattle population has surprisingly declined from 13.18 million in 1992 to 10.83 million in 1997, 9.23 million in 2003 and then to 10.50 million in 2007. The CAGR in cattle population has registered negative between 1992 and 2007. However, buffalo population has increased marginally between 1992 and 1997, but declined during 2003 due to drought in the previous period. Interestingly, its population has increased marginally again in 2007. These changes in bovine population indicate that the importance of buffalo among farmers is increasing for dairying, although cattle continue to remain as the predominant species.

Table 3.1. Number of Livestock in Karnataka: 1992 to 2007

Particulars	(In thousands)				
	1992	1997	2003	2007	CAGR* (%)
Cattle	13175 (44.56)	10831 (37.97)	9234 (36.47)	10503 (34.03)	-1.50
Buffalo	4251 (14.38)	4367 (15.31)	3991 (15.76)	4327 (14.02)	0.12
Sheep	5431 (18.37)	8003 (28.05)	7256 (28.66)	9558 (30.97)	3.84
Goat	6285 (21.26)	4875 (17.09)	4484 (17.71)	6153 19.94	-0.14
Horses and ponies	13 (0.05)	16 (0.06)	14 (0.05)	11 (0.04)	-1.24
Donkeys	33 (0.11)	28 (0.10)	25 (0.10)	26 (0.08)	-1.48
Pig	380 (1.29)	405 (1.42)	312 (1.23)	281 (0.91)	-2.01
Total livestock	29569 (100)	28526 (100)	25315 (100)	30859 (100)	0.29

Note: Figures in parenthesis are percentage to total

* CAGR is between 1992 and 2007

Small ruminants (sheep and goat) constitute the second largest species after the bovines. Among small ruminants, sheep population has increased considerably from 5.43 million in 1992 to 9.6 million in 2007 with the CAGR of 3.84 per cent. But, goat population has by and large declined with the CAGR of -0.14 per cent. Pigs are generally reared by marginalised and downtrodden sections of the society. The pig population has also declined quite dramatically between 1992 and 2007 registering negative growth rate.

Table 3.2. Districtwise Number of Cattle: 1992 to 2007

(In thousands)

District	1992	1997	2003	2007	CAGR (%)
Bagalkot**	-	272 (2.51)	231 (2.51)	305 (2.91)	1.17
Bangalore Urban	232 (1.76)	185 (1.71)	156 (1.69)	127 (1.21)	-3.93
Bangalore Rural	587 (4.46)	754 (6.96)	396 (4.29)	431 (4.10)	-2.04
Belgaum	660 (5.01)	499 (4.61)	498 (5.40)	599 (5.70)	-0.65
Bellary	625 (4.74)	426 (3.93)	363 (3.94)	391 (3.73)	-3.07
Bidar	352 (2.67)	276 (2.55)	256 (2.77)	277 (2.64)	-1.58
Bijapur	673 (5.11)	252 (2.33)	230 (2.49)	280 (2.66)	-5.68
Chamarajanagar**	-	317 (2.92)	257 (2.79)	274 (2.61)	-1.45
Chikmagalur	550 (4.18)	391 (3.61)	357 (3.87)	386 (3.68)	-2.34
Chitradurga	590 (4.48)	319 (2.95)	308 (3.33)	341 (3.25)	-3.59
Dhakshina Kannada	837 (6.35)	355 (3.28)	332 (3.59)	397 (3.78)	-4.85
Davanagere**	-	380 (3.51)	343 (3.72)	395 (3.76)	0.39
Dharwad	855 (6.49)	222 (2.05)	191 (2.07)	220 (2.09)	-8.66
Gadag	-	212 (1.96)	137 (1.48)	159 (1.51)	-2.85
Gulbarga	1000 (7.59)	823 (7.60)	805 (8.72)	907 (8.64)	-0.65
Hassan	760 (5.77)	614 (5.67)	511 (5.54)	633 (6.03)	-1.20
Haveri**	-	337 (3.11)	300 (3.25)	312 (2.97)	-0.77
Kodagu	202 (1.54)	138 (1.28)	114 (1.24)	119 (1.14)	-3.46
Kolar	636 (4.83)	532 (4.91)	457 (4.95)	477 (4.54)	-1.90
Koppal**	-	260 (2.40)	225 (2.44)	245 (2.33)	-0.59
Mandya	483 (3.66)	343 (3.16)	259 (2.80)	350 (3.33)	-2.12
Mysore	1122 (8.51)	566 (5.23)	496 (5.37)	617 (5.87)	-3.91
Raichur	801 (6.08)	402 (3.71)	352 (3.81)	405 (3.86)	-4.44
Shimoga	924 (7.01)	577 (5.33)	525 (5.69)	580 (5.52)	-3.06
Tumkur	787 (5.97)	598 (5.52)	478 (5.18)	589 (5.61)	-1.91
Udupi**	-	386 (3.57)	326 (3.53)	319 (3.03)	-1.91
Uttara Kannada	499 (3.78)	395 (3.64)	330 (3.57)	367 (3.50)	-2.01
Karnataka	13175 (100)	10831 (100)	9234 (100)	10503 (100)	-1.50

Note: Figures in parenthesis are percentage to total

* CAGR is between 1992 and 2007 and ** between 1997 and 2007

While horses and ponies population has remained almost stagnant with marginal decline during recent census, the population of donkeys has decreased considerably. Horses and donkeys are generally used for transport purposes. They constituted less than one per cent of the total livestock population. Decline in their population indicates that animal draught power is being replaced by mechanical power.

The districtwise analysis of livestock population will be more revealing in trends and growth rates. **Table 3.2** presents the districtwise cattle population. Among districts, Gulbarga has the largest cattle population followed by Hassan, Mysore and Belgaum. But, cattle population in all these districts has recorded negative CAGR between 1992 and 2007. Notwithstanding, all other districts except Bagalkot (1.17 per cent) and Davanagere (0.39 per cent) have showed decline in cattle population. In terms of absolute numbers, there is some marginal increase in cattle population in 2007 when compared to the inter-census periods 1997 and 2003, but lower than the population level recorded in 1992. The lowest cattle population was present in Kodagu. Overall, the widespread decline in cattle population across the districts does not augur well for development of dairying in the state.

In case of buffalo, seven districts have recorded positive growth in its population between 1992 and 2007 (**Table 3.3**). The highest growth was registered in Belgaum at 2.51 per cent. Other districts which showed positive growth rates were Bagalkot, Bellary, Bidar, Davanagere, Gulbarga and Koppal. But, in Dhakshina Kannada the decline in the buffalo population was quite sharp from 1,90,000 to 15,000 between 1992 and 2007. As compared to the cattle, buffaloes are sparsely distributed across the districts. The buffalo population ranged from 11,000 in Bangalore Urban to 8,60,000 in Belgaum during 2007. In fact, Belgaum has the largest buffalo population followed by Bagalkot and Gulbarga.

Table 3.3. Districtwise Number of Buffalo: 1992 to 2007 (In thousands)

District	1992	1997	2003	2007	CAGR (%)
Bagalkot**	-	198 (4.54)	201 (5.03)	254 (5.86)	2.50
Bangalore Urban	39 (0.92)	27 (0.63)	15 (0.37)	11 (0.26)	-8.02
Bangalore Rural	126 (2.95)	195 (4.47)	76 (1.90)	69 (1.59)	-3.92
Belgaum	593 (13.94)	651 (14.91)	701 (17.57)	860 (19.88)	2.51
Bellary	192 (4.51)	186 (4.26)	187 (4.70)	208 (4.80)	0.54
Bidar	152 (3.57)	161 (3.68)	169 (4.25)	177 (4.09)	1.03
Bijapur	312 (7.34)	152 (3.48)	146 (3.66)	191 (4.42)	-3.20
Chamarajanagar**	-	45 (1.03)	37 (0.94)	28 (0.66)	-4.49
Chikmagalur	121 (2.84)	115 (2.63)	106 (2.66)	98 (2.27)	-1.37
Chitradurga	281 (6.62)	173 (3.96)	179 (4.47)	193 (4.46)	-2.48
Dhakshina Kannada	190 (4.47)	57 (1.31)	26 (0.65)	15 (0.35)	-15.53
Davanagere**	-	222 (5.07)	219 (5.49)	224 (5.17)	0.09
Dharwad	293 (6.90)	90 (2.05)	90 (2.25)	100 (2.31)	-6.92
Gadag	-	93 (2.13)	61 (1.52)	80 (1.85)	-1.46
Gulbarga	209 (4.92)	218 (4.99)	224 (5.62)	249 (5.76)	1.18
Hassan	211 (4.97)	208 (4.75)	194 (4.87)	191 (4.42)	-0.66
Haveri**	-	128 (2.93)	123 (3.08)	120 (2.77)	-0.65
Kodagu	56 (1.32)	44 (1.00)	32 (0.79)	27 (0.62)	-4.82
Kolar	171 (4.03)	148 (3.38)	123 (3.08)	98 (2.27)	-3.64
Koppal**	-	90 (2.06)	97 (2.44)	109 (2.52)	1.91
Mandya	235 (5.52)	192 (4.39)	170 (4.26)	169 (3.90)	-2.17
Mysore	175 (4.12)	84 (1.93)	70 (1.74)	66 (1.53)	-6.28
Raichur	221 (5.19)	152 (3.49)	176 (4.42)	211 (4.87)	-0.31
Shimoga	292 (6.86)	225 (5.14)	194 (4.86)	191 (4.42)	-2.78
Tumkur	259 (6.10)	269 (6.15)	216 (5.41)	242 (5.59)	-0.46
Udupi**	-	86 (1.98)	49 (1.23)	27 (0.62)	-11.08
Uttara Kannada	123 (2.90)	159 (3.65)	109 (2.73)	119 (2.74)	-0.25
Karnataka	4251 (100)	4367 (100)	3991 (100)	4327 (100)	0.12

Note: Figures in parenthesis are percentage to total

* CAGR is between 1992 and 2007 and ** between 1997 and 2007

In terms of per cent distribution of buffaloes, Belgaum accounted for the highest share of 20 per cent followed by Bagalkot and Tumkur in 2007. Interestingly, in Belgaum the per cent share of buffalo in total state population increased consistently since 1992. The per cent distribution of buffalo was low in Bangalore (Urban), Dhakshina Kannada, Kodagu, Udipi and Chamrajanagar.

Table 3.4. Districtwise Number of Sheep: 1992 to 2007 (In thousands)

District	1992	1997	2003	2007	CAGR (%)
Bagalkot**	-	378 (4.72)	410 (5.65)	674 (7.05)	-4.34
Bangalore Urban	105 (1.93)	125 (1.56)	73 (1.00)	80 (0.84)	-1.80
Bangalore Rural	271 (4.98)	623 (7.79)	263 (3.63)	364 (3.81)	1.99
Belgaum	504 (9.27)	876 (10.95)	903 (12.44)	900 (9.41)	3.95
Bellary	318 (5.86)	529 (6.61)	397 (5.47)	656 (6.86)	4.94
Bidar	84 (1.54)	79 (0.99)	66 (0.91)	85 (0.89)	0.09
Bijapur	405 (7.45)	254 (3.18)	270 (3.73)	336 (3.51)	-1.24
Chamarajanagar**	-	125 (1.56)	117 (1.61)	133 (1.39)	0.62
Chikmagalur	65 (1.20)	74 (0.93)	63 (0.87)	96 (1.01)	2.62
Chitradurga	407 (7.49)	716 (8.95)	716 (9.86)	931 (9.74)	5.68
Davanagere**	-	241 (3.02)	205 (2.82)	334 (3.49)	3.30
Dharwad	293 (5.39)	51 (0.62)	34 (0.46)	57 (0.60)	-10.32
Gadag	-	206 (2.58)	209 (2.88)	314 (3.28)	-
Gulbarga	353 (6.50)	488 (6.10)	460 (6.33)	582 (6.09)	3.40
Hassan	188 (3.47)	196 (2.44)	154 (2.13)	201 (2.10)	0.44
Haveri**	-	248 (3.10)	198 (2.73)	266 (2.78)	0.69
Kolar	563 (10.37)	725 (9.06)	633 (8.73)	787 (8.23)	2.26
Koppal**	-	192 (2.40)	250 (3.45)	475 (4.97)	9.48
Mandya	393 (7.23)	363 (4.54)	340 (4.68)	383 (4.00)	-0.17
Mysore	340 (6.25)	215 (2.69)	199 (2.74)	257 (2.69)	-1.84
Raichur	422 (7.78)	379 (4.73)	383 (5.27)	552 (5.78)	1.80
Shimoga	33 (0.60)	19 (0.23)	14 (0.19)	25 (0.26)	-1.72
Tumkur	684 (12.59)	896 (11.19)	885 (12.20)	1068 (11.17)	3.02
Uttara Kannada	3 (0.06)	2 (0.03)	17 (0.24)	3 (0.03)	-1.18
Karnataka	5431 (100)	8003 (100)	7255 (100)	9558 (100)	3.84

Note: Figures in parenthesis are percentage to total; * CAGR is between 1992 and 2007 and ** between 1997 and 2007

The districtwise trend in sheep population is presented in **Table 3.4**. It can be observed that sheep population are densely distributed across dry land districts. Tumkur has the largest sheep population followed by Chitradurga, Belgaum, Kolar and Bagalkot. Despite marginal decline in population in Tumkur during 2003, it had increased considerably in 2007. Except a few districts, all others have registered positive growth in sheep population. The highest positive growth in sheep population was recorded in Chitradurga (5.68 per cent) followed by Bellary (4.94 per cent) and Belgaum (3.95 per cent) between 1992 and 2007. Koppal also has registered respectable growth rate between 1997 and 2007. The decline in sheep population was observed to be dramatic in Dharwad.

The per cent distribution of sheep population is also provided in **Table 3.4**. Among the districts, Tumkur accounted for the highest share of sheep population with 11.2 per cent followed by Belgaum and Kolar. Although Tumkur and Kolar accounted for relatively a high concentration of sheep in 1992, their share per cent share has almost declined in the subsequent census periods. The share of Gulbarga in sheep population more or less has remained constant across the study periods.

Similar trends in goat population can also observed across districts and census periods (**Table 3.5**). Grazing of goats is considered to be environmentally damaging because of their feeding pattern and thus maintenance of optimal population is necessary. Among districts, large number of goats is present in Gulbarga, which recorded the CAGR of 2.64 per cent between 1992 and 2007. Although goat population in Belgaum declined marginally, it constituted the second largest populated district followed by Tumkur and Bijapur. The decline in goat population in Dharwad and Shimoga was sharp across inter-census periods; from 8.06 per cent in 1992 to 1.18 per cent in 2007 in Dharwad and from 2.69 per cent to 1.00 per cent in Shimoga between the same periods.

Table 3.5. Districtwise Number of Goat: 1992 to 2007

(In thousands)

District	1992	1997	2003	2007	CAGR (%)
Bagalkot**	-	267 (5.48)	267 (5.95)	431 (7.00)	4.89
Bangalore Urban	76 (1.20)	41 (0.85)	31 (0.69)	41 (0.67)	-3.99
Bangalore Rural	260 (4.14)	345 (7.07)	169 (3.78)	262 (4.26)	0.05
Belgaum	619 (9.84)	442 (9.07)	509 (11.35)	610 (9.92)	-0.09
Bellary	376 (5.99)	370 (7.60)	222 (4.95)	272 (4.43)	-2.13
Bidar	154 (2.44)	127 (2.61)	131 (2.92)	189 (3.07)	1.39
Bijapur	852 (13.55)	358 (7.34)	322 (7.19)	452 (7.35)	-4.13
Chamarajanagar**	-	120 (2.45)	106 (2.36)	115 (1.87)	-0.41
Chikmagalur	116 (1.85)	43 (0.89)	47 (1.05)	75 (1.21)	-2.91
Chitradurga	392 (6.24)	218 (4.47)	220 (4.91)	369 (5.99)	-0.41
Dhakshina Kannada	30 (0.48)	22 (0.46)	17 (0.37)	26 (0.42)	-1.10
Davanagere**	-	121 (2.49)	113 (2.52)	154 (2.50)	2.41
Dharwad	506 (8.06)	72 (1.47)	61 (1.36)	72 (1.18)	-12.16
Gadag	-	123 (2.52)	101 (2.25)	172 (2.80)	3.45
Gulbarga	511 (8.13)	573 (11.76)	562 (12.54)	756 (12.28)	2.64
Hassan	237 (3.78)	112 (2.30)	100 (2.22)	132 (2.15)	-3.83
Haveri**	-	147 (3.02)	128 (2.85)	151 (2.45)	0.21
Kodagu	14 (0.22)	7 (0.15)	4 (0.10)	7 (0.12)	-4.21
Kolar	307 (4.88)	158 (3.24)	203 (4.54)	255 (4.14)	-1.23
Koppal**	296 (4.72)	137 (2.80)	135 (3.01)	199 (3.24)	-2.61
Mandya	-	233 (4.79)	205 (4.57)	244 (3.97)	0.47
Mysore	435 (6.92)	138 (2.83)	161 (3.58)	197 (3.20)	-5.15
Raichur	432 (6.88)	237 (4.87)	274 (6.11)	377 (6.13)	-0.91
Shiomaga	169 (2.69)	101 (2.07)	59 (1.31)	62 (1.00)	-6.49
Tumkur	482 (7.66)	342 (7.03)	322 (7.18)	518 (8.42)	0.48
Udupi**	-	2 (0.03)	2 (0.05)	3 (0.04)	5.86
Uttara Kannada	20 (0.32)	17 (0.35)	14 (0.30)	12 (0.20)	-3.43
Karnataka	6285 (100)	4875 (100)	4484 (100)	6153 (100)	-0.41

Note: Figures in parenthesis are percentage to total

* CAGR is between 1992 and 2007 and ** between 1997 and 2007

However, it is quite interesting to observe the overall trend in total livestock population across districts in Karnataka. Livestock and related activities are generally concentrated in dry land regions where the incidence of climatic variability is high. Livestock provides the rural households security against the risks such as crop loss and indebtedness. It can be observed from the **Table 3.6** that the districts falling in dry land tracts have the large livestock population. Among districts, Belgaum has the largest livestock population (3.0 million) followed by Gulbarga (2.53 million) and Tumkur (2.43 million). The livestock population has consistently increased in Belgaum, Bagalkot, Davanagere and Koppal across inter-census periods. The share of these districts in the state population was 9.72 per cent, 5.47 per cent, 3.61 per cent and 3.38 per cent, respectively. Gulbarga and Tumkur accounted for 8.21 per cent and 7.89 per cent of the total livestock population, respectively. The CAGR was high in Koppal and Bagalkot. The other districts that showed positive growth in livestock population were Belgaum, Bellary, Chitradurga, Davanagere, Gadag, Gulbarga and Tumkur.

However, some districts have shown decline in livestock population over time. These included Dharwad and Shimoga which are characterised by relatively developed crop agriculture and thus there is limited availability of grazing land for livestock rearing. In Dharwad, total livestock population was 1.96 million in 1992, which declined continuously to 0.44 million in 1997 and then to 0.38 million in 2003. There is some increase in population in 2007. In Shimoga, livestock population has fallen by about 60 per cent between 1992 and 2007. However, there is also marginal increase in population during 2007. Apart, Kodagu has also showed steep decline in livestock population during the census periods under study.

Table 3.6. Districtwise Total Live Stock: 1992 to 2007

(In thousands)

District	1992	1997	2003	2007	CAGR (%)
Bagalkot**	-	1137 (3.99)	1145 (4.52)	1689 (5.47)	4.04
Bangalore Urban	459 (1.55)	386 (1.35)	283 (1.12)	265 (0.86)	-3.59
Bangalore Rural	1257 (4.25)	1929 (6.76)	909 (3.59)	1131 (3.67)	-0.70
Belgaum	2402 (8.12)	2519 (8.83)	2649 (10.46)	3000 (9.72)	1.49
Bellary	1520 (5.14)	1554 (5.45)	1185 (4.68)	1542 (5.00)	0.10
Bidar	763 (2.58)	662 (2.32)	644 (2.54)	750 (2.43)	-0.11
Bijapur	2278 (7.70)	1052 (3.69)	999 (3.94)	1287 (4.17)	-3.73
Chamarajanagar**	-	608 (2.13)	518 (2.05)	552 (1.79)	-0.97
Chikmagalur	878 (2.97)	636 (2.23)	579 (2.29)	658 (2.13)	-1.90
Chitradurga	1682 (5.69)	1439 (5.05)	1430 (5.65)	1847 (5.99)	0.62
Dhakshina Kannada	1085 (3.67)	453 (1.59)	383 (1.51)	444 (1.44)	-5.79
Davanagere**	-	970 (3.40)	885 (3.50)	1113 (3.61)	1.39
Dharwad	1960 (6.63)	439 (1.54)	381 (1.51)	453 (1.47)	-9.31
Gadag	-	641 (2.25)	511 (2.02)	730 (2.36)	1.31
Gulbarga	2108 (7.13)	2134 (7.48)	2092 (8.26)	2533 (8.21)	1.23
Hassan	1418 (4.79)	1140 (4.00)	964 (3.81)	1161 (3.76)	-1.32
Haveri**	-	864 (3.03)	754 (2.98)	855 (2.77)	-0.11
Kodagu	328 (1.11)	232 (0.81)	178 (0.70)	180 (0.58)	-3.91
Kolar	1723 (5.83)	1592 (5.58)	1439 (5.69)	1628 (5.27)	-0.38
Koppal**	-	689 (2.42)	715 (2.82)	1042 (3.38)	4.22
Mandya	1419 (4.80)	1143 (4.01)	983 (3.88)	1153 (3.74)	-1.38
Mysore	2078 (7.03)	1007 (3.53)	935 (3.69)	1140 (3.69)	-3.92
Raichur	1897 (6.42)	1186 (4.16)	1195 (4.72)	1561 (5.06)	-1.29
Shimoga	1425 (4.82)	925 (3.24)	793 (3.13)	862 (2.79)	-3.30
Tumkur	2242 (7.58)	2133 (7.48)	1915 (7.56)	2434 (7.89)	0.55
Udupi**	-	477 (1.67)	379 (1.50)	349 (1.13)	-3.07
Uttara Kannada	648 (2.19)	579 (2.03)	471 (1.86)	502 (1.63)	-1.69
Karnataka	29569	28526	25315	30859	0.29

Note: Figures in parenthesis are percentage to total

* CAGR is between 1992 and 2007 and ** between 1997 and 2007

3.3. Fodder Cultivation

Table 3.7. Area under Fodder Crops in Karnataka and India (000' hectare)

Year	Karnataka	India
1996-97	62	7974
1997-98	76	8195
1998-99	50	7698
1999-00	55	8851
2000-01	47	9199
2001-02	46	8702
2002-03	52	6295
2003-04	54	8701
2004-05	53	8027
2005-06	35	8066
2006-07	47	8212
2007-08	35	8196
2008-09	31	8360

Source: Land Use Statistics, Government of India

In the state of Karnataka, the basic data related to fodder cultivation are not available. No systematic efforts have been made by any government agency to collect information on fodder area, production and other related details. Nevertheless, land use statistics compiled by the Ministry of Agriculture, Government of India provide data on area under different crops cultivated in various Indian states. Among others, area under fodder crops has also been reported for different years. The area under fodder crops as reported in land use statistics is provided in **Table 3.7**. According to this source, fodder crops occupied meagre 0.32 per cent (average for the period 2004-05 to 2008-09) of the total cropped area in the state. At all India level, it accounts for about 4 per cent. Given the size of ruminant population, the reported fodder area seems to be insignificant in meeting the fodder consumption requirements.

Further, data on area under cultivated fodder crops furnished by the Department of Animal Husbandry and Veterinary Services is provided in **Table 3.8**. According to this source, area under cultivated fodder has increased from 16,061 ha in 1993-94 to 19,276 ha in 1999-00. Among districts, Kolar has the largest area under fodder followed by Bangalore and Mysore. However, the Department data do not match with the data published in the land use statistics, which reports relatively more area

under fodder crops. There are State Livestock Farms operating in different parts of the Karnataka. Apart from breeding improvement programmes, these livestock farm also undertake research for enhancing production and quality of fodder crops. According to Bhende et al (2004), total green fodder produced in these farms increased from 5,196 tonnes in 1997-98 to 7,206 tonnes in 2002-03. However, fodder produced from these farms are largely utilised for feeding to animals in the livestock farm itself.

Table 3.8. Area under Fodder Crops in Karnataka

District	1993-94	1999-00
Bangalore	4499	5885
Belgaum	1130	485
Bellary	-	54
Bijapur	206	262
Dharwad	331	401
Dakshina Kannada	324	183
Gulbarga	286	213
Hassan	503	680
Kolar	5326	6759
Mandya	713	481
Mysore	525	2113
Raichur	427	-
Shimoga	409	1186
Tumkur	1382	574
Total	16061	19276

Source: Department of Animal Husbandry and Veterinary Services, Government of Karnataka

In sum, it is clear from the above analysis that total livestock population has increased across inter-census periods. While cattle population showed marginal decline, number of buffaloes have increased. However, buffaloes are sparsely distributed across districts as compared to cattle, which continue dominate the bovine population in the state. Interestingly, sheep population has increased dramatically over time registering annual growth rate of 3.84 per cent. Across districts, livestock are largely concentrated in dry land tracts. Data related to the cultivation of fodder crops across districts in Karnataka are not systematically collected. According to land use statistics, fodder crops accounted for only 0.32 per cent of the total cropped area in the state.

CHAPTER IV

SOCIO-ECONOMIC CHARACTERISTICS OF FODDER GROWERS

4.1. Background

As discussed in the Chapter II, a primary survey was conducted in Mandya, Chitradurga and Belgaum to understand fodder cultivation practices among farmer households. It is expected that with the increase in per capita income, the demand for livestock products will continue to rise. Consequently, the method of animal rearing so far considered as a supplementary enterprise to crop production is likely undergo considerable changes. These changes will include replacement of indigenous species by crossbred, increased allocation of land for cultivation of green fodder and feeding of purchased feeds to livestock. The present chapter discusses some characteristics of fodder cultivating sample households in the study area. These included demographic characteristics, land holding pattern, machinery use, livestock holding, cropping pattern, production status of livestock products and fodder crops, and livestock feeding practices.

4.2. Demographic Characteristics

The general characteristics of sample households are provided in **Table 4.1**. Among the selected farmers' households, small farmers accounted for 34 per cent followed by medium farmers (28 per cent) and marginal farmers (27 per cent). The marginal and small farmers combined have constituted 62 per cent of total sample households. Regarding average family size, large percentage of households has the number of family members ranging between 4 and 8. In fact, 79 per cent of the small farmer households' family size is falling in this category. Contrarily, about 57 per cent of the large farmer households have the family size of more than 8 persons. As for the education of the head of the family, about 38 per cent had completed secondary education, while 17 per cent had higher secondary education. Only 18 per cent of the sample farmers were illiterate. Among farm size

groups, about 44 per cent of marginal farmers had completed secondary education followed by medium farmers (41 per cent).

Table 4.1. General Characteristics of Sample Households

	(Per cent)				
Particulars	Marginal	Small	Medium	Large	Overall
% farmer households	27.36	34.33	27.86	10.45	100
Average Family Size					
Less than 4	20.00	8.70	16.07	4.76	13.43
4 to 8	69.09	79.71	51.79	38.10	64.68
Above 8	10.91	11.59	32.14	57.14	21.89
Total	100	100	100	100	100
Education of head of the family					
Illiterate	20.00	17.39	23.21	4.76	18.41
Primary	9.09	20.29	12.50	19.05	14.93
Secondary	43.64	34.78	41.07	28.57	38.31
Higher Secondary	18.18	13.04	19.64	19.05	16.92
Degree/Diploma	9.09	14.50	3.57	28.57	11.40
Total	100	100	100	100	100
Age of Head (Years)					
Up to 30	63.64	42.03	41.07	23.81	45.77
31-50	25.45	40.58	30.36	52.38	34.83
Above 50	10.91	17.39	28.57	23.81	19.40
Total	100	100	100	100	100
Annual Family Income (Rs)					
Less than 50,000	78.18	28.99	25.00	9.52	39.30
50,000-1,00,000	10.91	44.93	33.93	23.81	30.35
1,00,000-2,50,000	10.91	24.64	26.79	33.33	22.39
2,50,000-5,00,000	-	1.45	7.14	28.57	5.47
More than 5,00,000	-	-	7.14	4.76	2.49
Total	100	100	100	100	100

The average age of the head of households who was also the respondent for the current survey grouped into three categories viz., up to 30 years, 31-50 years and above 50 years. Interestingly, about 46 per cent of the respondents had the average age of below 30 years. Among farm size groups, majority of marginal farmers were young (below 30 years) as compared to the medium and large farmers. The young farmers are more dynamic, willing to take risk and eager to adopt new technologies. But, as reported by these

farmers the constraints with respect to access to credit, quality seeds, fertilisers and markets for output need to be overcome through better institutional and delivery mechanisms. Regarding the annual income of households (farm and non-farm), about 70 per cent of the sample households reported earning up to Rs. 100,000. Within the marginal farm size groups, over three-fourth of farmers reported earning annual income up to Rs. 50,000 only. The medium and large farmers have reported higher income range. The analysis clearly indicates that marginal and small farmers are in a disadvantageous position in terms of strengthening their earning capacity.

4.3. Land Resources

Table 4.2. Distribution of Land Holding of Sample Households

Particulars	(Per cent)				
	Marginal	Small	Medium	Large	Overall
Owned land					
Irrigated	10.8	26.3	29.0	33.9	100
Un-irrigated	9.3	19.5	29.0	42.1	100
Total	10.3	23.5	28.9	37.3	100
Leased-in					
Irrigated	51.6	30.1	18.3	-	100
Un-irrigated	22.3	27.7	49.9	-	100
Total	32.5	28.6	39.0	-	100
Leased-out					
Irrigated	48.9	17.5	33.6	-	100
Un-irrigated	25.0	0.0	75.0	-	100
Total	41.5	12.1	46.4	-	100
Fallow					
Irrigated	52.9	-	47.1	-	100
Un-irrigated	85.5	-	14.5	-	100
Total	73.0	-	27.0	-	100.0
Total Operational Land					
Irrigated	8.8	26.7	32.3	32.2	100
Un-irrigated	6.5	14.7	38.5	40.4	100
Total	7.7	21.6	35.0	35.8	100

The distribution of land holding is given in **Table 4.2**. Of the total operated area, medium and large farmer households accounted for 35 per cent and 36 per cent, respectively. The marginal and small holdings combined had 29

per cent of operated area only. In terms of access to irrigation, an important input, marginal farm size groups are in disadvantageous position accounting for only 9 per cent, whereas medium and large farmers group each accounted for over 60 per cent of the irrigated area. The ownership pattern of land is also tilted towards medium and large farmers. These farmer groups have accounted for 29 per cent and 37 per cent of total owned land in the study area, respectively.

It is evident from the distribution of landholdings that tenancy operations are largely undertaken by marginal, small and medium farmers groups. Marginal farmer households accounted for the largest leased in and leased out area. It appears that most of the land leasing in and leasing out activities are taking place among marginal farmers only. However, medium farmer households have also participated in the land market operations, but their activities are largely concentrated in un-irrigated land when compared to that of marginal and small farmers.

Table 4.3. Average Size of Land Holdings (Hectare)

Particulars	Marginal	Small	Medium	Large	Overall
Owned land					
Irrigated	0.52	1.06	1.85	4.33	1.44
Un-irrigated	0.49	0.89	1.69	4.46	1.48
Total	1.01	1.95	3.54	8.79	2.93
Leased-in					
Irrigated	0.42	1.15	1.40	-	0.63
Un-irrigated	0.58	1.14	2.06	-	1.15
Total	1.00	2.29	3.46	-	1.79
Leased-out					
Irrigated	0.44	1.25	2.40	-	0.72
Un-irrigated	0.40	-	2.40	-	1.07
Total	0.84	1.25	4.80	-	1.78
Fallow					
Irrigated	0.30	-	1.60	-	0.44
Un-irrigated	0.36	-	0.80	-	0.39
Total	0.66	-	2.40	-	0.84
Total operational Land					
Irrigated	0.53	1.13	1.88	3.96	1.53
Un-irrigated	0.48	0.81	1.90	4.09	1.62
Total	1.00	1.94	3.78	8.05	3.14

The average size of the land holding across farm size groups is presented in **Table 4.3**. As expected, the average size of total operated area was high for large farmers with 8.05 ha followed by medium (3.78 ha), small (1.94 ha) and marginal farmers (1.00 ha). Although, the marginal and small farmers constitute a large percentage in the total number of operational holdings, they operate only tiny area, which faces the problems like small marketable surplus and low bargaining power in the factor as well as product markets.

4.4. Farm Power and Machinery

Table 4.4. Distribution of Farm Power Machinery and Buildings of Sample Households
(Number)

Particulars	Marginal	Small	Medium	Large	Total
Tractor	2.0 (11.11)	1.0 (5.56)	6.0 (33.33)	9.0 (50.00)	18.0 (100)
Trolley	2.0 (11.11)	3.0 16.67	4.0 22.22	9.0 50.00	18.0 (100)
Harrow	2.0 (28.57)	2.0 (28.57)	1.0 (14.29)	2.0 (28.57)	7.0 (100)
Cultivator	3.0 (15.79)	2.0 (10.53)	5.0 (26.32)	9.0 (47.37)	19.0 (100)
Electric Motor	11.0 (11.58)	20.0 (21.05)	27.0 (28.42)	37.0 (38.95)	95.0 (100)
Diesel Engine	3.0 (37.50)	3.0 (37.50)	2.0 (25.00)	-	8.0 (100)
Planker	2.0 (33.33)	1.0 (16.67)	2.0 (33.33)	1.0 (16.67)	6.0 (100)
Spray Pump	4.0 (9.30)	10.0 (23.26)	17.0 (39.53)	12.0 (27.91)	43.0 (100)
Fodder Chopper	8.0 (50.00)	3.0 (18.75)	2.0 (12.50)	3.0 (18.75)	16.0 (100)
Cart	13.0 (14.29)	34.0 (37.36)	34.0 (37.36)	10.0 (10.99)	91.0 (100)
Drip System	2.0 (14.81)	2.0 (14.81)	3.0 (22.22)	7.0 (48.15)	14.0 (100)
Small Tools	119.0 (18.06)	214.0 (32.47)	198.0 (30.05)	128.0 (19.42)	659.0 (100)
Animal Shed	33.0 (22.15)	53.0 (35.57)	43.0 (28.86)	20.0 (13.42)	149.0 (100)
Shed for Fodder	7.0 (26.92)	5.0 (19.23)	11.0 (42.31)	3.0 (11.54)	26.0 (100)
Others*	3.0 (17.65)	8.0 (47.06)	5.0 (29.41)	1.0 (5.88)	17.0 (100)
Total	214.0 (18.05)	361.0 (30.45)	360.0 (30.37)	251.0 (21.13)	1186.0 (100)

Note: * includes arecanut cleaner, sericulture farm house
Figures in parenthesis are percentage to total

The ownership of farm machineries and implements by farmer households indicate the degree of mechanisation of agricultural operations. Interestingly, small and medium farm size groups owned about 31 per cent and 30 per cent of total number of farm machineries, respectively as reported by sample farmer households in the study area (**Table 4.4**). While, the large farmers owned 21 per cent, marginal farmers had only 18 per cent of the total farm machineries. Among the machinery types, the percent distribution of tractors was high among medium and large farmers. However, ploughing purpose machineries like harrow and planker were relatively high among marginal and small farmer households. This was because that these farmer groups intensively rent out their tractors for ploughing in other farmers' field. But, the higher concentration of diesel engines among marginal and small farmers as compared to medium and large farmers indicate that inequitable access to electricity in the study areas.

Table 4.5. Average Present Value of Farm Power Machinery and Buildings of Sample Households

Particulars	(Rs/household)				
	Marginal	Small	Medium	Large	Overall
Tractor	80000	350000	193600	232857	214773
Trolley	100000	62500	88750	105714	94286
Harrow	60000	2000	25000	35000	31400
Cultivator	20250	750	76000	32214	40469
Electric Motor	19600	32824	45818	38750	36508
Diesel Engine	25000	21000	43500	-	28571
Planker	25000	25000	5000	15000	15000
Spray Pump	1167	1485	2588	2514	2195
Fodder Chopper	1320	31167	16300	31667	17515
Cart	19825	20406	19545	12100	19060
Drip System	12000	35000	90000	37380	48991
Small Tools	5422	4810	7623	8247	6190
Animal Shed	25281	45245	40326	41056	38816
Shed for Fodder	24167	39400	42909	6667	33360
Others*	120000	46714	91950	250000	81908
All	18718	27090	35512	45435	31502

Note: * includes arecanut cleaner, sericulture farm house

Generally, animals are kept in open spaces in the villages. Interestingly, the small and medium farmer households have relatively high per cent of any type of built up animal shed. Further, the percent distribution of fodder chopper was high in the small farmers' category indicating that livestock rearing is an important activity among these poor land resource farmers. But, the distribution of sheds used for storing of fodder was high for small and medium farmers with 35.6 per cent and 28.9 per cent, respectively.

The average present value of farm machineries is provided in **Table 4.5**. The value of different machineries given here was reported by the sample farmers and can be considered as the current financial stock of the farmers. Among the machineries, average value of the tractor was the highest followed by trolley and other machineries for the total sample of farmers. Across the farm size groups, average value of machineries was high for large farmers followed by medium farmers. However, the distribution of number of machineries was skewed towards small and medium farmers. In fact, it was observed in the study area that small and marginal farmers largely engage in custom renting of machineries with the purpose of earning additional income in order to pay back the bank loans through which machinery was bought and also not to keep the equipments idle.

4.5. Livestock Resources

The distribution of livestock and poultry by farm size groups is provided in **Table 4.6**. The per cent distribution of cattle (indigenous and crossbred) was high among small and medium farmers. However, the small and marginal together had over 60 per cent of cattle female in milk. The use of bullocks for various agricultural operations and transport was prevalent in the study area. This is in fact, reflected in the distribution of male cattle among different farm size groups. The distribution of relatively high percentage of cattle female in milk and young stock female among small, marginal and medium farmers indicate the potential role in dairying in improving household income. The average number of cattle among these households is

also relatively high (**Table 4.7**). A similar pattern in the distribution of buffalo among farm size groups can also be observed. The small and marginal farmers combined owned over 50 per cent of buffalo female in milk and also young stock female.

Table 4.6. Distribution of Livestock and Poultry by Farm Size Groups
(Per cent)

Particulars	Marginal	Small	Medium	Large	Overall
Indigenous Cattle					
Female in Milk	21.05	40.00	30.53	8.42	100
Female Dry	5.71	37.14	45.71	11.43	100
Female Not Calved	-	66.67	33.33	-	100
Male	18.70	27.64	41.46	12.20	100
Young Stock Male	-	38.10	47.62	14.29	100
Young Stock Female	44.00	28.00	12.00	16.00	100
Crossbred Cattle					
Female in Milk	22.86	39.05	30.48	7.62	100
Female Dry	12.50	31.25	50.00	6.25	100
Female Not Calved	66.67	-	33.33	-	100
Male	14.29	42.86	28.57	14.29	100
Young Stock Male	8.33	33.33	33.33	25.00	100
Young Stock Female	11.76	35.29	41.18	11.76	100
Buffalo					
Female in Milk	26.43	23.57	31.43	18.57	100
Female Dry	20.00	37.50	17.50	25.00	100
Female Not Calved	23.53	29.41	35.29	11.76	100
Male	33.33	38.89	11.11	16.67	100
Young Stock Male	35.71	21.43	28.57	14.29	100
Young Stock Female	28.00	24.00	36.00	12.00	100
Sheep					
Male	36.67	53.33	10.00	-	100
Female	25.00	56.25	18.75	-	100
Young Stock	-	20.00	80.00	-	100
Goat					
Male	28.57	42.86	28.57	-	100
Female	54.55	18.18	27.27	-	100
Young Stock	-	-	100.00	-	100
Pig					
Male	100.00	-	-	-	100
Female	100.00	-	-	-	100
Poultry					
Hen	24.19	41.94	33.87	-	100
Cock	5.56	27.78	66.67	-	100
Chicks	-	46.43	53.57	-	100

Table 4.7. Average Size of Livestock Holdings

(No. of livestock/household)

Particulars	Marginal	Small	Medium	Large	Overall
Indigenous Cattle					
Female in Milk	1.33	1.46	1.61	1.14	1.44
Female Dry	2.00	1.63	1.60	1.33	1.59
Female Not Calved	-	2.00	1.00	-	1.50
Male	2.09	1.89	2.04	1.88	1.98
Young Stock Male		1.33	1.67	1.50	1.50
Young Stock Female	1.57	1.00	1.50	2.00	1.39
Crossbred Cattle					
Female in Milk	1.85	1.37	1.45	1.33	1.48
Female Dry	1.00	1.25	1.60	1.00	1.33
Female Not Calved	1.00	-	1.00	-	1.00
Male	2.00	2.00	2.00	2.00	2.00
Young Stock Male	1.00	1.33	2.00	1.50	1.50
Young Stock Female	1.33	1.20	1.75	1.33	1.42
Buffalo					
Female in Milk	1.42	1.50	1.57	2.17	1.59
Female Dry	1.00	1.36	1.17	2.50	1.38
Female Not Calved	2.00	1.67	1.20	2.00	1.55
Male	1.50	1.75	2.00	1.50	1.64
Young Stock Male	1.25	1.00	1.33	1.00	1.17
Young Stock Female	1.75	1.50	2.25	1.50	1.79
Sheep					
Male	1.57	3.20	1.00	-	2.00
Female	2.00	1.80	1.00	2.00	1.78
Young Stock	-	1.00	2.00	-	1.67
Goat					
Male	2.00	3.00	2.00	-	2.33
Female	6.00	2.00	1.50	-	2.75
Young Stock	-	-	1.00	-	1.00
Pig					
Male	2.00	-	-	-	2.00
Female	1.00	-	-	-	1.00
Poultry					
Hen	3.75	4.33	4.20	-	4.13
Cock	1.00	1.25	3.00	-	2.00
Chicks	-	4.33	7.50	-	5.60

The per cent distribution of sheep and goat were highly concentrated among marginal and small farmers. These farmer groups owned about 90 per cent of sheep and 70 per cent of goat in the study area. In general, pigs are

reared mostly by marginalised section of the society. It is in fact, reflected in their distribution among marginal farmers only. However, in case of per cent distribution of poultry they are largely reared by medium and small farmers. In recent years, poultry farming has become capital intensive and it largely depends on purchased inputs. The vertical integration of supply chain is also quite common giving the characteristics of an organised and industrial poultry production. Consequently, backyard poultry once a dominant enterprise among resource poor farmers and landless labourers helping them to meet emergency expenditure has now become an enterprise largely owned by relatively resource rich farmers.

The average present value of livestock and poultry had varied across farm size groups (**Table 4.8**). The average value will vary with quality of animals. In case of female cattle and female buffalo, price will be determined based on certain important indicators like milk yield, lactation stage and age. For sheep, goat, pig and poultry, price per animal will be determined based on the meat yield. Among indigenous cattle, for overall sample farmers the average price per female dry was the highest with Rs. 18,857 followed by female in milk (Rs. 16,576) and female not calved (Rs. 16,500). Similarly for crossbred cattle the average price for female in milk was the highest (Rs. 21,835) followed by female dry (Rs. 13,750) and male (Rs. 12,857). The average price of indigenous male cattle was higher than that of crossbred male cattle. This was because the former is sturdy and suitable for heavy work as compared to the latter.

In case of buffalo, surprisingly the average price was lower than that of cattle. This indicates that the dairy farmers prefer cattle to buffalo as it was reported by the farmers that consumers' demand for cow milk is higher than buffalo milk. The overall average price for buffalo female in milk and female dry was Rs. 16,489 and Rs. 12,690, respectively. Male buffalo are mainly used for transport purpose.

Table 4.8. Average Value of Livestock and Poultry by Farm Size Groups

(Rs/animal/household)

Particulars	Marginal	Small	Medium	Large	Overall
Indigenous Cattle					
Female in Milk	14833	17442	16556	17143	16576
Female Dry	8000	16714	21200	21333	18857
Female Not Calved	-	28000	15000	-	16500
Male	12182	11313	14045	17313	13343
Young Stock Male	-	10500	7667	5500	8571
Young Stock Female	5286	4643	7500	13000	7250
Crossbred Cattle					
Female in Milk	32615	18377	21591	16667	21835
Female Dry	17500	11750	14600	10000	13750
Female Not Calved	6000	-	12000	-	8000
Male	12500	14167	8750	17500	12857
Young Stock Male	6000	17167	12500	13500	11938
Young Stock Female	15333	8950	3225	4667	7304
Buffalo					
Female in Milk	14021	18227	18089	14917	16489
Female Dry	8500	17818	11083	9375	12690
Female Not Calved	1750	19333	9400	15000	11227
Male	5563	11188	20000	4125	8659
Young Stock Male	900	1500	1167	1400	1200
Young Stock Female	1875	5500	4500	1500	3538
Sheep					
Male	5357	5400	2167	-	4733
Female	4500	4800	3000	-	4111
Young Stock	-	800	300	-	227
Goat					
Male	7000	2000	2000	-	3667
Female	2500	3000	2250	-	2500
Young Stock	-	-	1500	-	1500
Pig					
Male	7000	-	-	-	7000
Female	2000	-	-	-	2000
Poultry					
Hen	288	233	600	-	370
Cock	300	163	300	-	239
Chicks	-	75	73	-	74

Regarding the average price of sheep and goat, it was higher for male sheep and male goat than their respective female species. The differences in prices

are due to differences in meat quality and meat recovery rate between male and female species. There are no distinct patterns observed in the average price of different livestock across farm size groups as the price varies with livestock management and feeding practices.

4.6. Cropping Pattern

Table 4.9. Cropping Pattern of Sample Households

Crop	(Per cent)				
	Marginal	Small	Medium	Large	Overall
Arecanut	0.87	3.07	1.29	6.19	3.27
Bajra	0.17	0.33	0.63	0.05	0.33
Coconut	2.11	1.81	0.65	2.01	1.48
Cotton	0.70	0.30	1.20	0.56	0.75
Cowpea	0.87	2.85	0.52	-	0.86
Groundnut	0.70	0.75	0.60	1.22	0.85
Horse gram	3.65	0.30	1.59	0.56	1.16
Jowar	5.93	9.12	11.35	12.05	10.63
Maize	11.44	15.82	21.65	26.03	20.97
Lentil	1.34	2.77	3.44	2.06	2.65
Moong	0.35	0.15	-	0.28	0.16
Mulberry	1.04	2.22	1.42	0.00	1.08
Napier	10.82	3.31	4.22	1.18	3.61
Paddy	23.42	29.55	22.21	5.11	18.13
Ragi	6.75	3.67	3.96	3.56	4.02
Red jowar/Chari	1.74	0.66	1.30	0.28	0.87
Soyabean	3.48	1.65	4.52	10.23	5.73
Sugarcane	13.22	13.11	7.92	13.60	11.39
Sunflower	1.39	-	0.69	4.32	1.82
Wheat	2.09	3.06	1.33	1.69	1.88
Vegetables	6.78	3.61	5.29	2.72	4.21
Fruits	0.52	0.30	0.00	2.44	0.93
Others*	0.61	1.57	4.22	3.85	3.21
Total	100.00	100.00	100.00	100.00	100.00

* Others include arhar, urad, gram, sesamum and coriander

The cropping pattern of sample households is presented in **Table 4.9**. The net cropping pattern is presented in **Annex Table 4.1**. The overall cropping pattern is dominated by coarse cereals, which accounted for over one-third of the gross cropped area. In Chitradurga, most of the surveyed farmers cultivated maize. Similar pattern was observed in Belgaum. Therefore, area under maize accounted for the highest share of about 21 per cent. The next predominant crop was paddy (18 per cent) followed by sugarcane (11 per

cent). However, there are significant differences in cropping pattern across farm size groups. For marginal, small and medium farmer groups, paddy was the predominant crop occupying 23 per cent, 30 per cent and 22 per cent, respectively. Maize and sugarcane also occupied a significant place in the cropping pattern with the highest per cent area was found among large farmers. Other coarse cereals like horsegram constituted 4 per cent within the small farmer group, while jowar constituted about 9 per cent, 11 per cent and 12 per cent among small, medium and large farmers, respectively. The area under cultivation of vegetables was relatively high among marginal farmers. However, perennial crop like arecanut had relatively high area allocation within the large farmer groups.

Interestingly napier grass, a cultivated green fodder, occupied a significant proportion of gross cropped area of marginal (11 per cent), medium (4 per cent) and small farmers (3 per cent). Over all, napier grass accounted for about 4 per cent of the gross cropped area. Farmers grow napier in a separate plot which is near to the irrigation source. Another cultivated green fodder namely red jowar also found a place in the cropping pattern. Red jowar is mainly cultivated in Chitradurga. Farmers grow red jowar generally on the border of field growing any main crop. Thereby it gives protection to the main crop against wind or animal damage and also green fodder to livestock. Jowar is cut after flowering stage and fed to animals. Some farmers also cultivated bajra exclusively for feeding livestock. Thus, it is clear from analysis that farmers allocate separate area for the cultivation of green fodder.

4.7. Production Status of Fodder Crops

The status of area, production and yield of the cultivated fodder crops during the last 10 years is given in **Table 4.10**. Farmers were asked to indicate whether area, production and yield of fodder crops increased, decreased and stagnant (remained same) during the reporting period. As for the area, large percentage of sample farmers (60 per cent) reported

stagnation for napier and jowar. Interestingly, majority of the farmers reported increase in trend in the production of green fodder from napier during the last 10 years. At the same time, over one-third of them have reported decrease in the production of napier, which is worrisome. Actually, fall in the production has been attributed to decrease in yield over time. As compared to food crops, farmers do not give much attention to the scientific method of cultivation of fodder crops.

As discussed elsewhere, farmers broadcast fodder seeds (for instance red jowar in Chitradurga) on the marginal lands or the borders of the main field considering that whatever is produced is extra over the harvest from the main crop. Further, the extra harvest is also obtained with a little input cost. Although napier is cultivated in a separate parcel of land, application of fertilisers and manure is very much limited. This has actually resulted in low yield.

Table 4.10. Status of Area, Production and Yield of Fodder Crops during last 10 years

(Per cent farmers reported)

Crops	Increase	Decrease	Same	Total
Area				
Jowar	3.14	2.52	94.34	100
Napier	29.86	10.42	59.72	100
Production				
Jowar	16.67	55.56	27.78	100
Napier	51.79	37.50	10.71	100
Yield				
Jowar	-	100.00	-	100
Napier	43.10	43.97	12.93	100

4.8. Status of Livestock Population and Production of Livestock Products

The status of livestock population in the study area during the last 10 years confirms more or less the evidences observed from the secondary data. It has been reported by over 80 per cent of the farmers that cattle female and male population has either decreased or stagnated in the last one decade (**Table 4.11**). There is a marginal increase in buffalo female population.

However, about 47 percent of the sample farmers reported decrease in goat population, while 43 per cent reported increase in sheep population. This is in conformity with the trend observed from the livestock census. Interestingly, about 46 per cent of the farmers reported increase in the poultry population, rearing of which is progressively getting organised in the rural areas.

Table 4.11. Status of Livestock Population during the last 10 years

(Per cent farmers reported)

Particulars	Increase	Decrease	Same	Total
Cattle female	16.2	36.2	47.6	100.0
Cattle male	9.8	30.4	59.8	100.0
Buffalo female	16.3	44.6	39.1	100.0
Buffalo male	4.8	47.6	47.6	100.0
Goat	33.3	46.7	20.0	100.0
Sheep	42.9	35.7	21.4	100.0
Pig	-	100.0	-	100.0
Poultry	46.2	23.1	30.8	100.0

Similar to the changes observed in status of livestock population, trend in yield of milk from cattle and buffalo, and meat from small ruminants and poultry was also solicited from the sample farmers. While a quarter of farmers reported increase in buffalo milk yield, but about one-third have reported stagnation and two-fifth have reported decrease during the last 10 years (**Table 4.12**). Similarly, about 45 per cent and 33 per cent of farmer reported stagnation and decrease in milk yield from cattle, respectively.

Table 4.12. Status of Milk and Meat Yield during Last 10 years

(Per cent farmers reported)

Particulars	Increase	Decrease	Same	Total
Milk				
Buffalo	25.93	40.74	33.33	100
Cattle	21.51	33.33	45.16	100
Meat				
Goat	39.46	37.46	23.08	100
Sheep	38.46	30.77	30.77	100
Pig	100.00	-	-	100
Poultry	46.15	15.38	38.46	100

As far as meat yield is concerned, large percentage of sample farmers reported increase in meat production from goat, sheep, pig and poultry. It was reported by the farmers that there is dramatic increase in demand for meat as a result their prices have increased substantially during recent years. However, the availability fodder locally, high cost of compound feed and labour shortages are the constraints in increasing the herd size.

4.9. Feeding Practices

In the present study, livestock feed are classified into three groups viz., roughages, concentrates and grains. The roughages include green fodder and dry fodder, while concentrates include compound (mixed) feed and oilcakes. Grains include broken food grains, wasted grains and seeds unfit human consumption. The green fodder included cultivated fodder, grasses and weeds gathered from the field bunds and forests, and sugarcane tops. Dry fodder generally included cereal straw, pulses straw and groundnut haulms. Feeding pattern of these different types of fodder to livestock by farmers has undergone some changes over time. Further, there is also shift in open grazing to stall feeding of animals.

The status of feeding practices to bovines during the last 10 years is presented in **Table 4.13**. Farmers are of the opinion that increased feeding of green fodder results in higher milk yield. But, it is quite discouraging to note that a large percentage of farmers reported decrease in use of green fodder. It has also been observed that there is conspicuous decrease in feeding of green fodder to cattle dry and buffalo dry. However, higher proportion of sample farmers reported stagnation in the feeding pattern of dry fodder and concentrates over time. Similar pattern in feeding of grains to livestock has also been noted among the farmers. In fact, farmers rarely provide concentrates and grains to non-milking animals due to higher market price.

Table 4.13. Status of Feeding Practices to Bovine

(Per cent farmers reported)

Particulars	Increase	Decrease	Same	Total
Indigenous Cow in Milk				
Green fodder	22.47	26.40	51.12	100
Dry fodder	22.35	16.76	60.89	100
Concentrates	13.98	5.38	80.65	100
Grains	21.92	1.37	76.71	100
Indigenous Cow Dry				
Green fodder	25.00	-	55.00	100
Dry fodder	11.54	23.08	65.38	100
Concentrates	-	5.56	94.44	100
Grains	18.18	36.36	81.82	100
Crossbred Cow in Milk				
Green fodder	23.46	27.16	49.38	100
Dry fodder	22.94	17.65	59.41	100
Concentrates	22.58	11.83	65.59	100
Grains	27.94	13.24	58.82	100
Crossbred Cow Dry				
Green fodder	13.04	52.17	34.78	100
Dry fodder	16.67	33.33	50.00	100
Concentrates	23.08	15.38	61.54	100
Grains	-	55.56	44.44	100
Male Cattle				
Green fodder	12.31	30.00	57.69	100
Dry fodder	14.81	17.28	67.90	100
Concentrates	9.57	3.19	87.23	100
Grains	16.44	8.22	75.34	100
Buffalo in Milk				
Green fodder	16.35	33.96	49.69	100
Dry fodder	21.54	16.92	61.54	100
Concentrates	8.53	4.65	86.82	100
Grains	16.25	10.00	73.75	100
Buffalo Dry				
Green fodder	22.64	54.72	22.64	100
Dry fodder	26.67	25.00	48.33	100
Concentrates	14.29	10.20	75.51	100
Grains	11.11	13.89	75.00	100
Male Buffalo				
Green fodder	28.00	32.00	40.00	100
Dry fodder	30.77	30.77	38.46	100
Concentrates	-	-	100.00	100
Grains	-	-	100.00	100

The feeding pattern of sheep and goat are different from bovines. In general, sheep and goat are taken for open grazing in common land, harvested fields and village forests. They are rarely stall fed. However, young stocks are kept and fed with collected grasses and tree leaves at animal shed initially for a few weeks. Later they are taken with main herd for grazing. It can be observed from the **Table 4.14** that majority of the farmers have reported stagnation in feeding of different type of fodders. However, about one-third of sheep farmers stated that there is increase in use of grains during the last 10 years. Overall, analysis clearly brings out that feeding pattern of livestock has changed over time with decline in feeding of green fodder and stagnation in that of dry fodder and concentrates.

Table 4.14. Status of Feeding Practices to Sheep and Goat

(Per cent farmers reported)

Particulars	Increase	Decrease	Same	Total
Sheep				
Concentrates	-	-	100.00	100
Dry fodder	-	16.67	83.33	100
Grains	33.33	-	66.67	100
Green fodder	5.41	8.11	86.49	100
Goat				
Concentrates	-	-	-	-
Dry fodder	-	-	100.00	100
Grains	-	-	100.00	100
Green fodder	-	-	100.00	100

The livestock feeding methods in terms of stall feeding and open grazing is provided in **Table 4.15**. It is evident that there is wide spread practice of stall feeding for different type of animals among farm size groups. A large percentage of medium farmers have reported stall feeding as compared to other farm size groups. Stall feeding as an intensive method of feeding has been adopted among medium farmers due to labour shortages. The marginal and small farmers have also relatively adopted stall feeding methods. Nevertheless, grazing of livestock seems to be a common practice among marginal and small farm size groups in the study area.

Table 4.15. Livestock feeding Practices by Sample Households (Per cent)

Particulars	Marginal	Small	Medium	Large	Overall
Stall feeding					
Indigenous Cattle					
Female in Milk	16.67	50.00	29.17	4.17	100
Female Dry	7.14	42.86	42.86	7.14	100
Female Not Calved	-	-	100.00	-	100
Male	22.73	22.73	50.00	4.55	100
Young Stock Female	33.33	50.00	16.67	-	100
Young Stock Male	-	16.67	66.67	16.67	100
Crossbred Cattle					
Female in Milk	16.13	54.84	22.58	6.45	100
Female Dry	12.50	37.50	37.50	12.50	100
Female Not Calved	50.00	-	50.00	-	100
Male	33.33	33.33	33.33	-	100
Young Stock Female	-	57.14	35.71	7.14	100
Young Stock Male	-	25.00	25.00	50.00	100
Buffalo					
Female in Milk	11.76	23.53	29.41	35.29	100
Female Dry	12.50	62.50	12.50	12.50	100
Female Not Calved	16.67	16.67	66.67	-	100
Male	25.00	37.50	12.50	25.00	100
Young Stock Female	33.33	22.22	22.22	22.22	100
Young Stock Male	-	-	100.00	-	100
Grazing					
Indigenous Cattle					
Female in Milk	66.67	33.33	-	-	100
Female Dry	-	100.00	-	-	100
Male	7.14	28.57	50.00	14.29	100
Young Stock Female	100.00	-	-	-	100
Young Stock Male	100.00	-	-	-	100
Total	43.48	23.19	27.54	5.80	100
Crossbred Cattle					
Female Milk	46.15	15.38	38.46	-	100
Female Dry	-	-	100.00	-	100
Male	-	66.67	-	33.33	100
Young Stock Female	100.00	-	-	-	100
Young Stock Male	100.00	-	-	-	100
Buffalo					
Female Milk	58.82	11.76	23.53	5.88	100
Female Dry	60.00	40.00	-	-	100
Female Not Calved	100.00	-	-	-	100
Male	50.00	50.00	-	-	100
Young Stock Female	33.33	-	66.67	-	100
Young Stock Male	33.33	33.33	16.67	16.67	100

Across different animal species, female in milk seems to have received high preference for stall feeding among farmers. Young stocks are allowed for grazing in the nearby fields. Given the relative high level of stall feeding practices, it would be interesting to analyse the quantity of fodder and feed consumed by various animal species in different seasons. The analysis of feeding practices by season assumes importance as the availability of fodder is influenced by the seasonality of their production.

Table 4.16 provides seasonwise quantity of feed given to different livestock species by fodder types. The average consumption rate of green fodder was higher during kharif than the rates observed in rabi and summer seasons. On the contrary, the consumption of dry fodder was observed relatively high during rabi and summer. However, the consumption pattern of concentrates and grains was by and large, similar across the seasons.

The consumption and feeding pattern vary with livestock types. Farmers feed certain select feed and fodder to select animals only. For instance, grains and concentrates are fed to lactating animals (Biradar et al, 2007). Among livestock types, the average consumption rate of green fodder per animal was worked out to be higher for crossbred cattle in milk across the seasons in the study area. In fact, the consumption of green fodder by crossbred cattle in milk was 17.5 Kg/day, 16.4 Kg/day and 13.9 Kg/day in kharif, rabi and summer, respectively. The corresponding rates for indigenous cattle in milk were 13.2 Kg, 12.1 Kg and 10.7 Kg. Similarly, the average consumption rate of concentrates was also higher for crossbred cattle in milk. The crossbred female cattle are not only large consumers of feed, but also large producer of milk. In fact, the farmers reported cross bred animal require lot of care and management. They prefer green fodder and mixed feed to other fodder types. They are also good feed converter.

Table 4.16. Seasonwise Quantity of Feed Given to Different Livestock Types
(Kg/animal/day)

Particulars	Green Fodder	Dry Fodder	Grains	Concentrates
Kharif				
Indigenous Cattle in Milk	13.16	8.58	1.40	2.48
Crossbred Cattle in Milk	17.51	12.18	1.36	3.28
Buffalo Milk	12.97	11.35	1.91	2.67
Indigenous Cattle Dry	12.17	14.42	1.25	2.21
Crossbred Cattle Dry	11.00	12.00	-	2.63
Buffalo Dry	11.09	12.61	1.14	2.23
Cattle Male	14.32	13.00	3.41	5.40
Buffalo Male	8.92	6.71	1.14	2.32
Young Stock	5.67	4.10	1.07	1.36
Sheep	3.18	3.00	1.88	0.75
Goat	6.71	1.00	0.50	1.00
Rabi				
Indigenous Cattle in Milk	12.05	8.73	2.64	2.61
Crossbred Cattle in Milk	16.40	13.48	1.18	3.74
Buffalo Milk	10.85	12.71	2.71	3.00
Indigenous Cattle Dry	10.42	15.88	1.25	1.78
Crossbred Cattle Dry	7.40	12.50	0.50	3.33
Buffalo Dry	9.50	12.36	1.23	2.48
Cattle Male	13.06	12.99	3.20	4.33
Buffalo Male	7.94	7.00	1.17	3.09
Young Stock	5.15	4.72	1.17	1.53
Sheep	4.00	2.00	1.75	1.17
Goat	5.40	1.00	-	1.50
Summer				
Indigenous Cattle in Milk	10.73	9.78	1.64	4.16
Crossbred Cattle in Milk	13.86	12.55	1.38	3.55
Buffalo Milk	10.87	12.35	1.42	2.99
Indigenous Cattle Dry	13.17	14.15	1.40	1.63
Crossbred Cattle Dry	8.00	15.00	-	4.33
Buffalo Dry	8.90	14.11	1.32	2.99
Cattle Male	12.38	13.19	1.91	4.57
Buffalo Male	7.32	7.41	1.14	3.95
Young Stock	4.56	5.16	0.84	1.60
Sheep	5.00	1.25	1.75	0.88
Goat	4.17	1.50	0.75	-

However, as compared to cattle, buffaloes are hardy and can cope with harsh weather conditions. Buffaloes are also good converter of dry fodder. The average consumption rate of green fodder for a buffalo was 13.0 Kg, 10.9 Kg and 10.9 Kg in kharif, rabi and summer, respectively. The corresponding rates for dry fodder were 11.4 Kg, 12.7 Kg and 12.4 Kg. The consumption of all types of fodder was lower for cattle female dry and buffalo female dry. However, consumption of fodder and feed by male cattle was higher than female dry animals. The consumption rate for young stock was by and large, constant across the seasons.

The analysis of feed consumption by major fodder type and different livestock species would be quite revealing. Among different fodder types, sample farmers fed the indigenous cattle in milk relatively high quantity of maize straw followed by paddy straw, napier and gathered grass (**Table 4.17**). The average quantity of these fodders fed per animal was 21.7 Kg, 14.7 Kg, 11.1 Kg and 8.3 Kg, respectively. However, for crossbred cattle relatively high quantity of napier (22.4 Kg), jowar straw (22.15 Kg), maize straw (18.3 Kg) and paddy straw (14.9 Kg) were given. As discussed earlier, the consumption pattern of buffalo was slightly different from cattle in way that buffaloes are largely fed with dry fodders. Jowar straw was given in large quantity followed by maize straw and paddy straw daily. Like cattle, buffaloes are also given adequate quantity of grains and concentrates. The detailed feeding pattern by season and fodder types is given in **Annex Table 4.2**.

Table 4.17. Consumption of Different Type of Fodder

(Kg/animal/day)

Type of Fodder	Indigenous Cattle in Milk	Crossbred in Milk	Buffalo in Milk	Indigenous Cattle Dry	Crossbred Dry	Buffalo Dry	Male Cattle	Male Buffalo	Young Stock	Sheep	Goat
Broken rice	3.60	2.00	2.00	-	-	1.75	2.00	2.00		3.00	0.50
Grains	1.86	-	2.00	-	-	-	-		-	-	-
Grass	8.33	-	-	-	-	-	-	0.33	-	-	-
Groundnut Cake	-	0.63	-	1.00	-	-	-	-	-	-	-
Groundnut Haulm	2.00	1.67	-	-	-	-	6.80	-	-	-	-
Horsegram	1.00	-	1.00	-	-	-		1.00		3.00	1.00
Husk (hottu)	1.58	4.00	1.00	1.00	-	-	6.57	1.00	-	-	-
Jowar Straw	-	22.15	25.00	-	-	20.00	26.67	20.00	-	-	-
Leaves	-	-	-	-	-	-	-	-	-	1.00	1.00
Maize Straw	21.67	18.25	16.67	10.00	15.00	-	16.00	-	5.00	-	2.00
Mixed feed	5.54	4.72	2.33	1.83	4.50	3.44	8.00	3.91	2.65	1.00	1.67
Napier	11.12	22.40	9.27	5.00	6.50	10.25	12.07	10.78	4.80	-	-
Oil cake	3.71	3.23	1.38	-	-	2.00	-	2.67	2.75	-	-
Paddy Straw	14.73	14.85	16.98	14.69	12.67	26.25	21.52	9.16	4.56	-	-
Ragi Straw	6.25	11.00	13.55	24.00	16.67	21.67	16.67	1.10	6.67		-

Table 4.18. Seasonwise Feeding Practices for Livestock (Kg/animal/day)

Particulars	Indigenous Cow in Milk	Crossbred Cow in Milk	Buffalo in Milk	Indigenous Cow Dry	Crossbred Cow Dry	Buffalo Dry	Male Cattle	Male Buffalo	Young Stock	Sheep	Goat
Marginal											
A1	12.59	22.53	13.03	12.68	13.00	8.00	12.83	11.67	4.65	1.75	2.00
A2	7.79	11.32	12.14	12.34	12.50	11.00	9.47	6.33	4.24	-	-
A3	1.83	0.88	1.30	1.08	1.67	-	1.33	1.00	2.00	-	-
A4	2.36	2.33	1.83	2.26	2.00	1.50	2.80	1.00	0.71	1.00	-
B1	12.45	20.23	10.04	10.71	10.00	4.67	12.00	10.00	3.79	2.67	6.00
B2	8.67	10.83	13.74	13.40	11.67	12.10	14.82	4.33	5.75	1.00	-
B3	2.50	0.75	3.80	1.00	2.50	-	2.00	1.00	2.50	-	-
B4	2.71	2.50	1.70	1.67	2.00	2.00	3.57	3.33	1.16	1.00	1.00
C1	10.65	17.97	10.96	13.17	10.00	7.50	11.60	10.00	4.19	2.67	2.67
C2	11.15	13.44	12.87	12.97	17.50	12.25	11.43	6.00	5.53	-	-
C3	2.67	0.75	1.50	1.50	2.50	-	2.00	1.00	1.00	-	-
C4	2.94	4.31	2.64	1.67	2.00	2.33	4.70	1.33	0.84	1.00	-
Small											
A1	11.86	14.81	10.97	11.33	10.00	13.03	16.94	5.39	4.98	3.40	3.33
A2	9.80	11.68	11.30	16.89	15.00	11.00	12.53	5.25	3.48	2.50	1.00
A3	1.00	1.86	1.43	0.75	-	-	1.50	1.33	0.92	2.17	-
A4	3.32	3.86	1.76	1.67	2.75	2.45	2.25	1.25	1.25	0.50	-
B1	11.16	13.02	9.69	10.00	5.00	12.13	15.69	6.04	3.95	4.00	4.50
B2	10.25	12.05	12.17	19.71	17.50	10.50	11.29	5.00	3.05	3.00	-
B3	1.00	1.50	1.00	0.50	0.88	-	2.00	1.33	0.50	2.17	-
B4	2.76	3.71	2.12	2.50	5.00	2.62	3.00	1.33	1.13	0.50	2.00
C1	10.82	12.65	10.55	12.50	10.71	-	18.91	6.64	4.39	6.00	4.50
C2	11.24	11.58	12.37	18.00	15.00	13.82	13.06	5.94	3.13	1.33	2.00
C3	0.88	1.79	1.38	2.00	1.13	-	1.67	1.33	0.50	2.17	1.00
C4	7.83	3.43	1.62	1.50	8.00	1.72	2.75	1.33	1.11	0.75	-

Table 4.18. Seasonwise Feeding Practices for Livestock (Kg/animal/day)

Particulars	Indigenous Cow in Milk	Crossbred Cow in Milk	Buffalo in Milk	Indigenous Cow Dry	Crossbred Cow Dry	Buffalo Dry	Male Cattle	Male Buffalo	Young Stock	Sheep	Goat
Medium											
A1	12.50	14.64	14.86	11.71	2.00	9.69	13.85	16.00	6.07	1.00	1.00
A2	8.94	14.50	11.43	13.63	4.00	12.89	15.69	10.25	5.07	1.00	1.00
A3	1.50	1.13	1.10	1.50	0.75	-	1.36	1.00	0.65	0.50	-
A4	1.88	3.73	4.52	3.13	3.00	2.29	8.78	5.00	1.68	-	-
B1	10.08	14.80	11.93	10.13	2.00	8.75	12.20	12.00	5.29	-	-
B2	8.74	18.09	15.24	15.00	5.00	13.56	14.16	14.25	6.73	1.00	1.00
B3	4.29	1.10	2.36	1.50	0.67	-	2.29	0.70	-	-	-
B4	2.70	4.76	5.25	1.00	3.00	2.44	6.19	6.50	2.05	-	-
C1	11.50	11.69	12.30	16.50	2.00	10.29	11.96	4.25	8.00	-	-
C2	8.24	13.52	13.21	11.40	5.00	15.76	14.68	12.75	7.05	1.00	1.00
C3	1.86	1.13	1.17	1.50	0.67	-	2.00	1.00	0.92	0.50	-
C4	1.55	3.44	5.26	2.00	3.00	4.59	5.75	10.17	2.39	-	-
Large											
A1	21.10	26.57	13.10	15.00	8.33	11.00	14.67	6.50	7.23	8.00	-
A2	6.19	7.67	10.09	6.50	10.50	21.00	12.30	6.00	3.43	6.00	-
A3	1.25	1.17	4.00	1.00	-	1.50	17.50	1.00	0.88	1.00	-
A4	2.08	1.25	1.91	2.00	2.58	1.50	2.67	2.00	1.33	1.00	-
B1	18.27	21.33	11.47	12.00	5.67	9.40	13.36	7.00	9.36	5.33	-
B2	4.83	7.00	8.76	5.50	11.39	16.50	11.36	6.50	2.57	-	-
B3	1.05	1.50	3.50	1.00	1.35	1.50	12.00	1.00	0.75	0.50	-
B4	2.00	1.33	2.10	1.50	3.33	2.33	2.75	2.00	1.29	2.00	-
C1	8.89	15.17	9.08	10.50	7.57	6.33	7.10	4.00	5.75	7.00	-
C2	6.65	7.00	10.03	9.50	12.50	14.33	12.33	2.00	2.71	-	-
C3	1.25	1.17	2.00	1.00	1.43	1.50	2.00	1.00	1.00	0.50	-
C4	2.50	1.17	1.95	1.50	4.33	2.67	2.92	1.00	1.25	1.00	-

Note: A-Kharif, B-Rabi, and C-Summer; 1- Green Fodder, 2 -Dry Fodder, 3 -Grains and 4 -Concentrates

The average quantity of different fodder and feed fed to dry cattle and buffalo was low. The dry animals are mostly fed with dry fodder mixed with some quantity of green fodder. Livestock young stocks are generally given a little quantity of both green and dry fodder as their digestive capacity is low. It was observed that adult male cattle are still used for drought purpose in the study area. Farmers feed the male cattle with large quantity of dry fodder and some quantity of green fodder. They are also allowed for open grazing on the harvested field and field bunds. Sheep and goat are fed with tree leaves and some quantities of grains.

The feeding pattern by seasons, fodder type and farm size groups are given in **Table 4.18**. There are differences in quantity of fodder and feed fed to different livestock by different categories of farmers. The average quantity of feed given for livestock was the highest for the large farmers followed by marginal, small and medium farmers. Quantity fed to animals also varied by fodder types and farm size groups. The large farmers fed green fodder in kharif at 21.1 Kg, 26.6 Kg and 13.1 Kg for indigenous cow in milk, crossbred cow in milk and buffalo in milk, respectively. The corresponding feeding rates given by marginal farmers were 12.6 Kg, 22.5 Kg and 13.0 Kg. The amount of feed given by medium famers is comparable with that of marginal farmers.

The average quantity of feed fed during rabi and summer seasons was by and large, higher for large farmers. The quantity of green fodder fed to animal in milk was relatively high among marginal farmers as compared to small farmers. But, surprisingly the amount of fodder given to dry female cattle was higher for marginal farmers than that of other farmer groups. However, there were little differences in quantity of grains and concentrates fed to different livestock. Similarly, quantity of feed given to male cattle was not much different across farm size groups. The stall feeding of sheep and goat was more prevalent among marginal and small farmers than other categories.

Overall, the analysis of data reveals that the percent distribution of different type of livestock was relatively high among marginal and small farmers. Surprisingly, about 80 per cent of the farmers reported that cattle female and male population has either decreased or stagnated during the last 10 years. Across livestock types, the average price of cattle was higher than that of buffalo indicating that cattle are highly preferred among farmers for dairying. The difference in average price was also observed between male and female species of sheep and goat.

Interestingly, sample farmers have allocated sizeable proportion of land for the cultivation of fodder crops. Among farm size groups, marginal farmers allocated about 11 per cent of their gross cropped area. Napier grass and jowar are the two major fodder crops that the farmers have grown in the study area. The feeding pattern of livestock has varied across farm size groups, livestock type and seasons. It has been observed that feeding pattern of livestock has changed over time with the decline in feeding of green fodder and stagnation in that of dry fodder and concentrates. Most farmers have reported that the village common land, which earlier was used for open grazing of livestock, has now been encroached for different activities. The disappearance of common property resources in the village has led to increased stall feeding and decrease in green fodder availability.

Annex Table 4.1. Net Cropping Pattern

(% of net cropped area)

Crop	Marginal	Small	Medium	Large	overall
Kharif					
Bajra	0.31	0.51	0.98	0.08	0.53
Cotton	1.24	0.46	1.88	0.92	1.21
Cowpea	1.56	4.38	0.81	0.61	1.58
Groundnut	1.26	1.15	0.94	2.00	1.36
Horse gram	6.53	0.81	2.49	0.92	1.94
Jowar	3.45	9.10	8.72	5.30	7.26
Maize	8.37	13.87	24.94	27.04	21.87
Moong	0.62	0.23	-	0.46	0.25
Paddy	28.81	35.35	26.82	7.45	22.50
Pigeon pea	-	-	0.34	-	0.13
Ragi	12.07	5.65	6.18	5.84	6.43
Red jowar	-	0.09	0.02	-	0.03
Sesamum	-	0.46	0.13	-	0.15
Soybean	6.22	2.54	7.06	16.74	9.17
Sugarcane	23.64	20.19	12.37	22.27	18.22
Sunflower	2.49	-	1.08	7.07	2.92
Urad	0.00	-	-	0.31	0.10
Vegetables	3.42	5.21	5.24	3.00	4.35
All	100	100	100	100	100.00
Rabi					
Bengal gram	-	2.83	6.33	10.53	6.61
Jowar	23.06	22.95	31.28	35.21	30.38
Lucerne	0.35	-	-	-	0.03
Maize	27.17	32.17	24.58	36.84	30.71
Masur/Lentil	5.38	13.09	14.90	7.99	11.14
Paddy	16.07	12.73	9.13	-	7.14
Safflower	-	-	-	1.45	0.53
Vegetables	19.57	1.77	9.12	2.90	6.47
Wheat	8.39	14.46	4.66	5.08	7.00
All	100	100	100	100	100.00
Summer					
Paddy	100.00	96.30	97.14	100.00	97.45
Vegetables	-	3.70	2.86	-	
All	100	100.00	100	100	100.00
Perennial					
Arecanut	5.67	30.41	13.71	52.38	29.98
Banana	-	2.70	0.00	20.63	7.92
Betel nut	-	2.03	21.42	0.00	7.05
Citrus	2.27	-	-	-	0.28
Coconut	13.61	15.00	6.85	16.98	13.01
Mango	1.13	-	-	-	0.14
Napier	70.52	29.86	44.77	10.00	32.47
Mulberry leaves	6.80	20.00	13.25	-	9.14
All	100	100	100	100	100.00

Annex Table 4.2. Seasonwise Feeding Practices for overall sample

Particulars	In Milk			Dry Animals			Male		Young Stock	Sheep	Goat
	Ind. Cattle	Crossbred	Buffalo	Ind. Cattle	Crossbred	Buffalo	Cattle	Buffalo			
Kharif											
(i) Green odder											
Bajra	8.3	20.0	8.8	-	-	5.0	12.8	10.0	4.0	-	2.0
Collected Grass	7.3	15.0	12.6	.	10.0	11.7	14.3	1.1	2.5	12.0	-
Jowar	13.9	12.5	10.9	14.3	-	12.1	12.3	11.0	5.8	8.0	-
Leaves	-	-	-	-	-	-	-	-	-	1.0	1.0
Maize	10.6	14.2	12.0	13.3	10.0	10.3	11.3	10.0	4.3	8.0	-
Napier	14.1	21.5	14.6	10.5	11.4	12.1	15.4	10.6	7.5	1.7	8.8
Sugarcane leaves	27.0	10.0	-	-	-	-	10.0	1.0	2.0	1.0	-
Areca nut Spathe	-	20.0	20.0	-	-	-	1.0	-	4.0	-	-
(ii) Dry Fodder											
Bhoosa	4.1	2.0	2.4	-	10.0	1.0	1.0	-	-	-	-
Groundnut Haulms	1.6	2.4	.	-	-	-	5.4	-	0.7	-	-
Jowar Straw	8.0	14.0	30.0	-	-	-	40.0	2.0	3.0	-	-
Maize straw	6.2	11.1	8.8	-	10.0	10.0	8.7	.	3.5	-	-
Paddy straw	11.4	14.5	12.3	13.3	11.3	15.1	16.1	7.8	5.3	1.5	1.0
Ragi straw	7.8	11.4	11.8	18.8	20.0	15.8	12.1	1.3	2.9	3.0	.
(iii) Grains											
Broken Maize	1.0	0.5	1.0	-	-	0.5	1.8	-	0.5	-	0.5
Broken rice	1.6	1.5	1.5	1.0	-	1.5	4.3	1.3	1.5	3.0	-
Horse gram	1.3	1.0	2.5	1.3	-	1.0	4.0	1.0	0.9	1.5	-
(iv) Concentrates											
Husk (hottu)	1.0	2.0	-	-	-	-	1.0	-	-	-	-
Mixed feed	2.6	3.7	2.5	1.7	3.3	2.0	4.0	1.7	1.3	0.8	-
Oil cake	2.0	1.9	1.2	1.0	-	2.0	1.3	2.5	1.8	-	-
Waste food/ gruel	-	5.0	6.0	-	-	4.5	8.0	9.0	-	-	-
Rabi											

(i) Green Fodder											
Collected Grass	4.5	10.2	8.3	-	5.0	8.5	11.0	-	2.0	2.0	.
Jowar	8.3	12.1	10.4	-	15.0	8.8	10.9	-	6.3	2.0	.
Leaves	-	-	-	-	-	-	-	-	-	1.0	1.0
Maize straw	12.2	15.0	11.6	11.3	10.0	9.6	11.6	9.0	4.6	7.0	-
Napier	13.9	21.1	11.0	7.7	7.3	10.4	13.2	8.5	6.0	2.2	6.5
(ii) Dry Fodder											
Bhoosa	2.4	2.0	2.3	-	-	0.8	-	-	-	-	-
Jowar Straw	-	20.0	32.0	-	-	-	38.0	2.0	5.0	-	-
Maize straw	5.1	9.3	10.3	8.0	12.5	9.3	12.0	7.0	3.0	-	-
Paddy straw	12.7	17.1	14.7	16.9	13.3	16.6	14.9	8.7	5.3	1.7	1.0
Ragi straw	7.8	10.6	11.3	15.0	10.0	10.8	11.0	2.9	2.8	3.0	.
(iii) Grains											
Broken jowar	-	1.0	1.0	-	0.5	0.5	-	-	-	-	-
Broken maize	1.0	0.5	1.0	-	-	0.5	2.0	.	0.5	-	-
Broken rice	4.1	1.4	2.3	-	-	1.9	1.7	2.0	2.5	3.0	-
Horse gram	1.0	1.0	3.4	1.3	-	1.0	3.8	1.0	1.1	1.3	-
(iv) Concentrates											
Husk (hottu)	1.0	6.0	-	-	-	-	1.0	1.0	.	.	.
Mixed feed	2.2	4.5	2.7	1.9	3.3	2.1	4.9	3.2	1.4	1.3	2.0
Oil cake	4.8	1.6	2.9	2.0	-	2.0	4.3	2.8	2.0	-	-
Waste food/ gruel	-	3.0	9.5	-	-	5.5	2.0	9.0	4.5	-	-
Summer											
(i) Green Fodder											
Collected Grass	8.5	8.0	6.0	-	-	6.0	2.0	1.3	1.0	2.0	.
Jowar	12.4	14.6	14.1	22.5	-	16.0	13.4	3.0	6.3	.	2.0
Leaves	-	-	-	-	-	-	-	-	-	1.0	1.0
Maize straw	11.7	12.6	10.0	6.0	10.0	8.5	10.8	4.0	2.9	2.0	8.0
Napier	9.5	15.7	9.8	9.3	7.3	7.0	9.6	12.6	5.5	3.3	4.7
(ii) Dry Fodder											
Bhoosa	3.6	-	1.9	-	-	0.8	-	-	-	-	-
Groundnut Haulms	1.9	7.2	.	-	-	-	5.5	-	5.3	-	-

Jowar straw	5.0	20.0	32.3	2.0	-	-	40.0	2.0	2.0	-	-
Maize straw	5.1	9.4	12.8	.	12.5	10.5	11.7	20.0	3.2	-	-
Paddy straw	14.2	15.5	14.1	15.0	15.0	16.6	15.1	7.8	5.7	1.3	1.0
Ragi straw	9.1	9.8	10.3	15.5	20.0	17.0	10.4	1.3	3.7	1.0	2.0
(iii) Grains											
Broken Bajra	5.0	-	2.0	2.0	-	2.0	.	-	0.5	-	-
Broken Maize	1.5	0.5	1.0	-	-	0.5	2.3	-	1.0	-	-
Broken Rice	1.8	1.7	1.6	-	-	1.8	2.2	2.0	1.0	3.0	0.5
Horse gram	1.1	1.0	1.2	1.3	-	1.3	1.0	1.0	0.9	1.3	1.0
(iv) Concentrates											
Husk (hottu)	1.0	4.0	1.0	-	-	-	1.0	-	-	-	-
Mixed feed	4.7	3.8	2.6	1.5	4.3	1.9	4.2	2.0	1.3	0.8	-
Oil cake	2.3	3.4	1.3	1.0	-	2.0	1.5	2.8	1.0	-	-
Waste food/ gruel	3.0	-	8.8	-	-	8.0	8.5	2.0	8.3	-	-

CHAPTER V

ECONOMICS OF PRODUCTION OF FODDER CROPS

5.1. Background

There is increasing importance of commercial rearing of different livestock among farmers in the study area. Among livestock sub-enterprises, dairying assumes great significance in terms of additional income to households, nutritional improvement of household members and employment generation. Rearing of cattle has also cultural significance. However, sample farmers have reported that there is no significant rise in herd size over time due to shortage of human labour for a better animal care and management. Nevertheless, the increasing commercial importance of dairying activities motivates the farmers to cultivate the green fodder in their own farm. In fact, it was observed that farmers have cultivated green fodders in a separate plot to make them available throughout the year. It was also evident from the analysis presented in the previous chapter that farmers feed relatively high amount of green fodder to cattle and buffalo in milk. Further, it was interesting to note that overall sample farmers have allocated about 4 per cent of the gross cropped area to the cultivation of napier grass, an important green fodder in the study area. Among the farm size groups, marginal farmers allocated a significant proportion of gross cropped area (11 per cent) under napier. The medium and small farmers have allocated about 4 per cent and 3 per cent of the cropped area, respectively.

The present chapter estimates the economics of cultivation of major fodder crops grown by the sample farmers. There are only two major fodder crops viz., napier and jowar cultivated in the study area. Farmers generally use the harvested green fodder for feeding their own livestock only and they rarely sell in the market. However, attempts were made to capture unit selling price of these fodders from the village experts during the survey. Using the price data, total returns from the cultivation of napier and jowar were also estimated.

5.2. Returns and Variable Cost of Cultivation of Napier

Napier grass has the characteristics of multi-tillering and palatable green leaves. Napier provides green fodder throughout the year. It is propagated through stem cuttings and can be planted during any part of the year. It requires frequent irrigation and heavy application of manures and fertilisers for getting better yield. The crop stands in the field for about 5 years with multi-cutting of green fodder. The first cut is taken two months after the planting and subsequent cuts can be taken at the interval of 40-45 days. So, ideally farmers can take 8-10 cuts every year. However, in the field situation the interval of harvest is quite different. Since a farmer maintains a small herd size comprising 1-2 milch animals, napier is harvested almost every day to feed the animals. The daily harvested quantity of green fodder also varies. Thus, it was really difficult to estimate the exact quantity of green fodder produced per year from a unit of land. The difficulty in the estimation also came up due to single time period survey. Further, yield varies with age of the crop. Nevertheless, information regarding average number of harvests and average quantity were collected from the farmers to estimate the green fodder production at the farm level.

Since napier grass is perennial, the establishment cost should be worked out to calculate the total cost of production. Unlike other perennials, an important feature of napier is that multi- cuts of green fodder can be taken within the same year of planting. Although yield will vary with the age of crop, farmers have reported that once they observe slowing down in yield in the subsequent cuts, existing crop will be uprooted and re-plantation will be undertaken. This actually complicates the method of estimation of cost details at a particular point of time. For the present study, cost of napier cultivation was worked out for the reference period of the survey irrespective of the age of the crop in the field. The initial establishment cost comprising labour and material cost of planting was estimated.

The establishment cost was amortized so as to incorporate it in the calculation of annual variable cost. Of the total cost, labour accounted for the highest followed by the material cost, which basically included cost of the stem cuttings (**Table 5.1**). There are differences in total establishment cost across farm size groups. The establishment cost was relatively high for small farmers followed by large and marginal farmers. The higher cost to small farmers has resulted from high cost of machine labour and stem cuttings.

Table 5.1. Establishment Cost of Napier

(Rs/ha)

Items	Marginal	Small	Medium	Large	Overall
Labour Cost					
Machine labour	85.3	237.1	80.3	108.6	115.0
Family labour	136.7	142.3	69.9	78.7	103.0
Hired labour	66.0	109.1	55.8	151.1	79.4
Own animal labour	11.5	50.7	31.0	25.4	28.9
Hired animal labour	57.7	86.9	12.2	25.4	40.4
Material Cost					
Cuttings	63.8	187.9	122.5	117.5	118.7
Total cost	421.0	813.9	371.8	506.7	485.4

The estimated total variable cost of napier cultivation is presented in **Table 5.2**. The overall variable cost was Rs. 1,907/ha of which family labour cost has constituted the highest proportion followed by manures. Cost of irrigation and plant protection was estimated negligible for the large farmers. In fact, the incidence of pest and diseases is rare for the napier grass. Nevertheless, the total variable cost was the second highest for the large farmers after small farmers. Incidentally, the cost of manure and fertiliser was high to small farmers as compared to other farm size groups implying that small farmers apply relatively high quantity of these inputs.

However, green fodder yield from napier is not promising and is very low as compared to the level obtained at the experimental station. The overall yield from the sample farmers was only 26 quintal per hectare. Among farm size groups, green fodder yield was the highest for medium farmers followed by

marginal and small farmers. The differences in yield have also resulted in differences in total return for different categories of farmers. The per hectare total return from napier cultivation was Rs. 8,398 for medium farmers, Rs. 8,316 for marginal farmers and Rs. 6,945 for small farmers. Higher return over variable cost indicates that napier cultivation is profitable provided marketing problems such as high transportation cost, small marketed surplus and storage problems are properly addressed.

Table 5.2. Cost of Cultivation of Napier

Particulars	(Rs/ha)				
	Marginal	Small	Medium	Large	Overall
Human Labour					
Family labour	1021.5	1114.2	528.0	1196.8	847.9
Hired labour	35.9	655.6	132.6	686.3	267.8
Manures	375.6	614.8	204.3	307.9	341.1
Fertilisers	164.7	377.3	201.3	343.8	240.9
Irrigation	13.5	43.8	13.1	-	17.7
Plant protection	18.8	29.0	24.5	-	21.1
Amortized establishment cost	99.9	193.2	88.3	120.3	115.2
Interest on working capital	51.9	91.1	35.8	79.7	55.6
Total variable cost	1781.8	3119.0	1227.8	2734.9	1907.4
Average yield (Quintal/ha)	27.7	23.1	28.0	18.2	25.9
Total Return (Rs/ha)	8315.9	6944.8	8397.6	5466.7	7774.1

5.3. Returns and Variable Cost of Cultivation of Jowar

Jowar is another important fodder crop grown among farmers in the study area. Jowar is also an important food crop in Karnataka. It provides not only green fodder, but also dry stover that can be stored and fed to animals all the round year. As discussed elsewhere, farmers grew fodder jowar in the marginal or degraded lands or on the borders of the field where main crop does not grow well. So the application of chemical inputs and irrigation is very much limited. Further, it was observed that only single cut varieties like MP chari or red jowar are grown during kharif season. The green fodder is harvested after flowering stage. The harvested green fodder is used for feeding of livestock directly or it is dried and then staked for later use. Since the inputs are not applied heavily for the cultivation, the overall estimated cost is low as compared to napier grass.

Table 5.3 provides cost of cultivation of jowar in the study area. The overall estimated variable cost was Rs. 223/ha. Family labour has accounted for the highest proportion of total cost. There are differences in total variable cost incurred across the farm size groups. The average per hectare variable cost was higher for small and marginal farmers with Rs. 574 and Rs. 419, respectively. The use of family labour is intensive among these farmers for the operations related to field management and harvesting of green fodder. So, relatively high family labour cost has resulted in higher variable cost. The total variable cost per acre for medium and large farmers was worked out at Rs. 162 and Rs. 84, respectively.

Table 5.3. Cost of Cultivation of Jowar

Particulars	(Rs/ha)				
	Marginal	Small	Medium	Large	Overall
Human Labour					
Family labour	197.8	262.1	84.4	28.1	102.7
Hired labour	43.6	20.6	4.4	4.9	9.8
Animal Labour	41.7	23.9	5.2	2.4	9.7
Machine Labour	-	50.2	24.8	9.7	22.4
Seed	10.1	17.2	6.4	1.8	6.9
Manures	63.9	150.7	13.3	6.1	38.3
Fertilisers	45.7	32.0	12.9	28.0	23.7
Plant protection	4.0	-	5.4	-	2.4
Interest on working capital	12.2	16.7	4.7	2.4	6.5
Total variable cost	419.0	573.5	161.5	83.5	222.5
Average yield (Quintal/ha)	2.4	8.9	4.2	1.2	3.9
Total Return (Rs/ha)	478.8	1774.9	850.0	244.6	775.1

The green fodder yield from jowar is abysmally low at 3.9 quintal per hectare. The average yield was high at 8.9 quintal among small farmers followed by medium farmers (4.2 quintal) and marginal farmers (8.9 quintal). Generally, farmers use green fodder from jowar for their own livestock feeding and rarely sell in the market. However, based on the price collected from the village experts like merchant traders and progressive farmers, total return from the jowar cultivation was worked out. The total return from the overall sample farmers was Rs. 775/ha. It was the highest among small farmers followed by medium and marginal farmers.

Table 5.4. Economics of Jowar Fodder vis-à-vis its competing Crop Paddy for the sample households

Farm Size Category	Jowar				Paddy			
	Yield (Qtl/ha)	Price (Rs/Qtl)	Gross Returns (Rs)	Returns over Variable Cost (Rs)	Yield (Qtl/ha)	Price (Rs/Qtl)	Gross Returns (Rs)	Returns over Variable Cost (Rs)
Marginal	2.4	200	478.8	59.8	13.4	778.9	12796	6152
Small	8.9	190	1774.9	1201.3	15.2	822.1	13500	7640
Medium	4.2	200	850.0	688.5	17.3	920.8	16920	12249
Large	1.2	190	244.6	161.1	13.7	930.0	12963	6591
Overall	3.9	200	775.1	552.6	15.8	890.0	15774	10300

The comparative cost of jowar fodder and paddy is presented in **Table 5.4**. Farmers do not allocate higher area under fodder crops due to low profitability in relation to their competing crops. As discussed elsewhere, the fodder markets are not well developed in the study area, hence farmers grow fodders to meet their domestic requirement only. It can be observed that the return over the variable cost is relatively high for paddy when compared to jowar fodder.

To sum up, total return from napier grass was higher than the variable cost of production indicating that its cultivation is profitable. Total return was relatively high for medium and large farmers. But, the estimated green fodder yield was very low at 65 quintal/acre. There is huge scope to increase the yield through timely application of fertiliser and irrigation, as napier is highly input intensive. As regards jowar, total variable cost of cultivation was much lower than that of napier grass. Among the cost components, family labour accounted for the largest proportion of total costs. The green fodder yield from jowar was also abysmally low for the sample farmers as this crop is cultivated in the marginal lands with a little input.

CHAPTER VI

PROCESSING AND MARKETING SYSTEM FOR FODDER CROPS

6.1. Background

Generally, farmers try to fulfil their fodder requirements at the village level. Locally available crop residues like cereal straws are utilised for feeding livestock. As discussed in the previous chapter, farmers in the study area grow fodder crops mainly to feed their own livestock. There was hardly any transaction reported on sale and purchase of green fodders. However, a few sample farmers reported sale and purchase of dry fodders within village and also from nearby villages. The purchase of fodders is necessitated only when there is severe shortage at the farm level. There are even exchanges of dry fodders reported for a settlement in the future. Farmers having surplus fodder provide to those in need of it with an understanding that the equal amount of fodder will be given back after the harvest of the crop. Thus, marketing of fodders (green and dry), is not so common among farmer households. Further, there were no established/organised fodder markets operating in the study area. The processing of fodders was also not so prevalent among the farmers.

The present chapter discusses marketing and processing of major fodder crops in Karnataka. First the disposal pattern of major fodders by market agents and location is discussed. The average price of fodder by agents and cost involved in marketing has also been presented in this section. The next section discusses methods of processing fodder, cost of processing and storage.

6.2. Disposal Pattern of Fodder Crops

The disposal pattern of major fodder crops grown in Karnataka is given in **Table 6.1**. The disposal pattern by agent type is presented to understand the channel through which farmers sell fodders. However, complete channel

of marketing of fodders from producer to consumer could not be traced. Further, only a few farmers have participated in sale of fodders in the study area. It can be observed that three types of agent viz., commission agent, consumer and local trader involved in marketing of fodder. Of the fodder types, entire quantity of jowar straw, maize straw and ragi straw were sold to commission agent only. In case of paddy straw, 69 per cent of total quantity sold by the farmers was handled by commission agent, 21 per cent by consumers and 10 per cent by local traders. The average price received by the farmers has varied slightly with type of agents.

Table 6.1. Disposal Pattern of Fodder Crops

Items	Commission Agent		Consumer		Local Trader		Overall	
	Quantity (%)	Price (Rs/Otl)	Quantity (%)	Price (Rs/Otl)	Quantity (%)	Price (Rs/Otl)	Quantity (%)	Price (Rs/Otl)
Jowar	100.0	200.0	-	-	-	-	100.0	200.0
Maize	100.0	300.0	-	-	-	-	100.0	300.0
Paddy	68.9	100.0	21.3	50.0	9.8	100.0	100.0	90.0
Ragi	100.00	100.0	-	-	-	-	100.0	100

It would also be interesting to look at the disposal pattern by the place of sale. The disposal pattern by place can be categorised into within village and outside village. Among fodder types, the entire quantity of jowar straw, maize straw and ragi straw was sold within the village only (**Table 6.2**). As for paddy straw, 79 per cent was sold within the village and the remaining outside the village. Some costs are involved marketing of fodders by different agents. These included commission charges and loading/unloading charges (**Table 6.3**). The average commission charge was estimated at Rs. 125/quintal, while loading and unloading charges for consumers was Rs.83/quintal and for local trader it was Rs. 100/quintal. However, caution may be exercised while interpreting the results, as only a few farmer sellers and trader buyers participated in the marketing of fodders.

Table 6.2. Disposal Pattern of Fodder Crops by Place of Sale

Particulars	Within Village		Outside Village	
	Quantity (%)	Price (Rs/Otl)	Quantity (%)	Price (Rs/Otl)
Jowar Straw	100	300	-	-
Maize Straw	100	200	-	-
Paddy Straw	79	90	21	100
Ragi Straw	100	100	-	-

Table 6.3. Marketing Cost Incurred by the Farmers

			(Rs/Qtl)
Agents	Commission	Loading/Unloading	Total
Commission agent	125	-	125
Consumer	-	83	83
Local trader	-	100	100

6.3. Methods of Processing of Fodders and Cost of Processing

Processing of fodders entails the conversion of raw fodder in to a new form. Processing is essentially done for two major reasons: (i) conservation and (ii) increase the palatability of feed. For increasing the palatability, fodders are chopped and mixed some additives like salt and then fed to livestock instantly. But, the function of conservation/preservation of fodders helps the farmers to use them during lean seasons. The conservation function also helps to preserve the nutrients contents of the forages.

Generally, two methods of conservation of fodders are followed. They include ensilage and hay making. Ensilage is the process through which a material called silage is produced through anaerobic fermentation of crops. For making silage, container called silo is used. Silos are of different types like pit silo, drench silo and drum silo (ICAR, 2009). Drying of forages is called hay making. Forages are generally dried under sunlight. The harvested forages or cereals straw are spread on the ground under sunlight and layers are changed regularly for drying evenly. The dried forages are staked in heaps for use. As compared to hay making, ensilage produces high quality feed with rich in nutrients. But, lot of care is required to make better silage under controlled conditions; otherwise it will result in bad quality and wastage. Hay making is easier, but it is difficult during rainy season.

Table 6.4. Farmers Adopted Hay Making as a Processing Method

					(Per cent)
Particulars	Marginal	Small	Medium	Large	Overall
Kharif	19.81	36.79	28.30	15.09	100
Rabi	31.82	36.36	20.45	11.36	100
Summer	19.15	23.40	42.55	14.89	100

In the present study, it was observed that the sample farmers practised only hay making of forage as a method of processing of fodders to preserve and use it for later. The quality of hay making is influenced by the seasonal conditions like forage availability and weather. Among farm size groups, large percentage of small farmers followed by medium farmers in kharif and marginal farmers in rabi have undertaken haymaking of any type of fodders (**Table 6.4**). In Karnataka, cereals like paddy, jowar, maize and ragi are cultivated both in kharif and rabi seasons. Thus, large quantities of crop residues available during these seasons are made use of by the famers for hay making. It has also been observed that about 43 per cent of medium farmers prepared hay making in summer from the crops harvested during that season. The percentage of large farmers who preserve forage through hay making is found to be low in the study area. However, analysis of per cent farmers involved in hay making by crops provides some interesting insights.

Table 6.5. Farmers Adopted Hay Making for Different Type of Fodder

Particulars	(Per cent)				
	Marginal	Small	Medium	Large	Overall
Kharif					
Jowar Straw	33.33	16.67	16.67	33.33	100.00
Maize Straw	23.08	38.46	38.46	-	100.00
Paddy Straw	25.33	38.67	26.67	9.33	100.00
Ragi Straw	-	50.00	30.00	20.00	100.00
Rabi					
Jowar Straw	14.29	14.29	42.86	28.57	100.00
Maize Straw	16.67	33.33	16.67	33.33	100.00
Paddy Straw	47.83	30.43	17.39	4.35	100.00
Wheat	-	100.00	-	-	100.00
Summer					
Jowar Straw	25.00	25.00	25.00	25.00	100.00
Maize Straw	17.65	29.41	47.06	5.88	100.00
Paddy Straw	21.05	21.05	42.11	15.79	100.00
Ragi Straw	14.29	14.29	42.86	28.57	100.00

Crops used for hay making by the sample farmers in the study area is shown in **Table 6.5**. Jowar and maize straw are the predominant forage types used for hay making during kharif and rabi seasons across farm size groups. Farmers have also used maize stover during all the seasons. Of the total sample farmers, 33 per cent each category of large farmers and marginal farmers undertook haymaking from jowar straw in kharif. However, for haymaking from paddy straw the small farmers accounted for the highest percentage in kharif followed by marginal farmers in rabi and medium farmers in summer. Ragi straw is widely used for hay making by the small farmers. In summer, sample farmers have converted all the available forage types into hay for want of fodder to feed livestock. Further, availability of bright sunshine during summer enables the farmers to make good quality hay.

Table 6.6. Details of Hay making for Different Forage Types

Particulars	Marginal	Small	Medium	Large	Overall
Jowar straw					
Average Quantity Stored (Qtl)	13.0	18.3	23.0	32.0	22.5
Average Quantity Lost (Qtl)	0.6	6.7	0.2	0.8	1.6
Period of Storage (Days)	195.0	165.0	135.0	240.0	190.0
Maize straw					
Average Quantity Stored (Qtl)	68.7	63.0	130.9	78.6	90.5
Average Quantity Lost (Qtl)	5.9	6.3	11.5	3.9	7.6
Period of Storage (Days)	56.7	169.3	171.2	198.3	152.0
Paddy straw					
Average Quantity Stored (Qtl)	102.3	112.7	138.3	44.6	110.3
Average Quantity Lost (Qtl)	2.8	7.9	4.6	4.1	5.1
Period of Storage (Days)	158.0	226.9	235.2	232.9	220.0
Ragi straw					
Average Quantity Stored (Qtl)	1.5	65.5	13.4	27.0	32.2
Average Quantity Lost (Qtl)	0.5	1.7	1.0	0.6	1.1
Period of Storage (Days)	90.0	208.0	225.8	188.8	185.0

Some details of hay made from different forage types in terms of average quantity stored, quantity lost during storage and average period of storage is provided in **Table 6.6**. Among fodder types, paddy straw accounted for the

highest overall average quantity of hay stored by the farmers with storage period of 220 days. The second highest quantity of hay stored was that of maize straw followed by ragi straw and jowar straw. The average period of storage for these forages was 152 days, 185 days and 190 days, respectively. It can be deduced from the number days of storage that the sample farmers store and feed the dry fodders to livestock in such a way that fodders are available throughout the year.

Paddy straw is the predominant hay stored by marginal, small and medium farmers for feeding livestock. For large farmers, maize straw accounted for the highest quantity followed by paddy straw and jowar straw. The average storage period of hay of maize straw, paddy straw and ragi straw is relatively high for medium and large farmers. Except jowar straw, average storage period of other fodder types was low for marginal farmers. This was because of lack of enough storage space at their residential premises. It was reported by sample farmers that small and marginal at times store their hay either in the village common land or in a raised platform in their own farm itself. Consequently, the average quantity of hay lost during storage was relatively high among these farmer groups as compared to medium and large farmers.

In sum, the sample farmers use the harvested green fodders for feeding their livestock only and there was no organised market for it. However, a few farmers sold dry fodders to commission agent, consumer and local traders. Except paddy straw, some quantities of which were sold outside the village, entire quantity of other dry fodder types were sold within the village. Hay making was the only processing method followed by the farmers in the study area. Among fodder types, farmers stored relatively large quantity of hay made from paddy straw for a maximum period of 220 days.

CHAPTER VII

PROBLEMS FACED BY GROWERS OF FODDER CROPS

7.1. Background

The cultivation of fodder as sole crops has trade off between the allocation of land for food crops and fodder crops. Competition also emerges for the use of inputs like irrigation, labour and fertilisers. Nevertheless, effective functioning of fodder markets and high profitability from livestock rearing may motivate the farmers to reallocate the resources for the cultivation of different varieties of forages. Forages are bulky and involve high transportation cost. Therefore, organised fodder markets may ensure high bargaining capacity and better price realisation by the farmers. The scientific rearing of animals for production of milk and other livestock products may give rise to higher yield and income.

However, it was observed that the herd size of the sample farmers was small and mostly fed on crop residues. The green fodders are not available throughout year except for those farmers who grow napier grass. Besides land allocation, there are other constraints which affect the cultivation of forages among farmers. The present chapter discusses the problems faced by growers of fodder crops in the study area. Since farmers in the study area rarely sell fodders, the problems related to marketing aspects could not be studied.

7.2. Production Problems

The production problems related to fodder cultivation is presented in **Table 7.1**. Of total sample farmers, the highest percentage of small farmers reported problems with respect to access to credit, labour availability, high expenditure on production, seed quality and access to technical knowledge. But, relatively large percentage of marginal farmers reported pests and diseases as a major problem. In fact, jowar fodder is infested by some pests

and diseases in the field, which affects the yield and quality. Input delivery like access to fertiliser through government controlled village co-operatives appears to be a major problem for medium farmers. Among other problems, large number of marginal farmers also reported shortage of labour, poor seed quality and lack of access to technical knowledge. The production problems also vary with different seasons of production.

Table 7.1. Overall Farmers Reported Production Problem (Per cent)

Problem Name	Marginal	Small	Medium	Large	Total
Access to credit	26.47	38.24	29.41	5.88	100
Any other	29.73	35.14	27.03	8.11	100
Availability and cost of labour	28.35	30.71	28.35	12.60	100
Expenditure on Production	24.14	32.76	27.59	15.52	100
Input delivery	25.00	28.13	40.63	6.25	100
Pests and Diseases	33.33	30.56	25.00	11.11	100
Seed Quality	28.00	30.00	26.00	16.00	100
Technical Knowledge	29.41	41.18	26.47	2.94	100
Total	27.94	32.60	28.43	11.03	100

Table 7.2. Details of Production Problem (Per cent)

Particulars	Marginal	Small	Medium	Large	Total
High					
Access to credit	22.22	44.44	22.22	11.11	100.00
Availability and cost of labour	26.03	30.14	27.40	16.44	100.00
Expenditure on Production	20.00	34.29	22.86	22.86	100.00
Input delivery	22.22	22.22	55.56	-	100.00
Pests and Diseases	33.33	25.00	16.67	25.00	100.00
Seed Quality	33.33	13.33	20.00	33.33	100.00
Technical Knowledge	14.29	57.14	28.57	-	100.00
Any other	62.50	25.00	12.50	-	100.00
Medium					
Access to credit	-	50.00	50.00	-	100.00
Availability and cost of labour	23.53	23.53	47.06	5.88	100.00
Expenditure on Production	20.00	40.00	40.00	-	100.00
Input delivery	-	66.67	-	33.33	100.00
Pests and Diseases	50.00	50.00	-	-	100.00
Seed Quality	-	66.67	22.22	11.11	100.00
Any other	-	-	-	100.00	100.00
Low					
Access to credit	20.00	60.00	20.00	-	100.00
Availability and cost of labour	41.67	41.67	8.33	8.33	100.00
Input delivery	-	100.00	-	-	100.00
Pests and Diseases	33.33	66.67	-	-	100.00
Seed Quality	50.00	25.00	-	25.00	100.00
Technical Knowledge	42.86	57.14	-	-	100.00
Any other	40.00	20.00	40.00	-	100.00

To understand the severity of problems faced by the farmers in the cultivation of fodder crops, farmers were asked to rank the constraints into high, medium and low. The detail of the production problems by these categories are given in **Table 7.2**. A large percentage of small farmers have, by and large ranked the production problems like access to credit, labour shortage, high cost of production, input delivery and technical knowledge between high and medium. Poor seed quality and pests and diseases appear to be a major problem for the marginal farmers and thus have been ranked high by them. For large farmers too, poor seed quality was ranked high affecting the level of production.

Over all, the availability of quality inputs and extension service delivery were reported to be major problems in the cultivation of fodder crops. Poor seed quality was ranked high by the different farm size groups. Incidence of pests and diseases particularly in jowar was also identified as one of the major problems affecting the yield of green fodder.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

8.1. Introduction

Traditionally, India's crop and livestock sector are interrelated to each other. The interactions between these two sectors are so complex that it would be difficult to separate out the contributions from each sector. The crop sector mainly provides fodder to livestock, while livestock supplies manure and draught power to crop sector. However, the interactions between crop and livestock sector has been weakening over time with the advent of new technologies, which have prompted mechanisation of most of the agricultural operations and brought about significant changes in the cropping pattern. This has not only affected the use of animal draught power, but also availability of fodder for feeding to livestock.

However, there are evidences of intensification of livestock production particularly dairying taking place across different regions in India. The intensification is varied by livestock species. Among others, human population density, urbanisation, small size farms have positive and significant effect on the intensification of livestock production (Birthal and Rao, 2004). Rise in intensification of livestock production is likely to impact the output prices, input prices, income and employment. In the process, undue pressure may also be put on the existing resource base.

In Karnataka, animal husbandry and dairying play a significant role in the growth of overall agricultural sector. Livestock has contributed about 18 per cent of total value of output from agricultural and allied sector in 2008-09. Interestingly, annual growth in livestock sector was over 3 per cent during 2004-05 to 2008-09 as compared to fluctuating and negative growth in the crop sector. Among livestock products, growth in milk production was relatively high.

A sustained growth in livestock sector requires adequate availability of fodder, quality veterinary services, access to output market and proper care and management of animals. Among these factors, year round availability of good quality fodders assumes great significance. Generally, farmers feed livestock with the commonly available crop residues, wasted grains and gruel. The practice of growing green fodders by the farmers is also very much limited in the state. However, with the changes in cropping pattern and crop management practices, there is increasing realisation among farmers on exclusive cultivation of green fodder in the farm for better feeding to livestock. However, there are no systematic studies available on economics of production of fodder crops and problems faced by the farmers in Karnataka. The present study focuses on economics of fodder cultivation, processing of forages and its marketing aspects. The specific objectives of the study are as follows.

1. To estimate the costs of production and returns associated with the cultivation of important fodder crops
2. To identify the processing and marketing system and to estimate the costs and returns at each link for these fodder crops
3. To study the problems faced by the producers in production, marketing and processing of these fodder crops.

The study uses both the secondary and primary data. The secondary data were compiled from various published sources such as Livestock Census and Statistical Abstract of Karnataka. To estimate the economics of fodder crops cultivation, processing and marketing, a primary survey of farmer households was conducted in three districts viz., Mandya, Chitradurga and Belgaum during 2008-09. The survey covered a sample of 201 farmers. Two villages were selected from each district in such a way that one village was located nearby the district head quarters and another farthest. A purposive sampling technique was adopted to select the farmers growing any type of fodder crops in the selected villages.

8.2. Summary of Findings

8.2.1. Livestock Population

The total livestock population has increased from 29.57 million in 1992 to 30.86 million in 2007 with the compound annual growth rate (CAGR) of 0.29 per cent. Among livestock species, cattle population has surprisingly declined from 13.18 million in 1992 to 10.50 million in 2007. However, buffalo population, except in 2003, has increased marginally across inter-census periods. Small ruminants constituted the second largest species after the bovines. While sheep population has increased considerably from 5.43 million in 1992 to 8.0 million in 2007 with the CAGR of 2.57 per cent, goat population has declined with the CAGR of -0.14 per cent.

Districtwise analysis of cattle population has revealed that except Bagalkot and Davanagere, it has registered negative growth rate between 1992 and 2007 in all other districts. In terms of absolute numbers, there is some marginal increase in cattle population in 2007. Nevertheless, the widespread decline in cattle population across the districts does not augur well for development of dairying in the state. As compared to the cattle, buffaloes are sparsely distributed across the districts. Seven districts have recorded positive growth in its population between 1992 and 2007. Belgaum has the largest buffalo population followed by Bagalkot and Gulbarga.

As for the sheep population, they are densely distributed across dry land districts. Except a few districts, all others have registered positive growth in its population with the highest in Chitradurga (5.68 per cent) followed by Bellary (4.94 per cent) and Belgaum (3.95 per cent). The decline in the population of sheep and goat was quite sharp in Dharwad. The decline in the population of total livestock was also observed in the agriculturally developed district like Shimoga.

8.2.2. Demographic Characteristics of Sample Households

The marginal and small farmers combined have constituted 62 per cent of total sample households. A large percentage of households have the average family size ranging between 4 and 8. As for the education of the head of the family, about 38 per cent had completed secondary education, while 17 per cent had higher secondary education. Only 18 per cent of the sample farmers were illiterate. Regarding the annual income of households (farm and non-farm), about 70 per cent of the sample households reported earning up to Rs. 1,00,000. However, within the marginal farm size groups, over three-fourth of farmers reported earning annual income up to Rs. 50,000 only.

8.2.3. Land Resources

Of the total operated area, medium and large farmer households accounted for 35 per cent and 36 per cent, respectively. The marginal and small holdings combined had 29 per cent of operated area only. Marginal farm size groups are in disadvantageous position with respect to access to irrigation. These farmers have only 9 per cent of the total irrigated area, whereas medium and large farmers together have accounted for over 60 per cent. Further, marginal farmer households accounted for the largest leased in and leased out area.

8.2.4. Farm Power and Machinery

The small and medium farm size groups owned about 31 per cent and 30 per cent of total number of farm machineries, respectively. Among the machinery types, the percent distribution of tractors was high among medium and large farmers. The higher concentration of diesel engines among marginal and small farmers as compared to medium and large farmers indicate that inequitable access to electricity in the study areas. Interestingly, the small and medium farmer households have relatively high per cent of any type of built up animal shed. Similarly, the percent distribution of fodder chopper was high among small farmers category. With

respect to the average value of agricultural machineries, it was relatively high for tractor followed by trolley and other machineries for the total sample of farmers. Across the farm size groups, average value of machineries was high for large farmers followed by medium farmers.

8.2.5. Livestock Resources

The per cent distribution of cattle (indigenous and crossbred) was high among small and medium farmers. In case of buffalo also, the small and marginal farmers combined owned over 50 per cent of buffalo female in milk and young stock female. The relative distribution of male cattle among different farm size groups indicates the use of bullocks for various agricultural operations and transport in the study area. The per cent distribution of sheep and goat were highly concentrated among marginal and small farmers. Pigs are mostly reared by marginal farmers only. The average value of animals varied across livestock types and farm size categories.

8.2.6. Cropping Pattern

The overall cropping pattern is dominated by coarse cereals accounting for over one-third of the gross cropped area. Among crops, area under maize constituted the highest share of about 21 per cent. The next predominant crop was paddy (18 per cent) followed by sugarcane (11 per cent). Across farm size groups, paddy occupied about 23 per cent, 30 per cent and 22 per cent of gross cropped area for marginal, small and medium farmer groups, respectively. The area under cultivation of vegetables was relatively high among marginal farmers. However, perennial crops like arecanut had relatively high area allocation within the large farmer groups.

Interestingly, napier grass has accounted for about 4 per cent of the gross cropped area of overall sample farmers. It occupied a significant proportion of total cropped area of marginal (11 per cent), medium (4 per cent) and small farmers (3 per cent). Farmers have also cultivated red jowar for the

purpose of feeding to livestock. But, unlike napier grass, red jowar was cultivated on the marginal lands with little inputs.

8.2.7. Production Status of Fodder Crops

A large percentage of sample farmers (60 per cent) have reported stagnation of area under napier and jowar. Majority of the farmers reported increase in trend in the production of green fodder from napier during the last 10 years. At the same time, over one-third of them have reported decrease in the production of napier, which is mainly due to decrease in yield. Although napier is cultivated in a separate plot preferably near the irrigation source, application of fertilisers and manure is very much limited.

8.2.8. Status of Livestock Population and Production of Livestock Products

It has been observed that over 80 per cent of the farmers reporting either decrease or stagnation in the population of cattle female and male in the last one decade. There is a marginal increase in buffalo female population. But, about 47 percent of the sample farmers reported decrease in goat population, while 43 per cent reported increase in sheep population. As regards the livestock products, while a quarter of farmers reported increase in buffalo milk yield, but about one-third have reported stagnation and two-fifth have reported decrease during the reporting period. Similarly, about 45 per cent and 33 per cent of farmers have reported stagnation and decrease in milk yield from cattle, respectively. A large percentage of sample farmers reported increase in meat production from goat, sheep, pig and poultry due to its increased demand during the recent years.

8.2.9. Feeding Practices

A large percentage of farmers reported decrease in the use of green fodder in the last 10 years. There is conspicuous decrease in feeding of green fodder to cattle dry and buffalo dry. Similarly, a higher proportion of sample farmers reported stagnation in feeding of dry fodder and concentrates to

large ruminants over time. A majority of the farmers have also reported stagnation in feeding of different type of fodders to sheep and goat. However, about one-third of sheep rearing farmers stated that there is increase in use of grains.

There is wide spread practice of stall feeding for different type of livestock. A large percentage of medium farmers have reported stall feeding as compared to other farm size groups due to unavailability of labour for proper care and management. The marginal and small farmers have also relatively adopted stall feeding methods. Nevertheless, grazing of livestock seems to be a common practice among marginal and small farm size groups in the study area.

The average quantity of consumption and feeding pattern vary by season and livestock types. The average consumption rate of green fodder was higher during kharif than the rates observed in rabi and summer seasons. The consumption of dry fodder was observed relatively high during rabi and summer. Among livestock types, the average consumption rate of green fodder per animal was worked out to be higher for crossbred cattle in milk across the seasons. In fact, the consumption of green fodder by crossbred cattle in milk was 17.5 Kg/day, 16.4 Kg/day and 13.9 Kg/day in kharif, rabi and summer, respectively.

Buffaloes are also good converter of dry fodder. The average consumption rate of dry fodder for buffalo was 11.4 Kg, 12.7 Kg and 12.4 Kg in kharif, rabi and summer, respectively. The corresponding rates for green fodder were 13.0 Kg, 10.9 Kg and 10.9 Kg, respectively. The consumption of all types of fodder was lower for cattle female dry and buffalo female dry. By fodder types, crossbred cattle was fed with relatively high quantity of napier (22.4 Kg), jowar straw (22.15 Kg), maize straw (18.3 Kg) and paddy straw (14.9 Kg).

Further, there are differences in quantity of fodder and feed fed to different livestock by different categories of farmers. The average quantity of feed given to livestock was the highest for the large farmers followed by marginal, small and medium farmers. The large farmers fed green fodder in kharif at 21.1 Kg, 26.6 Kg and 13.1 Kg for indigenous cow in milk, crossbred cow in milk and buffalo in milk, respectively. The corresponding feeding rates given by marginal farmers were 12.6 Kg, 22.5 Kg and 13.0 Kg. The amount of feed given by medium farmers is comparable with that of marginal farmers. Similarly, the average quantity of feed fed during rabi and summer seasons was also higher for large farmers although there were differences for different livestock types.

8.2.10. Returns and Variable Cost of Cultivation of Napier

Napier grass has the characteristics of profuse tillering and multi cuts of green fodder every year. Since napier is perennial, the establishment cost was worked out to calculate the total cost of production. Then, the establishment cost was amortized to incorporate it in the calculation of annual variable cost. Of the total cost, labour accounted for the highest followed by the material cost. The establishment cost was relatively high for small farmers followed by large and marginal farmers.

The overall estimated variable cost was Rs. 4,769/acre of which family labour has constituted the highest proportion followed by manures. Among farm size groups, it was relatively high for small farmers. However, green fodder yield from napier is very low at 65 quintal per acre. Among farm size groups, green fodder yield was the highest for medium farmers followed by marginal and small farmers. The per acre total return from napier cultivation was Rs. 20,994 for medium farmers, Rs. 20,790 for marginal farmers and Rs. 17,362 for small farmers.

8.2.11. Returns and Variable Cost of Cultivation of Jowar

The overall estimated variable cost was Rs. 556/acre. Among cost components, family labour has accounted for the highest proportion followed by manure. The average per acre variable cost was higher for small and marginal farmers with Rs. 1,434 and Rs. 1,048, respectively. The use of family labour is intensive among these farmer groups for the operations related to field management and harvesting of green fodder. The total variable cost per acre for medium and large farmers was worked out at Rs. 404 and Rs. 209, respectively.

For the overall sample farmers, the green fodder yield from jowar is abysmally low at 9.7 quintal per acre. The average yield was high at 22.2 quintal among small farmers followed by medium farmers (10.6 quintal) and marginal farmers (6.0 quintal). The total return from the overall sample farmers was Rs. 1,938/acre. It was the highest among small farmers followed by medium and marginal farmers.

8.2.12. Disposal Pattern of Fodder Crops

It was observed from the field that only a few farmers had involved in the marketing of dry fodders. Of the fodder types, entire quantity of jowar straw, maize straw and ragi straw were sold to commission agent only. In case of paddy straw, 69 per cent of total quantity sold by the farmers was handled by commission agent, 21 per cent by consumers and 10 per cent by local traders. The average price received by the farmers has varied slightly with the type of agents. Regarding the place of sale, the entire quantity of jowar straw, maize straw and ragi straw was sold within the village only. As for paddy straw, 79 per cent was sold within the village and the remaining outside the village.

8.2.13. Methods of Processing of Fodders and Cost of Processing

The sample farmers practised only hay making of forage as a method of processing of fodders to preserve and use it for later. Among farm size groups, large percentage of small farmers followed by medium farmers in

kharif and marginal farmers in rabi have undertaken haymaking of any type of fodders. As regards the forage types, jowar and maize straw were predominantly used for hay making during kharif and rabi seasons across farm size groups. However, small farmers have accounted for the highest percentage in kharif followed by marginal farmers in rabi and medium farmers in summer for haymaking from paddy straw.

As far as storage of hay is concerned, paddy straw accounted for the highest average quantity of hay stored by the farmers with storage period of 220 days. The second highest quantity of hay stored was that of maize straw followed by ragi straw and jowar straw. In fact, paddy straw was the predominant hay stored by marginal, small and medium farmers for feeding livestock. For large farmers, maize straw accounted for the highest quantity followed by paddy straw and jowar straw.

8.2.14. Production Problems Faced by Fodder Growers

A large percentage of small farmers have reported problems with respect to access to credit, labour availability, high cost of production, seed quality and access to technical knowledge. The marginal farmers reported pests and diseases as a major problem. A large number of marginal farmers also reported problems related to labour availability, seed quality and access to technical knowledge. Input delivery like access to fertiliser through government controlled village co-operatives appears to be a major problem for medium farmers. Concerted efforts should be made by different public institutions to facilitate the farmers to get access to required inputs and technical knowledge.

8.3. Conclusions

Based on the analysis of data and summary of findings of the study, the following general conclusions have been drawn.

- (i) Although total livestock population has increased across inter-census periods, the decline in cattle population is worrisome. There is marginal increase in buffalo population in the state.
- (ii) Districtwise analysis of livestock population revealed that a large number of livestock particularly small ruminants are concentrated in dry land tracts.
- (iii) Basic data on fodder crops grown in Karnataka are not systematically collected and provided by any government agency. As a result, it was difficult to analyse the status of area, production and yield of fodder crops.
- (iv) The analysis of field survey data showed that percent distribution of different type of livestock was relatively high among marginal and small farmers. But, unfortunately about 80 per cent of the sample farmers reported that the cattle female and male population has either decreased or stagnated during the last 10 years.
- (v) Interestingly, sample farmers have allocated sizeable proportion of land (4 per cent of gross cropped area) for the cultivation of fodder crops. Napier grass and jowar are the two major fodder crops that the farmers have grown in the study area.
- (vi) The feeding pattern of livestock has varied across farm size groups, livestock type and seasons. It has been observed that feeding pattern of livestock has changed over time with decline in feeding of green fodder and stagnation in that of dry fodder and concentrates. Among livestock types, the average consumption rate of green fodder per

animal was worked out to be higher for crossbred cattle in milk across the seasons.

- (vii) Total return from napier grass was higher than the variable cost of production indicating that its cultivation was relatively profitable among farmers. But, 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.
- (viii) 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 have sold dry fodders within the village.
- (ix) Hay making was the only processing method followed by the farmers in the study area. Among fodder types, farmers stored relatively 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.

8.4. Policy Recommendations

- (i) Concerted efforts should be made to encourage the farmers to cultivate green fodder crops for enhancing the quality of livestock rearing across districts in Karnataka. This may be attempted initially by providing subsidised seed material and fertiliser to group of potential farmers at hobli level and then can be replicated to others through these successful farmer groups.
- (ii) A large percentage of farmers reported lack of technical knowledge in the cultivation and preservation of fodders. It is thus, necessary to conduct farmers' training periodically by the officials of the

Department of Agriculture to impart skill and technical knowledge to the farmers. In this regard, a co-ordination between Department of Agriculture and Department of Animal Husbandry and Veterinary Services is necessary for better sharing of technical knowledge including on feeding practices with the farmers.

- (iii) As reported by the farmers, green fodder yield of napier and jowar was low. There is huge scope for increasing the yield through adoption of better technology and field management. For this, good quality seed material and other inputs should be made available.
- (iv) Most farmers have reported the village common land has been encroached for different activities as a result there is loss of pasture land. Thus, local institutions should be encouraged to play an active role in protecting the common property resources, which not only will help in the development of livestock enterprises but also in the maintenance of ecological balance.
- (v) Efforts should be made to popularise the improved breeds of different livestock which are adaptable to different agro-climatic conditions. Karnataka has relatively a large area under dry land. The livestock species suitable to dry land areas should be promoted so that they perform better in those areas. Efforts should also be made to promote rearing of high quality buffaloes for improving the dairy development. This assumes importance in the context of decline or stagnant cattle population in the state.
- (vi) Availability of reliable data on fodder cultivation will be useful for better planning of livestock development in the state. Concerted efforts should be made by the government departments to systematically collect and publish data on fodder cultivation.

REFERENCES

- Bhende, M.J., R.S. Deshpande and P. Thippaiah (2004). *Evaluation of Feed and Fodder Development under the Centrally Sponsored Schemes in Karnataka*, Agricultural Development and Rural Transformation Centre, Bangalore.
- Biradar, N., C. R. Ramesh and P.S. Pathak (2007). "Traditional Livestock Feeding Practices in Northern Karnataka", *Indian Journal of Traditional Knowledge*, 6(3): 459-462.
- Birthal, P.S. and P.P. Rao (2004). "Intensification of Livestock Production in India: Patterns, Trends and Determinants", *Indian Journal of Agricultural Economics*, 59(3): 555-565.
- Dikshit, A.K and P.S. Birthal (2010). "India's Livestock Feed Demand: Estimates and Projections", *Agricultural Economics Research Review*, 23: 15-28, January-June.
- Erenstein, O., W. Thorpe, J. Singh and A. Verma (2007). *Crop-Livestock Interactions and Livelihoods in the Indo-Gangetic Plains, India: A Regional Synthesis*, International Maize and Wheat Improvement Centre (CIMMYT), Mexico.
- ICAR (2009). *Handbook of Agriculture*, Indian Council of Agricultural Research (ICAR), New Delhi.

Comments on the report “Economics of Production, Processing and Marketing of Fodder Crops in Karnataka” submitted by ADRTC, Bangalore

1. Title of the draft report examined:

Economics of Production, Processing and Marketing of Fodder Crops in Karnataka

2. Date of receipt of the Draft report: Jan. 20, 2012

3. Date of dispatch of the comments: Feb. 3, 2012

4. Comments on the Objectives of the study:

The study has not addressed all the objectives set forth. It is well known that the basic data related to fodder cultivation are not available in different states as no systematic efforts have been made by any government agency to collect information on fodder area, production and other related details. Still, whatsoever is available, needs to be added to address the first objective of the study.

5. Comments on the methodology

The study lacks in adopting a common methodology proposed for all the coordinating centres. Only four categories of farmers were selected for the analysis as against the five proposed by the coordinating centre. I request you to kindly address to the issue, so that uniformity may be maintained which will immensely help in compilation/consolidation of the report by our centre. The report prepared by our centre has already been sent for your reference for making changes and addressing to gaps and inadequacies.

6. Comments on analysis, organization, presentation etc.

i) The calculations in various tables have been done in acres, which needs to be carried out on hectare basis (p.7, Tables 5.1 to 5.3).

ii) In Table 2.1, data for 2003 livestock census has been given. The latest data for 2007 livestock census may be provided.

iii) In Tables 3.1 to 3.6, the percentage share of each district in total state livestock population (for each livestock category) may be added. Also, have you calculated the Compound Annual Growth Rates (CAGR) or Average Annual Growth Rates (AAGR) for livestock population over two periods of time? Please recheck.

- iv) In Table 3.7, the area under fodder has been given up to 1999-2000. The latest data in this regard may be added for better implications.
- v) In Tables 4.2, 4.4 and 4.6, the absolute figures may also be provided along with the percentages to make it more useful. Otherwise, the average size of framers' holding, farm power machinery and buildings and livestock population is nowhere presented in the report.
- vi) The data provided in Table 4.5 needs to be thoroughly rechecked as it is providing misleading information/conclusions.
- vii) In Table 4.7, is the value on per animal basis or per household basis? Please recheck. Household basis information is desirable.
- viii) In table 4.8, cropping pattern has been provided based on the % to Gross cropped area. To facilitate uniformity in consolidation of the report, the cropping pattern may be provided based on % to Net cropped area. The season wise (kharif/rabi) analysis may also be added to identify various seasonal crops.
- ix) In Tables 4.9 to 4.11, the category-wise analysis are lacking, which needs to be incorporated.
- x) To facilitate uniformity in consolidation of the report, the Tables 4.14 to 4.17 needs to be modified according to the format of tables/report of AERC, Ludhiana, which have already been sent to you.
- xi) In chapter V, economics of the competing crops along with the Returns over variable cost may also be incorporated.
- xii) In chapter VI, category-wise analysis are lacking and the price spread analysis for various marketing channels may also be incorporated.
- xiii) In Table 6.1, the absolute quantity disposed of may also be added.

7. Overall view on acceptability of report

The report can be accepted after incorporating the above comments. I strongly suggest that the report should be copy edited before submitting its final version.

ACTION TAKEN REPORT BY ADRTC, BANGALORE

The draft report was revised based on the comments received from the AERC, Ludhiana. Appropriate changes have been made wherever possible. However, some clarifications have been made here to reflect the ground realities on the cultivation and marketing of fodder crops in Karnataka. First, due to small size of holding in the study area, only four categories of farmers were defined. The same is clearly explained in the Chapter II on Data and Methodology. The details of sampling are provided in Table 2.1. Second, for any data which are available at intervals (livestock census in the present case), the compound annual growth rate (CAGR) is considered as an appropriate technique to calculate the growth rate. There are several studies available on this in India and elsewhere. Third, for certain items, data analysis by farm size groups could not be carried out due to limited number of observations, reasons for which are clearly mentioned in the appropriate places.