Assessment of Livestock Feed and Fodder in Haryana

Yogesh Bhatt
Utkarsh Yadav
Renu Sain

Agricultural Economics Research Centre
University of Delhi
Delhi – 110007

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Research Team

Dr. Yogesh Bhatt, Assistant Professor, AERC Delhi

Mr. Utkarsh Yadav, Research Investigator, AERC Delhi

Mrs. Renu Sain, Research Investigator, AERC Delhi

Ms. Varnika Jain, Research Investigator, AERC Delhi

Mr. Parmeet Kumar Vinit, Research Investigator, AERC Delhi

Administrative, library and general support

Mr. Md. Asghar Ali

Mrs. Nandi Negi

Mr. Himanshu

Mr. Gyan Chand

Mr. Pramod Kumar

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Preface

The present study has been undertaken for the Ministry of Agriculture & Famers Welfare in coordination with the Agricultural Development and Rural Transformation Centre (ADRTC), Institute for Social and Economic Change (ISEC), Bangalore. The Agricultural Economics Research Centre, Delhi is one of the participating centre in this study attempted to assess the status of the livestock feed and fodder in the state of Haryana. The study majorly utilized the primary survey data for the analysis purpose to estimate the demand, supply and shortage status in three surveyed districts of Haryana. Various problems and constraints associated with the fodder cultivation and livestock rearing in study districts of Haryana were also studied.

Our first and foremost thanks are to the Ministry of Agriculture & Farmers Welfare for supporting this study. Our sincere thanks also go to the coordinating centre - ADRTC, ISEC, Bangalore for providing the study design, methodology and the questionnaire template. We would also like to thank all the officials in the survey districts for their support during field visits. Last but not the least, we would like to place on record our appreciation of our colleagues in the Agricultural Economics Research Centre, University of Delhi for their support.

Yogesh Bhatt

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Abstract

The present status of feed and fodder resources in the country is not able to meet the emerging demand. This study examines the demand for and supply of feed and fodder in Haryana. The growth patterns of major livestock population in Haryana are analysed. The study also assessed the problems and constraints faced by livestock rearing farmers. The results suggest that the limited land holding by sample household is the major constraint for affording more land area under fodder crops. There is lack of awareness among farmers about the government's programmes on fodder cultivation and practicing any post harvest techniques of fodder production.

Introduction

India has the largest livestock population in the world. To support this huge livestock population, India requires the proportional feed and fodder supply to meet the demand. The foreseen threats to make up for the demand of feed and fodder in the country are the limited land for their cultivation (nearly 4%) due to decline in pasturelands and shift in cropping pattern from coarse cereals to commercial crops. Coarse cereal residue is largely used as fodder in most parts of the country. The shortage is estimated at nearly 28% to 35% in green fodder, 10% to 11% in dry fodder and 33% to 35% in concentrates (Niti Aayog (2018), World Bank (2011). The present status of feed and fodder resources are not able to meet the emerging demand and remain unfulfilled. Assessment of livestock feed resources is also required for effective planning and policy making. This study examines the demand for and supply of feed and fodder in the Haryana.

Objectives

The broad objectives of the study are as follows:

- To study the growth pattern of major livestock population.
- To estimate the area, production and productivity of major green and dry fodder crops.

- To assess feed and fodder availability and requirement, and estimate deficit/surplus to improve livestock productivity.

Methodology

The study mainly relied on primary data. It includes analyzing the demand for and supply of feed and fodder based on data collected from the field level through a sample survey method. The reference period of the study is 2018-19 agricultural year. The household survey covers the socio-economic characteristics of livestock farmers; availability, production and recommended practices of feed and fodder resources for their livestock.

To select districts for the study in the state of Haryana, first, the district wise livestock population is collected based on the size of the population of each type of livestock (Cattle, Buffalo, Sheep and Goats) and ranks are given to individual district. Further, the average of the obtained ranks of individual district is worked out. The districts having top three ranks were selected representing different regions of every covered state for the study. A total of 120 'Cattle' rearing farmers, 120 'Buffalo' rearing farmers and 120 'Sheep & Goat' rearing farmers were surveyed from selected top three districts, on combined basis, using a pre-tested questionnaire. The farmers surveyed from each district are closely 120, combining all livestock type. Further, the study villages are selected based on the density of the animal population.

Findings

Salient findings of the study are summarized as below:

- The livestock population in Haryana was remained stagnant during period 2007 to 2012 but it declined (-20%) during 2012 to 2019 period. This is largely contributed by decline in buffalos' population in recent period.
- The major fodder crops are jowar, berseem and barley. The by-product of wheat is used as dry fodder. The area under fodder crops in the kharif season is nearly one-fourth of the total area and this area is just 7% in the rabi season in the study districts.
- The constraints such as non-availability of the village grazing land and common village forest area; and limited land holding of farmers, specially for goat and sheep rearing farmers, restrict the use of more land under fodder crops. Hence, higher productively will be needed to overcome the shortage of green fodder in the selected districts.

- The low cost of growing fodder crops compared to non-fodder crops can provide a scope to increase productivity by investing more on inputs such as irrigation, fertilizer and other such practices for fodder cultivation.
- There is pre-existing water scarcity in dry land areas. Improved and water-saving water management practices will contribute in boosting yield of fodder crops.
- There is lack of awareness among farmers about the government's programmes on fodder cultivation practices. Most of the farmers, especially in the small and marginal categories are illiterate and have limited financial resources.
- Farmers are not practicing any post harvesting technique of fodder production and suffer with the shortage of dry fodder in off season. There is large scope to encourage farmers at individual or at social group levels by training programmes to follow such practices.

Policy Implications

- The research system needs to pay higher attention on developing high yielding varieties of fodder and state department to promote those for increasing fodder production.
- The cost of growing fodder crops is cheaper compared with that of other food crops, so farmers may be encouraged on putting more efforts and inputs on fodder cultivation. Since, the farmers have limited financial resources, they may be provided with subsidized inputs such as good quality seeds and other related inputs.
- There is an urgent need to encourage farmers to adopt post-harvest techniques. There is a need to launch some initiatives to conduct training programmes on post-harvest management techniques and expose farmers about such initiatives related to fodder cultivation so that the farmers can utilize efficient practices in limited land resources to get better gains.

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Chapter 1: Introduction

1.1 Background

The agriculture and livestock are complimentary enterprises for each other. Both pay important role in strengthening food and nutritional security and provide options for rural livelihood and employment opportunities. The available statistics reveal that India has the largest livestock population in the world, which is nearly one-fifth of the world's livestock population. The livestock sector in India contributes to about 29.63 percent of total agricultural output and 4.11 percent to the Gross Domestic Product (GDP). To support this huge livestock population, the country requires the proportional feed and fodder supply to meet the demand. The foreseen threats to make up for the demand of feed and fodder in the country are the limited land for their cultivation (nearly 4%) due to decline in pasturelands and shift in cropping pattern from coarse cereals to commercial crops. Coarse cereal residue is largely used as fodder in most parts of the country. The shortage is estimatedat nearly 28% to 35% in green fodder, 10% to 11% in dry fodder and 33% to 35% in concentrates (Niti Aayog (2018), World Bank (2011).

The associated problems with fodder cultivation which further affected their supply are - limited availability of good fodder varieties/hybrids, lack of quality seeds of improved varieties/hybrids, poor quality of dry fodder like paddy/wheat straw, lack of post-harvest management for surplus fodder and poor management of grazing/pasture lands and inadequate research, extension and manpower support (Ministry of Agriculture, 2011). The potential solutions to meet the demand forfeed and fodder are through raising productivity, utilizing untapped feed resources,expandingcroparea, increasing import, and improving the productivity of the cereal crops used as fodder.

1.2 Need of the Study

The livestock population in India, constitute by major livestock animals – buffalo, cattle, sheep and goats,has increased by 5.3% in 2019 compared to 2012 (*livestock Census, 2019*). At the same timegrowing consumers' nutritional awareness, preferences and changing lifestyle is reflected in terms of increasing demand for milk and other livestock products. The present status of feed and

fodder resources are not able to meet the emerging demand and remain unfulfilled. Assessment of livestock feed resources is also required for effective planning and policy making. The demand and supply of feed and fodder varies across states. This study examines the demandforand supply of feed and fodder in Haryana state.

1.3 Objectives

The broad objectives of the study are as follows:

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

1.4 Methodology

The study utilizes secondary as well as primary data. The secondary data on livestock population of all the selected states are compiled from different Quinquennial Livestock Censuses. The Census provides livestock population by region, species, sex, age, and purpose. The data on livestock population is collected from the Department of Animal Husbandry and Dairying, Government Indiafor different species/type viz., cattle, buffalo, sheep and goat as reported in the livestock census periods 2007, 2012 and 2019. Further, secondary data on the area under fodder is collected from various issues of Land Use Statistics and from publications on Area, Production and Yield from the Ministry of Agriculture and Farmers' Welfare.

The primary data analysis covers various aspects of the study which are not available in recent time from secondary data. It includes analyzing the demand for and supply of feed and fodder based on data collected from the field level through a sample survey method. The reference period of the study is 2018-19 agricultural year. The household survey covers the socio-economic characteristics of livestock farmers, availability, production and recommended practices of feed and fodder resources for their livestock.

Sampling Framework and study coverage

At the coordinated centre level, this study is conducted in the following states viz., Gujarat, Haryana, Karnataka, Kerala, Rajasthan, Uttar Pradesh and West Bengal by respective Agro-Economic Research Centers. The selection of states for conducting the study is as suggested by the Ministry of Animal Husbandry, Dairy and Fishery, Government of India. For the purpose, the study districts are selected based on the livestock population from the available secondary data. The proportionate sampling technique is applied to select the sample households in districts in selected states. In particular, The Agricultural Development and Rural Transformation Centre (ADRTC), Institute for Social and Economic Change (ISEC), Bangalore is the coordinator of this project. The Agricultural Economics Research Centre (AERC) Delhi is assigned to cover/conducted the field survey in Haryana state.

To select districts for the study in the state of Haryana, first, the district wise livestock population is collected. Based on the size of the population of each type of livestock (Cattle, Buffalo, Sheep and Goats), ranks are given to individual district. Further, the average of the obtained ranks of individual districtare worked out. The districts having top three ranks were selected representing different regions of every covered state for the study. In every covered state, total of 120 'Cattle' rearing farmers, 120 'Buffalo' rearing farmers and 120 'Sheep & Goat' rearing farmers were surveyed from selected top three districts, on combined basis, using a pre-tested questionnaire. The farmers surveyed from each district are 120 (or nearly cose to 120), combining all livestock type.

The number of farmers for the survey are selected based on the proportion of cattle, Buffalo and 'Sheep & Goat' population existing in particular district i.e. in selected districts of every state based on proportion population sample size. Further, the study villages are selected based on the density of the animal population. The details on this basically exists in the district animal husbandry department. The cattle rearing farmers includes both 'crossbreed' and 'indigenous' cows, bulls and oxen or calves. If the farmer rearing all kinds of animals, he/she is considered as more than one sample.

Based on the above sample selection approach, the AERC Delhi conducted the survey in three districts of Haryana state. The selected district list and sample size is reported in following Table 1.1.

Table 1. 1: Sample districts in the study state and sample size of livestock rearing farmers

AERC Centre	States	Districts/farmers->	Cattle	Buffalo	Goat & Sheep	Total
AERC, Delhi	Haryana	Bhiwani (south)	31	46	47	124
		Hisar (north)	38	44	33	115
		Sirsa (central)	51	30	39	120
		Subtotal	120	120	120	360

Note: The total farmers rearing each type of livestock are 120 (last row) but the total farmers in each district are not exactly but close to 120 (last column).

1.5 Review of literature

India has one of the largest livestock population in the world. One of its notable characteristics is that almost entire feed requirement is met from crop residues, by-products and grazing on common lands. The population of livestock is increasing remarkably but not able to meet their feed and fodder requirement. There have been some attempts to estimate the demand and supply of feed and fodder (deficit/surplus) for livestock in the country. In this section, we have reviewed some the important studies.

Niti Aayog (2018) in its latest report estimated a deficit of dry fodder (10%), concentrates (33%) and green fodder (35%). It reported that the deficit is likely to widen by 2020-21 due to crop diversification from cereals to commercial crops affecting the availability of crop residues. The insecurity on 'feed and fodder' is observed for the livestock population in the country due to limited land under fodder crops that is stagnated for last 25 years. The report proposes providing fodder seeds among dairy farmers and ensuring availability of green fodder locally in plenty and strengthening of farms for fodder seeds & fodder production. A USDA report by *Landes et. al. (2017)* also found the shortfalls in actual feed use at about 11% for dry fodders, 33% for green fodders, and 35% for feed concentrates. According to study, the use of concentrate feeds for dairy production is reported to be relatively small in India, with most concentrates fed to dairy animals consisting of mixes produced on farm using locally available ingredients. The study suggested that future production prospects depend heavily on productivity of gains, primarily through improved breeding and feeding practices, and demand for feeds. A *World Bank study (2011)* was conducted to assess Demand Led Transformation of the Livestock Sector in India. This study alsorevealed that the feed deficit problem persists. It was estimated that as a national average, there is an 11% shortfall in dry fodder, 28% in green fodder, and 35% in concentrates. Crop residues represent the

largest feed component, but tend to be low in nutritive value, the supply of roughages is inadequate and the use of concentrates remains low. The quality of Common Property Resources (CPRs) has also degraded due to overgrazing. Between 1960-61 and 2004-05 permanent pastures and grazing lands have squeezed by 25% and of barren and cultivable waste lands by 51%. The area under fodder crops in India has stagnated at about 8.5-9.0 million hectares during last 25 years and accounts for only about 4.6 percent of the total cultivated area. The report suggested that the strategies for addressing feed problems need more attention for the benefit of the poor livestock keepers.

Datta (2013) in his study also revealed that India faces a net deficit of 61.1% green fodder, 21.9% dry crop residues and 64% concentrate feeds. Also, the study finds that the quality of fodder is not healthy and does not meet the feeding standards. The author suggested that to make a proper balance, India has to fulfil the fodder deficit from all corners of fodder including dry crop residues and feed after utilizing uncultivated land, unexploited feed reserves and increasing fodder productivity in mass scale. A study on the present demand and supply of fodder production was also undertaken by *Kamardi et. al. (2017)* in different districts of Karnataka. The results revealed that most of the districts (12 out of total 29) have less vulnerability of fodder deficit and also act as surplus districts to fulfil the fodder requirement of other deficit districts of Karnataka while 8 and 9 districts out of 29 come under highly vulnerability and moderate vulnerability category respectively towards fodder shortfall. The authors recommended that the government has to improve the fodder production status in Karnataka by proper procurement, transportation, conservation and distribution of excess fodder to the deficit districts, organizing fodder banks to supply the seeds and root slips at reasonable rate in adequate quantity to the farmers. A similar study was also conducted by *Chand et. al. (2015)* where the authors estimated the district level availability and requirement of livestock feed and fodder in Rajasthan using secondary data. The results showed a deficit of feed and fodder of around 25% per annum in the state. Availability of dry fodder and concentrates were estimated using appropriate conversion ratios to different field crop production, while green fodder was estimated by applying per hectare yield to different fodder sources. The authors concluded that the feed deficiency was estimated almost in all the districts except few. The eastern and south eastern districts were deficit in green fodder whereas western and southern hill districts were deficit in dry fodder. The authors suggested policies to develop silvi-pastoral model, creation of fodder banks/ storage facilities, strengthening extension system.

Thirunavukkarasu et. al. (2011) in their study estimated the availability and requirement of dry fodder for bovines in Tamil Nadu with the help of grain-to-straw ratios. The study also reveals that there is a deficit in the availability and requirement of dry fodder in the State. All zones in the State showed only deficit status of dry fodder except the Western and North-eastern zones where the deficit of dry fodder is better than the State average, all the other zones extensively lacked in dry fodder availability.All the authors in their above mentioned studies estimated that India is facing a deficit of dry fodder, green fodder and concentrates. In India, only 4% of the total crop area is under fodder crops which found to be the major reason behind the deficit of feed and fodder. The estimates made in these studies are useful to compare and validate the future research findings.

There are few studies which attempt to calculate the estimates of dry fodder, green fodder and concentrates in the country through various conversion factors/ ratios/ methods/ techniques. *Dikshit and Birthal (2010)* estimated the feed consumption rates for different livestock species in 10 livestock regions of India by applying scale-up factors at the levels of village, district and region. The factors for conversion of dry matter (DM) from each source into total digestible nutrients (TDN) were taken as 0.534 for green fodder, 0.476 for dry fodder, and 0.780 for concentrate feed. The factors for conversion of DM from each source into crude protein (CP) were 0.073, 0.016 and 0.180 for green fodder, dry fodder and concentrate feed, respectively. By using these conversion factors, the paper founds that India's livestock consumed 757 million tonnes of green fodder, 466 million tonnes of dry fodder and 47 million tonnes of concentrates. According to the study, by 2020 India would require a total 526 million tonnes of dry matter, 855 million tonnes of green fodder, and 56 million tonnes of concentrate feed. *Suresh et. al. (2012)* calculated the demand and supply of feed and fodder resources by using a suitable extraction ratio, also called Residues to Product Ratio (RPR). The quantum of green fodder, dry fodder, and concentrate feed was converted into dry matter (DM) by applying a factor of 0.25 for green fodder, and 0.90 for dry fodder and concentrate feed. From the best fitting models, the study found that the current total dry matter (DM) availability in India was estimated to be 510.6 million tonnes comprising of 47.2 million tonnes from concentrates, 319.6 million tonnes from crop residues and 143.8 million tonnes from greens. The authors suggested that these estimates will help the decision makers to implement adaptation strategies to ensure sustainable livestock production. *Handbook of Agriculture (2005)* considered the major fodder crops like maize, sorghum, pearl millet, Egyptian clover, Lucerne, cluster bean, etc. The area under fodder crops was calculated to be 8.9 million ha,

and the fodder productivity was estimated by using the weighted average of 40.93 tonnes/ha, considering the minimum yield of each fodder crop. *Pandey (2011)* estimate forestry's contribution to livestock feed in Uttarakhand by using contingent valuation approach to estimate the value of tree leaves/fodder. It was found that the fodder comprises mostly of grasses and tree fodder. The average proportion of feed quantity consumed by livestock was found to be 58% from forests, 39% from other than forests and 3% from markets for hilly region. For hilly region, the proportion of economic value varies from 40– 41% for forest; 40– 41% for agriculture and 18–20% from market. The author recommended that Community forestland should be taken for the use of fuel and fodder need and the natural forestland should be kept as protected and reserved forest so that the stability of the terrain could be maintained.

Some of the studies conducted in the context of other countries which also reviewed the availability and supply of livestock feed and fodder resources and the gaps/shortages associated with it. The shortage was identified by *Samanta, Bokhtiar and Ali (2019)* in their study on Livestock feed and feeding practices in South Asia. According to them, the livestock of South Asia primarily relies on agricultural crop residues (straw and stovers), shrubs and tree leaves, roadside grasses, pastureland, kitchen wastes to meet the roughage requirement. It was found that very limited land is allocated for fodder production which causes a huge shortage of green fodder in most of the South Asian countries against the requirement. *Birhan and Adugna (2015)* conducted a theoretical review to understandthe existing animal feed resources availability and associated risks in Ethiopia. Natural pasture, crop residues and agro-industrial by products are found to be source of animal feed in Ethiopia. The authors found that natural grazing land become reduced due to fast growth of country's population. On the other hand, remaining uncultivated pasture land also reduced in forage production due to over grazing and reduction of soil fertility. It was concluded that the main feed resource is crop residue which is low quality high fibre content, low digestibility of roughages as a result the livestock productivity decreased due to malnutrition with reduction of disease resistance. Many constraints of livestock feed resources in the country were also observed such as poor quality and quantity, drought, ecological deterioration, over grazing, land tenure/change of ownership, border conflict, weed and bush encroachment, soil infertility and lack of seed and planting material. To improve quantity and the quality of the available feed resources authors suggested different strategies like biodiversity conservation, pasture rehabilitation, integration of pasture and forage into farming system, irrigation and batter grazing

land management. *Mutimura1 and Everson (2011)* also determined the availability of feed resources that was used by farmers in the dry and wet seasons in the two districts of Rwanda. Feed calendar development was used in the study in which feed types used by farmers each month of the year were identified. The authors used box plots for the comparison of median scores of different feed resources according to farmers' criteria. According to Feed calendar development, the results indicated that during the rainy season a wide range of forage options are available, with emphasis on Napier grass. However, in the dry season feed resources become scarce sometimes leading to death of cattle. The preference ranking confirmed that overall Napier grass with highest scores found to be the major fodder crop used throughout the two districts followed by some indigenous species and crop residues. The authors concluded that the availability of quality and quantity of feeds has shown a shortage of livestock feed resources in both districts of Rwanda. Although farmers identified thirteen and twenty-one feed resources in the two districts of Rwanda respectively, but their availability during the year was limited. *Lukuyu et. al. (2011)* assessed feeds and feeding practices and identified feed resources availability in four study sites of Kenya. It was found that farmers in almost all study sites commonly fed crop residues such as dry maize stover, bean haulms, sorghum and finger millet stovers and wheat straw. Low concentrate feeds use was reported in all study sites. In all surveyed sites, farmers reported low milk production and high milk prices during the dry season due to feed scarcity and low-quality feeds. The authors recommended that simple feed processing strategies and methods for feed storage will help to enhance utilization of crop residues and hence help to alleviate feed shortages. Introduction of small-scale feed conservation strategies such as tube silage and box baling of hay will also help to ease feed shortages. *Assouma et. al. (2018)* studied the assessment of fodder intake by livestock in semi-arid sub-Saharan Africa. They measured the intake and digestibility of the feed consumed by cattle, sheep and goats over a yearly cycle at a monthly time step. They observed the seasonal variations in diet digestibility were bigger for cattle than for sheep, and smaller for goats. The results also confirmed the decrease in feed intake from the wet to the dry season faced by cattle. The digestibility of the grazed feed also decreased from the wet to the dry season. This suggest many under developed countries are facing the shortages in the availability of feed resources/fodder crops. Such countries are attempting to manage the shortage and concerned about quality of feed being fed to animals, whereas India is lacking in this aspect. Various sources of animal feeds in other countries are also discussed.

Some research studies have been conducted on feed scarcity and its implications on livestock sector. *Birthal and Jha (2005)* identified various constraints and the magnitude of losses cause in dairy production in 9 states of India. It was found that, in 2002-03, dairy output equivalent to 26% of the attainable output was lost due to different constraints. Species-wise indigenous cows suffer the most with a reduction of 37.6% in its attainable output, followed by buffaloes and crossbred cows. Feed scarcity found to be most important constraint, and accounts for nearly half of the total losses in dairy production. In buffaloes 61% of the total loss is due to feed scarcity and other nutritional problems compared to 39% in indigenous cows and 36% in crossbred cows. The authors suggested that there is an urgent need to develop and disseminate the low-cost fodder technologies for enriching the quality, nutritive value and digestibility of the fodders. *NitiAayog (2018)* in itslatest report witnessed that milching animals' productivity reduces drastically due to lack of fodder, feed and drinking water. The overall productivity of dairy sector is low because of inadequate nutrition from green fodder, along with dry residue and protein concentrate. Further, the cost of fodder is increasing at a much faster rate than price of milk thereby reducing profitability. The report proposes- providing fodder seeds among dairy farmers at subsidies rate and fodder seed distribution as mini kits by seed producing agencies. A USDA study by *Landes et. al. (2017)* on India's diary sector predicted that India's future role as a trader in dairy products is uncertain. Annual growth in milk production and consumption has been a robust 4.2% since 2000. Average milk yields found to be well below according to both international standards and those achieved under domestic best practices. The study reveals that improved feeding of the dairy herd is likely to be a key to sustaining or enhancing growth in milk production. Domestic dairy price stability must also be a key priority, with policy facilitating either imports or exports depending on domestic market conditions. Similarly, a *World Bank study (2011)* also reveals that growth rate of milk production has slowed in recent years – from an average of 4.3 percent per annum in the 1990s to 3.8 percent per annum in the 2000s. The average milk yield of Indian cows is about 4 kg per day which is very low when compared to other major milk producing countries i.e. the average milk yield per cow is 7.8 Kg per day in China, and 25.6 kg per day in the US. The report suggested that the strategies for addressing feed problems need more attention for the benefit of the poor livestock keepers.

1.6 Chapter plan

Chapter 1 provides the brief background of the research study, its objectives, methodology and review of literature. The demographic details and social characteristics of sample households are presented in Chapter 2. Details on land holding and cropping pattern are presented in Chapter 3. The availability and requirement of fodder is discussed in Chapter 4. Classification of livestock and their fodder requirement are discussed in Chapter 5. Cost related factors for growing fodder and livestock rearing practices are elaborated in Chapter 6. Chapter 7 covers the perception of farmers on constraints in fodder cultivation and benefits received. Finally, the summary, conclusions and policy implications are provided in Chapter 8.

Chapter 2: Demographicand social characteristics of Sample Households

The chapterdeals with the demographic and social characteristics of the farmers based on the primary survey. The results of the surveyed districts are discussed. The general characteristics of the sample households summarised here include the caste composition, the qualified education level of respondent, main and secondary occupation, engagement of family members in different agricultural activities and the income level of the household. The outcomes are discussed below.

2.1 Demographic, caste and educational details

The primary data analysis highlights that the overall gender ratio in the surveyed districts is 851 females per 1000 males. In Hisar and Sirsa this is 875, and in Bhiwani the ratio is 813 among the adult population. Of the total population, nearly 54% are male and 46% are female. The average family size is nearly of 6 members per household.

The livestock rearing farmers in the study districts belong to 'Scheduled Caste' category (42%) followed by 'general' (33%) and 'Other Backward Classes' (25%) (Table 2.1). Most of these farmers are illiterate (nearly 44%) and nearly same proportion (43%) is of 'higher secondary' pass farmers. Only 4% of such farmers attained college level education. More demographic information about sample househlds are given in Appendix II – Table A.1 to Table A.5.

2.2 Occupational engagements of Sample households

The majority of the sample farmers are 'primarily' involved in either animal husbandry and dairying occupation (46%) or in agricultural activities (38%). Further, nearly two-third of the respondents (65%) are involved in 'animal husbandry' as secondary occupation, if they are not involved in this work as primary occupation. At the district level, the shares of 'animal husbandry' and 'agriculture' as 'primary' source of occupation in the study districts are nearly 45% and 42% in Hisar, 53% and 33% in Bhiwani and 39% and 40% in Sirsa, respectively.

These farmers usually have, on an average, at least 20 years of farming and dairying experience. Nearly 1.5 family member per household is engaged in dairying activities. This is followed by farming activities (one family member/household) and sheep & goat rearing (0.8

members/household). Mostly, engagement of females is observed more towards dairying related activities while male labourers are preferred to work as casual labours. This classification is nearly followed by each study district.

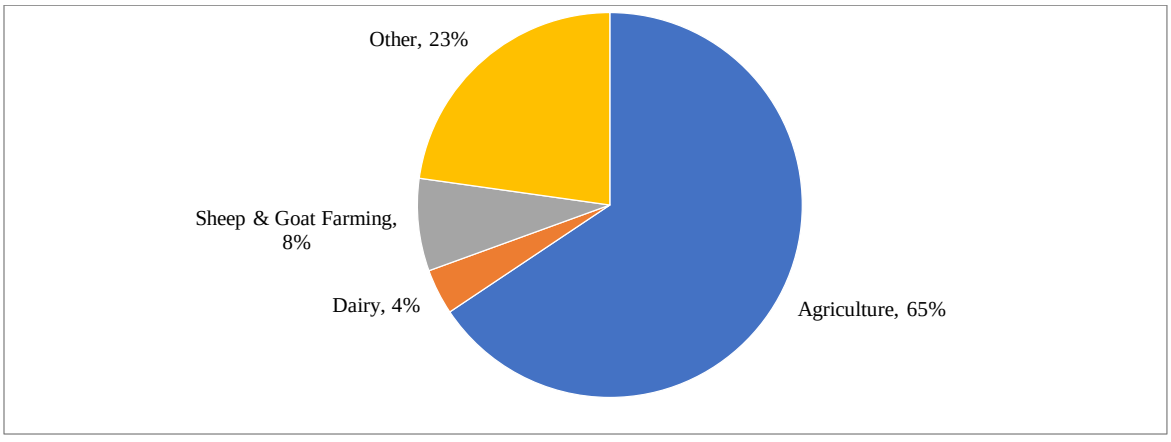
Table 2. 1: Key characterists of sample households

Caste composition		Education level		Occupational engagements (%)		
Caste	% share	Education	% share	Activities	Primary	Secondary
SC	42.3	Illiterate	43.9	Animal husb.& dairying	45.9	65.1
General	32.5	Higher Secondary	42.7	Agriculture	38.2	8.4
OBC	25.2	Primary	8.9	Nonfarm Labour	6.1	19.9
ST	0.0	College	3.7	Agri. Labour	3.7	3.0
Any other	0.0	Post- Graduation	0.8	Others	6.1	3.6

2.3 Average annual income of sample households

Overall, on an average, the farmers in surveyed districts receive about Rs.2 lakh per household per year from all agriculture and non-agriculture related activities. The major sources of the farmer's income are reported in the Figure 2.1. Among these farmers, the earning of the farmers from agricultural activities on per household basis is comparatively higher than those involve in such other activities. This is followed by earning from non-farm activities and sheep and goat farming. The earning from dairying is observed least among the famrers.

Figure 2. 1: Share of income from different sources - Overall



Chapter 3: Land use, cropping pattern and area under fodder crops

3.1 Land use pattern

The combined area under fodder crops in the three districts of Haryana is about 29% of net operated area in the study districts (Table 3.1). At the district level, the corresponding share of area under fodder crops in net operated area is about 43%, 33% and 21% in Hisar, Bhiwani and Sirsa, respectively. The livestock raring farmers in Sirsa having the larger land holding as compared to other two study districts. The entire net operated area available with the farmers is irrigated, except a small fraction of owned land in Bhiwani. Limited village grazing land is available in these districts; highest fraction is reported in Bhiwani (23%), followed by Hisar (6%), all such lands are mostly remains un-irrigated. None of the sample farmer confirmed about availability of any village land for agro forestry in the surveyed districts.

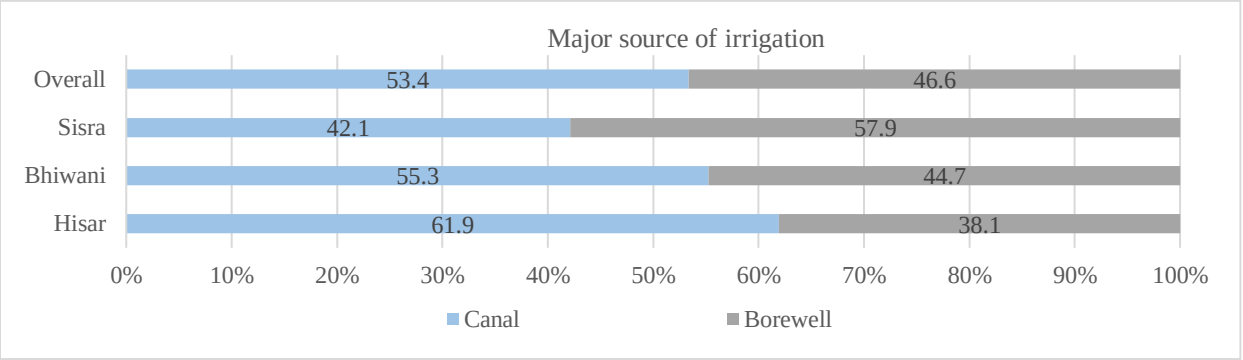
Table 3. 1: Land area record of the survey districts (in %)

Landholding type	Hisar	Bhiwani	Sisra	Overall
Owned	76.9	66.3	85.4	78.0
Leased in	23.4	40.9	15.4	24.5
Leased out	0.0	1.0	0.7	0.6
Uncultivated land	0.3	4.5	0.0	1.6
Net operated area	93.9	72.4	100.0	89.0
Area under Fodder crop	42.6	32.9	20.6	29.1
Village Grazing land	5.8	23.1	0.0	9.3
Village Agro forestry	0.0	0.0	0.0	0.0
Total land	100.0	100.0	100.0	100.0

Note: Net operated land is owned + leased in- leased out- uncultivated land. Total land is Net operated land + Village grazing land + Village agro forestry land. The share of area under fodder crop is from Net operated land. Village grazing land is all un-irrigated..

Canals and bore-wells are the major sources of irrigation in the study districts (Figure 3.1). Of the total respondents, majority of the farmers in Hisar and Bhiwani reported dependence on canal as a major source of irrigation, while in Sirsa, most of the respondents use bore-well as a preferred source of irrigation. Farmers also reported that due to less rain, the level of ground water is declining over time.

Figure 3. 1: Source of Irrigation (% respondents)



3.2 Cropping pattern in the survey districts

The farmers in the study districts grow cotton, paddy jowar, bajra and guar as major crops during kharif season (Table 3.2). Wheat, mustard and berseem are the important crops during rabi season. A very few farmers also grow sugarcane. The overall productivity of major staple crops, paddy and wheat, is nearly 19-20 quintal/acre. As the majority of farmers surveyed are involved in animal husbandry and dairying, theyprefer to grow the fodder cropsin some part of their land. The crops which are usually grown as fodder are jowar, berseem and barley. The by-product of wheat is used as dry fodder.

For the main food crops such as wheat and paddy, the returns are about 1.5 times of actual cost. The gains are about 100% for cotton, 216% for mustard and 82-84% for bajra and sugarcane of the actual cost of cultivation incurred. Limited response is received from the farmers on the returns from the fodder crops, as the selling of fodder is not a common practice among the surveyd farmers. The livestock rearing farmers usually grow the fodder crop in some part of the land for feeding time by time. Hence multiple cuttings are made on the same standing crop to get green fodder. Based on the response from the fodder growing farmers, the return from the fodder are comparatively high as compared to the other crops. This is manly contributed due to the low input cost of growing fodder compared to other food crops. Farmers receive nearly Rs. 24000 per acre (or Rs. 3000 per kanal) as a return from the jowar crop. The returns are nearly Rs. 25000 and Rs. 30000 from barley and berseem, respectively, on per acre basis. Despite being the profitable income source option, the farmers have limited land resources.

Table 3. 2: Cropping Pattern of sample households –All three districts

Name of crop	Area (%, season-wise)	Productivity (Qtl/acre)		Total cost/Acre (Rs.)	Total return/Acre (Rs.)
		Main Product	By-product		
Kharif/Rainy					
Paddy	30.7	19.6		20606	50978
Bajra	8.8	7.7		6828	12592
Cotton	40.9	6.6		15750	31924
Jowar	11.0	184.6		4066	24000
Guar	6.5	3.8		8464	11720
Chilly	0.3	30.0		20000	33000
Carrot	1.7	72.1		24905	58238
Rabi/Winter					
Wheat	75.2	19.2	18.4	13258	35387
Mustard	17.1	7.4		8856	27978
Berseem	6.1	166.2		4002	30000
Barley	0.59	13.6		6638.6	25000
Chilly	0.31	30.0		20000	33000
Carrot	0.16	60.0	4.0	30000	72000
Cauliflower	0.55	80.0	15.0	25000	80000
Perennials					
Sugarcane	100	250.0		43462	79231

Note: The 'main product' reported here is grain but if the whole product is only fodder, this is reported in the main product, i.e. in case of jowar, berseem etc. For the fodder crops, the green fodder production is considered as the by-product..The productivity of jowar and berseem is based on multi- cuts(up-to 4 cuts) per season. This applies to all the tables in this chapter.

Hisar

In Hisar, the major crops are cotton, bajra and jowar in kharif season and wheat, mustard and berseem in rabi season (Table 3.3). The area under paddy for surveyed farmers is comparatively very less. Sugarcane is also grown in small proportion among the farmers. A small number of farmers also grow cauliflower and barley in rabi season. Farmers get the by-products from wheat, cauliflower, jowar and barja crops, most of it is used as instant or dry fodder purpose. Among the three study districts, Hisar reported highest area under bajra crop (nearly half of the area of overall farmer's area reported). The average yield of most of the crops is reported nearly same as the overall average yield in the selected districts. For paddy and jowar, the average yield is comparably lower than the overall average of combining all three districts. The returns from crop are reported comparatively high for the fodder crops grown in both the seasons. The returns are nearly 2 to 3 times for rabi crops (specially, mustard, cauliflower and wheat). Whereas, the gain is about 70% for the kharif crops.

Table 3. 3: Cropping Pattern of sample households – Hisar

Name of crop	Area (%, season-wise)	Productivity (Qtl/acre)		Total cost/Acre (Rs.)	Total return/Acre (Rs.)
		Main Product	By-product		
Kharif/Rainy					
Paddy	3.6	11.5		15941	26732
Bajra	23.7	7.5		6729	11497
Cotton	51.5	5.8		14262	25367
Jowar	21.2	181.1		3930	24000
Rabi/Winter					
Wheat	64.9	17.9	17.0	10997	32808
Mustard	23.9	7.8		6952	27030
Berseem	8.9	176.4		3478	30000
Cauliflower	2.3	80.0	15.0	25000	80000
Perennials					
Sugarcane	100	250.0		35000	75000

Bhiwani

The highest area is reported under cotton, paddy, jowar and bajra in kharif season (Table 3.4). Wheat, mustard and berseem are important crops during the rabi season. Farmers reported 120-220% returns on cost incurred in rabi season and 57-138% returns in kharif season (with exception of guar). It is observed that farmers utilize by-products of vegetables as an instant green fodder along with the gain from the main produce. Like Hisar, some farmers grow cauliflower, in Bhiwani too, the carrot is grown by few farmers. Farmers in Bhiwani grow carrot with average yield of about 66 quintals per acres.

Table 3. 4: Cropping Pattern of sample households – Bhiwani

Name of crop	Area (%, season-wise)	Productivity (Qtl/acre)		Total cost/Acre (Rs.)	Total return/Acre (Rs.)
		Main Product	By-product		
Kharif/Rainy					
Paddy	27.0	14.8		17053	40547
Bajra	14.6	8.0		6932	13285
Cotton	36.8	4.6		13653	21405
Jowar	14.5	146.9		3809	24000
Guar	1.1	1.0		4000	3300
Carrot	6.0	72.1		24905	58238
Rabi/Winter					
Wheat	69.2	16.1	15.1	13389	29806
Mustard	20.2	6.9		9314	29961
Berseem	8.3	193.6		3437	30000
Barley	1.7	14		5000	25000
Carrot	0.6	60.0	4	30000	72000
Perennials					
Sugarcane	100	250.0		45000	80000

Sirsa

The farmers reported the highest net operated area in the district compare to other two study districts. The district holds a large share of area under cotton in the state, this reflected in the survey too. Cotton, paddy and guar are the major kharif crops (Table 3.5). In rabi, wheat is the single largest crop covers above 80% area. Mustard and berseem also hold decent area share in rabi.The returns from the fodder crops are comaparatively high due to low input costs. The returns are in range of 130-170% for the other major crops in both the season (cotton and paddy in kharif and wheat and mustard in rabi).

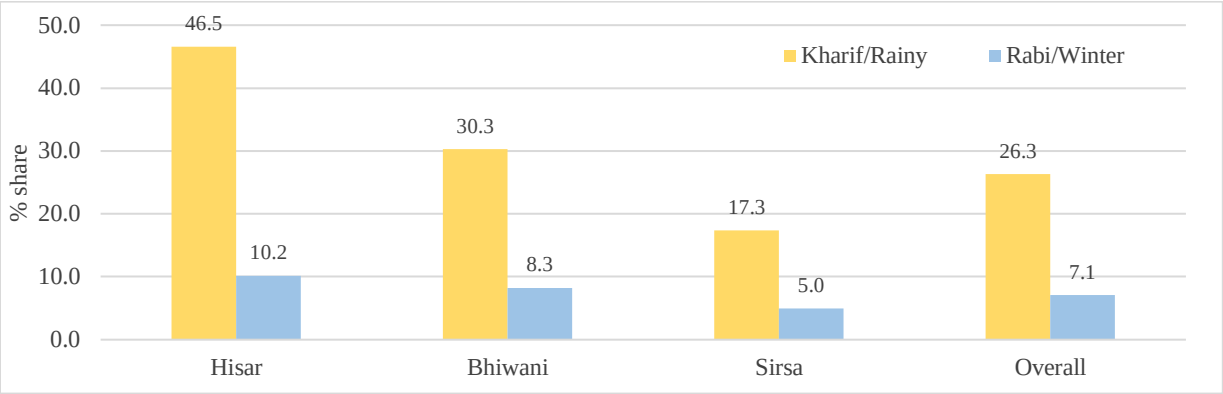
Table 3. 5: Cropping Pattern of sample households –Sirsa

Name of crop	Area (%, season-wise)	Productivity (Qtl/acre)		Total cost/Acre (Rs.)	Total return/Acre (Rs.)
		Main Product	By-product		
Kharif/Rainy					
Paddy	42.7	21.5		21975	55323
Bajra	0.2	8.0		7000	38500
Cotton	39.3	8.0		17538	40461
Jowar	5.3	212.2		4652	24000
Guar	11.9	3.9		8697	12160
Chilly	0.6	30.0		20000	33000
Rabi/Winter					
Wheat	83.5	21.0	20.4	14053	38915
Mustard	12.0	7.5		10272	27057
Berseem	3.6	154.0		5335	30000
Barley	0.24	12		5536.6	25000
Chilly	0.64	30.0		20000	33000

3.3 Area share (%) under fodder crops

The area under fodder crops in the kharif season is nearly 26% of the total area in the study districts (Figure 3.2). The area under fodder crops is just 7% in the rabi season. This is a common pattern of low area under fodder crops in rabi season compared to the kharif season. The fodder crops considered are the green fodder crops, in particular, in this section. The major fodder crops in the surveyed districts in the kharif season include jowar, bajra and guar, whereas, in the rabi season, these are berseem and barley.

Figure 3. 2: Area share (%) of fodder crops with respect to all crops



Chapter 4: Availability, requirement and shortage of fodder

4.1 Availability of feed and fodder (Supply)

Availability of feed and fodder on per animal basis

Availability of green fodder

The availability of 'greenfodder','dry fodder and concentrate' is calculated based on the primary data for three surveyed districts and also on combined basis. The production of green fodder is estimated through a potential production per unit hectare from the land classification data as estimated by the FAO (2012) and Ramachandra et al, (2007). The land utilization pattern data were classified into gross cropped area (GCA), forest area, cultivable wasteland, permanent pasture, other fallows and area under trees from which green fodder is available for livestock feeding. The availability of green forages is estimated as per the classifications and assumptions as suggested in the study proposal and as stated in FAO (2012) and Ramachandra et al, (2007). The green fodder availability is calculated using the following formula:

*Fodder availability from land use = Respective land use * Green fodder productivity (tones/ha/year)* ... *(1)*

The total green fodder availability from all the categories of classification is calculated by the following formula:

*Total Green fodder availability = (A*40.93) + (B*1.50) + (C*5.00) + (D*1.00) + (E*1.00) + (F*1.00) + (G*1.00)* ... *(2)*

where,

A = 'Area under fodder crop'

B = 'Forest area and on assumption that only 50% area was accessible for grazing'

C = 'Permanent pastures and other grazing lands'

D = 'Cultivable wastelands'

E = 'Current fallows'

F = 'Other fallows' and

G = 'Misc. Tree Crops and Groves not Included in Net Area Sown'

Based on the above equations (Eq. 1 and Eq. 2), the availability of green fodder is estimated for the study districts and at the combined level.

For measuring green fodder, only category 'A' (area under fodder crop) and 'C' (permanent pastures and other grazing lands) land resources are available in the study districts. The analysis suggests that the availability of 'green fodder' grown on land area (category 'A') is 5.14 tonnes/year/animal for the three study districts (Tables 4.1). The availability of 'green fodder' grown on permanent pastures and other grazing lands (category 'B') is estimated at 0.07 tonnes/year/animal from three districts. The availability of green fodder from 'land area' on per animal basis is calculated using only 'buffalo' and 'cattel' population. While the availability of green fodder from 'Pasture and other grazzing land' on per animal basis is calculated using only 'goat' and 'sheep' population. This is because the 'buffalo' and 'cattles' rearing farmers have not taken them for grazing in the study districts. On the other hand, 'goat' and 'sheep' rearing farmers prefer to take animals for grazing most often and feed the green fodder to such animals at home very rarely.

Table 4. 1: Availability of green fodder

Districts	Area under land-use category ('in Hectare)	Computed production of green fodder (Tonnes/year)	Computed production of green fodder (Tonnes/year/animal)
(A) Area under fodder crop (Productivity = 40.93 tones/ha/year)			
Three districts	84.2	3448.0	5.14
Bhiwani	27.3	1118.5	5.30
Hisar	27.9	1143.1	5.63
Sirsa	29.0	1186.4	4.62
C) Permanent pastures and other grazing lands (Productivity = 5 tones/ha/year)			
Three districts	30.4	151.8	0.07
Bhiwani	26.3	131.5	0.10
Hisar	4	20.2	0.02
Sirsa	N.A.	N.A.	N.A.

Source: Author's computation. Note: Green fodder productivity considered here is as reported in eq. 1 and eq. 2 above. For fodder crop this is 40.93 tones/ha/year and for permanent pastures and other grazing lands this is 5 tones/ha/year.

Availability of dry fodder

The quantum of available crop residues is often unable to be estimated directly, as it is seldom quantified. An attempt has been made to estimate the the availability of dry fodder and concentrates produced in the form of crop residues, oil cakes, grains, brans and chunnies using the conversion factor values of the 'harvest indices' and 'extraction rates'as suggested in the study proposal and as per FAO (2012), Ramachandra et al., (2007). The dry fodder and concentrates feed to the livestock from the crop production is calculated by using the following formulation:

$$\sum_{ij}(QCij)^{mn} = Yij * HIij \text{ or } ERij \quad \ldots (3)$$

where,

QCij, = Quantity of crop residues (dry fodder) and concentrates obtained from crop i in district j

Yij,= Yield of crop i in district j

HIij or ERij=Estimated conversion factor (harvest indices or extraction rate) for crop iin district j.

The conversion factors of 'harvest indices' and 'extraction rates' used to calculate the dry fodder are reported in Tabler 4.2.

Table 4. 2: Conversion factors of 'harvest indices' and 'extraction rates'

Conversion factors				
Crop	Harvest indices (HI)*		Extraction Rate(ER)	
	Crop residues	Oil Cakes	Grains	Brans and Chunnies
Jau	1.30		0.10	
Mustard		0.70	0.10	
Wheat	1.00		0.02	0.08
Sugarcane	0.25			
Bajra	2.50		0.05	
Guar	2.00		0.10	
Paddy	1.30		0.02	0.08

Source: Study proposal and FAO (2012), Ramachandra et al., (2007)

The total availability of dry fodder at district level and on combined basis for all three districts is calculated using the conversion factor values (Table 4.2) and using above formula (Eq. 3). The availability of 'dry fodder' estimated on combined basis from various dry fodder sources (crop residues, oil cakes, grains, brans and chunnies) is 1826.6 Tonnes/year and 2.72 Tonnes on per year per animal basis (Table 4.3). This suggest that the crop residues constitutes a major part in the total dry fodder availability. This is followed by 'brans and chunnies', 'oil cakes' and 'grains'. At the district level, Sirsa district contributes the largest share in the total dry fodder availability among the study districts. The availability of dry fodder on the 'per animal' basis is also observed highest in the district compared to the other two districts. Hisar reported the lowest yearly availability of dry fodder and also on 'per animal' basis.

Table 4. 3:Availability of dry fodderon ‘per year’ and ‘per year per animal’ basis

Districts	Crop residues	Oil Cakes	Grains	Brans and Chunnies	Total
Computed production of dry fodder (Tonnes/year)					
Three districts	1626.75	56.67	38.06	103.40	1824.87
Bhiwani	409.69	16.84	9.13	21.02	456.68
Hisar	249.20	20.02	7.56	14.62	291.40
Sirsa	967.86	19.81	21.37	67.75	1076.80
Computed production of dry fodder (Tonnes/year/animal)					
Three districts	2.42	0.08	0.06	0.15	2.72
Bhiwani	1.94	0.08	0.04	0.10	2.16
Hisar	1.23	0.10	0.04	0.07	1.44
Sirsa	3.77	0.08	0.08	0.26	4.19
Note- The harvest indices or extraction rate are assumed same in all the districts. The availability of dry fodder on per animal basis is calculated using only 'buffalo' and 'cattel' population due to the same reason as mentioned in the 'green fodder' calculation.					

Source: Author’s computation

Availability of feed and fodder on per hectare basis

The availability of ‘dry fodder and concentrate’ on per hectare basis is is also calculated for different fodder crops using Table 4.2 for each district and on combined basis for all three districts. The estimates ofquantities of crop residues and concentrates as dry fodder resources are reported in Table 4.4. For the three districts on combined basis, the quantity of crop residue and concentrate available from the different fodder crops is about 40.4 tonnes per year per hectare. Most of it is crop residue (above 92%), followed by oil cakes, grains and brans and chunnies. Broadly, seven types of feed/fodder resources are grown in the sampled districts. Paddy, sugarcane, wheat, bajra and barley are the major dry fodder sources. The district wise estimates of quantities of crop residue and concentrate are provided in Appendix V, Table A.16.

Table 4. 4: Availability of dry fodder and concentrate on per hectare basis – Three districts

District	Crop	Area (Ha.)	Sum of Main Product (Tonnes/Ha.)	Quantity of crop residues and concentrate (Tonnes/Ha./year)				
				Crop residues	Oil Cakes	Grains	Brans and Chunnies	Total availability
All three districts	Jau	1.52	3.36	4.37	0.00	0.34	0.00	4.70
	Mustard	44.23	1.83	0.00	1.28	0.18	0.00	1.46
	Wheat	194.56	4.73	4.73	0.00	0.09	0.38	5.21
	Sugarcane	5.26	61.75	15.44	0.00	0.00	0.00	15.44
	Bajra	22.01	1.90	4.76	0.00	0.10	0.00	4.85
	Guar/others	16.32	0.93	1.85	0.00	0.09	0.00	1.95
	Paddy	76.72	4.84	6.29	0.00	0.10	0.39	6.78
	All crops	360.62	4.88	37.44	1.28	0.90	0.77	40.39

Source: Author’s computation.

4.2 Requirement of feed and fodder (Demand)

Attempt is made to estimate the demand for feed and fodder from the primary data utilizing the livestock population and their per day consumption in different stages of life, species, age and gender of the animal. Since, the precise information is directly available from the livestock raring farmers (from field survey) about the daily fodder requirement of animals in different age-groups and based on their life-stages (milch, dry heifers etc.), hence, a direct method to measure the demand is utilised by multiplying the 'number of animals' in any specific category (animal type, life stage, age and gender) with the per day consumption of different fodders by livestock.

Finally the requirement of fodder as tonnes per year per animal is estimated by converting the daily consumption into yearly requirement. The yearly demand is calculated by considering a tentative 4 months (122 days) of 'dry fodder' requirement and 8 months (243 days) of 'green fodder and concentrate' requirement. The four months (122 days) during summer season are assumed as the peak months of dry fodder requirement. The green fodder and concentrates are assumed as required for eight months (243 days). Though, there is no particular period/season to feed concentrate but it balances the nutrient deficiency during shortage of fodder as well as majorly required for milch animals throughout the year. This assumption, is considered while computing demand, is based on field experience and response of farmers on feed and fodder requirement.

At the overall level, the requirement of green fodder is estimated about 11.16 tonnes per year per animal (Table 4.5). This is the total requirement generated on combined basis from each category of livestock. Similarly, the dry fodder and concentrate requirement on combined basis is estimated at 7.19 tonnes per year per animal. The requirement of green fodder by livestock type is nearly stable from 3.16 tonnes to 3.33 tonnes on per year basis for cattle and buffalos. The requirement of green fodder for goat and sheep is about 0.55 to 0.88 tonnes per year per animal, respectively. The fodder requirement on per day basis for each category of animal and based on the life-stages and age-group wise for each category of animals are reported in Chapter 5, section 5.3 in details.

The age group based fodder requirement of the livestock is estimated across livestock type. The age group categories are for animals of i) less than one year, ii) one to two years and iii) more than two years of age. Across all the livestock categories – buffalo, crossbreed cattle and indigenious cattle, the requirement is as usual highest for the age group 'more than two years'.

This is followed by animals in 'one to two years' and 'less than one year', respectively. The green fodder requirement varies from lower age to higher age animals from 1.2 to 3.3 tonnes per year per animal for buffaloes, 1.3 to 3.2 tonnes per year per animal for crossbreed cattle and 1.3 to 3.1 tonnes per year per animal for indigenious cattle (Table 4.6).

Similar trend is observed for the requirement of dry fodder and concentrates. The dry fodder requirement, as animal grows, varies from 0.3 to 1.7 tonnes per year per animal for buffaloes, 0.6 to 1.5 tonnes per year per animal for crossbreed cattle and 0.5 to 1.3 tonnes per year per animal for indigenious cattle (Table 4.7). The requirement of concentrates is also followed nearly similar trend as of the requirement of the dry fodder to different categories of animals (Table 4.8).

The requirement of 'green fodder' and 'dry fodder and concentrates' for different age groups of sheep and goats are reported in Table 4.9 and Table 4.10. Limited number of respeoses are received about the home fed fodder consumption patterns for goat and sheep. Farmers take this category of livestock for grazing for whole day, close to 8 hours per day. The green fodder requirement on per year per animal basis is ranging from 0.36 to 1.1 tonnes per year per animal for male and female sheeps, while this is ranging from 0.35 to 0.84 for the goats. In case of goat, the requirement of green fodder is observed high for the animals in the age group of one to two years, as compared to the older age animals of 'more than two years of age'. This may be due to the economic gain seeked by the farmers to sell a healthy animal in lower age up-to two years.

Table 4. 5: Requirement per animal of fodder by type and by livestock– Three districts

Livestock type	Requirement (in Tonnes/year/animal)			
	Green fodder	Dry fodder	Concentrates	Dry fodder and concentrates
Buffaloes	3.33	1.24	0.90	2.14
Crossbreed cattle	3.23	1.28	0.92	2.20
Indegenous cattle	3.16	1.05	0.98	2.03
Sheep	0.88	0.32	0.06	0.38
Goats	0.55	0.23	0.20	0.44
Requirement - All animals	11.16	4.12	3.07	7.19
Requirement - buffalo & cattle	9.72	3.56	2.81	6.37
Requirement - Sheep & goat	1.43	0.56	0.26	0.82

*Note: *Requirement is calculated considering a tentative 4 months (122 days) of 'dry fodder' requirement and 8 months (243 days) of 'green fodder and concentrate' requirement.This applies to all the tables in this section.*

Table 4. 6: Requirement per animalof green fodder for livestock by age-group– Three districts

Green fodder requirement (Tonnes/year/animal)			
Age of animal	Buffaloes	Crossbreed cattle	Indigenous cattle
Less than 1 year	1.239	1.312	1.312
1 to 2 years	2.892	3.086	2.552
More than 2 years	4.423	3.937	4.058
All age groups	3.330	3.235	3.157

Table 4. 7: Requirement per animal of dry fodder for livestock by age-group– Three districts

Dry fodder requirement (Tonnes/year/animal)			
Age of animal	Buffaloes	Crossbreed cattle	Indigenous cattle
Less than 1 year	0.342	0.610	0.464
1 to 2 years	1.135	1.269	0.830
More than 2 years	1.671	1.513	1.342
All age groups	1.236	1.280	1.046

Table 4. 8: Requirement per animal of concentrate for livestock by age-group– Three districts

Concentrates requirement (Tonnes/year/animal)			
Age of animal	Buffaloes	Crossbreed cattle	Indigenous cattle
Less than 1 year	0.170	0.177	0.316
1 to 2 years	0.680	0.885	0.875
More than 2 years	1.312	1.183	1.264
All age groups	0.903	0.919	0.984

Table 4. 9: Requirement per animalof green fodder for sheep and goats– Three districts

Green fodder requirement (Tonnes/year/animal)					
Age of animal	Gender	Sheep		Goat	
		Grazing (hrs/day)	Green fodder	Grazing (hrs/day)	Green fodder
Less than 1 year	Male	7.98	0.365	7.87	0.367
	Female	7.97	0.462	7.87	0.355
1 to 2 years	Male	8.00	0.729	8.62	0.839
	Female	8.20	0.642	7.67	0.722
More than 2 years	Male	7.89	1.103	7.93	0.583
	Female	7.90	1.101	7.83	0.590
All age groups and gender		7.99	0.880	7.97	0.554

Table 4. 10: Requirement per animalof dry fodder and concentrate for sheep and goats– Three districts

Dry fodder and concentrate requirement (Tonnes/year/animal)					
Age of animal	Gender	Sheep		Goat	
		Dry fodder	Concentrate	Dry fodder	Concentrate
Less than 1 year	Male	0.170		0.085	0.134
	Female	0.152	0.061	0.120	0.141
1 to 2 years	Male	0.349		0.157	0.267
	Female	0.231	0.061	0.185	0.170
More than 2 years	Male	0.394	0.061	0.290	0.243
	Female	0.407	0.061	0.290	0.233
All age groups and gender		0.323	0.323	0.057	0.233

4.3 Shortage of fodder

Finally, the shortage of the fodder is computed in the selected districts using the following formula:

$$Shortage\ of\ fodder = \frac{(Requirement\ of\ fodder - Availability\ of\ fodder)}{Requirement\ of\ fodder} * 100 \quad \ldots (4)$$

The analysis suggests that there is a shortage of the green fodder by nearly 26.6 % in the selected districts (Table 4.11). This is about 1252 tonnes per year. The deficit of dry fodder and concentrate is estimated even higher, nearly 35.3%. Overall, in the selected districts the shortage of all types of fodder is computed about 30%, this is nearly 2249 tonnes on per year basis.

Table 4. 11: Computed shortage of green fodder, dry fodder and concentrates (Tonnes/year)

Fodder type	Availability (Supply)	Requirement (Demand)	Shortage	Shortage (%)
Green fodder	3448.0	4700.6	1252.6	26.6
Dry fodder residue and concentrate	1824.9	2821.0	996.2	35.3
Combined	5272.9	7521.7	2248.8	29.9

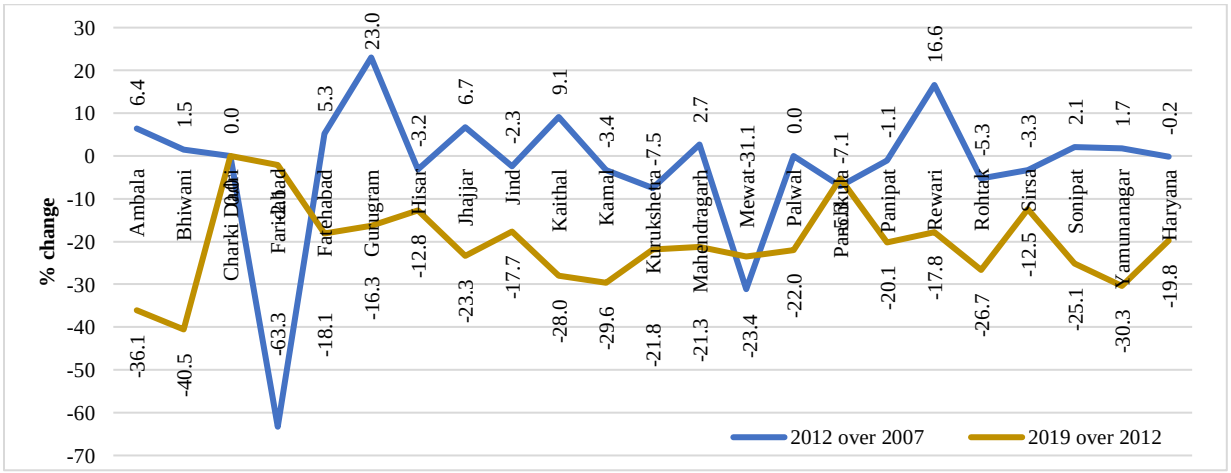
Note: Availability and requirement are calculated as per the field survey based outcome. Availability is based on various factors such as – Area under fodder crop, green fodder yield estimates from previous studies, conversion factors (for harvest indices and extraction rates) estimates from previous studie. Daily requirements are converted in to yearly requirement considering a tentative 4 months (122 days) of 'dry fodder' requirement, and 8 months (243 days) of 'green fodder and concentrate' requirement.

Chapter 5: Classification of livestock and fodder requirement

5.1 Overview of classification of livestock in Haryana

Haryana contribute nearly 1.3% livestock population (2019 livestock census) to the country but constitute nearly 8% of country's land area under fodder crops (2015-16, LUS database, MoA). Further, the state reported about 4% share of total buffalo population and 1.9 % share of total crossbreed cattle population in the country. The highest share in the total livestock is of buffaloes, contributing nearly 63% of total state's livestock population. Goat and sheep population is only about5% in the states. This is concentrated to the dry and hot agro-climatic zone districts, broadly in western and southern Haryana. The overall livestock population in Haryana was remained stagnant (-0.2% growth) during period 2007 to 2012 but it declined by nearly -20% during 2012 to 2019 period. This is largely contributed by decline in buffalos' population (-28%) in recent period (Figure 5.1).

Figure 5. 1: Comparative growth in livestock population - districts of Haryana



5.2 Classification of livestock in Haryana: analysis based on primary data

5.2 Classification of livestock based on age

Overall, of the total livestock reared in the selected districts by the farmers, about 10.5% are buffalo and 5.9% are cattle (of which 47% are crossbreed cattle and 53% are indigenous cattle). Overall, of the total goat and sheep population (which is about 83.6% of total livestock population

in terms of numbers, combined), 54% are sheep 46% are goats. Nearly 62% of the livestock animals (all type combined together) are of age over 2 years, 23% are in age less than 1 year and nearly 15% are in the age group of 1-2 years (Table 5.1).

At district level, the livestock animals of age over 2 years are reported highest in Bhiwani (72%), followed by Sirsa (62%) and Hisar (48%) (Table 5.1). In Bhiwani and Hisar, the share of crossbreed cattle in 'above 2 years of age' is reported 75% and 91%. Similarly, the share of goats in 'above 2 years of age' is reported highest in Bhiwani (84%) and Sirsa (69%). The results also suggest that on an average, each buffalo rearing farmer have 3.43 buffalos, each cattle rearing farmer have 1.91 cattle (including both type of cattle) and each goat and sheep (both, together) rearing farmer have 28.1 numbers of such animals. So, the average holding of a particular type of animal among the sampled farmers is lowest for cattle, followed by buffalos and is reported highest for goat &sheep.

Table 5. 1: Classification of livestock of the sample households based on their age (%)

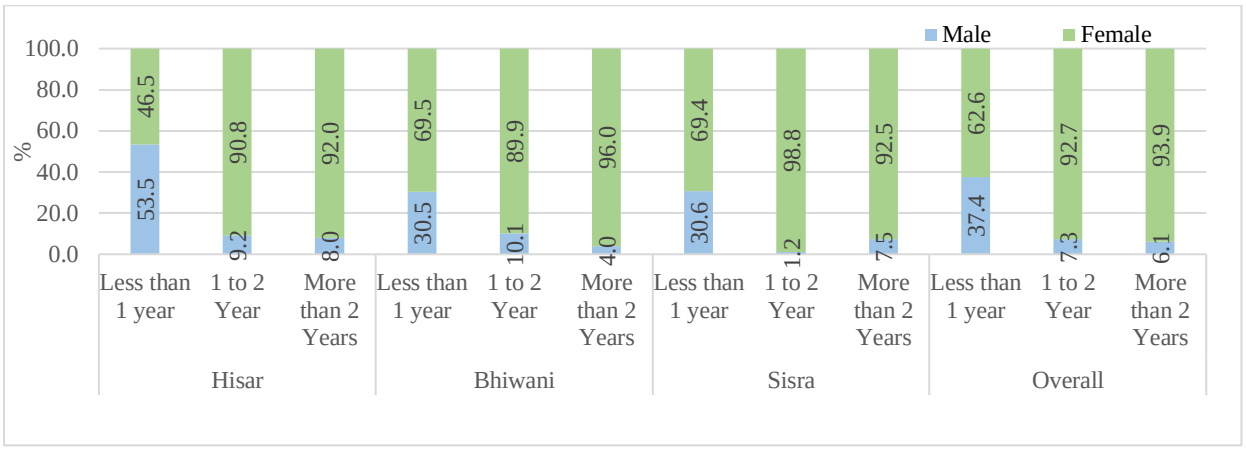
Districts	Age group	Buffalo	Crossbred Cattle	Indigenous cattle	Sheep	Goat	Livestock
Hisar	Less than 1 year	16.7	12.5	17.1	20.6	33.7	26.7
	1to 2 Year	20.3	12.5	17.1	31.7	24.5	25.5
	More than 2 Years	63.0	75.0	65.9	47.7	41.7	47.9
Bhiwani	Less than 1 year	23.8	4.8	19.1	21.0	9.6	17.2
	1to 2 Year	23.8	4.8	29.8	10.5	6.8	11.1
	More than 2 Years	52.4	90.5	51.1	68.4	83.6	71.7
Sisra	Less than 1 year	31.8	29.0	22.5	27.4	25.6	27.2
	1to 2 Year	18.9	23.2	25.0	11.1	5.4	10.8
	More than 2 Years	49.3	47.8	52.5	61.5	69.0	62.0
Overall	Less than 1 year	24.2	21.1	19.5	23.5	23.4	23.4
	1to 2 Year	21.0	17.5	24.2	14.2	12.7	14.7
	More than 2 Years	54.8	61.4	56.3	62.3	63.9	61.9

Classification based on age and gender

The results suggests that the sampled farmers in the selected districtsusually keep adult female (above 2 years) livestock to rare. Overall, at the combined basis of three study districts, the farmers reported raring 94% of livestock of above 2 years of age as female (Figure 5.2). Nearly 98 % of buffalos, 94 % of crossbreed cattle, 86 % of indigenous cattle, 94 % of goat and sheep are females in the 'above 2 years' age group (Table 5.2). The situation is different for the lower age groups of livestock. Overall, the proportion is about 37% male livestock and 63% female livestock in the lowest age bracket (below 1 year or age). The farmers rare about half proportion of male

buffalo and cattle in the age group of less than 1 year. This tendency also applies to the goat and sheep raring farmers, as nearly 45 % of goat and 26 % of sheep are male. These goat and sheep raring farmers usually deal in calves and sale most of the calf before they attain age of 2 years. Between age 1 to 2 years, the highest percentage of males are reared of indigenous cattle and buffalos. This brings us a tendency of farmers that they usually rare both (male and female) calves of livestock when they are in early age but for the longer period of time they prefer to keep the female livestock for milk and to grow livestock population. They also keep few males in the group for reproduction purpose.

Figure 5. 2: Age and gender based classification – All livestock



At the district level too, similar trend is observed. Farmer in Hisar, Bhiwani and Sirsa prefer to keep female livestock of the age group 2 years and above. At the overall level, across all type of livestock, the minimum share of female livestock population in the age group of "above 2 years" is 86.3% (for indigenous cattle). At the district level, the proportion of male-female population in 'less than 1 year' bracket is about 30%-70% for Bhiwani and Sirsa. This proportion is about 54%-46% (male-female) in Hisar. The detailed information on gender and age distribution of livestock for different category are reported in Table 5.2. Farmers keep the young and adult males (mostly cattle and buffaloes) for future use such as for cart transportation to carry agricultural produce, grains, fodder and other necessary things; and for livestock reproduction purpose.

Table 5. 2: *Age and gender based classification – by livestocktype*

Districts	Age group	Buffalo		Crossbred Cattle		Indigenous cattle		Sheep		Goat	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Hisar	Less than 1 year	56.5	43.5	33.3	66.7	71.4	28.6	20.6	79.4	63.7	36.3
	1 to 2 Year	28.6	71.4	0.0	100.0	42.9	57.1	1.0	99.0	9.4	90.6
	More than 2 Years	1.1	98.9	16.7	83.3	29.6	70.4	8.2	91.8	7.2	92.8
Bhiwani	Less than 1 year	44.1	55.9	0.0	100.0	66.7	33.3	29.4	70.6	18.8	81.3
	1 to 2 Year	11.8	88.2	0.0	100.0	42.9	57.1	8.2	91.8	0.0	100.0
	More than 2 Years	1.3	98.7	0.0	100.0	8.3	91.7	4.9	95.1	3.3	96.7
Sisra	Less than 1 year	53.2	46.8	60.0	40.0	22.2	77.8	24.9	75.1	27.3	72.7
	1 to 2 Year	7.1	92.9	0.0	100.0	0.0	100.0	0.0	100.0	0.0	100.0
	More than 2 Years	4.1	95.9	3.0	97.0	0.0	100.0	5.8	94.2	11.2	88.8
Overall	Less than 1 year	51.0	49.0	54.2	45.8	52.0	48.0	26.0	74.0	44.9	55.1
	1 to 2 Year	15.6	84.4	0.0	100.0	30.0	70.0	3.0	97.0	6.5	93.5
	More than 2 Years	2.1	97.9	5.7	94.3	13.7	86.3	5.7	94.3	7.0	93.0

5.3 Fodder requirement for the livestock

The average feed and fodder requirement for different categories (type) of livestock is worked out on per day per animal basis according to their life stages (i.e. the type of operation in which the animal is involve in) and their age. The different stages of life such as - heifer pregnant, heifer non-pregnant, milch and dry categories are covered for livestock in this analysis. Another criteria is the age of the animal i.e. less than one year, one to two years and more than of two years age. For sheep and goats, the main criteria is focused on age and gender.

Overall, the highest green fodder requirement is observed for the buffaloes, followed by crossbreed cattle and reported least for the indigenous cattle. The same trend follows for the consumption of dry fodder. The concentrates are consumed more by buffaloes, followed by indigenous cattle and crossbreed cattle. Broadly, nearly 9 kg to 19 kg of green fodder and 5 kg to 15 kg of dry fodder is consumed by bovine category of livestock (buffaloes, indigenous cattle and crossbreed cattle) varies by different stages (i.e. heifer pregnant, heifer non-pregnant, milch and dry). The fodder and concentrate demand is observed high for the milch animals and least for the non-pregnant heifers. These bovine livestock are not being taken for grazing purpose. This is basically because of unavailability of grazing land in the covered districts. Contrary to this, farmers take sheep and goats for grazing most of the time in a year. The average grazing period is reported about 7 to 8 hours a day. Some farmers also feed green and dry fodder to sheep and goats up-to nearly 3 kg a day.

This is observed that the requirement of dry fodder is concentrated to the period (nearly 4-5 months during winter to summer period) when the green fodder is not available at all. The farmers left with no option other than the dry fodder and concentrate to feed the animals. Very few farmers are observed following the post-harvest management of fodder for future use. Most of them either use the direct by-product of food-grains (wheat) as dry fodder or buy from the market or from other farmers. Most of the sheep and goat raring farmers are those who have very less land or they are landless farmers. Usually, the farmers in the dry belt districts of Haryana rare the sheep and goats.

Buffalos

The analysis suggests that the highest requirement of food is observed for the milching buffalos, followed by dry, heifer pregnant and heifer non-pregnant buffalos. The buffaloes consume nearly 9.4 kg to 19 kg of green fodder and about 7 kg to 14 kg of dry fodder, (Table 5.3). The lowest quantities of green and dry fodder are required for Heifer non-pregnant and highest quantity are for the mulching buffaloes. The requirement of concentrates varies from 2.1 kg to 5.9 kg on per animal per day basis. The supplement is required nearly 1 ml to 15 ml on per day basis. The requirement of fodder is observed higher for adult buffaloes (greater than 2 year), followed by buffalos of age 1 to 2 years, and least for the calves (of less than 1 year). The supplements are usually consumed by milch and adult buffalos. Buffalos were not being taken for grazing in any of the study districts.

The prices of different feed and fodder are confirmed with the farmers. At the combined level, farmers purchased the green fodder at an average price Rs. 482 per quintal. The prices of dry fodder isreportedhigher than that of the green fodder, average purchase price is Rs. 770 per quintal. The prices of concentrate is about Rs. 2854 per quintal. The supplements are costlier, though served in very small quantity in each diet. Its prices is nearly Rs. 116 per kg.

The district level details on fodder requirement and the cost details are reported in Appendix III, Tables A.6 to A.10.

Table 5. 3: Average feed and fodder requirement for buffalo (in Kg. per day per animal)

Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Milching	18.9	14.1	5.9	0.014
Dry	16.4	11.3	4.1	0.002
Heifer Pregnant	15.2	13.0	3.6	0.002
Heifer non-pregnant	9.4	7.1	2.1	0.001
Less than 1 year	5.1	2.8	0.7	n.a.
1 to 2 Year	11.9	9.3	2.8	0.001
More than 2 Years	18.2	13.7	5.4	0.011
Average feed and fodder prices (Rs./Qtl.)	481.9	769.6	2854.1	11639.3

Crossbreed cattle

The average consumption of green fodder by crossbreed cattle (including all types i.e. heifer pregnant, heifer non-pregnant, milch and dry) is ranging from 9.4 kg to 17.6 kg (Table 5.4). Crossbreed cattle consumes about 8 kg to 13 kg of dry fodder and about 2.5 kg to 5.5 kg of concentrates. This is the requirement on per animal per day basis. The highest requirement of fodder observed in adult cattle (older than 2 year) followed by the cattle of age 1 to 2 years old. Supplements were not provided to/consumed by calves and heifer non pregnant. This is mostly consumed by adult cattle, especially milching cattle. These cattle are not being taken for grazing. This is because of unavailability of grazing land in the covered districts.

The average prices of green fodder is nearly Rs. 534 per quintal. The prices of dry fodder iscomparatively high, about Rs. 712 per quintal. The prices of concentrate and supplement is nearly Rs. 2661 per quintal and Rs. 128 per kg, respectively.

Table 5. 4: Average feed and fodder requirement for crossbreed cattle (in Kg. per day per animal)

Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Milching	16.7	13.0	5.5	0.013
Dry	17.6	11.2	5.1	0.004
Heifer Pregnant	14.0	12.4	4.1	0.008
Heifer non-pregnant	9.4	7.9	2.5	n.a.
Less than 1 year	5.4	5.0	0.7	n.a.
1 to 2 Year	12.7	10.4	3.6	0.002
More than 2 Years	16.2	12.4	4.9	0.010
Average feed and fodder prices (Rs./Qtl.)	534.1	712.5	2661.2	12841.4

Indigenous cattle

The average consumption of fodder by indigenous cattle (including all types i.e. milch, dry, heifer pregnant and heifer non-pregnant) is ranging from 9.3 kg to 16.1kg (green fodder) and from 6.4 kg to 11.1 kg (dry fodder) on per animal per day basis (Table 5.5). Such cattle consume 3.4 kg

to 5.7 kg of concentrates in a day. The supplements are consumed by adult milch cattle. The highest requirement of fodder (both green and dry) observed in adult indigenous cattle. No such cattle in any category is being taken for grazing.

The price of green fodder and dry fodder are nearly Rs. 503 per quintal and Rs. 704 per quintal, respectively. The concentrate is purchased at price Rs. 2720 per quintal and supplement at price nearly Rs. 119 per kg.

Table 5. 5: Average feed and fodder requirement for Indigenous cattle (in Kg. per day per animal)

Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Milching	16.1	11.1	5.7	0.041
Dry	13.3	11.1	5.0	n.a.
Heifer Pregnant	14.7	10.7	3.7	n.a.
Heifer non-pregnant	9.3	6.4	3.4	n.a.
Less than 1 year	5.4	3.8	1.3	n.a.
1 to 2 Year	10.5	6.8	3.6	n.a.
More than 2 Years	16.7	11.0	5.2	0.015
Average feed and fodder prices (Rs./Qtl.)	502.6	704.1	2720.4	11919.7

Sheep

Usually, the farmer take the sheep and goats for grazing but sometimes they feed at the home when they can't take them out in the field. Some among the sheep and goat rearing farmers also feed at home even they take the animals for grazing. The requirement of fodder for sheep and goat is based on sampled farmers who are feeding their animal at home. The average consumption of green fodder for elder sheep (of age more than 2 years) is nearly 4.5 kg per day, followed by sheep in age group 1 to 2 years (nearly 2.6 to 3 kg per day) (Table 5.6). The green fodder requirement to lamb is about 1.5 to 1.9 kg per day. There is not much difference in consumption of green fodder for male and female sheep. The consumption of dry fodder is comparatively less than that of green fodder. The requirement on per day basis is nearly 1.2 to 1.5 kg for lambs, 1.9 to 2.9 for sheep of 1 to 2 years of age and nearly 3.4 kg for sheep of more than 2 years of age. Farmers usually do not feed concentrates and supplements to the sheep, but some farmers feed nearly 0.25 kg of concentrate to sheep on per day per animal basis. The price of green fodder and dry fodder is nearly Rs. 536 per quintal and Rs. 458 per quintal. The same of concentrate and supplement is nearly Rs. 4000 per quintal and Rs. 120 per kg. respectively. The average grazing period is about8 hours a day.

Table 5. 6: Average feed and fodder requirement for sheep (per day per animal)

Particulars	Gender	Green fodder	Dry fodder	Concentrates	Supplements	Grazing (hrs/day)
Less than 1 year	Male	1.5	1.4	n.a.	n.a.	8.0
	Female	1.9	1.2	0.25	n.a.	8.0
1 to 2 Year	Male	3.0	2.9	n.a.	n.a.	8.0
	Female	2.6	1.9	0.25	n.a.	8.2
More than 2 Years	Male	4.5	3.2	0.25	0.01	7.9
	Female	4.5	3.3	0.25	0.01	7.9
Avg. feed and fodder prices (Rs./Qtl.)		535.7	457.9	4000.0	12000.0	n.a.

Goats

The average consumption of green fodder for goats in age group 1 to 2 years is nearly 3 to 3.5 kg per day, followed by elder goats (of age more than 2 years) nearly 2.4 kg per day) (Table 5.7). Young goats (of age less than 1 year) consume 1.5 kg of green fodder per day. There is not much difference in consumption of green fodder for male and female goats. The consumption of dry fodder is comparatively less than that of green fodder. The requirement on per day basis is nearly 0.7 to 1 kg for young goats, 1.2 to 1.5 for goats of 1 to 2 years of age and nearly 3.2 to 3.5 kg for goats of more than 2 years of age. Farmers feed nearly 0.6 kg to 1.1 kg of concentrate to the goats on per day per animal basis. Farmers usually do not feed supplements to the goats except some farmers feed to female goats. The average price of green fodder is nearly Rs. 478 per quintal. The price of dry fodder is Rs. 577 per quintal. The same of concentrate is nearly Rs. 2082 per quintal. The average grazing period is reported of nearly 7 to 8 hours a day.

Table 5. 7: Average feed and fodder requirement for goats (per day per animal)

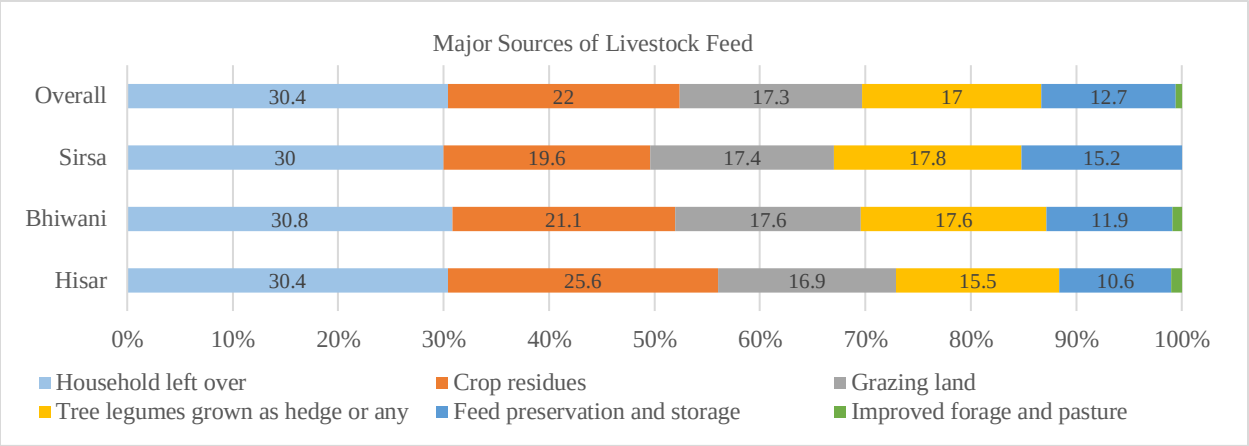
Particulars	Gender	Green fodder	Dry fodder	Concentrates	Supplements	Grazing (hrs/day)
Less than 1 year	Male	1.5	0.7	0.55	n.a.	7.9
	Female	1.5	1.0	0.58	n.a.	7.9
1 to 2 Year	Male	3.5	1.3	1.10	n.a.	8.6
	Female	3.0	1.5	0.70	0.03	7.7
More than 2 Years	Male	2.4	2.4	1.00	n.a.	7.9
	Female	2.4	2.4	0.96	0.03	7.8
Avg. feed and fodder prices (Rs./Qtl.)		478.0	577.2	2081.9	13000.0	n.a.

5.4 Major sources of livestock feed

Farmers were asked about the major source of feed they generally use. They reported multiple responses, as there may be more than one source of livestock feed for a particular farmer.

Overall, majority of farmers reported they feed their animals through household left over (30.4%) (Figure 5.3). This is followed by crop residue (22%), grazing lands (17.3%)tree legumes grown as hedge or any (17%), feed preservation and storage (12.7%). A negligible response is reported for improved forage and pastures as a source of livestock feed. Sampled farmers reported that the crop residue used as feeding stuff for animals It comprise mainly straws which the farmers store when crop is harvested and use it as dry fodder during the period when green fodder is not available. Grazing land is major source of feed for sheep and goats. It help such livestock raring farmers because they usually have either no agricultural land or very limited land, hence their livelihood largely depends on grazing the livestock.

Figure 5. 3: Major Sources of Livestock Feed



Chapter 6: Economics of fodder cultivation and livestock rearing

Various economic aspects of growing the fodder crops and rearing the livestock animals are discussed in this chapter. These includes – cost of growing fodder crops; cost of feed and fodder fed to the livestock; shelter cost and labour, veterinary and maintenance cost. The average value of the animals by type and the returns received from selling the livestock and their associated by-products are also discussed.

6.1 Cost of growing green fodder crops

At the overall level, the cost of growing fodder crops is varying from Rs. 4927 per acre in rabi season to Rs. 6083 per acre in kharif season. This is closely one-third of the cost of producing all 'other' non-fodder crops (such as food, commercial, oilseeds and other such non-fodder crops) combindly, on per acre basis. The cost of growing jowar and barseem is nearly Rs. 4000 per acre and that of growing barley is about Rs. 6600 on per acre basis. The survey farmers receive comparatively good retuns attributed to to the low input cost involve but the trading (selling/buying) of fodder is not common among the livestock rearing farmers, especially among the farmers who have own land resources and also rearing livestock. The share of costs incurred in growing fodder crops, as compare to the cost of growing all 'other' crops, together, is about 34% to 39% in kharif and rabi seasons, respectively (Table 6.1). This cost share with respect to the 'other' crops is slightly higher in rabi season as compared to the cost of growing fodder in kharif.

Table 6. 1: Average cost of growing green fodder and its comparison with other crops (Rs./Acre)

District	Season	Total cost/Acre (Rs.)		Cost ratio ofgrowing green foddercrops to all 'other' crops on per acre basis
		All fodder crops	All 'other'crops	
Hisar	Kharif	5409	14371.2	37.6
	Rabi	3648	10287.9	35.5
Bhiwani	Kharif	5326	15930.8	33.4
	Rabi	5539	12342.4	44.9
Sirsa	Kharif	7446	19849.9	37.5
	Rabi	5655	13585.6	41.6
Overall	Kharif	6083	18003.7	33.8
	Rabi	4927	12492.4	39.4

The farmers, usually, do not follow any post harvesting techniques of fodder production. Most of the surveyed farmers depend on the dry fodder as the by-product extracted during

harvesting of wheat. This dry extract is produced in almost equal amount (yield per acre) as the main product (the wheat grains).

6.2 Cost of feed and fodder fed to livestock

The cost of different types of feed and fodder on per animal per day basis is worked out for different categories of livestock and according to i) their life stages (i.e. milch, dry, heifer pregnant or heifer non-pregnant) and ii) their age (i.e. less than one year, one to two years, more than two years). The cost is observed high for buffalo and crossbreed cattle.

Across the type of livestock, the cost is comparatively high for buffaloes and crossbreed cattle as compared to the indigenious cattle (Figure 6.1). In most of the categories, the cost of fodder fed to 'milch' animals observed highest among life stages. There is no clear cost comparision of the fodder fed to 'dry' and 'heifer pregnant'. The cost is comparatively low for 'heifer non-pregnant' as compared to other three life stages of life. The similar cost trends are observed for the 'dry fodder and concentrates fed to different categories of livestocks based on their life stages (Figure 6.2 and Figure 6.3). Age of the animal also affects the cost of fodder. There is a clear outcome that the fodder cost increases as the age of the livestock increases. This applies to all type of livestock – buffaloes, crossbreed and indigeneous cattle (Figure 6.4, Figure 6.5 and Figure 6.6). The cost of each of the fodder components (i.e. green fodder, dry fodder, concentrates and supplements) is also reported in Table 6.2 to Table 6.4). The cost of feed and fodder fed to sheep and goat is reported in Table 6.5 and Table 6.6, respectively.

Based on the life stages of livestock, the cost of green fodder is varying from Rs. 45 to Rs. 95 on per day per animal for livestock (buffaloes and cattle). Similarly, the cost of dry fodder is varying from Rs. 47 to Rs. 104 on per day per animal. The variation in per day cost of concentrates is observed high for different stages of livestock, as compared to other inputs fed. Farmers usually offer high doses of concentrates to the mulching animals and very less or no doses to the non-pregnant heifers. The cost of concentrates is varying from Rs. 58 to Rs. 176 on per day per animal basis. In most of the cases, supplements are provided to the mulching animals or to the adult females. The cost associated with the supplements is negligible as compared to the cost of other components of feed.

The livestock are not consuming each of the component of feed and fodder on continuous basis throughout the year. This is, rather, based on the seasonal availability of fodder (dry is used

when there is shortage of green fodder, in summers). The districts level tables are reported in the Appendix IV, Table A.11 to Table A.15.

Figure 6. 1: Cost of green fodder based on life stages (Rs./day/animal)

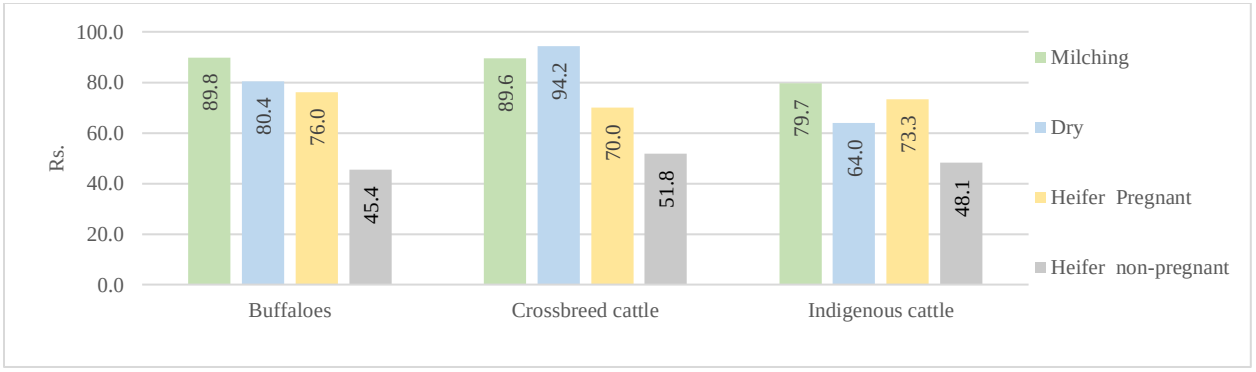


Figure 6. 2: Cost of dry fodder based on life stages (Rs./day/animal)

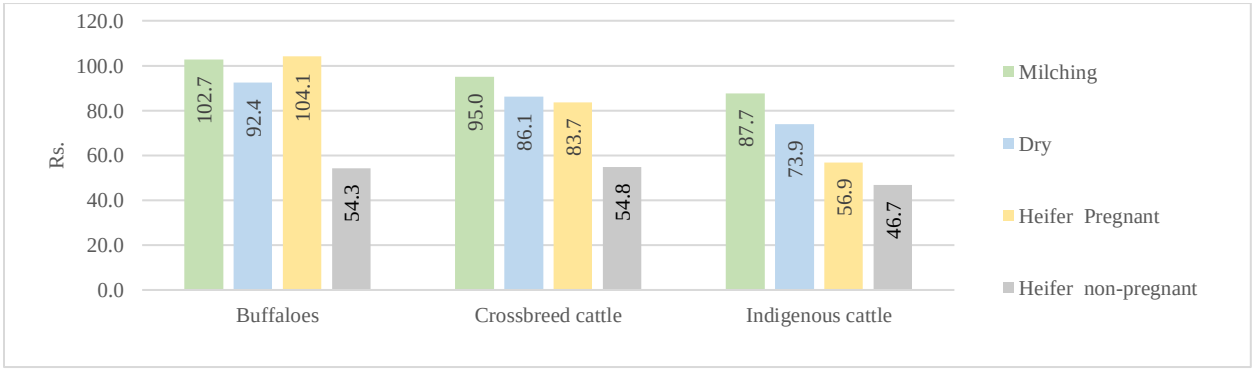


Figure 6. 3: Cost of concentrate based on life stages (Rs./day/animal)

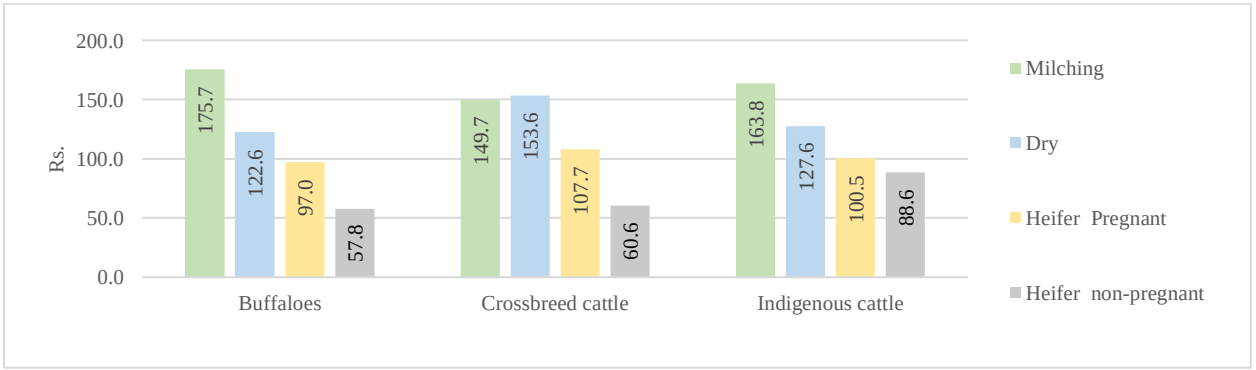


Figure 6. 4: Cost of green fodder based on livestock age (Rs./day/animal)

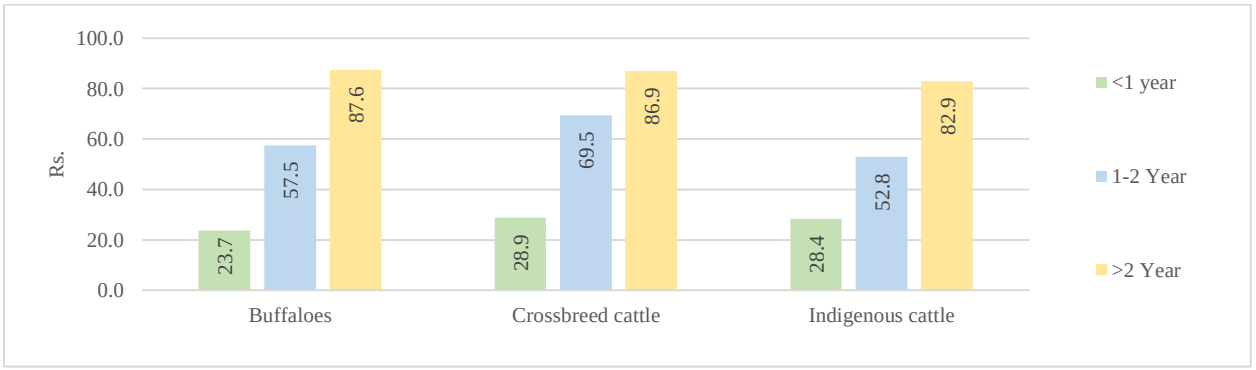


Figure 6. 5: Cost of dry fodder based on livestock age (Rs./day/animal)

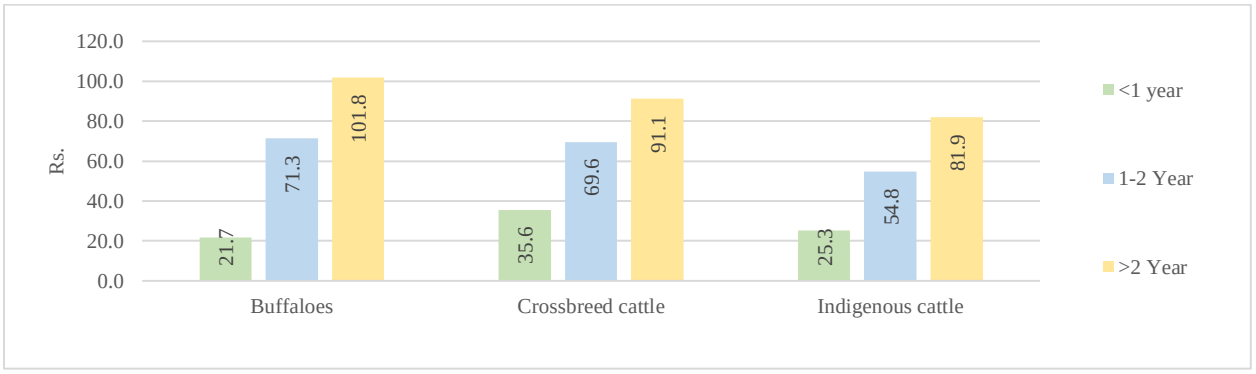


Figure 6. 6: Cost of concentrate based on livestock age (Rs./day/animal)

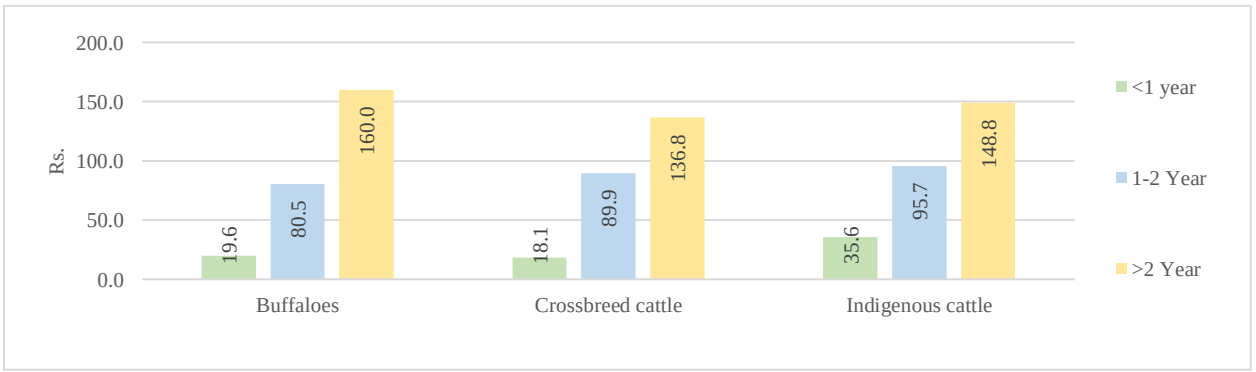


Table 6. 2: Average cost of feed and fodder for Buffalo (per day per animal)

Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Milching	89.8	102.7	175.7	1.7
Dry	80.4	92.4	122.6	0.3
Heifer Pregnant	76.0	104.1	97.0	0.2
Heifer non-pregnant	45.4	54.3	57.8	0.1
Less than 1 year	23.7	21.7	19.6	
1 to 2 Year	57.5	71.3	80.5	0.1
More than 2 Years	87.6	101.8	160.0	1.3

Table 6. 3: Average cost of feed and fodder for crossbreed cattle (per day per animal)

Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Milching	89.6	95.0	149.7	1.6
Dry	94.2	86.1	153.6	0.4
Heifer Pregnant	70.0	83.7	107.7	1.1
Heifer non-pregnant	51.8	54.8	60.6	
Less than 1 year	28.9	35.6	18.1	
1 to 2 Year	69.5	69.6	89.9	0.3
More than 2 Years	86.9	91.1	136.8	1.2

Table 6. 4: Average cost of feed and fodder for Indigeneous cattle (per day per animal)

Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Milching	79.7	87.7	163.8	4.7
Dry	64.0	73.9	127.6	
Heifer Pregnant	73.3	56.9	100.5	
Heifer non-pregnant	48.1	46.7	88.6	
Less than 1 year	28.4	25.3	35.6	
1 to 2 Year	52.8	54.8	95.7	
More than 2 Years	82.9	81.9	148.8	1.8

Table 6. 5: Average cost of feed and fodder for sheep (per day per animal)

Particulars	Gender	Green fodder	Dry fodder	Concentrates	Supplements
Less than 1 year	Male	8.0	6.8		
	Female	10.2	5.7	10.0	
1 to 2 Year	Male	16.1	12.7		
	Female	14.2	8.4	10.0	
More than 2 Years	Male	24.3	15.7	10.0	1.2
	Female	24.3	15.6	10.0	1.2

Table 6. 6: Average cost of feed and fodder for goat (per day per animal)

Particulars	Gender	Green fodder	Dry fodder	Concentrates	Supplements
Less than 1 year	Male	7.0	4.0	13.1	
	Female	6.7	5.6	13.6	
1 to 2 Year	Male	17.6	7.4	19.1	
	Female	15.1	9.3	12.2	3.9
More than 2 Years	Male	11.1	12.3	21.5	
	Female	11.3	13.1	20.6	3.9

6.3 Cost of livestock sheds and fodder storages

Cattle sheds

Cattle shed considered here is for buffaloes, and cattle (crossbreed and indigenious), combined. Overall, nearly 38% of the total reported farmers have 'pucca' (brick/cement walls with proper roofing facility) cattle shed with an average construction value of Rs. 105929 (Table 6.7). About 22% of the farmers have 'kaccha' (no stable boundaries and roofing facility) cattle shed with average constructed value Rs. 23469. Nearly 40% of the farmers have 'mixed' (brick/cement walls but no proper roofing facility, or vice-versa) cattle shed with average constructed value Rs. 56500. The farmers having 'pucca' cattle shed, accomodates on an average 4.1 animal per shed. This ratio is about 3.1 animal per cattle shed for 'kaccha' structure and about 4.4 animal per cattle shed for 'mixed' structure of sheds.

On an average, nearly 4.1 buffalo and cattle are accommodated in the 'pucca' cattle shed on per household basis. Similarly, 3.1 such category animals are accommodated in the 'kaccha' shed and 4.4 animals are accommodated in the 'mixed' shed on per household basis.

Sheep and goat sheds

Nearly 68% of the sheep and goat raring farmers have kaccha shed with average constructed value Rs. 6279 (Table 6.7). This is followed by mixed shed (nearly 26% farmers reported this) with average constructed value Rs. 37629. The cost is comparatively high due to bigger size of shed structure. The farmers usually have large number of such livestock. Only 6% of farmers reported havingpucca shed with average constructed value Rs. 25000. It is evident that majority of goat and sheep rearing farmers generally do not have any pucca shed for sheep and goats (only 6% farmers). Usually these farmers do not have much economically sound background and also do not have much land resources. Their financial situation even does not allow them to prepare a pucca house. For the farmers having the existing shed structures to accommodate goat and sheeps, the ratio of accommodating animals per shed are nearly 36.0, 23.7 and 37.7 animals per shed for 'pucca', 'kaccha' and 'mixed' structures, respectively.

On an average, nearly 36 goat and sheep are accommodated in the 'pucca' cattle shed on per household basis. Similarly, 23.7 such category animals are accommodated in the 'kaccha' shed and 37.7 animals are accommodated in the 'mixed' shed on per household basis.

The surveyed farmers store the fodder (green and dry) either in the livestock shed they have or in any separate storage room in their house. Mostly, the farmers with pucca sheds, they store the fodder in the same place where the animal stay. But the farmers have no such structures, prefer to store fodder at own house. The farmers rare bovine livestock, usually require a separate room to store the bulk of the dry fodder. Green fodder is not require the large and permanent storage as they get it from field when they need. The sheep and goat rearing farmers usually do not deal with green fodder as they feed such animals by grazing, but for dry fodder the farmers need some storage facility. In case, they do not have any such arrangements, they cover the dry fodder with 'tripals' in the open area near the kaccha shed they have or near peripheral areas of the house.

Table 6. 7: Details about cattle shed

Districts	Sheds for	Pucca		Kachcha		Mixed	
		No. of farmers (%)	Value (Rs)	No. of farmers (%)	Value (Rs)	No. of farmers (%)	Value (Rs)
Hisar	Cattle	51.1	90783	25.5	47700	23.4	65556
	Sheep and Goat	14.3	26667	65.7	6767	20.0	49714
Bhiwani	Cattle	40.5	134938	11.9	5200	47.6	61000
	Sheep and Goat	n.a.	n.a.	66.0	4340	34.0	42233
Sisra	Cattle	26.2	99118	26.2	14588	47.7	50968
	Sheep and Goat	5.0	22500	72.5	8591	22.5	20556
Overall	Cattle	37.7	105929	22.1	23469	40.3	56500
	Sheep and Goat	5.7	25000	68.0	6279	26.2	37629

Note: The percentage of farmers is calculated with respect to all type of sheds, combindly.

6.4 Cost of labour, veterinary and maintenance

The male laborers are usually hired to take care of livestock. On an average 6.5 hours to 8 hours per day were spent by these laborers for this. The reported farmers spent on an average Rs. 300/day for buffalo raring, Rs. 390/day for crossbreed cattle raring and Rs. 444/day for goat raring per year as expenditure on laborer's salary (Table 6.8).

The expenditure on veterinary cost is reported highest for buffalo raring i.e. nearly Rs. 4216 per year (Table 6.9). This is followed by costs spent on indigenous cattle (Rs. 2749), crossbreed cattle (Rs. 1917), goat (Rs. 1804) and sheep (Rs. 1742) on per year basis.

At the district level, theannual veterinary cost for buffalo is higher in Sirsa (Rs. 6980). Similarly, the veterinary cost of sheep and goat rearing is reported high in Hisar as compared to Bhiwani and Sirsadistricts. The annual maintenance cost includes cost of equipment, electricity,

water charges and other such expenses. This is observed highest for goat rearing (Rs. 2153), followed by buffalo rearing (Rs. 1610), Indigenous cattle rearing (Rs. 1246), crossbreed cattle rearing (Rs. 733) and sheep rearing (Rs. 687).

Table 6. 8: Labourcosts – All three districts

Labour use and cost	Buffalo	Crossbred Cattle	Indigenous cattle	Sheep	Goat
Labor use	5.3 animal/labour	1.5 animal/labour	n.a.	n.a.	47.3 animal/labour,
Labor cost (Rs/day/labour)	Rs. 300	Rs. 390	n.a.	n.a.	Rs. 444

Note: Only male labourers are reported in the selected districts.Hours are converted to 8 hours per day.

Table 6. 9: Veterinary and maintenance costs - All three districts

Veterinary and maintenance costs	Buffalo	Crossbred Cattle	Indigenous cattle	Sheep	Goat
Veterinary Cost (Rs/year)	4216.3	1916.7	2748.6	1742.1	1804.2
Maintenance cost (Rs/year)	1610.4	732.7	1245.5	686.8	2153.1
Any other cost (Rs/year)	200	166.7	425	480	225

Note: Maintenance cost includes Equipment, electricity and water charges etc.

Chapter 7: Perception of livestock rearing farmers

7.1 Constraints faced by farmers

Farmers were asked about their perception on various issues related to constraints faced in cultivating fodder crops, awareness and adoption of post-harvest techniques of fodder production, benefits received from the government related to fodder and livestock production and their suggestions to improve production of fodder related crops.

As high as 84% sample household responded 'limited land holding'as the major constraint. Due to small size of land for cultivation farmers are unable to allocate more area under fodder production (Figure 7.1). This is followed by 'non-availability of adequate irrigation water'(54% respondents). There can be more than one constraints associated with a particular farmer. High cost of fodder cultivation and low returns; and lack of awareness of government's programmes on various subsidies are other important constraints that farmers faces.

At the district level, in addition to the above constraints, farmer faced –unsuitability of land for fodder production, low pricesprevail for green fodder in market (Hisar and Sirsa);high cost of fodder seed (Sirsa); poor livestock extension services; and lack of awareness on production and post-harvest techniques (Bhiwani) (Table 7.1). At overall level, just 10% of farmers feel that the fodder cultivation is a laborious work.

Figure 7. 1: Constraints faced by farmers (%) - All districts

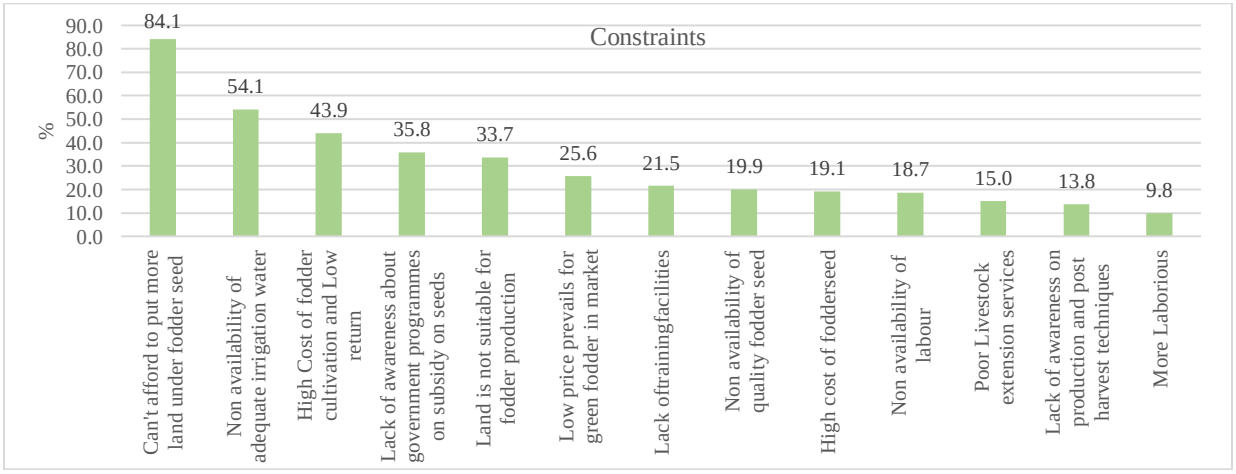


Table 7. 1: Constraints faced by farmers (%) - district level

Constraints	Hisar	Bhiwani	Sirsa
Small size of land holding	89.5	83.3	80.0
Inadequate availability of irrigation water	71.1	55.6	36.3
High cost of cultivation and low return from fodder production	27.6	40.0	63.8
Lack of awareness about government programmes	35.5	36.7	35.0
Unsuitable land for fodder production	42.1	17.8	43.8
Low price prevails for green fodder	31.6	13.3	33.8
Lack of training facilities	23.7	13.3	28.8
No provision of quality seed by society on credit&non availability of quality fodder seed	22.4	14.4	23.8
High cost of fodder seed	21.1	7.8	30.0
Non availability of labour	22.4	15.6	18.8
Poor livestock extension services	10.5	22.2	11.3
Lack of awareness on production and post-harvest techniques	9.2	16.7	15.0
More Laborious	14.5	12.2	2.5

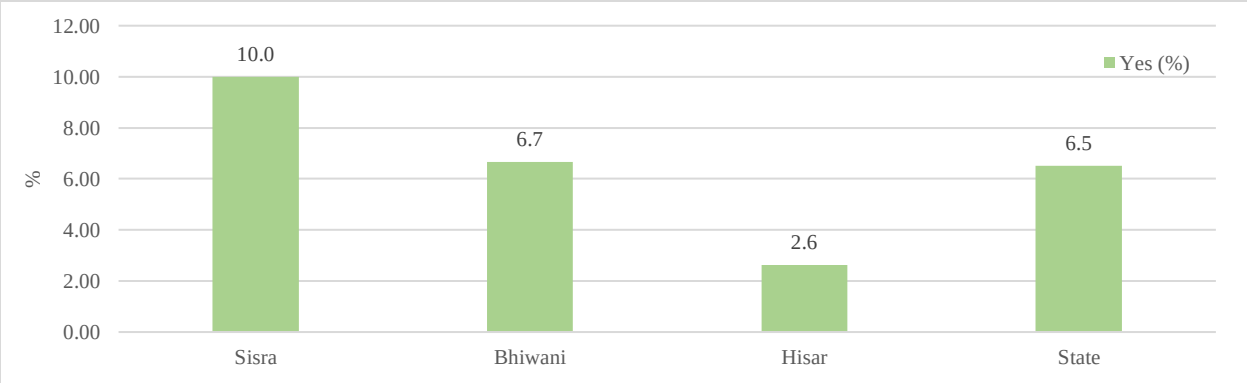
Note: The reported problem is occurring in farmer's response, irrespective of its rank.

7.2 Post-harvest techniques adopted

It is observed that the livestock rearing farmers have comparatively less land holding and the earning of few households among themis completely depends on a small patch of land (especially sheep and goat rearing farmers). These farmers rarely adopted (or capable to adopt) the post-harvest techniques. On overall basis, nearly 6-7% of farmers adopted such practices (Figure 7.2). Lack of proper such training facilities and awareness of farmers on such events are major constraint that directly impact farmer's choice to adoptsuchpost-harvest techniques.

At the district level, out of total sampled farmers, only 10% from Sirsa, 6.7% from Bhiwaniandjust 2.6% farmers from Hisarreported, adopted any post-harvest techniques.

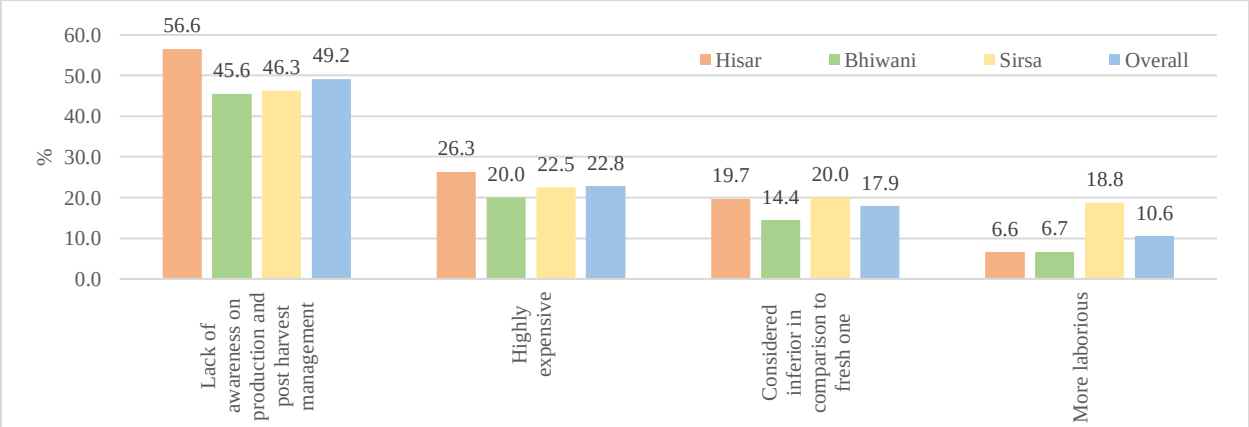
Figure 7.2: Farmers adopted post-harvest techniques (%)



The major reason for not adopting the post-harvest techniques is lack of awareness on production and post-harvest management. Nearly half of the surveyed farmers (49%) reported this (Figure 7.3). This reason is followed by 'high cost ofsuch techniques' (23%), and inferior in comparison to fresh fodder (18%).

At the district level too, nearly similar pattern is followed in reporting reasons for not adopting the post-harvest techniques. Lack of awareness on production and post-harvest management is the main reason, highest reporting fraction of farmers is from Hisar (nearly 57% farmers reported this). About 19% of the farmers in Sirsa consider the post-harvest techniques as laborious practice.

Figure 7. 3: Reason for not adopting any post-harvest techniques (%)

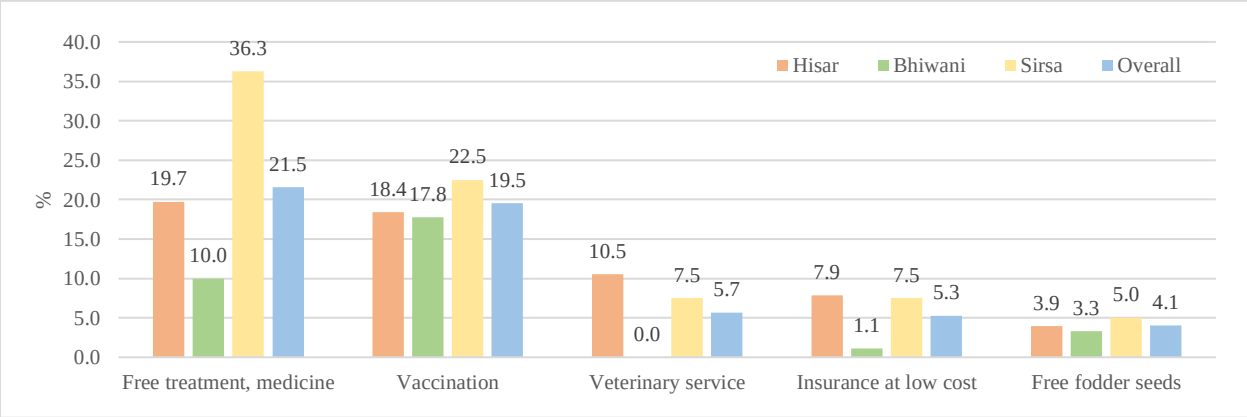


7.3 Benefits received by farmers

Most of the farmers are not receiving the benefits offered by the government. Only about 22% of farmers reported that 'free treatment and medicines' are received from the government (Figure 7.4). The benefits received in terms of 'vaccinations' of livestock is reported by nearly 20% farmers. Very few livestock rearing farmers are benefited by the veterinary services, low cost insurance and free fodder seeds distribution (4-6% of such farmers reported this). The unawareness of the farmers related to such schemes is major reason for this.

At the district level, livestock rearing farmers from Sirsa received these benefits most frequest in a larger proportion as compared to other two districts. Whereas, the farmers from Bhiwani appears struggled to receive the benefits from government. The status of veterinary services to the livestock appears better in Hisar compared to other two districts but only 11% surveyed farmers reported this benefit.

Figure 7. 4: Benefits getting from the government for livestock production (%)



Chapter 8: Summary, Conclusions and Policy Implications

In this study, an attempt is made to assess the supply of feed and fodder from various available land resources and the requirement of feed and fodder for livestock in Haryana. Various research studies have outlined the shortage of various types of feed and fodder used (i.e. green and dry fodder, concentrates and supplements etc.). Numerous reasons are highlighted for this shortfall such as – limited availability of area under fodder crops, limited availability of good varieties of fodder crops, lack of quality seeds, poor quality of dry fodder, limited post-harvest management technological up-gradation, poor management of grazing and pasture lands and inadequate research, extension and manpower support are name to few major. This study analyses the status of availability and requirement of fodder in three study districts in Haryana. For this purpose, the study mainly utilized the primary survey data. The farmers are selected based on the proportion of livestock in particular district using proportion population sample size.

On the supply side, nearly one-third of the net operated areais under fodder crops in the surveyed districts. Limited village grazing land in available around surveyed villages and a small fraction of land is reported as uncultivated. There is no village land available for agro forestry in the surveyed districts. Jowar, berseem and jai are preferred green fodder crops by majority of the livestock rearing farmers.On the demand side, the requirement of green and dry fodder is observed highest for the buffaloes, followed by crossbreed cattle and reported least for the indigenous cattle. The fodder and concentrate demand is observed high for the milch animals and least for the non-pregnant heifers. Due to unavailability of grazing land, these livestock are not being taken for grazing purpose. Whereas, farmers take sheep and goats for grazing most of the time. The requirement of dry fodder is highduring the summer periodwhen the green fodder is not available. Very few farmers are observed following any kind of post-harvest management of fodder for its future use. Most of them either use it directly, as a by-product from crop as green and dry fodder or buy from the market or from other farmers. Despite being a fodder growing state, the study finds nearly 30% of fodder deficit situation in the selected districts.

The limited land holding by sample household is the major constraint for affording more land area under fodder crops. The other constraints to fodder cultivation are - non-availability of adequate irrigation water, high cost of fodder cultivation and low returns; and lack of awareness of government’s programmes on subsidy on seed.Farmersusually do not follow any post harvest

techniques of fodder production. Lack of proper such training facilities and awareness of farmers on such events are major reasonsfor this. Farmers appraise the freetreatment and medicines for livestock are the valuable benefits provided by the government. Vaccinations' of livestock, veterinary services and insurance at low cost are some other benefits received. Farmers highlighted subsidy on fodder seeds and improvisation on irrigation facilities as important measuresfor improving the fodder production.

Salient findings of the study are summarized as below:

- The livestock population in Haryana was remained stagnant during period 2007 to 2012 but it declined (-20%) during 2012 to 2019 period. This is largely contributed by decline in buffalos' population in recent period.
- The major fodder crops are jowar, berseem and barley. The by-product of wheat is used as dry fodder. The area under fodder crops in the kharif season is nearly one-fourth of the total area and this area is just 7% in the rabi season in the study districts.
- The constarints such as non-availability of the village grazing land and common village forest area; and limited land holding of farmers, speciallyfor goat and sheep rearing farmers,restrict the use of more land under fodder crops. Hence, higher productively will be needed to overcome the shortage of green fodder in the selected districts.
- The low cost of growing fodder crops compared to non-fodder crops can providea scope to increase productivity by investing more on inputs such as irrigation, fertilizer and other such practices for fodder cultivation.
- There is pre-existing water scarcity in dry land areas.Improved and water-saving water management practices will contribute in boosting yield of fodder crops.
- There is lack of awareness among farmers about the government's programmes on fodder cultivation practices. Most of the farmers, especially in the small and marginal categories are illiterate and have limited financial resources.
- Farmers are not practicing any post harvesting technique of fodder production and suffer with the shortage of dry fodder in off season. There is large scope to encourage farmers at individual or at social group levels by training programmes to follow such practices.

Policy suggestions

- The research system needs to pay higher attention on developing high yielding varieties of fodder and state department to promote those for increasing fodder production.
- The cost of growing fodder crops is cheaper compared with that of other food crops, so farmers may be encouraged on putting more efforts and inputs on fodder cultivation. Since, the farmers have limited financial resources, they may be provided with subsidized inputs such as good quality seeds and other related inputs.
- There is an urgent need to encourage farmers to adopt post-harvest techniques. There is a need to launch some initiatives to conduct training programmes on post-harvest management techniques and expose farmers about such initiatives related to fodder cultivation so that the farmers can utilize efficient practices in limited land resources to get better gains.

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Appendix

Appendix I

Study Questionnaire

AGRICULTURE DEVELOPMENT AND RURAL TRANSFORMATION CENTRE

Institute for Social and Economic Change (ISEC), Bengaluru- 560072

ASSESSMENT OF LIVESTOCK FEED AND FODDER IN MAJOR STATES OF INDIA

A. Buffalo Rearing ☐ B. Cow Rearing ☐ C) Sheep & Goat Rearing: ☐

Date of Interview: Name of the Investigator:

1. General Information

Village		Taluk	
District		State	
Name of the respondent		Age (years)	
Gender [A]		Education [B]	
Caste[C]&Religion[D]		Mobile Number	
Occupation[E]	Primary		
	Secondary		
Average annual income (Rs.)	Agriculture		
	Dairy		
	Sheep & Goat farming		
	Other		
	Total		
Experience (yrs.)	Farming		
	Dairying		
	Sheep & Goat rearing		
Details of Family Members (no.)	Male		
	Female		
	Children		
	Total		
No. of family members engaged in	Farming		
	Dairying		
	Sheep & Goat rearing		
Do you have membership in social & cooperative organization (yes/no) :			

A. Male-1, Female-2;

B. Illiterate-1, Primary school-2, Middle school-3, High school-4, ITI or JOC-5, Diploma-6, PUC-7, Graduate-8, Post graduate & above-9;

C. SC-1, ST-2, OBC-3, General-4, D; Hindu=1, Muslim=2, Christian=3, jains=4, Others-4

E. Occupation: Cultivator-1, AH & Dairying -2, Agri. Labour-3, Nonfarm Labour –4, Own Non-Farm Establishment -5, Trade - 6, Employee in Service - 7, Other (Specify)

2. Landholding and using Pattern (in acres)

Particulars	**Irrigated**	**Un-irrigated**	**Total**	**Source of irrigation**
1. Owned				
2. Leased in				
3. Leased out				
4..uncultivated land				
5.Net operated area (1+2-3-4)				
6.Area underFodder crop				
7. Village Agro forestry				
8.Village Grazing land				
9. Other (specify)				

Source of irrigation; Canal-1, borewell-2 dugwell-3 Tank-4 Other (Specify)-5

3. Details of cropping pattern and fodder related information of sample household.

Name of crop & Fodder	**Area (acre)**		**Production (qtls)**		**Total cost (Rs.)**	**Total return (Rs.)**
	Irrigated	Rainfed	Main Product	By-product		
Kharif/Rainy 1.						
2.						
3.						
Rabi/Winter 1.						
2.						
3.						
Summer 1.						
2.						
3.						
Perennials 1.						
2.						
3.						

Note: 1.one protective irrigation is given to any crop during crop season, include as irrigated crop.

4. Details of Livestock, feed and fodder fed to the animals

Particulars			**Buffalo**				**Crossbred Cattle**				**Indigenous cattle**			
No. of animals														
Give the details of individual animal			1	2	3	4	1	2	3	4	1	2	3	4
Livestock details	**Breed name**													
	Age yrs.													
	Animal Value Rs.													
	Gender	**Male**												
		Female												
	Milch Animals	**Milch**												
		Dry												
	Heifer	**Pregnant/**												
		non-pregnant												
Feed & Fodder fed to Animal	**Green Fodder**	**Kgs**												
		Rs.												
		Purchased/own												
	Dry Fodder	**Kgs**												
		Rs.												
		Purchased/own												
	Concentrates	**Kgs**												
		Rs.												
		Purchased/own												
	Supplements	**Kgs**												
		Rs.												
		Purchased/own												
	Grazing (hrs/day)													

4. Details of Livestock, Feed and fodder fed to the animals

Particulars			Sheep						Goat					
			Below 1 yrs		1-2 yrs		Above 2 yrs.		Below 1 yrs.		1-2 yrs		Above 2 yrs.	
			Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
No. of animals														
Livestock details	Breed name													
	Animal val. (Rs.)													
	Milch Animals (no.)	Milch												
		Dry												
	Heifer (No.)	Pregnant/												
		non-pregnant												
Feed & Fodder fed to Animal	Green Fodder	Kgs												
		Rs.												
		Purchased/own												
	Dry Fodder	Kgs												
		Rs.												
		Purchased/own												
	Concentrates	Kgs												
		Rs.												
		Purchased/own												
	Supplements	Kgs												
		Rs.												
		Purchased/own												
	Grazing (hours/day)													

5. **How do you purchase of concentrates?.....**
a. Daily b. weekly c. monthly d. Biannually e. annually.

5.1 Where from you purchased.……

6. What are the sources of livestock feed? (√) Tick each. ……..a. Grazing land b.Crop residues c. Improved forage and pasture d. Household left over e. Tree legumes grown as hedge or any f. Feed preservation and storage)

7. Details of Farm Shed and Fodder Storage structure

Particulars	**Cattle shed**	**Sheep & Goat Shed**	**Feed and fodder storage**		
			Green fodder	**Dry fodder**	**Concentrates**
If structure is there tick yes otherwise no.					
Type (Pucca/kachcha/mixed/own house)					
Year of construction					
Constructed value Rs.					

8. Details of Labor and other maintenance charges

Particulars		**Buffalo**	**Indigenous cattle**	**Crossbred Cattle**	**Sheep**	**Goat**
Labor cost (Rs./day)	Male (hrs)					
	Female (hrs)					
Veterinary Cost (Rs/annum.)						
Maintenance cost (Equipments, electricity and water charges. Rs./annum)						
Any other cost (Rs)						

1.Men labour charges per day ----------2. Women labour charges per day ……

9. Returns from dairying, sheep and goat

Particulars		**Crossbred cattle**	**Indigenous cattle**	**Buffalo**	**Sheep**	**Goat**
Milk	Yield in litres					
	Sales price (Rs.)					
Dung	Tones					
	Sales price (Rs.)					
Sales details of animal	Animal weight kgs					
	Sales price (Rs.)					
Any other by-product specify	kgs/animal					
	Sales price (Rs.)					

10. Constraints faced by the sample households for Fodder cultivation

Constraints		Rank
1	Land is very less therefore cannot afford to put more land under fodder seed/crop production	
2	Non availability of adequate irrigation water	
3	Non Availability of labour	
4	Land is not suitable for fodder production	
5	High Cost of Cultivation/Production and Low return on fodder production	
6	Low price prevails for green fodder in market	
7	High cost of fodder seed	
8	No provision of quality seed by society on credit&Non availability of quality fodder seed in market	
9	Availability of Grazing lands	
10	Lack of training facilities	
11	Poor Livestock extension services	
12	Lack of awareness about government programmes on subsidy on seeds	
13	More Laborious	
14	Lack of awareness on production and post harvest techniques	
15	Any other1(mention)	
	Any other2 (mention)	

11. Do you adopt post-harvest techniques of fodders? (Yes/no) ……Reason Tick each.

a. Considered inferior in comparison to fresh one
b. Highly expensive
c. Lack of awareness on production and post-harvest management
d. More laborious

12. What are the benefits you getting from the government related to fodder and livestock production?

13. Suggestions to improve production of Fodder related crops?

Appendix II

Table A. 1: Caste composition of Sample households (%)

Caste group	Hisar	Bhiwani	Sisra	Overall
SC	38.2	34.4	55.0	42.3
ST	0.0	0.0	0.0	0.0
OBC	32.9	26.7	16.3	25.2
General	28.9	38.9	28.8	32.5
Any other	0.0	0.0	0.0	0.0
Total	100	100	100	100.0

Source: Author's computation from primary data. This applies to all the Appendix tables.

Table A. 2: Education of Sample household head (%)

Education level	Hisar	Bhiwani	Sisra	Overall
Post- Graduation	0.0	0.0	2.5	0.8
College	2.6	4.4	3.8	3.7
Higher Secondary	56.6	38.9	33.8	42.7
Primary	7.9	5.6	13.8	8.9
Illiterate	32.9	51.1	46.3	43.9
Total	100	100	100	100.0

Table A. 3: Occupation of Sample households (%)

Occupation	Hisar		Bhiwani		Sisra		Overall	
	Primary	Secondary	Primary	Secondary	Primary	Secondary	Primary	Secondary
Agriculture	42.1	14.5	33.3	8.0	40.0	3.3	38.2	8.4
Animal H. & dairying	44.7	60.0	53.3	62.0	38.8	72.1	45.9	65.1
Agri. Labour	5.3	5.5	0.0	0.0	6.3	3.3	3.7	3.0
Nonfarm Labour	6.6	12.7	6.7	30.0	5.0	18.0	6.1	19.9
Own Non-Farm Estab.	1.3	0.0	1.1	0.0	1.3	3.3	1.2	1.2
Trade	0.0	3.6	0.0	0.0	0.0	0.0	0.0	1.2
In service Employee	0.0	3.6	3.3	0.0	5.0	0.0	2.8	1.2
Others- (pensioners)	0.0	0.0	2.2	0.0	3.8	0.0	2.0	0.0
Responses (Numbers)	76	55	90	50	80	61	246	166

Table A. 4: Number of family members engaged in different activities

Particulars	Hisar	Bhiwani	Sisra	Overall
Farming	123	75	57	255
Dairying	114	140	118	372
Sheep & Goat rearing	77	58	68	203

Table A. 5: Details of family members and average family size

Family size	Hisar	Bhiwani	Sisra	Overall
Male	168	214	160	542
Female	147	174	140	461
Adult family members	315	388	300	1003
Children	140	183	122	445
All together	455	571	422	1448
Average family size	6.0	6.3	5.3	5.9

Appendix III

Table A. 6: Average feed and Fodder requirement for Buffalo (in Kg. per day per animal)

Districts	Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Hisar	Milching	20.8	16.0	5.7	0.013
	Dry	18.2	12.7	4.3	0.006
	Heifer Pregnant	12.9	12.9	1.8	n.a.
	Heifer non-pregnant	9.4	7.8	2.0	0.002
	Less than 1 year	5.4	3.8	0.6	n.a.
	1 to 2 Year	10.4	8.4	2.2	n.a.
	More than 2 Year	19.4	15.1	5.1	0.010
	Average price (Rs./Qtl.)	486.7	741.8	2917.8	11375.3
Bhiwani	Milching	17.4	13.3	6.7	0.017
	Dry	16.6	11.9	4.3	n.a.
	Heifer Pregnant	14.3	10.7	4.3	n.a.
	Heifer non-pregnant	9.1	6.8	2.3	n.a.
	Less than 1 year	5.7	4.0	1.2	n.a.
	1 to 2 Year	11.7	8.8	3.3	n.a.
	More than 2 Year	17.2	13.0	6.2	0.013
	Average price (Rs./Qtl.)	497.9	838.3	2878.6	12175.0
Sisra	Milching	18.4	12.9	5.1	0.012
	Dry	13.0	8.0	3.7	n.a.
	Heifer Pregnant	19.0	16.0	4.6	0.007
	Heifer non-pregnant	9.7	6.7	1.9	0.001
	Less than 1 year	4.6	1.5	0.4	n.a.
	1 to 2 Year	13.6	10.9	2.9	0.002
	More than 2 Year	17.8	12.8	5.0	0.010
	Average price (Rs./Qtl.)	472.0	738.6	2772.6	11679.8

Table A. 7: Average feed and Fodder requirement for Crossbreed Cattle (in Kg. per day per animal)

Districts	Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Hisar	Milching	17.1	14.2	5.2	0.007
	Dry	19.5	11.3	6.0	n.a.
	Heifer Pregnant	n.a.	n.a.	n.a.	n.a.
	Heifer non-pregnant	5.5	5.0	1.3	n.a.
	Less than 1 year	1.3	0.7	n.a.	n.a.
	1 to 2 Year	11.3	10.0	2.5	n.a.
	More than 2 Year	16.7	13.1	4.9	0.004
	Average price (Rs./Qtl.)	551.0	747.0	2790.5	12000.0
Bhiwani	Milching	16.3	10.4	6.8	0.004
	Dry	20.0	12.0	6.6	n.a.
	Heifer Pregnant	12.0	10.0	6.0	n.a.
	Heifer non-pregnant	6.7	6.0	3.0	n.a.
	Less than 1 year	2.0	1.0	n.a.	n.a.
	1 to 2 Year	10.0	10.0	5.5	n.a.
	More than 2 Year	16.7	10.7	6.5	0.003
	Average price (Rs./Qtl.)	491.7	765.8	2993.4	13000.0
Sisra	Milching	16.3	13.7	4.1	0.020
	Dry	13.6	10.4	2.8	0.010
	Heifer Pregnant	14.5	13.0	3.6	0.010
	Heifer non-pregnant	10.5	8.7	2.6	n.a.
	Less than 1 year	6.2	5.9	0.9	n.a.
	1 to 2 Year	13.1	10.4	3.7	0.003
	More than 2 Year	15.5	12.9	3.9	0.017
	Average price (Rs./Qtl.)	525.5	690.2	2511.8	12793.0

Table A. 8: Average feed and Fodder requirement for Indigenous Cattle (in Kg. per day per animal)

Districts	Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Hisar	Milching	17.6	9.8	4.7	0.031
	Dry	12.5	10.8	5.8	n.a.
	Heifer Pregnant	30.0	20.0	6.0	n.a.
	Heifer non-pregnant	6.8	6.0	1.0	n.a.
	Less than 1 year	5.7	2.9	0.8	n.a.
	1 to 2 Year	8.0	6.3	1.0	n.a.
	More than 2 Year	18.1	10.0	4.4	0.015
	Average price (Rs./Qtl.)	478.2	651.3	2871.0	12000.0
Bhiwani	Milching	16.2	10.3	7.3	0.063
	Dry	14.0	11.7	5.2	n.a.
	Heifer Pregnant	n.a.	n.a.	n.a.	n.a.
	Heifer non-pregnant	10.8	4.1	5.9	n.a.
	Less than 1 year	5.6	4.1	2.4	n.a.
	1 to 2 Year	10.6	4.6	4.8	n.a.
	More than 2 Year	16.8	10.5	6.8	0.014
	Average price (Rs./Qtl.)	500.1	818.0	2713.5	12124.5
Sisra	Milching	14.9	13.0	4.5	0.020
	Dry	14.0	11.0	3.2	n.a.
	Heifer Pregnant	14.0	12.0	5.0	n.a.
	Heifer non-pregnant	9.1	7.8	2.5	n.a.
	Less than 1 year	5.1	4.3	0.7	n.a.
	1 to 2 Year	12.0	10.2	3.7	n.a.
	More than 2 Year	14.7	12.7	4.3	0.016
	Average price (Rs./Qtl.)	509.6	708.8	2625.3	11714.0

Table A. 9: Average feed and Fodder requirement for Sheep (in Kg. per day per animal)

Districts	Particulars	Gender	Green fodder	Dry fodder	Concentrates	Supplements	Grazing (hrs/day)
Hisar	Less than 1 year	Male	1.8	0.6	n.a.	n.a.	8.1
		Female	1.2	0.9	n.a.	n.a.	8.5
	1 to 2 Year	Male	n.a.	n.a.	n.a.	n.a.	8.0
		Female	2.1	1.4	n.a.	n.a.	8.5
	More than 2 Year	Male	4.3	1.4	n.a.	n.a.	8.3
		Female	4.5	1.5	n.a.	n.a.	8.4
	Average price (Rs./Qtl.)		640.0	550.0			
Bhiwani	Less than 1 year	Male	1.5	1.5	n.a.	n.a.	7.9
		Female	1.6	1.4	n.a.	n.a.	7.6
	1 to 2 Year	Male	3.0	2.9	n.a.	n.a.	8.0
		Female	3.1	2.5	n.a.	n.a.	7.9
	More than 2 Year	Male	5.0	3.7	n.a.	n.a.	7.6
		Female	4.7	3.6	n.a.	n.a.	7.7
	Average price (Rs./Qtl.)		500.4	431.5			
Sisra	Less than 1 year	Male	n.a.	1.6	n.a.	n.a.	8.0
		Female	4.0	1.2	0.25	n.a.	8.1
	1 to 2 Year	Male	n.a.	n.a.	n.a.	n.a.	n.a.
		Female	3.0	1.3	0.25	n.a.	8.1
	More than 2 Year	Male	2.0	3.1	0.25	0.01	8.0
		Female	2.0	3.5	0.25	0.01	8.0
	Average price (Rs./Qtl.)		700.0	510.2	4000.0	12000.0	

Table A. 10: Average feed and Fodder requirement for Goats (in Kg. per day per animal)

Districts	Particulars	Gender	Green fodder	Dry fodder	Concentrates	Supplements	Grazing (hrs/day)
Hisar	Less than 1 year	Male	1.5	0.5	0.55	n.a.	8.0
		Female	1.5	0.7	0.61	n.a.	8.2
	1 to 2 Year	Male	3.5	1.3	1.10	n.a.	8.6
		Female	3.1	1.3	0.71	0.03	7.8
	More than 2 Year	Male	2.4	1.3	1.00	n.a.	8.3
		Female	2.5	1.5	0.96	0.03	7.9
	Average price (Rs./Qtl.)		480.1	637.1	2010.7	13000.0	
Bhiwani	Less than 1 year	Male	n.a.	1.0	n.a.	n.a.	8.0
		Female	n.a.	1.3	n.a.	n.a.	8.0
	1 to 2 Year	Male	n.a.	n.a.	n.a.	n.a.	n.a.
		Female	n.a.	2.0	0.50	n.a.	7.7
	More than 2 Year	Male	n.a.	2.5	2.00	n.a.	8.0
		Female	n.a.	2.5	2.00	n.a.	8.0
	Average price (Rs./Qtl.)			428.8	1533.3		
Sisra	Less than 1 year	Male	n.a.	1.1	n.a.	n.a.	7.3
		Female	0.9	1.0	0.50	n.a.	7.6
	1 to 2 Year	Male	n.a.	n.a.	n.a.	n.a.	n.a.
		Female	1.5	1.3	n.a.	n.a.	7.1
	More than 2 Year	Male	n.a.	2.9	1.00	n.a.	7.8
		Female	2.0	2.9	0.71	n.a.	7.5
	Average price (Rs./Qtl.)		465.0	565.2	3111.0		

Appendix IV

Table A. 11: Average cost of feed and fodder for Buffalo – District level (per day per animal)

District	Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Hisar	Milching	106.3	116.0	178.9	1.5
	Dry	97.4	97.1	123.9	0.7
	Heifer Pregnant	54.7	107.8	48.9	
	Heifer non-pregnant	44.1	52.3	56.6	0.2
	Less than 1 year	26.0	29.4	18.1	
	1 to 2 Year	49.8	57.4	63.2	
	More than 2 Years	98.2	111.0	154.9	1.2
Bhiwani	Milching	81.1	102.0	201.1	2.1
	Dry	73.7	113.4	129.0	
	Heifer Pregnant	86.0	91.7	117.1	
	Heifer non-pregnant	44.7	58.4	65.4	
	Less than 1 year	28.0	30.3	32.3	
	1 to 2 Year	60.7	79.8	94.8	
	More than 2 Years	81.3	100.9	185.6	1.6
Sisra	Milching	84.8	89.9	145.3	1.4
	Dry	63.6	59.2	109.5	
	Heifer Pregnant	92.3	118.9	125.8	0.8
	Heifer non-pregnant	46.8	51.5	52.6	0.1
	Less than 1 year	20.5	11.7	11.3	
	1 to 2 Year	63.9	80.1	80.4	0.2
	More than 2 Years	83.7	92.2	140.2	1.1
State	Milching	89.8	102.7	175.7	1.7
	Dry	80.4	92.4	122.6	0.3
	Heifer Pregnant	76.0	104.1	97.0	0.2
	Heifer non-pregnant	45.4	54.3	57.8	0.1
	<1 year	23.7	21.7	19.6	
	1-2 Year	57.5	71.3	80.5	0.1
	>2 Year	87.6	101.8	160.0	1.3

Table A. 12: Average cost of feed and fodder for Crossbred Cattle – Districts (per day per animal)

District	Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Hisar	Milching	79.7	106.3	145.6	0.8
	Dry	141.4	94.2	180.3	
	Heifer Pregnant				
	Heifer non-pregnant	27.5	35.0	32.5	
	Less than 1 year	6.7	4.7		
	1 to 2 Year	56.7	70.0	65.0	
	More than 2 Years	102.7	103.7	142.4	0.5
Bhiwani	Milching	89.4	75.0	200.9	0.5
	Dry	80.0	96.0	212.5	
	Heifer Pregnant			184.0	
	Heifer non-pregnant	33.3	45.0	84.6	
	Less than 1 year	10.0	7.0		
	1 to 2 Year	50.0	90.0	155.8	
	More than 2 Years	83.4	77.5	197.9	0.3
Sisra	Milching	90.0	96.5	104.7	2.4
	Dry	59.8	72.8	76.3	1.2
	Heifer Pregnant	72.5	87.8	89.3	1.4
	Heifer non-pregnant	58.8	59.7	62.5	
	Less than 1 year	33.5	41.7	21.7	
	1 to 2 Year	73.1	67.8	90.1	0.4
	More than 2 Years	82.5	90.9	98.9	2.0
State	Milching	89.6	95.0	149.7	1.6
	Dry	94.2	86.1	153.6	0.4
	Heifer Pregnant	70.0	83.7	107.7	1.1
	Heifer non-pregnant	51.8	54.8	60.6	
	<1 year	28.9	35.6	18.1	
	1-2 Year	69.5	69.6	89.9	0.3
	>2 Year	86.9	91.1	136.8	1.2

Table A. 13: Average cost of feed and fodder for Indigenous cattle – Districts(per day per animal)

District	Particulars	Green fodder	Dry fodder	Concentrates	Supplements
Hisar	Milching	83.7	75.7	149.1	3.7
	Dry	50.0	65.0	138.3	
	Heifer Pregnant		90.0	177.3	
	Heifer non-pregnant	33.8	33.0	26.4	
	Less than 1 year	28.6	20.0	23.2	
	1 to 2 Year	40.0	51.9	29.6	
	More than 2 Years	89.7	66.2	136.9	1.8
Bhiwani	Milching	78.2	92.6	206.3	7.3
	Dry	70.0	75.8	140.1	
	Heifer Pregnant				
	Heifer non-pregnant	56.0	33.2	158.0	
	Less than 1 year	27.8	33.6	64.4	
	1 to 2 Year	54.4	41.5	123.5	
	More than 2 Years	81.4	88.6	194.6	1.8
Sisra	Milching	75.3	93.3	121.2	2.3
	Dry	70.0	77.0	79.8	
	Heifer Pregnant	70.0	84.0	130.0	
	Heifer non-pregnant	47.3	55.3	66.7	
	Less than 1 year	27.5	29.8	17.0	
	1 to 2 Year	60.0	74.5	98.9	
	More than 2 Years	74.3	90.5	115.7	1.9
State	Milching	79.7	87.7	163.8	4.7
	Dry	64.0	73.9	127.6	
	Heifer Pregnant	73.3	56.9	100.5	
	Heifer non-pregnant	48.1	46.7	88.6	
	<1 year	28.4	25.3	35.6	
	1-2 Year	52.8	54.8	95.7	
	>2 Year	82.9	81.9	148.8	1.8

Table A. 14: Average cost of feed and fodder for Sheep – Districts (per day per animal)

District	Age group	Gender	Green fodder	Dry fodder	Concentrate	Supplements
Hisar	<1 year	Male	11.4	3.1		
		Female	7.6	4.9		
	1-2 Year	Male				
		Female	12.5	7.6		
	>2 Years	Male	28.3	7.9		
		Female	30.0	8.4		
Bhiwani	<1 year	Male	7.1	6.3		
		Female	7.9	5.9		
	1-2 Year	Male	15.3	11.7		
		Female	15.9	10.4		
	>2 Years	Male	25.0	16.9		
		Female	23.6	16.4		
Sisra	<1 year	Male		8.2		
		Female	28.0	6.0	10.0	
	1-2 Year	Male				
		Female	21.0	6.3	10.0	
	>2 Years	Male	14.0	16.3	10.0	1.2
		Female	14.0	18.3	10.0	1.2
State	<1 year	Male	8.0	3.1		
		Female	10.2	4.9	10.0	
	1-2 Year	Male	16.1			
		Female	14.2	7.6	10.0	
	>2 Years	Male	24.3	7.9	10.0	1.2
		Female	24.3	8.4	10.0	1.2

Table A. 15: Average cost of feed and fodder for Goat – Districts (per day per animal)

Districts	Age group	Gender	Green fodder	Dry fodder	Concentrates	Supplements
Hisar	<1 year	Male	7.0	3.3	12.2	
		Female	6.9	4.1	13.5	
	1-2 Year	Male	17.8	8.3	18.7	
		Female	15.9	8.6	12.0	3.9
	>2 Years	Male	11.1	8.4	21.2	
		Female	11.4	9.8	20.4	3.9
Bhiwani	<1 year	Male		3.7		
		Female		4.9		
	1-2 Year	Male				
		Female		11.2	10.0	
	>2 Years	Male		10.5	26.0	
		Female		10.5	26.0	
Sisra	<1 year	Male		6.5		
		Female	4.1	5.6	15.6	
	1-2 Year	Male				
		Female	7.0	6.7		
	>2 Years	Male		16.7	31.1	
		Female	9.3	16.7	22.1	
State	<1 year	Male	7.0	4.0	13.1	
		Female	6.7	5.6	13.6	
	1-2 Year	Male	17.6	7.9	19.1	
		Female	15.1	9.3	12.2	3.9
	>2 Years	Male	11.1	13.1	21.5	
		Female	11.3	13.1	20.6	3.9

Appendix V

Table A. 16: Availability of dry fodder and concentrate on per hectare basis –district-wise

District	Crop	Area (Ha.)	Sum of Main Product (Tonnes)	Quantity of crop residuesand concentrate (Tonnes/year/Ha.)				
				Crop residues	Oil Cakes	Grains	Brans and Chunnies	Total
Bhiwani	Jau	1.21	4.2	4.50	0.00	0.35	0.00	4.84
	Mustard	14.17	24.05	0.00	1.19	0.17	0.00	1.36
	Wheat	48.47	192.7	3.98	0.00	0.08	0.32	4.37
	Sugarcane	4.45	275	15.44	0.00	0.00	0.00	15.44
	Bajra	10.43	20.5	4.92	0.00	0.10	0.00	5.01
	Guar/others	0.81	0.2	0.49	0.00	0.02	0.00	0.52
	Paddy	19.23	70.1	4.74	0.00	0.07	0.29	5.10
	All crops	98.78	586.75	34.06	1.19	0.79	0.61	36.65
Hisar	Jau							
	Mustard	14.78	28.6	0.00	1.35	0.19	0.00	1.55
	Wheat	40.12	177.85	4.43	0.00	0.09	0.35	4.88
	Sugarcane	0.81	50	15.44	0.00	0.00	0.00	15.44
	Bajra	11.39	20.99	4.61	0.00	0.09	0.00	4.70
	Guar/others	0.00		0.00	0.00	0.00	0.00	0.00
	Paddy	1.72	4.9	3.70	0.00	0.06	0.23	3.99
	All crops	68.81	282.34	28.18	1.35	0.43	0.58	30.55
Sirsa	Jau	0.30	0.9	3.85	0.00	0.30	0.00	4.15
	Mustard	15.28	28.3	0.00	1.30	0.19	0.00	1.48
	Wheat	105.97	550.43	5.19	0.00	0.10	0.42	5.71
	Sugarcane							
	Bajra	0.20	0.4	4.94	0.00	0.10	0.00	5.04
	Guar/others	15.51	14.92	1.92	0.00	0.10	0.00	2.02
	Paddy	55.77	296.48	6.91	0.00	0.11	0.43	7.44
	All crops	193.04	891.43	22.82	1.30	0.89	0.84	25.85

Agricultural Economics Research Centre
University of Delhi
Delhi – 110007

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aerc.du.ac.in
+91-11-27667648
aercdu@rediffmail.com