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Understanding the Fodder Markets for Sustainable Development of Livestock Sector in Bihar-A Rapid Appraisal Approach

By

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Section I

Background

The present rapid appraisal is a part of the OPEC funded project entitled, “*Mitigating feed scarcity for resource poor livestock keepers through improvement of fodder markets and identification of fodder markets and identification of crop varieties with improved fodder characteristics in selected disadvantaged areas of India*”. At the first stage, an Inception Workshop in collaboration with Bihar Agricultural Management & Extension Training Institute (BAMETI), Patna and State Farmers’ Commission, Bihar, was hosted by International Livestock Research Institute (ILRI) in Patna and detailed outline for the project was prepared on the basis of outcomes of workshop. It was agreed that two complementary methods would be applied to implement the rapid appraisal: review of secondary data and information and the collection of primary data collected through semi-structured interviews of the actors of fodder marketing chain, who were identified through Rapid Appraisal by visits of different sites.

Introduction

The livestock as a source of sustainable livelihood and alternative source of food have remained integral part of socio-economic fabric of India. Sustained rise in per capita income and emerging new middle and high income groups, particularly in developing

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countries, are causing significant changes in food consumption pattern, resulting in increased demand for livestock products (Delgado et al., 1998). According to World Development Report 2008, *“livestock is one of the growing sub-sectors in developing countries, where it accounts for a third of agricultural GDP”*. It is estimated that by 2020, demand for animal food products is likely to double in India (Delgado et al., 1999; Parthsarthy Rao et al., 2004). It signifies that there is immense opportunity in this sector. High demand potential provides opportunity to the poor livestock keepers for sustainable livelihood and alternative income. But there are challenges too. Scarcity of feed (concentrate and fodder) is one of them.

Scarcity of feed and fodder is one of the most serious impediments in the way of sustainable livestock development, which has direct bearing on the income and livelihood of numerous resource poor livestock keepers. Various feeding constraints like scarcity of feed, fodder and concentrates affects the potentials of livestock and cause enormous losses in terms of production and depletion of livestock. Evidence indicates that feed related problems accounted for about 36 percent loss (per annum in value terms) in dairy animals (Birthal and Jha 2005). Losses due to scarcity of dry and green fodder were estimated to be 11.6 percent and 12.3 percent, respectively at national level (Birthal and Jha 2005). Mitigating scarcity of dry fodder and managing availability of green fodder round the year is a serious challenge for the livestock keepers because, a majority of the livestock keepers are marginal and small holders who are unable to produce and store livestock feed and forage in bulk and therefore face acute shortage during certain periods. It poses a serious threat and is a major impediment in the way of livestock production and development in the country. Deterioration of significant amount of available feed and forage due to toxins and contamination during transportation and storage is another serious problem that affects the quality of feed and forage and poses threat to the lives of livestock.

In addition, there is immense pressure on available feed and fodder as the net cultivated area is shrinking and the human and livestock population (Subrahramanian & Nagasree, 2005) is on an upsurge. It has been reported that by 2015, the total livestock population will become 322 million adult cattle unit as against 292 million adult cattle unit in 2000 and 301 million adult cattle unit in 2005 (Draft Report of the Working Group

on Animal Husbandry and Dairying for five-Year Plan, Govt of India, 2002-07, Planning Commission, August – 2001). Human population in India is also increasing at a substantially high rate of growth (1.9% as per 2001 census). The competing demand (for food and feed) between human and livestock population is expected to aggravate this pressure and further widen the gap between supply and demand of green and dry fodder.

Adequate supply of quality feed, particularly fodder is essential for sustainable development of livestock. Changing land use pattern with extensive and commercialized agriculture and development activities have been affecting livestock rearing pattern, which is shifting from grazing to stall feeding because of decrease in forest area, fallow and grazing lands. Increased income and rapid urbanization have accelerated the process of commercialization in dairy sector. Changes in the pattern of livestock rearing are therefore creating huge demand for fodder and concentrates.

The working group on Animal Husbandry and Dairying foresees that at national level there would be a gap of about 65 percent between the demand and supply of green fodder and 25 percent for dry fodder by the year 2025. These gaps are even more alarming in Bihar. The state has 27.16 million livestock that constitute 5.6 percent of the India's total livestock population (Livestock census, 2003). The estimated annual requirements of concentrates, dry fodder and green fodder for the livestock in Bihar are 5.9 million tonnes, 24.8 million tonnes and 38.2 million tonnes, respectively. In contrary the state is able to meet only 85 percent of its requirements of dry fodder and 4.4 percent of green fodder. Bridging these gaps is essential to achieve desirable growth in milk and other livestock production, which is imperative to achieve 4 percent growth in agriculture at national level. It is, therefore, imperative that the fodder supply chains and the roles of various actors influencing this chain be identified and understood properly to mitigate feed and fodder scarcity in the country.

However, there is little information available regarding the feed and fodder situation in Bihar, as no systematic study has been done in past, also due to problems with this department/sector during the regime of past state government little attention could be paid for its systematic development during past 15 years. In the present study, Bihar

has been taken as study area to understand the feed and fodder scenario along with its availability and quality in the state

Recurring floods and changing cropping patterns have created two distinct zones in Bihar; so far as the fodder availability is concerned, while northern part is generally deficit in fodder availability the southern parts are mostly surplus zones particularly in terms of dry fodder. There is a significant level of trading of dry fodder, particularly, *Bhusa* (wheat straw), *pual* (uncut paddy straw) and *Kutti* (cut paddy straw) at village, district, state and inter-state level, but, the structure and functioning of the market is still not known well.

An increasing urban population is creating huge demand for animal products, particularly milk in the region. This is attracting more people to start dairy activities for sustainable livelihood and such activities are leading to increasing demand for fodder in the region.

The present Rapid Appraisal would help understand the structure and linkages of markets to alleviate fodder scarcity, particularly for the poorest and landless sections of the society, who have very limited ability to produce their own fodder, but need to access quality fodder at reasonable price to produce economical livestock products.

Objectives

The overall objective of the rapid appraisal for studying the fodder scenario in Bihar is to understand the current fodder scenario in the state, its dynamics and constraints affecting this sector so as to suggest necessary measure for improvement in the sector so as to improve the livelihood of the various stake-holders of the fodder value chain.

The specific objectives are:

1. Systematic understanding of fodder and feed marketing including identifying surplus and deficit zones
2. To get a good general understanding of the various fodder production systems in both fodder deficit and fodder surplus areas of Bihar

3. To study the existence of feed markets and understanding their functioning along the supply chain,
4. Identification of fodder marketing chains and the role of different actors' in marketing

Section II

Approach and Methods

Method of survey

The present report is based on the information elicited through Rapid Appraisal (RA) conducted at different locations in Bihar with the help of semi-structured schedules. Five types of checklists, one for each of the different type of actors of fodder markets namely producer, consumer, trader, miller, and commission agent were prepared and used for conducting RA to draw overall idea about the fodder marketing in Bihar. RAs were conducted in 4 districts, 2 in the surplus zone and 2 in the deficit zone.

Apart from RA⁵; 12 Focussed Group Discussions (FGD)⁶ were organized with the help of scientists of Sanjay Gandhi Institute of Dairy Technology, Patna and State Farmers'

⁵ The term rapid appraisal does not refer to a single technique but to a range of investigation procedures. Their chief characteristics are that they take only a short time to complete, tend to be relatively cheap to carry out and make use of more 'informal' data collection procedures. The techniques rely primarily on expert observation coupled with semi-structured interviewing of farmers, local leaders and officials. <http://www.fao.org/docrep/W3241E/w3241e09.htm>

⁶ A focus group discussion (FGD) is an in-depth field method that brings together a small homogeneous group (usually six to twelve persons) to discuss topics on a study agenda. The purpose of this discussion is to use the social dynamics of the group, with the help of a moderator/ facilitator, to stimulate participants to reveal underlying opinions, attitudes, and reasons for their behaviour. The discussion is led by a trained moderator/facilitator (preferably experienced), assisted by an observer who takes notes and arranges any tape recording. The moderator uses a prepared guide to ask very general questions of the group. Usually more than one group session is needed to assure good coverage of responses to a set of topics. Each session usually lasts between one and two hours but ideally 60 to 90 minutes. www.dcc2.bumc.bu.edu/prdu/INRUD_2000_CDROM/Manuals/Qualitative_Methods_Manual/qm_ch4.doc

Commission, Bihar. Some of the producers, assemblers, traders (vendors, retailers and wholesaler, and commission agents) of fodder markets were assembled at different randomly selected sites and discussions on different aspects of fodder marketing were initiated and information was listed.

Delineation of fodder surplus and deficit zones

The state of Bihar has been delineated in four agro-climatic zones on the basis of certain specific agro-climatic indicators for the purpose of planning by the Planning Commission, GOI. These zones are: North-West Alluvial Plain (Zone I), North-East Alluvial Plain (Zone II), South-East Alluvial Plain (Zone IIIA) and South-West Alluvial Plain (Zone IIIB). Out of these zones, Zone I and Zone II are generally fodder deficit; and Zone IIIA and Zone IIIB are generally fodder surplus (Table 1).

Fodder surplus and deficit zones were identified after discussion with various officials of agriculture and animal husbandry departments of Government of Bihar considering the nature of inter-district and inter-regional trade. The zones, which are net seller of dry fodder (mainly paddy and wheat straw) were considered as fodder surplus zones whereas fodder deficit zones were those which were net buyers and depended on fodders coming from different fodder surplus zones/regions in the state and other parts of the country.

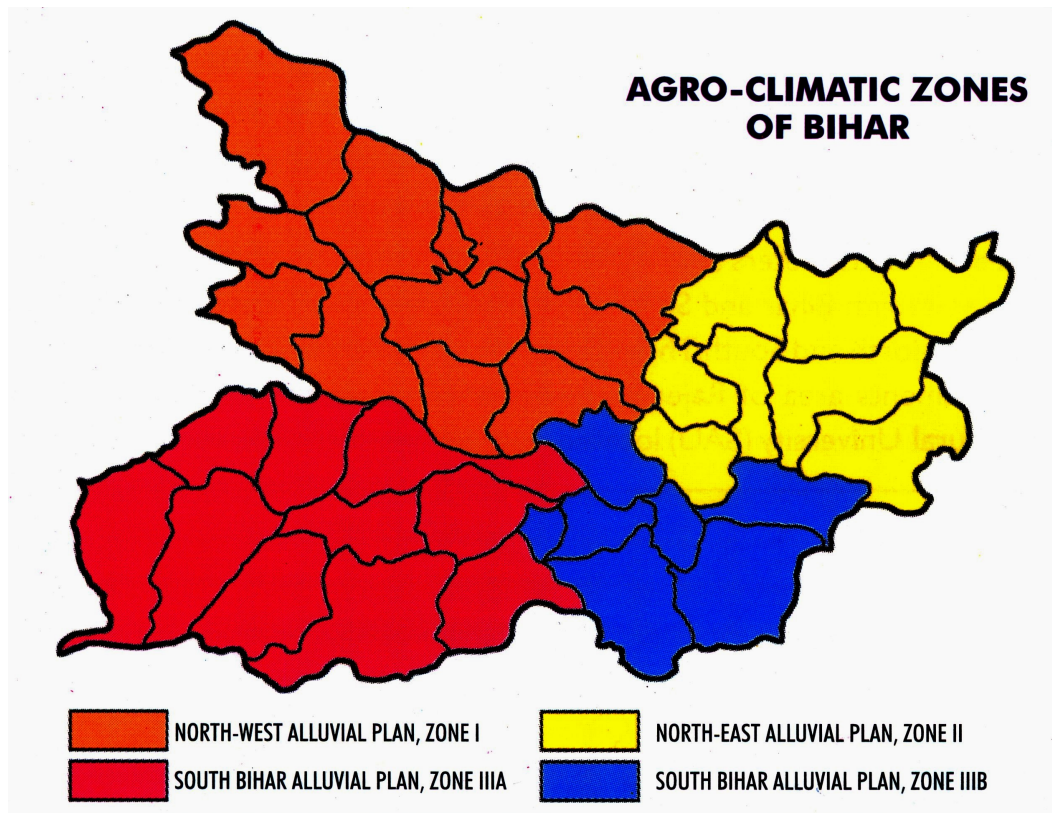


Table- 1: Agro-climatic zones of Bihar

Agro-climatic zones	Fodder scenario*	Districts
North-West Alluvial Plain (Zone I)	Deficit	1. Saran 2. Siwan 3. Gopalganj 4. Begusarai 5. Samastipur 6. Vaishali 7. Muzaffarpur 8. Sitamarhi 9. Sheohar 10. East Champaran 11. West Champaran 12. Darbhanga 13. Madhubani
2. North-East Alluvial Plain (Zone II)		1. Khagaria 2. Saharsa 3. Madhepura 4. Supaul 5. Araria, 6. Purnea 7. Kishanganj 8. Katihar and Naugachhia sub-division of Bhagalpur district
3. South-	Surplus	1. Bhagalpur 2. Banka 3. Munger

East Alluvial Plain (Zone IIIA)		4. Lakhisarai 5. Jamui 6. Sheikhpura
4. South-West Alluvial Plain (Zone IIIB)		1. Patna 2. Nalanda 3. Nawada 4. Aurangabad 5. Gaya 6. Jehanabad 7. Arwal 8. Bhojpur 9. Rohtas 10. Kaimur 11. Buxar

Source: Rajendra Agricultural University, Pusa, Samastipur Bihar, India.

* As identified by authors.

Fodder surplus and deficit zones were delineated on the basis of discussions with the State Government Officials and Scientists of the Rajendra Agricultural University, Bihar. It was agreed upon that fodder surplus zones could be defined as the territorial regions, which are generally self-sufficient in fodder production and are net exporters of fodder. Similarly, deficit zones could be defined as the areas which are dependent on other regions for their feed and fodder requirements. These zones are fodder deficit and face acute shortage of fodder during certain periods of a year. It is important to note that there are fodder surplus areas in deficit zones and likewise surplus zones also have many fodder deficit regions. But in general, fodder surplus zones produce fodder which is in access of the internal demand of those regions and therefore these are the major source of supply of fodder in the deficit zones.

Locations of Rapid Appraisal

Sites for Rapid Appraisal have been selected on the basis of two geographical domains to get a good comprehensive understanding of fodder markets. Rapid Appraisal (RA) was conducted at 31 locations of 4 districts in Bihar. Patna and Jehanabad districts in the surplus zone and Begusarai and Vaishali districts in deficit zones were selected for the rapid appraisal. RAs were conducted to have general understanding of study area for structural analysis and backward-forward linkages of fodder markets, various fodder production systems, feed demand-supply balance and the relative importance and impact of feed shortages, and the existence of feed markets. RA were also focused on identification, function and roles of the various actors along the chain.

In Bihar, the study of fodder marketing is unique and first by its nature, there is dearth of secondary data, but on the basis of other socio-economic, socio-ecologic and agro-ecological studies, two zones for fodder i.e. surplus and deficit have been identified as mentioned above. The northern part of Bihar comprising Agro-climatic Zone I and Zone II have been taken as deficit zone except Saran and Siwan districts, which faces recurring floods and its Diara areas (lower part of Gangetic plain) face prolonged water logging during rainy season and are only suitable for single cropping pattern. On other hand, southern Bihar comprises with Agro-climatic Zones IIIA and IIIB have been taken as surplus zone, notwithstanding that some parts of the region faces drought at some times but overall have relatively better infrastructure and multiple cropping patterns.

The actors of fodder and feed marketing; for checklist preparation have been identified on the basis of discussions with persons involved in fodder marketing. The visited sites were Patna (Chitkohra, Pahadipar and Rajabazar), Chhapra, Nalanda (Harnaut), Rohtas (Sasaram), Hajipur (Dharamkanta) and Serari (Sheikhpura). On the basis of conceptual understanding, the semi-structured check-lists were prepared for producer/farmers, traders, concentrate traders, concentrate millers, agents and consumers.

Two districts from each zone i.e. Patna and Jehanabad from surplus and Vaishali (Hajipur) and Begusarai from deficit zones have been selected to draw interviews on prepared checklists and three from each actor of fodder marketing chain have been interviewed.

Data

The report is based on primary level information generated by conducting a series of RAs and FGDs at various selected locations (Annex I) in fodder deficit and surplus zones of Bihar and the information were carefully tabulated and conclusions were drawn. They are outcome of collective wisdom as well as individual perceptions of different actors of fodder market.

In order to substantiate the results and to provide an overview of the livestock sector in Bihar some secondary data were also used and analyzed to supplement this report. The

secondary sources which were consulted for pulling some critical information are Basic Animal Husbandry statistics, 2006 and Livestock Census, 2003 and Annual Reports of Department of Statistics and Evaluation, Govt. of Bihar.

Section III

Livestock scenario in Bihar

Population and composition of livestock

Bihar occupies an important place in the livestock production in India. The state has 5.6 percent of the country's total livestock and 2.84 percent of poultry (Table 2) Livestock census 2003). Among livestock, about 6 percent of the country's total cattle and buffaloes, 8 percent of small ruminants (sheep and goats), 5 percent of pigs and 3 percent of poultry are reared in Bihar. The density of livestock per hectare of cultivated area in Bihar accounted for about 10.17 adult cattle units, the fifth highest among various states (Hazra 1995). During last 10 years, the livestock density has increased substantially because of shrinking cultivated area and increased livestock population.

Table- 2: Number of livestock in Bihar and India, 2003 (Number in '000)

Livestock species	Bihar	India	% of India
Cattle	10729	185181	5.79
Buffaloes	5743	97922	5.86
Sheep	382	61469	0.62
Goats	9490	124358	7.63
Pigs	672	13519	4.97
Total Livestock	27162	485002	5.60
Total Poultry	13911	489012	2.84

Source: State Livestock Census 2003, Govt. of Bihar and Livestock Census, Govt. of India 2003.

From table 1 it emanates that there has been a substantial increase in the population of livestock in Bihar. Since 1982, the total population of livestock has gone up by 25 percent and all livestock species have registered positive growth during this period. The

number of cattle increased to 10.5 million in 2003, registering an increment of 11.5 percent over the population of 94 million in 1982.

The population of buffaloes witnessed a phenomenal growth during the same period. It increased from 3.6 million in 1982 to 5.8 million in 2003, showing an increment over 60 percent. It indicates that relative importance livestock in the state is changing convincingly in favour of buffaloes. It is so happening because buffalo milk receives premium price as compared to cow milk after the emergence of dairy cooperatives in the state. The dairy cooperative determines milk price on the basis of presence of fat and SNF in the milk and buffalo milk has high fat and SNF contents. But this sort of changes in composition of livestock is certainly going to put pressure on available livestock feed because the feed requirements of a buffalo is comparatively more than that of an average yielding cow.

Table-3: Dynamics of livestock population in Bihar

Sl. No	Species	Livestock Population (in lakh)		
		1982	2003	% Change
1.	Cattle	94	105	11.49
2.	Buffalo	36	57.66	60.17
3.	Goat	77	96	24.67
4.	Sheep	3.27	3.46	2.75
5.	Total livestock	210.27	262.12	24.66

Source: State Livestock Census 2003, Govt. of Bihar

It also emanates from the table 3 that number of goats has also increased substantially during the last two decades. It increased to 9.6 million in 2003 from a count of 7.7 million in 1982. Goat is reared mostly for meat by the landless, marginal and small households, particularly schedule castes and extremely backward classes, which are sold directly to the butchers or their agents who keep strolling in the villages and purchase goat/ lamb. Goats are generally allowed free grazing on barren, uncultivated lands, bunds, and are hardly given any supplementary feed and fodder. However, a few goat rearers feed them with the leaves of jackfruit, banyan mulberry and bamboo leaves, etc, and it is a common belief that this helps goats gain weight. Ability of a goat to thrive and survive on grazed fodder and ease of its convertibility into cash by selling

them as and when required, makes it a perfect choice among poorer sections of the society and probably due to this reason the goat population has increased.

Table- 4: Distribution of livestock in different agro-climatic zones of Bihar
(figures in lakh)

species	Zone I			Zone II			Zone IIIA			Zone IIIB		
	1982	2003	% change	1982	2003	% change	1982	2003	% change	1982	2003	% change
Cattle	34	35	2.94	21	26	23.81	12	15	25.0	27	28	3.70
Buffalo	13	24	84.62	6	9	50.00	3	5	66.67	14	20	42.86
Goat	31	36	16.13	19	28	47.37	17	19	11.76	10	13	30.00

As far as the distribution of livestock across different zones is concerned, it appears that most of the livestock species are distributed evenly across the different agro-climatic zones of Bihar (Table 4). Agro-climatic Zone I, which covers the districts of Samastipur, Muzaffarpur, Vaishali, East and West Champaran, Sitamarhi, Darbhanga, Begusarai, Chhapra, Saran, Siwan, and Madhubani, holds special significance in livestock production in the state. The zone has 35 percent cattle, 24 per cent buffaloes and 36 percent goats in the state. It is interesting to note that cattle population during last two decades has just gone up by about 3 percent only whereas the population of buffaloes has increased by about 85 percent. This clearly indicates that buffaloes have become important in this region and cattle are struggling to maintain their position in the zone. More or less every zone has the same trend. Increase in the population of buffaloes is obvious and significant in each zone. However increase in the population of cattle in Zone II was substantial. It recorded an increment of 24 percent in 2003 since 1982. Zone II comprises the districts of Saharsa, Supaul, Purnea, Katihar, Araria, Madhepura, and Kishanganj. It is important to take into account that Zone II is considerably under developed and flood affected, more over non-descript cattle dominate the total bovine population. Spread of crossbred cattle is quite limited. The zone had only twelve thousand crossbred cattle that accounts for less than a half percent of the total cattle population in this zone. The increase in cattle population, 24% since 1982 to 2003, in this zone is due to increase in the number of non-descript cattle which require low investment, less care and minimal maintenance costs and during floods or outbreak of disease their owners bear less loss in comparison to crossbred cattle and buffaloes. Moreover, the reach of dairy cooperative societies is also very weak in the region.

Goat, which is termed as poor man's cow indeed seems to be more concentrated in the riskier and comparatively less affluent zones like Zone I & Zone II, which are feed (fodder and concentrate) deficit and often witness acute shortage of fodder during certain periods of the year. The feed requirements of these zones depend on inflow of cattle feed from the feed surplus regions (mainly of Zone III) of the state. Zone III has been subdivided into Zone IIIA and Zone IIIB.

Zone III B includes Patna, Jehanabad, Aurangabad, Bhojpur, Rohtas, Gaya, Nawada, Nalanda and Kaimur districts. The zone has a good network of canals and the cropping system is dominated by rice and wheat. Zone III A covers Bhagalpur, Lakhisarai, Sheikhpura, Munger, Banka, and Jamui districts of Bihar. Zone III B is extremely important for livestock development in the state as it generates maximum marketable surpluses of paddy straw and wheat in the state and most of the supplies of dry fodder (paddy straw and chaffed wheat straw) to the fodder deficit zones (Zone I and II) are made from this zone only.

Feeding systems

Cattle and buffalo are fed primarily on agricultural by-products, such as crop residues. They are allowed to graze on pasture, grazing and non-arable lands and forests are also used for animal grazing to certain a extent. Animals are also allowed to graze on common lands, natural pasture and homestead. However, stall-feeding is becoming fairly important as the lands available for animal grazing is becoming instinct day by day.

Cattle-feed

According to 11th Five Year Plan Approach Paper (DAHf, Bihar), around 80 percent of the cost of milk production depends upon the cost of feeding the animals besides the labour and management costs. The state has three cattle-feed plants in the cooperative sector with total installed capacity of 260 MT's per day. The Patna plant is working at almost full capacity, so would need to be expanded to meet the growing demand of balanced cattle feed and protein-enriched feed. The capacity of this plant is proposed to be augmented from 100 to 200 Mt's per day.

Fodder Production Scenario

Fodder is defined as the wide range of crop and pasture species that are grown, harvested and lightly processed to facilitate both on-farm use and domestic trade. A number of factors affect the production and supply of fodder in a region. Land use and cropping pattern of the region, number and density of livestock in the region, livestock feeding pattern, storage of fodder, and intra- and inter regional fodder trade are some of the critical factors, which have significant bearing on availability of fodder.

Land use pattern change and implications for fodder production

Bihar has a geographical area of 9.36 million hectares, of which about 59.4 percent area is used for cultivation of agricultural crops. Forest occupies 6.6 percent of the geographical area. Area under permanent pasture and other grazing land is merely 0.2 percent. The fallow lands (current and other fallow) along with cultivable waste land accounts for 9 percent of the geographical area of the state. A perusal of table 5 shows that in recent years there has been a considerable change in the land use pattern, particularly of those lands which hold special significance for livestock like pasture and grazing land, fallow lands, cultivable waste land, etc. in the state.

Table- 5: Land use Pattern Change in Bihar

(Unit: 000 hec.)

Sl. No	Item	Area		Percent Change
		1997-98	2005-06	
1	Total Geographical Area according to Village Paper	9360	9360	0
2	Land not available for cultivation			
(i).	Forest	616	622	0.97
(ii).	Barren Land	437	436	-0.23
(iii).	Land put to non-agricultural uses	1616	1675	1.91
3	Cultivable Waste Land			
(i).	Permanent Pasture and other grazing land	19	17	-10.53
(ii).	Cultivable Waste Land other than Fallow Land	51	46	-9.80
(iii).	Miscellaneous trees, Crops and Groves	233	240	3.00
(iv).	Current Fallow	632	666	5.38
(v).	Other Fallow	152	129	-15.13
4	Gross Cropped Area	7946	7396	-6.92
(i).	Net Area Sown	5603	5556	-0.84
(ii).	Area sown more than once	2343	1840	-21.47

Source: Department of Agriculture, Govt. of Bihar, various reports

Both net sown and gross cropped areas have also declined whereas area under non-agricultural uses has increased. About forty seven thousand hectares of cultivable land has been taken out of cultivation by 2005-06 since 1997-98. During the same period gross cropped area has declined by 7 percent and this poses a serious threat for food and fodder production in the state. It is important to recognize that substantial parts of the fodder are the by-product of cultivated agricultural crops. Therefore a decline in the cultivated area would not only have a negative consequence on the production of food grains/ concentrates but also adversely affect the availability of fodder in the state. It also emanates from table 5 that area under permanent pasture and other grazing lands, which have been a rich source of green fodder has decreased to the tune of 10.5 percent. The decline in area under permanent pasture and other grazing land thus limits the scope for grazing. Hence, a majority of cattle and buffaloes are now being stall-fed because pasture and other barren land, which were used for grazing of animals, now, comprise only 0.3 percent of the cultivated land area.

Changes in cropping pattern

It is important to recognize that about 85 percent of the households in the state is marginal and small (<2ha of land). They need food for their self consumption and thus their cropping pattern is predominantly food grain based. Rapid urbanization, increased income and transboundary trade have lead to a significant change in the cropping pattern, which is diversifying towards high value crops. Even cereals and pulses are witnessing a considerable shrinkage of area (table 6) as farmers tend to augment their incomes by taking cash crops like vegetables, tuber crops like potato, onion, and aromatic crops along with maize, lentil, etc. Non-agricultural uses of agricultural land like construction of dwelling houses, brick kilns, etc. are also adding to this fore. Therefore, a substantial increase in fodder area is practically not possible.

It is lucid to note that areas of rice, barley, gram, pigeon pea, peas and sugarcane have reduced substantially over the last several years. During 1997-98 and 2005-06, the area of rice shrunk by 13.28 percent; the decline in area of barley, gram, pigeon pea, peas and sugarcane was 43.3 percent, 29.5 percent, 14.3 percent, 30.6 percent and 1

percent, respectively. There was however, a marginal increase (1%) in the area of wheat but that was grossly insufficient to offset this diminishing trend.

Table- 6: Changes in Cropping Pattern in Bihar

(Unit: 000 ha)

Sl. No	Crop	Area		% Change
		1997-98	2004-05	
1.	Rice	3621	3140	-13.28
2.	Wheat	2009	2028	0.95
3.	Barley	30	17	-43.33
4.	Maize	609	614	0.82
5.	Pulses			
a.	Gram (Pigeon pea)	102	721	-29.41
b.	Masur (Lentil)	168	179	6.45
c.	Arhar	42	36	-14.28
d.	Khesari (Lathyrus aphaca)	170	118	-30.59
e.	Peas	26	23	-11.54
6.	Sugarcane	105	104	-0.95
7.	Tobacco	21		
8.	Potato	131	139	6.11

Source: Agricultural Statistics, Bihar

If the same trends continue, the state will definitely observe a stringent situation for livestock fodder and concentrate, since the residues and by products of these crops are the major source of livestock concentrate and fodder.

Area and production of fodder in Bihar

Source of Fodder

Three major sources of fodder supply are crop residues, cultivated fodder and fodder from common property resources like forests, permanent pastures and grazing land. It is believed that future scenario related to potential supply of crop residues especially for rice and wheat in the state is going to worsen due to popularization of use of combine harvesters in some of the important regions of fodder surplus zones in the state. During RA it was reported that a large portion of the stover is left in the field by the combine harvesters which is being burnt by the farmers, as they are unable to collect it due to scarcity of labour. In the coming years, the use of machinery is projected to increase from their present levels, as in future there is expected to be a greater scarcity of human

labour. This will further affect the availability of residues for use as fodder. If the same trend continues the state will face a shortage of about 30-35% of the residues in the coming years.

Farmers also feed their livestock with the residues of some of the cultivated pulses. However, trading in pulse residue has not picked up on a large scale, as most of the pulse residues, which are produced by the farmers, are kept for on-farm consumption by them as it is a common belief that it is superior than the residues of rice and wheat. As far as the oilseeds are concerned in general there is no practice of feeding animals with the residues of oilseeds, however, the use of oilseeds cake as concentrates is quite popular.

The most important sources of green fodder are the forests, permanent pastures and grazing lands, which include the village common property lands and the cultivated forages. The forest areas are also used for grazing and collection of fodder. However, all forest areas do not produce fodder. In the area with good canopy cover, there is not much grass cover and this forms about 50 percent of the forest area. The area under permanent pastures has been declining over the years and the trend could well continue in the future⁷. Due to overgrazing, the productivity of the pastures has been declining too and the area under fodder crops has also not picked up because of competition between feed-fodder and several other reasons. This is mainly for the want of proper land cover data reporting.

However, the situation in Bihar is even bleaker; the area under cultivated fodder crops in 2005-06 was close to 15 thousand hectares that accounted for only 0.26 percent of the total cultivated area (table 7). The analysis of fodder area shows that during 2000-01 and 2005-06 the area of cultivated fodder has grown at a compound annual growth rate of 10.2 percent. But it is difficult to maintain the same rate of growth for a longer

⁷ Merely 4 percent of cropped area in India is put under fodder production which is grossly insufficient to meet the growing demand for green fodder in the country. To meet the current demand of green fodder, at least 10 percent more area is required to be allocated to the fodder crops implying thereby that an additional 10 million hectares of land (wasteland) would have to be brought under fodder crops (National Commission on Agriculture).

period due to competing demands of land for food grains production. This apprehension is even confirmed by the same table as the area of green fodder has declined sharply in 2005-06. It calls for allocation of additional area for green fodder production.

Table- 7: Area under Fodder Crops, Permanent Pastures and other Grazing Lands in Bihar

(Area in 000 ha)

Year	Area under fodder Crops	Area under Permanent Pastures and other Grazing lands
2000-01	11.0	17.86
2001-02	8.8	17.8
2002-03	10.2	17.7
2003-4	13.2	17.6
2004-05	15.5	17.5
2005-06	14.7	17.0

* Authors calculation

The latest available data pertaining to 2005-06 reveal that in Bihar cultivated area, forests, and permanent pastures and barren and uncultivable land together produce only a paltry sum of 1.3 million tonnes of green fodder (Table 8). The production of dry fodder also has been more or less constant since 2000-01. Between 2000-01 and 2005-06, annual production of dry fodder was found to be fluctuating between 1.18 to 1.38 million tonnes.

Table- 8: Production of Green and Dry Fodder in Bihar

(Production in '000 tons)

Year	Dry Fodder *	Green Fodder	Total Fodder** (Dry matter basis)
2000-01	19523	1377	17915
2001-02	19158	1361	17582
2002-03	15612	1346	14387
2003-04	19816	1207	18136
2004-05	20876	1181	19084
2005-06	20978	1281	19200
2006-07	21081	1678	19392

Sources: DAC, BAHS 2004

*Dry fodder production for year 2003-04 and onwards are estimated by the authors using weights given by Parthasarthy Rao and Birthal, 2008.

** Estimated by the authors using dry matter in green fodder is 25% of the biomass

** Dry fodder is estimated on the assumption that dry matter forms 90% of the Bio-mass .

Annual Requirement of Fodder in Bihar

Both dry and green fodders are important for cattle and buffalo. Only green fodder supplement will not cater the hunger of animals as green fodder contains 75-80 percent of water and approximately 25 percent of its body mass contains dry matter. Therefore, in Bihar farmers prefer to feed their animals in ratios ranging between 1:3 to 1:10 or even more of green to dry fodder. To buffalo, minimum 7-8 Kgs of dry fodder is fed and green fodder is added as per the availability. As recommended, the requirements of green fodder for buffalo are 10 percent of its body weight. Dry fodder requirement is 8-10kgs and concentrate requirement is 2 Kgs for maintenance (daily activities) and per 2.5 Kgs of milk additional 1 Kg of concentrate is required

Animal rearers often face problems with the availability of feeds and fodder. Most of the commonly available fodders (Paddy and wheat straws, etc.) are of poor quality and need to be enriched with suitable processing or technology before feeding. Paddy straw and wheat straw are the most important crop residues and about 80-90% of feed energy available to ruminants in Bihar is obtained from these two only.

Species -wise annual requirement of fodder and concentrates are presented in table 9. It emanates from this table that about 5.9 million tonnes of concentrates, 38.2 million tonnes of green fodder and 24.8 million tonnes of dry fodder are required annually to meet the feed requirements of different species of livestock in Bihar.

Table- 9: Annual requirement of fodder in Bihar

(Requirements in 000 tons)

Species	Concentrates	Green Fodder	Dry Fodder
Cattle	2770.307	27397.841	15359.087
Buffaloes	1115.919	10477.241	7978.132
Sheep	34.636	-	50.563
Goats	960.668	-	1402.435
Horse	21.769	-	-
Pig	572.137	228.855	-
Poultry	315.87	51.361	-
Chicks	87.74	15.004	-
Total	5879.04	38170.302	24790.217

Source- 17th Animal Husbandry Report, Bihar

Gap between fodder demand and supply

The indigenous production of green and dry fodders is grossly insufficient to meet the requirements in the state. Table-10 presents the production and supply gaps of green and dry fodder from year 200-01 to 2005-06. It portrays a revealing picture of a persistent and wide gap between demand and supply of green and dry fodders which indicate how badly the state suffers the pangs of fodder deficit. It is a matter of shy relief that since 2003-04, at least the availability of dry fodder has started increasing because of replacement of old varieties of fodders by some high yielding fodder varieties. In recent years Government of Bihar has accorded high priority to agriculture and livestock development. It has launched a concerted programme to raise the livestock productivity by increasing availability of quality fodder in the rural areas. To achieve this goal mini kits of improved and high yielding fodder seeds are being distributed in the state and due of this, the production of green fodder is gradually increasing and gap between the demand and supply has started declining but despite this decline, there exists a difference to the tune of 13 percent.

Table- 10: Gap between availability and requirement of green and dry fodder in Bihar
(Production/Quantity in '000 tonnes)

Year	Production			Production as percent of requirement	
	Dry Fodder	Green Fodder	Total Fodder	Dry Fodder	Dry Fodder
2000-01	19523	1377	20900	78.8	3.6
2001-02	19158	1361	20519	77.3	3.6
2002-03	15612	1346	16958	63	3.5
2003-04	19816	1207	21023	79.9	3.2
2004-05	20876	1181	22057	84.2	3.1
2005-06	20978	1281	22259	84.6	3.4
2006-07	21081	1678	22759	85	4.4

However, the gap between demand and supply of green fodder has been remarkably wider and there has been a distinct pattern between these gaps of dry and green fodder. As explained, gap between the demand and supply of dry fodder has narrowed down in the recent years whereas this gap has remained static (about 96 to 97%) for the green fodder. This implies that hardly 3 to 4 percent of the state's green fodder

requirement is addressed with the domestic production. This indeed is a matter of serious concern, as it affects the dairy development in Bihar to a large extent and thus requires immediate attention for increasing its supply. To achieve this, there are two options:

1. One option is that some additional area be put under the fodder production. But existing land use pattern does not leave much scope for the horizontal expansion of fodder production as the net cropped area is already declining and any such effort danger the objective of strengthening food security in the state. Of course, green fodder production, to a certain extent, can be enhanced through vertical expansion of the fodder production by developing short duration, high yielding, and multi-cut, nutritive and low cost fodder technologies.
2. And the other viable option could be that some alternative sources of cultivated green fodder be identified, tested and fed to the animals. There are some localized practices of feeding livestock with tree leaves, trunks and leaves of succulent plants, local weeds, and wildy growing plants. It is imperative that such practices be scientifically tested and introduced to increase the supply of green fodder in the state.

Section IV

Observations and Findings

Important forage and concentrates

The results of Rapid Appraisal (RA) show a distinct pattern of livestock feeding which is by and large common in all parts of Bihar. Declining pastures and restricted entries in reserve forest as well as common property resources are forcing the livestock rears to shift from grazing to the practice of stall feeding, wherein a significant proportion of feed requirement is met by the produced and processed forage and concentrates. In-milk cattle and buffaloes receive a greater attention and a bulk of green fodder and concentrates are fed to them only. Dry bovines and other livestock usually get dry fodder with some residual of green fodder and concentrate.

Table- 11: Important forage (dry and green) and concentrates

Type of feed	Important items
Dry fodder (82%)	<ul style="list-style-type: none"> • Wheat straw (40%) • Paddy straw (55%) • Pulses straw (2%) • Maize stover (1%) • Others (2%)
Green fodder (10%)	<ul style="list-style-type: none"> • Grasses, rogues and weeds (40%) • Stover green (maize, sorghum) (30%) • Other cultivated fodder crops (Napier grass, Berseem, etc.) (20%) • Legumes (lathyrus, peas, etc.) (5%) • Leaves (peppal, banyan, Jackfruit, Madras thorn, bamboo, subabul zizipher, etc) & trunk (banana) (5%)
Concentrate (8%)	<ul style="list-style-type: none"> • Oil cakes (Linseed, mustard, others) (30%) • Wheat bran (Chokar), crushed wheat, maize, millets (Darra) (40%) • Broken and discarded/ degraded pulses (lathyrus, lentil, green gram, pigeon pea and other pulses (chunni) • Manufactured compound feed (25) • Others (Mineral mixture, salt, oil, jaggery, household wastes) (5%)

Source: Information elicited in RRA

Box-1: Important sources for feeding cattle in Bihar: Dry fodder

Paddy Straw

Paddy straw is the most important source of animal fodder in Bihar, and in agro-climatic zone IIIA and IIIB it dominates as a staple dry fodder of the region. Farmer prefers it because of its easy availability and popular traditional belief that it is easily digestible and better for milch animals. Paddy straw for feeding the animals is used in three forms, namely; loose unarranged paddy straw or *Pual*, neat bundles of paddy straw or *Newari* and Chopped Paddy Straw or *Kutti*, prepared from both *Pual* and *Newari*.



Fig-1 a & b: Paddy straw being chopped for feeding cattle

Wheat Straw

The other important source of dry fodder in Bihar is the wheat straw which is commonly used as a staple feed for cattle in agro-ecologic zone I & II of the state. Interestingly, farmer provides same reason for preferring it over paddy straw is that it is easily digestible and is better for milking livestock. However for trade, it is most demanded fodder which dominates particularly in agro-ecologic zone I and II because these regions faces perennial floods year after year.



Fig-2 a &b: Wheat straw used as a feed

Pulses Straw

Different type of pulses straw, which depends on cropping pattern of particular area, is in practice in Bihar, in which Lentil, Lathyrus, Gram, Mung and Urad straw are mainly feed by farmer. However, these straws are not being traded on a large scale, and mostly used for in-house consumption just after harvesting season because the farmers informed that the taste of pulses fodder becomes bitter after storing them for some time as moisture content goes up and is not preferred by cattle.

Maize Stover

In the areas where maize is a predominant crop like in agro-ecologic zone II particularly in Begusarai and Khagaria districts, its stover is used as a substitute of main dry fodder Bhusa/ Pual/ kutti.



Fig- Maize stovers dry for use as a fodder

There is however little evidence of trade in maize stover and it was found to be mostly consumed on the farm itself.

Crop residues and by products are the key components of livestock feed. Dry fodder constitutes largest proportion of the forage. During focussed group discussion (FGD) it emerged that about 82 percent of the feed requirement is met by the dry fodders (table-11). Straws of paddy and wheat are the two most important dry fodders which are fed to the livestock. These together contribute to about 95 percent of the dry fodders

consumed by the livestock in Bihar. There are other forages too whose dried parts (stems and leaves) are used as the animal feed. For instance, small quantities of beaten straws of some of the leguminous crops like lentils, green gram, red gram, lathyrus, etc, are mixed with other fodder while feeding the livestock in some of the areas like *Tal* and *Diara*. Maize stover also assumes significant importance in the maize growing areas of Bihar, where it is a common fodder for the livestock.

The proportion of green fodder in total livestock feed remains close to 10 percent. About 55 percent of green fodder are cultivated. Maize, sorghum, berseem, napier grass, and some of the legume species are mostly cultivated to meet the requirements of animals. Stovers of green maize and sorghum accounts for about 30 percent of the total green fodder particularly in maize growing areas. Some specific green fodder crops like berseem and napier grass are also cultivated. They constitute 20 percent of the green fodder.

Box-2: Important sources for feeding cattle in Bihar: Green fodder

Cut Grass

Cut grasses are the main source of green fodder for landless, marginal and small farmers. Most poor and landless cattle owners and their family members collect/cut green grasses from common property resources in and around the village and feed their animals every day. A bundle of freshly cut green grass is either mixed with dry fodder after chopping or fed to the animal as such in raw form.



Fig- Cut green grass for use as a green fodder

Berseem/Sudan grass

Now a day these grasses are becoming popular among farmer very few farmers are actually growing it due to lack of irrigation facilities, though most feel that it's a better green fodder option for animal health and enhancing the milk production. Generally it is mixed with dry fodder after chopping. Sudan grass is also being cultivated as fodder by farmers but face the same problem of irrigation as Berseem, as a result only large farmers who have adequate irrigation infrastructure are in a position to grow it .

Maize Stover green

As a green fodder, in maize growing areas it is popular. The green Stover is chopped and mixed with dry fodder for feeding the animals. It is also sold to dairy farmers located in nearby urban centers through various traders who in turn sell it to the urban dairy farmers.



Fig- Maize being grown as fodder

Banana Trunk & leaf

In some part of Bihar particularly the areas like Murliganj in Madhepura, Hajipur and Naugachhia in Bhagalpur districts where banana is grown on large area as main crop, the unique practice of using banana trunk and leafs as green fodder has been observed. The trunk is chopped and mixed with dry fodder but this is not a common practice and is preferred only during the periods of scarcity as a coping strategy.

Oat/Urd/Mung Green

In flood affected areas of Bihar, urd and moong is used as green fodder since traditionally in the areas where its cultivation is prevalent. In Rabi season oat is traditionally being cultivated as green fodder but its area is very low and decreasing in Bihar.

Bamboo leaf

This is a practice most popular in the eastern parts of the state, particularly, the North-eastern parts (agro-ecologic zone I and II), where bamboo is grown on a large scale. In these areas use of tender bamboo leaves as green fodder is a popular in and feed as alternative source of green fodder.



Fig-Bamboo leaves for use as fodder

Due to height of bamboo, even after submergence, most of the leaves and vegetative parts are accessible during flooding period and are an important source of green fodder for the resource poor farmers of Bihar. However, feeding of bamboo leaves to cattle is mostly used as a mitigating strategy and is avoided during other seasons.

Cut grasses, weeds and rogues are also potential sources of green fodder. They contribute substantially in the feeds of livestock. It was reported that atleast 40 percent of the green fodder is obtained in this way and given to the livestock after chopping. In addition, leaves of a few trees and banana trunk also suppliments the green fodder of livestock.

The proportion of concentrate in total feed comes close to 8 percent. Oil cakes, choker (wheat bran and husks of pulses), darra (crushed grains) and chunni (broken and discreded pulses) are the most important concentrates. Manufactured compound feed are also popular. In total consumption of concentrates, oil cake, compound cattle feed and other concentrates farmers are used in the proportion of 30, 25 and 45, respectively. But due to alternative uses of many of the concentrate items, their use may decline in future.

Storage

Every household that owns livestock stores fodder for their future use. The quantity of fodder stored varies in accordance with the number of livestock, storage capacity and space with the livestock rearers. Keeping these factors in mind fodder producers who also own livestock store 20 to100 percent of fodder produced at the farm. Commercial dairy farms and non-commercial milk producers who are the ultimate purchaser of fodder and concentrate also store a significant amount of fodder to meet their day to day requirement. For storage, different types of practices are adopted. Different types of storage practices are used for the different feed items.

Box-3: Different methods of fodder storage in Bihar

Fodder storage makes stock to feed livestock for throughout year, particularly dry fodder, which also maintains the demand during lean period and natural calamities. Farmer prepares storage according to the need and availability of fodder, which is generally projected during harvesting season. Structure of storage varies according to region, topography, environmental condition, cropping pattern, type of fodder and economical condition of the farmer. In subsistence economies, the storage practices are traditional and based on indigenous knowledge of farmer. The main storage practices are; (i) open (ii) in-house and (iii) special structured;

Storing in open

In paddy and maize growing areas, this type of storages is common for paddy straw and maize stover. In this method, either the paddy straw (*Pual*) is unsystematic heaped in open (fig: 1) or paddy straw (*newari*) is arranged systematic in a cylindrical shape with top covered with straw itself but arranged in a such a way that it protects the straw from rains (fig: 2). In areas facing recurring floods another method of storage is practiced where the bamboo poles are fixed in such a way that they support the fodder heap some 1-1.5 ft above the ground and the fodder can thus be saved from ground moisture in case of prolonged water logging (fig.3).



Fig 1: Paddy straw storage



Fig 2: Paddy straw storage



Fig 3 a & b: Open storage of paddy straw in flood affected area

In-House Storage

This type of storage is generally used for chopped paddy straw (kutti) and wheat straw (bhusa). Sometime farmer store in-dwelling houses and sometime specially constructed structures or huts are being used for storing dry fodder for livestock. But this type of storage is done by farmers, who are relatively better-off, very small and marginal farmers generally do not store fodder much and they rely either on day to day purchases or store in open.



Fig. 4: a & b: Common fodder storage structures in rural Bihar

Specially Structured Storages



Fig 5 a & b: In-house fodder storage

In some area pucca and/ or huts type structures are specially prepared for storing dry fodder, this is however a rare practice limited to either large farmers who have large land holdings or keep many animals for whom they need to store. These structures typically cost around Rs. 5000 to 10000 and can be used for 4-10 year. In these structures only chopped paddy straw or wheat straw is stored.

Generally, paddy straw is stored in open underneath the sky. The loose piles of paddy straw are stacked together in a corner of courtyard. This type of storage is common in the areas where paddy is harvested by the combines. The next important practice is storage of paddy straw in heaps/ bundles arranged in the cylindrical shape covered by a conical shape cap made of paddy straw/ thatches only in the fields or near the dwelling house. Due to conical shape of the heap cap, water does not percolate inside the heap and the whole pile of straw remains unaffected. Sometimes paddy straw is also stored in the dwelling house itself.

The method of storage of chopped paddy and wheat straws are different. Paddy straws are chopped by the animal rears before feeding. It is also chopped by the fodder traders who buy paddy straw from the farmers and chop it before selling to the small dairies/ livestock rears. Wheat straw is chopped while threshing. Both chopped paddy and wheat straws are never stored loose in open. Most of the time, these are stored in the dwelling house of the producers or the users. Besides, some special bamboo made storage structures (locally known as *Bukhari*, *bhuskar*, etc.) also prepared and used to store chopped paddy and wheat straws solely or along with food grains. These structures provide scientific, safe and economical solution to the problem of storage. Storage in such structures is therefore, the most popular and widely used method of

fodder and grain storage. Some affluent and big producers/ traders have also constructed cemented structures to store the fodder and grains. (Table-12)

Table- 12: Methods of fodder storage in Bihar.

Type of fodder	Open	In dwelling house	Bamboo structure	Under thatched roof
Paddy Straw (Pual)	+++	+	-	-
Paddy Straw (Newari)	+++	+	-	-
Paddy Straw (chopped)	-	++	++	+++
Wheat Straw	-	+++	+++	+++
Pulses Straw	-	+++	+	++

Source: Primary level survey

+++ indicates most common practice

Fodder and concentrate marketing

Fodder marketing in Bihar is absolutely unorganized and deprived of any institutional support. Paddy and wheat straws are the major traded fodders. Almost whole of the fodder trade revolves around the marketing of these two. Green fodder is also traded but its proportion is quite insignificant. With the commercialization of dairy sector and rearing of high yielding animals concentrate market has emerged in a big way. Both formal and informal markets operate in this segment.

Actors of fodder trade

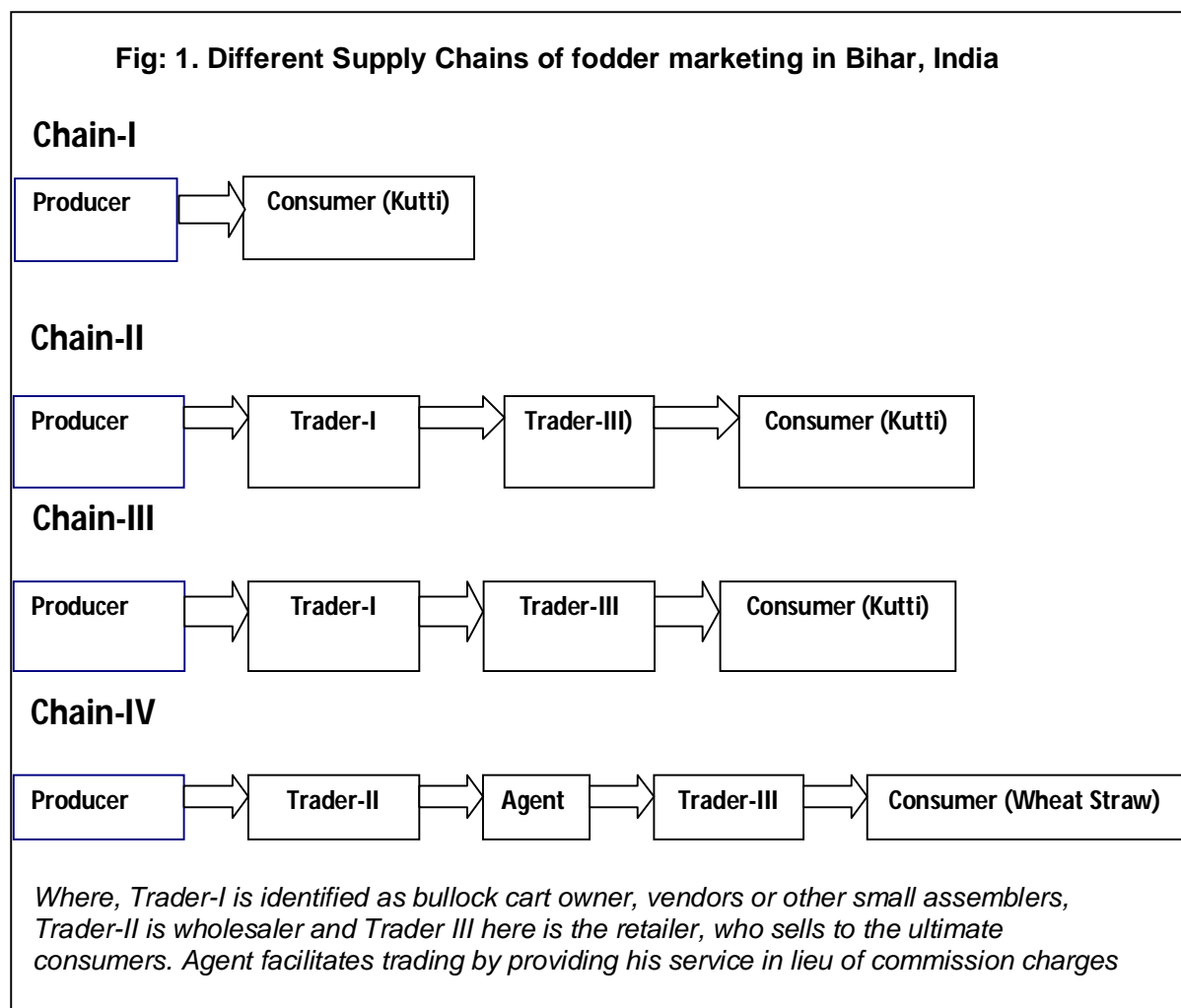
Fodder marketing involves a number of actors across the supply chain. As usual a normal supply chain begins with the fodder producer and ends with the ultimate user. Different types of supply chains were identified during the RRA. The most common fodder supply chain begins with the producers and proceeds further in different ways with the help of various kinds of actors such as assemblers and small vendors, commission agents, retailers, wholesalers and processors and ends with the ultimate users who are scattered across the state.

Supply chain of feed

Different types of fodder supply chains are shown in figure 1. It depicts that about 60 percent of the marketed surplus reaches in the fodder market from the producer by the Trader-I. Trader-I involves bullock cart owner, vendors and small other small assemblers who contact the producer and procure fodder from them. There are many

retailers who maintain good contacts with the producers and purchase fodder directly from them. The wholesalers are shown in figure1 as Trader II. Trader II procures 30 percent of fodder sold by the producers directly from them. Producers supply 10 percent of their marketable surplus to the consumers or ultimate users.

The longest supply chain involves producer, Trader I (explained above), Trader II (also defined above), Commission agents, Trader III and finally the ultimate consumers. Trader III here is the retailer, who sells to the ultimate consumers. Commission agents are those who provide their services in lieu of certain charges.

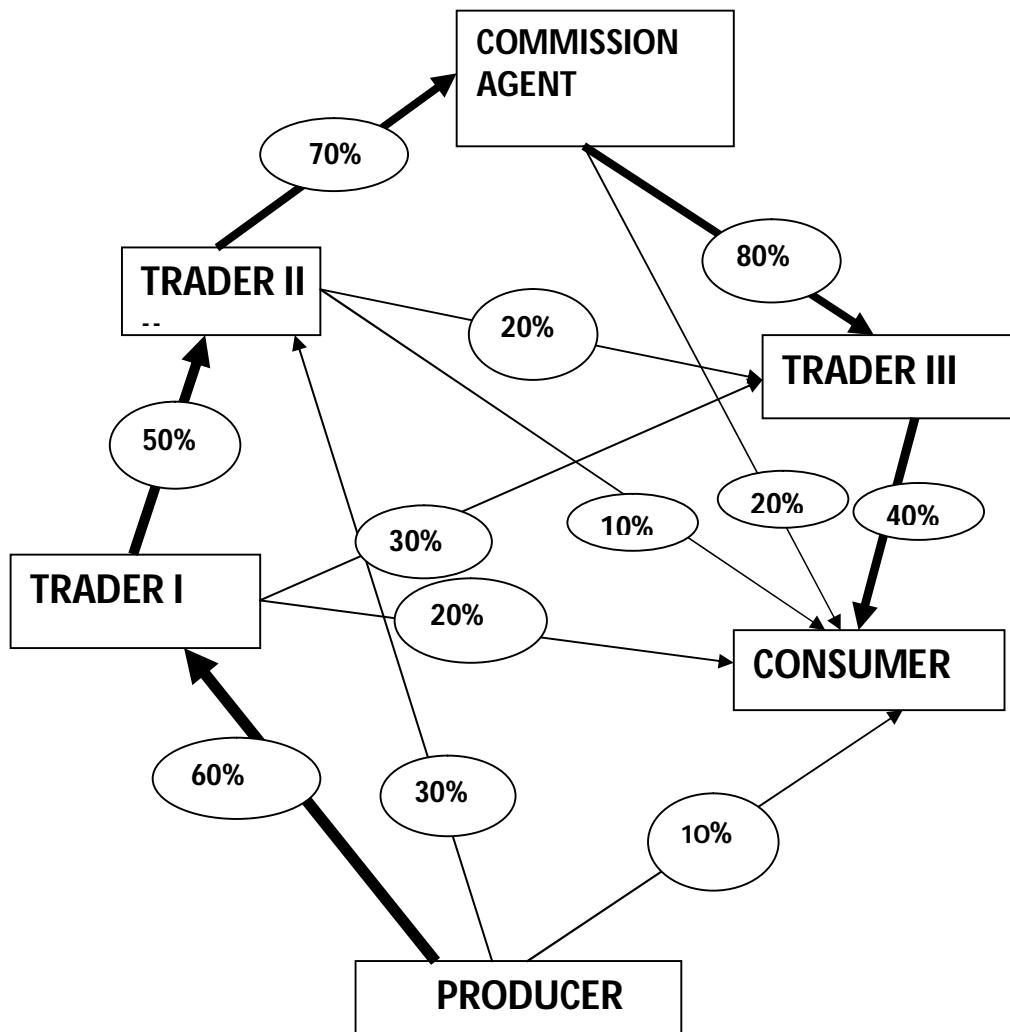


The largest purchaser of fodder from the trader I is Trader II. Trader I sell 50 percent of their purchased fodder in the hands of Trader II (retailers), 30% to the trader III (retailers), and 20 percent with the ultimate consumers. Trader II operates with the help

of commission agents who dispose 70 percent fodder of the trader II. Remaining 30 percent of the fodder with the trader II is sold directly to the Trader III and the consumers.

Commission agents route 80 percent of their volume of business via Trader III (Wholesalers & other big traders). Consumers too contact commission agents and buy fodder with their help. Commission agents channelize remaining 20 percent of the fodder in the hands of consumers.

Fig: 2. Flow of fodder transaction by different actors in Bihar



Method of fodder trade varies with the type of feed. Different practices are adopted to determine the quantity of traded feed (Table-13). Both weighing and measurement by volume are practiced in the fodder trade. Usually sale and purchase of rice and wheat straw at the farm level are done on the basis volume. The quantity of fodder is determined as per the lot size, size and number of small bundles; and truck/ cart load. The method of weighing is also practiced where facilities are available. Type of fodder also plays a deterministic role while measuring the quantity. Although wheat is harvested manually in most of the parts of Bihar, it is thrashed mechanically by the specially designed threshers which also chop the wheat straw in fine pieces-called bhusa. Practically all types of bhusa (chopped wheat straw) are sold by the lot size. Fodder transactions as per cart, tractor and truck loads also give fair estimates of weight and often become the basic units of sale.

Table- 13: Method of measurement of fodder/concentrate

Actors of Fodder Marketing	Method of Weighing		
	Weighing	Counting	By lot
Producer	+	+++	++
Fodder trader	+++	-	-
Consumer	+++	++	++
Agent	-	-	-
Concentrate trader	+++	-	-
Concentrate miller	+++	-	-

Source: Primary level survey, +++ indicates most common practice

Farmers sell paddy straw on the basis of counts of small bundles or by lot size made of thousand bundles by the producer farmers. A lot of thousand bundles weigh about 40 to 60 Kgs and sold at Rs 100 per bundle.

Formal weighing procedure is also adopted. All bulk trades in fodder beyond farm are done on the basis of formal measurement. Small balances are used to weigh the bundles/ sacks of fodder. For loaded trucks, tractors etc weighing bridges are used. These weighing bridges are installed at certain entry and exit points in urban and semi urban areas or along the side of important roads/ highways.

Mode of transport

All sorts of transport facilities are used to carry fodder from one place to other. Various modes of transport used in fodder marketing are presented in table-14. The mode of transport depends on distance and purpose of transportation.

Head loads are common for transportation of green fodder from the field to farms for self use. For localized fodder and concentrate trades (< 10kms) mainly bullock carts are used. A bullock cart load of wheat straw fetches a price of between Rs. 1200-1500 and roughly weighs 4 to 5 quintals. A number of bullock cartiers (bail gadiwalas), particularly in fodder surplus zones, are involved in fodder trade. They keep track of fodder producers; consult with them, make negotiations, purchase fodder, and sell it the local/ nearby markets. The modus operandi of these bullock cartiers are more or less similar. They load fodder on their carts in the evening through the mid night, travel to the nearby market centres- often located in the urban places, reach there by the dawn, stay there for 2-3 hours, sell fodder in the hands of dairy/ livestock owners in cash, and unload the cart at their doorstep. If they fail to find any such purchaser, they maintain contacts with a few permanent fodder traders/ processors and drop the fodder load at their shops at a rate, lower by 5 to 10 Rs. Per quintal than the normal market price. In such cases shopkeepers, make their payments as per their convenience or as and when the fodder is sold.

Table- 14: Important modes of fodder transportation

Important modes of fodder transportation
<ul style="list-style-type: none">• Head load• Different types of carts<ul style="list-style-type: none">○ Hand push cart○ Bullock cart○ Horse cart• Tractor- trolley• Trucks/ lorries<ul style="list-style-type: none">○ Big trucks○ Small trucks○ Pick-up vans

Tractor trollies are also very important for fodder transportation. About 10 to 15 quintals of wheat/ paddy straw is loaded on a tractor trolley, which is sold in the peri-urban markets. The tractor trollies transport fodder (wheat straw) using bamboos or specially

designed structures covered with gunny bags. The tractors plying with huge amounts of fodder can easily be seen on the National Highways or city roads in Bihar.

Fodder loaded trucks relatively cover longer distances. Most of the inter-state and inter-regional trade is accomplished by the trucks. A truck load of wheat straw accommodates 20-25 quintals and covers distant markets. The truckers purchase fodder from the farmers and petty traders of surplus regions of South Bihar and Eastern Uttar Pradesh and transport and sale it in different fodder deficit regions with the help of commission agents. A number of truck owners are involved in this business but some big fodder traders also hire trucks for this purpose. The most common commission agents are *Dharam Kanta Walas* (owners of weighing bridges). Both purchasers and traders contact these commission agents who facilitate the negotiations between the two and charge commission in lieu of their service. Sometimes the truckers stop at the *Dharm Kantas* and interact directly with the purchasers.

Direction of inter-state and inter-district fodder movement

Some very interesting patterns of fodder movement have emerged. Patna, Jehanabad, Nalanda, Sheikhpura, Lakhisarai and Rohtas, which are the fodder surplus districts are the main supply centres for dry fodder (table 15). Patna is the biggest transit point for fodder marketing. Apart from its own production, fodders from the nearby districts like Jehanabad, Nalanda, etc. channelized via Patna. Fodder (mainly rice and wheat straws) from these markets are supplied and traded in the deficit regions of Begusarai, Vaishali, Samastipur and in the flood affected districts viz. Madhubani, Saharsa, Madhepura, etc.

Table- 15: Direction of inter-state/inter-district fodder movement.

District	Out-going of fodder	
	Inter-district	Inter-state
Patna	1. Vaishali 2. Begusarai 3. Samastipur	Jharkhand
Jahanabad	1. Patna 2. Vaishali 3. Begusarai	Jharkhand
Nalanda	4. Patna 5. Vaishali	Jharkhand

	6. Begusarai	
Sekhpura	7. Begusarai 8. Vaishali	Jharkhand
Lakhisarai	9. Begusarai 10. Vaishali	Jharkhand
Rohtas	11. Vaishali	Jharkhand

Fodder markets of these regions are also involved in inter-state fodder marketing. The most important fodder purchasing state that buys fodder from Bihar is Jharkhand. Jharkhand itself is a fodder deficit state and most of the dairies and livestock owners depend on inter-state trade of fodder. Bihar also imports fodder from other state. The most important and regular inter-state trading (exporting) partner is Uttar Pradesh. Mainly wheat straw is traded and transported and sold directly in the fodder deficit regions of north Bihar. Vaishali district is the main transit point for this transaction. During acute fodder crisis fodder (exclusively wheat straw) is imported from the states like Punjab, Haryana and even Madhya Pradesh.

Mode of communication among different actors of fodder market

Supply of information plays a critical role in fodder marketing. Different actors of fodder market use different modes of communication to elicit information and contact their counterparts (Table-16). Three types of communication are in practice. Among producers/ farmers verbal communication seems to be the most important and sole practice. Of course a few exceptions are there where the producer farmers used telephone to contact the traders or buyers. In general, producers do not make any efforts to contact fodder traders/ buyers. The reason being that a majority of farmers (96%) in Bihar practice agriculture on <2ha of area and generates a very tiny surplus of grains and fodder. They dispose off their fodder stock when the purchasers visit them. Therefore, in majority of cases verbal communication alone solves the purpose of fodder producers.

Table- 16: Mode of contact among different actors of marketing chain

Actors of fodder marketing	Verbal Communication	By telephone	Individual Information
Producer/farmer	+++	-	-
Fodder trader	+	+++	++
Consumer	+++	-	+
Agent	++	+++	-
Concentrate trader	-	+++	++
Concentrate Miller	-	+++	-

Source: Primary level survey, +++ indicates most common practice

The consumers rely mostly on verbal communication. Most of the livestock rearers (consumers of fodder) communicate verbally as they prefer to contact other actors in person to negotiate feed prices and ensure feed quality. Individual information is also important for the fodder purchaser (ultimate users). Before purchasing they contact their acquaintances, friends etc. to have an idea about the price, quality and availability of fodder.

The role of efficient mode of communication is relatively critical for the livestock feed traders, agents and concentrate millers. It helps them integrate with the feed markets and establish backward and forward linkages in the feed sector. It also helps traders, agents and concentrates millers to take advantage of arbitrage or price differential between the two markets. Telephones and cellular phones are now being used extensively to communicate with different actors of fodder market chain to receive and disseminate relevant market information. Almost all fodder traders and agents own a cell phone, which help them to contact buyer and sellers in this business. However, verbal communication has not lost its significance. It is the next important mode, which is still popular among the petty traders in the rural fodder markets.

Price determination and determinants of price

About 95 percent of the dry fodders comprise paddy and wheat straw. Both of these are agricultural by-products that involve no additional production cost but supplement farmers' income when used for livestock production on farm or sold. The process of

price determination is simple. Farmers either accept the prevailing market price of fodder in the nearby region or negotiate with the purchasers assuming the prevailing market price as a reference. Of course exigency of demand and availability of fodder are considered while prices are determined.

Deficit zones often witness extremes of flood devastation and face critical shortage of livestock feed in consequence. Under such circumstances, the demand for livestock feed rises many fold and hence price negotiations are driven by the exigency of demand. Otherwise, in normal situations price negotiation remains supply driven.

Table- 17: Factors affecting fodder price in Bihar.

Type of fodder	Colour & Lustre	Taste	Softness & Freshness	Cleanliness	Moisture content
Paddy Straw	+++	++	++	++	++
Wheat Straw	++	+++	++	++	++
Pulses Straw	++	++	++	+++	++

Source: Primary level survey, +++ indicates most common practice

However there are other considerations too that affect the fodder price (Table-17). Certain quality aspects like good lustre, taste, cleanliness, softness, and moisture contents of fodder are considered while prices are determined. The fodders having all or some these good qualities receive premium price. Producers, therefore, often try to sort and grade their fodder considering these criteria.

Transportability and access are other important considerations. Purchasers/ traders usually prefer to procure fodder from such places which are connected with good roads. During RA it was reported that even in the same village there was a price differential because of location of the source of fodder. The fodders stored along the roadsides received higher price compared to that which were stored remotely inside the village. It was found that about 67 percent of the fodder producers succeeded in getting a higher price by making negotiations with the fodder traders / purchasers while 33 percent had

no options other than to accept the offered (prevailing) price of the fodders. Traders usually consider the demand and supply scenario and accordingly offer the price.

The prices of different concentrate feed depend on the prices of raw materials. In comparison to fodder market concentrate market is fairly organized and competitive. Livestock concentrates involve processing. The scale of their (concentrates) production also varies significantly. There are a number of millers/ processors who produce very small amounts of concentrates and trade these in the local markets. In contrary, there are several big processors whose scale of production is fairly high. They maintain good backward and forward linkage with different actors and target their products in different markets.

Fodder prices in surplus and deficit zones and terms of sale

There has been a wide difference in the fodder prices between the surplus and deficit zones (Table -18). It is obvious that fodders prices in deficit zones are of 17 to 50 percent higher than that of surplus zone. A quintal of paddy straw was sold at a price of Rs. 100/ qtl in the surplus zone. At the same time, the price of one quintal of paddy straw in the deficit zone was Rs. 150. The average price of wheat in the surplus zone was Rs. 200 per quintal whereas in deficit zone accounted to Rs. 300/ qtl. Price of cultivated green fodder is usually determined on the basis of its area. In surplus zones a hectare of green fodder is sold in the range of 15 to 25 thousand rupees. In deficit zone it is sold between 25 to 35 thousand rupees. Cut grasses and green fodders are also sold in some of the areas at the rate of Rs. 1 to 1.5 /kg.

Table- 18: Range and average of producer's price in surveyed area

Type of fodder	Surplus		Deficit	
	Range	Average	Range	Average
Paddy straw (Rs/50kg bundle)	75-125	100	125-200	150
Wheat straw (Rs/q)	125-250	200	200-500	300
Pulses straw	150-400	300	200-450	350
Standing green grass (Rs/115 Sq. feet)	300-500	400	500-700	500
Green grass bundle (app. 10 kg)	10-15	10	10-15	10
Sorghum per bundle of 10 steams (in urban area)	--	--	10	10

Source: Primary level survey, * only in banana growing areas

Both cash and credit sales are practiced in the livestock feed market. Though cash sale is preferred but many a times, circumstances force the producers, sellers and consumer to facilitate fodder feed marketing on credit too. It is a common practice in livestock fodder and concentrates market that traders purchase these items on credit, sell these in the market or to the consumers, clear the past dues of the supplier and again lift these items on credit. The responses of various traders, producers, agents and consumers are presented in table-19. The proportion of producers selling fodder in cash and credit was fifty-fifty. The proportion of traders selling fodder in cash and credit was 60:40. A large proportion of consumers buy fodder by making cash payments. Concentrate traders to insist on cash marketing and only one third of them reported that they sell it on credit. Millers also are bound to sale on credit. Six out of 10 millers reported that there are a number of millers who are willing to supply concentrates on credit to the shopkeepers/ traders and if they insist on cash sale only they will be thrown out of the market. This forces them to go for this practice despite they are harassed by the traders/ shopkeepers.

Table- 19: Terms of selling of fodder/concentrate

Actors of fodder marketing	Cash	Credit
Producer	7	7
Fodder trader	8	6
Consumer	9	5
Agent	--	--
Concentrate trader	8	4
Concentrate Miller	4	6

Source: Primary level survey. Figures in columns are numbers of the respondents.

Constraints of feed marketing and suggestion for improvement

Fodder and concentrate markets in Bihar face several constraints (Table-20). Many of these constraints are generic in nature and need to be addressed to the extent possible. Difficult storage and lack of appropriate storage facilities seriously affect round the year availability of fodder. Most of the marketable surplus of fodder is generated by the marginal and small farmers, who are in majority in the state but they have limited storage capacity. Due to difficulties in fodder storage they are forced to sell it immediately after the harvesting. Even if it is stored a large proportion of fodder gets spoiled or destroyed due to improper storage facilities.

Transportation of fodder from the production centres to the markets is also extremely inconvenient and involves huge transportation and transaction costs, due to poor road conditions in the rural areas. It is estimated that marketing of one quintal of fodder involves Rs. 395/- out of which the cost of fodder account for about 32 percent only and rest is the marketing cost including transportation cost. The highest cost item is transportation cost which accounts for about 36 percent. To avoid harassments by the government machinery a handsome amount of money (4%) is paid as bribe to various Government personnel (traffic police, octroi and tax, etc.).

Exploitation of producers by the fodder traders and agents is also very common. Many a times fodder is purchased on credit and payments are delayed extraordinarily or only a part of payment is made and farmers are convinced to forgo remaining amount. There are other difficulties too. Inadequate supply of fodder, low profit, inadequate capital, unorganized market, lack of any dedicated marketing place are some of the other critical problems that impede the growth of fodder markets in Bihar. Many of these problems are difficult to address but some of these can be effectively addressed.

Table- 20: Problem faced by actors of fodder/concentrate marketing chain

Problem	Farmer/ producer	Trader	Agent	Fodder purchaser	Concentrate miller	Concentrate trader
Lack of proper storage facility	7	--	--	6	--	--
Traders domination due to limited trader	7	--	--	--	--	--
Infrastructural problem	2	--	--	--	--	--
Weather hazards	1	--	--	--	--	--
Inadequate supply of fodder/concentrate	--	2	--	--	--	2
Low profit	--	6	2	--	4	6
Lack of specific place for marketing	--	4	--	--	--	--
Inadequate capital	--	2	--	--	--	--
Absence of institutional credit facilities	--	3	--	--	--	--
Harassment by administration	--	2	--	--	--	--
transportation	--	2	--	--	--	--
Credit sale	--	4	--	--	3	1
Declining demand	--	--	--	--	--	1
Unorganised market	--	--	--	--	2	1
Lack of electricity	--	--	--	--	2	1

Competition with inferior quality	--	--	--	--	1	2
Strenuous job	--	--	2	--	--	--
Seasonal business	--	--	--	--	3	--
Scarcity of raw material	--	--	--	--	5	--
Increasing input cost	--	--	--	--	2	--

Source: Primary level survey, Figures in columns are numbers of the respondents.

Table-21, presents the suggestions as envisaged by different actors of fodder market. A majority of them suggested that Government should come forward and develop fodder storage facilities in different regions so that farmers could store fodder that will ensure its availability throughout the year. Due to lack of adequate storage facilities and space producers are forced to dispose the fodder in excess of their marketable surplus and therefore many times marketed surplus exceeds the actual marketable surplus in this way.

It is also suggested that there should be some sort of institutional provision/arrangement to promote this sector. Credit support may be one of them. The persons who are involved in fodder trade are very poor and often start fodder business with a very small amount of capital that does not only limit the volume of business but also affects the interest of producer and seller.

Fodder markets are highly unorganized and informal and the role of public sector/govt. in its marketing is virtually negligible. There are no dedicated places (formally) for the fodder markets. Most of the fodder markets are operating along the roadsides and have no legal credentials. This becomes one of the reasons of exploitation of people who are involved in this business. It is envisaged that establishment of dedicated and legal market places would help fodder trade a great deal and also check corrupt practices and exploitations of poor producers and traders.

Table- 21: Suggestions by stakeholders of fodder/ concentrate marketing chain

S. No	Suggestions	Farmer/ Producer	Trader	Agent	Fodder purchaser	Concentrate Miller	Concentrate trader
1	Govt should develop storage facility	9	5	3	4	1	--
2	Systematic marketing system of fodder through Govt. interventions	11	3		3	--	1
3	Proper marketing place for buyer and seller	1	--		--	--	--
4	fodder bank by Govt.	1	--		--	--	--
5	Power supply	1	--		--	7	--
6	Better road linkages	--	2		4	1	--
7	Distribution of fodder during natural hazards	--	2		--	--	--
8	Price policy by Govt	--	2		--	--	2
9	Credit facility by Govt.	--	6		--	2	1
10	insurance for business	--	3		--	--	--
11	fodder trading association	--	4		--	--	--
12	Specific marketing place	--	3		--	--	--
13	Price should be stable and controlled	--	2	1	11	--	1
14	transportation cost should come down	--	2	4	--	--	1
15	Govt. should sell during deficit months	--	--	--	4	--	--
16	protection from wild animals	--	--	--	2	--	--
17	Subsidy by Govt.	--	--	--	1	1	1
18	Substitute of green fodder should be	--	--	--	1	--	--

	developed						
19	factory or company for milling	--	--	--	--	3	1
20	Advertisement	--	--	--	--	1	--
21	New technology in business	--	--	--	--	1	1
22	Control inferior quality	--	--	--	--	1	2
23	Packaging of concentrate	--	--	--	--	--	1
24	Production of raw materials	--	--	--	--	--	1

Source: Primary level survey

Fodder handling

Fodder is a bulky item, which makes its trading cumbersome and handling difficult. Some traders use compressing machines to make fodder blocks. This makes storage easy, transportation convenient and cost effective. A majority of machines used for compressing fodder are obsolete. These machines were designed for the compression jute in the jute factories during the colonial period. These machines, to some extent, serve the purpose of traders/ transporters but lack on efficiency count.

There is a need to design and develop some new, economical and cost effective machines to help fodder sector. Govt. of Bihar has planned to establish two plants for preparing feed blocks; one each in fodder deficit region (Samastipur) and feed surplus region (Patna).

Quality control issues

Quality control of manufactured compound feed and concentrates is also essential. Most of the traders and consumers feel that there should be a mechanism to ensure quality of manufactured feed and nutritional supplements. Millers feel that prices of most of the raw materials are escalating day by day, and this compels a number of millers/ manufacturer to go for cheaper substitutes or to use inferior material. They look forward for some cost effective and improved technology for the manufactured feed. Public sector R&D can play an effective role in this regard. This can also be done in public-private partnership.

Conclusions

Livestock is an integral part of rural economy in Bihar and fodder is a critical input for livestock development. Data shows that there exist a huge gap between demand and supply of fodder (both dry as well as green). Most part of the south Bihar comprising of agro climatic zones, IIIA and IIIB are fodder surplus because of cultivation of paddy and wheat under assured irrigation facilities. Agro climatic Zone I and Zone II are fodder deficit and mostly depend on fodder surplus regions for their fodder requirement. In order to promote fodder production and requirement it is imperative for the Government to come forward and develop fodder storage facilities at different locations in different regions, so that farmers could store fodder to ensure its availability throughout the year. Due to lack of adequate storage facilities and space producers are forced to dispose the fodder in excess of their marketable surplus and therefore many times marketed surplus exceeds the actual marketable surplus in this way.

Institutional support in the form of credit and creation of fodder banks in different fodder producing as well as deficit areas for maintaining buffer stock is essential. Fodder markets are highly unorganized and informal and the role of public sector/govt. in its marketing is virtually negligible. Most of the fodder markets are running on different places do not have any dedicated market place.. Most of the fodder markets are operating along the roadsides and have no legal credentials. This becomes one of the reasons of exploitation of people who are involved in this business. It is envisaged that establishment of dedicated and legal market places would help fodder trade a great deal and also check corrupt practices and exploitations of poor producers and traders.

Fodder is a bulky item, which makes its trading cumbersome and handling difficult. Some traders use compressing machines to make fodder blocks. It is important to develop some cost effective and efficient fodder compressing machine for ease of handling and transportation as well as cost saving.

Quality control of manufactured compound feed and concentrates is also essential. Most of the traders and consumers feel that there should be a mechanism to ensure quality of manufactured feed and nutritional supplements. Development of technology

for cost effective and nutritive feed is requires urgent attention and here Public sector R&D can play an effective role. This can also be done in public-private partnership mode.

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Annexures

Annex 1

Selected samples from different zones of fodder marketing chain

Region	Districts	Names of the selected locations	Category-wise number of respondents					
			Producer /farmer	Fodder trader	Concentrate trader	Feed Miller	Consumer	Agent
Surplus	Patna	1. Chitkohra 2. Harni Chak 3. Babu Bazar 4. Yogipur 5. Bhutnath Rd. 6. Gulzarbagh 7. Maharajganj 8. Chitragupta Nagar 9. Indrapuri (Azad dairy) 10. Rajabazar Govt.Cowshed 11. Kanchanpur (Bihta)	3	3	3	3	3	-
	Jehanabad	1. Kanaudi (near railway station) 2. Saibai Bazar 3. Raja bazaar 4. Sikariya village	3	3	3	3	3	-
Deficit	Vaishali (Hajipur)	1. Anjanpir 2. Hatsar ganj (Garhpar) 3. Dharamkata (near Paswan Chowk) 4. Zarhua Pokhra 5. Gardaniya Chowk 6. Karnpura 7. Lalpur Nawada 8. Ghataro	3	5	3	1	5	1
	Begusarai	1. Ratanpur 2. Kapasiya Chauk 3. Hemra Chowk 4. Matihani Road 5. Harhar Mahadev Chowk 6. Dr. D P Gupta Road 7. Purvi Kapasiya 8. Ramdiri Village	3	3	3	3	3	3
	Total	31 Locations	12	14	12	10	14	4

Source: Authors (Rapid Appraisal)

Location for Focused Group Discussion

Locations	Number of locations	Name of the locations
Patna	2	1. Chitkohra 2. Raja Bazar
Jehanabad	2	1. Kanaudi village 2. Sabzi Bazar
Hajipur	2	1. Anjaanpeer 2. Paswan Chowk
Begusarai	2	1. Kapasiya 2. Ramdiri village
Chapra	1	1. Rauja Ghaghata
Nalanda	1	1. Harnaut
Sheikhpura	1	1. Serari
Sasaram	1	4. Kachehari Road
Total	12	

Annex III

Chain 1: Producer→Trader I→ Trader III→Consumer (Kutti)

(Jehanabad to Ranchi)

Sl. No.	Type of expenses	Rs./truck	Rs/quintal
1	Farm gate price (12500 small bundles @ Rs. 500/thousand)	6250	125
2	Collection cost	1000	20
3	Chopping cost	1250	25
4	Bags charges	1000	20
5	Loading charges	500	10
6	Transportation	7000	140
7	Unofficial	800	16
8	Agents charge	300	6
9	weighing	100	2
10	unloading charges	300	6
11	Profit of Trader II	1250	25
12	Total Cost	19750	395
13	Per Quintal purchasing cost of trader III	395	
14	Profit of trader III	1500	30
15	Purchasing cost of fodder purchaser	21250	425

Source: Based on discussion with traders in Jehanabad, July 2008.

1000 small bundles = 4 quintals (standard), it can increase or decrease according to bundle size.

Annex IV

Chain 2: Producer → Trader I → Trader III → Consumer (Kutti)
(Patna villages to Patna city)

Sl. No.	Type of expenses	Rs./tractor	Rs/quintal
1	Farm gate price (7000 small bundles @ Rs. 500/thousand)	3500	125
2	Collection cost and loading	500	18
3	Transportation	2000	71
4	Unofficial	250	9
5	weighing	100	4
6	unloading charges	100	4
7	Profit of Trader II	600	21
8	Selling rate of trader I	7050	252
9	Per Quintal purchasing cost of trader III	255	
10	Chopping cost	700	25
11	Profit of trader III	700	25
12	Purchasing cost of fodder purchaser		302

Source: Based on discussion with trader in Patna, August 2008.

1000 small bundles = 4 quintals (standard), it can increase or decrease according to bundle size.

Annex V

Chain 3: Producer → Trader II → Agent → Trader III → Consumer (Wheat Straw)
(Masaurhi, Patna to Hajipur)

Sl. No.	Type of expenses	Rs./truck	Rs/quintal
1	Farm gate price @ Rs. 150/quintal for 50 quintal	7500	150
2	Collection cost and loading	800	16
3	Bags charges	1000	20
4	Transportation	3000	60
5	Unofficial	200	4
6	Weighing	100	2
7	Unloading charges	250	5
8	Agent charges	300	6
9	Profit of Trader II	1000	20
10	Selling price of trader II / Purchasing cost of trader III	14150	283
11	Profit of trader III	850	17
12	Purchasing cost of fodder purchaser	15000	300

Source: Based on discussion with trader in Hajipur, July 2008.