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Feed and Fodder Value Chains in Bihar: Some Empirical Evidences

K.M.Singh¹, R.K.P.Singh², A.K.Jha³, Abhay Kumar⁴, Anjani Kumar⁵ and M.S.Meena⁶

Introduction

Livestock production, especially dairy, has long been an important activity for smallholder and resource-poor farmers in India, both for household nutrition and income. Most of the livestock are kept in mixed farming systems, where crop residues—mainly cereal straws—have been an important feed resource (NIANP 2003).

India is deficient in the supply of fodder, resulting in very low levels of productivity that limit marketable surplus of milk. In Bihar State, over 50% of the land area is planted to rice, and rice straw along with wheat straw and some pulse residues form the main animal feeds. Recent studies in the Indo-Gangetic Plain have highlighted the problem of insufficient fodder and the poor nutritive value of fodder, a problem which becomes more acute in the more eastern parts of the region where agricultural resources—particularly arable land and water—become scarcer. This fodder scarcity affects most farmers but is particularly acute for landless and those with access to only small area of land.

Chronic feed deficit is the major constraint to animal production in Bihar. Most of the dairy farmers are smallholders having one or two local-breed milch animals, which are raised on crop residues and natural pastures with under-employed family labour. Feeding grains, oil cakes and green nutritious fodder are generally restricted to some crossbred cattle. The feed and fodder deficiencies, in fact, have been the main limiting factors in raising livestock productivity. (Singh and Jha, 2013).

However, especially in India's poor eastern states, the growth of the rural population is still leading to decreasing farm sizes, while rising demand for milk and improving marketing opportunities stimulate continuous growth in dairy production. Thus, the availability of fodder is a serious issue, especially for resource-poor livestock keepers with little or no land for cultivation. The level of this constraint varies temporally and spatially, creating scope for storage and trade. It has been observed that farmers generally store a considerable proportion of their harvested fodder and that large amounts of fodder are traded, both locally and over longer distances. But the structure and functioning of those markets are poorly understood and opportunities for improving the efficiency of fodder marketing as a potential tool contributing to the alleviation of fodder scarcity have

¹ Head, Division of Socio-Econ. & Extension, ICAR-RCER, Patna, India 800014

² Consultant, VDSA Project, NCAP, New Delhi

³ Assistant Professor (Dairy Econ.), S.G.I.D.T., Patna, India

⁴ Principal Scientist (Agric. Statistics), ICAR-RCER, Patna

⁵ Principal Scientist (Ag.Econ.), NCAP, New Delhi

⁶ Senior Scientist (Ag.Ext.), ICAR-RCER, Patna

not been adequately explored. Fodder markets are particularly important for the poorest and landless sections of these communities, which have very limited ability to produce their own fodder, but need access to quality fodder at reasonable prices to be able to produce milk economically and at competitive cost. Fodder trading is also an important livelihood activity for the poor who engage in it directly or who are employed in this value chain. To assess the contribution of crop residues and compare market structures, the production, trade and consumption of concentrates was also considered in this study.

A crucial aspect in regard to the supply of fodder which has been given little consideration to date is quality. It has been observed in other regions that fodder is differentiated by quality, resulting in significant price differences. In view of continuing intensification in dairy production, feed quality will play an increasingly central role. Even relatively small improvements of quality in the major feed components can enable significant productivity increases (Rai 2005). It has been shown in various crops that while nutritional quality of residues varies considerably between varieties, this variation is not correlated to grain yields. Thus, considering the nutritional quality of residues in crop improvement programmes would seem a very attractive pathway to increase the supply of better quality fodder. To assess the quality aspects of crop residues, it is necessary to first unravel the relationship between quality perceptions of farmers and traders and feed quality based on laboratory analysis.

Objectives and scope

The overall objective of the study was to improve the livelihoods of resource-poor livestock producers by alleviating fodder scarcity. The specific objectives of the project was:

- To develop a systematic understanding of fodder markets and to what degree they recognize the nutritive value of fodder.
- Quantify the variation in nutritive value of different varieties/cultivars of feed-food crops in relation to market availability and perceptions.

The study was conducted in Bihar state because:

- It is amongst the poorest states in the region, and livestock is an important source of livelihood, enabling a direct poverty relevance of the study's findings.
- Its agricultural sector is diverse and thus also its production of crop residue based fodder. Both the share of cereals in the cropping pattern as well as the shares of individual cereals vary across districts within the state, which has implications for quantity and quality of fodder.
- Both wheat and rice straw are widely fed in this state located between rice oriented eastern and wheat focused north-western states.
- The demand for fodder is also determined by urban producers, both within the state—mainly around the capital Patna—and beyond its borders. A considerable export of fodder to Kolkata in West Bengal has been observed.

Approaches

A participatory rural appraisal (PRA) was conducted to identify the actors in the fodder market and get a preliminary picture of the market.

Participatory Rural Appraisal: Methods and Results

Approach and method

Discussions with key informants indicated that there are five types of actors that are important in fodder markets in the state: producers, consumers, traders, feed millers and commission agents. Five semi-formal interviews were conducted with representatives of each of these types to draw an overall picture of fodder marketing in Bihar. PRAs were conducted in 4 districts, 2 in the surplus zone and 2 in the deficit zone. Then 12 Focus Group Discussions (FGDs) were organized at 12 sites in the state with the help of scientists of the Sanjay Gandhi Institute of Dairy Technology, Patna and the State Farmers' Commission, Bihar. At each site, some producers, assemblers, traders (vendors, retailers and wholesalers), and commission agents from fodder markets were assembled and discussions on different aspects of fodder marketing were held.

Results

Important forage and concentrate feeds

Crop residues and by-products are the key components of livestock feed. Dry fodder constitutes the largest proportion of forage accounting for about 82% of the feed requirement. Straws of paddy and wheat together contribute to about 95% of dry fodders consumed by livestock in Bihar. The proportion of green fodder in total livestock feed is close to 10%. About 55% of green fodders are cultivated. Maize, sorghum, berseem, napier grass, and some of the legume species are mostly cultivated. The stovers of green maize and sorghum account for about 30% of the total green fodder, particularly in maize growing areas, and berseem and napier grass constitute 20% of the green fodder.

Cut grasses, weeds and rogues are also important sources of green fodder—accounting for about 40% of the green fodder—and given to the livestock after chopping. In addition, leaves of some trees and banana trunk also supplement green fodder. The proportion of concentrate in the total feed is close to 8%. Oil cakes, *choker* (wheat bran and husks of pulses), *darra* (crushed grains) and *chunni* (broken and discarded pulses) are the most important concentrates. Manufactured compound feeds are also used to some extent. Oil cake, compound cattle feed and other concentrates account for 30, 25 and 45% of total consumption of concentrates, respectively. 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 future use. Storage practices differ according to types of feed items. Generally, paddy straw is stored in a corner of a courtyard in the open. The loose piles of paddy straw are stacked together. This type of storage is common in the areas where paddy is harvested by combine. The next important practice is storage of paddy straw in heaps/bundles arranged in a cylindrical shape covered by a conical shaped cap made of paddy straw/thatch in the fields or near the dwelling house. The conical shape of the cap prevents water from percolating inside the heap and the whole pile of straw remains unaffected except a thin layer on the top.

Sometimes when the quantity is fairly small, paddy straw is also stored in the dwelling house.

Chopped paddy and wheat straws are never stored loose in the open. Most of the time, these are stored in the dwelling houses of the producers or the users. Special bamboo storage structures (locally known as *bukhari*, *bhuskar*, etc.) are also built and used to store chopped paddy and wheat straws solely or along with food grains. Some affluent, big producers and traders have also constructed cemented structures to store fodder and grain.

Fodder and concentrate marketing

Fodder marketing in Bihar has no formal organized structure or formal institutional support. Paddy and wheat straws are the major traded fodders. Green fodder is also traded but its proportion is quite insignificant. Fodder marketing involves a number of actors along the supply chain. The most common fodder supply chain begins with the producers and proceeds further along a number of different channels 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.

There are five main actors or points of action in the wheat and rice straw supply chain: producer, trader-1 (vendor), trader-2 (wholesaler), trader-3 (retailer) and consumer. In between, there are other small actors such as bullock cart owners, assemblers, and commission agents who serve different principal agents to facilitate transactions. About 60% of the marketed surplus of straw is sold by producers to trader-1 and 3, 30% to trader-2 and 10% to consumers directly (Figure 1). There are many retailers who maintain good contacts with producers and purchase fodder directly from them. The longest supply chain involves the producer, trader-1, trader-2, commission agents, trader-3 and finally the ultimate consumers.

Different types of means of transport are used to carry fodder from one place to another, depending 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 trade (<10kms), mainly bullock carts are used. A bullock cart load of wheat straw fetches a price of Rs. 1200-1500 and roughly weighs 4 to 5 quintals⁷. A number of bullock carters (*bail gadiwalas*), particularly in fodder surplus zones, are involved in fodder trade. Tractor trolleys are also very important for fodder transportation along main highways for longer distances. Most of the inter-state and interregional trade is done by trucks.

In the case of inter-state movement of fodder, some very interesting patterns have emerged. Patna, Jehanabad, Nalanda, Sheikhpura, Lakhisarai and Rohtas, which are the fodder surplus districts, are the main supply centres for dry fodder. Patna is the biggest transit point for fodder marketing. The state that buys the most fodder from Bihar is Jharkhand, which is highly deficient in fodder supply from its own production. Bihar also

⁷ One quintal = 100kg

imports fodder from other states, notably from Uttar Pradesh for wheat straw sold directly in the fodder deficit regions of north Bihar.

Information plays a critical role in fodder marketing. Different actors in the fodder market use different modes of communication to elicit information and contact their counterparts. Almost all fodder traders and agents own a cell phone, which helps them to contact buyers and sellers, especially when making contacts at a longer distance. However, face-to-face communication has not lost its significance. It is the next important mode, which is still popular among the petty traders in rural fodder markets.

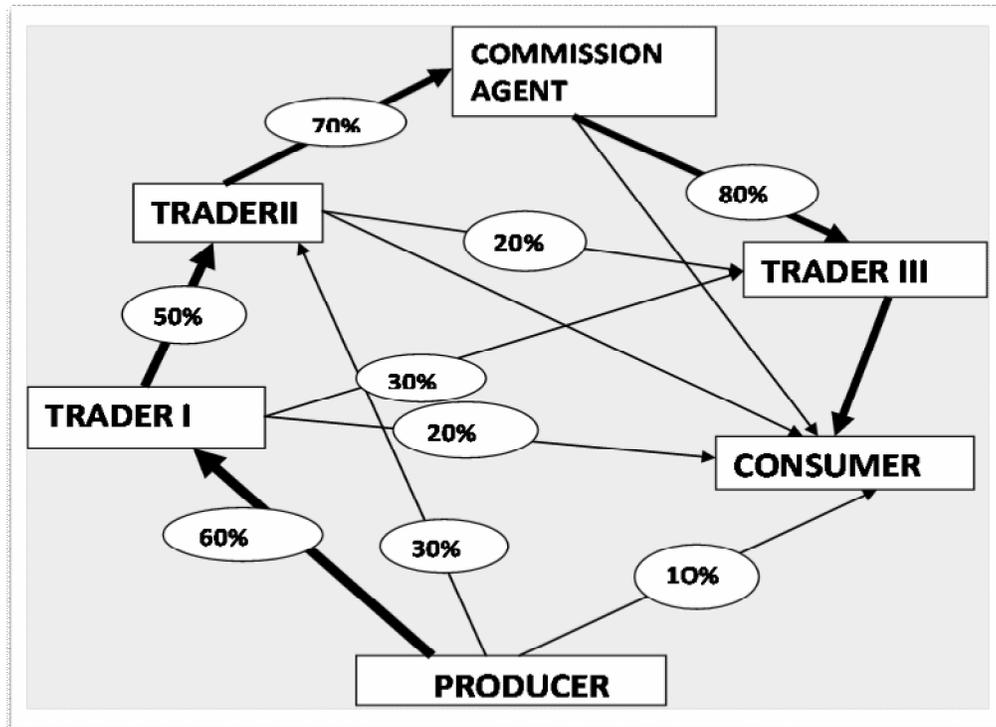


Figure 0: Flow of fodder transactions among different actors in Bihar

Price formation and determinants of price

The process of price formation is simple. Farmers either accept the prevailing market price of fodder in the nearby region or negotiate with the purchasers using the prevailing local market price as a reference. Of course, exigency of demand and availability of fodder are considered while prices are negotiated. Deficit zones often witness extremes of flood devastation and face critical shortages of livestock feed as a consequence. Under such circumstances, 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. However there are other considerations, too, that affect the fodder price. Certain quality aspects like good lustre, taste, cleanliness, softness, and moisture contents of fodder are considered when prices are determined.

There are usually wide differences in fodder prices between the surplus and deficit zones with prices in deficit zones being 17 to 50% higher than those in surplus zones. At the time of the study, a quintal of paddy straw was selling at a price of Rs. 100 in the surplus zone compared to Rs. 150 in the deficit zone. The average price of wheat straw in the surplus zone was Rs. 200 per quintal whereas in the deficit zone it was Rs. 300. The price of cultivated green fodder is also usually determined on the basis of location. In surplus zones, a hectare of green fodder is sold for Rs. 15-25,000, whereas in deficit zones, it is sold for between Rs. 25-35,000. Cut grasses and green fodders are also sold in some of the areas at the rate of Rs. 1 to 1.5/kg. Both cash and credit sales are practiced in the livestock feed market: though cash sale is preferred, circumstances often force producers, sellers and their clients to facilitate fodder feed marketing on credit.

Constraints in feed marketing and suggestions for improvement

Fodder and concentrate markets in Bihar face several constraints. Many of these constraints are generic in nature and presently are not being addressed.

Storage difficulties and lack of appropriate storage facilities seriously affect year-round availability of fodder. Most of the marketable surplus of fodder is generated by marginal and small farmers who are in the majority in the state, but have limited storage capacity. Due to difficulties in fodder storage, they are forced to sell immediately after harvest. Even if stored, a large proportion of fodder gets spoiled or destroyed due to improper storage facilities.

Transportation of fodder from producers to the market is fairly inefficient. Due to poor road conditions in rural areas and the absence of any block-making or baling technology, transportation and transaction costs are very high. It is estimated that marketing 100kg of fodder generates revenues of Rs. 395, of which the fodder raw material accounts for about 32% only and the rest is the marketing cost including transportation. The largest cost item is transportation which accounts for about 36%.

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 and transportation convenient, and so more cost effective. The majority of machines used for compressing fodder are obsolete. These machines, which were designed for the compression of jute in the jute factories during the colonial period, serve the purpose of traders and transporters to some extent, but are inefficient. There is a need to design and develop new economical and cost-effective machines to help the fodder sector. The Government of Bihar has planned to establish two plants for preparing feed blocks: one each in a fodder-deficit region (Samastipur) and in a feed-surplus region (Patna).

Quality control of manufactured compound feed and concentrates is also essential. Most 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 raw materials are escalating day by day, and this compels a number of millers and manufacturers to go for cheaper substitutes or to use inferior material. They seek cost-effective and improved technology for manufactured feed. Public sector R&D can play

an effective role in this regard, and can also be achieved through public-private partnership.

Conclusions from the PRA

Livestock is an integral part of the rural economy in Bihar and fodder is a critical input for livestock development. The data indicate that a huge gap exists between demand and supply of both dry and green fodder. Most of the south of Bihar comprising agro-climatic zones IIIA and IIIB are fodder surplus areas because of irrigated cultivation of paddy and wheat. Agro-climatic Zone I and Zone II are fodder deficit and mostly depend on fodder surplus regions for their requirements. Fodder production is seasonal, but demand is constant throughout the year or until the next crop season. Inadequate storage facilities and space sometimes force producers to dispose of much of their fodder rather than storing it for later use for their own needs or sale when prices are higher. To promote fodder production and trade, it is necessary to improve storage systems on-farm as well as en route to distant markets. Fodder markets are unorganized and informal and the role of the public sector/government is negligible. Most fodder markets occur without any dedicated market place, often along roadsides and without legal credentials. Having specific market places may facilitate flow of market information, increase interaction among buyers and sellers and facilitate transparency and competition leading to fairer prices.

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 cost-effective and efficient fodder compressing technology to ease handling and transportation as well as generate cost savings. 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 requires urgent attention and here public sector R&D can play an effective role. This can also be done in public-private partnership mode.

Survey of feed market actors

Approaches and methods

The PRA showed that there exists a huge gap between demand and supply of fodder (both dry as well as green). Most of south Bihar comprising agro-climatic zones IIIA and IIIB are fodder surplus because of cultivation of paddy and wheat under assured irrigation facilities. Agro-climatic zones I and II are fodder deficit and mostly depend on fodder surplus regions for their requirements. The PRA also identified various types of actors in the fodder and concentrate markets. In order to understand in more detail how fodder markets actually work and perform, a detailed survey was conducted among representative market actors so that more specific constraints in the market could be identified for possible interventions (technical, institutional and policy) for improving its performance.

Two contrasting zones, namely deficit and surplus, were identified and four districts from each zone were selected for detailed study using a multistage stratified random sampling

method (Figure 2). Bihar is divided into four agro-climatic zones. For the present study, we classified these agro-climatic zones into two groups based on fodder production status, i.e. surplus and deficit. Using a stratified sampling approach, four districts were randomly selected from each of the surplus and deficit groups. The selected districts from each group were: Bhabhua, Patna, Jamui and Bhagalpur from the surplus zone; and East-Champaran, Sitamarhi, Purnea and Khagaria from the deficit zone. From each district, two tehsils (administrative sub-unit) were then randomly selected. Within each tehsil, two villages were next randomly selected. The Government of India Village Census (2001) has been used as the sampling frame for selecting administrative sub-units and villages. From each village, 15 farm households were selected using a randomizing village walk approach. Thus, a total of 480 farm households were surveyed. In addition, other actors of the feed marketing chain were sampled from each district: fodder traders (10), concentrate traders (5), concentrate millers (5) and urban-dairy consumers (10). The total survey sample thus included: 476 fodder producers, 80 fodder traders, 80 fodder consumers, 40 concentrate traders and 40 concentrate millers. Separate questionnaires were prepared and pre-tested for each group.

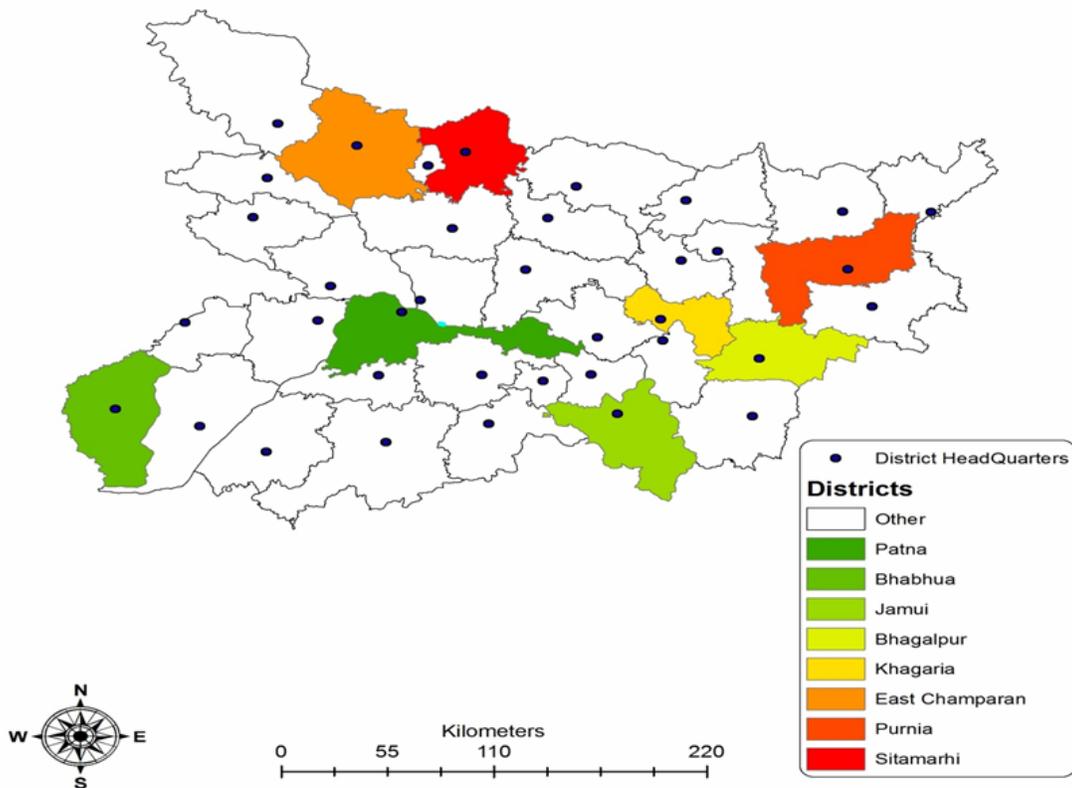


Figure 0: Location of selected sample districts in Bihar

After the survey, each type of actor was classified into sub-categories based on their functions and marketing behaviour.

- The fodder producers were stratified into three categories depending on their selling and/or buying status: net sellers (140), net buyers (221), and autarkic (113).

- Traders were stratified depending on the nature of their business into vendors (27), wholesalers (4), and retailers (49).
- Consumers were stratified into three categories; urban commercial dairy producers (80), rural commercial dairy producers (73) and other rural farmers (401).

Results and discussion

Fodder production

Residues of the principal crops, namely paddy, wheat, maize and pulses, are the main sources of dry fodder in Bihar. These crops constitute about 90% of dry fodder produced in the surveyed villages. Maize is not an important source of fodder in the surplus zone. Production of dry fodder is closely related to the size of land holdings; in both the zones, net sellers had larger land holdings and produced more dry fodder than net buyers.

Rice-wheat cropping systems were common in the surplus zone and these two crops constituted more than 90% of dry fodder production, whereas in the fodder deficit zone these two crops constituted 78 percent of total dry fodder production in surveyed villages. Pulses were the third most important dry fodder-producing crop in the surplus zone, whereas maize was the third most important in the deficit zone due to adoption of winter maize over large areas. Average production of dry fodder per household in the surveyed villages in the surplus zone was about twice that in the deficit zone, mainly due to the larger land holdings found there. The proportion of area used for production of the main dry fodder-producing crops (rice and wheat) was higher in the fodder surplus zone (75%) than in the fodder deficit zone (68%). The recent decline in area under rice and the use of combine harvesters in rice and wheat crops, particularly in the fodder surplus zone, could present a threat to fodder availability in Bihar. Retrieving straw from the field after combine harvesting is more costly and reduces the quality compared to manual harvesting, where cereal bundles are carried from the field for threshing.

Fodder sales from the producer perspective

Inter-zone, intra-zone and inter-state dry fodder marketing are all common in Bihar. The amount of dry fodder sold was higher (5.5 tonnes (t)/household) in the surplus zone than in the deficit zone (3.8 t/household). As discussed earlier, paddy straw was the most important dry fodder accounting for 67% of sale volume; its share was higher in the surplus zone: about 72%. Wheat straw was the second important dry fodder with respect to production and marketing.

Despite much higher production of wheat straw in the surplus zone, farmer preference there for feeding their animals with wheat straw rather than paddy straw translated into a smaller share of their wheat straw sold (39%) compared to the deficit zone (57%), with the quantities sold per household being almost identical in both zones. There is no market for maize stover in the surplus zone due to the negligible area under maize there. Livestock keepers in the surplus zone are not even aware that maize stover can be used as fodder. Marketing of pulse straw is not a common practice and less than one quintal was

sold per household in the surveyed villages. About 20% of output in the surveyed villages in the surplus zone and 11% in the deficit zone was sold. Per household sale of pulse straw was higher in the surplus zone (0.15 t) than in the deficit zone (0.03 t), reflecting a larger area under pulses in the surplus zone.

Among the major dry fodders in the surplus zone, pulse fodder is the most expensive (Rs. 1.94/kg) due to the higher preference given to it, followed by wheat straw (Rs. 1.17/kg) and paddy straw (Rs 1.07/kg). On the other hand, wheat straw was sold at a higher price (Rs. 1.33/kg) in the deficit zone, followed by paddy straw (Rs. 1.30/kg) and pulse straw, which was sold at much lower price (Rs. 1.14/kg). It is noteworthy that pulse straw fetched the highest price in the surplus zone whereas wheat straw is the most expensive in the deficit zone. Price behaviour of different types of fodder is influenced by farmer preferences in each zone. As expected, the prices of the main fodders (paddy and wheat straw) were higher in the deficit zone than in the surplus zone. The price of fodder was linked to type of purchaser. In the deficit zone, 51% of fodder sold by farmers was sold to fellow farmers in the village for higher prices than to other buyers. In the surplus zone, farmers sold more than 70 percent of fodder to vendors for lower prices. In the surplus zone, selling to vendors was preferred because they purchased almost all the surplus fodder at the same time. Wholesalers and dairy producers did not buy much fodder directly from producer farmers in either zone. However, farmers sold 6 to 8% of fodder to retailers in the surveyed villages. In both zones, almost all sales of fodder by farmers took place in the village, as it was difficult for farmers to transport their fodder to a market.

Fodder marketing

The market for dry and green fodders in Bihar is extremely underdeveloped and highly informal. However, there is a distinct pattern of fodder marketing between the fodder surplus and deficit zones. In fodder surplus zones, the main traded fodder is paddy straw. In these zones, an average trader buys 143 t of dry fodder per year, of which about 136 t (95%) is paddy straw. The scenario, however, is quite different in the fodder deficit zones. Paddy straw as a fodder is least preferred and is only fed to livestock when farmers do not have any alternative. About 89% of the dry fodder traded in deficit zones was wheat straw because it is supposed to be more palatable and nutritious. It also appeared that 53% of traded fodder passes through wholesalers in the deficit zone compared to 30% in the surplus zone.

The role of retail traders in fodder marketing appeared to be quite significant and critical. On average, retail fodder traders buy and sell more fodder than an average wholesaler. About 42% of the fodder being traded passed through retailers. Retail traders purchased about 118 t of dry fodder per annum, maintaining about 10% of that as running stock. The function of vendors was also important. They normally collect or buy small quantities of fodder from producers and sell it in nearby markets to dairy producers, semi-processors, wholesalers and retailers. In urban areas, they also buy fodder from retail traders. Vendors usually prefer to dispose off their fodder stock the same day.

Fodder processing, sorting, grading and storage by traders

About one quarter of the vendors, one third of the retailers and half of the wholesalers in Bihar store fodder. It is a common practice for traders to purchase fodder from producers, but to not take delivery of the entire lot at once. Instead, they store fodder in the farmers' yards and take delivery of it gradually as and when required. A small proportion of the fodder purchased is also stored at the business premises or houses of the traders.

As far as processing is concerned, about 41% of traders processed fodder in some way, with different forms of processing characterizing the deficit and surplus zones. Traders in the deficit zone did little processing. Some retailers (9%) did go for light processing like chopping of maize stover, etc., but in general fodder was sold without any additional processing. It is important to recall that wheat straw is the main marketed fodder in the deficit zone and it is automatically chopped into small pieces during harvesting by the threshers using combine harvesters or specially designed threshers. In contrast, paddy straw, which dominates the fodder markets in the surplus zone, is harvested and threshed manually by beating or hitting the small bundles (*antia*) of paddy. Therefore, paddy straw must still be chopped into small pieces before feeding. Chopped paddy straw fetches a higher price and hence almost all retailers and wholesalers chopped paddy straw before selling. Many vendors (42%) in the surplus zone also chopped paddy straw before selling it. No other forms of processing such as preparation of silage, fodder bricks, urea treatment, etc. were reported.

Price trends of important fodders

Fodder prices appear to be highly volatile, probably because of variation in demand and supply in the state. Frequent droughts and floods or the combination (drought followed by the flood) are regular features in many parts of the state and greatly affect production and availability of fodder which ultimately governs price. Besides year-to-year variation in fodder prices, intra year price differential is also common. Table 1 presents the maximum and minimum prices of fodder for the three years since 2006. It is obvious that based on these trends, projecting future prices is extremely difficult.

Table 1: Annual variation in price of different types of fodder (Rs./kg)

Type of fodder	Surplus-zone						Deficit-zone						Overall					
	2008		2007		2006		2008		2007		2006		2008		2007		2006	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
Wheat straw	2.41	1.74	2.42	1.67	1.98	1.59	2.95	1.78	5.63	2.40	3.01	1.64	2.81	1.77	4.78	2.21	2.75	1.63
Paddy straw	2.55	2.03	2.28	1.74	1.95	1.55	2.27	1.62	3.67	2.10	2.36	1.53	2.47	1.92	2.67	1.84	2.08	1.54
Pulse straw (lentil)	3.00	2.00	3.00	2.00	2.50	1.50	.	.	.	.	.	.	3.00	2.00	3.00	2.00	2.50	1.50
Pulse straw (lathyrus)	3.50	2.00	3.50	2.00	2.50	1.50	.	.	.	.	.	.	3.50	2.00	3.50	2.00	2.50	1.50
Pulse straw (gram)	3.00	2.00	3.00	1.50	2.50	1.25	.	.	.	.	.	.	3.00	2.00	3.00	1.50	2.50	1.25
Maize stover-green	.	.	.	.	.	.	4.00	3.50	5.50	4.00	4.00	3.00	4.00	3.50	5.50	4.00	4.00	3.00

Fodder consumption

Characteristics of feed consumers

Livestock holdings can be broadly categorized into three groups; urban commercial dairy, rural commercial dairy and rural smallholder dairy. They are the main buyers of fodder, with their demand for fodder varying according to the number of animals owned.

Commercial dairies in urban and rural areas of the deficit zone had larger herds compared to their counterparts in the surplus zone, although the proportion of dry animals was larger in the deficit zone. Urban commercial dairies in both zones had similar proportions of crossbred cattle in their herds, but the proportion of buffalo was higher in the surplus zone. In both zones, the herd size in rural dairy farms was small with about 50% of the animals being dry (Table 2).

Fodder and concentrate purchase

All categories of dairy farms in the surplus zone and urban commercial dairy farms in the deficit zone used paddy and wheat straw as the principal dry fodder. Pulse straw constituted less than 5% of total dry fodder used by dairy farms in the surplus zone and less than 2% on rural dairy farms in the deficit zone. Since the deficit zone is a maize growing area, rural commercial dairy farms there used a substantial quantity of maize stover. All maize stover in the deficit zone was not used as fodder because a substantial quantity was used either as fuel, particularly by poor households, or burned in the field.

Table 2: Livestock holdings of different types of consumers [in Tropical Livestock Units (TLU)]

	Surplus zone			Deficit zone			Overall		
	Urban comm. dairy producer	Rural comm. dairy producer	Rural other farmers	Urban comm. dairy producer	Rural comm. dairy producer	Rural other farmers	Urban comm. dairy producer	Rural comm. dairy producer	Rural other farmers
Herdsizes	11.1	3.9	3.2	19.3	4.3	2.3	15.2	4.1	2.8
Indigenous Cattle	0.7	1.3	1.6	2.9	1.4	1.5	1.8	1.4	1.6
Crossbreed Cattle	5.0	1.2	0.6	13.2	0.5	0.3	9.1	0.9	0.4
Indigenous Buffalo	5.2	1.4	0.9	1.7	2.2	0.4	3.4	1.8	0.7
Improved Buffalo	0.3	0.0	0.0	1.4	0.0	0.1	0.8	0.0	0.0
Adult dairy animals	9.1	2.5	1.7	15.0	2.5	1.0	12.1	2.5	1.3
In milk	7.0	2.0	0.9	9.5	1.5	0.5	8.3	1.8	0.7
Dry	2.2	0.5	0.8	5.5	1.0	0.5	3.8	0.7	0.7

Berseem, green oats, cut grass and maize are the main green fodders in Bihar, with berseem being the main green fodder in the surplus zone and maize in the deficit zone. Agriculture in the surplus zone is more developed and has improved irrigation infrastructure for production of berseem. Maize is an important crop in the deficit zone

and it is one of the important green fodders. Cut grass was an important green fodder on rural commercial dairy units in both zones, mainly due to easy access. Oats was also used as fodder, particularly in the deficit zone but not in the surplus zone. In the deficit zone, oats are grown as a green fodder crop prior to growing early summer vegetables. Bamboo leaves are also fed as green fodder in the deficit zone.

Table 3: Fodder and concentrate consumption per day per TLU and share by individual feeds

	Surplus zone			Deficit zone			Overall		
	Urban comm. dairy producer	Rural comm. dairy producer	Rural other farmers	Urban comm. dairy producer	Rural comm. dairy producer	Rural other farmers	Urban comm. dairy producer	Rural comm. dairy producer	Rural other farmers
Dry fodder (kg DM/day/TLU)	6.0	5.4	6.3	5.5	4.4	5.6	5.6	5.0	6.0
% of total dry fodder									
Wheat straw	26.7	55.5	39.0	90.6	44.8	52.5	65.9	51.0	44.3
Paddy straw	68.1	40.3	55.9	8.8	27.3	40.2	31.7	34.8	49.7
Maize stover	0.0	0.9	0.5	0.6	26.5	4.7	0.4	11.7	2.1
Pulse straw	5.1	3.0	2.8	0.0	0.7	1.0	2.0	2.0	2.1
Other dry fodder	0.0	0.3	1.8	0.0	0.8	1.6	0.0	0.5	1.7
Green fodder (kg DM/day/TLU)	0.28	0.87	0.96	0.33	1.12	1.25	0.32	0.99	1.08
% of total green fodder									
Berseem	44.9	19.9	35.9	14.1	0.7	4.6	24.2	9.6	20.6
Oat straw-green	6.0	0.0	0.2	12.9	8.4	6.4	10.6	4.5	3.2
Maize stover-green	0.0	4.1	1.2	23.5	17.3	7.8	15.8	11.2	4.4
Sugarcane top-green	0.0	2.5	2.9	0.0	3.8	3.1	0.0	3.2	3.0
Cut grass-green	11.9	52.8	38.3	29.2	54.0	56.4	23.5	53.5	47.1
Bamboo leaf-green	0.0	0.3	0.5	9.9	8.7	14.3	6.7	4.8	7.3
Sudan - green	7.2	0.8	1.4	5.8	6.9	3.9	6.3	4.1	2.6
Other green fodder	30.1	19.6	19.6	4.6	0.2	3.5	13.0	9.2	11.7

Rural commercial dairy units in both zones mainly buy fodder directly from farmers. Urban commercial dairy units in the surplus zone buy fodder mainly from retailers (43%) and vendors (29%). In the deficit zone, vendors are also important suppliers of fodder (49%) for urban commercial units which also purchased fodder from farmers (41%). Wholesalers were not an important source of fodder for commercial dairy units; they operate as middlemen in the fodder marketing chain.

Consumer feed use

Feed consumers combined individual feeds to make various rations. The resulting consumption patterns differed considerably between consumer types. About 5.6 kg dry fodder, and 0.3 kg green fodder were used per day per TLU by urban commercial dairy

producers, whereas rural commercial dairy producers fed 5.0, and 1.0 kg rural farmers fed 6.0, and 1.1 kg of dry fodder, and green fodder per day per TLU (Table 3).

Conclusions

State government intervention in fodder production and marketing is non-existent in Bihar. However, the government arranges to supply dry fodder and provides transportation support during floods. Fodder production and marketing does not feature in the 'Road Map for Agriculture and Allied Sectors' by the Government of Bihar, nor does fodder marketing feature in any dairy development programmes in the state. The main issues that emerge from the study are:

1. There is no specified place for fodder marketing, hence, a market place for fodder could be arranged by the government in existing market yards where sufficient unutilized space is available for this purpose.
2. Within villages, more than 80% of trade in fodder is direct to consumers and the price of fodder is high in the deficit zone.
3. Seasonal price fluctuations reflect the lack of storage capacity at producer, trader and consumer levels.
4. Urban dairy producers are major buyers of fodder; they buy about 73% of dry fodder sold by traders.
5. The type of fodder used also depends on the intensity of production: with increasing intensification of dairy production, the share of wheat straw being fed to dairy animals increases.

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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	1
	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

Annex 2**Selected location for Focused Group Discussion**

Locations	Number of locations	Name of the locations
Patna	2	1. Chitkohra 2. Raja Bazar
Jahanabad	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
Sekhpura	1	1. Serari
Sasaram	1	1. Kachehari Road
Total	12	

Annex III**Chain 1: Producer→Trader II→ 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 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.