A Micro Analysis of Fodder Production and Marketing in India: The Case of Bihar

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Introduction

Changing patterns of food consumption, linked to economic growth, and coupled with demographic changes are resulting in increased demand for livestock products in developing countries (Delgado et al., 1998). South Asia is no exception and has been experiencing rapid growth in livestock products – especially consumption of dairy products (Joshi et al., 2007a). It is estimated that the demand for milk in India will double between 2000 and 2025 (Joshi et al., 2007b). This demand growth potential can provide a significant source of income to poor livestock producers as there are examples of development of dairy sector in favour of resource poor livestock keepers (Rangnekar, 2006). However, one of the key constraints of the dairy development in resource poor areas of India is inadequate supply of fodder. Insufficiency of fodder inflicts very low level of animal productivity and a meager amount of marketable surplus of milk. Due to inflating food demand for burgeoning human population expansion of area under cultivated fodder is virtually impossible. Thus, livestock are heavily dependent upon crop residues as the main source of fodder (> 44% of feeds) in much of India (NIANP, 2003).

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 constraints like scarcity of feed, fodder and concentrates affect the potential of livestock and cause enormous losses in terms of production and depletion of livestock. Evidences indicate that feed related problems accounted for about 36 percent loss (per annum in value terms) in dairy animals and losses due to scarcity of dry and green fodder were estimated to be 11.6 percent and 12.3 percent, respectively (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 as majority are marginal and small holders unable to produce and store livestock feed and forage and face acute shortage during certain periods. There are also problems of deterioration due to toxins and contamination during transportation and storage that affect the quality of feed and forage and poses serious threat to livestock. 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.

Rice and wheat are cultivated over two –thirds of cropped area in Bihar, hence straw of these two principal crops, along with smaller quantities of some locally grown pulse residues, form the main animal feeds. The fodder scarcity affects most of the livestock farmers but it has a great bearing on those having limited access to land. Recent studies in the Indo-Gangetic Plain identified the problem of inadequacy of fodder and the poor nutritive values of most of the fodders as a problem in the eastern parts of the region where agricultural resources, particularly arable land and water are under acute stress (Erenstein, et al., 2007). Low productivity of livestock is a matter of great concern in which poor quality fodder and feed resources play a major role. The feeding cost accounts for about 60-65% of total cost of animal production. Chronic feed deficit is the major constraint to animal production in eastern states of the country. Most of the dairy farmers are small holders having one or two local 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.

An increasing urban population has created 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. There is significant trading of crop residues, at village, state and inter-state but the structure and functioning of these 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 not been explored. The study intends to address issues related to a better understanding of the production, and fodder markets to improve livestock productivity and hence rural livelihoods. The overall objective of the study is to develop a systematic understanding of fodder markets for improving the livelihoods of resource poor livestock producers by suggesting strategies to policy makers for alleviating fodder scarcity.

Methodology

The aim of the survey was to understand the relationship between various actors in the fodder markets and to identify constraints and opportunities for these actors. The various stakeholders like; crop feed producers, vendor, wholesaler, retailer and dairy farmers

(including livestock keepers who may have the option of producing feed for the market),. The focus was on various crop residues used and marketed as fodder. The survey also took into account availability of other types of fodder e.g. cultivated fodder and collected fodders. Local and intra-state fodder exchange is examined with an objective to identify options (technology, policy, institutional) for improving the efficiency of fodder markets**.** Many researchers have identified that, recurring floods and changing cropping pattern have created two distinct zones, northern part as fodder deficit and southern as fodder surplus zones in Bihar (Singh et al. 2013, Singh et al. 2009, Singh 1997).

Multi-stage Stratified Random Sampling Method (MSRSM) was adopted for selection of sample households for detailed study. North Bihar(fodder deficit region) and south Bihar (fodder surplus region) form the first stratum for sampling purpose. At the first stage, four districts from each region, making eight sample districts were selected randomly which include Bhabhua, Patna, Jamui and Bhagalpur from the Surplus Zone; and East-Champaran, Sitamarhi, Purnea and Khagaria from the Deficit Zone. At next stage, two blocks from each district and two villages from each block were selected, making block sample of 16 blocks and 32 sample villages for drawing respondents for detailed investigations. Finally, for detailed survey, 15 households were randomly selected from each village, making sample size of 480 households. In addition, the other actors of fodder marketing chains consisting of fodder traders (10), and fodder consumers (10), were taken from each district. The total survey sample thus includes Fodder producers (476), Fodder traders (80) and Fodder consumers (80) for this study.

Findings

Principal crops namely; paddy, wheat, maize and pulses are main sources of dry fodder in Bihar since these crops constitute more than three-fourths area under dry fodder in surveyed villages (Table 1). However maize is not an important source of fodder in surplus zone. Production of dry fodder has close association with size of land holdings. In both the zones, larger size of land holdings produced larger quantum of dry fodder. Rice-wheat cropping system was common in surplus zone and these two crops constituted about 75 per cent of area under dry fodder producing crops whereas in fodder deficit zone area under these two crops constituted 67 percent of total dry fodder producing crops in surveyed villages. Pulses was the third important dry fodder producing crop in surplus zone whereas maize

emerged as third important dry fodder producing crop in deficit zone, due to adoption of winter maize in large area. The recent declining trend in area under rice and use of combined harvester in rice-wheat crops, particularly in fodder surplus zone seems to be a threat to fodder availability in Bihar. Other dry fodder crops are not important and these crops (other cereals, oilseeds spices etc) did not contribute even one percent to total dry fodder production in surveyed villages.

Table 1: Average area under different crop on farm-households (ha.)

Particulars	Surplus zone	Deficit zone	Bihar
Wheat	1.11 (30.66)	0.43 (25.00)	0.77 (28.73)
Paddy	1.60 (44.20)	0.73 (42.44)	1.17 (43.66)
Maize	0.08 (2.21)	0.18 (10.47)	0.13 (4.85)
Other Cereals	0.01 (0.28)	0.01 (0.58)	0.01 (0.37)
Pulses	0.46 (12.71)	0.13 (7.56)	0.29 (1.49)
Fodder Crops	0.05 (1.38)	0.02 (1.16)	0.04 (1.49)
Miscellaneous	0.31 (8.56)	0.21 (12.21)	0.25 (9.33)
Total	3.62	1.72	2.68

Green fodder production

Green fodder is the essential component of feeding animals to make them healthy and productive, particularly to obtain desired level of milk production. In Bihar, dairy production has started being commercialized due to expansion of dairy co-operative institution which provides assured marketing facilities for milk in even remote villages. But production of green fodder crops is not a common practice in Bihar. In surveyed villages, the fodder crops (*Berseem, oat, lucern, jowar, maize* etc.) were main sources of green fodder which were grown on about one per cent of gross cropped area against national average of 4 per cent. Per household annual green fodder production/collection was 17 quintals in study area. In surveyed villages, there was negligible area was put to green fodder crops but cultivated fodder constituted about 50 per cent to total green fodders availability in these villages (Table 2)

Table 2: Per household green fodder production on surveyed households (q)

Particulars	Surplus zone	Deficit zone	Total
Wheat	0.00 (0.00)	0.04 (0.26)	0.02 (0.12)
Paddy	0.19 (1.02)	0.03 (0.20)	0.11 (0.65)
Maize	1.64 (8.81)	4.18 (27.23)	2.90 (17.04)
Other Cereals	1.31 (7.04)	3.88 (25.28)	2.59 (15.22)
Pulses	0.23 (1.24)	0.03 (0.20)	0.13 (0.76)
Fodder Crops	13.35 (71.73)	3.68 (23.97)	8.56 (50.29)
Miscellaneous	0.66 (3.55)	1.68 (10.94)	1.18 (6.93)
Sugarcane	1.23 (6.61)	1.83 (11.92)	1.53 (8.99)
Total	18.63 (100.00)	15.37 (100.00)	17.02 (100.00)

Note: Figures within parenthesis indicate the percentages.

Cultivated green fodders contributed about 73 per cent to total green fodders availability in surplus zone against only 24 per cent in deficit zone, mainly due to developed agriculture and livestock production systems in former zone. In Bihar, pulses (lathyrus and peas) are important green fodders during terminal months of winter season but these are not important crops in the majority of surveyed villages and contributed 1.23 percent in surplus and only 0.20 per cent in deficit zone.

Sugarcane green tops are commonly used as fodder in Bihar, particularly in sugarcane growing area. In surplus zone, sugarcane covered about 1 percent of area but contributed about 6.61 per cent to total quantum of green fodder production. Sugarcane was more important green fodder in deficit zone by contributing about 11.92 per cent to total green fodder production in the zone. The higher contribution of sugarcane was not only due to larger area under sugarcane crop but farmers of deficit zone could also be utilized maximum possible sugarcane green tops as green fodder to mitigate the fodder scarcity in the zone

Besides the green fodder production, members of weaker section households collect green fodders (grass, weeds, leaves of perennial trees, bamboo etc) for meeting the

requirement of animals in general and dairy animals, in particular which estimated to be not less than one million tonnes in a year in Bihar.

Sale of fodder

Inter-zone and intra-zone dry fodder marketing is a common practice in Bihar. Dry fodder producing crops are grown for production of grains, mainly for human consumption and fodder production is the by-product of crop production process. Rice and wheat straws are main dry fodders which constituted about 95 percent of total dry fodders sold in surveyed villages however the quantum of sale of these two dry fodders was higher in surplus zone(57 quintals/hh) to deficit zone (43 qts/hh) (Table 3). Paddy straw was most important dry fodder which had stake of about 66.60 percent in dry fodder marketing in surveyed village however its stake was higher in fodder marketing in surplus zone (72.10%). Wheat *bhusa* was the second important dry fodder with respect to production and marketing.

Despite much higher production of wheat *bhusa* in surplus zone, per household quantum of sale was almost identical to deficit zone understudy . It was mainly due to farmers' preference to what *bhusa* over paddy *bhusa* for feeding their animals in surplus zone. There was no market for maize stalk in surplus zone, due to its negligible area in the zone.

Table 3 : Dry fodder sold [in qtl] (average of different types of dry fodder)

	Surplus-zone	Deficit-zone	Total
Wheat	14.32	14.55	14.41
Paddy	41.12	23.80	34.31
Maize	00.00	04.40	01.73
Other Cereals	00.02	00.00	00.01
Pulses	01.52	00.13	00.98
Other crops	00.05	00.13	00.08
Total	57.03	43.01	51.52

. There was no market for maize stalk in surplus zone, due to its negligible area in the zone. Moreover, livestock keepers of surplus zone were not even aware that the stalk of maize can also be used as dry fodder. Marketing of pulses *bhusa* was not a common practice and per household less than one quintal was sold in surveyed villages. Per household sale of quantum of pulses bhusa was higher in surplus zone (1.52 quintals) than deficit zone (0.13 quintal), mainly due to higher area and production of pulses in surplus zone.

Green fodder production and marketing is in rudimentary stage in Bihar. A very small quantity of green fodder is marketed in peri-urban area in surveyed areas. Maize green fodders are generally sold after harvesting of cobs which meet the green fodder demand for poor households within the village. On the other hand, green fodder (other than maize) marketing was practiced in surplus zone but the per household quantum of marketing was less than half quintal. Important reasons for almost absence of green fodder marketing in Bihar may be traced from practice of non-commercialized animal production, predominance of non-descript low yielding animals and poor economic status of majority of farm households. However government programme for increasing awareness about importance of green fodder is almost absent; accept some initiatives taken by COMFED in making available fodder seeds to members of dairy co-operatives.

Wholesaler and dairy producers hardly buy directly from producer farmers in both the zone. However, farmers sold 6 to 8 percent of fodder to retailers in surveyed villages. In both the zones, farmers sold their substantial quantity of fodders in their respective villages, particularly to vendors. About one- third of fodder was sold to fellow farmers within their respective villages. Farmers could not transport their fodders to market place for sale (Table 4)

Table 4: Percentage of fodder sold by the farm-household to different type of buyer

Particulars	Surplus-zone	Deficit-zone	Total
Farmer	18.89	51.12	29.46
Dairy producer	1.45	.42	1.12
Vendor	71.59	35.89	59.88
Wholesaler	1.49	4.62	2.51
Retailer	6.58	7.95	7.03

While analyzing terms of fodder trade, cash purchase was the common terms of fodder trade in both the zones however one-fourth of rural commercial dairy units purchased fodder on credit since they purchased 91 percent fodder from fellow farmers of village and managed fodder purchase on credit.

Fodder marketing process

Fodder marketing, in general, is a simple business, which requires comparatively less capital and specialization. This enables a number of persons to take up this business by their

own, either as a part-time proposition or as an independent full time business. Aabout 89 percent vendors, 75 percent wholesalers and 88 percent retailers were involved in self-started fodder business. A sizable proportion of traders (72.5%) operate from the village and operate their business from the home (51.5 percent) or from dedicated premises (about 21%) within their respective village. About 27.5 percent of fodder traders operate in urban/ semi-urban areas, generally situated close to motor able roads to facilitate easy transaction and transportation of fodders

Bihar is a fodder deficit state. Therefore, round the year availability of fodder is essential to ensure continuous supply of fodder. It is essential that whatever fodder is available be stored properly. Traders also store a significant proportion of fodder. It enables the traders to take price advantage as the demand for fodder varies temporally and spatially. Table 4.3 depicts that about one-fourth of the vendors, one-third of the retailers and half of the wholesalers in Bihar opted for storage of fodder. It is a common practice that traders purchase fodder from the farmers/ producers but do not lift whole lot of fodder once at a time. Instead they store fodder in the threshing floor of farmers and lift it gradually as and when requires. A meager proportion of fodder is also stored at the business premises or adjacent to houses of the traders.

As far as processing is concerned, about 41 percent traders in the state went for some sort of fodder processing (Table 5). There was a distinct pattern of processing between the deficit and surplus zones. Traders in deficit zone hardly opted for processing. Some retailers (about 9 percent) did go for light processing like chopping of maize stovers, 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 in small pieces by the thrashers on producers farms while harvesting by the combine harvesters or thrashing of grains by the specially designed thrashers.

Table 5: Percentage of traders reporting storage and processing

	Surplus		Deficit		Total	
	Storage	Processing	Storage	Processing	Storage	Processing
Vendor	16.7	41.7	33.3	0.0	25.9	18.5
Wholesale trader	50.0	52.0	50.0	0.0	50.0	25.1
Retail trader	26.9	92.3	39.1	8.7	32.7	53.1
Total	25.0	57.5	37.5	5.0	31.3	41.3

In contrary, paddy straw, which dominates the fodder markets in surplus zone is harvested and thrashed manually by beating or hitting the small bundles (*antia*) of paddy. It is, thus, imperative that paddy straw is chopped in small pieces before feeding. Chopped paddy straw fetches higher price and hence almost all retailers and half ofwholesalers chopped paddy straw before selling. Even a good percentage of venders (42 %) in surplus zone was found to be involved in light processing by cutting the paddy straw in fine pieces before selling it in the markets. Surprisingly no other forms of proceeding likes preparation of silage, fodder bricks, urea tre ated forage, etc. were reported any where.

Grading, storage and processing are important marketing functions which are practiced in efficient marketing system. Though fodder marketing is not professionalized in Bihar, two-thirds of farm households stored about 14.51 percent fodder produced in surveyed villages. The storage of dry fodder was mainly for own consumption however 20 percent farmers reported that they stored fodder for selling in off-season on higher prices. Farmers of both the zones do not differ significantly with respect to storage of dry fodder. Grading and sorting were not a common practice in surveyed villages but 8.2 percent farmers in surplus zone and 3.6 percent farmers in deficit zone practiced grading of dry fodder. Grading or sorting was only done for paddy straw because it is generally sold without processing. There are some visible variations also in size, colour and texture of paddy and some of farmers tried to grade before sale of paddy straw. On the other hand, grading was not done in case wheat dry fodder since wheat grain and *bhusa* are produced simultaneously by threshing of wheat plants. Wheat-*bhusa* was sold and there was neither scope nor feasibility for grading of wheat bhusha.

In sample villages, majority of vendors (about 96 %) procured fodder from villages and sold it at different places like; nearby markets, towns (peri-urban and urban areas), and other dedicated business premises for fodder (Table 6). The similar pattern of sale was observed in both the zones under study. It is obvious that vendors played a very limited role in meeting the rural demand for fodder. The wholesale traders procured fodder directly from producers in villages and/ or from the vendors at their business premises; mostly established by the side of highways/ roads close to urban centres/ towns. In surplus zone, wholesalers did not face much trouble in securing supply of fodder; they had good contact with different vendors who supply them fodder at their business premises. About 57.5 percent of the fodder purchased by the wholesale traders was delivered at their business premises and 42.5 percent

of fodder purchased by the wholesale traders was obtained from the villages. However, the work of wholesale traders in deficit zone was full of drudgery. In order to meet the demand for fodder, they had to procure a major chunk of fodders (74.2%) from the producers scattered in villages through out the zone. It is evident that merely one-fourth of the fodder (25.8%) was purchased at the business premises. It is interesting to note that even in case of sales; wholesalers in surplus zone were comparatively more comfortable. About two-third (67%) of the fodder was sold in town from their business premises. In deficit zone, the situation was exactly opposite. Wholesalers were able to sell only 26 percent of fodder at their business premises wheras they need to explore market and sell fodder in the villages.

Almost similar was the situation of retail traders. They purchased about 72 percent of fodder at business premises from vendors. But in deficit zone, they had to purchase a bulk of fodder (57%) from the villages. For this, they had to travel in villages, find producers having surplus fodder or willing to sale, and maintain contact with producers, vendors and agents. All these involve time, money and labour. But their contacts and connections often make the marketing easier. The retail traders were able to sell 96 percent of fodder from their business premises only.

Table 6 Purchased and sale of fodder by different functionaries in village and town in Study area (%)

Particulars	Surplus		Deficit-zone		Total	
	In village	In town	In village	In town	In village	In town
Vendor						
Purchased	97.6	2.4	94.5	5.4	96.2	3.8
Sold	0	99.9	0.9	99.1	0.4	99.5
Wholesale trader						
Purchased	42.5	57.5	74.2	25.8	58	42
Sold	32.4	67.6	0	100	17.3	82.7
Retail trader						
Purchased	13.1	86.9	54.6	47.2	20.6	79.6
Sold	0	100.1	0	100	0	100
Total						
Purchased	25.7	74.3	70.5	30.5	36.9	63.2
Sold	1.3	98.7	0.3	99.7	1.1	98.1

Economics of Fodder Marketing

Fodder marketing in Bihar has no formal organized structure or 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 vendors, wholesalers, retailers , 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, vendor, wholesaler, 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.

Among different marketing channels, the most important channel is "producer-vendor-wholesaler-consumer" which accounts for about two-thirds of fodder marketing in Bihar. Marketing cost and margin in fodder marketing is discussed for this channel only. There are four important costs in fodder marketing namely; transportation ,weighing and labour,storage and processing.

Table: - Marketing cost incurred and net margin of different actors in fodder marketing in the study area

in Rs/quintal

Particulars	Vendors	Wholesale	Retailer	Total	Percentage
Producers Price	177	-	-	177	35.4
Transportation Costs	1.5	4.9	1.6	8	1.6
Labour and Weighing Cost	0.5	0.4	2.8	3.7	0.7
Storage Cost	8	0.7	1.8	10.5	2.1
Processing Cost	26	23.1	19.9	69	13.8
Marketing Margin	59	77	96	232	46.4
Consumer Price	-	-	-	500.2	100

Analysis of cost incurred and margin in fodder marketing revealed that the market margin obtained by different functionaries accounts for about 46.4 per cent of consumers price however retailers margin was comparatively high(Rs 96) .Fodder is processed at every stage and per quintal cost of processing was worked out at Rs 69 which was 13.8 per cent of consumers rupee. Transportation and labour cost was about 2 per cent of consumers

price because the most of fodder was marketed in adjacent urban area. In fodder marketing ,producers got only 35.4 per cent of consumers price. It was only due to non holding capacity of farm households who do not have sufficient safe place for fodder storage and the majority of them made distress sale of fodder in study area. There is no any market place for fodder and vendors purchase fodder at their own terms.

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.

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