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Marketing of Rainy- and Postrainy-season Sorghum in Andhra Pradesh, Karnataka, and Maharashtra

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Abstract

This study, an investigation into the marketing systems for sorghum grain and stover in the states of Andhra Pradesh, Maharashtra, and Karnataka, aims at describing the current market systems and partly assesses their performance. It needs to be viewed in the context of other components which address sorghum production, consumption and industrial utilization. The study is split into" three sections. While the first section gives an idea of the volume of marketed grain, and provides an overview of the actual flows, buyers, sellers and end-uses of sorghum grain traded in key districts in these states, the second section provides an indication of the producer's share in the sorghum consumer's rupee and discusses how the large projected increases in industrial demand for rainy-season sorghum may affect the marketing system. The final section draws together the key conclusions from the study.

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About ICRISAT

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ICRISAT was established in 1972. It is one of 16 nonprofit, research and training centers funded through the Consultative Group on International Agricultural Research (CGIAR). The CGIAR is an informal association of approximately 50 public and private sector donors; it is co-sponsored by the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), and the World Bank.

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Introduction

This study to investigate the marketing systems for sorghum grain and stover was undertaken over a two-week period from 21 Feb to 6 Mar 1998. Subsequent field work was carried out in selected markets in Karnataka in Apr and May 1998. The geographic locations of the markets covered are shown in Figure 1 and the methodology in Appendix A. The aim of the study was to describe the current marketing systems and to some extent assess their performance. The study is a component of the NRI-ICRISAT research project, Sorghum in India. This report should be viewed in the context of the other components, which address sorghum production, consumption, and industrial utilization. To some extent it forms a link between these studies.

This report is organized into three sections: Section I gives an idea of the volume of marketed grain in Andhra Pradesh, Karnataka, and Maharashtra, and sets out the structure of the marketing system. It also provides an overview of the actual flows, buyers, sellers, and end-uses of the sorghum grain traded in key districts in each of the three states. Section II provides an indication of the producer's share in the sorghum consumer's rupee, and investigates the extent to which the existing marketing arrangements affect utilization of sorghum. It also briefly discusses how the large projected increases in industrial demand for rainy-season sorghum may affect the marketing system. Finally, Section III draws together the key conclusions from the study.

In addition to the main body of the text, Appendix B takes a look at the marketing of stover in the three states.

Section I

Volumes and Structure of the Marketing System, and Movement of Marketed Sorghum

Volumes

During the 1980s, of all the states of India, Maharashtra accounted for the largest volume of sorghum arrivals at regulated markets: about 60% of recorded arrivals. It was followed by Madhya Pradesh (14%), Karnataka (8%), and then Andhra Pradesh, Tamil Nadu, and Uttar Pradesh, all contributing around 5%[1]. During the 1990s, the marketed volume of sorghum in Madhya Pradesh has been roughly on par with that of Andhra Pradesh but considerably below that of Karnataka, whilst market arrivals in Maharashtra continued to outstrip those of every other state (Table 1). Table 2 gives an indication of the concentration of market arrivals in certain districts in the four states of Maharashtra, Karnataka, Andhra Pradesh, and Madhya Pradesh during the 1990s.

Table 1. Market arrivals ('000 t) of sorghum at regulated markets from 1990/91 to 1996/97.

Year	Maharashtra	Karnataka	Andhra Pradesh	Madhya Pradesh
1990/91	842.1	148.5	69.0	48.5
1991/92	600.8	166.5	73.1	36.3
1992/93	1247.9	146.4	49.4	74.6
1993/94	772.3	138.0	56.0	81.6
1994/95	650.1	66.8	47.0	18.6
1995/96	774.5	56.9	50.0	47.1
1996/97	Incomplete data	46.4	52.5	Incomplete data
Total	4887.7	769.5	397.0	306.9
Average	814.6	110.0	56.7	51.1

Source: State Directorates of agricultural marketing.

The figures in table 1 pertain to all market arrivals, primary (sales by farmers or their representatives), and secondary sales (wholesalers).

Table 2. Market, arrivals of sorghum in important districts in Maharashtra, Karnataka, Andhra Pradesh, and Madhya Pradesh from 1990/91 to 1996/97 ('000 t).

Maharashtra		Karnataka		Andhra Pradesh		Madhya Pradesh	
District	Arrivals	District	Arrivals	District	Arrivals	District	Arrivals
Jalgaon	1,017.3 (20.9)[1]	Bijapur	146.0 (20.2)	Kurnool	91.8 (24.7)	Dewas	55.5 (18.1)
Dhule	488.9 (10.0)	Belgaum	144.5 (20.0)	Cuddapah	51.9 (13.9)	Guna	51.0 (16.6)
Buldana	443.4 (9.1)	Dharwad	127.9 (17.7)	Mahbubnagar	31.0 (8.3)	Rajgarh	34.0 (11.1)
Pune	407.1 (8.4)	Bellary	75.7 (10.5)	Chittoor	25.5 (6.9)	Shajapur	24.4 (7.9)
Sholapur	353.4 (7.3)	Raichur	63.1 (8.7)	Krishna	20.2 (5.4)	Chattarpur	15.7 (5.1)
Total	2,710.4 (55.7)	Total	557.3 (77.0)	Total	220.5 (59.3)	Total	180.8 (58.9)

1. Figures in parentheses are percentages of market arrivals in the state accounted for by the district.
Source: State directorates of agricultural marketing.

1. Source: Bulletin of Food Statistics, Directorate of Economics and Statistics, Ministry of Agriculture, Delhi (various issues).

Marketed Surplus

To understand the significance of the sorghum marketing system, it helps to have some idea of the proportion of the crop that enters the marketing system in the first place. A measure of this is the marketed surplus. This is defined by Acharya and Agarwal (1996) as "that quantity of produce which the producer-farmer actually sells in the market, irrespective of his requirements for family consumption, farm needs, and other payments".

Sorghum is sold through regulated and nonregulated channels. Regulated markets are those in which business is done in accordance with the rules and regulations framed by the statutory market organization, the market committee. The marketing costs in such markets are standardized and the practices regulated.

In addition to the regulated channel, farmers also sell their produce through various nonregulated channels. These include sales to neighbors, family members, creditors, and landlords, sales at nonregulated village markets commonly known as 'shandies', and sales to middlemen who buy in large quantities for shipment to secondary markets in urban centres.

Marketed surplus sold in regulated markets Unlike market arrival data, marketed surplus information is estimated. Table 3 presents figures from the Directorate of Economics and Statistics covering the period from the late 1960s to the early 1980s.

Table 4 presents market arrivals in four states as a percentage of the all-India production during the 1990s. This gives a rough approximation of the surplus marketed through regulated channels at the all-India level as these states account for over 90% of the regulated market activity. Market arrivals varied between 8.6% and 11.8% of sorghum production in India.

Table 3. Average proportion of annual sorghum production arriving at regulated markets from 1968/69 to 1983/84.

State	Annual average arrivals (%)
Andhra Pradesh	8.5
Karnataka	6.2
Maharashtra	11.7
AllIndia	10.1

Source: Bulletin of Food Statistics (various editions).

Table 4. Proportion of all-India sorghum production arriving at regulated markets in four major states from 1990/91 to 1995/96.

		Market arrivals (percentage of all-India production)				
Year	Production (mt)	Maharashtra	Karnataka	Andhra Pradesh	Madhya Pradesh	Total
1990/91	11.6	7.2	1.2	0.5	0.4	9.4
1991/92	8.1	7.4	2.0	0.9	0.4	10.7
1992/93	12.8	9.7	1.1	0.3	0.5	11.8
1993/94	11.4	6.7	1.2	0.4	0.7	9.1
1994/95	8.9	7.2	0.7	0.4	0.1	8.5
1995/96	9.3	8.3	0.6	0.5	0.5	9.9

In order to put this level of regulated-market arrivals into a broader context, Table 5 compares the marketed surplus for sorghum with that of wheat and rice at the all-India level. It is clear that the marketed surplus is much lower for sorghum than for the other two crops[2].

Table 5. Proportion (%) of India's production of rice, wheat, and sorghum arriving at wholesale assembling markets.

Crop	1987/88	1988/89	1989/90	1990/91	1991/92
Rice	32.3	29.7	30.1	30.9	29.8
Wheat	26.2	27.1	27.0	29.5	27.8
Sorghum	14.0	10.3	10.5	11.0	10.3

Source: Bulletin of Food Statistics (1992).

Nonregulated channels. Data on surplus marketed through nonregulated channels is not in great supply. Dayakar et al. (unpublished) interviewed random samples of farmers in six sorghum- growing districts: Bijapur (Karnataka); Mahbubnagar (Andhra Pradesh); and Pune, Nanded, Amravathi, and Akola (Maharashtra). The study found an average level of marketed surplus in excess of 30%.

Given that official figures suggest that about 10% of sorghum production is marketed through regulated markets, the findings of Dayakar et al. (unpublished) raise the possibility that substantial amounts of sorghum are being marketed through nonregulated channels. Before coming to any conclusions, it should be noted that in a study of western Maharashtra, Garande et al. (1997) also found that marketed surplus was around 30%; however, the authors estimated that two-thirds of the surplus was sold through regulated channels.

The paucity of data on nonregulated market transactions of sorghum suggests a need for further research on this issue. The volume of nonregulated market transactions needs to be established for all the major sorghum-producing states, and this compared with regulated volumes. It may well be that nonregulated market transactions are more important than previously thought.

Market Channels

Figure 2 shows the marketing chain for sorghum grain. It indicates that there are a number of possible ways for the farmer to dispose of sorghum off-farm.

Disposal by farmer. After harvest, sorghum grain may be retained on farm, to be used for home consumption or as seed. It may be used for payment in kind, or it may be sold either in a regulated market and/or through a nonregulated transaction. Nonregulated transactions may take a variety of forms (see Fig. 2).

'Basic primary markets' and 'primary/secondary markets'. Focusing on the regulated channel, farmers may sell to what is termed a 'basic primary market' in Figure 2, or to a 'regulated primary/ secondary market'. A basic primary market is one where farmers sell to wholesale traders through a commission agent, and the wholesaler then sells to parties outside the market, i.e., local retailers or other wholesalers in other markets.

Note that in these markets the wholesaler will almost invariably buy only from local farmers. This is in contrast to wholesalers in primary/secondary markets, who may buy from other wholesalers in other markets as well as from local farmers.

2. One of the reasons for this is the purchases by the state governments for their Public Distribution System buffer stock.

Commission agents and wholesalers. Once sorghum grain reaches the regulated market, commission agents organize the sale of the produce to wholesalers[3]. Many of the wholesalers have their offices in the market yard itself. In some cases commission agents also have wholesaler's licences. Whilst both commission agent and wholesalers are middlemen, they have a different relationship to the commodities they handle. Commission agents are a type of agent middlemen. Agent middlemen act as representatives of their clients, in this case, farmers. They do not take title to the produce and, therefore, do not own it. They merely negotiate the sale. They sell their *services* to their principals (farmers) and not the goods or commodities, and receive income in the form of a commission on each sale[4]. The commission agent takes over the physical handling of sorghum once it reaches the market, arranges for the sale, collects the price from the buyer, deducts his expenses and commission, and remits the balance to the farmer. A wholesaler, on the other hand, is defined as a merchant middleman, i.e., someone who takes title to the goods he handles. He buys and sells on his own, gain or loss, depending on the difference in sale and purchase prices.

Wholesale disposals from primary/secondary markets. After purchasing from farmers or other wholesalers, the wholesaler may sell to local retailers; other wholesalers in secondary or terminal markets — either directly or through a broker; individual consumers (normally a very small proportion of total sales); or, in the case of rainy-season sorghum, a variety of other nonfood users[3] (Fig. 2).

Brokers. Brokers play a role in transactions between farmers and wholesalers located in primary/secondary markets, and also between wholesalers in major markets. Like commission agents, brokers are a type of agent middlemen. However, unlike commission agents, they do not have physical control of the product. The main function of a broker is to bring together buyers and sellers on the same platform for negotiations. Their charge is called a brokerage, and in the case of sorghum, it appears that they normally claim brokerage from both buyer and seller.

Truck companies. The distances between markets can be significant, and the quantities delivered large. For this reason, truck companies are often contracted to transport produce between markets.

Movements and Utilization of Sorghum

Andhra Pradesh

Field work was carried out in Mahbubnagar, Kurnool, and Chittoor, which accounted for high levels of market arrivals of sorghum in the state during the 1990s (Table 2). Visits were also made to the major markets in Hyderabad city. Table 6 summarizes the types of sorghum produce bought and sold, and their uses in each of the markets visited.

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3. The method of sale is decided upon by the market committee. Two methods, the closed tender and the open tender, appear to be used quite widely. Under the closed tender system, buyers place their bids in a closed box, which is then opened by a member of the market committee, with the highest bidder receiving the produce. The open tender system is basically an auction, where buyers openly compete for the produce. The bidding is facilitated by the commission agent or auctioneer.

4. The rates of commission in regulated markets are decided by the market committee. These are normally 2-3% of the auction or tender price, although there are some markets where the commission is lower, e.g., Akola (1.5%). In addition to commission charges (in Karnataka markets, traders pay commission agent's charges), there are other costs which fall on the farmer. These include loading and unloading costs and weighing charges. (Table 13 gives a breakdown of costs and margins for two markets visited during field work.)

Table 6. Sorghum supply and utilization in Andhra Pradesh markets (1998).

Market	Catchment[1]	Varieties	Buyers/Uses[2]
Hyderabad	Up to 550 km for rainy-season sorghum hybrid	Hybrid rainy-season sorghum (several cultivars)	Hybrid rainy-season sorghum: Food, poultry, and cattle-feed uses. Wholesale traders sell direct to poultry-feed manufacturers, poultry farmers, hatcheries, and cattle-feed manufacturers or dairies locally and in other parts of Andhra Pradesh
	Up to 450 km for postrainy-season sorghum	Postrainy-season sorghum ('Maldandi', Gol, Rayalseema)	Postrainy-season sorghum: Mainly sold to foodgrain retailers within city
	Up to 300 km for local rainy-season sorghum (all secondary)	Local rainy-season sorghum	Local rainy-season sorghum: Sold to local retailers, food (several varieties) use (low-income groups)
Mahbubnagar, Kurnool, Chittoor	Within district for rainy-season sorghum (primary)	Hybrid (CSH 5, CSH 9, and others)	Rainy-season sorghum: Food and feed use. Local retailers buy for food use. Poultry-feed manufacturers and hatcheries are important buyers. (Travel up to 400 km.)
	Up to 250 km radius for postrainy-season sorghum (primary and secondary)	Postrainy season sorghum (mainly 'Maldandi')	Postrainy-season sorghum: Mainly sold to foodgrain retailers within district

1. 'Catchment' refers to wholesalers' estimates of the distances that farmers travel to sell their sorghum at the market (primary), and estimates of the distances between their market and other markets from which they buy (secondary).

2. 'Uses' refers to the types of buyers and utilization of sorghum produce by those purchasing from wholesalers at the market.

Arrivals

Mahbubnagar, Kurnool, and Chittoor

In each of the districts visited, wholesalers handle rainy- and postrainy-season sorghum imported from outside the district as well as locally-grown rainy-season sorghum. Most of the rainy-season sorghum is grown within a 60 km radius of the markets, and is brought by farmers by bullock cart if the distance is less than 20 km, or by van or tractor for longer distances. One of the distinguishing features of these districts is that considerable quantities of postrainy-season sorghum, in particular M 35-1 (known as 'Maldandi'), are imported from Feb onward. Most of the 'Maldandi' comes from Maharashtra (Latur and sholapur) and Karnataka (mainly Raichur).

Whilst sorghum of one variety or another is sold throughout the year, there is a distinct seasonality in sorghum arrivals: From Oct to Jan, locally-grown hybrid and local varieties of rainy-season sorghum reach the market. In Feb, wholesalers start to import 'Maldandi' from Maharashtra and Karnataka. This reaches a peak in Mar and Apr. Some traders reported that they import 'Maldandi' for local consumption right through the monsoon.

Hyderabad

There are four major markets in the city of Hyderabad: Osmanganj, Malakpet, Maharajganj, and Kishenganj. Sorghum is sold wholesale in each of these markets. These are essentially terminal markets which serve the city and its environs, receiving produce from a wide area. Various types of local sorghum are sold in these markets, together with hybrids (most commonly CSH 5, CSH 1, CSH 9, JK 22, and MAHYCO 51) and postrainy-season sorghums (most commonly 'Maldandi')[5]. Recently harvested rainy-season varieties start arriving in the markets in Oct. Much of the nonimproved rainy-season sorghum originates from districts within Andhra Pradesh, mainly to the south of Hyderabad: Cuddapah, Kurnool, Anantapur, and Mahbubnagar, amongst others. Rainy-season hybrids originate from Maharashtra as well as from within Andhra Pradesh. It appears that for some traders these Maharashtra hybrids are a major part of the hybrid sorghum trade. They originate from districts as far away as Aurangabad (550 km). Postrainy-season sorghum starts arriving in the markets in Feb. The most common varieties appear to be 'Gol', 'Rayalseema'—both originating from within Andhra Pradesh—and 'Maldandi', most of which seems to be coming from Bijapur, Raichur, and Gulbarga districts in northern Karnataka.

Buyers and Sellers

Mahbubnagar, Kurnool, and Chittoor

Locally-grown sorghum is sold by the farmers themselves. The method of sale is decided upon by the market committee and thus varies according to the market. In Mahbubnagar, the official method of sale is closed-tender bidding, organized by the commission agents. Where there are few buyers, however, trading can take place through negotiation, facilitated by the commission agent.

Sorghum imported from other areas is sold to local wholesalers by wholesalers of other areas, often through a broker. Buyers of postrainy-season sorghum are normally either retailers or consumers. Retailers (the main category of buyers) are usually from within a 60-km radius of the market. Consumers who buy directly from the wholesaler tend to be reasonably well-off, as they require to purchase at least one or two 100 kg bags at a time. These consumers generally reside in the same town as the market from which they buy. There is more variety among buyers of rainy-season sorghum. In addition to local retailers and consumers, some of the locally-grown rainy-season sorghum is exported from these districts to other markets in the state including Hyderabad, and some outside the state.

Poultry feed merchants and hatcheries, an important industry in the state, are significant buyers. This category may travel some distance to buy sorghum. For example, Mahbubnagar traders sell to hatcheries based in Guntur (250 km) and West Godavari (400 km). The purchase of hybrid rainy-season sorghum for poultry feed is highly influenced by the price of the grain relative to that of maize. If the price differential between sorghum and maize reaches a certain threshold, feed manufacturers substitute a part of their maize purchases with sorghum. The precise threshold appears to vary between Rs 50 and Rs 100 per 100 kg.[6] As one wholesaler in the Mahbubnagar market explained, there is an element of seasonality in the substitution: more sorghum is sold as poultry feed during July and August when there is little maize in the market.

5. One experienced trader estimated that rainy-season hybrids accounted for about 70% of the total trade in sorghum in the Osmanganj market, with local rainy- and postrainy-season varieties accounting for about 15% each.

In October maize comes to the market, and its price falls, poultry-feed buyers therefore switch back to maize. Molding of the grain reduces the price and to this extent makes sorghum more attractive.

However, commercial poultry-feed manufacturers are highly unlikely to purchase molded grain, as are broiler farms (because feeding molded sorghum to birds slows down weight gain). The main market for molded grain may, therefore, be commercial layer concerns that make their own feed. Such buyers, however, are sensitive to the degree of molding. Partially molded grain can be used in feed for layers, but completely molded grain appears not to be acceptable.

An indication of the wholesale prices (i.e., the wholesalers' selling price) as at the end of February 1998 in markets in these districts is given in Table 7.

Table 7. Wholesale prices[1] (Rs per 100 kg) in selected markets in Mahbubnagar, Kurnool, and Chittoor districts.

Market	Rainy-season hybrid (nonmolded)	Postrainy-season improved (M 35 -1)
Mahbubnagar APMC[2]	450	650
Kurnool APMC	400-450	700
Chittoor APMC	400	650

1. These prices are merely a benchmark; there may be considerable variation depending on the quality of the grain.

2. APMC = Agricultural Produce Market Committee.

Hyderabad

Wholesalers sell directly to consumers in a limited number of cases. Such consumers tend to be reasonably well-off, and are more likely to purchase postrainy-season sorghum than rainy-season varieties. Much more common than sales to individuals are sales to retailers who have businesses in the city. Another important category of customer for rainy-season sorghum is poultry feed manufacturers and hatcheries. There are large hatcheries near Hyderabad and in Nizamabad. Traders also sell rainy-season sorghum directly to cattle feed manufacturers (e.g., from Godavari district east of the city).

Karnataka

Field work was carried out in Bijapur (Feb 1998) and Dharwad, Bellary, Raichur, and Davangere (May 1998). Table 2 shows that during the 1990s Bijapur district topped the list for market arrivals of sorghum, accounting for 20% of the total recorded arrivals in the state, marginally higher than Belgaum. Dharwad was third (17.7%), followed by Bellary (10.5%), and Raichur (8.7%). Table 8 gives a summary of the types of sorghum bought and sold at these markets, together with the modes of utilization.

6. One trader in Chittoor said that it was Rs.50/100 kg; a trader in central Hyderabad estimated it to be Rs. 80. A commercial poultry-feed manufacturer in Bangalore put the range at Rs. 50-60; a trader in Bangalore gave a higher figure of Rs. 100. One trader in Akola stated that it was Rs. 50 to 75/100 kg.

Table 8. Sorghum supply and utilization in Karnataka markets (1998).

Market	Catchment[1]	Varieties	Buyers/uses[2]
Bijapur	Within district for postrainy-season (primary market)	Mainly 'Maldandi'	Food only: Local retailers; wholesalers from Maharashtra, Andhra Pradesh, and Karnataka; and medium to well-off consumers.
Dharwad	50-80 km within district (mainly primary)	Hybrid (CSH 50), local rainy-season	Lower-quality hybrid: Feed use. Mostly shipped to neighboring states Kerala, Tamil Nadu, and Andhra Pradesh. Good-quality hybrid: Local food use. Good-quality local rainy-season: Local food use and in Maharashtra.
		Postrainy-season ('Maldandi')	Postrainy-season: Local food use (60%), balance exported to neighboring districts in Karnataka and Maharashtra.
Davangere	30 km for hybrid rainy-season (primary)	Hybrid (CSH 5, MSH 4, Kanchan)	Lower-quality hybrid: Feed use, mainly exported to Bangalore and Tamil Nadu. Good-quality hybrid: Mainly local food use (lower-and middle-income groups).
	Neighboring districts for postrainy-season (secondary)	Postrainy-season ('Maldandi')	Postrainy-season: Local food use, mainly upper-and middle-income groups.
Bellary	Within district for hybrid rainy-season (primary)	Hybrid (CSH 51, Pioneer, CSH 5, CSH 6)	Good-quality hybrid: mainly for local food use; small proportion exported to Maharashtra and neighboring districts. Lower-quality hybrid: Local cattle feed and poultry.
	Neighboring districts for postrainy-season (secondary)	Postrainy-season ('Maldandi')[3]	Postrainy-season; Food use for higher-income groups.
Raichur[4]	25-30 km (primary)	Postrainy-season ('Maldandi'), hybrids (small quantity)	Postrainy-season: Food use only; bought by local retailers for consumers of all income groups; shipped to wholesalers in Andhra Pradesh.

1. 'Catchment' refers to wholesalers' estimates of the distances farmers travel to sell their sorghum at the market.
2. 'Uses' refers to the types of buyers and utilization of sorghum produce by those purchasing from wholesalers at the market.
3. The 'Maldandi' is imported from Dharwad district on a wholesaler-to-wholesaler basis. No 'Maldandi' is brought in by farmers from the local area.
4. Large quantities of marketed sorghum grown in the district are shipped directly to other markets such as Sholapur, Pune, Mumbai, and Sangli.

Arrivals

Bijapur, Dharwad, Davangere, Bellary, and Raichur

In Bijapur district, a large proportion of the total market arrivals is accounted for by the regulated wholesale market in Bijapur town. The reported volumes of sorghum sold fluctuated between 7,300 t and 16,450 t per annum from 1986 to 1995. Although no figures are available, the chairman of the market committee estimated that about 90% of the sorghum sold in the market is the 'Maldandi' variety. Certainly, this estimate was in line with the trading volumes of the traders interviewed.[7] Most of the 'Maldandi' originates within the district, with some proportion of it coming from Raichur and Belgaum districts. Small amounts of hybrid-sorghum come in from other districts. In terms of seasonal volumes, the newly harvested 'Maldandi' crop begins to arrive in late February and continues until the monsoon. Apr is the peak month for market arrivals. Prices reach a peak in early Feb, just before the new harvest[8]. Whiteness, grain size and the amount of dust—indicating insect damage—are the main criteria determining the price.

In Dharwad, hybrid (CSH 5), local, and postrainy-season sorghum are equally important in terms of market arrivals. Local sorghum is the traditional long-duration sorghum grown in the rainy season. Market arrivals of this type have decreased over the years as farmers now prefer to grow shorter-duration varieties. CSH 5 starts arriving in the market mainly during Oct, Nov, and Dec. Local sorghum arrives in Feb and Mar, and postrainy-season sorghum in Mar and Apr.

In Davangere, CSH 5 (highest arrivals), MSH 4, and Kanchan are the main hybrids that arrive in this market. White sorghum (postrainy-season) is imported from Dharwad district as secondary sales, and peak arrivals are during Apr and May.

In Bellary, MAHYCO 51 is by far the most important hybrid in the market followed by Pioneer, CSH 5, and CSH 6. A second hybrid sorghum crop is now grown as summer sorghum due to the availability of canal irrigation. The arrivals from this crop in this market are about 5-10% of the total hybrid arrivals. Small quantities of white sorghum are grown locally and arrive in the market in Feb/Mar while a large proportion is imported from the neighboring districts. The traders interviewed generally said that about 70-80% of the total sorghum arrivals are hybrids.

The Raichur market is well-known for 'Raichur sorghum'. It is mainly M 35-1, grown in the late rainy season or early postrainy season and is valued for its distinct quality compared with the postrainy-season sorghum grown in other areas. Small quantities of hybrid sorghum (1-2% of the total arrivals) are also sold in the market. Ten years ago, sorghum was one of the most important commodities in terms of arrivals. Nowadays, however, cotton, sunflower, paddy, groundnut, and green gram arrivals are more important. Until 1995/96, sorghum sales mainly took place outside the market yard in traders' shops located in the city. Farmers took their produce directly to the traders' shops. This was beneficial to the traders as it saved them commission agent charges and transport costs from market to shop. (However, they still paid the market cess at the prevailing rates). Two years ago, a tender system was introduced for sorghum, as was the case for crops like cotton sunflower, etc.[9] A few farmers now take their produce directly to the market yard. Another fact mentioned by the traders interviewed was that large quantities of Raichur sorghum are shipped directly or truck from the villages to Sholapur, Pune, Mumbai, Sangli, Hyderabad, and Kurnool. Only small farmers with 5-10 bags bring their produce to the traders. Sorghum production was low in 1997/98 due to poor rains and untimely storms compared to last 3-4 years. In 1996-97 the price of Raichur sorghum Was Rs. 500-550 per 100 kg compared with Rs. 700-750 per 100 kg in 1997-98.

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7. For example, in 1997, wholesaler trader M/s Bannad and Co. sold 1914 bags of sorghum, 1640 bags of M 35-1 (86%), and 274 bags of hybrid (14%).
8. In Feb 1997, wholesalers paid Rs 825 per 100 kg for good quality 1996 grain that had been stored for almost a year before being sold.
9. In all the markets surveyed in Karnataka, sorghum was sold through an open auction or tender system. However only a few lots go through this process. Once the auction price is determined, purchases are made around the auction price privately by the trader through commission agents. This trend perhaps indicates the declining importance of sorghum arrivals over the years.

Buyers and Sellers

In Bijapur, most of the sellers at the markets are either producers or village traders from within the district. Farmers and traders bring the crop to the market using the usual modes of transport: bullock carts for those located nearby (within 20 km) and vans and tractors for those further away. In the Bijapur, Dharwad, and Raichur markets, only in a low-production year are there any significant wholesaler-to-wholesaler imports of sorghum from other districts. In Davangere and Bellary markets postrainy-season sorghum is imported (wholesaler to wholesaler) from the neighboring districts in Karnataka (Dharwad, Gulbarga, Shahbad, Bijapur, Gadag, and Hubli).

Wholesalers at the market explained that there are three categories of buyers: wholesalers, mainly from Maharashtra, but also from Andhra Pradesh; local retailers from within a 100 km radius of Bijapur town; and wealthier consumers from the town who typically buy one or two bags at harvest. All of the sorghum sold is used as food. During a pilot study in 1997[10], some traders felt that demand from Maharashtra had increased in recent years. One trader estimated that 75% of his trade went to that state. He thought that this trend would continue, and said he could sell an extra 100 tonnes per year to Maharashtra if he had the supply.

In Dharwad, the first-quality hybrid sorghum is used for food locally and the second quality for feed. Most of the feed sorghum is shipped to neighboring states like Kerala (pig feed), Tamil Nadu, (poultry and cattle feed), and Andhra Pradesh (poultry feed). Local (traditional) sorghum is mainly for food use although molded grain is used for cattle feed. About a quarter of the good quality local sorghum is exported to Maharashtra for food use. Rabi sorghum is consumed locally as food (60%) and the balance exported to Maharashtra (Karad, Sangli, Kolhapur, and Satara) and neighboring districts for food use.

In Davangere, about 50% of the hybrid sorghum goes for feed use. Small quantities are sold locally in Davangere itself but the bulk of it is exported to Bangalore (to companies like Mysore Feeds, Lipton India, Chakand Oil mills); and Tamil Nadu (SKM Feeds India in Nammakal and Erode). In this market maize and sorghum compete for use in cattle and poultry feed. If the price differential between maize and sorghum is only Rs.25-50 per 100 kg, maize is preferred by the buyers, particularly poultry-feed manufacturers. Good-quality CSH 5 is purchased locally for food use, and small quantities are exported to Maharashtra depending on the demand there. Postrainy-season sorghum on the other hand (mostly imported from other markets) is purchased mainly by comsumers from higher-and middle-income groups.

In Bellary, first quality-hybrid sorghum is mainly used for local food purposes. About 10% of sorghum of this quality was exported in 1997 to Maharashtra for consumption by consumers of the lower-income group. In 1998 another 10% or more of sorghum of this quality was exported to neighboring districts in Karnataka (Koppal, Hubli, and Dharwad) owing to a shortage there. Second- and third quality sorghum goes for use as cattle and poultry feed locally. But this depends on the relative prices of sorghum and maize. In 1997, poor-quality sorghum went for use as cattle feed locally (Rs.250-300 per 100 kg). But in 1998, as sorghum prices were high relative to maize, local poultry farmers used maize, finger millet, and pearl millet. Exports of feed sorghum from this market are low.

In Raichur, sorghum is purchased by local retailers for food use. It is consumed by people of all income groups. In 1998, there was a slight decline in demand due to the higher prices; the lower income groups shifted their preference to cheaper varieties. With the exception of 1998, demand has been generally stable over the last 5-10 years. About 15-20% of sorghum arrivals are exported to Adoni, Yemmiganur, and Kurnool in Andhra Pradesh for food use. M 35-1 is generally never used for feed unless its price drops to less than Rs 300 per 100 kg. Local poultry farmers in Raichur buy maize brought from Andhra Pradesh.

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10. Sorghum Utilization in India: Pilot Study. Marsland et al. (Unpublished draft).

Maharashtra

As Table 2 shows, arrivals of sorghum in the Maharashtra markets are much higher than in Karnataka and Andhra Pradesh. For this reason, considerable emphasis was placed in this study on covering markets in the key areas of that state. Table 9 summarizes supply and utilization data for the markets visited in Maharashtra.

Table 9. Sorghum supply and utilization in Maharashtra markets (1998).

Market	Catchment[1]	Varieties	Buyers/uses[2]
Pune	Up to 300 km for rainy-season hybrids (primary and secondary);	Rainy-season hybrids (various)	Rainy-season; Local retailers (food), local nonfood industries
	Up to 400 km for postrainy-season (mainly secondary)	Postrainy-season (mainly 'Maldandi')	Postrainy-season Mainly foodgrain retailers in and around the city
Sholapur	Up to 150 km for postrainy-season (primary); Up to 350 km for rainy-season (secondary)	Postrainy-season (mainly 'Maldandi') Rainy-season hybrids (various)	Postrainy-season: Local retailers' food use, wholesalers, seasonal buyers in Maharashtra and cities in Maharashtra, Andhra Pradesh Rainy-season: Almost exclusively local retailers for poor consumers
Ahmednagar	Most of postrainy- and rainy-season sorghum comes from within district. In times of shortage, hybrid imported from other districts in Maharashtra and Madhya Pradesh	Postrainy-season (mainly 'Maldandi') Rainy-season hybrid (various)	About 30% of postrainy-season is sold to local retailers. Seventy percent sold to wholesalers in other markets within the state
Jalgaon	Rainy-and postrainy-season sorghum mainly from within the district	Postrainy-season (mainly 'Maldandi') Rainy-season hybrid (various)	Postrainy-season; Local retailers and wholesalers in other parts of Maharashtra for food use rainy-season: wholesalers in cities and growing areas but in postrainy-season addition various nonfood uses: poultry, catde, starch, alcohol, and seed.
Khamgaon	Mainly within the district for rainy-season hybrids (primary); Postrainy-season sorghum (secondary)	Mainly rainy-season hybrids, some local rainy-season varieties, small amounts of 'Maldandi'	Rainy-season sorghum: Mainly nonfood uses Nonfood use increases with grain molding (alcohol, cattle feed). For food use main customers are local retailers and wholesalers from other districts within state
Akola	Mainly within the district for rainy-season hybrids; Postrainy-season (secondary)	Mainly hybrids, some 'Maldandi'	Nonfood uses are important for rainy-season sorghum, particularly in cattle-feed and alcohol industries. Wholesalers from other districts also buy rainy-season sorghum for food use

1. 'Catchment' refers to wholesalers' estimates of the distances that farmers travel to sell their sorghum at the market (primary), and estimates of the distances between their market and other markets from which they buy (secondary).
2. 'Uses' refers to the types of buyers and utilization of the sorghum produce by those purchasing from wholesalers at the market.

Arrivals

Sholapur, Ahmednagar, Jalgaon, Khamgaon, and Akola

In Sholapur markets, 'Maldandi' is the most commonly traded variety by a considerable margin. Most of the arrivals of this variety at the main regulated market in Sholapur town originate within the district, and from Bijapur, Raichur (both in Karnataka), and Mohol districts (maximum distance 150 km). Hybrid rainy-season varieties (CSH 5, CSH 9, MAHYCO 51, and JK 22), are also imported from markets in other districts. All of the hybrids are imported into the district from as far away as Jalgaon, Akola and Buldana (more than 350 km), as well as Latur (150 km). The seasonality of arrivals of 'Maldandi' is similar to that in Bijapur. The rainy-season hybrids start arriving in October and tail off in February, reaching a peak in November. As at the time of the study team's visit, wholesale prices for 'Maldandi' and CSH 5 rainy-season hybrid are given in Table 10.

Table 10. Wholesale prices (Rs per 100 kg) of sorghum in the Sholapur (Maharashtra) market in Feb 1998.

M 35-1	CSH 5
Grade 1 : 750	Grade 1 : 500
Grade 2 : 650	Grade 2 : 400
Grade 3 : 500	Grade 3 : 250

In Ahmednagar, arrivals of rainy-season sorghum account for a higher proportion of the total arrivals than at Sholapur. Most of the postrainy- and rainy-season sorghum that arrives in the market is grown within the district. In times of shortage, hybrid sorghum is imported from outside the district and the state (from Madhya Pradesh).

Jalgaon, Khamgaon, and Akola are all situated near the border with Madhya Pradesh, with Jalgaon in the far northwest of the state, 100 km west of Khamgaon, which in turn is 300 km west of Akola.

Jalgaon district accounts for the highest volume of market arrivals of sorghum of any district in India. As Table 2 shows, during the 1990s the turnover of sorghum at markets in this district was about the same as that of the state totals for Karnataka and Andhra Pradesh combined. In the main regulated market in Jalgaon town, both rainy- and postrainy-season (mainly, but not exclusively, 'Maldandi') sorghum are important. Hybrid rainy-season sorghum grown on irrigated land (known locally as 'ratoon') is also marketed. Hybrid arrivals peak between Oct and Dec, and continue throughout the year with the ratoon crop arrivals starting in Feb and continuing until the monsoon. 'Maldandi' arrivals start in Feb, peaking in Mar-Apr and continue until the monsoon.

In Khamgaon and Akola, sorghum trading is dominated by rainy-season varieties. In this respect, these areas can be distinguished from Jalgaon, where postrainy-season varieties have a higher profile. In both districts the rainy-season sorghum arriving at the market is locally grown (100 km radius)

In all three areas, the importance of rainy-season sorghum and the frequent incidence of grain mold has given rise to a distinct grading system, with fully molded grain known as 'Disco', distinguished in price and end use from partly molded 'Super Disco' and nonblackened grain. Table 11 shows the price differences for the different grades at the time of the study team's visit (early Mar 1998).

Table 11. Prices (Rs per 100 kg) for different grades and varieties of sorghum in northern Maharashtra markets in early March 1998.

Sorghum grade/variety	Jalgaon	Khamgaon	Akola
'Maldandi'	650	-	600-700
Nonblackened rainy-season sorghum	300-400	325-400	350-400
'Super Disco'	280-300	280-305	300-325
'Disco'	250-260	240-270	280

Pune

Pune is Maharashtra's second largest town (after Mumbai). A considerable amount of sorghum is grown within Pune district, and large quantities are transported to the main APMC wholesale market in the centre of the city from other districts within the state and from other states. The most frequently mentioned varieties by the traders interviewed were 'Maldandi', CSH 5, and CSH 9. Sorghum sold in the primary market is mainly rainy-season sorghum originating from within Pune district, and is sold by farmers and village traders. Sorghum sold in the secondary market may travel long distances before reaching Pune. Rainy-season hybrids originate from Aurangabad (250 km), Beed (250-300 km), Jalgaon (350-400 km) amongst other districts, as well as from Madhya Pradesh (Indore, Dewas). Postrainy-season sorghum comes in from Ahmednagar (120 km), Sholapur (200 km), Bijapur (300 km), and other districts in northern Karnataka.

Buyers and Sellers

Sholapur, Ahmednagar, Jalgaon, Khamgaon, and Akola

In all markets apart from Pune, farmers/village traders make the largest contribution to market arrivals. Thus, most of the sorghum sold at these markets originates from within a radius of 60 km from the market, normally within the district. Once it reaches the market, the commission agent sells the sorghum on the farmer's behalf to the wholesaler. There is also a seasonal secondary market buying of sorghum from other areas by wholesalers at these markets. In this case the sellers are wholesalers from other markets. Characteristically, wholesalers from predominantly postrainy-season areas buy from wholesalers in rainy-season areas in the Oct-Dec period, and wholesalers from rainy-season areas buy from wholesalers in the postrainy-season areas in the Mar-May period.

In all the Maharashtra wholesale markets a high proportion of sorghum leaves the market via the wholesaler-to-wholesaler route, i.e., market-resident wholesalers selling sorghum to wholesalers in other markets. In addition, sales are made to local retailers and minor quantities to local consumers. Postrainy-season sorghum is normally consumed as food (although some is sold as seed to markets in north India—see Table 12). In the major centres of North India, industrial users of rainy-season sorghum can also account for a large proportion of the total sales especially when grain mold occurs. Table 12 gives a summary of the types of buyers and sellers mentioned by key informants (wholesalers) in each of the markets. This is an indicative table and should be interpreted only as a subjective guide to general trends.

Table 12. Relative importance[1] of different buyers and utilization types in various Maharashtra districts.

Buyer type	Sholapur		Ahmednagar (mainly postrainy-season)	Jalgaon		Khamgaon (mainly rainy-season)	Akola (mainly rainy-season)
	Postrainy-season	Rainy-season		Rainy-season	Postrainy-season		
Food use							
Local retailers	**	***[3]	**[4]	*[6]	**	**	**
Wholesalers from other areas	***[2]		***[5]	**	**	**	**
Local consumers	*	*	*	*	*	*	*
Nonfood use							
Poultry feed industry				*[7]		*[7]	*/**[7]
Cattle feed industry				**/***[7]		**/***[7]	**/***[7]
Starch industry				*[7]		*	*
Alcohol industry				*/**		**/***	*/**
Seed industry				*/**[8]	*/**[8]	*[8]	*[8]

1. Relative importance: * = Occasional buying relatively low proportion; ** = significant proportion; *** = very significant proportion.
2. Wholesalers can be divided into two groups: Seasonal buyers from rainy-season areas, e.g., Jalgaon, and buyers from major centres, e.g., Mumbai, Hyderabad, and Pune.
3. Much of this rainy-season sorghum is imported from northern Maharashtra (e.g., from Akola). It is consumed by poorer people who cannot afford to buy the locally grown M 35-1.
4. Accounts for a maximum of 30% of trade, all within 50-60 km of the market.
5. Accounts for upwards of 70% of trade. Wholesalers from Mumbai, Pune, and Sangli.
6. It was estimated that just 10% of rainy-season sorghum was consumed as food within the district. Top-quality rainy-season sorghum is exported for consumption in major centres such as Pune and Hyderabad, with some seasonal consumption in postrainy-season centres such as Bijapur and Sholapur.
7. Molding of grain and fall in prices (as in 1997) divert relatively more rainy-season sorghum away from food and into nonfood uses. Partly molded grain is acceptable to the starch and cattle feed industries. It appears that distilleries are less discerning and can be major buyers even of totally molded sorghum. From the interviews conducted, it appears that sales of sorghum—molded or otherwise—to the poultry feed industry are relatively nonimportant and much less important than sales to the cattle feed industry, although this needs to be confirmed.
8. From all three markets, rainy-season hybrid sorghum seed, particularly JK 22 and CSH 9, is sent to Uttar Pradesh, Bihar, and Punjab to be used for growing fodder sorghum. It is sown on irrigated land. Some traders also reported that they sold 'Maldandi' seed to buyers from Bihar, Uttar Pradesh, Gujarat, Madhya Pradesh, and Punjab. This is because of a shortage of seed in these states.

Cattle feed. It appears that considerable quantities of rainy-season sorghum grain from northern Maharashtra are used in cattle feed. One trader in the Khamgaon market reported that in a normal year (i.e., with no grain molding) up to 50% of sorghum goes for cattle feed. He stated that much of it finds its way to Gujarat—where there are four large cattle feed plants—and also to West Bengal[11]. Increased amounts of grain are diverted to cattle feed when they are partially molded. However, complete molding reduces the amount of sorghum used for cattle feed, and increases the amount diverted to alcohol brewing.

Alcohol. One trader in Khamgaon estimated that in a normal year somewhere between 20% and 30% of rainy-season sorghum hybrid market arrivals are used by the brewing and distilling industries. In 1997, however, there was severe grain molding.

11. One trader reported that produce is sent to West Bengal cattle feed plants by rail; 30-60 wagons at a time, each wagon carrying 550-600 bags.

This resulted in a large fall in prices (down from Rs 350 per 100 kg to Rs 240 per 100 kg) and heavy buying by breweries and spirit manufacturers in Madhya Pradesh, Uttar Pradesh, and Punjab. He estimated that as much as 80% of the grain was bought by the alcohol industry in 1997.

Starch. As for poultry feed, maize appears to be the main competitor crop for sorghum in starch production. Opinion in Akola was that only a small amount of sorghum finds its way to starch factories in comparison with the case of cattle feed. Starch factories prefer medium-quality sorghum. When grain is molded, they buy 'Super Disco' but not 'Disco' quality grain. The main starch factories are in Ahmedabad in Gujarat.

Trade in the Secondary Market

Trade in sorghum in the secondary market is thus due to its food use by people of different income groups. Additionally rainy-season sorghum is traded over long distances for various nonfood uses. A brief summary of the movements of sorghum in the secondary markets for various end uses follows.

Rainy-season sorghum shipments

Food use

- To predominantly postrainy-season sorghum-growing areas (for consumption by rural and urban low-income consumers).
- To nonsorghum-growing areas located in sorghum-growing states (to be consumed by rural and urban low-income consumers).
- To big cities, i.e., large secondary and terminal markets mainly in sorghum-growing states (urban low-income consumers).
- To meet seasonal shortages (deficits) in sorghum-growing areas.

Nonfood use

- Poultry feed, cattle feed, alcohol industry, starch manufacturing, and pig feed. Both sorghum-growing and nonsorghum-growing states (long distance).
- As seed for fodder purposes (small quantities but long distances).

Postrainy-season sorghum shipments

Food use

- To nonpostrainy-season sorghum-growing areas (consumed by middle-and higher-income consumers).
- To big cities, large secondary and terminal markets in sorghum-growing states (consumed by urban middle-income consumers).
- To meet requirements for preferred variety/quality.
- As seed to meet shortages.

Section II

Market Efficiency and Future Prospects

This section deals with two questions: Does the existing marketing system make sorghum a competitive foodgrain crop vis-a-vis other crops in terms of the producer's share in the consumer's rupee? And can the marketing system cope with increased volumes of market arrivals in response to greater industrial demand?

Does the Existing Marketing System Present a Constraint to Utilization as a Foodgrain?

Do the margins and costs of marketing sorghum make the crop competitive in relation to other crops? One tool, used to investigate the efficiency of the marketing channel is the producer's share in the consumer's rupee. von Oppen and Parthasarathy Rao (1982) report that in the mid 1970s the producer's share in the consumer's rupee for sorghum marketed and consumed in Andhra Pradesh near the place of production was 85%. This was just below the figure for pearl millet (86%), but higher than for other crops requiring processing such as pigeonpea (78%) and groundnut (73%). The authors concluded that in this sense the marketing system for sorghum did not put the crop at a disadvantage in comparison with other crops, and appeared to be reasonably efficient. In order to see whether this was still the case in 1998, marketing costs and margins were computed for two 'indicator' markets (Table 13).

Table 13 shows the costs incurred for sorghum produced and consumed within 20 km of two markets in Maharashtra: Khamgaon and Sholapur. The auction prices are actual prices. The Khamgaon price is about the lowest possible price for nonmoldy rainy-season sorghum anywhere in the three states studied (Nov 1997). The Sholapur price represents the maximum price for top-quality postrainy-season sorghum M 35-1 (Feb 1998). It can be stated with a reasonable degree of certainty that the producer's share in the consumer's rupee for all locally-produced and consumed sorghum will fall somewhere between these two extremes.

Several factors influence the producer's share in the consumer's rupee. For produce that is grown, sold, and consumed within a district, the most important factor is undoubtedly the price at which it is sold in the market. Normally, price is most influenced by the volume of market arrivals, which in turn is influenced by the time of year, variety, and quality. In relation to variety, the key distinction is between rainy-season and postrainy-season sorghum. Postrainy-season sorghum normally commands a substantial premium over rainy-season sorghum of similar quality whatever the time of year and wherever it is marketed. The price difference is usually between 30% and 50%. However, postrainy-season sorghum may sell for as much as three times the price of rainy-season sorghum if the rainy-season crop is affected by mold.

All else remaining the same, the producer's share in the consumer's rupee will be lower for sorghum traded between markets due to the increased transport costs and the additional middlemen's charges. As an illustration, if a wholesaler in Sholapur were to sell sorghum M 35-1 to a wholesaler in Latur through a broker, the additional cost per 100 kg bag could be Rs 47 [transport cost of Rs 20 and broker's fee of Rs 27 (3% of the wholesaler's selling price)]. Assuming the same retailer costs and margins as shown in Table 13, the final consumer price would then be Rs 980.75 per 100 kg. Thus, the producer's share in the consumer's rupee would fall to 79.5%.

Table 13. Breakdown of costs and margins (Rs) for producer, wholesaler, and retailer per 100 kg bag of C S H 5 in Khamgaon in Nov 1997 and M 35-1 in Sholapur in Feb 1998.

Prices and margins	Khamgaon	Sholapur
Auction price of sorghum	350.00	825.00
Commission agent's commission	8.75 (2.5%)	24.75(3%)
Labour charges ('hamali'; unloading)	1.50	2.00
Weighing charges	1.50	1.00
Sieving charges (optional)	2.50	2.50
Farmer's transport cost[1]	15.00	15.00
Net price for farmer	320.25	779.75
Wholesaler's buying price	350.00	825.00
Cost of gunny bags	15.00	15.00
Labour cost	2.00	2.00
Stitching charges	1.00	1.00
Transport to warehouse	2.00	2.50
Market cess (1 % of auction price)	3.50	8.25
Total cost incurred by wholesaler	23.50	28.75
Wholesaler's margin	10.5 (3.0%)	20.60 (3.0%)
Wholesaler's selling price	384.00	878. 50
Retailer's buying price	384.00	878.5
Loading/unloading	4.00	4.00
Transport	10.00	10.00
Retailer's margin	9.50 (2.5%)	22.0 (2.5%)
Retailer's selling price	407.50	914.5
Producer's share in consumer's rupee	78.5%	85.2%

1. Farmers have to pay for transporting their sorghum to the market. In the three states studied, it appeared that for distances up to 15-20 km, the transportation cost was Rs 10-15 per bag, irrespective of the mode of transport. Over 20 km, the cost normally increases to Rs 15-20. Costs for farmers living more than 30 km away from the market were not obtained.

Can the Marketing System Cope with Increased Volumes?

The answer to this question depends on the size of the increase in market arrivals and also the cause of the increase. It is possible that increases in foodgrain demand will come as a result of reforms in the Public Distribution System (PDS). However, the most likely source of increased demand for marketed sorghum in the future will be the industrial sector, in particular the poultry industry. Projections from Kleih et al. (unpublished) suggest that a minimum of 20% of total sorghum production, or more importantly, 30% of total rainy-season sorghum production will be required to meet the demands of industry by 2010. Thus even by the conservative projections of Kleih et al., industrial demand alone in 2010 will be about double the total volume of food and nonfood sorghum marketed through the regulated marketing channels during the 1990s (Table 4).

If it is to cope with such large increases in industrial demand, the marketing system, at least insofar as it relates to rainy-season sorghum, must have adequate physical capacity. In terms of the physical space needed to deal with increased volumes, all of the market yards visited for the study seemed to be well-constructed, with plenty of space for farmers to bring in their produce. Each of the wholesalers interviewed had warehouses, and all the market yards had sizeable warehouses that could absorb considerable increases in volumes. For example, the Khamgaon market in northern Maharashtra has a warehouse capacity of about 50,000 t (equivalent to about

15% of the total market arrivals between 1990/91 and 1996/97, or double the average annual volume of market arrivals during the 1990s). Markets located in the major sorghum- producing areas have good existing linkages with places of demand, and are set up to deal with large shipments. For example, the Akola market (also in northern Maharashtra) already sends considerable quantities of sorghum to West Bengal cattle feed factories by rail, and wholesalers in all the markets visited during the fieldwork are used to transporting truckloads of produce even over large distances by road.

From the fieldwork done for this study, it is clear that the markets visited can cope with some level of increase in volumes. However, it was not possible to estimate with any degree of accuracy the precise capacity of the existing regulated marketing system. Further study is needed to establish this.

In any case, it is possible if not probable that increased industrial demand for sorghum will result in significant changes in the existing marketing arrangements. It may well be that industrial users will wish not to go through the regulated channels, and may be able to obtain sorghum more efficiently through new institutional arrangements that compress the marketing chain to fewer actors, for example, through contract farming arrangements[12]. In this sense, it is possible to envisage the development of a two-track marketing system. One track will be the foodgrain marketing system, through which high-quality postrainy-season sorghum and indifferent-quality rainy-season sorghum will predominate (high-quality postrainy-season sorghum emanating from and largely consumed in the postrainy-season triangle which covers southern Maharashtra and northern Karnataka, and indifferent rainy-season sorghum being consumed by lower-income consumers particularly in Maharashtra and more generally by the poor in the urban areas of all the three states). The other track will be the nonfood system for industrial users through which exclusively hybrid rainy-season sorghum will be traded.

Summary

It would appear that the costs added to the price of sorghum on its journey from farmer to consumer are if anything slightly higher in relation to the producer's price than they were 20 years ago (although the method that von Oppen and Parthasarathy Rao used to calculate the producer's share in the consumer's rupee is not obvious). It should be noted, however, that most of the costs shown in Table 13 would be the same for sorghum as for other crops passing through the regulated system. The only slight differences might be in terms of the wholesaler and retailer margins, although even if the margins for these other crops were half those quoted in Table 13, it would not make a great deal of difference to the position of sorghum relative to these crops. The producer's share is of course likely to be lower for crops such as groundnut and pigeonpea, which have the additional costs of processing. In these circumstances, in terms of its competitiveness as a foodgrain against other crops, it would be difficult to argue that the marketing system per se constitutes a constraint to utilization of sorghum[13].

Looking to the future, it is possible that the marketing system will change due to the impact of increased industrial demand. The existing marketing arrangements may not be able to meet the standards of quality, quantity, and price demanded by industry. The possibility of a twin-track system developing, one for the foodgrain sector and another for the nonfood sector should not be discounted.

12. This issue is mentioned in Kleih et al. (unpublished). Some of the companies surveyed for this study were unhappy about seasonal shortages of sorghum. Some distilleries are envisaging some form of contract farming involving the supply of seeds.
13. The importance of this finding should, however, be assessed in the context of the Public Distribution System and associated subsidy schemes for rice and wheat. Price distortions introduced by such schemes in the three states mean that irrespective of the efficiency with which sorghum is marketed, it will never be able to compete on a level playing field basis with cereals, which are in any case regarded as being superior.

Section III

Conclusions and Directions

Volumes, System Structure, and Movements of Sorghum in the Three States

It is clear that sorghum is far from being a crop that is produced, marketed, and consumed within the same tehsil or district. This is true most obviously for rainy-season sorghum hybrids and also 'Maldandi', but it is also true in some areas for nonimproved rainy-season varieties.

It appears that the proportion of sorghum marketed through regulated channels has not changed much since the early 1980s. It is distinctly possible that more sorghum is being marketed through nonregulated channels than regulated, and this is probably at least partly due to the influence of industrial buyers.

The marketing chain cannot be put into convenient categories such as primary, secondary, and terminal markets. In practice, many markets have primary and secondary market functions, both of which are important. Typically, in the major sorghum areas, farmers and village traders will travel up to 60 km to sell their sorghum, although exceptionally they may travel up to 100 km. Wholesalers in these same markets may buy in sorghum from other markets in other states— perhaps 500 km away—at times of the year when there are local shortages. Sorghum for food use is traded between the major growing regions. Postrainy-season sorghum is shipped to rainy-season sorghum-growing areas and vice versa to meet the demand for sorghum from middle-income consumers (for postrainy-season sorghum) and lower-income consumers (for rainy-season sorghum). Small quantities of sorghum for food use are also shipped to nonsorghum-growing areas, particularly rainy-season sorghum.

While all postrainy-season sorghum is traded for food use, a large share of rainy-season hybrid sorghum traded through the market system is used for nonfood purposes: poultry feed, cattle feed, starch, and alcohol brewing. It appears that the most common nonfood consumers in Andhra Pradesh markets are the poultry feed industry; cattle and poultry feed industry in Karnataka; whereas in northern Maharashtra the cattle feed and brewing industries have a higher profile. Interestingly, it is the low-priced molded rainy-season sorghum which may travel the furthest distances—from Maharashtra to West Bengal, a distance of around 700 km.

The extent to which sorghum is utilized for nonfood purposes depends most crucially on price and quality. The fieldwork for this study confirmed that price in relation to maize is a key factor determining the demand for sorghum in poultry feed. Other work has shown that maize is a key competitor crop in relation to cattle feed and starch also (Somani 1996). Once the price of sorghum goes below a certain level in relation to the price of maize, there will be some degree of substitution of sorghum for maize[14]. Price is related to quantity but also quality, and a major factor for the latter is the degree of grain mold. Partly moldy grain is acceptable to some sections of the poultry industry and also to the cattle feed industry, but completely moldy grain appears to be acceptable only to the alcohol industry. It would be interesting and important to explore the maize-sorghum price relationship and also the grain mold issue in more depth in the proposed industrial utilization survey. It should be noted that the trade in moldy sorghum is a relatively recent phenomenon. Before the 1990s, it appears that moldy sorghum had a very limited market since nonfood uses of sorghum were not popular.

Rainy-season sorghum hybrids are also traded for use as seed, as is 'Maldandi', although the uses of the seed are probably quite different. It is known that the hybrid seed is used to grow fodder sorghum under irrigated conditions in Uttar Pradesh and Punjab.

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14. The nutritional value of sorghum in comparison with maize places a ceiling on the degree of substitution that feed manufacturers and poultry concerns are prepared to make. During discussions with several poultry owners, the maximum level of substitution was found to be 15%. For one commercial feed manufacturers, the maximum level was 10%.

The 'Maldandi' seed is probably used for growing food sorghum in those states where seed is scarce (this would need to be confirmed). The use of seed for fodder sorghum is interesting and could be investigated further. What is the likely future scenario for sorghum fodder demand in the context of conflicting pressures such as decreasing dryland areas in certain states; the rate of substitution of draft power with tractors; and increasing demand for dairy products, in particular milk, especially in the urban areas?

Market Efficiency and Future Prospects

The high producer's share in the consumer's rupee for both postrainy-season and rainy-season varieties of sorghum indicates that there are no major distortions in the regulated marketing chain, such that particular players are making an excessive profit to the detriment of either producer or consumer. Moreover, notwithstanding the PDS and associated subsidy schemes, the marketing system per se does not appear to put sorghum at a disadvantage in comparison with other crops as a foodgrain. For both these reasons it appears that the marketing system per se does not present a constraint to utilization of the crop as a foodgrain. This conclusion is in line with earlier work[15].

At the same time, however, it is possible that existing marketing arrangements may not be optimal for industrial users. (Maize is perhaps the best example of this.) Industrial users may wish to bypass regulated channels, and obtain sorghum more efficiently through new institutional arrangements, such as contract farming. This would lead to the development of a two-track marketing system: one track being the foodgrain marketing system, and the other track being the nonfood system for industrial users. There are some indications that this may already be happening, but further work is necessary to investigate this.

15. von Oppen and Parthasarathy Rao (1982).

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Appendix A. Timetable and Method

The study to investigate marketing systems for sorghum grain and stover was undertaken over a two-week period from 21 Feb - 6 Mar 1998. Subsequent field trips were made to Karnataka in May 1998. Fieldwork was conducted in Andhra Pradesh, Maharashtra, and Karnataka, and was focused on districts which were known to have the highest levels of marketed sorghum in their respective states. A number oftowns were visited and interviews were conducted with wholesalers, retailers, commission agents, farmers, and market officials. The areas visited are shown in the table.

State	District	Town	Grain	Stover
Andhra Pradesh	Hyderabad	Hyderabad	*	*
	Mahbubnagar	Mahbubnagar	*	*
	Mahbubnagar	Bodepally	*	*
	Kurnool	Kurnool	*	*
	Chittoor	Chittoor	*	NA
Karnataka	Bangalore	Bangalore	*	*
	Bijapur	Bijapur	*	*
	Dharwad	Dharwad	*	*
	Davangere	Davangere	*	*
	Bellary	Bellary	*	*
	Raichur	Raichur	*	*
Maharashtra	Sholapur	Sholapur	*	*
	Pune	Pune	*	*
	Ahmednagar	Ahmednagar	*	*
	Jalgaon	Jalgaon	*	*
	Buldana	Khamgaon		
	Akola	Akola		
	Nagpur	Nagpur	NA	*

1. NA = Not available

Appendix B. Sorghum Stover Marketing

In addition to the work carried out on sorghum grain marketing, this study also looked at sorghum stover marketing. Previous work has highlighted the fact that stover can be an important source of income for farmers, and that in some cases, for some varieties, per hectare income from stover can be higher than that for grain (Parthasarathy Rao 1985). More recent studies (Kelley et al. 1993; Kelley and Parthasarathy Rao 1996) have shown that sorghum stover prices have risen faster than sorghum grain prices, thus reducing sorghum grain-to-stover price ratios. These studies go on to recommend that grain yield alone is not a suitable criterion for selection of improved sorghum varieties/hybrids; instead, selection should be based on the total value of sorghum production, i.e., grain + stover value.

Figure B.1. shows that the marketing chain for stover is much more straightforward than the grain chain.

At each of the markets visited during this study, most of the stover originates from the surrounding taluks. Whilst farmers transport their own stover to the market, brokers also work as intermediaries between farmers and the market place, as indicated in Figure B.1. The distance travelled by farmers could vary from 10 km to 60 km; bullock-carts and tractors are the usual modes of transportation.

Whilst there is no secondary market activity as such, a proportion of the stover at some markets originates from further afield. Arrivals falling into this category are hybrid rainy-season sorghum arriving at Pune; processed (chopped) sorghum arriving at Hyderabad (from Rayalseema in Andhra Pradesh and Raichur district in Karnataka), and chopped sorghum arriving at Nagpur in Maharashtra as indicated by Table B.1.

Table B.1. Distances travelled to the market (traders' estimates) and modes of transport for marketed stover.

Location	Transport mode	Distance (km)
Hyderabad	Bullock-cart,	Up to 30
	truck (for chopped sorghum)	Up to 200
Bijapur	Bullock-cart	Up to 30
Sholapur	Bullock-cart	Up to 40
Pune	Van,	Up to 50
	truck	50-200
Ahmednagar	Van, tractor, truck	Up to 50
Jalgaon	Cart, van, truck	Up to 50
Nagpur	Truck (for chopped sorghum)	>200[1]

1. One trader selling chopped sorghum said that he had received his stocks from as far away as Hyderabad (400 km south).

Prices and market. Once the sorghum arrives at the market, the sale is normally facilitated by a commission agent. Most markets are informal (nonregulated). All the markets in Andhra Pradesh and Karnataka fall into this category. However, some in Maharashtra, for e.g., Pune and Sholapur are regulated, reflecting the importance of the sorghum stover trade in those areas. In some markets, processing is done by commission agents who operate diesel-driven machines, which chop the stalks into small pieces. The chopped sorghum is then sold at a premium over the nonchopped stalks which reflects the cost of processing plus a small margin. Being informal in nature, most stover markets do not maintain any arrival or price data (unlike the grain markets). The exceptions are again the few regulated stover markets in Maharashtra.

There is a considerable degree of interseasonal and varietal price variation. In Hyderabad, the most expensive stover is from local rainy-season varieties. Consumers value this on nutritional grounds. In Hyderabad, this 'yellow' sorghum is Rs 150-200 per cartload more expensive than 'white' postrainy-season stover. In all other markets apart from Hyderabad, postrainy-season stover commands the highest price in the market. This is because the rainy-season varieties for sale are hybrids, and the postrainy-season sorghum is almost exclusively 'Maldandi', which is prized on nutritional grounds. In Hyderabad, the minimum per cartload price for sorghum stover in 1997 was around Rs. 500 for white sorghum in March. The maximum price was around Rs. 800 for yellow rainy-season stover in January. In Bijapur, the minimum and maximum prices per cartload in 1997 were Rs. 450 and Rs. 700 respectively.

Customers. The most important category of buyers of stover is dairy-cattle owners. Typically, these individuals reside locally where they sell milk from cows and buffaloes to local consumers. In addition to urban-based dairymen, there are bullock-cart owners who buy sorghum stover to feed their animals that pull the carts around towns, transporting goods from one part of town to another. In some markets, retailers purchase stover for onward sale to consumers. This practice was observed in Pune.

As the case of a dairy farmer in Sholapur (see box) illustrates, urban dairymen in sorghum-producing areas value sorghum stover very highly indeed. As the urban population continues to grow and incomes rise, the urban demand for milk is also increasing. In such a context, growth in the demand for sorghum stover seems likely, although much will depend on competition from other crops such as rice, finger millet, and maize.

The case of Mr. Babu Dahihande, a dairy farmer in Sholapur city

Mr Dahihande has been engaged in dairying in Sholapur town for 35 years. He has 20 buffaloes, 10 are in milk at present, 5 are pregnant, and 5 are male. On an average, each lactating animal produces 8 litres per day, with milking twice a day. Each buffalo consumes 4-5 bundles of sorghum, 4 kg of rice straw, 1 kg of grass straw, 1 kg of wheat straw, and 1 kg of safflower cake per day. Mr Dahihande prefers 'Maldandi' stover as it is highly nutritious for his animals. He does not buy hybrid stover, even though it is cheaper. He says that sorghum stover is indispensable. If he doesn't feed his buffaloes sorghum stover, the milk yield is affected. He buys 100 bundles (one bullock-cartload) of stover per day, plus one cartload of green fodder (paragrass). He pays Rs. 100 for the cartload of paragrass. He gets all his sorghum stover from the fodder market.

He needs 100 bundles of sorghum per day throughout the year. He buys sorghum stover in bulk in May and June when prices are low. He then stores the stover, and uses it up until December. He would like to buy enough to feed his animals all year round but he doesn't have enough storage space. In May 1997 he bought 10,000 bundles, and he bought in bulk again in December.

His customers are people within the city. Demand is increasing as the population increases (the population of Sholapur has quadrupled since 1965). He wants to increase production but he faces a labor constraint and also space constraint. He doesn't need to sell to any dairies as he has enough demand for fresh milk.

He estimates that there are 700-800 milkmen in Sholapur city. There is also a dairy in the city.

Using prices and yields from the late 1970s, von Oppen and Parthasarathy Rao (1982) estimated that returns to the farmer from the sale of local rainy-season sorghum stover could be higher than from the sale of local rainy-season grain. They estimated that the fodder value from the local yellow sorghum was 55% of the total market value of the crop. This compared with only 24% for hybrid rainy-season varieties. Overall, the total grain and stover value for the local variety was comparable to the combined grain and stover value for the hybrids. The authors concluded that the high returns from fodder of the local yellow varieties could be an important factor explaining why farmers continued to grow such varieties despite the availability of higher (grain) yielding hybrids.

Figure B.2. gives an indication of the relationship between sorghum grain and stover yields. High grain yields can be achieved at the cost of stover yield and quality. (Stover quality could not be depicted in the graph). High grain yields are also accompanied by a decrease in grain quality and consequently grain price. Considering the dual-purpose nature of sorghum—i.e., farmers' preference for both grain and stover yields—more careful thought is required in breeding for new sorghum hybrids/varieties.

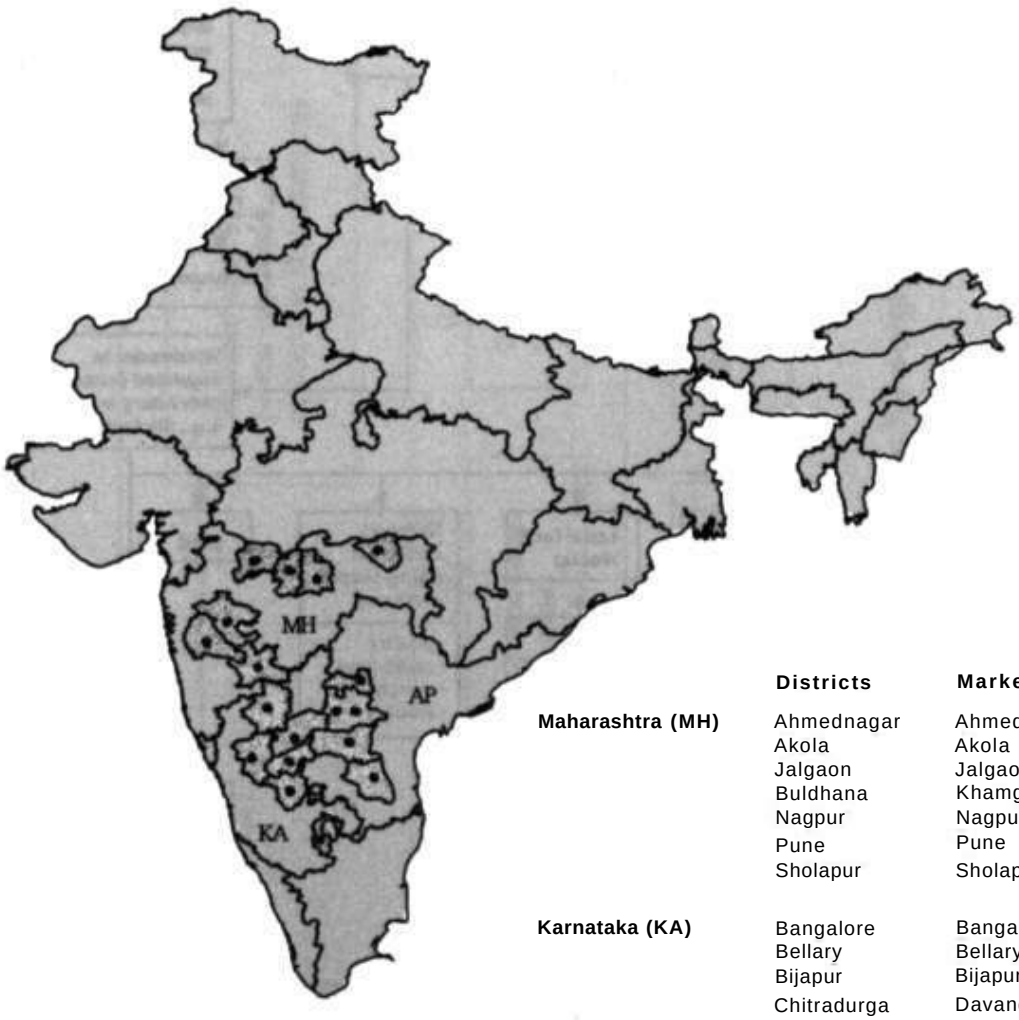
Table B.2. also gives an indication of different scenarios of sorghum grain and stover yield. Rainy-season hybrids presently grown in farmers' fields fit into Scenario 1, i.e., high grain yield with low grain price (due to low grain quality) and low stover yield and prices. The local rainy-season varieties on the other hand, fit into Scenario 3, with low grain yield but high grain price due to superior quality. These varieties also exhibit high stover yield and prices. The improved sorghum varieties fall in between these two extremes. For postrainy-season sorghum ('Maldandi' or M 35-1), the situation is similar to local varieties except for very high grain prices due to superior grain quality (Scenario 4).

In view of the emerging industrial utilization of sorghum, which scenario should the crop scientists be targeting? Obviously, the target should be to achieve Scenarios 5 or 6, i.e., high grain yield and low grain prices to make sorghum grain competitive with other crops—particularly maize for nonfood uses. In addition, from an industrial utilization perspective, it would make sense to tailor grain quality to specific industrial uses such as high-starch varieties for the starch and alcohol industries, and high-energy lines for the poultry industry. It should be noted that, increasingly, maize going into different industries in India is tailored in such a manner. Scientists and extension agents will need to bear in mind, however, that adoption may be affected if the tailoring process reduces fodder quality and/or quantity.

Table B.2. Various scenarios of sorghum grain and stover yield, quality and prices for increased adoption.

Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Low fodder yield	Medium fodder yield	High fodder yield	Medium fodder yield	Low fodder yield	Medium fodder yield
Low fodder price	Medium fodder price	High fodder price	High fodder price	High fodder price	Low fodder price
High grain yield	Medium grain yield	Low grain yield	Low grain yield	High grain yield	High grain yield
Low grain price	Medium grain price	High grain price	High grain price	Low grain price	Low grain price
Hybrid rainy-season sorghum	Improved rainy-season sorghum	Local rainy-season sorghum	Postrainy-season sorghum		Future options?

Maps and Figures



	Districts	Markets
Maharashtra (MH)	Ahmednagar	Ahmednagar
	Akola	Akola
	Jalgaon	Jalgaon
	Buldhana	Khamgaon
	Nagpur	Nagpur
	Pune	Pune
	Sholapur	Sholapur
Karnataka (KA)	Bangalore	Bangalore
	Bellary	Bellary
	Bijapur	Bijapur
	Chitradurga	Davangere
	Dharwad	Dharwad
	Raichur	Raichur
Andhra Pradesh (AP)	Cuddapah	Proddatur
	Kurnool	Kumool
	Hyderabad	Malakpet
	Mahbubnagar	Bodepally
	Mahbubnagar	Mahbubnagar

Figure 1. The states, districts, and markets covered by the study on sorghum marketing in India.

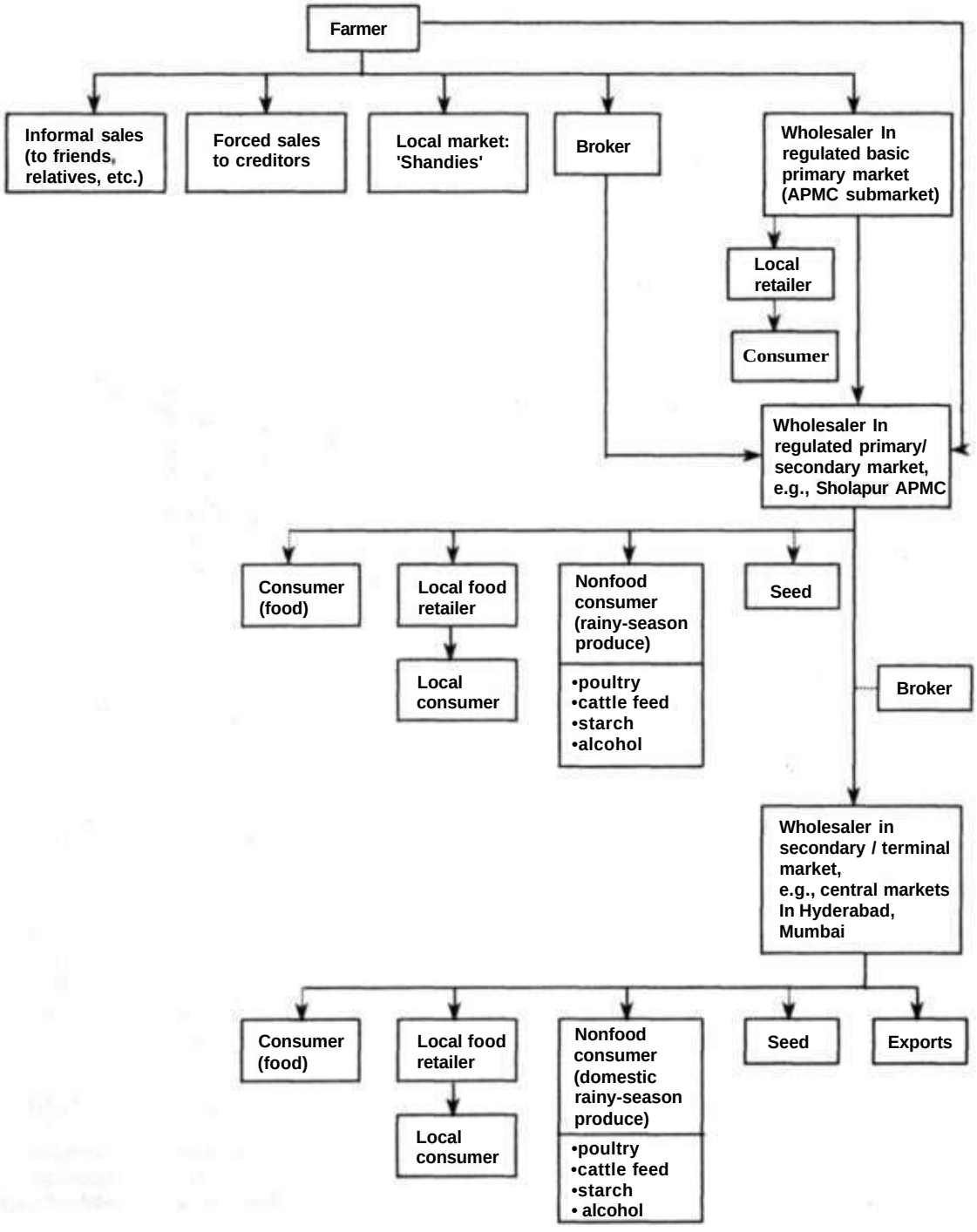


Figure 2. Flow chart of the marketing chain for sorghum grain.

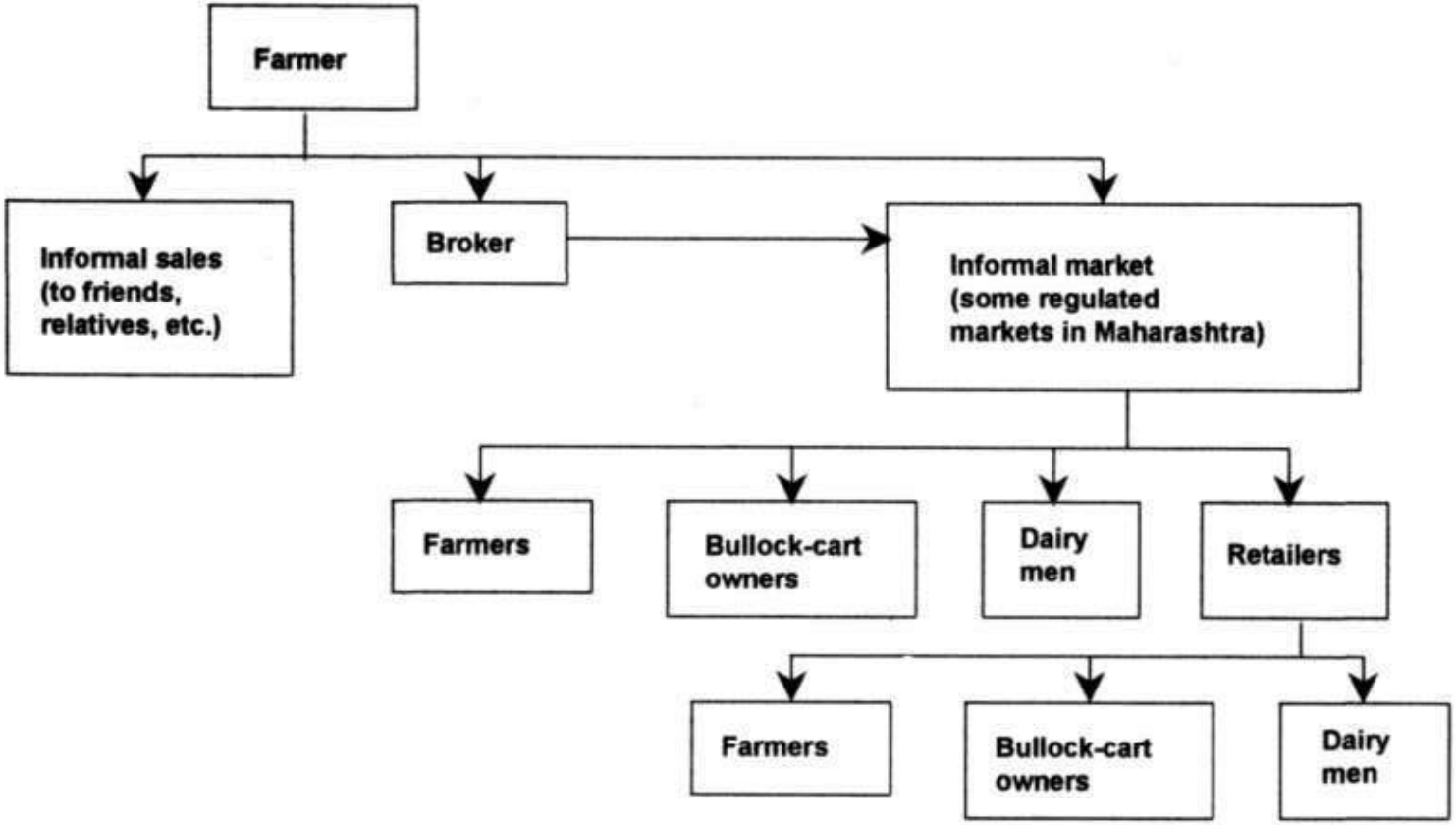


Figure B.1. Flow chart of the marketing chain for sorghum stover.

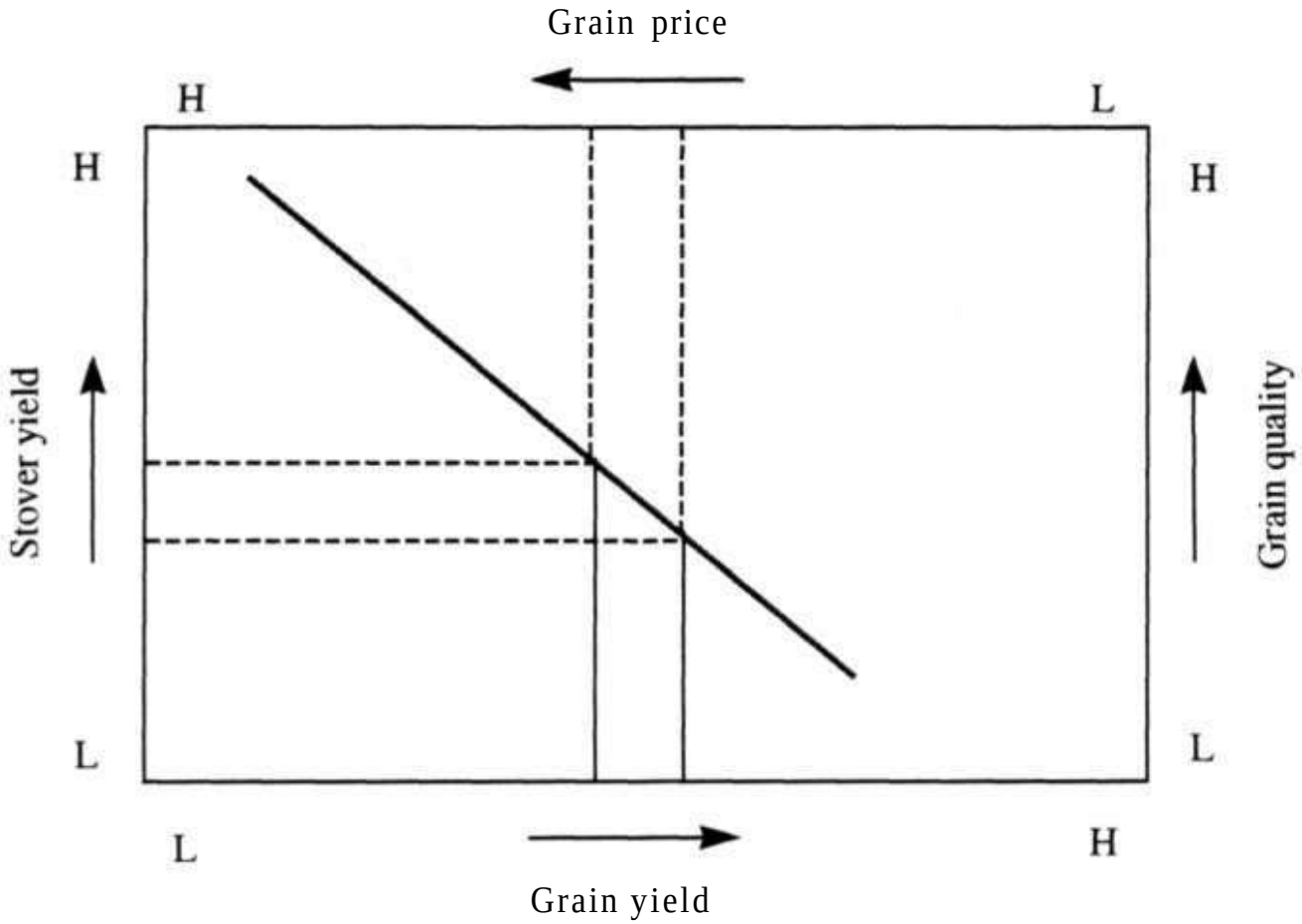


Figure B.2. Hypothetical sorghum grain and stover yield relationship (L = low; H = high).

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