Dynamics of Utilization, Markets, Trade and Coalitions: Sorghum and Millets in Asia

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Abstract

Production and consumption patterns of sorghum and millet in Asia have changed significantly in the last decade. While food use is declining, non-food or industrial uses are on the increase. This has implications on crop production and marketing with the entry of private industry in coarse cereal economies. This paper highlights the recent trends in the production, consumption and trade of sorghum and millet and spells out the need for a stronger coalition of sector stakeholders as a way of developing the non-food market by effectively linking farmers with new sources of demand for these crops.

Production and consumption patterns of sorghum (*Sorghum bicolor*) and millet have changed significantly in Asia in the last decade and this has important implications for cereal improvement programs, particularly those seeking to support the livelihoods of rural households. Notably, an increasing shift from food to non-food uses has made private industry a much more important player in coarse cereal economies. In this paper, recent trends in the production, consumption and trade of sorghum and millets are reviewed. The implications for institutional changes associated with the way public research programs might constructively interact with private companies, farmers and intermediary organization such as non-governmental organization (NGO) and farmer-operated enterprises such as associations and cooperatives are discussed.

The dilemma embodied by these developments is that not only there are clear social benefits to be derived for a crop that is primarily grown by small farmers in marginal production environments but also there is a need to ensure a smooth transition from food to markets for other uses. A coalition approach might be a useful way to strengthen links between scientists, industry and farmers so as to negotiate and generate technical and institutional innovations that will fulfill the agendas of all stakeholders. This is discussed in the final section of this paper.

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Evolving sorghum and millet economies: an overview

In 2002, Asia produced 22% of the world's sorghum and 39% of the world's millet[2]. Of approximately 987 million t of cereals produced in Asia in 2002, sorghum and millet account for 11.7 and 12.6 million t, respectively. Sorghum and millets are primarily grown in low rainfall and drought-prone areas that are unsuitable for growing other crops unless irrigation is available. Production is characterized by semi-extensive system under low input conditions. In contrast, in developed countries intensive commercialized production systems exist with yields averaging 3–5 t ha^{-1}; the grain is used and traded mainly for livestock feed.

Both sorghum and millet contribute to household food security in some of the most insecure regions of Asia. However, during the last two decades, several factors are contributing to a change in the traditional role of these crops as food security crops. Firstly, on the supply side the area planted to these crops is declining, due to slow productivity growth compared to competing crops and low/declining producer price. On the demand side, food use particularly for sorghum has declined due to income growth, urbanization and change in tastes and preferences, further lowering the prices. But utilization patterns in Asia are in a dynamic phase. Sorghum and to lesser extent millet grain are moving from their traditional use as a food crop to alternative uses such as livestock and poultry feed, bakery products [blended with wheat (*Triticum aestivum*)], potable alcohol and starch industry. In non-traditional uses, price competition from competing crops like maize (*Zea mays*) is an important determinant of demand for sorghum and millet. The straw/stover of these crops, however, continues to be valued as an important source of feed for livestock particularly in areas where other fodder sources are limited or year round fodder supplies are not available.

Sorghum and millet research needs to be placed in the context of current and future market forces that would have a bearing on the future prospects of these crops in various uses. In several niche areas where only sorghum and millet can be grown, they will continue to play an important role as a food security crop. But even here productivity increases can translate into higher incomes for the marginal and small farmers.

2. The Food and Agriculture Organization of the United Nations (FAO) does not publish separate data for pearl millet. For this analysis, area and production for all millets are reported. For the major millet-growing countries in Asia, pearl millet accounts for 10% of total millet production. Pearl millet accounts for 90% of millet production in Bangladesh, 58% in India, 85% in Mynamar and 90% in Pakistan (ICRISAT and FAO 1996).

In the sections that follow, the changes in the production, consumption trade and marketing patterns for sorghum and millets in Asia with particular reference to India are discussed.

Area and production

Asia accounts for 11.8 million t of sorghum (triennium ending 2002), with an average yield of one t ha^{-1}, except China where yields averaged 3.5 t ha^{-1}, comparable to yields in developed countries. India is a major producer accounting for 68% of total production in Asia followed by China. Sorghum area and production declined in major producing countries in Asia, and thus all Asia level (Table 1). Sorghum yields, however, increased in all countries averaging 1.1% annual growth between 1980 and 2002. The crop is capable of higher yields but is constrained since in many countries like India, China and Pakistan it is increasingly being pushed to more and more marginal areas

Table 1. Sorghum area, production and yield in major producing countries in Asia, triennium ending, 2000–02.

Country/Region	Area (million ha)	Production (million t)	Yield (t ha^{-1})	Annual growth rate (1980–2002) (%)		
				Area	Production	Yield
Asia						
India	10.0	8.0	0.8	–2.7	–1.6	1.1
China	0.8	2.7	3.3	–5.7	–4.1	1.7
Yemen	0.4	0.4	1.0	–2.5	–0.5	2.1
Pakistan	0.4	0.2	0.6	–0.3	0.03	0.3
Saudi Arabia	0.2	0.2	1.2	3.9	7.3	3.2
Thailand	0.1	0.2	1.5	–4.8	–3.0	1.9
Bangladesh	0.001	0.001	1.2	–4.7	–2.4	2.4
Syrian Arab Republic	0.004	0.003	0.8	6.0	4.4	–1.5
Region						
Asia	11.9	11.7	1.0	–2.9	–2.3	0.7
South Asia	10.4	8.3	0.8	–2.7	–1.6	1.1
Developing	38.2	42.8	1.1	–0.2	–0.2	–0.1
Developed	4.3	14.7	3.4	–2.4	–1.8	0.7
World	42.4	57.5	1.4	–0.4	–0.7	–0.3

Source: FAO (2003).

(Kelley and Parthasarathy Rao 1993). Developed countries account for only 10% of the total global area under sorghum but account for almost 26% of global production.

Asia produces 12.6 million t millets and as in the case for sorghum, India and China are the major producers. Unlike sorghum, developing countries account for bulk of millet production. Average yields are close to one t ha^{-1}, with the exception of China, where yields are higher. Between 1980 and 2002, as for sorghum, millet area too declined in all countries in Asia. Yield increases are generally positive thus dampening the decline in production (Table 2).

Thus, despite technological change for both sorghum and millet, area under these crops is declining. Relative profitability of competing crops, declining role as a food crop at the aggregate level, lower market prices, urbanization, income growth and change in tastes and preferences are some of the factors explaining decline in area and production.

Table 2. Millet area, production and yield in major producing countries in Asia, triennium ending, 2000–02.

Country/Region	Area (million ha)	Production (million t)	Yield (t ha^{-1})	Annual growth rate (1980–2002) (%)		
				Area	Production	Yield
Asia						
India	12.3	9.6	0.8	–2.0	0.1	2.1
China	1.2	2.1	1.8	–6.2	–5.4	0.9
Pakistan	0.4	0.2	0.5	–1.3	–1.2	0.1
Nepal	0.3	0.3	1.1	4.3	5.1	0.8
Myanmar	0.2	0.2	0.7	1.9	1.3	–0.6
Bangladesh	0.1	0.1	0.7	–0.5	–0.6	–0.1
Yemen	0.1	0.1	0.6	–0.3	1.1	–0.8
Saudi Arabia	0.01	0.01	1.2	–1.2	–2.3	3.6
Region						
Asia	14.8	12.6	0.8	–2.3	–1.4	0.9
South Asia	13.1	10.1	0.8	–1.9	0.1	2.0
Developing	35.1	26.0	0.7	0.2	0.4	0.2
Developed	1.7	1.6	0.9	–4.1	–3.4	0.8
World	36.8	27.5	0.7	–0.1	0.1	0.2

Source: FAO (2003).

Utilization

Sorghum

The role of sorghum and millets as food staples at the aggregate level has declined since 1980. In Asia, sorghum for food use contributed 5.7 kg capita^{-1} yr^{-1} and millets 5.2 kg capita^{-1} yr^{-1} in 1980. In 2000, it declined to 2.3 kg capita^{-1} yr^{-1} for sorghum and 3 kg capita^{-1} yr^{-1} for millets. During the same period the per capita availability of all cereals in Asia increased marginally from 164 kg capita^{-1} yr^{-1} to 171 kg capita^{-1} yr^{-1} (Table 3). Per capita availability of sorghum and millets declined in all countries including China, India and Pakistan. In India, the per capita availability of sorghum reduced by more than half and for millets by less than one-third. Despite the low and declining per

Table 3. Food use (kg capita^{-1} yr^{-1}) of total cereals, sorghum and millet in Asia[1].

	Total cereals		Sorghum		Millet	
Country/Region	1980	2000	1980	2000	1980	2000
Asia						
Myanmar	192	215	–	–	1.9	2.9
China	186	183	4.5	0.9	4.4	0.9
Syrian Arab Republic	171	177			0.6	0.0
Bangladesh	168	179	0.1	0.0	0.4	0.4
Nepal	164	194	–	–	7.2	10.7
Thailand	153	126	–	–		
Yemen	148	164	61.6	18.3	7.8	3.3
Saudi Arabia	145	154	12.4	9.7	0.7	0.5
Pakistan	144	149	2.3	1.3	1.1	0.6
India	140	159	13.4	6.6	12.2	9.0
Region						
Asia	164	171	5.7	2.3	5.2	3.0
South Asia	143	160	10.7	5.1	9.8	7.1
Developing	157	162	7.2	5.0	5.8	4.5
Developed	130	129	0.2	0.4	1.2	0.4
World	150	155	5.3	4.0	4.6	3.6

1. Domestic availability for food use, ie, domestic production – exports + imports ± stock changes – feed and other industrial uses.

Source: FAO (2003).

capita availability of sorghum and millets at the aggregate level their importance as food crops cannot be underestimated. For example, in the Indian states of Gujarat, Rajasthan, Maharashtra and Karnataka, coarse cereals accounted for 20–30% of the total cereal consumption in 1999–2000. For households below the poverty line in these states, coarse cereals account for more than 50% of the total cereal intake (Chand and Kumar 2002). Additionally, for many poor livestock keepers in the marginal areas sorghum straw is the only source of feed for bovines throughout the year (Kelley and Parthasarathy Rao 1994, Hall 2000).

The Indian government's agriculture and food policy geared towards rice (*Oryza sativa*) and wheat played an important role in reducing consumption of coarse cereals. Due to subsidies on farm inputs (irrigation, electricity, fertilizers), production of rice and wheat increased faster than the population growth rate. Also, subsidies on sale of rice and wheat through Public Distribution System (PDS) further contributed to reduction in sorghum and millet consumption (Chand and Kumar 2002). Due to high tariffs on edible oil imports, oilseeds production became more competitive replacing sorghum and millets (Gulati and Kelley 1999, Hall 2000).

Besides its traditional use as food grain crop in Asia, sorghum is used as feed grain in China, Thailand, Japan and South Korea, for liquor production in China and as a green fodder crop in India, Pakistan and China. In recent years its use as feed grain and to a limited extent other non-food uses is increasing in countries where it is traditionally used as a food crop (Table 4). In Asia, 35% of sorghum grain is used as livestock feed and other industrial uses; 58% is used in China and 8–10% in India and Pakistan. In a study on industrial uses of sorghum in India, it is projected that 2.5 to 4.3 million t of sorghum will be used in industrial uses by 2010, ie, three- to four-fold increase from its current usage levels in 1998. Poultry feed will account for bulk of the use followed by dairy feed, alcohol production and starch production (Kleih et al. 2000).

With expanding dairy and meat industry due to rising demand for livestock products (Ryan and Spencer 2002), forage sorghum has become important in many Asian countries. It is increasingly being grown both under irrigated and dryland conditions. However, data on area under forage sorghum are not readily available.

Millet

Food use is still the most important use of millets. In 2000, only 14% of total grain production in Asia was used for feed and other non-food uses. Feed use is high in China and Pakistan. In India, although, only 6% of millet production is used for feed its importance is increasing in recent years. For example, in Tamil Nadu in southern India, farmers growing improved cultivars of pearl millet (*Pennisetum glaucum*) are able to market their surplus to the animal feed sector, mainly poultry and cattle feed manufacturing units (Ramaswamy et al. 2000).

In contrast to sorghum and millet, more than 70% of maize production is used as feed and other industrial uses (starch, bakery products) in Asia as also at the global level. However, there are countries in Asia like India, where its use as feed grain is only 15%. Globally, maize is one of the main competing crops to sorghum and millets in non-food uses.

Table 4. Feed and other industrial uses (% to domestic availability) of sorghum, millet and maize in Asia.

	Sorghum		Millet		Maize	
Country/Region	1980	2000	1980	2000	1980	2000
Asia						
Syrian Arab Republic	98.5	96.8	68.4	-	94.3	95.4
Thailand	91.9	99.4	100.0	100.0	64.3	90.3
China	37.3	57.7	20.5	42.5	59.4	78.2
Saudi Arabia	12.5	5.0	26.7	5.0	95.0	99.1
Pakistan	10.6	10.0	55.0	55.3	39.9	37.7
Bangladesh	10.0	10.0	0.0	0.0	10.0	15.5
Yemen	8.8	8.0	4.0	4.0	36.3	48.6
India	7.8	8.2	6.3	6.5	14.5	14.3
Myanmar	–	–	15.0	15.0	28.1	58.2
Nepal	–	–	10.7	10.5	16.4	27.6
Region						
Asia	36.1	35.4	12.7	13.9	59.6	71.1
South Asia	7.9	8.2	7.4	7.5	17.5	18.5
Developing	40.0	46.9	15.7	16.7	54.3	64.0
Developed	97.1	88.5	25.6	71.3	89.0	79.1
World	56.8	55.8	16.5	20.0	75.4	71.6

Source: FAO (2003).

Trade

International trade

Sorghum

In 2002 about 7 million t of sorghum (13% of global production) was traded globally indicating a decline from 11 million t (20% of production) in 1980 (Table 5). Global sorghum trade compares favorably with trade in all cereals, which is about 12–13% of production. Developed countries account for the bulk of trade in sorghum, which is mainly for feed use (Fig. 1). In Asia, major sorghum-growing countries account for a small fraction of global trade, and their share has been declining over time (Fig. 1). Thailand was a major exporter of sorghum in the 1980s and China in the early 1990s. Exports from Asia declined drastically in 2001, reflecting the growing demand for sorghum in non-food uses.

Sorghum imports to Asia declined from 5.4 million t in 1980 to 2 million t in 2001. Japan accounts for bulk of these imports. China, Malaysia, Republic of Korea and Yemen import small quantities, with no discernable trend (Table 6).

Table 5. Sorghum exports in Asia.

	Exports ('000 t)			Exports as % of production	
Country/Region	1980	1990	2001	1980	2001
Asia					
Thailand	180.6	19.8	0.3	76.2	0.2
Indonesia	12.6	–	–	–	–
Singapore	9.8	0.1	0.2	–	–
Pakistan	5.4	0.0	0.02	2.3	0.01
China	1.0	289.3	19.0	0.015	0.7
India	0.1	0.0	0.4	0.001	0.004
Region					
Asia	209.5	309.5	20.6	1.1	0.2
South Asia	5.5	0.0	0.4	0.05	0.005
Developing	2,053.7	1,501.9	518.8	5.1	1.2
Developed	9,125.7	7,362.6	6,494.5	53.2	40.2
World	11,179.4	8,864.5	7,013.3	19.5	11.6

Source: FAO (2003).

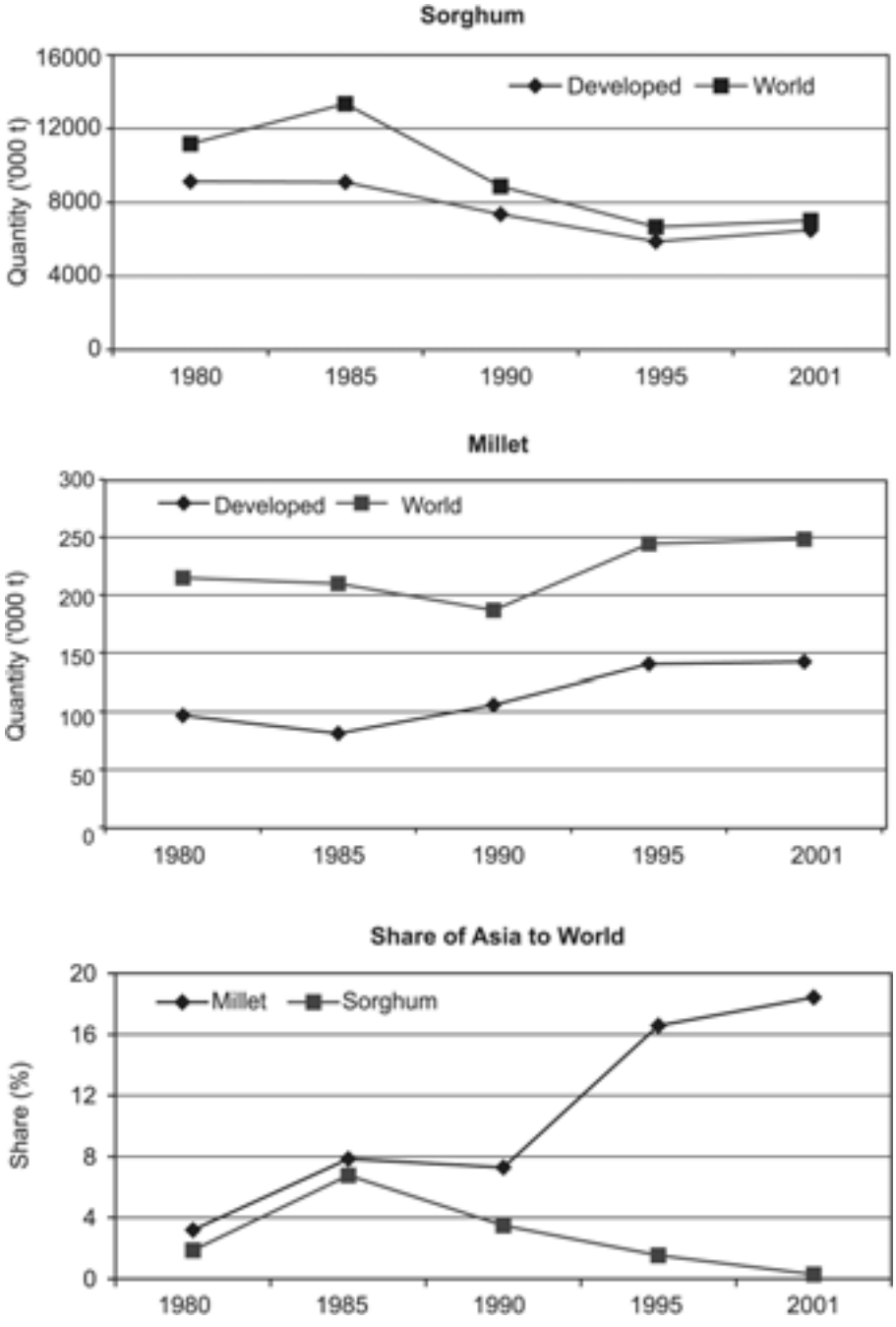

Figure 1. Sorghum and millet exports.

Table 6. Sorghum imports ('000 t) in Asia.

Country/Region	1980	1990	2001
Asia			
Japan	4,219	3,763	1,908
China	417	33	37
Israel	314	367	55
Cyprus	99	0.002	0.007
Saudi Arabia	31.9	0.5	0.1
Singapore	19.8	0.4	0.1
Malaysia	12.7	2.3	0.3
Republic of Korea	12.2	92.3	4.2
Bangladesh	5.7	0.0	0.0
Yemen	2.5	18.7	0.5
India	1.5	0.0	0.0
Thailand	0.1	1.3	0.9
Iraq	0	155.0	0.0
Lebanon	0	0.0	4.5
Philippines	0	0.3	4.5
Turkey	0	25.8	0.0
Region			
Asia	5,144.4	4,468.0	2,015.7
South Asia	7.1	0.004	0.013
Developing	3,659.3	3,556.0	5,301.9
Developed	7,372.6	5,035.9	2,265.6
World	11,031.9	8,591.9	7,567.5

Source: FAO (2003).

Millet

Around less than 1% of global production of millet is traded. This figure could be an underestimate since substantial quantities of millet trade are unrecorded (ICRISAT and FAO 1996). Official records on prices, etc are also not regularly published. Unlike sorghum, both developed and developing countries are important exporters of millet, and exports have generally increased over time (Fig. 1). Asia accounts for one-fifth of global exports and China and India are the major exporting countries (Table 7). Unlike sorghum, share of Asia in total exports of millet has increased over time although from a small base (Fig. 1). Asia imported about 66000 t of millets in 2001. Japan and Republic of Korea account for bulk of the imports (Table 8). Several other countries in Asia import small quantities mainly for food use.

Table 7. Millet exports in Asia.

Country/Region	Exports ('000 t)			Exports as % of production	
	1980	1990	2001	1980	2001
Asia					
China	5	3.9	21.4	0.09	1.09
Sri Lanka	1.4	0.002	0.005	8.90	0.12
Singapore	0.4	0.3	0.02	-	-
Thailand	0.03	1.3	0.2	-	-
Iran, Islamic Rep of	0.03	0.0	2.0	0.29	22.2
Turkey	0.002	0.6	0.8	0.01	12.3
India	0	4.5	19.1	0	0.17
Yemen	0	0.0	0.1	0	0.21
Kazakhstan	0	0.0	1.7	0	1.98
Region					
Asia	6.9	13.6	45.7	0.04	0.3
South Asia	1.4	4.7	19.1	0.01	0.2
Developing	118.1	81.1	106.0	0.51	0.4
Developed	96.7	105.9	142.3	5.12	9.7
World	214.9	105.9	142.3	5.12	9.7

Source: FAO (2003).

Domestic trade in India

Large quantities of sorghum are traded within India from the major growing areas to urban centers, to non-sorghum growing areas and also between growing areas. The trade is mainly to meet demand for sorghum from urban consumers and to meet quality requirements of consumers from different income groups. For example, poor consumers prefer sorghum grown in the rainy season because it is cheaper than sorghum grown in the postrainy season, which is of superior quality. Sorghum is traded over long distances mainly for non-food uses like poultry feed, cattle feed, alcohol manufacture, etc (Marsland and Parthasarathy Rao 1999).

Prices

World market

At the global level sorghum is almost exclusively traded as feed grain and its market price is closely related to production and trade of other feed grains

Table 8. Millet imports ('000 t) in Asia.

Country/Region	1980	1990	2001
Asia			
Japan	47.4	26.2	12.9
Kuwait	1.1	0.1	0.4
Republic of Korea	1.0	0.1	15.4
Saudi Arabia	0.8	0.0	5.2
Thailand	0.6	1.8	3.9
Singapore	0.5	1.0	0.1
Malaysia	0.5	2.2	3.2
Philippines	0.035	0.3	1.8
China	0.00	3.6	4.0
Indonesia	0.00	1.6	7.6
Israel	0.00	0.3	1.1
Sri Lanka	0.00	0.0	2.3
Turkey	0.00	0.0	1.9
Region			
Asia	52.2	41.6	65.9
South Asia	0.002	0.4	2.9
Developing	114.5	38.4	108.1
Developed	170.1	164.4	152.4
World	284.6	202.9	260.5

Source: FAO (2003).

such as maize, wheat and barley (*Hordeum vulgare*). There are no published data on sorghum trade and prices for food use due to small volumes traded. The closest competitor for sorghum in most non-food uses is maize. Maize is preferred over sorghum when there is no price difference between the two crops. Generally international market prices of sorghum are lower than maize prices by 5–10% (Fig. 2). The price difference varies from year to year depending on production of maize in the major growing or exporting countries.

Domestic prices in India

Index of real wholesale prices of sorghum in India declined sharply until early 1990s and rose above the rate of inflation since 1995 (base 1981 = 100), perhaps indicating renewed demand for sorghum particularly for non-food

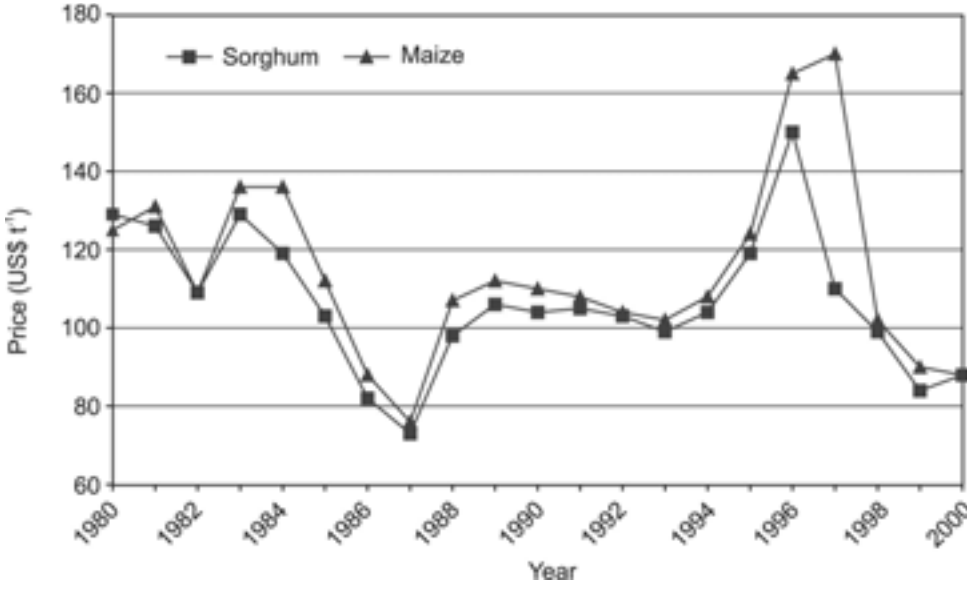

Figure 2. Average annual export prices of sorghum and maize at US Gulf ports.

uses. Since the mid-1990s real prices of rice and wheat (since 1997) have increased faster than the inflation rate. Due to an effective procurement price policy for rice and wheat, market prices are not a true indicator of demand for these crops. Sorghum prices are generally more volatile (large year to year fluctuations) compared to rice and wheat prices since its production is dependent on rainfall (Fig. 3a). In contrast, the real price of sorghum straw increased faster than the grain price leading to a sharp increase in the straw to grain price ratio over time, reflecting a growing demand for livestock feed, to meet the rising demand for milk and meat (Kelley and Parthasarathy Rao 1993). Compared to cereals, pulse price index increased sharply, with the index value around 135 in 2001 (Fig. 3b). The sharp rise in real prices of pulses has made it an attractive crop, with area under different pulse crops expanding, substituting area under coarse cereals.

As indicated earlier, maize is an important competitor for sorghum in alternative uses. As at the global level, even in India 10–15% lower market price for sorghum compared to maize is a minimum requirement for feed manufacturers and other industrial processors to partially substitute sorghum for maize. Wholesale market prices for sorghum and maize are assembled for

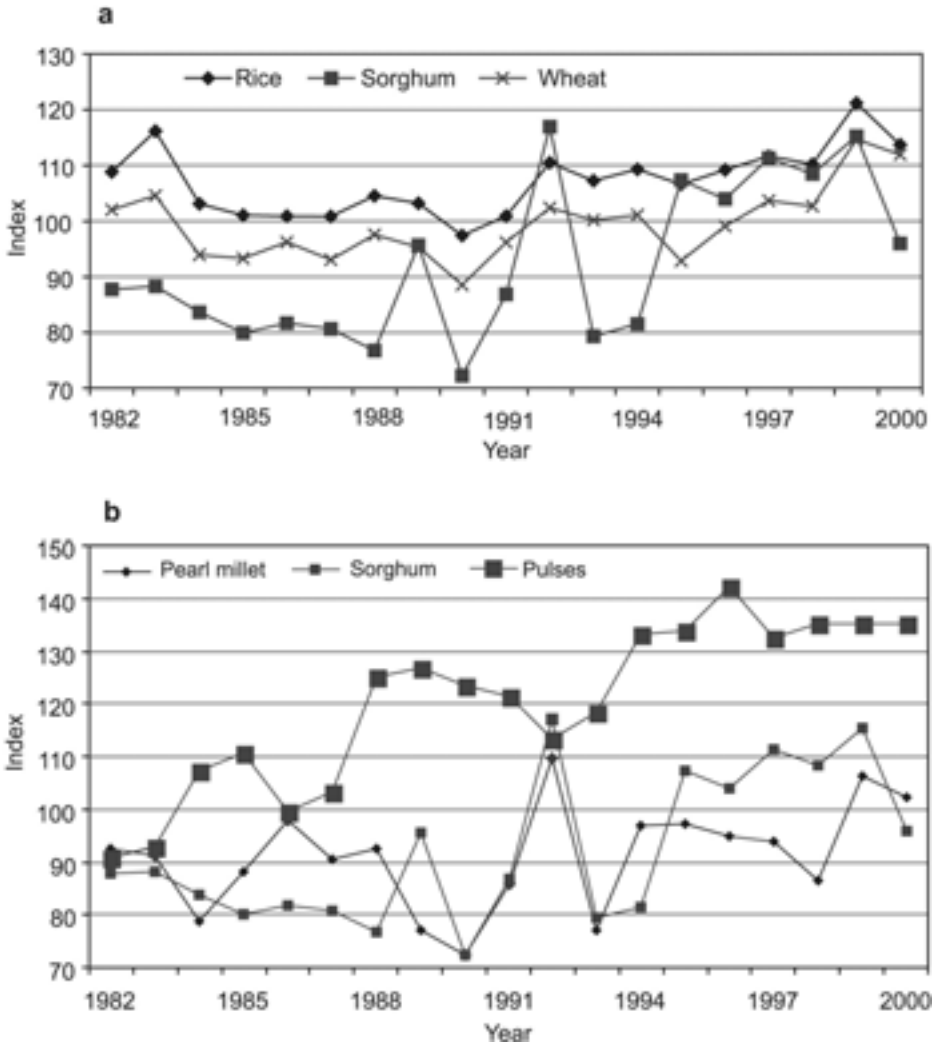

Figure 3. Index of real wholesale prices in India (base 1981 = 100): (a) Cereals; and (b) Cereals and pulses.

a few select markets in India and are shown in Figure 4. The ratio of sorghum to maize price is equal to or lower than maize prices in Bahraich, Chindwara, Kanpur and Calcutta markets in India except in few years when sorghum prices are higher than maize prices. If sorghum prices can be consistently lower than maize prices by 10–15% the prospects of substituting larger quantities of sorghum in non-food uses would be enhanced. According to

industry sources, besides price, sorghum usage for industrial uses would depend on continuous supply throughout the year. According to industrial processors, maize supplies are more consistent in any given year.

Marketing in India

The marketing system for sorghum in India is generally free of major distortions and is not a constraint to marketing of sorghum as a food grain. Although linked or tied output and credit markets lead to distress sale by small

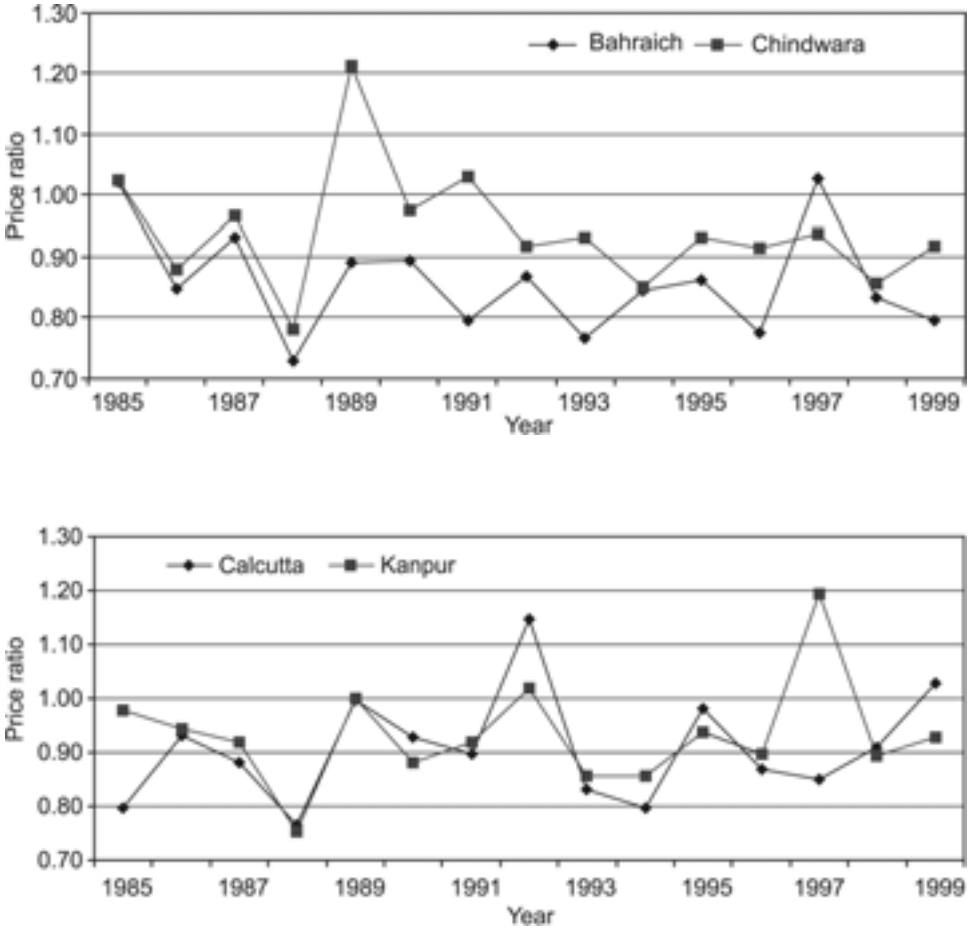

Figure 4. Ratio of sorghum to maize price in selected wholesale markets in India.

and marginal farmers, existing marketing arrangements may not be optimal for industrial users of sorghum and millet. Industrial users may wish to bypass the regular channels and obtain sorghum and millet more efficiently through new institutional arrangements. Thus, twin track marketing is envisaged for sorghum, one for food sorghum and another for industrial users (Marsland and Parthasarathy Rao 1999).

Promoting innovations in the coarse grain sector through science-industry coalitions

What clearly emerges from the trends discussed above is that sorghum and to a limited extent millet crops are making the transition from food to non-food markets. Supporting this transition with relevant postharvest interventions is a potentially important way of ensuring that new markets are found for a crop which farmers in marginal environments have little choice but to grow. The central empirical question concerns what the nature of that postharvest intervention should be.

Research and technology development in this area has had limited success. A major study of sorghum utilization in India (Hall 2000) concluded that increased utilization of sorghum in the industrial sector has happened despite any specific technical breakthrough in the formal public research sector. The same report goes on to emphasize that one of the critical weaknesses of current institutional arrangements is weak linkages between public and private sectors. This is unfortunate given the considerable amount of research that has been carried out on alternative utilization of coarse cereals.

Exploration of the potential role of the Indian private sector in relation to creating incentives for different coarse grain qualities reached a broadly similar conclusion (Hall et al. 2000). Again the recommendation from that study focused on the need for partnerships between industry and research as well as institutional innovations (such as contract farming) that link farmers to industry. While this constraint affects the postharvest sector in particular, it is a more general feature of the nature of relationships between the public and the private sectors in India (Hall et al. 2002).

Before going on to discuss how these issues could be resolved it is useful to briefly reflect on postharvest innovation systems. This allows us to investigate the implications these have for developing institutional arrangements that will simultaneously support industrial utilization of coarse cereals as well as ensure that the strategy also supports the livelihoods of poor farmers.

Postharvest innovation systems

Postharvest R&D seems to be placed uncomfortably in the conventional arrangements for agricultural research. Crop improvement research, for example, can clearly identify plant breeders (and increasingly molecular biologists) as the central scientific personnel. The product – new varieties – is well defined and the systems for disseminating this technology and the roles of extension services and seed supply agencies are relatively straightforward. The main client, the farmer, is clearly identified, as is the role of the client in applying this new input technology. In this view of agricultural research the number of players is fairly limited – scientist, extension workers, farmers – and their roles are clearly defined and mutually exclusive. While this is a stylized description of the R&D process and the way it is arranged, it is all too recognizable as the conventional model of agricultural research that persists in many parts of the world.

Postharvest R&D, on the other hand, cannot be so neatly categorized. Professionally the sector spans engineering, food science, pathology, marketing systems, economics and other disciplines. The postharvest sector is also characterized by its linkages and relationships between producers and consumers and between rural and urban areas, with markets playing a large role in mediating these linkages. The sector includes technology clients and intermediary organizations from the whole range of organizational types, from both public and private sectors and from an equally diverse set of stakeholder agendas and interests. Furthermore, postharvest technology applications often form part of complex techno-economic systems where many players are involved, each with different skills, responding to different incentives. As a result postharvest innovation is frequently embedded in a wider set of relationships and contexts than is implied by the conventional research-extension-farmers model of R&D. Managing postharvest innovation and doing so in ways that support a pro-poor policy goal is therefore challenging. It is increasingly argued that conceiving postharvest innovation as a process emerging from a system of supportive actors, relationships and institutional context, is a policy perspective that can be used to plan R&D more effectively (Hall et al. 2003).

A coalitions approach to postharvest innovation

To operationalize this concept of a postharvest innovation system, scientists from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), Patancheru, India have recently begun experimenting with a coalitions approach to research. The approach involves investigating and

strengthening the institutional context of the research undertaken, with a view to building local innovation system capacity. The focus of the coalition type project is specified in broad development terms (rather than narrow scientific terms) so as to articulate the identified problem in a way that includes the interests of both non-scientific as well as scientific stakeholders. Furthermore, instead of having a fixed workplan the approach uses an action research methodology whereby the program of work and the partners in the coalition involved can evolve along the way to match emerging circumstance and findings. The idea is that by building the right coalition of partners around an intervention task, the research element of the project becomes linked to and informed by those who will use and operationalize research products.

The focus of this experiment at ICRISAT is the promotion of sorghum by the poultry industry. The coalition, made up of breeders, economists, poultry scientists, poultry feed manufacturers and sorghum farmers, is testing new varieties in poultry rations. The project is exploring institutional arrangement that would allow a contract growing scheme to develop and in the longer term building a new relationship between sorghum breeders and the industrial sector that will increasingly determine the utilization quality characteristics of the crop. The novelty of this approach is not only the diversity of partners involved in the process, but also that the outcomes of the project are both technical and institutional.

While it is too early to predict the outcomes of this coalition experiment at ICRISAT, evidence from other postharvest interventions of this type suggest that it can bring about significant innovation and impact (Clark et al. 2003). Given what is already known about innovation process in the postharvest sector it is apparent that if the industrial utilization of coarse cereals in Asia will evolve in ways that support the livelihoods of poor producers, institutional development is likely to be as important as technological change. A critical part of institutional development will be stronger and more effective linkages between science, industry and farmers.

Conclusions

In recent years production, consumption and trade patterns for coarse cereals in Asia indicate a shift from food to non-food uses. Stronger coalitions of sector stakeholders should be promoted as a way of developing the non-food market and building stronger and more effectively linking farmers with new sources of demand for their crops.

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