



# Strategic Assessments and Development Pathways for Agriculture in the Semi-Arid Tropics

Policy Brief No. 13

December 2008

## Global Price Trends of ICRISAT Mandate Crops

P Parthasarathy Rao, FW Agbola, S Bhagavatula and MCS Bantilan

### 1. Introduction

The prices of agricultural commodities have been in the news in recent months following an increase in their real prices after three decades of falling/relatively stable prices. Although the prices of agricultural commodities started to rise from as early as 2001, the sharpest increase occurred in the years 2006-08. The rise in prices can be attributed to a multitude of factors both on the demand and supply side, such as consecutive bad harvests in major grain producing countries leading to record low stocks; stagnant yield levels of major crops; the increase in the price of crude oil leading to a rise in price of inputs such as fertilizers; income growth and urbanization in Asian countries fuelling demand and use of cereals/oilseeds for biofuel production, among several others.

While much has been written about the price trends of fine cereals and commercial crops, very little is known about the trends in crops like sorghum, pearl millet, chickpea and pigeonpea that are both staples and an important source of income for the small-scale farmers in the semi-arid tropics of the world, mainly in South Asia and sub-Saharan Africa.

This policy brief provides an overview of the historic trends in the global prices particularly of the ICRISAT mandate cereals (sorghum and millet) and legumes (chickpeas, pigeonpeas and groundnut); an understanding of factors driving them; extent of recent price increase for these crops; impacts and policy implications of price rise in general and for these crops in particular.

### 2. Agricultural commodity prices—an overview

Fuelled by technological change, the real prices of agricultural commodities witnessed a secular decline until 2000, at an annual rate of about 2% a year between 1970 and 2005, with some minor intermittent ups and downs, both absolutely and relative to the manufactured products (FAO 2006). The poor, who are net buyers of food, were able to access more and better quality food due to declining prices. However, the declining prices have negatively impacted farm incomes in many of the developing countries and worsened their terms of trade since agricultural products comprise a significant portion of their trade basket. Consequently, this has led to higher import bills and the conversion of short term borrowing to long-term debt in most developing countries (IMF/World Bank 2002).

The general pattern that the real prices of agricultural commodities (particularly cereals, pulses and oilseeds) follow is one of an increase in the 1970s, followed by a steady, and in some cases steep, decline in the 1980s and 1990s, and a gradual recovery in the 2000s. On the demand side, the factors that contributed to the steady but intermittent decline in the 1980s and 1990s were the introduction of synthetic substitutes, for example, margarine for butter and synthetic cooking oils; the slowdown in population growth, especially in the 1990s; and the maturing of the developed economies in terms of stable demand and supply characteristics. On the supply side, technological improvements, reduction in border protection in

Global Theme on Institutions, Markets, Policy and Impacts:

To inform future R&D strategies for sustainable development pathways for the SAT

many major producing countries, the emergence of major new producers, and the continuance of the provision of export subsidies and production subsidies have led to increased global supplies that exerted a downward pressure on the price of agricultural commodities (OECD 2004).

The long-term declining trend in the real prices is, however, characterised by ups and downs. Prior to the mid-eighties, prices fluctuated widely though the overall trend decreased sharply. Post eighties and in the nineties, the trend is characterized by a flatter decrease and reduced fluctuations, indicating slacker markets (FAO 2004). Trade liberalization and technological change have also contributed to reducing the volatility in the 1990s by positively effecting global supplies.

Since 2000-01, however, we see a marked rise in the level and volatility of agricultural prices and particularly food prices peaking between 2006-08. For example, maize, wheat, rice and soybean prices rose by more than 30-50% between 2006-08. The dramatic rise is attributable to a number of factors both on the demand and supply side that are of a different nature from those observed in earlier decades. For instance, on the supply side the main

factors were related to climate change (droughts, outbreak of disease, etc), lowest ever grain reserves, historically stagnant yield levels, low levels of land and water resources, and low supply response. On the demand side were increased food demand from developing countries due to rising incomes and urbanization (particularly in Asian countries). However, the principal underlying cause for the price rise as alluded to by a number of studies is the rising energy price (Figure 1), which drives transport, fertilizer and input costs up, implying close correspondence between crude oil prices and food prices. Another key factor is the increasing demand for feedstock such as maize and oilseeds by the biofuel industry that is again driven by rising oil prices. These changes are more structural in nature and hence would continue to put pressure on prices unless the underlying factors are addressed (Sharma 2008).

### 3. Price trends of ICRISAT mandate crops

This section discusses the historical price trends for ICRISAT mandate crops and impact of the recent price rise of food commodities on their prices. As alluded to earlier, sorghum, pearl millet, chickpea

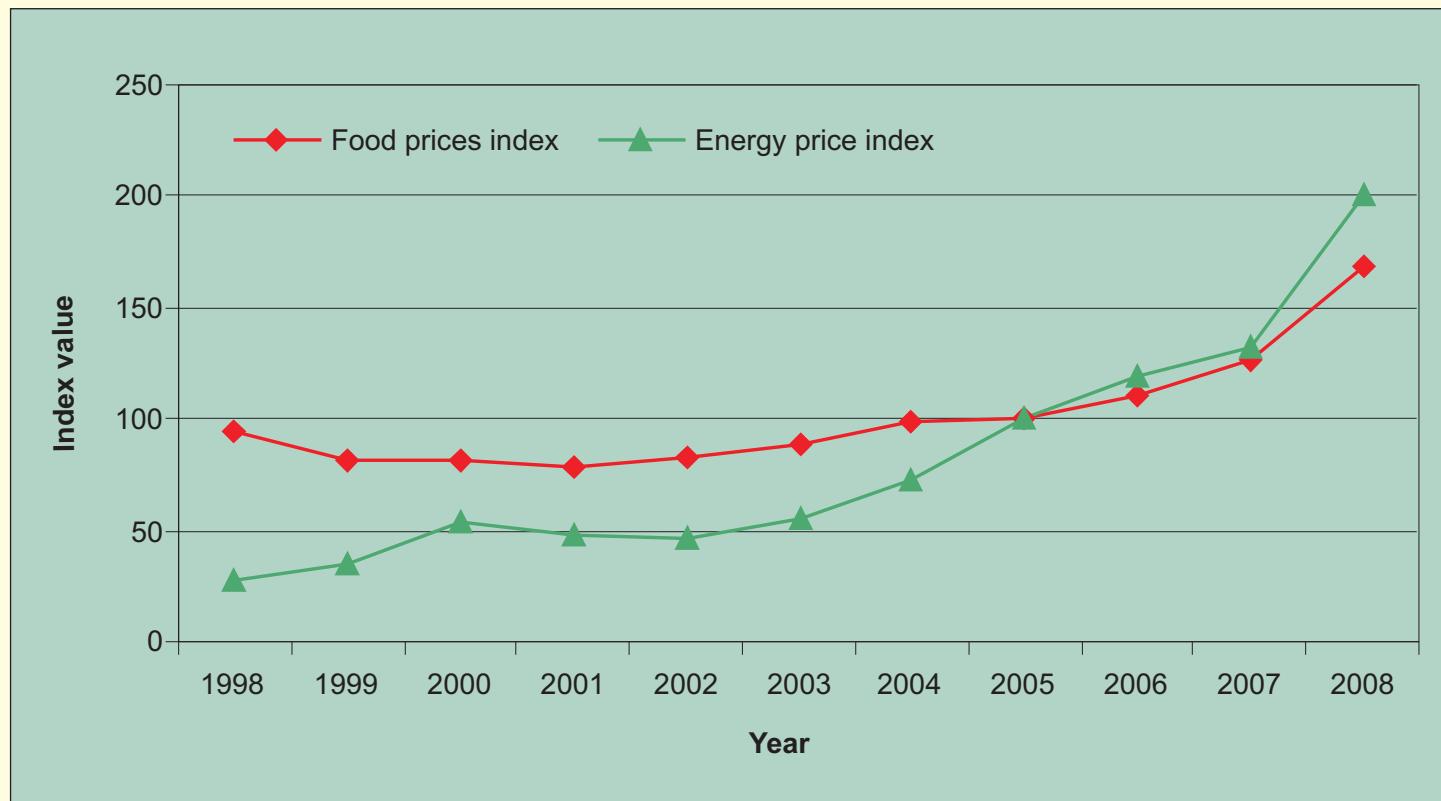


Figure 1. Trends in global food and fuel trends (2005=100).

Source: IMF Financial Statistics, accessed from <http://www.imf.org>

and pigeonpea are grown by small-scale farmers in marginal and low rainfall environments and are important staples for the poor, both in urban and rural areas.

### 3.1. Sorghum

Much of the sorghum produced for food use in South Asia and sub-Saharan Africa is consumed within the producing country. Thus, unlike cereals such as rice and wheat that are traded in the international market for food use, sorghum is traded largely to meet feed demand in the livestock sector. Sorghum exports account for about 11% of global production compared to 17% in the eighties (Table

1). The exports peaked between 1976 and 1985, accounting for nearly 20% of the total production, largely in response to the trade embargoes levied on maize imports to the Soviet Union by the US, which increased the demand for sorghum, a close substitute.

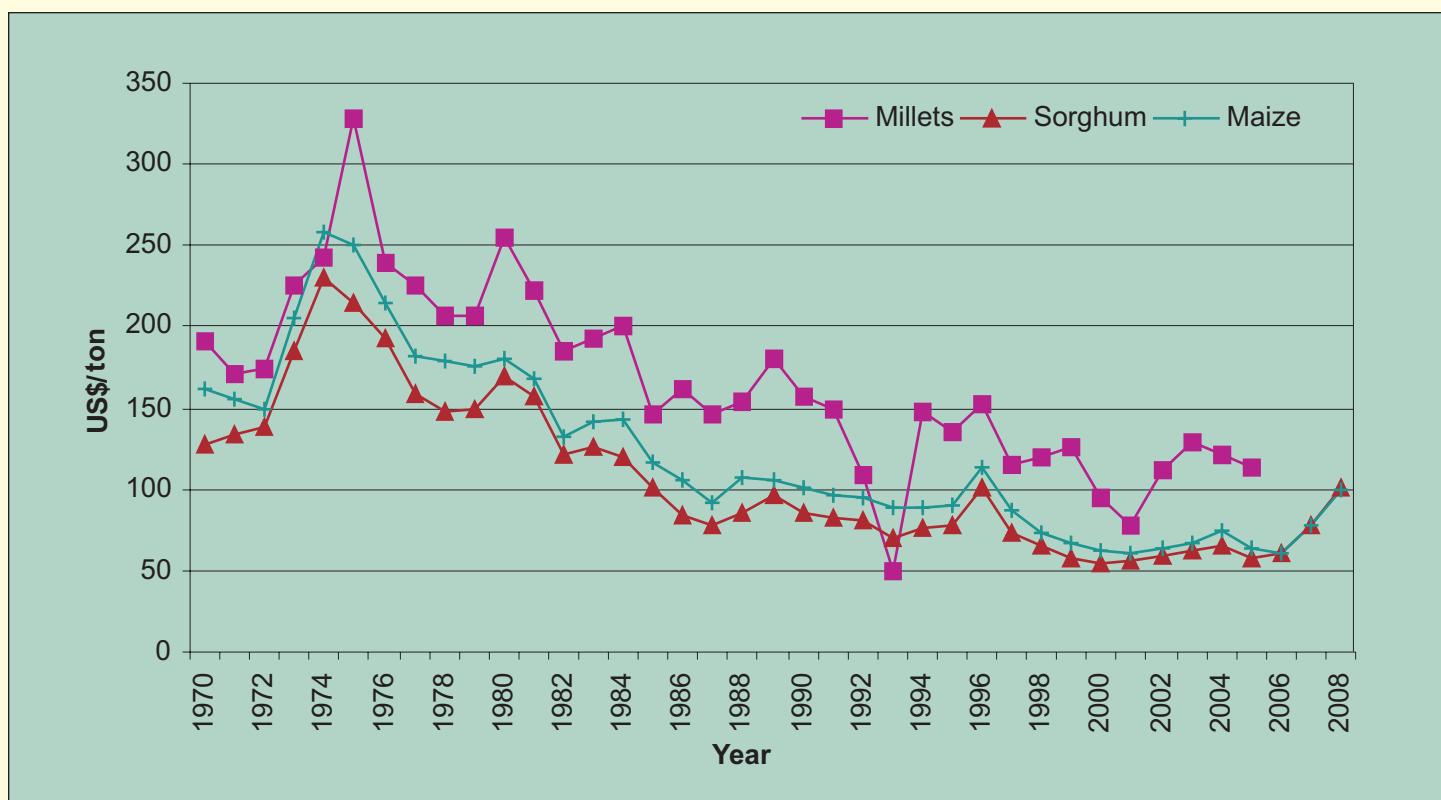
Over the last four decades the real prices of sorghum have exhibited a cyclical pattern, and show a decreasing trend. This decline is marked by a dramatic drop in the late seventies, followed by a more gradual decline and a slow increase in the period 2000-05 (Figure 2). Since 2005, prices have increased further with record high spikes in the years 2006-08.

**Table 1: Decadal averages of production of ICRISAT mandate crops (in million t), 1970-2005.**

Year	Sorghum	Millets	Chickpea	Shelled groundnut	Groundnut oil
1970-79	62.6 (14.9) <sup>1</sup>	28.2 (0.9)	6.8 (1.9)	18.0 (4.6)	3.0 (15.6)
1980-89	67.1 (16.9)	27.6 (0.7)	6.5 (5.1)	20.8 (3.7)	3.2 (12.2)
1990-99	60.7 (13.0)	27.7 (1.0)	8.0 (7.3)	28.3 (3.9)	4.5 (6.4)
2000-05	57.7 (11.2)	29.3 (1.0)	7.9 (10.9)	38.0 (2.9)	5.4 (4.1)

1. Figures in parentheses are the decadal averages of percentage of exports to its production.

Source of data: FAOSTAT (FAO 2007).



**Figure 2: Trend in real export prices of sorghum, millets and maize 1970-2008.**

Source of data: FAOSTAT (FAO 2007) and for 2006-08 (for sorghum and maize), Pink Sheet, World Bank 2008.

Historically, there are four distinct patterns that the prices of sorghum have followed. First, the period 1970-75 that shows significant increases. This increasing trend can be attributed to the increase in demand for sorghum by the United States following a shift in the beef industry to the southern plains and the low levels of sorghum stocks at that point in time owing to the domestic policies regarding disaster protection, which favored the cultivation of maize and wheat (Lin and Hoffman 1989). Second, the period between 1976 and 2000 shows a sharp decline in the eighties followed by a more gradual decline in the nineties. This decline is largely in response to the development of new hybrids and drought resistant varieties that led to an increase in yields and the production of sorghum. Third, the period between 2001 and 2005 is marked by a gradual recovery of its price growing at a rate of about 0.35% per annum (Table 2), following an all time low real export price of US\$55 per ton in 2000. Fourth, the years 2006-08<sup>1</sup> have seen sorghum prices shooting up by 29% with the estimated real price of sorghum at \$100 per ton owing to severe grain shortages in the world.

The reversal in price trends can be attributed to increased substitution of sorghum for feed grain in Europe owing to a shortage of other grains; robust growth in demand from China, Mexico, South Korea, Brazil and the United States (USDA 2004); and an increase in the demand for both sorghum and maize in the bioethanol industry. An interesting aspect about sorghum prices is that its price moves in tandem with the price of maize and is on an average lower than maize price by 5-10%. In recent years this gap is reducing, as demand for sorghum in the feed industry is rising with maize being diverted for

bioethanol production. The rise in global prices of sorghum has impacted domestic prices of sorghum used for food in several countries in Africa and India<sup>2</sup>, affecting the poor consumers.

### 3.2. Millets

At the global level, separate trade data on pearl millet, (which is the main millet crop for this study), are not readily available making it unfeasible to construct a price series for pearl millet. Instead, we present an aggregate price series of all millets of which pearl millet comprises over half the globally traded quantity. Taken as a group, only a small quantity of millet (about 1% of total production) is traded in the global market with most of it being consumed domestically within the major producing countries (Table 1). Most of the demand for millets is from Europe where it is used as bird feed. In the semi-arid tropics of Asia and Africa, all of it is used for human consumption particularly by the poor consumers.

The real price of millet shows a cyclical pattern over the course of the last four decades, and has trended downwards like for other food commodities. Its prices also rose sharply after 2000 (Figure 2). Overall, the real price of millets decreased during the period 1970-2005 at a rate of 2.5% per annum (Table 2). An important feature of millet prices is the sharp spikes that its price exhibits due to fluctuations in production since the crop is grown in marginal environments under low and erratic rainfall conditions.

The period 1970-75 saw an increase in the real price of millet mainly because of the increased demand for cereals and fluctuations in domestic production levels in some of the major exporting countries in Asia

**Table 2: Decadal average of compound annual growth rates of real export price of ICRISAT mandate crops, 1970-2005.**

Year	Sorghum	Millets	Chickpea	Groundnut oil	Shelled groundnut
<b>1970-79</b>	2.09	2.50	8.13	4.26	6.49
<b>1980-89</b>	-6.98	-4.31	-9.51	-6.49	-7.14
<b>1990-99</b>	-2.48	-1.76	-0.86	-0.63	-3.12
<b>2000-05</b>	0.34	2.45	0.27	1.26	-0.72
<b>1970-2005</b>	-3.60	-2.47	-3.48	-2.83	-2.98

*Source of data:* FAOSTAT (FAO 2007). Calculated on data series that has been filtered using the Hodrick-Prescott filter.

and sub-Saharan Africa, where weather variability and civil strife increased the volatility in the supply of millets to the global market (World Bank 1989). The period 2000-05 saw a recovery in the real price of millets, increasing at a rate of 2.45% per annum along with traded quantities. This increase in the real price of millet can be attributed largely to the increase in prices of cereal crops leading to an increase in demand for millet as a substitute crop<sup>3</sup>.

### 3.3 Chickpea

Chickpeas are the most important pulses being traded in the international market. These account for nearly 13% of the total quantity of pulses traded (Ben-Belhassen 2005). Chickpea is primarily consumed as food in most parts of South Asia and Africa, and to a lesser extent as feed in Europe. The share of chickpea exports to its production rose from around 2% in the 1970s to about 10% by 2005.

There are two types of chickpeas that are produced and traded — the kabuli type that commands a higher price owing to a larger seed size and the desi type that is smaller in size and relatively cheaper. The desi types form roughly 80% of the total quantity of chickpea trade. Among the main

exporters, Australia is the largest exporter of the desi variety and Mexico/Canada of the kabuli types.

The real price of chickpeas (average of kabuli and desi)<sup>4</sup> has generally declined on average, at a rate of 3.5% per annum during the period 1970-2005, rising only slightly since the early 2000s (Table 2 and Figure 3). In the period 1970-78, the prices exhibited an increasing trend reaching a high of US\$1170 per ton in 1978, but have been declining steadily thereafter. The decline in prices can be attributed to growth in chickpea production by close to 2% per annum between 1980 and 2000. The years 2003-06 have seen a recovery in prices in response to the increase in demand for chickpea for feedstock as the beef industry recovers, because maize, a close substitute, is being increasingly utilized in the production of ethanol. With nearly 25% of global chickpea exports going to India, the price of chickpeas are also vulnerable to supply fluctuations in India. Chickpea prices in India rose by 55%<sup>5</sup> between 2005-07 adding to the food price inflation in the country.

This recovery in prices is expected to be sustained owing to supply shortages due to bad harvests in

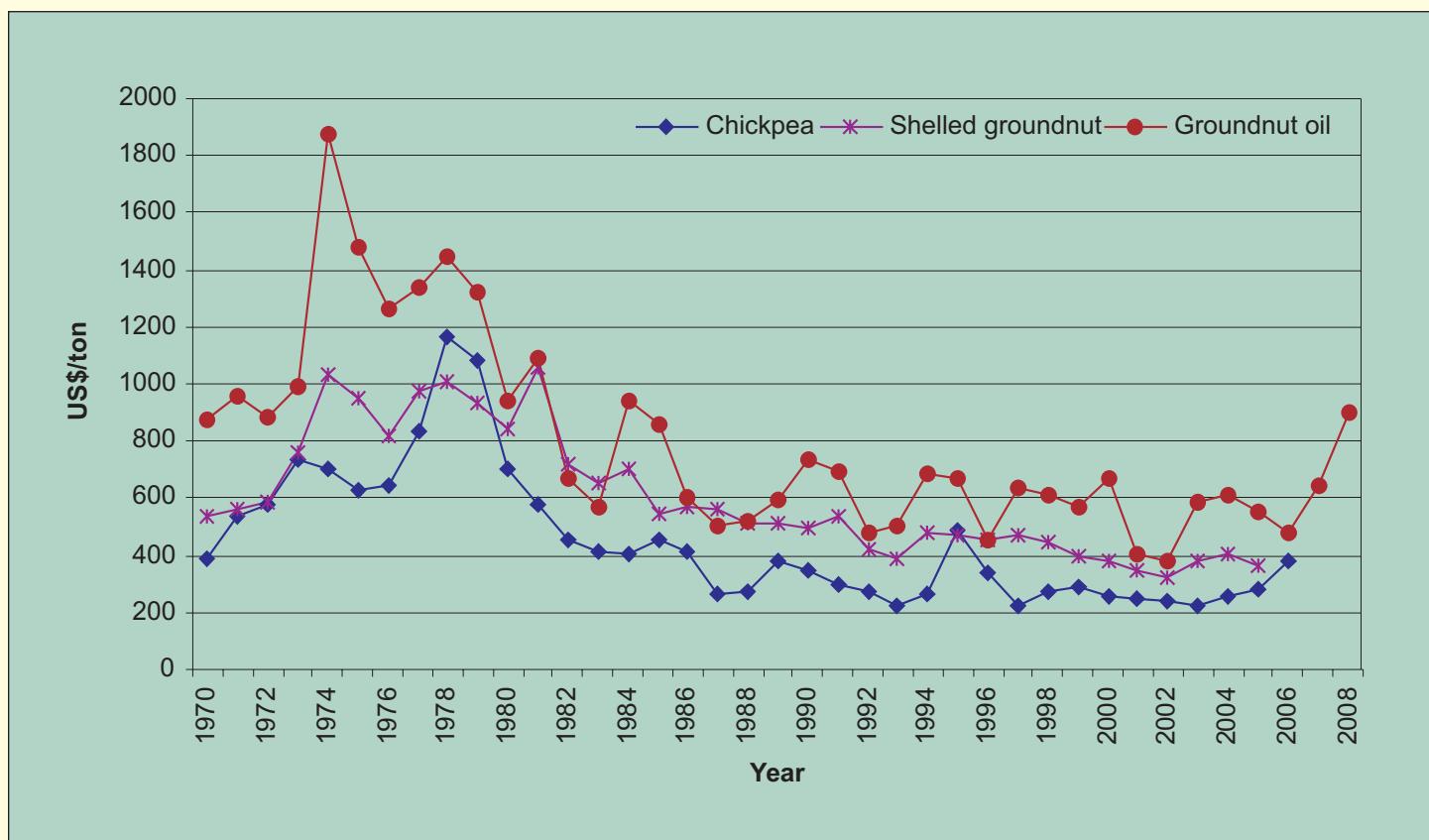


Figure 3: Trend in real export prices for chickpea, shelled groundnut and groundnut oil, 1970-2008.

Source of data: Derived by authors using data from FAOSTAT (FAO 2007) and for 2006-08, Pink Sheet, World Bank 2008.

Australia, rising import demand from India due to shortfall in domestic production, abolition of tariffs on imports of pulses to India and increase in prices of related commodities.

### 3.4 Pigeonpea

The data available on the trade and prices of pigeonpea are incomplete and not up to date. Trade data for pigeonpea, particularly in recent years from FAO, does not include pigeonpea imports to India, which is a major importer accounting for close to 80% of global imports of pigeonpea. The major exporters are Myanmar, Kenya and Uganda. In 2005, India imported 238.3 thousand tons of pigeonpea compared to 6.1 thousand tons in 1999 (GOI, various years). The increase in imports is despite an increase in pigeonpea production in India indicating growing demand. Although the traded volume of pigeonpea is very small compared to chickpeas and other pulses, the global trends in pigeonpea prices are similar to those of chickpea. In India, pigeonpea prices rose by 30.4% between 2005 and 2007. This trend is likely to continue as domestic production falls short of expected demand.

### 3.5 Groundnut

Edible oilseeds and oils are widely traded and their prices reflect their demand and supply situation. The large-scale diversion of rapeseed oil for biodiesel production has put pressure on its prices in recent years, with prices of all oilseeds increasing by 3.3% per annum between 2000 and 2005. Though an important oilseed grown widely, groundnuts (oil and kernel) do not form a very high percentage of the edible oils and oilseeds traded globally, and its share has further decreased in recent years. This is reflected in a decline in the share of groundnut trade to its own production in the period 1970-2005 — shelled groundnut from 5.2% to 2.3%, and groundnut oil from 13.3% to 3.8%. This is despite the fact that groundnut and groundnut oil production increased by 2.5% and 2.2% respectively during the same period. The decline in exports can perhaps be attributed to the stringent restrictions on exports due to aflatoxin contamination, and that an increasing portion of the groundnuts, particularly its oil, is being consumed domestically in the producing country.

Overall, between 1970 and 2005, the real export prices of shelled groundnut and groundnut oil have declined at roughly the same rate, 2.9% and 2.8% per annum respectively (Table 2 and Figure 3).

Similar to the trends in other food crops, real prices have declined in the eighties and at a slower rate in the nineties. From 2000, prices of all oilseeds have shown increases particularly in the period 2005-08, which reflects a spillover effect from the grain market, increased demand for oilseeds from the biodiesel industry and tighter global supplies. For groundnuts, the rise in prices is mainly reflected in the prices of groundnut oil, and to a lesser extent for groundnuts-in-shell.

Domestic trade policies are an important factor in determining the price of groundnuts and its trade in the international market. China's massive increase in groundnut production in the 1980s to become one of the top five exporters of both edible groundnut and groundnut oil was a result of policy reforms implemented by the government, including price support to farmers and the improvement of marketing facilities. China continues to administer the minimum price system and border protection remains extremely high. It also has import quotas and licenses on groundnut oil. Argentina, the world's leading exporter in groundnut oil levies an import tariff of 3.5% in order to encourage domestic processing of groundnut. The Indian government sets restrictions on the amount of investment that can be undertaken in the processing industry, thus restricting the industry to a small-scale level. Senegal continues to set a minimum support price in order to encourage domestic production and sets high import tariffs on processed groundnuts.

## 4. Impact of rising prices and implications for policy

A review of recent developments in the price of ICRISAT mandate crops has revealed that a number of factors on the demand and supply side drive price changes. Additionally, policy changes in major importing/exporting countries play an important role. Between 2000 and 2007, as for all major food crops, the prices of sorghum, millets, chickpea and pigeonpea have also increased with the largest increases coming in the last two years. Although the production of these crops has not been adversely affected with a few exceptions, the spillover effect from rising prices of other crops like maize and oilseeds has exerted an upward pressure on their prices. Thus, the recent rise in prices for the ICRISAT mandate crops, particularly sorghum, millets, chickpea and groundnut can be attributed to the large scale diversion of cereals and oilseeds

for biofuel production that has led to an overall increase in prices of all food crops; recovery in the global livestock sector has triggered the demand for substitutes to meet grain shortfalls, for example, the EU has turned to US sorghum as a reliable feed source for the livestock sector, pushing up its price (World Grain 2007). The supply shortages and low worldwide stocks after consecutive bad harvests in major producing countries due to droughts has exacerbated the problem. For example, by virtue of being a major producing and importing country of pulses, India's fluctuations in domestic production significantly impacts global trade and prices.

For groundnuts the import demand (mainly for shelled or edible groundnuts, groundnut cake and oil) has been declining during the last several years. The decline in trade could be attributed to the growing stringent quality specifications for aflatoxin levels. Investing in detection of aflatoxin contamination and creating awareness on the impact of aflatoxin on humans and livestock would go a long way in raising demand. Additionally, upgrading the existing crushing facilities to more cost effective technologies would help in capturing the value addition in the processing of groundnuts.

With world consumption of food, livestock feed and fuel outstripping world agricultural production for the third consecutive year, are the returns to farmers increasing? While the rising prices bode well for those countries that are net agricultural exporters in the developing world, the rising input costs particularly fertilizer, labor and transportation costs could nullify some or most of these gains at the farm level. Global fertilizer prices have increased by 150% between 2003 and 2008, with the largest increase in 2007-08. This is largely driven by rising crude oil prices that increased from US\$50/barrel to more than US\$100/barrel. In countries that import crude oil and fertilizers, the subsidy burden has gone up dramatically<sup>6</sup>, putting pressure on government exchequers and resources for development. Rainfed coarse cereals, pulses and oilseeds could be major beneficiaries since they need fewer inputs compared to irrigated crops. This, however, needs to be investigated with extensive micro-level data.

The increase in input costs has been passed on to consumers in the form of higher prices of agricultural commodities. Higher prices and the consequent inflation do affect the poor consumers/net food importing countries. This was reflected in riots in

several such countries during the last couple of years. Coupled with this, aid budgets to drought stricken developing countries of Asia and Africa have been reduced quite dramatically following the weakening of the US dollar. These developing countries now face higher than anticipated food prices and are increasingly finding it difficult to meet their food distribution goals (Walt 2008, Kilman 2007).

To mitigate the rising food prices, most countries are resorting to trade barriers such as export restrictions and export taxes. For example, Russia, Pakistan and Ukraine have all imposed export quotas on wheat to meet their domestic needs. India, which had started exporting food in the recent past, has now imposed bans on exports of essential commodities in order to prevent further price increases in the domestic market. Other measures include the lifting of set-aside rule by EU for one year in a bid to increase production. China, the largest producer and consumer of biofuel after the US, EU and Brazil, is limiting expansion in the corn-ethanol processing industry and is contemplating a shift from food-crop based ethanol production to non-food crop based ethanol production. Providing adequate safety nets and guarding against the negative fallout from rising food prices has to be a significant area of focus if the efforts to eradicate hunger are to be realized in developing countries.

## Footnotes

<sup>1</sup> The dip in prices in 2005 was due to the decline in feed grain demand owing to the Avian Influenza outbreak in Asia and a bumper harvest in the United States.

<sup>2</sup> Nominal price index for sorghum in India rose by 60% between 2005-07. For details see <http://www.agmarket.nic.in>

<sup>3</sup> The real price of millet fell in 2004 and 2005 due to the increased production in major producing countries in Africa and Asia in response to the high real price of millets in previous years.

<sup>4</sup> Although the price levels of the two types of chickpeas differ, the price trends are more or less similar.

<sup>5</sup> Calculated using data from <http://www.agmarket.nic.in>

<sup>6</sup> For example, in India, in 2007, the fertilizer subsidy doubled from previous estimates costing the exchequer \$10 billion. Figures from "All about fertilizer subsidy burden" from Commodity Online. Permanent URL <http://www.rediff.com//money/2007/may/25fert.htm>

## References

- Boubaker Ben-Belhassen.** 2005. Pulses: past trends and future prospects. Paper presented at 4th International Food Legumes Research Conference, New Delhi, 18-22 October 2005.
- FAO.** 2004. The state of agricultural commodity market. Rome, Italy: FAO.
- GOI.** Various years. Foreign trade statistics of India. Ministry of Commerce and Industry. Kolkata, India: Government of India.
- IMF and the World Bank.** 2002. Initiative for heavily indebted poor countries- status of implementation. Washington DC, USA: IMF.
- Scott Kilman.** 2007. Historic surge in grain prices roils markets. Wall Street Journal. New York, USA: Wall Street Journal.
- William Lin and Linwood Hoffman.** 1989. Sorghum, background for 1990 farm legislation. Washington DC, USA: USDA.
- OECD.** 2004. OECD Agricultural outlook 2004-2013. Paris, France: OECD.
- OECD.** 2006. OECD-FAO Agricultural outlook 2006-2011. Paris, France: OECD.
- OECD.** 2007. OECD-FAO Agricultural outlook 2007-2012. Paris, France: OECD.
- Anil Sharma.** 2008. Is higher demand for bio fuels fuelling food prices? Pages 37-40 in Economic and Political Weekly. Volume 43. No. 32.
- USDA.** 2004. Quarterly International trade report. Washington DC, USA: USDA.
- USDA.** 2005. Quarterly International trade report. Washington DC, USA: USDA.
- Vivienne Walt.** 2008. The world's growing food price crisis. Time Magazine. New York, USA: Time Magazine.
- World Bank.** 1989. Sub-Saharan Africa: From crisis to sustainable growth. IRBD/The World Bank, Washington DC, US: The World Bank.
- World Grain.** 2007. <http://www.world-grain.com>. Accessed on 1 October 2007.

## About the authors:

P Parthasarathy Rao is a Principal Scientist, S Bhagavatula is a Scientific Officer, and MCS Bantilan is the Global Theme Leader in the Global Theme on Institutions, Markets, Policy and Impacts, ICRISAT, Patancheru 502 324, Andhra Pradesh, India. FW Agbola is Senior Lecturer in Economics, School of Economics Politics and Tourism, Faculty of Business and Law, The University of Newcastle, Callaghan, NSW 2308, Australia.

## Acknowledgments:

The authors would like to thank Drs PS Birthal and VR Kiresur and colleagues at ICRISAT GT-IMPI for their valuable comments on an earlier draft. This brief is the outcome of the ongoing project on the Changing Competitiveness of World Chickpea Markets. The financial assistance provided by the University of Newcastle, Australia and GT MPI, ICRISAT is gratefully acknowledged.