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Cost of Compliance with SPS Standards

Delivering and Taking the Heat

Indian Spices and Evolving Product and Process Standards

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Foreword

Food and agricultural trade is the vital link in the mutual dependency of the global trade system and developing countries. Developing countries derive a substantial portion of their income from food and agricultural trade. The emergence of food safety and agricultural health issues and the related tightening of market requirements form challenges to further gains from trade due to the lack of technical and financial capacities of many developing economies.

As part of a joint program between the World Bank's Agriculture and Rural Development Department (ARD) and International Trade Department (PRMTR), a survey on the Cost of Compliance of exporting developing countries was undertaken. The survey was focused on the supply chains of high-value food products (horticulture, fish, meat, spices, and nuts). The study quantified the costs incurred by both the public and private sectors; identified the coping strategies employed by the various stakeholders in the supply chains; determined the constraints that hinder compliance; examined the structural changes in the supply chain resulting from compliance with the safety standards; and evaluated the impact of these standards on small-scale enterprises and producers. The survey included Ethiopia (animal products), India (fish and spices), Jamaica (nontraditional agricultural exports), Kenya (fish and horticulture), Latin America Southern Cone (animal products), Morocco (fruits and vegetables), Nicaragua (shrimp), Senegal (fish and groundnuts), and Thailand (shrimp and horticulture).

This working paper is one of a series of such case studies that examined the strategies and costs of compliance of the various stakeholders in developing countries with international agro-food standards. This paper was prepared by Steven Jaffee (PRMTR) of the World Bank.

A complementary perspective is provided by the companion series of buyer surveys involving representative importers, brokers, retailers, and distributors in the European Union, Japan, and the United States. This series, in turn, discusses the buyers' perception of the strengths and weaknesses of their suppliers and describes the assistance and/or interventions offered by the buyers to their developing country suppliers.

The findings and conclusions derived from these country studies are discussed in a synthesis report that seeks to identify possible points of intervention by the World Bank and other donor agencies and to determine the types of technical assistance that would be most efficient and appropriate. This synthesis report can be found at www.worldbank.org/trade/standards. It is hoped that the experiences of these exporter and importer countries will provide useful insights to practitioners in the field, and to national and international policymakers in both the public and private sectors.

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Acronyms

AGMARK	agricultural commodity grade label (India)
AICRP	All India Coordinated Research Project on Spices
ASTA	American Spice Trade Association
BHC	benzene hexachloride
BSE	bovine spongiform encephalopathy
CCPR	Codex Committee on Pesticide Residues (international)
CIS	Commonwealth of Independent States
DDT	dichlorodiphenyltrichloroethane
EIC	Export Inspection Council
EMRL	extraneous maximum residue limit
ESA	European Spice Association
ETO	ethylene oxide
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	FAO online multilingual statistical database
FDA	U.S. Food and Drug Administration
FOB	free on board
GAP	good agricultural practices
GOI	Government of India
HACCP	Hazards Analysis and Critical Control Points
IPC	International Pepper Community
IPM	integrated pest management
IPQC	In-Process Quality Control
ISO	International Organization for Standardization
ITC	International Trade Centre
JETRO	Japan External Trade Organization
JMPR	Joint FAO/WHO Meetings in Pesticide Residues
MRL	maximum residue limit
NAFTA	North American Free Trade Agreement
NGO	nongovernmental organization
PFA	Prevention of Food Adulteration Act and Rules
ppb	parts per billion
ppm	parts per million
R&D	research and development
SPS	sanitary and phytosanitary

Executive Summary

Developing countries are the dominant source of supply for the world's US$2 billion trade in bulk (whole) spices and value-added spice ingredients and products. World trade in spices has long been characterized by volatility, stemming from the structure of the trade, climatic conditions, and the rapidity with which producers can respond to price changes. Over the past decade, the normal cyclical challenges of the spice trade have been supplemented by other challenges associated with increased regulatory attention—in some important international markets—to food safety; plant health; and environmental aspects of production, preparation, and trade.

India is the world's largest producer and consumer of spices and for a very long time has been among the leading spice exporting countries. Upwards of three million Indian smallholder households produce spices and hundreds of thousands of others are involved in spice processing, distribution and trade. India is unique among the world's major spice exporting countries in that the bulk of its spice production is used in the domestic market. While the value of Indian spice exports has been $300-400 million in recent years, the estimated domestic retail value of spices in India is some $4 billion.

Over an extended period, the Indian spice trade earned a reputation for product quality and marketing service. Recent regulatory changes in selected destination markets, together with evolving requirements among major commercial buyers have triggered a variety of responses by Indian producers and processor/exporters and by the Spices Board and other governmental agencies. Changes continue to be made in production, post-harvest, and processing practices and technologies; in quality assurance and supply chain management systems; and in monitoring and testing products. The industry—via effective private and public sector collaboration—is also actively engaged in discussions at the international level to influence the "rules of the game" for the trade in spices.

Challenges remain, however. At the commercial level, India has been encountering intensified competition in the world market for bulk spices. Its ability to compete—on a cost basis—is constrained by the relative dynamism of its own domestic market. As a result, increasingly, India's spice export trade is shifting to a range of spice oils, dehydrated products, and oleoresins for which the country maintains a major, if not dominant, world market position. Several exporters also are seeking to develop their brands and markets for packed consumer products.

To increase competitiveness in these areas, effective use will have to be made of the installed technological capacities that have been put in place over the past decade, plus there is a need to intensify efforts to promote 'good agricultural practices' and improved post-harvest practices among spice growers and to more generally improve the oversight of spice procurement. Additional investments will be needed in technologies, systems, and human resources to improve spice hygiene and quality assurance. Furthermore, measures need to be taken to better apply and enforce regulations dealing with pesticides and domestic food safety. Given its spice industry's past track record, India is fully expected to meet these emerging commercial and regulatory challenges.

Historical Background

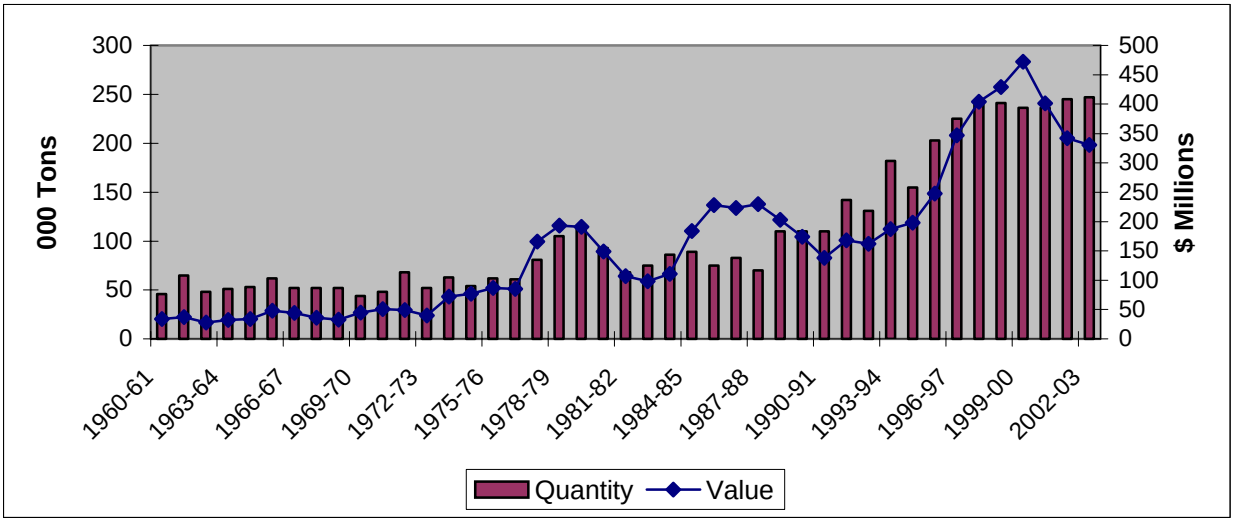
The Indian and global spice trade dates back several millennia. Spices such as black pepper, turmeric, cardamom, and cinnamon have been known and produced in India for thousands of years, with references made in early sacred writings and evidence found in excavation sites (Pruthi 1998). Ships laden with Indian spices, perfumes, and other products reached ancient centers in Arabia and Egypt. Subsequently, Greek, Roman and other merchants and seafarers sought out spices from India and other Asian lands. Spices were a major prize in the fifteenth and sixteenth centuries. During this age of discovery, Columbus, Vasco de Gama, and many others sought more direct routes from the metropolitan capitals in Europe to the lands of spice production in Asia. Black pepper, indigenous to Southern India, formed a central part of the trade with Portugal and the Middle East out of the port of Cochin during the fifteenth to seventeenth centuries. There were wide swings in annual prices and periodic attempts to monopolize this trade (Malekandathil 2001). In the seventeenth century, the Portuguese introduced chilies to India. All of these spices were extremely valuable. They provided flavor; masked the taste of tainted foods; provided a means to preserve meat and other foods; and were used in incense, medicines, fumigants, and cosmetics.

In the modern era, an array of governmental initiatives was undertaken in the 1950s and 1960s to address agronomic and marketing problems for Indian spices and to develop new technologies for spice processing and packaging. On the international level, India assumed a leadership role when a subcommittee on spices and condiments was formed in the early 1960s at the International Organization for Standardization (ISO), and India was one of the founding members of the International Pepper Community in the early 1970s. In 1986 the Spices Board of India was established to provide coordinated support to the development and promotion of India's spice exports and to regulate these exports, including through quality control and licensing. A year later, the All India Spices Exporters Forum was formed as an industry association to liaise with the Spices Board and other governmental departments and agencies; to address emerging issues facing spice companies; and to disseminate technical, regulatory, and other information to its members.

While India did export a variety of spices, it was especially known for its black pepper. This product accounted for more than half of the value of the country's spice trade through much of the 1950s through the 1980s. Pepper was sometimes referred to as the "king of spices" or the "black gold of India." Periodic surges or sharp declines in the Indian spice exports were normally associated with fluctuations in world black pepper prices. Yet, the country also developed a growing trade in turmeric, ginger, chilies, and a broad array of spice seeds (coriander, cumin). Beginning in the 1970s, through the pioneering work of the Central Food Technological Research Institute and subsequent private investments, the country also developed an industry to produce and export spice oils, dehydrated products, and oleoresins. That industry segment achieved modest growth in the 1980s, but has expanded considerably since, placing India in a position of world leadership in this trade.

Figure 1 highlights the trajectory of India's spice exports over the past 40 years, over which time export volumes have increased some 5-fold while export values have increased 10-fold. India's spice export volumes first surpassed 100,000 tons in the late 1970s, and 200,000 tons by the mid-1990s. The trade value first exceeded $200 million in the mid-1980s and later exceeded $400 million in 1997–98 through 2000–01.

Figure 1. Indian spice exports, 1960–2003



Source: Spices Board of India.

International Spice Market Context

Spices are traded in dried bulk (whole) form; in ground or powder form; and as oil, oleoresins, natural colors, and extracts. They are used in foods, cosmetics, toiletries, aromatherapy, pharmaceuticals, and fragrances. In foods they add or modify flavors, whether sweet, sour, bitter, "hot," or otherwise. They also bring distinctive colors to certain foods. They are widely used in ready-to-eat meals, in packaged meat and seafood, in soups and sauces, and in myriad other ways.

World trade statistics for spices provide only a proximate indicator of actual trade. Not only does the trade consist of a very broad array of individual commodities—sold in different forms and sometimes classified differently–but also this is an area in which there is an extensive amount of transshipment and re-export. Most widely traded spices are grown under tropical/subtropical conditions. Yet, one observes very substantial "exports" by temperate developed countries as well as trading entrepôts such as Singapore and the United Arab Emirates.

Table 1 below, draws on United Nations data to provide a best estimate of trends in world spice exports over the past two decades. This table covers only bulk spices, not value-added spice oils and oleoresins, for which world trade is approximately $250 million. In recent years, total world spice exports were approximately $2.7 billion. Since as much as one-third of the trade in bulk spices consists of re-exports, the total *net* export value for spices (combining bulk and value-added products) is probably closer to $2.0 billion.[1]

[1] Some re-export activity does involve value-adding functions, including customized grading, grinding, and repackaging.

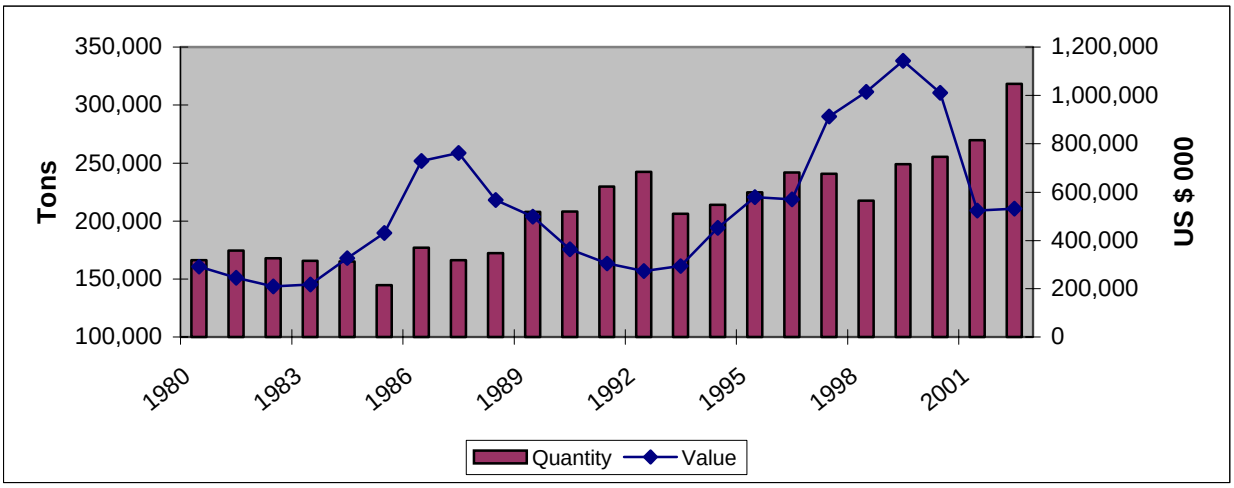
Table 1. Value of world spice exports *(US$ millions)*

	1980	*1985*	*1990*	*1995*	*2001*
Total	988	1306	1357	1716	2440
From countries of origin*	716	969	900	1067	1635
Re-export trade	272	337	457	649	805

Source: UNCTAD Commodity Yearbook; UN International Trade Statistics Yearbook.
* Developing and transition countries, not including Singapore or United Arab Emirates.

These figures in table 1 suggest a relatively rapid growth in developing country exports during the early 1980s and again in the period between 1995 and 2001, with more or less stagnant patterns in the intervening period from the mid-1980s to mid-1990s. However, this picture of surges and stagnation is more attributable to the volatility of world prices in selected spices rather than to underlying changes in trade volumes. Indeed, as will be illustrated below, there has been a rather steady progression of import volume growth for many important spices over an extended period of time.

Figure 2. World black and white pepper exports



Source: International Pepper Community.

The effects of fluctuating commodity prices on world spice trade values is well illustrated by patterns in trade for black and white pepper. Pepper accounted for about 20 percent of the total volume and value of world spices trade in 2002. The volume of black/white pepper exports exhibited little or no growth during the 1980s, yet has expanded considerably since then (figure 2). The only interruptions occurred during a few years due to adverse climatic conditions in important producer countries. In contrast, the value of trade has gyrated up and down over this period, with surges both in the late 1980s and late 1990s due to price spikes (figure 3). Similarly, wide gyrations in world prices have occurred in recent decades (and in recent years) for vanilla, cloves, and several other spices.[2]

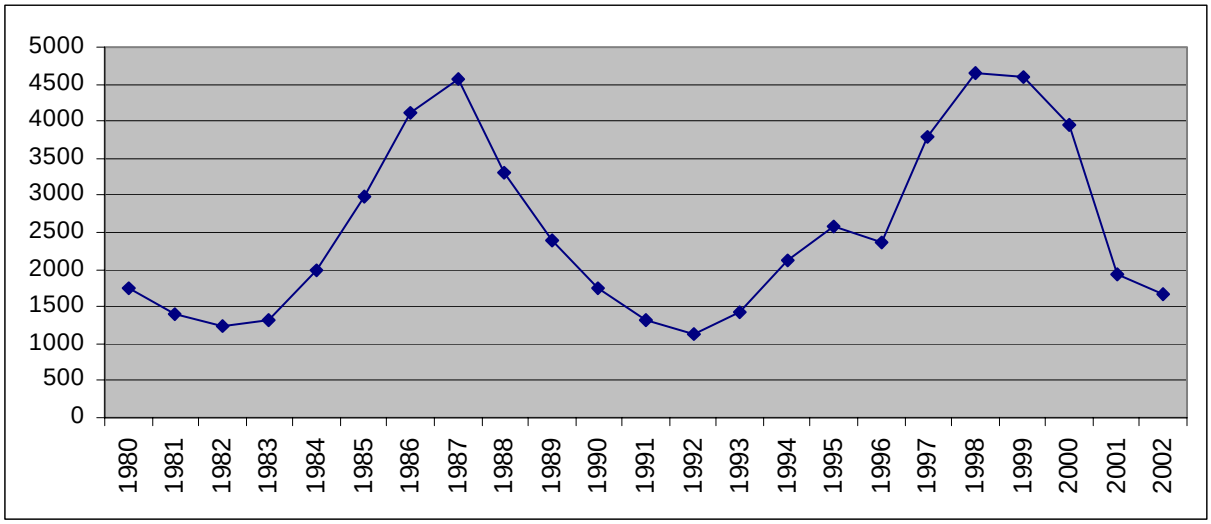
The specific reason for the most recent price collapse for black pepper was the dramatic expansion in production in Vietnam, resulting in global oversupply. Vietnamese production increased from 15,000 tons in the mid-1990s to more than 70,000 tons in recent years. Its own

[2] For example, over 1997–2003, vanilla prices have varied in the range of $25–400/kg for comparable-quality product.

domestic consumption is only 3000–4000 tons. The longer-term volatility in prices of pepper and several other major spices stems from the concentration in (export-oriented) production in a limited few countries and a combination of climatic impacts and pursuit of commercial strategies—including supply management—to influence prices.

Including re-exports, world imports of whole and ground spices consisted of some 1.375 million tons, valued at $2.5 billion in 2002. In that year, four categories of spices—pepper, capsicum, ginger, and spice seeds—accounted for nearly three-fourths of the total volume and just over half of the total value of world spice imports (table 2). Recent price changes led to radical shifts in the value shares of different spices in the total trade. For example, between 1998 and 2002, the share of pepper in the total value of trade declined by nearly half, while that for vanilla increased more than four-fold.

Figure 3. Average unit FOB price for world black and white pepper export *(US$/t)*



Source: International Pepper Community.

For many of the low-volume, high-unit-value spices, the bulk of world production enters world trade. This fact certainly applies to vanilla, saffron, nutmeg/cardamom, and cinnamon. Some two-thirds of world production of white/black pepper is also traded, with only India among the major producers retaining a large proportion of its supply for domestic consumption. Less than 25 percent of world production of ginger and of cloves enters world trade, while the share for capsicum/chilies is less than 15 percent.[3]

[3] Estimates based on world trade figures in ITC and production estimates in FAOSTAT.

Table 2. Share of world spice imports by commodity *(%)*

	1998		*2002*	
	Quantity	*Value*	*Quantity*	*Value*
Pepper	17	39	19	20
Capsicum	20	16	24	18
Vanilla	0.4	3	0.3	13
Nutmeg/cardamom	4	6	3	9
Spice seeds	15	8	14	8
Ginger	16	6	17	6
Cinnamon	7	6	7	5
Cloves	5	2	2	5
Thyme/saffron	1	3	1	3
Others + mixes	14	11	13	13

Source: ITC.

Spices are produced in many developing countries, and a broad array of countries export limited quantities. Nevertheless, discounting the re-exports by intermediary traders., fewer than a dozen countries account for most of world spice exports. Table 3 provides the estimated market share of the leading spice-exporting countries, factoring out the likely levels of transit/re-export trade. The listed 8 countries account for just under 80 percent of this adjusted estimate of trade. Again, recent shifts in prices have resulted in rather significant changes in the relative shares–with Madagascar (a vanilla exporter) seeing an increased share, and Indonesia and India experiencing reduced shares. Only over the past decade has China emerged as a major spice exporter, being a very cost competitive supplier for a range of spices, especially ginger, garlic, and chilies.

Table 3. Market share of leading spice exporters (% of world import value)

	1995	*2002*
China	11.7	15.0
Madagascar	4.1	14.0
Indonesia	21.8	13.3
India	18.9	12.8
Guatemala	3.8	6.6
Brazil	7.4	6.5
Vietnam	5.3	6.3
Sri Lanka	5.0	5.1

Note: As estimated by the ITC and adjusted by reducing the total value by one-third of the amount estimated to be associated with transit/re-export trade.

Similarly, for most individual spices, a limited number of countries account for the bulk of international trade. For cinnamon, vanilla, and ginger, the three leading countries account for 85 percent, 80 percent, and 76 percent, respectively, of total world exports. Somewhat lower yet still significant levels of concentration exist in the trade of cloves, pepper, and capsicum, where the 3 countries' shares are 62 percent, 57 percent, and 46 percent, respectively.

India is the leading world supplier of ground/crushed pepper, turmeric, spice mixtures, and spice oils/oleoresins. India is claimed to account for more than two-thirds of world trade in the latter value-added products. India is also a major player in the world markets for chilies and spice seeds. As mentioned earlier, its long-standing role as a leading supplier of whole black pepper has been eroded in recent years, with the bulk of its black pepper production now being consumed in the domestic market or processed into customized powders, oils, or oleoresins. In

fact, India has recently also become a significant *importer* of black pepper. With heavy domestic demand (see below), India has not been able to remain price competitive in international markets, including those for ginger[4] and cardamom.[5]

Even though spices are traded in a variety of forms, some 85 percent of trade involves the sale of whole, unprocessed raw materials. Only for pepper, curry powder, paprika, and spice mixtures is there a significant volume of trade in ground spices. Furthermore, there exists very little trade in consumer-packed, branded spice products. World trade in spice oils and oleoresins is also relatively small (estimated at $250 million). Several factors contribute to this pattern of trade:

- *Distinctive requirements of end-users*. Both in the European Union and the United States (the two largest world importers), some 60 percent of traded spices is used by industrial processors in the food industry, including for beverages, soups, dairy products, and meat and fish products. These industrial users have very distinct requirements for quality, taste, color, for which exact specifications they tend to rely on local firms/processors to meet. The catering trade, which accounts for another 10 percent–15 percent of spice sales in the EU and US, also has very exact specifications. Again, local firms may be more familiar with these requirements and/or better able to blend supplies from different sources to meet these requirements.[6] Figure 4 illustrates the distribution channels for spices in Japan.
- *Higher quality/safety standards for value-added products*. It is more difficult and costly to re-grade, clean, or decontaminate a defective ground/powdered spice than one that is imported in whole form. The intermediate and final products must also be absolutely free of microbiological contamination. The tolerance levels for impurities and presence of extraneous matter are substantially higher for whole, unground spice materials, enabling more suppliers to trade such products.
- *High concentration in the retail sale of branded products*. In industrialized countries, a very few highly promoted brands account for the bulk of retail sales, especially through supermarkets.[7] These are either national brands or those of leading multinational spice companies such as McCormick.[8]
- *Tariff escalation*. For the most part, tariffs for spices entering the EU, Japanese, and U.S. markets are very low, typically ranging from zero to 5 percent. However, there is some degree of tariff escalation for value-added products. For example, in the EU, whole pepper is duty free while crushed/ground pepper faces a 4 percent duty, and whole chilies are duty free while crushed/ground chilies face a 5 percent duty. In Japan, the crushed or

[4] In 2003 Indian ginger was available for $1400–1500/ton, compared with $800-900/ton for Chinese ginger.

[5] In 2002–03 the average export prices for cardamom were $16.4/kg for India vs. $11.5/kg for Guatemala. Guatemalan prices have been substantially lower than those of India in 7 of the past 9 years. Previous quality differences have been narrowed over the years.

[6] For example, curry powder might involve a blend of 30 or more different spices, with different restaurants or other users requiring very specific blends and styles.

[7] Spice raw materials account for a small proportion of the final price of consumer packaged spices. For example, one study commissioned by the Spices Board of India estimated that the black pepper raw material accounted for only 10% of the retail cost of a small 4-oz. consumer pack. Packaging assumed almost double this share while the retail gross margin was 30% of the total.

[8] In 2003 the net sales of McCormick worldwide were $2.27 billion.

ground versions of various spices attract a duty of 3.5 percent–4.2 percent; while the same items put in containers for retail sale face a 7 percent duty.[9]

The so-called Quad countries—Canada, the European Union, Japan, and the United States—account for some 50 percent of world whole/ground spice imports by volume and just under 60 percent by value.[10] These shares would be reduced somewhat if intra-EU trade were factored out. However, this reduction would be more than compensated if world trade in spice oils/oleoresins were included, because the Quad countries dominate world imports in those products.

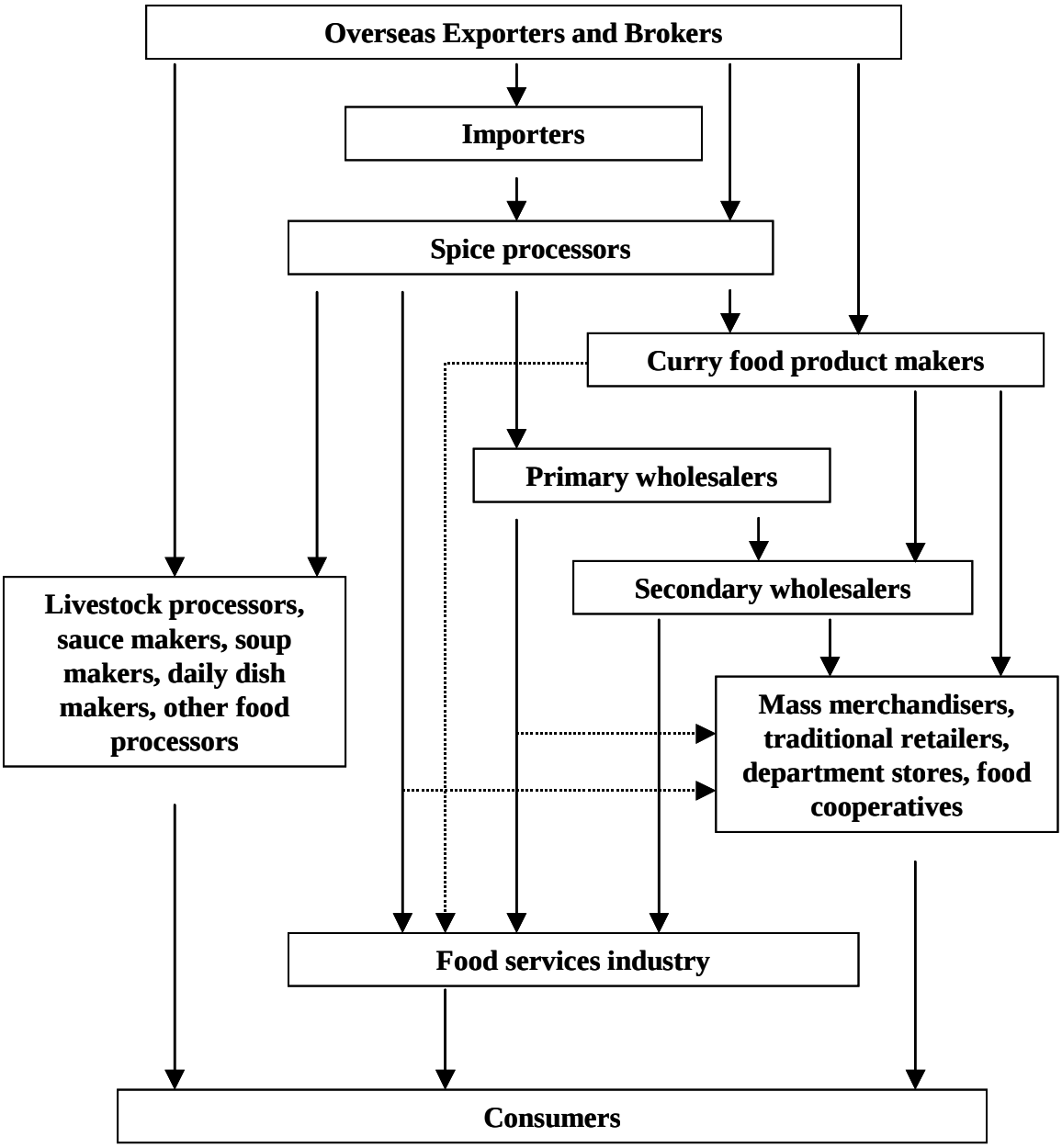
Overall and per capita spice consumption in the Quad countries exhibits sustained growth. Spices constitute a relatively small proportion of the cost of finished food products; hence, demand for spices is relatively price inelastic. Demand is most linked to income growth, dietary changes, and dynamics in the food processing and catering industries. Collectively, they use some 75 percent–85 percent of the spices imported into Quad countries. Spices are increasingly being used to create increased taste, flavor, and color to foods. They are appreciated as "natural ingredients. In Europe and the United States, increasingly diversified populations are increasing the demand for seasoned foods. In these countries and elsewhere, new cuisines are being sought. In addition, with demographic changes, there is greater consumption of ready-to-eat (cooked or semi-cooked) meals and increased out-of-home consumption. Spices are widely used in processed foods (especially meats and fish), soups, and seasonings. Furthermore, the scientific community is finding new intrinsic values of spices, including for medicinal purposes.

If one includes intra-EU trade, then the EU is the largest importer of spices (at about 22 percent). Discounting intra-regional trade, the EU's ranking falls to second (at 17 percent and behind the United States). In 2002 EU spice imports reached 300,000 tons, valued at nearly $750 million. Approximately one-third of its trade is intra-regional, with this share being 40 percent or more for certain individual items. The largest spice importers within the EU are Germany and the Netherlands, although the bulk of the latter's imports are re-exported, especially to Germany. As a result, nearly half of Germany's spice imports are not supplied directly from developing countries. Other significant spice importers within Europe are France, Spain, and the United Kingdom. The product composition of these imports differs widely among countries. Spice production within the EU is very small, accounting for approximately only 10 percent of apparent consumption. This "domestic" production is dominated by Spanish production of pimento. Among developing countries, India has the second largest market share of EU imports, accounting for 13 percent of the total, trailing Indonesia at 29 percent.

[9] For all the above reasons, less than 1% of Japanese spice imports involves packaged consumer products.

[10] The discussion that follows is based, in part, on JETRO 2003, ITC 2004, and Centre for the Promotion of Imports from Developing Countries 2003.

Figure 4. Distribution channels for spice products in Japan

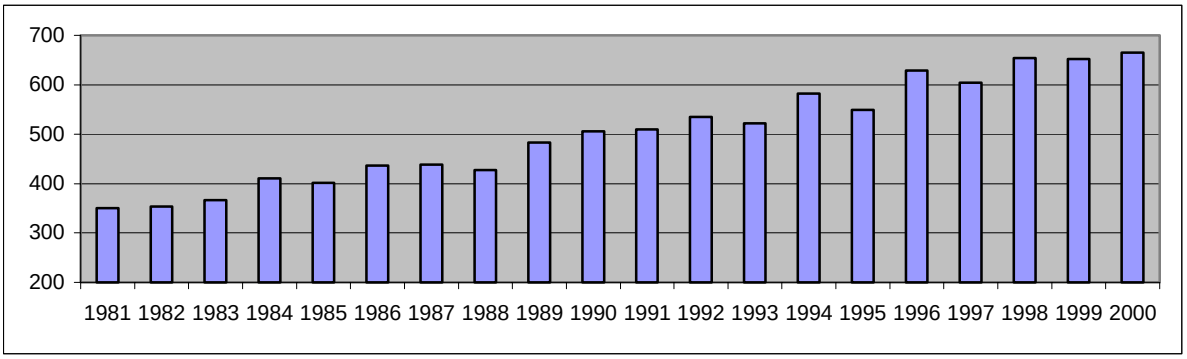


Source: JETRO

The United States is the largest single-country importer of spices, and these imports have grown both steadily and considerably over the past two decades (figure 5). Spice imports in 2002 were some 230,000 tons, valued at nearly $550 million. Much of the current dynamic in U.S. spice consumption and trade relates to “putting more heat” in food, with especially large increases in trade and consumption of pepper, chilies, and mustard seed. The United States is a significant

producer of dehydrated onion and garlic and a small producer of capsicums and mustard seed. For most other spices, consumption is based almost entirely on imports. If dried onion and garlic are included, U.S. domestic production accounts for some 40 percent of apparent consumption. Excluding these items, domestic production accounts for less than 20 percent of consumption. In terms of import value, India is the third largest supplier into the U.S. market, trailing Indonesia and Madagascar.

Figure 5. US spice imports, 1981–2000 *(millions of pounds)*



Source: American Spice Trade Association. Spice Statistics, 2000.

Japan accounts for approximately 10 percent of world spice imports. Due to slow economic growth and other factors, there has been a leveling off in Japanese spice imports in recent years. However, yet this slowdown is probably temporary.[11] Japan is a major importer of ginger, sourced primarily from China and Thailand; and imports modest amounts of pepper, chilies, vanilla, and spice oleoresins. Less than 10 percent of Japan's spice requirements are based on domestic farm production: small quantities of pepper, garlic, and horseradish. India is the third largest supplier to the Japanese market (accounting for 14 percent of volume and 8 percent of value), trailing only China and Malaysia.

There are several other significant spice importers. Singapore imports some 70,000 tons of spices a year, but most of this is for re-export. Other countries with annual spice imports exceeding $50 million include Canada, India, Malaysia, Mexico and Saudi Arabia. Other countries with annual imports of between $15–30 million include Brazil, Hong Kong, Korea, Pakistan, Poland, Russia, and Switzerland. India is a very active supplier to many of these medium-sized and secondary spice markets. Indeed, in recent years developing countries have been the destination for almost half of India's bulk spice exports.

[11] In the late 1990s and early 2000s, the Japanese food service industry suffered from the wider economic recession. Both this industry and the food processing industry were adversely affected by the outbreak of BSE in the country's cattle herd in 2001 and the subsequent decline in consumption of processed meats.

Evolving International Regulatory and Standards Environment

Traditional Foci on Qualitative and Physical Characteristics

International spice trade has a long tradition. Traditional trade names were commonly used that designated a type and origin of the spice and conveyed a set of qualitative *characteristics,* such as color, taste, pungency, and texture. Some of the famous trade names were associated with Indian spices, including the "Malabar pepper," the "Aleppey Green Cardamom," and the "Cochin Dry Ginger." Under the Indian Produce Grading and Marketing Act of 1937, a system of grades was formally designated for some 13 spices, which included the above qualitative characteristics as well as certain *cleanliness parameters,* such as the presence of extraneous matter. Under the Indian Prevention of Food Adulteration (PFA) Act and Rules 1954), these definitions and parameters were laid out for the domestic market. By 1963, they fell under a Compulsory Quality Control and Pre-shipment Inspection System for export.

At the international level, some attention has been given to the formation of specific standards for spices. However, most of the recent sanitary and phytosanitary (SPS) concerns with spices derive from horizontal regulations (that is, on plant protection, food safety, labeling) rather than from standards specifically centered on spices. Under the ISO, a Spices Committee was formed in the early 1960s, with India chairing its secretariat at the time. Between then and the late 1980s, nearly 50 ISO standards were created in relation to spices and condiments. Some of these were definitional. Others dealt with qualitative parameters. Still others related to *analytical methods* for sampling and testing spices for their qualitative or physical characteristics. These ISO standards were voluntary and essentially reflected accepted commercial and technical practices within the industry.

At the level of particular countries, the US Food and Drug Administration (FDA) conducted periodic sampling and testing of imported spices. Under the Code of Federal Regulations, it established maximum levels of natural/unavoidable defects in spices ("defect action levels') and used these to determine whether imports should be detained (for re-grading, cleaning.). These tolerances—related mostly to the presence of extraneous matter or mold—were applied in recognition that it was not economically practical to grow/harvest/process food raw materials that are totally defect free. With a steady increase in US spice imports in the mid-to-late 1960s, and with the bulk of these imports arriving at the port in New York, the FDA office there found itself overwhelmed by the needs for inspection and testing. It approached the American Spice Trade Association (ASTA), requesting it to prepare/adopt a set of cleanliness specifications and take on a substantial role of self-regulation of imports. The original ASTA specifications were adopted in 1969. Several subsequent revisions went beyond the original specifications and also included approved analytical techniques.

At the beginning of 1990, the ASTA specifications were unified with those of the FDA. These ASTA/FDA guidelines were widely used in the trade.[12] Major producing countries generally

[12] They include detailed specifications for all manner of impurities. For example, with regard to ground pepper, the acceptable tolerances include 475 insect fragments per 50 grams and 2 rodent hair fragments per 50 grams. Consignments of pepper pods are permitted up to 1% of insect filth and mold, 1% of "foreign matter," and up to one mg per pound of "mammalian matter" (excreta). The ASTA specifications also indicate the permissible content of ash and moisture.

geared up their systems and facilities to meet these specifications, and importing countries that lacked their own specifications requested that supplies comply with those of ASTA.[13] During the 1990s, individual European countries and the European Spice Association (ESA) came out with their own quality specifications, although these have not yet become uniform. There are some minor differences between some ESA and ASTA specifications.

Until the early-to-mid-1990s, the international spice trade was relatively weakly regulated. Most of the governing standards related to product quality and cleanliness, and most of the detailed specifications were those set by particular manufacturers or food service companies. With refinements in technologies in food processing and related industries, there came to be increased attention to the actual chemical constituents of spices, including the carotene content of paprika, the piperine content of black pepper and the capsaicin content of chilies. These technical parameters increasingly were specified in commercial transactions.

Growing Attention to Food Safety, Plant Health, and Environmental Parameters

With improved understanding of microbiological and chemical hazards in foods, and with growing consumer concerns about these hazards–generally, not yet specifically in relation to spices–the exclusive focus on quality/cleanliness characteristics in spices has come to be regarded as inadequate by regulators and consumer advocates. As with most foods, spices are susceptible to microbial contamination. Bacteria such as salmonella have been found in black pepper, paprika, and other spices. Aflatoxins—toxic chemicals derived from certain molds in food–have been found in chilies, paprika, ginger, nutmeg, and other spices.

In addition, many spices are grown under tropical conditions and are susceptible to insect infestation. Hence, their trade in raw form could pose plant health hazards with the potential introduction of exotic pests in the importing countries. Chemical pesticides are frequently used and may result in the presence of pesticide residues in the harvested spices. Finally, due to naturally occurring phenomena or certain production/post-harvest practices, there is a possibility that certain spices carry with them small amounts of heavy metals (lead, mercury), which, over an extended period of consumption, can be harmful to consumers. Thus, despite the very small quantities that most people consume of spices, there has been increased attention to the potential adverse health effects of spice consumption associated with the above hazards.

Beginning in the early 1990s, there has been a gradual incorporation of *health and hygiene specifications* in commercial supply chains and, to a lesser extent, in the regulatory oversight of international spice trade. The vast majority of these product and process standards have not been designed specifically for spices. Rather, the process has involved the increased application of an array of general food-related standards to the field of spices. Hence, spices are increasingly being brought within the fold of regulatory and private governance over microbiological contamination, pesticide use and maximum residue limits (MRLs), food additives, and food labeling.

Despite efforts to harmonize international standards in these and related areas under the *Codex Alimentarius*, there, in fact, remain significant differences in the specific rules and tolerance levels related to these dimensions or hazards among the major spice-importing countries. There also are differences among countries in relation to the procedures used by inspection and other agencies for sampling and testing of imported products. Both Japan and the United States apply

[13] This is still common in relation to Japanese imports.

the ASTA analytical approaches. Different countries in the EU apply different sampling and testing procedures.

In addition, there also are differences among countries with regard to the acceptable technologies that can be used to address particular food safety or plant health risks. For example, sterilization measures can be taken to address microbiological risks in spices. While in the United States use of ethylene oxide (ETO) sterilization and irradiation are acceptable, ETO measures are banned in Australia and the EU because of their adverse environmental impact, and irradiation has not found consumer acceptance in either Japan or much of the EU.[14] For these markets, there is a preference for steam sterilization, although this may adversely affect spice quality (reducing color and volatile oil) and is a much more expensive approach for exporters.

A similar situation exists with regard to methods of spice product fumigation to minimize plant health risks. When supplying Australia, Indian exporters are requested to undertake especially intensive fumigation using methyl bromide. In contrast, this fumigant is already banned for use in/for the European Union (as called for by 2010 under the Montreal Protocol) and is being phased out in the United States. The alternative technology, using aluminum phosphate, is far more time consuming and expensive for exporters.[15] Hence, there appear to be certain inconsistencies between environmental and SPS objectives, particularly in a situation in which many if not most international buyers are not prepared to pay higher prices to compensate for the use of more environmentally friendly sterilization and fumigation technologies.

With regard to aflatoxin, the specific standards and level of regulatory attention to these standards vary among countries. Most countries have no specific standards for aflatoxin in spices. However, the prevailing standards for agricultural raw materials (cereals, nuts for further processing) apparently are being applied to spices as well. These standards range from 30 ppb in India, to 20 ppb in the United States, 10 ppb (for B1 aflatoxin) in Japan, to 10 ppb (and 5 ppb for B1) in the European Union. The Indian standard is largely unenforced in the domestic market, and very little official attention is given by US authorities to aflatoxin in spice imports entering the United States. There has been periodic (and recently, growing) attention to aflatoxin in spice imports among selected EU countries, although it has received far less attention than has aflatoxin in other food products especially peanuts, pistachios, and other types of edible nuts.[16] In 2001 the European Commission amended a 1997 regulation dealing with contaminants in certain foodstuffs to make specific reference to the hazard of aflatoxin in spices and to establish a tolerance level of 10 ppb (and 5 ppb specifically for B1 type of aflatoxin). [17] Recently, certain EU members have also begun to track the level of ochratoxin in spices and other commodities.

[14] In the United States, herbs and spices are the most widely irradiated food products, especially when used as meat flavorings.

[15] Using methyl bromide, the task is complete within 24 hours. Using aluminum phosphate takes 5–7 days, thus requiring the exporter to have a larger fumigation chamber and bear extra financing costs on product inventory.

[16] Between 2000 and 2002, there was a very large increase in the number of regulatory detentions and "alerts" related to food safety concerns on imports. In part, this rise reflected higher levels of inspection by Member States. However, there was not a parallel increase in the number of detentions for spices/herbs. The number of alerts/notifications related to these products in 2000, 2001, and 2002 were 21, 35, and 30, respectively.

[17] In 1997 there was a coordinated EU surveillance program to assess the presence of aflatoxin in certain spices including nutmeg, black pepper, chili/chili powder, and paprika powder. Some 3100 samples were taken. The presence of aflatoxin was rare in black pepper but was found in more than half of the samples of the other products.

With regard to pesticide residues, there are very few Codex standards for MRLs related to agrochemical use on spices.[18] The exceptions are *cartap* in ginger, and inorganic bromide and hydrogen phosphide in all spices. Individual countries have set their own MRLs, generally for particular spices that are grown in small quantities in their own countries. For example, there are some 35 official MRLs for spices the United States, the vast majority of which relate to chemical use on capsicums/chilies. Australia, Germany, and Spain have similar numbers (30 to 40) of official MRLs for spices, again centered around a few individual crops.[19] Thus far, no MRLs have been set for spices at the EU level, although the Commission is authorized to do so. The existing MRLs for spices generally vary among countries. As an example, for ethion, an insecticide used on chilies, it is 0.05 for Australia, 0.1 ppm in Spain and 1.0 ppm in the US.

The enforcement of pesticide residue limits in spices also varies among countries. These limits have not been an area of priority for the USFDA's food import inspection system; consequently, there are relatively few detentions/rejections of spices for this reason.[20] Within Europe, there seems to have been more inspection attention to pesticide residues in spices among German and Spanish authorities than elsewhere. Within Asia, pesticide residue issues in spices have been raised for imports into Australia, not yet generally elsewhere. While spice consumption is on the rise in industrial countries, per capita consumption levels are still tiny compared with most foods, including foods such as fresh fruits and vegetables, for which concerns about consumer health effects of pesticide residues have been the most prominent.[21] In industrial countries, the actual health risks associated with pesticide residues in spices are infinitesimally small. Nevertheless, within these countries, there is an ongoing process to harmonize and tighten standards related to pesticide use and pesticide residues in food more generally. To varying degrees, this tightening is beginning to impact on the trade in and regulatory oversight of spices.

Over the past two years, there has been increased attention to the presence of artificial colorant additives in ground chilies and in chili or curry powder. One such additive is Sudan 1, a red dye that has normally been used for coloring solvents, waxes, and shoe and floor polishes. Its presence in food had been prohibited within the European Union since 1997, because animal studies have shown that Sudan 1 is a potential carcinogen. Since mid-2003, consignments of dried and crushed or ground chili entering the EU must be accompanied by an analytical report showing that they have been tested and are free of Sudan 1. With effect from January 2004, this requirement was extended to cover other chemical dyes and to be applied for other imported products, including sauces or chutney containing chili or curry powder as ingredients.[22] Consignments found to contain Sudan 1 or other illegal chemical dyes are destroyed. As will be seen later, a large number of consignments of Indian products have been rejected because of the detected presence of this additive.

[18] For comparison, there are hundreds or even thousands of MRLs established for combinations of fruits/vegetables and chemically active ingredients.

[19] Japan has 16 MRLs related to particular pesticides and spices.

[20] Spices are not a major item in USFDA detentions, of which there are generally 20–40 per month. Between June 2002 and May 2003, 134 consignments of Indian spices/flavorings were detained (out of a total of 383 detentions for such products from all sources). The majority of these detentions were due to "filth" requiring some re-cleaning/processing. A minority of cases involved unsafe colorants or improper labeling. The latter products were not allowed into the US.

[21] For example, per capita spice consumption in the U.S. is estimated to be 3.7 pounds (ASTA 2000). Compare this with per capita vegetable consumption of more than 400 pounds and per capita fruit consumption of 300 pounds.

[22] European Commission Decision 2004/92/EC.

In addition to the somewhat greater attention to product standards, there is a trend toward greater commercial attention to the application of improved hygienic practices and management systems. In this field, some particular spice-specific guidelines have been prepared under Codex. These are found in the "Guide for the Microbiological Quality of Spices and Herbs Used in Processed Meat and Poultry Products" (1991), which focuses on proper treatment methods, and the Code for Hygienic Practice for Spices and Dried Aromatic Plants **(**1995), which provides an array of guidelines for production and packing facilities, pest control, storage, and personal hygiene of workers. There are some industry guidelines, as with the Code of Hygienic Practice for Pepper and Other Spices, prepared by the International Pepper Community (IPC). More widespread adoption of ISO 9000 systems and (certified) HACCP plans also is taking place within the industry.

For those buyers for which the latter systems are considered important, it has become routine to conduct annual or otherwise periodic factory quality and safety assessments. These buyer audits—which may occur once or twice per year—include reviews of management policies, personnel training procedures, cleaning/sanitation/pest management procedures, HACCP procedures, and other process controls. Detailed audits might also be undertaken on the physical facilities and detailed features of hygiene throughout the procurement, handling, processing, and packing processes. Shortcomings and needed action steps are recommended or required.[23]

Comparison of Prevailing Official and Commercial Requirements

Tables 4-6 summarize the operative requirements for entering various international markets for chilies, black pepper, and spice oils and oleoresins. These tables compare and contrast the regulatory enforcement and the commercial importance of traditional quality/cleanliness parameters, various health/hygiene requirements, and phytosanitary requirements. These results are based on the experiences/perceptions of Indian spice exporters, as represented by the Indian Spice Exporters Association.

The codes used in the tables signify whether the provision is legally required and enforced and whether it is required or advantageous for commercial purposes. The codes used are:

Legal Requirement

A Legally mandated and strict enforcement
B Legally mandated and spot/sample enforcement
C Legally mandated yet minimal enforcement
D Not legally mandated

Commercial Requirement

4 Fully required for commercial purposes
3 Mostly required for commercial purposes (relaxed at certain times)
2 Not required yet somewhat beneficial for commercial purposes
1 Not required and unnecessary for commercial purposes.

[23] With regard to trade with the U.S. and compliance with its new "Bioterrorism Act," suppliers are now asked to address an array of food security concerns including access to factories and laboratories and preventive measures against product tampering and tracking.

India's largest markets for chilies are in South and East Asia. There, quality parameters remain the predominant standards. In some countries, there are some regulations related to pesticide residues and aflatoxin; yet, minimal official enforcement and little, if any, commercial importance are devoted to these variables. The United States is the next most important external market for chilies. For that market, there is strong official and commercial attention to product cleanliness, labeling for allergens,[24] and proper fumigation. Very modest attention is given to other food safety variables for this commodity. Australia and the EU are secondary markets for Indian chilies. For the EU, there has been increased official attention to an array of food safety issues (including pesticide residues, aflatoxin, and heavy metals),[25] while for Australia the most strict attention is given to plant health matters.

Table 4. Process and system requirements for dry chilies

	USA	*South Asia*	*East Asia*	*EU*	*Australia*
"Quality"					
Compliance with physical + chemical parameters	D4	D4	D4	D3	D4
Compliance with cleanliness parameters	A3	D4	D4	D3	D4
ISO 9000/1 certification	D1	D1	D1	D3	D1
"Food Safety"					
Compliance with MRLs	C2	C2	C2	B2	B3
Compliance with aflatoxin limits	C2	C1	C1	B2	C2
Certified absence of additives	D2	D1	D2	A4	D2
Compliance heavy metal limits	D2	D1	D1	B1	D1
HACCP program requirement	D1	D2	D2	D2	D2
Allergen policy	C4	D1	D1	C4	D1
"Plant Health"					
Fumigation requirements	A4	D2	D2	D2	D4
Phytosanitary Certificate	D1	D1	D1	D1	A2

Source: Author, based on exporter interviews.

Within the EU, there are apparently significant differences in the regulatory interest and intensity of oversight for particular issues. For example, Indian exporters report that each and every consignment of dry or ground chilies entering Spain is subjected to testing for pesticide residues. For Germany, a sample of such consignments (perhaps one in six) is so tested. In contrast, in the UK, most pesticide residue testing is done of products at the retail level, and spices are not generally included in the surveillance program.

With regard to black pepper, there is a somewhat lower level of official requirements and scrutiny, in part because agrochemicals are much less commonly used in black pepper production and because there is no aflatoxin risk with this commodity. The United States has been India's largest market for black pepper since the collapse of the Soviet Union. Relatively strict official (and private) attention is given to cleanliness parameters, proper fumigation, and the submission of documentation of inspection by the Indian Export Inspection Agency. Strong commercial attention is also given to compliance with microbiological parameters and measures to prevent contamination by potential allergens. In the EU, official attention centers on entirely

[24] Some spice seeds are known to be allergens.

[25] The U.S. apparently has given increased attention to the presence of heavy metals in dried onion and garlic, in part due to past practices in China, which involved drying these spices on coal.

different things (heavy metals, additives, and pesticide residues), although commercial requirements are relatively similar to those in the United States.[26] Within Asia, there are again differences in the focus of regulators, yet more or less similar concerns on the part of commercial partners.

Table 5. Process and system requirements for whole/ground black pepper

	US/Canada	*EU*	*Singapore*	*Japan*	*Australia*
"Quality"					
Compliance with physical + chemical parameters	D4	D4	D4	D4	D4
Compliance with cleanliness parameters	A4	D4	D4	D4	D4
ISO 9000/1 certification	D1	D3	D2	D2	D2
Export Inspection Agency Certificate	A4	D1	D1	D1	D1
"Food Safety"					
Compliance with MRLs	D2	B2	D1	C2	B3
Compliance with microbiological limits	D4	D4	D4	D4	D4
HACCP program requirement	D2	D2	D2	D2	D2
Allergen Policy	D4	D4	D2	D2	D2
Compliance heavy metal limits	D2	C2	C2	C2	D4
Plant Health					
Phytosanitary Certificate	D1	D1	D1	D1	A1
Fumigation requirements	A4	D4	D4	D4	D4

Source: Author, based on exporter interviews

Table 6 provides the summary for spice oils and oleoresins, an increasingly important part of India's spice trade and one in which it claims a dominant international position. The primary legal requirement relates to proper labeling, although in the EU there is also some testing for pesticide residues. There are very strict commercial requirements with regard to physical properties, microbiological limits, active ingredient specifications, and cleanliness. The extent of buyer attention to certified HACCP or ISO 9000 systems varies among regions.

Table 6. Process and system requirements for spice oils/oleoresins

	US/Canada	*European Union*	*Japan*
"Quality"			
Compliance with physical + chemical parameters	D4	D4	D4
ISO 9000/1 certification	D1	D3	D1
"Food Safety"			
Compliance with MRLs	D2	B4	D3
Compliance with microbiological limits	D4	D4	D4
Compliance with heavy metal limits	D2	D3	D2
Compliance with active ingredient limits	D4	D4	D4
Other			
Labeling requirements	A4	A4	A4
HACCP program requirement	D2	D2	D2

Source: Author, based on exporter interviews

[26] With the exception of more weight given to ISO 9000 certification.

Structure of the Indian Spice Supply Chain and Exports

Production

In 2001–02, India produced an estimated 3.4 million tons of spices on a planted area of 2.5 million hectares (ha). The country is by far the largest producer of spices in the world. India produces a diverse array of spices, some in very large quantities. Approximately one-third of Indian spice production and planted area is for chilies, grown for their color and pungency. A broad range of varieties comprise the more than one million tons of India's chilies output. Other spices grown in very volumes include turmeric (some 650,000 tons), garlic (520,000 tons), ginger (315,000 tons), and an array of spice seeds, including coriander (320,000 tons) and cumin (205,000 tons). India is the world's largest producer of each of these spices. India is also a significant producer of black pepper and cardamom and a relatively small producer of a broad group of other spices (including vanilla, cloves, nutmeg, and cinnamon).

Spices are produced in all of India's 28 states or territories. Andhra Pradesh is the leading producing area for chilies, turmeric, and several spice seeds. The state of Kerala is the leading producing area for black pepper and small cardamom. Garlic is grown primarily in Madhya Pradesh and Gujarat. Ginger is produced in large quantities in many states. With a few exceptions (for which production support is provided by the India Spices Board), spice production is supported by State (rather than the Federal) Departments of Agriculture.

The bulk of Indian spice production is undertaken on very small plots, often on hilly tracts of land. An estimated 2.5 to 3.0 million smallholder households grow one or more spices for consumption and/or sale. Individual plantings are typically a fraction of a hectare and fit into various types of cultivation patterns (table 7). For example, black pepper is typically grown as an intercrop with coconut and fruit trees.[27] Chilies are frequently grown as part of a rotation with other crops, especially cotton. A spice such as nutmeg comes from a perennial evergreen tree. Very little spice production is undertaken on a commercial basis on any significant scale. It is estimated that some 15 percent–20 percent of national black pepper production is done on medium- or larger-scale farms. There is also some medium-scale (5 to 10 acres) production of chilies and selected other spices.

Table 7. Estimated number of Indian growers and average planted area for selected spices

	Estimated no. of growers	*Average planted area (ha)*
Ginger	700,000	0.10
Black Pepper	650,000	0.27
Chilies	540,000	0.83
Turmeric	400,000	0.36
Cardamom	57,000	1.8
Source: India Spices Board.		

Average yields in India are comparatively quite low, although some gains have been made over the past decade. For ginger, the average yield for India is some 3300 kg/ha, compared with 7750 kg./ha in Indonesia and 11,600 kg./ha in China. For garlic, the comparative average yields are 4167 kg/ha in India vs. 14,479 kg./ha in China. Guatemala regularly obtains yields for small cardamom that are three times those for India. The intercropping of spices is one factor in the

[27] In the hills of Kerala, where some 94% of individual landholdings are less than one ha.

comparatively low yields for India; yet, also important are (1) the common planting of spices on marginal/hilly areas in India; (2) the inadequate supply of quality planting material for some spices; and (3) losses due to pests, diseases, and drought.[28]

India is unique among major spice-exporting countries in that the bulk of its spice production is used in the domestic market. In recent years, approximately 90 percent of Indian spice production has been used in the domestic market.[29] The share varies among different spices. For example, for garlic and ginger, the share of production consumed domestically is 99 percent and 97 percent, respectively. Some 93 percent of chilies and turmeric production is consumed domestically. A somewhat lower, yet still predominant, share of spice seed production–85 percent–is consumed domestically. Traditionally, and until very recently, black pepper was the primary exception to this pattern. For many years, a large majority of black pepper output was exported. However, with increased domestic demand and with recent intense price competition from Vietnam, more of India's black pepper production has been consumed locally. In 2003 some 35 percent of production was exported in raw form, while an additional 10 percent–15 percent of production was processed and exported in some value-added form.[30]

The domestic market dominates not only the volume but also the value of spice production and trade. It is estimated that the farm-gate and retail values of spices for the domestic market are in the order of $2.65 billion and $4.0 billion, respectively. For comparison, the total value of Indian bulk and value-added spice products was some $330 million in 2002–03, with a farm-gate value of some $200–225 million.

Given this dominance of the domestic market, little spice production in India is actually dedicated for the export market. Rather, it is generally sold through a network of upcountry traders or marketplaces through which supplies are aggregated and subsequently sold to wholesalers or exporters (figure 6). As will be discussed below, for some spices, this pattern has begun to change in recent years with somewhat more dedicated export production, variants of contract farming, and some separation of supplies to be directed through different marketing channels. Given the overall structure of production and use of Indian spices, only a subset of the 2.5 million or more spice growers are regularly involved in the export supply chain. The author's estimate would be in the vicinity of 500,000 households with the large majority of these being either Kerala black pepper producers or Andhra Pradesh chili growers.

Trade and Distribution

A variety of domestic standards apply to spices; yet, these standards are not really compatible with international standards. The former include mandatory provisions under the Prevention of Food Adulteration Act (PFA), the voluntary grading system for spices operated under the Ministry of Agriculture, and provisions under the Export Inspection and Quality Control Act. The domestic standards relate to the physical characteristics and cleanliness of spices and assign these various grades. They do not address microbiological or chemical hazards. Neither the PFA

[28] Radkahkishnan and others (2002) discuss a range of factors contributing to relatively low black pepper yields.

[29] Spices Board estimates are slightly higher than this but do not take into account the production used as raw materials in spice oil/oleoresin processing for export.

[30] For comparison, in 2003 Vietnam exported 98% of its black pepper production. The pertinent shares for Malaysia, Indonesia, and Brazil were 93%, 83%, and 82%, respectively (International Pepper Community).

nor the Agmark standards make any references to pesticides.[31] There is relatively little regulatory enforcement capacity, even for the cleanliness standards, and those penalties that are applied are inadequate as deterrents (Kitlu 2000).

India has approximately 1700 registered spice exporters and more than 300 registered processors of spices and condiments. However, most of these firms are very small or irregular participants in the export trade. The largest 100 companies account for over 80 percent of spice exports, with only the top 10 companies being responsible for about one-half of the total trade. Most spice exporters are Indian-owned and typically are family-based companies that have been in this business for several generations, both in the domestic market and through sales abroad. Over the past decade, several major international companies (including the world leader, McCormick) have entered the industry through joint ventures.

The overall trend is toward a growing concentration in the handling of India's spice exports. Significant contributing factors have been the (1) changing product composition of India's spice trade, especially the contraction of its trade in raw black pepper (in which hundreds of smaller firms were active for export), and (2) growing importance of value-added manufactured products within the overall spice export basket, for which only a handful of very sophisticated firms account for the bulk of sales.[32] Importantly for this Briefing Note, one cannot attribute the trend of increased concentration to the effects of increasingly stringent SPS standards by certain international buyers or importing countries. The large number of black pepper traders who have increasingly directed their business to the Indian domestic market were not driven out of export markets by rising standards. Rather, they could not compete with Vietnamese supplies on price or simply have found Indian domestic prices more attractive than international prices. Even though Vietnamese black pepper is frequently of a lower quality and cleanliness standard than that of India, price has increasingly driven international sourcing patterns.

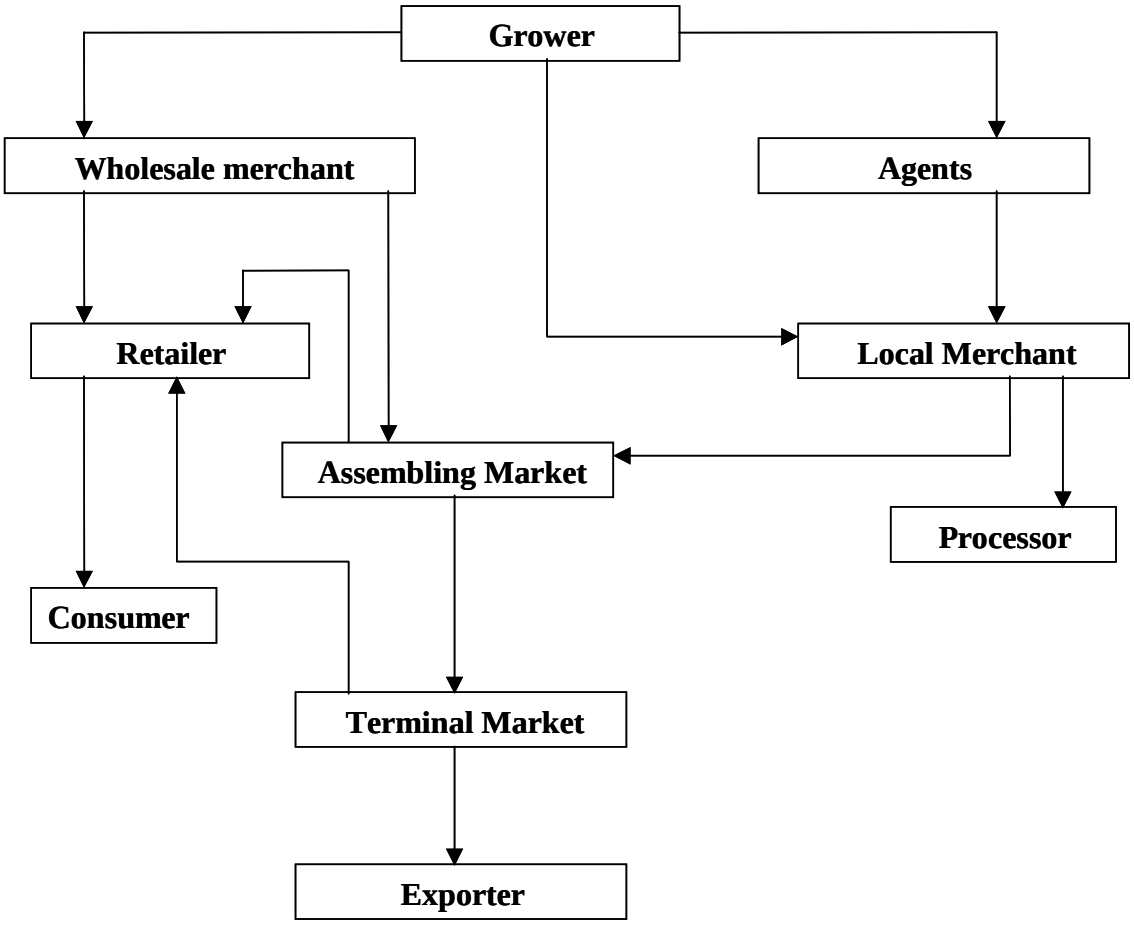
Over the past decade, there has been a major change in the product composition of India's spice exports (table 8). Historically, this trade was led by bulk black pepper. This product accounted for almost two-thirds of the value of India's total spice exports during the mid-1980s. As recently as the latter half of the 1990s, this product still accounted for more than one-third of the total value and, with favorable price conditions, accounted for 43 percent of the value of trade in 1999–2000. Since then, its contribution to total Indian spice exports has declined dramatically, accounting for just 3 percent of the value in 2002–03. Rather than exporting bulk black pepper, India has increasingly exported value-added pepper products, including pepper powder, dehydrated green pepper, pepper in brine, and pepper oil and oleoresin.[33]

[31] The Agmark standards initially were prescribed under the Agricultural Produce (Grading and Marketing) Act of 1937 and are periodically revised.

[32] The Spices Board of India indicates the export share of the 10 leading companies is 83% for black pepper and 87% for spice oils/oleoresins. In contrast, the trade in chilies and turmeric is more fragmented with the 10 leading companies totaling export share of 33% and 35%, respectively.

[33] For the past two seasons, the trade of these value-added pepper products has exceeded that of bulk black pepper exports. India is now a net importer of whole black pepper.

Figure 6. Marketing channels for Indian chilies



Source: Spices Board of India.

Both in quantity and value terms, chilies have recently surpassed black pepper as India's leading bulk spice export. The other major change has been the rapidly increased trade and share of trade in spice oils and oleoresins, especially during the past five years. A broad array of other spices, especially turmeric and various spice seeds, have more or less retained their shares of India's total spice exports. With the recent contraction of the bulk pepper trade, and with the expansion in trade in various spice oils, oleoresins, and powders, India's trade in value-added spice products is now approaching its level of trade in bulk spices (figure 7) and will almost certainly surpass that in the coming years. India's trade in value-added spice products exceeded $200 million for the first time in 2004/05.

Table 8. Changing product composition of Indian spice exports *(% of totals)**

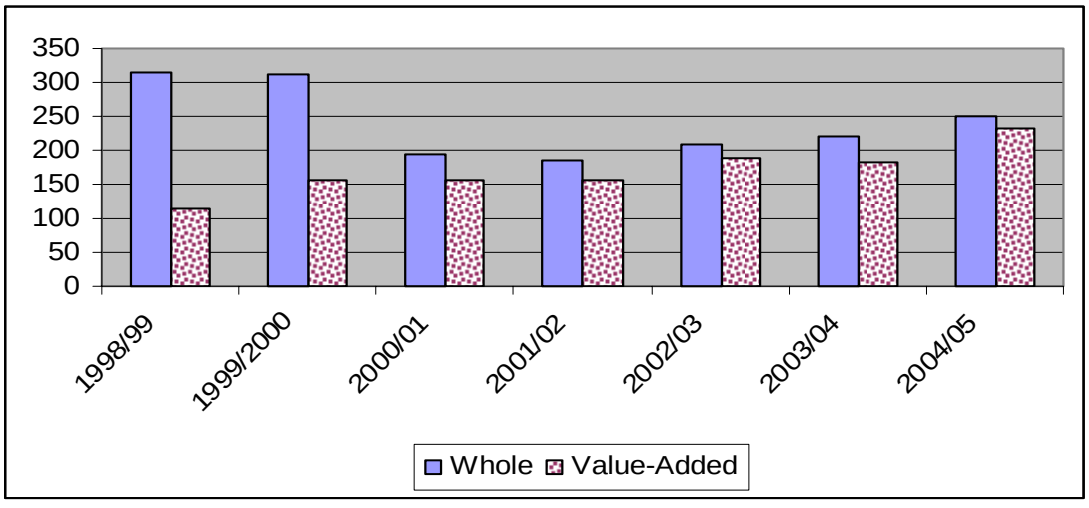
	1994–95		*1998–99*		*2004-5*	
	Quantity	*Value*	*Quantity*	*Value*	*Quantity*	*Value*
Whole black pepper	23	36	15	35	2	3
Chilies	13	9	28	14	42	26
Turmeric	18	7	15	7	13	8
Spice seeds	20	12	22	9	25	14
Other spices and powders	20	19	15	9	10	11
Curry powder	3	2	2	2	2	3
Mint oil	1	1	2	7	1	8
Spice oils and oleoresins	1	14	1	17	5	27
Total values Quantity (t) Value (US$ millions)	155,008 T	$198 M	240,662 T	$429 M	330,219 T	$434 M

*These data differ somewhat from the Spices Board aggregates as they exclude menthol products.
Source: Spices Board of India.

Recent years have also seen some contraction in India's exports of cardamom, garlic, tamarind, and nutmeg, primarily due to increased price-based competition from selected other countries. The large and growing domestic demand for these (and other) spices has put upward pressures on domestic prices, eroding the (price) competitiveness of Indian supplies on world markets.

India exports spices to some 120 countries. During the 1980s, the Soviet Union was the largest single export market for Indian spices, followed by the United States, with relatively small exports elsewhere. The collapse of the Soviet Union, differential demand patterns, improved access to certain markets, and the changing product composition of the trade have resulted in a very different geographical pattern in India's trade.

Figure 7. Indian spice exports in whole vs. value-added forms *($ millions)*



Source: Data from Spices Board of India.

The destination of India's trade in bulk spices is now evenly split between high-income and developing countries, with the trend in recent years increasingly geared toward the latter. Market liberalization and growing demand in those countries, with growing price-based competition for certain spices traded to high-income countries (especially black pepper), are the principle factors in this shift. The United States has remained the largest market for Indian black pepper and is

also a major outlet for Indian chilies. The bulk of the chilies trade, however, has been geared toward other South Asian countries, especially Bangladesh, Pakistan, and Sri Lanka. For cardamom and turmeric, the Middle East is the primary market.

In contrast with the pattern for bulk spices, some 80 percent of India's expanding trade in value-added products is geared toward high-income markets, especially the EU, Japan, and the United States. These products are sold to food and other product manufacturers and to elements in the food service/catering business. Table 9 below summarizes the geographical composition of India's spices trade.

In 2001–02 EU countries accounted for just over 19 percent of the value of India's spice exports. The largest part of this trade consisted of value-added products ($43 million) rather than bulk spices ($28 million). India has never been a very large supplier of bulk spices to Western Europe due to a combination of price competition from other suppliers and particular quality/variety preferences (preferring more mild chilies than those normally produced in India). As will be noted below, an additional factor contributing to the relatively modest Indian market share within Europe (recently) has been concerns about pesticide residues and other food safety aspects in spices in certain countries.

Table 9. Destinations for Indian spice and spice product exports
(% of export value, 2001–02)

	Bulk spices	*Value-added products*	*Total*
NAFTA[a]	27.5	35.2	30.1
Developing Asia[b]	36.7	10.9	28.0
European Union	15.3	27.2	19.3
High-income Asia[c]	8.5	17.2	11.5
Other[d]	13.1	9.5	11.2

Source: Derived from Spices Board of India data.
Notes:
a Mostly the United States, although some trade also with Canada and Mexico.
b Low and middle income countries of South and East Asia plus the Middle East.
c Australia, Hong Kong, Japan, Singapore, and Taiwan.
d Africa, Eastern Europe, Latin America, and CIS countries.

Since the mid-1990s, to meet growing domestic demand and to take advantage of less expensive international supplies for certain commodities, there has been a significant increase in India's spice *imports.* The volume of spice imports has increased from less than 25,000 tons in 1995–96 to nearly 120,000 tons in 2002–03. The latter figure is approximately one-half of India's spice exports. In value terms, Indian spice imports have increased from $22 million in 1995–96 to nearly $120 million in 2002–03. Compare this with whole spice exports valued at $152 million in that year. If present trends continue, India will soon be a net importer of whole spices.

The most significant imports are garlic, ginger, cloves, and black pepper. India is a substantial net importer of the first three items (as well as cardamom) and, if current trends continue, will soon be a net importer of black pepper. This growth in imports has taken place despite very high official tariffs on imported spices into India (generally 70 percent or more). Spice imports are duty free if they are to be re-exported with some value-addition. Also, as part of a trade agreement, spices from Sri Lanka enter India duty free. However, a considerable amount of recent imports have not been re-exported nor obtained from Sri Lankan producer/exporters.

Challenges, Strategies, and Costs of Compliance with Sanitary and Phytosanitary Standards

Over centuries, the Indian spice industry developed a reputation for reliable supply and good quality. Some particular varieties and geographical origins of supply within India were considered among the best in the world. This reputation remained strong into and throughout the twentieth century. India assumed a leadership position in the trade and among technicians and scientists working on spice production, post-harvest, and processing issues. The Agmark grades/standards, initiated in 1937, were among the most developed spice standards in the world and served as a basis for subsequent ISO standards.[34] India's system of compulsory inspection introduced in the early 1960s helped to ensure consistent and predictable quality of its spices sold abroad. This system remained in place until the mid-1980s.

Over the past decade and a half, the industry has experienced a variety of commercial and regulatory challenges. On the commercial side, there has been increased competition to sell certain commodities on international markets. This competition has periodically displaced parts of the Indian export basket, primarily due to local costs or prices. The dominant and relatively fast-growing Indian domestic market has created a strong and stable pull on Indian spice production, raising the costs of available raw materials for selected spices above the costs prevailing in China, Indonesia, Vietnam and elsewhere. The spice trade has long been a volatile one, and it is not possible to say whether relatively recent declines in India's world market share of several bulk spices will be a permanent trend. Even so, the steady growth in its domestic market suggests that this may well be the case. There is a growing recognition that India's future growth potential for spice exports lies most significantly in value-added and consumer products as opposed to bulk spices.

In relation to product quality and SPS matters, the Indian spice industry has faced accumulating challenges since the mid-1980s. Several events/circumstances have resulted in the temporary disruption of trade or the (sustained) contraction of trade directed to certain markets. Some events have had an adverse effect on the overall reputation of the Indian industry or at least that of certain segments in the industry. The responses—by government and by the private sector—to these events/circumstances have taken various forms. Some involved measures to address very specific problems. Other measures were more in the form of general improvements in supply chain and quality assurance management systems to better align the industry with prevailing practices in the food (and spice/seasonings) industry worldwide. The discussion that follows highlights core challenges, varied adjustments and investments that were made, costs associated with some of these investments, and outstanding issues that require further attention.

Black Pepper Cleanliness

Between December 1986 and May 1987, 20 of 60 shipments of whole black pepper that were sampled by the US Food and Drug Administration were detained for "filth," especially insects and mammalian excreta. The problem was not limited to one or a few suppliers. The 20 detentions represented 11different shippers, including some of the larger suppliers. As a result, the US placed black pepper from India under automatic detention in July 1987, and trade was

[34] The Agmark standards formerly were enforced by the Ministry of Agriculture but have been voluntary since the 1980s.

disrupted. Early 1988 discussions between the FDA and the GOI/Ministry of Commerce resulted in the creation of a black pepper certification program, to be implemented by India's Export Inspection Council. The EIC would test each consignment to be exported to the U.S., permit only those that met FDA's requirements to be shipped, and attach a certificate stating such to each consignment. The US would lift its automatic detention and subsequently audit sample only certified lots to ensure the effectiveness of the clearance program. In addition to normal certificates of inspection, consignments meant for export to the US were also to contain a separate certificate showing test results related to salmonella, insect filth and/or mold, mammalian excreta, and foreign matter. Trade was resumed.

Addressing quality/cleanliness problems in black pepper was among the first tasks of the Spices Board, established in 1986. The widespread presence of mammalian excreta in black pepper derived from the traditional drying methods of farmers. They applied cow dung to bamboo mats to preserve these mats. The pepper was being commonly sun-dried on such mats. An alternative approach was found that involved applying a paper fenugreek (a spice) paste to the mats that preserved them for extended use yet that did not affect the quality of the black pepper. A program was developed to distribute such mats, at a subsidized price, to smallholder pepper growers and to make farmers aware of the problem associated with the traditional practices. The black pepper cleanliness issue also was a catalyst for the Spices Board to establish, in 1989, a Quality Evaluation Laboratory, to monitor the quality of spices being exported. Over the next several years, this laboratory was equipped to conduct basic tests on the chemical and physical properties of spices and gauge compliance with ASTA/FDA cleanliness standards.

In the late 1980s and early 1990s, several spice exporters began to upgrade their black pepper cleaning and preparation systems. Previously, virtually all operations had been done by hand, with pepper being shaken through sieves, hand-washed, sun-dried, and hand-packed in sacks. Companies invested in mechanical cleaning, washing, drying, and packing equipment, with some of their US and other buyers offering modest price premiums for this cleaner and better-graded product. Another incentive to undertake this investment came from the EIC, which in 1991 introduced an "in-process quality control" option. This option enabled firms to have their black pepper cleaning/processing/packing systems and facilities inspected and precertified, thereby avoiding having to have each export consignment certified by the Council. This arrangement involved lower inspection and other transaction costs for the qualified firms. The larger black pepper exporters, which were making improvements in their systems, became certified under this program in the early 1990s and thereafter. USFDA concern about possible salmonella or other microbiological contamination of black pepper was a strong catalyst for several exporters and other firms to invest, in the mid-to-late 1990s, in sterilization facilities and equipment, especially involving use of ethylene oxide.

The combination of increased farmer awareness, improved post-harvest practices, company investment in processing/cleaning/sterilization equipment and improved management practices, and the EIC inspection system has helped to limit the further incidence of quality/cleanliness problems in black pepper over the past decade. Many of the smaller trading companies made little or no such investments; hence, a certain proportion of India's supply falls below necessary standards. For example, from 1995–96 to 2002–03, the proportion of consignments initially

rejected by the EIC has generally been 10 percent–20 percent.[35] In most years, the USFDA has retained dozens of Indian black pepper consignments because of "filth" or suspected microbiological contamination, although most such consignments were subsequently allowed in the US following additional treatments undertaken by the importers.

Since the mid-1990s, these general quality/cleanliness/hygiene concerns, together with more general practices within the international spice industry, have stimulated a growing number of industry spice companies to adopt HACCP, ISO 9000, and other certified food safety or quality assurance management systems By 2003, some 14 units were certified under ISO 9000, and 19 companies were approved under the "Indian Spices Logo", a program initiated by the Spices Board to promote good hygiene and manufacturing practices within the industry.

Not all firms have made sufficient advances in their quality assurance and hygiene systems. Relative to other countries, large number of consignments of Indian bulk and ground spice products continue to be rejected by the USFDA due to the presence of filth or microbiological contamination. Between May 2003 and April 2004, many dozen consignments were rejected on these grounds. They included a broad range of products including coriander, fennel, sesame, cumin, black pepper, and the powders of most of these spices. More spice consignments were rejected from India than from any other source.

Still, food safety issues have not been the reason why India has recently lost its share of the black pepper market in the United States or elsewhere. India has lost market share to other countries that have relatively greater problems with product quality (Vietnam) or microbiological contamination (salmonella in Brazilian supplies). Price has been the dominant factor in the black pepper trade, and India has been able to retain only those buyers that have very specific recipes or formulations that they do not want to adjust by using pepper supplied from elsewhere. Whether this loss of international market share has had much of a welfare effect is not clear. The domestic market has easily absorbed the available supply, frequently at prices above international market levels. Both traders and producers indicate that the domestic market is more stable and that it should continue to expand. Domestic producers would be adversely affected if Vietnamese or other international supply would accelerate and substantially larger low-cost supplies were to enter the domestic consumer market via imports. Nevertheless, past history shows this international market to be prone to temporary booms and busts so one should not draw too fine conclusions from near-term developments.

Chilies, Pesticide Residues, and Aflatoxin

Chilies are one of the few spices produced in India for which agrochemicals are commonly used. Chilies are vulnerable to a variety of pests and diseases. They also are commonly grown in rotation with cotton and in locations in which other commercial crops are grown (including tobacco, wheat, and vegetables) for which agrochemicals are commonly used as well. Some agrochemical use occurs in the production of coriander, fennel, and other spice seeds. Agrochemicals are rarely used or used in very small doses for black pepper, ginger, and other major spices grown in India.

While there have been periodic concerns or campaigns to address the risks that agrochemicals pose to farmers and agricultural workers in India, until the 1990s, there has not been much

[35] Many of these consignments were subsequently re-cleaned/reprocessed and then re-inspected (and cleared) by the EIC.

mention of pesticide residue concerns in spices. This began to change in the early 1990s in the context of the broader program within the European Union to reassess and reregister agrochemicals and to harmonize (and reduce) the permissible maximum residue limits (MRLs) in food products. Initially, questions were raised about spices by regulators or buyers in Germany. While Germany is Europe's largest market for spices, it was never a major outlet for Indian spices, especially for chilies. In 1994 and 1995, several consignments of Indian dry chilies were rejected by Spanish authorities because the detected pesticide residues exceeded the permissible MRLs for fresh/green chilies. The dehydration of chilies results in some magnification of pesticide residues, such that it is extremely difficult to meet the existing standards. Discussions with Spanish authorities for the need for a "multiplication factor' in considering pesticide residues in dried chilies were unsuccessful.

As a result, several Indian exporters cut back their chilies trade with Spain. This was never a very large trade, although some growth had been experienced in the early 1990s. These developments caused some uncertainty. Was this a measure being used to protect Spain's own producers of chilies? Would other EU countries begin to test spices for pesticide residues? In India's larger markets for exported chilies—South Asia and the United States—there was little or no attention being given to pesticide residue issues in spices. Nevertheless, during the mid-1990s, the Spices Board obtained the necessary equipment and competence to expand the functioning of its laboratory to include testing for a broad range of agrochemical active ingredients. Otherwise, little adjustment was made in the industry as it was not clear whether pesticide-related issues would prove to be of much significance in the spices trade.

The testing efforts of the Spices Board quickly brought out a complex reality for which the spice industry was little equipped to address, certainly not on its own. There are some 181 pesticides registered for use in India. The country has banned the manufacture, import, and use of 28 pesticides or pesticide formulations, banned domestic use yet permitted manufacture for export of 3 pesticides, and restricted the uses of 7 other pesticides. While India's regulatory framework has tracked developments internationally, albeit with a lag, its regulatory enforcement is relatively weak. In addition, farmer/user practices have tended to weigh cost considerations over safety or environmental considerations.[36] The bulk of pesticides in use are of older organophosphate or organoclorine types. One study found that, in the mid-1990s, 54 percent of the 86,000 tons of pesticides used in agriculture involved substances which were already banned or highly restricted in Western countries (Agrawal 1996). While DDT was banned for agricultural use in India in 1989 (and use restricted to public health purposes, especially malaria control), it is apparently still available for use in rural areas. DDT as well as other persistent organic pollutants (aldrin, endrin, dieldrin) are still frequently found as residues in a variety of domestic food products due to their presence in water and soil.[37]

In the mid-1990s, unable to provide a guarantee to certain European buyers that their product would be free of banned substances or otherwise comply with evolving MRL standards, Indian exporters simply did not pursue new market opportunities within parts of Europe. This barrier did not apply to all countries, however, and trade in chilies and related products was maintained

[36] http://parliamentofindia.nic.in/ls/jpc/chapter3.pdf.

[37] A study by Andhra University found that 42% of its samples of fresh vegetables had residues of benzene hexachloride (BHC), endosulfan, dieldrin, and other banned/restricted pesticides. A 2001 WHO-sponsored study conducted by the Ministry of Health and Family Welfare found that most of the spice samples (including chilies and chili powder) had detectable levels of stable organochlorine compounds including DDT, BHC, and aldrin.

or even increased. Yet, the issue could not be isolated. In 1996 some 75 containers of chilies was rejected by the USFDA because they contained residues of quinalphos, not a registered pesticide in the United States. Those goods were rerouted to another destination that was not concerned with the pesticide residue finding. In 1998 more chili consignments to Spain were rejected, and that country instituted a policy of inspecting every consignment of imported Indian chilies. A year later, Australian authorities detained and subsequently rejected several consignments of Indian chilies and curry powder on the basis of pesticide residues. An extended dialogue was carried out between Australian and Indian authorities. Although the issue was not resolved, the Australian authorities agreed to temporarily relax their restrictions and await a broader agreement—perhaps at the level of Codex—on the proper standards for pesticide residues in spices.

Between 1998 and 2000, a new issue entered the trade. Several consignments of Indian chilies and nutmeg were rejected in Germany, Italy, Spain, and the U.K. due to the presence of aflatoxin. At this time, there was a growing awareness about the long-term potential health effects of aflatoxin in foods. Most attention was being given to its presence in cereals and edible nuts; yet, chilies and nutmeg are among the few spices in which aflatoxin may emerge as a result of improper drying of the fruit pods. While India was one of the countries that raised concerns at the WTO regarding the scientific basis for the EU's proposed harmonized standards for aflatoxin, the country's spice industry did not view these standards as a threat and has made some adjustments and investments to minimize both the health risks and the potential disruption of trade.

Over the past 3–4 years, the Indian spice industry has adopted a range of strategies to address the challenges posed by pesticide residue and aflatoxin standards. These challenges have involved a considerable amount of collaboration and concerted effort among the Spices Board, the private sector, and other stakeholders. One of the strategies taken has been to try to influence the "rules of the game" pertaining to spices and pesticides. In conjunction with the ASTA, European Spice Association, All Nippon Spice Association, and several other parties, the Spices Board and the All India Spice Exporters Forum has established an International Organization of Spice Trade Associations, which obtained observer status at the Codex Committee on Pesticide Residues (CCPR). Given the paucity of established MRLs for spices grown in tropical countries, it was proposed, at the 34th and 35th Sessions of the CCPR, that new MRLs be established on the basis of monitoring data made available by both importing and exporting countries. This tack would be far less costly and more practical than starting from scratch and undertaking multiyear field trials. After much discussion, this proposal was accepted by the Joint FAO/WHO Meetings in Pesticide Residues (JMPR) in 2002. The JMPR since issued guidelines on how such data will be collected and utilized. As this proposal is pursued, it will expand the range and number of MRL tolerances for agrochemicals and spices.

With regard to chilies, a different approach is being taken. There are already a couple of dozen pesticides for which MRLs have been set—in Europe, North America, or elsewhere—in relation to fresh peppers. The proposal being made is that a dehydration factor be applied to account for the magnification of pesticide residues in dried chilies. The proposal is to apply a dehydration factor of 10. Hence, while the established MRL for Carbaryl is 5 mg/kg in fresh pepper, it would be 50 mg/kg in dried chilies. A similar approach has been proposed for other vegetables that are used as spices when dried (garlic, onion). Members of the spice industry will soon submit evidence to the JMPR to support the derivation of dehydration factors.

Even if these efforts are successful, outstanding issues will remain. One relates to the absence of so-called EMRLs (Extraneous Maximum Residue Limits) in relation to persistent pesticides, which although not still used for spices, given their presence in soil and water, nevertheless may show up in trace amounts as residues. Another important factor is that no international MRLs will be established for a range of other pesticides whose registration and acceptable use in Europe and/or North America has been withdrawn over the past decade as part of broader regulatory measures on pesticides.

A significant number of the pesticides still commonly used on chilies in India have been withdrawn from (approved) use in one or several of India's external markets (table 10). Should these countries fully enforce their pesticide-related regulations, India can expect to encounter problems as residues are detected for withdrawn pesticides.

Measures to address this challenge are being taken on several other fronts. At the level of producers, the Spices Board and others have stepped up information campaigns to increase farmers' awareness about the problem. However, this approach has an important limitation in the sense that more than 90 percent of chilies are consumed in the domestic market and most growers do not see any advantage (indeed, they see production risks) to modify their agrochemical use practices. More focused efforts have thus been initiated. One set of actions has been initiated by the Spices Board, working in conjunction with State Departments of Agriculture and various NGOs.[38] These actions involve the promotion of integrated pest management (IPM) and, in some locations, organic production of spices. The resources devoted to these schemes have thus far been modest,[39] although the current work plan for the Spices Board proposes substantially increasing the scale and range of this type of technical assistance. Included also in that plan will be the provision of partial subsidies to growers to adopt IPM and organic methods. The Board is working with the All India Coordinated Research Project on Spices (AICRP) to generate supervised field trial data as a basis for fixing national MRLs. The Spices Board has also helped address the aflatoxin concern by providing, on a subsidized basis, polyethylene sheets and construction of cement drying yards to facilitate better chili drying practices.

India's spice exporters also are making changes in light of the emerging risks. For selected spices—especially chilies—these firms are modifying their approaches to crop procurement. Firms have initiated "vendor screening" programs, more carefully determining who among their traditional up-country trader suppliers has made proper investment in storage facilities (to minimize the risk of aflatoxin), keep proper records, and are providing oversight to farmer post-harvest practices. Several firms also are now more directly connected with growers. In some cases, they have started contract farming schemes, in which they provide seed, detailed pest management guidelines, supervisory help (and policing), and premium prices to compensate for the higher production risk or lower yields that the farmers obtain. The firms have invested in mobile labs to bring to the field, testing there for both pesticide residues and aflatoxin, before making final purchase decisions. These carefully controlled and monitored supplies are then used

[38] The Spices Board's mandate focuses more on post-harvest and marketing issues than on farm-level production, with the exceptions of vanilla and cardamom. Support for primary production of other spices falls within the mandate of the State Departments of Agriculture.

[39] One pilot program was supported under the Development Marketplace, sponsored by the World Bank. A $250,000 grant was provided to train farmers and NGOs in organic farming techniques. Through mid-2002 more than 1000 farmers were involved in this program.

for sales to those international buyers that require guarantees on safety factors. As yet, there has been minimal backward integration into production. Firms are trying to promote production in non-traditional growing areas in which there are not established practices and the firms can better encourage use of neem and other natural pest control agents.

Table 10. Commonly used pesticides for Indian chilies and external market regulatory status

Pesticide	*UK*	*Germany*	*USA*	*Canada*	*India*	*Australia*
Acephate	N	N	Y	Y	Y	Y
Carbaryl	Y	B	Y	Y	Y	Y
Carbofuran	Y	Y	Y	R	Y	Y
Cypermethrin	N	Y	N	Y	Y	Y
Decamethrin	Y	N	Y	Y	Y	Y
Dichlorvos	B	Y	Y	Y	Y	Y
Dicofol	R	S.R	Y	Y	Y	Y
Dimethoate	Y	Y	Y	Y	Y	Y
Endosulfan	Y	N	Y	Y	Y	Y
Ethion	N	N	Y	Y	Y	Y
Acetamiprid	N	N	Y	N	N	N
Indoxacarb	N	N	Y	N	N	Y
Carbendazim	Y	Y	Y	Y	Y	Y
Methyl-parathion	N	Y	Y	Y	Y	Y
Monocrotophos	N	N	N	Y	Y	B
Phosalone	N	N	N	N	N	N
Sulphur	Y	Y	Y	Y	Y	Y
Triazophos	N	Y	N	N	Y	N

Sources: Regulatory status: PAN Pesticides Database; commonly used pesticides: India Spice Exporters Association.
Notes: Y = pesticide is registered; N = not registered; R = restricted; B = banned.

The increased attention to both pesticide residues and aflatoxin has led to increased investment in laboratory equipment and facilities. Since the late 1990s, the Spices Board has acquired expensive pieces of equipment to undertake tests in these areas and has had to draw on various contract researchers to cope with the heavy demand for such testing services. Over the past four years, the Board's lab has analyzed 9000–11,000 samples per year. These testing services have largely been provided to a range of smaller spice trading companies that do not have their own labs. However, a growing number of companies—now 98—have their own in-house labs. The larger companies have upgraded these labs in recent years to fully handle testing for pesticide residues and aflatoxin.

Export companies report considerable improvements in the quality of those raw materials sourced through more direct or more supervised methods. Their own tests indicate a much lower incidence of aflatoxin in chilies and chili-based products. Indeed, despite much closer regulatory attention given to aflatoxin in Europe in recent years, there have been only a few additional rejections of consignments from India.[40] The trade regards the harmonized EU aflatoxin standards as demanding, yet certainly achievable with proper production and post-harvest practices and increased levels of buyer oversight.

[40] In 2003 four consignments were rejected on this basis: 3 in Italy and 1 in Spain. Through mid-October 2004, 3 consignments were rejected due to aflatoxin.

There have been relatively few rejections of Indian spices in Europe due to pesticide residues in the past three years, although this may be more a reflection of defensive strategies by exporters than resolution of the underlying problems.[41] Rather ominously, over the past year, there have been a number of spice consignments rejected by the USFDA due to pesticide residues, the majority of which were used on sesame seeds, with a few cases involving whole or crushed chilies. It is not clear, however, whether these rejections signal a somewhat higher priority that FDA may be giving to spice pesticide issues.

Indian exporters report a very close working relationship among themselves, the exporters association, the Spices Board, and others in trying to address the challenges associated with pesticide use and residues. However, these are challenges that go well beyond the capacity of the spice industry to fully address given that spices account for a very small proportion of overall pesticide use in India. The leading applications are on cotton, wheat, paddy rice, and vegetables. There are systemic issues related to the enforcement of existing pesticide regulations. There needs to be generally more attention and resources devoted to the development and promotion of IPM and otherwise more safe and cost-effective pest management practices.

As yet, there is very little attention being given to pesticide residues in the Indian domestic food market generally,[42] particularly in relation to spices. The latter is probably appropriate given the small risks involved compared with other food safety problems. There is thus far no evidence that domestic consumer groups are devoting much attention to spices as a source of food safety risk. Neither the PFA nor the AGMARK standards refer to MRLs or aflatoxin tolerances in spices. Given the prominence of the domestic market for Indian spices, it will continue to be very difficult for its export-oriented segments to induce broad changes in farmer practices. One thus expects a continuation of the recent pattern in which the industry seeks to gain more control or oversight over certain sources or locales of production and intensifies the effort to promote "good agricultural practices," IPM, and/or organic production in these areas.[43]

The pesticide use/residue issue is the one SPS matter about which the exporters association and the Spices Board have been most concerned and vocal. However, one should be careful not to exaggerate the direct effect that these issues have had on India's spice trade (figure 8). India's exports of chilies have actually experienced enormous growth over the past decade. The countries of the EU have never accounted for more than 10 percent of India's exports of this product, and the 2 countries that have given the most attention to pesticide residues—Germany and Spain—had a combined 2 percent share of India's exports in only 2 years 1996–97 and 1997–98).

It is true that the level of chilies trade with these 2 countries was experiencing growth through the early-to-mid-90s—peaking at a combined 1050 tons in 1997–98 and that small price premia were paid by some buyers in these countries. Trade with these 2 countries fell sharply in 1998-99 and have only partially recovered (to 650 tons in 2002–03). However, the further growth

[41] In 2001 one consignment was rejected for pesticide residues. In 2002 two consignments were rejected for this reason. In 2003 and 2004 no consignments were prevented from entering the EU due to pesticide residues.

[42] Although recent events involving the presence of pesticide residues in soft drinks has raised media, consumer, and policymaker attention to this issue.

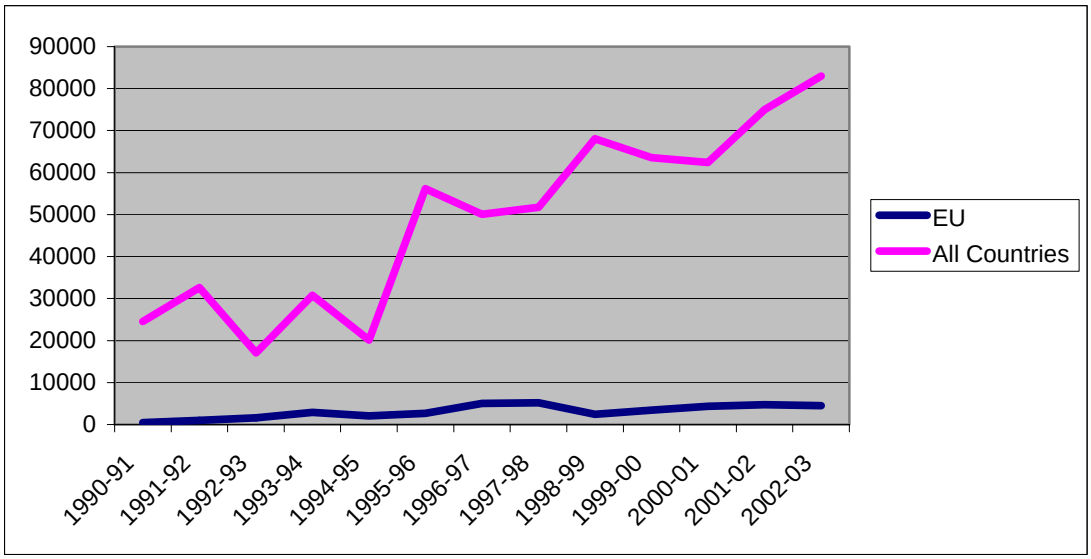
[43] In the aftermath of the soft drink episode and other events, the government has decided to set up a Food Standards Authority, which will integrate the country's food laws and set new standards for contaminants in food, including pesticide residues and heavy metals. How this plays out could impact on the spice industry, especially on the manufacturers of seasonings and spice-containing foods. (*Times of India*, 31 March 2004)

potential of Indian sales in these markets is considered modest—some 1500 tons combined—due to competition and taste preferences. Elsewhere in Europe, India's exports of chilies has been maintained (France, UK) or has increased (Italy).

The issue, therefore, is not that India has "lost' a large amount of actual or potential trade due to the pesticides issue.[44] The issue is more about principle—that the food safety concerns with pesticides and spices cannot be justified scientifically—and about the potential unfavorable impact that this issue has on the reputation of the spices business generally, and that of India, in particular. The spice industry, both in India and abroad, has been observing some of the dramatic changes in food safety oversight in other industries, especially the meat products and fresh produce industries, in response to adverse events, scandals, and/or media hype. The spice industry is concerned about the possible spillover of this regulatory intensification into its line of business and the implications this would have for the movement of goods, production practices, and overall costs.

Interestingly, the spice oil and oleoresin sector has not yet been adversely affected by this incremental regulatory concern with pesticide residues. Pesticide residues can get concentrated in oils/oleoresins because they are soluble in organic solvents. However, with the mix of spice crops used (the majority of which do not involve use of pesticides) and with careful crop procurement arrangements (including imports), this growing segment of India's trade has not, apparently, encountered major difficulties.

Figure 8. Exports of chilies from India *(MT)*



Source: Spices Board of India.

Sudan 1 in Chili and Curry Powder

In May 2003 some consignments of Indian chili powder sent to France were found to include the presence of the prohibited red dye Sudan 1. This issue was posted on the EU's Rapid Alert System for Food and Feed. Subsequent reports were made of product recalls in a number of

[44] As reported by the Spices Board, the quantity of chilies rejected in Europe in 1999–2001 due to pesticide residues was only approximately 150 tons.

countries because manufacturers had used contaminated chili powder, imported from India, in the production of various processed foods and seasonings. In response to these developments, the Spices Board temporarily suspended the certificates of export registration for five companies. The impression given was that these suppliers represented rogue elements within the industry and that the adulteration was not reflective of the high standards to which the industry ascribes. Indeed, these instances of product adulteration could have a very harmful effective on the overall reputation of the industry, included that of its value-added component, which has experienced considerable growth in recent years.

The original rapid alert and subsequent food recalls received coverage in the European media. In late June 2003 the European Union published a decision putting in place "emergency measures" in relation to hot chilies and chili products. It prohibited Member States from importing these products unless analytical reports accompanying the consignments demonstrate that the product does not contain Sudan Red 1. In the absence of such a report, the importer will be required to have the product tested and so certified. In October, the Indian Spices Board announced that any exporter of chili powder (or any other spice containing chili, though not including chili oil or oleoresin) would need to notify the Spices Board at least 48 hours prior to the shipment and to enable the Board or a designated agency to test samples from the export consignment to ensure the absence of the colorant.

Apparently, this directive was not enforced. Between October and December 2003, 14 consignments of Indian chilies, chili/curry powders, or other spice mixes were notified by an EU Member State as containing Sudan 1 dye. Seven of these cases involved "alert notification." During the first eight months of 2004, some 36 consignments of raw chili and 31 consignments of chili powder or curry from India to EU markets were found to contain Sudan 1 and were subsequently destroyed. These detentions took place on many different dates and involved products sent to Germany, Greece, Italy, the Netherlands, Portugal, and the United Kingdom.[45] On September 9, 2004, the Indian Spices Board issued a circular indicating that exporters of chilies or chili products would need to submit a certificate that samples from each consignment had been drawn for testing by one of several designated agencies. Customs authorities were advised not to clear consignments which are not accompanied by these certificates. No further consignments were detained/destroyed for the remainder of 2004.

The detection of illegal colorants in chili products was not limited to products originating from India. Many consignments of chili powder from other countries (including China, Pakistan, South Africa, Syria, and Turkey) were also rejected during this period for similar reasons. There have also been a large number of notifications that sauces and processed foods prepared within Europe—yet containing imported spice mixes—also contain the Sudan 1 dye. This evidence suggests that this practice of adulteration may be more widespread than commonly assumed.

In February 2005, the detection of Sudan 1 in a major UK company's brand of Worcester Sauce resulted in a massive recall of some 600 food products (including ready-made meals, pizzas, sauces, meats, etc.) for which this sauce is an ingredient. The recall affected all of the major UK retailers as well as large numbers of food manufacturers and food service companies.[46] This

[45] The concern about Sudan 1 does not seem to have spread to developing countries to which India exports chilies. Hence, Indian exports of chilies reached 138,000 tons in 2004-05, up from less than 87,000 in the previous year.

[46] This food recall is the largest ever in the U.K. Sudan 1-related food recalls have since taken place in other countries, including China and South Africa.

recall, together with other direct and indirect costs was estimated to have cost UK and other European food manufacturers and distributors some Euro 200 million.[47] The manufacturer of the sauce indicated that the affected product batch had used raw materials from older stocks which had been *imported from India in 2002*.[48] [49]

Costs and Benefits of Quality and SPS Compliance

As highlighted above, an array of adjustments and investments has been made by both the private sector and government to comply with international quality and food safety standards related to spices. Illustrations follow of the costs associated with these measures and commentary on associated benefits, whether concrete or intangible.

Little detailed information is available on the costs and benefits of alternative spice production and procurement practices. One analysis of a modified production regime involving use of IPM methods, bio-pesticides and other relatively safe agrochemicals found that unit production costs for chilies increased by some 17 percent, as reduced pesticide costs could not fully compensate for a 20 percent reduction in yield.[50] The higher production yield risks that may be associated with these methods or the cultivation of organic spices have been recognized by government. Thus, in the current (2002–03 to 2006–07) work plan of the Spices Board, partial subsidies will be given to farmers who adopt organic cultivation practices, IPM systems, and the certification thereof.[51] There will likely be health and environmental benefits from such a program, plus exporters report ample opportunity to sell organic spices at a 30 percent–40 percent premium over the conventional product.[52]

Exporters report that it costs them some 25 percent–30 percent more to procure ("safer") chilies under contract, considering the price premiums that they need to pay (to cover yield risk) and their costs for field staff, vehicles, and program record-keeping. Their more general efforts to control the procurement of certain crops—via more intensive vendor screening, monitoring, and record-keeping, also involve more personnel time. A few of the companies have deployed mobile testing labs—costing approximately $7500—to more carefully screen harvested or dried spices before purchasing them. Many of the overseas buyers of Indian chilies are not yet prepared to pay extra for this more rigorous oversight of the crop. However, some buyers are, as are a limited yet growing number of domestic food manufacturers and others. These measures are being taken to manage risks, and they constitute a sort of reputational insurance policy. One would expect some economies of scale and institutional learning to be associated with such production/post-harvest oversight, reducing the unit incremental costs as this type of approach becomes more widespread. Having more direct exporter contact with farmers may also contribute to improved field and post-harvest productivity.

[47] See Food Navigator.com article on 5/19/2005. "Sudan 1: banned food products , already withdrawn, appear again on shelves". Of this, the value of the recalled/destroyed products is some EURO 25-30 million.

[48] Thus, prior to the July 2003 requirement to obtain supplier certifications for the absence of Sudan 1. See Foodnavigator.com article on February 28.

[49] The presence of Sudan 1 in Worcester Sauce was detected by a small lab in Italy.

[50] All India Spice Exporters Forum.

[51] Although one study in Guntur reported by the Spices Board found that, on well-managed demonstration plots, using IPM methods could both reduce cultivation costs and increase yields compared with conventional methods. Some 8–10 rounds of spraying were done compared with 22 rounds in the conventional plots.

[52] India's exports of organic spices have increased in recent years, yet were only approximately 200 tons in 2002.

Indeed, already large numbers of farmers have benefited from training on post-harvest methods and support in the acquisition of improved materials and facilities for spice drying. These programs were started in the late 1980s, and a full series of data are not available. However, between 1997–98 and 2001–02, post-harvest training was provided to some 163,000 farmers, and improved drying sheets/mats were provided to some 68,000 farmers, with the Spices Board assuming 33 percent of the purchase costs for the latter. Cement drying yards were constructed in many producing areas. The total budgetary costs of these programs—combined under the Spices Board's 'Post Harvest Development Scheme' were some $800,000 over this five-year period. These costs almost certainly were an excellent public investment to improve the quality of smallholder spice output.[53]

Most of the longstanding exporters of black pepper made investments in mechanical grading, washing, drying, and packaging equipment at some point during the 1990s. The level of the investment varied with the capacity needed. One medium-scale company, with an annual turnover of approximately $1 million, invested in such a system with a capacity of 2 tons per hour. The equipment cost approximately $75,000, thus representing 7.5 percent of its turnover in one year. The firm initially benefited in its export sales, obtaining price premiums for the cleaner product. However, that particular benefit was short-lived in the face of collapsing international black pepper prices and the contraction of the company's exports. A larger proportion of sales were subsequently directed to the domestic market. This market is also segmented, and an estimated 25 percent of demand is for high-quality, cleaned product. This demand comes from several larger food manufacturers and brand name distributors, and they are willing to pay a premium over the prevailing market prices.[54] Hence, even this company that made its investment late in the 1990s has benefited from that investment. Those firms that made these investments in the first half of the 1990s would have benefited even more by obtaining premium prices including during the run-up of international black pepper prices in the late 1990s.

Insufficient information is available to make any concrete analysis of the returns to investments in or customized use of different types of spice sterilization facilities. Most of the investment has gone into ETO sterilization facilities, 12 of which are in operation in the vicinity of Cochin. Depending on their capacity, these facilities and equipment cost $100,000–300,000 to put in place. These amounts would be out of the reach of most of the small- or medium-scale companies and represented a significant investment for even the larger companies, whose annual turnover is in the range of $4–10 million. For most of these investments, some proportion of the costs was covered by the Spices Board as part of an ongoing program to encourage investments in technology upgrading and adaptation.[55] In addition to treating their own products, these firms have provided toll services to other exporters, typically charging $50–100 per ton.

Much more limited have been investments in steam sterilization facilities. Current models cost $300,000–400,000. Two firms invested in such facilities but experienced general business problems, and their assets are now being sold or discarded. Toll services are made available for $150–300 per ton, and the latter figure is typically the increment that firms add to the price of

[53] At least one company explored the feasibility of mechanical drying of chilies. However, relatively high energy costs would have substantially increased the final product cost, and buyers were not willing to pay for this.

[54] Said to be 2 to 3 Rupees/kg, equivalent to US$40–$60/ton.

[55] From 1997–98 to 2001–02, some 45 companies benefited from these grants, with a total budgetary cost of $518,000.

their product. A steam-sterilized black pepper product is a more valuable one. Yet, in the current international market environment, relatively few buyers have been willing to pay this premium.

Various costs and perceived/actual benefits are associated with different types of certified management systems. For a medium- to larger-scale company, designing and initially implementing a HACCP plan may cost upwards of $8000 in consultant and staff costs. This approach to risk management has been made mandatory by some buyers and provides a proxy for food safety to new or potential customers. Several managers indicated that the implementation of these plans has provided peace of mind, enabling them to sleep at night. The process of obtaining ISO 9000 certification has cost Indian firms approximately $6500. Certification provides external recognition for well-defined quality management systems and, for some customers, increases their confidence in the supplier.[56] Obtaining certification under the EIC's In-Process Quality Control (IPQC) program cost firms approximately $2000. While some advice is provided by the certifying parties, the primary benefit from this certification is reduced inspection fees and other transaction costs related to black pepper exports. The most expensive process of certification appears to be that associated with the American Institute of Bakers. This process costs some $11,000, and only a few firms have gone this route. Apparently, such certification provides a very powerful signal regarding food safety management systems that is appreciated among certain food manufacturers.

A significant amount of investment has been made over the past decade in laboratory facilities and equipment, with individual labs being extended beyond their initial focus on physical and chemical parameters to include testing for pesticide residues, aflatoxin, and, in a few cases, heavy metals. Since 1991, investments in equipment for the laboratory of the Spices Board have totaled about $540,000. Forty-five percent of these costs were covered under projects supported by the ITC or UNDP and the balance by budgetary resources. Various types of gas chromatographs have been needed to detect different classes of pesticides. For detecting the presence of aflatoxin (parts per billion, or ppb), equipment such as high performance thin layer chromatographs have been needed. Heavy metal detection has required the use of an atomic absorption spectrophotometer. The recurrent expenditures of the Spices Board lab have increased more or less steadily since the mid-1990s, going from $92,000 in 1995–96 to $170,000 in 2002–03. The lab is charging fees for its services, although the level of cost recovery is still modest, at 35 percent–40 percent in recent years.

Some 98 spice companies, including nearly all of the leading firms, now have their own labs. Many of these are rather basic, able to test only for physical and chemical properties. However, quite a few companies have expanded their lab capabilities since the mid-1990s. Between 1997–98 and 2001–02, the Spices Board provided grants to some 49 companies, covering up to 50 percent of the costs for setting up or improving lab facilities. These grants, however, were capped, and the aggregate level of grant support was only $363,000 (meaning an average of less than $10,000 per company). Equipping a fully functioning private lab for testing for pesticide residues and aflatoxin has cost the leading companies about $100,000–125,000 when the investments have been made in the past few years. While previously, they may have had one person staffing their labs, now most of these companies have 3 to 5 technicians working in their expanded labs. The variable costs associated with such an expanded battery of lab tests have not

[56] The Spices Board had a program to underwrite 50% of the costs associated with ISO 9000 or HACCP accreditation. Between 1998 and 2001, 16 companies took advantage of this grant.

been inconsiderable. For example, one firm estimates that the costs associated with testing for pesticide residues and aflatoxin is equivalent to 2.8 percent of the FOB value of dry chilies.

It would be difficult to determine the extent to which Indian companies have been able to pass on the added costs of testing to their overseas buyers. However, this investment in testing facilities and staff and the overall structural of internal controls for quality assurance and food safety should pay dividends over the longer term, especially for those firms that will continue to move toward value-added processing for export and/or for the domestic market. Even without additional regulatory changes, more of the overseas buyers of Indian spices will expect data and/or supplier guarantees pertaining to product content and the presence of contaminants. If, as expected, more of these firms enter into the production of branded consumer products, their enhanced testing capacities will prove more valuable than at present.

The application of more rigorous grading, cleaning, and sterilization of spice raw materials; the increase in the battery of tests to which products are subjected; and some increase in the standards required for spice packaging have collectively altered the cost structure for some, if not many, of India's spice export products. An illustration of this for chili powder is provided in table 11. While the average FOB value for this product was slightly higher in 2003 than in the mid-1990s, the raw material composition of the final cost declined both proportionally (from 79 percent to 67 percent) and absolutely (from $899 to $804), suggesting that farmers and intermediary traders have borne a significant part of the incremental costs incurred in cleaning, processing, and testing activity. The biggest cost increase has occurred for grinding/processing operations, nearly doubling from $91 to $168 per ton. The gross margins for exporters of this product remained essentially the same, at about 5 percent.[57]

Table 11. Changing cost composition for chili powder

	1995–96		*2003*	
	($/t)	*(% of FOB)*	*($/t)*	*(% of FOB)*
Raw material	899	79.0	804	67.0
Cleaning	46	4.0	72	6.0
Grinding/processing	91	8.0	168	14.0
Testing	23	2.0	54	4.5
Packaging	28	2.5	42	3.5
Exporter gross margin	51	4.5	60	5.0
Total	1138	100.0	1200	100.0

Source: Author's Exporter Survey.

The available information does not permit one to closely estimate the aggregate level of investment that has been made in the spices industry, for purposes of enhancing quality and food safety outcomes and testing. This investment has been going on over an extended period, with significant investments at least since the late 1980s. Investments, large and small, have been made by many different stakeholders at the farm, post-harvest, processing, and subsequent stages. However, it is worthwhile to use the available information to make an "order of magnitude" estimate of the pertinent investments since the mid-1990s and to relate this to the level of trade since then. For this purpose, we consider only the trade in whole and ground spices and not the investments and trade related to spice oils and oleoresins. Table 12 provides the

[57] Subsequent to the discovery of Sudan 1 in Indian chili powder and the imposition of required testing and certification related t this, post-production costs have undoubtedly increased.

pertinent estimates, broken down by whether these were made by the private sector (firms and farmers) or the public sector (primarily the Spices Board). The estimated total is $14.5 million, with some three-fourths of this investment being undertaken by farmers or spice companies and one-fourth by the Spices Board—either in its own capacity or through programs with or subsidies to the private sector, including farmers. While this level of investment in quality and food safety assurance capacity is significant, it is equivalent to only about 1 percent of the FOB value of India's whole/ground spice exports over the 5-year period from 1998–99 to 2002–03.[58]

Table 12. Order of magnitude estimate of investments made in spice quality/food safety enhancement and testing, mid-1990s to 2003 *(US$ millions)*

	Private sector	*Public sector*
Post-harvest materials, infrastructure, training	3.00	1.00
Cleaning, processing, sterilization equipment, and management systems	6.00	1.00
Laboratory equipment, personnel, and material costs	2.25	1.25
Subtotals	11.25	3.25
Total		14.50

Source: Author's estimates.

This level of investment can also be considered insignificant when compared to the direct and indirect costs incurred by downstream (European) food manufacturers and distributors as a result of the recent mass recall of products containing chili-based raw materials provided (in 2002) by an Indian supplier. As indicated earlier, this cost is now (May 2005) estimated to have reached nearly Euro 200 million.

Conclusions

For a long period, India has been among the world leaders in the production, trade, and application of post-harvest and processing technologies to spices. India also has, by far, the largest domestic market for spices in the world. Over an extended period, the Indian spice trade earned a reputation for quality and service, with several of the existing firms involving families who have been involved in this business for many generations. India's spices are sold throughout the world. Thus, it is an industry with an exceptionally broad and historical perspective.

Volatility seems to be the norm rather than the exception in international markets for spices due to the structure of the trade, climatic conditions, and the rapidity with which producers can respond to price changes. Over the years, longstanding Indian companies have ridden the tides of booms and busts in the black pepper and other markets. Over the past decade or so, the normal cyclical challenges of the spice trade have been intensified by additional significant challenges associated with increased regulatory attention—in some important overseas markets—to food safety, plant health, and environmental aspects of spice production, preparation, and trade. This increased regulatory oversight has triggered a variety of responses by Indian producers and processor/exporters and by the Spices Board and other government agencies. Changes have been, and continue to be, made in production, post-harvest, and processing practices and technologies; in quality assurance and supply chain management systems; and in monitoring and testing products. Through collaborative efforts between the private and public sectors, the industry is

[58] Total spice exports minus those of spice oils and oleoresins aggregated to $1.433 billion over this period.

actively engaged in discussions at the international level—both on a bilateral and multilateral basis—to influence the "rules of the game" for the trade in spices.

Challenges remain, however. At the international commercial level, India has been encountering intensified competition in the market for bulk spices—of black pepper, cardamom, ginger, and other commodities. Its ability to compete on the basis of cost is constrained by the relative dynamism of its own domestic market and by comparatively low yields of many spices at the farm level. India is already a new importer of several types of spices and may soon become a new importer for the category of whole spices in aggregate. Perhaps only for chilies, turmeric, and a few other spices will India remain a significant exporter of whole spices in the future. Exporters will face continued challenges related to the acceptability and cost of different technologies, especially for product sterilization (against microbiological risks) and shipment fumigation (against plant health risks).

There is a growing perception that the future growth potential of Indian spices lies in two realms. One is the range of spice oils, dehydrated products, and oleoresins for which the country has been a successful and even dominant international market participant. The core firms in this segment see opportunities for continued growth with sales to overseas food, perfume, and other manufacturers. The Spices Board intends to provide financial support and work with other agencies to increase R&D activity to identify additional nutritional, pharmaceutical, cosmetic, or other values of spices. The payoffs from this R&D are likely only in the medium-to-longer term, yet could be considerable.

A second sphere with expected growth potential is packaged consumer products, with the promotion of Indian or joint venture brand names. Thus far, a few Indian companies have been supplying packed consumer products to the Middle East. There is apparently potential to expand this market as well as to sell consumer products in Africa, Asia, the CIS, and Latin America. The Spices Board has commissioned studies to examine the feasibility of developing and promoting Indian branded products. For the current planning period (through 2006–07), the Spices Board has budgeted some $1.4 million to support new product development and market testing and promotion. It awaits to be seen what longer term damage the recent events related to Sudan 1 colorant have on the reputation of Indian food products and ingredients and the level of consumer and distributor confidence in them.

To continue to be, or to become, competitive in both of these areas, India must make effective use of the installed technological and testing capacities put in place over the past decade or two. Furthermore, there will need to be an intensification of efforts to promote "good agricultural practices" among spice growers and to more generally improve the oversight and governance of spice procurement. Over the past decade, most of the investment that has been made has been within processing and packing facilities and in testing laboratories. *The "weak links" in the chain lie in primary production methods and the interface between them and the firms that are seeking to add value to spices.* If, indeed, there will be a shift toward exporting consumer-branded products, then processors absolutely will need to ensure that they are procuring cleaner raw materials, without pesticide residues, heavy metals, or other contaminants that cannot be readily removed. Even if this shift to consumer-branded products does not occur, the recent trends are expected to continue with more and more overseas trading partners giving additional regulatory and commercial buyer attention to these issues.

The current discussions at Codex and elsewhere may yield a bit more flexibility on regulatory enforcement of MRLs. However, given current patterns of pesticide use and regulatory enforcement and the presence of persistent organic pollutants, the challenge for India is broader. The spice industry will not be able to fully address these challenges on its own. It is not the only industry affected, as recent problems faced by the soft drinks industry and the horticultural export industry attest. The spice industry can and should continue to promote good agricultural practices (GAP) and improved post-harvest practices; to promote IPM and organic production; to work with the research community and with farmers to enhance crop yields; and to further invest in technologies, systems, and human resources to improve spice hygiene and quality assurance. Nevertheless, other private and public agencies will need to consider strengthening the legislation that addresses pesticides and domestic food safety and to find ways to strengthen the enforcement of such regulations.

The lack of harmonization of international standards for spices is a cause for some uncertainty within the trade and added costs for exporters, since they must use different technologies and employ different types of tests to satisfy different markets. The harmonization of international standards would reduce this uncertainty and enable more uniform procedures. However, harmonization could be a two-edged sword, especially if the agreed international standard proved to be the most restrictive of the prevailing diverse patterns. For example, if a consensus standard for spice sterilization were adopted today, it would not likely be the cheapest method (irradiation), nor the next cheapest method (use of ETO). It likely would be steam sterilization, which is the most expensive method, a method that adversely affects spice quality, and for which there is little present capacity in India. Nevertheless, there are certain areas—including testing methods and sampling procedures for spices—that should be harmonized at the international level.

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