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India
India's Emergent Horticultural Exports
Addressing Sanitary and Phytosanitary Standards and Other Challenges

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Sustainable Development Sector Unit
India Country Management Unit
South Asia Region

Document of the World Bank

CURRENCY EQUIVALENTS

Currency unit: Indian rupee (annual average)

2000: US$ 1 = Rs 44.9	2004: US$ 1 = Rs 45.3
2001: US$ 1 = Rs 47.2	2005: US$ 1 = Rs 44.1
2002: US$ 1 = Rs 48.6	2006: US$ 1 = Rs 45.3
2003: US$ 1 = Rs 46.6	

FISCAL YEAR (FY)

April 1–March 31

UNITS OF MEASURE

ha	hectares	m ha	million hectares
kg	kilograms	m t	million metric tons
t	metric tons		

ACRONYMS

ACP	African, Caribbean and Pacific
AEZ	Agricultural Export Zone
APEDA	Agricultural and Processed Food Products Export Development Authority
APHIS	Animal and Plant Health Inspection Service (US)
APM	Agricultural Produce Marketing
APMC	Agricultural Produce Marketing Committee
BRC	British Retail Consortium
BSE	Bovine spongiform encephalopathy
C&F	Cost and freight
CODEX	CODEX Alimentarius Commission
COLEACP	Comité de Liaison Europe–Afrique–Caraïbes–Pacifique (Europe–Africa–Caribbean–Pacific Liaison Committee)
DGSV	Dirección General de Sanidad Vegetal, Mexico (General Directorate for Plant Health)
EC	European Commission
EDB	Ethylene dibromide
EIC	Export Inspection Council
EU	European Union
EurepGAP	Euro-Retailer Produce Working Group's Good Agricultural Practices
FAO	Food and Agriculture Organization of the United Nations
FOB	Free on board
FPO	Fruit Products Order
GAP	Good agricultural practices
GDP	Gross domestic product
GHP	Good hygiene practices
GMP	Good manufacturing practices
MRL	Maximum residue limit/level
MSAMB	Maharashtra State Agricultural Marketing Board
NABARD	National Bank for Agriculture and Rural Development
NAFED	National Agricultural Co-Operative Marketing Federation of India
NAFTA	North American Free Trade Agreement
NCDC	National Cooperative Development Corporation
NHB	National Horticulture Board
NHC	National Horticultural Council
NHRDF	National Horticultural Research and Development Foundation
NIAM	National Institute of Agricultural Marketing
NIPHT	National Institute of Post-Harvest Technology
NRC	National Research Centre
NSSO	National Sample Survey Organization
OECD	Organisation for Economic Co-operation and Development
PCPB	Pest Control Products Board
PFA Act	Prevention of Food Adulteration Act
PIP	Pesticides Initiative Programme
PPQS	Plant Protection, Quarantine, and Storage
PQS	Plant Quarantine Service
PRA	Pesticide risk assessment
PROMPEX	Comisión para la Promoción de Exportaciones (Peruvian Export Promotion Agency)
QMS	Quality Management Systems

Cont'd.

HACCP	Hazard analysis and critical control point	SAARC	South Asian Association for Regional Cooperation
HWT	Hot water treatment	SMEs	Small and medium enterprises
ICAR	Indian Council of Agricultural Research	SPS	Sanitary and phytosanitary
ICDCS	Permanent Inter-State Committee for Drought Control in the Sahel	TQM	Total Quality Management
IDB	Inter-American Development Bank	TRQ	Tariff rate quota
IPM	Integrated pest management	UAE	United Arab Emirates
ISO	International Organization for Standardization	UK	United Kingdom
		USA	United States of America
JMPR	Joint FAO/WHO Meeting on Pesticide Residues	USDA	United States Department of Agriculture
		VAT	Value-added tax
MEP	Minimum export price	VHT	Vapor heat treatment
MFN	Most Favored Nation	WTO	World Trade Organization
MoFPI	Ministry of Food Processing Industries		

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India's Emergent Horticultural Exports: Addressing Sanitary and Phytosanitary Standards and Other Challenges

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Acknowledgements

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Executive Summary

How Have Sanitary and Phytosanitary Issues Affected India's Horticultural Trade?

In recent years, both the private and public sectors in India have developed aspirations for expanding India's participation in international horticultural trade. Despite being one of the world's largest producers of horticultural crops, India trades very little of its massive production internationally. India's share in global horticultural trade was a mere 0.5 percent in 2004 (US$ 575 million, compared with a global trade of US$ 108 billion).[1] Given the increased attention to food safety and/or plant health concerns in many segments of international horticultural trade, questions have been raised as to whether sanitary and phytosanitary (SPS) measures have been or could be a "barrier" to India's present and future horticultural trade, and what the appropriate responses from Indian stakeholders should be.

SPS standards are but part of a wider set of competitiveness challenges facing Indian horticultural producers, processors, and exporters. Most subsectors face on-going challenges related to varietal development, postharvest loss, local and/or international logistics, and market organization. In many subsectors, the very fragmented system of production and trade is not especially suited for international trade, especially in cases where there are growing demands for the traceability and/or certification of products or raw materials. There is a widespread perception among stakeholders that India's huge domestic production of various fruits should inevitably translate into large-scale exports (for example, of mangoes, bananas, or even citrus). This perception is inconsistent with the experience of most leading developing country exporters, which fostered large, export-oriented supply chains backed up by smaller domestic markets. The challenges that India faces have arisen at least in part because of the huge rift between standards in India's domestic market, on the one hand, and international standards, on the other.

The challenges posed by standards have manifested themselves in different ways for Indian horticulture, including:

- *Absolute barriers or binding constraints for accessing particular markets.* The most prominent case involves fresh mangoes and the plant health concerns of US and Australian authorities.
- *Temporary losses from rejected (and sometimes destroyed) consignments of fresh or processed product.* The most high-profile incident occurred when some 28 containers of grapes consigned to Holland in 2003 were rejected due to violative pesticide residues. Less visibly, yet more commonly, numerous small consignments of processed horticultural products entering the USA have been rejected for improper labelling, poor packaging, inclusion of illegal additives, and other reasons. In other markets, there have been a few other rejections of fresh produce.
- *Higher consignment-specific or recurrent transaction costs* due to duplicative testing, high levels of entry-point inspection, or the further treatment of goods upon arrival in overseas markets. The profitability of India's cut-flower trade into Japan and the Netherlands has been affected, and exporters of other products have also had to bear added costs.

[1] In this study, "horticultural products" are defined as including fresh and processed fruits and vegetables, cut flowers, and ornamental plants. Nuts or dried/processed legumes and pulses are not included, although the Agricultural and Processed Food Products Export Development Authority (APEDA) generally includes them in its data on horticultural exports.

- *Patterns of "defensive commercialization,"* whereby firms fail to pursue opportunities for remunerative trade with certain countries or types of buyers because of concerns about their inability to ensure compliance with regulatory or private standards in those markets. This pattern is common in Indian horticulture, although additional factors have also weighed on these commercial strategies.

The Official Response to Trade-related SPS Management

There is a common assumption that developing countries such as India (and individual suppliers therein) have no room for maneuvering in the face of emerging standards. That is, they face situations of "comply or perish." In reality, countries and suppliers face a wide range of choices, even when they seek to comply with a particular standard, although the increased emphasis in recent years on proscriptive process/procedural requirements (rather than product or outcome standards) does somewhat curtail this room for maneuvering.

Developing countries (and individual suppliers) can pursue one or a combination of the following types of strategies in the context of evolving standards:

- *Compliance*: adopting measures to meet international standards or the requirements of one's trade partners. This strategy might involve some combination of legal/regulatory change, the application of certain technical or other risk management approaches, the implementation of testing, certification, and/or other conformity assessment measures, and other actions.
- *Voice*: seeking to influence the "rules of the game" and/or how they are implemented via participation in international standard-setting fora, communications with the World Trade Organization (WTO), negotiations with bilateral or regional trading partners, and/or business planning with downstream clients.
- *Redirection*: altering commercial strategies to encompass sales to different countries or market segments, changes in the mix or form of products, and other maneuvers, taking into account the costs and benefits of complying with different standards.

The timing and mode of strategic response may also vary. Actions may be taken on a proactive or reactive basis. A proactive response involves anticipating future requirements and taking measures ahead of time in a manner that minimizes costs or maximizes benefits. A reactive response involves a player waiting until the requirements are put in place and only then adopting responsive actions, perhaps hoping to limit action or at least to learn from the mistakes of the "first movers." The strategy can be either defensive or offensive; a defensive strategy involves measures designed to minimize the changes required, whereas an offensive strategy involves trying to exploit an opportunity created by standards, such as a price premium for organic products. The locus of strategic response may also vary. Some responses may be taken by individual firms, farms, or government agencies. Other responses involve collective action, perhaps through producer or industry organizations or interministerial task forces. There is scope also for strategic responses that involve public–private collaboration or collaboration between developing country stakeholders in multiple countries.

While there are certainly diverse views, the mainstream official and private perspective in Indian horticulture is that many, if not most, of the emerging SPS and other international standards are not scientifically based and therefore represent an unfair "barrier to trade." This situation is considered to result either from deliberate efforts to protect farmers or processors from competition or to be fueled by unreasonable consumer fears in high-income countries and improved technologies for detecting hazards. Whatever the driving forces,

the presumed primary solution is seen to lie in effective negotiations with India's (official and private) trading partners and, failing that, in addressing the various measures in international fora for setting standards or resolving disputes.

With such a perspective, arguably insufficient attention has been devoted to monitoring the requirements of official and private standards, interpreting their implications for Indian horticulture, and using current and anticipated requirements as catalysts to upgrade existing operations and strengthen supply chain management. This response is not altogether surprising, given the limited imprint of export horticulture on Indian agriculture thus far. Yet the absence of a proactive or preventive approach to managing SPS standards for trade has left Indian horticulture either to adopt "defensive" strategies of commercialization—that is, to avoid markets that apply more stringent standards—or to adopt reactive, "fire-fighting" methods when trading partners' concerns about India's noncompliance with standards lead to actual or threatened trade interruptions.

These approaches contrast sharply with those taken in leading (and competing) developing countries in the horticultural export trade, such as Brazil, Chile, Mexico, Thailand, Kenya, and South Africa. The mainstream Indian approach seems to call for negotiation first and belated (and begrudging) compliance second. In contrast, many other countries are investing in compliance as a means to both improve their competitive position and enhance the effectiveness of their negotiations on particular technical and commercial matters. With regard to trade performance patterns and the prevailing international reputation for horticultural industries, this latter approach seems to have been relatively more effective.

When faced with crises related to noncompliance with SPS measures, as in the case of grapes, the public sector has focused on end-of-the line solutions. This strategy has included a combination of: (1) aggressive enforcement of existing or modified regulations, (2) heightened requirements for mandatory testing of raw materials and finished products, and (3) considerable investments in new "hardware," either through investment in public sector laboratories or subsidies for private investment in laboratories, factory upgrades, and other improvements.

This approach has generally proven "successful," in the sense that access to the affected market was restored relatively quickly. **Yet such crisis management measures have generally been quite expensive**, both financially for the government and in terms of lost incomes or livelihoods for the many farmers, small and medium enterprises (SMEs), and factory workers adversely affected by regulatory crackdowns. In some cases (for example, grapes), the sustainability of the adopted measures is uncertain, given the higher overhead cost of compliance. The considerable attention given to product testing has enabled the Indian government and various sectors to gain a more detailed look at the symptoms of noncompliance (including results of tests indicating violative levels of microbiological parameters or pesticide residues), although insufficient attention and resources have been directed to address the underlying causes of these problems. Recent moves to improve agricultural practices through initiatives such as the IndiaGAP program suggest a shift in the right direction, however.

Taking a More Proactive Stance Towards SPS Management

Standards present an opportunity for modernizing export supply and regulatory systems and adopting safer and more sustainable practices. Countries that have taken a proactive stance, including staying abreast of technical and commercial requirements and anticipating changes, have been able to reposition themselves in more remunerative market

segments. Consignments from such countries are subjected to comparatively less inspection by trading partners. "Good" reputations, gained through demonstrated compliance, yield lower transaction costs for farmers and exporters.

Considerably more emphasis is needed to promote awareness about SPS management among agro-food system stakeholders. Taking a more proactive stance requires a move towards a more cost-effective and strategic approach. Such an approach would place somewhat less emphasis on mandatory controls, inspections, and testing. It would place considerably more emphasis on promoting agro-food system stakeholder awareness about SPS management and facilitating effective individual and collective action by private firms, farmers, and service providers. By narrowing the gap between domestic and international standards, India could create a better platform for expanding exports. Extension service providers have a large role in promoting agricultural good practices to ensure that farmers follow recommended dosages and appropriate preharvest intervals in using agro-chemicals and in assisting with soil and water testing. There is also a need for promoting good hygiene and manufacturing practices and quality management to minimize food safety, environmental, and other risks.

India and its private sector are in a position to anticipate standards and take early action to gain competitive advantage through compliance and differentiation. Unlike many other developing countries, India has enormous scientific and technical capacities. It can effectively undertake research and field trials to stay ahead of the game. For example, Indian stakeholders anticipate problems in complying with existing European Union (EU) pesticide residue tolerances for pomegranates. Indian complaints about "unfair" approaches used to test for residues in pomegranates are getting limited attention, given that this crop is of minimal commercial importance to India's trading partners. India needs to manage this challenge—through its own actions—by performing its own field trials to establish proper regulatory tolerances and by promoting better pest management practices among its pomegranate growers. Similarly, future challenges are expected in relation to compliance with heavy metal tolerance levels in vegetables. Proactive steps can be taken to reduce the incidence of such heavy metals, thus lowering the risks of future trade disruptions and the risks to Indian consumers.

By anticipating shifting standards in existing markets, India is likely to identify opportunities for expanding into more remunerative segments in these markets. India does not currently face very stringent standards for horticultural commodities in regional markets or in the Middle East. The bulk of Indian produce entering these markets is targeted at the migrant worker community. This low-priced, bulk market should remain an attractive outlet for Indian exporters, who benefit from inexpensive and frequent freight links and similarities in diet and culture with the targeted importers and consumers. Yet there should also be potential to more firmly tap into the expanding high-end market segment in the Middle East, especially supermarkets. The required standards do not match those applicable at the higher end in Europe, although buyers for these supply chains will increasingly want evidence of "good agricultural practices" and produce traceability.

There is a need to institute stronger monitoring and evaluation components to gauge the effectiveness of various investment and incentive schemes and/or instruments made available by the central and state governments to promote horticultural exports and facilitate the upgrading of postharvest practices, infrastructure, and quality assurance systems. For instance, there are plans for more than 48 Agricultural Export Zones (AEZs) for horticultural crops. Carefully evaluating the performance of some of these schemes will have large payoffs in terms of future strategic decision making and resource allocation. There is also a need to rationalize various subsidy schemes and make some of them easier for the private sector to access.

There is a need to carefully assess the costs and benefits of standards compliance and evaluate the trade-offs. Investments in phytosanitary and food safety risk assessment and mitigation should be guided by the market potential of the export commodity. For example, all things considered, it is not obvious that the likely costs and administrative attention required for Indian mangoes to gain access to the Australian market would match the benefits of participating in that market, given its probable size. Achieving compliance at a potentially high cost would not make sense if the actual commercial potential of this trade is limited.

The experience to date has been that the government has taken disproportionate responsibility for managing SPS-related "crises." It is often assumed that the management of food safety and agricultural health is predominantly the responsibility of the public sector. Indeed, many crucial regulatory, research, and management functions are normally carried out by governments. In a variety of circumstances, importing countries require certain functions to be performed by a designated "competent authority" in the public sector. The private sector also has fundamentally important roles to play, however, in the process of setting standards and in the actual compliance with food safety and agricultural health requirements. Experience elsewhere demonstrates that capacity building in the private sector can complement (or even substitute for) public sector capacity, including in research and development and conformity assessment (inspection, certification, and testing). This report contains both general and very specific recommendations pertaining to the redefinition of public and private sector roles and responsibilities in managing SPS-related challenges in Indian horticulture.

There is a much greater need for collective action by the private sector. International experience highlights the importance of collective action within the private sector to promote awareness of SPS matters, to find technical and institutional solutions to emerging challenges, to implement programs to promote "good" agricultural or manufacturing practices, and otherwise provide a degree of self-regulation, which then reduces the need for government agencies to play enforcement roles. Indian horticulture presents many instances in which limited cooperation among private sector actors has either created a vacuum that the government has had to fill or has forced individual firms to tackle problems on their own. For example, the absence of an organized forum among Indian grape exporters has prevented any self-regulation, with APEDA filling the void with a mandated system of multistage government oversight.

For crops with limited potential for short-term export development, it would be important to carefully weigh the benefits of reorienting production to the specifications of the export market versus strengthening the industry's practices and quality consciousness to increase productivity and provide India's own consumers with a better-quality and safer product. Given the size and anticipated growth of the domestic market, there could well be far greater financial and social benefits from a program centered on improving the domestic supply chain rather than on prospective exports. Doing so may also serve as a means of deflecting import competition from exporters such as the Philippines, assuming that on-going trade reforms will lead to a similar degree of import liberalization as has occurred for other fruit.

The emerging dynamics in the domestic market, especially the modernization of retail, will likely have a far more significant impact on Indian farmers and traders than the export market. As the food retail sector modernizes, the focus will initially be on convenience and quality, but over time more emphasis will be given to food safety parameters in the modernized sector. The growth of the modern food retailing sector will likely induce extensive changes in the structure of production and product aggregation. Greater supply chain coordination will occur in parallel with more traditional supply chains involving multiple intermediaries and sales through wholesale markets. The more coordinated supply chains for the domestic market could also provide an improved platform for exports of certain fresh fruits and vegetables,

although the value-addition that will occur in the domestic market will likely dwarf that which could be obtained through exports.

Prospects for exports of fresh horticultural produce to developing countries and processed products to high-income markets are the strongest. India exports a diverse range of horticultural products. Among its various fresh horticultural exports, India has had the greatest success with supplying onions and mangoes to other developing countries. Exports of fresh produce to high-income countries are small and have not exhibited much dynamism. India has had considerably more success in exporting processed horticultural products—including mango pulp, processed gherkins, dehydrated onions, and various traditional foods—to high-income markets. Although greater public sector attention has been devoted to promoting fresh horticultural exports to high-income countries, India's competitive prospects are likely to remain better in (1) fresh produce sales to rapidly growing developing countries and (2) processed food sales to higher-income countries. Such export supply chains also involve comparatively larger numbers of farmers and firms, providing scope for the benefits from trade to spread more broadly.

Chapter 1: Introduction

The Context

In recent years, policy makers have placed considerable emphasis on promoting high-value agriculture in India, particularly horticulture. Several factors drive this emphasis on horticulture, including the growing recognition that India's farmers—most of whom cultivate less than two hectares—cannot realize sufficient returns from traditional staple crops such as rice and wheat. Increasing water stress in many states has also influenced the promotion of diversification in agriculture and a shift to less water-intensive horticultural crops. Horticultural crops also command attention for their potential to generate more jobs in rural areas, because they are more labor intensive to produce than primary staples. While increased incomes and urbanization are contributing to rapid growth in India's domestic demand for horticultural produce, there is considerable interest among Indian policy makers and entrepreneurs in expanding participation in lucrative international horticultural markets. Trade expansion is expected to accelerate growth and employment in this subsector and thereby help reduce poverty in rural India.

Horticultural crops occupy about 8 percent of India's gross cropped area and account for 30 percent of agricultural gross domestic product (GDP). Over the past decade, horticultural production has increased by about 3 percent per annum. During the same period, the value of India's horticultural exports grew at a remarkable rate of 8 percent per annum in real terms, more than doubling in real terms.[1] Despite this fairly strong growth, India's share in global horticultural trade was a mere 0.5 percent in 2004 (US$ 575 million, compared with a global trade of US$ 108 billion). Although India exports a wide variety of horticultural products, only a handful of commodities or products account for the bulk of this trade.

India is the second-largest producer of fruits and vegetables in the world (following China). India produces about 6 percent of the world's fruit and 11 percent of its vegetables. It is the world's largest producer of mangoes, bananas, peas, and cut flowers and the second-largest producer of a broad range of vegetables. Very little of this massive production is traded internationally. Substantial proportions of output—ranging from 15 to 40 percent for most crops—are not sold or consumed at all but lost or spoiled in the stages from harvest to transport and storage. Only 2–3 percent of grape and mango production is exported. Despite being a massive producer and consumer of fresh horticultural produce, for most individual products India is considered only a minor or inconsequential player in international markets. Is India therefore an awakening giant, ready to compete on and profit from the world horticultural stage? Or is its dominant structure of horticultural production and marketing misaligned with existing opportunities, standards, and supply chain management requirements?

Many factors determine international competitiveness in horticultural trade. International competitiveness requires suitable agro-ecological conditions, efficient trade logistics, strong business and farm management capacities, and a favorable overall environment for investment. In recent years, the capacity to manage sanitary and phytosanitary (SPS) risks has also emerged as an increasingly important component of international competitiveness in horticultural trade. Trade in fresh and processed horticultural products can contribute to the spread of plant pests and diseases and to the consumption of microbial pathogens, chemical residues, and/or naturally

[1] In this study, "horticultural products" are defined as including fresh and processed fruits and vegetables, cut flowers, and ornamental plants. Nuts or dried/processed legumes and pulses are not included, although the Agricultural and Processed Food Products Export Development Authority (APEDA) generally includes these products in its data on horticultural exports.

occurring toxins in food. Advances in scientific understanding of these risks, recent food safety and plant health scares or crises, and other factors have increased consumer awareness of potential food safety risks and contributed to the adoption of more stringent SPS standards by many countries as well as by private importers (see World Bank 2005a, especially chapter 2).

The changing context presented by evolving regulatory and private sector supply chain governance measures creates both challenges and opportunities for developing countries that engage in or aspire to expand horticultural exports. The new context requires a strategic approach, whereby emerging requirements are factored into trade and investment choices (through consideration of costs, benefits, and risks) and, where deemed profitable or otherwise beneficial, internalized within private management systems and the regulatory and administrative approaches of government agencies.

With isolated exceptions, this strategic approach has been largely absent in Indian horticulture. Although diverse views certainly exist, the mainstream official and private perspective is that many if not most of the emerging SPS and other international standards are not scientifically based and therefore represent an unfair "barrier to trade." This barrier is considered to result from deliberate efforts to protect farmers or processors from competition, or from unreasonable fears of consumers in high-income countries, or from improved technologies for detecting hazards. Whatever the driving forces, the presumed primary solution is seen to lie in effectively negotiating with India's (official and private) trading partners and, failing that, addressing the various measures in international fora that set standards or resolve disputes.

Given this perspective, arguably insufficient attention has been devoted to monitoring the requirements of official and private standards, interpreting their implications for Indian horticulture, and using current and anticipated requirements as catalysts to upgrade existing operations and strengthen supply chain management. This tendency is not altogether surprising, considering export horticulture's limited imprint thus far on Indian agriculture. Little horticultural production is grown specifically for export, and India's overall administrative systems for food safety and plant health have not been designed or oriented to support export horticulture. Yet the absence of a proactive or preventive approach to managing SPS standards for trade has left Indian horticulture either to adopt "defensive" strategies of commercialization—that is, to avoid markets that apply more stringent standards—or to adopt reactive, "fire-fighting" methods when trading partners' concerns about India's noncompliance with standards lead to actual or threatened trade interruptions.

These defensive and reactive approaches contrast sharply with those taken by other developing countries that lead (and compete) in horticultural exports, such as Brazil, Chile, Mexico, Thailand, Kenya, and South Africa. Whereas the mainstream approach in India seems to call for negotiation first and belated (and begrudging) compliance second, many other countries are investing in compliance, both to improve their competitive position and to enhance their effectiveness in negotiations on particular technical and commercial matters. With regard to trade performance patterns and the prevailing international reputation for horticultural industries, this latter approach seems to have been relatively more effective.

Study Objectives and Methodology

This study was initiated by a request from the State Governments of Tamil Nadu and Maharashtra for the World Bank to examine the current and prospective SPS-related barriers facing their tropical fruit exports. Specific interest was expressed in examining issues and outlining solutions pertaining to exports of bananas, pomegranates, and fresh mangoes. As India

is the world's leading producer of these crops, policy makers anticipate that India can play a significant role in their international trade. Advice was sought on how state governments could assist the private sector to overcome SPS-related barriers.

When initiating fieldwork in May/June 2005, the study team discovered that (1) underlying commercial prospects for exports of fresh bananas, pomegranates, and mangoes had not yet been thoroughly examined, (2) critical constraints on export competitiveness in these fruits extended well beyond food safety and plant health matters, and (3) many of the most interesting Indian experiences, challenges, and opportunities related to SPS and horticultural trade had been associated with other product lines, including processed fruits and vegetables, grapes, and cut flowers.

These observations led to the team to adjust its approach and underlying objectives. Although they could not carry out extensive external market studies, they reviewed and documented broader competitiveness constraints for the focal tropical fruits and probed the experiences and future needs related to SPS management in a larger array of commodity subsectors. Despite the partial, case-study basis of the work, this study seeks to (1) provide insights into the range of SPS-related and broader competitiveness challenges and opportunities facing Indian export horticulture, (2) highlight strengths and weaknesses in current approaches and capacities to address these challenges, and (3) identify near- and medium-term priority actions—both specific and strategic—to enhance competitiveness and standards compliance. The study ultimately seeks to catalyze a more strategic dialogue between Indian policy makers, technical agencies, and the private sector regarding priority actions and the appropriate and sustainable division of roles and responsibilities of different players.

This work is part of a broader study on agricultural marketing of high-value commodities in India, which focuses on four states: Tamil Nadu, Maharashtra, Orissa, and Uttar Pradesh. Maharashtra and Tamil Nadu were selected for the SPS case study because they have comparatively more experience with exporting horticultural products. This study is primarily based on findings from fieldwork in India in mid-2005, together with follow-up correspondence, visits to selected external markets, and reviews of experiences elsewhere that can further inform the options available to Indian stakeholders. A broad range of stakeholders in the private and public sectors were interviewed, including farmers, representatives of farmer associations, agro-processors, exporters, regulatory and service providers, research institute staff, and state and central government officials. A number of interviews were conducted with foreign buyers and regulators in the United Arab Emirates (UAE), United Kingdom (UK), and United States of America (USA). The study also draws on findings of the 2005 World Bank India Agricultural Marketing Survey (World Bank, 2007), a desk review of existing institutional and regulatory structures for SPS management in India, and on various other published and unpublished secondary sources.

Report Outline

Chapter 2 provides an overview of selected international trends in horticultural trade and introduces some of the official and private standards. Chapter 3 shifts to the broader Indian context. It summarizes major trends in domestic horticultural production and marketing, the prevailing regulatory environment, and the complex apparatus of government support and other interventions in this sector. Chapter 4 denotes major trends in the growth and market orientation of Indian horticultural exports and highlights key competitive strengths and weaknesses in the export supply chains for a range of commodities or products. Chapter 5 examines how SPS measures and capacities affect India's current market access and the profitability of its

horticultural trade. The chapter identifies "looming threats" to this trade and discusses alternatives for mitigating them, including changes in crop production or procurement, conformity assessment, and/or other arrangements. Chapter 6 draws out the conclusions from the study and includes recommendations and policy options for the Government of India.

Chapter 2: The International Context of Horticultural Products Trade and Emerging Standards

Value, Growth, and Composition of Trade

World trade in horticultural products (fresh and processed fruits and vegetables, cut flowers, and ornamental plants) has expanded rapidly in response to rising incomes, trade liberalization, and consumers' growing interest in greater variety, freshness, convenience, and year-round availability of horticultural products. In 2004, world trade in horticultural products reached US$ 108 billion[2] The value of this trade quadrupled in the last two decades (more than doubling in real terms) (table 2.1). Horticultural trade now represents the second fastest growing segment of world agro-food trade, following that in marine products. Horticultural and floricultural products now account for 22 percent of developing country agro-food exports, surpassing all "traditional" export crops combined.[3]

Table 2.1: World horticultural exports, 1984–2004
US$ millions

	1984		1994		2004	
	World	**India**	**World**	**India**	**World**	**India**
Fresh fruits	8,862.19	15.73	21,869.37	29.49	37,457.04	64.57
Processed fruits	6,108.68	23.40	13,177.71	36.96	21,623.76	110.09
Fresh/dried vegetables	6,164.79	66.58	13,763.42	92.89	23,686.36	181.99
Processed vegetables	4,523.70	15.85	11,437.42	53.77	18,888.57	179.17
Fresh cut flowers	1,109.86	—	3,248.11	0.49	5,497.20	9.63
Dried cut flowers	20.36	0.02	168.93	5.07	183.57	5.19
Fresh/dried plants	133.22	1.23	519.24	9.26	967.52	24.58
	26,922.79	122.81	64,184.20	227.93	108,304.02	575.23

Source: Authors' calculations, based on UN Comtrade data.

World horticultural trade grew at a lower rate in 1994–2004 (3 percent per annum in real terms) than during the prior decade (5 percent per annum). Growth in horticultural trade stagnated during the late 1990s (figure 2.1), owing to slower economic growth, particularly within the European Union (EU), or to general economic decline, particularly in Japan and countries affected by the "Asian financial crisis." Growth in horticultural trade also slowed as prices of mainstream horticultural products fell, due to an expanded world supply and growing market saturation for these products.[4]

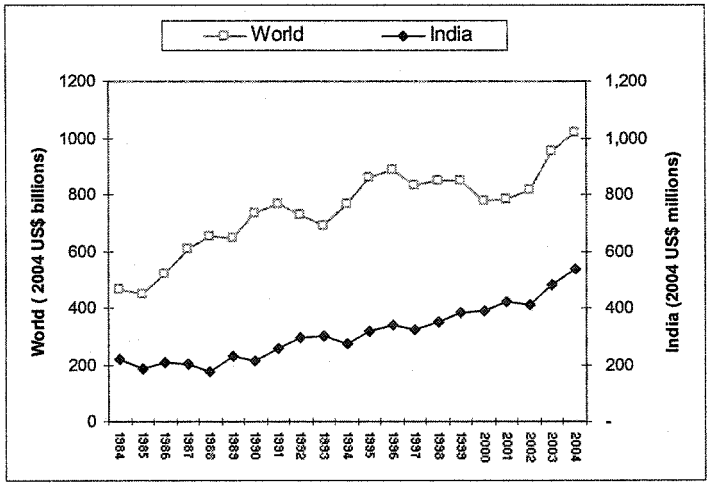
Fresh fruit, the largest single component of global horticultural trade, accounted for 35 percent of the total trade in 2004 (figure 2.2). While the fresh fruit trade involves a wide range of individual commodities, almost two-thirds consists of trade in citrus fruit, bananas, apples, and grapes. Trade in other and less traditional (sub-)tropical fruits—including mangoes, papayas,

[2] In this study, "horticultural trade" is defined as including trade in fresh and processed fruits and vegetables and flowers. To facilitate comparison of India's horticultural exports with those of other countries, data are taken from the United Nations (UN) Comtrade database. As Comtrade data rely on reports from individual countries, they tend to underestimate the value of trade as compared to Indian national data, since some of India's trading partners are not accounted for in the Comtrade data.
[3] Including coffee, cocoa, tea, cotton, sugar, and tobacco. See Aksoy and Beghin (2005) for a broader review of international agro-food trade patterns.
[4] Diop and Jaffee (2005) examine longer-term horticultural trade trends in greater detail.

kiwis, and others—has grown at a relatively fast pace over the past decade (8.6 percent in real terms), yet it still accounts for only 7 percent of the total world fruit trade.

Trade in fresh vegetables (including roots and tubers) accounted for about 22 percent of global horticultural trade in 2004. This trade is more fragmented than the fresh fruit trade. Tomatoes account for 20 percent of the total. Other highly traded vegetables include onions, potatoes, beans, peas, mushrooms, asparagus, and peppers. The global fresh vegetable trade increased by 4 percent per annum (in real terms) over the past decade.

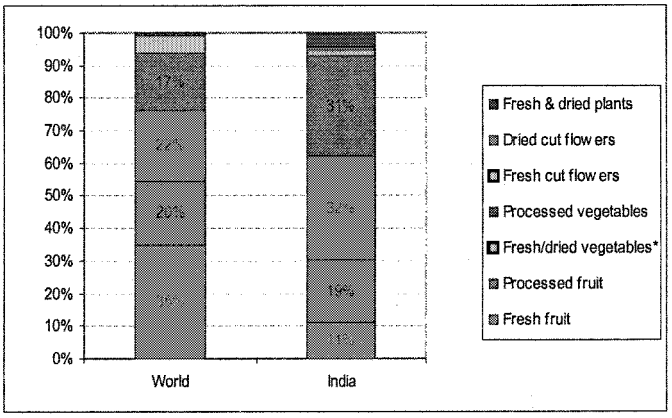
Figure 2.1: Exports of fresh and processed fruits and vegetables, 1984–2004



Source: Authors' calculations, based on Comtrade data.

Processed fruit products and processed vegetables account for 20 percent and 17 percent of global horticultural trade, respectively. Much of the processed fruit trade involves fruit juices (41 percent) and dried fruits (12 percent). Exports of processed fruits and vegetables grew at a real rate of 2.9 percent per year between 1994 and 2004. The emerging trend within the processed fruit and vegetable trade is a decline in the importance of canned and dried goods (tropical fruits and mushrooms) and a rise in exports of frozen vegetables (FAO 2003).

Figure 2.2: Composition of horticultural exports, 2004



Source: Authors' calculations, based on Comtrade data.

The value of global trade in cut flowers and foliage in 2004 reached approximately US$ 6.3 billon, with cut flowers accounting for 86 percent of this trade. Similar to the fruit and vegetable trade, growth in the value of world trade in cut flowers has slowed considerably, from

an average rate of 16 percent per year between 1988 and 1994 in real terms to roughly 3 percent per year between 1994 and 2004.

Tariffs[5]

The tariff structure faced by Indian exporters in prospective markets affects the overall competitiveness of horticultural exports. To varying degrees, the USA, the EU, and Japan use similar protection tools: low but highly dispersed ad valorem tariffs, specific duties, seasonal tariffs, entry prices, special safeguards, tariff escalation, and preferential access cum tariff-rate quotas. Average applied Most Favored Nation (MFN) tariffs are low in all these countries, ranging between 0.9 percent for fresh fruits in Canada to 9.2 percent in the EU for the same product category (table 2.2). For a variety of reasons, however, average tariffs do not reflect levels of protection.

Table 2.2: Most Favored Nation (MFN) tariffs applied to fresh fruits and vegetables by the EU, USA, Japan, and Canada

		Average and ad valorem rates (%)	All rates, average (%)	Lines covered (%)	Maximum (%)	Standard deviation	Total number of lines
EU (1999)	Fresh fruits	7.3	9.2	75	127.6	15.4	89
	Fresh vegetables	5.5	6.8	98	131.8	10.7	200
USA (2001)	Fresh fruits	6.1	4.6	100	29.8	7.0	70
	Fresh vegetables	4.1	3.1	98	24.3	5.0	189
Japan (2001)	Fresh fruits	8.7	8.7	100	32.0	6.8	56
	Fresh vegetables	3.9	3.9	94	40.0	5.6	185
Canada (2001)	Fresh fruits	0.9	0.9	72	8.5	2.5	67
	Fresh vegetables	1.1	0.1	74	16.0	2.7	216

Source: WTO–IDB database, as cited in Diop and Jaffee 2005.

Simple, uniform tariffs are a rarity in horticulture. For example, under the Uruguay Round Agreement on Agriculture, the EU replaced its reference price system with a system of minimum import or entry prices which apply to fruits and vegetables including tomatoes, citrus, table grapes, and apples. The entry price system works in conjunction with the system of tariffs. For example, during the peak European harvesting season, imports of table grapes into the EU are charged a 14.1 percent tariff on grapes priced 54.6 euros (€) or higher per 100 kilograms net weight. If the price is below this cutoff, the tariff jumps to 17.6 percent plus an additional charge per weight that increases incrementally up to € 9.6 per 100 kilograms net if the price is below € 50.2 per 100 kilograms net.

Many countries also use tariff rate quotas (TRQs). Tariff rate quotas essentially allow application of lower tariff rates to in-quota shipments and much higher tariffs to out-of-quota shipments. Fruits and vegetables turn out to be particularly infested by TRQs, with 355 TRQs in place, which is one-quarter of all such measures.

In many markets, India has to compete with exporters from other countries that are exempted from tariffs that Indian exporters must pay. The problem is most visible in the EU, which has concluded preferential trade agreements with important horticultural producers, quite apart from the unilateral preferences it has granted to some of the poorest countries. Thus Turkey enjoys duty-free access in a range of products, whereas India must pay average tariffs of 5–10 percent. Likewise, imports to the USA from India often incur a tariff from which competitors (for

[5] This section draws heavily on World Bank (2005b).

example, Mexico) are exempt, although it is not clear how effectively India would compete even in the absence of the tariff advantage that Mexico enjoys. The tariff rates applied to specific agricultural commodities from India in various export markets are shown in table 2.3.

Table 2.3: Tariff rates faced by India in selected markets

Product	USA	EU	Japan	Canada	Australia
Onions	Free	9.6%	8.5%	Free	Free
Dehydrated onions	25.6%*	12.8%	9.0%	6.0%	5.0%
Mangoes	Free	Free	Free	Free	Free
Mango pulp	Free	11.5%	7.5%	Free	5.0%
Fresh grapes					
Peak season	Free	14.1%+ EPS	17.0%	1.41 c/kg	5.0%
Off season	Free	11.5%+ EPS	7.8%	1.41 c/kg	5.0%
Pomegranates	Free	8.8%	6.0%	Free	Free
Fresh cut roses					
Peak season	6.8%	12.0%	Free	Free	Free
Off season	6.8%	8.5%	Free	Free	Free

Source: Authors' calculations, based on UNCTAD TRAINS data.
Note: EPS = entry price system; * indicates average of included categories.

The tariff structure in the EU, the USA, and other countries (for example, Japan and Korea) also features a high degree of escalation, which creates a disincentive to export relatively more processed products. As shown in table 2.3, processed products exported from India, such as dehydrated onions and mango pulp, face tariff rates that are on average 5–8 percentage points higher than rates for the product in fresh form. In a more general sense, table 2.4 notes that tariffs on processed products are consistently higher than those on semiprocessed products, and in the EU (but not the USA) tariffs on semiprocessed products are higher than those on agricultural raw products.

Table 2.4: Tariff escalation for agricultural products in the USA and EU, 2003
(simple average in %)

	USA			EU
Stage of processing	Applied rate	GSP rate	FTA rate	Applied rate
Agricultural raw products	6.9	4.5	0.5	3.5
Agricultural semiprocessed products	4.4	1.1	0.3	7.0
Agricultural processed products	9.9	6.6	0.7	10.9

Source: WTO–IDB CD ROM 2004, as cited in World Bank 2005b.
Note: GSP = Generalised System of Preferences; FTA = Free Trade Agreement

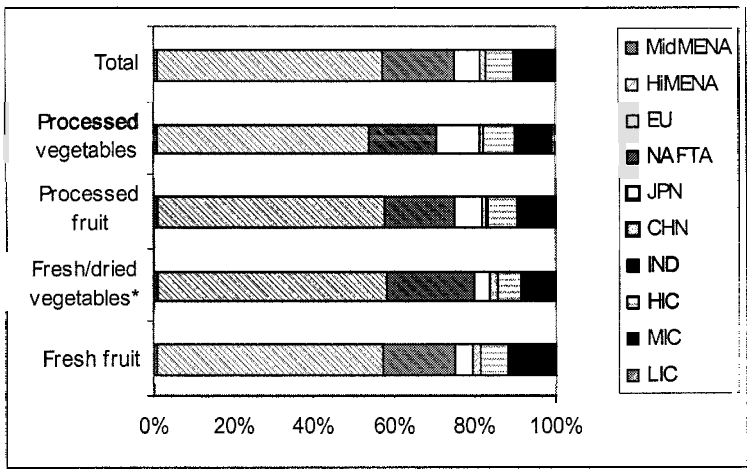
Directions of Trade and Participation of Developing Countries

The countries of the EU and the North American Free Trade Agreement (NAFTA) are the largest import markets for fresh and processed fruits and vegetables. The EU countries alone account for nearly 60 percent of global imports (figures 2.3 and 2.4). High-income countries account for more than 80 percent of global imports, although the imports of middle-income countries have grown especially rapidly over the past decade. There is considerable intraregional trade within both the EU and NAFTA countries. Some two-thirds of EU fruit and vegetable imports come from other EU member states, while almost 50 percent of NAFTA imports come from other members of the regional grouping. Physical geography, systems of trade preferences,

and the relative strength of cultural and commercial relations strongly influence broader directional patterns of international horticultural trade.

Overall, trade in horticultural commodities is highly concentrated. For example, close to 40 percent of fresh fruit exports originate from five countries—Spain, USA, Chile, Ecuador, and Italy. Similarly, 60 percent of fresh vegetable exports come from five countries—Spain, the Netherlands, Mexico, USA, and France. More than 80 percent of cut-flower exports come from the Netherlands, Colombia, Ecuador, Kenya, and Israel.

Figure 2.3: Major importers of horticultural produce, 2004



Source: Authors' calculations, based on UN Comtrade data.
Note: Fresh/Dried Vegetables excludes legumes. MidMENA refers to middle-income countries in the Middle East and North Africa; HiMena includes high-income countries in the Middle East; HIC includes high-income countries, except those in the Middle East, EU, North American Free Trade Agreement (NAFTA), and Japan (JPN); MIC includes middle-income countries, except those in the Middle East; and LIC includes all low-income countries, except India (IND) and China (CHN).

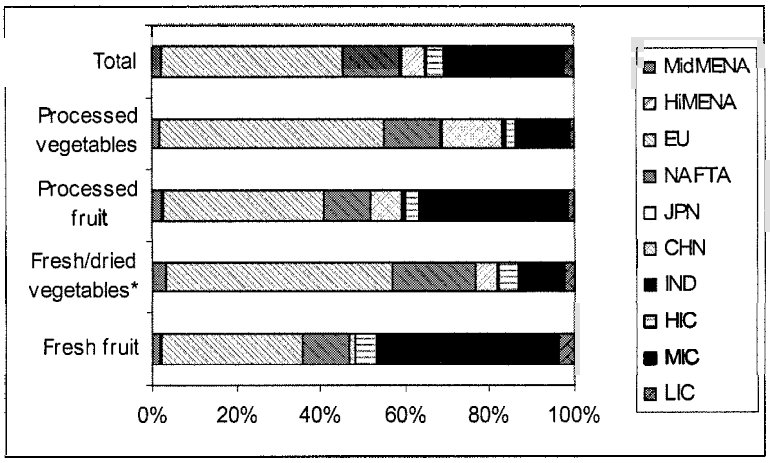
While many developing countries have entered fresh fruit and vegetable export markets, less than two dozen of these countries have succeeded on a sustained basis. The expanding overall share of developing countries in world exports of fresh fruits and vegetables hides heavy domination by just a handful of middle-income countries. Between 1997 and 2001, four Latin American countries alone—Mexico, Chile, Ecuador, and Costa Rica—accounted for 43 percent of developing country exports of fresh fruits (FAO 2003), and these countries are leading players in the most internationally traded fruit products (table 2.5). Although vegetable exports are similarly concentrated, the geographical distribution of exporters is wider. Mexico is the world's leading exporter of tomatoes, Kenya supplies 25 percent of the world's green beans, and Guatemala and Kenya jointly lead the world market for green peas.[6] Between 1997 and 2001, four suppliers—Mexico, China, Argentina, and Syria—accounted for 67 percent of fresh vegetable exports by developing countries (FAO 2003).[7]

A very small number of medium-income countries have succeeded in the processed segment of the export market, and developing countries as a group account for a relatively low share in world exports of these products (36 percent in 2001). China, Thailand, Chile, and Turkey

[6] Still, Mexico remains the world's top exporter of many other vegetable products, including asparagus, eggplant, and onions.
[7] The bulk of Syria's trade is with other Middle Eastern countries, while Argentina primarily targets other Latin American countries.

account for a combined 58 percent of developing country exports of processed fruit and vegetable products (FAO 2003). Secondary yet significant exporters include the Philippines, Mexico, Argentina, and Indonesia (with a combined 14 percent of developing country exports). Colombia and Kenya are the leading developing country exporters of cut flowers, although another dozen or so countries have experienced relatively sustained growth in the trade over the past decade or so.

Figure 2.4: Major exporters of horticultural produce, 2004



Source: Authors' calculations, based on UN Comtrade data.
Note: Fresh/Dried Vegetables excludes legumes. MidMENA refers to middle-income countries in the Middle East and North Africa; HiMena includes high-income countries in the Middle East; HIC includes high-income countries, except those in the Middle East, EU, North American Free Trade Agreement (NAFTA), and Japan (JPN); MIC includes middle-income countries, except those in the Middle East; and LIC includes all low-income countries, except India (IND) and China (CHN).

Product	Leading suppliers	Joint share of world exports (value)
Fresh produce		
Asparagus	Mexico, Peru, Thailand	94%
Mangoes	Mexico, the Philippines, Brazil	62%
Pineapples	Costa Rica, Côte d'Ivoire	61%
Bananas	Ecuador, Costa Rica, Columbia	60%
Avocados	Chile, Mexico	53%
Tomatoes	Mexico, Syria	52%
Grapes	Chile, Mexico, China	38%
Green beans	Kenya, Mexico, Jordan	49%
Green peas	Zimbabwe, Guatemala, Kenya	38%
Processed products		
Orange juice concentrate	Brazil	91%
Canned pineapple	Thailand, the Philippines, Indonesia	74%
Canned mushrooms	China	52%
Dried fruits	Thailand, China, Chile	35%
Tomato paste	Turkey, Chile, China	35%

Source: FAOSTAT database 2003; FAO 2003.

What factors appear to separate the more successful developing country horticultural exporters from their peers? To succeed in this field, a country must have some important assets, which provide an initial source of comparative advantage. These assets represent some

combination of the following: (1) favorable agro-climatic conditions and ample and accessible land and water resources, (2) a physical location on a coast or near a major market, (3) the availability of ample and relatively inexpensive labor, and (4) a class of entrepreneurs with commercial experience. Many countries possess some or most of these assets, but parleying these assets into a competitive horticultural industry capable of maintaining or improving competitiveness over time requires a distinctive set of investments and institutional structures, a range of facilitative government policies, and, normally, a bit of luck (see Jaffee 2003, Gabre-Madhin and Minot 2003, FAO 2003, and Huang 2004).

Jaffee (1993) examines the ingredients common to the initial growth spurt and subsequent maturation of some of the developing world's leading "success stories" in exporting fresh and processed fruits and vegetables.[8] In each case, the initial take-off occurred during a period of stable macroeconomic conditions and in the presence of a favorable investment climate. Important initial catalysts for export growth included sudden shortfalls in major overseas markets, new foreign direct investment or strategic partnerships, and/or improvements in international logistics capacity. Strategic, international technical and marketing partnerships provided a vehicle for transferring technology, penetrating new markets, and creating an identity for products from the exporting country.

Many countries have experienced only short-term spurts in horticultural exports. Countries with sustained horticultural exports, on the other hand, consolidated early gains through investments in research, further adaptation of international technologies, investment in expanded and upgraded logistical facilities, continued strengthening of vertical supply chains, the development of industry organizations for collective action, and the development of credible systems for quality assurance and food safety management. Industry expansion induced the development of associated industries, such as packaging, equipment supply, and technical consulting, which further contributed to the underlying competitiveness of the export industries. Additional investments were made in the industries' underlying assets, such as irrigation development and worker and management training. Synergies have generally developed between export horticulture and complementary industries, such as the domestic catering or tourist industry.

With certain historical exceptions, most of the long-standing export industries have featured private sector dominance in the commercial dimensions of the business, complemented by a rather substantial and multidimensional facilitative role for government. In the early stages of industry development, critical public sector roles have typically related to investment in transportation and port/airport infrastructure, investment in research and farm advisory services, measures to facilitate investor/farmer access to suitable land, policies to facilitate the transfer of technologies and skills, and the broad array of policies that foster a conducive investment climate. Over time, other important functions for government emerge, including SPS control measures, the promotion of competition within the industry and in critical support services, the negotiation of favorable international market access, and resolution of trade disputes.

[8] Including the industries in Brazil, Chile, Mexico, Kenya, and Taiwan.

Emerging Standards and Horticultural Trade

Standards have become crucial to facilitating transactions and trade, both within and between countries. Standards and technical regulations stipulate what can or cannot be exchanged and define the procedures that must be followed for exchange to take place. In the context of trade in horticultural products and associated production inputs, standards can play critical roles. For example:

- Standards can facilitate the flow of information between consumers and producers, particularly by providing information on unobservable characteristics such as food safety. Thus standards can reduce uncertainty for consumers and indicate to producers the expectations and requirements of consumers in terms of quality and safety.
- Standards can provide an important mechanism for technology transfer to developing countries. Technology is expressed through standards, which therefore help to diffuse technical information concerning products or processes.
- Standards are crucial in allowing firms in developing countries to integrate into global horticultural production chains, by ensuring the compatibility and traceability of products and/or raw materials from geographically dispersed places. Harmonized standards between countries and/or industries can reduce transaction costs by reducing duplicative conformity assessment functions, including inspection, testing, and certification.

Historically, the standards applied to international trade in horticultural products were quality standards related to varietal selection, physical and visual characteristics, tolerances for foreign matter, and other variables. Standards also evolved for packaging materials for fresh and processed horticultural goods. In recent decades, a wider set of standards has come to govern the international trade in horticultural products. Some countries have given much greater attention to managing food safety and plant health risks by adopting a range of measures, including outright banning of products (or suppliers), specifying the conditions under which products must be produced and/or the characteristics of the end product, or mandating labeling and other information requirements. Some countries have also given increased attention to the environmental and social dimensions of horticultural production.

Traditionally SPS standards and other measures have been promulgated and applied by public authorities and have provided a minimum set of food safety and/or plant health standards with which suppliers must comply. Some of these are so-called "horizontal" regulations, which affect many or most agro-food sectors, including horticulture. General food laws and plant quarantine regulations fit into this category. Other measures are more specifically targeted at horticultural products or production systems. In relation to horticultural products, some of the more prominent SPS requirements commonly laid down by governments include:

- Plant health measures, including requirements to carry out pest risk assessments; establish and maintain pest-free areas; apply chemical or physical treatments to export consignments to minimize the presence of live pests or larvae (for example, irradiation or fumigation); carry out phytosanitary inspections of growing areas, packinghouses, and so forth; issue phytosanitary certificates on export consignments; and otherwise follow the guidelines laid out by the International Plant Protection Convention (IPPC).

- Food safety measures, including requirements for registering the use of agro-chemicals for specific crops; outright bans on the agricultural use of certain pesticides; the setting of tolerance levels—maximum residue levels (MRLs)—for pesticide residues and for microbiological parameters; restrictions on the use of colorants, additives, or other

ingredients in processed foods; requirements for labelling and packaging; stipulations regarding needed management systems, such as requiring certified hazard analysis and critical control point (HACCP) systems[9] for fruit-juice makers; and requirements for the traceability of raw materials and finished products.

The private sector has also come to play a major role in specifying the "rules of the game" for participation in certain segments of the market for horticultural products.[10] In high-income countries and elsewhere, certain supply chain "leaders"—including major supermarket chains, fast food operators, and food processors—have established their own standards or supplier protocols as a means to comply with public standards, to ensure the quality and safety of their products, and sometimes to differentiate their products from those of their competitors. Different private sector protocols involve varying specifications for: (1) good agricultural practices (GAP), geared toward effective food safety and environmental management; (2) good hygiene or good manufacturing practices (GHP/GMP), involving the application of HACCP and similar principles in packinghouses and food processing operations; (3) quality management systems, including International Organization for Standardization (ISO) 9000 and others; (4) some degree of product and raw material tracking and traceability; and (5) conformity assessment of all of the above through buyer, third-party, or other auditing, testing, certification, and so forth. Some private sector protocols also contain provisions related to protecting worker or farmer welfare.[11]

Multiple factors are catalyzing these evolving official and private standards, including:

- A set of high-profile food safety crises or scares involving consumer illness and/or death and associated large commercial losses and political repercussions. Examples include the *E. coli* outbreaks in fast-food hamburgers in the USA, contaminated olive oil in Spain, dioxin in animal feed in Belgium, dairy product food poisoning in Japan, and bovine spongiform encephalopathy (BSE) and salmonella outbreaks in the UK.
- Demographic and socioeconomic trends, including rising per capita incomes, growing urbanization, and aging populations, as well as lifestyle changes leading to greater emphasis on eating out and ready-to-eat foods. Associated with these changes are changes in consumer awareness and preferences regarding food safety and the environmental and social dimensions of food production.
- Improved scientific understanding of food-related hazards, and advances in technology enabling more refined detection of contaminants and other hazards.
- The expansion in international agro-food trade, which has itself increased certain risks, especially for importing pests that are not present in the domestic environment.
- Rising commercial and political pressures, as reductions in conventional protection of markets (specifically tariffs) and in logistical barriers have enhanced competition. Some stakeholders have sought to use SPS and other measures to limit such competition.

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[9] HACCP is a systematic approach to the identification, evaluation, and control of significant food safety hazards.

[10] See the series of articles in *Food Policy* (30) 2005.

[11] In India and elsewhere, there is concern that emerging private sector standards—including EurepGAP for primary producers and the British Retail Consortium (BRC) Global Food Standard for processors or packers—are more difficult to comply with or that compliance is more costly to ensure (for example, through certification). While these private protocols are strongly based upon prevailing regulations, the technical requirements for specific areas are more stringent and/or need to be documented more systematically. The trend is also for private food safety standards to be supplemented with environmental and social requirements, some of which are either not yet reflected in regulations or officially enforced on traded products. See Lee (2005) for a discussion of pertinent issues.

While SPS measures should be scientifically based, it is obvious that the speed with which they are developed and the relative emphasis they receive will vary among countries. These differences arise not only because of large differences in consumer awareness and preferences, in demographic patterns, in patterns of food consumption, in the competitive structure of the domestic food industry, in scientific capacities, and in other variables, but also because of the geographical and agro-ecological circumstances that make countries more or less susceptible to plant health risks and even to the spread of certain food safety hazards. Thus while progress has been made in international or regional harmonization of certain standards or conformity assessment arrangements/procedures, enormous diversity remains in the SPS standards (and related private standards) that are actually applied and enforced in different countries—and even to some extent within distinct market segments and supply chains in individual countries (boxes 2.1, 2.2, and 2.3).

Box 2.1: Diverse standards in the EU "single market"

In response to changing political and economic circumstances, and in the wake of several high-profile food safety "scandals," EU countries moved to strengthen their underlying systems of food safety governance via changes in institutional responsibilities (including the creation of "independent" national or EU food safety agencies), in regulations, and in food supply oversight. Enormous efforts have gone into harmonizing national systems in ways that facilitate additional integration of the agro-food system within the EU and provide equivalent levels of consumer protection throughout the member states. For example, long-standing programs have been undertaken to harmonize approaches to risk assessment, to the registration of pesticides, and to surveillance systems for detecting and reporting food hazards.

In parallel, the private sector has undertaken many initiatives to develop and unify food safety "codes of practice" or protocols that can be applied across different subsectors within individual countries or applied in a particular subsector across different countries. This type of harmonization has been needed not only to facilitate intraregional trade and investment but also to reduce the costs associated with a proliferation of individual company standards. Examples of such private sector harmonization include the various protocols under EurepGAP (the Euro-Retailer Produce Working Group's Good Agricultural Practices). They also include the benchmarking of the British Retail Consortium (BRC) and other protocols based on hazard analysis and critical control points (HACCP) under the Global Food Safety Initiative.

To outsiders, this institutional, regulatory, and private governance restructuring initially projects an image of "Fortress Europe" devising ever more stringent official requirements and private sector specifications. Based on closer inspection and actual trading experience, however, the picture that emerges is one of an extremely diverse operational setting, with numerous distinct commercial and consumer segments, wide differences in how emerging regulations are interpreted and enforced, and thus considerable variation in the de facto rules of the game. For a broad range of issues, clear differences remain in how individual EU states approach food safety surveillance, inspection, testing, and sanctioning of noncompliance. Even a cursory review of EU Rapid Alert Notification data highlights the rather different sets of food safety concerns upon which the regulatory authorities among member states are focusing.

New entrants into this market have reason to be confused. Despite reams of paperwork documenting prevailing regulations and private protocols, the game is played in a more personalized manner, in which trust, reputations, on-going communication, and private warnings and signals all play critical roles. Incumbent players come to understand the operative rules, the areas of flexibility and inflexibility, and how best to maneuver, to conduct business, and manage risk. Long-standing players have learned the importance of developing strategic marketing relationships to help maneuver through some of the uncertainties and transaction costs of conducting horticultural business in this regulatory and commercial environment. With relatively few exceptions, Indian exporters are new to this market and are surprised (sometimes appalled) by the variation in how rules are applied in the European "single market."

Source: Based on Jaffee 2003.

Box 2.2: New EU regulations on food and feed hygiene and safety

On January 1, 2006, new EU regulations (EC No. 882/2004) on official controls on food and feed hygiene and safety came into effect. The new regulations provide for a harmonized approach to the design and development of national food and feed control systems, together with a common approach to monitoring member state imports of food and feed. The regulations require member states to present and report on multiyear control plans. They provide for the creation of a list of products of nonanimal origin that are known to pose serious risks to human or animal health and that should be subject to stricter inspection at the point of import.

Chapter V of the regulations covers official controls associated with EU imports of food and feed from nonmember "third countries." Most of the pertinent articles relate to the responsibilities of member countries to screen and inspect imports. Particular emphasis is likely to be placed on monitoring the imports of products that are designated to pose special risks or that have a history of frequent noncompliance with EU standards. Such a provision is already in place for peanuts, pistachios, and other nuts from designated sources and in relation to chilies and chili products. *There is little reason to expect such a designation to be extended to the types of fresh or processed horticultural products exported by India.*

At this stage, the EU does not require that third countries have a "competent authority" in place to provide assurances on food safety/hygiene for food of nonanimal origin. At this stage, there is no requirement for third countries to submit a food control plan for oversight of foods of nonanimal origin, and there is no need to preapprove eligible exporters of such products. *In practical terms, the new regulations do not require India to make any changes in food safety oversight in relation to its horticultural exports to Europe.*

That said, the new regulations make a provision (Article 23) for reduced levels of import inspections in Europe for countries of origin that have approved/recognized systems of quality control. Recognized systems need not involve government agencies directly; they may be private control and oversight systems. The EU Commission and its Food and Veterinary Office are currently considering how to implement Article 23. *Indian stakeholders should closely follow these deliberations and develop suitable approaches to best assure compliance and thus minimize overseas consignment inspections.*

For more information, see the European Commission report, entitled "Guidance Document: Key Questions Related to Import Requirements and the New Rules on Food Hygiene and Official Food Controls" (http://ec.europa.eu/food/international/trade/interpretation_imports.pdf).

Source: Authors

As will be highlighted in chapter 4, India's horticultural exports are directed at a large number of high-, middle-, and low-income countries. Indian suppliers to these markets are faced with enormous diversity in the stringency, actual enforcement, and specific features of SPS (and related private) standards. Table 2.6 provides a highly simplified summary of the relative stringency of SPS standards.

Table 2.6: Relative stringency of SPS standards facing India's horticultural trade

Category of standard	USA/ Canada	Japan/ Australia	UK/Netherlands/ Scandinavia	Other EU	Persian Gulf countries	South Asian Association for Regional Cooperation (SAARC)	Russia/ Former Soviet Union	Other middle income	Other low income
Official plant health	H	H	M	L	L	L	L	L-M	L
Official food safety	M	M	M	M	L	L	L-M	L-M	L
Private food safety	M	M	L-H	M	L-M	L	L	L-M	L
Private environmental/social	L	L	L-M	L-M	L	L	L	L	L

Source: Authors' analysis.
Note: H = high; M = medium; L = low.

Box 2.3: Emerging segmentation in Middle Eastern markets

When referring to their sales to the Persian Gulf countries, many Indian horticultural exporters indicate that there are effectively no SPS requirements. Phytosanitary inspection is lax or intermittent, and buyers are simply looking for decent quality at low cost. They are neither asking for assurances of good agricultural or good hygiene practices (GAP or GHP) nor doing more than visually inspecting produce. To some degree, this description reflects the broader market, especially as Gulf country regulatory authorities seem loathe to interfere with the vibrant fresh produce import and re-export trade. Yet the region's fresh produce market is becoming increasingly segmented between larger, modern grocery outlets, traditional corner shops, and the food service sector. The supermarket segment is most highly developed in the UAE, where it currently accounts for 25 percent of grocery sales and is expected to account for nearly 40 percent by 2009.

Both in the supermarket segment and in the food service sector, there are initial trends toward increased food safety due diligence, involving an increased appreciation of suppliers who can assure the application of GAP and uninterrupted cold chains. At the higher end of the market, preference is given to supplies from the relatively more advanced horticultural export sectors, including apples from New Zealand, citrus from South Africa, and vegetables from Kenya and Egypt. Indian onions and Asian vegetables take considerable shelf space but are sold as cheap alternatives (to Argentinean onions and Kenyan vegetables, for example) for price-conscious shoppers. Indian grapes and mangoes are also sold, on a seasonal basis, yet they have no special standing among supermarket or food service buyers.

The bulk of Indian produce entering Middle Eastern markets is targeted at the migrant worker community, with Indian produce competing with that from other South Asian or nearby countries. This low-priced, bulk market should remain an attractive outlet for Indian exporters, who benefit from inexpensive and frequent freight links and similarities in diet and culture with the targeted importers (many of whom are Indian) and consumers. Even so, there should be potential to tap more heavily into the expanding high-end market segment, especially supermarkets. Standards in these high-end markets do not match those at the higher end in Europe, yet buyers for these supply chains will increasingly want evidence of GAP and produce traceability.

Source: Field interviews in Dubai; Proceedings of Eurofruit Middle East Congress, Dubai, September 2005

Several general observations can be made. For example:

- Stringent plant health measures apply for accessing US, Japanese, and Australian markets. As will be highlighted in chapter 5, these measures typically involve pest risk assessments, followed by an agreement on which risk mitigation measures the supplier will undertake to access these markets. Such measures can therefore represent absolute barriers to trade. Port/airport inspections are also made on some or all consignments. Plant health measures are less exacting elsewhere and/or less vigorously enforced. There are exceptions, however, as with the more stringent measures taken by Netherlands authorities to mitigate the risks of imported pests to their own horticultural sector. India, itself, has variously applied strong phytosanitary measures against (potential) imports.
- Official food safety measures rarely represent absolute barriers to trade, although certain restrictions or needed tests may pose administrative challenges and shift competitiveness through their effects on the costs of production and conformity assessment. Food safety measures tend to be higher or more regularly enforced in higher-income countries than elsewhere. Each country has somewhat different concerns or areas of emphasis in import or market surveillance. For example, the USA gives relatively high attention to processed foods. It requires processed food suppliers to preregister with its authorities and particularly scrutinizes labelling, additives, packaging, and other characteristics. Some EU countries give particular attention to pesticide residues, while Japanese authorities focus on the potential incidence of various contaminants.
- The relative importance and stringency of private food safety standards also varies among and within countries. Standards are perhaps most stringent among certain supermarket

chains in northern Europe, where considerable regulatory, consumer, and commercial pressures have induced responses. Various consortia of firms have sought to harmonize private protocols. Even these markets, however, still show considerable variation in the private standards applied among different market segments (for example, among high-end supermarkets, discount supermarkets, "ethnic" food traders, or food service providers). Such variability is likewise found elsewhere.

- Outside of very specific market niches in the horticultural produce trade—such as organic produce—the specification and enforcement of environmental or social standards are still relatively limited. That said, some of the emerging private standards contain a blend of food safety, environmental, and social provisions. This trend will likely get stronger given changes in consumer awareness and preferences.

Clearly India's horticultural sector faces highly diverse "rules of the game" for participating in regional and international markets—simply in terms of the SPS and related private standards governing or affecting market access. This situation presents certain challenges as well as opportunities. One important challenge is to stay abreast of and understand the operative specifications, how they are applied, and what technical and administrative measures are needed by Indian suppliers for compliance. A second challenge is to build the necessary capacities, systems, and relationships to effectively and efficiently attain compliance. A third challenge is to monitor and anticipate likely changes in official and private standards so that these can be internalized within one's own supply and regulatory systems.[12] To the extent that a supplier (or an entire industry) gains a reputation for superior standards management or is able to anticipate regulatory, commercial, or consumer trends, standards compliance can be an opportunity for supplier differentiation in a competitive marketplace.

The challenges and opportunities posed by standards certainly need to be factored into the commercial and other strategies of farming, trading, and processing enterprises operating within India's horticultural sector. They also need to be factored into the government's policy and resource allocation decisions. Compliance with SPS, quality, and other standards may necessitate changes in regulations, in production or processing operations, in institutional arrangements for supply chain coordination, and/or in conformity assessment arrangements. Certain technical or administrative capacities will need to be developed or strengthened (box 2.4). These measures carry certain costs, although they could well be associated with significant near- or longer-term benefits. "Compliance costs" may include up-front investment costs in new infrastructure, equipment, management systems, and human capital. They may also include various recurrent costs such as those for inspection or testing. The level and distribution of compliance costs (and associated benefits) may well affect the profitability and/or competitiveness of supplying particular markets or marketing channels. Both the potential costs and benefits of compliance need to be considered in mapping strategies.

[12] Anticipating the trajectory of official and private standards in the high-income countries requires both judgement and guesswork. Some trends and patterns are clear, yet developments will also be influenced by episodic events—such as food safety crises—and not by systemic factors alone. There is even greater uncertainty about the speed and trajectory of standards evolution in what are now low- and middle-income countries. One can certainly anticipate more regulatory attention to both plant health and food safety risks. In the private sector, the pattern likely will be dualistic in the near- to medium-term, with an increasingly standards-conscious segment—servicing middle- and upper-income consumers—coexisting with the more traditional domestic market, where low-cost food supplies are the predominant focus. This latter pattern will also likely prevail within India's domestic market.

Box 2.4: Sanitary and phytosanitary management functions in horticulture

In the context of horticulture, SPS management involves an agglomeration of basic and more sophisticated technical and administrative functions, including:

- Applying good agricultural practices (GAP) and quality management at the farm level.
- Applying good management practices (GMP), hazard analysis and critical control point (HACCP), and quality management among packinghouses, processors, and other operations.
- Maintaining the identity (traceability) of products or raw materials.
- Registering/regulating the manufacture, distribution, and use of agro-chemicals.
- Applying quarantine procedures, including for emergency situations.
- Carrying out pest/disease surveillance and information management.
- Developing/maintaining pest-free areas.
- Inspecting and licensing fruit and vegetable processors.
- Testing products for contaminants and microbiological content.
- Verifying/certifying biological materials (such as seeds or seedlings).
- Verifying/certifying imported/exported products related to known hazards.
- Reporting possible hazards to treaty/trading partners.
- Notifying the World Trade Organization/trading partners of new SPS measures.

Such administrative and technical capacities for SPS management are embodied in institutional structures and procedures, physical infrastructure, and human capital. It is often assumed that the management of food safety and agricultural health is predominantly the responsibility of the public sector. Indeed, the public sector normally conducts various crucial regulatory and risk management functions, and in some circumstances importing countries require that particular functions be performed by government entities. However, the private sector also has fundamentally important roles to play in the process of setting standards as well as in the actual compliance with food safety and plant health requirements. Capacity building in the private sector can complement (or even substitute for) public sector capacity, as in the development of certification and testing services. Industry "codes of practice" may go a long way in assuring self-regulation. These issues will be examined more fully in chapter 5.

Source: Authors' analysis; World Bank 2005a.

Chapter 3: The Domestic Setting for Horticulture

Horticultural Production

India produced 48 million tons[13] of fruit on 4.0 million hectares and 79 million tons of vegetables on 7.0 million hectares in 2004 (table 3.1)—more than any other nation except China. Fruit and vegetable production has increased rapidly in response to growing demand, fueled by growth in urbanization and real incomes and by a concerted effort to promote agricultural diversification. Fruit production grew by 2.5 percent per year in the last decade, while vegetable production increased even faster, averaging 3.9 percent per year.[14] Even though India increased its vegetable production by 50 percent and its fruit production by nearly 40 percent within a decade, India's share in global production remained fairly constant, owing to the dramatic increase in horticultural production in China.[15]

Table 3.1: Fruit and vegetable production, 1994 and 2004

	World (million t)	Developed countries (million t)	Percent of world	Developing countries, excluding China and India (million t)	Percent of world	China (million t)	Percent of world	India (million t)	Percent of world
1994									
Total fruits and vegetables	1,011	268	27	426	42	226	22	90	9
Fruits	531	129	24	305	57	60	11	37	7
Vegetables	479	139	29	121	25	166	35	53	11
2004									
Total fruits and vegetables	1,505	293	19	582	39	502	33	127	8
Fruits	772	141	18	421	55	162	21	48	6
Vegetables	733	152	21	161	22	341	46	79	11

Source: Authors' calculations, based on FAOSTAT data.

India is also one of the world's largest flower growers. There is enormous demand for flowers such as marigolds, jasmine, chrysanthemums, and tuberoses, which are used for worship, festivals, and other traditional occasions. Most flowers are produced on open fields. Following economic liberalization in the early 1990s, floriculture in greenhouses or other protected structures emerged to produce roses and other cut flowers for export. Since then the industry has been widely promoted. The 10th Plan (2002–07) identified floriculture as a "sunrise industry" (Desai 2004). Today 735,000 tons of traditional flowers and about 2 billion flower stems are produced each year on about 70,000 hectares. The industry has experienced impressive growth: cut-flower production grew by 16.9 percent per year and traditional flower production by 12.2 percent per year between 1993/94 and 2002/03.

[13] All figures expressed in tons in this report are in *metric* tons.
[14] Growth between 1992/93 and 2002/03. Based on authors' calculations; data from FAOSTAT.
[15] Which, according to Food and Agriculture Organization (FAO) statistics, has more than doubled over the past decade.

Mangoes, bananas, citrus, guavas, and papayas are the major types of fruit grown in India, accounting for about 80 percent of the area under fruit production. The main vegetable crops—accounting for about half of the area—include potatoes, tomatoes, onions, cabbages, and cauliflower. Although India's fruit and vegetable yields are comparable to world averages, in many cases they are well below yields in comparator countries and leading developing country exporters (table 3.2).[16]

Table 3.2: Fruit and vegetable crop yields, 2004
t/ha

Crop	India	World	Comparator country
Apples	5.9	11.9	11.3
Bananas	24.7	15.8	48.6
Citrus fruits	17.8	14.2	20.5
Grapes	20.0	8.4	10.9
Mangoes	6.8	7.4	8.6
Papayas	8.8	17.9	45.2
Pineapples	14.4	18.7	43.2
Total fruits	**11.5**	**11.4**	**8.1**
Eggplant	16.1	17.6	32.5
Cabbages	21.4	21.1	34.0
Cauliflower	17.1	18.9	20.8
Okra	9.6	6.4	6.3
Onions	10.4	17.8	21.2
Peas	9.1	8.2	10.4
Tomatoes	14.1	27.5	55.4
Total vegetables	**11.2**	**16.0**	**11.3**

Source: Authors' calculations, based on FAOSTAT data.
Note: Comparator countries include China (for apples, onions, cauliflower, and overall fruit and vegetable yields); Costa Rica (bananas); Côte d'Ivoire (pineapples); South Africa (citrus); Chile (grapes); Mexico (mangoes); Brazil (papayas); Egypt (peas); Kenya (okra); Jordan (eggplant, cabbages); and Morocco (tomatoes).

Fruits and vegetables are grown throughout India. The leading fruit producers are Maharashtra, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, and Karnataka; the leading vegetable producers are West Bengal, Uttar Pradesh, Bihar, Orissa, and Maharashtra. Fruit and vegetable production tend to be concentrated in rainfed areas, as irrigated regions specialize in rice and wheat. Production is also concentrated in and around urban districts, because fruits and vegetables are highly perishable (Rao et al. 2004). As will be noted in chapter 5, these production conditions present certain food safety risks, because air, soil, and water pollution can introduce heavy metals and other contaminants into fresh produce.

Although farmers growing horticultural crops in India tend to have larger farms than the average farmer, their farms are typically very small. For instance, on average, mango farmers in Maharashtra and Tamil Nadu own and operate only about 3 hectares.[17] Only 5 percent of mango farmers in Maharashtra cultivated more than 5 hectares (Korstanje et al. 2005). By comparison, 50 percent of mango farms in Brazil are 20 hectares or more. Relatively few farmers in India use modern cultivation or postharvest practices, although such practices are more common in some states than others.[18] Attention to quality varies, but overall the quality of produce grown for domestic consumers is quite poor. Certainly the quality of most commodities is well below the standards even of low-end export markets. Despite efforts to promote integrated pest management (IPM) practices, improper use of agro-chemicals is widespread. Farmers do not adhere to recommended chemical dosages, spraying regimes, and preharvest intervals (the time between the last pesticide application and the harvest), and they can still obtain and use chemicals that are no longer registered or that are not recommended for use in horticulture. With growing consumer

[16] These average yield estimates are not specific to export supply chains. In some cases, average yields of exportable produce are considerably lower than yields in table 3.2. Because of certain agronomic practices, for example, grape yields on farms producing for the European market may average 10–12 tons per hectare. Average banana yields in India appear impressive compared with the world average, but very little of India's production is of export quality. The same point applies to citrus.
[17] On average, farmers in Tamil Nadu own 0.8 hectares, while farmers in Maharashtra own 1.8 hectares (World Bank 2006).
[18] For instance, the use of drip irrigation is becoming more common in Tamil Nadu and Maharashtra.

awareness, demand for safer and better-quality fruits and vegetables is increasing, but mainly in major urban markets catering to higher-income and more quality-conscious consumers.

Consumption of Horticultural Products Is on the Rise

With rising incomes, food consumption patterns in India are changing rapidly. Diets are becoming more diverse, health consciousness is increasing, and consumption of fruits and vegetables is on the rise. Per capita expenditures on fresh fruits and vegetables increased by approximately 25 percent in real terms between 1993/94 and 2003 (Government of India 2005c). In 2003, the average rural household spent about 35 rupees (Rs) on vegetables and Rs 10 on fruit each month, equivalent to 12 and 3 percent, respectively, of total food expenditures. Urban residents on average spent about Rs 46 on vegetables (11 percent of food expenditures) and Rs 24 on fruit each month (5 percent of food expenditures). Fruit is still considered a luxury for most households.[19] The richest households in both rural and urban areas spend about 4 times as much as the poorest households on vegetables and 20 times as much on fruit. According to the UN Food and Agriculture Organization (FAO), fruit consumption in India is projected to increase by 4 percent per year. Based on these estimates, demand for fruit is projected to reach 66 million tons by 2010, with tropical fruit accounting for the bulk of demand growth.

Marketing Chains for Fruits and Vegetables

Integrated production and export distribution is characteristic of the horticultural trade in most countries with leading shares of the export market, but most exporters and export processors in India still rely on traditional wholesale markets to procure fruits and vegetables (box 3.1). For several commodities, such as grapes and gherkins, dedicated export supply chains have emerged to comply with European buyers' delivery schedules and requirements for quality, safety, volume, and consistency. The more general challenges presented by the fragmented production base and system of marketing logistics do not provide a natural basis for increasing horticultural exports, however.

Marketing channels for fruits and vegetables in India vary considerably by commodity and state, but they are generally very long and fragmented. Figure 3.1 presents typical marketing channels for mangoes and onions in Tamil Nadu. Most domestic fruit and vegetable production is sold to wholesale markets, although—depending on the state and commodity—farmers may also sell to traders at the farmgate, to traders at village markets, or directly to processors, cooperatives, and others (table 3.3).

[19] The income elasticity of demand for fruit is estimated at 1.89 in rural areas and 1.36 in urban areas in 2003. The comparable figures for vegetables are 0.60 in rural areas and 0.51 in urban areas. These estimates are based on data from the 58th round of the Indian National Sample Survey.

Box 3.1: Procurement patterns of fruit and vegetable processors and exporters

About 40 percent of recently surveyed agro-processors and exporters said they purchased raw materials directly from farmers. For some crops such as mangoes, 90 percent of exporters (in a sample of 20 mango exporters) reported sourcing at least some produce directly from farmers (see table). Most of these mango exporters also reported that farmers deliver the fruit to the firm's collection points or packinghouse. More than half of the firms processing mango products for the domestic market claimed to purchase at least some mangoes directly from farmers. On the other hand, the majority of potato processors acquired their raw material at wholesale markets. While fairly large numbers of processors reported buying fruits and vegetables directly from farmers, only a small fraction (4 percent) did so on a contractual basis. Most contractual purchases were made by mango processors and exporters. The reputation of suppliers (for quality and, to a lesser extent, food safety) appears to be an important consideration for processors and exporters, even when they purchase from wholesale markets. These buyers routinely seek out produce from certain "regular" suppliers, based on past experiences.

When firms purchase raw materials for processing or export, they report undertaking a number of quality checks, mostly related to variety, ripeness, size, and overall visual appearance. Despite these checks, processors and exporters commonly report wastage of 10 percent or more in the produce they purchase. Given this fairly high volumes of losses, it is striking that few firms have access to cold storage facilities or refrigerated transport. Among all enterprises surveyed, only eight reported using refrigerated transport. About 1 percent of firms in the sample owned cold storage facilities and 2 percent rented such facilities.

Firms exporting fresh agricultural products were also asked about quality checks by their own buyers or by third parties. The majority reported that their buyers check the quality of produce supplied and are also concerned about the sanitary conditions in the packinghouse or factory. However, none of the surveyed firms volunteered any information about their produce ever being rejected by buyers due to quality and/or food safety concerns. This response is not unusual in surveys of this type, yet it almost certainly does not reflect actual experience.

Role of quality in the transactions of fruit and vegetable processors and exporters

	Sample size (no.)	Firms that purchase raw materials directly from farmers (%)	Firms that buy from regular suppliers (%)	Firms whose buyers purchase based on quality (%)	Firms that buy from suppliers based on sanitary conditions (%)	Firms whose buyers purchase based on sanitary conditions (%)
Mango processor	120	51	65	88	44	58
Mango exporter	20	90	75	100	60	90
Potato processor	28	0	75	89	86	86
Potato exporter	3	0	100	100	100	100
Tomato processor	29	41	90	93	76	76
Tomato exporter	1	100	100	100	0	1

Source: Authors' calculations, based on data from the 2005 India Agricultural Marketing Survey (World Bank 2007).

Source: Authors' analysis, based on the 2005 India Agricultural Marketing Survey (World Bank 2007).

A model Agricultural Produce Marketing (Development and Regulation) Act (APM Act) was prepared by the Directorate of Marketing and Inspection in the Ministry of Agriculture, and legislation based on this model was passed by individual states.[20] Under these Agricultural Produce Marketing Committee (APMC) Acts, wholesale markets (*mandis*) were created to centralize and improve marketing services and infrastructure (storage, weighing, packing, grading, and market intelligence). Even so, marketing arrangements vary a great deal between states as guided by legislation. In most states, all wholesaling of "notified" agricultural produce is required by law to take place in controlled markets, and market development is centered on state

[20] Kerala, Jammu and Kashmir, Manipur, Andaman and Nicobar Islands, Dadra and Nagar Haveli, and Lakshadweep do not have the regulation.

marketing agencies.[21] Tamil Nadu is one state where there are comparatively fewer "notified" commodities, thereby enabling more transactions outside of the state-run wholesale markets.[22]

In states where fruit and vegetable wholesaling must occur in regulated marketplaces, farmers cannot sell directly to large retailers and processing companies, which restricts the development of shorter and more efficient supply chains. Logistical costs and crop losses tend to be relatively high for perishable fruits and vegetables. In the majority of states, APMC regulations also prevent the private sector from investing in wholesale markets and marketing infrastructure, with the result that most markets have very rudimentary infrastructure, particularly for storing and handling perishable products. For example, less than 20 percent of markets included in a survey of 78 wholesale markets in Tamil Nadu, Maharashtra, Uttar Pradesh, and Orissa had cold storage facilities (World Bank 2007).

Table 3.3: Market destination of farmers' produce
% production sold

Commodity/location	Market destination				
	Wholesale market	Village market	Directly to processor	Trader at farmgate	Cooperative and other
Mangoes					
Tamil Nadu	53	1	5	34	7
Orissa	48	19	0	28	5
Maharashtra	72	10	5	3	10
Uttar Pradesh	55	24	0	6	15
All states	56	13	2	20	8
Tomatoes					
Tamil Nadu	85	7	0	7	1
Orissa	56	13	0.3	26	5
Maharashtra	79	16	0	4	1
Uttar Pradesh	67	13	0	4	16
All states	67	13	0.1	14	6
Potatoes					
Tamil Nadu	100	0	0	0	0
Orissa	58	18	0	20	4
Maharashtra	69	14	4	0	13
Uttar Pradesh	60	7	1	9	23
All states	63	11	1	11	14

Source: Fafchamps, Vargas-Hill, and Minten 2006.

Emergence of Coordinated Supply Chains

In the last few years, more coordinated supply chains for fruits and vegetables have emerged, catering to India's export and high-end domestic markets. On the domestic front, this trend has primarily been led by the growth of hypermarkets, supermarkets, and other organized retailers in metropolitan centers. The emergence of dedicated export chains has been prompted by stricter quality and safety standards in certain export markets.

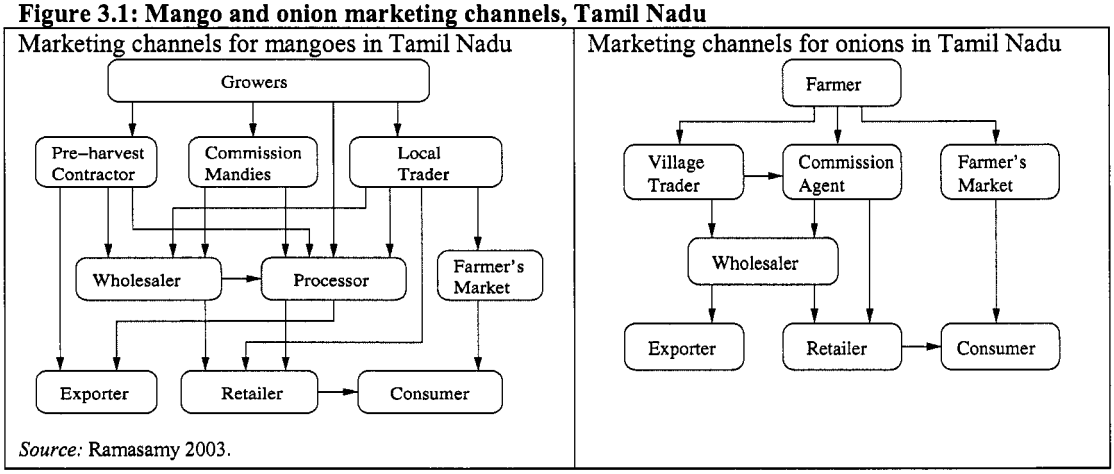
Coordinated supply chains involve structured relationships among producers, traders, processors, and buyers to provide detailed specifications on what and how much to produce, the time of delivery, quality and safety conditions, and price. These relationships often involve

[21] Formulated by the Government of India in 2003, the Model Act to reform the Agricultural Produce Marketing (Development and Regulation) Act, 1951 aims to foster a single market in the country by removing the restriction on selling agricultural commodities wholesale only in state-regulated markets and by permitting the private sector to develop and operate wholesale markets. By 2006, only five states had adopted the model and amended their APMC Act: Punjab, Madhya Pradesh, Himachal Pradesh, Sikkim, and Nagaland. Some states have allowed company-specific waivers (for example, Uttar Pradesh, Rajasthan, and Karnataka), whereas several other states are still amending the Act (Government of India, Ministry of Agriculture 2005).

[22] Tamil Nadu has 40 notified agricultural commodities, compared to 286 in Maharashtra and 106 in Uttar Pradesh (World Bank 2006).

exchanges of information and sometimes assistance with technology and finance. Coordinated supply chains fit well with the logistical requirements of modern food markets, especially markets for fresh and processed perishable foods. Safety and quality controls can be applied all along the supply chain, which can be more effective and efficient than applying such controls only at the end of the chain.

Figure 3.1: Mango and onion marketing channels, Tamil Nadu



Source: Ramasamy 2003.

Several companies in India are beginning to invest in integrated supply chain management systems and infrastructure, with an emphasis on quality and, to a lesser extent, safety. Different models are emerging, including fruit and vegetable retail outlets that directly procure produce from farmers or from grower associations through various formal or informal contractual arrangements. Collection-cum-grading centers established in rural areas move all produce through a central distribution facility with such modern infrastructure as cold storage, ripening rooms, and controlled atmosphere chambers. Growers are required to follow certain specifications and are often provided with some inputs and technical advice about agronomic and postharvest practices.

Contract farming for fruits and vegetables is already practiced in several states and likely to expand considerably following recent reforms. Until recently, contract farming was not legally recognized in most states, and a legal framework governing contracting arrangements was missing. Under the APMC Model Act, a new chapter on contract farming provides for the registration of contract buyers, the recording of contract farming agreements, and time-bound mechanisms for resolving disputes. It provides an exemption from market fees for produce covered by contract farming agreements and provides indemnity to farmers' land to safeguard against the loss of land in the event of a dispute. Contract buyers can now legally purchase commodities through individual purchase contracts or from farmers' markets. The legislation also contains a provision for direct sales of farm produce to contract buyers from farmers' fields, bypassing notified markets.

In Bangalore, a recently established terminal market for fruits and vegetables (known as SAFAL) can physically handle up to 1,600 tons of produce a day. It is linked to some 250 Farmers Associations and 40 Collection Centers in selected producing areas. The SAFAL market receives and auctions sorted, graded, and packaged produce from these associations and centers. SAFAL also has forward linkages to a number of retail outlets (Cash and Carry Stores). The market's infrastructure includes temperature- and humidity-controlled storage facilities and ripening chambers. The most recent budget speech announced allocations for more model

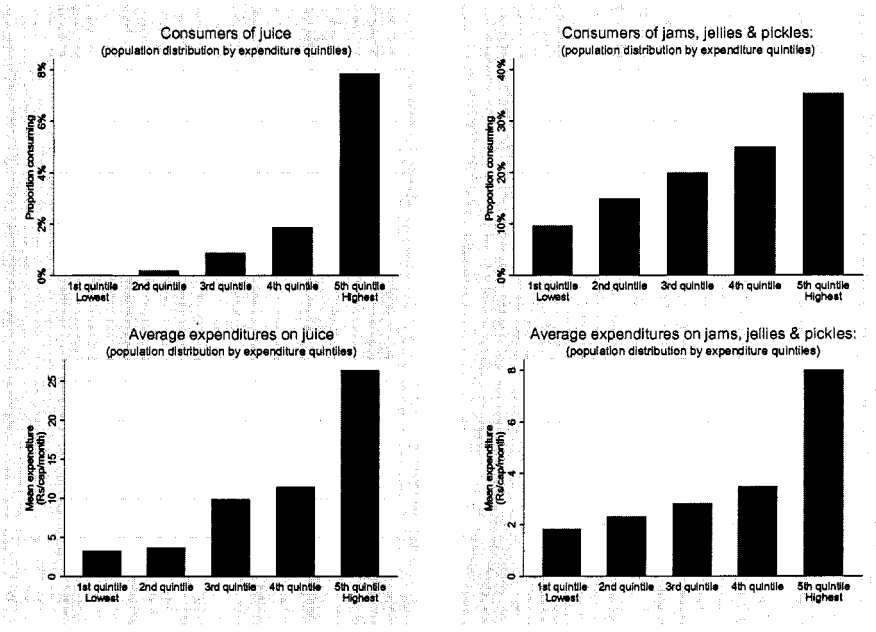
horticultural terminal markets to be set up through private–public partnerships under the National Horticulture Mission (discussed later in this chapter). SAFAL's experience should be closely monitored and lessons drawn to inform similar investments.

With increasing private investment in the food retail sector and impending changes in contract and marketing laws, shorter and more direct supply chains with traceability are expected to become more common (box 3.2). *Of the total food retail sales (estimated at US $135 billion in 2002/03), less than 1 percent currently occur in the organized sector* (Singh 2004). The incidence and spread of coordinated supply chains will be closely connected with the pace and direction of modernization in India's food retail sector. Thus far, changes in food retail have been gradual and considerably slower than those observed in many other developing countries.[23]

Fruit and Vegetable Processing

India's commercial fruit and vegetable processing sector remains small. Less than 2 percent of domestic fruit and vegetable production is estimated to be processed. A wide assortment of fresh fruits and vegetables is available year-round, and most consumers have a strong preference for consuming fresh over processed products. Moreover, although incomes are growing, the vast majority of households cannot afford processed products. The 2003 Indian National Sample Survey found that only 2 percent of all households reported expenditures on processed fruit juices and less than 20 percent on commercially produced jams and pickles (figure 3.2). Seventy-five percent of juice consumers fell in the top 25 percent income bracket, and these consumers had per capita monthly expenditures that were more than two and a half times larger than the expenditure of the average Indian consumer.

Figure 3.2: Processed fruit and vegetable consumption and expenditures



Source: Authors' calculations, based on data from India National Sample Survey 2003

At its current level of Rs 36 billion (about US$ 800 million) (Govindan 2005b), the fruit and vegetable processing industry in India is small, even compared to that in other developing countries. In 2000, exports alone of processed fruit and vegetable products from Thailand totaled US$ 836 million. South Africa's canned fruit and vegetable industry has a turnover of US$ 3

[23] Currently foreign chains are not allowed to invest directly in the food retail sector and have to open stores as franchises.

billion. For broader comparison, the fruit and vegetable processing sector in the USA has an annual turnover of US$ 40 billion.

Production in the fruit and vegetable processing sector is almost evenly split between an organized sector and an unorganized sector. There is quite a bit of difference in product composition between the sectors (figure 3.3), partly due to regulations that restrict the manufacture of some items such as pickles and chutneys exclusively to the small-scale sector.[24]

Box 3.2: The emergence of modern retailing in India: Implications for quality and safety standards for fresh fruits and vegetables

International experience suggests that the emergence of organized retailing in India is likely to bring about broad changes in quality and safety standards for fresh produce sold in the domestic market. Compared to changes induced by the growth of exports, changes in domestic retail markets are likely to have a larger impact in transforming traditional agricultural supply chains and in raising standards. Although the share of fresh fruits and vegetables currently exported from India in fresh form (1 percent of total production of fruits and vegetables) probably exceeds the share sold through the organized retail sector, the organized retail sector is expected to grow much faster than fresh fruit and vegetable exports. Within the next 5–10 years, the volume of fresh fruits and vegetables transacted through the organized retail sector will probably exceed export volumes.

Recent reviews of the rise of supermarkets in other developing countries indicate that as supermarkets enter the fresh fruit and vegetable market, their strategy to gain market share has been to widen the quality gap and narrow the price gap with traditional markets. To achieve this goal, supermarkets rapidly shift from traditional procurement arrangements primarily relying on wholesale markets to arrangements involving specialized wholesalers, preferred suppliers, and central distribution centers. Supermarkets also use private quality and safety standards.

Supermarket chains lacking established, direct relationships with producers or wholesalers initially tend to procure produce from traditional wholesalers or markets. In time, they shift to specialized wholesalers who ensure consistency in quantity, quality, price, and variety. Supermarkets may enter into formal or informal contracts with specialized wholesalers, with contracts stipulating delivery volume and frequency, quality standards, and sometimes code of practice requirements, such as using clean irrigation water and no banned chemicals. These specialized wholesalers may source product from central wholesale markets and will often start purchasing from "preferred suppliers." Purchasing from preferred suppliers enables them to monitor quality closely and ensure produce is adequately cleaned, graded, and sorted and meets other quality and safety requirements. In addition to conveying market specifications, specialized wholesalers may also provide some technical assistance to preferred suppliers.

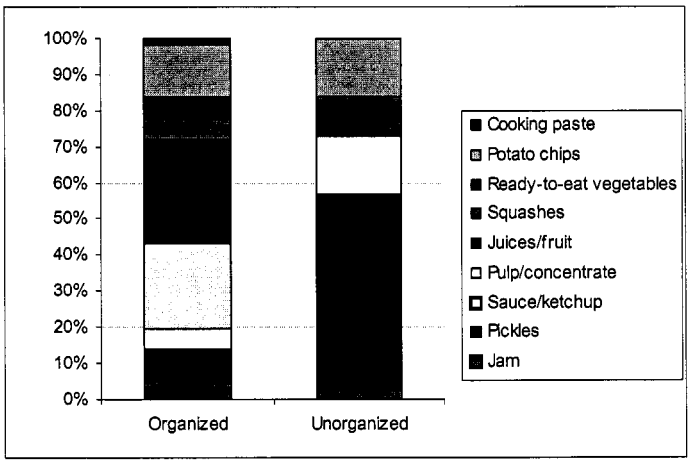
The larger chains quickly move to a centralized distribution system. Doing so provides major cost savings by lowering the costs of coordination (deliveries have to be monitored only at the distribution center) and inventory management. Substantial cost savings are also derived from economies of scale (for example, buying in bulk in one place or improving the ability to bargain with suppliers). Many of the larger chains may procure a sizeable proportion of their fresh fruit and vegetable supply directly from farmers through various formal and informal contracts, and they resort to wholesalers only to resolve shortfalls from regular suppliers. Directly sourcing from producers enables supermarkets to monitor and enforce more stringent quality standards. Some chains have introduced private seals of quality and codes of practice for their suppliers that initially are voluntary and over time become mandatory. There is also a tendency among supermarkets to first concentrate on quality and safety standards for high-risk products—for instance, those with a higher chance of *E. coli* or pesticide problems, such as leafy greens—and then gradually implement higher standards across the board. Chains catering to mid- and high-income consumers tend to employ more stringent quality and safety standards to differentiate their products from those of traditional markets.

Source: Reardon et al. 2003; Berdegué et al. 2005; Neven and Reardon 2004; Balsevich et al. 2003.

[24] Firms that do not meet the requirements for small-scale industry status can still process reserved items such as pickles and chutneys if they export at least 50 percent of production.

Pickles are by far the single most important processed fruit or vegetable, accounting for 30 percent of the total output of the sector. Juices, pulp/concentrates, and potato chips make up about 70 percent of the value of production in the organized sector, while in the unorganized sector pickles and sauces/ketchup are the main products. The industry currently has an installed capacity of around 2.3 million tons (IBEF 2006); this capacity has doubled in 10 years, although utilization is estimated at only 46 percent. Currently, about 45 percent of the production of processed fruits and vegetables is exported, and the rest primarily supplies the defense and institutional sectors (Sidhu 2005).

Figure 3.3: Segments in India's processed fruit and vegetable industry, 2003



Source: Govindan 2005b.

This brief description of India's horticultural sector provides the context for the questions posed in chapter 1. Given its huge volume of production and extensive institutional apparatus for promoting horticulture, is India an awakening giant, ready to compete and profit in the world's horticultural markets? Or is India's dominant structure of production and marketing misaligned with existing opportunities, standards, and supply chain requirements? These questions will be addressed in subsequent chapters, but first it is useful to understand the major government initiatives and institutions associated with horticulture development in India.

Institutions and Policy Environment for Horticulture Development

The horticultural sector has received considerable attention in recent years for its potential importance as a source of growth and employment. This government's National Horticulture Mission, launched in July 2004, has the doubling of horticultural production as one of its core objectives (box 3.3). Priority areas under the Mission include horticultural research and development, improving postharvest management, and promoting processing and marketing. The horticultural sector has already benefited from economywide trade and regulatory reforms that have improved the overall investment climate for domestic and foreign companies in India, as well as from more specific market or sectoral reforms.[25]

[25] Some of the main reforms include: removal of licensing requirements and government control over cold storage fees; amendments to state APMC Acts to allow contract farming, private investment in wholesale markets, and direct marketing between buyers and sellers; approval of foreign direct investments (FDI) in food processing and marketing, with the exception of retail marketing; removal/relaxation of quantitative restrictions on import and export of food items (except items on the negative list) and capital goods; abolition of minimum export prices (MEPs); and tax reform, including the adoption of a value-added tax (VAT) to replace purchase and sales taxes in several states. To promote investment in fruit and vegetable processing, the 2004–05 Budget has provided tax concessions for new processing units (Government of India 2005).

Box 3.3: India's National Horticulture Mission

Recognizing the importance of the horticultural sector in the growth of Indian agriculture as a whole, the Government of India launched a National Horticulture Mission in July 2004. The Mission's stated objectives are to: (1) double horticultural production to 300 million tons by 2011–12; (2) establish convergence and synergy among various on-going and planned programs in horticulture development; and (3) promote the development and dissemination of technologies by blending traditional wisdom and frontier knowledge.

The Mission will focus on horticultural research and development, improving postharvest management, and promoting processing and marketing. Postharvest management includes creating suitable infrastructure for efficient postharvest management and marketing. Promotional campaigns will involve the dissemination of market information to farmers, processors, traders, and consumers. The government will also provide incentives for setting up horticulture processing industries and food parks in selected areas. These parks will enable small- and medium-scale entrepreneurs to access common infrastructure, including cold storage facilities, warehouses, quality control laboratories, and effluent treatment plants. Special attention will be devoted to promoting horticultural exports by establishing focal Agricultural Export Zones (AEZs). The total budget allocated for the Mission during the 10th Plan period (2002–07) could reach nearly Rs 60 billion.

Since 2001, 60 AEZs have been set up across India to promote exports of agricultural commodities. Under the AEZ scheme of the Agricultural and Processed Food Products Export Development Authority (APEDA), state governments identify a geographically contiguous area with potential to scale up production and process different agricultural commodities for export. Coordinated and integrated export supply chains are to be developed in each zone. As part of the scheme, state governments also mobilize relevant government agencies, agricultural universities, and other entities to provide an integrated package of services to the various participants in the export supply chain. The private sector is encouraged to sponsor new AEZs. Of the 60 AEZs established to date, 40 are for various fresh or processed fruits and vegetables and another 8 are for flowers and/or medicinal or herbal plants. As most zones have been established fairly recently, their impact on export growth is not yet evident. There is a need to carefully monitor and evaluate the performance of these export zones and the different approaches/instruments in each zone to identify successful strategies for future decision making and resource allocation.

Source: World Bank 2005b; www.apeda.com.

Institutions Supporting Domestic Horticulture

The development of the horticultural sector is supported by a large number of government institutions at the central and state level. The **National Horticulture Board (NHB)** in the Ministry of Agriculture is the central institution responsible for facilitating the sector's development. The NHB mandate includes encouraging the development of commercial horticulture through demonstration farms, developing postharvest management infrastructure, strengthening market information systems, maintaining a horticulture database, assisting research and development programs, and providing training and education to farmers and the processing industry for improving agronomic practices and the adoption of new technologies. The **National Cooperative Development Corporation (NCDC)** under the Ministry of Agriculture supports fruit and vegetable marketing and processing cooperatives. It provides financial assistance for postharvest operations of cooperatives, including assistance for purchasing transport vehicles, creating cold storage and marketing infrastructure, and obtaining various other types of support.

Horticultural research and education are spearheaded by the **Indian Council of Agricultural Research (ICAR)** and its affiliated research centers. The Horticulture Division of ICAR has 9 research institutes, 11 national research centers, and 13 coordinated research projects. Those that have most actively supported export horticulture include the National Research

Centres (NRCs) for grapes and for onions. The **National Institute of Post Harvest Technology (NIPHT)** is responsible for transferring postharvest technologies to farmers, cooperatives, and the private sector. The **National Institute of Agricultural Marketing (NIAM)** provides specialized training, research, and consultancy in agricultural marketing. Funding support for the horticultural sector is provided by various institutions, including the **National Bank for Agriculture and Rural Development (NABARD)**, which has identified agro-processing, especially of fruits and vegetables, as a focal area.

The **Directorate of Marketing and Inspection**, under the Department of Agriculture and Cooperation, enforces and implements the Agricultural Produce (Grading and Marking) Act, 1937 (as amended in 1986). Its mandate includes promoting standardization and grading of agricultural products (including horticultural crops), conducting market research and surveys, developing market regulations and infrastructure, providing training on agricultural marketing, promoting development of cold storage facilities, and providing market information services (through AGMARKNET). As of January 2005, the list of commodities with AGMARK standards included 25 fruits and vegetables (AGMARKNET 2007). Different grades and standards are laid out under AGMARK for domestic consumption versus exports.[26]

The AGMARK grades are primarily voluntary grades related to the size, variety, weight, color, and moisture level of produce. The Directorate provides third-party certification under the AGMARK quality certification scheme. The AGMARK seal is intended to ensure quality and safety. Any consumer, trader, or manufacturer can have products tested at one of the 23 regional AGMARK laboratories for designated commodities.[27] Primary responsibility for enforcing domestic food safety laws related to fruits and vegetables rests with the Ministry of Health and Family Welfare and the Ministry of Food Processing Industries (box 3.4). Since 2003, the European Commission (EC) has designated the Directorate of Marketing and Inspection as an official authority and inspection body in India for checking conformity to marketing standards applicable to fresh fruits and vegetables prior to import into the EU. The inspection and certification is voluntary for exporters, with the exception of grapes shipped to the EU. [28]

Primary responsibility for the development of the food and vegetable processing sector lies with the **Ministry of Food Processing Industries (MoFPI).** MoFPI is implementing a number of schemes covering (1) infrastructure development, (2) technology upgrading and the establishment of modern food processing industries, (3) development of backward and forward linkages in the value chain, (4) the strengthening of quality management, and (5) human resource and institutional development. The first four schemes provide investment grants to the private sector. In recent years, MoFPI has emphasized upgrading the quality of food processing establishments. To this end, MoFPI has developed a scheme for Quality Assurance, Codex

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[26] For example, in the case of mangoes, the AGMARK grade specifies that for export "mangoes shall comply with the residue levels of heavy metals, pesticides, and other food safety parameters as laid down by the Codex Alimentarius Commission."

[27] Typically, only commodities prone to adulteration are tested, such as oils, ghee, whole and ground spices, honey, and whole and milled food grains. Blended edible vegetable oils and fat spreads are required to be certified under AGMARK.

[28] Standards for 18 important fruits and vegetables—including grapes, litchis, mangoes, pomegranates, guavas, pineapples, bananas, papayas, plums, shelling peas, sugar snap peas, ribbed celery, headed cabbages, spinach, Brussels sprouts, tomatoes, garlic, and onions—have been approved, are harmonized with EC and Codex Standards, and are in the process of formal Notification in the Gazette of India. Standards for another 7 fruits and vegetables—pears, cherries, strawberries, melons, watermelons, beans, and cauliflower—have been approved by a Standing Committee on Fresh Fruits and Vegetables in the Ministry of Commerce and Industry (AGMARKNET 2007).

Standards, and Research and Development. The components of the scheme include promotion of total quality management, promotion of quality assurance/safety, bar-coding, setting up quality control laboratories, and research and development in the processed food sector.

Box 3.4: Ensuring domestic food safety

Until recently, the main legislation pertaining to food safety for fresh and processed horticultural commodities in India has been the **Prevention of Food Adulteration Act (PFA)** of 1954 (and the PFA Rules of 1955) and the **Fruit Products Order (FPO)**, 1995. These have been implemented by various departments and agencies under the Ministry of Health and Family Welfare and the Ministry of Food Processing.

The Director General of Health Services, Department of Prevention of Food Adulteration is responsible for the implementation of the PFA Act and is mandated to protect domestic consumers against impure, unsafe, and fraudulently labeled foods. The Act covers various aspects of food processing and distribution, such as food color, preservatives, pesticide residues, packaging, labeling, and the regulation of sales. The PFA focuses primarily on the establishment of regulatory standards for primary food products. All imported products must also adhere to PFA rules, including those for labeling.

Promulgated under the Essential Commodities Act, 1995, the Fruit Products Order aims at regulating sanitary and hygienic conditions in the manufacture of fruit and vegetable products. It is mandatory for all manufacturers of fruit and vegetable products to obtain a license under this Order. The Fruit Product Order lays down the minimum requirements for sanitary and hygienic conditions of premises, surrounding areas, and personnel; the water to be used for processing; machinery; and equipment. Maximum limits of preservatives, additives, and contaminants have also been specified for various products. This legislation is enforced by the Ministry of Food Processing.

India's food laws were recently revised, and the Government of India passed an integrated food law, "**The Food Safety and Standards Bill, 2005**" in August 2006. The bill brings together diverse legislation under a single umbrella law and creates a Food Safety and Standards Authority of India. This process of legal and institutional reform took considerable time, dating from the formation of a Task Force on Food and Agro-Industries Management Policy in 1998.

Key provisions of the bill: (1) repeal a number of Acts and Orders (including the PFA); (2) establish a Food Safety and Standards Authority; (3) define standards for food additives, contaminants, genetically modified and organic foods, packaging, labeling, and food imports; (3) require accreditation of laboratories, research institutions, and food safety auditors; (4) require licensing and registration of food businesses and set penalties for offenses; and (5) establish a Food Safety Adjudication Tribunal.

Source: http://mofpi.nic.in/foodsfty.pdf; Govindan 2005a.

Each state also has its own infrastructure for the promotion of horticulture. For example, the **Maharashtra State Agricultural Marketing Board (MSAMB)** supports both domestic and export marketing for horticultural crops from that state. Aside from being the nodal agency for implementing AEZs in the state, MSAMB has invested in marketing infrastructure to support exports, including facilities for precooling, cold storage, ripening chambers, and packinghouses. MSAMB has also helped establish a vapor heat treatment (VHT) facility in Mumbai and an air cargo facility at the Lohgaon Airport in Pune (Korstanje et al. 2005).

Institutions Involved in Horticultural Exports and Trade-related SPS Management

Several government institutions focus primarily on promoting international agricultural trade, including horticultural trade. The **Agricultural and Processed Food Products Export Development Authority** (APEDA), an autonomous organization attached to the Ministry of Commerce, is the lead agency for promoting development of Indian agricultural exports, including fresh and processed horticultural products. APEDA advises potential exporters on market requirements, organizes product promotions, and participates in international trade fairs to

promote Indian exports. Given the growing importance of international standards for agricultural trade, APEDA has also initiated numerous schemes to encourage exporters to upgrade their facilities to comply with international requirements. These include:

- Assistance to exporters, producers, trade associations, public institutions, and others for setting up/strengthening laboratories.
- Assistance to exporters and producers for installing quality management, quality assurance, and quality control systems, such as ISO series, HACCP, and Total Quality Management.
- Activities related to standardization and quality control, such as the preparation of quality assurance manuals.
- Recognition of laboratories for export testing.
- Providing support to test for pesticide residues, veterinary drugs, hormones, toxins, and other contaminants in water and soil.
- Assistance to growers, manufacturers, exporters, and export-related organizations for upgrading technical and managerial personnel through training in India.
- Assistance to recognized associations of growers/exporters for organizing seminars/group activities, including study tours within the country, and for producing informational literature.

The Directorate of Plant Protection, Quarantine, and Storage (PPQS) in the Ministry of Agriculture is the main authority in India responsible for dealing with trade-related plant health issues. Its mandate includes ensuring that harmful pests do not enter India through agricultural trade, ensuring the availability of safe and effective pesticides under the Insecticides Act, 1968, popularizing adoption of IPM, undertaking export inspections, and issuing phytosanitary certification of plants and plant products in conformity with quarantine regulations of the importing country to fulfill India's obligations under international agreements. The plant protection and quarantine department of the Ministry of Agriculture is also responsible for SPS issues related to the WTO.[29]

The Plant Quarantine Service (PQS) within the PPQS directorate is the primary agency responsible for providing export inspection and certification services. The PQS is also responsible for fumigation and other treatment of agricultural commodities, cargo containers, and ship holds to certify that consignments are free of pests. Fumigation operations by approved pest control operators are supervised by PQS wherever required. The PQS, in association with State Departments of Agriculture/Horticulture, is also responsible for identifying pest-free areas or production sites in accordance with established international/national standards.

Responsibility for preshipment inspection of various export commodities notified under the Export (Quality Control and Inspection) Act, 1963, lies with the **Export Inspection Council (EIC),** an autonomous body under the Ministry of Commerce. The EIC certifies the quality of food items for export, as called for under agreements with several of India's trading partners (examples include black pepper sold to the USA, fish exported to the EU, and fruits and vegetables exported to Sri Lanka). The agency also issues Certificates of Origin to exporters as required under various preferential tariff schemes.

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[29] The PPQS has a well-established infrastructure with 91 field stations, including 26 Central Integrated Pest Management Centers, 32 Plant Quarantine and Fumigation Stations, 28 Locust Substations (including 23 outposts), 1 Field Station for Investigation on Locust, 2 Regional Pesticides Testing Laboratories, and a National Plant Protection Training Institute.

Chapter 4: Indian Horticultural Exports: Broad and Commodity-Specific Trends

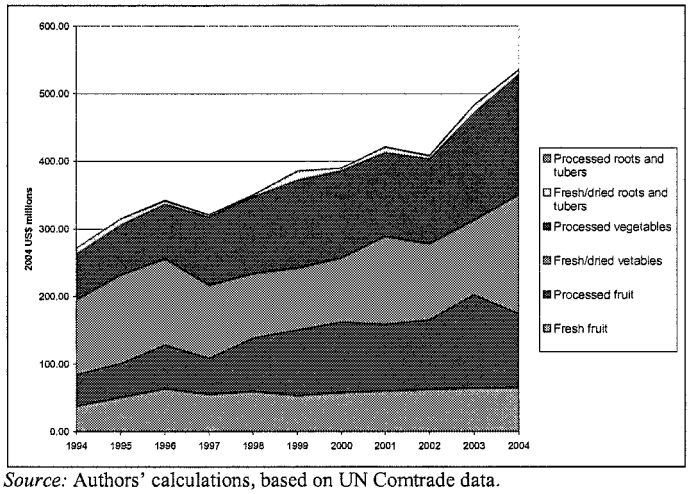
This chapter begins with an overview of broad and commodity-specific trends in Indian horticultural exports and concludes by identifying key competitiveness constraints and weaknesses in selected subsectors. The next chapter will detail SPS-related challenges to Indian horticulture and describe how the national government and private sector have responded.

Value and Composition of Indian Horticultural Exports

India's share of global horticultural exports is only 0.3 percent for fresh and processed fruit, 0.8 percent for fresh and processed vegetables, 0.2 percent for fresh-cut flowers, and 2.6 percent for dried flowers and fresh and dried plants. In 2004, India exported US$ 575 million of fresh and processed fruits, vegetables, and flowers,[30] equivalent to about 1 percent of India's total export earnings and about 7 percent of its agricultural export earnings.

Following major trade policy and exchange rate reforms in the early 1990s, India's horticultural exports expanded vigorously. Since 1994, fruit and vegetable exports have grown at about 8 percent per year in real terms, with exports reaching US$ 536 million in 2004 (figure 4.1). Segments with the fastest growth are processed vegetables and processed fruits, which have grown at 10 and 11 percent per annum, respectively, in real terms. Major processed fruit exports include mango pulp—which accounted for close to 50 percent of the value of this category of exports in 2004—as well as pickles and chutneys from various fruits, including mangoes. Gherkins, dehydrated onions, and mixed frozen vegetables account for 60 percent of processed vegetable exports. In 2004, exports of processed fruits and vegetables accounted for 19 percent and 31 percent of total horticultural exports, respectively (see chapter 2, figure 2.2).

Figure 4.1: Growth and composition of India's fruit and vegetable exports



Source: Authors' calculations, based on UN Comtrade data.

Fresh fruits make up around 11 percent of India's horticultural exports, while fresh vegetables account for 32 percent. Growth has been slower in the fresh fruit and vegetable segment than in processed products, averaging about 6 percent per year. Grapes and mangoes account for close to 60 percent of India's fresh fruit exports. In 2004, exports of fresh and dried vegetables were almost three times as large as exports of fresh fruits (about US$ 182 million). The largest export earner in this group was dried onions, with exports valued at US$ 156 million

[30] Recall that horticultural products are defined here to include fresh and processed fruits, vegetables, and flowers. This definition excludes nuts and fresh and dried legumes, which tend to be included in APEDA data. Nuts and legumes involve very different commercial channels and quality and SPS considerations than fruits, vegetables, and flowers.

in 2003/04. Important fresh vegetable exports include okra, peas, karela (bitter gourd), sweet and hot peppers, and eggplant.

Table 4.1: Export intensity of production of selected commodities, 2002/03

Commodity	Volume of production (000 t)	Production exported in fresh form (t)	Production exported in readymade form (t)	Fresh equivalent of readymade (t)	Share of production exported in fresh form (%)	Share of production used as raw material in processed exports (%)	Share of production exported in fresh or processed form (%)
Grapes	1,248	25,568	113	507	2.05	0.04	2.09
Onions	4,210	588,712	13,245	119,207	13.98	2.83	16.82
Gherkins	35	na	34,655	34,655	0.00	100.00	100.00
Mangoes	12,733	38,003	105,344	316,033	0.30	2.48	2.78
Bananas	13,304	8656	na	na	0.07	na	0.07

Source: Authors' calculations, based on data from APEDA 2004 and NHB 2004.
Note: A conversion factor of 9 to 1 is assumed for conversion from fresh to dehydrated onions, based on Lucier, Lin, and Allshouse 2001. For mango pulp, a conversion factor of 3 to 1 is assumed, based on authors' personal communication with industry experts. Raisin/sultana exports are converted to fresh grape equivalent using a conversion factor of 4.5 to 1 based on Sarigedik 2005.

With the exception of some horticultural crops produced primarily for the export market (gherkins, for instance), the export intensity of production—the share of total production that is exported—is low (table 4.1). For example, even though onions are one of India's largest horticultural export earners, India exports only about 17 percent of its domestic production in dried or dehydrated form.[31] Similarly, India exports less than 3 percent of its mango production and is not a major player in the global fresh mango trade.

While the basket of India's fresh and processed horticultural export products is very diverse, only a few products account for a large share of total earnings. In 2003/04 these included fresh onions (US$ 165 million), mango pulp (US$ 56 million), processed gherkins (US$ 28 million), fresh grapes (US$ 24 million), and fresh mangoes (US$ 25 million). These five commodities together accounted for just over 50 percent of India's horticultural earnings in 2003/04 (APEDA 2004).

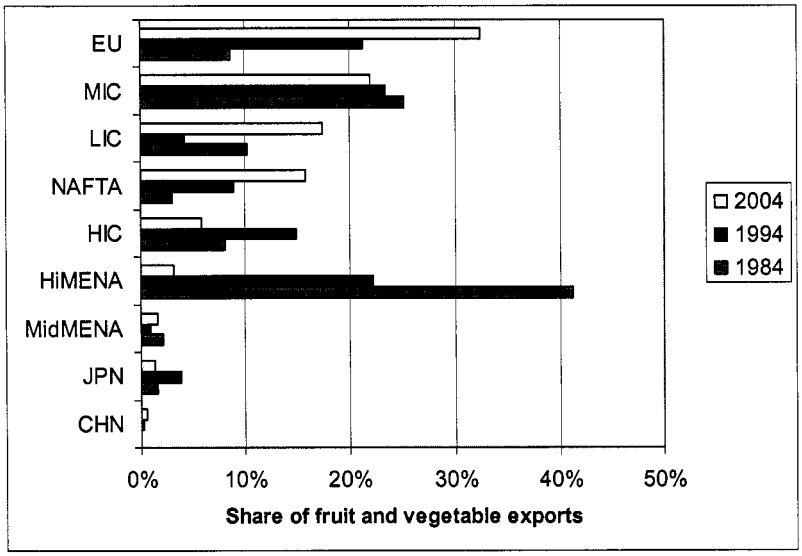
Direction of India's Horticultural Export Trade

During the past two decades, the direction of India's fruit and vegetable exports shifted dramatically. In 1984, half of these exports were directed to high- and middle-income countries in the Middle East (figure 4.2), but exports to EU and NAFTA markets rose substantially in the last 10 years, largely because of growth in the processed fruit and vegetable segments.

The bulk of fresh fruits and vegetables exported by India, however, still goes to neighboring countries or the Indian diaspora in the Middle East and Southeast Asia (table 4.2). Small amounts are also distributed through "ethnic" food markets and restaurants in Europe and countries with large populations of South Asian origin. To a large extent, this trade is based on personal ties and consumer preferences for specific varieties of produce, with prices closely tied to Indian domestic prices (adjusted for freight costs). India has also developed modest levels of trade in selected fresh products (including grapes, roses, and pomegranates) to mainstream OECD markets. This trade accounts for less than 15 percent of India's fresh horticulture trade.

[31] This export share has increased during the past two years, with exports of dried onions exceeding 800,000 tons per annum.

Figure 4.2 Destinations of India's fruit and vegetable exports, 2004



Source: Authors' calculations, based on *India-reported* data from the UN Comtrade database
Note: MidMENA refers to middle-income countries in the Middle East and North Africa; HiMena includes high-income countries in the Middle East; HIC includes high-income countries, except those in the Middle East, EU, North American Free Trade Agreement (NAFTA), and Japan (JPN); MIC includes middle-income countries, except those in the Middle East; and LIC includes all low-income countries, except India (IND) and China (CHN).

In contrast to its exports of fresh produce, India's exports of processed fruit and vegetable products are mostly directed at markets in the EU and USA. This trade has shown promising growth. Indian firms and industries have gained international market share in a range of processed products, despite the lack of market access preferences and the pattern of tariff escalation in relation to such products. It has been for processed (rather than fresh) products that India has been able to realize significant economies of scale from its large horticultural production base. Seventy-five percent of India's export earnings from fruit and vegetable exports are from 10 countries (table 4.2). Close to 60 percent of India's fresh flower exports are to Japan and the Netherlands (table 4.3).

Table 4.2: India's major trading partners for fresh and processed fruits and vegetables, 2004

	All fruits and vegetables			Processed vegetables			Processed fruits			Fresh vegetables			Fresh fruits		
Rank	**Country**	**Value of trade (US$ millions)**	**Share of trade (%)**	**Country**	**Value of trade (US$ millions)**	**Share of trade (%)**	**Country**	**Value of trade (US$ millions)**	**Share of trade (%)**	**Country**	**Value of trade (US$ millions)**	**Share of trade (%)**	**Country**	**Value of trade (US$ millions)**	**Share of trade (%)**
1	BGD	86.74	14	USA	50.10	27	DEU	23.72	17	BGD	63.18	30	UAE	22.12	25
2	USA	67.10	11	GBR	25.98	14	SAU	19.26	14	MYS	50.07	24	BGD	21.33	24
3	UAE	63.50	10	RUS	14.03	8	USA	15.99	12	UAE	27.28	13	GBR	16.20	18
4	GBR	54.26	9	DEU	13.52	7	NLD	11.27	8	LKA	21.83	10	DEU	6.94	8
5	MYS	52.72	8	FRA	11.76	6	CAN	10.84	8	SAU	7.54	4	NLD	5.81	6
6	DEU	44.69	7	ESP	7.12	4	GBR	9.23	7	BHR	6.76	3	SAU	4.11	5
7	SAU	37.21	6	BEL	6.84	4	UAE	7.80	6	QAT	5.77	3	OMN	2.06	2
8	LKA	24.65	4	UAE	6.30	3	YEM	6.03	4	SGP	5.23	2	BHR	1.84	2
9	NLD	22.40	4	SAU	6.30	3	JPN	5.36	4	MUS	3.61	2	LKA	1.09	1
10	FRA	20.18	3	ISR	6.21	3	FRA	5.33	4	MDV	3.03	1	QAT	1.03	1
	Subtotal	473.44	75	**Subtotal**	148.16	79	**Subtotal**	114.84	85	**Subtotal**	194.29	92	**Subtotal**	82.53	92
	Total	630.75		**Total**	186.75		**Total**	135.87		**Total**	210.42		**Total**	89.84	

Source: Authors' calculations, based on UN Comtrade data.

Note: Data for UAE are not reported in any of the years in the Comtrade data and are based instead on data from APEDA 2004. Similarly, data for Saudi Arabia in 2004 are from APEDA. The "All fruits and vegetables" category includes roots and tubers.

Country abbreviations:

AUS	Australia	GRC	Greece	OMN	Oman
BEL	Belgium	ISR	Israel	QAT	Qatar
BGD	Bangladesh	ITA	Italy	RUS	Russia
BHR	Bahrain	JPN	Japan	SAU	Saudi Arabia
CAN	Canada	LKA	Sri Lanka	SGP	Singapore
CHE	Switzerland	MDV	Maldives	UAE	United Arab Emirates
DEU	Germany	MUS	Mauritius	USA	United States of America
ESP	Spain	MYS	Malaysia	YEM	Yemen
FRA	France	NLD	Netherlands		
GBR	Great Britain	NZL	New Zealand		

Table 4.3: India's major trading partners for fresh flowers, 2003 and 2004

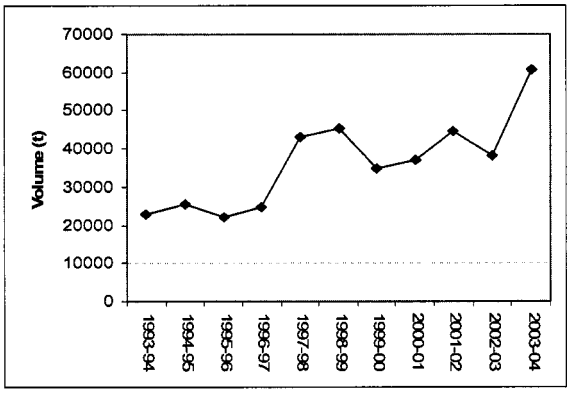
	2003			2004		
Rank	Reporter	Value (US$ millions)	Share of total (%)	Reporter	Value (US$ millions)	Share of total (%)
1	JPN	3.49	39	JPN	4.09	43
2	NLD	1.23	14	NLD	1.60	17
3	FRA	0.71	8	SGP	0.82	9
4	SGP	0.66	7	AUS	0.64	7
5	AUS	0.62	7	CHE	0.40	4
6	CHE	0.55	6	ITA	0.38	4
7	SAU	0.28	3	DEU	0.34	4
8	ITA	0.26	3	GRC	0.33	3
9	GBR	0.24	3	GBR	0.30	3
10	DEU	0.24	3	NZL	0.24	2
	Subtotal	8.29	93	**Subtotal**	9.14	95
	Total	8.91			9.61	

Source: Authors' calculations, based on UN Comtrade data. See table 4.2 for country codes.

Fresh Mangoes

India is the preeminent producer of fresh mangoes in the world. With an average annual production over the past three years of 10.7 million tons, India accounts for 40 percent of world production. India also boasts a broader range of mango varieties than any other production source: at least 30 varieties are in commercial production, and more than 1,000 varieties are claimed to exist in India. The leading mango-producing states are Uttar Pradesh, Andhra Pradesh, Bihar, Karnataka, Tamil Nadu, and Maharashtra. In 2003/04 India exported about 61,000 tons of mangos (equivalent to US$ 25.5 million), a steep increase over previous years (figure 4.3).

Figure 4.3: India's mango exports, 1993/94–2003/04



Source: Authors' calculations, based on data from APEDA 2004.
Note: The large increase in 2003/04 is primarily attributed to a jump in sales to Bangladesh.

Despite its dominant share of world mango production, the extended seasonal availability of its mangoes, and the broad range of quality characteristics associated with its mango output, India's role in the global mango trade is quite modest. India accounts for only 4–5 percent of world export volumes and value (table 4.4). As a major exporter it ranks sixth—behind Mexico, Brazil, Pakistan, Peru, and the Philippines—even though the combined production of these five countries is less than half of India's.

The export orientation index of Indian mangoes is substantially behind that of the six major exporting countries and ahead only of Indonesia among the principal producing countries. Exports for the three years from 2002 to 2004 amounted to 143,000 tons, representing only 0.44 percent of India's mango production of 32.2 million tons during the same period. India also realizes lower unit revenues from its mango exports than most major exporting countries. Of the

11 countries featured in table 4.4, only 3 (Pakistan, Ecuador, and China) had lower average export unit values than India. At US$ 0.47 per kilogram, India's realized revenues were a full 25 percent below the global average for fresh mango exports. This gap is even wider with respect to the mango unit price leader, the Philippines, which has an average unit revenue of US$ 1.17 per kilogram, 60 percent above India's.

The world's major mango importing countries include the USA, the Netherlands, Saudi Arabia, and the UAE. Prices in different markets vary widely. For example, average prices for mangoes imported into Japan exceed US$ 3,000 per ton, whereas prices of mangoes imported into Malaysia and Bangladesh are less than US$ 250 per ton. **This conclusion is based on field observations by the study team.** Despite these differences, the bulk of India's fresh mango exports are directed at low- or medium-priced markets (table 4.5).

Table 4.4: Principal mango exporting countries, 2003

Origin	Volume (t)	Volume share (%)	Value (US$ 000s)	Value share (%)	Value (US$/kg)
Mexico	216,316	28	117,200	24	0.54
Brazil	138,189	18	75,744	15	0.55
Pakistan	60,441	8	18,007	4	0.30
Peru	39,924	5	31,109	6	0.78
Philippines	38,436	5	45,000	9	1.17
India	**38,003**	**5**	**17,911**	**4**	**0.47**
Ecuador	37,621	5	16,335	3	0.43
South Africa	20,751	3	11,804	2	0.57
China	12,623	2	3,695	1	0.29
Israel	10,024	1	7,608	2	0.76
Thailand	8,098	1	4,550	1	0.56
Rest of world	157,397	20	144,003	29	0.91
Total	777,823	100	492,966	100	0.63

Source: Authors' calculations, based on FAOSTAT data.

Table 4.5: Distribution of Indian mango exports, 2001/02–2003/04

Country	Volume (t)	Volume share (%)	Value (US$ 000s)	Value share (%)	Value (US$/kg)
Bangladesh	58,224	41	12,914	22	0.22
UAE	47,900	34	24,470	41	0.51
Saudi Arabia	8,874	6	4,850	8	0.55
UK	4,113	3	3,661	6	0.89
Kuwait	2,230	2	1,828	3	0.82
Bahrain	2,100	1	1,429	2	0.68
Rest of world	19,542	14	9,842	17	0.50
Total	142,983	100	58,994	100	0.41

Source: Authors' calculations, based on data from APEDA 2004.

While Indian mangoes are widely recognized to be of superior quality, export logistics remain a challenge. For example, only about 25 percent of the mango crop in Tamil Nadu is probably eligible for export because of harvest and postharvest practices.[32] Careful attention is given to visual quality and the internal condition of the fruit, and considerable care is taken in washing, drying, wrapping, and packing mangoes into corrugated cardboard cartons for export. Yet there are usually no provisions for cold storage at the packing facility, although export-designated product must be held for up to 36 hours before packing and dispatch to the airport. Packing facilities also commonly lack running water, proper lighting,

[32] This conclusion is based on field observations by the study team.

holding tanks (for product accumulation), and packing tables. Selection and packing are done on the floor.

In Tamil Nadu, fruit packed for export is loaded onto unrefrigerated trucks for transport to the port or airport.[33] Fruit for air shipment is sent to the unrefrigerated holding facility at the Chennai airport for up to 18 hours before being loaded into the unrefrigerated cargo bay of a passenger aircraft for onward transit. The break in the cold chain during transit from the packing shed to the airport, and, more important, during the holding period at the airport is considerably long for a fresh product that is shipped by air. Flight times to major markets in Southeast Asia or the Middle East from Tamil Nadu are quite short, averaging three to five hours, although air freight costs appear relatively high at 65 percent of the cost and freight (C&F) cost. For ocean transport, the fruit can be loaded into refrigerated containers during waiting periods in Chennai or Tuticorin port before vessel departure.

While the expansion of mango exports has also been impeded by phytosanitary restrictions in prospective markets in the USA, Japan, and Australia (see chapter 5), the industry also suffers from a lack of intelligence on potential markets outside the Middle East and Southeast Asia. Market intelligence on potential costs, earnings, and quality specifications or expectations is vital in each market, as is consistent product promotion overseas. As for most commodities examined in this study, for mangoes there are no regional or commodity trade associations to assist in negotiating freight rates and services, alert members to commercial and phytosanitary threats and opportunities, and explore areas where intrasectoral cooperation can improve efficiency and profitability.

Grapes

India is a significant grape producer, producing approximately 1.2 million tons from 40,000 hectares in 2004. India's grape production has increased by almost 70 percent in the past 10 years, with current production representing about 2 percent of global grape production. Maharashtra produces the most grapes (about 75 percent of the national total).[34] Since the early 1990s, efforts have been made to export grapes to Europe. Grapes are a highly seasonal crop. There is a potential window in the European market from the beginning of March until the end of April or early May, when the main Southern Hemisphere production season (in South Africa and Chile) is ending, and grapes from Egypt and Turkey have yet to enter the market. India is one of the few countries that can produce good quality grapes at this time of the year.

Grape exports to the EU started in the early 1990s, mainly from Maharashtra. Grapes were exported in refrigerated containers, but very long transit times created difficulties with some early consignments. Once the logistics were refined and growers started to meet the higher European market standards for fruit and bunch size, exports quickly expanded. Virtually all exported grapes are of the Thompson Seedless variety. Production of this particularly early variety finishes before that of many other varieties in Chile and South Africa, which can grow most of the other varieties wanted by the market in the late season—varieties regarded as having better quality and costing less than Indian grapes. Although India's comparative advantage is based on just one variety during a short market window, this variety is becoming more popular in Europe as the preference for green seedless grapes increases.

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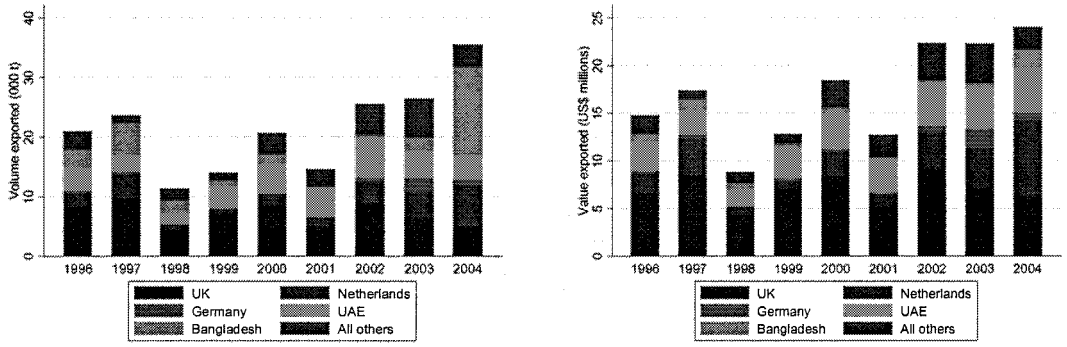
[33] In Tamil Nadu the trip to the airport takes up to four hours.

[34] The Department of Horticulture, Government of Maharashtra estimates the area in Maharashtra under production to be 29,756 hectares, with a production of 779,012 tons.

The Indian grape export industry to the EU is characterized by many registered exporters. Perhaps 12–15 larger exporters move between several hundred and several thousand tons per year. Many smaller exporters, with sales of 30–100 tons per year, use an Indian agent of a major EU-based importer to market their produce. These agents basically help coordinate a number of smaller exporters to achieve economies of scale and a degree of quality consistency. The larger exporters sell directly to the importers. Most Indian grapes are sold in Europe via supermarket networks.

In 2003/04 India exported about 27,000 tons of grapes, with an export value of around US$ 25 million (figure 4.4). The volume of grape exports to the EU peaked in 1997/98, then fell very significantly, and then gradually rebounded. Initially the UK was the main target for exports, but the Netherlands has become increasingly more important. Although exports to the Middle East have increased over the last few years, they are still less than half the volume of exports to Europe. The final and, until recently, smallest market (in terms of value) is in neighboring countries, primarily Bangladesh.

Figure 4.4: Destinations of India's grape exports by volume and value



Source: Authors' calculations, based on UN Comtrade data.

The C&F prices obtained for grapes are much higher in Europe than in the Middle East, and this difference is reflected in better farmgate prices. Within Europe, the UK market tends to pay higher prices than the Netherlands market—a reflection of different quality standards. However, both exporters and farmers have to invest considerably more in inputs, management, and transport to reach the standards demanded by these more distant markets. One exporter noted that typically farmgate prices of Rs 35–50 per kilogram could be obtained for grapes destined for the UK, Rs 25–40 for Holland, Rs 20–25 for the Middle East, and Rs 10–15 for the local or neighboring markets.

Despite having lower freight rates to Europe than some of its international competitors, India is not a low-cost supplier to Europe. Unit production costs are comparatively high due to lower yields for the Thompson Seedless variety, the variety's relatively short harvest season in India, and failure to attain the economies of scale realized by competing countries in many postharvest, packing, and transport operations. India is still a relatively young player in this market, and opportunities remain to increase productivity at the farm and logistical levels.

EU grape imports increased by nearly 10 percent per year from 1997 to 2004 thus reflecting strong consumer demand (table 4.6). Some countries that supply this market have seen their exports grow very significantly (such as Chile, South Africa, and Turkey), and several smaller suppliers have seen considerable growth (such as Egypt, Brazil, Argentina, Namibia, and Mexico). In contrast, supplies from India to the EU have been comparatively static. Eurostat data

on monthly imports from 2004 show that India is only a small player, even in the few months that it supplies this market. India supplied 10 percent of imports in April and May, but during these months, Chile and South Africa are still much more important suppliers, providing a range of varieties. Interviews with importers confirmed the minor importance of India in the overall EU grape market, but they agreed that India had a very important role to play in supplying Thompson Seedless grapes in April and May. The importers noted that India could easily become a more important supplier if it improved quality and accepted more competitive prices. However, India does not appear to be competitive for seeded grape varieties. As will be examined in chapter 5, India has also experienced major challenges in complying with pesticide residue tolerances in Europe.

Table 4.6: EU grape imports from selected countries, 1997–2004
tons

	1997	1998	1999	2000	2001	2002	2003	2004
India	10,397	7,318	9,892	9,447	6,463	11,318	14,058	11,259
Chile	80,884	69,957	82,347	82,766	76,427	79,618	101,533	106,884
South Africa	82,792	99,234	117,231	125,846	130,879	152,496	145,433	140,625
Egypt	1,349	1,850	2,553	3,568	5,182	9,310	9,406	17,260
Mexico	4,932	6,829	3,764	4,112	5,194	5,054	10,371	7,859
Turkey	28,207	32,760	42,320	51,377	44,491	36,152	31,955	46,965
Brazil	2,851	4,513	6,735	7,641	13,049	20,999	31,098	19,842
Israel	5,145	8,347	7,643	6,706	6,577	4,941	2,960	7,578
Argentina	8,008	12,157	13,123	20,993	19,974	23,933	25,387	30,515
Namibia	1,355	1,145	1,379	1,809	1,957	4,806	6,231	5,591
USA	10,973	11,063	16,898	17,971	13,894	14,274	7,864	10,522
Others	5,568	6,833	8,254	8,756	7,151	7,029	11,539	15,214
Total	242,461	262,006	312,139	340,992	331,238	369,931	397,836	420,113

Source: Eurostat.

Mango Pulp

Mango pulp is one of India's major horticultural export earners. In 2003/04 India exported close to 90,000 tons of pulp with an export value of some US$ 56 million. It is estimated that India, Mexico, and Colombia account for over 80 percent of worldwide exports of mango puree and concentrate (ITC 2004). India produces puree from a number of mango varieties, including Alfonso, Kesar, and Totapuri. Worldwide, Alfonso puree is recognized as a superior product and obtains a significant premium over all other varieties from India, Peru, Brazil, Pakistan, or Mexico. Alfonso puree prices are determined primarily by Alfonso supplies and are relatively unaffected by the prices quoted for other varieties. The prices for Alfonso-based pulp are around US$ 1,500 per ton. The remaining varieties of mango pulp trade in a lower price band of US$ 800–1,000 per ton, except for brief periods of overall market shortage. Importers indicate that product differentiation within the second tier of pulp varieties is difficult to achieve and that competition within this segment is based primarily on price and supplier service.

The Middle East is the dominant outlet for Indian mango pulp, although supplies are sent to many countries, including some in Western Europe and North America (table 4.7). Of all mango puree worldwide, 70 percent goes into juice beverages, with food preparations, dairy, and baking applications contributing another 20 percent; the final 10 percent is used in baby food. The generally large-scale juice, food preparation, and baby food manufacturers in Western Europe, North America, and North Asia strongly favor puree or pulp in aseptic bags in drums, because this format is easier to transfer into processing tanks than puree from Number 10 cans, and the empty packaging is far easier to dispose of. Estimated ratios of demand for aseptic bags versus

tins generally converged on a 95 percent/5 percent split, although Alfonso puree merits a higher acceptance level in cans (85 percent/15 percent split) due to its taste and other characteristics and limited availability. Middle Eastern and Southeast Asian juice manufacturers, on the other hand, are more sensitive to price and generally operate on a smaller scale, so they are more receptive to using Number 10 cans.

Table 4.7: Principal export markets for Indian mango pulp

Country	Volume (t)	2003-04 value (US$ 000s)	2003-04 value (US$/t)	3-year average, 2001–04 (US$/t)
USA	2,867	2,538	885	937
Netherlands	7,228	6,181	855	875
UK	2,718	2,064	759	860
UAE	6,913	3,821	553	630
Kuwait	6,158	3,649	593	598
Sudan	2,176	1,127	518	581
Saudi Arabia	31,521	16,298	517	559
Lebanon	2,308	1,030	446	515
Yemen	9,616	3,963	412	415
Rest of world	18,009	12,690	705	735
Total	89,514	53,361	596	634

Source: Authors' calculations, based on data from APEDA 2004.

All of the Middle Eastern importing countries paid prices below India's three-year price average (US$ 634 per ton), while all of the Western European and North American clients paid a 30–50 percent premium over the same average. At the same time, India is essentially absent from the markets of the Pacific Rim, which are currently dominated by the Philippines (table 4.8). If Indian exporters could sell their product at the same price as Philippine exporters—which is US$ 320 per ton higher than the average revenues for Indian mango pulp—Indian processors would see an increment in gross revenues of US$ 29 million per year. Direct competition with the Philippines, however, would require changes in the product, packaging, and accompanied services provided by Indian exporters.

Table 4.8: Principal export markets for Philippine mango pulp

Country	Volume (t)	2003-2004 value (US$ 000s)	2003-2004 value (US$/t)	3-year average (US$/t) (2001/02-2003/04)
USA	786	969	1,233	1,263
Japan	1,035	1,086	1,049	1,078
New Zealand	776	767	988	1,057
Hong Kong	624	615	986	973
South Korea	8,979	7,718	860	862
Rest of world	764	745	975	954
Total	12,964	11,900	918	954

Source: Bureau of Agricultural Statistics, Department of Agriculture, the Philippines (August 2005)

The majority of mango pulp in India is manufactured in Tamil Nadu, Maharashtra, and Andhra Pradesh. Within Tamil Nadu, the main pulp processing zone is in the Krishnagiri cluster. It is estimated that around 300,000 tons of mangoes (65 percent Totapuri, 5 percent Alfonso, 30 percent other varieties) are produced in the vicinity of the Krishnagiri cluster, covering some 40,000 hectares. The region claims good availability of water, electrical power, and labor, and good communications facilities and roads.[35]

The first two mango processing plants in the Krishnagiri cluster were constructed between 1986 and 1990. Two additional plants came on line by 1995. Considerable expansion occurred after that. Some 19 additional units came on line between 1996 and 2001, and 9 new plants have been added since 2001. Of the current complement of 32 separate processing plants, only a handful produce pulp in both aseptic drums and cans. The others are can-only operations,

[35] The Dharmapuri District Fruit and Vegetable Processors Federation (DDFVPF) estimates that pulp producers in the Krishnagiri cluster generate approximately 40 percent of India's total annual mango puree production. Ninety percent of the cluster's puree production is exported. Of the total export volume, 90 percent is sold through merchant exporters, and 10 percent is exported directly by the processors.

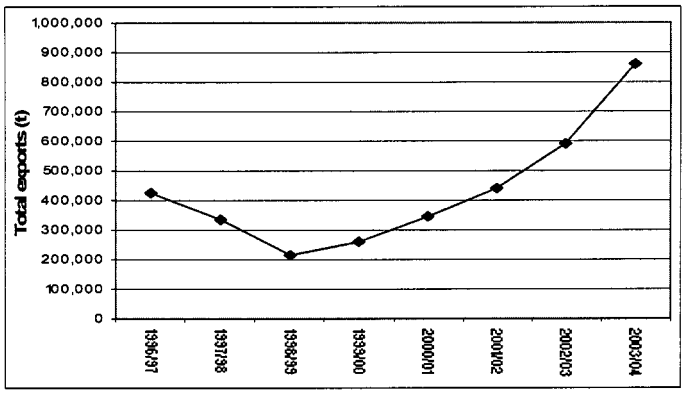
essentially excluded from the more lucrative markets. Total available pulp processing capacity is estimated at 65,000–70,000 tons per year, with current capacity utilization estimated at 60 percent.[36]

Importers complain that India suffers in relation to its Latin American competition because it cannot establish prices early in the season and maintain them at stable levels throughout the season. Current reliance on spot purchases, compounded by mistrust and antagonism between growers and processors and between processors and merchant exporters, makes it very difficult to set and sustain a stable pricing environment. This uncertainty places Indian exporters in a disadvantageous position. There is a need for the government and industry to develop new models of cooperation among growers, processors, and exporters to comply with prevailing commercial requirements (box 4.1). Poor crop intelligence is cited as a major impediment to maintaining stable and predictable product pricing, which indicates that the system for generating and monitoring crop estimates also needs to be improved.

Importers in the UK and elsewhere in the EU rely on stock positions maintained by exporters in ports such as Rotterdam to provide just-in-time deliveries to their industrial and retail customers. Mexico and Colombia are praised for their willingness to maintain such stock positions. Indian suppliers, on the other hand, resist requests to perform this service, putting them at a disadvantage compared to their major competitors.

Onions

Figure 4.5: Volume of onion exports from India, 1996/97-2003/04



Source: Authors' calculations, based on data from APEDA 2004.

Onions are India's leading horticultural export, at nearly 860,000 tons (figure 4.5) and US$ 165 million in 2003/04. APEDA expects that this trade will exceed one million tons and approach US$ 200 million in the near future. India is now the world's largest onion exporter, having recently surpassed both the Netherlands and China. Maharashtra is responsible for about one-fourth of India's onion production yet accounts for upwards of 80 percent of the country's exports. Most of this production is grown and traded through the wholesale markets around Nasik. In 2003/04 Maharashtra planted 75,500 hectares to onions and produced 1.53 million tons.

Onion exports increased in recent years after onions were removed from the official list of essential commodities and onion exports were progressively deregulated. Prior to this, exports were periodically banned or restricted, which prevented traders from developing reliable commercial relationships abroad. To this day, virtually no onion production is undertaken

[36] Capacity utilization in the pulp factories could possibly be improved by developing additional products for processing, such as pears, apples, pomegranates, guavas, and passion fruit. The result would be longer-term employment for the labor force, more cost-effective plant operations, and the generation of additional export earnings for owners and the government.

specifically for export, although exporters are beginning to source some of their supplies directly from farmers.

Box 4.1: Industry–grower price negotiations: Good practice from the pear canning industry

In the mango pulp sector in Tamil Nadu, considerable mistrust exists between growers and processors and between processors and exporters, who doubt that gross revenues are shared fairly across the value chain. Each group feels that it is being squeezed to the advantage of the others. As a result, there appears to be little loyalty across functions, and each group appears inclined to pursue ad hoc revenue optimization at the expense of price stability, channel diversification, and long-term market development. This atmosphere is compounded by the absence of transparency over transfer prices and of reliable buy–sell commitments fairly negotiated between informed representatives. Alternative models, however, could build confidence in the equity of such transactions and establish a transfer methodology whereby the processed component of the crop serves as a base against which sales of fresh produce can be managed more efficiently and profitably at the grower level.

One such model is the Washington/Oregon Canning Pear Association in the USA. With some 180,000 tons of product delivered each year to canneries, the Bartlett canning pear industry in the states of Oregon and Washington represents an annual farmgate value of approximately US$ 40 million. This volume represents some 70 percent of the total Bartlett crop grown in the US Pacific Northwest, with the remaining 30 percent distributed into fresh domestic and export channels.

When the Association was first founded in 1954, 20–25 processors operated in the Colombia River Basin, and more than 1,000 growers delivered product to them. Growers and processors alike complained about the volatility arising from competition among processors, the difficulty of making informed allocation decisions between fresh and processed channels, and the uncertainties as to markets for the growers and supplies for the processors. Since its formation, the Association has worked successfully to mitigate price volatility and market uncertainty among these grower and processor communities.

Today, the Association negotiates with three of the remaining five processors (the other two are cooperatives) on behalf of 40 percent of the industry's growers. Membership in the Association is voluntary. Members pay US$ 1 per ton of processed product, while the three participating processors also pay US$ 1 per ton on product received. The Association's general manager is guided by an elected board, with representative from all the grower districts. Well before harvest begins, the board meets to estimate crop size and generate a quotation to the three participating processors. Each of the three processors then negotiates independently with the Association, typically establishing a price before the harvest starts. While the pricing format has varied somewhat over the past several years, the structure is normally based on a price ranging from US$ 190 to US$ 250 per ton (depending upon crop size) for large, uniform fruit, free of hail damage and meeting specific quality criteria.

While the Association represents only 45 percent of the pears processed in the Pacific Northwest and negotiates with only 60 percent of processors, the prices negotiated by the Association serve as the industry standard for the four-month pear season. By communicating the negotiated price industrywide through word of mouth, the Association establishes a transparent pricing mechanism for the entire industry. Processors gain reliability in supplies and costs, while growers gain access to assured processing outlets at stable prices and can optimize the movement of their remaining crop into fresh channels.

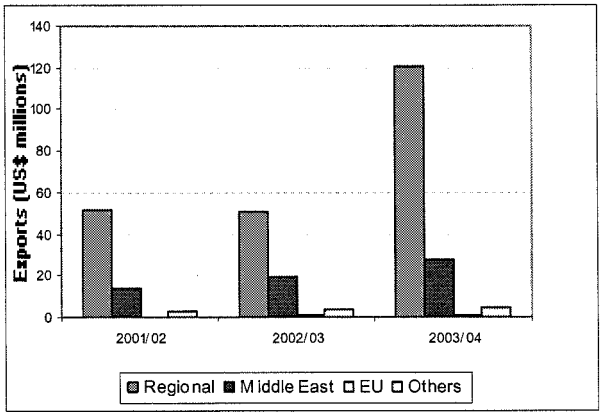
Source: Authors' personal communication with the Washington/Oregon Canning Pear Association.

India exports onions to a wide range of countries, although Bangladesh, Malaysia, the UAE, and Sri Lanka accounted for some 85 percent of sales in 2003/04 (figure 4.6). Each of these markets has very distinct quality preferences related to onion size, color, and pungency. As noted, much of the recent growth in export volumes was associated with a large increase in sales to Bangladesh. Shipments to the Middle East have remained steady for the past few years. Several attempts have been made to export onions to Europe during the late winter but have not yet succeeded. India's main onion varieties are too pungent for European tastes, and special yellow

onion varieties are needed for that trade. Some research and trial shipments have been undertaken.

The supply channel for exports to the Middle East and regional markets is a simple extension of the local market: exporters have a system of agents who buy either from the wholesale markets or sometimes directly from farmers. The onions are sorted again to ensure that they are the correct size for export, and damaged or diseased onions are removed. The various export markets have slightly different grading requirements. The Gulf market demands slightly larger onions and pays a higher price, while Bangladesh takes smaller and cheaper ones. After grading, onions are loaded into containers for shipping to various markets. Sometimes they will be loaded onto smaller "country craft," a cheaper but more erratic form of transport than containers on cargo ships. There are 60–70 regular exporters of onions. About 15 export more than 25,000 tons each year, 30 export 10,000–25,000 tons, and the remaining 20 export less than 10,000 tons. This large number of exporters ensures that there is considerable competition.

Figure 4.6: Value of onion exports from India, 2001/02–2003/04



Source: Authors' calculations, based on data from APEDA 2004.

In theory, the minimum export prices (MEP) are set at meetings between the exporters, who meet regularly under the auspices of the National Agricultural Co-operative Marketing Federation of India (NAFED). The exporters recognize but do not adhere to these prices; through natural competition, the price is established on the basis of supply and demand.

The two main growing seasons for onions in Maharashtra are *rabi* (winter) and *kharif* (summer), although the rabi season may be divided into early and late phases (table 4.9). Onion exports occur throughout the year, but most occur from the rabi crop because it is the biggest and has the best storage characteristics.

Table 4.9: Onion production seasons in Maharashtra

Season	Planting	Harvest	Storage quality	Percentage of production
Kharif	June/July	August/Sept	Poor	10
Late kharif	Sept/Nov	Dec/Jan	Poor	30–40
Rabi	Dec/Jan	March/April	Good	50–60

Source: Authors' personal communication with officials of the Maharashtra State Agricultural Marketing Board.

Average yields of onions in India are low (10.4 tons per hectare)[37] compared to yields in other countries competing in the world market. For example, yields in the USA are almost 50 tons per hectare, and the average yield in China—a major threat to India in some regional markets—is twice that of India. Countries such as China and the USA have sufficient variation in daylength to grow long-day hybrids, which yield and store better. Because India cannot grow long-day hybrids, it will not get comparable yields. This potential yield and storability disadvantage is not

[37] Data provided by NRC–Onions.

a serious issue for local and nearby export markets, but as transport costs increase and quality receives more of a premium, Indian exports could be disadvantaged. Onion exporters did report that Chinese onions were becoming a more serious threat to their markets in, for example, Malaysia and Singapore.

The National Horticultural Research and Development Foundation (NHRDF) and NRC–Onions are making efforts to target the European export market, where they see an opportunity for selling in the European winter, before produce is imported from countries such as Egypt. However, a significant number of issues make it difficult for Indian exporters to target this market. Exports would come from the late kharif crop, which keeps very poorly and makes transport in dry (nonrefrigerated) containers very difficult. Virtually all of the onions produced in India are red varieties, whereas Europeans prefer yellow types. Farmers would have to be contracted to grow varieties specifically for the European market, and if European market conditions became unfavorable, farmers could be left with onions that they cannot sell. A trial shipment of onions was made to Germany in 2004. Specific yellow varieties were grown under contract and it was claimed that these exports were successful. However, this trial did not continue in 2005 because there were problems with delayed plantings, low market prices, or the lack of an importer.

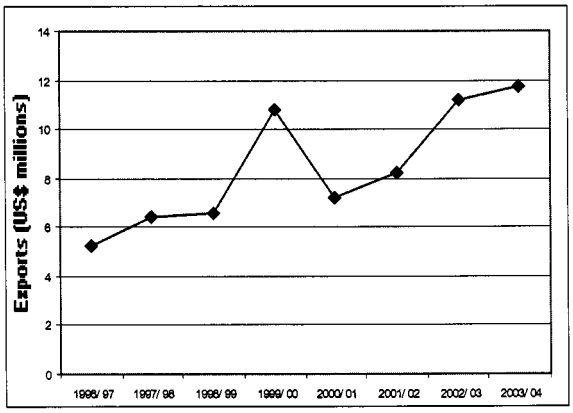
Indian onion exports have a very significant comparative advantage in local, regional, and Middle Eastern markets. The comparative advantages for Indian onions in regional and Middle Eastern markets—which are a simple extension of the local market—include: low production cost; the preferred varieties traditionally have been grown in India; India offers a year-round supply because of its three onion growing seasons; the poor storage characteristics of the kharif crop are not an issue because these markets are close at hand; and India has lower transport costs than virtually all other countries competing in the Middle Eastern market (India competes at some times of the year with Pakistan, Egypt, Iran, and, to a lesser degree, China).

Considerable progress has been reported in promoting low-cost, on-farm storage techniques and facilities for onions, and now the bulk of the crop is stored on the farm rather than by wholesalers. Important agronomic and market supply chain challenges remain, however. For example, an estimated 90 percent of production is based on farmer-saved seed, even though at least 30 improved varieties from Indian institutions or commercial seed companies are available. Widespread use of farmer-saved seed has contributed to considerable genetic mixing of varieties, so the delivered crop rarely represents a single, uniform variety. No more than 60 percent of the harvested onions are saleable. The rest are either too small, affected by pests or diseases, or lost during storage because of high moisture content.

While certain export markets (Malaysia) have preferences for larger onions and are willing to pay a premium for them, these and other quality-price market signals are still only weakly reflected through the wholesale market in Nasik and elsewhere. Exporters report that they need to purchase large lots of onions and have been restrained by local competition from being more selective in their purchases. This situation is beginning to change. Exporters are expected to purchase more onions directly in the future, especially as the last restrictions on exports—including the need to obtain "no objection" to exportation from a state marketing agency—are removed.

Dehydrated Onions

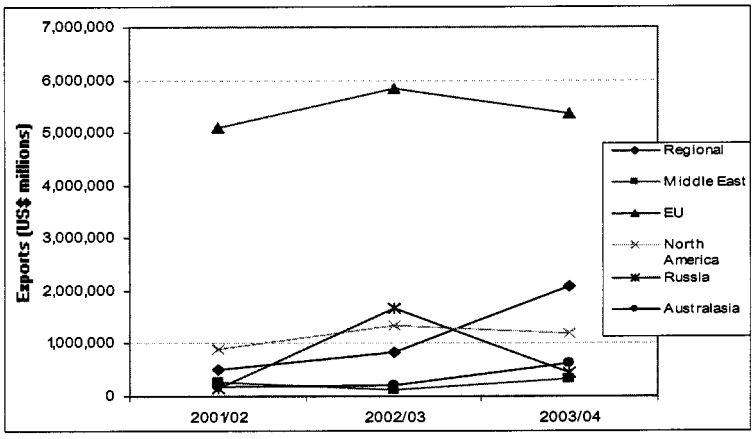
Figure 4.7: Value of dehydrated onion exports from India, 1996/97–2003/04



Source: Authors' calculations, based on data from APEDA 2004.

The total value of India's dehydrated onion exports in 2003/04 was US$ 12 million, nearly double the level of this trade in the mid-1990s (figure 4.7). Approximately half of this trade is directed to the EU. India has a number of processors of dehydrated onions. The largest company has bought up several factories and may now account for the majority of capacity within the industry. It primarily targets large food manufacturers in Western Europe and elsewhere. The other, smaller players in the industry direct the bulk of their sales to lower-priced markets in Eastern Europe, the Middle East, and developing countries. The onion-dehydrating industry is based on white varieties, in contrast to India's fresh market, which is based on red ones. The main processors contract with farmers to grow varieties specifically for dehydration. The processors provide seed and technical advice.

Figure 4.8: Value of dehydrated onions exported from India to various markets, 2001/02–2003/04



Source: Authors' calculations, based on data from APEDA 2004.

Within the EU, Germany and the UK are the main importers of dehydrated onions. North America, Eastern Europe, and the regional market are also important outlets in some years (figure 4.8). Sales to the regional market between 2002/03 and 2003/04 benefited from an increase in sales to Bangladesh, from zero to almost 2,000 tons—albeit of relatively low-value product (less than US$ 500 per ton). Owing to this increase, the regional market became slightly more important in 2003/04, in terms of volume, than the EU market. Indian exporters face considerable competition from the USA, Egypt, and France.

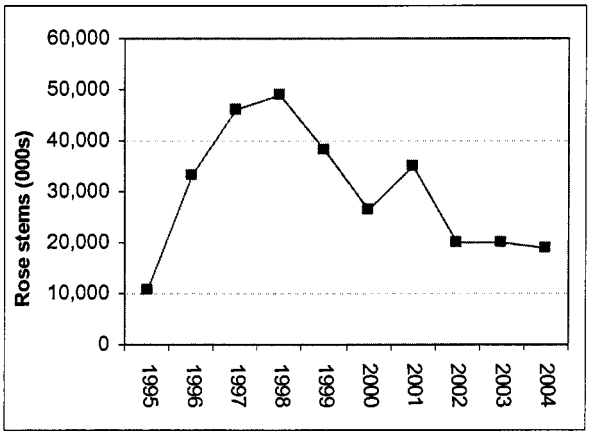
Flowers

In the early to mid-1990s, India sought to identify locations suitable for growing flowers for the European market. A number of significant investments in new technology and new flower types were made. Prior to this, most flowers were grown outdoors, with little investment in greenhouses or in a cold chain. Quality and shelf-life were poor. Efforts to develop the EU market yielded major changes in growing methods and quality, but most initial investments were financially unsuccessful. The government recognized that improved flower production technology could lead to significant exports, however, and APEDA decided to support the industry, for example, by providing air freight subsidies.

These first investments were based on India being a counter-seasonal supplier—in other words, selling to Europe in winter when local production was low or costly. Countries such as Zimbabwe and Zambia had targeted the same market for a few years, and they very quickly realized that freight was the largest cost and vital to their comparative advantage. The other lesson learned from these countries was that cut roses were potentially the most profitable. The very large market for out-of-season roses made them a sufficiently high-value crop to cover the freight costs. Virtually all of India's cut-flower exports are roses of the short-stemmed "sweetheart" types that are best suited to local growing conditions. In general, sweetheart types are cheaper than the larger intermediates or T-hybrid flowers.

A number of Dutch marketing and consultancy companies that successfully developed cut-flower production in southern Africa prepared feasibility studies for rose projects in India. Maharashtra (especially around Pune) was identified as a suitable production site. These studies recommended investing in such technology as greenhouses, cold chain systems, and imported varieties. A number of large Indian companies decided to diversify into rose production, and by the end of the 1990s, about 250 hectares of flowers were estimated to be grown in greenhouses. Exports to Europe peaked at just under 50 million stems in 1997 but had declined to 18 million by 2004 (figure 4.9). Initially the main market was the Dutch auctions, but now a much more diversified approach to marketing includes sales to a range of European countries as well as Japan and Australia. Exports to Japan and Australia have partly compensated for the decline in exports to Europe, but it is interesting to note that the two large exporters interviewed for this study exported to at least six countries. In contrast, most big flower-exporting companies in other countries have a carefully targeted approach to their marketing.

Figure 4.9: Volume of India's cut-rose exports to the EU, 1995–2004



Source: Authors' calculations, based on data from Eurostat.

Since the large corporations first invested in growing roses for export, very little further investment in exports has occurred. In fact, many original investors now produce a wider range of flowers for the local market, having failed to generate a satisfactory return on exports.

Considerable effort is being made to stimulate small-scale production for the local market. For example, the Horticultural Training Centre offers courses on cut-flower production, and the National Horticultural Board offers grants to help small-scale producers establish greenhouses. Some of these small-scale producers sell flowers to larger growers for export to Europe, especially around occasion days, but most of their crop is sold locally. In addition, APEDA is encouraging the establishment of Dutch-type local auctions for selling flowers; the first is scheduled to open soon in Bangalore, and a site near the international airport has been identified in Mumbai. Flower auction centers are also planned for Noida (near Delhi) and Kolkata. This approach should help local producers achieve better or more transparent prices but will probably not help with exports, although it might encourage better quality if buyers pay a premium for higher quality.

The size of the European market for imported roses has increased dramatically over the past decade (table 4.10, figure 4.10). The data show that India is an extremely small player in this market and has not taken advantage of the opportunity,[38] whereas Kenya and Uganda took considerable advantage of the expansion. These countries can produce roses throughout the year, whereas Zimbabwe,[39] Zambia, and India are only seasonal producers.

The two key factors for successful cut-flower exports to Europe are climate and the cost of air freight. An appropriate climate is needed to produce good-quality flowers and ensure a long marketing season.[40] The cost of air freight is critical, because it is the biggest budget item. India's climate gives it a significant comparative disadvantage. The very hot summers reduce flower quality,[41] which limits the main export window to mid-October through mid-March. Equatorial countries such as Kenya and Uganda have more uniform temperatures and can supply the market all year. The longer season means that more roses can be harvested: yields of 120–140 stems per square meter are reported by Indian exporters, compared with 200–250 stems for similar varieties grown in East Africa. The high humidity in India during the rainy season adds considerably to the fungal disease pressure and further reduces rose yields.[42]

Table 4.10: Exports of cut roses to Europe, 1995–2004
000 stems

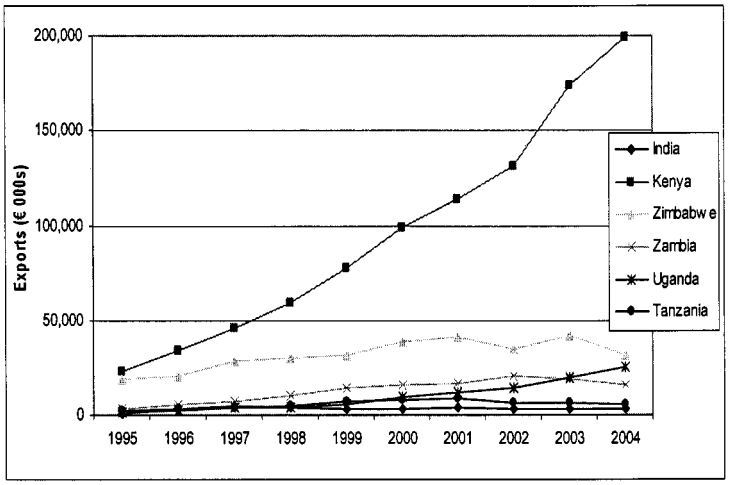
Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
India	10,612	33,360	45,920	48,849	38,080	26,401	35,163	20,080	20,071	18,860
Kenya	320,264	488,934	615,790	805,283	976,383	1,087,154	1,341,715	1,546,505	1,760,615	1,913,554
Zimbabwe	224,668	320,068	401,171	500,596	544,020	579,970	707,532	580,734	559,466	498,943
Zambia	28,550	49,141	58,401	96,845	121,397	119,108	155,547	194,977	161,990	139,581
Uganda	30,061	44,666	59,554	69,818	90,013	139,793	194,712	231,642	274,292	309,784
Tanzania	24,276	28,290	36,205	51,023	78,170	75,028	93,006	73,693	58,390	51,605

Source: Authors' calculations, based on data from Eurostat.

[38] The value of the European market for imported roses is almost US$ 400 million, with imports from India worth only about 0.5 percent of the total.
[39] Zimbabwean exports also declined because of the political situation.
[40] A long marketing season is vitally important to achieve high yields and spread overhead costs.
[41] High temperatures reduce stem and bud length, which are key factors in determining quality.
[42] Indian roses have a poor reputation in the European market. A number of importers and managers at the Dutch auctions were interviewed, and although some importers noted that exporters who have good farm managers deliver reasonable quality, most stated that the reputation of Indian roses in Europe was not good: the quality is poor, and they are not consistently on the market. India is generally regarded as a supplier for special occasions. Indian exporters chase high prices and, as they do not focus their efforts on specific markets, are not regarded as serious suppliers anywhere.

The cost of air freight can sometimes be as high as 50 percent of the C&F value of cut roses. Air freight costs from Mumbai to Northern Europe vary, but most exporters interviewed claimed to pay about Rs 120 (US$ 2.8) per kilogram—significantly more than most other countries supplying roses to the European market. Air freight rates are currently in a state of flux as a number of fuel surcharges have been added, but Indian exporters pay considerably more than their competitors.[43] To overcome this disadvantage, APEDA offers a freight subsidy to exporters, which was recently raised to the equivalent of 20 percent of the free on board (FOB) value. With the subsidy, the air freight rate is about US$ 2.11 per kilogram, which still surpasses the amount paid by East African exporters (about US$ 1.75–1.95 per kilogram). Another comparative disadvantage for Indian exports to Europe is the 12 percent duty levied by the EU.

Figure 4.10: Value of cut-rose exports from various countries to the EU, 1995–2004



Source: Authors' calculations, based on data from Eurostat.

Because they are not competitive in the European markets, many of India's flower exporters turned their attention to Japan and other markets. Unlike Europeans, Japanese consumers prefer soft pastel colors such as pink and light purple. Another issue facing exporters to Japan is the strict phytosanitary regulations (see chapter 5). The Japanese cut-flower market is large, valued at US$ 5 billion, although only US$ 313 million or 6 percent of the market is supplied by imports. However, imports are expected to expand owing to the advanced age of many Japanese growers and the increasing scarcity of agricultural land. Indian growers face competition in this market from growers in Malaysia and Australia, but in the longer term China is likely to be the most significant competitor.

India has expressed some interest in supplying the Middle Eastern flower market, which is currently well supplied from traders operating in the Dutch auctions. The Middle Eastern flower market differs from the market for fruits and vegetables, however, in which a distinct segment of consumers will pay for cheap Indian produce. There are possible plans to open a flower auction in Dubai to resemble the Dutch auctions, where produce is sold to buyers for on-shipment to countries around the world. It is hoped that many of the African flower-producing

[43] The cost of air freight is determined by a number of factors, including journey length, airport landing charges, the opportunity for back-hauls, the availability of subsidies, consignment size, and the regularity of supply. The precise reason why Indian exporters pay so much more than their competition is not fully understood, but the high cost of freight disadvantages flower exports. In addition, the total tonnage of perishable exports out of India to Europe is small—about 2,000 tons of vegetables and less than 1,000 tons of flowers. Regardless of these small volumes, it is believed that if the whole industry rather than individual exporters negotiated with the airlines, better rates could be achieved.

countries would use this auction and bypass the Netherlands, but it is unlikely that Indian flowers would be any more competitive with African flowers in Dubai than in Europe.

Asian Vegetables

Statistics for vegetables air-freighted to Europe from India are difficult to evaluate, because most data combine produce sent by sea and air, and most vegetables from India are classified as "other vegetables" in Eurostat or "mixed vegetables" in APEDA data. However, an effort has been made to evaluate the trends in exports to Europe. By far the most important European destination for air-freighted vegetable exports is the UK.

APEDA data suggest that the value of air-freighted fresh vegetables is only about US$ 2 million per year (table 4.11). The value of exports increased significantly between the mid-1990s and the early 2000s but has been more or less constant since then. Most exports fall into the "mixed vegetables" category, which includes the range of traditional "Asian" vegetables—the fresh chilies, eggplant, okra, and broad range of leafy and root vegetables that are staples of the South Asian diet. Most of the exports are freighted from either Delhi or Mumbai, although vegetables are also exported from other airports. The total value of exports air-freighted to the UK from Maharashtra is small, especially when compared to the sea-freighted exports of other vegetables to the Middle East or to local markets.

Table 4.11: Value of vegetables exported from India to the UK, 1996/97–2003/04
US$

Product	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
Mixed vegetables	169,199	354,299	567,989	609,625	1,171,831	1,606,273	1,599,669	1,562,481
Green chilies	61,171	8,539	28,687	92,051	409,002	358,482	61,186	237,327
Other chilies	0	0	29,414	33,408	4,882	13,634	0	7,560
Eggplant	0	0	0	0	0	0	0	224,679
Beans	0	0	0	0	0	0	0	10,149
Peas	3,098	364	9,339	0	0	0	95,846	31,991
Asparagus	0	0	0	0	0	0	0	5,513
Fresh gherkins	203,939	111,876	80,509	113,016	86,576	66,738	62,023	34,846
Total	437,407	475,077	715,938	848,101	1,672,291	2,045,128	1,818,724	2,114,546

Source: APEDA 2004.

The total volume of air-freighted vegetables from India to Europe is almost certainly less than 3,000 tons, down from a possible peak of 5,000 tons in 2001/02. To put this into perspective, note that Kenya exports more than 50,000 tons of vegetables by air every year—and even Bangladesh exports over 3,000 tons per year to Europe. The average unit value of vegetable exports from India to the UK is very low, generally less than US$ 700 per ton.

India's competitive advantage in exporting fruits and vegetables by air is based on being able to produce a wide range of produce specifically required by the South Asian ethnic market in the UK. Exporters claim that Indian produce has the correct quality and taste. The main disadvantage is that air freight is much higher out of India than Pakistan, Bangladesh, and some African countries that are also trying to compete in this market, although the APEDA freight

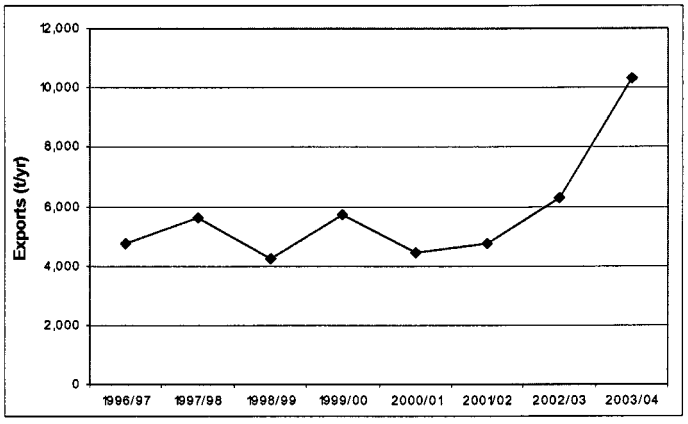
subsidy brings the air freight cost more in line with competing countries.[44] Another challenge in developing these exports is obtaining traceability from farmers; some exporters try to purchase from specific villages, if not from specific farmers. Finally, exports to Europe are disadvantaged by the import duty charged on the vegetables. The duty is equal to about 8 percent of the C&F value, which reportedly adds "0.70 to 0.90 pounds (£) per carton"—or roughly £ 0.15 per kilogram.

Indian vegetables have considerable competition from a number of countries, such as Bangladesh, Pakistan, Kenya, Ghana, and the Dominican Republic. Pakistan and Bangladesh are important suppliers of certain vegetables to migrant populations from these countries. Total exports from Bangladesh are slightly higher than those from India; vegetable exports from Pakistan are reportedly low. Exports of Asian vegetables from Kenya surpass 6,000 tons per year, and exports from Ghana are over 7,500 tons per year.

The reputation of Indian air-freighted vegetables in Europe is very mixed. Although Indian exports are important for making a wide range of vegetables available in the market, most importers would much rather deal with Ghana, Kenya, or the Dominican Republic, because these sources are cheaper and the quality of service is reportedly much better. One importer interviewed was satisfied with the produce imported from Maharashtra, but the exporter was a close relative and considerable effort had been made to ensure quality and consistency of exports. The importer also noted that he only imported certain, more unusual, product lines from India that could not be imported from other countries; in more traditional product lines, the high cost of air freight and import duties makes India noncompetitive with other countries. Other importers are much less positive, because some have had bad experiences dealing with India. The most frequent comments are that unless the exporter has very strong management and a serious commitment to quality and customer service, the produce is much too variable, the supply is too erratic, and it is relatively costly.

Pomegranates

Figure 4.11: Pomegranate exports from India, 1996/97–2003/04



Source: Authors' calculations, based on data from APEDA 2004.

India produces an estimated 50,000 tons of pomegranates, of which 70 percent (35,000 tons) are produced in Maharashtra. Pomegranate exports have been remarkably constant at between 4,000 and 6,000 tons per year (figure 4.11). However, in the 2003/04 season, exports increased to over 10,000 tons, mainly owing to a big increase in exports to Nepal and the Middle East, although exports to the EU also increased significantly. Traditionally most of India's pomegranate exports have been to the Middle East (almost 7,000 tons in 2003/04), but there is interest in further developing the market for this fruit

[44] One exporter noted that much lower rates could be obtained by using dedicated cargo planes. If exporters worked more cooperatively, more of them could make use of such aircraft.

in Europe. In the 2003/04 season, exports to the EU were just over 1,500 tons, with a value of US$ 1.75 million.

There are a number of reasons for this interest in developing pomegranate exports to the EU. First, there is a desire to build on the relative success of grape exports and use the same packinghouse facilities and cold chain logistics to spread prevailing overheads. Second, there is interest in the health and medicinal characteristics of pomegranate and its juice, raising the prospect for servicing the health food market segment. Finally, Indian researchers have introduced a new variety (Bhagwa) which is well colored and attractive and therefore should appeal to the European market.

Most of the European consumption of pomegranates is supplied from southern Europe between July and December, providing India with a market window in the first half of the year (although there is competition then from Iran). A number of exporters are reportedly trying to develop trade with supermarkets, primarily in the UK. It is important that the scale of the European market opportunity be thoroughly researched.

In addition to marketing the fresh fruit, there is considerable interest in evaluating the opportunity to export pomegranate juice. There is some interest in developing this concept in Europe. As yet there is no commercial-scale juicing of pomegranates in India, although pomegranate juice based on imported concentrate is packed and sold in the UK. Studies have reportedly been undertaken into the viability of a pomegranate-juicing factory, but no investment has been made.[45]

Bananas

As in the case of mangoes, India is also the world's preeminent producer of fresh bananas. With an average annual production over the past three years of 16.9 million tons, India accounts for 24 percent of world banana production (figure 4.12). Indian banana production is polyclonal, with over 200 cultivars claimed to be grown in the country and nearly 40 varieties in commercial production. India's leadership in banana production is not reflected in its involvement in the global trade in bananas. Only 0.07 percent of production is exported.[46] In 2003/04 India exported around US$ 250,000 worth of bananas.

Tamil Nadu bananas appear to have virtually no potential for short-term export development on an economically viable basis. Current cultural and postharvest practices frequently result in high internal and external damage to the fruit. The external appearance of bananas is of major importance in the international trade yet is not presently an area of concern in the Tamil Nadu banana supply chain.[47]

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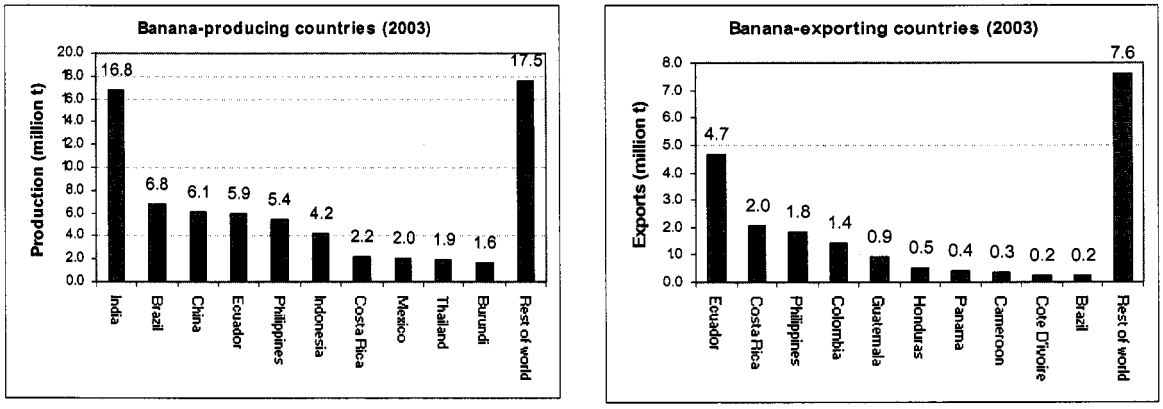
[45] A study evaluating the feasibility of establishing a pomegranate-juicing factory in Maharashtra was recently undertaken. An initial study reportedly showed that a US$ 4 million investment was required, but the study was reevaluated, and the initial investment was reduced to US$ 2 million, which made the concept more viable.

[46] At slightly more than 15 kilograms per capita per year, banana consumption levels in India are among the highest in the world. These levels of consumption clearly mitigate the need to institute the enormous structural and procedural changes to improve export competitiveness in the banana sector.

[47] The team did not examine the banana supply chain in other states.

Figure 4.12: Principal banana producers and exporters, 2003



Source: Authors' calculations, based on data from FAOSTAT.

In Tamil Nadu, banana plantings are rotated every one to three years, reportedly out of concern for nematode infestation and for spontaneous mutation. The producing section is then left fallow for a year before replanting. This practice requires an enormous amount of planting material, which, in the absence of reliable tissue culture labs, is rarely true to type. The primary effect of poor planting material can be seen within most stems, which contain an extraordinarily high percentage of deformed hands. Stems are staked at the peduncle, which guarantees a high incidence of pole damage to the outer bananas on most hands. Plants are cropped, or stunted, to maximize harvest during March, April, and May, reportedly for a combination of market and weather considerations. Cropping causes further stress and aggravates deformity. Based on a visual examination of stems on trees in several farms, it is estimated that no more than 35 percent of the hands on the stems would yield clusters that could be packed into cartons, due to point scar, excessive curvature, finger deformation, and prop damage. By comparison, commercial farms in Latin America would expect no more than 20 percent packinghouse shrink, including the weight of the stalk.[48]

Employment in Export Horticulture

As there are no readily available data on employment in the horticultural export trade, an attempt has been made to estimate this number for the six commodities in this study using data on export volumes, yields, area devoted to export production, and labor used in processing (table 4.12). For these six crops, which account for about 50 percent of India's horticultural export earnings, it appears that 170,000–240,000 farmers are involved in export supply chains. The majority of these farmers produce for the domestic market as well, with gherkins being an exception (the bulk of production is for export). Therefore, approximately 120,000 full-time equivalent jobs are generated by export-oriented horticulture for the six commodities.

[48] To harvest bananas, stems are cut from the peduncle and allowed to fall into baskets borne by backers. Stems are carried, sometimes 2 or 3 to a basket, to an open-stake truck, where they are lifted from the basket and stacked seven high for the trip to the market. On arrival at the auction market, the stems are tossed down to bearers, who deposit them on the asphalt outdoor auction floor. The rough handling results in further damage.

Table 4.12: Export horticulture and employment, 2003/04

Commodity/product	Export volume (t)	Export value (US$ millions)	Area planted of exported commodity or ready made (ha)	Estimated number of farmers involved in export supply chain (000s)	Estimated number of full-time equivalent jobs in export-oriented farm production (000s)	Jobs per US$ 1 million of exports
Fresh grapes	26,470	24	2,452	6-8	7	296
Fresh onions	859,939	165	82,686	100-150	40	241
Cucumbers and gherkins	87,148	28	16,000	50-60	37	1,340
Mango pulp	89,515	56	34,429	7-12	29	520
Dehydrated onions	12,566	12	10,875	3-4	6	496
Fresh mangoes	60,551	25	7,763	1-2	5	196

Source: Authors' calculations. Export volume and value data are from APEDA 2004; area planted for exports is estimated using average yields of 10.4 t/ha for onions, 7.8 t/ha for mangoes, 12 t/ha for grapes exported to Europe, and 16.8 t/ha for other grape exports. It assumed that about 35 percent of the volume of grape exports went to Europe. Gherkin area is estimated based on communications with the industry. Labor requirements used are 750 days/ha for grapes, 544 days/ha for gherkins, 125 days/ha for onions, and 167 days/ha for mangoes. Labor involved for processing onions and mango pulp is estimated at 20 days/t.

4.1 Despite the considerable interest in expanding exports of fresh horticultural products, the employment numbers suggest that exports of processed products such as mango pulp, pickled gherkins, and dehydrated onions generate relatively more jobs than fresh commodities. Pickled gherkins, mango pulp, and dehydrated onions generate about 500–1,300 jobs for each million dollars of exports, compared to 200–300 jobs per million dollars of exports of fresh grapes, onions, and mangoes. While export horticulture has generated a considerable number of jobs in India, the large number of farmers and the fragmented production base raise challenges in meeting SPS standards, particularly, as discussed in the next chapter, when product traceability is a requirement.

Chapter 5: SPS Management Experiences and Challenges in Indian Horticulture

A Strategic Approach to Prioritization and Capacity Building

Developing countries such as India, and individual suppliers in those countries, are commonly assumed to have no room for maneuver in the face of emerging standards: they must either "comply or perish." In reality, countries and suppliers face a wide range of choices even when attempting to comply with a particular standard, although the increased emphasis in recent years on proscriptive processes and procedural requirements (rather than product or outcome standards) does somewhat curtail this room for maneuver.

Developing countries and individual suppliers can pursue one or a combination of strategies to meet different objectives in a context of evolving standards (box 5.1):

- *Compliance*: adopting measures to meet international standards or the requirements of one's trade partners. This strategy might involve, for example, some combination of legal/regulatory change, the application of certain technical or other risk management approaches, and the implementation of testing, certification, and/or other conformity assessment measures.

- *Voice*: seeking to influence the "rules of the game" and/or how they are implemented via participation in international standard-setting fora, communications with WTO, negotiations with bilateral or regional trading partners, and/or business planning with downstream clients.

- *Redirection*: altering commercial strategies to encompass sales to different countries or market segments, changes in the mix or form of products, and other maneuvers, taking into account the costs and benefits of complying with different standards.

The timing and mode of strategic response may also vary. Actions may be taken on a proactive or reactive basis. Proactive strategies involve anticipating future requirements and taking measures in advance to minimize costs or maximize benefits. Players pursuing reactive strategies respond only after the requirements are put in place, perhaps hoping to limit the action they must take or at least to learn from the mistakes of the first movers. The strategic response can also be either defensive or offensive: the former involves measures to minimize the changes required, whereas the latter involves trying to exploit an opportunity created by standards, such as a price premium for organic products.

The locus of strategic response may also vary (figure 5.1). Some responses may come from individual firms, farms, or government agencies. Others involve collective action, perhaps through producer or industry organizations or interministerial task forces. There is also scope for a strategic response that involves public–private collaboration or collaboration between developing country stakeholders in multiple countries.

Figure 5.1: Actors in strategic response to standards

	Individual	Collective
Public	Specific ministry or agency	Interministerial taskforces Government-to-government memoranda of understanding Multicountry SPS counter-notification
Public–private	Subsidies/cofinancing Joint ventures	Joint public–private sector task-forces
Private	Firm/farm investments Company "codes of practice"	Industry association "code of practice" Grower association program Coordinated supply chain partnerships

Source: Authors' analysis.

More often than not, developing countries respond to emerging trade-related standards in reactive–defensive ways, frequently in the context of a crisis such as a trade ban or disease outbreak. The requisite public systems and private investments often are set aside until trade with an important market is likely to be interrupted. In this mode of response, both government and the private sector typically (and unfortunately) have fewer technical or administrative options to achieve compliance with the required standard. Their credibility in influencing how the standard is developed or implemented ("voice") may be undermined by weaknesses in the basic regulatory and private management systems for compliance.

The array of pertinent SPS management functions and the associated institutional, technical, and other capacity needs may appear daunting to developing countries aspiring to increase horticultural exports. A pragmatic and strategic approach is needed. For such countries, prevailing levels of capacity are either very low or concentrated in certain firms or agencies. At the same time, resources are limited, and the opportunity cost associated with investing in improved SPS management capacity is high. Countless other potential uses compete for scarce resources. It is essential to prioritize capacity-building efforts in terms of the integral functions of SPS management—considering technical as well as economic factors.

A useful framework in the development of priorities is the concept of a hierarchy of SPS management functions (figure 5.2) (World Bank 2005a). Functions towards the base of the pyramid represent the foundation stones. Functions towards the top add value and sophistication to the entire system of SPS management and gain in importance as export sectors mature and they encounter increasingly complex technical, administrative, and even political challenges.

The foundation of any SPS management system is emphatically not *sophisticated equipment and accredited laboratories. The true foundation of a functioning system is broad awareness among participating stakeholders about the relevance and importance of food safety and agricultural health to the competitiveness of their country/sector/firm and recognition of their own role in this system.* Where this awareness is especially weak, any system of regulatory enforcement will almost certainly be overwhelmed, and advanced testing will simply demonstrate the serious, systemic problems within the supply chain.

Awareness of major SPS challenges and opportunities is needed at several levels, including: (1) senior agricultural and trade officials, in order to assign appropriate priorities for public programs and expenditures; (2) owners and managers of producing/exporting firms and their industry organizations, as these people make pertinent investment, personnel, and other decisions; and, perhaps most important, (3) large numbers of farmers and farm and industry workers who produce and handle agricultural raw materials on a day-to-day basis. Lacking strong awareness at all of these levels, the system's foundations will be weak.

Box 5.1: Objectives and elements of success in a strategic response to complying with emerging standards

In considering possible responses to the emerging complex of food safety and plant health standards, what objectives are private entities and policy makers pursuing? It is also vital to consider what parameters define the success or failure of efforts to achieve compliance or otherwise respond to emerging standards. There are a number of possible responses, more than one of which may be pursued simultaneously. In the context of export-oriented horticulture, several parameters are important:

- ***Market access***: For efforts to comply with evolving standards, the most obvious measure of success is the level of access to existing or new markets for agricultural and food products. A measure of market access might include the value or volume of trade over time compared to some benchmark. In existing markets, the benchmark might be the level of exports or market share prior to the imposition of the standard, or it could be the level of exports estimated to have occurred in the absence of the standard. In a new market, the benchmark might be the level of exports or market share in a comparable market for which there is a history of trade.
- ***Benefits exceeding costs***: To be considered successful, the benefits from compliance measures or other responses should clearly exceed the associated direct and indirect costs. Compliance should not be sought "at any cost." Both the nonrecurring and recurring costs of compliance need to be compared with the expected flow of benefits over some defined time period in terms of the economic value of exports, spillover effects, and other variables. Cost-effectiveness might be used as an alternative metric, whereby differing approaches to maintaining or achieving market access are compared against the value of a defined unit of exports. This cost/benefit calculus might vary among different private stakeholders and between these and policy makers, depending upon which costs and benefits are included as being relevant to their own decision making.
- ***Long-term competitiveness***: Aside from short- and medium-term impacts on market access, it is important to recognize the effects of compliance efforts on the long-term competitiveness of an industry and its participants. Indeed, a more strategic perspective on standards would suggest that this is the most appropriate metric to use. Thus compliance efforts should be judged by the extent to which compliance acts to enhance competitiveness, on a sustainable basis, in the context of prevailing competitive forces and trends.
- ***Social inclusion/exclusion***: Beyond the trade effects of efforts to comply with new standards, it is important to recognize that the resultant changes to supply chain structure and *modus operandi* can work to include or exclude particular groups. Of greatest concern is the impact on vulnerable groups, for example smallholder farmers and small and medium enterprises (SMEs), especially if they have become dependent on export-oriented supply chains and have limited alternative livelihood opportunities.
- ***Spillover effects***: Efforts to comply with agro-food standards for external markets can have both positive and negative spillover effects for domestic consumers and producers, such as impacts on food safety, agricultural productivity, worker safety, and rural livelihoods. The extent of these spillovers will depend on the level of integration of supply chains and regulatory systems for international and domestic markets. Although rarely considered, the existence of such social and economic spillovers can have a significant impact on the balance of costs and benefits associated with capacity-building and compliance efforts.

These points suggest that standards for horticultural products need to be considered from a wider strategic perspective that encompasses many elements of development. Compliance decisions can have wide-ranging implications, not only for market access and the efficiency of resource use but for the livelihoods of vulnerable social groups and wider processes of economic and social change.

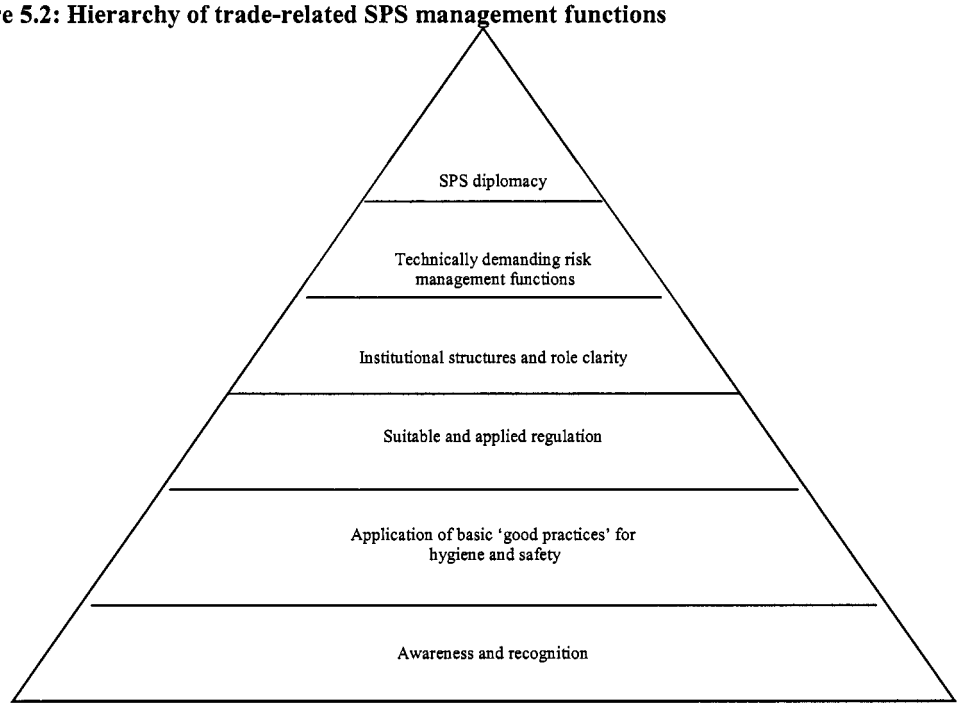
Box 5.1 Cont'd.

It is also evident that there may be trade-offs between the objectives described above. Certain approaches may rapidly restore market access yet entail considerable costs and require the exclusion of some or numerous producers and firms. In making strategic decisions regarding compliance with new standards in agricultural and food markets, inevitably choices have to be made regarding the relative importance of these parameters and the trade-offs between them. *Maintaining and/or gaining access to lucrative export markets cannot be pursued at any cost.* The time element is also important. It is imperative to consider both short- and long-term impacts, examining not only immediate trade flows but longer-term competitive issues and implications for social change. A good practice model for standards-related capacity building should take all of these elements into account, explicitly recognizing the trade-offs that exist and are deemed acceptable or unacceptable.

This strategic approach to standards in international trade is distinct from short-term "fire-fighting" in response to immediate problems. While immediate problem-solving is inevitable in certain contexts, for example when a new food safety risk threatens market access, all too often developing countries adopt a fire-fighting approach when a more strategic perspective is more appropriate and might yield competitive gains that offset the associated costs of compliance. This prospect suggests that standards-related compliance should be incorporated into broader policy-making and capacity-building decisions, forming part of wider efforts to promote competitiveness in international markets. This strategic approach requires that efforts to respond to standards be proactive, looking ahead to how requirements are likely to change and incorporating responses to longer-term development efforts.

Source: Authors' analysis.

Figure 5.2: Hierarchy of trade-related SPS management functions



Source: World Bank 2005a.

Another core set of building blocks that proceed from broad awareness is the application of basic and recognized risk and quality management practices at the farm and processing levels of supply chains, including HACCP, GMP, and GAP. The application of such practices mostly

involves training staff and family members in basic hygiene, the proper use and storage of potentially hazardous substances, improved record-keeping related to production practices, and the ability to conduct simple assessments of possible risks, among other skills.

With broad awareness and common application of good practices, many potential SPS risks can be managed effectively at the enterprise (or farm) level. Other risks cannot be fully controlled on such a decentralized basis. These risks are more systemic in nature and demand broader oversight or collective action. They require basic research, risk analysis surveillance systems, and quarantine and emergency management systems. In such contexts, scientific testing and verification systems become essential, because even if individual farms and firms apply good practices, they may not be able to control all hazards. Many of these higher-order functions require particular technical skills, often specialized equipment and well-defined procedures, supported by recurrent funding. Some of these functions need to be mandated by law to ensure that they are implemented appropriately. An effective regulatory framework and transparent institutional structures are therefore placed in the middle of the pyramid.

At the top of the pyramid is so-called "SPS diplomacy," which includes the international obligations of individual WTO members but also relates to engagement in the technical and political realm of official and private international standard setting, including negotiations with bilateral trade partners and with regional integration partners on matters dealing with harmonization, equivalence, joint programs, special considerations, and related matters. SPS diplomacy thus relates to the concept of "voice" in responding to emerging regulatory and commercial requirements.

Once established, SPS management capacity (at any level of the hierarchy in figure 5.2) must be sustained in terms of effectiveness, scientific and technical relevance, and access to financial, physical, and human resources. Sufficient political and economic priority must therefore be given to maintaining this capacity, perhaps from the perspective of trade promotion as well as the promotion of domestic producers' and consumers' welfare. Cost recovery systems, such as user fees, may be needed where appropriate. To be sustained, SPS management capacity must also be viewed from a dynamic perspective: the efficacy of the integral functions must be reassessed and updated in light of developments in science and technology, changing commercial aspirations, emerging food safety and phytosanitary challenges in the domestic setting, and changes in standards applied by major trading partners.

Challenges, Experiences, and Options in Indian Horticulture

The challenges posed by standards have manifested themselves in different ways for Indian horticulture, including:

- *Absolute barriers or binding constraints for accessing particular markets.* The most prominent case involves fresh mangoes and the plant health concerns of authorities in the Australia (and until recently in USA and Japan).
- *Temporary losses due to rejected (and sometimes destroyed) consignments of fresh or processed product.* The most high-profile incident occurred in 2003 when some 28 containers of grapes consigned to the Netherlands were rejected due to violative pesticide residues. Less visible yet more common instances include the rejection of numerous small consignments of processed horticultural products by the USA because of improper labelling, poor packaging, inclusion of illegal additives, and other problems. Other markets have experienced a few other episodes in which fresh produce was rejected.

- *Higher consignment-specific or recurrent transaction costs* due to duplicative testing, high levels of entry-point inspection, or the further treatment of goods upon arrival in the overseas market. These costs have affected the profitability of India's cut-flower trade into Japan and the Netherlands and added to the costs of exporters of other products.
- *Patterns of "defensive commercialization,"* whereby firms fail to pursue opportunities for remunerative trade with certain countries or types of buyers because of concerns about their inability to ensure compliance with regulatory or private standards in those markets. This pattern is common in Indian horticulture, although additional factors have also weighed on these commercial strategies.

Table 5.1 summarizes the types of impact that SPS measures and challenges have already had on Indian horticultural exports and notes several looming threats, all of which will be discussed below.

Table 5.1: Impacts of SPS measures and challenges on Indian horticultural exports

Binding constraint	Temporary losses	High compliance costs	Defensive commercialization	Looming threats
Fresh mangoes entering the USA and Australia	Grape consignment rejections in Europe Border rejections of many small consignments of processed fruits and vegetables Onion consignment rejection in Europe Periodic price discounts by private buyers	Pesticide monitoring program for grapes Fumigation of cut flowers in Japan Stalled upgrading of mango pulp operations EurepGAP and smallholder vegetable growers	Processed fruit and vegetable sales by SMEs Grape export strategies Onion export strategies Avoidance of certain cut-flower markets	Heavy metals in fresh and processed vegetables Pesticides in pomegranates Requirements for traceability in processed fruits and vegetables Environmental and social requirements in cut flowers

Source: Authors' analysis.

The defensive commercialization impact is perhaps least noticed but most pronounced in Indian horticulture. All other impacts appear vividly on the radar screen owing to specific events, bilateral negotiations, or clear, tangible costs. There are large differentials in the unit values of Indian exports to different markets and distribution channels (table 5.2). For many products, a majority of sales are directed at lower-value markets. This trend partially reflects comparative advantage—for example, India's location permits access to South Asian and Gulf markets at relatively low freight costs, and the resident and immigrant populations in these markets prefer fruit and vegetable varieties commonly grown in India. For some of these markets, transactions are readily managed by Indian suppliers, as commercial behavior strongly resembles the patterns found in the Indian domestic market.

Table 5.2: Unit value variations between markets applying higher and lower standards
average FOB unit values on Indian exports, 2002–03, in US$/t

Product	Higher-standard market	Lower-standard market
Grapes	1,035 (UK)	697 (UAE)
Mangoes	894 (UK)	545 (UAE)
Pomegranates	1,185 (UK)	433 (UAE)
Onions	148 (Malaysia)	116 (Sri Lanka)
Mushrooms	786 (USA)	516 (Russia)
Dehydrated onions	892 (Germany)	488 (Romania)
Preserved onions	1,256 (Germany)	856 (Sri Lanka)
Mango pulp	845 (UK)	591 (Saudi Arabia)
Preserved gherkins	402 (USA)	314 (Russia)
Mixed frozen vegetables	681 (UK)	494 (UAE)

Source: APEDA 2004

Yet at least some of these commercial patterns reflect either an inability or a lack of confidence among processors and exporters to comply with the quality, food safety, and/or plant health requirements of the higher value markets. These patterns may also reflect an implicit calculation on their part that they would not be commercially compensated for the investments and recurrent costs necessary to attain higher quality and/or comply with food safety or plant health standards. Nothing is wrong with serving less-demanding customers, especially if they provide consistent business and margins are adequate to sustain the supply chain. In some of these markets, India may face relatively less competition and thus command a large or even dominant market share. Being a cheap, reliable supplier may not be a sustainable commercial strategy in the long term, however. Dynamic horticultural markets may see new entrants. Lax food safety and plant health standards may not prevail in the future in the targeted middle- and low-income markets.

Grape Expectations: Successful Fire-Fighting?

India's export trade in grapes dates to the late 1980s and early 1990s, when domestic production surged, market prices fell, and some entrepreneurs and cooperatives sought higher returns in external markets. The primary initial focus was on supplying Middle Eastern markets, where specifications for quality and presentation were relatively similar to those in India's domestic market. Some exporters made small inroads into the European market with Thompson Seedless grapes, as described in the previous chapter.

Following the alleviation of shortages in staple food grains, the Indian government provided considerable support to the production of horticultural crops, including grapes. Research and development were expanded, and support was provided to develop irrigation systems, packinghouses, and other infrastructure. Domestic grape production boomed, increasing from an estimated 251,000 tons in 1987–88 to 1.1 million tons by 1996–97. Only a tiny proportion of this growing output was directed at export markets. Fresh grape exports increased from 5,300 tons in 1990–91 to just under 21,000 tons in 1996–97. By the mid-1990s, the majority of exports were directed at Europe.[49]

This small export trade attracted considerable attention, seemingly illustrating the potential for Indian nontraditional agricultural exports more generally. Various cooperative societies were formed and, with government support, targeted export markets. Private companies also entered this trade, typically diversifying into the export business from other, related activities, such as transport, cold storage, packaging, or freight forwarding. Progress was uneven and mistakes were made, yet the level of commercial and official interest in the horticultural export trade remained high. A specialized national research center for grapes was formed in 1997, and state and federal governments provided continued support.

Quality and other specifications for grapes differed in Europe compared to the Indian domestic and Middle Eastern markets. Buyers wanted larger berries with deeper color, no external blemishes, and higher sugar content. Bunches of grapes needed to be a certain size and packed for good visual presentation. Imported grapes were expected to have a certain shelf-life. These and other buyer specifications necessitated major changes in the production practices typically adopted for Indian grapes. Additional pruning was needed, at the sacrifice of yield. Shade netting was used to reduce direct sunlight and enhance fruit color. Synthetic growth regulators were applied to affect berry size. Much greater use was made of pesticides to control insect pests and mildew, thus

[49] See Naik (2004) for a review of the emergence and subsequent development of India's grape industry.

ensuring a blemish-free product. A crop cycle involving 30 or more rounds of chemical spraying was not unusual.

From the mid- to late 1990s, some limited testing was done for pesticide residues in export-oriented grapes. Testing was voluntary, and testing capacity was quite limited. For example, the government laboratory in Pune could test only for some 15 organochlorines and lacked clear guidelines on how to conduct the tests. In 1998–99, Pune analyzed only 31 grape samples. Testing was made mandatory in 2000, yet most of the testing equipment was not up to date, could not provide the same level of detection as in Europe, and could not detect certain heat-sensitive chemicals such as acephate and methomyl. In 2001–02 and 2002–03, the government lab at Pune tested 604 grape samples, of which only 10 failed to comply with applied standards. This remarkably low failure rate probably reflected the limited testing capacity more than the actual status of the Indian grape crop.

In parallel, major changes were afoot in the way the EU and individual member states registered agro-chemicals and monitored the presence of pesticide residues in food. A more rigorous set of environmental and human safety criteria were being applied to new pesticide approvals. Agro-chemical companies were required to submit extensive dossiers on all formulations for which re-registration was requested. This process substantially reduced the number of approved active substances for plant production. It removed many older pesticides and approved uses on so-called "minor" crops. Measures were also taken to harmonize legal tolerance levels for pesticide residues and to develop coordinated EU-wide programs of pesticide residue monitoring. Individual countries also stepped up their own distinctive programs to monitor pesticide residues.

Pesticide residues were found to be relatively common in grapes grown within Europe (Italy, Spain, and Greece) and imported from external sources (South Africa and Chile). Countries including the UK and Netherlands regularly included grapes in their pesticide residue monitoring programs. Violative residues were periodically found in Indian grapes, as with carbendazim in grapes imported into the Netherlands in 1997.[50] Aside from periodic government-to-government communications on such results, the grape trade continued uninterrupted.

A subset of Indian firms and cooperatives were not waiting for trouble to happen. They had already started to keep more extensive records of growers' practices, especially agro-chemical use, and devoted considerable attention to training farmers about buyers' requirements. They had buyers test for pesticide residues to confirm or augment local testing results. A few firms and cooperatives had their members or outgrowers prepare for and gain certification under EurepGAP. In response to buyer requests, upgrades were made in packinghouses, including the introduction of formal HACCP procedures. Yet this was not the total or indeed the mainstream response from this increasingly fragmented industry. Many exporters had little direct interaction with growers, except at harvest time to agree on prices and logistics. When agronomic advice was provided and growers experienced problems, they sometimes blamed the exporters and sought compensation.

In early May 2003, during the last week of India's export season to Europe, a bombshell hit. A Dutch importer, in the midst of a commercial dispute with an Indian exporter, had samples of that exporter's grapes tested by a private lab. Residues of the insecticide methomyl were found in excess of the MRL (0.05 micrograms per kilogram) for the EU. The importer placed an advertisement in the local paper indicating that grapes from the Indian supplier contained "poison" and alerted Dutch authorities. The latter took samples from the 28 containers of Indian grapes in Rotterdam port. Some 75 percent of the samples had violative residues of methomyl and/or

[50] As reported in Buurma et al. (2001).

acephate. The problem was reported on the EU Rapid Alert system. The price of Indian grapes dropped sharply, leading the shippers of those grapes to incur losses, either in selling to the Netherlands or diverting grape shipments to other markets.

This event came as a shock to the industry and to the Indian government. Previous overseas testing of Indian grapes had given no indication of any particular problem with methomyl or acephate. If the Dutch surveillance data are representative of the wider picture, however, there were indeed more serious issues, at least in relation to the insecticide methomyl. Of the 20 samples with violative levels of methomyl, 6 exceeded the MRL by 10 times, but most of the others were also far in excess of the MRL.[51] Still, the overall manner in which the event was handled—with the publicity of the "toxic" advertisement and the embarrassment associated with a series of Rapid Alert notices—perhaps damaged the reputation more than the finances of the Indian industry.

In the months following the end of the 2002/03 grape export season, APEDA consulted widely with the industry and with external experts and devised an integrated scheme of grape supply chain oversight to restore the industry's reputation and minimize future noncompliance with EU standards. Designed for implementation in the 2003/04 season, the new system would involve:

- Registration with the Department of Agriculture of all farms growing grapes destined for Europe. Some 6,200 growers registered for the 2003/04 season.
- Formation of a cadre of horticultural field inspectors who would visit each registered grape grower at least three times during the crop cycle. Some 244 inspectors were initially appointed and trained (there are now 291).
- Inspection and registration of all grape export packinghouses by APEDA. Approximately 100 packinghouses were inspected, of which 20 failed to meet certain basic requirements.
- Mandatory testing prior to harvest for pesticide residues in samples from each registered field of export grapes. Authorization for exporting grapes was given only to fields that passed the test. Grapes from fields with failed results would need to be sold in other markets or retested.
- Checking of every consignment by AGMARK to ensure conformity with EU quality specifications for grapes. AGMARK would issue certificates.
- Issuance of a phytosanitary certificate by PPQS for every consignment of grapes for export.
- In 2005, another procedure was added, whereby NRC–Grapes took a 5 percent sample from grape consignments exiting the packinghouse to test again for pesticide residues.

Ultimately the grape crisis gave rise to a heavily laden system of checks and controls to ensure that fruit shipped to Europe met prevailing standards. This system required considerable resources. Laboratory testing capacity needed to be enhanced quickly, so considerable supplementary resources were provided to public laboratories and partial subsidies were directed at supporting upgrades in private sector laboratories. Private and cooperative packinghouse upgrades were supported by a 25 percent government subsidy. Budgetary increases facilitated the training and placement of the grape field inspectors and the expanded work of AGMARK. Ongoing support to NRC–Grapes was enhanced, both for overseeing the pesticide monitoring program and for conducting an expanded program of research on pest management. Recognizing this considerable burden, APEDA committed to subsidizing 50 percent of the costs of the mandatory pesticide residue testing.

During 2003/04, implementation of the system was uneven. Getting the laboratories online was a particular problem. They were adapting to new equipment and methods, sometimes with recently

[51] See the analysis provided by van der Schee (2004).

hired staff, and they were unable to handle their much-expanded workload. Delays occurred in obtaining and testing field samples. The labs could not effectively test for certain chemicals that were routinely screened within Europe. With only limited confidence in the local test results, many exporters sent samples abroad to private laboratories. The costs of such tests were typically four to five times higher than the local tests. Of the 2,900 local tests on sample plots, some 20 percent failed, leading many farmers to redirect samples to other outlets. This remarkably high failure rate seemed to imply that while Indian exporters and government agencies had begun to understand the significance of the problem, growers' awareness and practical response remained inadequate. The entire apparatus of grower registration, inspector visitation, and mandatory testing had highlighted symptoms of the problem, but the underlying challenge of improving awareness and good practice remained. Since then, some improvements have apparently been made. For the 2003/04 season, the failure rate in the 4,200 tested samples was 12 percent. In 2006 the failure rate dropped to 6 percent (APEDA 2006).[52]

In at least some parts of the industry, major changes are underway to promote better agricultural practices and attain improved oversight and control of the entire supply chain. Several more companies are moving to have their outgrowers certified under EurepGAP as groups or so-called Produce Marketing Organizations. An estimated 30 percent of currently registered export grape growers (3,500–4,000) are either EurepGAP certified or will be so shortly. Increased attention is given to pest scouting and reducing the overall level of chemical spraying. Questions have been raised about the accuracy of preharvest intervals recommended on pesticide labels, and recommendations are being revised. Both private companies and cooperatives are closing export channels to growers who do not consistently follow good agricultural practices. Record-keeping is being improved, as are overall systems of traceability.[53] The Government of India is also developing a national program for good agricultural practices (IndiaGAP).

The experience in managing the grape crisis is regarded by Indian stakeholders as a "success," although many people acknowledge that it is not a replicable model, given its high cost in relation to the applicable trade (see below). The fact that no consignment of Indian grapes has been officially rejected or put on the EU Rapid Alert System in the past two years may be seen as outward evidence of "success." Published surveillance data show that in 2004 the UK authorities included far more samples of Indian grapes in their testing because of the events of 2003. None of the samples from India in 2004 were found to have violative MRLs, although cases were associated with supplies from Chile and Egypt. In 2005, the sampling of Indian consignments was reduced and again no violative MRLs were found.[54]

The inward evidence of "success" is that the crisis improved growers' awareness and led a number of exporting companies and cooperatives to further upgrade their management systems and strengthen interaction with and oversight of growers. Yet considerably more effort is needed in this area, together with an additional stream of research findings to refine grape production practices, especially in relation to pest management. There is still a lack of trust and confidence in what growers are doing. As one exporter noted, "If you can't trust the process, you have to control it." The experience gained by the public sector during the grape crisis also raised awareness of the importance of SPS management for promoting horticultural exports.

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[52] For comparison, South African pesticide monitoring programs covering grapes (and the fruit export sector more generally) have been encountering violative pesticide residues in less than 4 percent of samples.

[53] One firm is developing a sophisticated database combining information on farmers' pesticide spraying, weather, and residue tests to provide more exact recommendations to growers.

[54] Pesticides Residues Committee, Pesticide Residues Monitoring Reports, 2004 and 2005.

The current top-heavy system cannot be sustained either by industry or the government, however. Several of the policing checks—including the multiple visits of field inspectors and the quality sign-off by AGMARK—appear to provide little value or little real assurance of anything. Devoting nearly 300 horticultural field officers to advising or policing 3,000–4000 Europe-focused grape growers may not be the best use of Department of Agriculture extension staff. The mandatory testing of every field prior to harvest may have been necessary in the midst of the crisis, but it should give way to a more surveillance-based approach, managed and paid for by exporters to complement their own capacities to monitor farm practices.[55] With a shift toward surveillance testing, there is scope to phase out and then completely eliminate the pesticide residue testing subsidy. This testing should be regarded as a normal cost of business—as it is in many other countries exporting horticultural products.

The current compliance costs incurred by this industry are very high and way out of line with broader international experience. The cost of pesticide residue testing alone (to the government and private sector) is equivalent to 4.5 percent of the FOB value of India's grape trade to Europe (box 5.2). Given the investments that have gone into the pesticide monitoring program, as well as other costs associated with the oversight of the grape supply chain, SPS compliance costs are estimated to account for 10 percent of the FOB value. Consider some comparisons. In the Indian spice industry, the estimated cost for testing dry chilies for pesticide residues and aflatoxin is 2.8 percent of FOB value (Jaffee 2005). In the Bangladeshi and Nicaraguan shrimp industries, the total recurrent costs of compliance with export food safety requirements is 1.1 percent and 1.3 percent of export revenues. In a broader set of case studies, the World Bank found these patterns to be typical. That is, recurrent compliance costs—at a broad industry level—were normally in the range of 1–3 percent. For no industry reviewed did the World Bank find the proportionate level of recurrent compliance costs found in the Indian grape industry (World Bank 2005a).

Box 5.2: The real cost of meeting SPS standards for Indian grapes in the EU market

The costs of implementing the current grape oversight system have been spread between the public and private sectors. An effort has been made to estimate at least some of these costs, based on the following considerations or assumptions:

- Because equipment for measuring pesticide residues needed to be updated quickly, at least four laboratories received APEDA grants totaling Rs 4 crore (US$ 1 million, equivalent to US$ 100,000 per year if written off over 10 years)[a] to buy new equipment. Other laboratories also invested in new equipment to monitor residues. We estimate that Rs 6 crore (US$ 1.5 million) was invested privately. Although its main use has been to monitor residues in grapes, this equipment could be used on some other crops and products, such as pomegranates. To account for this alternative use, in estimating the cost of compliance we attribute only 50 percent of the annualized capital expenditures for laboratory upgrading.
- APEDA provided a 25 percent subsidy for packinghouse upgrades, spending Rs 2.5 crore in FY 2003/04. We assume this means that the private sector invested a total of Rs 10 crore, with one-fourth of this total being subsidized. This investment will be written off over 10 years.
- In each of the past few years, APEDA has allocated Rs 5–6 crore to NRC–Grapes for its research, pesticide monitoring, and other work. A detailed breakdown of expenditure categories was not

[55] For comparison, pest residue monitoring and assurance in the South African grape export industry is handled predominantly by the private sector. Exporters follow the guidelines provided by their overseas supermarket or other clients. The exporters typically require their farm suppliers to submit results of pesticide residue tests (paid for by the farmers) as well as grape cultivation plans, including plans for pestcide use. Any changes in pesticide use are communicated to the exporters. Exporters also randomly test batches from suppliers, perhaps once or twice per year. Supplemental surveillance testing is also conducted by the South African National Department of Agriculture, although this testing is based on random samples and is not used as a mechanism to approve export consignments.

provided. A very conservative assumption is that Rs 0.5 crore is allocated to administering the pesticide monitoring program and to the recurrent costs of testing product leaving the packinghouse.

- As all packinghouses have to be registered and approved by APEDA, there will be a small administrative cost.
- A small administrative charge and a cost for three farm visits will be incurred when farmers who wish to export grapes to Europe register their fields with the Department of Agriculture.
- Pesticide residue analysis is Rs 7,000 per sample, divided evenly between APEDA and the exporter.
- Costs incurred by AGMARK are mainly administrative and associated with transport and subsistence.

Based on estimates in the table, the total cost of SPS compliance is nearly US$ 1.5 million per year, the equivalent of about 10 percent of the FOB value of grape exports to Europe. If only the costs of pesticide analysis (excluding capital expenditures) are considered, the cost is still almost US$ 700,000, or 4.5 percent of the FOB value. Because the analysis of samples represents such a significant portion of total costs, expanding the volume of exports will not reduce costs significantly.

Table 5.3: Estimated annual cost of meeting SPS standards in the EU
2005 US$

Expense	Public sector	Private sector	Total
Laboratory equipment—amortized over 10 years and assuming only 50% of costs could be attributed to residue testing for grapes	50,000	75,000	125,000
Packinghouse upgrades—amortized over 10 years	62,500	187,500	250,000
NRC pesticide monitoring management, excluding capital investments	115,000		115,000
Packinghouse approval		5000	5000
Farmer registration (6,500 x US$ 10)	32,500	32,500	65,000
Field inspector farm visits (3 x 6,500 x US$ 10)	97,500	97,500	195,000
Pesticide residue testing (4,200 samples x Rs 7,000)	341,860	341,861	683,721
AGMARK certification (1,000 containers at US$ 25 each)		25,000	25,000
Total	699.360	764.361	1.463.721

Source: Authors' analysis, based on communication with APEDA, grape exporters, and laboratories
Note: Assuming exports of 15,000 t, the SPS compliance cost is US $98/t. Assuming average FOB price is US$ 1/kg, the cost of SPS compliance is 10%. The cost of residue testing alone, not including any capital expenditures, is US$ 45/t or 4.5% of FOB value.

In addition to the actions listed earlier, some exporters have organized (and paid for) their farmers to become EurepGAP registered. Some have also paid for their grapes to be analyzed in Europe to confirm results from Indian laboratories—and to prove they have taken every precaution to prevent grapes with excessive pesticide residues from reaching the European market. We have not included those efforts in this calculation, because very little duplicative testing was still done in 2005.

Source: Authors' analysis.
a International experience shows that equipment used to test for residues generally has no market value after 5 years due to rapid technological advances. However, the Government of India assumes a depreciation period of 10 years for laboratory equipment, and these norms are adopted here.

Entirely missing from the compliance regime is any form of collective action within the grape industry itself, creating a vacuum that the government—through APEDA—has had to fill (box 5.3). The formation of a Grape Exporters Association could contribute meaningfully to designing and implementing a sustainable "code of practice" for how the industry will manage pesticide residue concerns and deal with other problems. Only firms and cooperatives that effectively implement this code would remain members of the association and perhaps affix a stamp on their export consignments which, over time, would acquire a value in signaling industry good practice.

Box 5.3: Benefits of private sector collective action: Northwest Horticultural Council and exports of stonefruit to Canada and cherries to Mexico

Phytosanitary regulations, unanticipated changes in such regulations, or the unforeseen emergence of phytosanitary issues in destination countries can have immediate and devastating effects on a sector's profitability. At such times, access to an industry-friendly association with specialized skills in dealing with such problems can be of enormous value. Two recent incidents, which were addressed successfully by the Northwest Horticultural Council (NHC) on behalf of its membership, illustrate this value.

Stonefruit imported into Canada

Prior to 1999, shipments of stonefruit (principally apricots, peaches, and nectarines) into the Canadian province of British Columbia from the USA were required to undergo methyl bromide fumigation at the shipping point to protect against the introduction of oriental fruit moth into the province. Because British Columbia was the logical province of entry for all stonefruit imported from Washington, Oregon, and California, this requirement effectively covered most Canadian imports of American stonefruit. While effective in the control of oriental fruit moth, fumigation carried two major disadvantages. First, it materially reduced the quality and shelf-life of stonefruit. Second, new rules for using methyl bromide adopted by the Animal and Plant Health Inspection Service (APHIS) of the US Department of Agriculture (USDA) required stonefruit shippers to invest in certified fumigation chambers, a significant incremental expense.

At the urging of the NHC and of the California Tree Fruit Agreement (representing stonefruit shippers from that state), USDA/APHIS began negotiating with Canadian authorities to secure provisional approval for a systems approach protocol as an alternative to fumigation. The systems approach is based on the idea that pests can be managed throughout production, packing, and handling to ensure that the risk of introducing pests in the destination country is maintained at acceptable levels. Initial approval of a systems approach protocol, as a voluntary alternative to fumigation, came in 1999. Although it offered shippers an opportunity to avoid the deleterious effects of fumigation, the protocol included several onerous provisions, among them:

- Loads into British Columbia could not arrive on weekends or late in the day.
- Inbound loads were to be announced with three days' advance notice.
- Intercepted insects had to be sent to Ottawa for identification, a step that could delay product delivery by two days.

Despite many problems with the new systems protocol during the initial shipping season, Canadian authorities were eventually convinced of the efficacy of the approach as a control for oriental fruit moth. By 2003, Canada had significantly reduced the frequency and volume of physical inspections at the border and had eliminated the 72-hour notification provision. Today virtually all stonefruit shipments from Washington, Oregon, and California enter British Columbia under this protocol, with no reported interceptions of oriental fruit moth.

Cherries imported into Mexico

Under the protocol governing imports of sweet cherries into Mexico from the USA, Mexico's national plant protection organization, Dirección General de Sanidad Vegetal (DGSV), required that approximately 2,300 cherries from each shipment be cut by hand and inspected for the presence of leafroller larvae. This procedure destroyed an unacceptably high number of commercially valuable fruits and often generated burdensome delays in clearing the product at the border. The NHC discovered that this sampling system was developed by DGSV based on its experience of finding leafrollers in the pits of imported peaches and nectarines. DGSV had extrapolated this experience to cherries, which do not have this problem. The NHC identified an entomologist from Oregon State University to meet with USDA/APHIS and DGSV officials. The entomologist provided research evidence that the leafrollers that concerned Mexican authorities could not infest cherries without causing substantial visible external damage. Based on these discussions, DGSV established a new workplan stipulating that 228 cherries be selected from each lot, and that cutting be conducted only on specimens that exhibited external damage.

Source: Authors' communication with the NHC; see also www.nwhort.org.

Curtailing the role of government in pesticide residue monitoring in the grape industry is strongly recommended. If Indian exporters cannot—through their own or collective efforts—manage this problem, then grape exports should target markets where compliance is not a problem (for an example of successful public–private collaboration, see box 5.4). That said, appropriate roles for government remain, such as conducting further research on managing grape pests, ensuring proper labeling of pesticides (including properly designated preharvest intervals), ensuring that pesticides that are no longer registered for agricultural use in India are removed from the market, and performing other, related regulatory functions. Given the relatively narrow market window for Indian grapes in Europe, one cannot anticipate much of a growth trajectory for this specific trade. The types of "infant industry"' support that the government has provided to this industry should not continue, as other dimensions of horticulture exhibit considerably greater growth potential and scope for much wider smallholder participation and employment generation.

Box 5.4: Peruvian asparagus exports: A success story of public–private collaboration

Over the past decade, Peru has quickly risen to become one of the world's largest exporters of asparagus. In 2002, earnings reached US$ 187 million, representing nearly 25 percent of Peru's total agricultural exports. Peru is able to produce quality asparagus year-round, yet high transportation costs prevent exporters from matching the low price of asparagus from some other countries. Nonetheless, they have continued to increase exports and gain market share by growing asparagus of consistently higher quality that can be internationally certified.

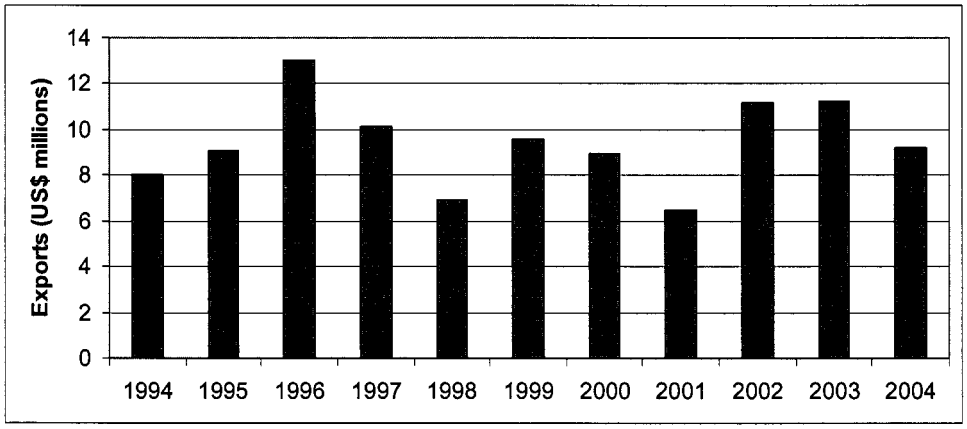
In 1997, Spanish health authorities asserted that two cases of botulism had been caused by consumption of canned Peruvian asparagus. Despite assurances from the Peruvian government and companies, press coverage of the botulism scare left an unfavorable impression among consumers in Europe (Peru's leading market), causing sales to slump. The incident motivated the industry and government to take action by reinforcing the fact that one careless exporter could disrupt markets. Beginning in 1998, officials of the Peruvian Export Promotion Agency (Comisión para la Promoción de Exportaciones, PROMPEX) convinced the asparagus industry to implement the Codex code of practice on food hygiene. PROMPEX specialists worked closely with industry leaders and production managers to ensure its proper implementation. The industry soon saw improved production methods, greater worker efficiency, and better product quality.

Later, in 2001, national fresh asparagus norms were published. They provided a quality and performance baseline for the industry that allowed many firms and farms to generate the skills and experience needed to voluntarily certify under more stringent international standards. Many large exporters have reached the level where they can now be certified under the even stricter EurepGAP protocol. Looking ahead, the Peruvian asparagus industry should be well positioned to adjust to new or more stringent requirements from trade partners, based on continued strong leadership and cooperation between the government and private sector.

Source: O'Brien 2004

Is the management of pesticide use and pesticide residues the only quality or SPS-related challenge facing India's grape export industry with respect to European trade? The industry's performance in the UK market suggests that there may be additional issues. The UK market has relatively more demanding quality requirements for table grapes, including size and color requirements. The increased consolidation of food retailing in the UK has placed greater pressure on international suppliers, not only to have EurepGAP-certified growers but also to have their packinghouses certified under the BRC Food Standard. The supply of Indian grapes that meet these management system and quality standards could well be insufficient, thereby explaining why Indian exports to this most remunerative market have not demonstrated a positive trend over the past decade (figure 5.3), despite considerable increases in overall UK grape imports.

Figure 5.3: Indian grape exports to the UK, 1994-2004



Source: Authors' calculations, based on UN Comtrade data.
Note: These are calendar-year UK imports from India.

Pomegranates: More Pesticide-related Concerns

India is a large producer of pomegranates, with production estimated at some 50,000 tons per year. In recent years, between 10 and 20 percent of this production was exported. This crop was not specifically grown for export. Exporters of grapes and other fruits have bought pomegranates off the wholesale markets and used the same infrastructure and marketing channels to handle this fruit.

The bulk of India's pomegranate trade has been directed either to neighboring countries (especially Nepal) or Gulf countries, where pomegranates are eaten fresh or squeezed for juice. Apparently no plant health or food safety issues have been raised in relation to that trade. There is growing interest in India about the scope for expanding the fresh pomegranate trade with Europe, including the possibility of supplying mainstream supermarket chains. There has been some recent growth in this trade, although the actual market potential needs to be thoroughly examined. Some market players believe that considerably greater potential lies in the commercialization of pomegranate juice, building upon its health and medicinal properties.

Challenges to pomegranate production in India include the management of fruit flies, other insects, and bacterial blight. Various pesticides are used. The application of safe and effective pest management practices—and conformity with official pesticide residue tolerance levels—could prove a major hurdle for any strategy to expand fresh pomegranate sales to Europe (box 5.5). Proper field trials to establish suitable MRLs have never been undertaken in India, and levels established where the crop is grown commercially—for example, the USA, southern Europe, and Israel—may not be applicable for Indian conditions. Because pomegranates are such a minor crop, agro-chemical manufacturers and European regulatory authorities have shown little interest in investing in establishing new MRLs based on field research for pesticides used in pomegranate production (see box 5.6 for a description of Indian spice industry efforts to establish MRLs for spices grown in tropical countries).

Box 5.5: Is testing the whole fruit for pesticide residues unscientific?

Indian stakeholders contend that the practice of European trading partners of testing the entire fruit rather than simply the edible portion of pomegranates and other fruits for pesticide residues is unscientific. There are two reasons for using the whole fruit. One has to do with the basic concepts behind the establishment of maximum residue limits (MRLs), and the other has to do with the reliability of the analytical methodology.

The MRLs for pesticides used in agricultural production are established to serve two legitimate objectives: to protect human health and to protect the environment. With regard to human health, MRLs ensure that no acute or chronic (long-term) adverse health effects are associated with consuming the treated commodities or foodstuffs derived from them. With regard to the environment, MRLs ensure that pesticides are used in accordance with good agricultural practice, taking into account effects on nontarget species (such as pollinating insects), potential for soil degradation, accumulation of the pesticide in the soil, potential for contamination of water resources, and other effects. Most important, the MRL ensures that all individuals of the target pest species are eliminated and none remain to evolve into resistant strains.

When a pesticide is authorized for use, the applicant (usually the company marketing the pesticide) must describe the good agricultural practice required to minimize these effects. Good practice may include the frequency and mode of pesticide application and usually includes the preharvest interval (between the last application of the pesticide and the harvesting of the commodity for the market). Good agricultural practice takes into account the pest and climatic situation in the growing area and may vary from country to country or from region to region within a country. Good agricultural practice and the associated MRL are established through government-supervised field trails, usually undertaken by a recognized agricultural research institute with the sponsorship of the company wishing to market the pesticide.

Contrary to common belief, MRLs are determined agronomically and environmentally, on the basis of good agricultural practice and not on the basis of toxicology (human health effects). This method ensures that the MRL reflects the lowest concentration of pesticide consistent with the requirement to control the target pest (or pests). The MRL is established on the basis of the whole commodity, because this procedure provides a more sensitive indicator of good agricultural practice than other indicators, such as use of the "edible portion."

The MRL derived from the good agricultural practice trials is compared with the toxicological evaluation, which is the human health risk assessment for the pesticide. The MRL is used to calculate a Theoretical Maximum Daily Intake, derived from food consumption data appropriate to the country or, in the absence of these data, on the basis of the World Health Organization Model Regional Diets for the purpose of estimating the intake of food contaminants and residues. At this stage, if part of the food is normally discarded prior to consumption or if processing changes the pesticide concentration, relevant factors are applied to obtain a realistic estimate of intake. If the Theoretical Maximum Daily Intake is less than the toxicologically determined Acceptable Daily Intake (ADI), the MRL is deemed to be safe and acceptable.

The Codex Alimentarius Commission, recognizing that good agricultural practices vary from country to country according to pest and climatic conditions, always adopts the highest numerical MRL derived from authorized good agricultural practices, provided that this MRL passes the toxicological assessment. In other words, the Commission adopts the least trade-restrictive, but safe, MRL.

Using the whole commodity as the basis for analysis removes any subjective interpretation of what constitutes its "edible portion" and therefore reduces arbitrariness in the analysis. For example, an instruction to remove the rind or skin could be interpreted in various ways, including the depth of rind or skin to be removed prior to analysis. In some commodities, such as bananas, this instruction might be relatively straightforward, but in others, such as pineapples, the depth of the rind or skin is highly variable.

Moreover, the use of the whole commodity eliminates problems with the interpretation of what is, and what is not, edible. In the case of citrus fruits, for example, the rind is often used to flavor desserts and drinks; the pith is eaten in some countries and not in others. The use of the whole commodity removes such arbitrariness and provides a direct indicator of whether good agricultural practice has been applied.

Box 5.5 Cont'd.

For more information on how MRLs are established, see the Food and Agriculture Organization (FAO) *Manual on the Submission and Evaluation of Pesticide Residues Data for the Estimation of Maximum Residue Levels in Food and Feed* (also available at http://www.fao.org/docrep/x5848e/X5848e00.htm#Contents). For information on the "Analysis of Pesticide Residues: Portion of Commodities to which Codex MRLS Apply and which is Analyzed," see Codex Guideline CAC/GL 41-1993 at http://www.codexalimentarius.net/web/standard_list.do?lang=en. Section 5 is particularly relevant to this discussion.

Source: Authors

Box 5.6: Voice and compliance in India's spice trade related to pesticide residues

Chilies are one of the few spices produced in India for which agro-chemicals are commonly used. Chilies are vulnerable to a variety of pests and diseases and are commonly grown in rotation with other commercial crops. Despite periodic concerns or campaigns to address the risks that agro-chemicals pose to farmers and agricultural workers in India, pesticide residue concerns in spices were rarely mentioned until the 1990s. This situation began to change in the early 1990s, when the EU began to harmonize its rules regarding permissible maximum residue levels (MRLs) in food products. Initially, questions on spices were raised by regulators or buyers in Germany. These were followed by rejections of several consignments of dried chilies by Spanish authorities, because pesticide residues exceeded permissible MRLs for fresh/green chilies. Discussions with Spanish authorities to apply a "multiplication factor" for pesticide residues in dried chilies were unsuccessful, and trade with that market subsided.

In the late 1990s, additional consignments of Indian chilies and other spices were rejected in Europe and elsewhere, frequently because no tolerance level had been established for particular pesticides and spices. Only a handful of Codex standards exist for MRLs related to agro-chemical use on spices. Individual countries have set MRLs themselves, generally for particular spices they grow in small quantities. For example, some 30–40 official MRLs are established for spices in Australia, Germany, Spain, and the USA, the vast majority related to a few individual crops. For comparison, these countries have hundreds or even thousands of MRLs established for fruits and vegetables and corresponding active chemical ingredients. Most spice and corresponding pesticide MRLs vary between countries.

This situation puts India and other spice-exporting countries in a vulnerable position should regulatory authorities and/or private buyers devote more attention to pesticide residues. In addition to addressing pesticide use practices in its own industry, India has sought to influence the international rules of the game. Working with the American Spice Trade Association, the European and Japanese spice trade associations, and several other parties, the India Spices Board and the All India Spice Exporters Forum established an International Organization of Spice Trade Associations, which obtained observer status at the Codex Committee on Pesticide Residues. Given the paucity of established MRLs for spices grown in tropical countries, it was proposed that new MRLs be established on the basis of monitoring data made available by both importing and exporting countries. This process would be far less costly and more practical than starting from scratch and undertaking field trials over multiple years. After much discussion, this proposal was accepted by the Joint FAO/WHO Meeting on Pesticide Residues (JMPR) in 2002. It is anticipated that this will expand the range and number of MRL tolerances for agro-chemicals and spices.

With regard to chilies, a different approach has been taken. In Europe, North America, and elsewhere, MRLs have already been set for a couple of dozen pesticides in relation to fresh peppers. It is proposed that a dehydration factor of 10 be applied to account for the magnification of pesticide residues in dried chilies. Thus while the established MRL for carbaryl is 5 milligrams per kilogram in fresh peppers, it would be 50 milligrams per kilogram in dried chilies. A similar approach has been proposed for other vegetables that are used as spices when dried (for example, garlic and onions). Members of the spice industry have submitted evidence to the JMPR to support the derivation of dehydration factors.

The overall solution for the Indian industry could not be provided by international negotiations alone. A significant number of pesticides still commonly used on chilies have been withdrawn from approved use in several of India's external markets. To address this issue, many other steps have been taken, both by the

Box 5.6 Cont'd.

government and the private sector. For example, the Spices Board is working with the All India Coordinated Research Project to undertake supervised field trials to generate data for fixing proper national MRLs. It is also working with state departments of agriculture and various nongovernmental organizations to promote integrated pest management and organic cultivation of spices and otherwise increase farmers' awareness of pesticide concerns. Private companies have carefully segmented their procurement of chilies. Supplies destined for the European market will generally be procured under contract farming arrangements or similar approaches involving more direct oversight of production practices. Supplies destined for alternative markets continue to be procured via intermediaries.

Source: Jaffee 2005.

At present, the EU has established some 186 MRLs for pesticides and pomegranates. All but 11 are set at the "limit of determination," which is the lowest level of detection possible given existing testing technology. It is not certain that any of these MRLs reflect results from field testing under tropical or subtropical conditions, although it is doubtful. As mentioned, aggregate pesticide use on this crop is too small for any agro-chemical company on its own to invest in gaining regulatory approval of a higher MRL. If India wants such approval, it will need to invest its own resources in proper field trials and/or collaborate with a program such as the Pesticides Initiative Programme (PIP), implemented by the Europe–Africa–Caribbean–Pacific Liaison Committee (Comité de Liaison Europe–Afrique–Caraïbes–Pacifique, COLEACP) (box 5.7).

Indian stakeholders contend that the primary issue here is the method by which European authorities want pesticide residues to be tested. Following this method, the entire fruit, including the skin, is crushed and tested rather than only the fleshy, edible part within. Indian stakeholders contend that tests of the fleshy part alone rarely reveal violative levels of pesticide residues, and this should be the proper means of testing. At least two counter-arguments can be made (box 5.8). First, this procedure is not unusual. European authorities commonly use the entire (crushed) fruit to measure pesticide residues in bananas, oranges, melons, and other fruits whose skin is not widely eaten. Second, in the specific case of pomegranates, the skin is in fact eaten sometimes; in the Middle East and elsewhere, pomegranate skin is commonly made into jam.

Box 5.7: Field trials and regulatory submissions for tropical horticultural crops: The Pesticides Initiative Programme

Over the last two years, the Pesticides Initiative Programme (PIP) has conducted extensive field trials on crops grown in African, Caribbean, and Pacific (ACP) countries and exported to the EU, notably green beans, pineapples, and cherry tomatoes produced in East and West Africa. The idea is to validate reference crop protocols that respect good agricultural practice and comply with EU regulations. Most of the residue trials have been completed, and the results are very promising.

The trials particularly aim to determine whether detected residue levels of the active substances recommended in the crop protocols fall within EU maximum residue limits (MRLs) set for imports. Based on the results, it will be determined whether, for certain active substances, import tolerance applications need to be submitted to the EU authorities, in the event that the residue rates exceed the MRL and when there is no valid substitute for the product. Collaborative efforts are already underway with ACP registration bodies. PIP is cooperating with Kenya's Pest Control Products Board, Tanzania's Tropical Pesticides Research Institute, and Ghana's Environmental Protection Agency, as well as the Permanent Inter-State Committee for Drought Control in the Sahel (ICDCS), which has nine African member countries (Burkina Faso, Cape Verde, Chad, Gambia, Guinea Bissau, Mali, Mauritania, Niger, and Senegal).

Source: Pesticides Initiative Programme; see www.coleacp.org.

Box 5.8: More systemic issues of farmer awareness and good practices? An anecdote

A European importer reports having had a contract in 2004 to supply upwards of 600 tons of pomegranates every year to a major UK supermarket. Samples from India were obtained and tested in private laboratories. High levels of dithiorcarbamates and carbendazim were detected. The importer sent technical specialists to India and a new spraying program was designed to combat prominent pests and comply with regulations. Farmers apparently did not implement the program, however, as residues of at least three pesticides not included in the program were found in the delivered produce. This experience persuaded the importer to search for alternative, non-Indian sources to meet the supermarket's requirements.

Source: Authors' communication with a European importer.

In 2005, surveillance testing of pesticide residues in so-called "exotic fruit" was introduced as part of a program coordinated by the EC. Samples were taken from consignments of passionfruit, persimmons, and pomegranates. The results from the UK monitoring program are published on the website of the Pesticides Monitoring Committee. From January to June 2005, 36 samples were tested (12 from each fruit). No residues were detected in 27 samples, yet violative residues (above MRLs) were found in 7. Of these, 3 were samples of Indian pomegranates with violative residues for dithlocarbamates.[56] The other violative samples were from Kenya (for passionfruit) and Israel (for persimmons). No health risks were associated with any of these samples.

The Indo-European dialogue on the appropriate method for pesticide residue testing should be resolved, but testing is probably not the central issue. If indeed there is commercial potential to expand fresh pomegranate sales to the mainstream European market, then the Indian industry—perhaps together with government agencies—will need to (1) invest in proper field trials to establish suitable MRLs for this crop, (2) refine and promote farmers' adoption of better practices for pest management for this crop, including reduced and better-timed applications of agro-chemicals, and (3) adjust current systems of crop procurement in the direction of more dedicated export supply chains with attendant systems for product traceability.

Asian Vegetables: Acting Now to Avert a Future "Crisis"

Some 15–20 Indian companies regularly export "Asian" vegetables—fresh chilies, eggplant, okra, and a broad range of leafy and root vegetables that are staples of the South Asian diet—to the UK and elsewhere in Europe, where they are still widely consumed by immigrant or second-generation communities. India competes in the Asian vegetable trade with other suppliers from South Asia, East and West Africa, and Europe itself. The trade and distribution channels for these vegetables as well as other "ethnic" produce remain somewhat distinctive within Europe, with continued prominent roles for traditional wholesale markets and smaller greengrocers and only very geographically specific entry into this product range by larger supermarket chains.

The Asian vegetable trade—both historically and at present—has featured a market structure based on personal and familial ties, and the predominant emphasis is on meeting consumer quality preferences at a low or reasonable cost. Phytosanitary issues have had little effect on trade, although certain issues—such as fruit fly in karalla and insect borer in okra—have had to be addressed. The Asian vegetable trade appears to be subjected to minimal levels of official border inspection or coverage in national programs of surveillance testing for pesticide residues or other food safety hazards. If problems have been detected, they have not been reported publicly. Unlike

[56] The recorded levels were 0.9, 0.8, and 0.6, as against the MRL of 0.5.

in the mainstream vegetable trade in the UK or Netherlands, in this trade there is practically zero demand for certified GAP or HACCP compliance among suppliers. Some selected buyers have begun to ask questions about traceability, yet Indian exporters report no specific requirements in this area.

The leading Indian exporters report having some regular suppliers of certain Asian vegetables but purchase the bulk of their supplies from the wholesale markets. Very little of the 3,000 tons of produce supplied to the UK "ethnic" market is specifically grown for export by Indian farmers. No specific tests are done for pesticide residues, microbiological parameters, heavy metals, and other contaminants. Indian exporters note that if such tests were undertaken, some samples would almost certainly fall outside of EU tolerances. In summary, this trade is based upon personal ties and company reputations for reliability and continuity of supplies, and it has not been inhibited to date by SPS measures, perhaps more because of official (European) inattention rather than assured compliance from India and elsewhere.[57]

Even though Indian suppliers and exporters face little immediate external (official or private) pressure to modify practices to comply with food safety or other requirements, the Asian vegetable trade would seem vulnerable to future interruptions, should greater official (or other) scrutiny be given to this product line, either as part of a targeted surveillance program (unlikely) or simply as a result of periodic testing of different food products. At the same time, the Indian supply chain for Asian vegetable exports is ill-prepared to take advantage of any emerging opportunities to supply safety-assured, traceable produce to European supermarkets that are trying to carry such lines for their ethnic minority and mainstream clientele.

The greatest vulnerability of this trade is likely to be the presence of high levels of heavy metals—such as lead, zinc, and cadmium—in parts of the Indian vegetable crop. These heavy metals may accumulate on the leafy surface of vegetables or be taken up by the crop roots and absorbed into plant tissue. The presence of heavy metals in vegetables may derive from air pollution or the use of irrigation water contaminated by sewage and industrial effluent. The incidence is thus highest in urban or periurban agriculture. Prolonged consumption of unsafe concentrations of heavy metals can disrupt numerous biological processes in the human body, with some elements acting as carcinogens.

Due to these risks, many countries have begun to adopt more stringent standards for heavy metal tolerances in food and to increase surveillance testing. For example, in 2005 the EC amended earlier food safety regulations to require that member states put in place—by February 6, 2006—a system for official monitoring and testing of foodstuffs for the presence of lead, cadmium, mercury, and other heavy metals.[58] The UK, through its Contaminants in Food (England) Regulations 2005, makes provisions to implement this Commission Directive. Official surveillance has begun in fish products and eventually will extend to other foodstuffs.

Recent survey work in the Delhi region measured the presence of heavy metals in a range of vegetables sold through wholesale markets (Marshall et al. 2003). High levels of heavy metals were found in many samples. For example, several hundred samples of palak (spinach beet) were tested. Some 72 percent had lead concentrations exceeding the Indian permissible limit of 2.5 milligrams per kilogram, while 100 percent exceeded the more stringent Codex limit of 0.3

[57] Supply chains for Asian vegetables in Kenya also do not feature heavy levels of production oversight or product testing. However, much of the production dedicated for export is contracted for and some level of product traceability is achieved.

[58] Commission Directive 2005/4/EC.

milligrams per kilogram. Approximately one-half of the lead concentration in palak was found in plant tissue, implying that diligent washing would not resolve the risk to consumers. While 100 percent of the samples had concentrations of cadmium within the Indian Prevention of Food Adulteration (PFA) Act limits (1.5 milligrams per kilogram), 70 percent of the samples exceeded the more stringent EU standard (0.2 milligrams per kilogram). For zinc, 21 percent of samples exceeded Indian and international standards.

It is certainly possible that the periurban origin of the tested vegetables would not render these testing results indicative of the heavy metal concentrations that would be found in Asian vegetables exported out of Delhi or Mumbai. Yet, as noted previously, the bulk of India's Asian vegetable exports are procured in wholesale markets, and their specific origins are not known by the exporters. There is currently no regular testing of heavy metals in vegetables by Indian health authorities.[59]

Even if the objective is only to maintain the current modest level of this trade—at about 3,000 tons, worth US$ 2–3 million per year—a prudent risk management strategy would involve some level of industry surveillance testing of delivered and export-graded produce to determine signs of underlying hazards, and then the development of specific measures—perhaps in a cooperative initiative involving a clustering of exporters, APEDA, and pertinent state agricultural departments—to address these issues.

While it is well beyond the scope of these entities to influence environmental pollution at its source (that is, the industrial and vehicular pollution of water, soil, and air), some specific measures can be taken. Such measures could include more selective geographical sourcing of supplies, screening of contract growers through water and soil testing, and thorough washing of vegetables packed for export to at least remove heavy metals from exterior surfaces. In the future, it may not be viable simply to purchase vegetables from the wholesale market. It is recommended to address this risk of trade interruption now, before the Indian vegetables are identified—by UK or other external authorities—as a dietary source of hazardous heavy metals, and before this issue finds its way onto the front pages of popular media. The health risks associated with heavy metals in vegetables are almost certainly higher for India's domestic consumers. There is an evident need to increase consumer awareness of mitigation practices (such as washing vegetables thoroughly), promote other supply chain practices to reduce the exposure of vegetables to pollutants, and more systematically monitor levels and sources of heavy metal contamination of vegetables (and selected other foods).

Fresh Mango and Plant Health Requirements: Will the Benefits Match the Costs?

As noted, India is by far the world's largest mango producer but a relatively small player in the expanding international trade in fresh mangoes. The bulk of India's mango exports are directed

[59] Other periodic tests do point to a potentially broad problem that could adversely affect India's trade and the health of consumers in India. For example, Dhaliwal (2005) reported that a 2005 survey by the Punjab Control Board found relatively high concentrations of heavy metals in samples of green and root vegetables. A study published in the *Journal of the American Medical Association* found that 20 percent of samples of Ayurvedic herbal medicine products made in South Asia and purchased in stores in the Boston area contained violative levels of heavy metals (Saper et al. 2004). Earlier research published in the *British Medical Journal* (Shukla et al. 1998) noted that high concentrations of cadmium in irrigation water and vegetables grown in eastern Uttar Pradesh and western Bihar could be associated with relatively high rates of gastrointestinal disorders in these areas.

to neighboring countries (Bangladesh and Nepal) and selected Gulf countries, where unit values are only one-fourth to one-half of the average international FOB values for traded mangoes. A small mango export trade is also directed to the UK and other EU markets, yet Indian mangoes feature minimally in the mainstream supermarket segment and are more generally distributed through "ethnic" food channels. These trading patterns are surprising, given India's diverse range of mango varieties, the excellent and distinctive taste of some varieties, and the more extended seasonal availability of mangoes in India compared with major exporting countries.

It is doubtful that concerns about quality have inhibited India's fresh mango trade. Rigid standards are not generally applied in the international mango trade, in part because each supply source has its own distinctive characteristics in terms of fruit size, shape, color, fiber, aroma, and shelf life. The intrinsic quality of many Indian mango varieties is considered to be either good or superior, as seen worldwide through India's competitive exports of mango pulp.

One set of factors that probably inhibit the development of the fresh mango trade to Europe is the highly fragmented structure of production, the general lack of direct sourcing of export supplies, and limited investments in improved packinghouse facilities that would ensure microbiological safety. Nearly all production comes from smallholders' farms and is channeled via intermediaries to wholesale markets. There are a limited number of larger orchards, although most of these are not export-oriented. In general, there is a lack of oversight of production practices for mango, including pesticide use, and buyers cannot trace supplies to their source. Few dedicated mango export operations apply HACCP or certified quality management systems. This type of fragmented and unspecialized supply chain is not problematic for nearby, lower-value markets or even the "ethnic" food market in Europe, but these systems and possible assurances would not comply with private standards in much of the mainstream European market.

In accessing other significant (including higher-value) markets, the binding constraint has been plant health concerns. Some 564 pests are considered to be associated with mango production in India, including some 476 arthropods, 19 nematodes, 62 fungi, and various bacteria and viruses (Australian Government 2004). Many of these pests are not present in potential mango-importing countries. Some could survive long-distance transport and storage and cause considerable damage to fruit and other agricultural production in the importing countries. Some of these pests are difficult or impossible to detect through visual inspection or cannot be contained simply by cleaning the fruit's surface. More elaborate phytosanitary measures are needed to manage the potential risks posed by these pests.

For extended periods, Indian fresh mangoes have been barred from markets in the USA, Japan, and Australia, although protracted negotiation between trading partners to resolve phytosanitary constraints is not unusual (box 5.9).[60] In relation to the USA and Japan, the primary concern was the risks posed by various species of fruit fly. India has been conducting a long-standing dialogue with the USA (lasting more than a decade) to agree on suitable phytosanitary measures to enter the US market. In March 2006, a Framework Equivalency Plan was outlined, which could enable Indian fresh mangoes to enter the US market within 18 to 24 months. The central part of this agreement is that Indian mangoes destined for the USA would be irradiated, at a low dose, at specially approved facilities. The system of compliance would also involve procedures for produce inspection (including preclearance), irradiation facility certification and auditing, and other measures. Indian regulations would also need to be modified to permit irradiation as a

[60] Pest risk issues also inhibited Indian mangoes from entering the Chinese market, although an agreement on market access was reached in July 2005.

phytosanitary measure. Various tests would need to be undertaken to determine how different Indian cultivars tolerate radiation and how it would affect their quality and shelf-life.

Box 5.9: Persistence in resolving plant health issues: Mexico's avocado trade with the USA

Overcoming phytosanitary barriers can be an arduous and protracted process. In addition to sound scientific arguments and considerable financial investment, dealing successfully with phytosanitary barriers frequently requires extensive reserves of both patience and persistence. In the case of many commodities, such an effort may not be justified. In the case of Mexican Haas avocadoes, however, the prize—access to the US market—was commensurate with the labor.

The Mexican Haas avocado had, since 1914, been prohibited from entering the USA because of concerns about potentially harmful pests, including the small avocado seed weevils, large avocado seed weevil, avocado stem weevil, avocado seed moth, and three species of fruit fly. In 1994, the Government of Mexico proposed a systems approach protocol covering Haas avocados grown in certain approved orchards in Michoacan State. A system involving nine measures was proposed to address US concerns: field surveys, trappings and field treatments, field sanitation, host resistance, postharvest safeguards, shipping only during winter months, packinghouse inspection, port-of-arrival inspection, and limited US distribution.

After observing and evaluating the effectiveness of these measures for three years, and despite fierce political resistance organized by the California avocado industry, the US Department of Agriculture (USDA) and Animal and Plant Health Inspection Service (APHIS) authorized the importation of fresh Haas avocados from Michoacan into 19 states in the northeastern USA during November, December, January, and February. The volume of this trade increased from 4,000 tons (and US$ 5.9 million) in 1997 to 13,000 tons (and US$ 20 million) by 2000.

In 2001, acting again at the request of the Mexican government, and in the absence of any adverse findings during the protocol's first four years of operation, USDA/APHIS authorized the expansion of the program to include an additional 12 states (bringing the total to 31) and an additional two months to the shipping season (bringing the total to six). This bilateral trade surged, reaching nearly 39,000 tons and nearly US$ 60 million by 2004.

In November 2004, USDA/APHIS published a rule allowing the distribution of Michoacan-sourced Haas avocados throughout the entire year. For the first two years of the new rule, distribution would be allowed to 47 states, excluding only California, Florida, and Hawaii. Thereafter, distribution would be authorized to all 50 states. In 2005, Mexico exported over 100,000 tons of avocadoes to the USA, with a value of US$ 186 million. During the 12 years that this incremental access exercise has been underway, Mexican avocado sales have grown to represent a major share of the total US avocado market.

Source: Authors' communications; see also www.aphis.usda.gov.

With regard to Japan, there has also been a long-standing dialogue on measures that could resolve Japan's plant health concerns.[61] The proposed solution has been to use vapor heat treatment (VHT) to manage the risk posed by fruit flies. Equipment for this technology was imported by APEDA and a testing and demonstration chamber created at Vashi. In June 2006, Japan formally lifted the ban on Indian mangoes. Initial trial shipments of Indian mangoes to Japan took place in July 2006. Several exporters have expressed interest in tapping this market and are willing to invest in their own VHT facilities. The Japanese mango market is well supplied from Southeast Asia and elsewhere, yet there could well be commercial opportunities for Indian exports. These should be examined further before investments in specialized treatment facilities are made.

[61] The Japanese have negotiated market access arrangements for fresh fruit with many countries, based on agreed methods of phytosanitary treatment. For example, agreements were reached for using VHT on Australian, Philippine, and Thai mangoes, on Israeli papayas, and Taiwanese litchis. Methyl bromide treatment is the agreed treatment for cherries from Canada, Colombia, New Zealand, and the USA. See Gupta and Khetarpal (2005) for elaboration on Japanese plant health requirements.

With Australia, more elaborate measures have been defined and agreed upon to enable Indian mangoes to enter that market again. Prior to 1996, Indian mangoes were regularly consigned to Australia and treated with ethylene dibromide (EDB). This trade was suspended following global phase-out of EDB because of concerns about worker health and safety. In 2000, APEDA proposed to Australia authorities that VHT be used as an alternative to disinfest fruit flies. In 2002 and 2003, the Indian government prepared updated pest lists and test results on the efficacy of using VHT and hot water treatment (HWT) to manage fruit flies. Australian authorities then carried out a very detailed pest risk assessment.

The pest risk assessment focused on 32 potentially transmissible pests that could damage Australian agriculture. The assessment examined the incidence of these pests in India and Australia, their probability of import, entry, and spread, and the possible consequences. Some 26 pests and 1 pathogen were determined to present sufficient risks to warrant control measures. The combination of required remedies is similar to those adopted in prior Australian agreements on mangoes with Mexico, Haiti, and the Philippines. These measures would include:

- Pre-export VHT or HWT to manage fruit fly species.[62] Such treatment would be conducted in facilities or packinghouses registered and audited by the Indian government.
- Designated pest-free places of production or production sites for the management of mango pulp weevil and mango seed weevil. The Indian government would be responsible for establishing such areas through surveying and monitoring.
- Inspection and remedial action for other identified quarantine pests, including those for which visual detection is possible.
- Supporting operational systems to maintain and verify phytosanitary status. These measures would include the registration of export orchards, the registration of packinghouses, preexport inspection by the government, specifications on packaging and labeling, phytosanitary certification, specific conditions for storage and transport, and on-arrival phytosanitary inspection and clearance by Australian authorities.

The Indian government has already designated several locations as free of mango pulp weevil and mango seed weevil. These include three locations in the Lucknow region of Uttar Pradesh, two locations in Gujarat, and five locations in Maharashtra. Terms of reference and institutional responsibilities for establishing and maintaining such pest-free areas have been outlined. One pilot scheme reportedly has begun in Maharashtra. Pursuing this approach will be an enormous challenge, given the unusually strong coordination required between federal and state agricultural agencies and research institutions, and given the lack of internal quarantine control mechanisms to prevent the movement of mangoes from one production site or state to another (although plant health reforms have recently been made; see box 5.10).[63]

[62] The PPQS issued guidelines for the certification of HWT facilities in May 2005.
[63] The PPQS issued guidelines for establishing pest-free areas for fruit flies and mango nut and pulp weevil in May 2005.

Box 5.10: Plant health reforms and capacity development

In recent years, India has instituted regulatory changes related to plant health and undertaken various initiatives to upgrade capacities in plant quarantine and related areas. The Plant Quarantine (Regulation of Import into India) Order, 2003 replaced various pieces of legislation, including one dating to 1914. This new Order brought Indian legislation into line with the International Plant Protection Convention in relation to plant health inspection, certification, and other matters. In a change from prior practice, it also requires a pest risk analysis as a precondition for imports of agricultural commodities.

Various other initiatives are also underway to strengthen phytosanitary management capacities within the government. These include the opening of 35 new plant quarantine stations at major and minor ports, the development of a national phytosanitary database and integrated/computerized information management system, the development of a national pest risk analysis unit, and skills upgrading and training for scientists, researchers, and others.

Source: Shah 2003.

All things considered, it is not obvious that the likely costs and administrative attention needed to fulfill all the requirements for accessing the Australian market would match the benefits of participating in that market. Costs and benefits must be more thoroughly assessed before making any major investments or public resource commitments. Achieving compliance at a potentially high cost would not make sense if the actual commercial potential of this trade is limited. However, instituting several of the required supply chain oversight and product inspection measures would likely have spillovers for enhancing India's fresh mango trade in other countries. A detailed assessment could better inform government policy and resource allocations (box 5.11). Part of that assessment should include a closer examination of the actual market potential for Indian mangoes in those countries that would especially value the improved Indian phytosanitary controls.

Box 5.11: Framework for an ex ante assessment of costs and benefits of sanitary and phytosanitary compliance

Cost-benefit analysis can and should be used to determine the advisability of new or potential investments in standards compliance. Expected costs will need to be compared with expected benefits. This is easier to do at the enterprise level (in financial terms) than at the broader sectoral or even national level, given that certain costs and (especially) benefits are likely to spill over onto other stakeholders, including participants in domestic market supply chains. Nevertheless, such likely impacts can be noted and at least partly estimated. Such forward-looking cost-benefit analysis related to the adoption of new standards is important to undertake. Although an inexact science, this exercise can normally shed ample light on the magnitude of likely costs and benefits and thus effectively contribute to policy making and public investment decisions.

In the context of trade, compliance costs are defined as the additional costs necessarily incurred by the government and/or private enterprises in meeting the requirements to comply with a given standard in a given external market. This definition has two key elements. First, it covers the costs that are *additional* to those incurred by the government and/or the private sector in the absence of the standard. Second, it refers to those costs that are *necessarily* incurred in complying with the standard. A distinction needs to be made according to the level of recurrence of compliance costs. Nonrecurring costs are the one-off or time-limited investments made to achieve compliance. Recurring costs are borne over time (for example, the costs of

Box 5.11 Cont'd.

maintaining regular surveillance and laboratory testing programs). For an ex ante analysis, nonrecurring costs need to be amortized appropriately. In estimating the costs of compliance, it is necessary to consider costs incurred by both the public and private sectors.

Examples of typical costs that may be incurred include:

- Investment in packinghouses or upgrading packinghouses.
- Investment in testing infrastructure (laboratories).

- Cost of pesticide residue surveillance programs.
- Third-party certification costs.
- Costs of training farmers, processors, and exporters in good agricultural practices, good hygiene practices, and good management practices (GAP, GHP, and GMP).
- Costs of measures required for phytosanitary treatments (such as fumigation, establishing pest-free areas, setting up hot water treatment facilities).
- Costs of field trials to confirm/modify preharvest intervals for pesticide use.
- Cost of upgrading procurement systems.
- Cost of hygiene controls in food processing, such as upgrading factories to meet hazard analysis and critical control point (HACCP) standards.

In addition to the costs of compliance, the associated benefits must also be identified and quantified.[a] Benefits could include maintaining market share, enhancing market access, or reducing costs through unimpeded access. As with compliance costs, the benefits associated with compliance can be recurring or nonrecurring. Potential tangible benefits relate most directly to the impact that better food safety control systems have on production costs, including reduced wastage and/or reworking, enhanced productivity, and so forth. Further tangible benefits may include broader access to markets and/or particular market segments. Although the focus here is on export-oriented supply chains, spillover benefits can also occur, through reduced wastage and enhanced safety of products in the domestic market.[b] These benefits act to offset recurring compliance costs such that the longer-term impacts might result in lower supply costs. These benefits can be augmented if the government and firms innovate in the face of new standards and thus minimize compliance costs.

Source: World Bank 2005a.

a Economists typically focus on the net impact of compliance with standards on social welfare, examining the impact on society as a whole and how it is distributed among different economic groups. The perspective here is partial, considering the economic benefits for the actors directly involved in compliance.

b In industrialized countries, much of the analysis of benefits from environmental or food safety measures focuses on the domestic context, valuing the change in consumer health, for example. When developing country suppliers make investments or adopt certain management systems, they reduce the human health hazards faced abroad. Hence, many of the tangible benefits from developing country compliance are realized abroad, reinforcing the public good nature of these benefits.

Processed Fruit and Vegetable Products: Building on the Current Core

Although maintaining a lower profile and receiving comparatively less attention from Indian trade promotion and agricultural institutions, India's trade in a range of processed fruit and vegetable products appears to have a stronger basis for international market access and competitiveness than its trade in fresh horticultural produce. With processed products, Indian suppliers do not encounter the plant health issues inhibiting the fresh produce trade. They also have somewhat less difficulty managing risks related to pesticide residues and other contaminants, greater flexibility with regard to domestic and international logistics, and greater potential for product differentiation and company branding. The industry already draws upon large numbers of farmers for raw materials and employs significant numbers of people relative to the capital invested.

India's fruit and vegetable processing industry is highly fragmented, although much less so with respect to exports. Some 70 percent of the entities licensed under the Fruit Products Order are cottage industry/household units producing traditional sauces or beverages. Another 20 percent of licensed operators are also very small, producing between 50 and 250 tons of output per annum. There is a cluster of older, medium-sized companies and then a relatively small number of larger companies with modern facilities. While precise data are not available, it is estimated that no more than two dozen companies account for upwards of two-thirds of India's expanding processed fruit and vegetable product exports. Many other companies do participate in the export trade, yet on a comparatively small scale. Despite the recent expansion of exports, all the main subsectors face challenges in improving their productivity and capacity utilization, in upgrading factory operations

to comply with food safety requirements and buyer preferences for packaging, and in improving the reliability and safety of their raw material sourcing.

India's trade in **dehydrated onions** has expanded in recent years. This is a bimodal industry. Many of the players operate on a small scale and target a low-price market within the region and among other developing countries. Quality and other specifications in that market segment are quite lax. In contrast, at least one major firm has targeted leading food service and food manufacturing companies in high-income countries. Recognizing the benefits of quality management systems (box 5.12), the firm has invested to meet buyer requirements for certified HACCP and ISO 9000 systems and to comply with official and private microbiological tolerance levels. Resources have been invested in research and development to breed a white onion variety that yields well under Indian growing conditions and provides sufficient factory out-turn (in terms of total soluble solids) to make the firm competitive with firms in the USA and elsewhere. The firm is visited annually by its main buyers for technical audits and commercial discussions. Some buyers want to obtain preshipment samples for testing and require sufficient records to trace raw material supplies. Farmers are contracted to grow the nontraditional onion variety, which does not have a ready local market. There is apparently potential to expand this trade, essentially by taking market share from alternative sources. Further refinement and expansion of the smallholder outgrower program are possible.

Box 5.12: Benefits of quality management systems: Fresh-cut produce firms in the USA

Quality assurance is of growing concern in the US fresh-cut produce industry. With growing consumer demand for convenient, healthy foods and food service demands for labor-saving inputs, the fresh-cut segment of the produce sector has grown rapidly. Sales of fresh-cut produce in the USA grew from about US$ 5 billion in 1994 to US$ 10–12 billion in 2005 and represent about 10 percent of total produce sales in the USA to retailers and food service companies. A recent survey of 38 firms operating in the fresh-cut produce industry explored the benefits of adopting Quality Management Systems (QMS). Firms reported significant benefits after QMS adoption, including increased product traceability, product quality, satisfaction with ability to hold on to customers, increases in quality of purchased inputs, increases in the quality of data used for decision making, satisfaction with market share, and satisfaction with sales.

The same firms reported significant decreases in product failure rates, number of product recalls, and the frequency of customer complaints. Investments in QMS represent a "sunk" cost, and firms encounter higher costs for various tasks, including record keeping, laboratory analysis, training personnel, input inventory, and input inspection. Even so, the likelihood of signing long-term contracts with customers and suppliers also increased, and the firms indicated that they received a premium for better-quality products. Seventy-six percent of firms in the sample had at least one QMS in place, and the remaining had two to five. Among all firms in the sample, 92 percent had HACCP in place.

Source: Fouayzi, Caswell, and Hooker 2006.

A handful of Indian companies have developed an expanding trade in **frozen vegetable products** sold into the UK and other markets where there are middle- and high-income immigrants of South Asian origin. The product mix includes various Asian vegetables and vegetarian prepared meals. These products are sold under own-company or buyer brands. Primary competition comes from UK-based companies. The companies active in this trade also produce mango pulp, which enables them to use their factories more fully over much of the year. Raw materials are purchased both directly from farmers and wholesale markets. Certified HACCP systems have been adopted, and each firm has a dedicated quality control team. At least one of the companies is currently preparing for certification under the BRC. Future challenges for the industry include moving toward more direct raw material procurement (to enable traceability and further manage risks related to pesticide residues and heavy metals), continuing to upgrade in-house food safety management, and developing systems to manage or recycle water effluent.

India's trade in **processed gherkins** is expanding rapidly as part of a broader global restructuring of this industry. With its ability to harvest gherkins over most of the year and with its relatively low labor cost, India has considerable cost advantages over traditional leading suppliers, including the USA, Hungary, and Russia. Global demand for processed gherkins is experiencing only slow growth (1 percent per year), yet Indian suppliers are taking market share from others. The industry, consisting of some 42 companies and nearly 50,000 smallholder outgrowers, is concentrated in Karnataka, Andhra Pradesh, and Tamil Nadu.

The leading players—including three companies featuring majority foreign ownership—have initiated a shift from exports in bulk containers to exports of branded final consumer jars. That product is targeted at high-income countries. That segment of the industry has functional HACCP systems, conducts regular product tests for microbiological parameters and pesticide residues, and is regularly visited by international buyers.[64] The less well capitalized companies continue to supply product in larger containers to lower-priced markets in Russia, Eastern Europe, and elsewhere. Less rigorous attention is given to food hygiene and possible contaminants. Some training or advisory services could help to reduce current risks.

The gherkin industry largely relies upon contract farming, as the varieties preferred for export have little or no domestic demand. The leading companies each have several thousand farmers under contract. Companies typically hold numerous field days, provide intensive oversight in the field, and keep extensive records of farmers' practices, especially pesticide use. At least one company has initiated efforts to certify outgrowers under EurepGAP, although this process has proven to be relatively costly and complex, given the nature of the prevailing production systems. There is certainly scope for more collective action within the industry—perhaps in partnership with state agricultural agencies—to promote "good agricultural practices" among the growing cluster of export-oriented gherkin producers. Given this industry's apparent growth potential, the scope for a private–public partnership to upgrade infrastructure and farm support services in the main production areas should be considered.

India's export trade in **mango pulp** features clusters of firms in parts of Tamil Nadu, Maharashtra, and elsewhere. Although India is a leading world supplier of mango concentrate and puree, the bulk of its exports are directed to very price-conscious juice and food manufacturers in the Middle East and Southeast Asia, with comparatively small quantities going to industrial consumers in higher priced European, North American, or North Asian markets. As in the case of processed gherkins, this industry also appears to have a bimodal structure. A limited number of companies operate modern factories with certified HACCP systems and have shifted to aseptic technology to prepare and package products for high-end customers.

The broader set of companies have less sophisticated quality and food hygiene management systems and would rarely confer with laboratories to test their raw materials, processing water, or finished product. These firms still use Number 10 cans, which can be sold only to the lower end of the global customer base. Relatively few firms have made the transition from one industry structure to another. Many older factories would need considerable adjustments in their physical facilities and product flow to improve food safety management substantially. One company reported spending US$ 35,000 to position itself to implement a proper HACCP system. The adoption of aseptic technologies would likely entail an investment of up to US$ 1 million and require a scale of operation considerably larger than the norm in this industry. Even if such technologies are not adopted and these companies remain targeted on lower-priced international markets, there would

[64] One of the companies is said to be the first food company in Asia to be certified under the BRC.

still be benefits—in terms of reduced risk of trade interruption and impact on the industry's international reputation—of an organized program to provide training and advisory services on food safety and quality management.[65]

In this and the other fruit and vegetable processing subsectors, it is recommended that a benchmarking survey be done to properly assess and characterize the status of quality and food safety management among active exporting companies. This survey would be the basis for adjusting existing or designing new industrial training, advisory service, and/or licensing arrangements. There is also scope for providing assistance to firms to help them refine their raw material procurement arrangements.

Cut Flowers

As noted in chapter 4, the Indian cut-flower export trade has developed unevenly over the past 15 years. Many pioneering companies went out of business, and many current players face broad competitiveness challenges and find more attractive returns, at lower risk, in the domestic market. Roses dominate India's exports of fresh-cut flowers. Rose exports to Europe peaked in the mid-1990s and have since declined. Some exporters have shifted to alternative markets—including Japan and Australia—with these sales partly compensating for the declining trade with Europe.

Plant health issues weaken the profitability of India's cut-flower exports, although other competitiveness factors—related to air freight rates, climatic conditions, and enterprise management—are probably more significant in the overall picture. During the rainy season, cut-flower growers face considerable challenges in managing thrips, aphids, spider mites, and other insects as well as powdery mildew disease. Effective pest scouting and chemical spraying are needed.

Some exporters indicate that they have received periodic warnings from Dutch officials or even have had (partial) consignments destroyed because insects and/or mildew were present. More diligent checking and inspection of flower consignments before they are loaded into pallets within India could minimize the incidence of such events. The Dutch tend to sample consignments of cut flowers at different rates, depending on their past experience of finding live or dead pests and on the underlying method and effectiveness of phytosanitary inspections or checks within the country of origin. Several countries have improved their inspection arrangements, substantially reduced the incidence of pests in their consignments, and reduced the level of entry-point inspection by Dutch authorities (for example, Kenya has achieved this reduction and Zambia is in the process of doing so). There is likely to be good scope for India to negotiate some type of protocol with the Dutch authorities and, upon its effective implementation, experience a similar reduction in entry inspection. This measure should prove to be cost effective, with exporters paying fees that cover the costs of the official inspection service.

The experiences in the Dutch market have been one factor leading Indian exporters to direct their flower consignments elsewhere. For the Australian market, Indian rose stems need to be dipped in a chemical before shipment to control against mildew. Upon arrival, consignments undergo compulsory fumigation with methyl bromide to control any living pests. For Japan, each rose consignment is inspected upon arrival. If there is any evidence of live pests, the entire consignment is fumigated at the exporter's expense. Exporters indicate that this happens with 25–

[65] India is routinely the most prominent origin of processed food products rejected by the US Food and Drug Administration. Some exporters have not registered with US authorities, while others find their products rejected because of improper labeling or the inclusion of unapproved colorants or additives.

33 percent of consignments. The costs can be considerable, especially if the volume of the consignment is relatively small. For a one-ton consignment, the costs of fumigation are equivalent to 6.5 percent of the C&F value, substantially eroding profitability for the exporter. Fumigation also reduces the shelf-life of the product.

In contrast with most of the leading flower exporting countries, India's flower export segment lacks a cohesive industry association to address common problems facing members or to undertake collective action. In Kenya (box 5.13), Uganda, and elsewhere, industry associations have played important roles, not only in relation to managing air freight requirements or addressing such issues as plant breeders' rights or registration of specialty chemicals, but also in the development and application of industry "codes of practice" related to environmental management and labor practices and conditions. Such organizations have facilitated members' access to advisory and certification services for the effective adoption of such codes and the various external protocols to which they are benchmarked. This has been fundamental in the mutual branding and risk management measures in these industries.

India, by contrast, appears to lack an industrywide approach for addressing the types of environmental and social concerns being raised by consumers, at least in some high-income countries. Overall awareness, let alone adoption of certified environmental and labor management systems is uneven, with each firm seemingly pursuing this matter on its own. Recent commercial challenges facing certain firms may have delayed or deterred investments in this area, which tend to involve up-front expenditures but provide benefit streams that accrue over time. With little cooperation among firms, there is little sharing of implementation experiences or cost-sharing of advisory, certification, or other services. While certainly not constituting a "magic bullet" to resolve all competitive challenges facing India's rose exports, the formation of an industrywide association, with a modest initial program of collective service provision, would effectively complement the current range of initiatives being implemented to promote the development of India's domestic market for cut flowers.

Box 5.13: Collective action for standards compliance: The Kenya Flower Council

The Kenya Flower Council (KFC) was established in 1996 by Kenya's largest producers, who were concerned about the industry's reputation in overseas markets. The organization was set up with the purpose of bringing together independent growers and exporters under one roof to ensure implementation of acceptable local and international standards.

To meet its objective, the KFC developed a Code of Practice, now in its sixth edition, detailing the standards to be met in Environmental, Social Accountability and Good Agricultural Practices by each member. The Code is the first national scheme to be benchmarked to EurepGAP and to attain "Equivalence Status" (in June 2005). Themes covered in the Code of Practice include:

- Health and safety of workers with respect to all aspects of providing a safe working environment (for example, the provision of personal protective equipment and procedural instructions).
- General worker welfare, including work contracts, job descriptions, wages, housing, safe transportation, medical provision, annual leave, maternity leave, and other terms of employment.
- Other major worker welfare rights, including freedom of association and collective bargaining.
- Good agricultural practices that include all EurepGAP requirements.

Box 5.13 Cont'd.

- Written crop protection strategies that include integrated pest management.
- Training all farm staff in the safe use of pesticides, health and safety, and first aid.
- Provision of first aid facilities and emergency procedures and instructions for farms.
- Identification and disposal of all possible waste generated in the company.
- Procedures for transportation, storage, and disposal of obsolete pesticides.
- Environmental management plan that includes water management.

- General protection of the natural environment, including water, air, land, flora, and fauna.
- Proper documentation of all aspects of cut-flower production processes, labor practices, maintenance and servicing of all machinery, health and safety observance, environmental requirements, compliance with relevant local laws and international requirements, postharvest handling, and exports of cut flowers to ensure traceability from the point of production to final destination. Documentation will also demonstrate compliance of good hygiene during production to ensure freedom from diseases and pests at propagation nurseries as well as the absence of harmful pathogens during postharvest handling.
- The scope of an annual internal audit of all the clauses in the code of practice.

Membership in the KFC is open to all producers, exporters, and propagators of cut flowers, but membership is open only to those who comply, within a 12-month period, with the minimum set of labor and environmental standards. Members that fail to maintain the necessary standards lose the right to use the KFC logo. Membership is voluntary. Presently, the Council has 42 members who have 52 separate farm units, accounting for about 80 percent of Kenya's US$ 200 million flower export industry. In addition the Council also has 13 associate members representing the major flower auctions and distributors in the UK, Netherlands, Switzerland, and Germany.

Source: Kenya Flower Council http://www.kenyaflowers.co.ke/index.html.

Chapter 6: Towards a Cost-Effective and Strategic Approach to SPS Management in Horticulture

Have SPS Issues Held Back India's Horticultural Export Trade?

Both the private and public sectors in India aspire to expand participation in international horticultural trade. The increased concern over food safety and/or plant health in many international markets has raised questions about whether SPS measures have posed or could pose a barrier to India's international horticultural trade and how Indian stakeholders should respond.

To what extent can India's growing yet still relatively minor role in international horticultural trade be attributed to increasingly stringent SPS requirements in major importing countries? The short answer is "relatively little," although SPS matters have contributed to certain periodic interruptions in trade and to a more general pattern of defensive commercialization among many Indian exporters. Overall, a range of factors explains India's role as a leading producer yet hesitant exporter of horticultural products.

Owing to India's large and rapidly growing domestic market for horticultural products, horticultural exports have not been a necessity for most stakeholders in the horticultural industry. Export trading has been exploratory and opportunistic. Most of India's fresh horticultural trade has simply catered to the consumption preferences of South Asian migrant workers or people of Indian origin in the Middle East and Southeast Asia. This trade is largely based on personal and ethnic ties among traders, and more or less represents an extension of India's domestic market. Much of India's fresh produce trade to Europe is also directed at "ethnic" food markets and restaurants.

Unlike many other countries, India does not rely on foreign exchange earnings from horticulture, and few concentrated efforts have been made to develop exports for high-income, mainstream markets. However, when opportunities have presented themselves, Indian exporters have taken advantage of them. Grape exports are a good example: Indian exporters exploit a short market window in Europe when grape production in the Southern Hemisphere has ended and before production in Turkey and Egypt is ready for the market. Similarly, most of India's rose exports occur around occasion days, such as Valentine's Day and Mother's Day, when peak demand in Europe ensures that prices are sufficiently high to cover the high costs of air freight from India.

The common varieties of many other horticultural crops grown in India, however, have very limited potential for short-term export development on an economically viable basis. Little production is export-focused. Common agronomic and postharvest practices lead to patterns of quality and of produce loss which are either inconsistent with export market requirements or render supply chains noncompetitive internationally. For example, in bananas, a combination of fruit damage and deformities sharply reduces the commercial (and potentially exportable) yield from most farms. For bananas, mangoes, and several other commodities that India produces in very large quantities, the fragmentation of production and intermediate trade, the virtual absence of coordinated supply chains, and weaknesses in crop and market intelligence and local/international logistics all contribute to relatively minor international market shares.

Plant health issues have posed an absolute barrier for fresh mangoes from India to enter certain high-income markets. Even so, the commercial potential for Indian mangoes in these markets remains to be seen, and it is not clear if other competitiveness challenges will emerge

once mutually agreed phytosanitary measures are in place. Other competitors already have a head start in these markets. Will India's somewhat unique mix of mango varieties take market share from established suppliers? Will it help to expand overall mango consumption (and thus imports) in these markets? India's relatively poor performance in competing in the European fresh mango trade—where plant health issues have featured far less prominently—suggests that a range of other issues, including those noted above, constrain trade. Still, the opening up of markets, such as the recent reentry into Japan and the USA, could catalyze new investment in mango production or supply chain coordination.

The bulk of India's exports of processed horticultural products is directed at markets in OECD countries and to some high-income Middle Eastern countries, such as Saudi Arabia and the UAE. Indian firms and industries have gained international market share in a selective range of products, despite the lack of preferential market access and the pattern of tariff escalation in such products. For processed products, India has been able to realize economies of scale from its large production base. Interestingly India's exports of processed horticultural products (fruits, vegetables, and flowers) have grown fastest in the era of increasingly stringent SPS standards. Exports of both processed fruits and vegetables have grown at about 10 percent per annum in real terms. Similarly, India has established itself as one of the top five exporters of dried flowers in the world, although this trade is very small (US$ 5 million).

For India's processed horticultural exports, the expansion into higher-income OECD markets would require exporters to contend with other commercial challenges in addition to stricter SPS standards for trade. An example is the preference in OECD markets for mango pulp in aseptic packaging. Two tiers of companies in India supply mango pulp today. A limited number with modern factories have shifted to aseptic technologies, and a broader set of companies uses less sophisticated technologies. Relatively few firms have made the transition from one tier to another. Many of the older factories would need to make substantial adjustments to their physical facilities and product flow to compete in the high-end markets. In addition, mango pulp importers in Europe rely on stock positions maintained by exporters in Rotterdam to provide just-in-time deliveries to end-users. India's main competitors provide this service, while most Indian firms do not. These are but a few of the examples cited in this report of how SPS-related challenges form a subset of a broader range of competitiveness challenges inhibiting the growth and international market share of Indian horticulture.

A Defensive and Reactive Approach to SPS Management

As discussed in chapter 5, the challenges posed by standards have manifested themselves in different ways for Indian horticulture, including: absolute barriers or binding constraints for accessing particular markets; losses due to rejected (and sometimes destroyed) consignments of fresh or processed product; higher consignment-specific or recurrent transaction costs adversely affecting profitability; and patterns of defensive commercialization, whereby firms fail to pursue opportunities for remunerative trade with certain countries or types of buyers because of concerns about their inability to ensure compliance with regulatory or private standards in those markets. This pattern is common in Indian horticulture, although additional factors have also weighed on these commercial strategies.

While there are certainly diverse views, the mainstream official and private perspective in Indian horticulture is that many, if not most, of the emerging SPS and other international standards are not scientifically based and therefore represent unfair barriers to trade. These barriers are considered either to result from deliberate efforts to protect farmers or processors from competition or to be fueled by unreasonable fears of consumers in high-income countries

and by improved technologies for detecting hazards. Whatever the driving forces, the presumed primary solution is seen to lie in effective negotiations with India's (official and private) trading partners and, failing that, in addressing the various measures in international fora for setting standards or resolving disputes.

Given this perspective, it is arguable that insufficient attention has been devoted to monitoring the requirements of official and private standards, interpreting their implications for Indian horticulture, and using current and anticipated requirements as catalysts to upgrade operations and strengthen supply chain management. This situation is not altogether surprising, considering the relative size of India's horticultural export markets. Yet the absence of a proactive or preventive approach to managing SPS standards for trade has left Indian horticulture either to adopt defensive strategies of commercialization—such as avoiding markets where more stringent standards are applied—or to adopt reactive, "fire-fighting" methods to limit the damage from apparent noncompliance with trading partner requirements. In response to various crises that have arisen on the SPS front (in grapes, for example), the strategy of the public sector has combined (1) aggressive enforcement of existing or modified regulations, (2) heightened requirements for mandatory testing of raw materials and finished products, and (3) considerable investments in new "hardware," either through investment in public laboratories or subsidies for private investment in laboratories, factory upgrades, and other improvements.

These are all end-of-the-line solutions. They contrast sharply with approaches taken by leading (and competing) developing countries in the horticultural export trade, such as Brazil, Chile, Mexico, Thailand, Kenya, and South Africa. The mainstream Indian approach seems to call for negotiation first and belated (and begrudging) compliance second. In contrast, many other countries are investing in compliance as a means both to improve their competitive position and to enhance the effectiveness of their negotiations on particular technical and commercial matters. With regard to trade performance patterns and the prevailing international reputation for horticultural industries, this latter approach seems to have been relatively more effective.

India's reactive approach has generally proven "successful," in the sense that access to the affected market was restored relatively quickly. Yet such crisis management measures have generally been quite expensive, both financially for the government and in terms of lost incomes or livelihoods for the many farmers, SMEs, and factory workers adversely affected by regulatory crackdowns. In some cases (such as grape exports), the sustainability of the adopted measures is uncertain, given the higher overhead cost of compliance. The considerable attention given to product testing has enabled the Indian government and various sectors to gain a more detailed look at the symptoms of noncompliance (including results of tests indicating violative levels of microbiological parameters or pesticide residues), yet insufficient attention and resources have been directed to address the underlying causes of these problems. Recent moves to improve agricultural practices through initiatives such as the IndiaGAP program suggest a shift in the right direction, however.

Internationally, there appears to be little confidence in India's food safety and agricultural health management systems, a situation which may lead to more intensive scrutiny of Indian products at border entry points. Among trading partners, India is commonly perceived as (1) having significant deficiencies in domestic and export-related SPS management systems and (2) periodically (mis-)using SPS measures to protect its own domestic market. This perception strongly undercuts the likely effectiveness of Indian complaints about "unfair" or "unscientific" measures on the part of its trading partners. International experience suggests that the effectiveness of SPS-related "diplomacy" is strongly tied to how well a country is perceived to have up-to-date legislation and functional systems of pest and disease surveillance, food

establishment inspection, and conformity assessment. In other words, voice is effective when the main ingredients for compliance are already in place. In such circumstances, negotiations can center on the details of implementation and mutual recognition. When confidence is lacking in the underlying integrity or accountability of SPS management systems, there is little basis for true negotiation.

Taking a More Proactive Stance towards SPS Management

Standards present an opportunity for modernizing export supply and regulatory systems and adopting safer and more sustainable practices. Countries (and individual exporters and supply chains) that have taken a proactive stance, including staying abreast of technical and commercial requirements and anticipating future changes, have been able to reposition themselves in more remunerative market segments. Consignments from such countries are subjected to comparatively less inspection by trading partners. "Good" reputations, gained through demonstrated compliance, yield lower transaction costs for farmers and exporters.

While it is important to be critical about standards and to bring legitimate cases of discriminatory practices or protectionism to the attention of the SPS Committee, the use of official rhetoric to delegitimize standards as "trade protectionism" becomes problematic, in that it sends entirely the wrong signals to the private sector and to public officials involved in the technical fields of SPS management. Rather than encouraging these stakeholders to adopt proactive strategies to address emerging standards/concerns, these declarations underplay the importance of legitimate concerns and present a misleading message that somehow these concerns can be negotiated away.

A more constructive and ultimately more effective approach necessitates more strategic, forward planning, in which the evolution of commercial and regulatory requirements is anticipated; the technical, administrative, and institutional options for pursuing compliance are determined; and priority measures are undertaken to build awareness and enhance necessary capacities within the private and public sectors. For India, this kind of planning may require a broader shift in the modalities of official action, away from an approach that emphasizes the imposition of mandatory controls, inspections, and testing—overseen by various central and state government agencies—to one that devotes greater attention to promoting awareness about SPS management among agro-food system stakeholders and to facilitating effective individual and collective action by private firms, farmers, and service providers. This shift will not come overnight. Even so, this report has outlined circumstances in which the respective roles and responsibilities of government and the private sector can and should begin to change in ways that may enable export-oriented horticulture to become more flexible and responsive to the needs and requirements of India's trading partners.

India and its private sector are in a position to anticipate standards and take early action to gain competitive advantage through compliance and differentiation. Unlike many other developing countries, India has enormous scientific and technical capacities. It can effectively undertake research and field trials to stay ahead of the game. For example, many countries have begun to adopt more stringent standards for heavy metal tolerances in food and to increase surveillance testing. This trend could pose a risk to India's Asian vegetable trade, as local surveys have found relatively high heavy metal content in vegetables grown in periurban areas. The Indian export sector needs to work with local research institutes and departments of agriculture to further determine the risks and, if necessary, shift crop procurement to different locations or to farmers whose production practices minimize the risks. Also, Indian stakeholders anticipate problems in complying with existing EU pesticide residue tolerances for pomegranates. Indian

complaints about "unfair" approaches to testing are getting limited attention, given this crop's minimal commercial importance to India's trading partners. India needs to manage this challenge—through its own actions—by performing its own field trials to establish proper regulatory tolerances and by promoting better pest management practices by pomegranate growers.

By anticipating shifting standards in existing markets, stakeholders are likely to identify opportunities for expanding into more remunerative segments in these markets. India does not currently face very stringent standards for horticultural commodities in regional markets or in the Middle East, where it earns more than 40 percent of its horticultural export income. The bulk of Indian produce entering these markets is targeted at the migrant worker community, with Indian produce competing with produce from other South Asian or nearby countries. This low-priced, bulk market should remain an attractive outlet for Indian exporters, who benefit from inexpensive and frequent freight links and similarities in diet and culture with the targeted importers and consumers. Yet there should also be potential to more firmly tap into the expanding high-end market segment in the Middle East, especially that involving supermarkets. The required standards do not match those applicable at the higher end in Europe, although buyers for these supply chains will increasingly want evidence of "good agricultural practices" and produce traceability.

Stronger monitoring and evaluation components must be instituted to gauge the effectiveness of various investment and incentive schemes and/or the instruments made available by central and state governments to promote horticultural exports and facilitate the upgrading of postharvest practices, infrastructure, and quality assurance systems. More than 48 AEZs are planned for horticultural crops. Careful evaluation of the performance of some of these schemes will have large payoffs in terms of future strategic decision-making and resource allocation. Various subsidy schemes must be rationalized and become easier for the private sector to access. It is also important for public agencies to communicate effectively with growers and exporters regarding the different services that are available.

A careful assessment of the costs and benefits of standards compliance and evaluation of the trade-offs is necessary. Investments in phytosanitary and food safety risk assessment and mitigation should be guided, at least partly, by the market potential of the export commodity. For example, all things considered, it is not obvious that the likely costs and administrative attention required for Indian mangoes to gain access to the Australian market would match the benefits of participating in that market, given its probable size. This possibility needs to be assessed more thoroughly before any major investments or public resource commitments are made. Achieving compliance at a potentially high cost would not make sense if the actual commercial potential of this trade is limited. Trade-offs also need to be carefully evaluated. For instance, in committing public resources to resolve SPS management issues it is important to weigh the cost-effectiveness and equity implications of investing resources when the benefits may be conferred on a relatively small group of arguably better-off farmers. Investing in other public goods may have higher returns and benefit a larger population. For example, the analysis in this report raises questions about the suitability and sustainability of the government's continued large investment in monitoring standards compliance in grape export supply chains aimed at European markets. The costs are relatively high, and the benefits seem to accrue to a comparatively small number of growers. Such resources might have a stronger impact on both trade and poverty reduction if reallocated.

The experience to date has been that the government has taken disproportionate responsibility for managing SPS-related "crises." It is often assumed that the management of food

safety and agricultural health is predominantly the responsibility of the public sector. Indeed, many crucial regulatory, research, and management functions are normally carried out by governments. In a variety of circumstances, importing countries require certain functions to be performed by a designated "competent authority" in the public sector. As indicated in table 6.1, the primary responsibilities of the public sector include diplomacy, awareness building, promoting good agricultural practices, and assessing and managing food safety and plant health risks. Within the public sector there are clear roles and responsibilities for the central and state governments. For instance, at the central government level, India's Ministries of Agriculture and Commerce are responsible for gaining market access through bilateral negotiations with trading partners. On the other hand, raising stakeholder awareness and promoting good agricultural practices are joint responsibilities of the central and state governments. However, the private sector also has fundamentally important roles to play—in the process of standard-setting and in actual compliance with food safety and agricultural health requirements. Experience elsewhere demonstrates that capacity building in the private sector can complement (or even substitute for) public sector capacity, including capacity in research and development and conformity assessment (such as inspection, certification, and testing).

There is a much greater need for collective action in the private sector. Indian industry groups tend to form and operate to lobby government, but international experience highlights the importance of collective action within the private sector to promote awareness of SPS matters, to find technical and institutional solutions to emerging challenges, to implement programs to promote good agricultural or manufacturing practices, and otherwise provide a degree of self-regulation, which then reduces the need for government agencies to play enforcement roles. Indian horticulture presents many instances in which limited cooperation among private sector actors has either created a vacuum that the government has had to fill or forced individual firms to tackle problems on their own. For example, the absence of an organized forum among Indian grape exporters has generally prevented self-regulation. APEDA has filled the void with a mandated system of multistage government oversight.

For crops with limited potential for short-term export development, it would be important to carefully weigh the benefits of reorienting production to export market specifications versus strengthening industry practices and quality consciousness to increase productivity and to provide India's own consumers with a better-quality, safer product. Given the size of the domestic market and its anticipated growth, there could well be far greater financial and social benefits from a program centered on improving the domestic supply chain rather than on prospective exports.

The emerging dynamics in the domestic market, especially the modernization of retail, will likely have a far more significant impact on Indian farmers and traders than the export market. As the food retail sector modernizes, the focus will be initially on convenience and quality, but over time more emphasis will be given to food safety parameters in the modernized sector. The growth of the modern food retailing sector will likely induce extensive changes in the structure of production and product aggregation. Greater supply chain coordination will occur, in parallel with more traditional supply chains involving multiple intermediaries and sales through wholesale markets. The more coordinated supply chains for the domestic market could also provide an improved platform for the exports of certain fresh fruit and vegetables, although the value-addition that will occur in the domestic market will likely dwarf that which could be obtained through exports.

Table 6.1: Roles of the public and private sector in enhancing trade-related SPS and quality management capacity

Public sector role	Private sector role
Diplomacy: *(Responsibility of central government)* • Undertake continuous dialogue and periodic negotiations to address emerging constraints or opportunities. • Emphasize commitments, confidence building, and opportunities for mutual recognition and joint problem-solving (rather than conflicts per se). **Building awareness and promoting good practices:** *(Responsibilities lie with central and state governments)* • Raise stakeholder awareness about and promote good agricultural, hygiene, and manufacturing practices and quality management. • Incorporate these areas into curricula of public agricultural/technical institutes and universities as well as consumer awareness campaigns. • Accredit private laboratories and conduct reference/consistency testing. • Facilitate technical, administrative, and institutional change and innovation within the private sector (for example, through public–private partnerships for product innovation or product traceability systems). **Risk assessment and management:** • Adopt suitable food safety and agricultural health legislation modeled on international good practices and consistent with India's WTO and other treaty obligations. *(Responsibility of central government)* • Manage national or state systems of pest and animal disease surveillance. *(Responsibilities lie with central and state governments)* • Undertake coordinated market surveillance programs to gauge the incidence of various food safety hazards in the domestic agro-food system. *(Responsibilities lie with central and state governments)* • Find solutions to phytosanitary constraints that limit domestic (for imports) and foreign (for exports) market access. This effort might entail pest risk assessment, product inspection, agreed development of pest- or disease-free areas. *(Primary responsibilities lie with the central government, but state governments have an important role in implementation)* • Support research to address food safety and agricultural health concerns (for example, field trials to determine alternative pest management approaches or to establish suitable MRLs for crops with market potential; improve the quality of planting material). *(Responsibilities lie with central and state governments; role for national- and state-level agricultural research organizations)*	**"Good" management practices:** • Implement appropriate management practices to minimize food safety, environmental, and other risks. Examples include "good" agricultural, hygiene, and manufacturing practices and HACCP principles. • Where commercially valuable, gain formal certification for such adopted systems. • Develop incentives, advisory services, and oversight systems to induce similar adoption of the above "good practices" by supply chain partners. **Traceability:** • Develop systems and procedures to enable the traceability of raw materials and intermediate and final products in order (for example) to identify sources of hazards or manage product recalls or other emergencies. **Develop training, advisory, and conformity assessment services:** • On a commercial basis, provide support services to agriculture, industry, and government related to quality and food safety management. Invest in the needed human capital, physical infrastructure, and management systems to competitively supply such services. **Collective action and self-regulation**: • Work through industry, farmer, and other organizations to share the costs of awareness-raising and systems improvement, alert government to emerging issues, advocate for effective government services, and provide a measure of self-regulation through the adoption and oversight of industry "codes of practice."

Source: Authors' analysis

Specific Recommendations

In addition to the general recommendations discussed previously, several more specific recommendations arise from the findings and analysis in this report. These crop- and product-specific recommendations are outlined here.

For grapes, it is recommended that:

- NRC–Grapes and other research institutes undertake further research to confirm or modify recommended preharvest intervals displayed on labels of pesticides used on grapes and other fruits and vegetables that India will currently or potentially export to high-income countries in fresh form.
- NRC–Grapes, in conjunction with participating laboratory agencies and the grape exporting sector, conduct a deeper analysis of pesticide residue test results over the past three seasons to differentiate among various potential factors separating compliant from noncompliant growers, including geographical location (specifically, proximity to other cash crop production), climate, farm size, farm production diversity, intensity of oversight of grape buyers, and other variables.
- Modify the role of Horticultural Field Inspectors from their current function of policing export-oriented grape production to a broader role in promoting "good agricultural practices," IPM, and other practices in multiple crops grown for export in Maharashtra and other states. Some of these field staff could be assigned to programs of awareness-raising and farmer training, jointly managed by state agricultural departments and private sector associations. The government plans to promote good agricultural practices and private extension through the proposed IndiaGAP.
- Review the functionality of the mandatory AGMARK inspection and grading of export-oriented grapes and either modify or eliminate this intervention to add rather than subtract value from the supply chain.
- Over a three-year period, phase out mandatory testing of grape field plots for conformity with pesticide residue tolerances (and phase out the testing subsidy program). In its place, institute a surveillance program involving random sampling of grapes at the field, packinghouse, and export levels, perhaps overseen by the Export Inspection Authority.

For pomegranates, it is recommended that:

- Pertinent research institutes, with backing from APEDA and the export industry, conduct field trials on pomegranates to establish proper MRLs and recommendations for preharvest intervals under Indian growing conditions for pesticides approved for use by India's trading partners. Such trials could be done in coordination with European regulatory authorities and/or authorities in other pomegranate-exporting countries. These trials would form the basis for revising current international, European, and domestic MRLs related to this crop.

For vegetables, it is recommended that:

- The Vegetable Exporters Association, in conjunction with state agricultural departments and research institutes, more closely examine the incidence of heavy metals in vegetables sourced from different locations and develop an action plan—potentially involving direct sourcing from certain areas—to mitigate the risk posed to the export trade. To protect domestic consumers, parallel programs should be developed involving more regular market surveillance and the identification and promotion of risk-mitigating farming practices.
- Remove restrictions on onion exports, eliminating the need for "no objection" from state marketing authorities. This uncertainty inhibits the development of forward contracting between exporters and growers, on the one hand, and exporters and overseas buyers, on the other.
- Evaluate the need for NAFED to retain its current infrastructure and consider the potential market development benefits if some of that infrastructure were sold or leased to the private sector.

For mangoes, it is recommended that:

- The true commercial potential of fresh mango exports to Japan, Australia, and the USA be examined *before* further committing India's public resources to plant health surveillance systems or infrastructure for fruit treatment. APEDA might retain the services of a consultancy firm to gauge this commercial potential in relation to market trends, competing sources of supply, and considerations of seasonality, comparative costs, and quality and other preferences.

For cut flowers, it is recommended that:

- Inspection arrangements be improved to ensure more diligent checking and inspection of flower consignments prior to their loading into pallets within India. Negotiate protocol with Netherlands authorities on acceptable inspection arrangements, and improve inspection arrangements in India in accordance with these protocols to reduce levels of entry-point inspection.

Sectoral Initiatives

The prior sections provided recommendations at the broad strategic level and in the context of specific subsectors. These are supplemented by recommendations for action at the sectoral (or multisectoral) level. It is recommended that:

- APEDA, in conjunction with pertinent Chambers of Commerce and industry associations, conduct a baseline survey of fruit and vegetable processors that are regularly active in the export trade to define their status and their strengths and weaknesses in terms of facilities, staffing, and procedures to apply quality management and GMP/GHP. Based on the results of this survey, appropriate measures should be taken—which may involve adjustments in licensing, the introduction of training or technical assistance programs, or the development/implementation of industry "codes of practice," among others. Subsequent initiatives could be targeted at nonexporting companies, with the objective of facilitating incremental adoption of better quality management and GMP/GHP.

- In selected subsectors, state agricultural departments could undertake joint "supply chain initiatives" with clusters of private companies (or an overarching association), involving farmer outreach and organization and promotion of GAP and farm/postharvest hygiene and quality management—to ensure compliance with industry (and downstream buyer) requirements. Such initiatives are underway in Maharashtra, where they are directed at the mango industry.

- Pertinent federal and state agricultural departments work closely with the Indian agro-chemical industry and relevant commodity associations (in horticulture, spices, and so forth) to address problems in agro-chemical product labeling and distribution and to promote safer pesticide use, storage, and disposal. This effort might involve further training of chemical stockists and farmers and better enforcement of existing regulations. A program of regularized surveillance of pesticide residues in domestic produce should be introduced to further guide extension and targeted pest management programs.

- The broad proactive and strategic orientation laid out in section 6.3 may be difficult to implement across India's large, complex, and geographically dispersed horticultural sector. Rather, this type of strategic approach may be more feasible within a more

specific geographical area, involving a particular cluster of firms, farmer groups, public institutions, and supply chain clients. Thus, this type of strategic planning and collaborative implementation might best be pursued at the state level or, more narrowly, at the level of particular AEZs or localized clusters. APEDA, state governments, or private associations could take the lead in catalyzing the needed consultations and identifying appropriate collective action or public investment. Either local consultants or external partners can be used to facilitate these processes of assessment, priority setting, role identification, and implementation.

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