

Quality and safety in the traditional horticultural marketing chains of Asia



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Agricultural Management, Marketing and Finance Service
FAO Agricultural Support Systems Division

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Contents

PREFACE	v
ACRONYMS	vi
ACKNOWLEDGEMENTS	vii
INTRODUCTION	1
CHAPTER 1 FACTORS AFFECTING QUALITY AND SAFETY OF HORTICULTURAL PRODUCTS	3
Production factors	4
Harvest and post-harvest handling	5
Packaging, transport and storage	7
Ripening and produce preparation	8
Wholesale and retail marketing	9
CHAPTER 2 FACTORS INHIBITING THE SUPPLY OF HIGH-QUALITY AND SAFE FRUITS AND VEGETABLES BY FARMERS	11
1. Market-related factors	11
2. Economic, financial and social factors	14
3. Information and awareness	15
CHAPTER 3 FACTORS CONSTRAINING THE CAPACITY OF TRADERS TO SUPPLY HIGH QUALITY AND SAFE FRUITS AND VEGETABLES	17
CHAPTER 4 FACTORS AFFECTING FRUIT AND VEGETABLE PURCHASES BY CONSUMERS	21
CHAPTER 5 STANDARDS, REGULATIONS AND NATIONAL PROGRAMMES TO PROMOTE IMPROVED QUALITY AND SAFETY	25
Standards, regulations and their impact	25
National programmes for quality and safety	29
CHAPTER 6 SUMMARY, DISCUSSION AND RECOMMENDATIONS	33
Summary	33
Discussion	35
Recommendations	41
REFERENCES AND FURTHER READING	45

Preface

This paper has been prepared under the auspices of the FAO programme on “Enhancing Food Quality and Safety by Strengthening Handling, Processing and Marketing in the Food Chain”. It has been prepared on the basis of eight case studies commissioned by FAO in 2004. The paper concentrates on the issue of how to improve quality and safety in traditional marketing systems for fresh horticultural produce. Other work under the same FAO programme looks at issues relating to fruit and vegetable processing.

Other FAO programmes address quality and safety issues from the perspectives of standard setting, institutional development, post-harvest improvement, pesticide control, good agricultural practices and training. This paper endeavours to examine what actually happens within the horticultural supply chain to affect safety and quality and what are the constraints faced within that chain that impact adversely on the ability to make improvements. Particular attention is paid to the incentives, if any, provided to farmers by traditional systems to make technical improvements. Without such incentives it is argued that activities involving training, standard-setting, etc. are likely to have relatively limited impact.

The paper is aimed at staff of ministries of agriculture, including extension officers, who are working to develop improved safety and quality in the horticultural sector. It is hoped that it will also be of interest to those working in regulatory organizations, to traders and wholesale market management, who clearly need to improve quality and safety if they are to compete with the new supply chains being developed by supermarkets, and to donors and NGOs working to improve horticultural marketing and to promote good agricultural practices.

Acronyms

AFMA	ASSOCIATION OF FOOD AND AGRICULTURAL MARKETING AGENCIES IN ASIA AND THE PACIFIC
AGMARK	AGRICULTURAL PRODUCE GRADING AND MARKETING ACT (INDIA)
ASEAN	ASSOCIATION OF SOUTHEAST ASIAN NATIONS
DDT	DICHLORO-DIPHENYL-TRICHLOROETHANE
EUREPGAP	EURO-RETAILER PRODUCE WORKING GROUP GOOD AGRICULTURAL PRACTICES
GAP	GOOD AGRICULTURAL PRACTICES
GMP	GOOD MANUFACTURING PRACTICES
HACCP	HAZARD ANALYSIS AND CRITICAL CONTROL POINT
IFOAM	INTERNATIONAL FEDERATION OF ORGANIC AGRICULTURE MOVEMENTS
IPM	INTEGRATED PEST MANAGEMENT
MRL	MAXIMUM RESIDUE LEVEL
PRB	PESTICIDE REGISTRATION BOARD (MYANMAR)
SARS	SEVERE ACUTE RESPIRATORY SYNDROME

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AWS

Introduction

This study attempts to relate the subject of food safety and quality to the way in which fruits and vegetables are both produced for the market and handled during the marketing chain.¹ It starts from the assumption that traditional approaches to the topic have not been too successful. For example, the research and literature on the post-harvest handling of horticultural produce has not resulted in significant improvements to post-harvest techniques being applied in domestic markets of developing countries. Despite numerous interventions by FAO and other organizations in Asia to provide training in post-harvest issues, many traditional marketing systems continue to exhibit extremely poor handling practices. A similar argument can be made in the case of food safety controls, including regulations regarding the use of pesticides and maximum residue levels. Unsafe pesticide-application practices continue to be followed by farmers, illegal pesticides continue to be used, and food with high residue levels continues to be sold. Furthermore, despite knowledge of the dangers of microbial contamination, unhygienic practices remain widespread, and national and local governments continue to operate unhygienic market facilities.

Before promoting improvements to food safety and quality, it is therefore necessary to examine the constraints experienced by farmers and traders in making such improvements. Lack of knowledge is one constraint but, as will be discussed, farmers and traders who know their practices are unsound, or even illegal, may continue to follow them. The paper tentatively concludes that traditional marketing systems presently provide little motivation or incentive for farmers to make improvements to quality or safety. In the absence of incentives, resource-poor farmers have little scope to make improvements. Regulation would not appear to provide a satisfactory solution to the problem of fruit and vegetable safety because the costs of monitoring compliance are prohibitive.

The paper is based primarily on eight unpublished case studies carried out for FAO in late 2004, early 2005. References to specific country situations come from those case studies, unless otherwise indicated. Authors were asked to provide an overview of factors affecting quality and safety in their country and of the rules and regulation relating to the topic and the institutions implementing them. They were also asked to carry out two studies of specific horticultural chains. The Indian case study looked at mangos and tomatoes, while the study on Myanmar considered tomatoes and grapes. The Nepal study reviewed the chains for tomatoes and bananas; that on Pakistan the mandarin and mango chains and that on the Peoples' Republic of China the chains for peaches and wild rice stem. The study of the Philippines reviewed mangoes and lettuce while the Thailand case study looked at tangerine and baby corn. Finally, the study on Viet Nam reviewed chains for cabbage and dragon fruit.

Chapter 1 briefly reviews the main factors affecting quality and safety, both at farm level and along the marketing chain. This is followed by a discussion in Chapter 2 of the

¹ Quality and safety are, of course, also much affected by consumer and food industry handling, storage and food preparation practices, but these issues are largely outside the scope of this paper. For more information on this topic, see Cuevas, R. 2004.

factors constraining the ability of farmers to supply high-quality and safe horticultural produce, while Chapter 3 looks at the problems experienced by traders. Chapter 4 then considers the subject from the standpoint of consumers. Chapter 5 looks at the impact of existing standards and regulations and the agencies that implement them. Programmes to promote improved quality and safety that have been introduced in some countries are also considered. A final chapter briefly summarises the main issues, discusses ways in which quality and safety could be improved in traditional marketing chains, and makes a number of recommendations.

The paper concludes that improving quality and safety will require recognition that, firstly, farmers and traders need to be motivated to make changes. That motivation will come primarily from increased incentives and reduced risk. Secondly, the availability of information and resources to enable those involved to make those changes is essential. Incentives may come about as a result of changes in consumer demand. Within Asia, programmes could not only promote increased fruit and vegetable consumption but also provide advice to consumers on quality aspects. It is unclear whether traditional marketing channels will be able to adjust to supply better quality or whether this will only be possible through new marketing channels, such as supermarkets, that by-pass existing channels.

The paper argues that governments need to view markets as more than just sources of revenue, particularly if they wish to see traditional marketing channels surviving in the face of competition from supermarkets. Significant improvements in markets can be brought about by improving management. Municipalities should reinvest market fees in the markets and, wherever possible, private sector investment in markets should be encouraged. Wholesale markets need to investigate the feasibility of developing separate sections to handle fruits and vegetables that meet defined safety and quality standards. Ways in which farmers can link with retailers through traditional channels, including through organization into groups, clusters, associations, cooperatives, etc. should be explored. Governments should consider whether certificates of origin can be introduced for fruits and vegetables meeting defined production criteria and the potential use of brand or other registered names should also be investigated.

Countries should develop training programmes for traders and for pesticide dealers. For farmers, the use of crop-specific leaflets in the vernacular to provide advice on the cultivation, handling and marketing of various crops following Integrated Pest Management (IPM) and other improved techniques is recommended. Radio and television programmes can also be used and are particularly useful where there is a high level of illiteracy. Education and awareness-raising of consumers would also appear to be important if the production of safer and higher quality produce is to be promoted.

Finally, the paper concludes that governments should pay more attention to microbial contamination issues. While resources are devoted to pesticide control and Maximum Residue Level monitoring, little attention appears to be paid to other forms of contamination. Ways of reducing such contamination need to be identified and information on the topic made widely available to farmers and traders. Further research on the causes of contamination during production and marketing is recommended.

1 Factors affecting quality and safety of horticultural products

The main quality and safety problems are discussed below,² and this is followed by a discussion of the ways in which those problems develop in the production and marketing chains of Asia.

Some examples of poor quality are easy to observe. Bruising occurs on farm and throughout the marketing chain. The three main causes are impact, when fruit is dropped, either individually or when packed; compression as a result of pressure from a pile of fruit, excess produce being squeezed into a container or the collapse of containers; and abrasion caused by friction. The effects of bruises are cumulative and a significant loss of quality can result. Lesions occur during harvest and subsequent handling and can be caused by harvesting tools, pickers' and sorters' fingernails, peduncles of other fruit, rough edges of packaging, etc. Storage damage can lead to overripe fruit and produce that is soft and lacks the texture and appearance required by consumers. Rot caused by contamination by micro-organisms can be severe in warm climates with a high relative humidity. Rotting produce in storage contaminates the rest and stimulates the rate of deterioration. Where ethylene-releasing crops are placed in the same store as ethylene-sensitive crops undesirable reactions take place, including loss of colour and yellowing. In the case of potatoes, sprouting is stimulated.

While many quality defects, such as bruising and rot, can be clear to the consumer at the point of sale, he or she has no way to detect the presence of dangerous substances. Pathogens can be present on fresh produce. Viruses, bacteria and parasites can all be carried, but bacteria are the main causes of illnesses related to the consumption of fruits and vegetables. The main potential sources of contamination are the use of untreated animal manure as fertilizer, the use of polluted water for irrigation or cleaning and poor personal hygiene or practices on the part of farmers and their workers. While such microbial contamination presents a potentially serious threat to human health the main concern of consumers until now has been pesticide residues. Agrochemicals are widely used in horticulture as herbicides, insecticides, fungicides, fumigants, rodenticides, growth regulators, barriers such as waxes, and disinfectants. Their use gives cause for concern among consumers even when they are applied following manufacturers' recommendations. As will be discussed below, usage in Asia often does not follow recommended practices.

For ease of discussion, the stages of the horticultural production and marketing chain at which quality and safety can be affected are grouped together below as:

- production;
- harvest and immediate post-harvest handling;
- packaging, transport and storage;
- ripening and produce preparation; and

² In addition to the case studies, this section draws heavily on FAO, 2004 (see References and Further Reading).

- wholesale and retail marketing.

Production factors

Production factors affecting quality and safety include:

- **Variety.** Choice of variety planted can have a big impact on the quality of products eventually reaching the consumer and plant breeders are increasingly developing varieties with shelf life in mind. For example, in Myanmar, hybrid varieties of tomato are considered more suitable for long-distance transport than local varieties, as the skins are thicker.
- **Soils.** High nitrate content of soils can cause health problems, particularly for leafy vegetables. Some soils contain excess heavy metals, such as mercury, cadmium, chromium, arsenic and lead, which can be absorbed into the growing plants.
- **Irrigation.** Too much water can result in produce being easily damaged. Too little water can lead to small sizes and, where relevant, to low juice levels. For non-irrigated products a dry spell followed by wet weather can lead to splits or cracks in the skin. Irrigation usually employs surface water. Quality of that water can be a major problem for urban or peri-urban production, with sewerage often being discharged into rivers and streams, but the same risks can apply to production anywhere. Upstream discharge into rivers of sewerage or of effluent by industrial concerns can have a significant impact on water quality. The risks are compounded by irrigation practices that spray the whole plant rather than irrigate the roots, a particular problem for products that are eaten raw. The case studies suggest that testing of irrigation water quality is rare.
- **Location.** Airborne contamination can occur when farms are close to roads, factories, etc.
- **Natural contaminants.** These may be present on both fruits and vegetables. Some plants may produce toxins, e.g. phytohaemagglutinin in red kidney beans, solanines, in tomatoes and potatoes, and oxalates, which are found in spinach.³
- **Use of untreated animal manure.** The use of untreated manure for purposes of fertilization increases the possibility of contamination from *E. coli* and other pathogens. Heavy fertilization of lettuce with chicken manure is reported as a concern in the northern Philippines. In Thailand and elsewhere manure is not treated prior to application and adequate time is not allowed for the breakdown of manure into the soil.
- **Diseases, pests and other damage.** The case studies did identify some consumers who preferred to buy fruits and vegetables that had clearly been attacked by pests, on the grounds that this meant that the produce was likely to be free of pesticides. In general, however, the case studies report that consumers tend to make their purchases on the basis of appearance. Unblemished fruit counts for much, which is why farmers are frequently under pressure from the marketing chain to use agrochemicals. Production risks faced by farmers can be considerable. For example, there are about 500 species of insect known to attack mango trees, and Indian farmers have to contend with 45 percent of them.

³ Moy, 2005.

- **Pesticide use.** In the countries studied there is clear evidence of overuse of pesticides. Knowledge of Integrated Pest Management (IPM) approaches is not widespread and pesticides tend to be applied following a calendar-based rather than a needs-based approach. For example, during the rainy season up to thirteen applications are reported on mango trees in Mindanao in the Philippines. Where bagging⁴ of mangoes is practised, spraying is not needed beyond seventy days after flower induction but where there is no bagging, which is usual in the Philippines, spraying (often of a mixture of pesticides at the same time) may continue until just a few days before harvest. Farmers may respond to marketing channel perceptions of consumers' quality requirements for blemish-free fruit and spray excessively in order to achieve this. The cost of pesticides and their application is calculated to be 34 percent of variable tomato production costs in the Myanmar Highlands. Most case studies have indicated that farmers place more emphasis on maximizing yields than on minimizing residue levels. This is despite the fact that many are well aware of the dangers inherent in their production practices. For example, farmers in Nepal say that they do not feed plant residues to their animals because they don't want to kill them (from pesticide residues)! Farmers in several case-study countries commented that they would not eat what they produced. In Viet Nam, which in 1995 had in use 200 insecticides, 83 fungicides and 52 herbicides, there have been many reported deaths from poisoning, apparently as a result of fruit and vegetable consumption.

Pesticide applications on tangerine crops in Thailand are reported by the case study to range from 9 to 72 times a year, with an average of 32 applications. Moreover, farmers are known to apply doses higher than those recommended on the label. There have been several reports of pesticide poisoning among people living close to tangerine plantations. Several of the country case studies reported that banned pesticides continue to be used; these are allegedly smuggled in from neighbouring countries and farmers use them because they are cheaper and because they are unaware that they are banned. Fifty percent of tomato farmers and all grape growers surveyed in Myanmar used monocrotophos, which is banned in that country. Mango farmers in India use the banned methyl parathion to counteract the mango hopper. The Indian case study reports that 23 banned pesticides continue to be freely available in the country. In Pakistan, pesticides designed for cash crops, such as cotton, are often diverted for use on vegetables. Sometimes, the usage on vegetables is greater than that recommended for cotton. Pesticide spillage is quite common and empty containers are often not properly disposed of and become a source of contamination.

Harvest and post-harvest handling

Harvest-related problems include:

- **Pesticides and harvesting.** Recommended periods between final spraying and harvest are sometimes not followed, because farmers are ignorant of the requirements, because they or traders want to take advantage of high prices or

⁴ Wrapping the growing fruit in paper to prevent insect attack.

because they have an urgent need for cash. Some legitimate pre-harvest spraying is carried out to both delay fruit maturation and increase storability. In Viet Nam, however, some farmers spray watermelon with a chemical solution, apparently in order to make the skins shinier and more attractive for sale.

- **Early harvest.** Optimum harvest times are well known. However, the case studies suggest that produce is frequently harvested at too early a stage to provide consumers with the ideal eating quality. Early harvest may be because the producing area is distant from the market, because it is the practice to harvest an entire field or tree at one go, for example when this is being done by a contractor or carried out mechanically, or for the same reasons as recommendations regarding the timing of the last pesticide application are ignored. Early harvesting also makes produce more susceptible to physiological disorders. Leaves harvested before maturity wilt rapidly and become unsaleable.
- **Delaying harvest.** Some farmers use pesticides to delay the time of harvest, a practice that is sometimes used by the world's wine grape producers. Dragon fruit farmers in Viet Nam reportedly also do this to postpone harvest until prices rise.
- **Harvesting techniques and equipment.** Poor harvesting techniques can lead to skin breakages, crushing and bruising, thus promoting physiological damage and disease infection. Dirty clippers, knives, harvest bags and field crates can also lead to contamination, as can the placing of harvested produce on the ground and the mixing of clean and dirty produce. The case studies indicate that cleaning of containers is uncommon.
- **Time of day.** Produce is best harvested when the temperature is at its coolest. However, a balance has to be achieved between harvest time and transport time. If the marketing channels do not permit collection soon after harvest then the benefits of harvesting at the coolest part of the day are lost if the produce is left waiting on the farm in the hot sun. Water losses are four times greater in sunlight. Some protection can be provided by storing produce under shade and covering it with damp cloths, but this is rarely done.
- **Preparation of fruits and vegetables by the farmer prior to sale.** Preparatory activities can include sorting, trimming, washing, wiping, brushing, delatexing and post-harvest disease control, e.g. to prevent soft rot in cabbages. In most countries only large-scale growers sort produce by size and maturity at their packing sheds. Even where packing houses are widely used they can often be some distance from farms. Delayed or non-existent treatment to control microbial growth, especially where the temperature and relative humidity are high, can lead to a proliferation of spoilage and of food pathogens. Roots and tubers and other crops are frequently washed prior to sale. Other vegetables, particularly leafy ones, are often watered by farmers to make them look fresher (and increase their weight!). The quality of water used for such washing is frequently questionable and farmers have little knowledge about water-borne contamination. Produce must be dried thoroughly prior to sale; often the materials used for drying also become a source of contamination.

Farm workers including family members can be a source of biological and physical contamination during the handling of fresh fruits and vegetables. Produce can be contaminated by dirty hands and also through sneezing, coughing, and spitting. Sources of contamination include failure to wash hands after visiting the toilet, handling animals, smoking and handling waste food and rubbish. Produce waiting

to be purchased or picked up by traders is usually held at ambient temperature at the side of the road. Animals may walk freely near the fruits or vegetables and there is rarely any protection from dust or other contaminants.

Packaging, transport and storage

Produce that leaves the farmer in perfect condition can still reach the consumer in extremely bad condition. Factors contributing to this include:

- **Packaging quality.** Containers frequently are made from locally available materials. While these are low-cost they have many disadvantages. Poor rigidity, together with bad transport practices, can lead to produce being squashed and bruised. Sharp edges can lead to bruising or piercing of produce. Even where good-quality packaging materials are used there is a tendency to overfill the containers, so leading to produce damage. This particularly occurs when transport is charged on a “per piece” basis. Crates or other containers are rarely lined to protect fruit from contact with the package and from damage during transit; where lining is done it is usually with old newspapers. Damage often occurs when lids are nailed on. Produce is sometimes packed in plastic or string bags, which offer little or no protection.
- **Dirty packaging materials.** Containers are frequently re-used. Cleaning, if carried out at all, is usually of a cursory nature. It is virtually impossible to clean or disinfect traditional materials and such packaging thus represents a source of contamination when reused.
- **Dirty transport vehicles.** On the farm the same transport is invariably used for farmyard manure, live animals, agrochemicals and fertilizers as is used for transporting fresh produce to the market. Efficient cleaning of animal carts or tractor trailers is unusual and produce for sale is frequently transported in bulk, thus being directly exposed to contaminants in the vehicles. Similar problems are observed throughout the marketing chain as trucks are normally used for multiple purposes although, with the exception of crops such as watermelon and cabbage, produce is normally transported with at least some basic packaging. Even where trucks are used primarily for fruits and vegetables, failure to clean them properly can result in contamination by rotting fruit left in the vehicle.
- **Transport practices.** Produce is often damaged by attempts to maximize loads by squeezing as many containers as possible into a vehicle. This negates the considerable care that is sometimes taken at the time of packaging. Produce is damaged by bad roads, excessive speed on such roads, by transport in the heat of the day and by limited air circulation in vehicles, caused by tight stacking. The bottom layers of containers in a truck can collapse during a long journey. Vehicle breakdowns are fairly common, with major implications for the quality of products when they eventually reach the market. Combining produce with differing transport requirements in the same vehicle can also cause problems. Ethylene-producing fruit are sometimes mixed with ethylene-sensitive produce.
- **Handling.** Produce can be handled many times on the way to the final consumer. Those doing the handling, usually labourers, have few incentives to treat fruits and vegetables with care and are usually under pressure to carry out their work quickly. Rough handling leads to bruises and other damage.

- **Storage practices.** Most horticultural products are not suitable for long-term storage. Exceptions are some roots and tubers, onions and garlic, apples, pears and citrus. Ripe, ethylene-releasing fruit needs to be separated from unripe fruit prior to storage, but this is not always done. Every crop has an optimal combination of temperature and relative humidity for storage. In many cases there are differences between varieties. Thus, as a rule, different products should be kept in different stores, but limited storage space means that this is also rarely done. Stores are often dirty and used for inputs and other products as well as fresh produce. Pesticides are also used for storage purposes. In Viet Nam the banned DDT is still used for red onion storage.

Refrigeration is often used for extending the post-harvest life of fruits and vegetables, although it is not common in traditional marketing chains of Asia. Care must be taken to avoid chilling injury as low temperatures may damage plant tissues. For example, if temperatures are mistakenly kept too low, freezing can form ice crystals inside tissues, leading to a general breakdown of tissues when thawing occurs. Blackening of banana skins can be a symptom of chilling, as can softening of the fruit and the appearance of sunken areas in tomatoes, aubergines and peppers. Produce with different storage temperature requirements is often mixed together in transport and storage.

Ripening and produce preparation

Bananas and mangoes are ripened during the marketing chain by using chemicals. Other produce preparation carried out by traders includes grading, sorting, washing and cleaning, waxing, treating against fungal infections and pests, colouring, and watering to preserve freshness. Most such practices have implications for both quality and safety.

- **Washing.** Surface washing can reduce the overall potential for microbial contamination. However, it is important that the water used is clean and is changed frequently, which is not always the case.
- **Fungicide and insecticide application.** Some products are treated with insecticides to protect them against pests such as army worm. Fungicides are used for surface decontamination of citrus and mangoes. Case studies suggest that relatively high doses are used, in the belief that this makes the treatment more effective. In Mindanao, Philippines some traders use benomyl as a post-harvest treatment against decay of bananas, although the fungicide has been recalled. Pre-harvest sprays are sometimes used for post-harvest treatment despite the fact that the spray has to be applied not less than seven days before harvest. Farmers and traders sometimes spray insecticides directly onto fruits and vegetables to keep insects off the produce.⁵
- **Ripening.** There are several approaches to ripening of bananas and mangoes. In India, Pakistan, the Philippines and Thailand, calcium carbide is still used, although in India it is technically banned as it contains impurities, including arsenic hydride.⁶ Recommended application rates are often not followed. A chemical used in India

⁵ R. Cuevas, FAO. Personal communication. 2005.

⁶ Indian officials reportedly destroyed 8.5 tonnes of fruit ripened with calcium carbide. "Something is rotten in fruit trade." The Hindu Business Line Internet Edition, May 16th 2005.

for banana ripening and to impart a yellow gloss to the fruit is sold as a plant growth regulator, not as a ripening agent. Much ripened fruit has an unsatisfactory flavour or aroma because it has not reached maturity before harvest. Although perhaps necessary from a commercial perspective, ripening in much of Asia thus has an impact on both produce quality and safety.

Because a large number of tomatoes are purchased green by traders in Myanmar, ripening is carried out. This is despite the fact that wholesalers in Yangon report that this leads to poor quality produce with a very limited shelf life, as the fruit becomes soft during transport.

- **Watering.** Leafy vegetables are universally watered to preserve freshness during transportation and in markets. Again, the quality of water used may not be suitable for such practices.
- **Waxing, colouring and other treatments.** Waxing is carried out to reduce dehydration, to seal small wounds and to replace natural waxes removed by washing. Waxes can also be used for the application of some fungicides. It is clearly important that waxes and other treatments are approved for human consumption, but this is not always the case. In India some fruits are given a shine by traders using petroleum jelly, which is suspected of being a carcinogen. Furadan, an insecticide, is reportedly used by vendors to give aubergine a glossy, deep purple colour. Also in India, green dyes are applied to capsicum, ladies finger and cucumber.

Wholesale and retail marketing

In many, but not all, Asian countries municipalities tend to regard markets as sources of revenue rather than as essential institutions for the efficient delivery of quality and safe food to consumers. The standard of markets is very poor, as are many marketing practices. Problems in markets include:

- **Poor sanitary conditions.** Arrangements for waste disposal are frequently inadequate. Produce is often sorted in wholesale markets and unsaleable fruits and vegetables are left lying around in heaps. Leafy vegetables are often trimmed before sale and the trimmings discarded without formal disposal arrangements.
- **Exposure of produce to ambient conditions.** Markets in many countries lack shelter and produce is exposed to direct sunlight and rain, which hastens quality decline.
- **Poor packaging materials and practices.** Produce is often moved between markets using second-hand packaging. The Pakistan case study, for example, reports that empty fertilizer and cement bags are used.
- **Sorting and trimming.** At all stages of the marketing chain produce is sorted to remove spoiled fruit. At wholesale and retail stages trimming of leafy vegetables is carried out. Sorting and trimming is frequently done on the ground, in the sunlight and often on bare earth.
- **Retail display on the ground.** Many markets have limited facilities in terms of suitable stalls. Even in those that do have good facilities retailers sometimes prefer to display their produce exposed on the ground, in areas that they believe attract

the most customers. This leads to quality decline and, possibly, to contamination. Poor market management allows such situations to develop, leading to as many traders as possible moving out of the formal facilities to join their competitors in unhygienic locations. A commonly observed problem in retail markets is that purpose-built covered areas, designed for fruit and vegetable traders, become occupied by clothing and dry goods sellers.

- **Handling by retailers and consumers.** Many retail markets lack toilets or suitable washing facilities, leading to poor hygiene for traders. Produce on display is often picked over by consumers. This can lead to bruising and contamination of the produce.

2 Factors inhibiting the supply of high-quality and safe fruits and vegetables by farmers

Chapter 1 reviewed the factors affecting quality and safety of fruits and vegetables in Asian marketing chains. There is extensive knowledge of the technical reasons why quality can be poor and techniques for improving or maintaining quality are well known amongst researchers and specialists. Training materials on how to produce quality produce, how to avoid microbial contamination and on how to improve post-harvest handling are available. Similarly, there is by now a vast body of knowledge about cultivation using reduced quantities of pesticides, such as through IPM approaches, and IPM training programmes have been established in many countries. Given the availability of such knowledge it then becomes relevant to ask why quality and safety problems continue to be a major concern in traditional fruit and vegetable marketing systems of Asia. Why is the knowledge not applied by farmers?

The case studies suggest that the reasons why improved practices are not followed and why known techniques are not adopted can be divided into three categories: market factors, social and economic factors including financial constraints, and information and awareness factors. These will be discussed below. These categories are used for ease of discussion but, clearly, there is much overlap between them.

1. Market-related factors

Market-related factors include the market demand for high-quality and safe produce, the marketing practices employed at farm level and the quality demands placed on farmers by traders.

Market demand. Various national studies reported on by the case studies suggest that quality and safety come relatively low on the list of consumer priorities. Price and location of the retailer are generally considered more important, except by the more affluent. Thus, even if traders wished to market higher quality produce they are constrained in doing so if prices have to rise as a result. Where initiatives have been taken to make available higher quality produce, limited demand for that produce and the limited number of locations at which it can be purchased have jeopardized the programmes in some countries. In Viet Nam, growers of “safe” vegetables close to Ho Chi Minh City found that they could only sell thirty percent of their production at higher prices through specialist outlets. The remainder had to be sold at wet markets⁷ at the prevailing market price. A Safe Vegetables Farmers’ Association in Viet Nam, with a production capacity of 30 tons a day, only managed to sell 700 kg a day to a supermarket chain. There is thus a considerable risk associated with trying to supply produce for which there is presently limited market demand. This risk is exacerbated by the fact that “safe” vegetable production practices often mean that the produce does not meet the appearance criteria demanded by the wider

⁷ The term “wet” market is widely used to refer to purpose-built or street retail markets for fresh produce.

market. Farmers cannot change production practices on a field-by-field basis as demand increases. If they are going to follow “safe” practices this has to be done on the whole farm, with the consequent market risks.

As Asian economies develop, the consequent growth in purchasing power inevitably leads to an increased demand for fruits and vegetables. In responding to this demand farmers, often with limited land, have sought to increase yields. Studies in Nepal have identified more intensive production as being the main reason for increasing pesticide residue levels. A related problem is that FAO and others have for long encouraged farmers to address problems of seasonal glut and market price collapse by developing a capacity to produce out of season. While such a policy may be economically rational for skilful farmers and can lead to high returns, it has to be recognized that out-of-season production generally involves having to contend with a potential lack of suitable water sources and a greater range of pests and diseases. In turn, this usually necessitates an increased use of agrochemicals. In Nepal, for example, it was found that residue levels were higher for summer vegetables than for winter ones. In P.R. China in 2003-2004 excessive residue levels were found in 19 percent of samples in the summer but this dropped to four percent in the cool season.⁸ Traditional marketing systems are used to the vagaries of seasonal production. However, drawing on the example of western supermarket chains, supermarkets in Asia are now attempting to provide year-round availability of most products. Farmers therefore face the problem of providing supply continuity without using excessive amounts of agrochemicals.

Marketing practices at farm level. The main problem faced by farmers who wish to apply new techniques and practices to improve quality is that in order to do so they may have to develop entirely new marketing channels (see Chapter 6). The great majority of traditional traders are not equipped to buy more than one grade, which can loosely be described as “fair average quality” and are not equipped to provide significant guidance on quality improvement. Any grading that takes place is usually carried out at subsequent stages of the marketing chain, not at farm gate. Thus, although traders may well refuse to purchase produce because it does not meet minimum standards there is no price incentive for farmers to produce quality above those standards. In the case of pesticide residues there may actually be a disincentive to produce safer produce, if by so doing the farmer produces less attractive fruits and vegetables, which risk not meeting the minimum standards of the marketing channels.

Where farmers face unreliable marketing services and considerable price risk (e.g. for products often subject to gluts) there is little incentive to do more than the bare minimum necessary to make a sale. The case study of Thailand, for example, attributes the reluctance of some baby corn farmers to change their farming practices to the “erratic” buying behaviour of traders. The person buying produce from farmers can often be the first in a fairly long, disaggregated chain. In the Myanmar tomato trade, agents buy from farmers and then sell the tomatoes to local wholesalers. In turn, these supply wholesalers in the big cities, who sell to retailers. Under such circumstances it would appear difficult for any meaningful signals about quality to reach the farmer. Furthermore, the agents who buy from the farmers do not take title to the produce but buy on a commission basis. It may be

⁸ World Bank, 2005.

in their interests to maximise purchases even when farmers offer tomatoes that have not reached the mature green stage.

Sometimes traders are able to introduce new practices to farmers, despite lengthy supply chains. In Viet Nam, for example, farmers started to use a new variety of tomato that turned out to be softer and have a shorter shelf life than established varieties. This information was passed back to farmers, who did not use the tomato variety in the following year. It is possibly easier to transmit information about varieties than about more subjective quality issues such as ripeness, appearance, etc. but traders would appear to be an important potential conduit for information about safe and unsafe practices.

It is a common practice in Asia for traders to make financial advances to farmers to enable them to buy inputs and pay for farm labour and, in some cases, to help them meet their daily living expenses.⁹ For example, mango producers in northern India are estimated to be financed to the tune of Rs. 300 million¹⁰ annually by Delhi-based traders. With such an arrangement the trader, in the short run at least, becomes a captive market for the farmer. The trader cannot reject the produce as the loan is repaid out of the sales revenue. This may reduce the incentive on the part of the farmer to supply quality produce, particularly where traders do not pay price premiums for quality or even prescribe minimum standards.

Another common practice is for traders to “buy the field” or “buy the orchard”. This means that the trader (often known as a contractor) pays the farmer a lump sum for the entire harvest from the field or orchard. Arrangements vary: in some cases the contractor may harvest immediately after the deal is reached; in others the arrangement may be made some time before harvest. In the latter case the trader may take over all activities to bring the crop to the harvest stage or the contract may require the farmer to do this. Either way, the farmer would appear to have limited interest in quality matters once agreement has been reached with the contractor. In the Philippines, commercial mango farmers are often professionals or entrepreneurs living in urban areas. They usually delegate all production and post-production activities to sprayer-contractors who bear all production costs. Payment for this is in the form of revenue sharing.

Quality criteria imposed by traders. In Nepal, farmers indicated that traders place great emphasis on the physical appearance of produce above everything else, a fact confirmed by the traders themselves who say they are responding to retailers’ requests for produce that looks good on retail display. Retailers, on the other hand, indicate that they just sell what the wholesalers supply, although they did confirm that appearance was the most important criterion for them, reflecting consumer demand. Farmers contacted said that they had to use pesticides in order to grow produce with an appealing appearance. Although many were aware of possible dangers of using pesticides they were not prepared to risk market rejection or possible crop loss by not using them. The desire to produce blemish-free fruit to satisfy traders’ demands is given as the reason why mango farmers in Mindanao in the Philippines sometimes spray up to thirteen times a year during the rainy season.

⁹ See Shepherd, 2004.

¹⁰ One US\$ = Rp.43.5 in July 2005.

2. Economic, financial and social factors

Farmers are generally convinced that failure to use pesticides reduces their yields and can make their produce unsaleable. In Thailand, the apparent economic benefits of using pesticides are strengthened by the fact that pesticides are exempt from import duties and other taxes. When there are outbreaks of pests, agrochemicals are provided to farmers free of charge. In Nepal, some pesticides have also been exempt from sales tax as a response to unauthorized imports from India, while in Viet Nam customs duties and low import taxes, combined with the growth of domestic production, have led to a significant growth in pesticide use in the last decade. In several countries credit schemes provide pesticides as fixed components of in-kind loans, thus contributing to high pesticide use.

Positive results from IPM trials that indicate that IPM can be more profitable than the prevailing farming practices have not reached most farmers. Such results would probably not be accepted by risk-averse farmers without first seeing demonstrations of improved practices, but extension capacity to demonstrate IPM-based alternatives to fruit and vegetable growers is generally limited.

The Indian case study reports that farmers estimate that a significant reduction in pesticide use could reduce yields by thirty percent and lower quality. According to the Thailand case study, tangerine farmers estimate crop losses from pests to be around 25 percent, even with heavy spraying. They believe that these losses would increase to 80 percent if they didn't spray. Seventy percent of those interviewed claimed that higher pesticide prices would not convince them to change their spraying patterns. In Myanmar, farmers increase their spraying rates after they have sold their first harvest, when they have more money to buy the chemicals. Programmes to promote improved practices therefore need to address the concern of small, resource-poor farmers to minimise risk.

Several case studies reported that banned pesticides continue to be used, often allegedly being smuggled in from neighbouring countries. A study of farmers in Phu Yen province of Viet Nam found that 84 percent had used banned agrochemicals, often not knowing that they were banned. In Myanmar, the pesticide monocrotophos continues to be used by about half the tomato farmers interviewed, despite the fact that farmers are aware that it is illegal. This is attributed to the fact that it is much cheaper than legal chemicals.

In Thailand, problems of land ownership and tenure and the widespread use of short-term rental contracts for land discourage farmers from making investments in change, such as constructing packing sheds or building toilets or washing facilities for workers (as required by GAPs). Formal land ownership restrictions in India and land shortages in other countries encourage a greater intensification of horticultural production, as do labour shortages in Thailand, which have led to a greater use of herbicides. Given the limited resources available to most of them, it is clearly difficult for farmers to make changes requiring significant investments.

Farmers generally attach more importance to the price they will receive, rather than to quality or safety. The concern to maximise income encourages farmers to make sales when

prices are high, regardless of safety or quality considerations. This has already been noted in the case of the sale of green tomatoes by Myanmar's farmers but farmers in all countries sometimes sell shortly after having carried out spraying, if the price seems favourable. Two-thirds of Myanmar tomato farmers interviewed admitted to selling tomatoes almost immediately after spraying, thereby ignoring pre-harvest intervals that are prescribed to avoid pesticide residues on crops. Farmers taking part in IPM training in Viet Nam admitted that before they were trained they had practised spraying just one or two days before harvest.

For small-scale farmers the cost and complications of developing linkages with new outlets that demand improved quality and safety can often outweigh the benefits. As a minimum they need to organise themselves into groups or develop contractual arrangements with intermediaries in order to be able to supply the quantities required by supermarkets.¹¹ However, indications are that even that may not be adequate, and that larger farmers will come to dominate the supermarket trade. Where farmers have sought to improve farming practices and have developed specific linkages with supermarkets and other outlets, initial high returns may not last. There was a 200 percent premium for "hygienic" vegetables in 1994 in Thailand. By 2004 this had come down to 40 percent. The extent to which this decline has resulted from price pressure exerted by buyers or from a general scaling up of quality of all produce is unclear. Furthermore, farmers supplying local traders can usually obtain immediate payment; those supplying supermarkets may have to wait up to 90 days to be paid. Price premiums may not compensate farmers for higher production costs. Studies in Viet Nam found that "safe" vegetable yields are 10-15 percent lower than traditional production practices and that production costs can be 25-30 percent higher when using greenhouses. Improved practices generally require additional labour for weeding, insect catching, etc. which can be a major constraint when labour is in short supply. On the other hand, studies of improved practices using the IPM Decision Tool (IDT) on mangoes in the Philippines found that although yields were slightly less than with prevailing practices, this was more than compensated for by reduced pesticide costs.

Some farmers feel an element of social pressure to conform to the prevailing pesticide spraying patterns, believing that, if they stopped spraying, their neighbours' farms could suffer as well as their own. This issue was highlighted by the case studies from both Thailand and Nepal and may be an important barrier to the adoption of improved practices, unless all farmers in one area can be persuaded to adopt IPM practices at the same time.

3. Information and awareness

In a Philippines survey of vegetable farmers' perceptions of vegetable quality and safety, freshness ranked first and safety just twelfth out of thirteen attributes. Lack of reliable information and poor education affect the ability of farmers to adopt safe practices. Access to information remains an impediment. A study in Mindanao found significant differences between perceptions of vegetable farmers and those of market intermediaries about the nature of consumer demand. The authors concluded that closer collaboration among

¹¹ For a discussion of Asian supermarket procurement channels and their impact on small farmers, see: Chen *et al.*, 2005.

supply chain members was critical and this should lead to a common definition of specifications for each vegetable.¹²

In some cases illiteracy means that farmers are unable to read the labels on pesticide containers. Frequently the labels are not in local languages and some chemicals are sold in containers without labels. The main source of information for farmers in nearly all countries of the region is the local agrochemical retailer, who clearly has an interest in maximizing sales. In many countries, pesticide importing companies run aggressive campaigns to promote their products. Lacking alternative sources of information farmers are naturally concerned that output would be affected were they to change their current practices. Although IPM programmes have been introduced in most countries they are not yet widely available. Without training in IPM techniques fruit farmers invariably practise calendar spraying¹³ and vegetable farmers tend to spray immediately on signs of pests. While those who had been trained in IPM in Viet Nam were found to follow some improved practices, a high proportion of those who had been trained continued to throw plant residues into water as a waste disposal method, thus contaminating the water.

In the 1990s more than half of Thai farmers reportedly applied pesticide doses higher than those indicated on the label. Decisions on pesticides to use and application rates were made on the basis of retailer recommendations or the established practices in the community. Alternative sources of information are reportedly difficult to obtain. Case studies report that farmers continue to apply heavy doses of pesticides even when, as in the case of bananas in Nepal, there is limited evidence that they control infestation. Extension services should be able to provide assistance but knowledge of extension officers of quality and safety matters is reported to be limited in most countries. In China, extension agents who are responsible for providing information on safe pesticide use also receive part of their income from the sale of pesticides.¹⁴

Farmers have insufficient information to enable them to judge whether they are applying pesticides in an economic way. Moreover, they are generally not aware that inappropriate pesticide use can exacerbate pest problems. This results in unnecessarily high levels of use and consolidates incorrect perceptions that intensive use is necessary to deal with the high pest pressure being faced. While farmers clearly know that they are applying large amounts of agrochemicals they are probably not always aware that such applications lead to residues in the fruits and vegetables they grow. With limited testing facilities, which are usually only available in areas distant from the farms, it is difficult to demonstrate the existence of such residues to farmers.

While farmers in the Philippines are becoming increasingly aware of issues relating to pesticide use, the case study reports that there is virtually no knowledge of possible microbial hazards associated with fruit and vegetable production. Other case studies make similar observations. In general this seems to be a much neglected issue in all countries and extension services are provided with limited information about the dangers and ways of avoiding them.

¹² Concepcion *et al.*, 2005.

¹³ spraying according to the date or the stage of growth of the crop, rather than in response to identified pests.

¹⁴ World Bank, 2005.

3 Factors constraining the capacity of traders to supply high quality and safe fruits and vegetables

Case studies indicate that in most countries of the region the main emphasis of the majority of poorer consumers is on price. Faced with this situation it is difficult for traders to promote improved quality and safety unless such improvements can be brought about without increasing prices for consumers. Fruit and vegetable marketing in most countries is highly competitive, leaving little opportunity to sell higher-quality but higher-priced produce. As the case study of Pakistan emphasizes, traders are usually more interested in competing on price than on quality. This may be because they have little appreciation of the potential for quality and safety improvement but is more likely to be a reflection of the consumer demand. Nevertheless, there are some indications of changes. These are often being brought about by globalization, which has led to increased imports of fresh produce in the region. Wholesale traders, seeing that imports are of higher quality than the produce they can supply and that imports obtain higher prices, are beginning to put pressure on farmers to match import quality. This has been noted in Azadpur market in New Delhi where apple traders have faced strong competition from imports from China, Australia and the USA.

In most countries there is a growing demand among the upper middle class and, in some, the middle class for better quality fruits and vegetables, particularly fruits, which in many societies remain a luxury. Richer consumers are beginning to demand better quality. In some countries supermarkets are beginning to address this demand and there are special quality programmes, such as the “safe” vegetable programme of Viet Nam. However, this demand is not usually supplied through traditional marketing channels. Where it is, as in Myanmar, the supermarkets source their products from wholesale markets and thus sell exactly the same fruits and vegetables as sold through traditional channels. Quality may possibly be higher, through more rigorous purchasing criteria and better storage practices in the supermarkets, and the produce is cleaned and graded before sale, but any safety problems are exactly the same. In one or two countries traditional wholesale markets and the traders working in them are beginning to recognize the need to compete with supermarkets by offering higher quality produce. However, developments in this direction have to date been very tentative.

Throughout the region traditional marketing channels seem to have a very limited capacity to handle more than one quality grade of a particular product. While there is some grading carried out, usually on the basis of size, there is little quality differentiation. Traders are usually unable to trade in other than “fair average quality”. The traditional marketing systems neither require the purchase of higher quality produce, nor are they equipped for separate handling of different qualities en route to the consumer. Furthermore, the standard of fruit and vegetable handling in the marketing chain is often so bad that even were it possible for traders to buy different qualities from farmers there may be little quality differentiation by the time the consumer makes the purchase. The common practice of

unpacking, sorting and repacking, which may take place two or three times in some of the lengthier marketing chains, means that there is little incentive to improve farm-level handling and packing.¹⁵

In several countries traders are constrained by the poor infrastructure of the markets in which they operate. Few wholesale markets are GMP certified. Different markets operate different systems. In countries where wholesale traders can buy facilities in a market or rent them on a long-term lease, there may be scope for them to make infrastructural improvements. In others, where leases may be on a short-term basis, or even seasonal as is the case in Delhi's Azadpur terminal market for produce such as apples and mangoes, there would appear to be little opportunity to make improvements. Traders, usually working through associations, can work with market management to improve operations of markets and, *inter alia*, improve quality and safety. This usually involves relatively simple day-to-day matters, such as pointing out the need for maintenance and cleaning (e.g. blocked drains).¹⁶ Some associations have collaborated with municipalities in the planning and design of new markets but in many countries there is reluctance on the part of municipalities to invest in markets unless the costs of not doing so, e.g. through traffic congestion, are greater than the costs of the investments. Thus, while municipalities may invest in new markets, it is difficult to persuade them to make improvements to existing markets. By and large markets are seen primarily as sources of revenue for local authorities.

Retail markets are often of poor quality or non-existent. The Nepal report notes that in the absence of organized markets the number of street vendors and itinerant traders has grown rapidly. Not only does this have implications for quality and safety but it also means that if the authorities had the resources to implement fresh produce inspection at retail level this would be difficult to carry out because the retailers are much dispersed.

Storage facilities available to traders are often of poor quality and fail to comply with codes of hygiene. Suitable storage is rarely provided in wholesale or retail markets and when traders own their own facilities they usually lack the financial resources to make significant improvements to their storage. Several of the case studies pointed out the need of wholesalers for improved access to cold storage. While this would be beneficial for fruits, and vegetables such as potatoes, it serves little purpose for perishable produce unless there is a cold chain that stretches from farm to retail store. For reasons of cost and management capacity such a cold chain is impractical in most traditional marketing systems at the present time.

Few traders own vehicles for their trading operations. The seasonal nature of their work, the investments required, the inability to generate sufficient purchases to fill a truck and the complexity of running a vehicle means that most prefer to hire transport. Unless they are able to hire an entire vehicle they are not really in a position to control the way in which produce is handled. Smaller traders thus may find their produce being squeezed into a truck together with that of other traders, trampled on in the loading process and badly handled on arrival. Furthermore, the quality of roads in many countries of the region is

¹⁵ Paty, 2005.

¹⁶ see Shepherd, 2005.

poor and, as discussed earlier, this contributes to the damage experienced by produce during transit.

Post-harvest handling training activities provided by governments and donors are nearly always targeted at farmers. Rarely is training offered to traders. In Myanmar, the Government uses radio programmes to educate food retailers about hygienic practices but there is no support on quality and general safety issues. In all countries studied there appear to be few activities to provide post-harvest advice to traders. Thus traders may not be fully aware of the causes of the quality problems that they experience on a daily basis and therefore unable to implement improvement activities.

China has recently introduced several initiatives to promote safer food (Chapter 5). However, it appears that these are not well known by the trade. Labels used for “green” food, “organic” food and “pollution-free” food are not well recognized by traders and many are unclear about their meaning. Seventy percent of those traders surveyed were found to have no better than an ambiguous understanding of the meaning of the terms. As evidence for this, a recent survey by the World Bank found that supermarket managers had difficulty in obtaining produce that met safety requirements and found that a high percentage of produce did not comply with established standards.¹⁷

¹⁷ World Bank, 2005.

4 Factors affecting fruit and vegetable purchases by consumers

Consumers' requirements in terms of fruit and vegetable quality and safety vary considerably according to country, sex, age, socioeconomic status and other factors. Nevertheless, there are some quality criteria that are almost universal. Presentation, appearance, colour, uniformity, ripeness and freshness are the main components of the decision to purchase at the point of sale. Other quality criteria, such as flavour, aroma and texture cannot be easily assessed at the shop but consumers can base purchase decisions on previous experiences of a particular variety or appearance of produce or of fruits and vegetables purchased from a particular shop. In some cases it may be possible to judge internal quality from external appearance. By looking at fruit, for example, it may be possible to tell whether it is ripe or unripe and, therefore, whether it is sweet or sour. Where consumers are permitted to touch fruit, quality can be assessed by smell, degree of hardness and even sound. As noted earlier, though, touching of fruit by consumers can have a negative impact on quality.

Many consumers decide what to buy only when inside the store. Thus appearance is one of the most important factors affecting purchases. Grading contributes to consumer acceptance, in part by indicating that a degree of selection has already taken place. In some cases internal or external defects do not affect product excellence but are usually seen by consumers as reasons to reject the produce. Freshness, which is the condition of being as close to the harvest as possible, is important for vegetables, particularly leafy ones. Ripeness, used for fruits, refers to the point of maximum edible quality, which may be several months after harvest for fruits that can be kept in store. Colour is an important factor in consumer choice, as an indicator of ripeness in non-climacteric fruit, where no changes take place after harvest, and as an indicator of age, such as where green leaves are yellowing.

It is rarely possible to recognize uncontaminated food when it is on retail display. Thus the case studies suggest that those consumers who are concerned about fruit and vegetable safety, and can afford to do something about it, tend to make their purchasing decisions on the basis of trusting the store or their usual retailer. This is seen particularly when consumers purchase produce to be eaten raw or with minimal preparation. In Thailand, consumers are said to have more trust in supermarkets than in certification schemes, despite the fact that, at present, the safety standards of some Thai supermarkets may not be much higher than those of competing wet markets.

Although there is an increasing awareness of food safety issues in Asia, as a result of Bovine Spongiform Encephalopathy (BSE), avian influenza and cases of poisoning after fruit and vegetable consumption (see Chapter 5), this awareness has yet to be translated into changes in purchasing decisions, other than among upper middle-class consumers in a few countries. Where there is concern expressed by consumers about dangers from fruit and vegetable consumption, this concern seems confined to dangers from pesticide residues. There is little knowledge of, and hence limited concern about, microbial and

parasitic contamination, either by consumers or by the marketing chain. Even stores that stress that their produce is pesticide-free, or at least pesticide-reduced, may pay no attention to other forms of contamination.

Consumers surveyed in Pakistan stressed general appearance, shape, colour, ripeness, absence of damage or decay and taste as being factors influencing their purchase decisions. Few had knowledge of safety factors or expressed concern about safety. The general view was that in the absence of information, such as labels identifying produce as being pesticide-free, they had no option except to buy whatever was available in the market. For the majority of poor consumers price is the dominant factor affecting purchase decisions. In Nepal, consumers expressed concern about possible pesticide poisoning but not about microbial infections. There was a general belief that eating food that had been both washed and cooked meant that any dangers would be avoided. Physical appearance was then the major factor affecting consumer choice when buying.

In Myanmar, surveys found that consumer choice was based on freshness, size, absence of blemishes or bruises, maturity and shape, in that order. Two-thirds of consumers interviewed in Yangon for the case study were unaware of safety implications and the same proportion indicated that they would not be able to pay more for safer produce. Those that did have some awareness tended to shop in supermarkets. Purchase practices are strongly correlated with incomes. For example, those consumers without refrigerators would buy produce such as tomatoes with different degrees of ripeness, in order to avoid daily trips to market.

In Viet Nam, a study of Ho Chi Minh City consumers found that location was the dominant factor affecting purchases and was considered more important than produce freshness, safety or price. Consumers in Viet Nam do have the option to buy “safe” vegetables (see Chapter 5). However, sales of such vegetables account for only around five percent of total consumption, despite past fatalities from consuming fruits and vegetables. In one survey in Ho Chi Minh City consumers gave as reasons for not buying “safe” vegetables the inconvenient location of the stores selling them (56 percent of responses), a lack of conviction that such vegetables were indeed safer (28 percent) and the high prices (16 percent). In a different survey in the Mekong Delta consumers said that the range of safe vegetable products was limited (33 percent), they believed that washing vegetables could remove all toxins (31 percent), prices were too high (12 percent) and store locations were inappropriate (8 percent). Consumers in Viet Nam were also asked about their willingness to pay for safer produce. In Ho Chi Minh City around 80 percent of respondents indicated that they would pay ten percent more, but only around fifteen percent were prepared to pay thirty percent more for safe produce.

A survey of consumers in Los Baños in the Philippines found that three quarters were aware of hazards associated with fruit and vegetable consumption. About one-third of consumers expressed a wish to buy organic produce, despite the 30 - 50 percent price premium. However, the survey, in a university town, would not have been representative of all consumers in the country. Low-income consumers surveyed based purchase decisions on affordability, availability and quality, in that order. Most consumers surveyed felt that produce that was fresh, clean and packed was also safe. Many of those concerned with

safety purchased fruits and vegetables from supermarkets in expectation of higher safety standards. Some consumers reported looking for produce with insect bites, on the grounds that these were indicators that the produce had not been sprayed excessively. Mangoes and strawberries were perceived to have the highest food safety risk among fruits and green leaves among vegetables. Other case studies indicated that produce that was eaten without peeling was considered by consumers to be potentially the most harmful.

In general it appears that price and convenience of the retail outlet location are as, if not more, important than quality when poorer consumers come to purchase produce. In other words, consumers purchase fruits and vegetables at prices they can afford and, at those prices, make purchase decisions on the basis of quality criteria. While consumers are aware of safety issues, safety does not appear to play a vital role in consumer choice, except among the higher income groups, where safety becomes an important component of product value.¹⁸ There seems to be a widespread suspicion that fruits and vegetables advertised as being safe are not. At the same time, in countries where supermarkets are important, there seems to be a general belief that produce purchased from them is likely to be safer. This is despite the fact that supermarkets often procure their produce from the same channels as do wet markets and that supermarket display practices that enable consumers to handle the fruits and vegetables may actually make them less safe.

¹⁸ see Speece, 2002.

5 Standards, regulations and national programmes to promote improved quality and safety

Standards, regulations and their impact

The exact impact of uncontrolled pesticide use and other unacceptable practices on fruits and vegetables is almost impossible to quantify. Several of the pesticides that are being used are known to pose long-term risks to human health but little concrete research exists to quantify the actual impact in Asia. Acute poisoning can occur if crops are consumed that have been over-dosed or treated shortly before harvest with highly toxic pesticides. Microbial infection can lead to immediate illness, even death, and there are recorded cases of this within the Asian region. The extent of the problem is difficult to gauge. While contamination that causes the deaths of several people will clearly be noticed, individual illnesses or deaths may not be attributed to contaminated food due to misdiagnosis, to the fact that people affected do not seek or are unable to seek medical attention, or to the fact that health systems do not keep good records.

All countries have agencies responsible for registering pesticides and other chemicals and for controlling their use. Unfortunately, the picture that emerges throughout the region is of ineffective controls due to a multiplicity of ill-coordinated agencies and, sometimes, a lack of resources. For example, in the Republic of Korea there are eight different agencies involved in implementation and regulation, with no clear delineation of responsibilities.¹⁹ Throughout the region, there is often very limited liaison between those agencies charged with promoting food safety and those charged with controlling pesticide use and promoting good agricultural practices.

In Nepal standards exist for processed foods but none presently exists for fresh produce, although this is to be rectified. The Pesticide Act of 1991 and associated Rules of 1994 have been recognized as inadequate and incapable of implementation. The Act requires the approximately 4 000 pesticide retailers to be registered. Retailers are required to undergo a two-day training course in order to obtain a licence and are issued with a booklet providing guidance on the most suitable pesticides for each crop. Each district has one Pesticide Inspector who is supposed to ensure the correct use of pesticides, but there is no meaningful regulation of pesticide use. A survey conducted by the Department of Food Technology and Quality Control of the Ministry of Agriculture and Cooperatives identified increasing levels of pesticide use, noting that residue levels are higher for summer (or off-season) vegetables. Considerable contamination of soil, air and water were identified by the same study. Even if it were possible for a country such as Nepal to devote resources to the regular testing of fresh produce samples, the case study conducted for FAO notes that it would be almost impossible to trace the source of produce exceeding MRLs.

¹⁹ Lee, 2005.

Numerous illnesses due to use of pesticides are reported in Nepal although the main victims of pesticides appear to be the farmers themselves.

In Pakistan there are no formal standards relating to fruit and vegetable quality and safety. Legislation covers processed foods and the catering trade, but does not cover fresh produce. The limited number of residue testing facilities and the high cost of testing (US\$50-70 for one residue analysis) means that it would not be really feasible for the domestic trade to establish residue levels as a quality criterion, even if traders considered this important. Over the years Pakistan's researchers have carried out many surveys of pesticide residue levels in fruits and vegetables. High proportions of produce have been found to be contaminated and surveys have recorded that up to one half of some fruits and vegetables have exceeded MRLs. In 2000, a survey of fruits and vegetables in the Multan area found even higher percentages exceeding MRLs. Multan is a cotton-growing area and it appears that chemicals supplied for use on cotton are also being widely used on fruits and vegetables.

In Myanmar, there are several acts regulating pesticide use and a Pesticide Registration Board (PRB) was established in 1992. Education and training in the safe handling of pesticides is provided by the Ministry of Agriculture and Irrigation. Despite this Myanmar's farmers continue to misuse pesticides and use banned pesticides reportedly smuggled in from neighbouring countries. The Government lacks the resources necessary to control this. Greater dissemination of information by the PRB would appear to be desirable. As in other countries, there appears to be little liaison between the National Food and Drug Administration, which has responsibility for food safety, and the PRB. There appears to be little testing for MRLs. A similar situation is reported in Cambodia, with duplication of regulatory activity, fragmented surveillance and a lack of coordination.²⁰

Food safety in Thailand is governed by the Food Act of 1979. Under the Act the Ministry of Public Health has issued a number of notifications to clarify what is considered as dangerous. The most recent, issued in 2003, covers acceptable levels of pesticide residues. Grading and packing sheds must be certified by the Ministry, and this requires a hygiene inspection. Such establishments are encouraged to become GMP²¹-certified and some of the more advanced are also HACCP²²-certified. GMP certification is provided under a special programme of the Ministry of Agriculture and Cooperatives. The Ministry also has a programme underway to create a network between packhouses and GAP²³-certified farms, involving inspection and sample testing from both farms and packing establishments. The Department of Agriculture has about 700 inspectors competent to certify farms as GAP compliant, although this is primarily for export production. Hygienic and sanitary practice codes for markets, retailers, restaurants and street food vendors are covered by the Public Health Act of 1992. Regulations under the Food Act of 1992 also specify that fresh fruits and vegetables must be free of chemical or microbiological contamination that could cause disease or health risks. However, the case study on Thailand notes that enforcement of the various rules and regulations tends to be weak at all levels. Banned pesticides continue to be used, either because old stocks are still available or

²⁰ Phat Leng, 2005.

²¹ Good Manufacturing Practices

²² Hazard Analysis and Critical Control Point

²³ Good Agricultural Practices

because of illegal imports. Fruits and vegetables supplied under various safe vegetable schemes are often sold with high levels of pesticides. Many retail facilities continue to operate under unsafe conditions. The case study concludes that weak institutional coordination is a major problem and that this leads to a lack of regulatory enforcement.

In India, there are now proposals for an integrated food law but, presently, there are multiple laws and regulations at both central and state level. This has led to inefficient management, which often culminates in unnecessary harassment and an approach that emphasizes inspection rather than improvement. The Agricultural Produce (Grading and Marking) Act of 1937 provides the enabling legislation for quality and safety regulations. AGMARK standards for nineteen fruits and vegetables were framed, with two or three grades prescribed for each product. In framing the standards there was little consultation with domestic traders. The standards are voluntary on the domestic market. A considerable Government-funded programme was undertaken in the 1970s to promote AGMARK standards at farmer level. However, the trade did not use these grades for transactions and the standards were not linked to the price received, thus providing no incentive to farmers to grade. Rules introduced in 2004 under the Prevention of Food Adulteration Act stipulate approved residue levels of heavy metals and pesticides in fruits and vegetables. However, previous experiences with an Act for processed foods have not been too positive. Adulterated food rarely leads to criminal convictions but the Act has provided arbitrary powers for inspectors, enabling them to indulge in corrupt practices.

The Central Insecticide Board of India registers pesticides for domestic use. This Board is not responsible for establishing MRLs or ADIs (Acceptable Daily Intakes) of the registered pesticides and there is no linkage between the establishment of MRLs by the Ministry of Health and the registering of a pesticide. As a consequence, sixty percent of registered pesticides presently have no approved MRLs. As noted above, this inconsistency is now being addressed by proposals for an Integrated Food Law. As the Indian case study notes, the present situation can lead to anomalies whereby a farmer can legitimately use a registered pesticide but is breaking the law if he or she sells produce that contains any residues of that chemical as, in the absence of an MRL having been established, the MRL for the pesticide is considered to be zero.

Despite high pesticide use by farmers in India, the use of possibly damaging chemicals to improve the appearance of produce during marketing and the dirty conditions in many markets, there are very few checks of fruits and vegetables for contamination. The case study was unable to identify examples of where market managers had been required to rectify unhygienic conditions. Even an advanced and relatively affluent city such as Bangalore has no pesticide residue testing facilities available to the Municipality. Yet surveys by the All-India Coordinated Research Project for Pesticide Residues have found pesticides (including DDT, which is banned in many countries) at levels far exceeding those recommended as safe. Surveys between 1986 and 1996 found 55 percent of samples to be contaminated, with about ten percent exceeding MRLs. In Uttar Pradesh and Kerala all samples were reported to be contaminated, with around one half above the MRLs. Surveys by other agencies have reported similar results. Other studies have found that vegetables grown in and around urban areas are contaminated with toxins.

In the Philippines, grades and standards were formulated for twenty fruits and vegetables in 1963, but these have not been widely disseminated and have never been used by the private sector. New standards are under development, essentially following Codex standards and have been subject to public consultation. Again, it is unlikely that the domestic trade will adopt these voluntary standards. There are six regional laboratories capable of testing for pesticides but these are inadequate to cover the major regions of the country. Furthermore, the same situation as faced by India is noted: there are no MRLs established for many pesticides. In 2003 the Department of Agriculture analyzed 632 samples of 25 types of vegetable and four fruits. Sixteen percent were found to be positive for pesticide residues but only one percent exceeded established MRLs. As with all other countries there appears to be very little testing for possible microbial contamination. Data on such contamination becomes available when funding is obtained to carry out studies but such studies are not followed up with activities to improve production or post-harvest practices.

The best-documented cases of deaths due to fruit and vegetable consumption come from Viet Nam. In 1995 there were 13 000 documented cases of poisoning from fruits and vegetables, leading to 354 deaths in the Mekong River Delta. Between 1999 and 2002 there were 19 500 documented cases and 250 deaths. The identified causes of the illnesses and deaths were, firstly, microbial infections, followed by chemical contamination and natural toxins present in the produce. In response to such events the Government of Viet Nam introduced a “safe” vegetable programme, as will be discussed below. However, this programme applies to relatively limited areas of production. Given this, and the extent of past illness and fatalities, it is perhaps surprising that recent surveys have found relatively few samples in Viet Nam that exceed Codex MRLs. At the end of 2003 Viet Nam introduced a comprehensive Ordinance on Hygiene and Safety of Foodstuffs, which goes a long way towards overcoming the problems of regulatory coordination discussed at the beginning of this Chapter.

According to Chinese statistics 500 000 people a year suffer from poisoning as a result of pesticide residues, with the death toll exceeding 500,²⁴ but the percentage caused by fruit and vegetable consumption is unclear. Recent surveys in Beijing found twenty to thirty percent of fruits and vegetables to contain excessive levels of pesticides or heavy metals. Use of pesticides on cash crops such as cotton can contaminate fruits and vegetables grown on neighbouring plots. Methamidophos, a highly toxic pesticide used for tree crops, is often found in high levels in fruit and vegetables.²⁵ As in Pakistan it may also be the case that farmers are using such inappropriate chemicals directly on their food crops.

Concern about food safety was strengthened by the SARS contagion in 2003, which originated in P.R. China, and by problems with fake baby milk in 2004. As a consequence the country is now embarking on an ambitious programme of improvements. The Ministry of Agriculture has introduced a “pollution-free” food plan to supervise the entire quality control process, while the Ministry of Health has developed an Action Plan for Food Safety to establish food hygiene laws, to set up a pollutant monitoring and information system and to supervise food processing practices. However, as in other countries

²⁴ World Bank, 2005.

²⁵ *Ibid.*

contradictions and conflicts between laws and regulations exist. Laws relating to food hygiene are made by the Ministry of Health, relating to pesticide use by the Ministry of Agriculture and relating to product quality by the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ). Policies and regulations tend to reflect the views of individual ministries, which are inclined to strengthen their own administrative power rather than cooperate with other agencies.

National programmes for quality and safety

While all countries studied apply produce standards to varying degrees of effectiveness, particularly in relation to pesticide residues, only a few countries have introduced specific programmes that help consumers to identify produce with particular characteristics. P.R. China has three categories: organic vegetables, “green” vegetables and “pollution-free” vegetables. Pollution-free vegetables are supposed to be the national minimum standard for fresh produce but it is likely to be some years before such standards are fully applied. Certification is both of the production location and of the product, with 4 100 locations having been certified by May 2003. Most fruits and vegetables sold in supermarkets still do not reach minimum standards and are referred to as “normal” produce. Although a few wholesale markets, such as one in Sichuan Province, are beginning to develop a capacity to handle produce specifically identified as pollution-free, almost all produce sold through traditional channels still falls into the “normal” category. Farmers have experienced difficulties in meeting “pollution-free” criteria, which they see as labour intensive. There remains a preference for selling through traditional channels. “Green” food is supposed to be non-polluted, safe, nutritious, and grown in a sustainable (e.g. minimal energy consumption) manner. Food meeting these standards can use an authentication symbol issued by one of 38 branches of the Green Food Development Centre. By the end of 2002 there were 1 756 “green” food enterprises. The Organic Food Distribution Centre (OFDC) in China was accredited by IFOAM²⁶ in 2002. Prices obtained by organic products are said to be 50 percent higher than normal products while “green” produce commands a premium of around 10 - 20 percent.

In addition to national programmes, several large cities in P.R. China are implementing their own programmes. Beijing, which will host the Olympics in 2008, introduced the “Meat and Vegetable Quality Reassurance Project” in August 2002. The aim is to develop a “from farm to dining table” control system, involving producers in taking responsibility for product safety and leading to a “Green Olympics”. The programme has reportedly been successful in reducing pesticide residues. Guangzhou has implemented a Food Quality Reassurance project. In 2001 Shanghai introduced “Standards for Safe and Hygienic High-Quality Vegetables” covering seed and land selection, fertilizer and pesticide use and quality monitoring. The aim of this programme has been to move emphasis away from increasing the quantity of production to improving quality. However, standards are presently fairly low and production has yet to come up to “pollution-free” levels.

In Thailand, several farm-level accreditation schemes have been in operation. All emphasize control of pesticide residues and little attention is paid to microbial or other types of contamination. The “Pesticide Safe” vegetable programme, run by the Department

²⁶ International Federation of Organic Agriculture Movements

of Agriculture, involved inspection and crop testing. Farmers could still use pesticides and mineral fertilizers but products had to contain pesticide residues lower than the maximum level set by Codex Alimentarius. The “Hygienic Vegetables” programme is promoted by the Medical Sciences Department. This places responsibility on the packer for sourcing vegetables with safe pesticide residue levels.

Thailand has now developed the “Q Mark” with the objective of consolidating the various codes that presently exist. The system of Q standards covers different steps of the supply chain. Q GAP is for farm-level certification; Q-GMP is for packing plants; while Q-Food Safety (Q-GAP plus Q-GMP) is for packers sourcing only from farmers who are Q-GAP certified. To date, the majority of certifications have been for longan, durian, mangosteen and asparagus.

Following the major food safety problems in Viet Nam discussed earlier in this chapter, the Ministry of Agriculture and Rural Development established temporary standards for “safe” vegetables. The criteria include nitrate and heavy metal content, pesticide residues, and the level of micro-organisms. Vegetables are also required to be harvested at the correct stage of maturity, not to contain foreign matter and to be suitably packed. “Safe” vegetables have to be produced on farms certified by the Government. These must meet standards related to water quality, and fertilizer and pesticide use. Inspections are carried out periodically, with samples taken from markets, supermarkets and production areas. There are several weaknesses in the procedures: limited funds mean that the number of samples taken is small and the testing equipment can only identify a limited number of pesticides. This opens up the possibility that farmers may fail to comply with the standards, given the limited risks of being caught out.

Malaysia has introduced a commodity branding programme called “Malaysia’s Best.” This is an umbrella brand for the country’s horticultural products that guarantees quality and safety in accordance with Malaysian Standards and the Malaysian Good Agricultural Practice System. It was initiated for carambola, papaya, pineapple, mango and watermelon, but is to be extended to all other commodities. All farmers can apply to be certified although, initially, most certified farmers are contracted to the Federal Agricultural Marketing Authority (FAMA) for delivery to supermarkets.²⁷ In Indonesia, the Government has also responded to a lack of quality incentives in the marketing system by introducing commodity and location-specific certification systems. Prima III is the lowest standard, with produce required to meet MRLs. Prima II incorporates Prima III and quality attributes. Prima I broadly complies with EurepGAP standards.²⁸

Several countries have introduced IPM programmes but these tend to be constrained by a lack of funds to reach and work with large numbers of smaller farmers, and the often limited skills and perhaps conflicting interests of extension workers. Indifference of both farmers and consumers to potential hazards is a factor. In addition, the message of IPM has to compete with aggressive marketing by agrochemical companies and the fact that farmers face no difficulty in selling produce grown with heavy pesticide use. The Government of India adopted IPM as the main focus of plant protection in 1985. This has

²⁷ Salleh, 2005.

²⁸ Wibawa, 2005.

led to a decline in total pesticide sales but, as noted earlier, problems do persist. IPM packages have been developed for 77 crops (mid-2004) and the rates of dissipation have been determined for most chemicals, allowing farmers to be advised on safe periods of use prior to harvest. Even so, banned chemicals continue to be used and approved chemicals continue to be used to excess.

In Myanmar, neem pesticide is produced by the Myanma Agriculture Service and the extension service promotes this to vegetable farmers. However, only a few farmers in the main surplus-producing areas have adopted neem pesticide and most tend to rely on chemical pesticides. An ASEAN Fruit and Vegetables Project conducted training for extension workers on managing produce quality and food safety, in August 2005, as has also been done in other ASEAN countries.²⁹ P.D.R. Laos has a programme of bio-fertilizer production and is promoting IPM. The Government has selected three production zones that must be free of all agrochemicals.³⁰ Pakistan is seeking to promote horticultural exports. Activities to create awareness of EurepGAP certification are being carried out and it is envisaged that such activities will have an eventual impact on production for the domestic market. IPM has been successfully demonstrated with donor support, but widespread adoption is hindered by lack of resources to demonstrate procedures and benefits to farmers.

²⁹ See RMIT, 2005.

³⁰ Kombounyasith, 2005.

6 Summary, discussion and recommendations

Summary

There are many ways in which quality and safety of fresh produce can be negatively affected, ranging from the soil used to cultivate the crop to handling by consumers and retailers at the time of sale. At the production level, soils can contain excess heavy metals, while water used for irrigation and for washing harvested produce can be, and frequently is, polluted. The choice of variety can affect the attractiveness of a product to consumers and can also have an impact on its shelf life. Use of untreated manure can spread pathogens. Harvesting practices can have a major impact on both quality and safety, with fruits and vegetables often being harvested immature, too soon after pesticide application, or at the wrong time of the day. Diseases and pests are widespread and can have a major impact on quality. However, countering such problems by using pesticides has major implications for food safety, particularly when they are not applied in accordance with recommendations or when banned chemicals continue to be used.

Problems relating to quality and safety do not, however, stop at the farm. Poor packaging and the tendency to squeeze too much produce into a container or vehicle can have a significant impact on quality. Exposure to the elements while awaiting transport can reduce quality, as can poor handling. Dirty packaging materials and dirty vehicles can introduce physical and microbial contamination as can washing during marketing or the watering of leafy vegetables using dirty water. Poor storage practices may damage produce and reduce its shelf life. Chemicals used for ripening and for surface decontamination, often not recommended for that purpose, can affect safety of fruits and vegetables, as can the use of some waxes, colouring agents and insecticides applied during the marketing process. Marketing infrastructure is often inadequate and unhygienic; produce is frequently exposed to ambient conditions and stored, trimmed and sold while placed on bare earth. Finally, produce quality can be seriously affected by the practice of allowing consumers to pick their own fruits and vegetables from a retail display and microbial contamination can also result from this.

Case studies suggest that farmers rarely undertake actions to improve quality or safety. Factors explaining this are market-related, socio-economic, and awareness-related. For many poorer consumers in Asia price is seen as the most important factor influencing a purchasing decision. There is a reluctance to pay more for quality and a general lack of awareness of safety issues. Where there is a perception of quality it is largely related to the physical appearance of the produce, with the result that traders put pressure on farmers to produce blemish-free fruits and vegetables, which may involve using large amounts of pesticide. Increased demand for fruits and vegetables, together with land and labour shortages, has led to intensification, involving higher levels of pesticide use, as has the growing demand for out-of-season production.

Although traders do reject produce as unacceptable, fruits and vegetables meeting minimum standards are generally purchased at the same price regardless of quality or safety

characteristics. Farmers thus have little incentive to improve quality beyond the minimum necessary to make a sale. There may be a disincentive to reduce pesticide usage if, as a consequence, fruits and vegetables become blemished and fail to meet minimum appearance standards. Unreliable marketing channels and uncertainty about the price similarly discourage investment. Marketing channel practices, such as buying the field or orchard or providing finance to farmers in advance of the harvest, may also have implications for produce quality. Seeking to maximise their income farmers often sell unripe produce in order to take advantage of higher prices. Where marketing channels are unreliable farmers may sell immature produce because they cannot be sure that a trader will be buying when the produce is ready.

Risk-averse farmers frequently believe that reducing use of pesticides would significantly reduce their yields. In some countries this propensity to use agrochemicals is enhanced by policies that exempt pesticides from taxes or duties or by credit programmes that include the cost of pesticides as part of a loan package. Banned chemicals continue to be used, in part because farmers are unaware that they are illegal but also because they are cheaper. Concern to maximise income often leads farmers to sell produce that has only recently been sprayed, ignoring recommended pre-harvest intervals. Use of pesticides is also promoted by social pressure; no farmer wants to be seen as the cause of a local infestation. Overuse and misuse is promoted by some agrochemical retailers who are often the only source of information available to farmers. Illiterate farmers often do not know when to apply pesticide and are unaware of the correct product or dose. Knowledge at farm level of factors contributing to microbial contamination is negligible.

Traders seeking to improve produce quality are constrained by the purchasing power of consumers. In general, consumers make quality choices within an affordable price range. Limited surveys indicate a willingness to pay slightly more for “safe” food but the premium consumers are willing to pay may not compensate for the higher production costs. Amongst the middle class there is an increasing demand for better quality and safety but traditional marketing channels face problems in supplying such demand as they seem to have limited capacity to handle more than one quality grade of a particular fruit or vegetable. Some sorting of produce does take place in marketing channels but this is usually on the basis of size, or to remove unsaleable items. Traders are further constrained by poor market infrastructure, poor storage facilities, an inability to control the quality of transport and handling, and a lack of knowledge of post-harvest techniques.

Several countries have quality standards for fruits and vegetables but these are usually voluntary and not applied by marketing channels, which set their own standards normally on the basis of size grades. All countries have pesticide legislation and agencies responsible for registering and controlling the use of agrochemicals. However, in many countries enforcement remains inadequate. Controls appear to be largely ineffective due to poor coordination between the agencies involved with food safety and quality and those charged with controlling pesticide use and other aspects of production, combined with a lack of resources and a general lack of compliance with laws and regulations, which makes enforcement of regulations next to impossible. Many countries report significant illnesses and deaths resulting from consumption of fruits and vegetables contaminated with either microbes and pesticide residues and these reports possibly understate the true picture. Local agencies are generally ill-equipped to monitor microbial contamination and little

advice appears to be available for farmers and traders about ways of avoiding such contamination.

Several countries have introduced programmes to promote “safe” vegetable production, including the People’s Republic of China, Thailand and Viet Nam. Progress is reportedly fairly slow and the case studies reported that most produce sold still fails to meet minimum standards. Lack of resources for implementation appears to be a major constraint. Similarly, several countries have introduced IPM programmes but these are only slowly expanding their coverage due to constraints in funding and available extension staff.

Discussion

Changing practices to improve quality and safety will require recognition that, firstly, farmers and traders need to be motivated to make changes. That motivation will come primarily from increased incentives and reduced risk. Secondly, the availability of information and resources to enable those involved to make those changes is essential. Little can be achieved by establishing regulations and then sitting back and waiting for them to be implemented. Unless those involved see personal benefit in following rules and regulations they are likely to ignore them. Experience in the region has shown that enforcement of most rules relating to the domestic market is difficult.

In Western countries supermarkets have been in the forefront of quality and safety improvement, and one consequence of this has been the fact that Asian exporters who are supplying European retail chains are often now obliged to comply with private standards such as EurepGAP. The extent to which supermarket insistence on improved safety standards for fruits and vegetables reflects consumer demand, as opposed to a wish to avoid legal action should consumers be poisoned, may be open to debate but, clearly, consumer pressure has played an important role. Supermarkets have also led the way in improving fresh produce quality. Here, again, things are far from straightforward. “Quality” is overwhelmingly defined in terms of appearance rather than taste or nutritional quality. Increasing quantities of fresh produce are being thrown away by farmers in the West solely because they lack the appearance specifications of supermarkets.

Improvements to quality and safety in Asia are likely to result not only from regulation but from a combination of regulation and consumer demand. There are indications that middle class consumers are demanding higher standards, having been exposed to imported produce as a result of globalization. Within Asia, programmes could be envisaged that would not only promote increased fruit and vegetable consumption but would also provide advice to consumers on quality aspects. The unanswered question is whether traditional marketing channels will be able to supply better quality or whether this will only be possible through new marketing channels that by-pass existing channels.

(a) Marketing channel incentives

There would appear in theory to be at least three ways in which traditional marketing channels could provide farmers with the necessary incentives or motivation to improve produce quality and safety. Traders could prescribe higher minimum standards. They could introduce parallel marketing channels for different qualities. New marketing channels for high quality produce could be developed. These approaches are discussed below:

Higher standards through traditional channels. As noted above, some marketing channels, such as the Indian apple trade, are already beginning to demand higher standards in response to consumer demand. However, while some consumers may want higher standards, and be prepared to pay for these, the bulk of Asian consumers remain very price-sensitive. While traders may tell farmers to produce better quality, and may raise their minimum buying standards, those traders may not be in a position to pay more for higher quality. There is likely to be resistance from farmers if quality improvements require investments that are not rewarded, unless failure to make such investments results in an inability to make sales. Furthermore, the extent to which traders are in a position to advise farmers on how to improve quality is questionable and extension services have limited capacity in most countries. As we have seen, there is also no clear agreement on what constitutes “quality”. Also, improved quality at farm level will achieve little if there is no concomitant improvement in post-harvest handling. This requires action from traders, possibly through their associations, to develop improved handling logistics and follow Good Manufacturing Practices. Most traders may not be willing to introduce new techniques unless they see that they work, so improvements are likely to result from the initiative of a few innovative traders or through interventions by governments or donors. For example, in the 1990s an FAO project in Nepal introduced plastic crates for tomato transport, replacing traditional packaging that resulted in high losses due to compression during transport. Despite the complications involved in re-using plastic crates and in ensuring that they could be easily returned to the producing area, the benefits of the new containers were effectively demonstrated by working with a few leading traders. Witnessing the success of the crates other traders began to purchase them. On the other hand, the high price of such crates reportedly led to low adoption rates in Sri Lanka.³¹

Although post-harvest losses in traditional marketing channels are frequently overstated, they can often be high. Unfortunately, little work appears to have been done with traders to demonstrate the costs of such losses and relate these to the costs and benefits of making improvements. Traditional loss-assessment work often concentrates on physical losses but there can also be significant losses of nutritional quality and of sales value, as damaged produce commands a lower price.

While small traders can impose minimum quality standards it is almost impossible for them to establish safety standards as safety cannot be assessed during the transactions. Unless traders work closely with farmers and monitor their production practices, assessment of fruit and vegetable safety can only be done by using prohibitively expensive testing equipment.

Parallel marketing channels through traditional systems. Working with marketing channels to improve quality through higher minimum buying standards and better post-harvest handling may improve the quality of produce but is unlikely to have a significant impact on safety unless production practices are also improved. Traders working with large quantities of produce cannot be expected to monitor farmers’ production practices or carry out tests of residue levels. Thus if traditional systems are to offer farmers outlets for higher quality and safer food the supply channels will have to be slightly different.

³¹ Palipane, 2005.

This paper has noted the many layers that are frequently found in traditional marketing systems. In such fragmented systems it is difficult to see how individual traders can handle significantly different qualities at the same time, particularly if one of the quality criteria is safety. Marketing of safer food requires monitoring of on-farm practices, pesticide use and water cleanliness, as well as provision of advice to farmers. Where a wholesale market trader buys from unnamed farmers through rural traders it would not be possible to identify produce that comes from approved farmers. Furthermore, rural traders and transporters are not geared up to keep different qualities separate. Thus if traditional channels are to offer higher quality and safer produce it is likely to be through individual traders dedicating themselves to marketing high quality fruits and vegetables. This requires the development of linkages with farmers or farmer groups, as done by supermarkets, using the concept of “preferred suppliers”. This is already being done in the Republic of Korea, where wholesalers contract directly with farmers and implement their own inspection system.³² Another example of such a development comes from Ho Chi Minh City, where a lettuce wholesaler carefully coordinates his supply chain in collaboration with a selected group of field collectors. The wholesaler shares information about market conditions with the collectors and makes orders five days in advance, to enable the collectors to identify the best sources of supply. He provides his collectors with training in harvesting and packing, so enabling him to obtain higher than average prices and reduce losses.³³ Improvements may also require the development by wholesale markets of separate facilities to handle quality produce, which may involve a cold chain. A few wholesale markets in Asia are already beginning to offer such facilities as a way of trying to retain business being lost to supermarkets. In Beijing, for example, farmers supplying the city’s retail or wholesale markets must sign an exclusive production contract, specifying the production base, implementing standardized production and taking responsibility for product safety.

New marketing channels. The growth of supermarkets in Asia and the supply chains they are developing has recently been reviewed by FAO.³⁴ The desire to be able to offer higher quality and safer produce to consumers has been an important reason why supermarkets have begun bypassing traditional channels, although far from the only reason. Supermarkets do not, however, offer the only outlet for farmers wishing to supply higher quality produce. For example, farmer groups operate in many retail markets to sell “green” produce and retail outlets other than supermarkets are often interested in marketing a range of high quality produce.

This paper has reviewed some of the programmes developed in Asian countries to facilitate the supply of “safe” fruits and vegetables and has noted problems with such programmes. In Viet Nam there is presently a relatively small market for “safe” vegetables. Farmers who have taken the trouble and expense to be certified as “safe” vegetable producers have found that they produce more than the market can presently absorb. As a consequence they are forced to sell their higher quality produce on traditional markets at lower prices. Traditional markets often resist safer vegetables because, as they are grown with limited pesticide application, they give evidence of infestation, which does not conform to market expectations. Another problem with programmes to provide safe or

³² Lee, 2005.

³³ See Cadilhon *et al.*, 2005.

³⁴ See Chen *et al.*, 2005.

higher quality vegetables is that, in time, a downward pressure on prices paid to farmers develops, such that the returns from investing in improved practices become negligible or negative.

Farmers wishing to access high-quality markets will almost certainly have to work together as members of formal or informal groups, following the same technical package. Individual small farmers cannot produce sufficient quantities to supply the needs of buyers, and intermediaries do not want to work with one farmer in one village and another in the next. They would prefer to work with all farmers in one particular location. Working in groups also offers the possibility to develop a brand name. At present the consumer relies on the supermarket to provide the assurance that produce meets certain standards; groups of farmers may in future be able to provide that assurance by labelling their own products.³⁵

(b) Relating new practices to socio-economic circumstances

Initial steps to introduce improved practices at farm level, such as through IPM Farmer Field School programmes in several countries, have shown some success but have been constrained by availability of resources to rapidly increase the number of farmers trained and by the limited number of extension workers qualified to undertake the training, which is time-intensive.

Farmers cannot learn new attitudes and skills through short training courses. Such skills are really only developed when they are applied and when farmers themselves believe that they are likely to be better off because of those new skills. The paper has identified the problems that farmers face in applying new practices and in convincing themselves that they would be better off. All training programmes have to address these problems if they are to have an impact. The most important issue is that of economic risk. Small farmers are unprepared to follow practices that they fear may lead to significant crop losses. While richer farmers may be able to afford the loss of one harvest this would be disastrous for most small farmers and could plunge them permanently into debt. Thus adoption of improved practices will not be achieved by telling farmers what to do, only by letting them see the benefits of the proposed practices. Inevitably, such an approach puts up the cost of promoting improvements and also means that the time required to introduce them on a widespread basis is much longer. Proposals for improvements must also recognize the labour constraints that some farmers face. Changed practices that require increased labour are unlikely to be acceptable, unless accompanied by reduced costs in other areas and, even then, may be unacceptable if labour is unavailable.

In many areas farmers face considerable social pressure to conform to established practices. As earlier noted, they are reluctant to experiment with using less pesticide if they fear that by so doing they could endanger their neighbours' farms. Thus improvement programmes need to work with all farmers in an area in order to have a chance of success.

Some reductions in pesticide use could be achieved by addressing obvious abuses of pesticides. Much of this abuse can be attributed to ignorance about the pesticides being used, about the correct quantities to be used and about correct application methods. Often,

³⁵ see, for example, Anh and Minh, 2005.

the only source of information is the local agrochemical retailer who would not only like to promote increased use, but may also be ignorant about correct usage. Better selection of pesticides can also be a tool for reducing risks from pesticide use, particularly if highly hazardous pesticides are being replaced with biopesticides. The availability of leaflets and other materials in local languages to provide advice on correct selection, use and application for the main pesticides may go some way towards overcoming ignorance. The problem of illiteracy could be addressed by the preparation of videos and television programmes. Emphasis should be on the cost savings that could be achieved by following recommended practices, as well as on the health benefits to the farmers themselves.

Training farmers and their extension workers on post-harvest practices will achieve little if farmers see no benefit from applying recommended practices. As noted, these benefits may not immediately come from higher prices, as traditional marketing channels are not usually able to handle different qualities. However, it may be possible to achieve benefits in terms of reduced losses or a higher proportion of produce deemed acceptable by the traders. Training in packaging improvement needs to be carried out in association with traders and transporters. Little can be achieved by informing farmers about improved packaging if the marketing system is not willing to accept such packaging and if the transporters are not in a position to improve their handling practices.

(c) Improving marketing infrastructure

Over the years FAO has devoted considerable effort to encouraging Governments and municipalities to improve the infrastructure available for marketing.³⁶ While there have been notable improvements in market infrastructure in some countries, the fact remains that in many Asian countries the quality of assembly, wholesale, and retail markets is far from adequate. Poor structural facilities are often compounded by inadequate management that results in haphazard operations and unhygienic facilities.

Markets in Asia are not simply places where produce is delivered by one person and ownership transferred to another. In most cases they are also places where considerable post-harvest activities take place. Trimming and removal of outer leaves, in the case of cabbage for example; removal of damaged produce; sorting and grading; ripening of fruit; repackaging; and watering to keep produce fresh or, at least, to give it an appearance of freshness, are all carried out. While the facilities at many markets may be adequate for the simple transfer of ownership they are usually inadequate for such post-harvest activities. Waste disposal arrangements are often poor and a common sight is that of piles of rotting fruits and vegetables close to the trading areas. Post-harvest activities frequently take place on the bare earth. Governments therefore need to view markets as more than just sources of revenue; particularly if they wish to see traditional marketing channels surviving in the face of competition from supermarkets. There is scope for private investment in markets, as clearly demonstrated by some markets in Thailand, for example.

Investment in cold stores is often proposed as a solution to post-harvest problems. At the same time, many cold stores have failed to perform as expected. Reasons for this include the fact that stores are constructed by donors and managed by governments or

³⁶ see, for example, the Food Supply and Distribution to Cities Programme at: http://www.fao.org/ag/ags/agsm/sada/index_en.htm and publications on market infrastructure, available at: <http://www.fao.org/ag/ags/subjects/en/agmarket/infrastructure.html>

government-owned markets. Under such circumstances there is (1) frequently a failure to conduct a realistic appraisal of feasibility and (2) rarely an incentive to ensure commercial operation and maintenance of the store. Many such stores rapidly fall into disuse. Secondly, cold stores are sometimes seen as an answer to surpluses. The argument is made that if cold stores were available farmers or traders would not have to sell off produce at the end of the day at low prices or risk quality loss by keeping produce until the next day. However, this ignores the fact that vegetables stored overnight in a cold store have to compete the next day with freshly delivered produce. Such storage facilities are best offered by the private sector. In the case of highly perishable produce, an integrated cold chain can have a significant impact on quality and shelf life but cold storage at just one stage of the chain will achieve little. Asian traditional marketing channels lack the resources to invest in such chains and even many supermarket supply chains do not presently use cold chains.

(d) Adopting a chain approach and improving coordination

The promotion of food safety, as well as quality, needs to consider the entire food chain, from producer to consumer. However, as has been made clear by the case studies reported on in this paper, many countries have an inadequate understanding of the concept of the food chain. This manifests itself through the existence of regulations that govern one particular stage in the chain, such as regulations relating to pesticide use in the case of farmers or MRLs in the case of retail sales, but which largely fail to adopt a holistic approach. This problem stems largely from the fact that there is usually no comprehensive policy or approach to food quality and safety. There is often a multiplicity of organizations with overlapping functions involved in regulation but no organization with overall coordination responsibility. This leads to situations discussed earlier such as that where a pesticide can be legally used but, because no MRL has been established, there is no acceptable level of residue for that pesticide. The new Ordinance on Hygiene and Safety of Foodstuffs introduced by Viet Nam goes some way towards presenting a coordinated approach. It replicates UK legislation, which encourages customers to check on the operations of their suppliers.³⁷

Throughout the region there appears to be a tendency to approach safety and quality problems with reference to law and regulation. The problem with such an approach is that laws are rarely effective unless those to whom the laws apply are convinced that it is in their interests to obey them. Such interest can stem from a clear belief in the desirability of the laws or from a high probability that non-compliance will result in punishment. In the case of laws relating to safety and quality, neither would appear applicable in the region. Farmers and traders receive little training or information to increase their awareness of safety and quality issues and the cost of policing such laws is usually prohibitive. In the case of rules relating to residue levels there is the additional practical difficulty of measuring the pesticide residue levels in fruits and vegetables. Testing is expensive and beyond the resources of most small traders, who are thus in no position to know whether or not the produce they sell complies with the law.

A food chain approach thus involves much more than the simple passing of regulations. It involves a detailed analysis of the factors affecting safety and quality

³⁷ This contrasts with the approach of Beijing, discussed above, which places full responsibility on producers for the quality of produce supplied to markets.

throughout the chain, as has been attempted in this paper, with identification of the most practical and cost-effective improvements that could be implemented. Such improvements may involve training and awareness creation in addition to regulation.³⁸ Donors could assist with pilot-scale activities to demonstrate new approaches.

Recommendations

Issues relating to quality and, in particular, safety are very complex and embrace not only the quality and safety of produce entering marketing channels but also public health, environmental safety and the safety of farmers using pesticides, among other issues. This paper has addressed just one aspect of the subject, i.e. the impact on quality and safety of marketing channels and the way they operate. The following recommendations are therefore addressed primarily to this topic. Emphasis is on recommendations that are achievable within the context of the resource constraints that most Asian countries face.

1. At national level there is a clear need for improved coordination between the different government agencies involved in this sector. Governments should consider the need to develop comprehensive policy on the subject. Integrated food safety laws need to be developed but in doing this it should be recognized that laws and regulations must be compatible with the ability to enforce them. Rules, in themselves, are not enough to bring about change. The development of food safety standards and regulations must be done in consultation with the private sector, and must be dynamic and capable of change in response to changing technologies and consumer requirements. For domestic trade, laws relating to quality standards should reflect prevailing industry practices and should not establish unrealistic minimum standards, which are either unenforceable or likely to remove large quantities of nutritious food from the market. Efforts should be made to increase the involvement of local communities and farmer organizations in the provision of education and training.
2. At the regional level, there are many lessons, both positive and negative, that can be learnt from the practices in other countries. This paper has only been able to identify a few of them. Steps should be taken by FAO and other agencies to carry out a detailed inventory of programmes implemented by governments, wholesale markets and the private sector to facilitate the production and marketing of better quality and safer produce. A detailed survey to identify best practices would be desirable. Exchange of information thus obtained can be achieved through newsletters, workshops, etc. Also at regional level, the availability of smuggled, illegal pesticides gives considerable cause for concern. Countries in Asia should consider harmonizing standards and should enforce their existing pesticide legislation.
3. The role of traditional marketing systems in supplying the great bulk of consumers with fresh produce and the need of those consumers for produce that is both safe and of improved quality must be recognized and appropriate resources allocated to

³⁸ See, for example, FAO's "Global Inventory. Reference Materials and Food Safety Training Programme to Improve the Safety and Quality of Fresh Fruits and Vegetables". http://www.fao.org/ag/agn/food/food_fruits_en.stm

facilitating improvements. At present, governments, even in those countries where horticultural exports are relatively unimportant, tend to devote disproportionate resources to the export sector.

4. Efficient wholesale and retail markets are vital for food quality and safety. Significant improvements can be brought about without extensive investment, by improving management skills. Ministries of agriculture or other relevant agencies should advise municipalities to reinvest market fees in the markets and should point out the quality and safety benefits of so doing. Wherever possible, private sector investment in markets should be encouraged. While emphasis should be on an overall upgrading of market facilities to facilitate the supply of higher quality produce, wholesale markets should also investigate the feasibility of developing separate sections to handle fruits and vegetables that meet defined safety and quality standards. Working through trader associations, the possibility that some traders could develop separate supply chains for safer and higher quality produce should also be explored by ministries of agriculture and other agencies. Trader associations should also consider whether they could implement training for their members on issues relating to organoleptic quality and safety. Standard guidelines of good practices at all stages of the food chain should be developed and circulated in the vernacular.
5. The implications of modern retailing trends for small farmers in the region need to be recognized. Ways in which farmers can link with larger retailers, including through organization into groups, clusters, associations, cooperatives, etc. should be explored. Governments should investigate whether certificates of origin can be introduced for fruits and vegetables meeting defined production criteria and the potential use of brands or other registered names similar to “Malaysia’s Best” should also be investigated.
6. Governments should consider promotion of Good Manufacturing Practices principles for marketing infrastructure. Inspection of farms, packhouses, stores and markets must be considered an ongoing process and not just a one-off activity for purposes of initial certification.
7. The case studies suggest that many problems of pesticide misuse stem from ignorance and from inaccurate information provided by pesticide dealers. The studies imply that such misleading information is given out of a desire to sell more pesticides. It could also result from ignorance on the part of the retailers. Countries should consider developing training programmes for pesticide dealers, preferably as part of a licensing scheme.
8. There is scope for further development of IPM techniques. Emphasis should be on the broad development of skills rather than on GAP certification. Resources will never be sufficient to provide on-farm IPM training to all farmers and efforts thus need to be focussed on areas where IPM activities will have the most impact, while other more cost-effective ways of getting messages to farmers need to be

considered in parallel.³⁹ The use of crop-specific leaflets in the vernacular to provide advice on the cultivation, handling and marketing of various crops following IPM techniques is recommended. Radio and television programmes can also be used and are particularly useful where there is a high level of illiteracy. Contracting farmers to follow IPM practices for demonstration purposes may also be useful, although this may run into problems where there is considerable social pressure to use pesticides.

9. The case studies and other research for this paper have identified few rigorous economic calculations of the benefits of using improved methods to produce safer and higher quality food. More studies need to be carried out in order to be able to demonstrate to farmers that the use of new techniques is economically viable. There is a further need for cost-benefit data comparing current pesticide use practices with alternatives such as IPM. Care must be taken that such calculations reflect the situation in the field when the techniques are being applied by farmers working as groups or on their own rather than the situation on a research station or on farms that are benefiting from unsustainable technical support. Practical and effective tools for cost-benefit assessment need to be developed.
10. Governments should pay more attention to microbial and parasitic contamination issues. While resources are devoted to pesticide control and MRL monitoring, little attention appears to be paid to other forms of contamination. Ways of reducing such contamination need to be identified and information on the topic made widely available to farmers and traders. Further research on the causes of contamination during production and marketing is recommended.
11. The case studies have identified several examples of where pesticide use is encouraged by favourable taxation or import duty concessions. Such policies could have had a negative impact on consumer safety. Governments in the region are recommended to cease providing blanket concessions for pesticides. Indeed, they should consider using taxes and subsidies to discourage overuse of chemical pesticides and their replacement with alternative approaches. A regional approach to agrochemical taxation is desirable, in order to stop differential taxation promoting cross-border trade.
12. The experience of Western countries has been that changes in production practices stem, in part, from changes in consumer demand. Education and awareness-raising of consumers would thus appear to be important if the production of safer and higher quality produce is to be promoted. The media can play an important role, as can consumer groups.

³⁹ For example, focusing IPM training on areas of known pesticide abuse and enhancing the availability of alternatives to chemical pesticides such as bio-pesticides, traps and biological control agents.

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Quality and safety in the traditional horticultural marketing chains of Asia

This paper examines what happens within the horticultural supply chain to affect safety and quality and what are the constraints faced within that chain that have an adverse impact on the ability to make improvements. The paper tentatively concludes that traditional marketing systems currently provide little motivation or incentive for farmers to make improvements to either quality or safety. Improving quality and safety will require recognition that farmers and traders need to be motivated by the marketing system to make changes. The availability of information and resources to enable those involved to make those changes is also essential. The paper further argues that governments need to improve the condition of many markets through upgrading management and reinvesting market fees in physical infrastructure. Wholesale markets need to investigate the feasibility of developing separate sections to handle fruits and vegetables that meet defined safety and quality standards. Ways in which farmers can link with retailers through traditional channels, including through organization into groups, clusters, associations, cooperatives, etc., should be explored.

The paper is aimed at staff of ministries of agriculture, including extension officers, who are working to develop improved safety and quality in the horticultural sector. It should also be of interest to those working in regulatory organizations, to traders and wholesale market management, who clearly need to improve quality and safety if they are to compete with the new supply chains being developed by supermarkets, and to donors and non-governmental organizations working to improve horticultural marketing and to promote good agricultural practices.