Post-harvest barriers to horticultural expansion

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Introduction

Australia is placed in an ideal situation to supply affluent Northern Hemisphere markets with fresh out-of-season horticultural produce. Because of our wide range of climatic zones we can also provide a comprehensive range of produce including tropical fruits, temperate vegetables, and native ornamentals.

Local markets in Australia are often oversupplied with produce and export is necessary to absorb any future increases in horticultural production.

Distance and the perishable nature of horticultural produce are however the main limitations to competing with other Southern Hemisphere suppliers on these markets.

Consumers in overseas markets demand top quality, orchard fresh fruits and vegetables. They have a choice of the world's best and currently fashionable products and are willing to pay high prices because they regard it to be healthy to eat fresh fruit and vegetables.

Australian exporters can only receive the high prices necessary to cover our high costs of production and transport by supplying produce which is perceived to be of superior quality to that of our competitors. Consumers buy with their eyes and then judge by taste. Having selected brightly coloured blemish-free Australian fruit the consumer will return to buy again if the product is crisp, sweet and juicy.

Deterioration of fresh produce during storage and transport is inevitable and it is important for Australia to maximize the use of post-harvest technology and handling innovations to ensure that loss of quality is kept to an absolute minimum. To facilitate this there is a need to increase the emphasis on post-harvest research and training, so that industry can employ qualified people to use existing technology to develop post-harvest handling systems and quality assurance schemes for Australian produce.

I will discuss in more detail the challenges we must face and the post-harvest technical innovations we have available to facilitate the expansion of horticultural exports.

Perishability

Apples, pears, citrus, grapes, bananas, onions, potatoes and carrots account for the bulk of international trade of horticultural produce. Apples, pears, carrots and citrus have a low rate of respiration when cooled to a low temperature; bananas and pears can be transported in an unripe condition and potatoes and onions store well under ventilated conditions.

These products can generally be sea-freighted to the U.K., Europe and the Middle East under refrigerated or ventilated carriage conditions.

The more perishable soft ripe fruits and tropical fruits such as peaches and mangoes, and the leafy vegetables, lettuce, celery, cauliflower and broccoli have sufficient life for sea freight to South East Asian markets.

Highly perishable produce including asparagus, berry fruit, sweet corn and rock melons is air freighted to overseas markets. Post-harvest technology however can now facilitate the sea freight of some highly perishable produce to South East Asian markets.

Quarantine barriers

Access to markets in Japan, U.S.A., Canada, Taiwan and New Zealand is restricted by the availability of acceptable disinfestation treatments for fruit flies, codling moth, light brown apple moth and Fuller's rose weevil. Ethylene dibromide was banned for use on fruit soon after 21 years of negotiations for its use to gain access to the Japanese market. In order to help overcome quarantine barriers to horticultural trade, the Federal Government has made available grants for disinfestation research on produce with potential markets in U.S.A, Japan and New Zealand.

The most acceptable disinfestation treatments involve the use of heat or cold. Vapour heat treatment at high temperature and humidity is showing promise for treatment of mangoes and cucurbits which have a short storage life and are susceptible to chilling injury. Cold treatment of citrus for 16 days at 1?C is now accepted by Japan to disinfest citrus against fruit fly, but there is an urgent need to develop an effective system for treatment of Fuller's rose weevil. Orchard control systems and a hot water dip treatment are being developed as alternatives to fumigation of citrus with methyl bromide on arrival in Japan.

Combinations of cold treatment and fumigation with methyl bromide are being developed for table grapes, apples, and stone fruit to control light brown apple moth and codling moth.

There are difficulties in finding suitable disinfestation treatments for berry fruits and the more perishable tropical fruits. Insecticide dips in dimethoate and fenthion can be used for disinfestation of tomatoes and avocados but not all countries will accept post-harvest treatment with insecticides.

Irradiation has been considered for disinfestation of strawberries and citrus but the economics of treatment and consumer acceptability are questionable. Doses of irradiation sufficient to sterilise insects without killing them may not be acceptable to quarantine authorities.

Loss of quality is a major problem with disinfestation treatments and often a trade-off in quality is necessary in order to obtain a high level of quarantine security.

Quality assurance and quality control

Quality control is a vital component of the successful exporters post-harvest system. By documenting procedures, allocating responsibilities and carrying out quality control checks many potential outturn problems can be identified and avoided.

For each fruit and vegetable there is a system of selection, harvesting, preparation and packaging which will ensure minimal deterioration during transport to overseas markets. Exporters must ensure that essential pre-harvest and post-harvest treatments are applied to produce intended for export. Pre-harvest calcium sprays to control bitter pit of apples, copper sprays to control anthracnose of citrus and regular field spraying of table grapes to control botrytis are essential for reliable outturn. Post-harvest treatments include fungicides for wastage control, rapid cooling using forced-air, hydro-cooling or vacuum cooling and plastic film packaging to control dehydration and slow deterioration.

Importers in U.K. have established quality control laboratories which check the arrival condition of horticultural produce. Australian exporters must adopt quality control procedures to ensure that produce satisfies the importers' specifications before export.

Post-harvest chemicals

There is only a limited range of post-harvest chemicals available for the control of post-harvest pathogens and consumers are demanding pesticide free fresh produce.

The development of fungicide tolerant strains of penicillium mould has resulted in the need to apply two chemically unrelated fungicides to citrus after harvest. Other strategies important in minimizing wastage and maintaining the effectiveness of the limited range of post-harvest chemicals include attention to shed

hygiene, chlorination of rinse water, and physical separation of the packing area from the fruit receival area.

There is an urgent need to develop effective non-chemical methods for control of post-harvest diseases of horticultural produce. Heat treatment and biological control are showing some promise as acceptable alternatives.

In Israel the pomelo, a citrus fruit with a thick edible rind, has been successfully heat treated to control decay. Plastic wrapping of the fruit prevents dehydration while the fruit is held at 34?C for 72 hours.

Micro-organisms have been isolated from the surface of fruits and cultured for application to control post-harvest diseases. Promising results have been obtained but further testing is required to ensure that the control mechanism is not toxic to humans.

Transport innovations

The high cost of long and slow voyages to Northern Hemisphere markets has encouraged Australian researchers to develop innovative transport systems to minimize freight costs. Bulk handling systems have been developed to maximize the use of container volume, and packaging systems have been developed to maintain quality and use low cost non-refrigerated transport.

The system developed in Western Australia for bulk shipment of Granny Smith apples to the U.K. has been extended to the bulk shipment of loose oranges to Penang and New Zealand.

The ventilated "fantainer" system developed by CSIRO for transport of onions to U.K. using non-refrigerated containers has been successfully used to transport plastic-wrapped citrus fruit to Singapore.

Plastic wrapping has also facilitated the transport by sea freight of rock melons from South Australia to Singapore and Hong Kong.

Adoption of controlled atmosphere technology to refrigerated container shipment has potential for slowing deterioration of apples and pears and facilitating the sea freight of avocados and mangoes to the Middle East and Europe. Further development of P.S.A. and Permea nitrogen generation equipment may eventually allow the refrigerated produce to be exported under controlled atmosphere conditions.

Presentation packaging and changing fashions

Australian exporters need to be more responsive to changing fashions in marketing produce in Northern Hemisphere markets. Consumers are becoming less conservative and are buying new varieties; for example consumption of easy peel mandarins has increased by 200% in the U.K.

Consumers will pay for the most attractively presented produce especially when it is identified with a well known label indicating the country of origin and supported with point of sale material offering advice on alternative uses.

There are numerous examples of the high prices consumers are willing to pay for the attractively presented top quality produce sold as gift packs in Japan and Europe.

Package strength is also extremely important since our produce is marketed in tropical conditions which can result in package failure and damage to produce.

Post-harvest technologists

The application of existing post-harvest technology is limited by the lack of qualified post-harvest technologists employed by the horticultural industries and exporters. Post-harvest technology is a multi-

disciplinary field which requires the integration of technology to develop handling systems for each product.

Experienced technologists are required to develop quality assurance programmes for exporters and to ensure that post-harvest treatments and procedures are correctly applied throughout the distribution system.

There is also a need for horticultural industries to support research into some of the basic physiological limitations to export of tropical

produce. The ability to control ripening and avoid chilling injury at low temperatures would enable us to market more perishable produce into Europe and the Middle EAst.

Summary

Distance from markets and the perishable nature of horticultural produce are the main barriers to horticultural expansion.

Application of the latest post-harvest technology combined with innovative transport systems is essential to expansion of export markets.

A knowledge of market requirements and introduction of quality control and quality assurance is essential to avoiding post-harvest losses.

Qualified post-harvest technologists should be employed by horticultural industries to ensure that existing technology is applied.

Further research is required to overcome other physiological and quarantine barriers to horticultural export expansion.