POST-HARVEST TREATMENT OPTIONS FOR MANAGING INSECT INFESTATION OF FRUIT AND VEGETABLES

Summary

1. An important opportunity exists to replace existing chemical treatments of Australian fruit and vegetables, which pose risks to human health and the environment, with the safe, chemical-free process of food irradiation. With the wider application of food irradiation technology, Australia can ensure it maintains a safe and secure local food supply that meets consumer expectations as well as industry needs and government regulatory requirements.

Food irradiation

2. The process of food irradiation involves briefly exposing produce to a certain type of energy known as ionising radiation. Exposure to this energy kills insects, moulds and micro-organisms in the food. Food irradiated to approved limits is wholesome (i.e. poses no nutritional or microbiological problems).
3. Food Standards Australia and New Zealand (FSANZ) have approved the use of irradiation for herbs and spices and certain tropical fruits (such as mango, papaya, rambutan and litchi).
4. Considerable scientific research over the past five decades indicates that food irradiation is safe and effective. Food irradiation has been approved in 40 countries including the United States, Japan, France and the Netherlands and is supported by the World Health Organization (WHO) and the Food and Agriculture Organisation (FAO).
5. The Codex Alimentarius Commission has issued a General Standard that declares any food irradiated up to 10 kGy[1] "presents no toxicological hazard" and requires no further testing.

Replacing toxic chemical fumigants

6. Currently, in order to kill insects and bacteria and meet government regulatory requirements in relation to food safety and quarantine, fruit and vegetable growers often use chemical insecticides and fumigants such as Dimethoate, Fenthion and Methyl Bromide.
7. These chemicals are toxic and pose issues relating to chemical residues in food and occupational safety risks associated with their application. In addition, there are concerns about the impact of these chemicals on the environment (for example Methyl Bromide is ozone depleting and Fenthion is highly toxic to birds).
8. The use of these chemicals in commercial horticulture is increasingly being restricted around the world. For example, the European Union has banned the use of Methyl Bromide for most purposes. In Australia, Methyl Bromide is being officially phased out as a soil fumigant and there are expectations Dimethoate and Fenthion will be phased out in horticulture over the medium term.
9. Such a move would create a significant challenge for fruit and vegetable growers, who will need to adopt alternative measures to treat their produce, as well as wholesalers and retailers, who rely on growers as their suppliers. Consumers could also be impacted through reduced availability or lower quality of locally produced fruit and vegetables, higher prices and more imported product.
10. The impact of a ban on Dimethoate and Fenthion would be most acute for growers in tropical areas, in particular Queensland, where strict quarantine standards must be meet in relation to certain pests and diseases (e.g. fruit fly) before they can sell their product in the major southern markets.

Treatment options

11. If and when these chemicals are no longer available to the horticulture industry, other methods will need to be implemented. There are a range of alternatives, each of which have their own particular pros and cons in relation to cost, timeliness and the impact on product quality.
12. Utilising food irradiation is one of the most appealing alternatives as it is non-invasive, effective against a broad spectrum of insects, does not heat the fruit and vegetables, and is a relatively quick and cost competitive process. Irradiation stands out from treatments that heat and damage the fruit and vegetables, such as hot air or water, and those that are suitable only for produce with a long shelf life, such as refrigeration.
13. It is unlikely that any one alternative alone will replace insecticides and fumigants, but rather it will be a combination of methods. Some of the pros and cons of the different post-harvest commercial disinfestation treatments are as follows:

1. A kGy (kiloGray) is a unit of irradiation dose. 1 kGy = 1000 Gy. 1 Gy is 1 Joule of energy deposited in each kg of irradiated materia

Commercial post-harvest options for managing insect infestation*

	Cost (per unit)	Fruit quality (sub tropical and soft fruits)	Operational reliability and simplicity	Range of insects treatable	Toxic chemical residues	Quarantine approval process
Chemicals (e.g. Dimethoate, Fenthion, Methyl Bromide)						
This is a commonly used treatment option but there are some regulatory, supply, safety and environmental risks associated with the chemicals.	Cost competitive.	Fumigation can damage several fruit types.	Some post treatment handling required.	Some insects are either resistent or become resistent.	A risk of chemical residues.	Regulatory restrictions and consumer resistance increasing.
Irradiation						
The product is exposed to high-energy gamma or x-rays which is highly effective in killing or sterilising insects.	Resonably cost competitive.	Generally minimal impact on fruit quality.	A simple process that can be applied to fruit that is already packed.	Effective against a broad range of insects.	No risk of chemical residues from treatment.	Limited but growing acceptance in Australia and internationally.
Refrigeration						
Cooling the fruit kills insects of tropical or sub-tropical origin over several days. Commonly used.	Resonably cost competitive if energy use not considered.	Exposure to cold temperatures can damage fruit quality.	Some issues with reliability and quality assurance of the process	Not effective against some insects.	No risk of chemical residues from treatment.	Widely recognised and accepted.
Hot water						
Fruit is exposed to heated water for a specific period to kill pests. A rapid method suitable for pre-packed product although with some issues relating to product quality.	Cost competitive.	Adverse impact on quality and self life.	A simple process but fruit shape and size can be an issue	Effective against a broad range of insects.	No risk of chemical residues from treatment.	Widely recognised and accepted.
Vapour heat						
Fruit is exposed to heated air in a staged process. Used for special markets.	Relatively expensive.	Adverse impact on quality and self life.	Fruit requires significant post treatment handling.	Effective against a broad range of insects.	No risk of chemical residues from treatment.	Limited acceptance.
Controlled atmosphere						
Fruit is placed in sealed containers with low oxygen/high CO2 levels. Conditions in containers need to be monitored and fruit needs to have a long-shelf. Commercial use is rare.	Relatively expensive.	Minimal impact on quality for fruits with long shelf life.	Simple process but lengthy and some issues with assurance.	Effective only on a limited range of insects.	No risk of chemical residues from treatment.	Limited approvals.

* This table is Steritech's opinion only and is intended to provide a high-level overview of the different treatment options available. It should not be considered a complete review of all the treatment options and all the possible measures of performance. Industry participants are advised to explore options further in order to find the alternatives that best suit their particular business needs.