Executive Summary

This application seeks a variation to the Food Standards Code, Standard 1.5.3 Irradiation of Food, by adding

1. Apple (*Malus domestica*)
2. Apricot (*Prunus armeniaca*)
3. Cherry (*Prunus avium*)
4. Honeydew (*Cucumis melo*)
5. Nectarine (*Prunus persica* var. *nectarina*)
6. Peach (*Prunus persica*)
7. Plum (*Prunus domestica*)
8. Rockmelon (*Cucumis melo*)
9. Strawberry (*Fragaria x ananassa*)
10. Table grape (*Vitis vinifera*)
11. Zucchini and scallopini / summer squash (*Cucubita pepo*)

under the same dose and usage conditions presently prescribed for tropical fruits, persimmon, tomato and capsicum, that are currently approved in the Australia New Zealand Food Standards Code. No other variation to Standard 1.5.3 is sought. The purpose of irradiation will be for a phytosanitary objective and the minimum and maximum doses will be 150 Gy and 1 kGy, respectively.

Applicant

This application is submitted by the Queensland Department of Agriculture, Forestry and Fisheries (QLD DAFF). QLD DAFF brings together specialist knowledge, networks and services to work with significant businesses and industry sectors to support the economic development for the benefit of all Queenslanders.

Purpose

The minimum dose requested for the phytosanitary regulatory treatment is 150 Gy and the maximum dose requested is 1000 Gy.

Apple, apricot, cherry, honeydew melon, nectarine, peach, plum, rockmelon, strawberry, table grape and zucchini are potential hosts to fruit flies and other regulated pests, and are subject by regulation to phytosanitary treatments against specified pests as a condition of entry into many plant quarantine jurisdictions. This applies to both domestic and international markets.

Irradiation at levels between 150 Gy and 1 kGy is effective at killing or sterilising regulated insect pests, such as fruit fly, without posing a risk to human health or significantly affecting product quality.

Queensland Fruit Fly (Q-fly) is considered one of the world's worst pests of fruiting crops, and is listed as a pest requiring treatment by most international and interstate markets trading in the movement of fresh fruit.

Food Standards Australia and New Zealand (FSANZ) previously stated, "decades of research worldwide has shown that irradiation of food is a safe and effective way to kill bacteria in foods, extend its shelf life and reduce insect infestation."

Irradiation is potentially a valuable tool to help the apple, apricot, cherry, honeydew melon, nectarine, peach, plum, rockmelon, strawberry, table grape and zucchini trade ensure biosecurity and that phytosanitary requirements are met. Irradiation treatment provides an end product treatment option for these affected industries.

The need for irradiation

Several approved options exist for phytosanitary treatments of apple, apricot, cherry, honeydew melon, nectarine, peach, plum, rockmelon, strawberry, table grape and zucchini. Among the most commonly used are pre and postharvest treatments with insecticides. Following the review of dimethoate and fenthion use by the Australian Pesticides and Veterinary Medicines Authority (APVMA), many phytosanitary uses were lost or restricted.

QLD DAFF and the horticulture industry consider trade in these fruits and vegetable at risk of market disruption. The forecast value for total fruit and vegetables in 2012–13 is $2453 million (mil), with total fruit and nuts accounting for $1334 mil and total vegetables $1119 mil (Qld AgTrends 2013). The Gross Value of Production (GVP) for grapes is forecast at $1110 mil, apples $402 mil, strawberries $212 mil and melons $159 mil (Horticulture Factsheet 2012). The volume of trade in the domestic trade of fruit and vegetables is by far the largest. Supplying the domestic market is the major focus of the horticulture industry in Queensland (overall approximately 70%). Access to interstate markets is vital to the ongoing economic viability of the state and industry and to regional health.

New Zealand Fresh Produce Importers Association (NZFPIA) represents wholesalers, traders and retailers who import fresh produce, including fruits and vegetables, into New Zealand. NZFPIA's members rely heavily on Australian produce, in particular imports from Queensland, to meet the needs of New Zealand consumers.

In addition to increased regulatory restrictions on the use of dimethoate and fenthion, there is growing awareness within the horticulture sector of the need for alternative treatments to insecticides due to consumer concerns about chemical residues and the potential occupational health and safety issues associated with the use of chemicals in the supply chain.

While methyl bromide is approved for use in all states and territories within Australia there are consumer concerns regarding chemical treatments. However, the lack of harmonisation on the use of systems approaches (e.g. pre-harvest cover sprays and postharvest inspection) within Australia could mean that the only option for entry into several Australian markets may be methyl bromide fumigation.

Irradiation already is an approved phytosanitary treatment for a range of tropical fruits and vegetables. The treatment would provide an alternative phytosanitary treatment for these affected industries. It is anticipated that industry can commercially incorporate irradiation treatment into their supply chain with minimal impact on efficiency and profitability of the supply chain.

Irradiation as a quarantine measure

International evidence supports irradiation against fruit flies and other regulated pests. The International Plant Protection Convention (IPPC) implemented several International Standards for Phytosanitary Measures (ISPM) relating to the use of irradiation for phytosanitary purposes. ISPM 18, "*Guidelines for the Use of Irradiation as Phytosanitary Measure*" provides technical guidance on the specific procedures for the application of ionising radiation that countries should adopt when trading in irradiated fresh fruits and vegetables. ISPM 28 "*Phytosanitary Treatments for Regulated Pests*" sets out minimum doses for a range of pests.

For fruits and vegetables that are hosts to the fruit fly the required treatment is applied in accordance with international requirements, under ISPM 18 Annex 7 (2003). The required treatment would specifically comply with ISPM 28*, Irradiation Treatment for Fruit Flies of the Family Tephritidae* (2007) with a minimum dose of 150 Gy for the prevention of the emergence of adult fruit flies in all fruits and vegetables.

Further support for the efficacy of irradiation as a phytosanitary treatment for fruit fly exists in the US. In 2006, the US Animal and Plant Health Inspection Service (APHIS) approved generic irradiation doses of 150 Gy to reduce fruit fly infestation on specific fruits.

In this application, the minimum dose requested is 150 Gy, which is a generic treatment for economic fruit fly species. The proposed treatment range of 150 Gy minimum dose and 1 kGy maximum dose will comply with ISPM 18 and 28 requirements and is identical to the current levels approved in Standard 1.5.3.

Irradiation treatment is suitable for these fruits as the minimum effective dose for a phytosanitary purpose is lower than the radiation tolerance of the fresh produce of concern. Studies on the effect of low dose irradiation on the eleven fruits - apple, apricot, cherry, honeydew melon, nectarine, peach, plum, rockmelon, strawberry, table grape and zucchini (QLD DAFF 2012, 2013; Attachments 1–8) and previous studies (Part 3.1) show that the nutritional value and postharvest fruit quality of irradiated fruits were not significantly affected.

Additionally, a Codex Recommended Code of Practice for Radiation Facilities for Processing of Food and ASTM International Standards provide internationally accepted guidance on the establishment and routine operation of irradiation facilities, including detailed advice on dosimetry and record keeping.

Exports of irradiated Australian mango, papaya and litchi have been approved by Biosecurity New Zealand for several years and trade in irradiated fruits and vegetables, particularly in the US are increasing, with imports of irradiated fruits from many developing countries. In August 2013, Biosecurity New Zealand approved irradiated tomato and capsicum from Australia.

In 2011, the use of irradiation for phytosanitary purposes for domestic trade was approved and accepted by all states and territories in Australia. This treatment is available to businesses under the national Interstate Certification Assurance Scheme as Operational Procedure number 55 (i.e. ICA 55). It applies to all insects, excluding only Lepidoptera that pupate internally, and to all fruits for which FSANZ has approved the use of irradiation.

Safety

The safety of food irradiation has been thoroughly studied and evaluated comprehensively over the past 60 years. No food technology has ever been as extensively studied with respect to food safety as food irradiation. Panels of experts have systematically evaluated data from animal feeding tests and multi-generation tests in animals. In 1980, the Joint FAO/IEAE/WHO Expert Committee on the Wholesomeness of Irradiated Food (JECFI) affirmed that "Irradiation of any food commodity up to an overall average dose of 10 kGy introduces no toxicological hazard; hence toxicological testing of food so treated is no longer required". The JECFI also stated that irradiation of food up to a dose of 10 kGy introduces no special microbiological or nutritional problems. Investigations since 1981 have continued to support the JECFI's conclusions.

Codex Alimentarius issued a general Standard for Irradiated Foods (CAC1983, revised 2003), that any food irradiated up to an overall dose of 10 kGy is safe and wholesome. Irradiation for a phytosanitary purpose in this application has a maximum dose of 1 kGy. There is overwhelming evidence that irradiated food is toxicologically safe, and presents no special nutritional problems. The Food Irradiation Clearances Database shows over 60 countries that have at least one use of food irradiation, 30 countries have approved irradiation as a disinfestation treatment (includes approvals for delayed ripening and inhibition of sprouting), about 23 countries have approved irradiation up to 1 kGy for all fruit and vegetables and, 12 countries for specified fruits and vegetables (including Australia and New Zealand through FSANZ 1.5.3) (IAEA 2011).

Various studies on toxicology and chemistry of irradiated foods and food components have been reviewed, particularly of alkylcyclobutanones (ACBs). These substances also exist in non-irradiated foods and in foods processed by more conventional processes such as cooking. While minute amounts of such alkylcyclobutanones were detected in foods that contained high levels of total lipid and palmitic acid, such as in chicken and beef, the amounts as a result of irradiation at doses up to 1000 Gy, if any, would be minute and insignificant, and therefore would not pose a toxicological problem and is safe to eat. The lipid content of these fresh fruits is nil or very low compared to the 5–25% in meat products. No evidence of a hazard has been found on examination of radiolytic products produced.

The American Council on Science and Health (ACSH) and the Centres for Disease Control and Prevention in the US support food irradiation as a science-based technology that has been proven to be safe and effective (Loaharanu 2003, 2007). The use of irradiation provides consumers with a wider choice of safe, high-quality food. The most important public health benefit is its ability to destroy pathogenic organisms in food. The application in this submission is for a phytosanitary purpose, for a maximum dose 1kGy.

FSANZ has previously assessed the toxicological hazard and nutritional adequacy of various irradiated tropical fruits (breadfruit, carambola, custard apple, litchi, longan, mango, mangosteen, papaya, persimmon and rambutan) and vegetables (tomato and capsicum) and concluded that there are no public health and safety issues associated with their consumption when irradiated up to a maximum dose of 1 kGy.

At dose ≤1000 Gy, carbohydrates, proteins, dietary fibre and levels of minerals or trace elements in fruits and vegetables largely were not affected. Overall vitamin changes were minimal or not significant between treated and untreated fresh produce. The impact of storage rather than irradiation generally impacted fruit nutritional and postharvest quality (QLD DAFF 2012, 2013 – Attachments 1–8) when these effects were reported. As with other food processes, vitamin losses can be mitigated by protective actions (Diehl 1995). Irradiated fruits will be consumed as part of a mixed diet, and the treatment therefore will have little or nil impact on the total intake of specific nutrients.

Irradiation of fresh produce for a pest disinfestation purpose has no microbiological implications and the maximum absorbed dose allowed (1 kGy) is one-tenth of the general maximum permitted under the Codex Standard.

Dietary Intake Assessment

A Dietary Intake Assessment (DIA) for the eleven fruits is useful but the weight of data and evidence obtained from the DAFF studies and other research indicate that irradiation up to 1 kGy is unlikely to have any marked effect on the nutrient content of apple, apricot, cherry, honeydew melon, peach, plum, nectarine, rockmelon, strawberry, table grape and zucchini.

Differences in the levels of irradiation sensitive (pro) vitamins (beta-carotene and Vitamin C) in apple, apricot, cherry, honeydew melon, peach, plum, nectarine, rockmelon, strawberry, table grape and zucchini were within the range of the vitamin losses that would have occurred during storage of non-irradiated fruit. Ripening and other food processing methods have been shown to have much larger impacts on vitamin levels than irradiation treatment.

An estimate of < 2% decrease on population intakes of Vitamin A and Vitamin C was projected in an assessment of the combined cumulative nutritional impacts of all the currently permitted irradiated foods (including tomato and capsicum) (FSANZ 2013 Risk and Technical Assessment report).

Available data indicate that macronutrients (carbohydrate, fat, protein) and minerals of foods are unaffected by irradiation at doses up to 1 kGy.

A robust and very comprehensive DIA was undertaken in a previous assessment (tomato and capsicum) for Australian and New Zealand populations (FSANZ 2013 Risk and Technical Assessment report). FSANZ concluded that the irradiation of tomato, capsicum and certain tropical fruits at up to 1 kGy, and assuming a maximum nutrient loss of 15% nutrient loss applied to all fresh tomato, capsicum, and tropical fruits already permitted in the Standard, is not likely to have any impact on population intakes for any irradiation-sensitive nutrients (i.e. water- and fat-soluble vitamins). Furthermore, dietary intake would typically be derived from a wide range of foods.

At the major food group level, ‘vegetable products and dishes’ and/or ‘fruit products and dishes’ are not major contributors (<5%) to thiamine, riboflavin or niacin intakes. The more frequently consumed banana is identified as the major contributor to Vitamin B_6 at the minor food group level. Therefore population dietary intakes of these nutrients in Australia and New Zealand will not be affected by irradiation treatment of these 11 fresh produce.

Vitamin B_{12}, Vitamin D and pre-formed Vitamin A (retinol) are not present in quantifiable amounts in these 11 fresh produce under consideration for irradiation treatment. Much of these vitamins are largely found in animal products (NHRMC 2006) and therefore these 11 fresh produce are clearly not dietary sources of these vitamins. Population dietary intakes of these nutrients in Australia and New Zealand will not be affected by irradiation treatment of these produce.

The impact of irradiation on Vitamin A is also minimal. The major sources of Vitamin A for Australian and New Zealand children are carrots, similar root vegetables and milk. In older age groups vitamin A contributions are sourced from animal organ meats and dairy products. In a previous assessment on tomato and capsicum, FSANZ found that even a worst case scenario of 15% carotene loss the impact of Vitamin A intakes was minimal (<1%) and mean intakes remained above the Estimated Average Requirements (EAR).

Similarly the FSANZ assessment on tomato and capsicum, using a worst case (15% loss) scenario for Vitamin C loss was 2% for older Australian and New Zealand population groups and ≤1% for all other population groups. Mean intakes were above the EAR in all population groups.

There is currently no data available on the proportion of fresh apple, apricot, cherry, honeydew melon, peach, plum, nectarine, rockmelon, strawberry, table grape and zucchini that may be potentially irradiated. Estimates on production volume of these fresh commodities are provided in the application however the proportion available for sale as irradiated produce in Australia and New Zealand can be expected to be lower.

On the Australian domestic scene, fruit produced in endemic fruit fly areas that is being sent to areas free of fruit fly are required to undergo phytosanitary treatments. Current treatment options available for regulated pests include - cold disinfestation, heat treatment, chemical treatment (insecticides and fumigants), systems approach, conditional non-host status and irradiation (n.b not all treatment options are available for the crops listed in this application). However, not all fruit produced in endemic fruit fly areas requires treatments as the major markets on the east coast of Australia (Brisbane, Sydney, Melbourne etc.) are within endemic fruit fly areas and phytosanitary certification is not required. As such it is difficult to estimate the percentage of fruit within Australia that will require treatment.

For New Zealand, which is free of fruit flies, all imports from fruit produced in endemic fruit fly areas will require treatment. Fruit produced in fruit fly free areas (e.g Tasmania) will not require treatment. As such it is difficult to estimate what percentage of fruit will require irradiation treatment given that the need to treat fruit will vary with each commodity and where that commodity is produced.

Other implications

Irradiation at low doses is an effective alternative treatment that is safe to use. The treatment method overall does not significantly impact on the nutritional and postharvest quality of fruit. The approval for its use for a phytosanitary purpose will ensure continued access for fresh produce within Australia and overseas. Literature and QLD DAFF data show this to be the case for many fresh fruits and vegetables. The data indicated that the irradiated fruits treated under the same conditions for a phytosanitary purpose, would not present any nutritional concerns and postharvest quality is not severely impacted.

Packaging materials used for packing these fresh produce are made from the same materials currently approved for use with irradiated mango, papaya and litchi fruit. They are packaging materials suitable for irradiation treatment and comply with regulated articles both domestically and overseas, and approved for use in food irradiation by the US Food and Drug Administration (US FDA). The irradiation treatment does not impair package integrity nor deposit toxic radiation reaction products or additives on the produce.

Packages containing treated produce will be labelled in accordance with the labelling requirement as stated in FSANZ Code Standard 1.5.3. Labelling identifies that the fruit was treated by irradiation and ensures that all parties are informed, thus providing choice for consumers. Interestingly, foods that are chemically treated do not have to be labelled.

The irradiation facility carrying out the treatment will be a licensed and regulated radiation facility, and abides by requirements of good manufacturing practice (GMP) and acts in accordance with the Codex Alimentarius General Standard for Irradiated Foods (2003b) and its associated Code of Practice for the Operation of Irradiation Facilities Used for the Treatment of Foods (1983). Proper dosimetry systems and compliance by the approved irradiation facility with accurate records allow tracking of the irradiated produce from receiving through shipping.

Australia has very strict food safety standards that apply to retail, wholesale, exporting and processing. These standards are developed jointly be leading Australian retailers and Food Standards Australia New Zealand (FSANZ). All reputable Australian and New Zealand fruit and vegetable producers operate an independently audited HACCP-based food safety system. These systems cover all facets of production and include periodic testing of fruit to ensure it complies with maximum residue level (MRL) requirements in proposed destination markets.

Conclusion

The approval of irradiation of apple, apricot, cherry, honeydew melon, nectarine, peach, plum, rockmelon, strawberry, table grape and zucchini for a phytosanitary purpose will provide a safe and effective option to maintain market access throughout Australia and New Zealand for those fruit crops grown in areas with endemic fruit fly populations and/or other regulated pests. Consumers will benefit from the continued availability, choice and price stability of these fresh produce. The harmonisation of phytosanitary irradiation treatments for regulated pests could mean access to new markets for Australian and New Zealand fresh produce, particularly for commodities whose production period is counter-seasonal to that of the importing country.