

INTERNATIONAL DEVELOPMENTS OF IRRADIATION AS A QUARANTINE TREATMENT OF FRESH FRUITS AND VEGETABLES

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Background

The role of irradiation as a quarantine treatment of fresh fruits and vegetables was first evaluated internationally by a group of experts convened by FAO and IAEA in 1970 (IAEA, 1971). Although it was recognized at that time that irradiation was an effective quarantine treatment of such commodities, there was no economic incentive in using it commercially in view of the wide application of fumigation, especially using ethylene dibromide (EDB), to overcome quarantine barriers.

Following the ban of EDB in the USA in 1984, the International Consultative Group on Food Irradiation (ICGFI), established under the aegis of FAO, IAEA and WHO since 1984, which has one of its functions to advise the three Organizations and their Member States of the global developments on food irradiation, convened a Task Force on Irradiation as a Quarantine Treatment to evaluate available data on radiation sensitivity of various fruit fly species and other arthropod pests, and, phytotoxicity of commodities treated for this purpose. On the basis of these data, the Task Force recommended a generic dose of 0.15 kGy (minimum) as a quarantine treatment of fresh fruits and vegetables against fruit flies of the tephritidae family, and 0.30 kGy (minimum) against other arthropod pests including mango seed weevils (ICGFI, 1986).

Additional data on radiation sensitivity of several more fruit fly species, other insects and mites were generated by the FAO/IAEA Co-ordinated Research Programme on the Use of Irradiation as a Quarantine Treatment of Food and Agricultural Commodities, in operation between 1986 and 1990. Data from this international co-ordinated research programme together with those on the use of conventional quarantine treatments were evaluated by the second Task Force on Irradiation as a Quarantine Treatment of Fresh Fruits and Vegetables, convened by the ICGFI, in 1991. The Task Force recognized that adequate data exist to establish radiation doses that will meet quarantine security for a number of pest species in

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Currently, EPPO is evaluating quarantine procedures and measures as a follow-up to the European Single Law Act which has been in force since 1993. The Act allows free circulation of any goods including food and agricultural products, throughout its member countries without restrictions. A number of food and agricultural commodities imported from other regions may harbour insect pests which could damage local agriculture in some member countries of the EU, especially those in the sub-tropical areas around the Mediterranean. Countries such as Spain, Israel, Egypt and Morocco which are members of EPPO, are producing increasingly large quantities of fruits such as mangoes, papaya, pineapple, banana and cherimoya which may become host to a number of exotic fruit fly species. Thus, quarantine barriers may soon be imposed by the EU to protect local agriculture. Irradiation as a quarantine treatment of fresh horticultural products is being considered by EPPO, along with other treatments, as a measure to overcome such barriers.

Governments which are members of Association for South-East Asian Nations (ASEAN) have already agreed to harmonize their regulations on food irradiation and to develop a uniform quarantine treatment using this technology for fresh fruits and vegetables destined for the USA and other markets. An ASEAN workshop to develop a treatment protocol of such commodities was held in Jakarta, Indonesia, 7-8 October 1997.

Approval of Irradiated Fresh Fruits and Vegetables

Although the Codex Alimentarius Commission recommended its member governments to accept all food irradiated with doses up to 10 kGy, most governments opted for approval of irradiated food on an item-by-item basis, and occasionally on specific groups/classes of food, e.g. fruits, vegetables, cereals, roots and tubers, etc. Currently, some 40 countries have approved one or more irradiated food items or groups of food including fresh fruits and vegetables for consumption. It is significant to note that while the U.S. Food and Drug Administration has approved all types of irradiated fresh fruits and vegetables, treated up to a maximum dose of 1 kGy, the USDA/APHIS, however, has issued a specific regulation on irradiation as a quarantine treatment of only three fruits from Hawaii against fruit fly infestation. It is anticipated that the USDA/APHIS will soon allow irradiation to be used as a quarantine treatment against major species of fruit flies regardless of commodities on a routine basis.

**Irradiation as a Quarantine Treatment of Mites and Insects other than Fruit Flies
(Summary)**

| Scientific name | Common name | Major host(s) | Minimum dose required (Gy) |
|---------------------------------|--------------------------|------------------------------|---|
| Coleoptera | | | |
| <i>Sternochaetus mangiferae</i> | mango seed weevil | mango | 300 (no emergence) |
| <i>Orchidophilus aterrimus</i> | orchid weevil | orchid flowers | 150 (no adult emergence; adult sterility) |
| Diptera | | | |
| <i>Liriomyza trifolii</i> | leafminer | leaf vegetables, cut flowers | 100 (no emergence) |
| Homoptera | | | |
| <i>Myzus persicae</i> | green peach aphid | vegetables, ornamentals | 200 (sterility) |
| <i>Pseudococcus comstocki</i> | mealybug | ornamentals, tree fruits | 400 (sterility) |
| <i>Coccus viridis</i> | green scale | ornamentals, tree fruits | 750-1,000 (partial adult mortality*) |
| Lepidoptera | | | |
| <i>Conopomorpha sinensis</i> | litchi stem-end borer | litchi, longan | 250 (no emergence) |
| <i>Spodoptera litura</i> | cutworm | cut flowers | 100 (no emergence) |
| Thysanoptera | | | |
| <i>Frankliniella schutzei</i> | blossom thrips | tree fruits | 250-300 (sterility*) |
| <i>Retithrips syriacus</i> | slender thrips | common cut flowers | 200 (sterility) |
| <i>Thrips tabaci</i> | onion thrips | common cut flowers | 400 (sterility) |
| <i>Thrips palmi</i> | melon thrips | cut flowers, vegetables | 1,000 (larval mortality) 400 (sterility) |
| Acarina | | | |
| <i>Panonychus ulmi</i> (eggs) | European red spider mite | fruits, fruit trees | 150 (no emergence) |
| <i>Tetranychus cinnabarinus</i> | carmine mite | vegetables, cut flowers | 320 (sterility) |
| <i>Tetranychus urticae</i> | two-spotted spider mite | vegetables, cut flowers | 320 (sterility) |
| <i>Oligonychus biharensis</i> | red spider mite | ornamentals | 200 (sterility) |

*) Preliminary results

The doses needed to immobilize, kill, and decrease hatch or development estimated so far cannot be applied on living plant materials. For example, ginger irradiated with doses higher than 1 kGy would not be acceptable to the market. The high doses weight losses in a short period of time. Deterioration of color and texture also will create additional problems. Doses reported for the control of nematodes in onion, garlic, or potato are too high and will result in plant tissues deterioration.

Plant parasitic nematodes therefore appear to be resistant to irradiation as the dose required to render them sterile (min. 4 kGy) would cause damage to fresh horticultural commodities. Irradiation would be a useful quarantine treatment against this pest only for durable commodities such as pot soil, wood products, etc.

Irradiation as an alternative treatment to methyl bromide fumigation for insect control

The interest in using irradiation as a quarantine treatment of fresh and stored food products has increased recently as methyl bromide (MB), the most widely used fumigant to control insects in food and agricultural commodities, is being phased-out globally under the Montreal Protocol (an international treaty for the regulation of ozone depleting substances worldwide and under the auspices of the United Nation Environmental Programme). Currently, MB's use as a pre-shipment and quarantine treatment is exempted under the Montreal Protocol. At the last Meeting of the Parties to the Montreal Protocol, held in Montreal, Canada, in September 1997, it was agreed that MB should be phased-out according to the following schedules:

| | |
|----------------------------|--------------------------|
| Advanced countries: | 25% reduction by 1999 |
| | 50% reduction by 2001 |
| | 70% reduction by 2003 |
| | Phase-out by 2005 |

| | |
|------------------------------|--------------------------|
| Developing countries: | 20% reduction by 2005 |
| | Phase-out by 2015 |

The USA which is the main producer and exporter of MB decided to change its law

can no longer be accepted under the WTO procedures. International trade in irradiated food including fresh fruits and vegetables to overcome quarantine barriers, therefore, is likely to increase in the near future.