Irradiation as a Phytosanitary Treatment of Fresh Horticultural Commodities

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Summary

The effectiveness of irradiation as a quarantine treatment against tephritid fruit flies has been clearly demonstrated and is endorsed by national and international plant protection authorities. Little data are available on the effect of irradiation against other insect pests, many of which depend on methyl bromide fumigation to satisfy quarantine requirements in trade. In response to the global phase out of methyl bromide starting in the USA and the European Union in January 2001, the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, sponsored a co-ordinated research programme (CRP) on Irradiation as a Quarantine Treatment of Mites, Nematodes and Insects other than Fruit Flies from 1992 to 1997. The following achievements were made from this CRP:

(i) Irradiation as a Quarantine Treatment of Mites (Acarina) Infesting Agricultural Commodities.

Data on the effects of irradiation on different acarid mites *(Acaridae)* were obtained. A minimum dose of 0.15 kGy appears to be adequate to prevent post-diapause hatching of wintering eggs of the European spider mite. Thus, this dose appears to meet quarantine requirements against this mite species in commodities such as apples which are infested by this developmental stage. In other mite species, e.g. red spider mites, two-spotted spider mites, carmine mite, nymphs were more resistant to radiation than eggs and larvae. A minimum dose of 320 Gy was sufficient to cause sterility of this stage and meet the criterion of "inability to reproduce".

(ii) Irradiation as a Quarantine Treatment of Insects other than Fruit Flies

Effects of irradiation as a quarantine treatment of insects (other than fruit flies) of the Orders Coleoptera, Diptera, Hemoptera, Lepidoptera, Thysonoptera were examined. Insects belong to Diptera order are most sensitive to radiation, i.e. a min. dose of 100 Gy is sufficient to prevent adult emergence. Most insects belonging to other order could be sterilized by a min. dose of 300 Gy, thus meet quarantine requirements. A few insect species including green scale, mealy bugs appear to require doses higher than 300 Gy to become sterile, however.

(iii) Irradiation as a Quarantine Treatment of Plant Parasitic Nematodes

Evaluations of effects of radiation on various plant parasitic nematodes showed that most species are tolerant to radiation. A min. dose of 4 kGy was needed to prevent infectivity of most of these nematodes. Such a dose cannot be tolerated by most fresh horticultural produce.

Thus, irradiation as a quarantine treatment of plant parasitic nematodes would have to be limited to commodities which are tolerant to irradiation such as soil and wood products.

(iv) Tolerance and Quality of Various Horticutural Commodities Irradiated for Quarantine Purposes

Many types of fresh fruits and vegetables could tolerate radiation doses required for quarantine purposes. However, the tolerance of cut flowers to irradiation varied widely from tolerant up to a dose of 700 Gy including ferns, phoenix leaf, narcissus, tulips, prairie gentian, carnation, red ginger, etc. to sensitive to dose below 200 Gy including chrysenthymum, rose, lily, anthurium, dendrobium, heliconia, gerbera, etc.

An international research protocol on irradiation as a phytosanitary treatment of insects other than fruit flies is being developed in consultation with national plant protection and quarantine authorities of major trading nations. Such a protocol will be used in future research to confirm the effectiveness of irradiation against various insects and mites of quarantine importance. This research will also be co-ordinated by the Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture through a CRP on Irradiation as a Phytosanitary Treatment of Food and Agricultural Commodities, starting from January 1999. Priorities of this CRP will be given to research on selected pests/commodities combinations, both for fresh and durable food and agricultural commodities, which would represent major trade problems and have a realistic opportunity to implement the use of this technology in the near term.