WHAT MIGHT BE THE LOWEST POSSIBLE PHYTOSANITARY IRRADIATION DOSES?

Guy J. Hallman
Joint FAO-IAEA Programme on Nuclear Applications in Food and Agriculture, Vienna, Austria

Phytosanitary irradiation (PI) is a steadily growing commercially applied phytosanitary treatment and methyl bromide alternative. In 2015 a total of approximately 25,000 metric tons of fresh commodities was irradiated for phytosanitary purposes in several countries and exported to several more. The main commodities are guava and sweet potato, but a variety of other commodities are irradiated as well. PI is the only solution to quarantines of some commodities and has great potential for further expansion of commercial use.

The most commonly used dose is 400 Gy, which is used for well over half of all commodities irradiated because it is the generic dose accepted by the United States of America (USA) for all insects except pupae and adult Lepidoptera (moths and butterflies), and the USA is the largest importer of commodities irradiated for phytosanitary purposes. However, some commodities, such as some citrus, may not tolerate that dose (Prakash 2015), especially when applied on a commercial scale. Because of the large dose uniformity ratio achieved when 400 Gy is prescribed, in some irradiation processing facilities commodities will absorb up to two and a half times the minimum doses prescribed, or even more. This is especially true for application to pallet-loads of product, which is the most economical way to irradiate.

Based on research done through a recent IAEA Collaborative Research Project (Hénon 2015) and other research done throughout the world in recent years viable lower doses are apparent. Hallman and Blackburn (2016) and Hallman et al. (2016) list a number of doses that are supported by research (Table 1). New Zealand, a pioneer in importing PI-treated produce, already accepts some of these doses for several fruits imported from Australia (MPI 2016; Hallman and Blackburn 2016).

The dose of 250 Gy may be as low as is possible for most quarantine pests using the rather conservative measures of efficacy mostly used for PI. If more liberal measures of efficacy are accepted doses could be lower, but more research would be needed to support this concept. Doses for other groups of fruit flies besides *Anastrepha* (includes Caribbean, Mexican South American and West Indian fruit flies) might also be reduced from the generic dose of 150 Gy. Lower doses for individual species of quarantine pests can be implemented where supporting research exists; for example, 100 Gy is widely accepted for Mediterranean fruit fly. Research is needed to support doses for other key groups and species of quarantine pests, such as snails and thrips.

References Cited

Hallman, GJ, and CM Blackburn. 2016. Phytosanitary irradiation. Foods 5, 8.

Hallman, GJ, Y. Hénon, AG Parker, and CM Blackburn. 2016. Phytosanitary irradiation: an overview. Florida Entomologist 99: (in press).

Hénon, Y. 2015. Research in phytosanitary irradiation: the role of the International Atomic Energy Agency and the Joint FAO/IAEA Division. https://mbao.org/static/docs/confs/2015-sandiego/papers/59henony.pdf

MPI [Ministry for Primary Industries]. 2016. Standard 152.02: Importation and Clearance of Fresh Fruits and Vegetables into New Zealand. Ministry for Primary Industries, Wellington. https://mpi.govt.nz/document-vault/1147

Prakash, A. 2015. Effects of phytosanitary irradiation on the quality of pummelos and mandarins. https://mbao.org/static/docs/confs/2015-sandiego/papers/62prakasha.pdf

Table 1. Generic phytosanitary irradiation doses supported by research (Hallman and Blackburn 2016; Hallman et al. 2016).

Pest group	**Dose (Gy)**
Fruit flies	150*
Anastrepha fruit flies	70
Weevils	150
Leafminers	200
Mealybugs	250
Scale insects	250
Moth eggs and larvae	250
All insects except moth pupae and adults	300
Moth pupae	400
Spider mites	400
Other mites	500

*150 Gy is already widely accepted as a generic dose for all fruit flies of the important family Tephritidae.