PPQ Irradiation Program: Research Needs and Future Directions

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The US Department of Agriculture (USDA) Animal Plant Health Inspection Service (APHIS) Plant Protection and Quarantine (PPQ) approved irradiation as a phytosanitary treatment in 1996. Since that time, PPQ has overcome many obstacles to establish irradiation as a successful alternative to methyl bromide fumigations. Recently, PPQ has faced challenges such as the establishment of generic radiation doses for treatment and destruction purposes and the use of modified atmosphere packaging for irradiated commodities.

In 2010, more than 500,000 pounds of methyl bromide were used in PPQ-supervised fumigations on commodities entering the United States. Each year, the majority of methyl bromide import usage can be attributed to the same commodities: Chilean grapes, kiwis, and lemons, Peruvian asparagus, Costa Rican pineapples and yams, and cut flowers from Colombia and the Netherlands. As the required dosage is known for many of these pest complexes, irradiation of these commodities is a possibility. Efforts are underway to examine the economic ramifications of using irradiation as a methyl bromide alternative.

In 2006, APHIS approved a rule for generic radiation quarantine treatments for all fresh horticultural products, allowing radiation doses of 150 Gy for any tephritid fruit fly and 400 Gy for all other insects except the pupa and adult stages of Lepidoptera. Generic treatments facilitate trade between countries; if no pupae or adult Lepidoptera are associated with a commodity, then no additional research is necessary for import/export approval. Future research is required to establish generic doses for Lepidoptera pupa and adult stages and to find generic doses below 400 Gy for arthropod groups other than fruit flies.

Recently, PPQ started domestically irradiating mangoes imported from Pakistan. Because it was a possibility that non-target pests could be discovered at the treatment location, it was necessary to establish an absorbed dosed to be used as a destruction treatment. A dose of 1100 Gy (1.1 kGy) was selected to mitigate the risks associated with all life stages of the most radio-tolerant insects. 25,000 Gy (25 kGy) was selected to control three pathogens of concern: *Xanthomonas campestris* pv. *mangiferaeindicae, Cytosphaera mangiferae*, and *Phomopsis mangiferae*. Because these dosages exceed the 1000 Gy limit established by the FDA for fruits and vegetables, commodity irradiated at these dosages must be disposed of after treatment. Further research is necessary to determine if these treatments can be used as a destruction standard for all non-target pests entering the country.

Modified Atmosphere Packaging (MAP) is a process that alters the gas composition surrounding a commodity, prolonging the shelf-life of perishable goods. To slow the speed of aerobic microorganisms, low O_2 environments are created by displacing O_2 in the packaging with other gases (e.g. N_2 or CO_2). In the past few years, requests to use MAP for phytosanitary treatments have dramatically increased. Unfortunately, in the low O_2 environment created by MAP, insects are able to tolerate higher absorbed doses of irradiation than under normal atmospheric conditions. In conjunction with industry and USDA-ARS, CPHST is designing the research to establish the necessary environmental parameters that would allow industry to use MAP for phytosanitary quarantine treatments.