PPQ IRRADIATION PROGRAM: CURRENT STATUS AND RESEARCH NEEDS

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Irradiation is the exposure of a substance to ionizing energy (radiation) to achieve a desired effect. In the case of phytosanitary treatments, the desired endpoint is mortality, sterility, reduced fitness, or the inability to emerge or fly. There are three sources of ionizing radiation approved for phytosanitary treatments: E-beam, gamma-emitting radioisotopes, and X-rays. The dose, measured in Gray (Gy), is the amount of ionizing radiation absorbed. PPQ treatments are in the range of 60-400 Gy.

In 1997, USDA Animal and Plant Health Inspection Service (APHIS) Plant Protection and Quarantine (PPQ) approved Irradiation as a Phytosanitary Tool (IPT) for use on papayas shipped from Hawaii to the conterminous U.S., Guam, Puerto Rico, and US Virgin Islands. In 2002, IPT was approved for all fresh fruits and vegetables imported into the US. Over the past few years there has been a dramatic increase in the amount of fruit irradiated as part of the IPT program. More than 8 million kg of fresh fruit were irradiated in PPQ-supervised treatments in 2010, a 4000% increase since 2007. Most PPQ irradiation treatments occur in the exporting country as part of a preclearance program. Presently, PPQ supervises irradiation treatments in India, Mexico, South Africa, Thailand, and Vietnam. Many commodities (such as sweet potato and curry leaves) are irradiated for domestic movement within the US. In 2011, PPQ certified the first domestic irradiation facility for treatment of US exports to Mexico. Also in 2011, PPQ started irradiating mangoes from Pakistan at a treatment facility in the US. After the landmark Southern States CFR change in 2012, PPQ irradiated the first US import, South African persimmon, in a Southern State in 2013.

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.

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.