



Phytosanitary Irradiation Research Needs

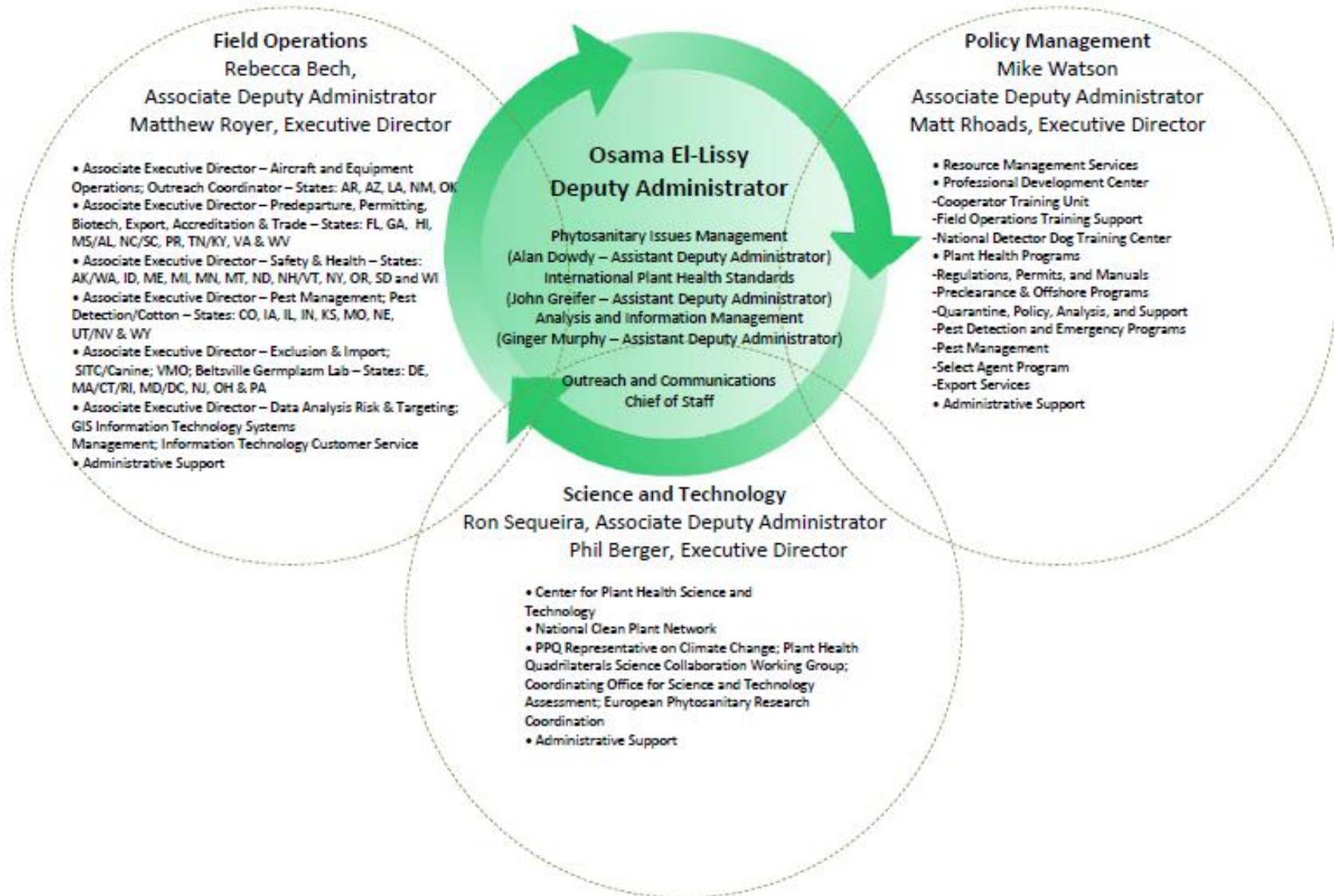
Woodward D. Bailey

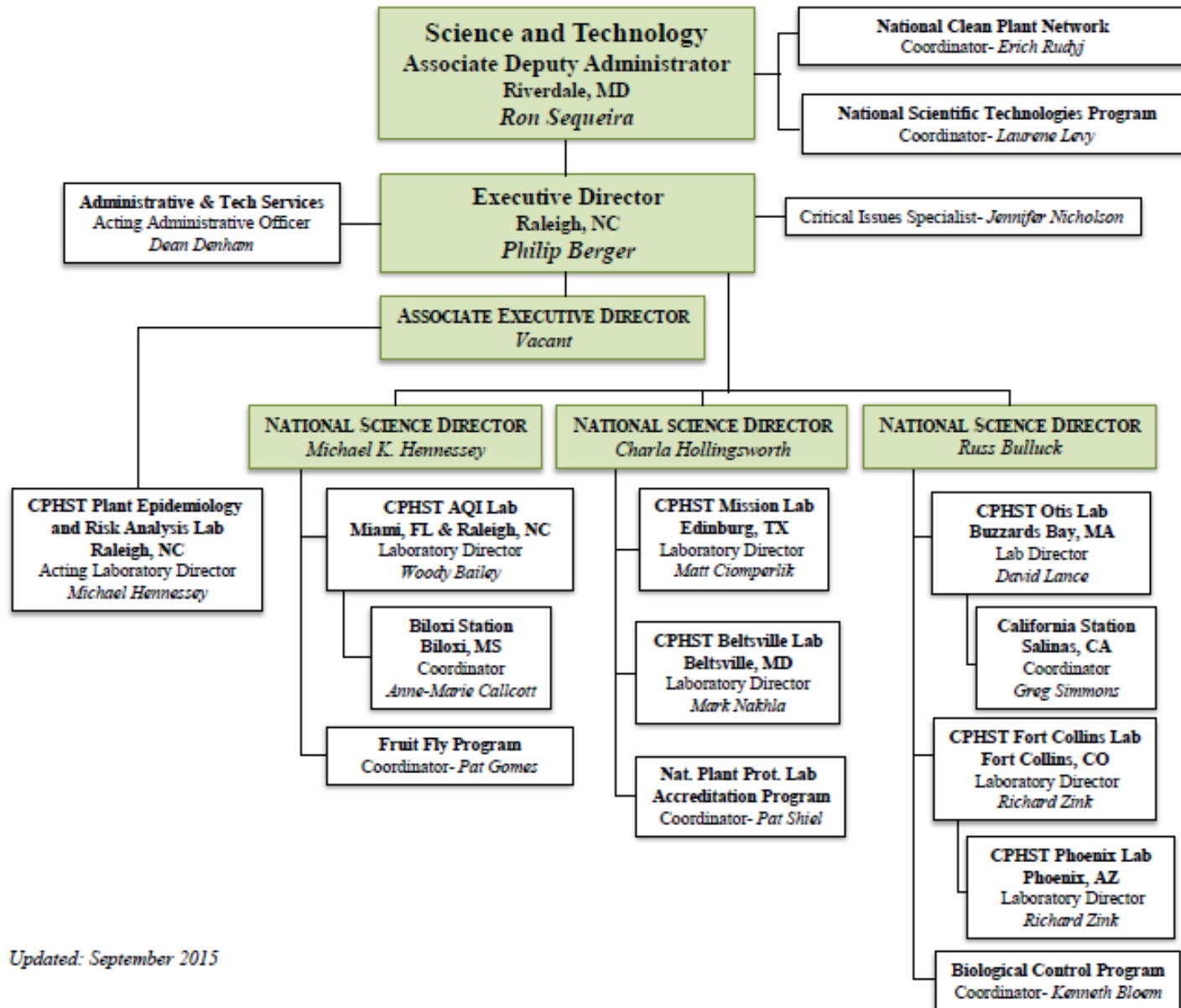
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Science and Technology
Plant Protection and Quarantine
Animal and Plant Inspection Services
United States Department of Agriculture

Plant Protection and Quarantine Organizational Structure

Current as of September 2015





S&T Irradiation Efforts

- PPQ policy and standard development
- Research proposal review and/or development
- Research (quality, MAP, generic & specific pest doses)
- Cooperator research project management
- International and domestic outreach
- Facility, packaging and process configuration approval (non-routine)
- Facility certification and recertification (non-routine)

S&T Irradiation Research Efforts



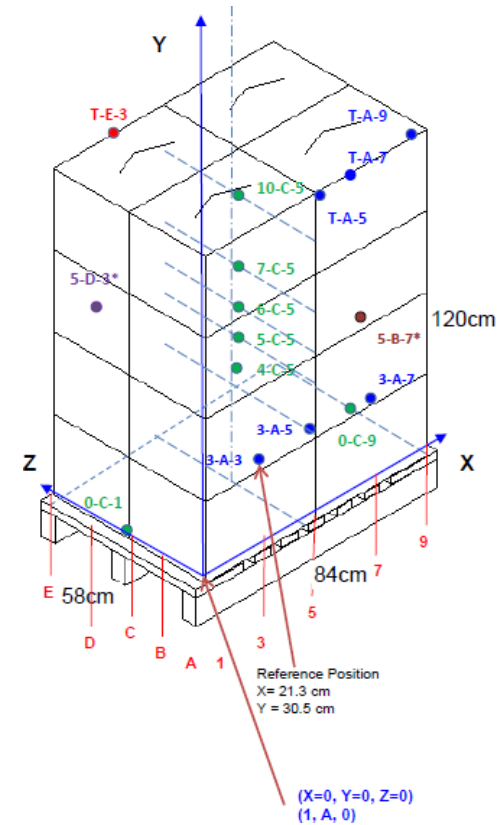
- Process configuration approval
- Modified atmosphere packaging
- Treatment verification tool
- Quality studies
- Odds n ends

Dose Mapping

It is important to know what the absorbed dose range will be throughout the configuration

Dose mapping

- Identify areas of high and low absorbed dose
- Determine R_f (reference dose)



Process Configuration Testing

Packaging approval and process configuration testing and approval has to occur before commodity is shipped to the US from the country of origin

Issues with current process:

- Time consuming
- Cost prohibitive (destructive)
- Overly conservative
- Very difficult for Port of Entry Irradiation Program



Process configuration testing on Thai longan

Process Configuration Testing

Industry requested APHIS to help develop procedures:

- Non-destructive testing
- Immediate release of commodity

PPQ has validated industry proposals from 3 facilities

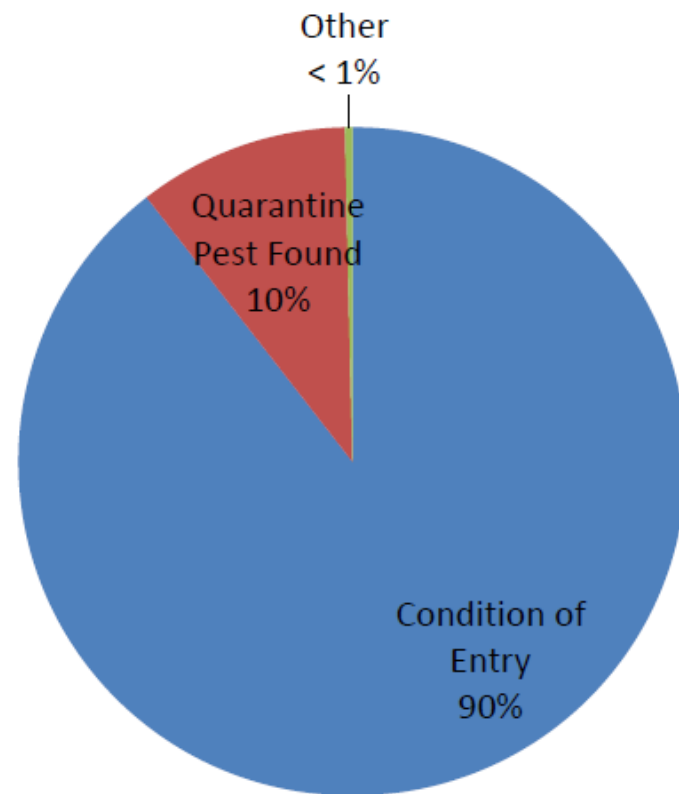


Methyl Bromide Alternative

Condition of entry
treatment



Emergency
action at port of
entry



US Imports: 2014 MB Usage

The Evolution of Pest Proof Packaging



Modified Atmosphere Packaging

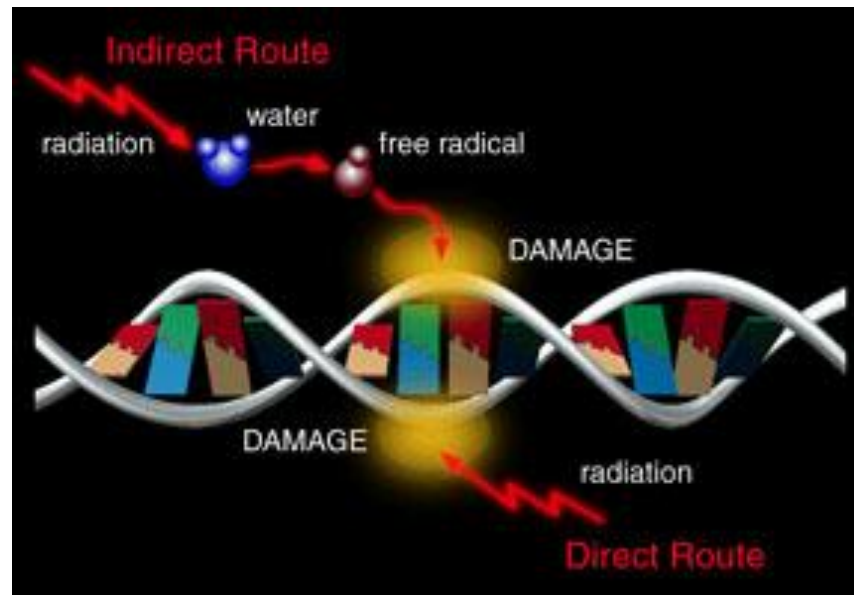
MAP is a process that alters the gas composition surrounding a commodity.

- prolongs the shelf-life of perishable goods
- slows the speed of aerobic microorganisms



In the past few years, requests to use MAP for phytosanitary treatments have dramatically increased.

Modified Atmosphere Packaging



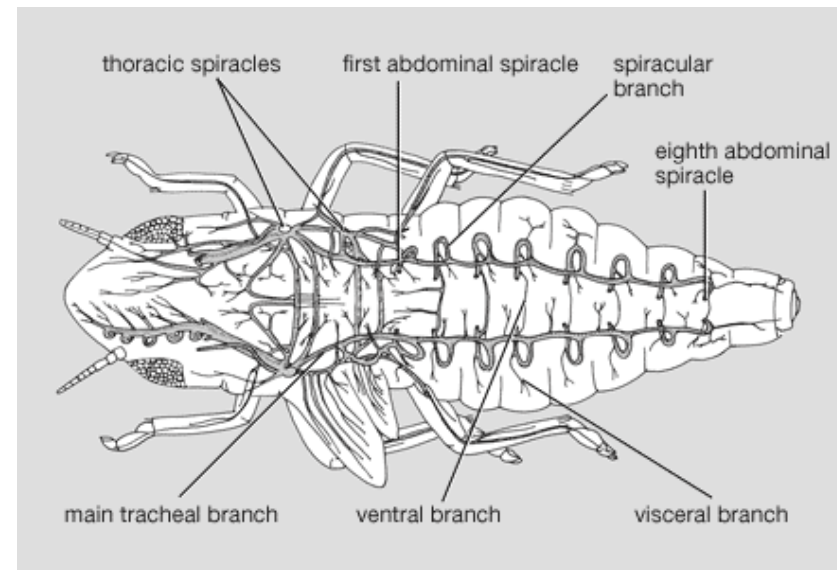
The generation of free radicals from oxygen and water cause tissue damage.

Modified Atmosphere Packaging

Most MAP creates a low O₂ environment.

Insect respiration slows, resulting in reduced O₂ concentrations in the hemolymph.

In hypoxic environments, higher absorbed doses may be necessary to achieve same physiological effects.



Modified Atmosphere Packaging

Anoxic environment reduce efficacy of irradiation treatments

In hypoxic environments, higher absorbed doses may be necessary to achieve same physiological effects

Current policy requires a minimum concentration of 18% O₂ in MAP (very conservative)





United States Department of Agriculture

Modified Atmosphere Packaging

CPHST is funding University of Florida research to characterize the effects of modified atmospheres on irradiation treatments with Lepidopteran pests



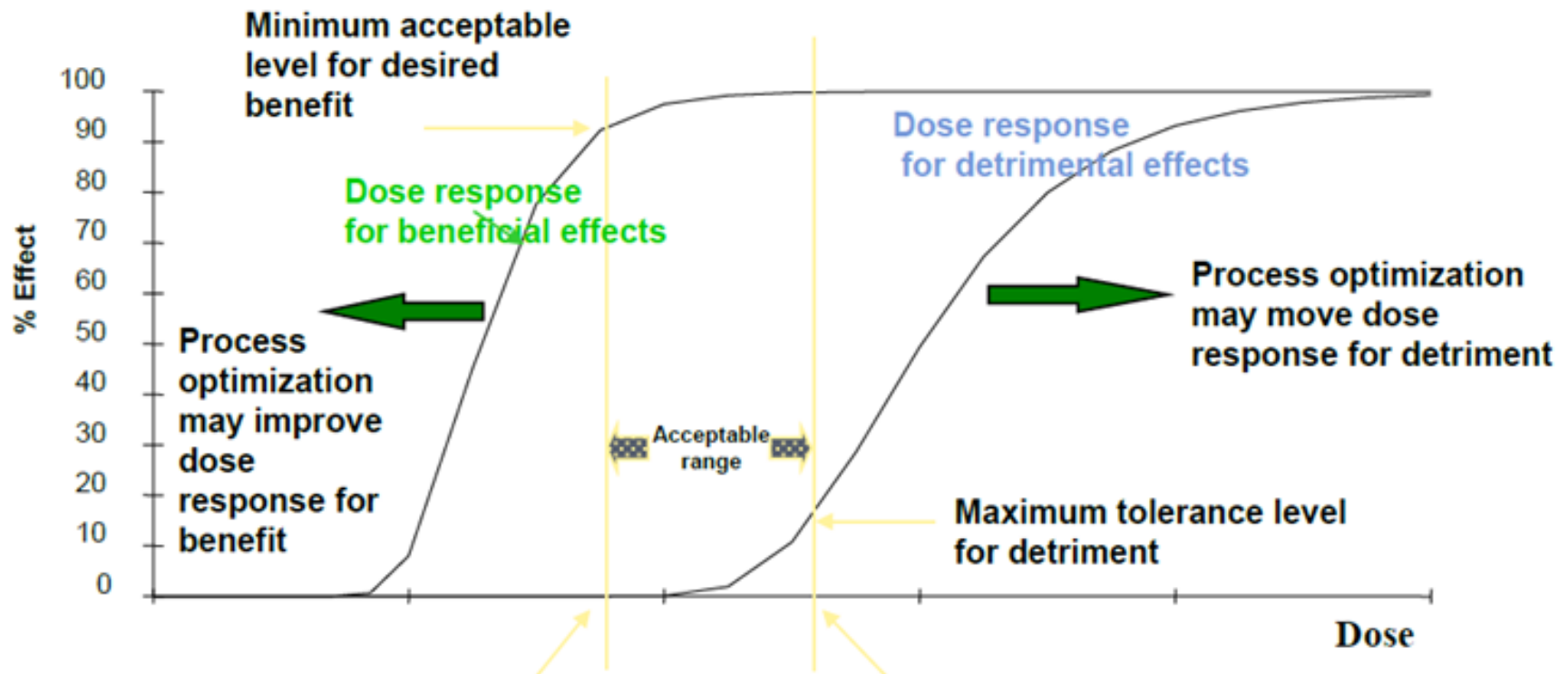
Quality Work



Most fruit can be irradiated with 150-600 Gray with no adverse effects

- Log reductions of pathogen loads
- Increased shelf life
- Improved quality

Quality Work



Quality Work

Joint Project (Chapman University, FTSI, and PPQ)

- Peaches irradiated 250, 400, 700, and 1000 Gy
- Analysis performed 1,7,and 14 days after treatment
- Shelf life, pH, Brix, and weight loss



Quality Work

Irradiation positively affected the liking/acceptability of all peach varieties tested



Shelf life, pH, Brix, and weight loss are not negatively affected by irradiation (variety and age play a bigger role)

Quality Work

Effect of phytosanitary irradiation on the quality and shelf-life of citrus

- Determine if phytosanitary irradiation is a feasible treatment for Chinese citrus imports
- Partnering with Chapman University
- Following an irradiation treatment, fruit will be evaluated for changes in quality and shelf-life indicators



Treatment Verification Tool

In the event that CBP intercepts a live pest within the pest proof packaging, PPQ needs a tool to verify that an irradiation treatment has occurred.

Ideally, the treatment verification tool would:

- Provide immediate Y/N answer
- Be inexpensive
- Be easy to use
- Not require hazardous reagents
- Have low-maintenance storage requirements
- Work for multiple insect families

Treatment Verification Tool

CPHST has just initiated a cooperative agreement with the University of Florida to develop a diagnostic assay to confirm phytosanitary irradiation treatment.





Thank you.

Questions?