Component II: Protection of Agricultural and Horticultural Crops

2e. Stone Fruit (U.S. Value 2007: $1.3 billion)

***Problem Statement*:** The principal commercial stone fruit species (cherries, peaches, apricots, and nectarines) do not produce maximum yields of quality fruit due to the following pests:

- Cherry Fruit Fly
- Plum Curculio
- Peachtree Borers
- Oriental Fruit Moth
- Peach Twig Borer
- Phytophagous Mites
- Aphids
- Cherry Bark Tortrix
- Stink Bugs
- Thrips
- Root Feeding Weevils
- Japanese Beetle and Green June Beetle
- Glyphosate-Resistant Weeds

***Research Needs*:**

1. **Cherry Fruit Flies**

   Importance: The western cherry fruit fly is a major quarantine pest of sweet cherries in the Pacific Northwest of the United States. There is a zero tolerance for cherry fruit fly larvae in fresh cherries whether for export or domestic sale, with specific phytosanitary requirements varying among countries. Methyl bromide fumigation of cherries against cherry fruit fly is required by several trading partners, though the cherry industry is actively seeking an alternative to this fumigant.

   Research Gaps: Research is needed to provide growers with better tools to determine the status of cherry fruit fly in their orchards and to reach fly-free status. This includes quantifying the densities of flies in unmanaged cherry trees and the risks of flies dispersing and infesting managed commercial orchards; determining the adequacy of current spray programs for control of the flies (in

particular the use of different spray intervals and newer and safer insecticides at pre- and post-harvest); determining chilling regimes that are most effective in killing egg and larval stages of the fly in fruit; and determining if current methods used to detect fly larvae in harvested cherries in the warehouse are adequate to ensure a high level of assurance that fruit are free of infestation.

Actions: ARS will:

- Determine the efficacy of new and safer materials for use in spray programs for control of cherry fruit fly.
- Determine optimal chilling regimes for killing cherry fruit fly larvae in harvested fruit in the warehouse.
- Develop a better understanding of cherry fruit fly behavioral responses to attractants, baits, and traps.
- Develop new knowledge of cherry fruit fly phenology, host use, dispersal and orientation, and food sources.

2. Plum Curculio

Importance: The plum curculio has traditionally been a critically important pest of stone fruits (including peaches, plums, and cherries) as well as pome fruits, particularly in the eastern United States, as well as some other significant stone-fruit producing states. Due to potential changes in its distribution and host use, it threatens to be of importance throughout the entire country. The insect causes direct damage to the fruit by feeding and oviposition.

Research Gaps: Detection and monitoring of plum curculio is difficult and rarely conducted by growers, since chemical attractants perform poorly and traps are cumbersome. Isolation and identification of pheromones and host attractants, and a better understanding of plum curculio reproductive behaviors would lead to improved lures and traps. Current management of plum curculio relies on applications of broad spectrum chemical insecticides. Biological and microbial control agents have shown some efficacy in suppressing plum curculio larvae in the soil, but additional research is required to integrate optimum biological control tactics with other management strategies. Furthermore, research is needed to define this pest's ecology (particularly movement patterns) on a landscape scale.

Actions: ARS will:

- Determine efficacy of biological and microbial control agents.
- Integrate optimum biological control tactics with other management strategies.
- Develop improved attractants and trapping systems for the plum curculio.

3. **Peachtree Borers**

Importance: The peachtree and lesser peachtree borers are major pests of peach, plum, and cherry trees. Larvae cause severe damage to trees by boring into the trunk, limbs, and roots. These pests have increased in importance due to the removal of certain broad-spectrum insecticides used for control.

Research Gaps: Currently, there are no treatments available that produce acceptable levels of control, so alternative management solutions are needed for both of these pests. Entomopathogenic nematodes can kill the larvae, though desiccating conditions on the tree trunk or limbs limit the nematodes' efficacy. Advances and optimization in application technology and formulation of entomopathogenic nematodes are needed to facilitate effective implementation of this biological control solution. Mating disruption or an attract-and-kill strategy may provide a complementary or alternative management option.

Actions: ARS will:

- Investigate mating disruption for management of lesser peachtree borer.
- Investigate novel formulations and methods of application for use of entomopathogenic nematodes.
- Optimize the timing and rates of application for entomopathogenic nematodes and other biological control agents.
- Develop applications of target-specific insecticides.

4. **Integrated Pest Management of Secondary and Newly Invasive Insect Pests of Cherry, Peach and Nectarine Crops**.

Importance: Technologies and strategies are needed to manage insect pests of commercial cherry, peach and nectarine crops to reduce damage, reduce pesticides in the environment and on the commodity, improve worker safety and improve profitability.

Research Gaps: Alternative technologies, methods, and strategies are needed for management of numerous insect pests of stone fruits, in part to replace organophosphate insecticides that are increasingly restricted by regulation. New insect pests become problems on a frequent basis, either through introduction into the United State or changes in their geographic distribution.

Actions: ARS will:

- Develop improved attractants and trapping systems for brown marmorated stink bug.

- Identify, through foreign exploration in Asia, biological control agents of brown marmorated stink bug for evaluation and introduction into North America.
- Develop improved attractants, traps, and trapping strategies for monitoring and management of the brown stink bug.

5. Glyphosate-resistant and Other Weeds

Importance: Weed control is a significant annual management issue in *Prunus* fruit orchards. In young plantings, weeds compete with fruit trees for nutrients, light, water, and space. Weeds also can harbor insect and rodent pests, increase disease pressure, and interfere with irrigation systems. Glyphosate is the most common herbicide used in these orchards, though the recent identification of glyphosate-resistant weeds in some areas may lead to reduced weed control in these systems which, in turn, could lead to use of herbicides with less acceptable environmental impacts, decreased productivity, increased cold damage, or increased insect and pathogen problems.

Research Gaps: A greater understanding of the biology, ecology and physiology of weeds is needed as well as the development of alternative control strategies.

Actions: ARS will:

Research directed to managing glyphosate-resistance in other crops should have application to stone fruit systems.

***Anticipated Products*:**

- Novel alternative pest management tactics involving biological or microbial control agents, pheromonal mating disruption, and attract-and-kill.
- Improved methods for production, formulation, and delivery of biological control agents.
- Development of integrated orchard management systems.
- New and improved lures and trapping systems for use in detecting and monitoring pests.

***Potential Benefits (Outcomes)*:**

- New effective pest management strategies for stone fruit crops that are ecologically and economically sound, and that increase productivity and competitiveness in U.S. stone fruit crops.
- Model systems of biological control agent production and application, and integrated pest management programs that are broadly applicable to other commodities.

***USDA ARS Resources*:**

- Beneficial Insect Introduction Research Unit, Newark, Delaware
- Fruit and Vegetable Insect Research Unit, Wapato, Washington
- Fruit and Nut Research Unit, Byron, Georgia
- Invasive Insect Biocontrol and Behavior Laboratory, Beltsville, Maryland