Martin-Gatton
College of Agriculture, Food and Environment
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Plant Pathology Research Report **PPRR-07**

Survey of Apple and Peach Pest Management Practices in Kentucky (2022)

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Tree fruit are important commercial crops in Kentucky. Pests and pathogens can result in tree damage and fruit loss. Grower surveys were conducted in 2022 to determine the importance of tree fruit pests in Kentucky. Growers provided orchard demographics, as well as overall importance, yield losses for each, and approach to management.

The objective of these surveys was to help determine arthropod/insect, disease, and weed priorities for peach and apple. Surveys were used to summarize grower practices, while providing an overall understanding of management practices. Ultimately, this will help Extension specialists and researchers prioritize programs and resources by focusing on management practices that should be utilized more often and those that appear to be misunderstood.

Apple Priorities

This survey represented apple orchards between 0.1 and 40 acres of production.

Disease Priorities

Analysis of survey responses determined that the five most important diseases were fire blight, bitter rot, sooty blotch and flyspeck, black rot, and white rot. All disease responses are included in Table 1.

Survey results indicated that growers monitored or predicted diseases through visual scouting and monitoring of weather conditions (predictive models). Growers utilized various methods for disease management. The primary management strategy for each disease is detailed in Table 1.

Growers indicated that the following resources were most valuable for reducing losses: disease publications (24% of respondents), field days (24%), educational videos (20%), fungicide education (20%), and virtual trainings (12%).

Growers reported spending $40 to $600 per acre per year on fungicides.

General pathology notes

- Disease cannot be identified by symptoms, alone. Submit samples to a diagnostic lab or work with an Extension agent/specialist. Visual monitoring of diseases often results in misidentification or identification of infection too late for effective management.
- Disease history should drive management decisions in subsequent seasons.
- Moisture and temperature are major drivers of plant disease. Risk of disease increases during rainy or humid (>70% RH) conditions and during moderate (65° to 75°F) temperatures.

Pest Priorities

Analysis of survey responses determined that the five most important arthropod pests of concern for growers were codling moth, plum curculio, woolly apple aphid, borer, and oriental fruit moth. All pest responses are included in Table 2.

Survey results indicated that growers monitored or predicted arthropod pests using pheromone traps and visual scouting. Growers utilized various methods for insect management. The primary management strategy for each insect is detailed in Table 2.

Table 1. Ranking of the most important diseases of apple, as reported by growers, management strategies commonly implemented, and shortfalls in management strategies.

Ranking[1]	Disease of importance, as reported by growers	Average annual % loss reported by growers	Grower actions, reported in survey	Specialist recommendations & comments
1	Fire blight	4%	Fungicides, pruning to remove diseased and dead tissue, scouting	Bacterial diseases should be managed with antibiotics or antimicrobials; fungicides are not effective against bacteria. Scouting is not effective; utilize alerts and forecasting systems for best use of preventative applications of bactericides/antimicrobials; include growth regulator for added protection. Prune during dormancy.
2	Bitter rot	5%	Fungicides, pruning to remove diseased and dead tissue	Fungicide timing should begin at petal fall; improve coverage using low pressure and avoiding runoff.
3	Sooty blotch & flyspeck	3%	Fungicides	Forecasting system is available for improved application timing.
4	Black rot	5%	Pruning to remove diseased and dead tissue	Pruning and removal of infected wood from the orchard is critical; apply fungicides if orchard has a history of disease.
4	White rot	5%	Sanitation, pruning to remove diseased and dead tissue, scouting, fungicides	Pruning and removal of infected wood from the orchard is critical; apply fungicides if orchard has a history of disease.
5	Apple scab	-	Scouting, fungicides	Fungicides should begin at green tip, especially for susceptible cultivars. Sanitation is critical.
6	Brown rot	-		Disease may have been misidentified; there is no brown rot disease on apple.
6	Root & collar rot	1%		Specialized fungicide may be suppressive if disease pressure is low to moderate.
7	Leaf curl	-		Disease may have been misidentified; there is no leaf curl disease on apple.
7	Rot	-	Scouting, fungicides	There are several “summer rot” diseases of apple fruit; proper diagnosis is needed for proper management strategy.
8	Frogeye leaf spot	-		Caused by the same fungus that causes black rot on fruit.
8	Rust	3%	Pruning to remove diseased and dead tissue	Resistant cultivars and/or properly timed fungicides (beginning at tight cluster).

[1]Rankings have been assigned based on order and frequency of responses. Rankings are not associated with % yield loss. Items receiving the same number rating occurred with the same order and frequency and are presented in alphabetical order.

Table 2. Ranking of the most important arthropod pests of apple, as reported by growers. Factors that may have influenced growers' interpretation of "importance" included: difficulty to manage, required inputs, and potential for yield loss.

Rating[1]	Insect of importance, as reported by growers	Average annual % loss reported by growers	Grower actions, reported in survey	Specialist recommendations & comments
1	Codling moth	5%	Insecticide sprays according to pheromone trap catches and growing degree day models, removal of dead limbs and trees	While still common, it is frequently confused with Oriental fruit moth, which is increasing in importance. Controlled with the same insecticides (although timing of applications differ) used for oriental fruit moth management. May also be managed using mating disruption.
2	Plum curculio	1%	Insecticides	Typically controlled with insecticides at first cover. Recent late season damage in neighboring states to the north indicate range expansion of the Southern multi-generation strain. This was confirmed in the lab at UK in 2023.
3	Woolly apple aphid	4%		Becoming more common due to changes in insecticide used for other pests; monitor regularly. Semi-resistant rootstocks are available.
4	Borer	-	Insecticides	Stressed plants attract flatheaded appletree borer. Maintain plant health through proper nutrient and irrigation management and pruning. Remove weak and dead wood; remove cuttings from the orchard.
5	Oriental fruit moth	10%		Oriental fruit moths are becoming more common across the state. Monitor emergence using pheromone traps and/or growing degree day models (prediction model). Mating disruption pheromones for both codling moth/oriental fruit moth can be used alone or in combination with insecticides.
6	Brown marmorated stinkbug	5%	Insecticides	Scout border rows regularly beginning mid-season, use insecticides as needed. Sanitation is not an effective management option for stink bug.
7	Japanese beetle	1%		Sporadic. Use insecticides as needed. Avoid use of traps, which attract beetles.
7	San Jose scale	1%		Dormant oil is effective when used from half-inch green to bud development to target nymphs or in late spring when crawlers are active.

[1]Rankings have been assigned based on order and frequency of responses. Rankings are not associated with % yield loss. Items receiving the same number rating occurred with the same order and frequency and are presented in alphabetical order.

Growers indicated that the following resources were most valuable for reducing losses: insect publications (26% of respondents), educational videos (21%), field days (21%), insecticide education (21%), and virtual trainings (11%).

Growers reported spending between $20 and $500 per acre per season on insecticides.

General insect management notes

- Insect management in apples relies on pest monitoring (scouting and trapping), prediction (degree day modeling of key pests), sanitation, and rotation of insecticides to manage insecticide resistance. Mating disruption has been slowly increasing for both oriental fruit moth and codling moth management.

Weedy Plant Species Priorities

Analysis of survey responses determined that the top five weeds of concern for growers were johnsongrass, honeyvine milkweed, morning glories, yellow nutsedge, and dandelion. All weed responses are included in Table 3.

Survey results indicated that growers monitored or predicted weeds through visual scouting. Growers utilized various methods for weed management. The primary management strategy for each weed species is detailed in Table 3.

Growers indicated that the following resources were most valuable for reducing losses: weed publications (29% of respondents), educational videos (23%), field days (18%), herbicide education (18%), and virtual trainings (12%).

Growers reported spending between $10 and $155 per acre per season on herbicides.

General weed management notes

- Proper identification of the weed is important. If identification is uncertain, growers should work with an Extension agent/specialist.
- Preventing seed-set of weeds in the orchard, or dispersal from fence rows, will reduce future management problems but not eliminate them. Weed seed already in the soil can survive for many years depending on the species.
- Management of perennial weeds may take several years before changes are observable in the orchard.

Table 3. Ranking of the most important weeds of apple orchards, as reported by growers. Factors that may have influenced growers' interpretation of "importance" included: difficulty to manage, required inputs, and potential for yield loss.

Rating[1]	Weed of importance, as reported by growers	Average annual % loss reported by growers	Grower actions, reported in survey	Specialist recommendations & comments
1	Johnsongrass	1%	Herbicides, mowing	Pre-emergent herbicides prevent seedling establishment. Post-emergent herbicides are only effective on young plants. Repeated mowing, followed by spot spraying in fall, gives control. Avoid cultivation, which spreads rhizomes.
2	Honeyvine milkweed	-	Herbicides	Pre-emergent herbicides are more effective than post-emergent herbicides. Manual removal of deep taproots.
3	Morning glories	1%		Pre-emergent herbicides reduce germination of seeds of annual species.
3	Yellow nutsedge	-	Herbicides	Nutsedge is shade intolerant. Populations may increase in a spindle-type training system as more light reaches the orchard floor.
4	Dandelion	1%		Spot spraying of amine forms of 2,4D can be applied. Mowing during bloom is important so that pollinators stay in the crop.

[1]Rankings have been assigned based on order and frequency of responses. Rankings are not associated with % yield loss. Items receiving the same number rating occurred with the same order and frequency and are presented in alphabetical order.

Peach Priorities

This survey represented peach orchards between 0.5 and 36 acres of production.

Disease Priorities

Analysis of survey responses determined that the top five diseases of concern for growers were brown rot, peach leaf curl, peach scab, bacterial spot of fruit, and bacterial canker. All disease responses are included in Table 4.

Survey results indicated that growers monitored or predicted diseases through visual scouting and monitoring of weather conditions (predictive models). Growers utilized various methods for disease management. The primary management strategy for each disease is detailed in Table 4.

Table 4. Ranking of the most important diseases of peach, as reported by growers. Factors that may have influenced growers' interpretation of "importance" included: difficulty to manage, required inputs, and potential for yield loss.

Rating[1]	Disease of importance, as reported by growers	Average annual % loss reported by growers	Grower actions, reported in survey	Specialist recommendations & comments
1	Brown rot	7%	Sanitation, remove diseased fruit and mummies, fungicides	Avoid fruit injury. Practice sanitation. Use fungicides beginning at bloom.
2	Peach leaf curl	4%	Sanitation, fungicides	Sanitation is not the ideal management option for peach leaf curl. Fungicide applications should be made before bud break or in fall right before dormancy. Resistant cultivars are available.
3	Peach scab	5%	Fungicides	Fungicide applications should occur beginning at petal fall. Sanitation (removal of infected fruit and twigs) can be effective in small orchards.
4	Bacterial spot of fruit	2%	Sanitation, fungicides	Bacterial diseases should be managed with antibiotics or antimicrobials; fungicides are not effective against bacteria. Once disease develops, it is too late for controls. Preventative sprays should be applied if bacterial spot was problematic the previous year. Sanitation is critical.
5	Bacterial canker	2%	Sanitation, fungicides	Bacterial diseases should be managed with antibiotics or antimicrobials; fungicides are not effective against bacteria. Stem/trunk infections are induced by wounds, including winter injury. Select cold tolerant cultivars. Avoid dropping pruning debris on the ground. Perennial canker, a fungal disease, looks similar to bacterial canker; lab confirmation is required.
6	Bacterial leaf spot	-	Fungicides	Bacterial diseases should be managed with antibiotics or antimicrobials; fungicides are not effective against bacteria. Caused by the same bacterium that causes bacterial spot on fruit.

[1]Rankings have been assigned based on order and frequency of responses. Rankings are not associated with % yield loss. Items receiving the same number rating occurred with the same order and frequency and are presented in alphabetical order.

Growers indicated that the following resources were most valuable for reducing losses: disease publications (24% of respondents), educational videos (20%), field days (20%), fungicide education (20%), and virtual trainings (16%).

Growers reported spending between $20 and $600 per acre on fungicides.

General disease management notes

- Disease cannot be identified by symptoms, alone. Submit samples to a diagnostic lab or work with an Extension agent/specialist. Visual monitoring of diseases often results in misidentification or identification of infection too late for effective management.
- Disease history should drive management decisions in subsequent seasons.
- Moisture and temperature are major drivers of plant disease. Risk of disease increases during rainy or humid (>70% RH) conditions and during moderate (65° to 75°F) temperatures.

Pest Priorities

Analysis of survey responses determined that the top five insects of concern for growers were brown marmorated stink bug, Japanese beetle, lesser peachtree borer, peachtree borer, and green June beetle. All insect responses are included in Table 5.

Survey results indicated that growers monitored or predicted insects using pheromone traps and visual scouting. Growers utilized various methods for insect management. The primary management strategy for each pest is detailed in Table 5.

Growers indicated that the following resources were most valuable for reducing losses: insect publications (26% of respondents), educational videos (22%), field days (22%), insecticide education (22%), and virtual trainings (8%).

Growers reported spending between $18 and $400 per acre on insecticides each season.

General insect management notes

- Insect management in peaches relies on pest monitoring (scouting and trapping), prediction (degree day modeling of key pests), sanitation, and rotation of insecticides to manage insecticide resistance. Mating disruption has been slowly increasing for oriental fruit moth and codling moth management in apples but has not been implemented in peaches in Kentucky.

Weedy Plant Species Priorities

Analysis of survey responses found that the top five weeds of concern for growers were johnsongrass marestail, honeyvine milkweed, horsenettle, and nutsedge. All weed responses are included in Table 6.

Survey results indicated that growers monitored or predicted weeds through visual scouting. Growers utilized various methods for weed management. The primary management strategy for each weed species is detailed in Table 6.

Growers indicated that the following resources were most valuable for reducing losses: educational videos (23% of respondents), field days (23%), weed publications (23%), herbicide education (18%), and virtual trainings (13%).

Growers reported spending between $10 and $125 on herbicides per season.

General weed management notes

- Proper identification of the weed is important. If you are unsure, work with an Extension agent/specialist.
- Preventing seed-set of weeds in the orchard, or dispersal from fence rows, will reduce future management problems but not eliminate them. Weed seed already in the soil can survive for many years depending on the species.
- Management of perennial weeds may take several years before changes are observable in the orchard.

Commercial sale of peaches (Photo: John Strang, UK)

Table 5. Ranking of the most important arthropod pests of peach, as reported by growers. Factors that may have influenced growers' interpretation of "importance" included: difficulty to manage, required inputs, and potential for yield loss.

Rating[1]	Insect of importance, as reported by growers	Average annual % loss reported by growers	Grower actions, reported in survey	Specialist recommendations & comments
1	Brown marmorated stink bug	8%	Sanitation, insecticides	Scout border rows regularly beginning mid-season. Use insecticides as needed. Sanitation is not an effective management option for stink bug.
2	Japanese beetle	2%	Insecticide applications according to trap catches	Sporadic, use insecticides as needed. Avoid use of traps, which attract beetles.
2	Lesser peachtree borer	5%	Insecticides	Common pest of peach. Monitor populations with pheromone traps; apply insecticides at peak flight. Examine trapped moths carefully to properly identify.
3	Peachtree borer	4%	Insecticide applications according to trap catches	Sporadic pest. Monitor populations with pheromone traps; apply insecticides at peak flight. Examine trapped moths carefully to properly identify.
4	Green June beetle	-		Sporadic but easy to monitor. Population levels will vary dramatically from year to year. Damage occurs near harvest; adhere to insecticide PHI.
4	Oriental fruit moth	5%	Insecticide applications according to trap catches	Monitor emergence using pheromone traps and use degree day models to time insecticide applications. Mating disruption pheromones can be used alone or in combination with insecticides.
5	Plum curculio	-		Typically controlled with insecticides at first cover. However, recent late season damage in neighboring states to the north indicate range expansion of the Southern multi-generation strain. This was confirmed in the lab at UK in 2023. Late July sprays may be needed.
6	San Jose scale	5%		Dormant oil is effective when used from half-inch green to bud development to target nymphs or in late spring when crawlers are active.

[1]Rankings have been assigned based on order and frequency of responses. Rankings are not associated with % yield loss. Items receiving the same number rating occurred with the same order and frequency and are presented in alphabetical order.

Table 6. Ranking of the most important weeds of peach orchards, as reported by growers. Factors that may have influenced growers' interpretation of "importance" included: difficulty to manage, required inputs, and potential for yield loss.

Rating[1]	Weed of importance, as reported by growers	Average annual % loss reported by growers	Grower actions, reported in survey	Specialist recommendations & comments
1	Johnsongrass	1%	Mowing, herbicides	Pre-emergent herbicides prevent seedling establishment. Post-emergent herbicides are only effective on young plants. Avoid cultivation, which spreads rhizomes.
2	Marestail	1%	Herbicides	Shallow cultivation destroys young plants. Pre- and post-emergent herbicides can be effective. Glyphosate-resistant marestail is becoming common. Late season management is required, as this species can germinate late into the calendar year.
3	Honeyvine milkweed	-	Herbicides	Pre-emergent herbicides are more effective than post-emergent herbicides. Manual removal of deep taproots.
4	Horsenettle	-		Mow repeatedly. Post-emergent herbicides are only effective on young plants. Avoid cultivation, which spreads rhizomes.
4	Nutsedge	-	Herbicides	Nutsedge is shade intolerant. Limited seed are produced; spread is from production of nutlets or from cultivation. If trees are non-bearing, there are more herbicide options; take advantage of years when there is no crop.

[1]Rankings have been assigned based on order and frequency of responses. Rankings are not associated with % yield loss. Items receiving the same number rating occurred with the same order and frequency and are presented in alphabetical order.

Conclusions

Based on information gathered through both the apple and peach grower surveys, pests of importance have been identified. Diseases, insects, and weeds that received rankings of 1 through 5 will serve as priority items and become the focus of future research and educational programs. Future work should focus on the development of publications, field days, and educational videos. These new resources will improve grower knowledge, resulting in improvements in pest management practices, ultimately limiting losses from these issues.

Additional Resources

- Department of Plant Pathology Extension Publications
https://plantpathology.ca.uky.edu/extension/publications
- Department of Entomology Extension Publications for Fruit Crops
https://entomology.ca.uky.edu/entfacts/fruit
- Department of Horticulture Extension Publications for Fruit Crops
https://www.uky.edu/hort/documents-list-commercial-fruit-nut
- Plant Disease and Insect Prediction Models
http://weather.uky.edu/plant_disease.html
- Plant Disease and Insect Prediction Models for Mobile Devices
http://weather.uky.edu/dim.html

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