

## Elements of IPM for Apples in New York State

<p>IPM Elements provide a basis for self-assessment of your apple IPM practices.</p> <p>Practicing 80% of all the Apple IPM Elements qualify a crop as “IPM-grown” (excluding those not applicable (NA) to your orchard).</p> <p><a href="#">Download the Worksheet for Apple Elements in Excel format.</a></p> <p>This page also includes: <a href="#">Major Pests of Apples</a> and <a href="#">References</a></p>	
<p><b>I. Site, Rootstock, Cultivars and Planting Systems</b></p>	<p><b>Check if Done</b></p>
<p>1. Select new orchard sites that have good air drainage or proximity to large bodies of water for frost protection.</p>	
<p>2. Site selection should consider non-point-source pollution from orchard-applied fertilizers and agrochemicals and how soil type, slope, watersheds, and groundwater relate to surface runoff, tile drainage, and persistence in and leaching through the soil profile.</p>	
<p>3. Whenever possible, avoid selecting sites near abandoned orchards where pests and diseases can be harbored.</p>	
<p>4. Remove abandoned orchards to reduce sources of pest infestations and disease inoculum in a manner that minimizes soils erosion.</p>	
<p>5. Do not plant new apple orchards immediately after old apple orchard removal. Practice crop rotation out of apples for at least one year, <a href="#">or plant a cover crop</a> in the year before planting and incorporate into the soil to improve organic matter content, suppress replant disease, weeds, and, depending on cover crop species, reduce nematodes.</p>	
<p>6. New orchards should include size-controlling rootstocks to improve spray coverage and reduce amount of spray material applied per tree row volume.</p>	
<p>7. Select apple rootstocks that are adapted to local soil conditions and resistant to Phytophthora root and crown rot and fire blight. Plant disease resistant cultivars that have market-appeal, as soon as they are available.</p>	
<p>8. Plant single rows to promote light penetration, air circulation, optimal spray coverage, and rapid drying.</p>	
<p>9. Establish groundcover between rows quickly to prevent erosion and suppress weeds.</p>	

<b>II. Soil Management, Tree Nutrition and Irrigation</b>	<b>Check if Done</b>
1. New orchard soils should have good tilth and fertility and adequate soil drainage should be provided to prevent root diseases and promote healthy root development.	
2. Before planting, chemically analyze new orchard soils and correct pH, phosphorus, and potassium.	
3. Chemically analyze soil and leaf tissue at appropriate regular intervals and add fertilizer, either to (1) maintain tree nutritional status or (2) correct a nutrient deficiency, based on the soil or leaf analysis results and <a href="#">Cornell Guidelines</a> . Keep records.	
4. To maintain tree nutritional status, add fertilizer, based on soil and leaf analysis results, and do not exceed the yearly maximum amounts of 100 lb N/acre, 50 lb P <sub>2</sub> O <sub>5</sub> /acre, 150 lb K <sub>2</sub> O/acre, 50 lb MgO/acre and 4 lb B/acre.	
5. Apply all soil nitrogen in spring between bud break and 10 days after petal fall. Applications of more than 50 lb N/acre must be split into two or more applications, especially on soils with low cation exchange capacity.	
6. Balance nitrogen applications with tree growth to eliminate late summer and fall growth, to protect against the shoot blight phase of fire blight and winter injury.	
7. For irrigated orchards, use trickle or drip irrigation so that water quantity and placement minimizes disease development, optimizes water use, and minimizes erosion.	
<b>III. Tree Training and Crop Management</b>	
1. Prune annually during the dormant season to promote light penetration, air circulation, optimal spray coverage and rapid drying; chip and recycle prunings in orchard middles with flail mower or burn prunings where local regulations allow burning of brush.	
2. Whenever spray coverage and pest management suffers from dense canopies, summer prune densely foliated, vigorous trees in a manner that does not negatively impact fruit size or finish.	
3. Use appropriate fruit thinning to promote annual bearing and improve management of sooty blotch, fly speck, and obliquebanded leafroller.	
<b>IV. Pest Monitoring, Forecasting, and Management</b>	
1. Alternate hosts for apple insect and disease pests near commercial orchards should be removed as much as is feasibly possible and in a way that preserves the habitat of native wildlife and soil quality.	
2. Regularly monitor pests (weeds, insects, mites, diseases & vertebrates) and their damage to assess their levels. Use visual assessments, pheromone traps, sticky traps, etc.	
3. Keep records of all monitoring information, sampling dates, pest or damage levels, trap catches, thresholds used for each block, etc.	
4. Base pesticide treatments against pests on established thresholds, pest forecast models, weather conditions, established presence of the pest, and history of damage in the orchard or on fruit at harvest. Consult <a href="#">Cornell Guidelines</a> .	

5. Keep records of pesticide applications, including: date, time, weather, operator, sprayer, field identification (farm, orchard, block, rows — as applicable), targeted pest, pesticide name and EPA number, formulation, REI, PHI, rate applied, and number of acres treated. Computer software, such as <a href="#">TracApple</a> , can streamline record-keeping.	
6. Keep detailed records of tree row volume (TRV) calculations whenever pesticide sprays are applied on this basis.	
7. Use only pesticides registered in New York State and approved for the target pest and crop. Consult NYS current product registrations at <a href="#">PIMS</a> .	
8. Among registered pesticides of comparable efficacy, base selection on the optimal combination of (1) being least toxic to humans, livestock, wildlife and the environment, (2) selectivity, having low toxicity to key natural enemies, (3) having shortest residual persistence in the environment, and (4) reasonable cost. A way to guide selection is to consider those with the lowest Environmental Impact Quotient <a href="#">EIQ (108k pdf file)</a> value or to use the Natural Resources Conservation Service pesticide screening tool, <a href="#">WIN-PST</a> software.	
9. Apply insecticides, miticides, fungicides, bactericides and herbicides in accordance with resistance management program guidelines when using pesticides at risk for pest resistance development.	
<b>IV.A. Groundcover and Weed Management</b>	
1. Manage groundcover in a manner to reduce soil erosion, nutrient runoff, and herbicide use.	
2. In the row middles, use close mowing to manage weeds.	
3. Eliminate broadleaf plants that harbor insect pests and virus diseases from sodded row middles by prudent use of selective, broadleaf herbicides.. .	
4. Maintain adequate weed suppression in the tree row in a strip <1/3rd the between row spacing or <1/4th in irrigated orchards.	
5. Base herbicide rates and selections on weed surveys. Keep records.	
6. Keep records of location and identity of difficult to manage weeds.	
<b>IV.B. Insect and Mite Management <a href="#">Table of Specific Practices</a></b>	
1. Arthropod monitoring methods and thresholds should conform to Cornell Cooperative Extension New York State IPM Program guidelines.	
2. Use pheromone traps and phenological developmental models to inform management decisions for problem insects as necessary, such as obliquebanded leafroller, codling moth, oriental fruit moth, plum curculio, spotted tentiform leafminer, San Jose scale, apple maggot, etc.	
3. When applicable, mating disruption is used as a management tactic.	
4. Release and conserve predatory insects or mites by using selective pesticide programs.	
5. Sample fruit at harvest from blocks to assess and record damage levels of direct-feeding pests and optimize future management programs.	
<b>IV.C. Disease Management <a href="#">Table of Specific Practices</a></b>	
1. Cultural practices for disease management, where practical, should include removal of overwintering inoculum, pruning and removing cankers, and weed and canopy management to promote air circulation and rapid drying.	

	<b>Check if Done</b>
2. Disease management, monitoring methods and thresholds should conform to Cornell Cooperative Extension New York State IPM Program guidelines.	
3. Use disease development and forecast models to inform management decisions for problem diseases as necessary, such as apple scab, fire blight, etc.	
4. Scout orchards for the shoot blight phase of fire blight. Prune out infections where practical and remove infected prunings and trees from the orchard.	
5. To preserve predatory mites, use EBDC fungicides (mancozeb, maneb, metiram, thiram and zineb) prior to bloom only or not at all.	
6. Sample fruit at harvest from blocks to assess and record disease levels and optimize future management programs.	
<b>IV.D. Vertebrate Management <a href="#">Table of Specific Practices</a></b>	
1. Use appropriate exclusion fencing (barrier, electric, invisible fencing with dogs), or exclusion netting, trunk guards, habitat manipulation, and orchard sanitation (eliminate dropped apples and brush) whenever possible.	
2. Reduce vole and rabbit populations with close and regular mowing of drive lanes, orchard middles, and surrounding fields to minimize available habitat and food sources. Eliminate unmowable areas within the orchard.	
3. Enhance natural predator populations (kestrels, owls, fox, etc.) by manipulating or providing habitat to assist with vertebrate management.	
4. Monitor for rodents to determine the need for rodenticides. When needed, apply rodenticides in bait stations, rather than broadcast treatments.	
5. Conduct vertebrate pest population reduction through shooting or trapping only as defined by New York State Department of Environmental Conservation regulations.	
<b>V. Safe and Efficient Spray Application Methods</b>	
1. Use drift-reducing sprayers (tunnel, sensor, tower) or sprayers modified to direct the air (towers, deflectors, angled fans, side baffle plate, air induction nozzles).	
2. Select nozzles that optimize droplet size and don't create too many fine droplets. Nozzles must point towards the target canopy.	
3. Use buffer zones near water, neighboring crops, properties and other sensitive locations.	
4. Spray only when wind, temperature and humidity conditions are suitable for spraying.	
5. Inspect, maintain, and calibrate crop and herbicide sprayers once per year, or more often if needed, to ensure mechanical reliability and accurate spray delivery. Keep records as described in the <a href="#">Orchard Spraying</a> website.	
6. Sprayers should only be operated by certified applicators, as defined by New York State Department of Environmental Conservation regulations, wearing appropriate personal protective equipment (PPE).	
7. Sprayer application records should include details of the sprayer such as nozzles fitted, pressure, forward speed and application rate.	
8. Thoroughly clean sprayers after use or between different product applications.	

<b>VI. Harvest and Fruit Storage</b>	<b>Check if Done</b>
1. Bins of harvested fruit should not be left in the orchard overnight.	
2. Remove any soil and sod stuck to bin runners prior to stacking bins of fruit.	
3. Use a sanitation system to kill bacteria, yeasts, and fungal spores in water flumes.	
4. As bins are emptied on the packing line, any decayed fruit left inside the bins are removed and trashed.	
5. Remove empty bins from the packing area as soon as possible to prevent their contamination with airborne spores.	
6. Remove culled fruit and other debris from the packing area and from the packing house floors daily.	
<b>VII. Post Harvest Treatments</b>	
1. Use postharvest drench treatments only when such treatments are essential for controlling superficial scald or carbon dioxide injury.	
2. Whenever possible, apply calcium treatments as field sprays rather than as postharvest treatments.	
3. Fit drencher reservoir tanks with appropriate agitation systems to keep postharvest treatment chemicals in suspension and regularly change solutions as per the chemical label.	
4. Remove all solid residues from the bottom of the drencher reservoir tank before the tank is refilled.	
<b>VIII. Education of Growers and Employees</b>	
1. Attend two or more regional or national tree fruit meetings or conferences.	
2. Maintain membership in an appropriate grower association and in a local county Cornell Cooperative Extension Association.	
3. Have access to the current year's copy of the <a href="#">Cornell Pest Management Guidelines for Commercial Tree-Fruit Production</a> .	
4. Participate in an IPM extension/research project.	

<b>MAJOR PESTS OF APPLE</b>		
<b>Insects</b>	<b>Diseases</b>	<b>Weeds</b>
American plum borer	Apple rusts	Annual broadleaves
Apple aphid	Apple scab	Annual grasses
Apple maggot	Bitter rot	Nutsedge
Apple rust mite	Black rot	Perennial broadleaves
Codling moth	Blister spot	Perennial grasses
Comstock mealybug	Blossom end rot	Woody perennials
Cutworm	Crown & collar rot, Phytophthora	
Dogwood borer	Fire blight	
European apple sawfly	Nematodes	
European corn borer	Powdery mildew	
European red mite	Sooty blotch & flyspeck	
Green fruitworms	Senescent breakdown	
Internal lepidopterans	Storage rots	
Lesser appleworm	White rot	
Mullein plant bug		
Oriental fruit moth		
Oystershell scale		
Plum curculio		
Potato leafhopper		
Rosy apple aphid		
San Jose scale		
Sparganothis fruitworm		
Spirea aphid		
Spotted tentiform leafminer		
Tarnished plant bug		
Two spotted spider mite		
Variiegated leafroller		
White apple leafhopper		
Woolly apple aphid		

## TO LEARN MORE...

Apple IPM — A Guide for Sampling and Managing Major Apple Pests in New York State. 1999. A. Agnello, J. Kovach, J. Nyrop, H. Reissig, D. Rosenberger, and W. Wilcox. New York State Integrated Pest Management Program, Number 207, Cornell University, Ithaca.

[Cornell Pest Management Guidelines for Commercial Tree-Fruit Production](#). A. Agnello, A. Landers, W. Turechek, D. Rosenberger, T. Robinson, J. Schupp, J. Carroll, L. Cheng, P. Curtis, D. Breth, and S. Hoying. Cornell Cooperative Extension, Cornell University, Ithaca.

[A Method to Measure the Environmental Impact of Pesticides](#). 1992. New York Food and Life Sciences Bulletin Number 139, Cornell University, Geneva

### [IPM Fact Sheets for Tree Fruit](#)

The above reference material can be obtained from county Cornell Cooperative Extension offices or by contacting The Resource Center, Cornell University, PO Box 3884, Ithaca, NY 14852-3884, 607-255-2080; email [resctr@cornell.edu](mailto:resctr@cornell.edu)

### [Cornell Fruit Resources - Fruit Trees](#)

#### [Tree Fruit and Berry Pathology - Pome Fruit](#)

Natural Resources Conservation Service pesticide screening tool [WIN-PST software](#)

New York State Current Product Registrations at [PIMS](#)

### [Trac Software](#)