

IPM Plan Guide Sheet Practices for Fruit Crop Production

Introduction

This tool has been designed as a guide for evaluating on-farm pest management practices for farmers interested in a Natural Resource Conservation Service (NRCS) 595 Integrated Pest Management (IPM) Plan. A 595 IPM plan is one of many practice standards offering financial assistance to farmers through the NRCS Environmental Quality Incentives Program (EQIP). This evaluation tool outlines industry standards of IPM that have been peer reviewed by universities, independent consultants, nongovernmental organizations, NRCS staff, and other state and federal agencies, and provides site specific information for implementing IPM.

EQIP is a voluntary conservation program with annual signup periods often offered in the winter. The applications are scored and funds are awarded competitively to applicants that propose cost-effective conservation practices, address local priorities, and provide the greatest environmental benefit. Contact your local USDA service center to find out specific signup dates for your state.

EQIP application information by state

http://www.nrcs.usda.gov/programs/eqip/EQIP_signup/2009_signup/index.html

Conservation plan application form – this is the required application form for applying for EQIP funds Form CCC-1200 <http://www.nrcs.usda.gov/programs/eqip/>

What is IPM?

IPM is a comprehensive approach to managing pests that uses an array of practices that minimize impacts on the environment, while providing safe, effective and economical means of pest control. The principles and practices of IPM are applied to any setting where pests (e.g., insects, diseases, mammals, birds) are present. IPM practices have the added benefit of offering solutions to pest control that reduce the use of pesticides and protect resources by mitigating their impacts on the environment.

The fundamental principles of implementing IPM are as follows:

1. **Pest identification:** Proper identification of pests is necessary to identify the best options for control.
2. **Pest biology:** Understand pest life cycles, natural hosts and enemies and environmental conditions that influence pest activity.
3. **Pest monitoring:** Scout for pests and beneficial insects and trap pests through the growing season, and keep records of all pest activity.
4. **Establish action and economic injury thresholds:** Thresholds are used to determine when pest infestation is severe enough to warrant control.
5. **Select appropriate treatment strategy:** IPM relies on cultural, mechanical, biological and chemical controls for prevention or suppression of pest populations.
6. **Evaluate effectiveness of the pest management program:** IPM is not static; make changes that increase the level of IPM that is being practiced from year to year.

PAMS	PRACTICES	REFERENCES	Apples	Blueberries	Brambles	Grapes	Strawberries	Cherries
PREVENTION	Use certified pest-free nursery stock and transplants where available. (Example: Purchase certified stock and ensure plants are free of insects, diseases, and weeds before transplanting.)							
	Prevent weeds from going to seed. (Example: Cultivate, pull, mow, flame, etc.)	Flaming ³¹ , Organic Weed Management ³⁶	Weed management to control tarnished plant bug movement into trees					
	Reduce moisture on cane, branch and leaf surfaces to prevent disease incidence. Use drip irrigation or avoid overhead irrigation between 6 p.m. and midnight to minimize disease.							
	Employ methods to avoid spreading pests (pathogens, weeds, and insects). (Example: Work crop when dry, work infested areas last, hose down equipment between blocks, etc.)	Organic Weed Management ³⁶						
	Destroy and/or remove crop residues for block sanitation procedures, including leaf litter.	IPM for Ontario Apple Orchards ²⁷ , NYS IPM Elements ¹ , Ohio IPM Elements ²	Remove and destroy infected limbs of fruit trees to reduce black rot and fire blight. Destroy brush piles from winter pruning, mummified fruit, and dead wood from trees. Apply calcium nitrate or urea to leaf litter in fall for increased rate of decomposition to reduce overwintering scab inoculum. Use a flail mower to destroy leaves and pruning residues 1" diameter and smaller.	Removal of overripe and cull berries will help reduce Japanese beetle populations.	Removal of overripe and cull berries will help reduce Japanese beetle, yellow jacket and picnic beetle populations.			Removal of un-harvested cherries to reduce post-harvest population build-up of plum curculio and cherry fruit fly.

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PREVENTION	Conduct annual winter pruning on fruit trees, vines and canes to promote healthy growth and improve air flow and light penetration; pruning will also maximize effectiveness of spray applications.	Grape Pest Management ²¹ , Pruning Mature Apple and Pear Trees ²⁴ , Pruning Raspberries and Blackberries ²⁵	Conduct annual pruning during dormancy to maintain canopy and tree height. Thin fruit in clusters to promote faster drying time, spray coverage, fruit size and return bloom	Prune old growth during dormancy to maintain bush size and canopy density	Conduct annual pruning of flora canes during dormancy	Leaf pulling and late summer pruning may be necessary in dense trellis canopies to maintain adequate spray coverage, promote fast drying and prevent shading of fruit. Conduct annual pruning yearly during dormancy		Conduct annual pruning during dormancy to maintain canopy and tree height.
	Eliminate unmanaged plants that serve as pest reservoirs, such as abandoned crops, nearby wild and scrub plants, or weed hosts of viruses.	IPM for Ontario Apple Orchards ²⁷ , Midwest Small Fruit Pest Management Handbook ¹⁸	Remove older unprofitable or abandoned orchard blocks, alternative host plants for key pests from surrounding woodlots		Remove wild brambles within 500 ft of cultivated planting. Avoid planting within 250 yards of conifers to prevent blackberry <i>psyllid</i> .	Remove abandoned vineyard blocks and wild grapes adjacent to plantings		Remove older unprofitable or abandoned orchard blocks, alternative host plants alternative host plants for key pests from surrounding woodlots
	Test plant tissue annually and soil every two years to determine proper fertility and pH levels for crop and time application according to crop needs. Apply nutrients, fertilizers, and pH-adjusting agents according to the following recommendations.	NYS IPM Elements ¹ , IPM for Ontario Apple Orchards ²⁷	Adjust mineral soil pH to 6.0-6.8, limit vegetative growth to 12” or less annually, reduce attractiveness to phloem feeding pests.	Adjust mineral soil pH to 4.5-5.2	Adjust mineral soil pH between 5.5 - 6.5		Adjust mineral soil pH between 5 -6.5	Adjust mineral soil pH between 6-6.8, limit vegetative growth to 12” or less annually, reduce attractiveness to phloem feeding pests.

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AVOIDANCE	When planting a new crop, take note of the species previously grown and associated diseases in that area. Do not plant crops from the same family or with same pest susceptibility at less than recommended intervals for the identified pest(s).	NYS IPM Elements ¹					Select field rotated at least two years from peppers, tomatoes, potatoes, eggplant, strawberries or raspberries to break pest cycles.	
	Maintain soil aeration and drainage to avoid standing water and minimize plant disease. (e.g., use tile drainage, sub soiling, grassed waterways, raised beds, and organic matter additions.) Avoid planting in low and wet spots.	Injury to Tree and Small Fruit Plants ²²	Do not attempt to plant fruit trees in wet soil.			Select vineyard sites with good cold air drainage or proximity to large bodies of water for frost protection		Do not attempt to plant fruit trees in wet soil.
	Choose pest-resistant cultivars.		Select cultivars that are resistant to apple scab and fire blight. Select rootstocks resistant to fire blight.		Plant varieties with resistance to <i>Phytophthora</i> root rot and raspberry leaf spot.	Plant virus and powdery mildew resistant grapes	Select cultivars that have resistance to red stele and Verticillium wilt if a history of the disease exists.	Select cultivars that are resistant to cherry leaf spot

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MONITORING	<p>Monitor for pests as recommended for each crop. If no monitoring guidelines available, monitor weekly to determine presence, density, and locations of pests and to determine crop growth stage.</p> <p>Use pest-forecasting tools (e.g., computer modeling software) as additional guides for on-farm pest monitoring activities in conjunction with weather data to predict risk of pest infestation and optimize timing of control measures to proper life stage of targeted pest.</p> <p>Record findings. Record keeping is required. (Example: Scout crops and use other appropriate monitoring aids such as pheromone traps, disease diagnostic tests, etc. Map weeds in the fall to help plan where specific measures may be needed to target problem weeds the following spring.)</p>	<p>NYS IPM Elements¹, Ohio IPM Elements² Weed Assessment List⁴³, See additional resources^{9-15, 19, 23, 26, 27}, Pest Bulletins⁵⁵⁻⁶¹</p>	<p>Use pheromone-baited traps at recommended per acre rates in all blocks to monitor codling moth, oriental fruit moth, leaf rollers, borers, and leaf miners. Use volatile-baited red sphere or yellow sticky traps at recommended rates to monitor apple maggots. Use volatile-baited pyramid or screen traps to monitor plum curculio. Use sticky tape on trees to monitor scale crawlers. Monitor non-adult moth life stages mites, aphids, green fruit worm, plant bugs, leafhoppers and associated plant/fruit damage levels according to extension recommendations for your region.</p>	<p>Monitor blueberry maggot flies with baited yellow sticky traps. Place sticky tape around branches to detect scale crawlers. Sample buds for cranberry weevil before bloom. After bloom bushes are scouted for fruit worms, plum curculio, tip borer and leafroller damage.</p>	<p>Early in season, monitor orange rust and viruses on black raspberry and black berry, remove and destroy infected canes. Monitor flowers during bloom for tarnished plant bug. Sample leaves for mites and other pests</p>	<p>Monitor grape berry moth using baited pheromone traps. Scout vineyards for <i>Eutypa</i> at 10- to 12-inches of shoot growth. Tag infected trunks and prune out infections by double cutting³⁵. Scout for strawberry clipper, two spotted spider mite and tarnished plant bug weekly. Continue to scout for secondary pests post harvest</p>		<p>Use pheromone-baited traps at recommended per acre rates in all blocks to monitor leaf rollers and borers. Use volatile-baited yellow sticky traps at recommended rates to monitor cherry fruit fly. Use volatile-baited pyramid or screen traps to monitor plum curculio. Use sticky tape on trees to monitor scale crawlers. Monitor non-adult moth life stages mites, green fruit worm, aphids, leafhoppers and associated plant/fruit damage levels according to extension recommendations for your region.</p>
	<p>Use on-farm weather monitoring devices to measure precipitation, humidity, temperature, and leaf wetness and/or use commercial weather prediction service for prevention and control of plant diseases (e.g., install weather station with rain gauge, hygrometer, maximum and minimum temperature recording equipment and leaf-wetness sensors.)</p>	<p>Skybit⁵³, UMCE Apple IPM Program Forecast⁵⁴ MSU MAWN and Env.weather⁵¹</p>						

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CULTURAL AND PHYSICAL CONTROLS								
SUPPRESSION	Use size-controlling rootstock for better spray coverage and to reduce the amount of material require for effective applications.		When orchard blocks are replanted use dwarfing and semi-dwarfing root stocks. Use opportunity to select disease resistant rootstocks as well.			Select rootstocks appropriate for the variety that will ensure trellis fill but avoid over-vigorous growth. Select variety & rootstocks that are appropriate for the given site based on winter hardiness, soil type and site characteristics and pest management goals/expectations		
	Use cover crops, especially pest-suppressing crops (allelopathic), between crop rows or within to reduce weeds and disease incidence, prevent liquid run-off and to improve soil quality.	See references 29-45 for cover crop guidance and SARE Nematode fact sheet ¹⁰						
	Plant using appropriate within- and between-row spacing optimal for crop, site, and row orientation. (e.g., use row spacing and plant densities that assure rapid canopy closure.)	NYS IPM Elements ¹ , Ohio IPM Elements ² , Fruit Crop Ecology and Management ²³	Plant rows in the direction of prevailing winds to promote better air circulation and faster drying in the orchard			Rows should be oriented in a north/south direction to promote light interception and air circulation to promote rapid drying. Where necessary, rows are perpendicular to slopes to minimize erosion		
	Use mulches including plastic or reflective mulches for insect or weed control.							
	Use mechanical pest controls. (e.g., weed badger, mow, hoe, and hand remove insects and weeds, prune diseased or insect-infested plants, remove diseased plants.)							

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SUPPRESSION	Use physical pest controls and deterrents. (e.g., use flame weeding or other heat methods for insect, disease, and weed control; noise-makers; reflectors; ribbons; and predator models.)	Flaming ³¹ , Organic Weed Management ³⁶ , Guide to Biological Control ¹⁵		Use netting and visual scare devices for birds					
	Use exclusion devices for insects or wildlife. (e.g., use netting for row covers and/or fencing around blocks and trees.)	Organic Weed Management ³⁶							
	Physically remove and destroy branches, canes, and vines infested with insect or disease pests to prevent their spread to other parts of the planting				Remove and destroy plants infested with raspberry crown borer				
	BIOLOGICAL CONTROLS								
	Use insect mating disruption devices where pest pressure is low to moderate. MD can be used to help lower population pressures with a goal of reducing companion pesticide use over time, eventually becoming more of a stand-alone program.	Pheromone traps for insect pest mgt ¹² , Mating Disruption for Management of Insect Pests ¹⁹	Use codling moth mating disruption for apples						
	Conserve naturally occurring biological controls. (e.g., select pesticides and time applications to minimize impact on beneficials, use floral perimeter crop to attract and support beneficial insects.)	Environmental Impact of Pesticides (EIQ) ⁴⁷ , Guide to Biological Control ¹⁵	Avoid mowing during bloom and petal fall where mowing destroys habitat for pollinators and beneficial organisms						
	Release beneficial organisms where appropriate.	IPM Manual for Minnesota: Apple Orchards ²⁶ , Guide to Biological Control ¹⁵							

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SUPPRESSION	Use compost as a soil amendment to increase biological diversity in soil and plant health and suppress plant disease.	Pests of the Garden and Small Farm: A Growers Guide to Using Less Pesticide ⁴ , NYS IPM Elements ¹							
	CHEMICAL CONTROLS								
	Minimize chemical use. Only use chemicals in conjunction with accurate pest identification and monitoring, action thresholds, alternative suppression tactics (biological, cultural, etc), and judgments based on previous year's weed map and/or pest scouting records.	Midwest Small Fruit Pest Management Handbook ²⁰ , NYS IPM Elements ¹	Use fungicide combinations that allow for extended spray intervals of 10 to 14 days rather than a 7-day protectant program. Delay petal fall sprays for plum curculio, leaf rollers and codling moth as long as possible to preserve beneficial insect populations				To preserve predatory mites, use EBDC fungicides (mancozeb, maneb, metiram, thiram and zineb) prior to bloom only or not at all		
	Select pesticides, formulations, and adjuvant based on least negative effects on environment, beneficials (e.g., pollinators, predators, parasites), and human health in addition to efficacy and economics.	See environmental cautions on pesticide label and Environmental Impact of Pesticides (EIQ) ⁴⁷							
	Use lowest labeled rate that is effective based on label, scouting results, and Extension-recommended action thresholds for target pest.	Contact state NRCS or Extension office for spray record keeping forms							
Limit applications to partial fields or banding to reduce quantity or impact of pesticide. (e.g., spot treat where pests are found or use banding, seed, edge or block perimeter/border treatments.)									

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SUPPRESSION	Calibrate sprayers or applicators prior to use to verify amount of material applied.	Pesticide Calibration Guide ⁴⁶	Base choice of spray volume per acre on tree-row volume					
	Use pesticide-resistance management strategies as appropriate and where required on pesticide label. (e.g., alternate applications of chemicals with different modes of action to avoid development of pest resistance or leave part of crop unsprayed to serve as a refuge for susceptible pests and natural enemies.)	Managing Pest Resistance to Pesticides ⁴⁸						
	Use specialized pesticide application equipment to increase efficiency and reduce chemical drift. (e.g., use wiper applicators, digitally controlled adjustable tool bars, direct injection sprayers, double-drop sprayers, laser guided precision sprayers, direct injection, low-drift nozzles, shielded applicators or air induction booms, built-in tank washers, etc.)							
	Use spray-monitoring equipment. (e.g., use water-sensitive cards to measure spray pattern and drift.)							
	Use vegetative buffers, set-backs, or filter strips to minimize chemical movement to sensitive areas such as surface waters, schools, residences, and neighboring crops.							
	Use mitigation practices as necessary in accordance with pest monitoring results, pest predictions, action thresholds, and WinPST output.							
	Pesticide applicator must be properly licensed and certified when using restricted use pesticides or when doing custom pesticide applications for hire. Contact state pesticides regulatory agency for license and certification requirements.							

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	<p>NOTE: Additional pesticide use requirements from the 595 Practice Standard:</p>	<p>*NOTE: See documents listed in the attached resource list for additional guidance.</p>						
	<p>> Always follow all pesticide label instructions and environmental cautions.</p>							
	<p>> Store, handle, transport, mix, use, and dispose of pesticides and pesticide containers per state pesticides regulatory agency recommendations and regulations.</p>							
	<p>> Follow state and federal worker protection standards.</p>							
	<p>> When drawing water for pesticide mixing from any surface waters of the state, use anti-siphoning devices and do not use hoses that have been in contact with pesticides.</p>							
	<p>> Do not mix or load pesticides within 50 ft from the high water mark of any surface waters of the state.</p>							

IPM Practices Resource List

IPM Guidelines and Elements

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<http://www.nysipm.cornell.edu/elements/default.asp>
2. The Ohio State University. Elements of IPM in Ohio. 2000.
<http://ipm.osu.edu/element/index.htm>
3. IPM Guidelines. 2007. Umass Amherst.
<http://www.umass.edu/umext/ipm/guidelines/index.html>

General IPM

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5. Flint, M.L. and P. Gouveia. 2001. IPM in Practice: Principles and Methods of Integrated Pest Management. University of California. Publication 3418.
6. Pest management. 1998. National Association of Soil Conservation Districts. [Tip sheet].
<http://www.ma.nrcs.usda.gov/news/publications/pestmgt.pdf>
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Insect and Disease Management

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10. Everts, K., S. Sardanelli, R. Kratochvil, and L.B. Gallagher. 2005. Agricultural innovations fact sheet: Cultural practices for root-knot and root-lesion nematode suppression in vegetable crop rotations. Sustainable Agriculture Research and Education. SARE Publication #06AGI2005. <http://www.sare.org/publications/factsheet/0605.htm>

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12. Kowalsick, T. Pheromone Traps for Insect Pest Management. Cornell Cooperative Extension of Suffolk County. <http://ccesuffolk.org/assets/Horticulture-Leaflets/Pheromone-Traps-For-Insect-Pest-Management.pdf>
13. Mahr, D. L., P. Whitaker, N. M., Ridgway. 2008. Biological control of insects and mites: An introduction to beneficial natural enemies and their use in pest management. Cooperative Extension Publishing.
14. Natural Enemies in Field Crops: A Guide to Biological Control. 2001. MSU Extension Bulletin 2721. <http://web2.msue.msu.edu/bulletins/Bulletin/PDF/E2721.pdf>
15. Weeden, C.R., A.M. Shelton, and M.P. Hoffmann (Eds.). Guide to biological control: A guide to natural enemies in North America. Cornell University. <http://www.nysaes.cornell.edu/ent/biocontrol/>

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18. Bordelon, B., Ellis, M., Weinzierl, R. 2008. Midwest Commercial Small Fruit and Grape Spray Guide 2008. <http://hort.agriculture.purdue.edu/pdfs/08SprayGuide.pdf>
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Pesticide Management

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Pest and Disease Forecasting

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54. University of Maine Cooperative Extension Maine apple IPM program forecast. 2007. [Includes current and long-range weather forecasts.]
<http://pmo.umext.maine.edu/apple/forecast.htm>

Pest Bulletins and News Letters

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<http://ipmnews.msu.edu/fieldcrop/>
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<http://ipcm.wisc.edu/WCMNews/tabid/53/Default.aspx>
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IPM Web Resources

62. Field Crop IPM Resources. University of Illinois <http://ipm.illinois.edu/fieldcrops/index.html>
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