

Massachusetts Tree-fruit Production BMP Handbook

Rating of Runoff / Leaching Potential of Blocks

1. Compare the relative risk of ground and surface water contamination among different fields on your farm.
2. Identify the fields on which you may want to consider using more extensive water protection practices.
3. Set priorities for adopting soil management practices, constructing soil conservation structures, and making changes to nutrient or pesticide management practices.
4. This is applicable for both established plantings and preplant situations.

Instructions

1. If you know that your field has high leaching or runoff potential, you may skip this section.
2. Obtain a scaled map of the field(s) to be assessed. Overlay a soils map to determine the soils that are present on the land. Identify any relevant watershed areas.
3. Identify production fields or natural divisions with similar soils and slopes. Mark the location of each area on the map that was done in step 1. Identify the predominant soil type and average slope in each area.
4. From the county soil survey, fill out the table on page 2 for each field. This will identify if a block has a high potential to leach pesticides or fertilizers into groundwater or a high potential for surface runoff that may carry fertilizers or pesticides into surface waters.

	Soil Hydrologic Group (see below)	Rating	Average Field Slope	Rating	
	A	1	< 3%	1	
	B	2	3 – 6%	2	
	C	3	7 – 12%	3	
	D	4	> 12%	4	
Block ID					Sum of Ratings
1.					
2.					
3.					
4.					

Sum of Ratings - Results

- 2 – 3 = **High leaching potential**. Use caution when making ground-directed herbicide or fertilizer applications especially when heavy rainfall is expected. Split applications of nitrogen fertilizers are recommended.
- 4 – 5 = **Intermediate conditions**. The site may be intermediate in both the risk of runoff and leaching potential.
- 6 – 8 = **High runoff potential**. Installation of filter strips around field is highly recommended. Delay application of pre-emergence herbicides and fertilizers when >1" of rainfall is forecast.

Soil Hydrologic Group	Description
A	Low runoff potential – high leaching potential. Mostly deep coarse-textured soils such as sandy loams, gravels, coarse gravelly loams.
B	Moderately low runoff potential – moderately high leaching potential. Mostly permeable loams.
C	Moderately high runoff potential – moderately low leaching potential. Mostly fine-to-medium textured soils and/or those with imperfect drainage.
D	High runoff potential – low leaching potential. Mostly very fine-textured soils and/or those with poor drainage.

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1. Management Considerations for Sites with High Leaching or Runoff Potential	
1.1 If site has a <u>high leaching potential</u>, is a plan in place to minimize this risk?	BMP rating
A management plan is in place to reduce the use of pesticides and fertilizers with high leaching potential. AND Nitrogen rates are adjusted by using split applications or fertigation or ground application. AND Applications of ground-directed fertilizers and herbicides are delayed when heavy rains are expected.	5
No management plan is in place to address leaching. AND Nitrogen rates are adjusted by using split applications or fertigation or ground fertilization. AND Applications of ground-directed fertilizers and herbicides are delayed when heavy rains are expected.	3
No management plan is in place to address leaching. AND Applications of ground-directed fertilizers and herbicides are delayed when heavy rains are expected.	1
Herbicide, insecticide, fungicide, and fertilizer applications are made on a cost and need only basis with no consideration to leaching potential. OR No knowledge of which inputs are most prone to leaching, and herbicide rates are not adjusted according to soil texture. OR No plan is in place to address leaching.	0
Comments:	
1.2 If site has a <u>high runoff potential</u>, is a plan in place to mitigate the runoff?	BMP rating
A plan is in place that addresses runoff with appropriate soil conservation structures. AND Alleys between tree rows are have a permanent cover established soon after initial tilling. AND Application of herbicides, fungicides, insecticides, and fertilizers is delayed if rainfall is forecasted within the drying time of the application.	5
No plan is in place to address soil conservation. AND Alleys between tree rows are have a permanent cover established soon after initial tilling. AND Application of herbicides, fungicides, insecticides, and fertilizers is delayed if rainfall is forecasted within the drying time of the application.	3
No plan is in place to address soil conservation. AND Alleys between tree rows are have a permanent cover established soon after initial tilling. AND Weather conditions and runoff are not considered prior to application of pesticides and fertilizers.	1
Soil conservation practices (e.g. diversions, filter strips, drainage) are not considered. AND Alleys between rows are maintained by cultivation. AND Weather conditions and runoff are not considered prior to application of pesticides and fertilizers.	0
Comments:	

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2. Additional Preplant Considerations	
2.1 Are complete soil nutrient analyses done before planting?	BMP rating
Soil analyses are done on all distinct portions of the site, and different soil types are sampled separately.	5
More than one soil analysis is done, but the site is not thoroughly sampled.	3
Only one complete soil analysis is done although the site is not uniform.	1
Only pH is tested: a complete soil analysis is not done. OR No soil analyses are done.	0
Comments:	
2.2 Is preplant soil compaction addressed?	BMP rating
Soil compaction is directly evaluated. AND If soils have impermeable layers or hard pans, subsoiling is performed the year prior to planting. OR Soils are gravelly with no perched water tables or clay layers requiring subsoiling.	5
Soil compaction is not directly evaluated BUT Subsoiling is done the year prior to planting.	3
Soil compaction is not directly evaluated. AND Preplant subsoiling is not done. AND Soils are well-drained gravels or gravelly loams in hydrologic classes A and B, which are less prone to compaction.	1
Soil compaction is not directly evaluated. AND Preplant subsoiling is not done. AND Soils have silt or clay layers, and/or perched water tables. OR Soils are in hydrologic classes C and D, which are prone to compaction.	0
Comments:	

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2.3 Are drainage problems addressed?	BMP rating
Soils are well drained to excessively well drained and no tiling is required. OR Pattern tiling is established, with tile lines parallel to rows at an adequate density for the soil texture.	5
Soils are evaluated and drainage requirements are determined before planting. AND Tile drainage is designed and installed on poorly drained areas or in heavy soils.	3
No preplant design or evaluation for tiling is done. BUT Tile lines installed in observably wet areas.	1
Soil drainage is not considered preplant. AND Soils are poorly drained, no tile drainage present even in wet spots and low areas. AND Standing water persists after rainfall.	0
Comments:	
2.4 If necessary, is soil pH adjusted?	BMP rating
In the year prior to planting, soil pH is adjusted with lime so the top 16" of soil is between 6.0 and 6.5. AND If the total amount recommended is >6 tons per acre, the lime is split between two applications in the year prior to planting.	5
In the year prior to planting, soil pH is adjusted with lime so the top 16" of soil is between 6.0 and 6.5. AND Lime applications are <i>not</i> split if >6 tons per acre is required.	3
In the year prior to planting, soil pH is adjusted with lime so the top 16" of soil is between 6.0 and 6.5. OR Less than 3 tons per acre of lime is applied after planting.	1
Soil pH is not adjusted before planting. OR Soil pH is not known. OR More than 3 tons per acre of lime is applied after planting.	0
Comments:	

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2.5 For sites with low soil organic matter (<3%), is additional organic matter added?	BMP rating
Organic matter is supplied per soil test results through one of the following methods: cover crops (particularly with sorghum/sudan hybrids); compost; or manure, preferably composted.	5
Organic matter is supplied at 2/3 of the soil test recommendation.	3
Organic matter is supplied at 1/3 of the soil test recommendation.	1
Organic matter is not added, particularly on sandy sites.	0
Comments:	
2.6 For sites previously planted to the same tree-fruit crop, was a crop rotation plan carried out before replanting?	BMP rating
Land was not previously in the same tree-fruit crop. OR Land was planted to same species in the past and rotated to non-related (i.e., non-rosaceous) crops or cover crops for at least 3 years prior. AND/OR Cover crops used were selected for specific properties (e.g., marigolds for suppressing nematodes, sudangrass for suppressing weeds and/or adding organic matter).	5
Land was previously planted to the same tree-fruit crop and rotated to non-related crops or cover crops for 2 years before replanting AND/OR Cover crops used were selected for specific properties (e.g., marigolds for suppressing nematodes, sudangrass for suppressing weeds and/or adding organic matter).	3
Land was previously planted to the same tree-fruit crop and rotated to non-related crops or cover crops for only 1 year before replanting.	1
Land was previously planted to the same tree-fruit crop and replanting is occurring without rotating to a different crop or fallow period.	0
Comments:	

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3. Site and Soil Considerations for Established Orchard Blocks	
3.1 Is pH adjusted if necessary?	BMP rating
Lime is added according to soil test recommendations if topsoil pH is less than 6.0. AND No more than 2-3 tons per acre is applied per year.	5
Lime is added according to soil test recommendations. AND More than 3 tons per acre is applied in a split application.	3
Lime is added according to soil test recommendations. AND More than 3 tons per acre is applied in one application.	1
Soil tests are never taken and lime is added systematically or not at all.	0
Comments:	
3.2 How is soil erosion addressed if evident?	BMP rating
No soil erosion is evident. AND Grass alleys are well maintained between tree rows. AND Where erosion is evident corrective measures are taken. AND Buffer/filter strips are established around all water bodies, wetlands, and outlet ends of concentrated flow areas.	5
Grass alleys are well maintained between tree rows. AND Where erosion is evident corrective measures are taken. AND/OR No buffer/filter strips are established around any water bodies, wetlands, and outlet ends of concentrated flow areas.	3
Grass alleys are poorly maintained. AND Where erosion is evident corrective measures are taken (e.g. grass waterway, diversions, filter strips), but some erosion is still evident. AND/OR No buffer/filter strips are established around any water bodies, wetlands, and outlet ends of concentrated flow areas.	1
Grass alleys are not established between tree rows. AND/OR Erosion is evident and no corrective measures are taken.	0
Comments:	

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3.3 Is biodiversity of soil microorganisms considered when making soil management decisions?	BMP rating
A conscious effort is made to increase and diversify the soil microbial populations with 3 or 4 of the following methods: <ul style="list-style-type: none"> • Annual application of compost or other organic matter • No row-middle tillage • Reduction in or elimination of preemergent herbicide use • Avoiding the overuse of postemergent herbicides 	5
At least 2 of the bulleted points listed above are used to benefit soil microbial populations.	3
One of the bulleted points listed above are used to benefit soil microbial populations.	1
No effort is made to improve soil microbiology.	0
Comments:	

4. Nutrient Management for Established Orchard Blocks	
4.1 Are fertilizer applications based on leaf tissue analysis and soil tests?	BMP rating
Soil and leaf tissue tests are performed annually and used to guide fertilizer applications.	5
A leaf tissue test only if performed once in 3 years and used to modify fertilizer program if indicated.	3
A soil test only is performed once in 3 years and used to modify fertilizer program if indicated.	1
No soil or tissue tests are performed on established blocks.	0
Comments:	

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5. Plant Culture and Irrigation Practices	
5.1 Is the training system designed to optimize air circulation and drying conditions for foliage so as to reduce disease incidence?	BMP rating
Apple, cherry, or pear trees are on dwarfing rootstocks with small canopies. AND Pruning is performed annually allowing for good access to light and air circulation throughout the canopy. OR Peach trees are dormant and summer pruned annually.	5
Apple, cherry, or pear trees are on dwarfing rootstocks and pruned biannually. OR Apple, cherry, or pear trees are on semi-dwarfing rootstocks and pruned annually. OR Peach trees are dormant pruned annually.	3
Apple, cherry, or pear trees are standard or semi-standard in size and pruned annually.	1
Apple, cherry, peach, or pear trees are standard or semi-standard in size and only occasionally pruned.	0
Comments:	
5.2 Is irrigation supplied to tree rows?	BMP rating
Drip irrigation is supplied to tree rows to deliver water when needed for plant growth and fruit development. AND At frost-prone locations, overhead irrigation is supplied to tree rows for frost protection during bloom. AND A water use plan is used which minimizes disease development, optimizes water use efficiency, and minimizes erosion and run-off.	5
Drip irrigation is supplied to tree rows to deliver water when needed for plant growth and fruit development. AND At frost-prone locations, overhead irrigation is supplied to tree rows for frost protection during bloom.	3
Overhead irrigation is supplied to tree rows for to deliver water when needed for plant growth and fruit development, frost protection during bloom.	1
No irrigation is supplied to tree rows.	0
Comments:	

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5.3 Does planting arrangement maximize light penetration and minimize soil erosion?	BMP rating
To reduce the potential for erosion, rows are planted along the contour in areas with significant slope. Otherwise, tree rows are oriented in a north-south direction to maximize light penetration by the tree canopy.	5
Rows are planted in a north-south orientation, regardless of slope.	3
Rows are planted in a consistent orientation with other trees in the orchard without consideration of light penetration or slope.	1
Rows are planted up and down the slope in an east-west direction.	0
Comments:	
5.4 Are tree spacing within rows and spacing between rows appropriate for the site, rootstock, variety, and training system?	BMP rating
All pertinent variables (site effects, soil conditions, rootstock vigor, variety vigor, and the training system to be used) are factored into the decision regarding the spacing of trees within rows and the distance between rows. AND Tools, such as the tree-spacing calculator (umassfruit.com/clements/appletreespacing.htm) are used to assist with this decision.	5
Tree and row spacing are based on recommendations for the variety/rootstock/training system combination, but the soil and site conditions are not factored into the assessment.	3
Tree and row spacing are based loosely on recommendations for the variety/rootstock/training system combination, but adjustments are made based on incorrect assumptions.	1
Tree and row spacing are judged solely on current trees within the orchard, regardless of rootstock, variety, or system.	0
Comments:	

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6. Pesticide Handling <ul style="list-style-type: none"> • <i>Only pesticides approved and registered for tree fruit in the state are used.</i> • <i>Pesticide drift is minimized.</i> • <i>Re-entry and pre-harvest intervals are adhered to.</i> 	
6.1 Is the Insecticide/fungicide sprayer calibrated regularly?	BMP rating
The insecticide/fungicide sprayer is calibrated before the start of the season following an established protocol. AND Insecticide/fungicide sprayer is recalibrated at least once midway through the growing season.	5
The insecticide/fungicide sprayer is calibrated before the start of the season.	3
The insecticide/fungicide sprayer is calibrated only when nozzles are replaced.	1
The insecticide/fungicide sprayer is not calibrated regularly.	0
Comments:	
6.2 Is the herbicide sprayer calibrated regularly?	BMP rating
The herbicide sprayer is calibrated before the start of the growing season following an established protocol. AND The herbicide sprayer is recalibrated midway through the growing season.	5
The herbicide sprayer is calibrated before the start of the growing season.	3
The herbicide sprayer is calibrated only when nozzles are replaced.	1
The herbicide sprayer is not calibrated regularly.	0
Comments:	

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6.3 Are spray records are maintained and organized?	BMP rating
Records of pesticide applications are maintained, including date, block, target pest, crop stage, pesticide name and EPA number, formulation, rate, and number of acres treated using published software. AND Win-PST analysis (http://policy.nrcs.usda.gov/viewerFS.aspx?id=1476) is conducted for all pesticides considered for use on the farm.	5
Records of pesticide applications are maintained, including date, block, target pest, crop stage, pesticide name and EPA number, formulation, rate, and number of acres using published software.	3
Records of pesticide applications are maintained, including date, field and block, target pest, crop stage, pesticide name and EPA number, formulation, rate, and number of acres treated in paper files and not electronically or by using published software.	1
Records of pesticide applications are kept, but are incomplete and not well organized.	0
Comments:	
6.4 Are all applicators and other employees appropriately trained?	BMP rating
All individuals applying pesticides have a pesticide applicator's license, whether or not they are specifically under the direction of an individual with a license. AND All other employees have received Worker Protection Standard training. AND Additional training is provided to employees to ensure the best possible pest control and the safest possible working environment. AND All appropriate posting is done regarding pesticide application .	5
Only a single applicator is licensed, and that individual directs all others who apply pesticides. AND All other employees have received Worker Protection Standard training. AND Additional training is provided to employees to ensure the best possible pest control and the safest possible working environment. AND All appropriate posting is done regarding pesticide application .	3
Only a single applicator is licensed, and that individual directs all others who apply pesticides. AND All other employees have received Worker Protection Standard training. AND All appropriate posting is done regarding pesticide application .	1
Training and licensing are not adequate to meet the legal requirements.	0
Comments:	

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6.5 Are pesticides handled safely?	BMP rating
All pesticide users understand the toxicity of the materials being applied. AND Appropriate safety equipment is provided and used during the handling and application of the pesticide. AND Plans and equipment are in place in case of accidental poisoning. AND Contact information for Poison Control and a physician is available for easy access by all applicators and other employees.	5
Appropriate safety equipment is provided and used during the handling and application of the pesticide. AND Plans and equipment are in place in case of accidental poisoning. AND Contact information for Poison Control and a physician is available for easy access by all applicators and other employees.	3
Appropriate safety equipment is provided and used during the handling and application of the pesticide. AND Contact information for Poison Control and a physician is available for easy access by all applicators and other employees.	1
Users have little understanding of pesticide safety and do not have equipment to protect safety or plans for dealing with an emergency.	0
Comments:	
6.6 How are spills and rinsate handled?	BMP rating
A containment pad, with enough containment capacity to hold the entire contents of the sprayer being filled, is used during all pesticide loading operations. AND Spilled spray material, spray material remaining in the tank after spraying, and rinsates from cleaning the tank are disposed of in a manner consistent with the pesticide label and State and Federal regulations.	5
A containment pad is used during all pesticide loading operations, but it has inadequate capacity to contain a full load from the sprayer. AND Spilled spray material, spray material remaining in the tank after spraying, and rinsates from cleaning the tank are disposed of in a manner consistent with the pesticide label and State and Federal regulations.	3
No containment pad is used. AND Spray material remaining in the tank after spraying and rinsates from cleaning the tank are disposed of in a manner consistent with the pesticide label and State and Federal regulations.	1
No containment pad is used. AND Excess spray material and rinsate are drained onto the ground at the filling facility.	0
Comments:	

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6.7 Is the orchard sprayer managed to reduce off-target application?	BMP rating
New technologies (low-drift nozzles, air-induction nozzles, tower sprayers, tunnel sprayers, “Smart” sprayers) are used to minimize the potential for drift. AND Sprayer is well calibrated to apply accurately to the desired target. AND Sprays are applied only during optimal weather conditions to reduce drift.	5
Standard air-blast technology is used. AND Sprayer is well calibrated to apply accurately to the desired target. AND Sprays are applied only during optimal weather conditions to reduce drift.	3
Standard air-blast technology is used. AND Sprayer is well calibrated to apply accurately to the desired target. AND Sprays are applied whenever time is available.	1
Standard air-blast technology is used. AND Sprayer is not regularly calibrated. AND Sprays are applied whenever time is available.	0
Comments:	

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7. Pest Control Practices	
<ul style="list-style-type: none"> • <i>Specific pest biology and current monitoring and control information are included in the New England Tree Fruit Management Guide.</i> • <i>Time-sensitive details on pest activity are given in the weekly publication Healthy Fruit.</i> • <i>Results from research trials on pest management appear in the quarterly Fruit Notes.</i> 	
7.1 Do you maintain access to current pest information and recommendations?	BMP rating
You have the current version of the <i>New England Tree Fruit Management Guide</i> . AND You receive all current newsletter information regarding pest management (<i>Healthy Fruit</i> and <i>Fruit Notes</i>). AND You read all pesticide labels thoroughly.	5
You have the current version of the <i>New England Tree Fruit Management Guide</i> . OR You receive all current UMass newsletter information regarding pest management (<i>Healthy Fruit</i> and <i>Fruit Notes</i>). AND You read all pesticide labels thoroughly.	3
You rely solely on the pesticide salesmen for pesticide application recommendation. AND You read the pesticide labels thoroughly.	1
You base pest-control decisions solely on historical approaches. AND You do not maintain any up-to-date management recommendations.	0
Comments:	
7.2 Are insect pests monitored appropriately?	BMP rating
Currently recommended approaches to assess pest presence and potential for damage are used for all pests. AND Recommended threshold levels are used to determine when to control the pest.	5
Currently recommended approaches to assess pest presence and potential for damage are used for 2/3 of the pests. AND Recommended threshold levels are used to determine when to control the pest. AND Other pests are controlled on a calendar basis.	3
Currently recommended approaches to assess pest presence and potential for damage are used for 1/3 of the pests. AND Recommended threshold levels are used to determine when to control the pest. AND Other pests are controlled on a calendar basis.	1
No monitoring is done. AND Pest control is applied on a calendar basis.	0
Comments:	

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7.3 Are disease pests monitored appropriately?	BMP rating
Continuous weather monitoring and recording equipment is used during the growing season. AND Appropriate models are used to predict the incidence of disease.	5
On-line or other non-local sources of weather data are used. AND Appropriate models are used to predict the incidence of disease.	3
On-line or other non-local sources of weather data are used. AND Models are used only for some pathogens.	1
No monitoring is done. AND Pest control is applied on a calendar basis.	0
Comments:	
7.4 Are vertebrate pests monitored appropriately?	BMP rating
Control practices involving exclusion of herbivores are in place. AND Herbivory is monitored. AND Poison controls (where legal) are used only when threshold levels are reached.	5
Control practices involving exclusion of herbivores are in place. AND Poison controls (where legal) are used only in areas where damage has occurred in previous years.	3
Control practices involving exclusion of herbivores are in place. AND Poison controls (where legal) are applied on a calendar basis.	1
No exclusionary controls are used AND No monitoring is done. AND Poison controls are applied on a calendar basis.	0
Comments:	

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7.5 How is the orchard floor managed?	BMP rating
Grass alleys are maintained between tree rows. AND Weed incidence and species within the tree row are monitored. AND Weed control in the tree rows is performed with minimal herbicide application. AND The herbicide strip does not exceed 3 feet in dwarf trees or 4 feet in semi-dwarf trees.	5
Grass alleys are maintained between tree rows. AND Minimal use of broad-spectrum herbicides are used to maintain moderate weed control. OR Weeds are managed as described in the section immediately above, but herbicide-strip width exceeds recommendations.	3
Grass alleys are maintained between tree rows. AND Regular herbicide application is used to maintain a weed-free tree row. OR Weeds are managed as described in the section immediately above, but herbicide-strip width exceeds recommendations.	1
The entire orchard floor is maintained weed free with regular herbicide application.	0
Comments:	
7.6 Are the least toxic and most environmentally safe approaches used to control pest?	BMP rating
Non-pesticidal control practices are used whenever possible. AND Choice of pesticides is made based on reduced human toxicity and reduced environmental impact.	5
Non-pesticidal control practices are used whenever possible. AND Choice of pesticides is made solely on cost and availability.	3
Non-pesticidal control practices are used in a few cases. AND Choice of pesticides is made solely on cost and availability.	1
Only pesticidal control is used. AND Choice of pesticides is made solely on cost and availability.	0
Comments:	

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8. Plant Growth Regulators <ul style="list-style-type: none"> • <i>Only growth regulators approved and registered for tree fruit in the state are used.</i> • <i>Growth regulator drift is minimized.</i> • <i>Re-entry and pre-harvest intervals are adhered to.</i> 	
8.1 Is apple-fruitlet thinning conducted appropriately and effectively?	BMP rating
Apple-fruitlet thinning is accomplished with a multi-step process including possible multiple applications of chemical thinners. Specifically, bloom density and weather are used to assess potential need and type of applications at petal fall. AND Assessment of initial set, at the 6-8mm stage, is used to determine the need and type of application to be made at the 7-14mm stage. AND If a treatment was made at the 7-8mm stage, another assessment of set is made before the 13 mm stage and is used to determine the need and type of application. AND Assessment of set at the 20mm stage is used to determine the need for a late-season thinning treatment. AND Assessment of final set is made at the 30mm stage and hand thinning is accomplished as needed.	5
Assessment of initial set is used to determine the need and type of application at the 7-10mm stage. AND Additional assessment of set at the 10-12 mm stage is used to determine the need and type of application. AND Assessment of set at the 20mm stage is used to determine the need for a late-season thinning treatment.	3
Assessment of set is made only at the 10 mm stage and is used to determine the need and type of application. AND Assessment of final set is made at the 30+mm stage and hand thinning is accomplished as needed.	1
Only hand thinning is used to reduce fruitlet numbers to acceptable levels.	0
Comments:	
8.2 Is peach-fruitlet thinning conducted appropriately and effectively?	BMP rating
Peach-fruitlet thinning is initiated with bloom application of chemical thinners. AND Final set is determined as soon as possible after bloom, and hand thinning is accomplished as necessary.	5
Final set is determined as soon as possible after bloom, and hand thinning is accomplished as necessary.	3
Final set is determined as more than 6 weeks after bloom, and hand thinning is accomplished as necessary.	1
No fruitlet thinning is performed	0
Comments:	

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8.3 Are vigor-management approaches used appropriately?	BMP rating
Tree vigor is evaluated, and treatments are imposed on trees only in cases where the relationship between reproductive and vegetative growth are out of balance in favor of vegetative growth. AND Less than 30% of the orchard is treated with growth-retarding chemicals (such as prohexadione calcium and ethephon) or with nonchemical treatments (such as ringing and scoring). Occasional spring frosts which reduce the crop may require that a greater percentage of the orchard is treated.	5
Tree vigor is evaluated, and treatments are imposed on trees only in cases where the relationship between reproductive and vegetative growth are out of balance in favor of vegetative growth. AND Less than 30% of the orchard is treated with growth-retarding chemicals, but no consideration is given to nonchemical approaches.	3
From 30 to 60% of the orchard trees are treated with growth-retarding chemical treatments without accurate assessment of the balance of vegetative and reproductive growth.	1
From 60 to 100% of the orchard trees are treated with growth-retarding chemical treatments, with no assessment of the balance of vegetative and reproductive growth.	0
Comments:	
8.4 Are chemicals used to alter ripening and drop used appropriately?	BMP rating
Progress of ripening, preharvest drop, market demands, and availability of labor are integrated in developing a plan for manipulating ripening. AND Applications of ethephon and aminoethoxyvinyl glycine are used to advance and delay ripening, respectively, of no more than 25% of the orchard.	5
Progress of ripening, preharvest drop, market demands, and availability of labor are integrated in developing a plan for manipulating ripening. AND Applications of ethephon and aminoethoxyvinyl glycine are used to advance and delay ripening, respectively, of between 25 and 50% of the orchard.	3
From 50 to 75% of the orchard trees are treated with chemical treatments which alter ripening.	1
From 75 to 100% of the orchard trees are treated with chemical treatments which alter ripening.	0
Comments:	

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9. On-farm Energy Conservation and Production	
9.1 Is energy used efficiently?	BMP rating
Farm energy consumption is evaluated periodically. AND Energy conservation technologies replace less efficient technologies in all recommended areas (for example, refrigeration, heating, lighting, and work vehicles).	5
Farm energy consumption is evaluated periodically. AND Energy conservation technologies replace less efficient technologies in most recommended areas.	3
Farm energy consumption is evaluated periodically. AND Energy conservation technologies replace less efficient technologies in some recommended areas.	1
Farm energy consumption is not a concern. AND No measures are taken to specifically reduce energy use.	0
Comments:	
9.2 Are alternative energy sources exploited?	BMP rating
Alternative, renewable energy sources (for example, solar, wind, wood, biofuels) provide more than 50% of the energy needs of the farm.	5
Alternative, renewable energy sources provide between 20 and 50% of the energy needs of the farm.	3
Alternative, renewable energy sources provide between 5 and 20% of the energy needs of the farm.	1
Alternative, renewable energy sources provide less than 5% of the energy needs of the farm.	0
Comments:	

Some elements of this checklist are based on New York State's Sustainable Viticulture Workbook (<http://www.vinebalance.com/>).