I. Soil Management

Vineyard sites in New York vary in slope and soil texture, depth, parent materials and pH. Many of the most productive soils in western and central NY are gravelly loams that drain rapidly. Hillside vineyards are subject to erosion and runoff, and many older hillside vineyards have suffered from severe erosion in the past. Surface runoff carries sediment, nutrients, and pesticides off the farm and into streams and lakes. Long Island soils are sandy and overlay an aquifer that provides drinking water for Long Island residents. These well-drained soils have high leaching potential, which increases the risk of ground water contamination.

Careful management of soils, starting before you plant and continuing through the life of the vineyard, is crucial for maintaining vineyard productivity and minimizing runoff and leaching of nutrients and pesticides. Questions in this section address runoff and leaching potential, preplant vineyard design and soil amendments, soil compaction, soil erosion, and the use of cover crops and mulch to manage soil erosion and water use in your vineyard.

Site Characteristics: Determination of Soil Leaching and Runoff Potential

Background

Long Island: Leaching of pesticides and fertilizers into the groundwater is a major concern for all vineyards on Long Island due to shallow, sandy soils and the presence of an underground aquifer. Runoff is also a concern because of the presence of both fresh and marine surface waters in close proximity to farms. Long Island sites should be considered to have high leaching potential.

Finger Lakes and Lake Erie: Vineyard sites are extremely variable. Soil textures range from sandy and gravelly loams to heavy clay. Depth of the rooting layer ranges from a few feet to 6 feet or more. Differences in soil parent material have resulted in soil pH ranging from 4.0 to 7.0. Many vineyards are on moderate to steep slopes, and some – particularly those that have been in production since the turn of the century – have suffered from severe erosion in the past. Because of this diversity, the potential for erosion, ground water, or surface water contamination varies greatly – even on the same farm. This worksheet is designed to:

1. Compare the relative risk of ground and surface water contamination among different vineyard blocks on your farm.

2. Identify the vineyard blocks on which you may want to consider using more extensive water protection practices.

3. Set priorities for adopting vineyard floor management practices, constructing soil conservation structures, and making changes to nutrient or pesticide management practices.

4. Be applicable for both established vineyards and preplant situations.

Pages 1-3 will allow you to enumerate and classify the risk potential for each vineyard block. If the assessment shows a high or moderate risk of sedimentation or ground or surface water contamination, you will want to consider possible ways to modify that risk.

If your vineyard is on Long Island, you may skip this section and proceed to the first question on page 4.

If you already know the leaching potential of your soil, you may skip to page 4.

Vineyard Site Characteristics Worksheets - Instructions

1. If you know your vineyard's leaching and runoff potential, you may skip this section.

2. Use a County Soil Survey of your property to identify soils and slopes present on your land, or ask for assistance from your local Soil and Water Conservation District to obtain a computer-generated map of your property with soils and slopes identified.

3. Identify major vineyard blocks or natural divisions with similar soils and slopes. Mark the location of each area on the map. Identify the predominant soil type and average slope in each area.

4. From the county soil survey, use information on each soil type to fill out the following table for each vineyard block. 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	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.

Rating of Runoff/Leaching Potential of Vineyard Blocks

Soil Hydrologic Group	Rating	Average Block Slope	Rating
A	1	< 3%	1
B	2	3 – 6%	2
C	3	7 – 12%	3
D	4	> 12%	4

Vineyard Block ID	Hydrologic Soil Group Rating	Average Block Slope Rating	Addition of Rating Numbers
1.			
2.			
3.			
4.			
5.			
6.			
Addition of Numbers - 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. For example, a flat site on heavy clay would likely have less runoff and more leaching than a hillside vineyard. Similarly, a well-drained, gravelly soil on steep slopes may be subject to both runoff and leaching.

6 – 8 = High runoff potential. Installation of filter strips around vineyards is highly recommended. Delay application of pre-emergence herbicides and fertilizers when >1" of rainfall is forecast.

Management Considerations for Sites with High Leaching or Runoff Potential

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
If vineyard has a high leaching potential, is a plan in place to minimize this risk?	A management plan is in place to reduce the use of pesticides and fertilizers with high leaching potential, and appropriate herbicide application rates are used to limit movement. AND Nitrogen rates are adjusted by using split applications or fertigation, and applications of ground-directed fertilizers and herbicides are delayed when heavy rains are expected.			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.	

Management Considerations for Sites with High Leaching or Runoff Potential

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
If vineyard has a high runoff potential, is a plan in place to mitigate the runoff?	A conservation plan is in place that addresses runoff with appropriate soil conservation structures (e.g. diversions, filter strips, drainage) and vineyard floor management options. Application of herbicides, fungicides, insecticides, and fertilizers is delayed if rainfall is forecasted within the drying time of the application.			Soil conservation practices are not considered in vineyard layout and management. AND Weather conditions and runoff are not considered prior to application of pesticides and fertilizers. (i.e. No management plan exists for reducing erosion and runoff.)	

Preplant Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Are complete soil nutrient analyses done?	Soil analyses are done on all distinct portions of the site, the slope is sampled separately from the flat area and different soil types are sampled separately.	More than one soil analysis is done, but the site is not thoroughly sampled.	Only one complete soil analysis is done.	Only pH is tested: a complete soil analysis is not done. OR No soil analyses are done.	
Are soil samples sent for nematode analysis? *(Not applicable for Labrusca growers.)*	Prior to planting, samples are collected according to laboratory instructions and sent for nematode analysis.			Nematode analysis is not done.	

On Long Island, nematodes can be problematic for potato growers. Though there is no evidence of nematode damage to grapevines, some species are known to attack grapevines in other regions. In the Finger Lakes, the dagger nematode *Xiphenema index* has been found to vector ringspot viruses, a disease of concern for hybrid varieties. Consequently, assessing the soil nematode populations may help to address a later problem. One of the best defenses against nematode injury is excellent early care of the vineyard, as healthy vines are better able to tolerate an infestation than compromised vines.

Preplant Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is preplant soil compaction addressed?	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.	Soil compaction is not directly evaluated. BUT Subsoiling is done the year prior to planting.	Soil compaction is not directly evaluated. 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.	Soil compaction is not directly evaluated. Preplant subsoiling is not done. AND Soils have silt or clay layers and/or perched water tables. Soils are in hydrologic classes C and D, which are prone to compaction.	

The need for subsoiling should be judged based on local experience and/or the use of a penetrometer, a device that measures soil compaction. On Long Island, vineyards are planted on old potato and vegetable ground. These farms almost always have a hardpan, usually at 18-24", due to repeated shallow plowing. Preplant subsoiling is therefore recommended. In other regions, the need for subsoiling should be assessed in consultation with a vineyard consultant, CCE and/or NRCS. While preplant subsoiling is not a standard practice, it may be of help on sites with poor drainage.

Preplant Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Are soil pits dug to evaluate the soil profile?	If soils are variable, soil pits are dug in a grid pattern. Drainage, topsoil depth, and texture are evaluated in each block.	Soil pits are dug at several distinct sites on a potential property. Drainage, topsoil depth, and texture are evaluated.	One soil pit is dug at the potential vineyard property.	No soil pits are dug prior to planting. No evaluation of soil physical properties is made.	

Soil pits allow evaluation of the soil profile in order to better gauge appropriate scion/rootstock choices, spacing, irrigation, trellis design, etc. Preferably all distinct areas on a site will have a pit. They should be done according to recommendations from a vineyard consultant or a CCE, NRCS or Soil & Water Conservation District representative. On Long Island, typically 2-4 pits are dug on a 20-acre parcel. In the Finger Lakes, variation in soil types may dictate the need for more pits on a 20-acre parcel. Pits are typically 5-6 ft long x 3-4 ft wide x 4-5 ft deep.

Preplant Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Are drainage problems addressed?	Soils are well drained to excessively well drained and no tiling is required. Pattern tiling is established, with tile lines parallel to rows at an adequate density for the soil texture. OR Tile spacing is appropriate for variety type. AND	Soils are evaluated and drainage requirements are determined preplant. Tile drainage is designed and installed on poorly drained areas or in heavy soils, with tile spacing appropriate for variety type (vinifera may need more than natives to be productive). AND	No preplant design or evaluation for tiling is done. BUT Tile lines installed in observably wet areas.	Soil drainage is not considered preplant. Soils are poorly drained, no tile drainage present even in wet spots and low areas. Standing water persists after rainfall. AND	

Preplant Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
If necessary, is soil pH adjusted?	In the year prior to planting, soil pH is adjusted with lime so the top 16" of soil is approximately 6.5 for *V. vinifera,* 6.0 for hybrids and 5.5 for natives. AND If the total amount recommended is >6 tons per acre, the lime is split between two applications in the year prior to planting.	In the year prior to planting, soil pH is adjusted with lime so the top 16" of soil is approximately 6.5 for *V. vinifera,* 6.0 for hybrids and 5.5 for natives. AND Lime applications are not split if >6 tons per acre is required.	In the spring just before planting, soil pH is adjusted with lime so the top 16" of soil is approximately 6.5 for *V. vinifera,* 6.0 for hybrids and 5.5 for natives. OR Less than 3 tons per acre of lime is applied after planting.	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.	

Three major types of grapevines are grown in New York: natives, hybrids, and *V. vinifera* types. Native labrusca types are adapted to acid soils, with optimum pH around 5.5. *V. vinifera* grapevines are more adapted to neutral soil pH (6.5-7.0) and can exhibit nutrient deficiencies in acid soils. Interspecific hybrid varieties are hybrids of American (often acid-adapted) *Vitis* spp. and *V. vinifera*, so are thought to have an adaptation to intermediate soil pH (6.0) somewhere between the European and American parents. Although this idea hasn't been rigorously tested for every hybrid, these guidelines seem to work reasonably well in practice.

Application of lime should be done in the year prior to planting. Additions of large amounts of lime just before planting can induce manganese, potassium, or magnesium deficiencies in vines. Also, lime applied immediately preplant may not have time to react with soil particles.

Preplant Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
For sites with low soil organic matter (<2% for Long Island, <3% for Finger Lakes and Lake Erie), is additional organic matter added?	Organic matter is supplied through one of the following methods: cover crops (particularly with sorghum/sudan hybrids); compost; or manure, preferably composted.			Organic matter is not added, particularly on sandy sites.	
How are vineyard rows oriented with respect to slopes?	Vineyard rows run perpendicular to the slope (across slope). OR Slope along rows is <3%; hill slope is <12%. AND Direction of slope is uniform.	Vineyard rows run perpendicular to the slope. AND Slope along rows is <6%; hill slope is <12%. AND Some side slopes present.	Vineyard rows are perpendicular to the main slope. AND Substantial side slopes are present (slope direction is not uniform).	Vineyard rows run up and down the slope. AND Slopes are >6%.	

Vineyard rows can reduce the effective slope by channeling water across it. Such protection is less effective when the slope ***along vineyard rows*** exceeds 3%, when slope direction is not uniform (side hills present), or when the main slope exceeds 12%.

Established Vineyard Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is pH adjusted if necessary?	Lime is added according to soil test recommendations if topsoil pH is less than 6.5 for *V. vinifera,* 6.0 for hybrids or 5.5 for natives. No more than 2-3 tons per acre is applied per year.	AND	Lime is added according to soil test recommendations. More than 3 tons per acre is applied in one application.	Soil tests are never taken, and lime is added systematically or not at all.	

Established Vineyard Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
How is soil compaction addressed if evident?	Equipment is chosen or modified to minimize compaction (e.g. lightest equipment possible, wider or larger diameter tires, tire pressure is as low as possible). In compacted areas, subsoiling is completed every other year in the tire tracks, or deep-rooting cover crops are planted to help restore soil structure. Equipment use is avoided when soils are saturated.	In compacted areas, subsoiling is completed every two to three years. Equipment use is usually avoided when soils are saturated.	Compaction status is not known. Equipment is sometimes used when soil is saturated.	Compaction status is not known. Equipment is regularly used when soil is saturated.	

Common implements used for subsoiling include the chisel plow, spader and paratill. A chisel plow typically has two shanks that ride in the tire tracks. It is more effective with drier soil and can extend to a depth of 18". The spader, a series of rotary shovels, loosens topsoil and fractures subsoil. It reportedly works in both dry and wet soils to a depth of about 14". The advantage to a spader is that it incorporates green cover. The paratill consists of a pair of coulters that slice the soil followed by 2 angled legs each with a foot and riser plate on the bottom. It typically reaches depths of 12-18". It lifts and partially shatters the soil profile with maximum shatter occurring with drier soils. It does not mix top and subsoils nor create clods or large trenches. Note that it is not unusual for the chisel plow and paratill to sever vine roots in established vineyards.

Vineyard Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
How is soil erosion addressed?	Permanent cover crops are established in vine row middles and maintained throughout the year. AND Where erosion is evident corrective measures are taken (e.g. grass waterway, diversions, filter strips). AND Buffer/filter strips are established around all water bodies, wetlands, and outlet ends of concentrated flow areas. AND Straw mulch is applied to row middles where available.		Winter annual cover crops are established in vine row middles. 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.	No cover crop is established. AND/OR Erosion is evident and no corrective measures are taken.	

The services of the Natural Resources Conservation Service (NRCS) and the Soil and Water Conservation District (SWCD) can be utilized to design and install appropriate erosion control methods.

Row Middle Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
If cultivation is used in row middles, what practices are used?	Slope is <3% for heavy soils or <6% for medium to coarse-textured soils. AND Shallow or trashy cultivation is practiced every other year or less.	Slope is <3% for heavy soils or <6% for medium to coarse-textured soils. AND Row middles are clean-cultivated no more than one time per season. OR Slope is 6-12% and row middles are shallow cultivated no more than once per year.	Slope is 3-9% for heavy soils or 6-12% for coarse-textured soils. AND Shallow cultivation is practiced 1-3 times per season.	Row middles are clean cultivated every year. AND Slopes are >12% for coarse textured soils or >9% for heavy soils.	

Cultivation, whether in the row middle or under the trellis, can have negative consequences particularly if done in excess. It renders soils more prone to erosion, destroys soil organic matter and can alter the quantity and diversity of soil microbial populations. Under Long Island conditions, row middle tillage may negate the benefits of a row middle cover crop (no net increase in organic matter). However, row middle tillage can and should be done to periodically renovate row middles (reduces weed populations such as dandelions) and as a vine management tool in dry years (reduces competition for water).

Row Middle Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
What type of seeded cover crop is used?	Permanent cover crop is established.	Annual cover crops are fall-seeded with a no-till drill every year. AND Cover is established most of the year.	Cover crops are seeded into cultivated row middles. AND Cover is established from late fall through bloom.	Annual cover crops are established following cultivation only on slopes >12%.	
If permanent cover is used in row middles, how is it managed?	Vegetation covers more than 2/3 of the vineyard floor. AND Vegetation is uniformly dense within the 2/3 cover. AND A no-till seeder is used when renovating cover crops.	Vegetation covers more than 2/3 of the vineyard floor. AND Occasional bare spots occur on less than 10% of the vineyard. AND Cultivation is practiced only when renovating cover crops.	Vegetation covers less than ½ of the vineyard floor. OR Bare spots occur on eroded knolls on more than 20% of the vineyard.	Vegetation is difficult to establish, and frequent gaps in vegetation cover are present.	

For vineyards on slopes that are managed for high tonnage bulk wine or juice varieties, using herbicides once per season to kill sod or seeded cover crops can conserve soil moisture in dry years, while providing protection against soil erosion and reducing moisture competition to crops. On Long Island, the environmental risk from this practice is increased due to leachable soils. However, drip line irrigation reduces the vines' soil moisture competition with sod and therefore the need to suppress its growth with herbicides.

Row Middle Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
What is the frequency of mowing?	Monthly from bloom to veraison, and only thereafter for worker comfort and safety.	Vineyard is mowed monthly from bloom to harvest.	Vineyard is mowed more than monthly during entire season.	Vineyard is mowed weekly.	
In regions where Lyme disease is a concern, more frequent mowing is warranted as a safety measure for workers. Mowing should be restricted to the amount necessary to allow normal vineyard operations, worker safety, or other carefully considered vineyard objectives. Mowing does not reduce water use during droughts, and excessive mowing wastes fuel, tractor time, and management time better devoted to other tasks. Of course, vineyard blocks next to tasting rooms may be justifiably manicured as a marketing practice. By the same token, sustainable vineyard management can be a marketing strategy, and mowing less can provide an opportunity for tasting room staff to demonstrate this to customers directly.					
If mulch is used in row middles for erosion control, how is it managed?	Mulch is applied to every row middle on eroded areas as needed. OR Mulch is applied to all vineyard blocks with slopes >12%.	Mulch is applied to alternate row middles in vineyard blocks with >12% slope.		Row middles are never mulched. AND Slopes are >12%, and permanent sod is not well established. OR Soils are eroded or low in organic matter.	

Application of straw mulch to row middles is a highly beneficial practice, particularly on eroded hillside vineyards. It conserves moisture, adds organic matter to the soil, and is highly effective in reducing erosion and runoff. It is commonly applied to alternate row middles, and often applied in the fall after harvest. Straw mulch can supply significant amounts of potassium to soils. It is most cost effective to use when growers bale the straw themselves and have open land that they can devote to producing it. Round bales are most often rolled out using self-fabricated tractor-mounted equipment to unroll the bales.

Established Vineyard Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is ephemeral (small rills that concentrate into channels) or gully erosion occurring on the farm?	No gully or ephemeral erosion is evident.	There is ephemeral erosion occurring in some blocks. AND There is no gully erosion. AND Sod prevents sediment from entering watercourses.	Both ephemeral and minor gully erosion is present. The erosion forms a distinct, narrow channel through which water runs during a storm or when ice and snow melt. Channels remain after tillage operations.	Both ephemeral and gully erosion are present.	

Established Vineyard Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Are filter strips (grass borders along watercourses) used?	Vegetative buffers are at least 20 ft wide and meet NRCS Standard NY-393s. Filter strips surround all watercourses and vineyard borders.	Filter strips are present along most vineyard borders. AND No sediment is entering a major watercourse.	Filter strips are present along some vineyard borders.	Sediment directly enters a watercourse. AND/OR No filter strips are in place.	
Are drainage problems addressed?	Pattern tiling is established with tile lines parallel to rows at an adequate density for the soil texture. AND Tile spacing is appropriate for variety type (Vinifera may need more tiling than natives to be productive).	Soils are well drained to excessively well drained. OR Tile drainage is installed on poorly drained low areas or heavy soils. AND Tile spacing is appropriate for variety type (Vinifera may need more tiling than natives to be productive).	Soils are moderately drained to poorly drained. AND Tile lines extend only to observably wet areas.	Soils are poorly drained, and no tile drainage is utilized even in wet spots and low areas. AND Standing water persists after rain events.	

Established Vineyard Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
If a nitrogen (N) supplying cover crop is used (e.g. a legume), are its N contributions factored into the vines' N requirements?	If your vineyard has a N requirement and a component of your cover crop fixes N (e.g. legumes such as clover and vetch), the fixed N is taken into account when calculating the application rate of additional N.		If your vineyard requires additional N, a component of the cover crop fixes N. BUT Total N supplied by the cover crop is not calculated. AND Vines show balanced growth, no excess vigor.	Although N is required, no legumes are used to fix N (i.e. all N is purchased and applied). OR A component of the cover crop fixes N, but the total N supplied by the cover crop is not calculated. AND Vines show excess vigor.	

A general equation used to calculate nitrogen contributions from cover crops is found on page 32.

Estimating Available Nitrogen Supplied by Cover Crops

To estimate the amount of nitrogen in your cover crop you must assess the total yield of the cover crop and the percentage of nitrogen in the plants just before they die.

There are two ways to estimate yield. The most accurate is to take cuttings from several places (of known surface area) in the vineyard, then dry and weigh them. Clip the plants at ground level within the known area. Dry them out in the sun for a few days and use the following formula to determine the per acre yield of dry matter.

$$\text{Yield (lbs/acre)} = \frac{\text{Total wt of dried samples (lbs)}}{\text{ft}^2 \text{ sampled}} \times \frac{43{,}560 \text{ ft}^2}{1 \text{ acre}}$$

An easier but less accurate method is to estimate your yield from the height of the cover crop and its percent cover. At 100% cover and 6" height, most grass legume cover crops will contain roughly 2000 lbs/acre of dry matter. For each additional inch, add 150 lbs. For example, a typical fescue, perennial ryegrass, or white clover vineyard cover crop that is 8" tall will yield 2000 lbs/acre of dry matter plus an additional 150 lbs for each additional inch for a total of 2300 lbs of dry matter per acre. If the stand is less than 100 percent, multiply by the percent cover. In this example, for an 80% cover you would obtain: 2300 lbs x 0.80 = 1840 lbs dry matter/acre.

To convert the yield to total nitrogen, use the following guideline: cover crop grass legume mixtures contain 2-3% N before flowering and 1.5-2.5% after flowering. Therefore, total nitrogen in the cover crop = yield (lbs/acre) x % N/100

To estimate the nitrogen available to the vines, divide the total nitrogen by 4 for cover crop material left on the surface in a no-till system.

So, in our example if you mowed the vineyard 3 times during the season when the cover reached a 6" height you would have 6000 lbs/acre of dry matter.

Total nitrogen = 2000 lbs/acre x 3 cuttings = 6000 lbs

6000 lbs/acre x 2.5* = 150 lbs

* Average nitrogen percentage before flowering.

Nitrogen available to vines = 150 lbs = 37.5 lbs/acre

100

4

This procedure provides a gross estimate of available nitrogen in the soil from cover crops. To obtain a more accurate estimate you would have to send plant samples to a lab for analysis.

Organic matter decomposition in the soil also produces nitrogen. Each 1% of organic matter supplies 15-20 lbs/acre/year of nitrogen (Dr. Terry Bates, Cornell University, Fredonia Vineyard Laboratory).

Modified from: Sustainable Agriculture Network (1998).

The Benefits of Using Cover Crops in Vineyards

Cover crops do not need to be worked into the soil. Cultivation, whether in the row middle or under the trellis, can have negative consequences, particularly if done in excess. It renders soils more prone to erosion, burns off soil organic matter and can alter the quantity and diversity of soil microbial populations. Row middle tillage generally negates the benefits of a row middle cover crop (no net increase in organic matter as it is burned off roughly as fast as it is added). However, row middle tillage can and should be done to periodically renovate row middles (reduces weed populations such as dandelions) and as a vine management tool in dry years (reduces competition for water). Under Finger Lakes and Lake Erie conditions, using contact herbicides in row middles in dry years is an effective tool for managing water use without tillage while maintaining cover to reduce the potential for erosion. In regard to mowing, more organic matter is preserved by mowing and letting the residue lie on the surface versus cultivation of any kind (roots contribute to organic matter as well).

From Ohmart and Matthiasson (2000):

- Permanent cover crops are the most practical and cost effective means of supplying the organic matter needed to maintain and improve the soil.
- Cultivation decreases organic matter.
- As the cover crop decays, it provides nutrients for the grapevines.
- Grass cover crops usually require some added nitrogen (20-40 lb per acre), whereas legumes may require phosphorous and sulfur and should not receive any nitrogen, otherwise they become weedy.
- Different types of cover crops can either reduce or enhance vine growth.
- Cover crops tend to use more water than clean cultivation. Increased infiltration of rainfall may offset this loss in some years.

Established Vineyard Considerations

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
For soils with low organic matter (<2% for Long Island, <3% for Lake Erie and Finger Lakes), is additional organic matter added?	Organic matter, such as compost or composted pomace, is banded to the soil under the vine row annually, or as needed. Compost is analyzed for nutritional composition as well as contaminants. AND Vine prunings are chopped and remain in vineyard.*	Organic matter, such as compost or composted pomace, is banded to the soil under the vine row occasionally. Compost is not analyzed. AND Vine prunings are chopped and remain in vineyard.*	No organic matter is added to the soil. BUT Vine prunings are chopped and remain in vineyard.*	No organic matter is added to the vineyard. AND Vine prunings are removed from vineyard.*	

It is most practical to apply compost to a swath under the trellis rather than a broadcast application. Reasons include limited availability of high quality compost, the fact that large quantities are needed, and the expense involved. Dr. Ian Merwin, of Cornell University's Department of Horticulture, has documented that compost application increases soil microbial activity (CO_2 evolution), CEC (Cation Exchange Capacity), and available P, Ca, and K. Compost application can also result in shifts in microbial community structure. These changes in soil have not yet been linked to any increases in nutrient uptake, growth or yield in tree fruit.

*Chopping the prunings may aid movement through the vineyard rows, and on rare occasions, removal of vine prunings is warranted to reduce fungal disease inoculum.

Calculating Compost Application on Vine Rows

Examples

Row spacing: 7 ft between rows x 5 ft between vines in row
Rows: 350 ft long; approximately 18 rows per acre
Compost: have available about 5 tons/acre of compost
10,000 lbs/18 rows = 550 lbs/row

To apply compost to a certain depth:
There are 1.5-2 yd^3/ton
350 ft row x 2 ft swath x 0.042 ft (0.5" deep layer of compost) =
^{3} per row x 18 rows/acre = 522 ft^3
39 ft
522 ft^3/27 ft^3 per yd^3 = 14 yd^3

Summary: The amount of compost needed to apply a 2 ft swath under the trellis 0.5" deep over 1 acre of vines is 14 yd^3 or between 7 and 9 tons of compost. Generally, compost applications should be limited to no more than 10 tons/acre annually to avoid nutrient imbalances.

Benefits of Soil Organic Matter

- Attracts and holds nutrients in an available state, reducing leaching losses.
- Increases soil water-holding capacity.
- Binds soil particles into crumbs (aggregates), producing a granular structure that promotes the penetration of air to roots, the capillary movement of water and the penetration of roots through the soil.
- Transforms into vitamins, hormones, and other substances, which stimulate growth in plants.
- Feeds soil organisms, which in turn feed soil predators that also prey on root pests.

The soil builds up organic matter faster if the organic material is left on the surface than it does if it is worked into the soil. The oxygen introduced by the tillage "burns off" the organic matter. The natural process is for the material to "melt" into the soil over time.

From Ohmart and Matthiasson (2000).

Vineyard Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is biodiversity of soil microorganisms considered when making soil management decisions?	A conscious effort is made to increase and diversify the soil microbial populations with 4 or 5 of the following methods: • Use of compost or other organic matter • Minimal row middle tillage • Reduction in or elimination of preemergence herbicides • Avoiding the overuse of postemergence herbicides • Increase the diversity of plant material on the vineyard floor	At least three of the bulleted points in category 1 are used to benefit soil microbial populations.	One or two of the bulleted points in category 1 are used to benefit soil microbial populations.	No effort is made to improve soil microbiology.	

A diverse soil microbial population has been implicated in nutrient uptake and retention, disease suppression and overall plant health.

Vineyard Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
How is pomace utilized?	Pomace is composted on site and returned to the vineyard.	Pomace is composted off the farm and returned to the vineyard as mature compost.	Pomace is spread in the vineyard fresh.	Pomace is not returned to the vineyard.	

Recycling of organic matter back into the vineyard is important to maintain soil organic matter and soil biodiversity. Pomace can be combined with a carbon source – leaves, for example – to create a more nutritionally balanced product that enhances the soil over and above the addition of fresh pomace. Though difficult to totally eliminate, even through proper composting, grapevine seedlings will proliferate from the spreading of fresh pomace. These seedlings are often infected by downy mildew, but are generally controlled through standard weed control practices such as herbicide use, cultivation or mowing.