IV. Irrigation Management

Irrigation can be an important management tool for managing vine water relations, particularly in areas with sandy or gravelly soils, young vineyards with limited root systems, and soils with limited water-holding capacity. The availability of water to the vine (both in amount and timing) plays a crucial role in fruit quality. Drought stress limits yield and reduces the vine's ability to fully ripen fruit, while surplus water can lead to excessive vine growth, loss of fruit quality and delayed or reduced winter acclimation. Although rainfall generally meets or exceeds vine needs in the Northeast, drought conditions extending from late July through September are increasingly frequent.

Irrigation also presents the opportunity to deliver fertilizers efficiently to vines through fertigation. The benefits include better timing and placement of fertilizer in the root zone, minimization of losses to volatilization and leaching, and reduced costs associated with field application of fertilizers.

Efficient use of irrigation involves proper maintenance and design of irrigation systems and an understanding of how to apply the right amount of water at the right time to benefit vines. Questions in this section address design, maintenance, and efficient operation of irrigation systems for vineyards.

This section of the workbook pertains to irrigated vineyards. If your vineyard is not irrigated, you may skip this section.

Irrigation Management

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is there off-site water movement?	Irrigation practices result in no runoff. AND Conservation practices are in place to minimize runoff (e.g. perennial cover crops, subsoiling, buffer/filter strips, diversions, and grass waterways).	Irrigation practices result in no runoff. AND Conservation practices are present but some need improvement.	Irrigation practices result in no runoff but runoff and erosion occurs during high rainfall events. AND/OR Conservation practices need major improvement.	Runoff occurs when irrigating and/or during rainfall events.	
See also the guidelines on drainage in the Soil Management section.					
igation do you use?	A low volume system such as drip is installed. AND System has been designed by a technician with experience in irrigation to ensure uniform distribution of water.	A low volume system such as drip is installed but no design was used.		A low volume system is not used.	

Irrigation System Maintenance

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Do you check for distribution uniformity?	System is checked at the beginning of each growing season by measuring emitter outflows and pressure differential in each zone.	Distribution uniformity is tested irregularly by measuring emitter outflows and pressure differential in each zone.		Distribution uniformity is never checked.	

Drip irrigation distribution uniformity should be checked at the beginning of each growing season to ensure that the system is applying water in a uniform manner. This is particularly important for scheduling purposes and if fertigating.

1. Using a graduated cylinder, measure the output of 3 consecutive emitters close to the pump, 3 in the middle of the zone and 3 at the farthest point from the pump.
2. Convert the measured flow to gallons per hour as follows:
   __ ml/__sec x 1 oz/29.57 ml x 1 gal/128 oz x 60 sec/min x 60 min/hr.
3. Average the measurements, making sure the flow range does not exceed ± 15% of the average flow rate. Readings >15% indicate problems with the system, the most obvious being clogged emitters.

Irrigation System Maintenance

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is routine maintenance performed on the irrigation system?	Water filters are inspected and cleaned whenever pressure differences indicate, and irrigation lines are flushed at the beginning and end of each season. AND Chemical treatment of the water is completed if tests show a problem (e.g. to prevent precipitate buildup and kill algae or bacteria present in the system).	Water filters are inspected and cleaned whenever pressure differences indicate, and irrigation lines are flushed at the beginning of the irrigation season each year.		Water filters are not regularly inspected or cleaned, and irrigation lines are not flushed at all.	
OxiDate, a hydrogen peroxide product, is labeled as an irrigation disinfectant. Rutgers Cooperative Extension also has several useful publications on irrigation system maintenance - **http://www.rce.rutgers.edu/.**					
Is a flow meter installed?	Flow meter is installed and used to monitor application rates throughout the season.	Flow meter is installed but not regularly used to monitor the system.	Flow meter is not installed.		

Irrigation Scheduling

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Is the vineyard's soil water holding capacity used in setting irrigation schedules?	The USDA Soil Survey is utilized to determine the average water holding capacity of the most common soils in the vineyard. AND The effective rooting depth of your soils has been determined through excavation. AND This information is used in irrigation scheduling.	The USDA Soil Survey is utilized to determine the average water holding capacity of the most common soils in the vineyard. AND This information is used in irrigation scheduling.		Soil water holding capacity is not known. Vines are irrigated when soil looks dry.	

Irrigation Scheduling

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
Are monitoring devices used to determine the irrigation schedule?	Soil moisture monitoring devices (e.g. neutron gauge, tensiometer or gypsum blocks) are installed and used to track soil moisture depletion. AND Weather data is recorded and seasonal rainfall amounts are considered when deciding when to irrigate and how much water to apply.	Soil moisture monitoring is done by bucket auger (judging by feel). AND Weather data is recorded and seasonal rainfall amounts are considered when deciding when to irrigate and how much water to apply.	Soil moisture monitoring devices are not installed. BUT Weather data is recorded and seasonal rainfall amounts are considered when deciding when to irrigate and how much water to apply.	An irrigation schedule is maintained regardless of soil moisture or weather conditions.	

Tensiometers reveal soil moisture potential in a specific area. They read changes in soil moisture by measuring the vacuum created by water movement through a ceramic tip. This mimics how soil moisture moves into the root zone of a plant. Tensiometers can help determine when to irrigate but not how much water should be applied. Begin irrigation when the tensiometer reads between 30 and 40 centibars. Observe the response on the tensiometer after irrigating. If it shows that the soil is wet (a gauge reading of 0-10), the system is working well. Operation times can be adjusted based upon the response of the tensiometer.

There are a number of other methods for measuring soil moisture such as neutron probes and gypsum blocks. Alternatively, a more accurate method may be to measure vine water potential using pressure bombs.

Irrigation Scheduling

	1 - Low Risk	2	3	4 - High Risk	YOUR RANK
What factors are used to determine length of time for irrigation?	Water is applied according to the water holding capacity of the soil, soil moisture measurement, vine demand and weather conditions at that time. AND Application time is calculated according to the application rate of the system and the measured depletion in the root zone.	Water is applied according to the water holding capacity of the soil, vine demand and weather conditions at that time. Soil moisture is not measured. AND Application time is calculated according to the application rate of the system.	Irrigation water is applied systematically when conditions are dry.	Irrigation water is applied systematically without regard to weather conditions, or water holding capacity of the soil.	

Vine water demand is highest as leaf area increases in spring and summer. Similarly, large canopies such as divided or minimally pruned canopies have higher water requirements than smaller canopies such as those in VSP training. According to Dr. Alan Lakso, a Concord vine with a full canopy needs about 4 – 4.5 gal/day in July and August. It is likely that vinifera vines with smaller canopies require less water.

Once the application rate of the system has been determined, (see previous sidebar) operating time can be determined. This is the length of time necessary to replace the water a single vine uses per day. Assuming a peak consumptive use for vinifera grapes is between 0.2 and 0.25 inches per day, calculation of irrigation time is possible by estimating the rooting area of the vine in square feet. For example: vines are planted 4' x 8', estimated rooting area is 32 ft^2 and estimated peak consumptive use is 0.23 in/day.

0.23 in/day/12 in/ft x 32 ft^2 x 7.48 gal/ft^3 = 4.59 gal/vine/day

$$\frac{4.59 \text{ gal/vine/day}}{\text{\# emitters/vine x gal/hr/emitter}} = \_\_\_\_\_\text{hrs of operation}$$

To minimize leaching, do not exceed calculated operation time for peak consumptive use.

Peak consumptive use (PCU): Weather data was collected from a weather station located on a LI sod farm. The data was entered into an irrigation-scheduling model (Blaney Criddle Method) from Michigan State to calculate consumptive use for specific crops. PCU is the average daily amount of water consumed in evaporation from the soil and transpiration through the leaves in the photosynthetic process by a crop during the 6 – 10 days of the highest water consumption of the season. It generally occurs as the crop is nearing harvest, when vegetation is most abundant and temperatures are high.