



UNIVERSITY OF CALIFORNIA

Division of Agriculture and Natural Resources

<http://anrcatalog.ucdavis.edu>

In partnership with:



Natural Resources Conservation Service

<http://www.nrcs.usda.gov>

Farm Water Quality Planning

A Water Quality and Technical Assistance Program for California Agriculture
<http://waterquality.ucanr.org>

This reference sheet is part of the **Farm Water Quality Planning (FWQP)** series, developed for a short course that provides training for growers of irrigated crops who are interested in implementing water quality protection practices.

The short course teaches the basic concepts of watersheds, nonpoint source pollution (NPS), self-assessment techniques, and evaluation techniques. Management goals and practices are presented for a variety of cropping systems.



Sediment Management Goals and Recommended Practices for Orchards and Vineyards

MARK BATTANY, Farm Advisor, University of California Cooperative Extension, San Luis Obispo County

This fact sheet includes *Management Goals* (MG) and *Recommended Practices* (RP) for reducing soil erosion at the source and capturing sediment before it enters waterways and causes water quality problems downstream.

The development of a comprehensive farm plan for sediment management in orchards and vineyards involves a sequence of eight Management Goals:

- MG 1. Assess the existing soil conditions and rainfall runoff patterns.
- MG 2. Develop an orchard or vineyard layout that minimizes erosion.
- MG 3. Manage the orchard or vineyard floor to maintain protective vegetative cover during the rainy season.
- MG 4. Coordinate efforts to control sources of runoff, sediment, and erosion with neighboring landowners.
- MG 5. Manage roads and non-cropped areas of the orchard or vineyard to reduce runoff and prevent soil erosion.
- MG 6. Retain eroded sediment and runoff before it leaves the orchard or vineyard.
- MG 7. Prevent erosion that results from irrigation practices.
- MG 8. Evaluate and maintain Management Goals and Recommended Practices.

Each Management Goal can be accomplished through a customized set of Recommended Practices, listed under each Management Goal below. The choice of which practices you implement will depend to a great deal on your individual situation.

The best strategy for preventing sediment loss, water pollution, and damage to the orchard or vineyard is to develop an integrated system of practices. Sole reliance on a single strategy is not sufficient for most orchards and vineyards grown where the topography is variable. As you evaluate the economics of practices that could be used in your operation, keep in mind that prevention of the conditions that lead to runoff and erosion is always cheaper than fixing the physical problems caused by runoff and erosion after the fact.

Many of the specific Recommended Practices require some hydrologic or engineering calculations to reduce the likelihood of damage from large storms. Natural Resources Conservation Service (NRCS) practice names and numbers are provided for those practices that have NRCS construction standards and specifications. Please consult your local NRCS office for free assistance with developing these practices.

MG 1. Assess the existing soil conditions and rainfall runoff patterns.

RP 1.1. Identify the areas of the orchard or vineyard with the most erodible soils and the locations where erosion and soil deposition have occurred in the past.

RP 1.2. Identify sources of runoff water and sediments that are upslope of your operation. For example, this could include an undeveloped hillside, an adjacent roadway or ditch, a neighboring farm, a construction site, recently graded land, or a burned area.

RP 1.3. Evaluate the slopes and surface water flow patterns in the fields and in adjacent areas that are hydrologically connected. Ask the question, “Where would the runoff flow if an extremely large rainstorm occurred?”

RP 1.4. Evaluate the current cultural practices to identify which have been the most effective in controlling runoff and erosion.

MG 2. Develop an orchard or vineyard layout that minimizes erosion.

RP 2.1. Avoid cultivation of steep slopes.

RP 2.2. Avoid orchard or vineyard development operations during the winter rainy season.

RP 2.3. Leave an adequate uncultivated setback from any riparian areas.

RP 2.4. Evaluate, through numerous soil pits, the permeability characteristics of the soil. Look for any compacted horizons or notable stratifications that may impede infiltration.

RP 2.5. Consider deep ripping to break up any restrictive soil layers and mix together stratified horizons (NRCS Deep Tillage #324).

RP 2.6. Smooth and level the surface to remove any pockets where water could accumulate (NRCS Irrigation Land Leveling #464).

RP 2.7. Consider installing drainage tile if historical or current evaluations indicate that excessive water accumulates in the soil profile.

RP 2.8. Arrange the orchard or vineyard blocks to best encompass uniform soil and slope factors within each block.

RP 2.9. Locate and construct access roads so that they will not be sources of runoff and erosion or conveyances of runoff from other areas (NRCS Access Road #560).

RP 2.10. Install terraces or other structures to alter the orchard or vineyard slope and water flow characteristics. Proper planning, layout, and maintenance of terrace structures is mandatory if they are to function as conservation measures. Consult qualified personnel when designing and constructing them.

RP 2.11. Orient orchard or vineyard rows to facilitate management without creating an erosion hazard (NRCS Row Arrangement #557):

RP 2.11.1. Rows oriented with the slope may be suitable for heavily mechanized operations, but care must be taken that wheel tracks do not become channels for runoff.

RP 2.11.2. Rows oriented across the slope may reduce the erosion hazard, but with steeper slopes problems may arise with machinery access.

RP 2.11.3. Curving rows along the slope contour are suitable for the steepest areas. In vineyards, this will require a more elaborate trellis system than for straight rows, and that can hinder mechanization. The typical cropping density for curved rows is lower than for straight rows (NRCS Contour Orchard and Other Fruit Area #331).

RP 2.12. When considering planting in an area that is highly susceptible to erosion, decide whether the projected value of the crop from that area will justify the extra costs necessary to properly plant and maintain the orchard or vineyard there.

MG 3. Manage the orchard or vineyard floor to maintain protective vegetative cover during the rainy season.

RP 3.1. A cover crop should be included in the Recommended Practices (NRCS Cover Crop #340).

RP 3.1.1. Annual cover crops combined with cultivation or mowing (e.g., barley) may be appropriate if summer and fall soil cover is not required.

RP 3.1.2. Reseeding winter annuals with minimal or no floor tillage may be more appropriate if it is important to have protection from erosion as early as possible in the fall.

RP 3.1.3. Consult sources such as *Cover Cropping in Vineyards* (UC ANR Publication 3338) and observe local orchards and vineyards to help determine which cover crop management scheme is best for your situation.

RP 3.2. Floor management can maintain some surface residues from a cover crop. The use of no-till implements allows you to maintain weed control while retaining the benefits of surface residue (NRCS Residue Management #329).

RP 3.3. Areas under development need to have the protection of a winter cover crop (NRCS Cover Crop #340).

RP 3.4. Use mechanical equipment that helps maintain the soil in a non-erodible condition.

RP 3.4.1. Consider the use of tracked vehicles for difficult terrain.

RP 3.4.2. Wide tires on wheeled vehicles can reduce rut formation.

RP 3.4.3. Use lightweight vehicles when possible.

MG 4. Coordinate efforts to control sources of runoff, sediment, and erosion with neighboring landowners.

RP 4.1. Work with neighboring landowners, when possible, to reduce runoff sources and impacts of soil erosion and sedimentation downstream or on adjacent lands. Erosion problems can often be solved without expensive measures if neighboring landowners are involved.

MG 5. Manage roads and non-cropped areas of the orchard or vineyard to reduce runoff and prevent soil erosion.

- RP 5.1. Protect roads and other non-cropped areas from incoming, concentrated runoff. Diversion structures or drainage systems may be necessary to divert concentrated runoff from an upslope source. Common sources include adjacent surfaced roadways, culverts, and natural drainages from uncultivated areas (NRCS Diversion #362).
- RP 5.2. Non-cropped areas such as row headlands should be managed with winter cover crops (NRCS Cover Crop #340).
- RP 5.3. Low-lying areas within the orchard or vineyard that tend to become channels for surface runoff may best be left unplanted and instead used as grassed filter strips to trap any sediments carried by runoff. Consult qualified guidance for the design and construction of grassed filter strips (NRCS Filter Strip #393).
- RP 5.4. Stream setback areas need to have year-round cover. If these areas have been disturbed or previously cultivated, they should be planted to a compatible native species that will not require maintenance in the future (NRCS Critical Area Planting #342, Riparian Forest Buffer #391, Stream Bank Protection #580).
- RP 5.5. Roads need to be situated such that they are not sources or conveyances for runoff (NRCS Access Road #560). To accomplish this,
- RP 5.5.1. Avoid locating roads on steep slopes, if possible.
 - RP 5.5.2. Grade the road surface to encourage water to drain off of the road surface.
 - RP 5.5.3. Incorporate rolling swales to prevent the movement of runoff over large distances on the road surface.
 - RP 5.5.4. Incorporate drainage structures to remove accumulated water from the road surface or from the road ditch.
 - RP 5.5.5. For specific information, consult manuals such as the *Handbook for Forest and Ranch Roads* available from the Mendocino County Resource Conservation District (RCD).
- RP 5.6. Non-surfaced roads in the orchard or vineyard can also be planted with a cover crop. This is particularly suitable for those roads that are not generally accessed in the winter due to muddy conditions. A cover crop will also reduce the length of time that these roads are inaccessible (Critical Area Planting #342).
- RP 5.7. Avoid driving on muddy roads; this creates channels for runoff.
- RP 5.8. Cut banks and exposed fill areas should be protected with straw, jute netting, and a cover crop until the native vegetation has become reestablished (NRCS Cut Bank Stabilization #742).
- RP 5.9. Plant bare soil and disturbed areas of the farm such as cut banks, field margins, and abandoned slopes with a dense cover of vegetation to control erosion and suppress weed growth. A mix of species should be selected to accomplish quick establishment but also provide long-term coverage, attract beneficial insects, and compete against weed species (NRCS Critical Area Planting #342).

RP 5.10. A hedge of shrubs can be established along field margins or between field blocks to reduce wind effects, protect slopes from erosion, and attract beneficial insects. A mix of species should be selected to extend the shrubs' flowering season (NRCS Hedgerow Planting #422).

RP 5.11. A row of trees or large shrubs can be established as a wind break to reduce spray drift and intercept insect and weed seed disbursement. This planting can also help protect steep slopes, stabilize stream or ditch banks, and reduce soil saturation in low-lying areas (NRCS Tree/Shrub Establishment #612).

RP 5.12. Manage existing gullies on the farm by controlling concentrated runoff with a combination of management, vegetative, and structural measures to prevent the advance of the gully. Prevent head cutting by installing a grade stabilization structure (NRCS Grade Stabilization Structure #410, Diversion #362, Critical Area Planting #342, Underground Outlet #620, Row Arrangement #557).

MG 6. Retain eroded sediment and runoff before it leaves the orchard or vineyard.

RP 6.1. Permanent sediment-trapping structures can be built to capture and filter runoff that is generated in the orchard or vineyard, preventing it from moving downstream. These structures will require annual maintenance and cleaning as well as installation costs. They should be seen as a safety measure; the majority of effort should be focused on reducing the formation of runoff and erosion at its source.

MG 7. Prevent erosion that results from irrigation practices.

RP 7.1. Design irrigation systems to suit the intake rate of the soil, thus preventing runoff.

RP 7.2. Maintain irrigation systems to prevent breaks and leaks.

MG 8. Evaluate and maintain Management Goals and Recommended Practices.

RP 8.1. Evaluate the Management Goals and Recommended Practices implemented for sediment management during future runoff periods to ensure their proper operation and function. Correct any deficiencies as needed. Remove accumulated sediment from basins annually or as needed, and spread it back onto field areas.

REFERENCES

Adapted from *Sediment management goals and management practices for strawberries*, UC ANR Publication 8071 (Daniel Mountjoy, 2002).

OTHER RESOURCES

Ingles, C. A., R. L. Bugg, G. T. McGourty, and L. P. Christensen. 1998. Cover cropping in vineyards: A grower's handbook. Oakland: University of California, Division of Agriculture and Natural Resources, Publication 3338.

UCCE Amador County. 1999. Cover cropping in vineyards—An introduction to vineyard cover crop management. UCCE Amador County Publication #1975. Online at <http://ucce.ucdavis.edu/files/filelibrary/40/930.pdf>

USDA Soil Conservation Service. 1985. Hillside vineyards unit: Redwood Empire target area. Available for viewing in some US Natural Resources Conservation Services offices and some UC Cooperative Extension county offices.

Weaver, W., and D. Hagans. 1994. Handbook for forest and ranch roads. Available from: Mendocino County Resource Conservation District, 405 S. Orchard Avenue, Ukiah, CA 95482.

FOR MORE INFORMATION

You will find related information in these titles and in other publications, slide sets, CD-ROMs, and videos from UC ANR:

Evaluating Water Quality, Publication 8118

Groundwater Sampling and Monitoring, Publication 8085

The Farm Water Quality Plan, Publication 9002

To order these products, visit our online catalog at <http://anrcatalog.ucdavis.edu>. You can also place orders by mail, phone, or FAX, or request a printed catalog of publications, slide sets, CD-ROMs, and videos from

University of California
Agriculture and Natural Resources
Communication Services
6701 San Pablo Avenue, 2nd Floor
Oakland, California 94608-1239

Telephone: (800) 994-8849 or (510) 642-2431, FAX: (510) 643-5470

e-mail inquiries: danrcs@ucdavis.edu

An electronic version of this publication is available on the ANR Communication Services Web site at <http://anrcatalog.ucdavis.edu>.

Publication 8219



This publication has been anonymously peer reviewed for technical accuracy by University of California scientists and other qualified professionals. This review process was managed by the ANR Associate Editor for Agronomy and Range Sciences.

©2007 by the Regents of the University of California
Division of Agriculture and Natural Resources.

All rights reserved.

The University of California prohibits discrimination or harassment of any person on the basis of race, color, national origin, religion, sex, gender identity, pregnancy (including childbirth, and medical conditions related to pregnancy or childbirth), physical or mental disability, medical condition (cancer-related or genetic characteristics), ancestry, marital status, age, sexual orientation, citizenship, or status as a covered veteran (covered veterans are special disabled veterans, recently separated veterans, Vietnam era veterans, or any other veterans who served on active duty during a war or in a campaign or expedition for which a campaign badge has been authorized) in any of its programs or activities.

University policy is intended to be consistent with the provisions of applicable State and Federal laws.

Inquiries regarding the University's nondiscrimination policies may be directed to the Affirmative Action/Staff Personnel Services Director, University of California, Agriculture and Natural Resources, 1111 Franklin Street, 6th Floor, Oakland, CA 94607, (510) 987-0096. For information about obtaining this publication, call (800) 994-8849. For downloading information, call (530) 297-4445.

pr-10/07-WJC/RW