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Farm Water Quality Planning

A Water Quality and Technical Assistance Program for California Agriculture

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This Fact 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.

UC PEER REVIEWED

Management Goals and Management Practices: Strawberries

Nutrient Management Goals and Management Practices for Strawberries

GIULIO FERRUZZI is Agronomist, USDA–NRCS, San Luis Obispo County.

This fact sheet includes Management Goals and Management Practices for reduction of nutrient pollution in strawberries. The following Management Goals and Management Practices are designed to serve as a guide for strawberry production with the goal of improving the management of nutrients and so reducing or eliminating nutrient losses in surface runoff.

For our purposes, we are defining a *Management Goal* (MG) as the best economically achievable technology or process for limiting the movement of nutrients, particularly nitrogen (N) and phosphorus (P), into ground or surface waters. Management Goals are general: for example, "Base the amount and timing of N fertilizer applied on crop needs." As a grower, you should implement every water quality Management Goal that is relevant to your farm.

As used here, a *Management Practice* (MP) is a specific practice for accomplishing a Management Goal: for example, "Monitor soil moisture between irrigations and use the information to guide irrigation timing decisions." Growers and crop advisors have found the practices listed here to be suitable for strawberry production in California's coastal region. Management Practices are not requirements and are not necessarily feasible or necessary for pollution control in every situation. Rather, they are possible options for achieving Management Goals in effectively managing N and P fertilizer and water.

The development of a comprehensive farm plan for nutrient management on strawberry crops involves a series of nine Management Goals:

MG 1. Evaluate current irrigation and fertilization practices and plan improvements in management.

MG 2. Avoid spilling fertilizer material during all phases of transport, storage, and application.

MG 3. Base the amount and timing of fertilizer applications on crop needs and production goals.

MG 4. Place N fertilizer materials where maximum plant uptake will occur.

MG 5. Minimize leaching losses of nitrate.

MG 6. Operate irrigation systems to minimize deep percolation and N losses.

MG 7. Improve the irrigation uniformity of existing sprinkler systems.

MG 8. Improve the irrigation uniformity of existing drip irrigation systems.

MG 9. Evaluate and maintain nutrient management goals and recommended practices.

To implement the Management Practices, you may have to obtain certain technical information. Consult your local UCCE farm advisor for assistance as you develop these practices.

MG 1. Evaluate current irrigation and fertilization practices and plan improvements in management.

MP 1.1 Determine nitrate and salt contamination of groundwater in existing wells and assess the potential for transport of soluble contaminants such as nitrates and salts downward to the ground water and laterally to surface waters.

MP 1.2 Develop and implement a system for keeping long-term records on each field for water and nutrient/soil amendment inputs, cultural operations, pest problems, land leveling or other improvements, and crop yield and quality.

The Farm Water Quality Plan (ANR Pub 9002) gives one method for developing a long-term system.

MP 1.3 Review current cultural practices and develop improved nutrient and water management plans.

MG 2. Avoid spilling fertilizer material during all phases of transport, storage, and application.

MP 2.1 Provide organized training sessions for field personnel.

MP 2.2 When transporting fertilizer, do not overfill trailers or tanks. Cover or cap loads properly and display appropriate placards on vehicles.

MP 2.3 When transferring fertilizer into on-farm storage or into a fertilizer applicator, take care not to let materials accumulate on the soil.

MP 2.4 Maintain all fertilizer storage facilities in a way that meets government and industry standards and protects them from the weather.

MP 2.5 Clean up fertilizer spills promptly.

MP 2.6 Shut off fertilizer applicators during turns and use check valves on application equipment.

MP 2.7 Maintain proper calibration of fertilizer application equipment.

MP 2.8 Whenever you are injecting fertilizer into irrigation water, ensure that backflow does not occur.

MP 2.9 Distribute rinse water from fertilizer application equipment evenly throughout the field.

MG 3. Base the amount and timing of fertilizer applications on crop needs and production goals.

MP 3.1 Before you apply nutrients early in the growth cycle, conduct soil sampling and analysis to assess the amount of each nutrient already present in the soil. Test for P and K in addition to N. A field may have accumulated sufficient P and K concentrations for strawberry growth from previous seasons' applications.

MP 3.2 When applying manure before you plant a crop, determine the nutrient content of the manure and the amount of nitrate already present in the soil. Apply manure at a rate consistent with the crop nutrient requirements.

MP 3.3 Where possible, make multiple small applications of N fertilizer rather than a single large application.

MP 3.4 If you are growing a cover crop, determine the crop's nutrient contribution to the soil and its utilization of nutrients from the soil. Adjust your N fertilizer rate accordingly.

MP 3.5 Use soil nitrate testing and/or plant tissue sampling to guide your fertilization decisions.

MP 3.6 Do not apply fertilizer N within 24 hours before a predicted large storm event.

MP 3.7 To prevent winter leaching, use only slow-release N fertilizers during bed preparation. Higher N applications may be appropriate if the soil test results are low or crop demand is high.

MP 3.8 Measure nitrate levels in the irrigation water and adjust N fertilizer rates accordingly.

MG 4. Place N fertilizer materials where maximum plant uptake will occur.

MP 4.1 Incorporate N fertilizer into the crop bed by banding fertilizer 2 to 4 cm beneath the transplants or by broadcasting fertilizer and then listing it up into the bed.

MP 4.2 Consider the conversion rate of organic N to other forms when incorporating manures and other organic amendments into soil.

MG 5. Minimize leaching losses of nitrate.

MP 5.1 When winter rains prohibit planting, grow a cover crop rather than leave the fields fallow.

MP 5.2 Prevent excessive upfield runoff from entering or ponding in field.

MG 6. Operate irrigation systems to minimize deep percolation and N losses.

MP 6.1 Monitor soil moisture between irrigations and use the information to guide irrigation timing decisions.

MP 6.2 Consider strawberry variety and growth stage, climate, and soil type when determining irrigation amount and timing.

MP 6.3 Know the flow rates and the time required to apply the desired amount (inches) of water.

MP 6.4 Use the minimum leaching fraction that will prevent stand establishment problems or yield reductions from salinity.

MP 6.5 Follow state regulatory requirements and industry guidelines for backflow prevention when injecting fertilizer into irrigation water (see CCR Title 3 Excerpt at the end of this publication). Schedule regular maintenance of backflow prevention devices.

MP 6.6 If irrigation efficiency remains low after all practical improvements have been made, convert to a more efficient irrigation system.

MP 6.7 When feritgating with a sprinkler or drip system, run the fertilizer in the later part of the set so as not to leach nutrients beyond the root zone.

MG 7. Improve the irrigation uniformity of existing sprinkler systems.

MP 7.1 Monitor flows and pressure variations throughout the system to detect non-uniform application.

MP 7.2 Maintain the irrigation system by repairing leaks, replacing malfunctioning sprinklers, and maintaining adequate water pressure through the entire set.

MP 7.3 Operate sprinklers during the least windy periods whenever possible. When applying sprinkler irrigation under windy conditions, reduce the spacing between laterals if possible to optimize application uniformity.

MP 7.4 Use offset lateral moves on successive irrigations to improve distribution uniformity.

MP 7.5 Use flow-control nozzles when the pressure variation throughout the system is too great.

MP 7.6 To reduce runoff and erosion, make set times as short as possible during establishment.

MP 7.7 For very large blocks, consider irrigating smaller sub-blocks individually.

MP 7.8 Utilize the services of a mobile irrigation lab.

MG 8. Improve the irrigation uniformity of existing drip systems.

MP 8.1 For lateral hoses, use lengths that ensure uniformity.

MP 8.2 To reduce flow variations that result from pressure differences, make sure that your drip tape has a small emitter discharge exponent.

MP 8.3 Conduct water analysis and fertilizer/water compatibility tests to determine the potential for clogged emitters.

MP 8.4 Use filtration, chemical treatments, and flushing as needed to prevent or correct clogging problems.

MP 8.5 Utilize the services of a mobile irrigation lab.

MG 9. Evaluate and maintain nutrient management goals and recommended practices.

MP 9.1. Periodically re-evaluate the management goals and recommended practices that your have implemented for nutrient management. Correct deficiencies as needed.

REFERENCE

Pettygrove, G. S., S. R. Grattan, B. R. Hanson, T. K. Hartz, L. E. Jackson, T. R. Lockhart, K. F. Schulbach, and R. Smith. 1998. *Nitrogen and Water Management for Coastal Cool-Season Vegetables*. UC ANR Publication 21581. Oakland: University of California, Division of Agriculture and Natural Resources.

Chemical Soil Tests for Soil Fertility Evaluation, http://vric.ucdavis.edu/veginfo/topics/fertilizer/soiltests.pdf

CREDIT

Adapted by the author from *Nutrient Management Goals and Management Practices for Cool-Season Vegetables: Farm Water Quality Planning Series* (UC ANR publication 8097).

CCR TITLE 3 EXCERPT

California Code of Regulations (CCR)—Title 3

6610. Backflow Prevention.

Each service rig and piece of application equipment that handles pesticides and draws water from an outside source shall be equipped with an air-gap separation, reduced pressure principle backflow prevention device, or double check valve assembly. Backflow protection must be acceptable to both the water purveyor and the local health department. Authority cited: Sections 11456 and 12976, Food and Agricultural Code. Reference: Section 11501, Food and Agricultural Code.

For the entire Code, see the California Department of Pesticide Regulation website: http://www.cdpr.ca.gov/docs/inhouse/calcode/subchpte.htm

FOR MORE INFORMATION

You'll find detailed information on many aspects of strawberry culture and resource conservation in these titles and in other publications, slide sets, CD-ROMs, and videos from UC ANR:

Strawberry Deficiency Symptoms: A Visual and Plant Analysis Guide to Fertilization, publication 1917

Strawberry Production in California, publication 2959

To download 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
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