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Management Goals and Management Practices: Nursery and Floriculture:

Nutrient Management Goals and Management Practices for Nursery and Floriculture

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This fact sheet includes Management Goals and Management Practices for reduction of nutrient pollution in nursery and floriculture. The following management goals and management practices are designed to serve as a guide for the production of nursery and floriculture crops with the goal of improving the management of nutrients and thereby 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 management goal that applies to your operation.

As used here, a *Management Practice* (MP) is a specific practice for accomplishing the Management Goal; for example, "Monitor soil moisture between irrigations and use the information to guide irrigation timing decisions." Growers and crop advisors have found these practices suitable for nursery and floriculture production in California's coastal region. Keep in mind that a Management Practice is not a required practice. Rather, it is an option for efficient management of N and P fertilizer and water.

Nursery and floriculture production are distinct from other agricultural production systems because of the variety of ways individual plants may be grown; inside a greenhouse in containers, beds, hydroponically, outside in containers, or planted in fields. Proper nutrition management requires knowledge of irrigation and fertilization as well as of the ways irrigation and fertilizers interact with the substrate.

The development of a comprehensive farm plan for nutrient management on nursery and floriculture crops involves a set of ten Management Goals:

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

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

MG 3. Conduct efficient fertilizer practices for plants grown in containers, beds, and fields.

MG 4. Follow efficient fertilizer practices for hydroponically grown plants.

MG 5. Evaluate the substrate or soil that crops are grown in to optimize root growth.

MG 6. Operate irrigation systems to minimize nutrient losses, especially N.

MG 7. Operate irrigation systems to improve irrigation efficiency.

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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.

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

MG 9. Improve the uniformity of existing sprinkler irrigation systems.

MG 10. Evaluate and maintain nutrient management goals and management 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 ground water in existing wells and assess the potential for transport of soluble contaminants such as nitrates and salts from production facilities 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 growing area for water, nutrient/soil amendment inputs, cultural operations, pest problems, land leveling or other modifications, and crop yield and quality.

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

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

MP 2.1 Provide organized training sessions for personnel handling fertilizers.

MP 2.2 Verify regularly that fertigation equipment is properly calibrated and fertilizer solution tanks are free of leaks.

MP 2.3 When transporting fertilizer, do not overfill trailers or tanks. Cover or cap loads properly and display appropriate placards on vehicles.

MP 2.4 When transferring fertilizer into on-farm storage or into a fertilizer applicator, take care that you do not allow materials to spill.

MP 2.5 Locate fertilizer storage and mixing areas as far away from water conveyances (streams, creeks, and storm drains) as possible.

MP 2.6 Store fertilizers in a storage structure that complies with local, state, and federal guidelines.

MP 2.7 Immediately clean up fertilizer spills, and do so according to a predetermined protocol.

MP 2.8 Use check valves on application equipment. When applying fertilizer from a tractor or rig in a field, shut off the fertilizer applicators during turns.

MP 2.9 Maintain proper calibration of fertilizer application equipment.

MP 2.10 Whenever you are injecting fertilizer into irrigation water, make sure that you do not allow backflow into wells or other water sources.

MP 2.11 Distribute rinse water from fertilizer application equipment evenly over the crop.

MP 2.12 Dispose of fertilizer bags in lidded trash bins to prevent trash with fertilizer residues from blowing into nearby waterways.

MG 3. Conduct efficient fertilizer practices for plants grown in containers, beds, and fields.

MP 3.1 Determine the nutrient crop requirements for each plant species.

MP 3.2 Perform a chemical analysis of the substrate to determine its nutrient status. Adjust fertilizer applications to reflect any significant nutrition contributions from the substrate.

MP 3.3 Analyze field soils before fertilizer applications in order to prevent the application of excess nutrients, especially phosphorus and potassium.

MP 3.4 Incorporate controlled-release fertilizer in single or multiple applications based on the requirements of the plant species.

MP 3.5 Substrate pH should be monitored to ensure that nutrients, especially micronutrients, are available for plant uptake.

MP 3.6 In container-grown plants, monitor the leachate for nutritional status on a regular basis to determine whether levels are excessive.

MP 3.7 Utilize hand-held EC meters to monitor EC levels of the substrate during production.

MP 3.8 Limit the use of overhead fertigation. It may cause the unnecessary loss of nutrients carried in irrigation water that does not enter growing containers or runs off the field.

MP 3.9 Do not stockpile growing media after you have amended it with controlled-release fertilizer; the fertilizer will begin to release into the soil, especially if temperatures in the stockpile are elevated.

MP 3.10 Grow a cover crop rather than leaving fields fallow, especially during the rainy season.

MP 3.11 Reduce fertilizer applications or application rates during cooler periods when plant growth is less vigorous.

MG 4. Follow efficient fertilizer practices for hydroponically grown plants.

MP 4.1 Determine the nutrient crop requirements for each plant species.

MP 4.2 Recycle nutrient solutions in hydroponic systems.

MP 4.3 Construct hydroponic systems to provide optimum contact between nutrient solutions and root systems.

MP 4.4 Provide sufficient space for adequate root development within the growing container.

MP 4.5 Minimize any exposure of nutrient solutions to light in order to prevent algae growth and the breakdown of sensitive chelates.

MP 4.6 Provide optimum aeration of nutrient solutions.

MG 5. Evaluate the cultural conditions that crops are grown under to optimize root growth.

MP 5.1 Evaluate the physical properties (total porosity, available water, and air capacity) of the substrate or soil as they affect its capacity to provide optimum root growth. For container-grown plants, an ideal substrate would have a total porosity of at least 50%, available water of at least 30% by volume, and an air capacity of at least 10% by volume.

MP 5.2 In container-grown plants, avoid hydrophobic substrates in order to insure that irrigation will result in uniform wetting.

MP 5.3 Minimize the impact of temperature extremes on the root zone (space containers properly, shade them from intense light, utilize pot-in-pot techniques, etc.).

MG 6. Operate irrigation systems to minimize nutrient losses, especially N (these practices apply to all irrigation system types).

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

MP 6.2 The crop's water need should determine amount of irrigation.

MP 6.3 Know the irrigation system's flow rate and how much time it will take to apply the desired amount of water.

MP 6.4 Monitor the water quality of your irrigation source by sampling it seasonally or annually for levels of constituents such as bicarbonates, sodium, chloride, nitrate, boron, and soluble salts.

MP 6.5 Determine the minimum leaching fraction required to maintain production yield and quality for the crop you are growing.

MP 6.6 When fertigating with a drip or sprinkler system, run the fertilizer in the later part of the irrigation set so as not to leach nutrients beyond the root zone. Avoid fertigating with furrow irrigation systems.

MP 6.7 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 for backflow prevention devices.

MP 6.8 Recycle irrigation water (and, in turn, nutrients) by constructing collection reservoirs to capture surface runoff or constructing vegetation filter strips or grassed waterways to slow the movement of surface runoff and increase the uptake of nutrients from the runoff.

MP 6.9 If irrigation uniformity remains low after all practical improvements have been made, consider converting to an irrigation system with greater potential for improvements to uniformity.

MG 7. Operate irrigation systems to improve irrigation efficiency (these practices apply to all irrigation system types).

MP 7.1 Conduct an irrigation audit or utilize the services of a mobile irrigation lab and then make appropriate adjustments to your system. Use the catch-can method to determine the efficiency of a drip irrigation system.

MP 7.2 Apply irrigation directly to container-grown plants by converting overhead irrigation systems to drip or sub-irrigation.

MP 7.3 For container-grown plants, weigh pots at container capacity and at wilt point. This will provide you with a value for the maximum amount of water the plants can use. Irrigate when half of the available water has been used.

MP 7.4 Time your irrigation water applications to occur when evaporation rates are lowest.

MP 7.5 For crops grown in containers, organize them into beds with the same irrigation requirements based on container size, age, and crop.

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

MP 8.1 Utilize pulse or cyclic irrigation to apply irrigation water over short intervals, thereby reducing the amount of water and nutrients lost from the container.

MP 8.2 Monitor flows and pressure variations throughout the system to detect non-uniform application.

MP 8.3 When irrigating field-grown crops, use lateral hose lengths that ensure uniformity.

MP 8.4 To reduce flow variations that result from pressure differences, make sure that your drip tape has a small emitter discharge exponent (exponent values are supplied by the manufacturer; values below 0.5 indicate emitters that are insensitive to changes in pressure).

MP 8.5 Conduct water analysis and fertilizer/water compatibility tests to determine the potential for clogged emitters.

MP 8.6 Use filtration, chemical treatments, and flushing as needed to prevent or correct clogging problems.

MP 8.7 Maintain appropriate water pressure throughout the system.

MG 9. Improve the uniformity of existing sprinkler irrigation systems.

MP 9.1 Monitor flows and pressure variations throughout the system to detect non-uniform application.

MP 9.2 Maintain the irrigation system by repairing leaks, replacing malfunctioning sprinklers, monitoring nozzle performance to detect wear, and maintaining adequate water pressure through the entire set.

MP 9.3 Operate sprinklers during the least windy periods, whenever possible. When sprinkler irrigating under windy conditions, reduce the spacing between laterals or heads when possible to optimize application uniformity.

MP 9.4 Use offset lateral moves on successive irrigations to improve distribution uniformity.

MP 9.5 Use flow control nozzles when the pressure variation throughout the system is too great.

MP 9.6 Make set times as short as possible during stand establishment.

MP 9.7 For very large blocks, consider converting to linear-move sprinkler systems.

MG 10. Evaluate and maintain nutrient management goals and management practices.

MP 10.1 Periodically evaluate your management goals and management practices implemented for nutrient management. Correct any deficiencies as needed.

REFERENCE

Schnelle, Mike, Jim Criswell, Gerrit Cuperus, Anna Fallon, Mike Kizer, Michael D. Smolen, Sharon L. Von Broembsen, and Cody J. White. 1998. Water Quality Handbook for Nurseries. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, Oklahoma State University, Circular E-951.

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 resource conservation in these titles and in other publications, slide sets, CD-ROMs, and videos from UC ANR:

Nutrient Management Goals and Management Practices for Cool-Season Vegetables, Publication 8097
Farm Water Quality Planning Short Course Objectives, Publication 8052
The Farm Water Quality Plan, Publication 9002

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