Minimizing Pollution Risk from Nutrient Management

Fertilizers provide the additional plant nutrients that often are necessary for optimum crop production. Both chemical (inorganic) and organic fertilizers (including animal manure) are major sources of the nitrogen and phosphorus that pollute streams and coastal waters. Although it is not now a major problem in Hawaii, inorganic nitrogen fertilizer is the major source of nitrate pollution in groundwater. The public health standard for nitrate-nitrogen in drinking water is 10 milligrams per liter (mg/L, equivalent to 10 parts per million [ppm] for water measurement).

This worksheet provides information on nutrient management for your agricultural activities. It will help you identify the level of risk from your current practices and develop an action plan to establish practices that reduce the risks of contamination to surface waters and groundwater.

How do you use nutrients?
Thinking about how you apply nutrients and how much to apply will help you to save money and reduce pollution risks. Some things to consider when making a nutrient management plan are:

- The location, soil type, and soil characteristics for each of your fields.
- The amount and availability of soil nutrients or the levels of plant nutrients for each field. Soil nutrient analysis is usually best for annual crops, while tissue nutrient analysis is best for perennial crops.
- The types and amounts of fertilizer (both organic and inorganic) applied to each field over the past 3–5 years, and the crop yields from each field during that time. Be sure to include nutrient inputs from animal manure or irrigation with mill water if you apply these to your fields.
- The amount and nutrient content of any fertilizers you plan to apply in the next growing season.
- How you will apply each type of nutrient formulation.

Field location and soil properties
The location of your field influences the pollution risk associated with nutrient applications. Fields located next to streams are more likely to be a source of nutrient pollution. Strips of vegetation between cropped areas and streams can greatly reduce pollution risks. Be especially careful on fields with steep slopes, because nutrients can be carried away with eroded soil particles.

Soil properties also influence nutrient behavior. Some soils hold nutrients such as calcium, potassium, and magnesium better than others. Soils that don’t hold nutrients well, including sandy soils and some highly weathered soils, are at higher risk of nutrient leaching. Another important soil property is its ability to hold phosphorus. Many Hawaii soils, particularly volcanic ash soils, bind phosphorus into the soil structure, making it unavailable to plants. This factor needs to be considered when determining optimum phosphorus fertilizer application rates. HAPPI-Farm 3, Land management, contains more information on how to determine soil properties.

Nutrient application rates
Nutrient applications should be based on a comparison between available nutrients and plant requirements. The amount of added nutrients should be equal to the plant requirement minus the nutrients currently available in the soil. If you apply the amount of nutrients necessary to meet plant needs, only small amounts will be lost and cause water pollution. Base your estimates of plant needs on realistic target yields for the climatic conditions at your site, not on the maximum possible yield for the crop.

Soil tests can measure soil nutrient status for annual crops. More information on soil testing can be found in CTAHR publication AS-4, Testing your soil—why and how to take a soil-test sample.
For perennial crops, plant tissue tests are believed to be a better indicator of current nutrient status. Cooperative Extension Service agents can provide information to help you interpret tissue nutrient levels for perennial species important in Hawaii, such as macadamia nut and papaya.

**Types of chemical fertilizer**

“Complete” fertilizers are blends containing nitrogen, phosphorus, and potassium (N, P, and K). Applying complete fertilizers based on crop needs for only one nutrient can result in over- or underapplication of the other nutrients they contain. In many cases in Hawaii, growers have applied complete fertilizers based only on crop nitrogen needs. This has led to overapplication of phosphorus. The best way to avoid this problem is to apply appropriate amounts of single-nutrient fertilizers based on crop requirements and soil and tissue analysis.

**Animal manure**

Some people believe that because animal manure and other sources of organic fertilizer are not “chemical” fertilizers, they cannot cause water pollution. This is not true. You should include the type and nutrient content of organic nutrient sources in your nutrient management plan. The nutrient content of organic materials such as manure can vary widely among different sources and at different times of the year. You should also consider the ratio of nutrients in organic sources. If animal manure applications are calculated based only on plant nitrogen requirements, for example, this may result in excessive phosphorus being applied.

**When do you apply fertilizer?**

If fertilizer is applied before or after the plant is best able to use it, it will not be taken up and may leach through the soil or be carried away in eroded soil or runoff water. Rather than a single application, you should apply smaller amounts of fertilizer several times during the growing season, and adjust the applications to make nutrients available when the plants most need them. Depending on your situation, slow-release fertilizers may be a good option to control nutrient availability.

**Fertilizer handling and mixing**

Never mix fertilizers using water from a hose attached directly to a well or other water source without using a backflow prevention device and maintaining an air gap between the hose end and the water already in the tank. If you do not maintain an airgap, the fertilizer solution could flow backward into your water supply. Fertilizer solution tanks should be rinsed in the field, with the wash water applied to crops. Tanks should never be rinsed or directly emptied into streams or other water bodies. Both granular and liquid fertilizers should be mixed on a level concrete pad where any spills can be quickly contained and cleaned up.

**Fertilizer storage**

If stored properly in a secure location, fertilizers pose little danger to groundwater and surface water bodies. On larger farms, you should store all liquid fertilizers on an impermeable floor, such as concrete. The floor should have a curb that will hold up to 125 percent of the volume stored in case of a spill. A mixing and loading concrete pad with secondary containment should be provided for all liquid fertilizers. Store piles of dry bulk fertilizer on an impermeable surface under cover or in a building. For smaller farms, simple storage cabinets and concrete mixing areas may be adequate. In all cases, keep fertilizer storage areas away from streams and lakes, and be sure all fertilizer storage is secure from children, animals, and theft.
Assessing your risks
Complete the risk assessment table below to determine your water pollution risks. For each category, choose the set of practices that best fits your situation. Then, go to page 4 and develop an action plan to minimize water pollution on your land.

<table>
<thead>
<tr>
<th>Risk Assessment Table for Nutrient Management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low risk</strong></td>
</tr>
<tr>
<td><strong>Nutrient management planning</strong></td>
</tr>
<tr>
<td><strong>Soil testing</strong></td>
</tr>
<tr>
<td><strong>Tissue testing (if appropriate)</strong></td>
</tr>
<tr>
<td><strong>Soil properties</strong></td>
</tr>
<tr>
<td><strong>Organic fertilizer applications</strong></td>
</tr>
<tr>
<td><strong>Animal manure nutrient content</strong></td>
</tr>
<tr>
<td><strong>Type of fertilizer applied</strong></td>
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<tr>
<td><strong>Fertilizer application frequency</strong></td>
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<tr>
<td><strong>Fertilizer storage and handling</strong></td>
</tr>
</tbody>
</table>
**Your action plan**

Now that you have assessed your management practices, you can take action to change practices that may be causing water pollution. For areas that you identified as high or moderate risk, decide what action you need to take and fill out the Action Plan below.

<table>
<thead>
<tr>
<th>Write down all your moderate-risk and high-risk activities below</th>
<th>What can you do to reduce the potential risk for water pollution?</th>
<th>Set a target date for action</th>
</tr>
</thead>
</table>
| **Samples of action items:**  
*Don’t know soil nutrient status for all fields.*  
Collect soil sample(s) and send to private lab or CTAHR Agricultural Diagnostic Service Center for analysis.*  
By the end of next week |  |  |

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