Fact Sheet

NO. 12 JANUARY 1999

Fertilizing for Profit

Tips for Small Acreages in Oregon

"Watch earnestly over every acre."

- Clarence Poe

USDA Agricultural Research Service

Make the Most of Your Fertilizer

In 1900, each American farmer produced enough food and fiber for 10 people. Today, with advances such as synthetic fertilizers, that number is 129 people. This abundance of food and fiber brings with it the responsibility to keep fertilizers on the land and out of the water. **Nutrient management** is a practice that applies fertilizers efficiently without polluting water. The benefits are:

High crop yields with lower fertilizer costs.

In one study, Oregon dairy farmers applied manure as a fertilizer. They saved $30 to $70 in commercial fertilizer costs per acre without decreasing yield.

Healthy animals.

Horses, cattle, sheep, and goats can get nitrate poisoning from forage grown on overfertilized soils. Taking a soil test and applying the right rates of fertilizer and manure can reduce this health problem.

Clean water for healthy people and fish.

When fertilizers reach surface water and groundwater, nitrate in well water may harm infants. Excess phosphorous may cause algae blooms, reduce oxygen, and kill fish. Applying fertilizers correctly has reduced nitrate in groundwater in Ontario, Oregon.

Fertilize at the Right Rate: Soil Tests

A soil test is the simplest way to manage fertilizers for a healthy crop and environment. A soil test will tell you the level of nutrients in your soil and how much fertilizer to apply to the crop. Follow these steps to take a soil test:

1. **Draw a map of your farm.**
   Assign a name or code for each area to be soil tested. Use this map to record fertilizer applied, crops grown, and yields. This will help you to identify your soil samples and to record the results of your nutrient management program.
2. **Use the right equipment.**
   Take soil samples with a soil probe, garden spade, or shovel. Collect the samples in a clean plastic pail or paper bag. Soil sampling tools should be chrome-plated or stainless steel when testing for micronutrients.
3. **Establish sampling areas.**
   Identify areas that have different soils, crops, or manure histories and test these separately. Avoid taking samples from unusual areas like fence rows, manured areas, and old building sites. Stay at least 150 feet from gravel roads.
4. **Sample in the spring or fall.**
   Send in soil samples at least 3 to 6 weeks before planting. This should give labs enough time to test soils and send you the results in time for planting. Consider sending samples in the fall when labs are less busy. Test at the same time of year to compare results from year to year. Follow lab fertilizer and lime recommendations or use OSU Fertilizer Guides.
5. **Take 15 to 20 subsamples per area.**
   The area should be less than 20 acres. Scrape plant litter from the soil surface and sample the top 8 inches of soil (depths for special situations are in the table on page 2). If using a shovel, dig an 8-inch-deep hole and slice a 1-inch-thick slab from the side. Trim soil away on each side, leaving a 1-inch-thick strip for the subsample.
6. **Mix subsamples together in pail and dry in a clean area.**
   Do not use an oven or the hot sun to dry soils.
7. **Send at least 1 cup of soil for each sample to a lab.**
   Ask the lab about costs and mailing instructions. Include information on past cropping history, crop to be grown, and yield goal. Label soil samples and key them to your map. For a list of labs, see the Oregon State University (OSU) Extension Service publication A List of Analytical Laboratories Serving Oregon (EM8677). To get this publication, see the website listed in the "For Help" section at the end of this fact sheet or visit your local Extension Service office.

This fact sheet was produced by the Washington County Soil and Water Conservation District (SWCD) and the Small Acreage Steering Committee. The Governor's Watershed Enhancement Board, the Oregon Association of Conservation Districts, and the USDA Natural Resources Conservation Service funded the project. Media Works of Bozeman, Montana designed the fact sheet.

Location	Building Site	Garden	Permanent Pasture	Lawn	Cropland	No-till Crop
How Often to Take Soil Test	Once, after topsoil is replaced	1 to 3 years	2 to 3 years	3 to 5 years	1 to 3 years	1 to 3 years
How Deep to Sample Soil	0 to 8 inches	0 to 8 inches	0 to 3 inches	0 to 8 inches	0 to 8 inches	0 to 4 inches pH, P, K

Fertilizer Labels: Cracking the Code

Plants need many nutrients to grow and reproduce. Plants most often lack **nitrogen, phosphorus, potassium,** and **sulfur.** In the late winter and early spring, plants may be yellow or purple due to temporary deficiencies in wet or cold soils. Wait until plants are actively growing before fertilizing. Here are some signs of nutrient deficiencies in plants:

- **Nitrogen (N)** - Older leaves have a light green to a pale yellow color that proceeds to the younger leaves.
- **Phosphorus (P)** - Leaves have a dull blue-green color and stems may be purple.
- **Potassium (K)** - Older leaves have scorched brown tips or a yellow color that proceeds to younger leaves.
- **Sulfur (S)** - Older leaves are green while younger leaves are light green or yellow.

Fertilizers add to nutrients already in the soil. All fertilizer bags are labeled with a series of numbers that show the percentage of nutrients in a bag. A label of **27-13-7** means there's 27 percent **nitrogen,** 13 percent **phosphate,** and 7 percent **potash** by weight in the bag. A 100-pound (lb.) bag of 27-13-7 spread over 1 acre would spread 27 pounds of nitrogen, 13 pounds of phosphate, and 7 pounds of potash per acre.

Organic fertilizers are unprocessed and unrefined fertilizers like blood meal, rock phosphate, and manure. When organic fertilizers are purchased in bags, they are labeled in the same manner as synthetic fertilizers. In general, an organic fertilizer releases nutrients over a longer time than a synthetic one. This can be an advantage as nutrients are supplied to a plant throughout its growth. A drawback is that the organic fertilizer may not release enough nutrients at a critical growth point.

Soil pH: the Acid Test

Soil pH is a measure of soil acidity and affects the availability of nutrients. A soil with a pH below 7.0 is acidic, while one with a pH above 7.0 is alkaline. A very acidic soil will release aluminum and manganese and become toxic to plants. A very alkaline soil will make phosphorus and iron unavailable to plants. Ideal pH ranges are:

- Pure grass stands 5.5 - 6.0
- Legume-grass mixes 6.0 - 6.5
- Row crops, small grains 6.0 - 6.5
- Alfalfa 6.5 - 7.5

Western Oregon soils are generally acidic and **eastern Oregon** soils are often alkaline. If the soil is too acidic for your crop, add lime to raise the pH. OSU Fertilizer Guides will help you to determine how much lime is needed based on the soil pH and buffer pH shown on your soil test results. If your soil test shows that magnesium is deficient, apply dolomite lime. If magnesium levels are acceptable, apply the less expensive "ag lime." Sometimes soil is too alkaline for a particular crop and sulfur is needed to lower pH. For more information, see the OSU Extension Service publication *Fertilizer and Lime Materials* (FG52).

Fertilizers in the Right Place, Right Time

To get the most bang for your fertilizer buck and avoid pollution, follow these strategies:

Ada Soil Conservation District

Use the right amount.

This is where "an ounce of prevention is worth a pound of cure." Avoid applying excess levels of nutrients to the soil. Otherwise, nitrate may leach and pollute groundwater, phosphorus runoff may cause algae blooms, and high nitrate levels in forages may poison horses, goats, sheep, and cattle. Fertilize based on a soil test and realistic crop yield goals. Calibrate fertilizer spreaders. If manure cannot be worked into the soil, avoid spreading manure more than one-half inch thick on the ground each year. This will reduce the potential for polluted runoff.

Put it in the right place and work it into the soil.

Most phosphorus is immobile in soil. This means plant roots must grow to the source of phosphorus. If phosphorus is needed, band the fertilizer 2 inches to the side and 2 inches below the seed to give seedlings a good start. Beware of banding fertilizers too close as banded nitrogen, potash, and boron may burn the seed. Manure that is broadcast should be worked into the soil within 3 days. Otherwise, up to a third of the available nitrogen in manure may be lost as gas. Know your field limitations. When nutrients cannot be worked into the soil, avoid spreading in areas where water flow may concentrate, in floodplains, or within 50 feet of streams.

Apply it at the right time.

Water can dissolve nitrogen and carry phosphorus attached to soil particles. This means rain, snow, or floods can move nitrate into groundwater and nitrogen and phosphorus over land and into lakes and streams. Apply fertilizer and manure during the growing season when crops will use the nutrients. Split the applications of nitrogen on pastures, lawns, and crops for maximum plant uptake and minimum loss to runoff. Avoid applying fertilizer or manure during fall rains, in the winter, or on saturated soils. This may require manure storage, depending on your situation. For more about manure storage, see the fact sheet *Managing Mud and Manure* in this series.

Follow the right conservation practices.

Phosphorus is held tightly to soil and is moved mostly by loss of soil due to erosion. Reduce phosphorus losses using erosion control practices such as conservation tillage, contour strip cropping, and grass waterways. Capture phosphorus and nitrogen with winter cover crops, grass filter strips at field borders, and streamside buffers. Manage irrigation water to reduce leaching and erosion losses and excessive runoff.

Take Credit for Legumes

Grow legumes to add nitrogen naturally to the soil. Legumes include alfalfa, clovers, beans, peas, and birdsfoot trefoil. Reduce your nitrogen application by 40 pounds when following clover and up to 100 pounds per acre after alfalfa. Even grass may add a flush of nitrogen to the soil.

Fertilizing Pastures

Pastures need less fertilizer than row crops because grazing animals return manure nutrients to the soil. Rotational grazing will distribute manure more evenly. Take a soil test to find out the nutrient levels and pH in your soil. For more information, see the OSU Extension Service publication *Pastures: Western Oregon and Western Washington* (FG63).

Make the Most of Manure

Manure is like an unmarked bag of fertilizer. Consider this: if you fed **10 acres of corn** to your livestock, your animals would excrete enough phosphorus and potassium to grow another **7 acres of corn.** Treat manure as you would treat a bag of fertilizer. Store it in a covered place and apply it when and where it won't get washed away. With a little patience, you can find the fertilizer value of manure on your farm:

1. Take a manure test. Manure is not uniform.

Take samples from many places in the manure pile or from each spreader load. Find a lab that tests manure. Fill a plastic container two-thirds full to accommodate liquid expansion, freeze or refrigerate before shipping to reduce nitrogen loss, and send to the lab at the beginning of the week so that samples are not held over the weekend. As a minimum, test for percent solids, total nitrogen (N), ammonium-nitrogen (NH4+-N), total phosphorus (P), and total potassium (K). Test at least once a year or more if there are significant changes in manure storage methods.

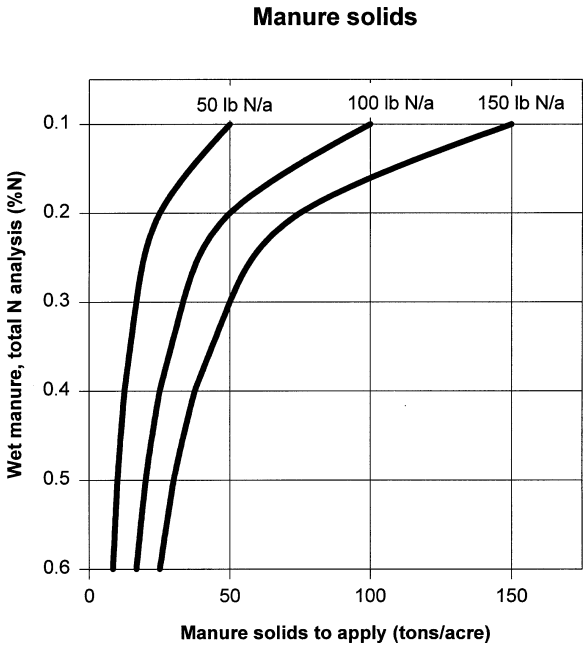
2. Use soil and manure test results to determine the amount of nutrients in soils and manure.

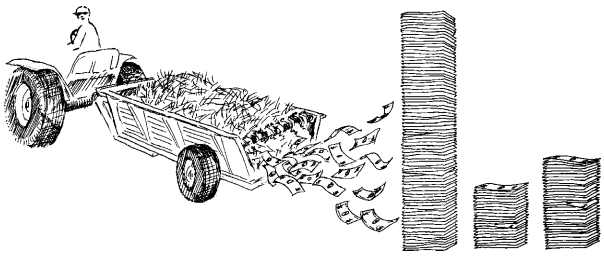
Use soil test results and OSU Fertilizer Guidelines to determine the nutrient needs for your particular crop. Manure test results are reported in "percent N, P, and K as received."

3. Calibrate your wheelbarrow or spreader.

Estimate the number of cubic feet of manure that your wheelbarrow will hold. One cubic foot of manure weighs about 62 pounds. Divide the number of cubic feet by 2,000 pounds to determine the fraction of a ton that your wheelbarrow will hold. Use your answer, the soil test, and the manure test results to spread the correct number of tons needed per acre to spread manure as a fertilizer, according to the graph.

To find the number of tons of manure in a **spreader load,** use the sheet method, the stated capacity from the owner's manual, or portable truck scales. To use the sheet method, place a **10-foot by 10-foot plastic tarp** in the field and drive over it with the spreader. Weigh the manure and multiply the weight (in pounds) by 0.22 to determine tons applied per acre. Do this at least three times and take an average. Use your answer, the soil test, and the manure test results to spread the correct number of tons needed per acre to spread manure as a fertilizer, according to the graph. For more information, see the Oregon State University Extension Service publications *Manure Application Rates for Forage Production* (EM 8585) and *Dairy Manure as a Fertilizer Source* (EM 8586).





- The soil and water conservation district and USDA Natural Resources Conservation Service may provide technical advice on soil testing, applying fertilizers, and spreading manure. Contact your local office by looking in the phone book blue pages under Federal Government.
- The Oregon State University (OSU) Extension Service provides technical advice through publications, workshops, and over-the-phone assistance. Publications may be found online at http://osu.orst.edu/dept/infonet/soilfert.htm or at your local Extension Service office.