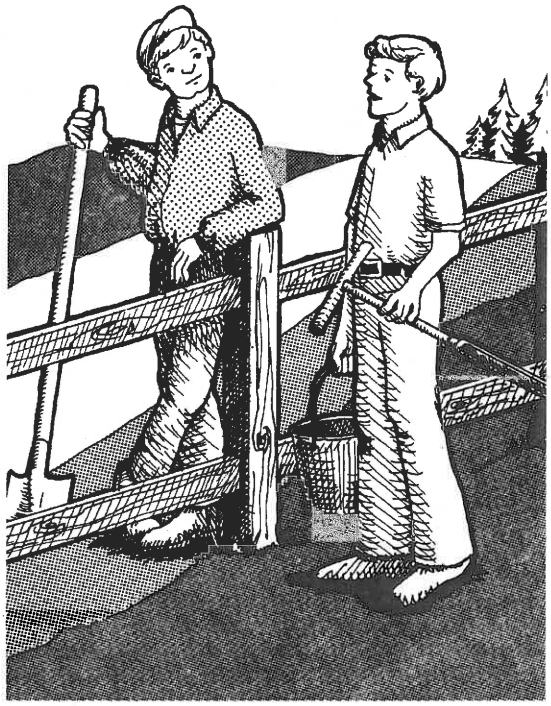
EC 628 • Reprinted April 2003

Soil Sampling

for Home Gardens and Small Acreages



OREGON STATE UNIVERSITY
EXTENSION SERVICE

Laboratory soil tests will help you develop and maintain more productive soil and increase crop production by providing information on the available nutrient content of your soil. Soil testing helps you select the correct kind and amount of fertilizer and liming material. Recommendations are based on the results of fertilizer experiments, soil surveys, and results obtained by farmers.

A soil sample weighing about 0.5 pound represents from 2 to 40 million pounds of soil in the field. Thus, care in sampling is essential.

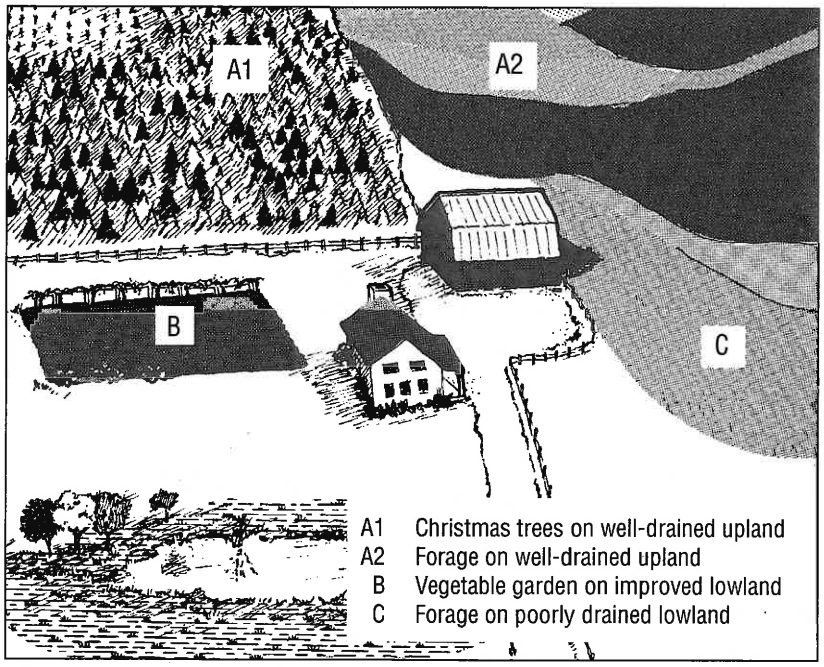
When should I test my soil?

- *For perennial crops* such as orchards, Christmas trees, alfalfa, grass seed, and permanent pasture, the most important time to test the soil is before planting so that necessary nutrients can be mixed into the soil. This test is especially important in acidic soils where liming is likely to be needed. Apply lime and mix it with the soil several months before planting (for example, in the fall for spring planting), since it reacts slowly with the soil. Then:
  - For perennial grass seed, legumes, and pastures, test soil every 3 years after planting.
  - Soil testing usually is not used for established fruit trees, berries, or grapes. Use foliar nutrient analysis instead.
  - Testing soil in timber or Christmas tree plantings usually is not necessary until replanting, unless tree growth is unsatisfactory.
- *For annual crops,* especially vegetables, test soil each year before planting. If you plant successive crops in a single season, you don't need to test before each planting.
- *Additional information* on nutrient testing methods and requirements for various crops is available in OSU Extension publications.

Each soil sample should represent only one soil type or soil condition

The farm in the illustration below has three soil types: A (upland), B (improved lowland), and C (poorly drained lowland). On the upland soil, two areas have different management histories: A1 (Christmas trees) and A2 (pasture).

Sample each soil type (A, B, and C) separately. Areas with different management histories (A1 and A2) also should be sampled separately. In this example, a separate soil sample should be taken from each of the four areas.



How to sample

Sample where the crop will be planted

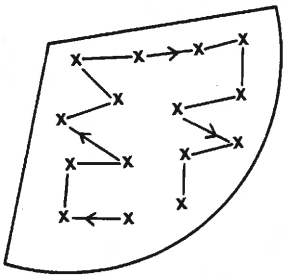
If you are using raised beds, such as for vegetable crops, take your samples in the beds, not in the areas between them.

Avoid unusual areas

Avoid sampling in small areas where you know that conditions are different than the rest of the field (for example, former manure piles or fertilizer bands). You often can spot these areas by looking for plants growing very well or very poorly.

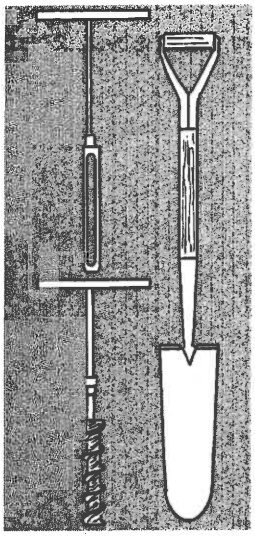
Take 15 to 20 subsamples

Each sample should consist of subsamples (X) taken from 15 to 20 locations within the sampling area.



Avoid contaminating the sample

- Use clean sampling tools and avoid contaminating the sample during mixing or packaging. A small amount of fertilizer residue on tools or hands, for instance, can cause serious contamination of the soil sample.
- Do not use galvanized, brass, or bronze sampling tools to collect samples that will be tested for micronutrients such as zinc.



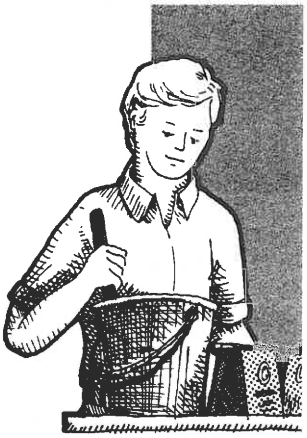
Note: This publication is not intended to be used as guidance for obtaining soil samples for environmental testing.

Take the soil sample to the correct depth

- Sample the part of the soil where the plant roots will grow. For most annual and perennial crops, sample from the surface down to about 6 to 9 inches.

Carefully mix the soil sample

Place all of the soil subsamples from a single sampling area in a clean container and mix thoroughly.



Forwarding the soil sample

- A list of laboratories that perform soil tests is available on the Web (http://eesc.oregonstate.edu) or from your county office of the OSU Extension Service.
- Call one or more labs to determine the cost of the soil test you need.
- After choosing a lab, request any necessary paperwork (such as an information sheet), find out how you should prepare and submit the sample, and obtain the address where you should send the sample.
- Prepare and submit the sample according to the instructions. Plastic zipper bags work best; do not use a paper bag. Most laboratories ask you to label the sample bag with identifying information and to fill out and include an information sheet with the sample. Don't forget to include payment.
- Number each sample and keep a record of the fields and areas sampled.

What analysis should I request?

The standard soil test from most laboratories measures organic matter, phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), sodium (Na), and soil pH (acidity). For acidic soils, the SMP buffer test is the best way to determine how much lime is needed. Certain crops might have higher requirements for specific nutrients. Consult OSU Extension publications to determine whether you should test for nutrients such as sulfur (S), boron (B), or zinc (Zn).

Special soil-sampling techniques sometimes are required

- Nitrate nitrogen soil tests are recommended only for a few crops in eastern Oregon.
- For orchards, leaf sampling is more useful than soil sampling.

This publication, originally prepared by E. Hugh Gardner, former Extension soil science specialist, was revised by Michael Robotham, Extension small farms faculty, Clackamas County, and John Hart, Extension soil science specialist; Oregon State University.

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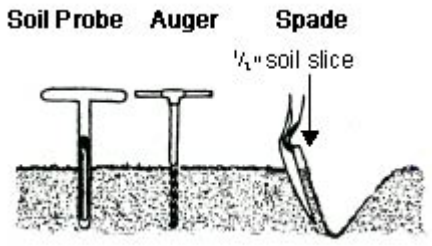
SOIL SAMPLING PROCEDURES

The accuracy of the soil test results depends on the sample submitted

It is important to remember that a soil test is a reflection of the area sampled. Good soil sampling techniques are an important first step in obtaining a meaningful soil test. The following guidelines are intended to present the basics of soil sampling. More detailed sampling information is contained in A & L's SOIL SAMPLING REFERENCE GUIDE which is available from your regional A & L laboratory.

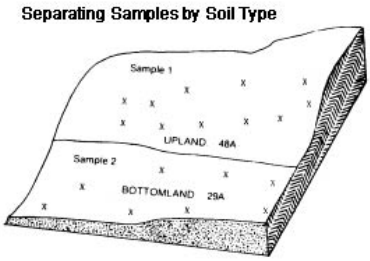
Sampling Tools

- Tools that may be used to take a soil sample include a soil-sampling probe, an auger, or a spade.
- Tools should be either stainless steel or chrome-plated to avoid contamination of the sample.
- Preferably, collect in a clean, dry plastic container as soil may pick up zinc for example, if the container is galvanized.



Determining the Area to be Sampled

- Areas that differ in soil texture, color, plant growth, or treatment should be sampled separately, provided the areas can be treated separately.
- Site-specific farming may necessitate sampling by the acre.
- A soil map or plant response map can be of help in distinguishing areas.
- Unless of specific interest, avoid dead furrows, corners of fields, end rows, and areas that are poorly drained or have had fertilizers or amendments dumped on them.
- Stay at least 50 feet away from barns, roads, lanes, or fence rows when sampling fields.
- Perennial crops may be sampled by tagging specific trees or vines and returning to the same stations each time sampling is done.
- Home gardens or landscape may be sampled according to area of concern.
- Submitting at least two samples from different areas will help determine the degree of diversity, whereas one sample will provide only an average of all conditions present.



Collecting the Soil Sample

- The soil sample collected should be a composite from 10 to 20 locations within a selected area; a sufficient number to "average out" variations.
- Sample from areas of main root development.
- Before collecting each subsample, scrape away surface residue then sample the top 6 inches or the depth of tillage.
- Deeper profiles may be sampled separately, if a concern. For example, nitrate nitrogen may be sampled at 1-foot increments down to 3 feet or more. Sodium, chloride, boron, and free lime may be more predominant deeper down.
- For permanent pastures and turf areas, it may be sufficient to sample only the top 3 to 4 inches.
- Even shallower sampling may be in order if determining water infiltration problems due to irrigation water low in salts.
- Mix cores or slices thoroughly in a clean plastic container, and send about a pintful (2 cups) of the composite sample to the laboratory.
- Submit a separate pint for nematode testing.
- Avoid submitting excessive quantities.
- Seek further advice for extensive testing that may require more than a pint of soil (1 gallon required for infiltration rate test).
- Annual sampling may be necessary to monitor residual nitrogen and problem soils.

- **Banded areas:** It takes only a trace of fertilizer to contaminate a sample. It may be wise to avoid these areas altogether when sampling.

- **Low-volume fertigation (microirrigation):** Do not sample directly below emitters. Consider sampling from around half the radius of the wetting zone.

- **Nematode Sampling:** Sample only from moist soil and always try to include feeder roots. This may be the top six inches for turf or down to three feet for many deep-rooted crops. Avoid sampling from completely dead plants.

Identifying and Submitting Samples

- Identify each sample with numbers and/or letters, by depth for example, or good versus bad (up to five alphanumeric characters).
- Avoid numbering samples simply as 1,2,3, ... as it may lead to confusion later.
- Indicate specific analyses to be run and provide complete information on plant type and age and whether preplant or maintenance fertility guidelines/recommendations are required.
- Select either the standard format (five samples per page) or the graphical format (one sample per page).

Shipping Samples

- If samples are very wet, they should be air-dried to a workable condition before packaging. (Nematode samples are an exception. They should be kept cool and moist).
- Include a completed soil sample information sheet or cover letter with instructions within the same package. Processing will be delayed if sent separately.
- Also, include payment if you do not have an established account.

- Samples should be shipped by a carrier such as UPS or FEDEX, or by first class mail.
- Ensure that samples are not packaged loosely, as they are likely to shift around and burst open during shipping.

- **Caution:** Do not submit organic amendments or soilless nursery media as "soils". They require different testing.

Send Samples to:

A & L Western Agricultural Laboratories, Inc.

Oregon Office:
10220 S.W. Nimbus Ave., Bldg. K-9
Portland, OR 97223
Phone (503) 968-9225 o Fax (503) 598-770

How To Fill Out A Soil Test Form

There are several labs that conduct soil testing. A simple web search will bring up a list of local testing labs in your area. Below is a partial list of labs in the Vancouver-Portland area.

A & L Western Agricultural Laboratories Inc.
Portland Office: 503-598-7703
www.al-labs-west.com

Agri-Check Inc.
Umatilla , OR 800-537-1129

Analytical Laboratory and Consultants Inc.

Eugene. OR 800-262-5973

For this example we used the A & L Western Agricultural Laboratories Inc. test form which is available on their website or in this soil test kit .

Soil Sampling Procedures

The accuracy of the soil test results depends on the sample submitted. It is important to remember that a soil test is a reflection of the area sampled. Good soil sampling techniques are an important first step in obtaining a meaningful soil test. Detailed instructions on soil sampling and soil test kits are available in this kit or at your regional testing laboratory.

Filling Out The Soil Sample Information Sheet

Fill in your contact information, name, address, and phone number in the CUSTOMER information box. Check the appropriate box for the type of form you wish to receive: Graphics report (there is an additional $1.00 charge per sample); FAX report (include your fax number); or email report (include your email address). Email reports will be sent as a PDF and will be the quickest way to receive your report.

#1 Customer Info (Home Gardener)
Fill in your contact information, name, address and phone number in the **CUSTOMER information** box.

#2 Form of Report You Wish To Receive
Check the appropriate box for the type of form you wish to receive. Graphics report **(**there is an additional $1.00 charge per sample); FAX report (include your fax number); or email report (include your email address). Email reports will be sent as a PDF and will be the quickest way to receive your report.

#3 Sample ID
Each soil sample (one baggie) will need to be given a 5 character ID. The character ID should be a maximum of 5 characters, numbers or letters, and should clearly represent the area being tested, i.e. LAWN2 for the lawn area. Clearly label the soil sample bag with this ID and then enter it on the sample form under the Sample ID column.

#4 Test Packages
Refer to the soil sampling procedures/soil analysis sheet included in the soil test kit. Determine which test is best for you and check the appropriate box. *For most homeowners the S1B test with recommendations will be sufficient.*

#5 Filling In the Information Columns
First check the recommendations box for: RATE: LBS PER 1,000 SQ FEET. This will be the rate used for soil amendment recommendation. Next fill in the columns for: crop or plant type, previous crop or plant type, planting dates, sample depth, amendments applied and method of irrigation. This information will help determine what amendments may be needed for your soil. Note: There is an important distinction between new (pre-planted) soil versus established soil with previous plantings. Please note this under previous crop or plant type if applicable.

Send In Soil Test Form and Soil Sample Sign and date completed form and send form and soil sample to the lab with a *check or money order* to cover the fees for each test.

SOIL SAMPLE INFORMATION SHEET

A & L WESTERN AGRICULTURAL LABORATORIES, INC.

MODESTO OFFICE
1311 WOODLAND AVENUE, SUITE #1 • MODESTO, CA 95351 • (209) 529-4080 FAX (209) 529-4736

PORTLAND OFFICE
10220 S.W. NIMBUS AVE., BLDG K-9 • PORTLAND, OR 97223 • (503) 968-9225 FAX (503) 598-7702

LAB USE ONLY

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CUSTOMER	GROWER	SUBMITTED BY
PHONE NO:	PHONE NO:	PHONE NO:

❑ Graphics Report ($1.00 per sample) ❑ Fax Report (____) _____ ❑ Email Report (email address required) _____

SAMPLE ID (5 CHARACTERS)	TEST PACKAGES									CHECK BOX IF RECOMMENDATIONS REQUIRED ☐ LBS PER ACRE ☐ LBS PER 1,000 SQ FT ☐					
	S1B	S1BN	S2	S2N	S3C	S10C	TEXTURE	NEMATODE	OTHER ANALYSES	CROP OR PLANT TYPE	PREVIOUS CROP OR PLANT TYPE	PLANTING DATES	SAMPLE DEPTH	AMENDMENTS APPLIED	METHOD OF IRRIGATION
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EXPLANATION OF TESTS (SUBMIT ABOUT TWO CUPS OF SOIL PER SAMPLE)

S1B: BASIC SOIL ANALYSIS. Organic matter estimated nitrogen release, phosphorus (weak Bray and sodium bicarbonate-P), potassium, magnesium, calcium, sodium, sulfate-sulfur, soil pH, buffer pH, C.E.C. and percent cation saturation (computed).
S1BN: BASIC SOIL ANALYSIS plus nitrate-nitrogen.
S2: BASIC SOIL ANALYSIS plus soluble salts and excess lime.
S2N: BASIC SOIL ANALYSIS plus soluble salts, excess line, and nitrate-nitrogen.
S3C: COMPLETE ANALYSIS. BASIC SOIL ANALYSIS (plus soluble salts, excess lime, nitrate-nitrogen, Zn, Mn, Fe, Cu, and B).
S10C: COMPLETE ANALYSIS plus saturation percentage, SAR, ESP, carbonate, bicarbonate, chloride, and saturated paste boron.
NOTE: Strong Bray Phosphorus may be substituted for Sodium Bicarbonate Phosphorus in S1B package. Ask for package S1A

NO_3-N = Nitrate - N
SO_4-S = Sulfate - S
Zn = Zinc
Mn = Manganese
Fe = Iron
Cu = Copper
B = Boron
Mo = Molybdenum
Cl = Chloride

PRINT NAME OF SAMPLER _____

SIGNATURE OF SAMPLER _____

DATE SAMPLES SUBMITTED _____

Understanding Your Soil Test Report

The first step for a homeowner in accurately fertilizing a lawn, garden, or landscape planting is to collect a representative soil sample and send it to a laboratory for analysis. After completing the analysis, the laboratory sends the results back to you along with the amendment recommendations. Interpreting these results correctly is important. Sometimes people mistakenly think that the Soil Test Report will tell them if they have disease-causing organisms in their soil, plant attacking parasites, pesticide residues that might be harmful to their garden of landscape plants, or an analysis of the numbers of beneficial microorganisms that will indicate whether they have good soil. Most soil test reports focus on describing the fertility status of your soil and providing information that will help improve the mineral nutrition of your plants. Knowing exactly what your soil needs helps prevent over applying fertilizer which saves you money and protects the quality of our surface and ground water. (WSU King County Ext. Fact sheet #6) The soil test report contains a lot of information and some technical terminology that can be confusing to the average home gardener. The following is a list of definitions/applications for the most useful technical terms and abbreviations used in your soil and links to useful sources on soil fertility:

pH: This section will display a number between 5 and 7.3 which indicates the pH level of the soil sample you sent them. A pH level of 6.6 to 7.3 is neutral, while levels below 6.6 are acidic and levels above 7.3 are alkaline. Usually the most desirable pH range for mineral soils is 6.0 to 7.0 and for organic soils 5.0 to 5.5. Lime and sulfur are added to the soil to adjust the pH levels. If your soil sample needs adjusting, this section will tell you which substance to apply and the proper rate at which to apply it. The soil pH is the value that should be maintained in the pH range most desirable for the crop to be grown. Buffer pH is an index value used for determining the amount of lime to apply on acid soil to bring the pH to the desired pH for the crop to be grown. The lower buffer pH reading, the higher the lime requirement.

EXAMPLE: Hydrangeas **FAQ:** How can I turn my pink hydrangeas to purple? To obtain a purple/blue hydrangea, aluminum must be present in the soil. To ensure that aluminum is present, aluminum sulfate may be added to the soil. To make aluminum **available** to the plant, the pH of the soil should be low (5.2-5.5). Adding aluminum sulfate will tend to lower the pH of the soil. Another method for lowering the pH is to add organic matter to the soil such as coffee grounds, fruit and vegetable peels, grass clippings etc. If the soil naturally contains aluminum and is acid (low pH) the color of the hydrangea will automatically tend toward shades of blue and/or purple. If not, it will eventually return to pink as the pH level naturally rises. The choice of fertilizer will also affect the color change. A fertilizer low in phosphorus and high in potassium (25-5-30) is helpful in producing a good blue color. Superphosphates and bone meal should be avoided when trying to produce blue.

Soil Analysis: This section is often displayed in graph format and lists how much macro and micronutrient are in the soil sample. The results are displayed in a rate of pound per acre (ppa) or parts per million (ppm). This section also typically has a bar graph that visually indicates very high to very low levels of the various nutrients. Soil supplies 13 essential plant nutrients. Each nutrient plays one or more specific roles in plants. The most common nutrient deficiencies are for the primary nutrients –N,P, and K.

Macronutrients

Primary	Nitrogen	N (NO_3)
	Phosphorus	P
	Potassium	K
Secondary	Sulfur	S (SO_4)
	Calcium	Ca
	Magnesium	Mg

NO_3-N (Nitrate Nitrogen) - Nitrogen, for example, is a component of chlorophyll, amino acids, proteins, DNA, and many plant hormones. It plays a vital role in nearly all aspect of plant growth and development. Plants need a large amount of nitrogen to grow well. The nitrate nitrogen is a measure of the nitrogen available to the plant in the nitrate form. Soil test labs don't routinely test for nitrogen because there is no simple way to predict nitrogen availability. In our climate area this measurement is often inaccurate and may be of limited value except at planting time. The lab will give a general nitrogen recommendation, based on the plants you are growing and on information you provide about your soil. Nearly all soils lack enough available N for ideal plant growth.

Phosphorus (P) - The phosphorus test measures phosphorus that so7old be available to the plants. The optimum level will vary with crop, yield and soil conditions. For most field crops a medium to optimum rating is adequate. For soils with pH above 7.3 the sodium bicarbonate test will determine the available ???

Potassium (K) - This test measures available potassium . The optimal level will vary with crop, yield, soil type, soil physical condition, and other soil related factors. Generally higher levels of potassium are needed on soils high in clay and organic matter verses soils which are sandy and low in organic matter.

Sulfur (S) - Measured as sulfate (SO_4)- readily available form preferred by most plants.

Calcium (Ca) - Primarily soil type, drainage, liming and cropping practices affect the levels of calcium found in soil. Calcium is closely related to soil pH. Calcium deficiencies are rare when soil pH is adequate.

Magnesium (Mg) - The same factors which affect calcium levels in the soil also influence magnesium levels except magnesium deficiencies are more common. Adequate magnesium levels range from 30 to 70 ppm (60-140ppa).

Each nutrient deficiency causes characteristic symptoms. In addition affected plants grow more slowly, yields less and are less healthy than plants with adequate levels of nutrients. Excess nutrients can be a problem for plants and the environment. Excesses usually result because too much of a nutrient is applied or because a nutrient is applied at the wrong time. Fertilizers supplement a soil's native nutrient supply. They are essential to good plant growth when the soil nutrient supply is inadequate. Rapidly growing plants such as annual vegetable crops generally need more nutrients than slowly growing plants such as established perennials. You can use processed fertilizers, organic fertilizers, or a combination of the two to supply soil nutrients. (Cogger)

Organic or Processed? Processed fertilizers are manufactured or are refined from natural ingredients to make them more concentrated and more available to plants. Organic fertilizers are natural materials that have undergone little or no processing. Once in the soil, organic fertilizers release nutrients through natural processes. The released nutrients are available to plants in water-soluble forms. These soluble forms of nutrients are the same as those supplied by processed fertilizers. When compared with processed fertilizers, organic fertilizers usually have a lower concentration of nutrients and release nutrients more slowly. Thus, larger amounts of organic fertilizers are needed, but their effects last longer. Using organic fertilizers recycles material that otherwise would be discarded as waste. Production of processed fertilizers, on the other hand, can create waste and use substantial amounts of energy. (Cogger) Fertilizers usually contain 3 primary nutrients: nitrogen, phosphorous, and potassium which will be listed in order on the label. For example, 5:10:10 means 5% nitrogen, 10% phosphorous, and 10% potassium. (WSU King County Ext. Fact Sheet #6)

Calculating Fertilizer Amounts Fertilizer recommendations usually are given in pounds of nutrient (such as nitrogen) per unit area (typically 100 or 1,000 square feet for gardens). You will need to convert the recommendation from pounds of nutrient to pounds of fertilizer. **Example:** You are following a fertilizer recommendation that calls for adding 2 lb of N per 1,000 square feet using a fertilizer with a 1:1:1 ratio of nitrogen, phosphorus, and potassium. Follow these steps to find out how much fertilizer to use:

1. Choose a fertilizer with an appropriate analysis—an 8-8-8 fertilizer, not a 21-4-4.

2. Calculate how much 8-8-8 is needed for 1,000 square feet. Divide the amount of nitrogen recommended for 1,000 square feet (2 lb) by the fraction of nitrogen in the fertilizer (8% or 0.08): 2 lb/0.08= 25 lb per 1,000 square feet.

3. Calculate the area of your garden. If it is a rectangle, the area is length times width. If your garden is an odd shape, divide it into rectangles, calculate the area of each rectangle, and then add them together.

4. Calculate the amount of fertilizer needed for your garden. Divide the area of your garden (500 square feet) by the area in the fertilizer recommendation (1,000 square feet). Multiple by the fertilizer amount calculated in step 2. (500/1,000 x 25 = 12.5 lb of 8-8-8 fertilizer. This is the amount of fertilizer needed for your garden.

Reading Soil Tests Additional Information and Resources

In addition to the information provided to you from the laboratory of your choice, you might find it helpful to review the following Extension Publications:

Cogger, Craig *Home Gardener's Guide to Soils and Fertilizers,* Washington State University Extension EB 1971E, 2005. http://cru.cahe.wsu.edu/CEPublications/eb1971e/eb1971e.pdf

Halverson, A.R.,Adams, EB., and Hallock, B.G. *Fertilizer Guide Vegetable and Flower Gardens, Except Irrigated Central Washington,* Washington State University Extension, FG50. Revised 1981. http://whatcom.wsu.edu/ag/homehort/FertilizerGuide.pdf

How Much Fertilizer Should I Use? Washington State University, EB1123. http://cru.cahe.wsu.edu/CEPublications/eb1123/eb1123.html

Marx, E.S., Hart, J., and Stevens, R.G., *Soil Test Interpretation Guide,* Oregon State University Extension, EC 1478, Reprinted August, 1999. http://ir.library.oregonstate.edu/xmlui/bitstream/handle/1957/14361/ec1478.pdf?sequence=1

WSU Extension publications:

Cover Crops for Gardens in Western Washington and Oregon (EB1824)
Fertilizing Landscape Trees and Shrubs (EB 1034)
Growing Small Fruits in the Home Garden (EB1640)
Home Lawns (EBO482)
How Much Fertilizer: Conversion Guide for Gardeners (EB1123)
Role of Lime in Turfgrass Management (EB 1096)
Soil Testing and Soil Improvement (Community Horticulture Fact Sheet #6)
Soil Treatment Procedures for the Home Gardener (EB1158)

OSU Extension Publications:

La Construccion de Camas Elevadas (EC1537-S) *Cover Crops for Home Gardens* (FS 304)
Los Cultivos de Cobertura:Una Manera Facil de Mejorar el Suelo (EC 1538-S)
Fertilizing Shade and Ornamental Trees (FS 103)
Fertilizing Your Garden: Vegetables, Fruits and Ornamentals (EC 1503)
Gardening and Water Quality Protection: Understanding Nitrogen Fertilizers (EC 1492)
Gardening and Water Quality Protection: Using Nitrogen Fertilizers Wisely (EC 1493)
Gardening with Composts, Mulches, and Row Covers (EC 1247)
A List of Analytical Labs Serving Oregon (EM 8677)
Raised Bed Gardening (FS 270)
Soil Samplings for Home Gardens and Small Acreages (EC 628)
Willamette Valley Soil Quality Card Guide (EM 8710)

WSU Extension Services Resources: For further questions regarding interpreting your soil test results, ask a Master Gardener. Call the Master Gardener Heritage Farm Answer Clinic at 360-397-6060 Ext. 5711 or email MGanswerclinic@clark.wa.gov.WA. You can also visit the clinic at 1919 NE 78th Street Vancouver, WA. Clinic hours are Tuesday and Wednesday 8:30 AM until 2:00 PM; Thursday 11:30 AM until 5:00 PM. Phone and email messages are monitored Monday through Friday.

Other Internet Sources: http://hydrangeashydrangeas.com/colorchange.html