Soil Test Interpretation

This section will be appearing in the new upcoming Master Gardener Manual under soils.

To understand you're the results of your soil test, you need to download from the web the OSU publication EC 1478 "Soil Test Interpretation Guide" available online at https://ir.library.oregonstate.edu/jspui/bitstream/1957/14361/1/ec1478.pdf. It is recommended to study the whole guide, then look up your soil test results and follow each element in the soil test with the explanation in the guide.

The following soil test results (Table 1) were obtained from OSU central analytical laboratory from soil samples collected from three Master Gardener demonstration gardens in Lincoln City, Newport and Yachats at the Oregon coast.

Table 1. Lab results for soil samples submitted from demonstration gardens in Newport and Yachats Oregon.

Sample Number	Lab Number	pH	SMP	Bray-P ppm	K ppm	Mg ppm	Ca ppm	Cu ppm	Mn ppm	Zn ppm	Fe ppm	C %	N %
Yachats native	110030.01	5.3	4.9	3	296	520	888	3	12	3	172	12.73	0.98
Newport compost	110030.02	7.1	6.8	123	70	48	224	1	2	1	2	33.51	1.07
Yachats demo	110030.03	6.4	5.8	3	204	347	1097	2	3	1	55	5.46	0.32
Yachats compost	110030.04	5.6	5.5	90	752	741	1987	4	30	26	375	14.56	0.99
Newport forest	110030.05	4.9	4.8	3	179	50	113	2	3	1	52	6.79	0.45

Let us pick the Newport forest soil sample and go through the soil test interpretation guide to see how we could interpret this soil. This soil was collected from the forest and is being used in a raised bed to grow vegetables. It was sampled up to 4 inches deep, composited or mixed and sent to the lab.

The first and second column shows sample and lab number. The sample number is the name you give your soil sample which the lab will adopt while conducting analyses. The lab number is assigned by the lab to your specific soil sample. In most cases when submitting a soil sample to the lab, you fill out a lab form that may have these numbers. If sending more than one sample, make sure your bag is properly labeled and the numbers are sequential.

The third column is showing the soil's pH. Soil pH shows how acidic or alkaline your soil is. In this case our pH is 4.9 which is very acidic for vegetable growth as most crops grow best if the soil pH is between 6.0 and 7.5. However, this is the average pH found on undisturbed forest soils along the coast. From the guide, any pH below 5.1 is strongly acidic. Therefore this soil needs lime. Accurate lime recommendations cannot be made without performing an SMP test, whose results are shown on column four. Our Newport soil has an SMP value of 4.8.

The SMP test is used to estimate the amount of lime required to raise the pH of the surface 6 inches of soil and for our Newport soil sample the SMP value is 4.8. Understand that a low SMP value indicates a very high reserve acidity and higher lime requirements and vice versa. The SMP table below (Table 2) is used to determine how much lime in tons/acre, would be used to raise the pH to a desired level using a 100-score lime source. Desired pH levels are shown on the second row in the SMP Table 2 below, and they are 5.3, 5.6, 6.0 and 6.4.

Table 2. SMP lime requirements – field scale (OSU publication EC 1478)

SMP buffer	Tons/acre of 100-score lime needed to raise pH of surface 6 inches of soil to the following pH's			
	5.3	5.6	6.0	6.4
6.7	—	—	—	—
6.6	—	—	—	1.1
6.5	—	—	1.0	1.7
6.4	—	—	1.1	2.2
6.3	—	—	1.5	2.7
6.2	—	1.0	2.0	3.2
6.1	—	1.4	2.4	3.7
6.0	1.0	1.7	2.9	4.2
5.9	1.4	2.1	3.3	4.7
5.8	1.7	2.5	3.7	5.3
5.7	2.0	2.8	4.2	5.8
5.6	2.3	3.2	4.6	6.3
5.5	2.6	3.6	5.1	6.8
5.4	2.9	3.9	5.5	7.3
5.3	3.2	4.3	6.0	7.8
5.2	3.6	4.7	6.4	8.3
5.1	3.9	5.0	6.9	8.9
5.0	4.2	5.4	7.3	9.4
4.9	4.5	5.8	7.7	9.9
4.8	4.8	6.2	8.2	10.4

Example: If the "SMP buffer" value is 5.9, the amount of lime needed to raise the pH to 6.0 is 3.3 tons of 100-score lime/acre.

From Table 2, our Newport forest soil will take 4.8, 6.2, 8.2 and 10.4 tons/acre of lime to raise the pH from 4.9 to 5.3, 5.6, 6.0, and 6.4 respectively. Since vegetables do well in soils with pH of 6.0-7.5, we would need at least 8.2-10.4 tons/acre of lime for our soil. However, the raised beds we are using at the demonstration gardens measure only 8 feet by 4 feet (32 sq. feet). Therefore knowing that an acre has 43,560 square feet, our 32 square feet of garden will require only 0.006-0.0076 tons of lime or 12 – 15.2 pounds of 100-score lime per each bed. This lime should be mixed thoroughly into the soil and not spread on top of the garden for lime reaction and pH change to take place.

Column five shows Bray's phosphorus (P) content that estimates plant available P. Our soil test shows a value of 3 ppm (parts per million), which is very low. Any soil having less than 20 ppm is too low and any soil with over 100 ppm of P has excess P. If possible apply phosphorus in band rather than broadcast in the raised bed.

Column six is potassium (K) with a value of 179 ppm. We only recommend adding potassium if soil test values are below 150 ppm. Therefore our potassium is adequate.

Column seven is Magnesium (Mg) with a value of 50 ppm. Any soil test value below 60 ppm is low, therefore we need to add Mg to our soil. Liming with dolomitic lime can also correct Mg levels. If not using dolomitic lime, you can use Epsom salt or if you are lower on sulfates use of Magnesium sulfate can raise magnesium levels too.

Colum eight shows calcium (Ca) levels at 113 ppm. Ca is usually low if less than 1000 ppm and we are very low in this soil. Since we will be using lime (calcium carbonate) to correct pH, this will satisfy our Ca requirements.

Column nine is micronutrient copper (Cu). Micronutrients are required in very small quantities to satisfy plant growth requirements. For Cu, any values above 0.6 ppm are sufficient for plant growth and therefore our 2 ppm is more than enough.

Column 10 is manganese (Mn) with a value of 3 ppm. For Mn, values above 1.5 ppm are sufficient and therefore this soil has enough Mn. Usually Mn deficiencies occur in soils with pH above 7.0.

Column 11 is zinc (Zn). For Zn, values above 1 ppm are sufficient and therefore our soil at 1 ppm has enough Zn for plant growth.

Column 12 is iron (Fe) with a value of 52. In Oregon, testing for Fe is not recommended because testing methods do not discern between forms of iron and therefore the test has little meaning. Fe deficiencies are uncommon and for acid loving plants like azaleas and rhododendrons growing in alkaline soil, application of acidifying fertilizers will help alleviate this problem. Also use of foliar fertilizers can correct any Fe deficiencies that may occur.

Column 13 is total carbon (C). Total carbon estimates all carbon available in the soil and the percentage is sometimes used to calculate organic matter content. In this soil, it shows that total organic carbon in the soil is 6.79%. Compare this to Newport compost soil which has too much carbon at 33.51%. Good garden soils should have between 4 and 10% total carbon.

Colum 14 is total nitrogen (N). Total nitrogen analysis measures N in all organic and inorganic forms. A typical agricultural soil will contain between 0.10 and 0.15 % N. This is equal to about 5000 pound of N per acre in the field providing up to 200 pounds per acre of nitrogen for plant use per year. Our soil has a higher value of about 0.45 % which is over 3 times the normal soil showing that given correction of other soil factors like pH, our soil will be able to support and provide N for plant growth.