



INTERPRETATION OF SPECIAL ORCHARD SOIL TESTS

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Several special soil tests have been developed which serve as aids in diagnosing problems with old orchard soils, or explain the failure of trees to perform well. The discussion of each of the tests listed below are brief. They are intended to indicate in what way they may be related to poor tree performance and what practices may be causing them.

Soluble Salts

When a soil is sufficiently high in soluble salts to reduce the growth of crops it is said to be "saline". Salt levels of up to 4.0 mmhos/cm are found occasionally in orchards. When levels are over 2-3 mmhos/cm the situation should be given attention.

High salt readings can be found in samples taken from areas where fertilizer has been recently applied. Fertilizer should be broadcast evenly, not banded or spotted, to avoid injury to roots.

Salinity can be caused by waters which are high in salts. Irrigation water should be tested to determine if it is the source of salts and if it is suitable for continued use. If ground seepage is a problem, interceptor drains may need to be installed.

Salt readings should be interpreted along with tests of soil pH. The two when used together are more meaningful.

<u>Salt Level</u>	<u>Soil Acidity</u>	<u>Interpretation</u>
mmhos/cm	pH	
Below 1.0	any pH	No problem with salts is indicated
1.0 to 3.0	any pH	High salt reading may be caused by recent or improper fertilizer applications.
over 3.0	Below 8.0	Suggests poor distribution of fertilizer. Fertilizer should be broadcast evenly to avoid root injury.

<u>Salt Level</u>	<u>Soil Acidity</u>	<u>Interpretation</u>
3.0 to 4.0	Above 8.0	Indicates that a salt problem may be developing. Check salinity of irrigation water and for possible problem with seepage.
over 4.0	Above 8.0	Indicates a salt problem is developing. Check salinity of irrigation water and area for possible seepage.

Arsenic (As)

Arsenic can be a problem in old orchard soils. The heavy use of arsenic sprays for insect control has left many soils with large amounts of residual arsenic. Arsenic can be toxic to fruit trees, particularly young trees and stone fruits.

Interpretation of results are difficult. High levels of arsenic close to the surface may be less detrimental than moderate levels found throughout the root zone, down to three or four feet. Peach and apricot are very sensitive to arsenic levels while apple and pear are more tolerant. Cherry is intermediate. Wherever arsenic is present in amounts over 25 ppm even in only the surface foot of soil, it is advisable to plant all trees with fresh soil (soil which does not contain arsenic).

Treat peach trees with a soil application of about five pounds of zinc sulfate per tree to prevent shot-hole and defoliation. Apply as a broadcast treatment over about 100 square feet of soil surface around the tree and maintain a high rate of nitrogen fertilizer application.

Soil test results may be interpreted as follows:

<u>Soil Depth</u> feet	<u>Arsenic Level</u> ppm	<u>Interpretation</u>
0 - 3	less than 25 ppm	Arsenic is probably not a problem
0 - 1 1 - 3	25 to 50 ppm less than 25 ppm	May reduce growth of sensitive trees such as apricot and peach. Should not seriously effect growth of apple, pear and cherry.
0 - 3	25 to 50 ppm	Symptoms of arsenic toxicity may appear on apricot and peach during hot summer. Newly planted apple, pear and cherry may be reduced in growth but should still grow well.
0 - 1 1 - 3	50 to 100 ppm less than 25 ppm	Survival of apricot and peach doubtful unless planted with arsenic free soil. Symptoms of arsenic toxicity should be severe on established apricot and peach. May limit growth of newly planted apple, pear and cherry.
0 - 3	50 to 100 ppm	Significant reduction in growth of any newly planted trees should be anticipated. Avoid planting stone fruits.
0 - 1 1 - 3	over 100 ppm over 50 ppm	Hazardous to plant any new trees under these conditions.

Boron (B)

Soils in Washington vary considerably in boron content. In general they are low except where boron has been applied. In orchards where boron has been applied at high rates for many years, boron may have reached high levels. Soil tests should be taken.

Test Values below 0.5 ppm: Low levels. Blossom blast in pear and bark necrosis in apple may occur. Boron may be applied as a soil treatment. Broadcast boron at the rate of 3 pounds/acre (approximately 30 pounds of agricultural borax/acre). Retest soil before making any additional soil application.

Test Values of 0.5 to 1.0 ppm: Desired soil level. No ground application should be necessary. If symptoms of boron deficiency are still apparent, a supplemental nutrient spray may be made using either Solubor or Boro-spray at the rate of one pound of actual boron per acre.

Test Values of 1.0 to 2.0: High level. Applications of more boron may cause a severe toxicity. Apply a nutrient spray of boron only when a deficiency has been definitely diagnosed.

Test Values over 2.0 ppm: Possible boron toxicity. Consult local Extension agent or fieldman. Special precautions should be taken.

Nitrate Nitrogen

Test levels are expressed as ppm nitrogen (N). Levels found in the soil must be interpreted according to the location of the soil sample and the time of sampling. Soil samples taken shortly after nitrogen fertilizer application should test higher than later in the growing season. High nitrogen levels in the soil during the summer and fall can delay fruit harvest and result in poor fruit color. Trees may tend to grow late into the fall and be more subject to winter injury.

Similarly samples taken in or close to the area where nitrogen has been applied will test higher. Surface soil samples would be expected to test higher than soil samples from lower depths.

High levels of nitrate nitrogen are sometimes found in subsoil samples even though trees appear low in nitrogen. Failure of trees to utilize nitrogen in the soil can be caused by a faulty root system. Examine tree and soil condition before applying additional nitrogen.

<u>Nitrogen Index</u>	<u>Interpretation</u>
less than 25	Low levels of nitrogen
25 to 50	Low to moderate level depending upon season and location of sampling
50 to 100	Moderate level in the spring and near the surface. High level during the summer and fall and at lower levels

<u>Nitrogen Index</u>	<u>Interpretation</u>
100 to 200	High level in the spring and near the soil surface but not excessive if soil sample was taken where fertilizer was applied. Such high levels in subsoil samples and/or late in the growing season suggest excess fertilizer application and/or poor utilization of nitrogen fertilizer.
Over 200	Samples taken near where fertilizer was applied may test this high early in the season. Such high values in the subsoil and/or late in the growing season are excessive. If trees appear short of nitrogen look for other sources of the problem. Consult your Extension agent or fieldman.

Nitrate Nitrogen

Test levels of nitrate nitrogen in the soil (expressed as N) are not correlated with requirements for nitrogen. Rather they can indicate faulty condition in the orchard. Nitrate levels are usually higher in the early spring and after fertilizer application. They should decline throughout the growing season.

<u>Soil Nitrate</u> ppm	<u>Depth</u> feet	<u>Interpretation for Profile Samples</u>
Under 25	0-4	Low at any time of year but desired in late summer and fall
Under 50 ppm		Low in spring but moderate in summer and fall
50 to 100 ppm		Moderate levels of nitrate in spring but high during summer and fall
Over 100 ppm		Indicates excessive accumulation of nitrates. May be caused by excess application or concentration of fertilizer in small bands
Over 200 ppm		Suggests possible toxic condition caused by excess nitrates. Can be caused by excess application of nitrogen or faulty soil condition.

To simplify the presentation of information, it is sometimes necessary to use trade names. No endorsement of products is intended.

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