Tissue Testing: Detecting Hidden Plant Health Problems

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Hidden plant health problems can reduce crop performance and final yields with plants showing no visible symptoms. It is easy to look at a field and think the crop is producing high yields when plants may be under stress and will not produce high yields. To avoid any surprises, there are several easy-to-operate tissue testing meters that allow you to monitor crop nutrient levels while in the field or at home. Tissue analysis is an important tool to balance nutrient requirements during the season.

Visual Refractometer

Electronic Refractometer

Refractometers: Refractometers measure total dissolved solids in plant sap (called Brix) and provide information about photosynthesis, proteins and sugars. Low Brix levels (<12) can indicate a lack of specific nutrients due to poor growing conditions (wet soils, cloudy weather, etc.) or low fertility. Brix readings of >12 indicate good plant health. Refractometers are available in both visual and electronic versions.

pH meter: pH meters measure acidity of soils and plant sap. Plant sap with a pH< 6.4 indicates a need for Ca, Mg, K, or Na. A pH > 6.4 indicates a need for phosphates or sulfates. After balancing mineral deficiencies, Brix readings will also increase and crop performance will improve.

EC meters: EC meters measure electrical conductivity in the sap which is an indication of ion uptake and incorporation by the plant. Low EC readings mean that plants are not taking in adequate nutrients. High EC readings may indicate excessive levels of certain ions such as nitrate nitrogen.

Specific ion testers: These meters measure levels of specific ions such as nitrate nitrogen, potassium, sodium and iron. They are useful to determine rates of additional fertilizing materials (such as Foliar Plus™) applied during the growing season..

Soil penetrometers: Penetrometers measure the degree of soil compaction (soil structure). There are several types ranging from inexpensive rods with no measuring system to computerized versions that collect data points at regular intervals. Penetrometers locate hardpans, compaction zones, etc. At a compaction reading of 300 psi, plant root growth is inhibited.

Infrared thermometers: Plants that are under any stress (fertility, soil compaction, diseases or pests) have increased metabolism that can be measured as the difference between ambient air temperature and plant foliage temperature. IR thermometers permit rapid measurements and provide an easy method to quickly assess crop stress. The greater the difference in ambient and foliar temperatures, the greater the level of stress on the plants.

SPAD meters: SPAD meters measure chlorophyll content (plant "greenness") which is related to leaf nitrogen content. Healthy plants have readings of 50-55. If plants are tested after a few hours in the sun and readings remain <50, nitrogen fertility should be reassessed. SPAD readings correlate well with nitrogen levels in

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Refractometer Readings

Within a given species of plant, the crop with the higher refractive index will have a higher sugar content, higher mineral content, higher protein content, and a greater specific gravity or density. This adds up to a sweeter tasting, more minerally nutritious food with a lower nitrate and water content and better storage characteristics. It will produce more alcohol from fermented sugars and be more resistant to insects, thus resulting in a decreased insecticide usage. Crops with a high sugar content will have a lower freezing point, and therefore be less prone to frost damage. Soil fertility needs may also be ascertained from this reading.

	REACTIVE INDEX OF CROP JUICES			
	Calibrated in % Sucrose or Degree Brix			
	Poor	**Avg**	**Good**	**Excellent**
Alfalfa	**4**	**8**	**16**	**22**
Apples	6	10	14	18
Asparagus	2	4	6	12
Avocados	4	6	8	12
Bananas	8	10	12	16
Beets	6	8	10	12
Bell Peppers	4	6	8	12
Broccoli	6	8	10	12
Cabbage	6	8	10	12
Carrots	4	6	12	18
Cantaloupe	8	12	14	16
Cauliflower	4	6	8	12
Celery	4	6	10	12
Cherries	6	8	14	16
Corn Stalks	4	8	14	20
Corn, young	**6**	**10**	**18**	**24**
English Peas	8	10	12	14
Field Peas	4	6	10	12
Grapes	8	12	16	20
Grapefruit	6	10	14	18
Green Beans	4	6	8	14
Honeydew	8	10	12	14
Hot Peppers	4	6	8	12
Lemons	4	6	8	12
Lettuce	4	6	8	12
Limes	4	6	10	12
Onions	4	6	8	13
Oranges	6	10	16	20

	REACTIVE INDEX OF CROP JUICES			
	Calibrated in % Sucrose or Degree Brix			
	Poor	**Avg**	**Good**	**Excellent**
Parsley	4	6	8	12
Peaches	6	10	14	18
Peanuts	4	6	8	12
Pears	6	10	12	14
Pineapple	12	14	20	22
Raisins	60	70	75	80
Raspberries	6	8	12	14
Rutabagas	4	6	10	12
Small Grains	**6**	**10**	**14**	**18**
Sorghum	6	10	22	30
Soybeans	**4**	**8**	**12**	**16**
Sugar Beets	**4**	**8**	**10**	**12**
Squash	6	8	12	14
Strawberries	6	10	14	16
Sweet Corn	6	10	18	24
Sweet Potato	6	8	10	14
Tomatoes	4	6	8	12
Turnips	4	6	8	12
Watermelon	8	12	14	16

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