Spotlight on Agriculture

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Ministry of Agriculture,
Water and Rural Development
Directorate of Agriculture Research and Training
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PLANT TISSUE ANALYSIS

an AID for better CROP PRODUCTION

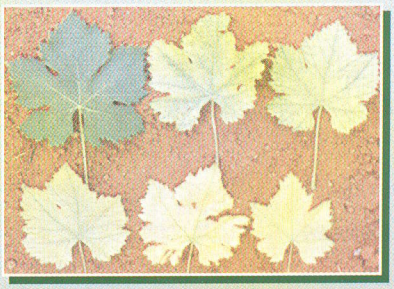
Tissue analysis is a diagnostic technique to assist in the production of healthy plants of all types. It should be used in conjunction with soil and irrigation water analysis, but it is often the best way to rapidly detect plant nutritional problems.

Plant tissue analysis can be used for:

- Planning solid fertilizer and foliar feeding programs.
- Correction of nutrient deficiencies in the growing crop.
- Providing information for fertilization of subsequent crops.
- Helping to differentiate between nutritional and disease problems.
- Formulation of feeding solutions for hydroponics in association with irrigation water analysis.

Analysis is normally carried out on recently matured leaves, although sometimes the whole young plant or other parts of the plant are used. The tissue is dried and ground to a fine powder and either oxidised by strong acids or converted to ash by burning in a muffle furnace. The concentrations of nitrogen, potassium, calcium, magnesium and also minor or micro-nutrients such as iron, zinc, manganese, copper and boron are determined by a variety of methods. The nitrogen content is often determined by a separate acid digestion procedure. Some laboratories also measure sodium, sulphur and molybdenum.

The results are rated as 'deficient', 'sufficient' or 'excess', depending on the amounts expected in healthy tissue at an equivalent stage of growth. Interpretation schemes often take into account the relative proportion of different elements as well as their absolute concentration. As long as background data is available for the crop in question, the analysis should be able to provide interpretation and recommendations for fertilisation and remedial action.



Iron deficiency *(normal leaf in top left corner)*

Potassium deficiency *(normal leaf on the left)*

Magnesium deficiency

A plant tissue analysis service is now being offered by the Ministry of Agriculture, Water and Rural Development for farmers, horticulturists and home gardeners on a fee basis.

An information bulletin on the service and how to take tissue samples is available on request from:

Agriculture Laboratory, MAWRD,
Private Bag 13184, Windhoek
Tel 061-2087039 • *Fax* 061-2087068
E-mail agricaez@namib.com
Ground Floor, MAWRD Building,
Government Office Park

Recommended procedures exist for different crops to provide the best interpretation of the results at a variety of growth stages. Generally recently matured leaves should be sampled. With plants showing growth problems samples should include tissue from plants that have just developed the symptoms as well as material from healthy plants. If the leaves are wet or can not be transported quickly to the laboratory then they should be air-dried to avoid deterioration. Plant tissue can be transported in clean polythene or paper bags. Material that is contaminated with insecticide or fertiliser residues or soil particles should be briefly washed in clean water (preferably distilled water) and dried. The presence of chemical or soil residues may affect the analytical results.

RECOMMENDED SAMPLING PROTOCOLS

NAME	PLANT PARTS SAMPLED	AGE / SEASON / STAGE OF GROWTH
Sweet Corn (*Zea mays sp. mays*)	8 unfurled leaves (5th leaf from tip)	30cm→tassel→silk→end of silk
Maize (*Zea mays*)	15 whole tops	plants < 30cm tall
	12 leaves below the whorl	prior to tasselling
	12 ear leaves	initial silk
Sorghum and Pearl Millet	25 whole tops	23-39 days (seedlings < 30cm tall)
(*Sorghum bicolor and*	25 mature leaves from new growth	37-56 days after planting
Pennisetum americanum)	25 leaves, 3rd leaf below head	bloom stage, head just visible
	25 leaves, 3rd leaf below head	grain in dough condition
Water melon (*Citrullus lanatus*)	12 unfurled leaves (5th leaf from tip)	flower start to small fruit
	12 mature leaves from new growth	mature plants, small fruit stage
Cowpea (*Vigna unguiculata*)	12 most recent fully developed trifoliate leaves	early bloom
Cabbage (*Brassica oleracea*	15 whole tops	2-6 week old plants
var. capiata)	12 wrapper leaves	mature plants
Groundnut (*Arachis hypogaea*)	25-50 whole tops	prior to bloom→early pegging
Sunflower (*Helianthus annuus*)	25 mature leaves from new growth	summer
Cotton (*Gossypium hirsutum*)	25 vegetative stems	first squares→full bloom
Date (*Phoenix dactylifera*)	25 leaflets, mid-section recently matured leaves	summer
Onion (*Allium cepa*)	12 whole tops	1/3 maturity→1/2 maturity→mature
Tobacco (*Nicotiana tabacum*)	15 mature leaves from new growth	30 days→100 days→bloom stage
Pigeonpea (*Cajanas cajan*)	50 mature leaves from new growth	summer
Sweet Potato (*Ipomoea batatas*)	15 mature leaves from new growth	summer
Cassava (*Manihot esculenta*)	25 mature leaves from new growth	vegetative growth period
	10, 30cm bark sections, main stem, just above soil	14-month-old plants
Potato (*Solanum tuberosum*)	25 most recent fully developed leaves	30cm tall→tubers 1/2 grown
Soya Bean (*Glycine max*)	25 mature leaves from new growth	prior to pod set
Tomato (*Lycopersicon*	15 compound leaves adjacent top inflorescence	mid bloom
lycopersicum)	25 mature leaves from new growth	mature plants non-fruiting
Rice (*Oryza sativa*)	25 mature leaves from new growth	maximum tillering→panicle initiation
Grass for forage, hay, silage etc.	whole tops or newly mature leaves	interpretation is based on age
Citrus (lemon, orange, grapefruit)	30 mature leaves from new growth	vegetative growth
	30 mature leaves from non-fruiting shoots	between growth flushes
	30 mature leaves, subtending fruit	5-7 months into growing season
Grapes - table and wine	50 leaf petioles opposite basal flower cluster	full bloom
(*Vitis sp.*)	15 whole leaves opposite bunch cluster	early to late summer

Interpretation of the data may be more difficult with plants showing growth problems if they are sampled at different growth stages than suggested above.

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