Understanding the

FAS report

LEAF ANALYSIS

FAS Agricultural Laboratory

Introduction

The SASRI Fertiliser Advisory Service (FAS) conducts routine leaf analysis of sugarcane samples with guidance given on whether the test values are within a predetermined sufficiency range. This guide highlights key features when reading and interpreting this report. Consult your Extension Specialist or agronomic advisor or look at the relevant SASRI information sheets for specific nutrient or topics for further guidance on optimal crop nutrition (visit the Knowledge Hub at www.sasri.org.za to download the latest versions of the information sheets).

The results of each leaf analysis is presented in PDF and Excel formats that are emailed to the grower. The main PDF report is discussed in this guide, with other formats duplicating information from this.

There are three formats of FAS results that the grower receives:

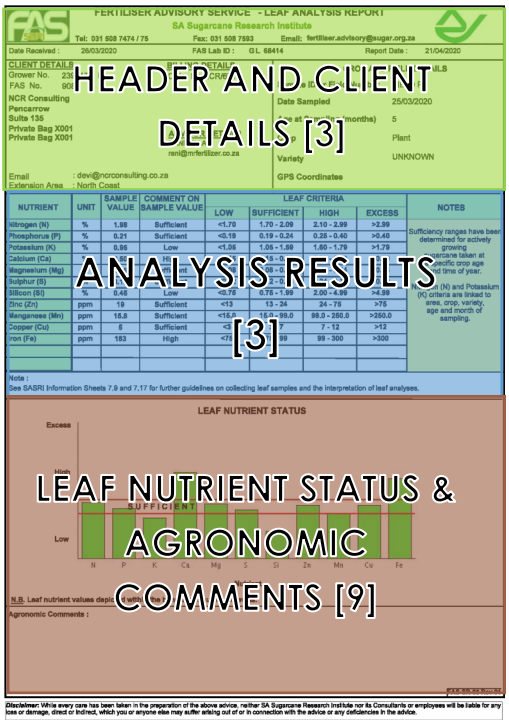
- **a PDF report per leaf sample**
- **a collated summary PDF report for showing all sample results, and**
- **a collated Excel summary report with results (to ease record keeping in a database or spreadsheet).**

For details on leaf sampling and interpretation see Information Sheet 7.15

Leaf report contents

This booklet provides guidance on interpreting the leaf sampling report in order to understand the nutritional status of your crop.

Click the report menu or blocks below to navigate.
Page numbers in [ ]



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Header and client details

FERTILISER ADVISORY SERVICE - LEAF ANALYSIS REPORT

SA Sugarcane Research Institute

Tel: 031 508 7474 / 75 Fax: 031 508 7593 Email: fertiliser.advisory@sugar.org.za

Date Received : 03/05/2019 FAS Lab ID : GL 4567 Report Date : 11/06/2019

CLIENT DETAILS

Grower No. 12345 A
FAS No. 4567

Louis Titshall
170 Flanders Drive
Mount Edgecombe

BILLING DETAILS

Order No:

ADVISOR DETAILS

Email : Louis.titshall@sugar.org.za
Extension Area : Midlands North

CROP AND FIELD DETAILS

Sample ID or Field Number	DS30B
Date Sampled	24/04/2019
Age at Sampling (months)	5
Crop	Plant
Variety	N52
GPS Coordinates	

This section shows the information provided by the client on the leaf sampling submission form and relevant field management details.

Analysis results

The results from the laboratory analysis are shown in this section. Test values represent the total concentration of the elements. Below is an example of the results you receive.

NUTRIENT	UNIT	SAMPLE VALUE	COMMENT ON SAMPLE VALUE	LEAF CRITERIA				NOTES
				LOW	SUFFICIENT	HIGH	EXCESS	
Nitrogen (N)	%	2.27	High	<1.60	1.60 - 1.96	1.97 - 2.81	>2.81	Sufficiency ranges have been determined for actively growing sugarcane taken at a specific crop age and time of year. Nitrogen (N) and Potassium (K) criteria are linked to area, crop, variety, age and month of sampling.
Phosphorus (P)	%	0.24	Sufficient	<0.19	0.19 - 0.24	0.25 - 0.40	>0.40	
Potassium (K)	%	1.68	High	<1.05	1.05 - 1.59	1.60 - 1.79	>1.79	
Calcium (Ca)	%	0.29	Sufficient	<0.15	0.15 - 0.38	0.39 - 0.59	>0.59	
Magnesium (Mg)	%	0.15	Sufficient	<0.08	0.08 - 0.18	0.19 - 0.34	>0.34	
Sulphur (S)	%	0.20	Sufficient	<0.12	0.12 - 0.23	0.24 - 0.39	>0.39	
Silicon (Si)	%	0.52	Low	<0.75	0.75 - 1.99	2.00 - 4.99	>4.99	
Zinc (Zn)	ppm	19	Sufficient	<13	13 - 24	24 - 75	>75	
Manganese (Mn)	ppm	48.0	Sufficient	<15.0	15.0 - 99.0	99.0 - 250.0	>250.0	
Copper (Cu)	ppm	6	Sufficient	<3	3 - 7	7 - 12	>12	
Iron (Fe)	ppm	235	High	<75	75 - 99	99 - 300	>300	
Boron	ppm	1.6	Low	<10.0	10.0 - 20.0	20.0 - 35.0	>35.0	

Row headings

Nutrient: The element that was measured in the sample.

Unit: Macronutrients are reported as a percentage (%) element (or gram element per 100 gram dry leaf) and micronutrients are reported as parts per million (ppm, equivalent to milligram element per kilogram dry leaf). See page 10 for useful conversions.

Sample value: Refers to the actual test result measured for the sample.

Comment: This indicates whether a particular sample value may be Low, Sufficient or High. Low suggests inadequate supply from the soil or poor uptake by the crop, Sufficient indicates sample is in the ideal range, while High means over supply or luxury uptake by the crop. Low and High test values may lead to poor crop performance.

Leaf Criteria: This section defines the threshold values used to decide if a nutrient is Low, Sufficient or High. Ensure that you sample at the correct crop age (see table below) as these ranges are calibrated to samples collected during these periods.

Crop age (months)	Northern Irrigated	Coastal Lowlands	Midlands
	3 to 5	4 to 7	4 to 9

A guide to the analysis parameters

Nitrogen (N): N is essential for protein and chlorophyll production, and is used in leaf growth and expansion. The N threshold is also dependent on sampling month (*see Information Sheet 7.15: Leaf sampling and analysis for sugarcane*). Where deficiency is detected this can often be remedied by topdressing with an N fertiliser (though caution must be used not to apply too close to harvesting as this can lead to reduced sucrose content). Excess N suggests over-supply and luxury uptake, and can lead to excessive foliage production, late maturation and lower sucrose content.

Phosphorus (P): P is key in the plant's energy supply chain and establishing a healthy root system. There is limited scope to remedy P deficiency once the crop is established. Ideally, P deficiencies should be addressed during the plant crop cycle where soil P can be properly addressed.

Potassium (K): A key nutrient for sugarcane utilised in large amounts. Crops deficient in K tend to be less resistant to disease, cold and drought. Sugarcane will, however, take up excess soil K without apparent negative impact on yield or growth, but can negatively impact on milling efficiency and sugar recovery. Excess K may also reduce Ca and Mg uptake. Some soils are able to supply large amounts of K from soil minerals.

Calcium (Ca): Calcium activates numerous enzymes, plays structural roles and mitigates the effect of toxic aluminium in soil. Sugarcane is not very tolerant of low Ca levels. Deficiency is often associated with acid soils and remedied with lime and gypsum applications. Excess Ca may, however, inhibit K and Mg uptake.

Magnesium (Mg): Magnesium is essential for photosynthesis. Deficiency is often associated with acid soils and remedied with dolomitic lime. Excessive application of gypsum on sandy soil is also known to trigger Mg deficiencies due to excess leaching of Mg.

Sulphur (S): Sulphur is necessary for several biochemical processes in the plant. Deficiency is mostly associated with sandy, low organic matter and free-draining soils. Gypsum is frequently used to alleviate deficiency.

Silicon (Si): Adequate Si has been associated with increased yield, reduced lodging, reduced pest and disease infestation e.g. eldana, while affording the crop greater drought tolerance. In well-weathered and sandy soils it can be difficult to elevate Si levels, though research evidence indicates even small increases will impart benefit to the crop. Ensuring a healthy root system is necessary to improve uptake.

Zinc (Zn)*: Zn is essential for several enzyme reactions in the plant and of the micronutrients, Zn is most frequently deficient. Where deficiency is detected, apply a Zn containing fertiliser or $ZnSO_4$ in the furrow. Foliar sprays can also be used in some situations.

Copper (Cu)*: Cu is important for many enzyme reactions in plants. Deficiency is not commonly reported. Some soil parent materials are Cu-deficient leading to low levels in the soil, while high pH and high organic matter levels can lead to deficiency. Where deficiency is detected, apply $CuSO_4$ in the furrow. Foliar sprays have also been found to effectively remedy Cu deficiency (though seems rarely used).

Manganese (Mn)*: It is vital to plant enzymes, but in excess can cause Fe deficiency and can become toxic. Mn is more readily available at low pH and under waterlogged soil conditions where toxicity can become more common. When Mn is toxic due to acidity, correct pH with lime or, if due to waterlogged soils, improve soil aeration and drainage. Where deficiency is found, apply manganese sulphate ($MnSO_4$) in the furrow at planting, though foliar sprays are reported to be more effective.

Iron (Fe)*: Fe is a key component of chlorophyll, so deficiency symptoms manifest as chlorosis (pale yellow/white leaves on young cane) and yield depression. It is often associated with early growth on alkaline soils. It is effectively corrected with a ferrous sulphate ($FeSO_4$) foliar application, but in most cases the crop will outgrow early symptoms. Soil treatment is seldom beneficial, except at very high Fe application rates.

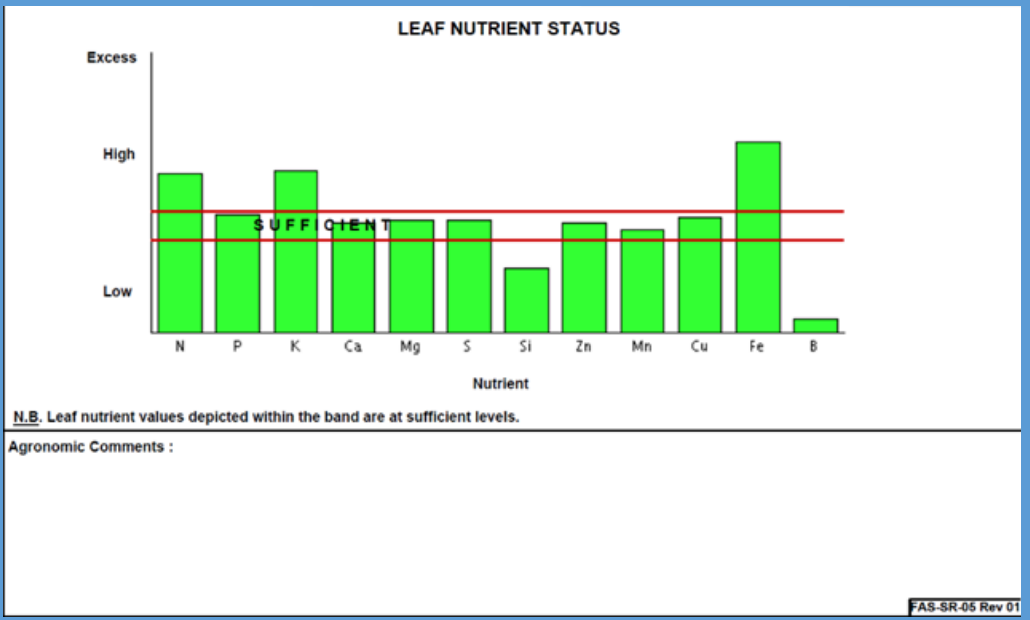
Boron (B)*: Boron is needed in cell division. While deficiency is not common, it is more likely on sandy and low organic matter soils. Apply a soluble B fertiliser to the furrow is usually sufficient to remedy. In established crops topdressing or foliar sprays can be used. Due to B becoming readily-toxic, it is wiser to apply it conservatively and reapply if more is needed.

*SPECIAL NOTE

on micronutrients

As calibration between soil micronutrients levels and crop response tend to be poor, it is advisable to undertake leaf sampling where soil test values indicate a deficiency or if the crop presents deficiency symptoms.

Leaf nutrient status & agronomic comments



This section provides a graphical scaling of the nutrients to show which fall within the sufficiency range (in between the red parallel lines). Values below the bottom line indicate deficiency and values above the upper line indicate high and excess values (compare results to thresholds supplied in the main results table). Take note where the sample lies with respect to the sufficiency boundaries. Those that are near the Low or High boundaries should receive closer attention for future management. Depending on the sample details and results, various comments will be provided in the Agronomic Comments box.

Additional notes

Diagnosis and Integrated Recommendation System for leaf analysis (DRIS): Using leaf nutrient ratios to assess optimal uptake.

Sometimes test values are within sufficiency ranges yet the crop still presents sub-optimal performance. This may be due to imbalances within the crop caused by excessive or deficient uptake of one nutrient relative to another. In these instances, there's value in considering nutrient ratios in the plant. The DRIS norms represent nutrient ratios found in healthy crops. While these are not definitive due to the tremendous variation that can occur from crop to crop, across seasons, varieties and even management regimes, this does provide some guidance where critical value comparisons do not suggest concern. They may also be useful where leaves were sampled outside of the recommended sampling periods. The following are the typical ranges for commonly reported ratios for sugarcane in South Africa*.

Ratio	Typical value	Ratio	Typical value
N/P	8.5	**Mg/N**	0.12
N/K	1.7	**Mg/P**	0.96
K/P	5.3	**Mg/K**	0.19
N/S	17	**Zn/N**	13
Ca/N	0.15	**Zn/P**	108
Ca/P	1.21	**Zn/K**	22
Ca/K	0.27	**Zn/Ca**	91
Ca/Mg	1.16	**Zn/Mg**	94

* *To calculate the ratio divide the values given for the element on the left by the element on the right using the units given in the FAS report (i.e. do not convert to the same scale).*

Useful conversions for FAS data

Sometimes end-users of the FAS results may wish to convert the units to other forms to allow for comparisons to other records or to suit specific requirements. The following approximate conversions are useful for some of these situations.

To convert	To	Conversion
% (equivalent of g/100g)	ppm (equivalent to mg/kg)	Multiply by 10 000
% (equivalent of g/100g)	g/kg	Multiply by 10
ppm (equivalent to mg/kg)	% (equivalent of g/100g)	Divide by 10 000
ppm (equivalent to mg/kg)	g/kg	Divide by 1 000