Understanding the

FAS report

WATER QUALITY

FAS Agricultural Laboratory

Introduction

Irrigation water quality must be monitored to ensure suitability of the water for irrigation for different soil properties. Excess salt can lead to serious soil and crop health problems and is costly to remedy. The FAS Agricultural Laboratory undertakes routine irrigation water quality analysis focusing on determination of excess salt and the suitability of the water source for irrigation. In addition, some growers may use this water for agrochemical mixing. Using good quality water is important to optimise the efficacy of chemicals.

For details on irrigation water quality for soil health, see SASRI Information sheets:

- **5.12 Water quality for soil health,**
- **5.11 Properties of saline/sodic soils and their reclamation.**

For guidance on filling the submission form, see FAS booklet:

- **How to fill the soil salinity and water sample submission form.**

For detail on agrochemical mixing, see SASRI Information Sheet:

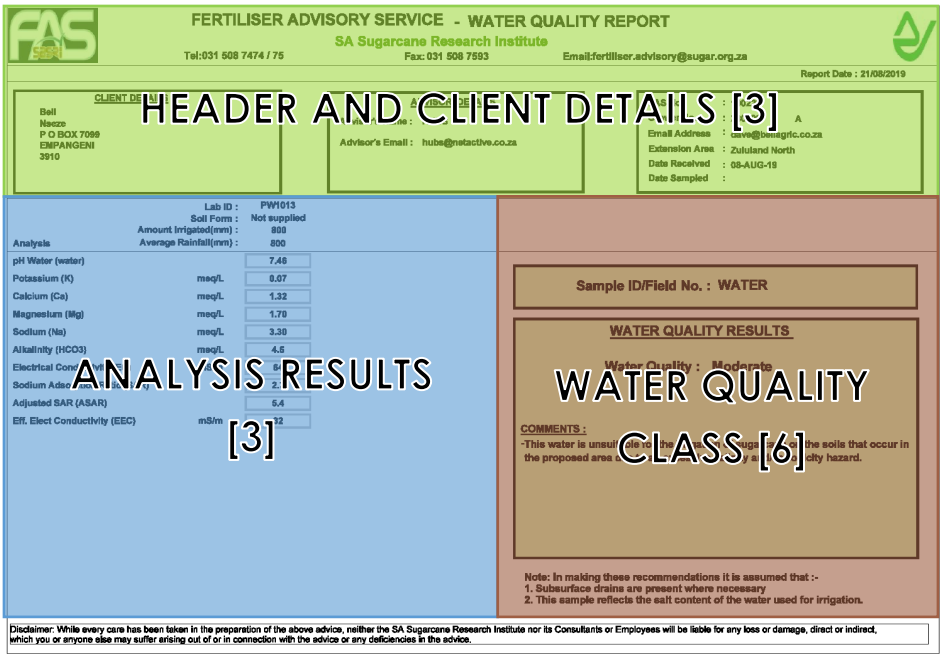
- **10.5 Water quality for herbicides.**

These are available from the Knowledge Hub at www.sasri.org.za

Water quality report contents

This booklet provides guidance on interpreting the water quality report for irrigation purposes and interpreting the results for use in agrochemical mixing applications.

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



Header and client details

FERTILISER ADVISORY SERVICE - WATER QUALITY REPORT

SA Sugarcane Research Institute

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

Report Date : 15/11/2019

CLIENT DETAILS

Client name
Postal address
where invoice
and results
can be mailed

ADVISOR DETAILS

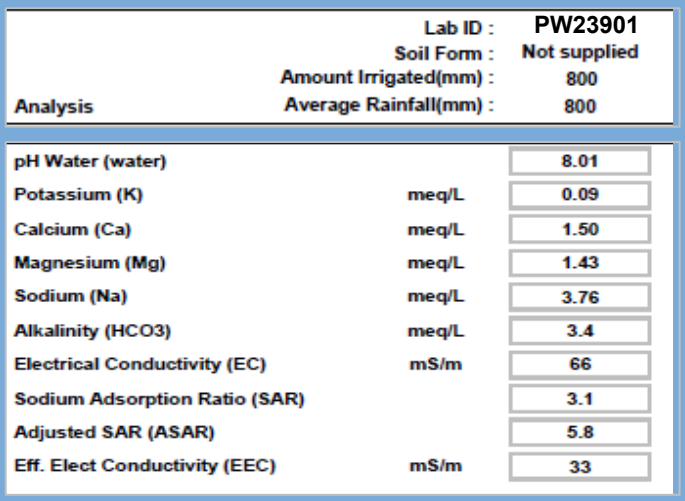
Advisor's Name : Advisor name

Advisor's Email : Advisor contact details

FAS No.	: Unique FAS client number assigned
Grower No.	: Mill region grower No.
Email Address	: Client email address
Extension Area	: Client extension region/area
Date Received	: 11-NOV-19
Date Sampled	: Date sample was taken

These boxes reflect the information provided by the client on the submission form when submitting a water sample for analysis.

Analysis results



Analysis		Lab ID : PW23901
		Soil Form : Not supplied
		Amount Irrigated(mm) : 800
		Average Rainfall(mm) : 800
pH Water (water)		8.01
Potassium (K)	meq/L	0.09
Calcium (Ca)	meq/L	1.50
Magnesium (Mg)	meq/L	1.43
Sodium (Na)	meq/L	3.76
Alkalinity (HCO3)	meq/L	3.4
Electrical Conductivity (EC)	mS/m	66
Sodium Adsorption Ratio (SAR)		3.1
Adjusted SAR (ASAR)		5.8
Eff. Elect Conductivity (EEC)	mS/m	33

Provides the FAS Lab ID assigned to the sample (a unique number from FAS prefixed with "PW") and the information provided by the client on the submission form (rainfall and irrigation amounts).

pH: This is an indicator of the acidity or alkalinity of the water sample. Ideal pH values range between 5 – 7.5. Low pH (< 5) water can lead to equipment corrosion and acidify soils, while alkaline water (pH > 7.5) is linked to saline and/or sodic conditions and can cause scale build-up in irrigation systems.

K, Ca, Mg and Na: Collectively these minerals make up the **dissolved base cations** in the water sample. The concentration of Ca, Mg and Na in the water is used to determine the sodium adsorption ratio (SAR) (see **SAR**). Typically under high pH (>7.5) excess salts can lead to precipitation and scaling in irrigation pipes and blockages of nozzles and emitters. The unit meq/L (milliequivelant per litre) is the same as millimol charge per litre (mmolc/L).

Alkalinity (HCO_3): A measure of the excessive alkalinity present. This value is used to adjust the SAR value (see **ASAR**) for the impact of the excess bicarbonate in solution. It is also called the residual alkalinity or bicarbonate risk.

Electrical conductivity (EC): An indicator of the amount of total dissolved salts in the water. Continuous use of water with a high EC can lead to the accumulation of salts in the soil and result in a saline soil.

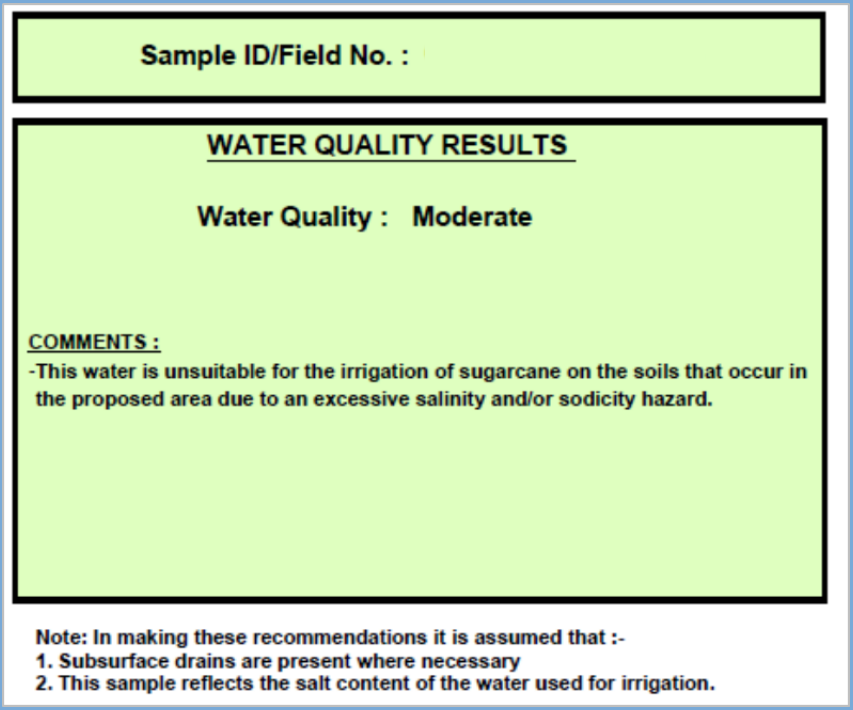
Sodium Adsorption Ratio (SAR): An indicator of the potential negative effects of Na in the water. Water with a SAR that exceeds the advised threshold can lead to the development of a sodic soil.

Effective Electrical Conductivity (EEC): This is an adjusted value that considers that the crop will receive water from rain and irrigation, where the rainfall is assumed to have a diluting effect on the overall salt concentration. This is calculated as:

$$EEC = \left(\frac{\text{Irrigation amount}}{\text{Irrigation + rainfall amount}} \right)$$

Adjusted Sodium Adsorption Ratio (ASAR): In alkaline waters, carbonates and bicarbonates effectively increase the ratio of Na to Ca + Mg (i.e. increases SAR). To account for the effect, an Adjusted SAR (ASAR) is determined in alkaline samples.

Water quality class



Sample ID/Field No. :

WATER QUALITY RESULTS

Water Quality : Moderate

COMMENTS :

-This water is unsuitable for the irrigation of sugarcane on the soils that occur in the proposed area due to an excessive salinity and/or sodicity hazard.

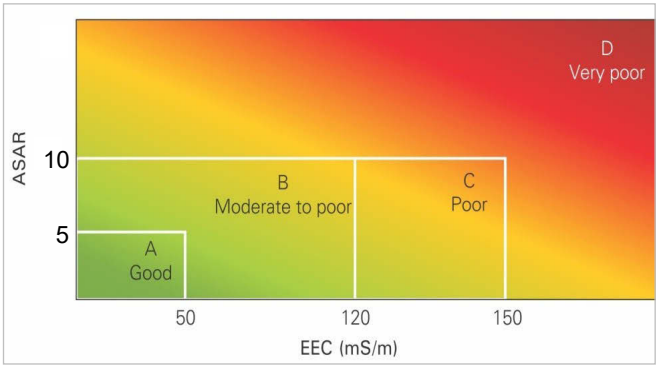
Note: In making these recommendations it is assumed that :-
1. Subsurface drains are present where necessary
2. This sample reflects the salt content of the water used for irrigation.

The water quality results are displayed in two boxes. The upper box indicates your own sample identification from where the sample was collected. This is relevant for your own records.

The lower box indicates the water quality class and provides comments on the suitability of the water for irrigation purposes.

Important notes

The water classes are derived from the **EEC** and **ASAR** values according to the diagram on the right.



Good water quality: Class A

Suitable for use on all irrigated soils. Samples in this region indicate low risk except in very dispersive clay soils (typically black clay soils that show cracking when dry).

Moderate to poor water quality: Class B

Suitable for irrigation on moderate to well-drained soils. These samples indicate increasing risk to all dispersive and poorly drained soils (and drainage is advised).

Poor water quality: Class C

Poor quality water which can only be used on very well drained soils. These samples are very high risk to soil quality and the water should not be used for irrigation purposes without treatment.

Very poor water quality: Class D

Unsuitable for irrigation of sugarcane under normal irrigation practice. Use of this water is not advised.

- When a water sample is classified, it is assigned to one of the water quality classes based on discrete categories (diagram on page 6). However, this can lead to confusion as to the suitability of the water for irrigation under different conditions, especially where samples lie near category borders. To better guide the suitability and risk associated with using the water, evaluate where the sample lies relative to the colour gradients shown in the diagram on page 6. Descriptions of the classes are also on page 6.
- It is assumed drainage is installed where required and that the sample is representative of the water quality to be used for irrigation purposes.

Calculating salt loading for a given water quality & irrigation volume

Even where good quality water is applied, a build-up of salts in the soil can occur, particularly where there is poor drainage. It is thus useful to estimate the amount of salt being applied for a given salt content and amount of irrigation. The following provides a guide on how to convert the soluble salt determined from the water analysis to a mass basis per given amount of irrigation applied.

Parameter (meq/L) from salinity report	To convert to mg/L multiply by	To convert to kg/L divide by	To convert to kg/ m^2 multiply by irrigation amount	To convert to kg/ha multiply by
K	39.1	1 000 000	Irrigation (mm)	10 000
Ca	20.04			
Mg	12.15			
Na	22.99			

Example with 800mm irrigation:

Parameter	Amount in report (meq/L)	kg/ha
K	0.09	28.15
Ca	1.5	240.48
Mg	1.46	141.91
Na	3.76	691.54

Irrigation water & agrochemical mixing

Often, growers use irrigation water as a mixing solution for agrochemicals such as herbicides and pesticides, and even fertigation. While routine irrigation water quality analysis is aimed at assessing risk for salinity and sodicity, there are several parameters that have relevance to chemical mixing. Some simple conversions will allow the grower to assess the suitability of the water for use in chemical mixing. The following guidelines should be considered, along with the specific product requirements given on product labels **Always read the product label before mixing and applying**.

pH: Different products require different pH values to ensure optimal efficacy of the agrochemical. A pH buffer may be required. Check the product label for any specific requirements.

Dissolved salts: Excess amounts of dissolved K, Ca, Mg and Na can interfere or precipitate with added chemicals. Typically if dissolved cations are > 150 mg/L (or ppm) then this can interfere with product performance and a salt buffer may be required. Consult your product label for specific requirements.

To convert meq/L (as given in the report) to mg/L (or ppm) the following conversion can be used:

Element in meq/L	Element in mg/L (or ppm)
Potassium (K)	Multiply by 39.1
Calcium (Ca)	Multiply by 20.04
Magnesium (Mg)	Multiply by 12.15
Sodium (Na)	Multiply by 22.99

To determine the total amount of dissolved cation salt, add the mg/L value for Ca, Mg, Na and K together. If only specific cations need to be used, then only add the relevant ions. Consult the product label for product requirements.

Some herbicides that are sensitive to excess salt include several glyphosate formulations and halosulfuron. High grade ammonium sulphate products are recommended by some herbicide labels to mitigate high cation content. Consult the product label for specific levels and follow the recommendations given.

Alkalinity (HCO_3): This estimates water hardness. Excess alkalinity may negatively affect chemical performance. Check the product label for threshold levels and whether correction is required for high alkalinity in the water.

EC: A high EC (electrical conductivity) reflects a high amount of dissolved salt in the water. Some products have reduced efficacy where the EC is high, though this is usually linked to specific ions in solution (e.g. Ca or Mg). Check product label for specific precautions.

SPECIAL NOTE

Where water is visibly dirty and contains suspended particles, it is not suitable for use in spraying equipment as this can lead to nozzle blockages and reduced chemical efficacy. Water should be filtered before use.