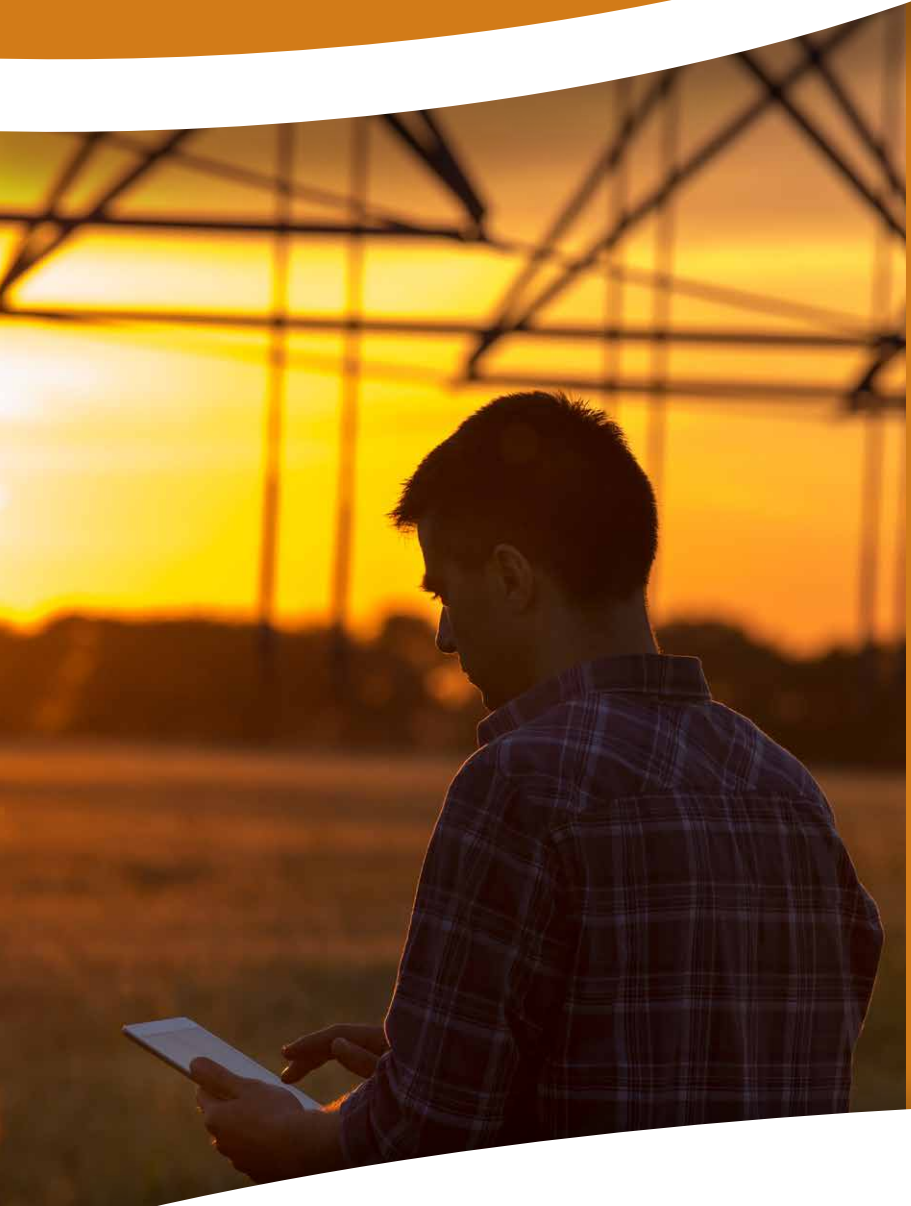
Published by the South African Sugarcane Research Institute

THE LINK

May
2021
Volume 30. Number 2

In this issue...



Managing erosion
Growers are encouraged to view the guidelines and practices listed to minimise erosion risk and promote soil health ***(page 4).***

Soil Crusting
Heavy rain or irrigation striking an unprotected soil surface can cause crusting, which inhibits water infiltration and seed emergence. Guidelines for manging crusting are provided on ***page 14.***

Grondtipe en besproeiingstelsels
Grondklassifikasie en die bepaling van grondeienskappe is belangrik vir die besproeiingsontwerp stadium en is 'n noodsaaklike inset vir besproeiingstelsels. Die tabel op ***bladsy 20*** gee 'n lys van die tekortkomings van verskillende grondeienskappe vir verskillende besproeiingstelsels.

SASRI
SOUTH AFRICAN SUGARCANE RESEARCH INSTITUTE
Unlocking the potential of sugarcane

Guidelines for selecting an irrigation system

Irrigation system selection is dependent on a number of factors, including cost, water availability and energy supply. The article on ***page 10*** provides guidelines for selecting an appropriate irrigation system based on a number of capital and operating cost factors.

NEW DIRECTOR FOR SASRI

Dr Terence Stanger
(SASRI Director)

SASRI is pleased to welcome Dr Terence Stanger (Terry) to the position of Director.

Terry takes over the reins from Dr Carolyn Baker, who retired in March this year after a 12-year stint at the helm.

Terry is originally from KwaZulu-Natal, having attended school in Port Shepstone before completing his undergraduate studies at UKZN, Pietermaritzburg. He holds a BSc in Agriculture, with majors in Plant Breeding and Genetics, and an MSc (cum laude) in Agriculture. Terry completed his PhD in Forestry at North Carolina State University, USA in 2003.

His career started at the then Department of Agriculture, working as a Maize Breeder. From 1989, Terry spent four years at the Institute for Commercial Forestry Research (ICFR) in Pietermaritzburg where he was promoted to Programme Manager: Tree Improvement. Terry was thereafter recruited by Sappi Southern Africa and held several positions over many years. In 2008, he evolved from pure research roles to more managerial roles, starting as General Manager: Forestry Projects, promoted to General Manager: Forestry in 2012. In 2014 he was promoted to Managing Director: Sappi Forests. In 2017 he was appointed as Vice President: Forestry where he was responsible for all Sappi Forestry Operations in South Africa.

Terry has held directorships in several organisations such as NTE Company Limited, Usutu Forest Products Company Limited, Sappi Southern Africa and Forest First Colombia.

He joins SASRI with extensive leadership, agricultural research experience and in-depth commercial knowledge – attributes that will surely benefit SASRI greatly.

Dr Carolyn BAKER

SASRI would like to thank Carolyn for her years of dedicated leadership and support at the SASRI helm.

Carolyn joined SASRI in 2001 as Knowledge Manager, developed the role of Business Manager before taking on the role of Director in 2009.

We are truly grateful for Carolyn's leadership, knowledge, vision and wisdom over some very challenging years. Her innumerable selfless contributions to SASRI will forever be remembered.

Thank you, Carolyn. You will be sorely missed. We wish you well in your retirement.

If you lose it, you can't use it!

Soil loss and erosion

Dr Louis Titshall *(Senior Soil Scientist)*, **Dr Rian van Antwerpen** *(Senior Soil Scientist)* and **Rowan Stranack** *(Extension and Biorisk Manager)*

Soil is a primary, non-renewable resource that is critical to field crop production, yet many growers do not pay enough attention to conserving the very foundation of their farming system. Soil loss is one of the most severe forms of soil degradation encountered in agricultural systems. It is the ***permanent loss*** *of the productive topsoil layers, most commonly due to excess water runoff removing soil from fields and depositing it elsewhere (invariably where it is not wanted) through a process called* ***erosion.***

Most of the time, erosion leads to the loss of a few millimetres (mm) of the nutrient-rich topsoil leaving small rills in the exposed fields, with run-off water that may be slightly muddy. The loss of one or two millimetres of soil is not readily observed in fields; this so often gets ignored and can easily be "ploughed away". However, consider that a loss of one millimeter of soil over one hectare is the equivalent of between 10 and 14 tons of soil. Some have estimated that this is a loss of about 20 kg sucrose per hectare and comes with increased fertiliser and site preparation bills. When soil loss becomes noticeable, it indicates that more than 150 tons per hectare (about 15 to 20 mm of topsoil) have been lost. Furthermore, erosion also causes damage to roads which restricts field access, while sedimentation of dams and rivers can lower the water holding capacity and water quality of these water sources.

The South African Conservation of Agricultural Resources Act (No 43 of 1983) requires that agricultural land users undertake measures that protect and conserve natural resources, including the soil, with a strong emphasis on preventing erosion and soil loss. A key step in this process is understanding where it all starts.

Types of erosion

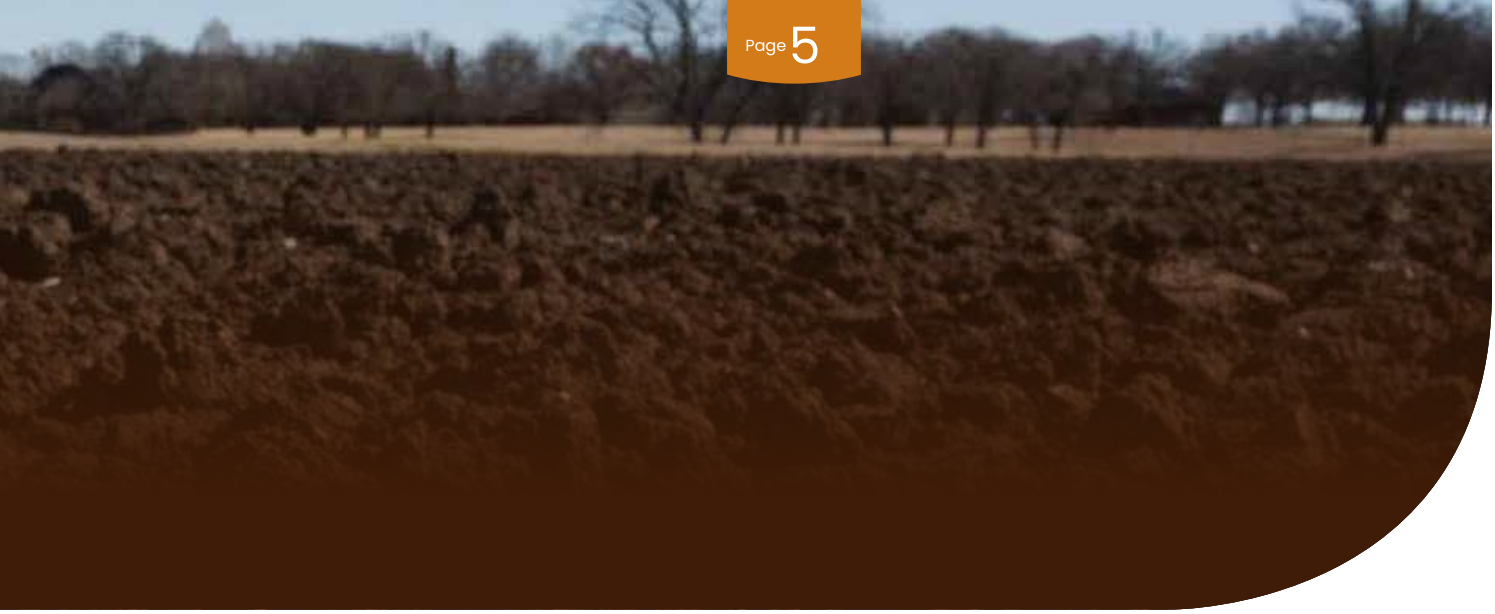
Several types of erosion can occur, however, the most common to the South African sugar industry is water erosion. Water erosion is the effect that rain or irrigation water drop impact and water flow have on soil particles:

- **Splash erosion** is the first stage when water drops hit a bare soil surface and detach soil particles that are displaced, thus sealing the surface and forming a crust which promotes run-off. For a more detailed understanding of crusting, see the article on Page 14.

- **Sheet erosion** is when the dislodged soil particles begin to move with the surface water flows, thus removing thin layers of surface soil over multiple events. In many cases, it is not very noticeable but slowly robs you of fertile topsoil. In more extreme cases, entire sheets of topsoil can be removed, exposing the less fertile layers below.

- **Rill and inter-rill erosion** occur as small channels (most often seen on bare soils exposed to higher intensity rainfall) that scour away the topsoil. They can concentrate water flow, further increasing the damage caused. While these are easy to "plough away", they are a clear indication of soil loss from fields.

- **Gully erosion** is when the rills develop into deep, wide-open channels in the landscape "(dongas)". While the area they affect tends to be small, they can greatly hinder access to fields and can result in large amounts of sediment being washed into waterways. These are costly to repair.



Of the types of erosion mentioned, the first three are perhaps the most insidious forms of erosion leading to the loss of vast amounts of nutrient-rich surface soils. Despite the strong visual impact of "dongas" in a landscape, gully erosion constitutes only about 4% of the surface area affected by sheet erosion. Typically, gullies are not present in worked fields due to regular site preparation practices that stop them from developing fully. However, splash, sheet and rill erosion are an ever-present threat and will rob you of large amounts of topsoil if suitable mitigation practices are not put in place.

What causes erosion?

Erosion is a natural process and is responsible for much of the landscape as we see it today, although this happened over several thousands of years.

Natural factors affecting erosion are: slope steepness and length, soil texture and structure, water permeability and content, as well as the prevailing climatic conditions. In general, steeper longer slopes, with fine sand and silty textures or poor aggregation are more susceptible to erosion. Shallow or saturated soils are also more likely to experience run-off.

Perhaps one of the biggest causes of erosion is high-intensity rainfall events (big storm events) that, when combined with other higher risk factors, can lead to severe soil loss.

Intensive agricultural practices have, however, caused an excessive and rapid rise in erosion rates. Poorly designed and installed water flow control structures are a major contributing factor as they allow excessive and uncontrolled water flow through a farm. Proper contour layout and terraces design, also control water flows to prevent unnecessary soil loss.

Excessive tillage is linked to the loss of organic matter and breakdown of soil structure making the soil more prone to erosive losses. Where these soils are left bare and exposed, particularly on steep slopes, this greatly increases the risk of soil loss in the event of large storms. Poorly draining soils (compacted, crusted) are also more prone to erosion.

Seeing is believing – how to spot soil loss

While some extreme forms of erosion are observable and unmistakable, many other visual indicators will point to the risk or occurrence of soil loss taking place. Some obvious signs include bare and crusted soil (indicating high risk of erosion), exposed roots and stones, the presence of soil pillars or thin, gravelly surface layers and rills in fields, cloudy and muddy run-off water from fields and waterways, build-up of sediments behind objects such as cane stalks or leaves, as well as in dams and waterways.

Cloudy and muddy water running from fields is a strong indication that soil loss is taking place where, the muddier the water, the more soil is being removed.

Stop it before it starts!

Farm and field layouts are an essential step in managing excess water flows and every farm should have a proper Land Use Plan developed to help design these structures and flows.

More general practices to adopt include the following:

- Do not plant areas unsuitable for cultivation (notably steep slopes, shallow soils and wetlands).
- Ensure proper design and maintenance of water control structures and roads (both off and in the field) and row alignment to follow contours on slopes.
- Minimise infield traffic and soil disturbance – adopt controlled traffic and minimum tillage practices.
- Remediate conditions that promote run-off (crusting, compaction, sodicity, poor drainage).
- Keep the soil covered:
  - Adopt green manure fallows.
  - Reduce time soil is bare and exposed.
  - Green cane harvest and mulch (or where burning, retain tops and scatter).
  - Use strip-planting and harvesting, especially on slopes.
  - Keep unplanted areas vegetated with suitable ground cover.
  - Promote good soil health as this improves the root health of any live cover.
- Use weather forecasting tools to avoid undertaking major soil preparation operations coinciding with high rainfall events.
- Apply organic amendments where possible to promote the build-up of soil levels, improve soil structure and stability as well as overall health.
- Do not over irrigate to avoid run-off.
- Inspect and monitor continuously for signs of erosion and act immediately if detected.

Numerous resources are available to guide the layout and design of fields, roads and other water flow structures, as well as guidance on practices that minimise risk and promote soil health.

Consult your regional Extension Specialist for specific guidance or visit the SASRI eLibrary for downloadable content. Useful guidance on implementing conservation practices is also available in the SUSFARMS® guidance material - visit https://sasri.org.za/susfarms

Topical Tips

Rowan Stranack *(Extension and Biorisk Manager)*

Harvesting mature, fresh and clean cane

Favourable weather conditions this summer will allow for an abundance of crop this season. With the challenges of restricted milling capacity on the coast and Midlands, the principles of harvesting a crop that is **Mature, Fresh** and **Clean** are important this year. Adhering to these rules will not only help maximise RV yields and profitability, but will also help mills operate with minimum delays caused by poor quality cane.

In the rainfed areas, mature cane is not necessarily always the oldest cane on your farm. A check of the 'brix gradient' down the stalk using a refractometer and the Pur*Est*© app will not only indicate the relative maturity of various fields, but will also help decide on the optimum topping height.

In the irrigated areas, the early season ripener programmes will be well under way. The refractometer readings and the Pur*Est*© App will determine suitability for ripening. One needs to ensure that there are more than seven healthy green leaves at the time of spraying ripeners. Ripening cane with less than four green leaves will result in ineffective ripening and even result in early cane deterioration. Use ethephon only on cane with whole stalk juice purity below 75% and Fusilade Forte (or generic products) on cane with whole stalk juice purity below 85% and with a low purity gradient. Ripening cane with juice purity above 75% with ethephon can lead to an inverse reaction, resulting in reduced RV% and will make the cane more susceptible to eldana. Keep to the recommended "spray to harvest" period for the best effect and maintain enough soil moisture on ripened cane to sustain photosynthesis and do not dry off ripened cane excessively.

Clean cane means consignments with very little extraneous matter (dead leaves, roots and tops). There is a lot of focus on topping height lately, but the principles have always been the same. Deliver only that part of the stalk which contains sucrose. A well-topped stalk should show no sign of leaf rings – only a clean cut through the stalk at a point just above the internode where sweetness is detected. In a burnt field, this is in the 'coffee-coloured' part of the stalk.

To get fresh cane to the mill, it is advised that one should keep burn-harvest-to-crush-delays limited to minimise loss of RV-yield due to sucrose degradation and stalk desiccation. This is paramount during hot and humid conditions. There is no financial gain in postponing delivery after burn and harvest (as some believe); cane starts to deteriorate as soon as it is burnt. Cane left for a long time before delivery can cause problems with processing at the mill, slowing down the system for all growers and impacting negatively on the progress of the season.

Your CTS printout provides a wealth of important information about the condition of the crop. Consult your Extension Specialist for help in interpreting your weekly CTS report.

Crop nutrition

Fertiliser prices could rise dramatically this year and availability might also be affected. Under such conditions, it makes good sense to confirm that no nutrients are wasted or applied excessively, by taking soil samples and sending them to FAS. Days of blanket applications of single blends are a thing of the past. When planning a fertiliser programme remember the Four Rights (SASRI Information Sheet 7.1)-
The **RIGHT TYPE** of fertiliser, the **RIGHT RATE** of application, the **RIGHT TIMING** of application and the **RIGHT PLACEMENT** of the nutrient source. The first two Rs are established by taking a soil sample and having it analysed by FAS. A SASRI Extension Specialist will be able to assist with timing and placement.

Whilst it is important to manage all nutrients, nitrogen, is the one nutrient requiring the most attention. Choose a realistic yield target on your sample submission for a start. For sandy soils or areas prone to waterlogging, split applications are advised. In irrigated regions with fertigation, multiple applications can be applied at intervals during the peak growth period. Leaching and volatilisation are additional risks to be managed. In rainfed regions, do not apply nitrogen in the cooler months when crop growth is limited.

Under average conditions, less than 60% of N applied makes it into the plant, and under marginal conditions even less. Thus, management of applied nitrogen is essential.

Nutrients will not be utilised by the crop effectively unless issues such as soil acidity and salinity/sodicity are addressed. This provides all the more reason to take soil samples!

Seedcane planning

The planning of your seedcane requirements is at least a two-year process depending on where your farm is situated in the industry. Certified Seedcane planted this year will be bulked into approved nurseries next season to be planted the following year into commercial fields. It is advised that one should have your own well-planned nursery system, to enable you to have full control over what varieties are planted on your farm and when the seedcane is available. Remember that, by 2023, all commercial fields must be planted with either Certified or Approved Seedcane. Speak to your Biosecurity Officer or Extension Specialist for guidance. Having fields planted with good disease-free seedcane of the correct variety is one of the quickest and easiest ways to ensure long ratoon life and increased profitability of your fields.
Autumn planting season in irrigated north: Autumn (March to May) is the most important planting season in the irrigated north to allow for full benefit from the early and mid-season harvest periods. Adjust planning to benefit from the autumn planting season and start planning seedcane requirements for the 2022 and 2023 autumn planting season. Plan fallow periods for autumn seedcane fields.

Fields for replanting must be tested for RSD before harvest. If found positive, fallow these fields for at least one year. Plant a low-growing green manure or cash crop during the fallow so that volunteers can be easily identified and removed. Fields tested positive for RSD may not be used as seedcane nurseries.

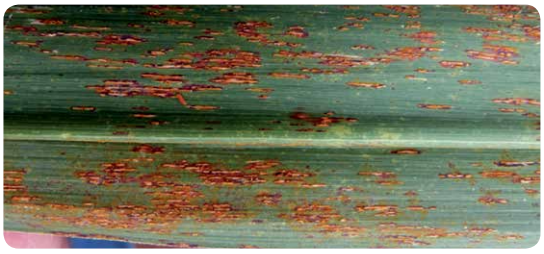
Cane killed using glyphosate in summer this year, in preparation for planting in winter or spring, should be carefully checked for regrowth. Unfortunately, glyphosate seldom gives a 100% kill, and you need to return at least twice to remove regrowth.

Eldana and carryover cane

With another season with a strong likelihood of additional carryover cane, an eldana spray programme is a necessity in those areas where the pest is a problem. Scout for Eldana – do not wait for the Biosecurity teams. Check young cane scheduled for harvesting next season to plan an effective spray programme. Completing the spray programme is also important. There is also a stool drench option in fields where heavy infestation was present at harvest. This will not necessarily provide long-lasting control of eldana. Follow-up scouting will determine the need for further treatments.

Tawny rust

Tawny rust could appear this autumn and winter. Be vigilant for symptoms of tawny rust, especially on susceptible varieties during autumn and apply fungicides early to ensure effective control.



Smut

Smut is now being noticed quite regularly in the rainfed regions on the KZN coastal belt and even in the Midlands on some intermediate susceptible varieties. Routine roguing of commercial fields is not common practice in the rainfed regions but with varieties such as N52, N54 and N59, this will be required if these productive varieties are to remain.

Yellow sugarcane aphid

There have been some serious outbreaks of yellow sugarcane aphid (YSA) recently, particularly in the Irrigated North. Whilst there now are products registered for the control of YSA on sugarcane, spraying cane when the damage is evident is generally too late and a waste of time and money. YSA is more prevalent on certain soils and on certain varieties. General scouting across the whole farm is essential. Take note of where outbreaks have occurred in the past and monitor these areas closely over the next few months. Spraying can then be timed and targeted when aphids are first observed to prevent a massive build-up of the pest.

Guidelines for selecting an irrigation system

Dr Ashiel Jumman *(Agricultural Engineer: Irrigation)*

Choosing an irrigation system is site and context specific. A system can only be considered appropriate when it is well matched to the landscape, topography, soils, cropping regime, agronomic practices, water sources, energy supply, finances, labour, knowledge and skills of the farmer/manager. For this reason, there is no best irrigation system (silver bullet), only better systems for different constraints and circumstances.

Traditionally, capital costs used to be the main factor that dictated system selection. Increasing water scarcity, and the rapid increase in electricity and labour costs, however, have strengthened the influence of the operating costs in irrigation systems selection. Operating costs over the lifespan of the system far outweigh the capital costs.

Table 1 below depicts factors and costs for different irrigation systems.

Table 1: Typical ballpark costs for the different irrigation systems (Dated: 2019)

Irrigation systems		Capital Cost Estimates (in-field equipment only) (R/ha x 10^3)	Operating Cost Factors				
			System efficiency (%)	Life expectancy (years)	Labour (ha/labour)	Annual maintenance costs (% of capital costs)	Pressure requirements at emitter (kPa)
Overhead sprinkler	Dragline	12 – 14	75	10	25	4	250 – 400
	Semi-permanent	11 – 15	83	12	25	2	250 – 400
	Permanent	25 – 27	90	15	50	1	250 – 400
	Centre Pivots	19 – 22	90	15	100+	5	150 – 300
	Linear Move	16 – 19	90	15	100+	6	150 – 300
	Travelling Big Guns	10 – 12	75	10	25	6	400 - 900
Drip	Surface Drip	12 – 24	95	2-10	30	2[a]	100 - 250
	Sub Surface Drip	21 – 26	98	10	25	3	100 - 250
Surface /Flood	Furrow	N/A[b]	86	10	15	5	0

Source: ARC Irrigation User's Manual.
Note: The estimated capital costs exclude the costs of the pump station, supply system, distribution system and installation of the equipment.
[a]Maintenance cost of thin walled drip pipe installed above ground surface is estimated to be 30% of the capital costs.
[b]N/A – no costs available

If water is limiting, and there is a greater imperative to use water more efficiently, the system efficiency column in Table 1 can be considered. A higher system efficiency indicates which system is adept at using water more effectively (higher efficiency = lower water losses).

If the cost of electricity is a concern, the pressure requirement at the emitter (last column) is an indication of energy requirements and the relative cost differences that can be expected across systems. A higher pressure requirement at the emitter indicates a higher energy requirement.

If labour is limiting, Table 1 indicates how the different systems compare in terms of labour requirements.

Finally, an irrigation system is an asset and the benefit of investing in high capital systems is dependent on the longevity of the irrigation systems. For this reason, monitoring, evaluation and preventative maintenance to maximise the lifespan of the irrigation system is very important. The respective lifespan and the required investment for maintenance, as shown in Table 1, must be duly considered when selecting a system.

For more information, see SASRI Information Sheet 5.8 which is dedicated solely to the topic of irrigation system selection (available at www.sasri.org.za). The content in the info sheet is largely based on information presented in the ARC Irrigation User's Manual (updated in 2019).

Pertinent information from both sources has been reproduced in this article and address a specific request made by the Research Development and Extension Workshop held in Malelane in March 2020.

Riglyne vir die keuse van besproeiingstelsels

Dr Ashiel Jumman *(Landbou-ingenieur: Besproeiing)*

Besproeiingstelsel keuses word beïnvloed deur spesifieke omgewingsfaktore asook die konteks waarbinne die besproeiingsontwikkeling moet plaasvind.

'n Besproeiingstelsel kan slegs as toepaslik beskou word indien dit goed aanpas by die landskap, topografie, grond, gewas regulerings praktyke, agronomiese praktyke, water bronne, energie voorsiening, arbeid, asook die kennis en vaardigheid van die boer en/of die plaasbestuurder. Dit is om hierdie rede dat daar nie so iets soos die ideale besproeiingstelsel bestaan nie, maar slegs beter stelsels vir verskillende beperkings en omstandighede.

Tabel 1 verskaf inligting oor 'n reeks faktore wat die verskillende besproeiingstelsels makliker kan vergelyk. Tradisioneel is kapitaalkoste die oorweldigende faktor wat die keuse van die stelsel voorgeskryf. Toenemende waterskaarste en die vinnige toename in elektrisiteit- en arbeidskoste het egter die invloed van die bedryfskoste in die seleksie van besproeiing stelsels versterk. Bedryfskoste oor die lewensduur van die stelsel weeg swaarder as die kapitaalkoste.

Tabel 1: Tipiese kostes vir verskillende besproeiing stelsels (gedateer: 2019).

Besproeiingstelsel		Kapitaalkoste beramings (slegs in-veld toerusting) (R / ha x 103)	Bedryfskoste faktore				
			Stelseldoeltreffendheid	Lewensverwagting (jare)	Arbeid (ha / arbeid)	Jaarlikse instandhoudingskoste (% van kapitaalkoste)	Drukvereistes van drupper (kPa)
Oorhoofse sproeier	Sleeplyn	12 – 14	75	10	25	4	250 – 400
	Semi-permanent	11 – 15	83	12	25	2	250 – 400
	Permanent	25 – 27	90	15	50	1	250 – 400
	Sentrale spilpunte	19 – 22	90	15	100+	5	150 – 300
	Lineêre skuif	16 – 19	90	15	100+	6	150 – 300
	Verskuifbare Spilpunte	10 – 12	75	10	25	6	400 - 900
Drup besproeiing	Oppervlak Drup	12 – 24	95	2-10	30	2[a]	100 - 250
	Ondergrondse drup	21 – 26	98	10	25	3	100 - 250
Oppervlakte / Vloed	Voor	N/A[b]	86	10	15	5	0

Bron: LNR Besproeiing verbruikers Handleiding.
Opmerking: die beraamde kapitaalkoste sluit die koste van die pompstasie, toevoerstelsel, verspreidingstelsel en installasie van die toerusting uit. Onderhoudskoste van dunwanddruppyp wat bo die grond geïnstalleer word, word beraam op 30% van die kapitaalkoste.
BTW - geen koste beskikbaar nie.

Indien water 'n beperkende faktor is, en as dit belangrik is om water doeltreffender te gebruik, kan die "stelseldoeltreffendheid" kolom in Tabel 1 oorweeg word. 'n Hoër stelseleffektiwiteit dui aan watter stelsel die beste is om water doeltreffender te gebruik (hoër effektiwiteit = minder/laer waterverliese).

As die koste van elektrisiteit 'n bekommernis is, is die drukvereiste by die drupper (laaste kolom), 'n aanduiding van die energiebehoeftes en die relatiewe kosteverskille wat oor stelsels verwag kan word. 'n Hoër drukvereiste by die drupper dui op 'n hoër energie behoefte.

Indien arbeid 'n beperking is, kan Tabel 1 aandui hoe die verskillende stelsels in terme van arbeid met mekaar vergelyk.

Laastens kan die besproeiingstelsel as 'n aanwins beskou word aangesien die voordeel van die belegging in hoëkapitaalstelsels afhanklik is van die besproeiingstelsels se langer lewensduur.

Om hierdie rede is monitering, evaluering en voorkomende instandhouding van die besproeiingstelsel baie belangrik om die lewensduur daarvan te verleng. Die lewensduur en die vereiste belegging vir instandhouding, soos getoon in Tabel 1, moet ook deeglik in ag geneem word wanneer 'n stelsel gekies word.

Vir meer inligting raadpleeg die SASRI informasie blad 5.8, wat meer inligting bevat oor besproeiing, raadpleeg.

Die inhoud van die informasie blad is meestal gebasseer op inligting wat in die LNR (Landbou Navorsings Raad) besproeiing inligitingstuk wat in 2019 opgegradeer is, verskyn.

Belangrike inligting uit beide bronne is in hierdie artikel weergegee en spreek 'n spesifieke versoek aan wat deur die Navorsingsontwikkelings- en voorligter werkswinkel in Maart 2020 in Malelane gehou is.

CRUSTING

The Skin Disease of Soils

Dr Rian van Antwerpen *(Senior Soil Scientist)* and **Dr Louis Titshall** *(Senior Soil Scientist)*

This article continues with the theme of soil erosion that was introduced on Page 4. Here, we focus on the development, effects and management of surface crusts.

In the eastern seaboard of Africa where rainfall is relatively high, erosion happens predominantly via an uncontrolled flow of water over unprotected soil due to lack of infiltration. One of the main obstacles reducing the rate of water infiltration into the soil is a thin, impermeable layer on the surface of the soil, known as a crust (like on your loaf of bread).

Why the focus on crusts?

One might wonder what the big deal is over such a thin layer of soil. However, these seemingly fragile thin layers have a disproportionately large impact on essential soil processes. A common feature of all crusts is that they greatly reduce the movement of water into the soil and the exchange of air in and out of the soil.

Other problems associated with crusts are that germination and sprouting can be inhibited and functioning of the roots become limited. Roots need water, nutrients and fresh air (oxygen) to function and if any one of these are restricted, roots will be limited.

Crusts will reduce water availability and air exchange leading to the build-up of unwanted, toxic gasses in the soil. Research has shown that crusting can reduce plant water availability by up to 42%, leading to stalk yield losses. The reduced infiltration rate of water is concerning because it enhances the risk of our biggest agricultural problems – soil erosion.

Most soils in the sugarcane industry are susceptible to crusting and therefore to erosion. Soils with less chance to develop crusts are high in clay (>45%) with a strong structure (often with shrink-swell properties), high in organic matter and free of dispersive agents (i.e. sodium salt). All other soils will develop crusts if left unprotected.

Problems associated with crusts:

- Reduced water infiltration.
- Enhanced runoff.
- Increased erosion risk.
- Reduced soil air exchange.
- Reduced functionality of roots.
- Reduced germination success.
- Reduced yield potential.

How are they formed?

Two main types of crusts found in soils, are mineral crusts and biological crusts.

Mineral crusts form due to the disintegration of soil structure via three mechanisms:

- The most common mechanism is the force by which water droplets from rain or irrigation hit unprotected soil. This causes the aggregates to break into individual soil particles which settle into surface pore spaces, sealing off the passages into the soil, creating a crust.
- Mineral crusts can also be formed by a chemical mechanism which disperses aggregates into their smallest particle sizes (clays and silts) which then settle into pore spaces. The most common cause for this is excess sodium which is often found in large quantities in sodic soils occurring mainly in irrigated regions.
- Slaking is the third mechanism and involves the explosive collapse of aggregates when immersed in water. The disintegrated single soil particles then block soil pores. This can happen when soil is suddenly flooded.

The mineral soil crusts formed by these processes are very dense and highly impermeable to water and air. These crusts are very thin ranging from less than 1 mm to about 5 mm. Sometimes multi-layered crusts are formed, increasing the thickness to 10 mm or more.

Biological soil crusts are formed by numerous types of organisms binding soil particles, i.e. bacteria, algae, fungi, lichens and moss-like plants that prefer moist habitats although they can survive in drier environments. Biological soil crusts are commonly found in all environments from the relatively water-rich east coast to the Kalahari Desert in the west. This type of crust is also commonly found in the damp shaded environment created by sugarcane.

Alleviation of crusts

Although crusts can prevent germination due to their physical strength, they are still weak compared to mechanical methods available to alleviate them. Surface crusts are normally thin (<10 mm) and do not require much force to disrupt and break them. In small, isolated locations, a simple garden fork will be effective. In a commercial setup, the easiest is to pull a rotary hoe over the soil to break the continuity of a crust. However, crusts form very easily on unprotected susceptible soils and will form again following the first rain or irrigation. Thus, alleviation should be followed by a crust management plan to eliminate or reduce the potential of reforming.

Prevention is better than cure!

Management of soils prone to crusting

The most effective strategy against crusting is to protect the vulnerable soil surface with a mulch or living plant cover. When farming with a high biomass crop such as sugarcane, there is no shortage of residue to be used as a mulch. Even when fields are burnt in preparation for harvesting, the amount of residue left under a dryland scenario should be sufficient to cover at least 70% of the surface. A thin layer of residue is all it takes to eliminate crusting. In a situation where no residue is available (the period following planting), ensure that water flow control structures are in place to keep the momentum of surface water slow. Examples of these include:

- Cane rows should follow the contour. On steep soils (slope > 10%), each cane row can be ridged to act as a mini water carrying structure.
- Install contour banks at intervals recommended by the Contour Spacing Design Tool (CoSDT) in consultation with your extension specialist. These contours should be accompanied by appropriately designed waterways.
- Consider strip cropping as a means of breaking the momentum of water on steep slopes.

Soils with poor aggregation will require soil structure building. The ingredients required for this are organic matter (i.e. mulch) and ameliorants such as gypsum, phosphogypsum and molasses meal. For a quick effect, these should be applied in a period with little chance of rain (to prevent erosion of a bare surface) and incorporated (mixed into the topsoil). The establishment of a quick-growing cover crop such as oats in winter and sorghum or sunn hemp in summer should be considered to assist with building soil structure and to keep the period that the soil is bare to a minimum.

If salinity-sodicity or sodicity is the reason for structure collapse, then gypsum and organic matter should be incorporated followed by the application of 100 mm water for every ton of gypsum that was applied to leach the sodium. Consult your extension specialist for more information about this procedure.

Although biological soil crusts will also reduce water infiltration, they are a strong anti-erosion agent. It is best to leave them undisturbed but to put measures in place to keep the velocity of runoff water low.

Remember:
*Once the **soil** has been **eroded** – it is **gone!***

Goedgekeurde Saadriet Produksie

Na 2023 mag geen lande aangeplant word met saadriet wat nie aan die minimum Industrie standaarde voldoen nie en wat nie deur LPD&VCC goedgekeur is nie.

KOMMERSIËLE SUIKERRIET
- Aanplantings met Goedgekeurde Saadriet.
- Slegs vir kommersiële gebruik.

GOEDGEKEURDE SAADRIET
- 9 maande braaklê periode waarvan 6 maande braak moet wees sonder riet.
- Braaklê gewasse: "geen bewerking" en laag groeiende breëblaar.
- 3, 6 & 9 maande braakland inspeksie deur P&D.
- Gebruik uitsluitlik gesertifiseerde saadriet vir aanplanting.
- Intensiewe lukraak siekte en opslagriet inspeksies deur P&D, ten minste 2 voor 6 maande ouderdom.
- RSD toets op 9 maande.
- Eldana opname voor oes.
- P&D goedkeuring na voldoening van die bogenoemde inspeksies.
- Uitsluitlik vir die vestiging van kommersiële lande.
- Slegs Plant en 1ste Ratoen is van toepassing.

GESERTIFISEERDE SAADRIET
- Gesertifiseerde saadbron gebruik vanaf 'n P&D geregistreerde kwekery.
- Warm water behandel.

WAAROM 'N GOEDGEKEURDE KWEKERY AANPLANT?

- Om siektevrye, variëteit suiwer plantmateriaal te verseker.
- Goedgekeurde plaas kwekerye het ten doel om gesertifiseerde saadriet te vermeerder tot voldoende hoeveelhede vir die aanplant van kommersiële lande.

NEEM KENNIS:

- Braaklande moet by P&D geregistreer word voor die aanvang van die 9 maande braaklê periode.
- Slegs laag groeiende breëblaar gewasse moet aangeplant word tydens die braak periode.
- Goedgekeurde saadriet is nie Gesertifiseerde Saadriet nie.
- Goedgekeurde saadriet kan slegs gebruik of verkoop word om kommersiële lande mee te vestig.
- Kommersiële lande kan nie as goedgekeurde saadriet gebruik/ verkoop word nie.

The role of **soil type** in the design of **irrigation systems**

Dr Ashiel Jumman *(Agricultural Engineer: Irrigation)*

The time and effort to investigate, classify and map the soil in terms of soil water holding capacity and infiltration rates must be completed at the irrigation design stage. Thereafter, standard irrigation design norms and principles are applicable. Qualified and/or SABI accredited designers are preferred. Any irrigation designer, irrespective of the type of system, should use the properties of the soil to guide irrigation design.

The available water holding capacity (mm/m) must be determined along with the soil depth at the outset. These factors are then used, along with the crop rooting depth, to determine the size of the soil reservoir available to hold water (Total Available Water (TAW)).

For irrigation design purposes, only a fraction of the TAW can be depleted. Generally, the Readily Available Water (RAW) is calculated as 50% of the TAW. The RAW represents the fraction of soil water reservoir which can be depleted by the crop and replenished by irrigation, without experiencing water stress. For this reason, the depth/volume of water applied per irrigation event (Gross Irrigation Requirement (GIR)) should be aligned to the RAW. Irrigation designers, therefore, must necessarily calculate the cycle length, stand times and GIR according to both crop demand (Net Irrigation Requirement (NIR)) and the RAW. In other words, the cycle length, stand time and target application depth must be designed to be able to meet the peak crop demand, while simultaneously not applying more water than what the soil can store. Over-design will result in water loss and unnecessary costs. Excess irrigation, beyond the storage capacity of the soil, however, can be considered when salinity is a concern and harmful salts must be periodically leached out of the root zone. In this instance, the soil must be free draining below the root zone.

The second soil-related aspect is Gross Application Rate (GAR, mm/h), the rate at which water is applied. After calculating the required sprinkler/emitter flow rate and selecting an appropriate sprinkler/emitter, the designer must check to ensure that the gross application rate is less than the soil infiltration rate (the rate at which the soil can absorb the water) to eliminate the risk of run-off.

The information in Table 1 below provides an account of limitations/constraints for the different irrigations systems in relation to selected soil properties.

The following colour bar is used to indicate the degree of limitation that might occur:

No limitation	Little limitation	Moderate limitation	Severe *(Requires further thorough investigation by an expert)*

Table 1: Possible soil limitations for different irrigation systems

Criteria	Furrow	Sprinkler		Drip	Big gun	Centre pivot
		Dragline/ Hop a long	Permanent			
Soil Texture						
> 20% clay						
10 - 20% clay						
< 5% clay						
Soil Depth						
< 600 mm deep						
600 - 1200 mm deep						
Initial infiltration rate of soil						
< 20 mm/h						
> 150 mm/h						

Source: SABI design norms and standards (www.sabi.co.za)

In conclusion, characterising the soil at the design stage is an essential input for irrigation systems. Soil texture and soil depth are necessary to calculate the water-holding characteristics of the soil, in addition, matching the soil infiltration rate to the system application rate is important to prevent runoff, soil erosion and/or ponding.

Die rol van **grondtipe** in die ontwerp van **besproeiingstelsels**

Dr Ashiel Jumman *(Landbouingenieur: Besproeiing)*

Wanneer 'n besproeiingsontwerp beplan word is dit wys om voor die beplanningsfase alreeds te begin met grond ondersoeke, gronde te klassifiseer en gronde te karteer in terme van grondwaterhouvermoë en om infiltrasiesnelhede. Hierna is standaardnorme en -beginsels vir besproeiingsontwerp eers van toepassing. Gekwalifiseerde en/of SABI-geakkrediteerde ontwerpers word aanbeveel. Enige besproeiingstelselontwerper, ongeag die tipe stelsel, moet die eienskappe van die grond gebruik om die besproeiingstelsel te ontwerp. Die beskikbare waterhouvermoë (mm/m) moet saam met die gronddiepte aan die begin van die proses bepaal word.Hierdie faktore word dan saam met die gewasworteldiepte gebruik om die grootte van die beskikbare grondreservoir om water in te hou, te bepaal (Totale Beskikbare Water).

Vir besproeiingsontwerpdoeleindes moet slegs 'n gedeelte van die totale beskikbare water gebruik word. As 'n algemene rëel word geredelik beskikbare water bereken as 50% van die totale beskikbare water. Totale geredelike beskikbare water verteenwoordig daardie gedeelte van die grondwaterreservoir wat deur die plant gebruik kan word sonder om waterstremming te ervaar. Om hierdie rede moet die diepte/volume water wat per besproeiing toegedien word (Totale Besproeiings-Behoefte), in lyn wees met die geredelik beskikbare water van die grond. Besproeiingsontwerpers moet dus die sikluslengte, staantye en totale besproeiingsbehoefte bereken deur die plant se verwagte water verbruik en die geredelik beskikbare water van die grond in ag te neem.

Met ander woorde, die sikluslengte, staantyd en teikentoedieningsdiepte moet so ontwerp wees dat dit aan die hoogste hoeveelheid water wat die gewas benodig voldoen, terwyl daar nie meer water toegedien word as wat die grond kan berg nie.

Oorontwerp sal waterverlies en onnodige koste tot gevolg hê. Oorbesproeiing, meer is as die opbergingsvermoë van die grond, kan egter oorweeg word as die soutgehalte kommerwekkend hoog is en skadelike soute periodiek uit die wortelsone geloog moet word.

In hierdie geval moet die grond onder die wortelsone vry kan dreineer.

Die tweede grondverwante aspek is die bruto toedieningshoeveelheid [BTD, mm/h]), die tempo waarteen water toegedien word. Na die berekening van die vereiste spreier/drupper vloeitempo en die keuse van 'n toepaslike spreier/drupper bepaal is, moet die ontwerper seker maak dat die bruto toedieningshoeveelheid minder is as die grondinfiltrasietempo (die tempo waarmee die grond die water kan absorbeer) om die risiko van afloop te elimineer.

Die inligting in Tabel 1 hieronder voorsien 'n uiteensetting van tekortkominge/beperkings vir die verskillende besproeiingstelsels met betrekking tot geselekteerde grondeienskappe.

Die verskillende kleure in die tabel hieronder word gebruik om die mate van tekortkomings wat kan voorkom, aan te dui:

Geen tekortkomings nie	Min tekortkomings	Matige tekortkomings	Ernstige tekortkomings *(Vereis deeglike ondersoek deur 'n kundige)*

Tabel 1: Moontlike grondbeperkings vir verskillende besproeiingstelsels.

Kriteria	Voor	Spreier		Drup	Kanon spuit	Sentrale spilpunt
		Sleeplyn/ Hop a Long	Permanent			
Gondtekstuur						
> 20% klei						
10 - 20% klei						
< 5% klei						
Gronddiepte						
< 600 mm diep						
600 - 1200 mm diep						
Aanvanklike infiltrasiesnelheid van grond						
< 20 mm/h						
> 150 mm/h						

Bron: SABI-ontwerp normes en standaarde (www.sabi.co.za)

Ten slotte is die karakterisering van die grond in die ontwerpfase 'n noodsaaklike inset vir besproeiingstelsels. Grondtekstuur en gronddiepte is nodig om die waterhou eienskappe van die grond te bereken. Daarbenewens is dit belangrik om die grondinfiltrasiesnelheid aan te pas na gelang van die toedieningshoeveelheid van die stelsel om afloop en gronderosie of staande waterpoele wat mag vorm, te voorkom.

Don't guess, use FAS!

Dr Louis Titshall *(Senior Soil Scientist)*, **Naven Naicker** *(Laboratory Manager)* and **Keith Collings** *(Resource Manager: Diagnostic and Analytical Resource Unit)*

Proper nutrient management is essential for optimal crop production, and fertilisers are a considerable investment cost in the sugarcane production system. Sugarcane fertiliser recommendations are based on a soil test. Choosing a laboratory to undertake your analysis can be a daunting task and you need certainty about the quality of the results you get from your service provider. The Fertiliser Advisory Service (FAS) at SASRI provides high-quality results and recommendations you can trust.

Appropriate recommendations

FAS recommendations are based on a strong foundation of research into optimising sugarcane nutrition and soil health, that has been conducted over many years. New knowledge gained is continuously introduced into FAS, keeping the service relevant and current. (See "*Updated leaf nutrient content thresholds*" box for an example of how FAS keeps abreast of current research and trends.)

Each recommendation takes a myriad of factors into account including the analysis of results and grower management practices. Site-specific adaptations can be done to further refine and optimise fertiliser use in conjunction with your regional Extension Specialist, SASRI Research Specialist or agronomist.

Test methods

Several years ago, FAS overhauled its test methods and workflows to align them with the vast range of soil samples sent from both sugar and non-sugar growing soils. This improved the recommendations for fertiliser and liming ameliorants and reduced turn-around times to the benefit of growers.

Comprehensive packages

The FAS routine soil fertility package provides one of the most comprehensive sets of analyses available to growers and includes pH($CaCl_2$); extractable Ca, Mg, K, Na, Cu, Fe, Mn, Zn, P, S and soil acidity; estimates of organic matter and clay, reserve-K, and several calculated parameters (nitrogen mineralisation category, N volatilisation risk, total cations, acid saturation, exchangeable sodium percentage, Ca:Mg ratio).

All these parameters are used to guide the appropriate type and rate of nutrient or ameliorant to improve sugarcane production. Some of these, like the N category, N volatilisation risk and reserve-K, are unique to FAS and are key in providing more robust and sustainable recommendations to growers.

FAS also provides routine subsoil analysis to provide recommendations for the amelioration of subsoil acidity problems, as well as routine soil salinity and sodicity testing and water quality analysis. Comprehensive leaf analysis for sugarcane and other crops are also provided. Fertiliser, composts and other ameliorations can also be tested for nutrient composition.

Confidence in your results

At FAS, we understand the implications of providing incorrect test values. Thus, multiple practices are used to minimise such errors:

- Considerable time and cost is spent on ensuring that equipment is maintained and working as expected.
- Laboratory staff receive regular competency training to ensure efficient and accurate testing.
- For every batch of samples processed, and for every test conducted, a known control test sample is included in the procedure (a "blind" test). This allows the laboratory manager to check the quality of the results for each batch of analyses conducted. Where the control samples are out-of-norm, the analysis process is stopped and the fault rectified. Thereafter, all samples are reprocessed and rechecked before being released.
- Screening of final data takes place to identify numbers that seem out of place based on the experience from samples from the same region and on well established relationships between soil properties.
- FAS subscribes to the national agricultural laboratory proficiency scheme (Agrilasa) for soil analysis and the international scheme for leaf analysis (Wepal). These schemes independently test the quality of results obtained from many laboratories.

Ease of access

FAS has a sample delivery network through the SASRI Extension Services covering all the sugarcane growing areas in South Africa. This allows samples to be dropped off with your Regional Extension Specialist or at designated drop-off points to be couriered to the FAS laboratory in Mount Edgecombe weekly. For dedicated drop-off points and collection times, visit the FAS website www.fasagrilab.org.za

Results are emailed back to the grower and Regional Extension Specialist timeously.

The FAS will continue to strive to give growers the best value while maintaining quality standards. To discuss your sample analysis needs or for further information, please contact FAS at Fertiliser.advisory@sugar.org.za

Updated leaf nutrient content thresholds

In interpreting laboratory analyses, the FAS uses a table of norms and thresholds to establish whether the level of a particular nutrient is low, sufficient, high or in excess.

Reviews of local and international research, along with practical experience, have indicated that adjustments to the leaf norms or thresholds were required to bring these in line with current understanding for optimal crop performance. Changes were made to the nutrient thresholds for potassium, calcium, magnesium, sulphur, silicon, zinc, copper and iron.

For a complete schedule of current threshold values, please see SASRI Information Sheet 7.15 *Sugarcane leaf sampling*, which also contains valuable guidelines for collecting samples and interpreting laboratory results.

WEATHER

Phillemon Sithole *(Agrometeorologist)*

Review

The industry received good rainfall during the 2020/21 summer rainfall season (October 2020 to March 2021) with an average of 112% of the industry's long term mean for the same period (Figure 1). In late January, tropical storm Eloise swept through Mpumalanga and northern parts of KwaZulu-Natal, resulting in heavy rainfall of up to 200 mm within two days in some of the affected areas. February was again very wet for the northern parts of the industry, with Mpumalanga recording 300 mm.

The heavy rainfall in January and February resulted in increased streamflow which drastically improved dam water levels (Figure 2) and will see adequate irrigation water supplies in the irrigated areas for the foreseeable future.

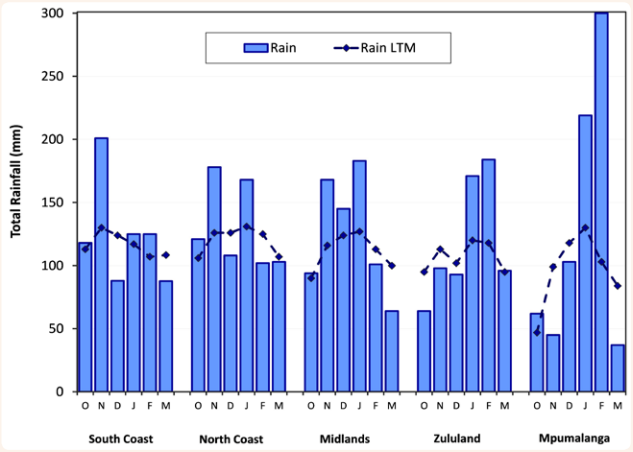


Figure 1: Regional average monthly total rainfall (Rain) for October 2020 to March 2021, compared to the monthly long-term mean (Rain LTM).

Outlook

The strong La Niña phase of El Niño-Southern Oscillation (ENSO) which lasted through most of the 2020/21 summer is now weakening and predictions are pointing to a neutral state by winter 2021. However, the state of ENSO has little impact on winter rainfall patterns in South Africa.

The South African Weather Service predicts above-normal rainfall in early winter and below-normal for late winter, while the International Research Institute for Climate and Society and the European Centre for Medium-Range Weather Forecasts both predict near-normal rainfall for most parts of the industry during winter this year.

Mostly normal- to above-normal minimum and maximum temperatures are predicted.

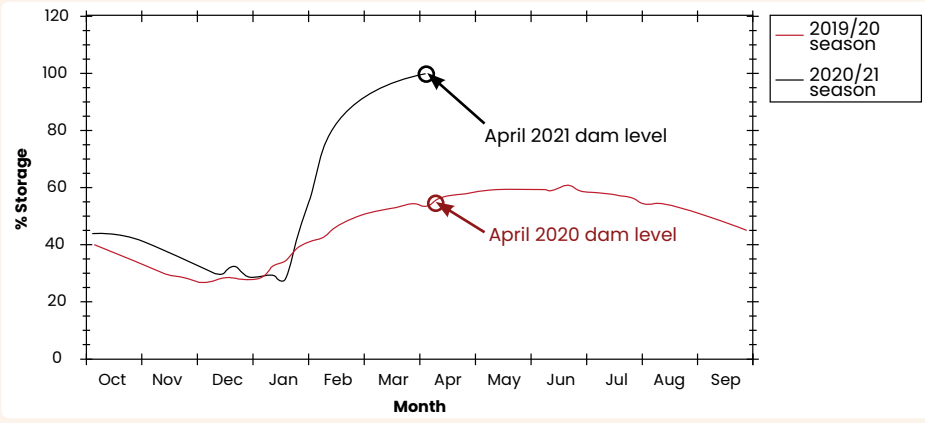


Figure 2: The Kwena Dam (Krokodil River, Mpumalanga) water levels (expressed as a percentage of storage capacity) for the 2019/20 and 2020/21 seasons, showing the dramatic rise in water levels this year (Source: Adapted from https://www.dws.gov.za/Hydrology/).

Please visit the SASRI WeatherWeb https://sasri.sasa.org.za/weatherweb for the latest industry weather reports and links to up-to-date seasonal climate forecasts.

Editorial Team: *Kalisha Naicker, Poovie Govender, Michelle Binedell, Sharon McFarlane, Rowan Stranack, Dr Sumita Ramgareeb, Dr Louis Titshall & Dr Deborah Sweby.*

Layout & Design: *Wayne Mthembu*
Publication Details: *Published four times a year, usually January, May, July & September*

Feedback & Enquiries:
Email: pubs@sugar.org.za
Website: www.sasri.org.za