Published by the South African Sugarcane Research Institute

THE LINK

July
2019
Volume 28. Number 3

Conventional lime *versus* Liming products

Liming is an extremely important practice known for its benefits in reducing acidity and aluminium toxicity in the soil. Conventional liming can be a costly exercise resulting in many growers looking for more convenient products. However, the majority of these products are incapable of achieving the same benefits as conventional liming. To get the best from your lime, one must consider some key aspects of how lime works in a soil ***(Page 4).***

In this issue...

SUSFARMS®

Version 4.0 of SUSFARMS® has just been released. Download the manual and the associated Progress Tracker from the SASRI website at www.sasri.org.za/susfarms *(page 8).*

Bats and eldana

The use of insect-feeding bats is an aspect of eldana IPM that is often overlooked. These animals feed on the eldana moths and can eat almost 73% of their body weight, assisting in reducing eldana numbers *(page 10).*

Green cane harvesting

Spreading of crop residues is the ideal way to improve water use efficiency in rainfed and irrigated regions. Read more on the advantages and disadvantages on *page 2.*

SASRI
SOUTH AFRICAN SUGARCANE RESEARCH INSTITUTE

Unlocking the potential of sugarcane

ADDITIONAL SOIL WATER WITH CROP RESIDUES

Rianto van Antwerpen (Senior Scientist) & Sandile Mthimkhulu (Assistant Research Officer)

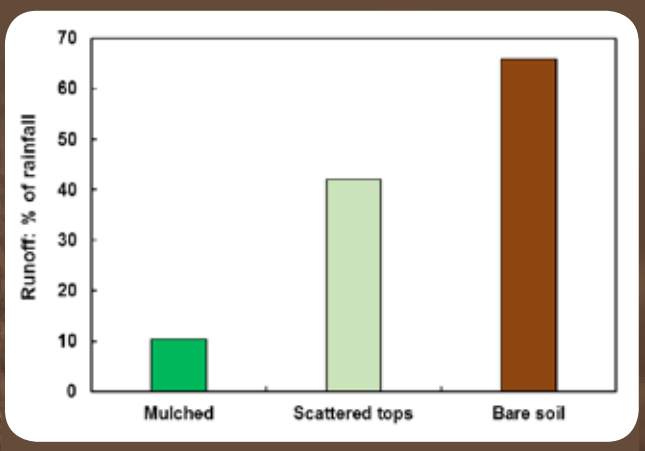
With the advent of global warming, we are entering a future with erratic weather patterns including either extremely wet or dry periods. This complicates the uncertainty of weather predictions and decision-making in terms of soil water management for those producing food and other agricultural commodities. In the sugar industry, we are fortunate to have an abundance of residue (cane leaves) available which can be used to improve water use efficiency in rainfed and irrigated regions. It is the ideal material to reduce the impact of short drought spells and, at the same time, improve the quality of the soil.

Advantages

In rainfed scenarios, a mulch blanket (surface blanket of cane leaves) will have the following beneficial effects:

- Reduced evaporation from the soil surface. This equates to less crop stress due to a shortage of water, reduced risk of eldana infestation, which leads to improved crop yield.
- Additional plant available water of about 90 to 100 mm/annum (depending on thickness of the mulch blanket and local weather conditions) due to increased amounts of water infiltration into the soil (leading to less runoff) and reduced evaporation.
  - This additional water improves fertiliser use efficiency as the availability of nutrients to plants is strongly influenced by the amount of water available for growth.
  - Under rainfed conditions, cane yields will improve by at least 9 tons/ha.
  - In irrigated regions, the above benefits also apply except for the effect on stalk yield. In this case, the effect of a mulch blanket is measured in the reduced amount of water required and lower pumping costs. In field trials, these input costs were lowered by as much as 25% although 15% is closer to the norm.
- By keeping the soil moist for longer, crop residues sustain microbial life, leading to improved soil quality. Sugarcane residues contain useful amounts of nutrients (i.e. 0.5% N, 0.08% P and 1.3% K) that are recycled to the soil following decomposition by microorganisms.
- The mulch blanket reduces weed competition and therefore water losses. This improves crop water use efficiency and leads to a reduced need for herbicides.
- It acts as an effective barrier to absorb the force of water droplets therefore reducing the risk of crusting. Crusting is the primary cause of reduced infiltration rates and erosion on steep slopes.

A study investigating the impact of different loads of sugarcane crop residues on runoff of rainwater on a Longlands soil, indicated that mulching following green cane harvesting reduces runoff to about 10% (see 'Mulched' on graph). In other words, about 90% of rainfall can be retained in green cane harvested fields. In situations where cane has to be burnt at harvest, spreading of residue after harvesting (see 'Scattered tops' on graph) reduced runoff to approximately 40% and thus retained 60% of the rainfall in the field. About 65% of the rainfall was lost through runoff where cane was burned and all residue removed after harvest (see 'Bare soil' on graph). The resultant loss on this field was at least 2 tons/ha of soil. Previous research has revealed that up to 5.3 tons/ha of soil can be lost in a single rainfall event!



The reduction in runoff under three different crop residue management scenarios (mulched, scattered tops and bare soil).

Disadvantages

Growers should also be aware of the following restrictions when mulching is considered:

- Avoid mulching on soils that are prone to water logging, areas with a high water table or areas located in valley bottom regions as the mulch blanket will prevent evaporation of excess water. This leads to continual wet conditions which might cause stool mortality.
- Responses to mulching are highest under conditions of drought. In exceptionally wet seasons, yield losses can materialise.
- The surface temperature of the soil under the mulch blanket is cooler than the uncovered soil in summer and higher in winter. However, in winter the temperature immediately above the blanket will be lower by about 3 - 7 °C. This can result in increased frost damage of parts of the plant above the blanket. For this reason, mulching is not recommended for frost-prone regions.
- In some regions where stalk yields are likely to reach 100 tons/ha or more, mulching should be used with caution as it could produce excess residue which forms an extremely thick blanket leading to reduced stalk yield and, in severe cases, stool mortality.
- In some regions (especially the northern irrigated region), the presence of a mulch blanket can result in localised caterpillar (trash caterpillar) damage of young germinating cane. This pest is usually biologically controlled by a wide variety of parasitic insects and pathogens in the field.

Above: *20 Tons of soil was estimated to have been lost in this particular unprotected sandy field following a single rainfall event.*

Above: *Runoff following a rainfall event. The muddy water indicates substantial sediment loss of the most fertile portion of the soil – the top soil layer.*

Liming: Are low dose ultrafine products effective?

Louis Titshall (Senior Soil Sceintist), Dimpho Elephant (Soil Scientist), Neil Miles (Senior Soil Scientist), Adrean Naudé (Extension Specialist)

The benefits of liming acid soils for sugarcane production are well known. However, the increasing cost of ameliorating acid soils using traditional liming practices has driven many growers to use products that are promoted as achieving the same outcome with considerably lower amounts of lime. Unfortunately, these products are frequently incapable of achieving the full benefit of conventional liming practices. To get the best from your lime, one must consider some key aspects of how lime works in a soil.

Basics of liming

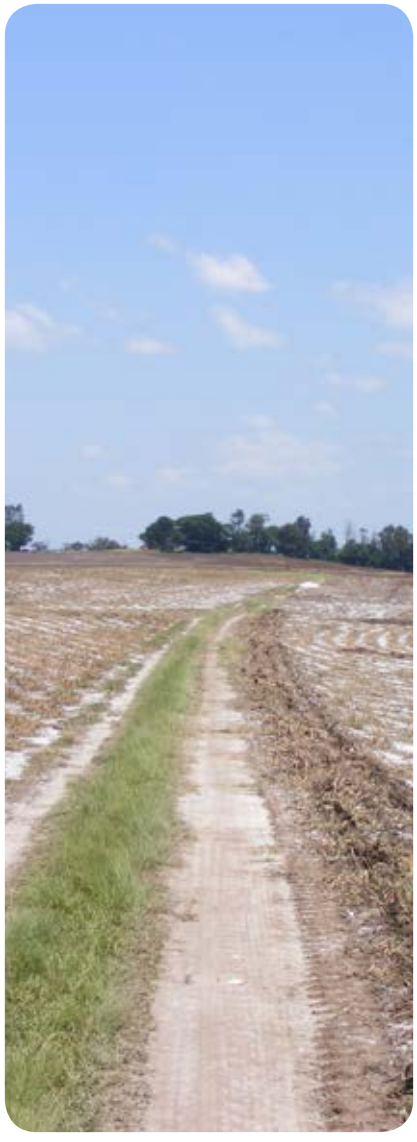
Liming materials, such as calcitic and dolomitic lime, are able to neutralise the acidity by reducing the amount of exchangeable acid ions (H^+ and Al^{3+}). Liming to a target acid saturation threshold (20% or lower for sugarcane) aims at reducing the levels of exchangeable aluminium ions to plant tolerable levels. This improves root health and increases the availability of other beneficial nutrients. However, there are several factors that affect lime reactivity in your soil.

Soil properties

The key drivers of how a soil reacts to lime is clay content and type, organic matter content and moisture. Research has shown that high clay and organic matter soils (i.e. soils with high CEC) typically require much more lime than sandy and low organic matter soils (low CEC). A moderately acid sandy soil may require 2 to 3 t/ha of conventional lime while an acidic clay soil may require more than 10 t/ha to reduce exchangeable acidity to acceptable levels.

Lime properties

Lime efficiency is evaluated on its **relative (or effective) neutralising value (RNV)**, where its calcium carbonate equivalence (an indication of how well it reduces acidity), particle size (fineness or coarseness), mineral hardness (affects solubility) and content of non-liming components (like sand particles) can change how effective the liming material is. SASRI's Fertiliser Advisory Service (FAS) recommendations are based on the assumption that the RNV of aglimes being used are greater than 75%.



Finer liming material has greater reactivity in the soil, especially where this has been mixed well. Finer particles cover a greater surface area, thus increasing the chemical reaction rate and causing rapid increases in pH. This, however, still relies on **thorough mixing with the soil** and the amount of acidity neutralised still depends on the **relative neutralising value** of the liming material.

Studies show that finely milled liming products are generally about 20% more effective at acidity control than conventional aglimes and only when applied at **similar** rates. However, these fine limes are difficult to handle when using conventional field applicators. South African legislation requires that aglimes contain 100% particles less than 1.7mm in size and that at least 50% of these are less than 0.25 mm (visit https://www.nda.agric.za for regulations). This provides a reasonable balance between fine and coarse material while allowing for manageable handling.

So what about "enhanced efficiency" liming products?

There are several products marketed as enhanced efficiency liming products, with claims that you require a mere fraction of that product to achieve the same result as a conventional liming programme. If this sounds too good to be true, be warned, *it most certainly is*.

The question to ask is, 'Can a few litres or kilograms of an ultrafine lime product provide the same neutralising benefit as several thousand kilograms of conventional lime, especially for a long-term crop like sugarcane?" The short answer is *"No, it cannot, ever!"*.

There are two main types of enhanced efficiency liming products, both based on the use of ultrafine liming materials, namely, "liquid or suspended" and "pelletised or granulated" limes. The main marketing claim is that you need considerably lower rates (ranging from a third to a tenth of conventional rates) due to the higher reactivity of the ultrafine particles they consist of. Some marketing material even claims as little as 10 to 15 kg of the product can replace a conventional liming programme. However, recall that the effective neutralising power of a lime determines it effectiveness, and it is not chemically possible for a third to a tenth of any liming material to achieve this. If you applied an ultrafine lime you may reasonably be able to lower your recommended conventional lime rate by around 20% (so 1000 kg/ha drops to 800 kg/ha). This still means you need considerable amounts to counter high acidity levels. A bottle or two of fine lime cannot even come close to achieving this.

In the case of suspended fine limes (liquid limes), it is claimed that the fine material will readily filter through the soil pores. At best, the material may penetrate a few millimetres through the soil surface and will still need to be mixed in to ensure complete reactions. Think about your swimming pool sand filter – the fines get trapped near the surface, and that is under pressure from the pump!!! Even the downward migration of the dissolved liming compounds takes time, with estimates of no more than about 25 mm per year in most soils.

In the case of pelletised products, handling is vastly improved (limited dust) and this is appealing. It is often claimed that these pellets disintegrate fully on water contact and disperse through the soil. However, unless the pellet has indeed disintegrated completely and been mixed well in the soil, you will end up with localised spots of lime and limited control over bulk soil acidity. Several studies have shown that these pellets tend to remain intact in the soil with limited distribution or acidity control (Figure 1). And recall, you still require sufficient neutralising capacity to have a meaningful effect on acidity levels, a few handfuls just will not achieve this.

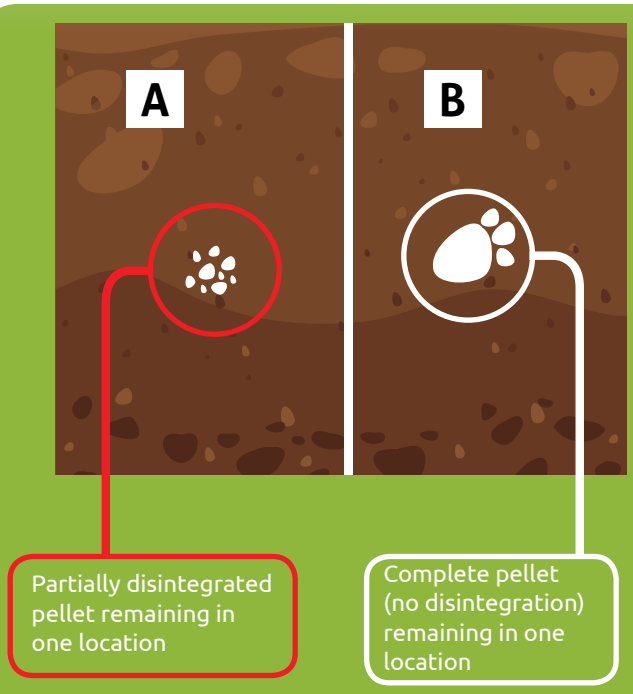


Figure 1: *Illustration of intact pellets a year after application in a soil*

Banding of the reduced rate liming products is sometimes advocated (with companies showing sharp increases in soil pH in those bands). This increases the effective application rate as one is applying the dose to a much smaller area, typically a band around the plant stems and roots. However, this only provides acidity control immediately around where the lime was placed, but the rest of your soil remains acidic. This will severely restrict root growth and limit the plant's water and nutrient uptake from the surrounding soil. This is not a favourable situation for field crops like sugarcane.

A further concern of these products is their claim to improve many other aspects of soil health and crop performance. This can only be achieved through holistic use of best practices and integrated management. Soil is a complex system and seldom does a single low dose of any product provide the necessary input to cause a significant change.

So simply put, a few kilograms of ultrafine lime can never replace the application of conventional lime to alter the bulk soil acidity. Unless these products are applied at similar rates to conventional limes (at great expense to the grower), they are just not capable of proper acidity management. The chemistry just does not support the marketing hype. It is also worth remembering that you are growing a ratoon crop, so you have limited opportunity to remedy acidity problems after planting. A few litres of lime at planting will have no lasting effect. So before you agree to replace the recommended conventional liming practice with a seemingly more cost effective alternative, consider if the product will achieve the results you need. Ask the sales representative for proper, independent studies with suitable control comparisons to demonstrate the claims (not the brochure full of pictures) and if still in doubt, call your SASRI Extension or Research Specialist for an opinion.

Topical tips

Rowan Stanack (Extension & Biosecurity Manager)

Pests and diseases

- In eldana-prone areas, ensure that you have planned your IRAC-compliant insecticide spray programme on carry-over cane. You must regularly scout your cane. This will allow a good sense very early on of which fields will require spraying.
- Yellow sugarcane aphid (YSA) has been particularly widespread and damaging this year. Ensure that you continue to scout in anticipation of a possible outbreak in spring. Grasses in canebreaks and field edges can give an early indication of the presence of YSA.
- Ensure that seedcane nurseries are tested for RSD prior to the cane being planted.

Weeds

Careful, strategic application of herbicides in the winter and early spring can buy time for later when weed growth begins in earnest. Use your Herbicide Selector to plan your chemical weed control programme well in advance. Download the Herbicide Selector from the SASRI website (www.sasri.org.za).

Flowering

This season, flowering has been particularly profuse, especially in varieties prone to flowering e.g. N23, N27, N42. Heavily flowered cane should not be carried over to next season and these fields should be harvested before the end of October. As a rule of thumb, fields with more than 20% stalks flowered should not be carried over. Determine the percentage of flowered stalks by infield inspection. Consult your Extension Specialist for advice if seedcane fields have flowered heavily.

What influences **cane quality?**

Rowan Stanack (Extension & Biosecurity Manager)

Although the Recoverable Value (RV) cane payment formula penalises growers for the amount of non-sucrose and fibre delivered in cane, it should never be forgotten that more than 90% of RV is sucrose. Therefore growers still need to apply every measure possible to maximise sucrose production per hectare.

Maximising cane yield and quality begins in the field. The cane needs to be well grown and this depends on the level of attention and **management** of the following:

- **Soil health**
- **Land preparation and planting**
- **Pest and Disease control**
- **Variety choice**
- **Weed control**
- **Quality of seedcane**
- **Fertiliser application**

When planning the harvesting of a field, growers should follow three easy principles.

1. The cane needs to be **mature** when harvested which means harvesting the cane at the correct age and the appropriate time of the season for the variety concerned. Application of ripener and drying off practices are also important considerations. Use the SASRI Pur***Est***® app to assist you with this. The app not only assists with making ripener decisions, but also can be used to assess the relative maturity of fields so that the most mature crops can be prioritised for harvest.

2. Growers should also ensure the cane is as **clean** as possible which means there must be a minimum of extraneous matter such as dried leaf material, tops, roots and soil in consignments. Accurate base cutting is important to ensure the high value, sucrose-rich lower part of the stalk is delivered to the mill.

3. Cane needs to be as **fresh** as possible when it reaches the mill. Cane starts to deteriorate rapidly beyond 48 hours after burning. So try to ensure that cane is delivered within this period.

Applying these three easy principles of **mature, clean and fresh** in the harvesting operation will ensure that you maximise returns and incur minimal losses under the RV cane payment formula.

Look out for the next Link for an article on Cane Testing and Cane Payments.

SUSFARMS®

South Africa's Sustainable Sugarcane Farm Management System

Michelle Binedell (Knowledge Manager)

The sugar industry's Sustainable Sugarcane Farm Management System, SUSFARMS®, is a management system that has evolved into a useful tool for facilitating the production of sugarcane in a profitable, sustainable and environmentally responsible manner. While the journey of its development began in the 1990s amongst the Noodsberg cane growers, the system has received substantial inputs over the years from a number of other stakeholders, namely environmental bodies, technology providers and sugar customers.

The system includes two useful resources

1 A **Manual,** which serves as a repository of better management practices and legal requirements. This acts as a guide to growers on how to implement practices that reduce negative impacts on the environment, maintain worker health and safety while encouraging financial compliance.

2 A **Progress Tracker** in the form of an Excel spreadsheet that allows growers to perform a self-assessment. This helps to establish the extent to which best practices have been implemented.

The system can be effectively used by farm managers to evaluate their current best farming practices and, more importantly, explore other practices they can implement in the future to improve their farms.

For the new grower, the SUSFARMS® manual is a valuable resource with notes on what practices are important to ensure satisfied workers, protection of soil, water and other natural resources as well as financial sustainability.

The 4th edition of SUSFARMS® has just been released.

Growers are encouraged to access an e-version of the manual and the associated Progress Tracker by downloading it from the SASRI website at www.sasri.org.za/susfarms

THE EVOLUTION OF SUSFARMS®

1998: Noodsberg Cane growers realised the need to improve environmental standards of sugarcane farming, and subsequently started the development of an Environmental Management System (EMS).

2002: The 'System for Environmental Management in Sugarcane' (SEMIS) was completed.

2004: WWF partnered with Noodsberg to support the development of a more practical system. This partnership led to the development of SuSFarMS™.

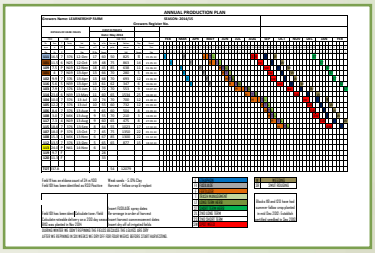
2012: SASRI initiated a legislation update and simplified the system before launching the 2nd edition of SUSFARMS®.

2015: SUSFARMS® Version 3 released after benchmarking with global standards.

2019: SUSFARMS® version 4 released after further stakeholder engagement and benchmarking with global standards.

Aspects covered in SUSFARMS®

Land Use Planning
Production Planning
Financial planning and compliance



Worker health & safety
Cultural assets
Recreational activities

Biodiversity
Soil & water conservation
Pest & disease management
Haulage operations

Going batty about eldana!

David Wilkinson (Extension Specialist: Midlands North) & Janet Edmonds (Biosecurity Officer: Midlands North)

Over the last two or three seasons, the topic of eldana control in the Midlands has been largely dominated by chemical control. Whilst this is an effective way of maintaining control of eldana populations, there are many growing concerns. One of the most important being the long-term implications of widespread spraying, with the impact of some active ingredients on beneficial, non-target insects.

Integrated Pest Management (IPM) continues to be promoted by SASRI, with a focus on the planting of sedges to reinstate wetland areas (natural eldana habitat) and Melinis grass to repel moths, the release of natural eldana predators (flies and wasps), avoidance of planting cane in marginal areas, regular scouting and planting of resistant varieties.

Recently, there has been a renewed interest in an aspect of IPM that has been overlooked — the importance of bats.

At a recent series of eldana grower days in the Midlands North region, Wendy White of the KZN Bat Interest Group got growers talking. Wendy explained the importance of both fruit-eating and insectivorous bats in the agricultural context of pollinating flowers for fruit production, dispersal and germination of seeds for forest re-establishment and, most importantly, the consumption of eldana moths (by the thousands!).

Aside from the direct consumption of moths, bats also help to control eldana populations through **disruption**. The mere sight or sound of a bat causes disruption to the moths' behaviour and interrupts the movement and breeding of the moths.

Past research

Several studies have been conducted on the positive economic returns resulting from bats consuming insect pests, instead of using chemical sprays. A study in America showed that bats contributed a value of almost R4 000/ha per year (2007) in pest control services i.e. the bats equated to a saving of this amount that would otherwise have been spent on chemicals to achieve the same effect. The effect in South Africa is expected to be even higher since our bats do not hibernate, as is the case with American bats - which hibernate for up to 7 months per year.

In South Africa, a 2015 study on macadamia orchards revealed that bat predation of stinkbugs resulted in an avoidance of up to R45 million in pesticides (over 25 000 ha of macadamias).

Feeding patterns

Depending on their sex and breeding state, bats consume up to 73% (lactating female) of their body weight every night. In a study in Swaziland's sugarcane region, the diet of African free-tailed bats was shown to comprise up to 50% moths, of which a high proportion were eldana, with a further 25-40% of the diet comprising mosquitos. In this study, it was estimated that the bat colony (100 bats) consumed approximately 30 tons of eldana moth per year.

When radio-tracked, the bats were found to show a distinctive preference to feed over sugarcane fields rather than riparian forest, savannah or urban areas. The bats travelled up to 4.8 km from their roost and had foraging areas of up to 1 437 ha.

It has been proven that bats are certainly beneficial in controlling insect populations. So what can we do to facilitate this?

Encouraging a bat-friendly habitat

Bats are very slow breeders and 70% of the pups do not survive beyond the first year. Much of their natural habitat has been transformed to agriculture, thus roosting sites are limited. The first step is to encourage bats back into the area by creating suitable roosting sites, in the form of suitable vegetation and bat boxes.

Natural vegetation can be re-established along riparian areas to encourage tree-roosting bat species. Bananas can be planted in unused areas of the farm – these will attract banana bats, which roost in the uncurled leaves. They have been found to eat up to 2 000 mosquitos per night and are also important moth predators.

Artificial roosts, in the form of wooden bat boxes are also highly effective. Bat boxes should be placed away from indigenous vegetation (to avoid common species occupying the boxes and competing with rarer, tree-dwelling bat species) and should also not be placed near owl boxes, for obvious reasons!

Bat boxes should be placed near open water, as bats drink water when they leave and return to the roost. They should also be elevated at least 3 – 4 m above ground and the entrance/landing platform should face South East. So elevated water towers, grain silos and farm sheds are perfect structures to use for bat boxes.

Above: *Bat boxes on Fountain Hill Estate – the box on the right was occupied by bats within 3 months of placing it on the building. Bat occupation is evident by the guano on the ground directly underneath. The water tank structure in the background is another good example of a suitably-elevated structure on which to place bat boxes.*

Above: *Bat bank with varied boxes back to back, elevated on poles (Source: www.ecosolutions.co.za).*

Another recommendation is the use of a "bat bank" instead of a single box – this provides different types of accommodation for the bat colony members, including a nursery box, the six-chamber box and the Old George box (an American design). This allows for a greater range of roosting sites for bats at different life stages, e.g. nursery/ maternity roosts, hibernation roosts, bachelor roosts and resting roosts.

WEATHER

Phillemon Sithole *(Agrometeorologist)* Abraham Singels *(Principal Agronomist)*

Review

Early winter (May to June) rainfall was well below average across the industry with an industry average of 35% of the long term mean over the two months (Fig. 1).

Irrigation water supply was generally stable over the review period, with the exception of supplies from the Goedertrouw dam in Zululand which remained severely restricted.

Outlook

The El Niño-Southern Oscillation (ENSO) is currently in a weak El Niño phase which is expected to last through spring, with a likely transition to neutral conditions by late summer. This will have little impact on rainfall over eastern South Africa. The *South African Weather Service* and *European Centre for Medium-Range Weather Forecasts* predict below normal rainfall and above average temperatures during the 2019 spring months (Aug, Sep) while the *International Research Institute for Climate and Society* predicts average rainfall and temperatures.

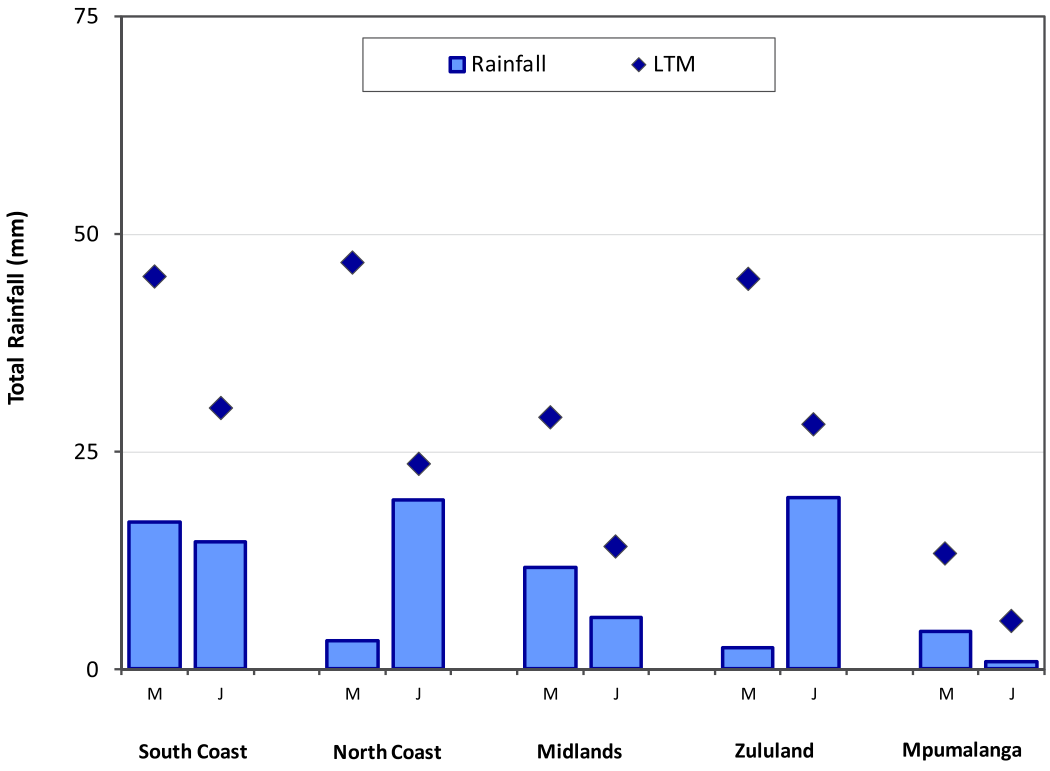


Figure 1: Regional average monthly total rainfall for May and June 2019, compared to the monthly long term mean (LTM).

Please visit the WeatherWeb available via the SASRI website: www.sasri.org.za for links to up-to-date seasonal climate forecasts and also for the latest rainfall and other weather data.

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Layout & Design: *Wayne Mthembu*

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

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