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THE LINK

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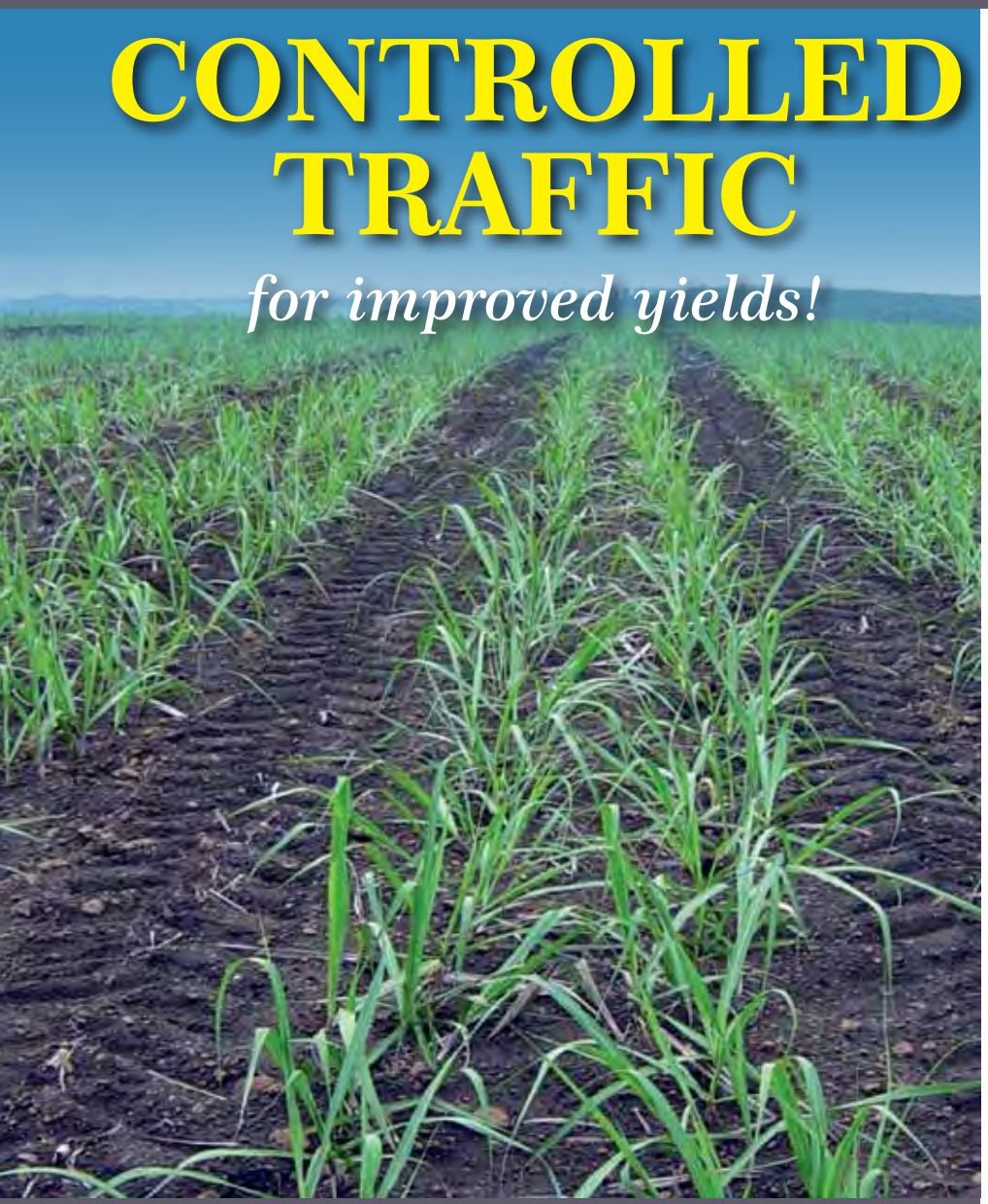
CONTROLLED TRAFFIC

for improved yields!



Stool damage by infield traffic has been identified as one of the primary causes of yield loss in the industry. Growers are encouraged to match wheel spacing and the cane row spacing when using vehicles and equipment infield. The picture above depicts a field laid out for a controlled traffic system, i.e. where vehicle and equipment wheels are restricted to the traffic lanes between cane rows. See page 6 for the agricultural and economic benefits associated with such a system.

Also in this issue...

Chemical ripeners

Results from a long-term chemical ripener evaluation trial at Mount Edgecombe provide some recommendations for ripener use on some of the newer varieties grown under coastal conditions (Page 10).

SASRI WeatherWeb

Die SASRI WeatherWeb het nou intydse weerdata beskikbaar. Hierdie splinternuwe ontwikkeling stel data van 16 outomatiese weerstasies, wat elke vyf minute opgedateer word, beskikbaar vir gebruikers (Bladsy 12-14).

Trash caterpillars

Trash caterpillars can cause some damage to the sugarcane crop by feeding on cane leaves. Fortunately, the pest is usually suppressed by several of its natural enemies such as spiders, ants and wasps (Page 18).

SASRI

Unlocking the potential of sugarcane

Topical Tips

September - December 2014

Nutrition

- By August, your fertiliser application programme should have started due to the warmer climate. With the arrival of the spring rains in September, you should be well on your way with your fertiliser application programme especially in the coastal areas.
- Don't forget to follow up with a leaf sampling programme for the appropriate summer months to audit your fertiliser applications.

Pests and Diseases

- The focus should be on roguing for smut and mosaic. Avoid planting mosaic susceptible varieties between 1 November and 1 February in high mosaic risk areas - in accordance with P&D rules.
- This is the time to consider in-furrow applications of insecticide to reduce possible damage by thrips later during summer.
- The current dry weather conditions will favour sour rot development, particularly in more mature cane in the midlands. Check for this disease when doing eldana surveys and flag infected fields for early harvest.
- Keep an eye out for eldana by doing your final inspections in carry-over cane during October. Monitor the application of FASTAC® to ensure the correct rates are applied for effective eldana control.

Weed Control

- The advent of the spring rains also means that weeds can become a problem, so you should consider applying long-term herbicides.
- Always check on the effectiveness of the herbicide application, identify fields with problem weeds and carry out follow-up treatments.
- In the midland areas keep an eye out for any winter weeds in last season's cane.
- With the advent of the holiday season, ensure all your harvested fields have received the necessary herbicide treatment before your staff go on their annual December/January leave.

Planting

- If you have received good spring rains, begin your spring planting programme.
- Always ensure you are using the best seedcane available.

The SASRI Extension Team

Management

- This would be the time to start your long fallow programme of crop eradication and green manures for commercial fields or nurseries due to planting in late autumn or spring the following year.
- Should you be considering minimum tillage or chemical stool eradication, ensure you check that all cane tillers have emerged on these fields before spraying. Keep an eye on the effectiveness of your spraying.
- With the onset of decent rainfall during this period, watch out for the rapid growth of vegetation in your verges and breaks, implement a programme to mow them.
- SUSFARMS® is the preferred management system to ensure sustainable and profitable sugarcane farming and is the management tool all growers should be using. Please fill in your Progress Tracker to determine the status of your farming operation and to assist in ensuring you are compliant with legislation.

Message from the... DIRECTOR

> Effective knowledge exchange is a group effort between SASRI and all stakeholders.

Dr Carolyn Baker

Determining exactly what makes up SASRI's annual programme of work is a complex task and takes into account the needs and requirements of growers, as well as the latest scientific findings from other agricultural industries. This is achieved through an elaborate and finely designed system of engaging with local RD&E Committees each year to acquire a clear understanding of local research needs. Research proposals then undergo careful scrutiny through a series of clarifications and refinements before final approval is granted.

After this stringent process, one would think that the final products of the research that is conducted would be embraced and swiftly adopted. This is not necessarily the case; adoption of new technologies is often slow – and for a number of different reasons. If growers were more intimately involved with and informed about each of the stages in the research as it progresses, there would perhaps be improved take-up of the end products, largely as a result of growers knowing about, and feeling confident in, the nature of the technology and its value. This of course requires that the added value of new technology is understood and also effectively communicated from both an economic and also sustainability perspective – both areas that still require considerable focus from us at SASRI.

Being able to truly engage with all growers in a process of knowledge exchange is difficult and at SASRI we rely largely on our Extension Specialists to assist us in this regard. There is undoubted value in encouraging SASRI's scientists to be more active in these exchanges but not at the expense of the research process itself - there are always limitations on their time. The key is to be sure that the work that we do takes our stakeholders circumstances into account and really

meets all growers' needs and not just those of a select few. This means talking to one another – and I mean really having a conversation – that demonstrates mutual understanding and learning. The farming experience of every grower is an invaluable resource that should inform and influence our research and ultimately result in fostering a co-design approach that delivers solutions and technologies that are best suited to sugarcane agriculture.

Ideally we would like to achieve maximal adoption of new technologies, but this cannot be achieved in isolation – and we appeal to growers to guide us more vociferously and to engage with SASRI activities more intensely. In a world where 'nice-to-haves' are simply not an option, it is essential that every aspect of SASRI's work is recognised and valued as being required to meet our agreed strategic intent. If we were to identify a single factor to provide some insight into the effectiveness of SASRI as an organisation, some might say that it would be related to the extent and rate of adoption of our recommendations. However, this is clearly a group effort that requires considerable commitment from both SASRI (the service provider) and also growers (stakeholders).

Dealing with accidental CANE FIRES

Growers need to be aware of the course of action to follow in the event of accidental canefires. Briefly, the guidelines are:

- If the cane is very short and there is no visible stick, the cane should be left to tiller from the base of the stool.
- If the cane has already developed some stick but is too short to send to the mill, it should be cut back by hand and the regrowth treated as a normal ratoon.
- If the cane has sufficient stick for milling, it should be harvested and milled with minimum delay.

Full details are contained in SASRI Information Sheet 4.1: Management of fire cane which also provides guidelines for dealing with nutrition, conservation, eldana and weed control after accidental fires.

The following two cautionary notes are not contained in the current version of the info sheet, but will appear in an updated version:

- Burnt cane with millable stick that is not harvested, and is left standing until the following season, will result in poor tillering of the next crop. That crop will also have old dead sticks which will have a negative impact on cane quality.
- Even under conditions of a cool burn and where the meristem is still alive, there could be burst cells in the cane stalk or the buds, resulting in secondary infection. This leads to further cane deterioration and poor cane quality.

For guidance on harvesting and transporting short cane, refer to the relevant section in SASRI Information Sheet 4.5 Management of cane affected by drought.

Why Should I Consider

CONTROLLED TRAFFIC?

A controlled traffic system keeps wheels away from the sugarcane stools and restricts them to the traffic lanes between cane rows where compaction is less harmful to the ratooning crop.

For a very long time, yield losses as a result of uncontrolled traffic were attributed to soil compaction only. While it is true that soil compaction will cause some reduction in yield, stool damage by infield vehicles is by far the bigger culprit. In fact, under certain circumstances, soil compaction can be seen as beneficial, for example, it provides a firm surface for improved traction for infield vehicles. Stool damage, however, will never be regarded as beneficial under any circumstances, and is responsible for severe reductions in yield. Under adverse conditions, local and international literature quotes yield losses of 25% and higher due to stool damage. Additionally, a single stool damage event can have a negative yield impact into following ratoons, even if no subsequent traffic occurs near the cane stool.

In Columbia, an example was reported of yields on control traffic plots and adjacent plots which had no control traffic under similar management. The yields on the uncontrolled traffic plots were 15% lower. At a yield of 70 t/ha, this difference equates to about 10 t/ha yield loss which would be worth approximately R4000 per hectare or approximately R60/ton. This extra value goes a long way towards harvesting and haulage costs. Locally, a South Coast grower adopted control traffic principles

and measured an increase in yields of 15% on two consecutive years. There are numerous examples of growers that have implemented various designs that incorporate principles of control traffic, some for as long as the past 28 years!

So where does one start with implementing a controlled traffic system?

The answer to that question will depend on what your current practices are, and on how much you are prepared to change.

The most logical method is to change the row spacing of newly planted fields to suit the wheel spacing of your equipment. However, this is a long-term project that could take 10 years to implement. Some situations may simply require an adjustment of the wheel spacing of infield vehicles and equipment to match the current traffic lane spacing. Yet other scenarios may call for a combination of adjustments, i.e. to both field layout and vehicle wheel spacing.

When making such a major change to the sugarcane production system, the farmer has to consider the implications of the change on various farm operations such as method of seedbed preparation, quantity of seedcane per hectare, placement of fertilisers, where to sample for soil analyses, how to combat weeds, position of dripper tapes, etc. All these aspects are discussed in more detail in an information booklet which is currently being prepared by SASRI.

Based on our knowledge regarding the costs of the various activities that make up a controlled traffic system, we are confident that farmers will benefit economically from a controlled traffic system because of reduced stool damage, reduced weed control costs, increased number of ratoons and sustained yields.

Growers considering the implementation of a controlled traffic system should, in the first instance, contact their Extension Specialists for advice and guidance.

Rian van Antwerpen *(Senior Soil Scientist)*, **Peter Tweddle** *(Agricultural Engineer)* **and Peter Lyne** *(Former SASRI Principal Engineer)*

A field laid out to accommodate infield vehicles.

The effect of severe stool damage on regrowth.

Hoekom Ek BEHEERDE SPOORVERKEER? Moet Oorweeg

'n Beheerde spoorverkeerstelsel is nodig om verkeer in lande te beperk tot dieselfde spore as wat die vorige seisoen gebruik is. Met hierdie stelsel word wiele weggehou van die suikerriet stoele deur dit te beperk tot die verkeersbane tussen die rye suikerriet waar verdigting minder skadelik is vir die ontkiemende riet.

Oesverliese weens onbeheerde spoorverkeer is vir baie lank aan grondverdigting toegeskryf. Terwyl daar waarheid in steek dat grondverdigting oesverliese tot gevolg kan hê, is stoelskade deur voertuie by verre die grootste oorsaak. Trouens, onder sekere omstandighede kan grondverdigting as voordelig beskou word, byvoorbeeld bied dit 'n ferm oppervlakte vir beter vastrap van voertuie. Stoelskade kan egter onder geen omstandighede as voordelig beskou word nie, omdat dit verantwoordelik is vir drastiese oesverliese. Oesverliese van 25% en hoër as gevolg van stoelskade word in internasionale en plaaslike literatuur aangehaal. Enige skade aan 'n stoel is permanent van aard. Dit beteken dat die daaropvolgende oes ook die oesverlies sal wys selfs al is geen verdere skade aan stoele aangerig nie.

In 'n studie wat in Kolombië gedoen is, is gewys dat waar daar onbeheerde spoorverkeer toegepas is, die oesverliese 15% laer is in vergelyking met waar daar wel 'n beheerde spoorverkeerstelsel geïmplimenteer is. Dieselfde bestuurspraktyke is in albei gevalle toegepas. 'n Opbrengs van 70 t/ha kan 'n oesverlies van 10t/ha beteken met 'n waarde van ongeveer R4000 per hektaar of R60/ton. Hierdie bedrag is genoeg om 'n betekenisvolle bydrae te maak tot die vervoer van die oes na die

meul. 'n Boer van die Suidkus het die beheerde spoorverkeerstelsel op sy plaas geïmplementeer en het vir twee agtereenvolgende jare 15% verhoging in sy oes gemeet. Daar is talle voorbeelde van boere in die suikerindustrie wat verskeie ontwerpe van die beginsels van die spoorverkeerstelsel op hulle plase geïmplementeer het, sommige al vir so lank as 28 jaar!

Hoe begin 'n mens met 'n beheerde spoorverkeerstelsel?

Die antwoord op hierdie vraag hang van die huidige praktyke op jou plaas en hoeveel jy bereid is om dit te verander, af.

Die mees praktiese metode is om die ry spasiëring in nuwe aanplantings aan te pas by die wiel spasiëring van jou huidige implemente. Dit is egter 'n langtermyn projek wat 10 jaar kan neem om te implementeer. In sommige situasies kan 'n eenvoudige aanpassing van die wiel spasiëring van voertuie en implemente gemaak word om by die bestaande ry spasiëring aan te pas. 'n Kombinasie van toepassings, dit wil sê beide land uitleg en voertuig wiel spasiëring, kan ook probeer word.

Wanneer so 'n groot verandering aan die suikerriet produksiestelsel gemaak word, impliseer dit dat die boer veranderinge op verskeie plaas aktiwiteite soos saadbed voorbereiding, hoeveelheid saadriet per hektaar, plasing van kunsmis, waar om grondmonsters te neem vir grondontledings, hoe onkruidbeheer moet plaasvind en spasïering van drupbesproeiing ensovoorts sal moet maak. Al hierdie aspekte word in meer besonderhede bespreek in 'n inligtingsboekie wat tans deur SASRI voorberei word.

Op grond van kennis oor die koste van die verskillende aktiwiteite wat 'n beheerde verkeerstelsel insluit, is ons vol vertroue dat boere ekonomiese voordeel sal trek uit 'n beheerde verkeerstelsel as gevolg van verminderde stoelskade, verminderde onkruidbeheer koste, verhoogde aantal ratoene en volgehoue goeie oeste.

Boere wat dit oorweeg om 'n beheerde verkeerstelsel toe te pas moet hulle voorligter kontak vir verdere inligting en bystand.

'n Land wat uitgelê is om voertuie te akkommodeer.

Die effek van erge stoel beskadiging op die hergroei van suikerriet.

UPDATE

Chemical Ripener Responses

in varieties grown under coastal production conditions

Due to the proven economic benefits associated with the use of chemical ripeners, research on this topic forms part of the SASRI programme of work on a continuous basis.

The main objective of this field-based research is to determine the cane quality and yield response of commercial varieties to the registered chemical ripeners, Ethephon and Fusilade® Forte. The response of varieties is determined in replicated treatments where these two ripeners are applied separately or in combination in the so-called "piggy-back" treatment and then compared to the control (no ripeners applied) treatment. Another objective of the research is to monitor the varieties for any negative residual effects of chemical ripener application on the growth of the subsequent ratoon.

In the long-term chemical ripener evaluation trial situated at Mount Edgecombe, the ripener response of new varieties released for cultivation along the coast is being evaluated. During the past three seasons, varieties N42, N47 and N51 were evaluated. The first, second and third ratoon crops were treated with Ethephon, applied 12 weeks before harvest; Fusilade® Forte, applied 6 weeks before harvest; and the "piggy-back" (combination) treatment, where Ethephon was applied 12 weeks before harvest followed by Fusilade® Forte 6

weeks later. All three crops were harvested at a crop age of 12 months in early May of each year.

The combined results, averaged over the three ratoon crops, are briefly summarised below:

a) In varieties N42, N47 and N51 the best ripener treatments increased cane quality by 2.0, 1.7 and 1.9 RV% units respectively over the values recorded in the controls.

b) The maximum cane yield reduction induced by some of the ripener treatments varied between 3 – 11 t/ha in crops where the controls yielded 100 – 130 t/ha.

c) The reduction in cane yield induced by some of the ripener treatments was offset by the very large increases in RV%, thus translating into **positive RV yield gains in all cases**. In varieties N42, N47 and N51 the best ripener treatments increased RV yields by 3.0, 1.6 and 1.8 t/ha respectively over the values recorded in the control.

The field trial results obtained over the three seasons were subjected to rigorous statistical analysis in order to develop the most appropriate ripener recommendations for each of these varieties. These recommendations are provided in the table below.

For variety N42 Fusilade® Forte (or generics), and in particular the combination treatment, is recommended. Ethephon, when used on its own, results in only a mediocre ripening response. The same holds true for variety N51. This variety does respond well to the combination treatment, but not as pronounced as variety N42. Variety N47 responds well to Ethephon or Fusilade® Forte (or generics), but achieves very little additional benefit from the combination treatment. Cost recovery of the second ripener application thus becomes questionable, especially under commercial cultivation conditions.

Chemical ripener recommendations for varieties N42, N47 and N51.

Variety	Ethephon	Fusilade Forte	Combination treatment
N42	No*	Yes	Yes**
N47	Yes	Yes	No*
N51	No*	Yes	Yes

**Only a mediocre response (not statistically significant); **Responds particularly well to combination treatment*

By Riekert van Heerden
(Sugarcane Physiologist)

Important considerations:

- When used under favourable growing conditions ripeners increase RV yield in these three varieties. The reductions in cane yield that sometimes do occur leads to further benefit in the form of harvest and transport cost savings.
- Three years of research on these varieties have shown that none of the treatments resulted in any negative effects on ratooning.
- In crops grown on a 15 – 18 month cycle, the naturally more mature state of the crop makes the use of Ethephon questionable. Juice purity testing before application is strongly advised before the use of Ethephon is considered. Ethephon is only effective if the juice purity is below 75% at the time of application. Contact your Extension Specialist for more details on how to conduct juice purity testing. In most cases Fusilade® Forte (or generics) will be the ripener of choice in these more mature crops.
- It is beyond SASRI's capacity to conduct formal ripener evaluation trials on each released variety across all production areas, soil types and cutting cycles. However, on-farm strip trials conducted by growers in partnership with the regional extension specialist and SASRI's ripener scientist have proven to be very effective for fine-tuning recommendations for specific production scenarios. Outcomes of these on-farm strip trials have been communicated at several grower days and in previous editions of The Link. Interested growers are encouraged to contact their extension specialists for further information on conducting on-farm trials in collaboration with SASRI.

SASRI Weather Products

... for better decision making!

The SASRI meteorological office collects and processes weather data from over 50 automatic and manual weather stations, and from an equal number of rainfall stations, situated throughout the sugarcane producing areas of South Africa. This information is made available on the internet through SASRI's WeatherWeb.

In an exciting new development, SASRI is now able to provide live weather data (updated every five minutes) for 16 stations in the industry, with more sites scheduled to come online soon.

The weather controls sugarcane growth and affects most agricultural operations. Weather information is therefore essential for predicting crop water use, cane yield and cane quality, and for benchmarking agronomic performance. It is also required for important production management decisions as well as for research purposes.

Advances in information technology now enable continuous weather data acquisition and update on the SASRI's WeatherWeb throughout the day. Live weather information is currently available for 16 of our Automatic Weather Stations, and more will be added with time. Rainfall, temperature, solar radiation/sunshine duration, relative humidity and wind speed and direction are updated every five minutes (Figure 1). Other weather-based variables include the fire danger index, human discom-

Information available in WeatherWeb to support farming decisions

Type of information	Description	Potential use
Soil water content	The water content in the root zone of a full canopy, dryland crop growing at the specified site on the specified soil.	Identify periods of, and severity of, water stress. Get an indication of the likely response to chemical ripening. Get an indication of dryland yield potential.
Evapotranspiration	The rate of water-use by a well-watered, full canopy crop for the specified site.	Determine crop water and irrigation requirements.
Stalk growth	The potential rate of stalk growth of a well-watered, full canopy crop.	Get an indication of yield potential for the specified growing period.
Cane quality	The RV index reflects how favourable dryland conditions were for good cane quality (high RV %).	Assess the likely responsiveness of crops to chemical ripening, readiness for harvesting.
Flowering	Flowering reports provide a record of the favourability of conditions for flowering for the specified site and soil.	Predict the likely extent of flowering in the current season and compare it to previous seasons.

fort index, sugarcane stalk growth and evapotranspiration. Graphs of the last 24 hours and last 7 days can be viewed (Figure 2), while current and recent data can also be downloaded for further analysis.

Rainfall, leaf wetness, wind speed and direction and the fire danger rating could assist with planning of crop spraying, cane burning and harvesting operations. Rainfall and evapotranspiration data are needed for irrigation scheduling decisions. Temperature, humidity and leaf wetness data can give indications of the likelihood of diseases developing. A tool using these variables to predict rust is currently being developed at SASRI.

The SASRI WeatherWeb is available on the SASRI website at www.sugar.org.za/sasri. Select Real Time Weather on the WeatherWeb to access live weather data.

Other functions

New users of the website may be interested to know that the SASRI WeatherWeb is the gateway to historic weather information for the SA sugar industry, with Swaziland weather data becoming available soon.

Apart from basic weather data, valuable weather-based information is available for assessing soil water content, crop water use, cane growth and yield, cane quality and flowering. This information, which is summarised in the table below, can be accessed by selecting Custom Reports or Flowering Report from the WeatherWeb menu.

All data can be viewed, graphed or downloaded in various formats and users can specify the site or area of interest, the period of interest and the data variables of interest. Spatial colour maps of any basic or derived variable can also be generated according to user specifications (Figure 3). The WeatherWeb also provides links to short- and long-term weather forecasts.

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

SASRI would like to acknowledge the contribution of all collaborators and weather station owners. For queries or comments, please contact: Email: metoffice@sugar.org.za, Tel: 031 5087428

Figure 1: Live weather data for the Melmoth-Merino Farm automatic weather station. All records are updated every five minutes.

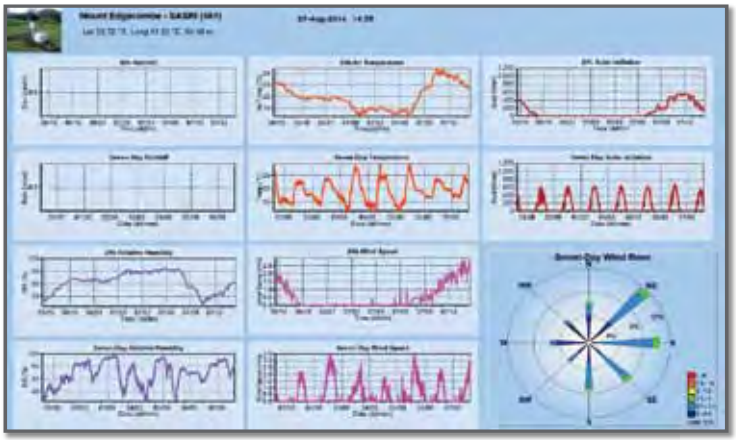


Figure 2: Graphs of different weather variables for the previous 24-hour and seven-day periods for Mount Edgecombe - SASRI AWS.

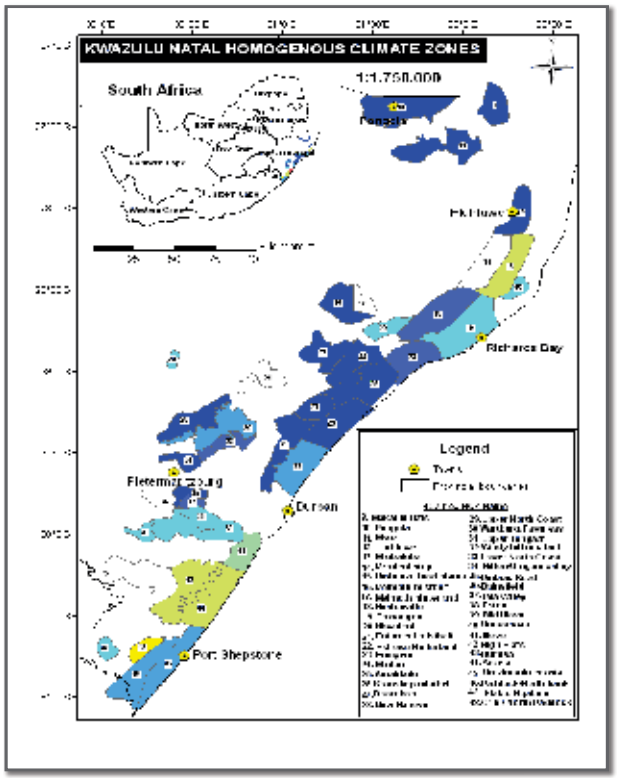


Figure 3: An example of a monthly rainfall map for a specific period for homogenous climate zones in the KwaZulu-Natal sugarcane growing belt.

SASRI se "WEER PRODUKTE"

vir die neem van beter besluite!

Die weerkantoor by SASRI versamel en verwerk weerdata van meer as 50 outomatiese- en hand weerstasies en van 50 reënvalstasies versprei regdeur die suikerrietproduksie areas. Die inligting is beskikbaar op die internet deur middel van SASRI se weer webwerf ("WeatherWeb").

'n Opwindende ontwikkeling is dat SASRI nou in staat is om heersende weerdata, wat elke vyf minute opgedateer word, van 16 weerstasies te voorsien, met meer weerstasies wat binnekort aanlyn sal kom.

Reënval, temperatuur, sonstraling/dagligure, humiditeit, windspoed en -rigting data word elke vyf minute opgedateer (Figuur 1). Ander weergebaseerde veranderlikes sluit in 'n brandgevaarindeks, menslike ongemaksindeks, suikerriet groei en evapotranspirasie syfers. Grafieke van die afgelope 24 uur en die afgelope 7 dae is ook beskikbaar (Figuur 2) terwyl heersende en onlangse data ook vir verdere ontleding afgelaai kan word.

Reënval, blaarnatheid, windspoed en -rigting asook die brandgevaar indeks kan gebruik word met die beplanning van lugbespuitings, brand van riet en oesaktiwiteite. Reënval en evapotranspirasie inligting is nodig vir die skedulering van besproeiing. Temperatuur, humiditeit en blaarnatheid inligting kan aanduidings gee van die risiko van siekte ontwikkeling. Daar word tans 'n metode deur SASRI ontwikkel om die inligting te gebruik om die voorkoms van roes te voorspel.

Die SASRI Weer Webwerf (WeatherWeb) is op die SASRI se webwerf beskikbaar by www.sugar.org.za/sasri. Om toegang te kry tot die heersende weer data, kies "Real Time Weather" op die "WeatherWeb".

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

FAS SABS ISO 9001: 2008 Certification

SASRI is proud to announce that the Fertiliser Advisory Service (FAS) has received SABS certification for the successful implementation of the international ISO 9001:2008 Quality Management System (QMS).

This means that FAS has identified and documented processes required to deliver a customer focused service and complied with the requirements of the ISO 9001:2008 standard.

FAS is committed to practicing total quality management which includes:

- Continually improving the effectiveness and efficiency of operations.
- Continually reviewing our objectives to ensure that stakeholder and client needs, requirements as well as expectations are being addressed.
- Ensuring that laboratory equipment and applied technology is suitable to meet client needs.

The Certification is a stamp of confidence that FAS will continue to deliver an evolving, quality service to clients.

The Fertiliser Advisory Service continually strives to improve the service offered to their patrons. Above, is the FAS team proudly displaying their SABS certification.

SOIL HEALTH

Neil Miles
(Senior Soil Scientist)

Earthworms SOIL DOCTORS!

The presence of earthworms in soils is visible evidence of soil health, because conditions in which earthworms thrive are also conducive to the proliferation of other soil fauna and flora, and also plant roots. Understandably, therefore, growers generally show a keen interest in earthworm populations in their soils. This article focuses on the role of earthworms in improving soil health, and on production practices that favour the proliferation of earthworms.

Habits

Numerous species of earthworms are found in our soils. Some live at the immediate soil surface, while others feed on surface litter, but build extensive systems of burrows into the soil - often extending to a depth of 1 m and more.

Earthworms consume soil and organic matter, and produce 'casts'; pellets which are deposited both on the soil surface and below ground. They emerge mainly at night and in wet weather to forage for litter that they draw back into their burrows. Researchers have found that, amazingly, earthworms living in one hectare of land may process between 50 and 100 tons of soil in a year.

Figure 1: Earthworms thriving under a blanket of crop residues.

Impact on soil fertility and productivity

Earthworms are legendary for the numerous ways they improve soil fertility and productivity.

- The burrows act as channels for soil aeration and water infiltration, and also serve as conduits for root penetration into soils.
- Secretions from earthworms help bind soil particles together, thereby promoting all-important structural development in the soil profile. These same secretions also appear to stimulate plant growth in ways that are currently not fully understood.
- The consumed organic matter (including crop residues) is mixed with soil in the earthworm gut. As the soil and organic matter pass through the worm, the organic matter is decomposed and the resultant casts have microbial and fertility levels that are higher than the bulk soil. In samples taken from a field in the Midlands, it was found that casts had markedly higher pH and lower acid saturation levels than the surrounding soil (see table below). In addition, plant-available nutrient levels in the casts were two to three times those in the surrounding soil.
- The body tissues of earthworms have high concentrations of nitrogen, phosphorus and sulphur. When the earthworms die and decay, these nutrients are made available for uptake by plants. Where soils contain relatively large populations of worms, this mechanism has been shown to provide a large proportion of the crop nutrient requirements.

Figure 2: Evidence of intensive mole activity following the liming of a pasture on a highly acidic soil. Lime stimulated earthworm populations and thereby worm-predating moles.

- Studies in New Zealand, Australia and the USA have shown that earthworms are highly effective in drawing top-dressed manures, lime and fertilisers down into the soil. Given the poor mobility of P, K and lime in most soils, coupled with the tendency of the soil surface to rapidly dry out and thus render nutrients unavailable to the crop, this function of earthworms is of immense value in crop production.

Production practices for encouraging earthworms

- Most earthworm species are highly sensitive to soil acidity, and tend to thrive in a calcium-rich environment. For these reasons, liming generally results in a sharp increase in earthworm populations. Interestingly, frequent evidence of vigorous mole activity following the liming of pastures is attributed to lime-induced increases in earthworm populations (Figure 2).
- Keeping the soil surface covered with residues is crucial for the proliferation of earthworms. Thus cool burns to ensure large amounts of remaining tops, or better still, green cane harvesting, are desired practices.
- Earthworm production is encouraged by green manure crops as well as organic products such as manures, compost and filtercake, all of which serve as sources of food for the worms.
- Interestingly, a number of studies have shown that the appropriate use of fertilisers encourages earthworm populations. This is due to the fact that fertilisers improve yields and thereby the amounts of roots and above-ground residues which serve as food for the worms.

Soil fertility status of earthworm casts and the surrounding soil from a site in the Midlands.

	pH ($CaCl_2$)	Acid Sat %	P	K	Ca	Mg	Zn
			mg/L				
Surrounding soil	4.37	23.8	8.0	106	414	168	0.6
Casts	5.19	0.7	15.7	256	1018	339	4.0

Neil Miles *(Senior Soil Scientist)*

TRASH CATERPILLARS in Sugarcane

By Mike Way *(Entomologist)* and
Paul Botha *(Extension Specialist: Midlands South)*

What is a trash caterpillar?

Occasionally damaged leaves of ratooning plants are seen in sugarcane fields. Striped larvae hide amongst the crop residue (formerly known as leaf trash) and insect faeces are present at the base of the plant. These pests are trash caterpillars or trash worms (See Information Sheet 8.4: Leaf Eaters). The species *Mythimna phaea* is known to eat the edges of green leaves; however there are at least six other species involved, although some feed only on the dry trash. The pictures below show typical leaf damage and the tell-tale droppings (frass) at the base of damaged shoots.

Figure 1: Defoliated leaves and insect frass in sugarcane at Eston in April 2014.

How is this pest controlled?

Trash caterpillar larvae feed on the green leaves at night to avoid natural enemies, nonetheless, predators, parasitoids and pathogens do reduce numbers significantly and outbreaks are soon controlled. Although it is not possible to assess levels of parasitism in the field, their activity can be demonstrated through examining field recovered larvae in the laboratory. As many as 92% of such specimens succumb to these natural control agents; some of which are shown in Figure 2.

Furthermore developmental abnormalities may occur often due to adverse weather conditions and so disrupting the life cycle. The life cycle of trash caterpillar is shown in Figure 3.

What can I do?

Even though some damage to the crop occurs, as noted earlier, the pest populations' peak and then decline, due to natural mortality and the impact of natural enemies, and the crop soon recovers, as shown in Figure 4. As a result, no intervention is required.

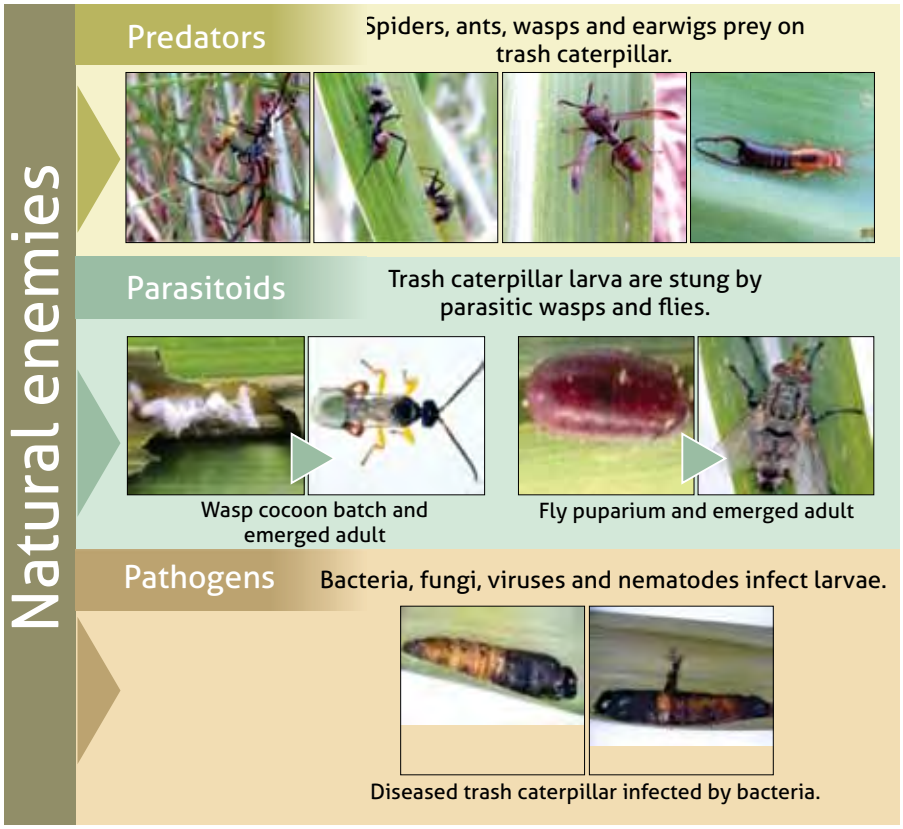


Figure 2: A selection of predators, parasitoids (Braconids and Ichneumonids) and pathogens that suppress the trash caterpillar pest in sugarcane.

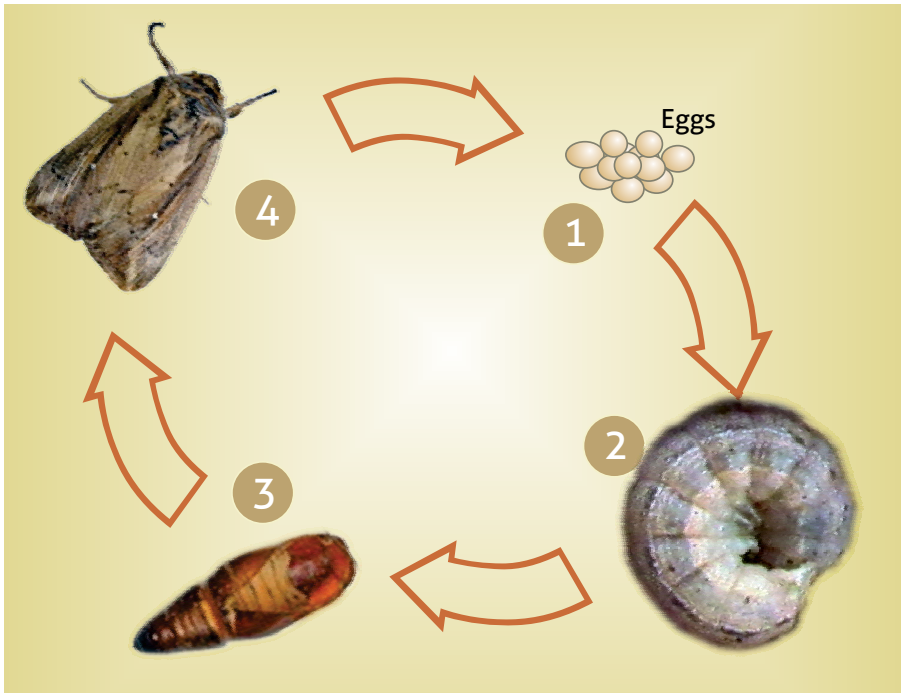


Figure 3: Trash caterpillar life cycle: Moths lay eggs (1) in batches on trash. Eggs hatch into larvae (2) that feed on leaves at night. Larvae develop, and pupate (3) in the soil. Adults (4) emerge from the pupae and give rise to the next generation.

Figure 4: The crop at Eston damaged by trash caterpillars showing how it had recovered two months later without intervention.

Evaluating Suga for Energy

Bryan Rees *(SASRI Masters student, UKZN)*
and Rianto van Antwerpen *(Senior Soil Scientist)*

Given the dwindling supplies of fossil fuels, the consequent increasing costs of petrol and diesel, and the environmental impacts of their use, significant attention is being placed on the use of biomass (e.g. brown leaves of sugarcane) as a sustainable and environmentally friendly source of renewable energy. Over the past year a study has been conducted to investigate the economic feasibility of methods or routes of recovering the residue from the field and delivering the residue to a sugar mill for use as a source of energy in South Africa.

The brown leaf recovery route can consist of four major operations, namely, the harvesting method, collection method, processing method and transport. The harvesting methods which this project took into account include manual harvesting (bundle, stack or windrow) and mechanical harvesting (chopper harvester). The infield residue recovery methods considered were the use of a baler, forage harvester or silage wagon. In addition to these, residue processing was also considered as this would increase the bulk density of the residue and thus reduce transport costs over longer distances.

A sugarcane production economics spreadsheet model developed by SASRI, was adopted, adapted and further developed to take into account all necessary operations for the residue recovery routes investigated. This model takes in-

arcane Biomass Production

put values from the intended area from which residue will be collected and gives an approximate cost for each applicable residue recovery route in that area. This cost is represented as both a cost per ton of collected residue (R/ton residue) and as a cost per unit energy (R/GJ). The model also takes into account the agronomic benefit of leaving a trash layer infield, and estimates a monetary value of the trash layer (R/ha). This agronomic benefit comprises of a reduction in both irrigation and herbicide costs. Currently, if a grower was paid a coal equivalent price for the residue, he would receive approximately R 600 per ton of residue, therefore it would be economically beneficial to the farmer if he is able to collect the residue for a price which is less than this. Sugar mills currently pay approximately R 36.18/GJ for coal, and thus any recovery route which costs less than this would be economically feasible.

After validation, the model was run for two different case studies. For the first case study, where the two major inputs included an annual harvested area of 30 500 ha and an average field-to-mill distance of 25 km, the least-cost residue recovery route was found to be to harvest the sugarcane manually, transport the cane and the residue together, and separate the residue from the cane at the mill. The cost of this route was R 497.69/ton of residue, or R 29.80/GJ. For the second case study, where the two major inputs included an annual harvested area of 3 333 ha and an average field-to-mill distance of 153 km, the least-cost residue recovery route was found to be to harvest the sugarcane using a chopper harvester with the extraction fans running and with the infield residue being raked and collected using a forage harvester, followed by it being transported 5 km to a processing plant (to increase the bulk density of the residue) from where it would be processed and transported 153 km to the mill. The cost of this route was found to be R 424.77/ton of residue, or R 25.44/GJ. The cost of the least-cost residue recovery routes for both these case studies proved to be less than that of a coal equivalent cost (R 600/ton, or R 36.18/GJ), and thus both would be economically feasible. However, other residue recovery routes investigated were not economically feasible and hence the economics of the residue recovery routes need to be assessed for each production system investigated.

This model was developed with the intention to replicate the real world as best as possible, but can by no means be regarded as completely accurate. The results from this study serve to give an indication of the potential of residue recovery and how it could be a more economical fuel source than coal, in addition to being sustainable and environmentally-friendly.

CLIMATE CHANGE

> South Africa will get noticeably warmer with increased atmospheric CO_2 concentration, over the next 80 years.

By Matthew Jones *(Scientific Programmer)*

SASRI recently received an enquiry regarding the impact of climate change on sugarcane agriculture. Concerns revolve around the impact of changes in radiation, temperature and rainfall on the industry's limited irrigation water supplies and on pest and disease severity.

Work conducted at UKZN and SASRI thus far indicate that climate change is indeed expected to impact the South African sugar industry. The models used to generate climate change projections tend to show relatively high levels of agreement with each other regarding future temperatures, so we can view these projections with a high degree of certainty. In short, it is very likely that South Africa will get noticeably warmer, on average, over the next 80 years.

There is greater uncertainty regarding rainfall projections: the models' predictions vary greatly, with some models indicating annual rainfall decreases while others predict increases in rainfall. Annual rainfall is projected to increase slightly in the Eastern regions of South Africa. Droughts, calculated annually or over

impact on sugarcane agriculture

the summer or winter months, are likely to decrease in frequency/severity in northern KZN and Mpumalanga in future. There is no clear indication on the effects of climate change on floods. The characterisation of future radiation under climate change is also not clear.

Sugarcane yield

Agro-climatic potential sugarcane yields are likely to increase in the intermediate and, to a lesser extent, more distant future as a result of increased atmospheric CO_2 concentration, increased temperatures and increased or unchanged annual rainfall in future. The impacts of climate change on sucrose content and sucrose yield are less clear.

The potentially beneficial impacts of intermediate-future climate change on yield are greatest in currently cooler, rainfed areas. Currently warmer, higher-potential (and typically fully-irrigated) areas stand to gain the least, because temperatures there are already close to optimal for sugarcane production.

Water

According to climatic and hydrological models, irrigation water supplies per se are likely not to decrease in future for sugar-growing regions in South Africa. Streamflows (flows of water recharging rivers, dams and groundwater resources) are likely to increase in magnitude in future – there is likely to be more water supplying our dams and rivers in future. However, increased irrigation demands and more extreme weather events might require upgrading of water supply infrastructure and/or on-farm irrigation hardware capacity, or other compensating actions such as changing to sub-surface drip irrigation or trashing at harvest to minimise soil evaporation.

Pests and diseases

Climate change is very likely to lead to increased pest and disease severity. Creeping grass weeds – having similar physiology to sugarcane – will no doubt thrive under warmer, higher-CO_2 conditions. A greater proportion of the industry is likely to become climatically-suitable for eldana, as well as new pests such as Chilo. Losses due to diseases such as smut are likely to be greater under warmer conditions.

While it is impossible to predict precisely the impacts of climate change on sugarcane agriculture, many key aspects can be estimated with a reasonable degree of certainty. Climate change impact work is ongoing at SASRI.

Weather

Review

The industry has received below average rainfall since April 2014 (Figure 1), causing severe drying of soils in rainfed areas, as can be seen in the example for Umzimkulu mill supply area (Figure 2). The last good rains occurred in March 2014, and the extended dry spell caused moderate to severe water stress in crops from about May 2014. This reduced growth and yields, however, good cane quality was promoted. Rainfed crops have also become more vulnerable to eldana damage. The dry, sunny weather in irrigated regions enhanced cane growth and quality of irrigated cane.

Winter day-time temperatures were generally higher than average while night-time temperatures were below average due to the predominantly clear sky conditions. Severe frost events were experienced during the second week of July in the South Coast (hinterland) and Midlands regions, causing widespread crop damage which will impact negatively on the 2015/16 crop.

Outlook

The outlook for ENSO is uncertain with some forecasting a weak El Nino phase and others a neutral phase to occur during the 2014/15 summer. The South African Weather Service and the International Research Institute for Climate and Society both predict enhanced probabilities of below-normal rainfall for September. There is consensus amongst several climate forecast groups that early summer (October to December) rainfall in the industry could be above-normal. Temperatures are also expected to be above normal.

Growers are encouraged to keep track of the various forecasts, as they may change, and to adjust their crop management if needed.

Please visit the SASRI weather web http://portal.sasa.org.za/weatherweb/ for links to up-to- date seasonal climate forecasts and also for the latest rainfall and other weather data.

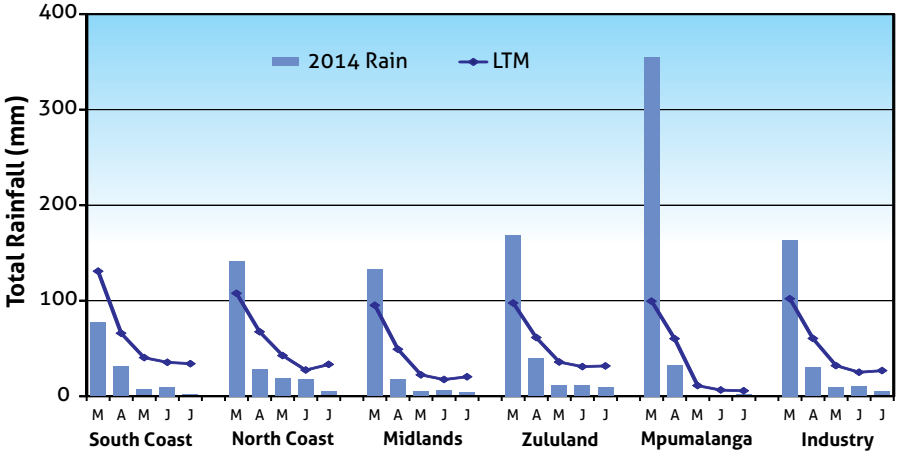


Figure 1: Regional and industry average monthly total rainfall and the monthly long term means (LTM) for March to July 2014.

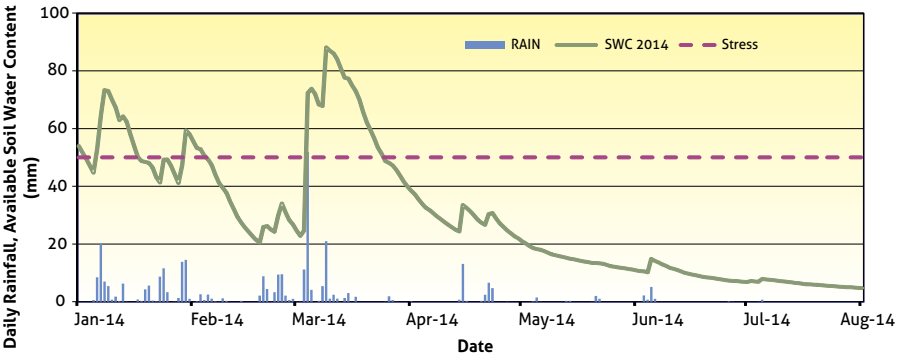


Figure 2: Umzimkulu mill supply area average daily rainfall and the calculated daily available soil water content (SWC) for a soil with total available water of 100 mm for January to July 2014. SWC levels below the stress line indicate periods of water stress.

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

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