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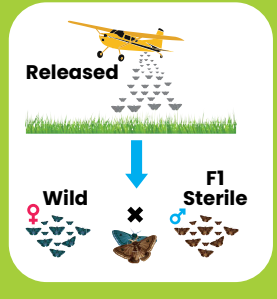
Managing carry-over cane

Tried and tested methods coupled with the use of insecticides are resulting in increased efficiency of eldana control in carry-over crops. ***(page 10)***

On ***page 11*** a resin-P test is highlighted, which has confirmed that the current soil test thresholds used by our Fertiliser Advisory Service (FAS) are adequate for providing valid recommendations.



Sterile Insect Technique (SIT) is discussed on ***page 12,*** with explanations of its role in the eradication, reduction, containment or prevention of targeted pest populations.

SOUTH AFRICAN SUGARCANE RESEARCH INSTITUTE
Unlocking the potential of sugarcane

Important recommendations to effectively manage carry-over cane including ways to minimise losses in quality are provided on page 4.

DIRECTOR'S Message

Dr Terry Stanger

A year ago, we were in the midst of the second wave of COVID-19, and shortly after, the crippling third wave struck South Africa and sadly SASRI lost two employees to the pandemic. Our thoughts are with their families and loved ones that have had to endure these painful losses. As I pen this message, the fourth wave is upon us; peaks and troughs of the COVID-19 pandemic seem to be the new normal. Despite these challenges, SASRI continued to ensure continuity of its operations whilst maintaining a safe workplace for its employees.

In the September issue of the Link, I mentioned that a new five-year strategic plan had been approved by the SASA Council. SASRI's proposed annual programme of work (POW) for 2022/23, currently in the approval process, has been realigned to the six key critical success factors. Seventeen new projects are proposed for 2022/2023 in the Critical Success Factors of Sustainable Sugarcane Production (5 projects); Enhancing and Enabling Adoption (1 project), Biosecurity (3 projects) and Smart Agriculture (8 projects). Included in the proposed new project portfolio are studies to:

- investigate any potential collateral effects of the Bt GM variety under development on non-target organisms;
- obtain proof-of-concept of the effectiveness F1 sterile insect technique on controlling eldana in a pilot field study;
- obtain proof-of-concept of the effectiveness of a state-of-the-art gene-editing technology in sugarcane (contracts with external research service providers);
- investigate the potential value of modern imaging, geo-spatial and data processing technologies in land-cover mapping, field and panel boundary delineation, detecting early symptoms of YSA infestations, locating saline and water-logged soils, and leaf and soil nutrient status monitoring; and
- maximise the value of modern imaging, geo-spatial and data processing technologies in delivering practical tools for extension services and the biosecurity inspectorate to improve efficiencies.

These projects will benefit the entire grower community.

As the off-season approached towards the end of 2021, it seemed the most topical conversation was "carry-over cane", and how the growers can best manage the risks. The article on the next few pages, is an attempt to assist growers with some suggestions around these challenges arising out of an ever-increasing cane area being carried over and consequent increased cane age. One of the biggest concerns for growers is the unprecedented volume of carry-over cane in some areas, as there is an increased risk of eldana infestations exceeding acceptable levels that could result in LPD&VCCs having to issue destruction orders. However, there has been some encouraging and exciting progress in some of the Biosecurity related eldana research projects, as follows:

Recent eldana surveys of mature sugarcane in the sterile insect technique (SIT) treatment and control cages revealed that damage to sugarcane and eldana populations in the treatment cage, in which the F1 and wild-type adults were released was lower, compared to the control, in which only wild-type adults were released. This is early but ongoing and encouraging evidence that the novel SIT F1 approach developed by SASRI is effective in limiting the eldana population growth and consequent sugarcane damage. Follow-on testing of the approach in a pilot field study is planned for 2022/2023.

Analysis and a novel interpretation of eldana data obtained from a white grub trial conducted at the Tugela Mouth have raised an interesting possibility that a once-off spraying of cane with Coragen in late February, targeting early stalk elongation and the March-April-May eldana moth peak, may have long-lasting beneficial effects on eldana control, including reduced damage to predator populations. As well as a reduction in damage to beneficial predator communities, the approach may provide other advantages, including ease of spraying of young cane, higher insecticide "load" per unit plant biomass and enhanced plant coverage. A new SASRI project proposed for 2022/2023 (Project Reference: 21CP02) presents an opportunity to monitor insect predators in cane as it ages, and the impact of early versus late application of insecticides thereon.

Data obtained from eldana light-traps in the Midlands revealed the stability in time of the March-April-May moth peak thereby confirming that this peak should be prioritised for targeting with insecticides.

Further evidence has been obtained of the involvement of the induced expression in sugarcane of a dirigent domain-containing gene (*DIR*) in the response of an eldana-resistant variety to eldana attack. In the long-term, knowledge of genes expressed in response to eldana attack on the sugarcane stalk and associated with susceptibility or resistance may lead to more precise breeding approaches.

Managing carry-over cane this season

Rowan Stranack *(Extension and Biorisk Manager)*, Dr Riekert van Heerden *(Senior Scientist, Sugarcane Physiology)*, Dr Stuart Rutherford *(Principal Scientist, Integrated Pest Management)*, Dr Louis Titshall *(Senior Soil Scientist)* and SASRI Extension Specialists *(coastal and midlands rainfed regions)*

The current crisis of increased areas of unplanned carry-over cane in the coastal rainfed and Midlands regions is receiving considerable attention from both growers and millers.

The solutions to the overall problem of milling capacity could take some years to sort out, but in the meantime, growers are faced with several short-term critical decisions.

This article is an attempt to assist growers with some suggestions around these challenges arising out of an ever-increasing cane area being carried over and consequent increased cane age.

The immediate challenge is therefore to effectively manage a larger area of older cane to minimise losses in quality and to prevent build-up of pests and diseases such as eldana.

Too much sugarcane available could ultimately require a reduction in the area under cane. However, as there are industry initiatives under way, it might be premature to make far-reaching changes until there is a clearer indication of the future.

Some obvious short-term strategies such as less replanting, longer fallows, topping lower and reducing fertiliser could reduce the amount of cane available for crushing. However, each of these comes with its own implications, risks, and challenges and some of these are addressed in this article.

Certain other issues are also highlighted, more relevant to the current season, again with some possible strategies to adopt.

Management of unplanned carry-over cane

Ripening older cane

Management of cane quality in the carry-over crop will be a key factor this coming season. An informative article was written by Dr Riekert van Heerden (Senior Scientist, Sugarcane Physiology at SASRI), for the January 2021 edition of The Link, *'Cane quality management in carry-over crops'*, which you are encouraged to read, as a very similar situation faces us again in the 2022/2023 season.

In the January article, Dr van Heerden first highlighted the potential for significant financial benefits from ripening in longer-cycle rainfed crops, at harvest ages between 18 – 24 months, provided care is taken in the identification of crops suitable for ripening. He then went on to address the situation of large areas of older carry-over cane present at the beginning of the season.

The major factors influencing cane quality in carry-over cane (particularly very old cane) and their associated recommendations are as follows:

Severe lodging caused by high yields. Lodging causes stalk and leaf smothering, damage to stalks, side-shooting, and the development of bull shoots. Lodged carry-over crops, that have not yet re-established an upward-facing leaf canopy, should not be ripened because the leaf canopy must be able to efficiently intercept the chemical spray droplets.

Eldana infestation, as well as other pest and disease issues such as sour rot, are very common in carry-over crops unless controlled. Eldana-infested (> 5e/100) carry-over crops should not be ripened since the chemical effects on the plant are known to intensify infestation. Growers are encouraged to start scouting carry-over fields for eldana from early January.

Any **water-stressed** carry-over crops should not be ripened, because this will place added stress on the leaf canopy, which could lead to excessive stalk desiccation, intensification of eldana infestation and other pest and disease problems. Water stress can be caused by either too little or too much water.

Flowered cane that has been carried over often suffers from severe pithing (cavity formation inside the stalks) and profuse side-shooting. Profusely flowered carry-over crops should not be ripened due to the general poor growing state of these crops (very few green leaves), high risk of eldana infestation and pith formation that will curtail the ripening process.

In carry-over crops not suffering from any of the above, the best way to determine suitability for chemical ripening is through visual inspection of crop growth vigour in conjunction with an estimation of whole stalk juice purity with a refractometer and the Pur*Est*® smartphone application.

Non-judicious use of chemical ripeners including inappropriate choice of chemical, and the timing of application or application to eldana-infested cane can affect cane quality.

Missed opportunities by not ripening carry-over crops deserving of treatment. This will be an important consideration for the 2022/2023 season with some of the mills planning to start early.

High summer rainfall of favourable distribution can easily cause certain carry-over crops to become suitable for chemical ripening due to extended favourable growing conditions. Good indicators are at least eight mature green leaves and whole stalk juice purities of less than 85%. However, many older crops will maintain juice purities above 85%, despite immaturity (low Brix% values) in the upper parts of the stalk. If this immaturity level is large enough, chemical ripening can still be financially rewarding. The Pur*Est*® smartphone application will automatically inform the user when testing of such crops take place.

Whole-stalk juice purities in carry-over crops tends to be too high (> 75%) for using Ethephon (and other trade names). In carry-over crops falling into this category, the use of these products must be avoided because of detrimental consequences including loss of maturity and intensification of eldana infestation. In these carry-over crops, products with the active ingredient fluazifop-p-butyl or trinexapac-ethyl are suitable alternatives.

Chemical ripening is not the only intervention that can be considered to manage cane quality in carry-over crops. If **immaturity** (lower Brix% values) only affects a few internodes below the apical meristem, a downward adjustment of topping-height could be a better solution to manage cane quality, especially in carry-over crops that were not suitable for treatment on the required spray date.

During planning of the ripening and harvesting programme, keep the SASRI **spray-to-harvest interval guidelines** in mind. Spray date guidelines can be obtained in SASRI Information Sheets 12.3 to 12.5 and with the spray date guide calculator in Pur*Est*®. A too-short interval between spraying and harvesting will result in missed opportunities because of insufficient time for ripening, while a too long interval can lead to excessive cane yield loss under good growing conditions, even in older crops. Optimal spray-to-harvest intervals can easily vary between seasons and varieties. The best approach to track the completeness of the chemical ripening process is through refractometer testing between spraying and the planned harvest date.

Frost damaged carryover cane

Mainly in the Midlands North region there are significant areas of frost-damaged carry-over cane. Regarding the management of this cane early in the 2022/23 season, David Wilkinson, (SASRI Regional Extension & Biosecurity Specialist) has suggested that, where there was forced carry over of fields frosted in the winter of 2021, it might be best **not** to start the season with this category of cane.

His recommendation is to start the season with the oldest, most mature high-yielding cane. If conditions are favourable, the frost damaged fields could then be ripened in April and cut in June/July. This would put frost-prone fields back into cycle with a winter harvest.

Regarding which ripener to use, the use of a refractometer and the Pur*Est*® app should help with making the decision.

Fields with high levels of eldana and other high-risk fields should also be prioritised for harvest early in the season once the mill re-opens.

Harvesting operations

To remain 'ahead of the game' it is essential to assess the relative condition of fields planned for harvest at the start of the season. The only way to do this effectively is to take a random sample of stalks from these fields – at least 100 stalks and examine the cane by splitting the stalks. This will very quickly give an idea of the relative condition of the cane – eldana, number of flowered stalks, pithing, sour rot, effects of ripener applications will immediately be apparent and give some indication of relative maturity and where to start. Combining this with refractometer tests and use of the Pur*Est*® app one should get a very good idea of relative maturity of fields.

The key issues of topping height, eliminating extraneous matter, and reducing burn-harvest-to-crush delays (BHTCD) are now even more important. Excluding dead stalks and not loading old zone cane will all contribute to getting the best possible quality out of cane which is possibly well beyond its optimum harvest age.

Topping low will reduce tonnage. As a broad rule, on a per hectare basis, every 10 cm of stalk equates roughly to 5 tons of cane. Some areas are adopting severe topping to reduce tonnage – and improve quality – but as much as this could be a useful area strategy, a good start would be to top where the time of season indicates i.e. lower topping at the beginning and end, and at the meristem during the peak sucrose period mid-season and topping low enough to eliminate any of the leafy top region of the stalk. The old, yet reliable taste-test of each internode below the growing point is still a very good indicator of where to top. Ripened cane should be topped at or just below the meristem.

Control of topping height is not easy and not necessarily always in the cutter's best interest. Therefore, some incentivisation of harvesting quality may be required.

A big win is in reducing BHTCDs, which at an industry level are still at unacceptable levels. Deterioration sets in as soon as cane is burnt despite apparent increases in RV% - which are due to reductions in moisture as cane sits unharvested or on the zone. As a rule, as far as possible keep delays to less than 48 hours to prevent losses.

Flowering

Flowering has been a major factor in the coastal and irrigated regions in recent seasons due to favourable growing conditions during late summer and early autumn. Profuse flowering creates problems later in the season if the cane is not able to be harvested and even greater problems if heavily flowered cane is carried over. SASRI has published numerous guidelines in this respect (see eLibrary at www.sasri.org.za/elibrary).

There is unfortunately not much which can be done about this problem in the short-term. Some growers are experimenting with flower suppression and there is literature to suggest this can be successful in seasons when flowering is profuse. A paper presented by Humm at the SASTA Congress in 2001 reporting on work done on the South Coast, is an example. Unfortunately, the product concerned is not registered for this practice and although some success has been achieved, there are risks especially in seasons where suppression is practised and there is limited flowering due to weather conditions. Effectively then, the cane has been stressed unnecessarily and this could lead to issues with eldana infestations and possible yield losses later.

Due care needs to be taken and more work is required before this can be considered as a recommendation, particularly for the rainfed regions.

Management of the ratoon crop

Strategies to control eldana

With the Biosecurity teams in high demand to check carry-over cane, it will be very difficult for them to get around to all farms in the relatively short off-crop period. This year, quite like never before, requires growers to do their own field surveys if they wish to incur the least amount of financial loss.

Dr Stuart Rutherford (Principal Scientist, Integrated Pest Management at SASRI) has been involved in developing strategies to control eldana and other pests threatening sugarcane such as yellow sugarcane aphid and the longhorn beetle.

To obtain effective control of eldana, Dr Rutherford has long advocated targeted spraying with an insecticide of the diamide group of chemistries, to coincide with the recognised moth peaks in March-April-May and the second peak later in the year during September-October-November. Spraying during these periods will target the eldana moths, eggs, and 1st and 2nd instar larvae.

Where fields have high levels of eldana at the beginning of the year, spraying in the March-April-May peak is unlikely to have much benefit if the fields are due for harvest very early in the season. However, where fields are likely to only be harvested later, say in June, then there could be merit in applying in January or February to coincide with the early moth peak thereby reducing the risk of possible re-infestation of the field.

Apart from infield scouting, loading zone surveys are also an effective means of monitoring eldana. High levels of eldana identified in cane on the zone could mean a significant 'below ground' infestation present in the field which could bring into consideration stubble treatment with Emma to prevent re-infestation of the field.

A more detailed strategy is highlighted in the article, '*Early application of insecticide against eldana*' on page 10.

Crop nutrition

The current astronomic price of fertiliser is presenting an obvious strong temptation to cut drastically fertiliser inputs to attempt to reduce yields. As obvious a strategy this may seem, it comes with risks. Dr Louis Titshall, (Senior Soil Scientist at SASRI) states that the key concern in reducing fertiliser applications relates to subsequent poor crop health, and when combined with carry-over, could trigger pest and disease problems, particularly eldana. Also, cane which has not grown well tends to have an open canopy and weed growth is enabled. Once this happens, it would take a big expense to get the weeds under control again – particularly if creeping grasses are the problem.

Dr Titshall emphasises the importance of keeping the balance of nutrients (proportionality) to avoid excesses of one nutrient while others are deficient - notably nitrogen (N) and potassium (K) as the major inputs. Dropping one in favour of the other could be a problem, for example applying only N when K is deficient or vice-versa. Even if the overall fertiliser level is reduced, by avoiding imbalances one can maintain better overall crop health, even if yields are reduced.

A better strategy could be to drop poor performing and problematic fields and long-fallow these for some time in favour of better yielding fields.

Another question is around the need to apply fertiliser to long-cycle cane once it is mature i.e. in the second season of growth. The current view and evidence is that this has limited benefit, except maybe on sandy soils or where high N losses are known to have occurred.

These are instances where a monitor plot can indicate if there are responses.

Cutting back on fertiliser should be considered based on the results of a soil sample. Without knowledge of the nutrient status of a soil, everything is guesswork which can be costly. The cost of a soil sample is miniscule compared to the cost of a ton of fertiliser, but the information it provides can save thousands of rands. If you intend cutting fertiliser, at least you can decide where the best place would be to cut, rather than guessing with some reduced blanket application.

Some key principles in crop nutrition under the current circumstances:

1) Take soil samples. Then reduce fertiliser after taking advice and use monitor plots to check for responses to nutrients – this will be cheaper than going the blanket over-the-top approach as standard. Ask your Extension Specialist for help in setting up monitor plots.

2) Be realistic with yield targets as this affects N and K application rates.

3) Avoid default blanket fertiliser applications (like 5:1:5 or 6:1:9) if certain nutrients are not needed.

4) Avoid building excessive nutrient "capital" beyond advised thresholds as this greatly increases risk of losses with no benefit to yield or luxury consumption. Both are a waste of money.

5) Focus on improving other limiting factors (e.g. reducing acidity). This will improve nutrient use by the crop and in some cases could lower input requirements.

6) Adopt better fertiliser management strategies (like N splitting or alternative N sources) that reduce loss risks. Right now, the cost of the two popular N-carriers is almost the same which could help in applying the most appropriate N source and not applying simply based on price. Attention to timing and application practices could also keep losses to a minimum.

7) Consider long-fallowing poor performing fields and rather focusing on the better fields.

8) Use techniques to adjust fertiliser rates more dynamically – mainly N on the plant crop. One could drastically cut N applications at planting, the first application - then use monitor plots to decide if crop responds to higher/lower rates for the second split at 3-4 months. Growers can lower N required between 10 – 40% by using such splits and adjusting rates. A similar approach can be used for ratoon cane.

9) Where cuts are to be made, try to keep nutrient ratios proportionate/balanced to avoid creating imbalances that could lower plant health.

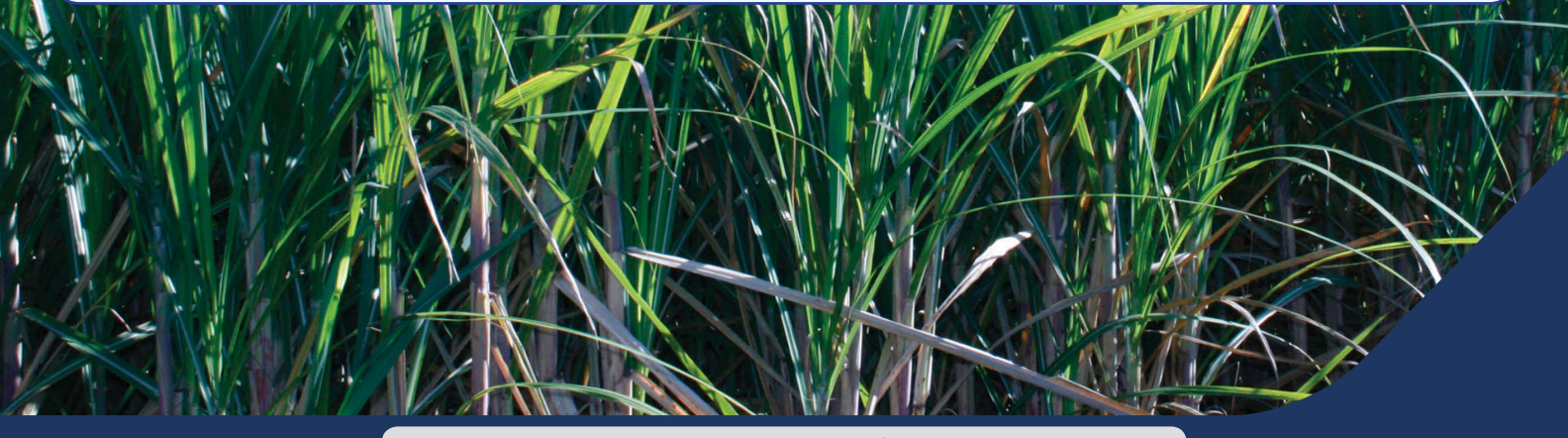
Replanting strategy

Reduced replanting in the short-term makes sense. Not replanting fields considered marginal or high input will obviously save money in the short-term. To not replant at all however is risky as past droughts have proved, where, after the drought, relatively younger ratoons bounced back much better than the older ratoons.

The next few years, with the opportunities to long fallow makes an ideal environment to develop sources of certified and approved seedcane, in readiness for possible improvements in the industry's outlook.

Whether choosing to plant green manures or cash crops (see SASRI Green Manure Bulletin at sasri.org.za/elibrary), or just leaving the land under a weed (controlled) fallow, will yield significant benefits in the long term. Breaking the pest and disease cycle, building up organic matter and storing moisture are all some of the direct benefits of a fallow on soil health.

Poorer performing fields are the obvious candidates, but it could also depend on opportunities for other crops which influence the choice of fields to rest from cane.



Varieties and age of cane

Changing the variety policy on a farm is a decision requiring a long-term view. Whilst there are aspects of the current crisis which point to a possible reduction in cane area, the extent of this and where it will happen are still somewhat uncertain.

At this stage, it would be a good idea to discuss this issue with your Extension Specialist and to get their opinion. There is a view that the variety N12 – which is still widely grown - is better suited to the needs which prevail right now i.e., older cane, some resistance to stress and eldana as well as a tendency to remain upright; N12 ticks these boxes. Keeping fields of N12 makes good sense for the while.

Whether or not to actively begin replanting the variety is a different decision and needs some careful consideration. Sources of certified or approved seedcane are scarce and much of the N12, particularly on the South Coast is infected with sugarcane yellow leaf virus (SCYLV) and a replenishment of virus-free seedcane is required.

Many of the newly released varieties, the N50s onward are early-maturing and high-yielding resulting in early lodging. There is unfortunately little that can be done about this other than to limit the areas planted to single varieties and to actively seek those niches on your farm where these varieties perform at their economic optimum, even though needing to be cut younger.

There are several newly released varieties for the coastal and inland areas and these all need to be considered. The current situation lends itself very well to on-farm variety trials to test out the new varieties. Simply taking varieties for the sake of it should be replaced with a strategy to evaluate these new varieties semi-commercially, not necessarily with full-size fields but areas big enough (+ - 0.5 ha) to evaluate possible varieties for the farm and its conditions. This could prove very useful in the event of an upturn and the need to start replanting again.

Early application of **insecticide** against eldana

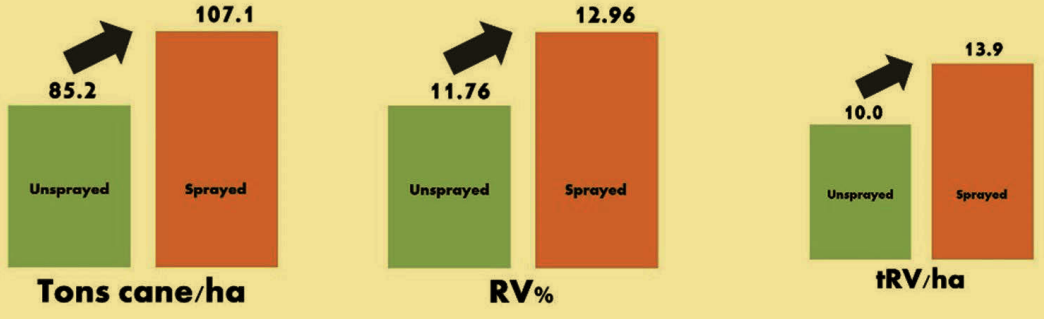
Dr Stuart Rutherford (Principal Scientist: Integrated Pest Management)

Insect predators feeding on newly hatched larvae make an important contribution to natural control of insect pests. In their early stages, eldana larvae feed mainly on the outside of sugarcane stalks before they are old enough to bore into the stalk. During this time, they are vulnerable to predation.

In ratoons following burning, the predator population builds up slowly and peaks when the cane is between six to ten months of age. Natural predation then becomes significant. A concern is that this period coincides with the time when insecticides are applied to reduce the impact of eldana. The use of insecticides in older cane is potentially damaging to the predator population.

Currently, the use of insecticides against eldana is focused on the preventative application to a carry-over crop. Typically, the insecticide is first applied near the end of August, targeting the September- October- November (SON) moth peak, when the crop is eight to nine months old. While this approach is commercially successful, it would be less damaging to predators and a much easier operation if the insecticide could be applied earlier in the crop cycle.

To test this approach, a November ratoon was selected which had previously been infested by eldana. A residual larval population in the stubble and below-ground in the stool was expected to reinfest the ratoon. The application of an insecticide at four months of age, targeting a period shortly after the beginning of stalk elongation and covering the crops' first March-April-May (MAM) (2020) moth-peak yielded outstanding results. A 39% increase in tRV/ha was attained at 18-months. This was despite the SON (2020) and MAM (2021) moth-peaks being left untreated.



Spraying at the end of February probably controlled any larvae that hatched up to two weeks earlier, as they would have remained outside the stalk during this early stage of their life. The treatment would also have continued to control moths and external larvae for up to two-months after spraying.

This once-off spraying late in February targeting early stalk elongation and the MAM moth peak probably controlled any initial infestation arising from a residual stubble and below-ground larval population, at a time when predation was low, with long-lasting effects including reduced damage to predator populations in older cane.

This approach may be particularly suitable for crops ratooned in the late season (October to December) and efficacy is being confirmed in additional trials.

Confirming phosphorus soil-test thresholds

Dr Louis Titshall (Senior Soil Scientist)

A series of SASRI trials across a range of soil types have confirmed that the current resin-P soil test thresholds (10 – 15 mg/L) being used by our Fertiliser Advisory Service (FAS) are adequate for providing valid recommendations.

Due to the complex behaviour of phosphorus (P) in the soil, identifying a single chemical extractant for use in routine soil testing has been difficult, with no single extraction providing the best answer for all conditions. The method that has been adopted most recently by FAS at SASRI is the anion-exchange resin-strip method. It provides a good indication of the short to medium-term P requirements of the crop and has been found to work well across most soil types, regardless of pH.

The recent series of trials have indicated that resin-P values below 10 mg/L leads to RV yield decline. For values above 20 mg/L , no meaningful crop responses are likely. Therefore, the current thresholds being used (10 to 15 mg/L), should remain as they are.

However, the proportion of P extracted by the resin-P test is reported to account for between 1 – 10% of the total P in most soil types, indicating that additional reserves of P may be present, which could be accessed by the crop under some conditions. Access to these soil reserves can be improved by ensuring a healthy soil and crop root system.

Deficient soil P can lead to reduced crop growth.

Deficiency often presents as a reddening or purpling of leaf margins.

Current recommendations advise a higher P application at planting (even if the P test is higher than the threshold), to provide subsequent ratoon crops with sufficient P for several seasons and so reduce the need for ratoon P applications.
Responses to top-dressed P in ratoon crops tends to be poor unless soils are severely deficient (<10 mg/L). Periodic soil sampling is thus advised to evaluate the soil status to ensure test values remain within the optimal range.

See Information Sheet 7.4: Phosphorus Management, for more information on best practices for P nutrition. Leaf sampling remains one of the more effective methods to test if adjustments to P fertiliser rates must be made to ensure adequate plant uptake (Information Sheet 7.15: Leaf sampling).

Test phosphorus availability by regularly sampling your soils. The FAS Agricultural Lab offers phosphorus analysis as part of their routine soils analysis package.

F1 – Fast tracking the **Sterile Insect Technique** for eldana control

Lawrence Malinga (Research Entomologist) &
Dr Stuart Rutherford (Principal Scientist: Integrated Pest Management)

Understanding SIT

The sterile insect technique (SIT), which dates back to the 1930s, is a biologically friendly means to control insect pests. The technique is commonly implemented with the mass production, sterilisation, and subsequent release of an abundance of sterilised male insects into an affected area, where they mate with wild females leading to no reproduction. This results in the eradication, reduction, containment or prevention of the targeted pest population. Several successful long-term applications of SIT are either suppressing or eradicating pests in agriculture, veterinary, and medicine, giving, in some cases, over three times return on investment.

A drawback of SIT is that it is expensive to set up the SIT facility, however, SIT is a control option that gets cheaper as it takes effect because fewer insects are needed to meet a required overflooding ratio as wild populations decline. SIT is more effective in larger areas compared to smaller farms unless the farm is well isolated to avoid the migration of wild insects.

SIT in sugarcane production

The early years

Almost 20 years ago, SASRI, in conjunction with FAO*[1] and IAEA*[2], initiated SIT research on eldana. Significant progress has been made through scientifically based studies to understand better the factors and variables that affect the quality and the field performance of released moths. Valuable lessons learned from the SIT research include development of diet, mass-rearing of high-quality eldana moths, determination of best irradiation level, transportation and storage of moths, as well as pilot cage releases. This made this a viable control measure for eldana and increased human capacity and competence in different SIT aspects.

Current research focus

In the absence of an irradiator in KwaZulu-Natal, SASRI is pioneering a novel approach to SIT. Instead of irradiating moths and releasing these directly, as in traditional SIT, the first-generation offspring are mass-reared. To achieve this, male and female pupae are transported to XSIT, a commercial SIT facility at Citrusdal in the Western Cape. Male moths are partially sterilised by irradiation, mated with unirradiated females, and eggs are returned to SASRI for mass rearing and release. Full sterility is inherited in this mass reared F1 generation.

Currently, research is being conducted to determine the effectiveness of this approach in large cages. Weekly releases of sterile male moths in the treatment cage over the last year have significantly and continuously reduced eldana damage in sugarcane stalks and decreased the eldana population, compared to the control cage where no sterile insects were released. These promising results have encouraged a pilot field release programme, using the same principles followed in the large cages, which is a natural progression to a full SIT programme.

Future plans

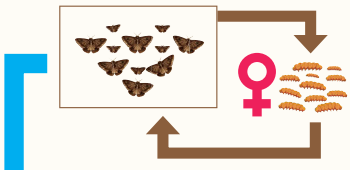
The next phase of the programme involves increased mass rearing capacity to provide the extra sterile male moths needed to overflood the wild eldana populations. This will be conducted in chosen pilot release fields and will develop sound protocols for field releases.

Further research will focus on the suitability of releases of pupae to provide the sterile moths instead of the actual moths themselves, a distinct advantage in our approach. If positive results are obtained, the commercialisation of the SIT technology for the control of eldana in sugarcane will become a viable proposition.

A business case will be developed to determine the best way to use SIT as a tool in the Area Wide-Integrated Pest Management (AW-IPM) programme against eldana. This can be achieved by either establishing a mass rearing and irradiation facility that will supply all the sugarcane growing regions in South Africa with sterile males or promoting the innovation of using a remote irradiator, which the Entomology researchers have pioneered at SASRI over the past few years.

*[1] Food and Agriculture Organisation of the United Nations
*[2] International Atomic Energy Agency

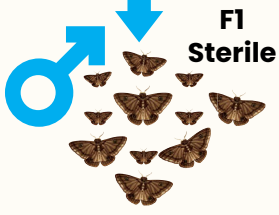
The use of SIT as a component of the AW-IPM programme against eldana would further enhance the protection of carryover sugarcane. This is provided that growers implement the already established control measures against eldana in an integrated way to keep populations low for SIT to work cost-effectively.



Mass rearing of wild eldana moths at SASRI. Pupae transported to XSIT.

Irradiation of male moths at XSIT using gamma rays @ 200 Gy dose.

Pairs of irradiated partially sterile males and unirradiated female moths mate and oviposit.



Eggs are returned to SASRI and mass rearing of sterile F1 male moths.

Release of sterile F1 male moths in the sugarcane field.

Irradiated F1 male moths compete with wild males to mate with wild female moths.

Females lay eggs that are infertile.

Infertile eggs do not produce offspring.

Farming Calendar

JANUARY	• Inspect and rogue fields for diseases and off-types. • Service vehicles and equipment. • Follow-up hand weeding of Panicum and Sorghum spp. • Conduct under-canopy spraying of creeping grasses. • Plan and finalise chemical ripener programme. • Analyse individual field performance to assist in replant decisions i.e. varieties, seedcane, fallowing implications (green manure crops). • Plan eldana insecticide spray programme for the season.
FEBRUARY	• Draw up a programme plan of operations for the coming season. • Conduct budget planning. • Plan seedcane requirements for next year. • Rogue fields and nurseries for diseases and off-types. • Mow verges and breaks. • Estimate crop for the coming season. • Survey carry-over fields for eldana.
MARCH	• Plan drying-off programme for irrigated fields. • Sample replant fields for RSD. • Maintain and repair farm roads. • Complete autumn planting.
APRIL	• Train cane cutters. • Focus on cane quality: Mature, Clean and Fresh. • Schedule irrigation, do not over-irrigate. • Plant green manure crops e.g. Winter Oats. • Take soil samples in plough-out fields. • Review field layout for plough-out fields. • Order lime. • Monitor ripener programme.
MAY	• Maintain waterways, drains and conservation structures. • Abide by local burning code of practice. • Place certified seedcane orders for next season. • Survey potential carry-over cane to see if spraying is needed to control eldana. • For the Midlands: Inspect fields for early frost damage. • Apply lime.

JUNE	• Plan evaluation of irrigation systems. • Repair irrigation system equipment. • Clear firebreaks. • Order fertiliser and plan application. • Begin construction of new field layouts. • For the Midlands: Inspect fields for frost damage.
JULY	• Control winter weeds. • Service and calibrate fertiliser and herbicide applicators. • Sample seedcane nurseries for RSD. • Complete new field layouts and structures. • Begin scouting fields and breaks for yellow sugarcane aphid.
AUGUST	• Train staff in herbicide application. • Check fallow fields for volunteers. • Complete grassing of waterways. • For the midlands: Ensure that all frost-damaged fields have been harvested.
SEPTEMBER	• Begin fertiliser application. • Apply long-term herbicides. • Conduct spring planting. • Rogue for smut. • Plan leaf sampling programme to audit fertiliser applications.
OCTOBER	• Check effectiveness of herbicide application. • Identify fields with problem weeds and begin treatments. • Continue roguing for smut.
NOVEMBER	• Spray minimum tillage fields. • Mow verges and breaks. • For high mosaic risk areas: Do not plant between 1 November and 1 February. • For the Midlands: Monitor winter weeds in last season's cane. • For the Midlands: Plan long fallow to next spring for minimum tillage fields.
DECEMBER	• Check effectiveness of chemical stool eradication. • Follow-up weed control. • Rogue smut- and mosaic-susceptible varieties. • Follow up treatments on problem weeds; particularly creeping grasses.

WEATHER

Phillemon Sithole *(Agrometeorologist)*

Review

Most rainfed parts of the industry received normal to above normal rainfall from late winter to spring (August to October) 2021, while early summer rainfall in November was below normal (Figure 1). In the irrigated northern region of Mpumalanga, well above normal rainfall was recorded at the onset of the summer rainfall season in October and November.

Irrigation water supplies remained stable and mostly sufficient in the irrigated parts of the industry.

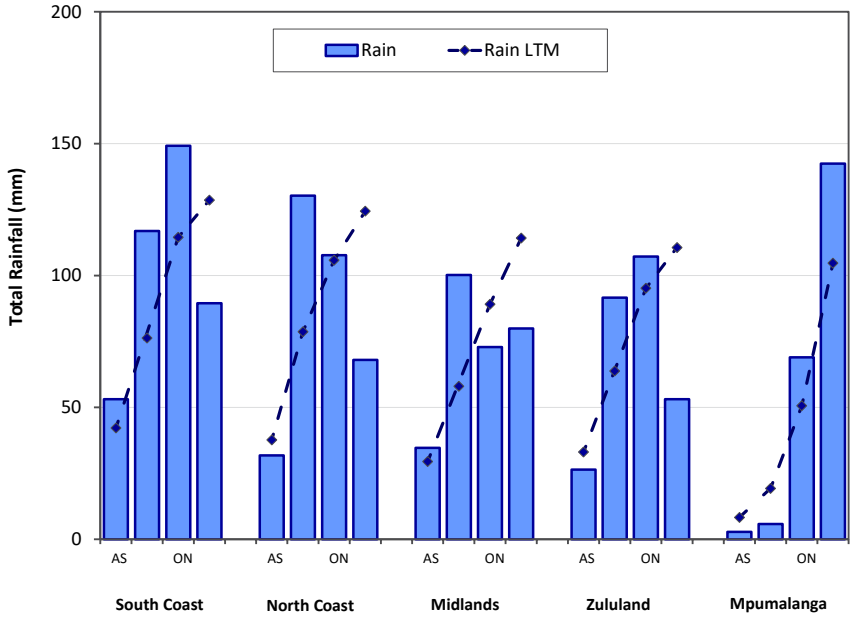


Figure 1: Regional average monthly total rainfall (Rain) for August to November 2021, compared to the monthly long-term mean (Rain LTM).

Outlook

The El Niño-Southern Oscillation (ENSO) is currently in a La Niña phase and is expected to last through to late 2021/22 summer before returning to a neutral state. The La Niña phase is associated with above-normal summer rainfall in the eastern parts of South Africa, including the sugarcane belt.

The *South African Weather Service* and the *International Research Institute for Climate and Society* predict normal to above normal rainfall for the remainder of the 2021/22 summer season for the industry while the *European Centre for Medium-Range Weather Forecast* expects normal rainfall.

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, Rowan Stranack, Dr Riekert van Heerden, Dr Stuart Rutherford, Dr Louis Titshall, Dr Lawrence Malinga and Phillemon Sithole.*

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