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2019 RD&E COMMUNIQUÉS

REPORT-BACK TO RD&E COMMITTEES ON PRIORITY TOPICS IDENTIFIED

CONTENTS

1. 2019 RD&E COMITTEES' WORKSHOP

The RD&E Committees' workshop held in Mount Edgecombe on 7 March 2019 to assess regional priorities for inclusion in the 2020/2021 SASRI research, development and innovation (RDI) programme was attended by 72 delegates, including the Chief Director for National Extension Support in the Department of Agriculture Land Reform and Rural Development, Mr Bonga Msomi (Figure 1).

1.1. Workshop Participants and Evaluation

The majority of the 40 participants (Figure 1) who completed the post-workshop evaluation questionnaire indicated that the workshop was largely successful in its aim of aligning the SASRI RDI programme with producer needs (Table 1).

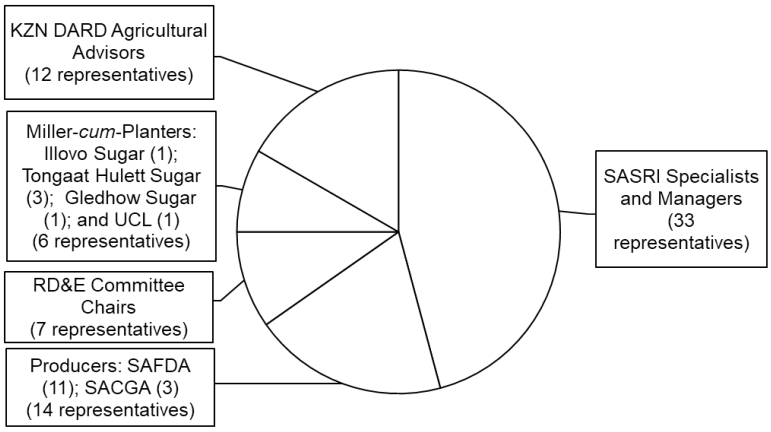

Figure 1

Affiliations of Participants in the Research, Development on Extension Committees' Workshop convened on 7 March 2019 in Mount Edgecombe. The Workshop identified key priority issues for cane production under rain-fed conditions to guide the SASRI RDI Programme of Work in 2020/2021.

Table 1

Value of the 2019 RD&E Committees' Workshop as Perceived by Participants. Views of the participants were ascertained by means of a post-workshop questionnaire. Further information on the views expressed is available on request.

Workshop was valuable in: (1) clarifying role of Committees; (2) facilitating communication of grower needs; (3) improving alignment of SASRI research with grower needs.	**Yes**	**No**
	36	4
Workshop structure and processes were compatible with achieving this value.	**Yes**	**No**
	39	1
Structure and processes followed in 2019 should be retained for 2021.	**Yes**	**No**
	38	2

Overall rating of 2019 Workshop.	**Excellent**	**Good**	**Fair**	**Poor**
	16	23	1	0

1.2. Regional Priorities Identified for 2020/2021

During the workshop, nine topics were identified as being of high priority (Table 2), including management of the yellow sugarcane aphid, white grub control, variety nitrogen-use efficiency and silicon nutrition. For the small-scale production sector, equitable seedcane allocations and specific challenges around herbicide use emerged as priority topics.

Table 2

Regional Priority Topics for Cane Production Identified for 2020/2021 during the 2019 RD&E Committees' Workshop

TOPIC	DESIRED OUTCOMES
Yellow Sugarcane Aphids	• Scouting/survey methods • Intervention thresholds • Management recommendations • Biological control options • Affordable alternative chemistries
Thrips	• Scouting/survey methods • Intervention thresholds • Management recommendations • Biological control options • Affordable alternative chemistries
White Grubs	• Control in ratoon cane
Herbicides (Velpar)	• Alternative herbicides for use on plant cane • Suitable pack sizes for small-scale cane producers • Observation plots on correct Velpar use
Eldana IPM	• In-field burning of tops as part eldana IPM-related field hygiene discouraged
Variety Nitrogen-use Efficiency	• Variety NUE ratings provided • Variety NUE accommodated in FAS recommendations
Silicon Nutrition	• Suitable products for silicon supply • Silicon application methods
Seedcane	• Equitable seedcane allocation to small-scale producers
Remote Sensing	• Remote YSA detection technology • Collaboration with external parties for service provision

1.3. Actions for 2020/2021 Resulting from Workshop

The priority topics emerging from the workshop were considered carefully by SASRI scientists during a series of workshops held in April 2019. As a result of these discussions, specific knowledge exchange campaigns, RDI projects and other interventions have been planned for commencement in 2020/2021, as follows:

- five knowledge exchange campaigns on yellow sugarcane aphids, thrips, eldana IPM (with an emphasis on field hygiene), silicon nutrition and variety nitrogen-use efficiency;
- two research and technology development projects on yellow sugarcane aphids to uncover new knowledge about the pest and its interactions with sugarcane that will ultimately lead to improved area-wide integrated management options for all cane producers;
- a research project that will investigate the role of root health in silicon nutrition;
- a technology development project that will ultimately establish a regional network of participatory observation trials for small-scale producers on weed management options (this project is one of five of suite of new proposed projects on technology development specifically for small-scale producers); and
- ongoing discussions with stakeholders regarding options to enable equitable access by small-scale producers to seedcane of new varieties.

1.4. Communiqués on Priority Topics

Communiqués on the nine priority topics identified during the workshop are presented per region in the sections that follow.

2. ZULULAND REGION

2.1. Yellow Sugarcane Aphid Control (Ref: #1)

2.1.1. Rating

Critical

2.1.2. Background

- While the outbreaks of Yellow Sugarcane Aphid within the Amatikulu Mill Supply area are nowhere near as severe as south of the Tugela, there is concern that the incidence could escalate.
- Allice® is effective, but the duration of control is too short.
- Another chemical with long-term efficacy is required.

2.1.3. Solutions Needed

- Identification and/or scouting protocols for the pest.
- Thresholds to be applied when it comes to activating control measures.
- Recommended control measures and management strategies.
- Recommendations for biological control.
- If chemical control is recommended, a more effective, yet affordable chemistry, is required to complement or serve as an alternative to Alice.

2.1.4. Communiqué

Yellow sugarcane aphids (YSA) are small (<2 mm), brightly coloured aphids with numerous hairs covering the head, thorax, and abdomen. YSA reproduces without mating (i.e. parthenogenetically) in warm climates and produces live young. However, low winter temperatures induce sexual forms and egg laying. Intensive surveying of sugarcane field verges on the North Coast has revealed very low overwintering populations of YSA on grasses. Thus, the aphid never completely disappears and awaits suitable environmental conditions before making an explosive comeback.

YSA development occurs more rapidly on several grass genera (*Digitaria*, *Echinochloa*, *Panicum*, *Paspalum*, *Pennisetium* and *Sorghum*) than on sugarcane. Development from nymph to reproducing adult takes about 8 days on *Sorghum*, but 18 to 22 days on sugarcane and is highly dependent on environment, especially temperature. Females produce one to five nymphs per day for between 16 – 25 days on these host plants. This suggests that a single female could produce up to 125 offspring depending upon factors such as temperature, humidity, host plant (variety) and predation.

Temperature (optimally mid to high 20s ^{o}C) and low humidity are prime drivers of YSA outbreaks. Under warm dry weather conditions in spring, natural enemies are slower to develop and lag behind the aphid, but eventually can control infestations during summer. However, control may not occur before the aphids have caused visible plant damage. Likewise, with higher humidity during summer, entomopathogenic fungi can also limit aphid infestations.

YSA often attacks young sugarcane prior to the development of multiple internodes. The aphids prefer to feed on the underside of the more mature leaves, eventually causing yellowing/reddening of tissues leading to premature senescence and chlorosis. Feeding on young plants can cause major damage under high levels of infestation. In the USA,

chlorosis of 2–3 leaves early in the growing season has been reported to reduce sugar yields up to 6% with losses of up to 19% occurring when >6 leaves are chlorotic.

YSA taps into the phloem vessels of parallel leaf veins of their grass hosts. This aphid tolerates dense populations on the leaves and usually begins to move to other leaves or plants only after the host leaf or plant has become mostly yellow and is about to die. The apparent preference of YSA for lower leaves suggests that it benefits from leaf senescence. During senescence of older leaves, nutrients particularly nitrogen in the form of amino acids, are recycled to younger plant parts via the phloem. Aphid development benefits from this nutritional enrichment of phloem sap. Once numbers build up sufficiently, the aphid itself seems to be able to induce premature leaf senescence through weight of numbers.

A possible role of excessive nitrogen application on aphid performance is therefore likely where a higher rate of aphid growth could be attributed to a higher concentration of amino acids in the phloem sap. Potassium and phosphorous deficiencies, and mild water stress (e.g. due to sub-soil acidity) can also lead to premature leaf senescence and increased concentration of amino acids in the phloem. These factors have been tentatively linked to repeated early infestations in certain fields.

Growth and development of YSA on resistant sugarcane cultivars is reduced several-fold relative to susceptible cultivars, though mechanisms of resistance have not been studied. Feeding by YSA on resistant cultivars also causes less leaf senescence and chlorophyll loss than in susceptible cultivars, suggesting that any yield loss will be less apparent in resistant cultivars. Resistance is therefore a useful tool in managing YSA. A slower aphid population growth rate allows natural enemies to keep up in terms of their own population growth, further limiting aphid infestation intensity.

In the USA, chemical control is not consistently recommended, as there is little evidence that insecticide applications targeting YSA improve yields. Further, there is concern that insecticides, particularly pyrethroids, may disrupt natural enemy populations resulting in pest resurgence. Registered insecticides are systemic when they are applied to the soil (Bandito®) or limited to the leaves contacted by foliar sprays (Actara®, Allice®). Once taken up into leaves these insecticides can give extended control, of up to 3-4 months in the case of Bandito®.

In terms of scouting, growers should select at least two fields for scouting on a farm. These fields should include one that the aphid has first infested in previous years (“early warning”) and one considered to be at risk, e.g. a susceptible variety between 2-7 months of age. Scouting must begin before visible symptoms appear. Scout the fields at two-weekly intervals. Whilst traversing the fields take note of any obvious aphid presence.

In the absence of obvious infestation, intensively search 20 stalks divided between four rows (at least 20m apart depending upon field size). At each location in a row, intensively search one stalk in a stool. Inspect all live leaves below and including the TVD leaf. Record presence or absence of the aphid for the stalk as a whole. Pace approximately 20 metres to the next stool and repeat.

Once aphid presence has been detected, it is important to determine whether the initial infestation is developing into one likely to cause excessive damage. Factors, which may limit infestations from becoming damaging, include varietal resistance, optimal plant nutrition, reduced plant stress and the presence of natural enemies. Reduced aphid population growth rate allows natural enemies to keep up in terms of their own population growth, further limiting aphid infestation intensity.

This scouting method requires the determination of percent leaves infested at weekly intervals. At each of 20 sampled stalks, number of leaves searched and number of leaves infested are recorded. A leaf is infested whenever there is at least an adult aphid and its daughter together. Note the presence or absence of natural enemies on each leaf as this should influence control decisions.

Calculate the % of YSA infested leaves.

Some general rules developed in Colombia could be applied to guide control decisions, as follows.

- If less than 15% of leaves are infested then no control is recommended.
- If greater than 30% of leaves are infested then control is recommended.
- If between 15 and 30% of leaves are infested make a second evaluation 7 days later.
- If the infestation has declined then no control is recommended.
- If the infestation has increased then control is recommended.
- If the infestation has not changed then make an additional evaluation 7 days later.

Current and future SASRI projects include species diversity of natural enemies; the testing of additional insecticidal modes of action; continuous cultivar resistance evaluation; the effect of N, P and K nutrition on aphid population growth; ground-truthing of scouting procedures (that were developed in Zambia) and remote sensing (UAV and satellite) for the detection of YSA damage.

In the mean-time, growers are advised to take note of current cultivar resistance ratings; to ensure adequate K and P nutrition; to fertilize with N according to actual yield potential (not desired yield); to utilise Bandito® in the furrow at planting and onto the soil surface of ratoons in Spring especially where nematodes and thrips are additionally problematic.

2.2. Thrips Control (Ref: #3)

2.2.1. Rating

Essential

2.2.2. Background

- Bandit® is registered for the control of thrips at planting and appears to be effective for a couple of months.
- Allice® is the only registered chemical for aerial application. While it is effective, the length of control appears to be limited to three-or-so weeks, where after re-infestation rapidly takes place again.
- A chemical with a longer residual action is needed.

2.2.3. Solutions Needed

- A new product, Bandito® is to be registered shortly, which should be communicated to the industry
- Identification and scouting procedures are needed.
- Thresholds for implementation of control measures.
- Recommendations on control measures and management strategies.
- Recommendations on biological control.

2.2.4. Communiqué

Sugarcane thrips are regarded by growers as a pest of major concern and field studies by SASRI have shown large potential yield losses to thrips. While there has been considerable progress in developing IPM measures for thrips, and these have been communicated to the industry, there has been further progress in the interim, which needs to be communicated to growers. In addition, many growers are apparently not aware of the presence of the pest and its symptoms, how to scout for and identify it, and do not are unfamiliar with its seasonal phenology and what IPM measures can be implemented.

Previous communications, principally as articles in *SASTA Proceedings* and *The Link*, and an Information Sheet, have covered the following topics: (1) pest identification and

damage symptoms; (2) yield loss; (3) variety resistance categories; (4) manipulating time of planting to reduce pest impact; and (5) insecticides that have been registered for control. With regard to insecticides, concern has been raised that, although effective, Bandit® (a.i. imidacloprid) can only be applied at planting and is susceptible to rapid degradation by UV if furrows are not closed immediately after application. Thereafter, Allice® (a.i. acetamiprid) is the only chemical registered for aerial application on ratoons and its period of effectiveness is limited to a few weeks, after which thrips rapidly re-infest the crop. However, two new chemicals will soon be available, namely, Bandito®, which has recently been registered for control in both plant and ratoon cane, and a second product that is due for registration.

Monitoring of thrips populations has continued at Umfolozi and these data, together with those previously collected by P&D in other areas, have provided good information on the seasonal population dynamics of the insect. This information can be used to fine-tune control measures, specifically insecticide application. Various predators on thrips have also been identified, in particular an assassin bug (*Aurius*), stressing the need for growers to conserve biodiversity and use insecticides with caution, in order to encourage natural biological control. At present this is the only identified biocontrol option.

While desirable, the development of management thresholds is especially difficult and costly and cannot be accommodated in the SASRI programme of work at this time.

These developments, along with updated information on variety resistance of older and recently released varieties, will be released as part of a knowledge exchange campaign on thrips, which will include articles in The Link, an updated Information Sheet, and Extension newsletters. This will be aimed at increasing thrips awareness and adoption of IPM on an ongoing basis, particularly through alerts issued at appropriate times during the season.

3. COASTAL REGION

3.1. Yellow Sugarcane Aphid (Ref: #1)

3.1.1. Rating

Critical

3.1.2. Background

- Lack of management practices.
- Becomes worse every year leading to loss in production.
- Possible link to spread of other diseases.
- No clear pattern (seems to move quickly).
- Variety choice.
- Infestations unpredictable.
- Plant cane seems to be mostly affected

3.1.3. Solutions Needed

- Knowledge and education important.
- Variety choices.
- Mapping technology for prediction.
- Need management guidelines (scouting method, timing and thresholds for interventions).
- Survey method for P&D teams and growers.
- Field and field verge hygiene and management in limiting spread.

3.1.4. Communiqué

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3.2. Silicon deficiencies (Ref: #6)

3.2.1. Rating

Essential

3.2.2. Background

- Silicon deficiencies are a common occurrence and are widespread across the industry.

- Silicon plays a role in plant defence against pest and diseases
- The effect of silicon deficiencies on yields and pest and disease susceptibility are unknown.
- The role of long-term application of lime is uncertain.

3.2.3. Solutions Needed

- Suitable products for silicon supply.
- Application methods for silicon.

3.2.4. Communiqué

Many growers report deficient sugarcane Si levels, yet despite considerable prior research, no clear guidance on soil or crop management practices is available. This requires attention and clarity in the advice provided.

The issue of Si uptake has been previously raised and reported in RD&E communiques issued in 2016 (Issue #38) and 2017 (Issue #24). Both reports highlighted some key concerns associated with the current state of knowledge.

Previous research has shown that adequate Si in the plant provides protection against several pests and diseases, and may impart benefits against lodging and drought stress. However, local research to-date has not identified a definitive set of conditions or a Si source that will ensure adequate crop uptake, and recommendations remain inadequate. At present, where Si deficiencies are detected, a Si containing product is advised, typically a calcium silicate slag. Unfortunately, while the use of such products in potted sugarcane experiments achieves Si uptake, this does not guarantee adequate plant uptake under field conditions and so poses a high cost risk for growers considering this approach.

Of interest is that many international studies have clearly demonstrated considerable improvements in Si uptake by sugarcane when silicate slags are applied (typically at quite high rates). Often these studies are on soils similar to those of local growers where Si deficiencies are reported (leached, nutrient poor soils, typically either well drained, humics or freely draining sandy soils). However, responses reported in South African studies on these soil types are variable and inconclusive. The chemistry in the soil, and thus likely crop response to applied Si, is expected to be different between these two soil types. Previous studies have acknowledged these differences and hypothesised on likely causes, yet the exact mechanisms remain elusive.

In seeking an approach to develop suitable recommendations, the following observations from past Si research have been made and feedback from several grower/extension interactions received:

- The lack of Si uptake (indicated by leaf deficiencies) is predominantly in soils dominated by well-weathered minerals (well-drained sandy soils and, well weathered clay soils (typical of many humic soils)). These soils types are common in the rainfed regions. Si deficiencies are not frequent in the irrigated regions, which is attributed to the presence of less weathered clay minerals that supply high amounts of Si.
- Soil tests are very difficult to calibrate to crop response and most research suggests several extractants are required and that the relationship between them be used to identify responsive soils. Dual extraction is, however, not practical from a routine fertility analysis perspective.
- Field and pot experiments often give conflicting results, likely a function of the changes caused by mixing and confining soil and crop in a pot compared to the “open” nature of a field system, where soil disturbance is markedly less.
- Application of products to plants grown in pots typically results in increases in Si uptake, but under field conditions, the increases are seldom to levels that would impart the benefits associated with high leaf Si (mostly P&D resistance). The consistency of response is also highly variable, thus it is not possible to define practical recommendations.

- Many studies evaluating response to Si have not measured all the parameters needed to elucidate causal factors for crop response. As such, the lack of response is often attributed to hypothesized causes. While useful to develop further thinking, without information on the mechanisms, suitable guidelines cannot be developed.
- Both local (SASRI) and international studies have demonstrated that soil fumigation results in improvements in uptake of nutrients in sugarcane, including Si. In most cases, the specific mechanisms of this have not been clearly identified, but it appears the improved nutrient uptake is associated with aspects of improved root health. When fumigating all soil biota are eliminated, which includes several species of biota that adversely affect root growth in sugarcane. With this constraint removed, sugarcane growth typically improves and is linked firstly, to enhanced root development by the cane and secondly, improved relationship between the new roots and beneficial soil organisms, notably mycorrhizal fungi that re-inoculate from non-fumigated soil layers.
- Several growers in the rainfed regions have adopted soil health management practices (singly or in some combination) that are reported to improve crop health (including improvement to optimal leaf Si and other nutrients). While the evidence is anecdotal, these improvements (including increased Si uptake) may be due to improvements of various aspects of soil and crop health. Each is briefly outlined as follows.
    - **Liming to very low acid saturation levels** (<10%, sometimes down to 0%): Benefits are likely to be associated with reduced Al availability (thus reduced complexation with Si), improved soil Ca (particularly on leached, well weathered soils) with apparent benefits for root health (and thus nutrient uptake, including Si) and generally improved soil structural attributes and biological function – both of which promote enhanced root function.
    - **Introduction of mulching in a green cane harvesting system** (and/or use of other organic sources such as manures, bagasse etc): Benefits may be associated with recycling of leaf/biomass Si back to the soil, competition for Al by organic decomposition products, and improved soil structural and biological parameters due to improved organic matter content (leading to enhanced root health and consequently nutrient uptake).
    - **Use of a green manure/fallow between replant cycles**: Improvements in crop health typically associated with reductions in root pathogens, improved soil physical attributes and release of nutrients, all of which promote enhanced rooting by the crop.
    - **Improved soil compaction and surface crust management**: The key benefit seems related to better root growth (improved aeration and drainage in the soil) and thus improved exploration of soil rooting volume. Aeration is critical to the function of roots, where compaction and crusting limits air exchange, leads to anaerobic soil conditions and excessive soil strength, all factors that limit root growth and exploration.

It is clear that there is still an incomplete understanding of sugarcane response to Si and the conditions that drive this. Undertaking pot and field-based trials would require a high research investment to create the necessary database of information to explore the range of soil types, crop nutritional interactions, climatic conditions, management factors (placement, Si form) and the various interactions between these components. This is not considered feasible at this time. Thus based on observations from past research and anecdotal evidence of enhanced Si uptake as a result of changes in soil management practices, three approaches to better understand sugarcane response to Si are proposed:

1. **Step1: A grower based data survey**: Several growers have been identified that undertake regular soil and leaf sampling while maintaining good records of field management inputs and yields. The specific management objectives vary between such growers, but in most cases it is apparent that partial, and sometimes comprehensive, best management practices are adopted (including comprehensive liming, green manuring, mulching, controlled traffic, etc). Where good records exist and the practices have been applied consistently for a meaningful period of time (at least 3 years), it may be possible to track changes in crop performance in relation to

the soil attributes and applied management practices. While it is unlikely that this approach will elucidate exact mechanisms of improved Si uptake, it will provide insight into grower based activities that provide improvements and how these have changed over time. Based on those trends more focussed investigations can be developed to better identify sites where Si uptake has improved and conditions that drive that. This approach will also allow for investigation of other aspects such as micronutrient responses (which also lack definitive recommendations), and provide a better general understanding of factors that are likely to be impacting on improved crop health.

2. **Step 2: A meta-review of local research and international Si research in sugarcane**: Unlike a conventional qualitative review, a meta-review attempts to collate both positive and negative response data within a single standardised statistical framework to permit trend analysis. Along with the use of precision weighted statistical techniques this provides a less biased view on the direction and magnitude of responses. Further techniques that can be included (depending on available data) are multivariate relational techniques, as this will allow similarities between local studies and international studies to be identified, providing insight into causal drivers of responsiveness (or the lack thereof).
3. **Step 3: Demonstration and/or paired plot field-based trials**: These would aim to stack several best practices considered beneficial for soil and crop health and where any improvements are monitored (which would include Si uptake). This is intended as an integrative approach that will holistically examine shifts in various soil and crop parameters simultaneously, and with the use of multivariate relational techniques, attempt to establish links between cause and effect (in effect an ecological monitoring approach). This project would commence after the grower and literature based surveys and review have identified likely practices and conditions that can be linked to improvements in crop performance.

Thus a project has been proposed for commencement in 2020/2021 (SASRI Ref: 19CM02 (*Evaluating and demonstrating the value of best management practices for soil and crop health: Silicon as an indicator*). The project will:

- undertake steps 1 and 2 above to collate existing data and identify the conditions and practices that result in improvements in Si uptake in a sugarcane crop; and
- develop a field-based demonstration or paired-plot study (Step 3) with sites, practices and possible treatments decided based on the outcomes of the survey and review process from Stage 1, along with outcomes from other research sources (e.g. Root Health Project 12CM01 (closed), root health management booklet 18KE05 (current)).

3.3. Extension Technology (Ref: #8)

3.3.1. Rating

Critical

3.3.2. Background

- Need to adopt state-of-the-art technology to improve efficiencies.
- Modern digital monitoring technology would reduce the need for physical surveys and improve detection and enable effective, targeted action.

3.3.3. Solutions Needed

- Using YSA as a case study for testing drone / satellite monitoring technology.
- Develop and evaluate detection technology.
- Collaborate with external parties (e.g. Sappi) to improve efficiencies and cost-effectiveness.

3.3.4. Communiqué

A need was identified whereby SASRI Extension and Biosecurity should make more effective use of new technology available to assist in identifying growth and particularly pest and disease problems, remotely. Specific reference was made to the use of remote sensing using satellite imagery, and more detailed surveying using drones and associated technologies. There was the possibility that if these technologies were effectively employed, then fewer physical surveys would be required and problems could be identified earlier than at present, therefore enabling a more rapid and effective response. Possible collaboration with external service providers was also suggested.

SASRI has noted the useful suggestions made during the workshop. There are currently projects which have been proposed to explore the use of both remote sensing and drone technology in the early detection of pest damage on sugarcane. If proven to be successful these techniques could ultimately be used to supplement ground pest and disease surveys allowing effective early warning and a more strategic and targeted response to new outbreaks. The use of external service providers is planned where appropriate in order to avoid the need to purchase costly capital equipment.

Regarding the use of new technology relating to crop growth and production, the use of Normalised Difference Vegetation Index (NDVI) has been investigated in various projects with respect to the ability of remote sensing using NDVI to identify crop stress in different forms.

A project has been proposed for to investigate the effectiveness of drones in applying ripeners to sugarcane (SASRI Ref: 19TD05 (*Advancing cane quality management in the small-scale grower sector*)). This will give indication of the potential use of this application method in sugarcane agriculture going forward.

The use of apps by extension is also becoming more routine, for example Purest and RustCalc. Other apps are also planned.

3.4. Allocation of New Varieties to Small- and Medium-scale Growers (Ref: #9)

3.4.1. Rating

Essential

3.4.2. Background

- Lack of access by small- and medium-scale growers to new varieties is of concern.
- This occurs across all regions except the South Coast and Lower South Coast.
- These growers are losing out on the value of the new releases.

3.4.3. Solutions Needed

Review of plant breeding bulking and new releases allocation procedures.

3.4.4. Communiqué

In some areas of the industry, small-scale and land reform growers find it difficult to access seedcane of newly released SASRI varieties. The price of certified seedcane and proximity to sources of this seedcane are significant barriers to access amongst small-scale growers.

In light of the 2023 deadline by which time all commercial planting must be carried out using either certified or approved seedcane, this problem requires urgent attention. A review of the current bulking and release protocol was requested.

SASRI acknowledges the challenges faced by small-scale and land reform growers in this regard. Whilst SASRI is responsible for breeding and selecting new varieties, once they

are approved for release to growers, the responsibility for the bulking up and final release of seedcane to growers is that of the Local Pest Disease and Variety Control Committees (LPD&VCCs). These committees select co-operators to bulk up the NovaCane® plant material prior to final release to growers. These co-operators are compensated by SASRI. Once this first phase of bulking is complete LPD&VCCs typically choose to bulk up further on the same or other farms before the variety is finally released to growers. Growers then buy seedcane of the new varieties from the growers who have bulked it up.

In order to enable earlier access in the bulking-up process to new varieties by small-scale growers, a proposal was made to the SRASA Working Group tasked with pest, disease and variety control issues. This proposes that once the new varieties grown on co-operators' farms reach maturity in the first phase of bulking, an agreed quantity from the bulking plots is provided free to small-scale and land reform growers. The quantity allocated to these grower groups is to be agreed on by the LPD&VCC and calculated based on, for example, area under cane or tonnage delivered by these groups. Whatever method is used shall be fair and equitable.

In the proposed model, small-scale and land reform growers will themselves decide on a bulking up procedure appropriate for their grower communities and thereby enabling earlier access to new varieties than was the case in the past.

4. MIDLANDS REGION

4.1. White Grub Control (Ref: #2)

4.1.1. Rating

Essential

4.1.2. Background

- It is acknowledged that research has been conducted on white grubs previously but there is no commercially available control measure/product, especially in ratoon cane.
- White grubs are found mostly in humic soils (in Ecozones 1, 2, 4 and 8 of the Midlands North region) where infestations are severe.
- The problem is widespread (at least 60% occurrence throughout the Midlands North region), as white grubs are found in every soil pit, although the problem is less severe in the Midlands South region.
- Symptoms of white grub infestations are yellowing of the cane and root damage, especially in N35 which seems to be susceptible.

4.1.3. Solutions Needed

White grub control option for ratoon cane.

4.1.4. Communiqué

As indicated, previous research has been undertaken by SASRI on white grubs. The investigations focussed on finding suitable biological control agents which could be used against this pest. Although a suitable agent was discovered, the primary barrier to developing this work further has been securing a commercial partner to develop this agent. A similar barrier has been encountered with regards to chemical control options. To this end, SASRI will approach the forestry industry who are also working on this pest to assess any potential collaboration opportunities. It is speculated that if a bigger market for the product can be shown, then companies may be persuaded into looking at development of management options for this pest. The second barrier to obtaining effective management options for this pest is the difficulty of proving efficacy of a particular product or management method. For registration purposes, efficacy must be proven in field trials as stated in the guidelines provided by Department of Agriculture,

Land Reform and Rural Development (DALRRD). This however is difficult to do as white grubs are extremely patchy in the field and are difficult to find. This patchy nature also makes such work extremely risky and often quite expensive further dissuading companies from working with this pest. To this end, SASRI has engaged the Office of the Registrar of Act 37 of 1947 with regards to an alternate pot trial methodology. It is envisaged that successful implementation of the alternate method will allow for both SASRI and industry to effectively test different management options. This is currently under discussion with industry. Future work will be concentrated on developing the already discovered agent into a readily available commercial formulation for growers. In addition to that, other management options such as new chemicals or biological control options will be investigated as well as pheromone identification.

4.2. Velpar® Use on Plant Cane by Small-scale Growers (Ref: #4)

4.2.1. Rating

Important

4.2.2. Background

- Velpar® K3 (Arysta; active ingredients hexazinone - 250 g/kg; diuron - 533 g/kg) is being used by small-scale growers on plant cane despite the product not being registered for that purpose. Potential problems associated with this must be conveyed to small-scale growers, especially that application in plant cane may result in yield loss and that ratoon cane may also be negatively affected.
- This practise has become widespread as the product is available in small affordable packs, is applied as a powder and is convenient.

4.2.3. Solutions Needed

- Information provided to small-scale growers on alternative herbicides available for 1 – 2 ha of plant and ratoon cane. It would be ideal to have a single product that is suitably packaged, priced and labelled for SSG.
- A demonstration plot to show effect of Velpar on plant cane.

4.2.4. Communiqué

There are three parts to this topic:
- Velpar® registration for use in plant cane;
- herbicides for use in plant cane that areavailable in small pack sizes; and
- demonstration plots on the effect of Velpar® on plant cane.

Velpar® registration

Dr Peter Turner, a consulting sugarcane agronomist who is familiar with the initial Velpar® registration process, is of the opinion that the risk of application on plant cane was seen as too great by Du Pont, a view which would have been supported by SASRI at the time. Hence, it was a commercial decision taken by a company not wanting to take on this risk. Dr Turner also commented that there are effective safer options available for pre-emergence weed control in plant cane. From a literature survey of internal documents it is evident that the risk of damage to plant cane is strongly influenced by a soil texture and soil moisture interaction. One author concluded that, with care, Velpar® can be successful in plant cane weed management but the safety margin is very low. There is little room for error during field applications, either with the dose applied or with delays in the timing of the sprays. Consequently Velpar® and Velpar®/Diuron® combinations should be considered phytotoxic to plant cane even at low doses. Due to the narrow margin of selectivity between sugarcane and weeds, the use of treatments containing Velpar® is not recommended in plant cane situations. Imprecisely controlled applications may lead to crop phytotoxicity.

Alternative herbicide treatments for plant cane

Pack size is a difficult issue, which is driven by agrochemical company economics and is one over which SASRI can exert little influence. Past interventions have been unsuccessful. To address this, the recently developed SASRI Herbicide Selector was employed to find alternative registered options in plant cane. One of the options available was Lumax® (Locate and Local are generics of Lumax®). Lumax® is available in 5L containers which is sufficient for one hectare. Fanie Horn (Cane Development Manager, Illovo Noodsberg Mill) demonstrates Lumax® for use in one hectare of plant cane. Other options in small quantities include Metrad® or diuron + acetochlor + paraquat. In addition, at least one agrochemical company is prepared to make available e.g. halosulfuron in small packages. They are open to discussions regarding certain other products.

More recently, Sifiso Hlela (SASRI Small-scale Grower Extension Specialist) indicates there are certain grower buying groups that co-operate and so have gained the advantage of economies of scale. Hence larger containers e.g. 20L can be shared. This is properly mentored and supervised.

In addition, a new electronic method for drum calibration to cover one hectare is being developed. This will make granule herbicide use easier to understand and more convenient, therefore widening the selection of available small pack treatments.

Demonstration plots on Velpar® effects on plant cane

Past interventions of this type have been unsuccessful. Establishing demo plots for SSGs with Velpar® and Lumax® to demonstrate potential negative effects of Velpar® and not Lumax® has been discussed. However, demonstration plots of this type are considered inappropriate as: (1) the outcome of a comparison of two commercial products might influence grower purchasing decisions, which is beyond SASRI's mandate; and (2) Velpar® might not affect plant cane (as phytotoxicity has proven variable in several trials) and could potentially place SASRI in a position of being seen as promoting an off-label and illegal practice.

4.3. Eldana IPM and Insect Habitat Diversity (Ref: #5)

4.3.1. Rating

Important

4.3.2. Background

In the Midlands, there is concern over the practise of burning tops at harvest. This was originally recommended as part of field hygiene as stick residue remained in field after harvesting and was thought to harbour eldana insects and act as potential oviposition sites. The misconception of burning tops as advantageous needs to be dispelled and a renewed drive to increase habitat diversity for IPM is required.

4.3.3. Solutions Needed

- Investigate strip harvesting as an option for IPM.
- Communication (field days).
- Drive to stop growers from burning harvest residue and encouraging them to spread crop residues on the fields instead to realise the benefits.

4.3.4. Communiqué

Burning is recommended where heavy eldana infestations occur in severely droughted cane. The reasons for this are:

- to ensure good field hygiene by not leaving infested stalks concealed under crop residues;
- to enable cutting at the soil surface, so removing larvae that would have been left in a stubble; and
- to destroy the reservoir of eggs, pupae and adult moths associated with dry leaf material.

It is important to remove all whole stalks and pieces of stalk from the field. In many instances as much as 4% of millable stalks have been found to be left in the field (e.g. 80 tc/ha with 3.2 tc left in the field represents a revenue loss of more than R 1300 per hectare).

Tops should never be burnt and should always be scattered. Eldana does not lay eggs on green leaf material and larvae only very rarely bore the tops. Research trials have shown that a good cover of cane tops can have as much as 70% of the beneficial effects of a full residue blanket.

Where infestations have been high, growers now have the option of treating fresh stubble with Emma®. This product has been shown to greatly reduce dead-hearts caused by below-ground eldana larvae surviving into ratoons.

Loading zones should also be cleared of all stalks and pieces left behind, even if they are not fit to be sent to the mill. Leaving eldana-infested stalks in the field or at the zone provides a residual eldana population that will infest ratooning cane and will result in increased eldana levels in young cane.

4.4. Variety Nitrogen-use Efficiency (Ref: #7)

4.4.1. Rating

Essential

4.4.2. Background

There is a standard N recommendation from FAS based on end yield. However, it is unknown whether this is this suitable for all varieties.
Knowledge of variety nitrogen-use efficiency (NUE) may have economic impact if, for example, newer varieties have improved NUE and N levels applied can be reduced.

4.4.3. Solutions Needed

Inclusion of a NUE ‘rating’ and associated N fertiliser levels per variety in FAS reports.

4.4.4. Communiqué

Breeding and identifying NUE varieties in sugarcane

At present, SASRI recommended N application rates-based best fertiliser management practices are issued according to the results of leaf or soil nutrient tests and expected crop requirements. This will remain the cornerstone of improving N-use by crops from applied fertiliser. Limited past research has suggested that there may be slight variation in the nitrogen use efficiency (NUE) of sugarcane varieties (e.g. Schumann *et al*. 1998; Weigel *et al*. 2010). However, the very high complexity of crop response to nitrogen application means it is not possible to include this in any recommendations package. Furthermore, it is not deemed feasible or cost effective to include NUE within a variety breeding and evaluation program without compromising the integrity of other important traits being selected for. Better gains can be made by adopting best management practices for N fertilisation. These aspects, in the context of SASRI recommendations, are outlined below.

Generating the N recommendation (FAS results report)

Nitrogen reserves in the soil are readily transformed between different forms (organic, ammonium and nitrate) and are largely influenced by soil organic matter (OM) content. Recommendations for N are thus based on expected crop demand (yield target), soil organic matter content and contributions to N pools through the use of green manures.

Target yield adjustments: Current recommendations are adjusted for targets yields between 50 and 200 t cane/ha (both plant and ratoon crops), with further division based on the soil OM category (see below). Past research has established expected N demand of different crop yields and these form the basis of the target yield adjustment. Thus, N requirement (and consequently N recommendation) is adjusted upward as target crop yield increases. It is essential that target yield is estimated as accurately as possible to ensure the appropriate N rate is advised.

Soil organic matter category: Research has clearly demonstrated that soils higher in OM are able to release more N than low OM soils. Laboratory methods to estimate the N release from OM are laborious and not practical for routine testing. Thus the more general, but well established (from long-term field trials) OM N supply relationships, are adopted as four categories. By taking this into account, in conjunction with the target yield (see above), a more accurate N requirement can be estimated.

Developments currently underway are testing an indirect estimator of total nitrogen in the soil that can replace the soil OM category, which will provide a more accurate and continuous (as opposed to category based) classification for N requirement. This will provide further refinement to the N recommendations.

Plant vs ratoon: It has been found that plant crops typically show no to low response to N application rates, this mostly attributed to mineralisation of soil organic N reserves. The plant crop is also slower to take up N during early growth due to its need to establish a root system. Ratoon crops respond better to N applications, partly as the N reserves are being depleted (while the lack of tillage reduces further release) and a partial root system is already in place to take up N. As such, plant N recommendations are lower than for ratoon crops.

Green manure adjustments: Where green manures are planted between sugarcane cropping cycles, these have the potential to increase both soil OM and N content. This is particularly true where legumes are included in the green manure mix. After incorporation of the green manure into the soil this biomass will mineralise and release accumulated N which can be used by the subsequent plant crop. To accommodate this in the recommendations, N recommendations are adjusted based on whether a cover crop was used and the yield of cover crop.

Other considerations: While not specifically leading to adjustments in the recommendations, consideration is given to risks associated with the use of volatilisation prone fertilisers (notably ammonium-based formulations). These risks are highlighted in the fertiliser reports as a risk factor for recognition when choosing fertiliser blends. Key considerations here are the use of an N-volatilisation risk rating, use of lime in the ratoon, as well as trashing, all of which affect the choice of ammonium or nitrate based fertilisers.

Due to these various criteria used to estimate N recommendations, it is essential that growers ensure they supply all necessary details requested on the sample submission form. Where crucial information is not supplied, default values are applied that may not accurately reflect the crop needs, leading to possible yield losses or wasteful expenditure on inputs.

It is also pertinent to follow the recommended best practice for N application. SASRI advises split applications (depending on region and crop-cycle length) of N fertiliser to better coincide with crop requirement (and uptake) by the growing crop. This reduces the

risk of N-losses to the environment while maximising uptake by the crop (and thus improving NUE). Leaf testing for N is also particularly useful later in the season and before application of split N dressings, as it allows adjustments to split application rates based on crop performance at that time.

Better N fertiliser management

It has been shown that N losses through poor N fertiliser management can range from 50 to 80% (i.e. only 20 to 50 Kg N/ha is used by the crop if 100 kg N/ha is applied), while under good management this can be reduced to 10 to 30% (70 to 90 kg N /ha is utilised by the crop in a 100 kg N /ha application). In this context it is clear that the most beneficial gains for improving NUE efficiency relates to better management of applied N. This has been previously highlighted by Schuman (2000) and Weigel *et al*. (2014) for sugarcane production in South Africa.

The Four Rs of nutrition management also provides a sound framework to develop a suitable N nutrition program (see article in Link May 2019 for more details or visit http://www.ipni.net/4R). In brief, the right source, placement, timing and rate of N is critical to reduce losses. Efforts are currently underway at SASRI to provide better and easily accessible guidance on how to best manage N fertiliser. Project 18KE01 is revising all current soil nutrition and management information sheets. Included in this project will be N management information sheets that will be aimed at providing the grower useful guidance on optimising the use of their N fertiliser. This will be supported by associated articles in Link and other sources and presented at grower interactions and training events where nutrition management are discussed.

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