

CROP CIRCULAR

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CropLife
SOUTH AFRICA SUID-AFRIKA



IN THIS ISSUE

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CONTRIBUTE

We are always looking for news, photographs or event updates from our members.

Please forward your contributions to elriza@croplife.co.za

WELCOME

When I wrote the welcome for our Crop Circular #5, our country was at Alert Level 4 of the Covid-19 National Lock-down. As I write this welcome note, our country has moved to Alert Level 3, but with the surge in the infection rate in key 'hot spots' of the country, the risks associated with the pandemic remain very real and a real threat to us all.

It is most certainly not business as usual but thankfully, our industry has continued to operate through the lockdown and the use of technology has allowed us all to remain in contact, do business and support each other.

In an AgBiz article published 30 June 2020, the AgBiz Chief Economist Mr Wandile Sihlobo reported on the state of the country's agricultural economy. Remarkably, given the trials and tribulations of the recent past, the local agricultural economy rebounded with a 27.8% quarter on quarter growth number when adjusted seasonally and annually. Looking to the full year, the expectation from Wandile is that the year on year growth for the agricultural industry should average around 10%. After the devastating drought, this is a remarkable forecast.

The harvest of grains in the summer rainfall region of the country is well under-way and even complete for some areas and crops, with harvest estimates for maize, sunflower and soybeans all showing increases from the previous season. Citrus and deciduous fruit production too are showing improved harvests from the previous season, as is sugarcane production. What I found interesting in Wandile's comments was the observed disconnect between the recovery in agricultural production versus the Agbiz/IDC Agribusiness Confidence Index – the index is showing the industry retains concerns about the future of the industry. This is probably due to the effects of the devastating drought, the impact the Covid-19 pandemic has already had on our country and business activity, plus the expected impact that the Covid-19 pandemic will have on us all going forward.

As you all know, securing a local registration for a plant protection solution in South Africa in terms of Act 36 of 1947 is our 'right-to-operate'. Unfortunately, the delays experienced with registration applications that have been submitted to the Office of the Registrar (Act 36 of 1947) continue and this creates serious risk for our industry, especially export crops and produce, as we are unable to bring new technologies to the market fast enough to replace older solutions that are disappearing from global markets. CropLife SA continues to engage with many different role players in an effort to improve the short-term situation, as well as identify and propose long-term solutions that are sustainable.

The CropLife SA team continues to work remotely at the time of writing this note, but we are very proud of the fact that we have maintained an uninterrupted service and activities for all member companies during this lockdown period. Stay safe.



Rod Bell
Chief Executive Officer
CropLife South Africa

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New Executive Council for CropLife SA

In a first for CropLife South Africa, the Annual General Meeting was seamlessly conducted on 18 May 2020 via teleconference. The meeting was opened by CropLife SA CEO, Rod Bell, after which Marius Boshoff, CropLife SA President, gave an overview of the progress made throughout the year based on the four strategic pillars defined by ExCo, namely stewardship; government liaison, legislation and regulatory compliance; communication, brand and image building; and education, training and skills development.

The meeting concluded by unveiling the newly elected members of the Executive Council who join CropLife CEO, Rod Bell:

Group A Suppliers

Antonie Delport
Henk van der Westhuizen
Kobus Meintjes
Kobus Steenekamp

Syngenta
Philagro
Corteva
Bayer Crop Science

Group B Suppliers

Gerrit Badenhorst
Jan Botha
Marius Boshoff
Paul Roux

Rolfes Agri
UPL
Villa Crop Protection
Avima

Group C Distributors

Chris Thompson
David Wood
Niel Kruger
Quintin Cross

Laeveld Agrochem
Farmers Agri-Care
InteliGro
AECI Plant Health

The council convened a meeting the following day and elected Quintin Cross as first time President, and re-elected Kobus Meintjes as Vice-President of the association.

CropLife South Africa would like to thank all the outgoing council members for their dedication to the industry and the association over the past year, with a special mention to outgoing President, Marius Boshoff, who has served the association with commitment and enthusiasm for the past two years.

Congratulations to the newly elected members and best of luck as we work together to take the association and the industry forward.

Word from the New CropLife SA President

Over the last five years, my involvement as an executive member of CropLife SA has been both interesting and rewarding. During this time, the organisation has undergone significant change and it has been a privilege to be part of this process and to witness the collective knowledge and experience of the other executive members.

I am not always sure that everyone realises that serving on the CropLife SA executive is completely voluntary and without compensation. We do it because we are passionate about the industry in which we operate and want to see it continue growing. To be honest, it does require an investment in time and energy if we are to properly serve the membership and with today's busy schedules, it can be difficult to find people with enough time to do so. Without qualified volunteers, however, this organisation would fail.



Quintin Cross
CropLife SA
President

Fortunately, over the past few years some incredible executives have contributed meaningfully to the organisation. This is equally true following the election at the 2020 AGM and the executive now features some fresh new faces and the return of some experienced leaders who will help us chart our course and set us on a track to new accomplishments.

In August 2016, following an executive strategy session, a paradigm shift occurred within CropLife SA that transformed this organisation into one with a new alignment to vision and a clear purpose. This was enhanced in mid-2018, firstly with the appointment of Rod Bell as the CEO and then followed by a talented, dedicated team under him that has set about executing the strategic remit in support of our vision. It encompassed the four pillars which many of you are now familiar with, listed again at the end of this article.

It is now 2020, and the phrase “unprecedented times” is commonly used. The reality is that disruptive forces beyond our control have changed the way we operate, think, react and interact. Although this has brought some downsides, our industry has largely been spared the worst of the impact. We must not, however, allow the situation to distract us from dealing with the industry challenges we face. Mostly notably: a broken regulatory system; shrinking margins that threaten our ability to reinvest in the industry; inadequate product stewardship and the need to address socio-economic expectations.

I appreciate the opportunity to serve CropLife SA as its president over the next two years and I thank the executive for entrusting me in this role. I also look forward to working with our CEO, Rod Bell as well as each executive council member. As a council, we aspire to tackle the industry challenges and leave a legacy for those that succeed us. In this regard and in line with the current mandate we will be focusing on:

Stewardship

- Implement a viable empty pesticide container management solution before it is forced upon us through regulation - better to regulate ourselves than be regulated.

Government liaison, legislation and compliance

- ✂ Address the immediate backlog on registrations, notwithstanding the lock-down situation
- ✂ Work with stakeholders and the DALRRD to formulate an efficient and effective regulatory system for the country

Communication and brand building of the crop protection industry

- ✂ Continue building a CropLife SA brand that matches our vision

Education, training and skills development

- ✂ Refine the CPD programme to enhance the professionalism of members and the credibility of the industry
- ✂ Further develop the Agri-Intel database features and benefits to add value to stakeholders

As members, you are CropLife SA! I therefore invite each of you to become more involved. Participate in our committees and working groups. Engage with the Executive. Constructively criticise. After all, it is your ideas and your energy that will move this Association forward and enable all of us to live our vision...

“to be the absolute proponent of responsible production, distribution and application of crop protection and public health solutions across the entire value chain. We will continue to enable our members to be providers of environmentally compatible solutions that ensure sustainable, safe and affordable food production, and therefore food security, in South Africa.”

INFORM | REGULATE | EDUCATE | PROMOTE

Condolences

It is with great sadness that CropLife SA has learned of the passing of oom Kallie Troskie (Agro Organics) and Jacques Hill (Wenkem), both due to Covid-19.

Our thoughts are with their families, friends and colleagues during this exceptionally difficult time.

Rodenticide Safety

The Small Pack Forum identified the need for an awareness campaign at consumer level about the necessity to only use rodenticides with bait stations as the statement on the product label alone did not have the desired effect.

For this reason, CropLife SA, along with the designers from Protek, developed a rodenticide safety poster in both English and Afrikaans, which is available on the member portal.

The aim is for supplier members of rodenticide products to encourage their distributors and retailers to display the safety poster at the point of sale, so consumers are made aware of the correct application methods.

A sincere thank you to everyone involved in this project.

Rodenticide Safety

ALWAYS

- Keep rodenticides out of reach of children and pets.
- Keep rodenticides locked away when not in use.
- Place rodenticides where it is NOT visible or accessible to children and pets.
- Apply rodenticides in a bait station that is affixed to a wall.
- Collect and dispose of spilled rodenticide safely.
- Collect and dispose of dead rodents safely.
- Keep the number of the poison information centre available to call in case of accidental ingestion.



NEVER

- Allow children to handle rodenticides.
- Leave rodenticides unattended.
- Use unregistered poisons to kill rodents.
- Mix rodenticides with food grade materials such as peanut butter.



EMERGENCY NUMBER
Griffon Poison Information Centre
+27 (0)82 446 8946

MEMBER LOGO

CropLife 
SOUTH AFRICA SUID-AFRIKA

+27 (0)87 940 4168
info@croplife.co.za
www.croplife.co.za

Pollinator Safety

It is no secret that pollinators play a crucial role in sustainable agriculture, and no one should be more aware of this than farmers, however, there are incidents where pollinators are adversely affected by the improper use of pesticides. Why is this still the case?

In South Africa, pesticides can only be registered after a rigorous review of the product's toxicology, which includes the review and approval of comprehensive efficacy, residue, stability and plant compatibility studies that need to be submitted. Furthermore, the label directed use of the product should not pose an unacceptable risk to human and environmental health, which includes pollinator safety.

It is important to note that even though a pesticide may be toxic to bees when ingested, it does not mean that it cannot be applied safely.

This is the difference between hazard and risk. Take bleach as an example. The bleach itself, whether standing on a kitchen counter or locked away in an impenetrable vault, is a hazard because it can be toxic to humans, however, it only becomes a risk if you decide to drink it.

It is the same scenario with pesticides and pollinators, which is why field trials are so important to determine whether bees could be exposed or affected. Most pesticides pose very little risk to bees once the spray is dried off on the plant surface.

If the regulatory environment ensures all these checks and balances are in place to protect our pollinators, then we need to ensure that the pesticides are applied accordingly. This means that the crop adviser and the farmer must ensure the products are only used according to label instructions.

Any other application is not only illegal, but could have dire consequences for pollinators.

The following points must be kept in mind when developing a spray programme by both crop advisers or sales agents and farmers:

Do's

- ✓ Always follow the label instructions and pay special attention to pollinator warnings or precautions.
- ✓ Interrogate Agri-Intel (www.agri-intel.com) for pesticides that are registered for the purposes required; the labels are, however, the final port of call for safety and use instructions.
- ✓ Apply directly to the target and ensure minimal spray drift.
- ✓ Apply early evening when bees have returned to their hives.
- ✓ Communicate with all beekeepers in the area and inform them of planned spray programmes.
- ✓ Scout the area for pollinators before applying.
- ✓ Be aware of residues and the amount of time it may still be toxic to bees.
- ✓ Remember that systemic insecticides have long periods of residual activity.
- ✓ Ensure that flowering plants or weeds that are attractive to bees are not in the area of application.
- ✓ Familiarise yourself with the product. Insecticides are the most hazardous to bees while herbicides, fungicides and plant growth regulators have little or no impact.
- ✓ Ensure that equipment has been correctly calibrated for the application.
- ✓ Ensure to practice integrated pest management and only apply pesticides when absolutely necessary.

Don'ts

- ✗ Apply directly onto flowers. If no other option exists but to apply pesticides in bloom, do not apply directly onto the flowers.
- ✗ Apply while pollinators are active in the area that needs to be treated.
- ✗ Apply at night because inversion can prevent successful deposition of pesticides onto the target and cause serious drift.
- ✗ Apply any product that is not registered for the specific crop or application method.
- ✗ Apply during windy conditions, especially if foliar application is the only available option.
- ✗ Mix pesticides with substances that could be a lure for pollinators.
- ✗ Add adjuvants to fungicide applications during bloom or where there is pollinator activity in the field.
- ✗ Apply toxic pesticides to standing bodies of water.

A poster summarising these points is available on www.croplife.co.za in the resources section.

A key point to ensure pollinator safety is effective and timeous communication between both farmers and beekeepers. Not only must the farmer inform beekeepers in the area of their intended spray programmes, but beekeepers must also inform the farmer about their intended activities.

Just as we need to protect our crops from devastating pests, we must nurture and protect our pollinators, therefore each role-player must be extra vigilant and take extreme precautions with regards to crop protection product application.

Read the Label Standard Operating Procedure (SOP) - Championing Bees

Q&A with
Roger Poole
TIPWG Chairman

Where did the idea of combining the messages of 'read the label' with the plight of bees come from?

This SOP was inspired by a CropLife SA article in the 2nd 2019 edition of the Crop Circular entitled "Canola Insecticides and Bee Safety Alert". The article really hit home the impact poor pesticide use can have on bees and got me thinking about how important the simple act of "reading the label" really is. Using pesticides without reading the label is like letting a child play with a loaded revolver, there are so many ways in which it is almost certain to go wrong.

Pesticides in general have a bad reputation, with media reports often giving the impression that pesticides themselves are the problem, when in fact it is almost always the user. For me, the real tragedy is that most pesticide-based environmental disasters could have easily been averted if the user had simply read the label. This is certainly the case with the two examples of mass-bee die-offs given in the CropLife article.

Why is the ‘read the label’ message so important?

To ‘read the label’ is such a basic requirement of pesticide use, that to need a SOP may seem like stating the obvious and thus overkill. However, as we have seen from the pesticide-related bee disasters that have resulted in other agricultural sectors, there are still those who are not reading the label.

The labels contain all the necessary information a pesticide user needs to know in order to use it correctly, safely and effectively, while minimising the potential environmental impacts it may have. As such, it is a fundamental responsibility of all pesticide users and one that should be continually reiterated.

One of TIPWG’s key objectives is to promote the effective and responsible use of pesticides, reading the label is the foundation stone of this. By reiterating this message via a SOP, there can be no confusion that as an industry, ‘Reading the Label’ is what we expect of our members.



Why choose to champion bees?

Again, the CropLife SA article, which threw down the gauntlet to CropLife members to do more for bees, was a source of inspiration. There are also strong ties between forestry and bees, the best honey (I believe) is from hives situated in Eucalyptus plantations and these can be found within the landholdings of many of FSA members. In fact, through championing bees many of FSA members are also supporting neighbouring communities as a result of honey harvesting initiatives and opening their compartments up to local beekeepers.

Beyond that, while all species are equal, we - the human race - rely on some more heavily than others. Bees are top of that list. The dramatic global decline in bee populations should have us shaking in our boots.

In terms of global crises, it is up there with climate change. 70% of the food we eat is pollinated predominantly by bees, they help keep biodiversity ticking over by pollinating wild plants and their honey has many medicinal properties (as well as being a pantry staple). Life without bees would be difficult to imagine but could become a reality. We all have a responsibility to reverse the decline. The SOP provided a platform where we could remind members of the bee's plight and how they could help reverse the decline. Global issues often appear insurmountable, but if we all do our part then these issues can be addressed – we just need to start acting on the issues and contributing how we can, rather than waiting for a global solution that is unlikely to come.

What do you want to see as a result of this SOP?

Obviously, it is meant to inspire all within the sector to always read the label. This is not something that is easily measured, but I guess one way of ensuring it is done is by not having any pesticide-related incidents in the sector that could have been averted by simply reading the label.

We would also love to see the forestry sector take up the challenge and become champions of bees. For them to look at the products they are using and opt for products, application methods and application timings that will have the least impact on bees. We would also love to see the establishment of bee gardens across the forestry landscape, as this is a simple way to make a huge difference.

Going beyond that, we would love the SOP to inspire members to take the message home. We presented it to NCT Forestry Staff on World Bee Day and it has been great to hear how they are adopting a more 'bee-friendly' approach in their homes. This is a message we would love to see go beyond the forestry community and be spread across the agricultural sector, which is why we were thrilled by CropLife SA's request to add the SOP to their website.

TIPWG CropLife SA Partnership?

TIPWG is a proud partner of CropLife SA and extremely excited about the SOP featuring on the CropLife SA website. We see it as an opportunity to promote a very important message to a sector that we are proud to be a part of. Pesticides, and as a result, the agri-forestry sector are often blamed for the demise of the bees.

Certainly, the inappropriate use of pesticides is a key contributing factor. Yet on the most part, our members use pesticides sparingly, responsibly and only when necessary. This is a message we need to start communicating; however, we also need to show we walk-the-walk and are not just all talk. Having SOP's like this one, actively driving initiatives to help reverse the decline, I feel is a good way of showing how, as a sector, we want to do everything in our power to help save the bees.

The SOP is available on www.croplife.co.za in the resources section.

SOP: READ

World Bee Day 20 May acknowledges the role of bees as pollinators. It is an opportunity to assess our impact on the environment and find solutions to help curb their decline. The **always read the label** when using pesticides.

Bees were recently identified as the most important species on the planet by the Earth Watch Institute at a 2019 meeting of the Royal Geographic Society.

So what makes bees such an important species?

Honey is not only delicious, it also has a number of health benefits?

As wild flower pollinators, bees have a huge role in **maintaining global biodiversity.**

Approximately **75%** of global agriculture depends on pollination by bees!

TIPWG CHALLENGE

Plant a bee garden!

Small steps bring about big changes especially if they are a collaborative effort. We are challenging members to help us create **20** bee gardens to celebrate the new decade, planting bee-friendly, non-invasive, wildflower species. **Bee part of the solution.**

Agapanthus

Vygies

Aloes

Protea

Dandelions

Interpreting the label

1 Logo

2 Product

HERBICIDE

3

A SYSTEMIC WATER SOLUBLE HERBICIDE FOR THE CONTROL OF ACACIA sp. IN PINE AND EUCALYPTUS PLANTATIONS AND EMERGENCE CONTROL OF BROADLEAF WEEDS, CANOLA.

4

HRAC: HERBICIDE GROUP

5

Clpyralid (pyridine compound)

6

NET VOLUME RE

7

Batch No.

8

Date of Manufacture

9

Typical application rate: 24 g/ha

10

- 1** Manufacturer's name
- 2** Product name
- 3** Registration number
- 4** Description of product and where it can be used
- 5** Active ingredient
- 6** Registration holder details
- 7** Batch number - manufacturer identification
- 8** UN number - identifies how to transport, store

FORESTRY SOUTH AFRICA

References: 1. FAO website 2. Honey Health 3. CITES

Image credits: Background vector and frame vector created by st

THE LABEL

The important ecological role of bees and other impact as the Forestry and Timber Industry and look at the single biggest impact a forester can make is to ensure, to ensure only the intended pests are targeted.

Please note, this label is merely an example and has been chosen as the product in question (a herbicide) has NO impact on bees.

Reg. No./Nr. Act/Wet 36/1947

OPLOSSING VLOEISTOF ONKRUIDDODER VIR DIE EUCALYPTUS ONDERDRUKING VAN ACACIA sp. IN DENNEN EN EUCALYPTUS PLANTASIES VAN JAARLINGE EN VIR DIE NA-OPKOMS BEHEER VAN AS GELISTE, IN EENJARIGE BREEBLARE, SOOS AANGETOON, IN KANOLA.

P CODE O HRAC: ONKRUIDDODERGROEPCODE

Active Ingredient/Aktiewe Bestanddeel

(ind) 100 g/l Klopiraled (piridien verbinding)

..... NETTO VOLUME

Lot Nr. 15

Datum van Vervaardiging

UN NO: Not Regulated

14

13

11

12

CAUTION VERSIGTIG

- 9 Storage information
 - 10 PPE for handling concentrate
 - 11 Toxicity warning
 - 12 Application PPE requirements
 - 13 Toxicity colour band
 - 14 Emergency contact details
 - 15 LOT number - manufacturer identification
- and use

The world is facing a global bee crisis!

The global bee population has declined by 90%, as a result of:

- Habitat loss
- Pesticide usage
- Climate change
- Disease

Bees are now officially classified as an Endangered species³.

BEE-AWARE
when using
the following
Neonicotinoids

Clothianidin

Thiacloprid

Thiamethoxam

Imidacloprid

Acetamiprid

Go beyond the active ingredient by ensuring the following pre-application checks are made, with minimising the impact on bees in mind:

1. Plant's growth stage - is it flowering?
2. Formulation and application method
3. Residual action
4. Potential and implications of spray drift
5. Spray time and temperature
6. Surrounding ecosystems

www.tipwg.co.za

www.forestrysouthafrica.co.za

Chantel Arendse
Lead: Plant Biotechnology

From the Biotech Desk

June 1st marked the official transition of the plant biotechnology programme to CropLife SA with the establishment of the biotech desk. The first order of business was to engage industry members and stakeholders on the critical priority areas that would frame the strategic goals and map the workplan of the biotech portfolio. In summary, these discussions identified that the biotech portfolio would direct its efforts at regulatory advocacy on global priority topics such as new breeding innovations, stacked traits policy approaches, GMO labelling, intellectual property and developments at multilateral conventions.

The aim of these engagements is to ensure consistency and alignment with international best practices so that the South African regulatory system remains responsive to promoting biotech innovation and commercialisation of products.

South Africa remains in the top ten list of GM producing countries globally with an estimated 2.7 million hectares under GM cultivation. While South African producers continue to enjoy the benefits of biotech adoption, opportunities remain to bring those technologies closer to smallholder producers through extensive outreach and stewardship collaboration. As the arrival and establishment of pests such as Fall Armyworm (*Spodoptera frugiperda*) continues to have an impact on agricultural production, the Biotech desk will look to exploit opportunities to integrate biotech into its crop protection toolbox to address sustainable management practices, responsible use and improve overall perception of available technology tools.

Commercial adoption of Bt cotton in eSwatini, ongoing drought resistant TELA maize trials in Mozambique and recent interest from Angola to conduct GMO field trials, signals a positive shift in policy support towards agricultural biotechnology within Southern Africa and possibly across Africa as a whole. With these positive developments, the biotech desk is available to provide technical support where appropriate and work with regulators, partners and stakeholders in the biotechnology value chain to achieve success.

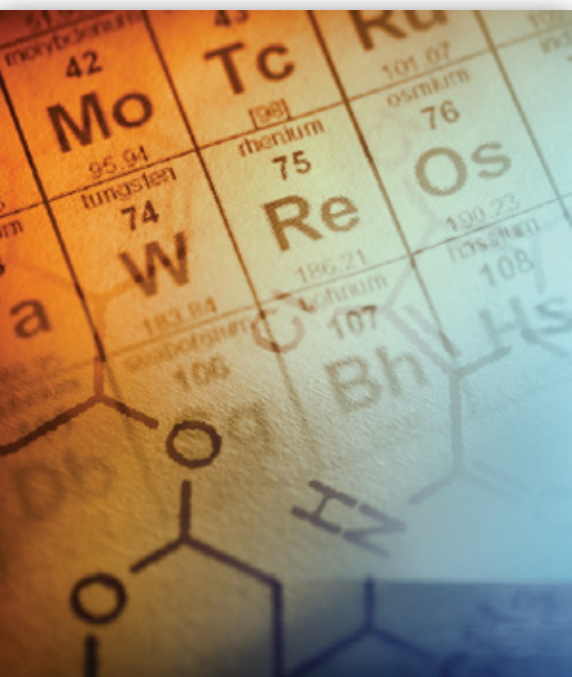


The Wonders and Beauty of Chemistry... and the BS

Dr. Gerhard Verdoorn
Operations and
Stewardship Manager

In the beginning

There was nothing. No space. No time. No matter. No energy. No sound. Nothing. It was 13 billion years ago. Suddenly, a massive explosion erupted. The Big Bang gave birth to our Universe in which time, space, matter, sounds and energy were all conceived to grow into what we have today: a massive, mystical entity that is unfathomable for the minds of the normal mortals. Guess what: The Big Bang was the largest synthetic chemistry experiment in the existence of the Universe and perpetuates to this very day with chemicals being formed, chemicals disappearing into black holes and chemicals being transformed into energy according to Einstein's amazing theories.



The entire Universe is a massive collection of chemicals consisting of elements, molecules, black matter and the wonderful living organisms we have on planet Earth and hopefully, somewhere else in this massive chemical factory called Universe, there are other life forms as well.

Inorganic and organic chemicals in the universe

Speculation is rife about the nature and character of the so-called God Particle that scientists postulate as the origin of the Universe, but in the modern day and age we can at least be certain about two things: The Universe has inorganic matter and organic matter.

Inorganic matter is the bulk of the Universe's physical matter and is made of elements ranging from the simple hydrogen atom through to heavy metals, noble metals like the much sought after gold, radio active elements such as radium and up to synthetic elements like Moscovium, and of course, combinations of such elements to form molecules like the fantastic array of minerals we have on the Blue Planet.

Stars, planets, galaxies, nebulae, meteorites, comets and other celestial bodies all consist of inorganic matter either in solid, liquid or gaseous form. It is beyond fascinating that we live in and amongst all this chemistry that was born, transformed and wiped out in universal processes over the past 13 billion years.

But despite this enormous pot of scientific wonders of elements and inorganic molecules that make up the minerals, metals, gases and other matter of the physical part of the Universe, humankind is far more intrigued by the organic chemistry of the Universe probably because it is the chemistry of life.

The fundamental elements of life are carbon, hydrogen, oxygen and nitrogen with much support from phosphorus, sulphur and a few other elements. Organic molecules are built on carbon skeletons with an ensemble of hydrogen and some oxygen and nitrogen. Simple amino acids have nitrogen atoms in the carbon skeletons and when a few amino acids are cemented together they form peptides, and a few peptides combined by chemical bonds form proteins, and the rest is simple: life is possible!

There is of course big debate about the origins of life: was it a divine intervention or was it purely random events that could have formed organic molecules that over millennia were expanded into life? It is yours to decide but let us look at the scientific side and leave the philosophical part for another day.

Organic molecules

The simplest of organic molecules is formaldehyde (remember the lab and the preservation of lab specimens in formalin?): it has one carbon atom, two hydrogen atoms and one oxygen atom. It is a natural chemical produced by nature while a fairly well qualified synthetic organic chemist can synthesise it in the laboratory in

no time at all. Methane or CH_4 is also a very simple organic molecule that is flagged as greenhouse gas but is something that can act as a building block for much more complex molecules.

Nature also synthesises other organic molecules from small to very large, like the proteins and the code of life namely deoxyribonucleic acid or DNA. They are all organic chemical compounds with carbon, hydrogen, oxygen, nitrogen, phosphorus, sulphur and some other elements like iron (haemoglobin) and magnesium (chlorophyll).

To date, more than nine million organic molecules are known to science and a very large percentage of those are man-made substances. Synthetic organic chemists like Nobel Prize winner Prof Elias J Corey can synthesise virtually any standard molecule that nature produces, but they also synthesise analogues of natural organic molecules and organic molecules that have never been and will never be synthesised in nature.

The link between natural organic molecules and synthetic organic molecules is very, very strong. Scientists often find their inspiration for synthetic organic molecules by searching for biologically active natural organic molecules.

A simple example is the amazing salicylic acid found in the willow tree; it is easily transformed into acetylsalicylic acid, one of the oldest pain killers and mildest of anti-inflammatory agents in the world.

The great natural versus synthetic controversy

Certain schools of thought want the world to believe that synthetic chemicals are bad and natural chemicals are good. It is a particularly important argument when discussing pesticides and medicines, however the idea that synthetic products are “chemicals” and the natural ones are organic is unfortunately flawed. All these molecules, bar a small percentage of inorganic compounds like magnesium sulphate for example, are organic molecules consisting of carbon skeletons with other elements attached to form the molecules.

There are also many who claim that their products are free of chemicals. Brothers and sisters of the Universe: your bodies are chemical factories producing billions of molecules annually. There is no synthetic laboratory to match the synthetic ability of a living organism's body.

Not even the awesome Elias J Corey is a match for his own body's synthetic prowess. Yet, we make molecules just like Mother Nature and the only difference is that ours are man-made synthetic molecules while nature's are natural synthetic molecules. Synthesis in chemical terms means to build a molecule; both scientists and nature do synthesis.

Nature though, has a huge advantage over us and that advantage lies in the enzymes that synthesise the natural synthetic molecules, while Professor Corey and company use reagents and clever reactions to synthesise our man-made synthetic molecules.



Perhaps to clear the confusion we should use the terms bio-synthesise versus synthesise, the former being the natural process and the latter being the laboratory process. To end this paragraph, an illustration of the power of laboratory chemical synthesis is as follows: cane sugar or sucrose (alpha-D-glucopyranoside-beta-D-fructofuranoside) can be transformed by a series of chemical reactions using a range of chemical reagents to synthesise natural or man-made analogues of prostaglandin hormones. So, what Mother Nature bio-synthesises in our bodies very quickly using enzymes, we can synthesise in the laboratory with a lot of effort and at great cost, but it is possible. Yours truly did that as part of doctoral study in synthetic organic chemistry.

Is natural safer and better than man-made?

The idea of all natural chemicals being better than man-made chemicals is not valid. The penicillin anti-microbials are natural products while some of the other antibiotics are man-made synthetic chemicals and collectively, they serve a great purpose, namely fighting diseases that would otherwise have wiped out humankind.

Imagine a bubonic plague outbreak without antibiotics to fight the *Yersinia pestis bacterium*; we could have a repeat of the Black Plague that killed about 20 million people in Europe early in the 14th Century.

Natural soaps contain a load of chemicals while man-made soaps also contain a load of chemicals. Some of the natural pesticides like nicotine had better be left alone (you know why) while man-made molecules like the pyrethroids are more efficient than most natural pesticides. It does not mean that natural molecules are not efficient; take for example azadirachtin, abamectin and matrine: these are natural compounds with excellent insecticidal properties.

We do, however, have man-made molecules that are equally efficient like the diamides and the old organophosphates, but the latter are rapidly falling out of favour due their acute toxicity. We can easily dump the man-made synthetic chemistry for natural synthetic compounds, but are we prepared for the sacrifices? Loss of life to dreadful diseases due to loss of synthetic drugs. Loss of crops due to insect pests, rodents, plant pathogens and weeds.

Or would you perhaps enjoy food produced with mercury and arsenic as pesticides? And would one cope without detergents to clean laundry, cutlery and crockery? Would the women of the world sacrifice all their perfumes and beauty care products, most of which are serious concoctions of natural and man-made chemicals?

Chemistry is part of our lives. Chemistry is life. Without man-made and natural chemicals there is no life for humankind, at least not as we enjoy it today. Natural and man-made chemicals are all chemicals; our mission is to find those ones that serve our purposes, and it may very well be that Mother Nature is the synthesiser of such molecules.

Organic, natural and synthetic pesticides

If there was ever a misunderstood topic, this one reaches the finishing line ahead of everything else. Various copper compounds are certified for “organic” agriculture, yet the very same chemicals are used in conventional agriculture. Pyrethrum is used in organic agriculture and similarly in conventional agriculture. So is neem oil, of which the active ingredient is azadirachtin. The list goes on and on.

A pesticide is a pesticide, irrespective of whether it was synthesised in a laboratory by the hands of an organic chemist or whether nature synthesised it in some living organism. The molecules are all organic in the chemical sense of being built on carbon frameworks.

Synthetic chemicals are harmful to people and the environment: Really?

The fact that Mother Nature synthesised a molecule does not necessarily mean it is safe. On the contrary, the fact is that we have never been able to synthesise a molecule in the laboratory that beats the toxicity of some of the natural organic compounds.

Try and snack on poorly prepared Japanese puffer fish and feel the effects of tetrodotoxin, a deadly alkaloid that is much more potent than Sarin, one of the feared nerve gases used in chemical warfare. Or touch the vividly coloured poison arrow frogs of the Amazon and collapse in seconds to the incredible power of curare toxins and batrachotoxin that can paralyse a victim in seconds.

Go a few steps forward to one of the world's most powerful toxins namely botulinum toxin that is produced and stored in decaying food matter, evaporating water bodies and bones of skeletons. It can be deadly, and it is Mother Nature's ultimate weapon. Wild animals like birds die by the thousands if this naturally made protein poisons open water bodies during high temperatures that cause wilting and rapid evaporation. Ungulates that chew on bones of their fallen mates drop dead due to flaccid paralysis caused by this toxin and people who get food poisoning sometimes wish they could die! Same goes for some natural metabolites of plants. Monofluoroacetic acid of the poison leaf plant is a terrible livestock killer and as little as 4 mg can kill an adult person within four hours.

Yes, some of our man-made synthetic chemicals are very toxic to people and the environment but Mother Nature's chemical arsenal is nothing to play with. A toxin or toxicon or poison or venom is an organic compound (mostly) that need not be man-made to be incredibly toxic.

Pesticides are poisonous: Yes, but what about the other chemicals?

It is very important for people to distinguish between peer reviewed science and sensational garbage. The father of toxicology, namely Philippus Aureolus Theophrastus Bombastus von Hohenheim, generally known as Paracelsus, cast the founding principle of toxicology in stone: "all substances are poisons, there is none that is not a poison. The right dose differentiates a poison from a remedy".

Without even knowing it, Paracelsus also founded the principles of hazard versus risk with this statement, which we will touch on it later. Being mindful of Paracelsus's founding principle, let us evaluate human medicines.

Paracetamol must be one of the most used pain killers in South Africa and is sold over the counter in pharmacies, retail outlets and even the forecourts of fuel stations. Its acute mammal oral toxicity is on par with that of the pyrethroid cyphenothrin, which is used in many household insecticides.

The tetracycline anti-microbial doxycycline that is very effective to cure patients who contracted tick bite fever, is of the same level of mammal oral toxicity as the organophosphate fenthion. Codeine hydrochloride is quite a poisonous substance and is also known as a potential habit-forming drug (developing dependence) but is sold over the counter for self-medication.

The list of substances that are toxic is endless but what does it mean for the layman who is not a toxicologist? Go back to Paracelsus's statement and don't eat the entire tube of toothpaste because what is supposed to be a remedy, becomes a poison!

Take 1,000 mg of paracetamol tablets and not half the container because the medicine becomes a poison at such a dosage, and yes, many patients overdose on paracetamol and end up in hospital with paracetamol poisoning.

The concept of toxicology is far wider than acute or chronic oral (intake) or dermal (touch) toxicity.

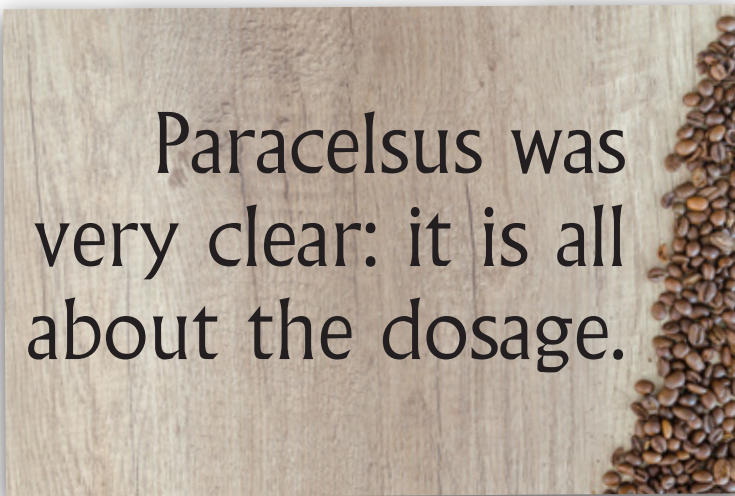
Some chemicals are carcinogens (cancer causing agents), other teratogens (cause birth defects), some mutagens (cause mutations of genetic coding in DNA), others clastogens (accelerates existing cancer in a patients), some ototoxins (affects hearing) while some effects on vision, organ function and the endocrine system must also be considered in the discipline of toxicology.

The drug that shook the world in the 1960s and 1970s was thalidomide that has virtually no acute oral toxicity but is a terrible teratogen that caused birth defects in thousands of babies.

Considering the massive amount of chemicals in the environment and what is consumed daily via food, water and beverages, one wonders how we remain alive and healthy? The answer lies in the science of toxicology.

It is all about the dosage, not about the substance

The caffeine in energy drinks is in a very high dosage and gulping down two cans of it is bound to trigger a near toxic response in the person who does so. Meanwhile, caffeine is a stimulant taken in billions of cups of coffee every day all over the world without any adverse effects on people apart from offering serious enjoyment to the coffee drinkers.



Paracelsus was
very clear: it is all
about the dosage.

Botulinum toxin is toxic at a level of 0.0001 mg per kg body mass, but does it kill a person with food poisoning? Not always, because the person may not have ingested enough to perish from the toxin.

Two dogs, one a Jack Russell and the other a Rottweiler, may lick a methomyl-based fly bait. The Rottweiler is unaffected, but the Jack Russell becomes violently ill with shivering, nausea, vomiting, pupil constriction and rapid breathing.

Both dogs ingested the same quantity, but the dose was too little to affect the 70 kg Rottweiler, but near fatal for the Jack Russell. It is all about the dosage.

Why do you think a medical doctor gives a prescription for a scheduled medicine? Not only to cure the patient but also to ensure that the patient takes a therapeutic instead of toxic dosage.

In toxicology there are certain safety parameters for all substances, most important of which is the ADI or allowed daily intake. Toxicologists do meticulous calculations of the substance's toxicology, the food basket (meaning looking at the average food consumption of a person) and the MRLs or maximum residue limits of the substance and then produce an allowed daily intake of the substance for human beings. That figure is universally accepted as the daily dosage of a substance that a person may ingest without it having any health effects on the person.

Glyphosate is regularly in the news, so let's consider glyphosate. The ADI for glyphosate is between 1 and 2 mg/kg body mass per day meaning an 80 kg adult can safely consume 80 mg to 160 mg glyphosate per day without any adverse effects. It is alleged that bread in South Africa contains 2 to 4 mg glyphosate per loaf, so go ahead and eat 20 to 40 loaves of bread if you can! This assessment of the allowed daily intake is not only based on acute oral toxicity; it also considers all other toxicological effects. Some substances may not have a significant oral toxicity but may damage organs over prolonged period of times. Aspirin developed a reputation as a nephrotoxin (kidney toxin) simply because people overdosed on aspirin by continuously using excessive dosages of this wonderful medicine.

To add some flavour here: the same principles are applied to man-made synthetic pesticides, natural pesticides and so-called "organic" pesticides. Every pesticide must have an ADI, whether nature made it, or man made it.

Risk versus hazard

Pesticides are connected by one common characteristic namely to kill undesired organisms. This common characteristic is feared by the uninformed and used as a lobby tool against pesticides. Understanding the difference between hazard and risk is perhaps the most valuable tool to allay the public fears of pesticides, but also to instil a sense of responsibility into people who use pesticides. The toxicity of a pesticide is mostly expressed as its hazard to human beings using oral and dermal acute toxicity. Taking a laboratory mouse into a controlled laboratory environment and exposing it to an acute dosage of a pesticide to monitor its response, is a hazard evaluation.

Allowing mister mouse to range freely in an agricultural system where the same pesticide is sprayed at a highly diluted concentration over a very large area and monitoring the mouse's response to the pesticide is a risk assessment. In the laboratory, the mouse is an obligate target of the pesticide because it is either fed the pesticide with its food, injected with the pesticide or exposed to an atmosphere filled with the pesticide's vapours.

Such conditions only measure that hazard or the direct toxicity of the pesticide to the mouse. It is impossible to relate that to field conditions where the mouse will never eat food that is deliberately laced with the pesticide (unless it is a rodenticide), be injected with the pesticide or inhale air that is saturated with the pesticide. Although the pesticide may be hazardous, the risk for the mouse in field conditions is negligible. It is a great pity that some scientists do laboratory studies, force certain results to prove that certain compounds are hazardous, but deliberately fail to express the real-life risks to the environment and people.

That pesticides may pose a risk is indisputable, but it takes some extra logical thinking to unfathom the risk versus hazard. A benign compound like alpha-cypermethrin is a low hazard pesticide, but it is a high risk in the hands of the public who fail to use personal protective clothing and suffer severe dermal irritation because of skin contamination with the product. Technically speaking, the hazard is an inherent physical property of a compound and the risk is a man-made property. The most benign compounds of low hazard may pose a high risk to people if used irresponsibly, while high hazard compounds like dichlorvos can be low risk if used responsibly. Pyrethroids are typical low risk compounds for most mammals and birds, but extremely high risk for fish and amphibians due to extreme toxicity for such organisms.

The final word

A world without chemistry is unthinkable because human beings rely on chemicals for their well-being, food, fibre, homes, transport and medication. Take the man-made synthetic chemicals out of the picture and as a species, we head for extinction, maybe not too soon, but definitely in the long run. The medicines will be severely reduced, the household products will disappear, and the pesticide market will collapse. What should we do? Abandon chemistry as one of the life support systems for humankind? No! Simply stop believing all the BS and Google rubbish and be responsible whenever using **any** chemical product.



Don't use chemicals of whatever nature excessively. Don't use chemicals when not really required, like drenching a room in an aerosol mist because there is one mosquito. Read all the instructions of the chemical's container and follow it, even if it's something like a laundry detergent. Store chemicals in a safe place out of reach of children and pets. A benign compound is a potentially high-risk weapon in the hands of the uninformed, irresponsible or careless person. There is no bad chemical in the Universe, it is people who turn chemicals into harmful compounds by being irresponsible.

Adhering to Pesticide Label Instructions: A Critical Compliance Issue

CropLife South Africa advises all role players in the value chain to strictly adhere to pesticide label instructions.

Legal requirements

The label is the only legal document of a pesticide. Regulation No. R1716 of 26 July 1991 of Act No. 36 of 1947 stipulates that a pesticide must be used strictly according to label instructions. This means a pesticide may only be used for (1) the crop or situation as indicated on the label; (2) for the pest, disease or weed as indicated on the label; (3) at the dosage as indicated on the label and (4) by the application methods as indicated on the label.

Making recommendations for the use of pesticides

A recommendation, whether verbal, in writing or electronic format, for the use of a pesticide made by any person or institution of whatever nature, must be strictly according to the label instructions. No person may offer advice, guidance or recommendations on pesticides contrary to their label instructions. Manufacturers, registration holders, distributors, agents, crop advisers, technical advisers, consultants, cooperative personnel, retail personnel or any person in whatever capacity, may only recommend to, and advise farmers on the use of pesticides according to their label instructions.

Sales of pesticides

Pesticides may only be sold or offered for sale for the purposes and applications as directed by the label instructions. No person in whatever capacity may sell or offer a pesticide for sale for any other purposes or for any other application methods than those instructed by the label.

Use (application) of pesticides

A person, in whatever capacity, may only apply a pesticide for the purposes and by the application methods as instructed by the labels.

Poor performance or crop damage due to off-label application

A farmer who experiences poor pesticide performance or suffers crop damage due to applying pesticides contrary to label instructions (“off-label”) of own accord, or whether upon the advice, guidance or recommendation of any other person or institution, has no claim against any other party because the farmer himself contravened Regulation No. R1716.

Consultants, distributors, crop advisers, agents, sales representatives compliance with label instructions

Any person that advises, guides or recommends the use of a pesticide to a farmer, “sells” the pesticide to the farmer because the definition of “sell” in Act No. 36 of 1947 covers all forms of promoting the use of a pesticide. A consultant, distributor, crop adviser, agent, sales representative or any person or institution of whatever nature who advises, guides or recommends the use of a pesticide, or sells such a pesticide contrary to its label instructions to a farmer, contravenes Regulation No. R1716.

Responsibility of farmers to check whether advice, recommendations and sales comply with label instructions

It is the farmer’s duty to ascertain whether the advice, guidance or recommendation offered by any person or institution of whatever nature, is according to the label instruction of the pesticide upon which such advice, guidance or recommendation is offered. It is also the farmer’s duty to check whether pesticides offered for sale are offered according to the purposes and application methods as directed by label instructions.

Common contraventions of Regulation No. R1716

- Offering advice contrary to label instructions of the pesticide.
- Making recommendations contrary to label instructions of the pesticide.
- Offering guidance contrary to the label instructions of the pesticide.
- Taking off-label advice, guidance or recommendations from any person or institution and implementing such advice, guidance or recommendations when applying the pesticide.
- Offer a pesticide for sale or selling a pesticide for purposes or for application methods that are not indicated on the label.
- Disposing of (giving away, donating) a pesticide for purposes or for application methods other than those directed by the label instructions.

The rationale for adhering to the label instructions

Pesticides are developed for certain purposes and certain application methods. The data is submitted by the manufacturers or suppliers to the Registrar of Act No. 36 of 1947 who registers pesticides for the purposes and application methods as applied for, based on the data that is submitted.

Any other purposes or application methods can therefore not be verified or validated for the pesticides and are not approved by the Registrar because the Registrar cannot consider purposes or application methods that are not submitted for evaluation.

Consequences of off-label use for farmers

More than 95% of crop damage and poor pesticide performance can be traced back to off-label use. Farmers who apply pesticides off-label are at great risk of crop damage or crop losses due to poor pesticide performance.

The regulatory consequences of off-label use

Apart from pesticide performance failure and crop damage due to off-label use, the Registrar has a mandate in terms of Act No. 36 of 1947 to impose certain conditions upon any registered pesticide, such as restricting its use to pest control operators. The Registrar may also cancel a registration of any pesticide if he is of the opinion that it is misused, such as for example off-label use. This means that off-label use of a pesticide may result in it being cancelled and no longer available to farmers or restricted to be used only by pest control operators.

The Scourge of Wildlife Poisoning

Dr. Gerhard Verdoorn
SA Grain
May 2020

Few countries in the world can compete with South Africa's wildlife wealth: We have around 24 000 indigenous higher order plant species, over 900 bird species, more than 400 mammals as well as a rich diversity of frogs, fish and reptiles.

Even the arid regions like the Karoo and Kalahari are blessed with a diversity of wildlife. Conservation of our natural resources is enshrined in the Constitution of 1994, so it is our obligation as citizens, the state and government to take care of the biodiversity.

Wildlife all over the world is facing a cataclysmic decline – so much so that iconic species like the African lion, the Bengal tiger and all rhinoceros species may disappear from the face of the earth within the next five decades.

The impact of wildlife poisoning is one of the most serious impacts that animals and plants are facing. Most people do not understand that plant ecology is probably more important for biodiversity than the animal ecology, hence very little attention is paid to the impact of herbicide misuse on plants. Whether an animal or plant is poisoned is immaterial – the fact remains that an essential organism is taken out of the ecosystem – leaving a void that human beings cannot fill. Poisoning can literally wipe a species off the face of the earth; the wanton use of diclofenac drove most of the vulture species in India to the verge of extinction in a decade.

Poisoning: Evil habits or simple mishaps?

Poisoning is not unique to South Africa. Since the earliest times, human beings have used poison to not only kill animals, but also to settle personal feuds with each other. In 1913 the then Union of South Africa issued a declaration to producers to poison wildlife such as most predators, eagles and vultures with strychnine that was provided by the state. A bounty was paid by the state for heads and tails of such poisoned wildlife. One would think that the growing environmental conscience would have put a stop to wanton poisoning by now, but it is not the case.

There is hardly a wildlife poisoning that can be labelled as a genuine mishap. Perhaps, with some empathy towards the individuals responsible for such mishaps, one could refer to incidents such as the one in which bees were poisoned in the Western Cape in 2018 as a result of an insecticide used to control ants in vineyards.

The bees were attracted to the sugar that was added as a lure for the ants. No one had any intention to poison bees and the immediate removal of the sugar stopped the bee poisoning completely.

Wildlife poisoning can be attributed to two possible scenarios: Either deliberate and unlawful poisoning or deliberate misuse of pesticides, even though the intention is not to poison wildlife. The latter is very often overlooked because the effects are not as devastating as a deliberate poisoning. A good example is when bromacil (herbicide) is applied against label instructions in sensitive habitats. When the rains come, the herbicide migrates rapidly away from the point of application to kill even the hardiest of trees at distances of up to 300 meters.

Another example is where rodenticides are used without bait stations to control gerbils. Other animals like antelope eat it and become poisoned. Even though the impact is often overlooked, it is still an impact on the ecosystem that may be very difficult to restore. Shepherd trees that were killed in the bromacil incident may never be seen again in our lifetime in that area.

The worst form of wildlife poisoning is when someone targets an organism in a highly irresponsible manner with a pesticide. A landowner close to Aliwal North poisoned a calf carcass with a pesticide and the next morning a leopard was found dead next to it.

According to the family they never even knew about the existence of leopards in the area. On 13 December 2013 a colleague and fellow conservationist, Kare Webster, found 65 Cape griffon vultures dead on a farm close to Molteno. They succumbed to carbofuran that was put into sheep carcasses to kill jackals and stray dogs.

The same happened a year later when Cape griffon vultures were poisoned in the Swartberg area of Kwa-Zulu-Natal. Producers called from far and wide to express their absolute dismay at the loss of over 60 vultures. Another incident occurred close to Richmond in the Karoo, in which more than 200 blue cranes were poisoned – deliberately – with diazinon. Just imagine the national bird lying in blue flocks in the Karooveld, wasting away in the wind.

It is undisputed that predation is a serious issue for small stock, cattle and wildlife producers, but to take to poisoning is no longer acceptable. There are many management tools available to combat predation and most producers manage predation in an environmentally sound fashion. It is a punishable offense in terms of several acts to poison wildlife, but it is also a crime against the earth to deliberately poison wildlife.

Something that is increasing alarmingly is poachers using poisons to kill animals like lions, elephants and rhinos. A secondary activity which is even more disturbing, is that they poison such animal carcasses to kill vultures. This is a mitigation measure deployed by poachers to prevent game rangers from becoming aware of poached animals; vultures descending upon a site or rising is an indication to rangers that an animal has been killed. A single incident in Botswana in recent months saw over 600 vultures killed in one foul swoop with carbofuran.

Where do the poisons come from?

The most commonly used poisons in wildlife poisoning incidents are agricultural remedies, notably the older carbamates and organophosphates, most of which are used in crop production today.

Pesticides like aldicarb and methomyl are also smuggled in from Zimbabwe by crime syndicates who target valuable wildlife. Aldicarb has already been banned in South Africa – even the possession thereof will land one in jail. However, with a non-existing border between South Africa and Zimbabwe, it is very easy to walk across the Limpopo River with a load of aldicarb and go unnoticed by the law enforcement agencies.

The Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947) is very lenient on who may acquire a pesticide. It only demands that whoever buys a pesticide and uses it, does so in accordance with label instructions. It does not prohibit anyone from buying a pesticide per se and that is perhaps an issue that needs to be reviewed. A person should not be able to be in possession of a pesticide for which he cannot provide substantial evidence for an immediate need thereof. Why is it possible for a livestock producer in the middle of the Karoo to be in possession of carbofuran that is strictly for crop production? There is only one reason and that is to poison wildlife. When a maize producer uses carbofuran according to label instructions, the risk of wildlife poisoning is nil. Perhaps it is time to review the laws that govern pesticides.

The solution to wildlife poisoning

Preventing wildlife poisoning is a mammoth task of which the easy part is working with normal, productive salt-of-the-earth South African producers. Most important is to stick to label instructions which include following the warnings and precautions as well as locking pesticides away when not in use. Secondly, farm workers have to be trained on the safe handling and use of pesticides. They need to be warned against the crime syndicates who may target them to unlawfully get their hands on these products. This should prevent a large percentage of mishaps in which wildlife may be poisoned.

The problem escalates to insurmountable when it comes to those who wilfully and deliberately poison wildlife.

It is interesting to note that virtually all the reports of wildlife poisoning that are received come from producers, indicating that the broad-based farming community is opposed to wildlife poisoning. What is near impossible to achieve is identifying the crime syndicates that poison the iconic species as they operate in military fashion under the cover of darkness when most people are fast asleep.

It is also time to add drastic measures to the biodiversity laws and to Act No. 36 of 1947 to curtail the misuse of pesticides and other poisons. The maximum penalty under Act 36 is a lean R1 000 fine and/or two years imprisonment, while the biodiversity conservation legislation leaves one huge loophole: It does not cater for a bycatch. This means that if a culprit poisons a carcass to kill predators and vultures are killed, his defence will be that it was not his intention to kill the vultures. It makes a mockery of the prosecution of such criminals. Change the laws, nail the culprits!

Banning pesticides?

Certain conservationists plead that pesticides that are used in wildlife poisoning should be banned. The question is, what effect will it have? It will remove tools that are required by law-abiding producers for legitimate purposes such as crop production.

We have already learnt a lesson when aldicarb was no longer registered in South Africa; the poisoning brigade turned to other pesticides like methomyl and terbufos. Although banning is therefore not an option, severely restricting access to such products may have a positive effect. If a person is caught walking in the Kruger National Park with a legitimate and labelled container full of oxamyl, it should immediately be an offense – as such a person is in the park unlawfully and has no lawful reason to be in possession of methomyl.

CropLife SA'S Progress on Pesticide Stewardship

CropLife SA members are rapidly developing and implementing pesticide stewardship programmes for a variety of reasons – one being to prevent unnecessary pesticide impacts on wildlife. It may mean that some products such as the very toxic carbamates may be restricted by the registration holders themselves, while another measure is to sign crop advisers and producers into agreements to ensure strict label-directed use and safe on-farm storage. It is encouraging to see how many producers appeal to CropLife SA and its members to support them with training, as it already paves the way for much better control over pesticides. We have also developed an adverse reaction reporting protocol and forms that can be downloaded from the website www.croplife.co.za under Resources. This is for use by any member of society to report wildlife poisoning.

The Impact of Crop Pests on Food Security

Dr. Gerhard Verdoorn
AgriAbout
May 2020

Crop production and animal production probably provide 90% of the world human population's food needs. Very few people on earth live as hunter-gatherers (maybe those who do are the lucky ones) while the rest of us rely on agriculture to supply our food.

Food crops are very sophisticated biological entities with high yield potential under ideal conditions, but we are hampered not only by the challenges of climate change but also by the pressure of crop pests (invertebrates and vertebrates), weeds (competing plants) and plant diseases (pathogens and microbes). Historical events still reverberate in our minds to caution us against devastating crop pests, weeds and diseases like the late blight that killed potatoes in Ireland between 1845 and 1849 and caused severe famine and mass human mortality. The challenges of climate add the pressures of pests and make life interesting if not stressful for modern farmers.

Can modern crops succeed under pest pressure without pest management?

A fair percentage of the world's human population have no idea what crop production means. People buy their food from the retail outlets and demand healthy, tasty and good-looking fresh produce and processed foods without understanding that it is produced in a constant "war" situation – that "war" is waged against crop pests, weeds and diseases.

Question is why plant pests and diseases are in such competition with us? The answer is quite logical: we managed to select certain traits like high yields, growth form, short growth cycle in cultivation but in the process the natural compatibility or resistance against pests and diseases are sacrificed. A second rationale for the challenges we face with plant pests and diseases is the agricultural practice we use for food production, namely large tracts of land planted with dense stands of monocultures. Any arthropod species will cash in on such abundant food supply while pathogens are very easily spread between individual plants while proliferating in magnitude to epidemic proportions. Fact is that our modern crops are highly susceptible to plant pests and disease while weeds are omnipresent in crop production. There is no way in which we can produce enough food for the 8.5 billion people without supporting our crops with sound pest management. Nature's little beasts are simply too numerous and competitive to be left without control.

Arthropod and nematode pests

Insects and arachnids like mites are considered serious crop pests. Nematodes are often forgotten due to their small size, but they can be totally devastating to many crop species.

Sporadic pest outbreaks

The recent red locust outbreak in central Africa is an example of how a single insect species can destroy virtually all crops in a short period of time. We have a similar species namely the migratory locust in South Africa that damages natural veld, but if left unchallenged it invades cash crops like maize. Another pest that occurs sporadic in many crops is the African bollworm.

There were outbreaks in the Western Cape canola and wheat in 2018 and 2019 that caught farmers off guard. Our African armyworm is another sporadic pest that often “appears out of nowhere”, damages veld and grazing and even spills over into crops. The sporadic pests are perhaps more dangerous than the endemic pests because the farming community does not expect such pests and are unprepared to deal with it. The agricultural sector and state agriculture organs need to develop efficient early warning systems for such sporadic pests to prepare farmers better to combat them.

Invasive pests

The Fall armyworm that invaded South Africa in 2016 is a pest that sent shivers through the agricultural network and destroyed cash crops of a large percentage of small farmers and some commercial farmers in South Africa.

Had it not been for genetically modified maize that has an inherent control mechanism for Lepidoptera (worm) pests, the maize crop in South Africa would have been devastated. We also see other invasive pests like different fruit flies that arrive uninvited in South Africa and jeopardise fruit crops. The problem with invasive pests is that there are often no registered pesticides available, leaving farmers at a loss for suitable and effective control mechanisms.

Another problem is that such invasive pests establish themselves as endemic pests within a short period time and add to the frustration of farmers and costs of production. South Africa recently also experienced the arrival of the polyphagous shot hole borer that invades ornamental and crop trees, inoculates it with the dangerous Fusarium fungus and we have no effective control mechanism for this pest yet.

Endemic pests

Farmers are usually acquainted with the “standard” pest like stalk borers, thrips, whitefly, loopers and various nematodes (there are many, many others!) and their cyclic nature coincide with crop cycles and spray programmes are established to control such pests. We seldom see a real problem with endemic pests that cannot be controlled effectively and if such problems do arise, it is mostly because of poor agricultural practices or incorrect application of pesticides.

The threat posed by nematodes to food security

One may think that the physical damage caused by pests to crops is the only



impact we are concerned about, and yes, physical crop damage either in the larger plant itself or the part that should be harvested like fruit or an ear of wheat, can wipe out a farmer's prospects of sending his produce to the market.

Physical damage like nematodes in potatoes and bananas, worms in maize, whitefly in tomatoes and thrips in fruit crops can destroy a crop completely but the secondary effects may also be as devastating. That is when a biting and sucking insect inoculates the crop with a plant pathogen, virus or bacterium that kills the plant or damages it to the point where it is not able to yield a harvest. Thrips and plant lice are tiny plant pests that can destroy a crop by establishing a disease in a crop.

Damage caused by such pests can be tertiary in nature when fungal spores are carried into the crop by wind and enter the damaged areas; it is not necessarily only insect borne diseases that damage crops. On the commercial scale the physical and secondary damage to crops may not really be a threat to food security, but for a small farmer or the subsistence grower, it may take out his or her food supply for an entire season. If we, however, remove plant protection from commercial agriculture, as much as one quarter of the national crop may be wiped out by plant pests which leaves a serious national food security risk for a nation.

Weeds

Weeds may be indigenous or exotic of nature and have the amazing ability to always perform better than crops.

There are several threats that weeds pose to crops namely competition for nutrients, competition for soil moisture, competition for sunlight, hosting pests and diseases, and allelopathy. The latter is when a weed species produces chemicals that negatively impact on a crop species' ability to germinate or grow; it basically poisons the crop plants.

Another challenge that weeds pose to crops is contamination. Seeds of weed species that contaminate cereal crops for example, may render such cereals useless for humans or animals.

Datura seeds are dangerous when found in any cereal crop and such a crop may not be sold in market.

Invasive weed species

From time to time, agriculture is faced with an invasive weed species like the *Amaranthus palmeri* or Palmer amaranth that entered South Africa probably in 2016. It is a frightening species because of its resistance to glyphosate and a lot of other herbicide active ingredients.

Imagine if this weed invades the GM maize areas of South Africa: it may bring maize production to a total standstill due the impossible task of controlling it and that will be devastating to the nation's food security.

General resistance against herbicides

Some weed species in South Africa have developed resistance against some herbicides and cause headaches for farmers that grow cereal crops.

Rye grass, wandering Jew and flea-bane species are some of our current challenges. It may not seem a real threat to food security but if left uncontrolled these species may eventually take over large tracks of arable land and impact on productivity and profitability that leads to lower yields. Ever little drop in the bucket adds to the concern for food security and not just the large-scale challenges like Palmer amaranth.

Global production losses due to weeds

It is estimated that weeds account for as much as 40% of global crop losses. It is alarming that such a large impact is looming if weed control is left in the background. Weeds often harbour the insect pests that damage crops and in some areas the weed growth is so dense that harvesting the crop becomes nearly impossible.

Vertebrate pests

Rodents are the main vertebrate pests that impacts on food security while some bird species like the red-billed quelea sporadically have devastating impact on grains such as wheat, sorghum and millet. A three and half million strong flock of red-billed quelea will make short work of a 40 hectare wheat field and leave nothing to harvest. Rats and mice are pests of stored grain crops and it has been mooted that they consume as much as 20 million tonnes of stored grains in Africa alone. Apart from consuming grain that is grown for human, livestock and poultry consumption, they are also vectors for dangerous microbes like *Salmonella* and *Escherichia coli*.

that may cause life-threatening diseases in human beings.

Plant diseases

During the plant's growth season, it is prone to fungal, bacterial and viral infections.

Some viral infections like the banana bunchy top virus are extremely dangerous and can destroy vast tracts of bananas.

Fungal infections can be controlled but it needs a very intensive scouting programme which includes an eye on the weather patterns.

Fusarium, to mention but one pathogen, is a dreaded plant disease that can kill a crop in no time at all. It is omnipresent like other fungi and lies waiting for the crop and the correct climatic conditions to infest and destroy a crop.

The list of fungal diseases is awfully long but fortunately for farmers the knowledge base is exceptionally good and diseases can be managed effectively with the correct spray programmes.

A factor to consider for food supply and food safety is post-harvest diseases. One often finds fresh produce on the shelf that is rotten and that is due to post-harvest pathogen infections.

This becomes a big issue when post-harvest treatment is either not done or poorly implemented for fresh produce to prevent fungal and bacterial infection.

No one likes to see green mould on citrus, and no one will buy or eat such foodstuffs anyway.

Effective and environmentally compatible pest management

Plant pests, diseases and weeds need to be managed to ensure sustainable crop production and food security.

South Africa is blessed with a wide range of registered plant protection products that fulfils 95% of the needs of farmers to protect their crops.

Changes in climate, market demands, market preferences and government performance in terms of registering plant protection products all play a role in planning plant protection programmes.

Lobby groups and misinformation often taint certain plant protection products with false information which leads to negative regulatory interventions.

Regulators often fail to take food security into account when wiping plant protection products off the table. A good example is the continuous fight about glyphosate and the potential impact of banning it on food security.

One must also bear in mind that food security is not only having good supply to all people but also affordable supply of essential foodstuffs.

Going organic may sound idyllic but what is the cost of such foodstuffs going to be? Put your thinking cap on!

Dr. Gerhard Verdoorn
SA Grain
June 2020

Crop Protection: The Advent of New Active Ingredients

One often hears that the world's growing human population demands more food. Along with that comes the need for new technology to be more productive as far as food supply goes. It is not only the needs of society that drive innovation to produce novel technology, but also the inquisitive nature of scientists that prompts the discovery and development of new technology.

An issue often forgotten, is that we also need new technology to minimise or counter the impact of human beings on the natural world. This is why plant protection products are constantly scrutinised and softer products are being sought by the industry. Maize is a good example of innovation. Three decades ago, it was unthinkable that dry-land maize could yield up to eight tons per hectare, but with new cultivars and new plant protection technology, that yield is now not only a feasible dream, but a reality for many producers.

How new products arise from the nebulous clouds of science

Plant protection products go back as far as the times of ancient Egypt, the Chinese dynasties and the Meso-American civilisations. Arsenic, tobacco extract, sulphur and pyrethrum were some of the very early pesticides used by ancient cultures to protect their crops against plant pests and diseases. The industrial revolution kick-started the chemical industry with pharmaceuticals, industrial chemicals and pesticides pouring out of academic research and manufacturing industries. Some of the chemicals (pesticides) were discovered by chance, while others were purposefully developed by scientists.

Finding a new pesticide (insecticide, acaricide, nematocide, herbicide, fungicide or adjuvant) is not simply a case of building new molecules. It is certainly exciting to synthesise new molecules, but such synthesis must be purpose driven. Modern science can identify certain biochemical functions in living organisms that can be targeted for disruption or termination by a pesticide molecule.

Molecules need to 'fit' into receptor sites in living organisms to trigger a physiological response that will either disrupt the organism's normal biochemical processes or terminate certain ones that are critical for life.

Hence the organism will be 'controlled'. A vast amount of computer modelling goes into molecular design, but despite the enormous advances of the past two decades in such technology, it is not a 100% exact science. It still requires the synthesis of a variety of molecules that match or closely match what the computer model produces as well as the physical testing of such molecules against living organisms to gauge their effect upon such organisms. Synthesis of molecules is what organic chemistry is all about.

One starts off with simple building blocks like amino acids, terpenes or even natural sugars like xylose and then conducts a series of successive chemical reactions or manipulations to end up with a final molecule.

This work is tedious, very costly and demands very good scientific knowledge and innovative thinking. However, in practice a good synthetic organic chemist can synthesise any organic molecule that consists of a carbon skeleton and is supplemented with functional groups that contain hydrogen, oxygen, phosphorus, sulphur, nitrogen and halogens like chlorine, bromine and fluorine. Plant science companies employ many synthetic organic chemists that synthesise very large numbers of potential pesticide molecules. Such molecules, once available, are subjected to laboratory tests (very often on tissue cultures) to find ones that show promising effects against pathogens, weeds and insect/arachnid/nematode pests.

Once a molecule shows the desired effects, it is manufactured in larger quantities for pot trials. Pot trials are trials conducted in hothouses on crop plants that are inoculated with the weeds, pests or pathogens and the trials are conducted under strictly controlled conditions. Out of these trials the company hopes to find at least one molecule that can be commercialised.

Whilst all of this is going on, the toxicologists do assessments of the human toxicology and environmental toxicology – which sounds quick, but is a mammoth task.



Toxicology is not only determining the acute and chronic toxicity (oral, dermal and inhalation) but also testing for carcinogenicity, mutagenicity, teratogenicity and other related health effects. Environmental toxicology involves various mammals, birds, aquatic organisms, bees, earthworms and algae. Many promising molecules fail the toxicology screening due to unacceptable parameters that manifest during the screening and are abandoned.

Eventually, after eight years of research and development, only one out of 20 000 molecules that are synthesised and tested, make it to the market as commercial plant protection products. The average development costs are around 400 million Euros to bring one new product to the market.

Plant protection is not only about chemistry

The days of total reliance on chemistry in plant protection are long gone. Most large plant science companies invest big money in natural organisms such as bacteria, fungi, viruses, predatory insects and nematodes as new technologies for pest, weed and disease management.

Although it is generally believed that natural products are less harmful than most chemicals, the responsible companies spend as much effort in developing such tools for agriculture. Biological pest control is not just a buzzword; it is a critically important component of integrated pest management – especially in high value crops. Grain crops have benefitted from the new technology, as there is already a good number of biological insecticides for the control of Lepidoptera pests.

Something old, something new

Plant protection companies are not abandoning older molecules wilfully, because many of them still have a place in the market and service the pest control needs of producers. Some of the forwardthinking companies take older molecules and blend them with other chemicals in new formulations to enhance their efficacy.

This creates new life for old molecules and generally speaking such products are still affordable. An 'old' molecule in a totally new formulation is also an option, such as using micro-encapsulation to render a safer formulation (safer for the user). This also prolongs the release of the active ingredient, giving it better residual effect and superior efficacy compared to the same molecule in standard formulations.

Be informed

New technology is slow to enter the market due to the significant costs of development, but when it becomes available the owners thereof market it extensively. Producers should be using the CropLife SA Agri-Intel database, because new pesticides are added as and when they pass the registration process in South Africa. It is also important to attend new product launches, because that is where the plant science technologists and scientists explain the workings and do's and don'ts of the new products.

Producers need to not just read labels, but study labels of new products to understand and implement the correct application measures and dosage rates.

Crop advisors may not recommend or sell products for any other purpose than those stated on the labels. New technology is 'soft' and needs to be handled with kid gloves. Global health and environmental concerns push new plant protection products to the 'safer' arena, but it has one drawback. Chemical pesticides are much more target selective and unfortunately are much more prone to resistance being developed against them.

That is why integrated pest management is so important – it saves the 'lives' of new products. Using a new molecule repeatedly is a bad idea, because resistance progression against soft molecules is rapid. If a label instructs the user to only apply the product twice in a growth season, it has a lot to do with the resistance management.

Directly under the paragraph that describes the general purpose of the product, the resistance code of the active ingredient can be found. Ensure that products with different resistance codes are used in spray programmes to put the brakes on resistance development.

New application technology

Innovation also includes new application technology. Tractor boom sprays were used for a very long time. Then came aerial application, followed by newer terrestrial application equipment. Most recently came the exciting, but often troublesome, use of drones. Drones are here to stay, but in this regard, drones are not the toys one can buy in the retail market.

Drones for dispensing of pesticides are huge, remotely piloted, unmanned aircraft that require registration by the Civil Aviation Authorities and aerial applicator pest control operator registration issued by the Registrar of Act No. 36 of 1947.

A good drone may be invaluable for producers, because it can be used not only to dispense pesticides that are registered for aerial application, but can also be used with infrared technology to scout the crop's general health, signs of stress, pathogen or insect infestation and moisture in large tracts of crops. Another advantage of deploying the full force of drone technology, is that affected areas in large crop fields can be identified and selectively treated if the required products are registered for aerial application. This is very useful when new products that are very costly, are deployed to fight pest and disease infestations in the identified areas in the crops.

Roger Poole
TIPWG Chairperson

Weaning the Forestry Industry from its Paraquat Reliance

In the last ten years, 153 576 hectares of plantation forest have been damaged by fire. This figure would have been exponentially higher if it wasn't for the kilometres of legally required firebreaks prepared annually by the Forestry Industry.

A large proportion of forestry firebreaks are in ecologically sensitive areas where using man-made features such as roads are not an option, in these cases firebreaks need to be burnt. Tracer-belts are used to prevent firebreak burns becoming runaway fires, etching a 31.2m boundary line with herbicide either side of proposed firebreak.

Paraquat has been the go-to product when it comes to tracer-belt preparation for over a decade. A fast acting, non-selective, contact herbicide, paraquat is perfectly suited for this application. By only removing the above-ground portion of both grasses and broad leaf plants, allowing regeneration of the vegetation with the onset of spring rains, using paraquat reduces the risk of erosion and/or invasion by alien vegetation.

From an environmental and economic perspective, paraquat is the obvious choice, being more efficient, cost-effective and posing far fewer potential environmental hazards than its glyphosate and glufosinate-based alternatives. However, there is a darker side to paraquat, its acute toxicity to animals and humans. In China alone, on average 5 000 deaths a year are attributed to paraquat (<https://en.wikipedia.org/wiki/Paraquat>) and it is not just China, globally thousands of people, every year, die as a result of paraquat poisoning, 93% of these are suicides (<https://en.wikipedia.org/wiki/Paraquat>). Ingestion of just two teaspoons is enough to kill, causing liver, lung, heart and kidney failure (<https://en.wikipedia.org/wiki/Paraquat>).

The forestry industry in South Africa understood the risk of paraquat and have put measures in place to prevent any accidental injuries or fatalities. Only skilled operators are used for applying the paraquat, with use limited to areas that are inaccessible to mechanised operations, i.e. on steep terrain. All operators undergo medical checks before and after the tracer preparation season and regular urine tests are taken. To date, no paraquat related fatalities have been reported in forestry in South Africa – a statistic the industry is very proud of.

The health risks posed by paraquat has seen it banned in the European Union, Thailand, Vietnam and Malaysia. A global ban, under the Rotterdam Convention has been petitioned by several countries, but repeatedly blocked by developing nations and the US who stress the economic importance of paraquat for third world farmers who cannot afford alternatives and the effectiveness of paraquat on a wide range of sites and vegetation types.

While a global agricultural ban on the use of paraquat may not be around the corner, the forestry industry in South Africa has taken proactive steps, actively seeking an alternative. This is good news for those Forest Stewardship Council® (FSC®) certified, which is 80% of SA forestry, as for them a ban is imminent.

The implementation of FSC's updated pesticide policy (FSC-POL-30-001 V3-0 EN) on 1 August 2019 bans the use of any Highly Hazardous Pesticides (HHP) listed as prohibited. These are pesticides that are acutely toxic or can induce cancer or contain either dioxins/heavy metals. Paraquat falls under the former, being acutely toxic and so could only be used until the end of May 2020, as per the FSC derogation extension.

This means as from 1 June 2020, paraquat is no longer available for use in FSC certified forests.

So what now?

Firebreaks, and thus tracer-belts, still need to be maintained as a legal requirement. The simple answer would be to look at what else is in our current pesticide arsenal. Glyphosate is registered for this use but comes with major environmental drawbacks - namely its effectiveness as a systemic product on plant material both above and below ground. By killing the plant completely, glyphosate prevents spring-rain regrowth and increases the potential for soil erosion and insurgence from alien invasive species.

If not glyphosate, what else?

Here is the predicament the forestry industry currently finds itself in. Within the primary production sector, forestry constitutes a relatively small pesticide market, that does not command the same attention from pesticide manufacturers. Especially, when so many pesticide companies have had their products removed from approved lists as a result of certification requirements.

Without the pesticide manufacturers initiating the search for new and innovative products to replace paraquat, the responsibility has fallen on the shoulders of the forestry sector, with Forestry South Africa (FSA) Pesticide Working Group (TIPWG) taking the lead. Working in collaboration with Prof Keith Little, Nelson Mandela University (NMU), since 2012 TIPWG has been exploring paraquat alternatives.

First phase trials identified a number of potential alternatives to paraquat. A second phase of experimentation identified a broad spectrum of weed species the alternative acted upon and tested the efficacy of various application methods and timings. Currently, a third phase of bridging trials are under way.

Bridging the gap

This is an example of where industry-led research and collaboration has enabled us to find industry-based solutions to industry problems and illustrates the importance of industry-led and funded research.

A special thank you goes out to all the chemical companies who have helped us get to this point by providing product for testing.

We're here to help

If you require assistance, would like to become a member, or if you have general feedback, we would love to hear from you. Please contact any member of our team:

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Please Stay Safe

As the number of Covid-19 cases continuously rise throughout our country, we would like to urge our members to remain vigilant and to continue to follow the rules. Please remember to sanitise often, wear your masks, refrain from unnecessary outings and keep to social distancing guidelines.