CROP CIRCULAR

ISSUE 10
2021

IN THIS ISSUE

CONTRIBUTE

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

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

WELCOME

Rod Bell
Chief Executive Officer
CropLife South Africa

I opened my welcome for the last edition of the CropLife SA Crop Circular by expressing disbelief at the fact that we had been under some form of Covid-19 lockdown for more than 12 months – well, we are now again at Level 4 lockdown and by the time you read this, we would have been under some form of lockdown for more than 480 days! Unfortunately, this pandemic continues to claim the lives of family members and colleagues, despite the promise of relief offered by the various vaccines that are slowly being rolled out through our country. Even though the agricultural industry is deemed to be an 'essential service' , this does not mean we are immune to the virus so please continue to maintain vigilance, follow Covid-19 protocols and consider vaccination when you get the opportunity.

CropLife SA was also shocked and saddened by the lawlessness that befell our country in the middle of June 2021. The lawless actions of mobs impacted the infrastructure and inventory of a number of our member companies, especially in KwaZulu-Natal. In addition to large areas of sugarcane and grain crops being destroyed as a result of arson, many individuals in our industry faced the threat of personal injury and/or loss of their personal property during the unrest. The entire CropLife SA team and membership is saddened by this wanton destruction and we stand in solidarity with our industry colleagues.

Apart from these challenges, I must say that the regulatory environment in our industry keeps the CropLife SA team incredibly busy. Interaction with the relevant authorities aimed at highlighting areas of improvement and shortening lead-times is a constant in our lives. If you think your regulatory team in your company is frustrated, imagine Fikile's level of despair at times when the cumulative frustrations of all our member companies land in her email inbox or her mobile phone. A daunting thought. Despite these challenges, the CropLife SA team will not shy away from engaging with government in order to improve our country's regulatory environment.

Most of the Skills Development Facilitators (SDFs) in our distribution member companies have started to work on the new Continuous Professional Development (CPD) platform. Initial interactive training has been offered to all SDFs and self-training modules are in place for future reference. As we roll out new features and the self-learn online modules, we are confident that all crop advisers associated with our distribution member companies will be able to attain their annual certification in a simple and efficient manner. The annual membership renewal process is thankfully now over. Some members elected not to renew their membership for the 2021/22 cycle, but we have more members joining than leaving which is a great situation. The benefits of being part of the CropLife SA family are becoming widely appreciated.

On the empty pesticide container front, there have been a number of positive developments. More of our member companies are starting to setup collection points for triple-rinsed, punctured, empty pesticide containers in their areas of operation - a trend for which we are very pleased. Gerhard continues to tirelessly drive the process, even when the interest from farmers and some member companies is low. It is critically important for the image of our industry that this matter be taken seriously. As mentioned at the AGM and in various communications and ExCo meetings, the Department of Fisheries, Forestry and the Environment has published an umbrella legislation that compels producers of waste packaging to establish collection and recycling programmes, with substantial fines for transgressions. We expect the regulation focusing on pesticide packaging to be out for public comment still in 2021, so it is better that we as the industry association have a system in place for our members before the new regulation enters into force. Remember that Gerhard has a vast amount of guidance information on the CropLife SA website covering this subject. Alternatively, reach out to Gerhard or another CropLife SA team member should you have questions about the collection and recycling of empty, triple-rinsed pesticide containers.

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CONTENT

The CropLife SA Agri-Intel database continues to be an invaluable tool to members, non-members, exporters, importers and purchasers of South African agricultural produce. The Agri-Intel team works tirelessly to keep the data current and add new value-adding benefits all the time. This takes resources, so we also continue with efforts to generate some income to cover Agri-Intel costs. In addition, we are delighted to welcome Ms Liezel Cronje to the team. Liezel is working full time for CropLife SA as part of the Agri-Intel team, but on a half-day basis initially, with a view to full-day service once the demand for her time warrants. So along with Chana-Lee and Luigia, we have a fantastic team looking after Agri-Intel.

Marketing and communication form part of another association foundation pillar that is not being forgotten. Many infographics, articles, press releases, technical bulletins and video clips have been produced and are rolled out to various publications and on social media all the time. Be sure to check in on the CropLife SA website should you be missing these important bits of information. In addition, the offer stands to all members – we would welcome receiving any articles from you that have industry-wide interest (sorry, nothing relating to your specific products or commercial efforts please) or impact for inclusion in further issues of the Crop Circular; engage with Elriza in this regard please.

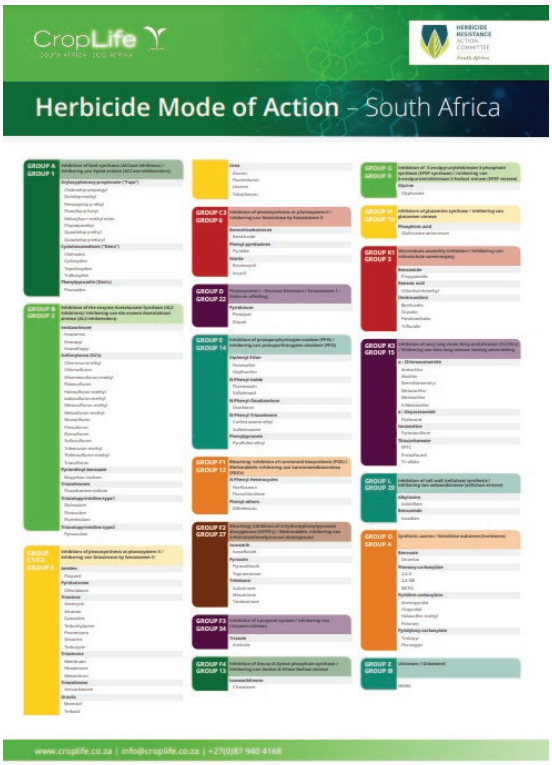
As always, the CropLife SA team strives to fulfil its various mandates, two of which are to look for ways of improving the image of the industry, as well as supporting our members wherever possible. We do, however, need our members' support in these efforts.

The CropLife SA team has been receiving on an almost daily basis reports of persons affiliated in our industry, member companies and even our families being struck down by Covid-19 infections. Thankfully, the vast majority of these individuals are recovering but it is heart-breaking to hear when people in the greater CropLife SA community and family members of the CropLife SA team lose their lives to this virus. I extend sincere condolences to all who have lost loved ones and colleagues to Covid-19; please stay safe and respect all Covid-19 protocols.

Herbicide Mode of Action Poster

The new Herbicide Mode of Action poster has been finalised and is available to download on the CropLife SA member portal in the Forums & Committees section within the HRAC heading. The reason for updating the poster was because Global HRAC did a review of the Herbicide MoA classification in 2020.

The update on this classification was necessary to capture new active ingredients and ensure the classification system reflects the current state of knowledge. In addition, it needed to ensure global consensus between all classification systems (i.e. HRACs, CropLife and certain weed societies) to harmonise these globally, hence the transition was made from alphabetical (legacy codes) to numerical codes, which are more globally relevant and sustainable.



Aerial Application Course

Another successful aerial application course was presented in May 2021 after the course had to be cancelled in 2020 due to the National Lockdown. The sought-after course was presented by Gerrit van Vuuren of Rolfes Agri, along with the assistance of Orsmond Aviation.

CropLife SA would like to extend its sincere gratitude to Rolfes Agri, Gerrit van Vuuren and Orsmond Aviation for dedicating their time and resources towards this initiative and for assisting to promote and uphold the CropLife South Africa brand within the agricultural industry.

Gerrit van Vuuren

Orsmond Aviation has over 40 years' experience in agricultural aviation, plague and pest control, firefighting and aircraft maintenance.

Rolfes Agri is a proud formulator and manufacturer of a variety high quality agricultural products for local and international markets

Chair for Pesticide Application Forum

We are calling on members to submit nominations for a Chairperson for the Pesticide Application Forum. After a long tenure as Chairperson of the forum, Gerrit van Vuuren has decided to step down in order to provide the opportunity for a new person to take over the reins.

We would like to thank Gerrit for his dedication to the forum and for the knowledge he passed on during his time as Chairperson. If you would like to nominate a suitable candidate, kindly forward their details to rod@croplife.co.za.

Member Portal

A friendly reminder that all CropLife SA communications and relevant documents are stored on the CropLife SA member portal. You can access the member portal through the website and the username and password can be obtained from your company's nominated representative.

Biotech Campaign

CropLife SA has embarked on an awareness campaign about the importance of stewardship in plant biotechnology as well as the benefits of the technology to farmers over the past couple of months. Interviews were conducted with various stakeholders ranging from farmers, independent consultants and other experts in the industry. The interviews are available on www.croplife.co.za in the Plant Biotechnology tab under "Marketing & Communications +Media".

New CPD Platform Launched

After months of preparation, the new CPD platform has finally been launched. While the new system will take some time to get used to, we are confident that it will be a much more user-friendly system with functionalities such as real-time reporting, digital card availability and easily accessible online training modules.

At this stage only the basic functionalities are live, such as the crop adviser profiles and loading of training instances. Once these have been mastered, the other functionalities will be rolled out sequentially.

Condolences

The global Covid-19 pandemic has affected all of us and many have lost family members, friends or colleagues due its impact. We wish to extend our condolences to every person that is part of the CropLife SA family who had to say goodbye to someone dear to them.

Proudly Supporting CropLife SA's Container Management Programme

Chris Thompson
Laeveld Agrochem

In the agricultural crop protection industry, as in other businesses, there are individuals and companies that are seen to be "early adopters".

Just as integrating biological products into an Integrated Pest Management (IPM) programme was breaking new ground a decade or more ago, so too was the concept of responsible recycling of agrochemical containers.

In 2010, Dr Gerhard Verdoorn, then a consultant for AVCASA, saw the need for a recycling programme and it was formally launched in 2014. The programme, now coordinated and supported by CropLife SA, is considered one of the most effective agrochemical container recycling programmes worldwide. It is estimated that upwards of 70% of crop protection containers used on South African farms are now recycled, benefiting not only the environment, but also providing substantial business and employment opportunities.

Anton Bredell in Marble Hall is one of Laeveld Agrochem's (LAC) visionary franchisees and one of the country's top crop advisers. Anton had, even before Dr Verdoorn's initiative, recognised the need for a service to the community and his customers, as well as the importance of environmental concerns. Accordingly, back in 2005/2006, to enable his farmers to comply with EUREPGAP (now GLOBAL.G.A.P.) requirements, he set up one of the first crop adviser collection points in South Africa. Laeveld Agrochem Marble Hall not only accepted deliveries of triple rinsed and punctured containers from growers, but even assisted in their collection from their customers' farms. Furthermore, Anton had, together with AgChem Africa (now Rolfes Agri), purchased chipping machines and the chipped plastic was then transported to AgChem's premises in Pretoria to be recycled.

Because of CropLife SA's stewardship initiative and the example set by Anton, support for the project within Laeveld Agrochem grew. Currently eight LAC depots in various provinces belonging to LAC's franchisees support the recycling programme. Apart from Marble Hall, LAC's depots in Baltimore, Hoedspruit and Polokwane (Limpopo); Middelburg (Mpumalanga), Bethlehem (OFS), and Jan Kempdorp and Douglas (Northern Cape), serve as collection points.

Pierre Nel is LAC's franchise owner in Douglas. He constructed his holding cage for the returned containers out of old disused farm gates and centre pivot poles. The recycling project assists his potato and cucurbit export growers with their GLOBAL.G.A.P. requirements and audits. He also assists the crop sprayers by recovering their empty containers for recycling. Even other growers, who are not LAC's clients, make use of his collection point. Pierre reports that he has an excellent working relationship with Dick Greeff of Drom Monster who collects the containers once the cage is full.

Feedback from the other LAC cooperating agents is similarly positive. Their involvement requires minimal extra effort on their part and the system runs smoothly. They see this as an additional service in support of their client base. In turn, their growers are grateful for the service provided and the easier accessibility it offers in their regions for responsible and convenient empty container disposal.

Laeveld Agrochem is proud to be a participating and contributing partner in a worthy CropLife SA initiative!

Elkeen het ’n Verantwoordelikheid

Niel Kruger
Inteligro

Een van die belangrike aspekte wat ’n kern deel uitmaak van die industrie se rentmeesterskapprogram is die bestuur van leë houers.

Oor die afgelope paar jaar, onder leiding van Dr Gerhard Verdoorn en CropLife SA, is daar baie klem op die rentmeesterskapprogram gelê en ook baie hulpmiddels beskikbaar gestel om as deel van hierdie verantwoordelikheid te gebruik.

Dit is egter uiters belangrik dat elke persoon/besigheid wat deel is van die ketting, die verantwoordelikheid verstaan en die nodige aksies in plek sit om dit suksesvol aan te spreek.

Die verskillende aspekte wat ter sprake is as deel van die sogenaamde gewasbeskerming rentmeesterskapketting sluit die volgende in:

- Die vervaardigingsproses
- Vervoer van die produk
- Regte opberging volgens standaarde
- Veilige hantering van die produkte (opleiding en toepassing)
- Toediening - Geïntegreerde Plaagbeheer (IPM) beginsels.
- Leë houer bestuur
- Bestuur van oortollige of vervalle produkte

Wat die leë houer bestuur betref is daar ook verskeie versamelpunte regoor die land waar leë houers afgelaai kan word. Die belangrikste faktor is egter die korrekte hantering van leë houers voordat dit by die versamelpunte gelewer word, anders kan dit nie aanvaar word nie.

Die beginsel van leë houer bestuur berus op elkeen in die kanaal se skouers, verskaffers/vervaardigers, distribusie/verspreiding maatskappye en produsente. Daar is verskeie inisiatiewe in plek om die proses so maklik as moontlik te maak en so veel as moontlik versamelpunte regoor die land in plek te kry.

Die groot risiko indien die leë houers nie reg hanteer word nie, is die potensiële omgewingsbesoedeling en vergiftiging wat kan plaasvind indien die kanne in die verkeerde hande beland en verkeerd aangewend word. Die volgende is 'n paar praktiese voorstelle vir die bestuur van gewasbeskermingsprodukte en leë houers op die plaas:

Aksie	Hoekom
Goeie seisoen nabetragting en in-seisoen beplanning in samewerking met die regte gewasadviseur.	Regte strategie en produkvoorsiening. Verhoed dat produkte oorstaan of potensieel verval.
Dring aan op formele aanbevelings van betrokke produkte.	Ondersteunend tot die strategie en belangrik vir akkurate bestuur en rekordhouding.
Gebruik slegs produkte wat geregistreer is volgens Wet Nr. 36 van 1947, vir die doel waarvoor dit aangewend gaan word.	Dis die regte ding om te doen.
Lees die produketiket voor aanwending.	Risikobestuur (waarskuwings, weerstandbestuur en versoenbaarheid)
Maak seker dat die mense wat by die hantering en fisiese toediening van die produk betrokke is, goed opgelei is en dat die nodige veiligheidsmaatreëls toegepas word, sowel as dat veiligheidstoerusting beskikbaar is en gebruik word.	Beperk potensiële skadelike blootstelling aan produkte.
Spoel die produkhouers 3 maal uit volgens die protokol, terwyl die spuitmengsel in die spuitkar aangemaak word.	Verhoed dat die spoel aksie later moet plaasvind en die addisionele maatreëls wat daarmee gepaard gaan.
Kap gate in die leë houers, verwyder die doppe en stoor in 'n geslote area op die plaas totdat dit na die versamelpunt geneem word.	Verseker dat dit nie vir 'n ander doel gebruik word nie.
Maak seker dat die versamelpunt 'n goedgekeurde CropLife SA versamelpunt is sodat die nodige dokumentasie uitgereik kan word.	Nodig vir ouditdoeleindes en rekordhouding.
Besoek CropLife SA se webtuiste of kontak die CropLife SA span vir enige verdere vrae rondom die hantering van produkte of leë houers op die plaas	Baie handige inligting beskikbaar op die webtuiste (www.croplife.co.za).
Indien daar ou produk op die plaas is wat reeds verval het, kontak vir A-Thermal.	Kan help om die produk op die regte manier te vernietig.

Novon Retail Company offers SHE Training to Farmworkers

During the month of June, Novon Retail Company offered two training sessions to over 1000 farmworkers in Letsitele and Komatipoort. The sessions covered topics such as crop protection products and the law in South Africa, how to read the product label, the safe handling and storage of crop protection products, record keeping and good practices. These are the type of good-news stories we should continuously share with our members and the public to show the industry's commitment to ensuring safe and responsible use of agrochemicals.

CropLife SA Hosts Genome Editing in Agriculture Webinar Series

International Perspectives and Lessons for Regional Alignment – 25 May 2021

The world of plant biotechnology is rapidly evolving, and these new innovations and technologies are becoming key in assisting farmers to meet the global food demand of a growing population. One of these promising technologies is genome editing, which in some instances differs from genetic modification in that only a small, controlled change is made to the organism's existing DNA, similar to changes that are introduced through conventional plant breeding. The challenge, however, arises in how these new technologies should be regulated and more importantly, working towards global regulatory harmonisation to ensure that these innovations are not stifled and that policies disproportionate to safety concerns, are not implemented.

For this reason, CropLife South Africa hosted a webinar on 25 May 2021, to provide a platform where stakeholders in South Africa and the region could gain a better understanding of genome editing technology, get insight into best practices regarding policy in various regions, as well to encourage alignment in policy approaches.

The event was moderated by Ben Durham, the chief director of bio-innovation at the Department of Science and Innovation, and subsequently opened by the US Department of Agriculture's Chargé d'Affaires, Todd Haskell, who set the stage by describing the long-standing relationship between the US and South Africa. He indicated that in 2020 alone, over $8 Million was achieved in bilateral agricultural trade between the two countries. He continued by describing how South Africa's adoption of proven scientific approaches in biotechnology has paved the way for its farmers to increase maize production exponentially over the past 20 years, resulting in South Africa being the continent's leader in plant biotechnology and a reliable supplier of maize across the region, and in the world.

Dr Julian Jaftha, the chief director of plant production and health at the Department of Agriculture, Land Reform and Rural Development, explained the considerations of regulating genome editing in South Africa in terms of the GMO Act of 1997. He acknowledged that developing this framework was still a work in progress and that one of the main questions that needed to be answered was whether or not genetically edited products or techniques should be regulated under the same Act, and if so, what kind of risk assessment route needed to be followed. At present, he said, a two-tiered approach is being considered, where the first tier would encompass the core information required to perform a basic risk assessment and the second would, if needed, include supplementary information based the characteristics or unintended use of the genetically modified organism. To date however, no formal application for registration under the GMO Act, 1997 for a genetically edited product has been received in South Africa.

Shedding some light on the responsibilities for the regulatory framework in Nigeria, was Dr Rufus Ebegba, the chief executive officer at the National Biosafety Management Agency. He illustrated the process map used in Nigeria that assists in deciding whether a product is considered genetically modified or not. Some of the considerations include whether there is a transgene or foreign DNA present, if the product uses the transgene temporarily and if the final product is free of the transgene.

Alejandro Hernandez, the regional director of biotechnology for CropLife Latin America, followed with an informative presentation about the regulation approaches in Central and South America.

He highlighted that some legislation discriminates between genome edited and genetically modified products by analysing whether the final product can result from conventional breeding, mutations or natural intervention. He emphasised the importance of definitions and specific wording contained in the regulations and provided examples from countries such as Honduras, Brazil, Chile, Colombia and Argentina, who follow the same consultation approach regarding whether the final product is considered a GMO or not.

Dr Donald Mackenzie, the executive director at the Institute for International Crop Improvement concluded the day by suggesting that conversations around genome editing and plant breeding innovations should be rooted within the historical context of plant breeding and crop improvement. He further explained that the vast majority of market-oriented plant breeding innovations are mutations that are indistinguishable from the kinds of mutations produced using classical mutation breeding. He concluded by suggesting that the science should be followed and the learnings of more than three decades of regulating GMOs, should be captured.

Enabling opportunities for agricultural innovation – 22 June 2021

Genome editing is considered a valuable and complementary addition to modern plant breeding practices. Increased utilisation of these innovative technologies in plant science promises to accelerate improvements in agricultural production in an efficient and sustainable way, preserving our environment and delivering benefits to both producers and consumers. The challenge, however, is to ensure that regulatory approaches provide clear guidance, are science-based to ensure safety, while simultaneously promoting innovation and utilisation of these technologies.

As a follow up to the previous virtual discussion platform on this topic, CropLife South Africa in collaboration with the USDA Foreign Agricultural Service and local SA partners, hosted the final event in its Genome Editing in Agriculture webinar series on 22 June. This event provided a platform for stakeholders in the South African agricultural sector to gain insight into how genome editing impacts innovation and breeding, as well as the economic benefits for agriculture and farmers.

The event was opened by Doug McKalip, a senior advisor at the US Department of Agriculture, who set the tone for the discussions by elaborating on how the availability of innovative genetic tools have been critical to the efficient production of vaccines during the current Covid-19 pandemic, demonstrating the responsibility of governments to adopt science-based reviews to make technologies available in a timely manner. He confirmed that climate change will be a priority under the current US administration and that biotechnology, as well as genome editing, will be an important contributor to providing sustainable solutions. He acknowledged that, while genome editing holds so much potential and promise, the realisation of benefits is largely dependent on a science-based regulatory approach that provides a clear pathway for products. He concluded that collaborations between countries are important to ensure compatibility between regulatory systems so that they can work seamlessly across boundaries.

Discussions were moderated by Dr Hennie Groenewald, executive manager of Biosafety South Africa, a service platform that supports sustainable innovation for the South African bioeconomy.

Presentations kicked off with Dr Martin Lema, adjunct professor in biotechnology at Quilmes University, who provided an overview of Argentina's experience with genome editing in agriculture. He shared details on the regulatory criteria and process for assessment of genome editing applications, confirming that their case-by-case mechanism determines whether a product should be regulated as a GMO or as a new conventional variety.

He acknowledged that preliminary assessments on whether to regulate or not, has encouraged innovation and research investment by an increasing number of local companies and public research institutes, resulting in more local product applications. Beyond GEd regulatory systems, he also emphasised the importance of public communication and understanding of genome editing and elaborated on how the Argentinean government has engaged the public on this issue. He concluded that within the LATAM region, many countries have adopted the Argentinean approach to genome editing and are seeing similar results with regards to local and foreign investments in innovation.

Dr Lukeshni Chetty, general manager of the South African National Seed Organisation (SANSOR), followed with a presentation on genome editing in the seed industry. She shared information about the scientific fundamentals of plant breeding and how the application of genome editing tools could assist breeders to develop varieties in less time and with greater precision.

She elaborated on the global seed trade industry, emphasising the importance of regulatory harmonisation to facilitate the movement and trade of seed. Her presentation also referred to the position of the International Seed Federation advocating for the adoption of consistent, harmonised and science-based approaches for varieties developed from innovative breeding applications. She highlighted that there are lessons to be learned from the global patchwork of regulations for GMOs that has led to asynchronous approvals of GM products, creating challenges with trade and technology availability. Outcomes of a study on perceptions of plant breeding and plant breeding innovations revealed the knowledge gaps amongst consumers and the importance of knowing the level of understanding amongst target groups so that messages can be better communicated.

Sharing some perspectives on the importance of genome editing tools for the vegetable industry, was Dr Glendon Ascough the research director for plant breeding activities at Starke Ayres. Glendon provided an overview of the various tools used in their plant breeding programme to bring competitive products to market, confirming that these innovative tools have made the plant breeding process more accurate, efficient, quicker, and ensured better decision making. He clarified Starke Ayres's decision to exclude GMOs from its breeding programme and separating itself from the stigma and perceptions attached to GMO's. He pointed out that the current GMO definition in South Africa included gene editing and that from a developer perspective, these regulatory hurdles would be too costly and time consuming, if not addressed. He concluded that for the potential of innovative plant breeding to be realised, there needs to a be clear and differentiated definition and pathway for gene editing products that are not GMOs. Importantly, he added that regulations in South Africa should focus on the safety of the end product, not the development method, to avoid having strict regulations that stifle the innovation process.

Dr Dirk Swanevelder, a senior researcher at the Agricultural Research Council followed with an informative presentation on some of the promises and practical challenges posed by genome editing in agriculture. His presentation highlighted genome editing in crops of significance to the southern African region, as well as provided examples of gene editing in animals and the biomedical research sector. In conclusion, he stated that research in South Africa is ready to embrace genome editing, but that the absence of clear regulatory guidance defining the scope of products to be regulated, creates uncertainty and deters investments in local innovation projects. Sinelizwi Fakade, a commercial farmer from the Rocky Park Farming Group in the Eastern Cape concluded the day's presentations by sharing perspectives on how the farming sector cannot afford to ignore technologies such as biotech seed and gene editing innovations in order to meet food production targets and achieve food security. He further stated that investments in plant breeding technologies are offering farmers better solutions to protect their harvests against weeds, diseases and other pests, while minimising impacts on the environment. He concluded that technology is the future and that farmers needed to embrace it.

Aerial Application of Agrochemicals: Factors to Consider

SA Grain Digital
Elriza Theron
May 2021

When it comes to planning a crop protection spray programme for the season, there are various aspects to consider for achieving optimal results – one of which is the correct application method.

Producers have a variety of options available to them, providing of course that the crop protection product is registered for the purpose and the application method they envisage to use. One of these options, if allowed by label instructions, is aerial application. In some instances, it may be the only suitable application method if, for example, crop fields are too wet for ground-based spray equipment. Other times aerial application is the best solution due to the crop growth stage or structure – again, only if the label instructions include aerial application.

Advantages of aerial application

There are several advantages of aerial application, such as the ability to treat larger areas in a short period of time; reduced volume of water that needs to be transported; not risking mechanical damage to the crop or soil compaction as well as not spreading weed seed or diseases by means of equipment as may be the case in ground-based applications.

Some of the disadvantages, however, include sensitivity to adverse meteorological conditions; availability of safe landing strips along with good quality available water at the landing strip; a higher risk of incompatibility in tank mixtures and – of course – the danger of obstacles such as trees and power lines close to the target areas.

In addition, the cost is not always economically viable when spraying smaller areas of land. One matter of serious concern is damage inflicted to surrounding crops, especially with herbicide applications if aerial application is not done strictly by the book. Whatever the reason for choosing this method, the various parameters involved in the responsible application of crop protection products need serious consideration. Below are some of the aspects that a producer needs to pay attention to when choosing aerial application.

Meteorological conditions
Weather conditions need to be considered when using any agrochemical application method. However, there are additional factors to be cognisant of in aerial application.

Wind speed
Spraying of pesticides must cease at wind speeds of 15 km/h or more, or at 10 km/h for glyphosate-containing herbicides. This rule applies to both terrestrial and aerial application. In addition, operators and producers must be aware of temperature inversion under calm conditions when wind velocity is below 5 km/h. Inversion conditions normally prevail in the early morning and occur when cool air on the surface is prevented from moving upwards by a pocket of warm air overlying it. This causes spray mixture to remain suspended in the air, while not being deposited onto the target. Any of these factors can cause serious off-target drift and should be avoided at all times.

Relative humidity
Application should not be done when the relative humidity is 40% or less, or if the difference between a wet and dry bulb thermometer is eight degrees or higher. This is because the relative humidity affects how quickly a droplet can evaporate.

In addition, the rate of evaporation can lead to spray drift because bigger droplets could evaporate into smaller, drift-prone droplets.

Ambient temperature
Temperature affects both inversion conditions and relative humidity. Spraying should not occur during the heat of the day, because high ambient temperatures result in water evaporation from the spray droplets, a reduction in droplet size and poor deposit onto the target. If temperatures are above 30°C, the application must be rescheduled.

Other meteorological conditions to consider include the probability of rain (as the agrochemical may not be rain fast) or avoiding application when there is heavy dew covering the crop.

Spray volume, droplet size and distribution
Some labels on contact agrochemicals recommend higher volumes and droplet densities.

In the case of contact remedies, a denser droplet coverage is usually required than for remedies with systemic activity. With regards to spray volume, 30 ℓ/ha to 40 ℓ/ha is generally indicated for aerial application. However, these low volumes may not be effective against certain pests such as the fall armyworm in its advanced developmental stages in maize.

Insect pests that hide in the plant whorl are then unaffected, because the low spray volume does not allow the active ingredient to penetrate the plant whorl.

For normal pests and diseases, even the low dispensing spray mixture volume may be advantageous, because the aircraft's motion assists to effectively deposit the spray mixture onto the target.

With regards to droplet size, the specific hydraulic nozzle size in aerial spraying is chosen to control the flow rate and not to obtain a specific droplet size spectrum as in the case of soil application. Instead, the use of the relative airspeed over the nozzle provides the different droplet sizes.

With regards to hydraulic nozzles, different degree settings are used relative to the flight direction to obtain a certain size droplet. Larger angles relative to the flight direction contribute to bigger droplet sizes.

The effect of wingtip vortices in droplet distribution

Wingtip vortices are the result of the lift process generated by the shape of the wings and aerodynamic flow of the air. It is essential that operators avoid droplets getting trapped by wingtip vortices as the droplets will then need to travel a further distance to the target and can evaporate. In addition, these droplets are carried higher into the air before they start falling to the target, meaning smaller droplets are blown away from the top of the vortex, which can potentially cause drift damage.

In order to prevent the droplets getting into the vortex, the nozzles should be placed within the inner 66% to 75% of the wingspan. Another option is to install winglets (ag-tips) on the tips of the wings, eliminating the vortex effect to a certain extent and improving droplet distribution across the swath. Note, however, that certain manufacturers do not allow this due to increased forces to the main spars of the wings.

The flying height and aircraft altitude also need to be considered. Pilots should take care not to fly too low or spray while banking or diving down into the field. This could strengthen aerodynamic air currents, forcing droplets into the vortex.

Operators should fly straight and level at 3 m to 5 m above the crop canopy in order to solve this problem.

Regulatory considerations

Three sets of regulatory tools govern the aerial application of pesticides, namely the Fertilizers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947), the Civil Aviation Act, 2009 (Act No. 13 of 2009) and the South African National Standard for Aerial Application of Pesticides (SANS10118) together with the supporting regulations of the two acts.

Act No. 36 of 1947

According to this Act, a pesticide that is intended for aerial application must be registered for such application and must have certain clauses from SANS10118 printed on the label as well as specific instructions for aerial application in the directions for use. If this information does not appear on the label, then the remedy may not be used in aerial application. The Registrar of Act No. 36 of 1947 may impose certain conditions on any registered pesticide, such as limitations on where a remedy may be applied geographically. It is therefore critical that producers and operators study the product label carefully and comply with any restrictions.

The pest control operator (PCO) regulations of Act No. 36 of 1947 specify that a pilot of an aircraft used for aerial application must be registered as an aerial application PCO by the Registrar of Act No. 36 of 1947 to offer such services, subject to other requirements of the Civil Aviation Act and its regulations.

SANS10188

SANS10118 has definitive instructions on aerial spraying and outlines the responsibilities of all the different parties involved. One of these is that the pilot must record and log all meteorological conditions as well as other information pertaining to the specific spraying operation. This log must be signed by the producer or his representative directly after the spraying was completed or stopped.

The producer, on the other hand, must inform the pilot of any sensitive areas such as adjacent crops, natural areas, wetlands, human habitation, community centres and places of animal husbandry, prior to commencing the spray operation so that those areas can be avoided.

The target area, including the buffer zone, must be clearly marked out and the information provided to the pilot. In addition, the producer has a responsibility to inform his/her immediate neighbours of any planned aerial application operations.

The Civil Aviation Act

There is a set of regulations in the Civil Aviation Act specifically regulating aircraft (including drones) and pilots operating aircraft for aerial application of pesticides. Any aircraft, be it a helicopter, fixed-winged or microlight aircraft, or drone, must be licensed and certified for aerial application of pesticides, sometimes also referred to as crop dusting. Prior to registering as an aerial application PCO, a pilot will need to be licensed as a commercial pilot with an agricultural rating for aerial application. In addition, the pilot must be in possession of the necessary radio telecommunication equipment and have the competency to operate it.

All of these requirements apply to drone operators as well. Producers must therefore insist on checking the certification of a pilot along with his/her aerial applicator's registration under Act No. 36 of 1947. They must also ensure that the aircraft is licensed and certified for crop spraying.

As can be seen, there are numerous considerations when choosing aerial application as a method for applying crop protection remedies. Producers should insist on only using products that are registered specifically for aerial application and label directions should be followed accordingly.

Can Biotech Crops Secure Enough Food?

AgriAbout
Chantel Arendse
May 2021

Food security and nourishment is an important consideration in the developing world, including the African continent. However, addressing the food security challenge is a complex issue for which there is no single solution. While the green revolution in agriculture has provided several strategies to increase crop production, such as improved crop varieties, farming practices, mechanisation, information technology as well as the use of fertilisers and agrochemicals, these solutions are not enough to help farmers achieve zero hunger by 2030.

The introduction of plant biotech seed almost 30 years ago signalled new opportunities to address the food security challenge.

Unfortunately, the polarised debate on genetically modified organisms meant that not all countries have embraced the technology, leaving sectors of the population who are most dependent on agricultural production for their livelihoods, at risk. So how then are biotech crops stepping up to secure enough food for the growing population?

Fighting pests and diseases

Crop losses due to pests and diseases are increasingly prevalent in regions of the world where the effects of extreme weather are hard hitting.

This is also the case in important food production areas in Africa, where the onslaught of destructive pests such as fall armyworm, locust swarms and diseases such as Fusarium wilt and maize lethal necrosis, continue to wreak havoc and cause major crop losses.

While traditionally the management of pests has meant the deployment of herbicides and pesticides, the availability of biotech crops with inherent pest control traits provides farmers with an additional tool in the fight against pests.

Globally, farmers have embraced the adoption of biotech crops with input traits for herbicide tolerance and insect resistance. Herbicide-tolerant (HT) crops mostly conferring resistance to glyphosate, have provided effective weed control while reducing labour demands and costs for farmers.

Insect-resistant (IR) crops with insecticidal proteins from the soil bacterium, *Bacillus thuringiensis* (Bt), has reduced crop losses by damaging pests such as maize stalk borer and cotton bollworm.

The utilisation of these technologies has resulted in significant yield gains for growers of biotech crops, with the added benefit to smallholder farmers of being able to secure enough food for themselves as well as generate an income to improve their livelihoods.

Furthermore, reduced crop damage because of Bt insect-resistant maize has delivered additional food safety benefits by reducing mycotoxin contamination levels in maize field crops as well as in storage. The superior performance of biotech seed in delivering effective control of weeds and offering protection against damaging pests has helped minimise the environmental footprint of agriculture through reduced pesticide applications and no tillage practices.

It is evident that the adoption of biotech crops has provided all farmers, whether commercial or smallholders, an opportunity to farm in a sustainable way to ensure food security while limiting the impact on the environment.

Adapting to climate change

The world's climate is changing rapidly and as droughts, floods and unpredictable weather patterns are more common, it is becoming harder for farmers to produce enough food. To mitigate the impact of climate change on the ability of farmers to increase food production and feed the growing population, they need access to the best mix of agricultural technologies and innovation.

A prime example of how climate resilient technology is making a difference is the availability of drought tolerant biotech crops. In Africa, which is plagued by drought and erratic rainfall, the rollout of biotech drought tolerant maize varieties in several countries is expected to transform agricultural production and help the continent progress towards food security. Developments in plant science continue to expand the scope of biotech climate mitigation strategies.

Future biotech traits in the pipeline to address environmental stresses include varieties with improved nitrogen fixation, heat tolerant varieties of rice and wheat, salt tolerance in rice, as well as varieties with improved yield stability.

Feeding the world's growing population

With the world's population expected to exceed 9 billion by 2050, there will be a higher demand for food and increased pressure on the limited resources available. To produce enough food to feed everyone, farmers will need to produce as much as 70% more food.

The use of conventional agricultural methods and tools alone will not help to overcome the food security challenges that we face. The benefits of integrating biotech crops into the food production system over several decades is well documented.

Considering the significant potential of biotech crops' contribution to improving agricultural productivity under challenging conditions, it is inevitable that innovative technologies will need to be part of the solution to sustainably produce sufficient and nutritious food to feed the world's growing population.

Brown Locust Outbreaks Threaten Southern Africa

Farmers Weekly
Annelie Coleman
May 2021

Dr Gerhard Verdoorn, operations and stewardship manager at CropLife South Africa, has warned that the recent huge outbreaks of brown locusts (*Locustana pardalina*) in Southern Africa could cause a humanitarian crisis.

In an interview with Farmer's Weekly, he said that outbreaks "of note" had been reported in Namibia, Botswana, and the Karoo area of South Africa. The outbreak in the Karoo expanded deep into the Kalahari, as far as Van Zylsrus and Askham.

"In the Northern Communal Areas of Namibia, natural grazing has been destroyed by the swarms, and the insects are now attacking crops such as the staple crops of maize and pearl millet, or mahangu, as it's known. The same is happening in the northern parts of Botswana, and large outbreaks are also still being reported all over the Karoo," Verdoorn said.

According to a Reuters report, swarms of the pest had so far destroyed 719 000 ha of grazing land and approximately 1 200 ha of crop fields in 10 of Namibia's 14 regions. This was the third outbreak so far in the 2020/21 season. Reuters stated that Namibia's Karas region along the South African border had been the hardest hit, with 775 000 ha of grazing affected. Grazing land in the fertile Zambezi region had also suffered extensive damage, and the Ngamiland region in Botswana had been particularly hard hit.

The Food and Agriculture Organization of the United Nations (FAO) was among seven international bodies and local farming organisations providing technical help and material to combat the locusts. The FAO previously announced that it was working with the Southern African Development Community and the International Red Locust Control Organisation for Central and Southern Africa to support the governments of countries affected by locusts.

According to Verdoorn, the fact that the Namibian authorities had failed to take the necessary precaution by not ordering sufficient pesticides had exacerbated the situation. "The pesticides needed for large-scale outbreaks are manufactured according to specific formulations and are not readily available in retail shops. That is why it is of such major importance that they should be ordered timeously. It's no use waiting until the actual outbreaks occur," he said.

Verdoorn added that the outbreaks that had so far occurred in South Africa, Namibia, Angola and Botswana formed part of a single complex that developed after the good rainfall in 2020/21. "Populations can reach plague proportions. A few years ago, I witnessed a swarm that was 30 km in length and 17 km wide between Prieska and Vosburg," he said.

Weerstand Teen Onkruiddoders Raak jou Sak op Lang Duur

Elriza Theron
SA Graan
Mei 2021

Die kwessie van weerstand teen onkruiddoders moet heel bo-aan elke gewasprodusent se prioriteitslys wees, want dit raak nie net die omgewing en volhoubare landbou nie, maar ook die produsent se sak op lang termyn. Dit kan met weerstand teen antibiotika in mense vergelyk word. Die probleem is nie ooglopend terwyl die medikasie aanhoudend geneem word nie. Dit lyk inteendeel soos 'n wonderkuur en 'n mens kan nie gesteur wees om die voorskrif te volg nie, want die langtermyneffekte is nie onmiddellik sigbaar nie.

Slegs wanneer die ergste gebeur en die mikrobes teen die medikasie bestand raak, sal die omvang van hierdie fout duidelik word. Dieselfde beginsel geld by onkruiddoders. Hierdie middels is noodsaaklik om die opbrengs en gehalte van gewasse te beskerm deur onkruide wat vir noodsaaklike hulpbronne meeding, te beheer.

Maar om hierdie middels toe te dien en nie die produketiket sowel as weerstandwaarskuwings noukeurig na te kom nie, kan op die lang duur ernstige gevolge inhou. Weerstand vind plaas omdat 'n klein aantal onkruide in 'n populasie natuurlik bestand teen sekere vorme van onkruiddoders is. Die toediening van 'n onkruiddoder sal byna die hele bevolking beheer, behalwe dié wat natuurlik bestand is. Die oorlewendes lei tot die volgende generasie weerstandige onkruide en binnekort is die vermenigvuldigingseffek amper onbeheerbaar. Dit gebeur wanneer dieselfde onkruiddoder met dieselfde meganisme van werking herhaaldelik op dieselfde populasie van onkruide toegedien word.

Gestel 'n produsent het byvoorbeeld nie die riglyne vir weerstandbestuur nagekom nie en skielik is daar 'n misbredie-infestasie in sy land. Dit is egter nou weerstandig teen die einste glifosaat wat hy jaar in en jaar uit toegedien het. Dink aan die impak as hy nie meer produkte wat daardie aktiewe bestanddeel bevat, kan gebruik nie!

Glifosaatgebaseerde produkte is 'n enorme bate in die bevordering van grondgesondheid en waterbewaring deurdat dit die produsent toelaat om geenbewerkingspraktyke toe te pas. Dit beteken dat die grond meestal onversteurd bly, met gewasreste wat agtergelaat word. Gevolglik word erosie uitgeskakel.

Die uitskakeling van gronderosie voorkom nie net die verlies van vrugbare grond nie, maar dit verhoed ook verminderde gewasopbrengs as gevolg van 'n afname in plantwaterreserwes, die agteruitgang van grondstruktuur en die verlies van worteldiepte.

Benewens verminderde opbrengste, het die produsent nou ook 'n toename in produksiekoste, aangesien konvensionele bewerking heel moontlik nou nodig sal wees, wat brandstof- en arbeidskoste verhoog. Daar sal ook waarskynlik 'n toename wees in die hoeveelheid onkruiddoder wat benodig word om die bestande onkruid hok te slaan.

Hierdie is net een voorbeeld, maar in werklikheid is daar meer as 250 onkruidspesies wat wêreldwyd teen 160 verskillende onkruiddoders weerstand ontwikkel het. Daar is 'n hoë risiko om weerstand te ontwikkel indien 'n spuitprogram vir onkruidbeheer staatmaak op produkte wat net een meganisme van werking het, indien onkruid beheer slegs chemies is of as dieselfde meganisme van werking per seisoen herhaaldelik gebruik word. Ander faktore sluit in: geen rotasie in die oesstelsel nie, hoë onkruidbesmetting en swak beheer in vorige jare. Dit is vanselfsprekend dat elke produsent homself daartoe moet verbind om weerstand teen onkruiddoders te voorkom en nie net te reageer wanneer dit wel gebeur nie. Deur die beginsels van geïntegreerde plaagbeheer toe te pas, naamlik 'n kombinasie van chemiese, biologiese, meganiese en kulturele onkruidbeheermetodes en nie slegs een nie, is 'n produsent reeds sterk op pad in die regte rigting.

Die belangrikheid daarvan om die produketiket te lees, kan nie oorbeklemtoon word nie. Dit bevat nie net die riglyne vir die voorkoming en/of bestuur van weerstand nie, maar ook die spesifieke weerstandsbestuursgroep waaraan die onkruiddoder behoort, wat 'n deurslaggewende rol in die beplanning van 'n onkruidbeheerprogram speel.

Daar is 'n magdom hulpbronne en bestepraktykdokumente op die Herbicide Resistance Action Committee (HRAC) se webwerf (www.hracglobal.com) beskikbaar, insluitende 'n globale klassifikasie-instrument. CropLife SA moedig produsente aan om hulleself met hierdie hulpbronne vertroud te maak en om hul deel te doen om weerstand teen onkruiddoders te bekamp.

Bt Maize – How to Prevent Resistance

Ursula Human
AgriOrbit
May 2021

The word 'stewardship' is heard a lot in the agricultural industry. This is because producers are inherently custodians of the soil, water and the greater environment in which they farm.

Stewardship can be defined as the responsibility of taking care of something. Just like producers need to take care of the natural resources on which they rely, they also need to preserve the products of plant biotechnology that contribute to the sustainability of food production.

In this context, stewardship refers to the responsible introduction and long-term use of plant biotechnology products such as insect-resistant (IR) and herbicide-tolerant (HT) crops. All producers, regardless of whether they are large commercial producers or small-scale farmers, need to know how to plant these valuable crops responsibly and sustainably. According to non-profit industry association, CropLife SA, producers can implement a few things that help oversee the responsible use of plant biotechnology in South Africa.

Integrated pest management

One of the most critical aspects of biotech stewardship in crops, is resistance management. Like weeds become resistant to herbicides if active ingredients are not alternated, insects can become resistant to IR genes in biotech crops that usually repel them. Therefore, producers need to implement an integrated pest management (IPM) strategy to prevent this from happening.

IPM is a holistic approach that uses all available pest management techniques and does not rely only on chemical methods. In fact, it is a legal requirement for technology permit holders to monitor resistance management in terms of the Genetically Modified Organisms Act, 1997 (Act 15 of 1997).

This requires technology developers to develop a surveillance plan for detecting resistance development to undertake grower educational programmes, as well as develop a compliance management plan to counteract resistance development.

In South Africa, resistance to biotech maize with the single Mon 810 IR trait has already been reported. However, according to CropLife SA, the management of resistance to insecticidal proteins from the naturally occurring soil bacterium *Bacillus thuringiensis* (Bt), still requires concerted stewardship efforts. This after biotech crops have been present in the country for 20 years. The goal is to prevent Bt resistance in biotech crops from repeating in future.

Resistance management of Bt crops

A vital component of a resistance management programme for Bt crops, is adopting a refuge strategy to prevent insect resistance from developing. Resistance management also applies to maize with stacked IR and HT genes. A refuge is a strategy to reduce the resistance of insects such as the maize stalk borer (*Busseolla fusca*) to Bt maize.

A refuge is an area planted with non-Bt crops that supports the production of Bt susceptible insects. For example, growers using Bt maize are required to plant a refuge area of non-Bt maize.

This works by maintaining a population of susceptible insect pests that are not exposed to the Bt protein.

Consequently, high numbers of susceptible insects are available to breed with resistant insects that emerge in the Bt maize field. This method ensures that susceptibility is passed on to offspring, which helps to prevent the emergence of resistant populations over time. To achieve this, a refuge must be planted within 400 m of Bt-cultivated maize fields. There are two refuge options. For the first option, the refuge can be a minimum of 5% non-Bt maize that is not treated with an insecticide. For the second option, the refuge can be a 20% non-Bt maize field that may be treated with a registered non-Bt-containing insecticide or biopesticide.

More resistance management tips

Apart from the refuge strategy, CropLife SA shared other important considerations in IPM and resistance management strategies for Bt crops:

- Producers need to know about pest biology and ecology.
- They need to understand the efficacy of available insecticidal traits.
- The selection of locally adapted crop varieties also forms part of this strategy.
- Understanding local cropping systems will also improve IPM.
- Scouting and monitoring for target pest damage is an important step in pest management.
- When needed, the application of alternative pest management options is essential.
- Continuous education and training on responsible use is a must.

Co-operation for a sustainable future

Although South African growers have successfully adopted biotech crops such as maize, the benefits of these crops depend on these technologies' stewardship. In 2018, South African producers planted an estimated two million hectares of biotech maize, according to the International Service for the Acquisition of Agri-biotech Applications (ISAAA). Of the two million hectares, 207 000 hectares comprised IR maize, 460 000 hectares HT maize, and 1,3 million hectares stacked IR/HT maize.

It is evident that the maize industry relies heavily on plant biotechnology to remain sustainable.

Dink Mooi oor Voorplant Onkruid- en Insekbeheer

Dr Gerhard Verdoorn
AgriAbout
Mei 2021

Bewaringsbewerking skakel groot probleme en moeite vir graanboere uit. Daar word nie meer grondverdigting, erosie en grondverlies veroorsaak as gevolg van jaar na jaar se dolploeg nie. Dit spaar ook baie direkte finansiële koste vir graanboere want dieselgebruik is minder terwyl slytingskoste op trekkers en implemente ook aansienlik minder is. Vir produsente wat in die droëer areas mielies en ander kontantgewasse produseer, is die bewaring van grondvog 'n kritiese faktor om suksesvol hul gewasse te produseer. Die stofstorms van die Noordwes- en Vrystaatprovinsies is iets van die verlede want die skeurploeë ruk nie die aarde se hart uit nie.

Daar is altyd, soos Sir Isaac Newton gesê het, 'n gelyke maat teenoorgestelde reaksie vir elke aksie en dieselfde universele beginsel geld vir bewaringsbewerking. Iewers neem die natuur sy wraak en kastei die produsent. Een van die grootste uitdagings van bewaringsbewerking lê in die oordrag van plantplae, plantsiektes en onkruide. Met die standaard van skeurploeg en diepbewerking word plantreste saam met patogene, inseklarwes en eiers, onkruide en hul sade, begrawe en vernietig.

Met bewaringsbewerking bly die plantreste op die grond oor na stroop en skep dit 'n veilige hawe vir insekte en swamsiektes, en dit bedek ook onkruidsade wat rustig wag op die gunstige lenteweer om te ontkiem. Bewaringsbewerking is nie die alfa en omega van gewasproduksie nie en verg steeds die produsent se gewigtige aandag om dit sinvol toe te pas. As die uitdagings nie aangespreek word nie, word dit 'n nagmerrie vir kontantgewasprodusente.

Sinvolle meganismes om plaag-, siekte- en onkruidoordrag te voorkom

Verskeie bewaringsbewerkingprodusente met wie daar onlangs onderhoude oor die uitdagings gevoer is, het erken dat die uitdagings, veral met nat seisoene soos wat oor Oktober 2020 tot Maart 2021 ondervind is, op 'n sinvolle wyse ontleed en aangepak moet word. Snywurms was 'n ernstige probleem oor baie dele van Suid-Afrika. Die nat toestande het veroorsaak dat die wurms 'n "KGB" strategie gevolg het en ondergronds gewerk het sonder dat produsente ooit daarvan bewus geraak het. Dit het veroorsaak dat die toegediende piretroïede geen effek op snywurms gehad het nie.

Wat produsente egter wel ook besef het is dat die toediening van die piretroïede saam met glifosaat, om beide die snywurms en onkruid te beheer, nie resultate sou kon gee nie omdat die deklaag van plantreste veral die piretroïede sou adsorbeer en onbeskikbaar maak. Bewaringsbewerking het ook oor die jare heen 'n grondregime geskep waarin daar baie organiese materiaal opgebou het. Dit is 'n baie positiewe eienskap want dit maak die grond 'lewendig' met gunstige mikrobes wat 'n gesonder produksie-omgewing skep, maar dit veroorsaak ook dat ongunstige insekte, soos stronkboorders en draadwurms, makliker kan oorleef, plus die klomp gunstige mikrobes metaboliseer gewasbeskermingsmolekules soos piretroïede baie vinnig; dit is noodwendig baie gunstig vir grondgesondheid maar nie tot voordeel van die produsent as sy hulpmiddels voor mikrobes sneuwel nie.

Boere maak planne en meeste van dié waarmee ons in gesprek was het aangedui dat hulle die landerye vlak gaan bewerk om die plantreste in te werk, onkruide en hulle sade in te werk en insekte en hulle larwes te begrawe. Daarna sal hulle dan die snywurms takel voor die grond te nat raak en die wurms weer ondergronds hul aanvalle loods. Hulle het ook weer saam met CropLife SA die etikette van lambda-sihalotrien-bevattende piretroïede gaan bestudeer en stem saam dat landerye skoon moet wees voordat die middel teen snywurms aangewend word.

Ongelukkig word aanbevelings oor plaag-, siekte- en onkruidbeheer soms verkeerd aangebied. Gewasprodusente moet hulself vergewis van die volle implikasies van etiketvoorskrifte en streng daarvolgens werk, ten einde suksesvol met plaagbeheer te wees.

Nagmuise baljaar in bewaringsbewerkingsareas

Verskeie indiwidue is erg gekant teen die standpunt dat bewaringsbewerking gunstig vir nagmuise is. Alle aanduidings wys egter daarop dat die staking van diepbewerking die nagmuisbevolking 'n hupstoot gegee het. Waar daar glad nie meer geploeg word nie, word geen meganiese skade aan neste en kolonies aangerig nie en word hulle getalle en voorkomsareas net al hoe groter. Dit skep groot kopsere vir kontantgewasprodusente wat desnoods knaagdierdoders aanwend en as dit nie met omsigtigheid gedoen word nie, het dit 'n uitwissende impak op uile en daglewende roofvoëls.

Daar waar nagmuise heeltemal buite beheer geraak het, raak dit noodsaaklik om daardie landerye in die vroeë lente diep te ploeg om kolonies te verwoes, waarna die normale biologiese beheer met uile en uilversoenbare knaagdierdoders weer ingespan kan word. Een keer se ploeg elke vier tot vyf jaar sal nie die bewaringsbewerking tot niet maak nie maar net die produsent die kans gee om nagmuise, skadelike insekte en plantsiektes 'n goeie knou te gee.

Uitdagings vir die 2021-2022 seisoen
Vir mielieprodusente wat die Bt-geen mielies verbou is daar nie vrese oor wurmplae soos stronkboorders en kommandowurms nie, maar alle aanduidings is dat die mielies nie hulself teen die snywurms kan beskerm nie. Wees dus bedag en berei voor om die snywurms meganies en chemies korrek en op die regte tyd uit te wis. Wees ook bedag op enige misbredies van die *Amaranthus* genus, veral in die Noord-Kaap, verre noorde van Limpopo en gedeeltes van KwaZulu-Natal naby die Drakensberge want die Palmer amarant sprei sy vlerke en is uiters moeilik om met meeste onkruiddoders te beheer. Enige misbredie moet as verdag beskou word en met alle mag en mening uitgewis word en onthou dat dit totaal teen glifosaat weerstandig is. Kontak CropLife SA by gerhard@croplife.co.za vir die Palmer amarant gids en uitwissingsprotokol.

Kontantgewasprodusente in die besproeiingsareas van die Noord-Kaap en Oos-Kaap wat aan die Karoo grens en Noordwesprovinsie se westelike gebiede moet ook voorberei op 'n moontlike sprinkaaninval later vanjaar want die hele Karoo en Kalahari was die afgelope somer met bruin sprinkane oortrek, en dit is te verwagte dat die komende somer 'n nagmerrie kan wees.

Easy Calculations

Dr Gerhard Verdoorn
SA Grain
June 2021

All pesticides must be applied at a certain dosage rate that is unique to every product to ensure effective management (control) of the target organism. The registration holder of a pesticide has gone through great pains and financial investment to arrive at the dosage that is printed on the product label. Failing to apply the pesticide at the given dosage in the directions for use, may result in ineffective control, or worse, phytotoxicity to the crop with resultant crop and financial losses for the producer.

Challenges of dosages given on most labels
The South African agriculture arena has seen a significant demographic change in the past decade, with many small farmers, self-sustaining farmers and home garden farmers entering the sector. It is a very exciting development – the enthusiasm of these new entrants is fixating and warrants a nod of approval from government and civil society.

One of the biggest challenges for such farmers is to interpret label instructions, especially the dosage that is printed in the directions for use. For a largescale commercial producer who cultivates large tracks of land with tractors and ground or aerial spray equipment, the dosage rate which is generally stated as quantity of the pesticide per hectare, is no problem.

However, for a farmer with an acre of maize or cabbages, it poses a real challenge if he/she has to convert pesticide quantity per hectare to the amount of pesticide that has to be poured into a knapsack spray holding 16 ℓ.

There is no golden rule or one-size-fits-all rule of thumb; every label must be read and interpreted before the conversion calculation can be made. That is because every pesticide has its own dosage and every label instructs the user on the spray volume per hectare.

Start from scratch
Calculus, or simple mathematics, need not be difficult if one unravels the calculations to its basic elements, after which one systematically puts the elements together again to arrive at the desired results. The elements needed to calculate the quantity of pesticide in any volume of spray equipment, are as follows:

- *The dosage per hectare.* A strong hint here for efficacy, prevention of phytotoxicity and resistance development or sensitivity shift, is to work strictly according to the label's directions for the dosage rate. Dosage may be anything from a few hundred millilitres (or a few hundred grams) per hectare to several litres (or several kilograms) per hectare.
- *The recommended spray volume per hectare.* This differs vastly between different pesticides, between different crops and between different application technologies.

- *The surface area of the crop that needs to be sprayed.* This surface area must be measured as accurately as possible to ensure that the correct dosage is applied to the crop field.
- *The exact volume of the spray tank*, which may range from a few litres (like 16 ℓ for a knapsack) to a few thousand litres for a large tractor drawn boom spray.

Units of measure: a simple metric system

Due to the requirement of some farmers to only treat a small surface area, it is senseless to stick to kilograms or litres. Remember the following unit conversions:

- One kilogram equals 1 000 grams.
- One litre equals 1 000 millilitres.
- One hectare equals 10 000 square meters.

For small volume spray mixtures, such as hand sprays or knapsack sprays, always work on the gram/millilitre and square meter units of measure. It is even advisable for large volume spray mixtures to ensure accurate calculations.

The calculation: a stepwise approach to the correct measurements

1. Calculate the total spray area (TSA) in units of hectares that is to be treated with the pesticide, by pacing it out as accurately as possible or measuring with the aid of GPS coordinates if it is a large field. This should give a good and accurate estimate of the surface in square meters or hectares. For example, an area of 125 m long and 70 m wide will therefore be a TSA of 125 X 70 = 8 750 m² which is 0,875 ha (8 750/10 000 = 0,875).

TSA = length in meters X width in meters = total square meters/10 000 = TSA in hectares

2. Calculate the total spray volume (TSV) required (in units of hectares) to spray the TSA by multiplying the TSA by the label-directed spray volume (LSV) per hectare, for example 0,875 ha X 300 ℓ/ha = 262,5 ℓ.

TSV = TSA X LSV

3. Calculate the total pesticide quantity (TPQ) measured in units of millilitres required for the TSA by multiplying the TSA by the label-directed dosage (LDD) per hectare measured in units of millilitres, for example 0,875 ha X 4 500 ml = 3 938 ml.

TPQ = TSA X LDD

4. Calculate the pesticide volume per spray tank (PVT) by dividing the spray tank volume (STV) in units of litres by the TSV and multiplying that by the TPQ, for example for a knapsack spray that holds a volume of 16 ℓ, the calculation is (16 ℓ ÷ 262,5) X 3,938 = 240 ml.

PTV = (STV ÷ TSV) X TPQ

Practical Examples (Fictitious)

For a large-scale commercial farm: A maize field of 421 ha must be sprayed with a pesticide at a dosage of 4,5 ℓ/ha in a volume of 300 ℓ spray mixtures per hectare. The volume of the tractor boom spray tank is 1 500 ℓ:

1. TSA = 421 ha.
2. TSV = TSA X LSV: Total spray volume is 421 X 300 = 126 300 ℓ total spray volume.
3. TPQ = TSA X LDD: Total pesticide quantity is 421 X 4 500 ml = 1 894 500 ml or 1 895 ℓ (rounded off).
4. PTV = (STV ÷ TSV) X TPQ: Pesticide per spray tank volume is (1 500 ÷ 126 300) X 1 895 = 22,5 ℓ per spray tank.

Take note: In this example, the 1 500 ℓ spray tank's total spray volume must be dispensed over 5 ha (1 500 ℓ ÷ 300 ℓ/ha), which means 84,2 tanks of spray mixture will be sprayed out.

For a small farming operation: A cabbage field of 75 m by 120 m must be sprayed with a pesticide at 260 ml/ha in a spray mixture volume of 150 ℓ/ha by knapsack sprays that hold a volume of 16 ℓ:

1. TSA = 75 X 120 = 9 000 m² or 0,9 ha.
2. TSV = TSA X LSV: Total spray volume is 0,9 X 150 = 135 ℓ total spray volume.
3. TPQ = TSA X LDD: Total pesticide quantity = 0,9 X 260 ml = 234 ml.
4. PTV = (STV ÷ TSV) X TPQ: Pesticide per spray tank volume is (16 ÷ 135) X 234 = 27,73 rounded off to 28 ml per spray tank.

Take note: For this small-scale operation, 8,5 tanks of spray mixture will be sprayed out (135 ℓ total spray volume ÷ 16 ℓ spray tank volume).

Potato Tuber Moth Insecticides, their Modes of Action, and Sensible Use to Prevent or Delay Resistance Development

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CHIPS - May/June

Insecticides are grouped according to an international system developed by the Insecticide Resistance Action Committee (IRAC). The IRAC Mode of Action (MoA) classification groups each active ingredient according to a specific chemical class and resistance group, based on the MoA of the active ingredient.

Insecticides and their IRAC grouping
The IRAC classification guides the use of different modes of action successively to prevent sensitivity shift, and to prevent or delay the development of insecticide resistance (visit www.irac-online.org or download the IRAC app for smart devices).

During the past few seasons, higher than normal potato tuber moth (PTM) populations were reported and the dry and hot seasons most likely contributed to these numbers. Warm winters with high temperatures during the day and little to no frost allow earlier than normal occurrence of PTM. Seasons with high moth 'explosions' are not an unknown phenomenon and occur every few years, especially during droughts and warm periods.

Insect life cycles are temperature dependent and are normally shortened by increased temperatures, resulting in increased numbers of PTM generations in one season. A higher percentage of unmarketable potato tubers (>30%) was harvested during the past three years, compared with the usual expected 5 to 7%.

Insecticides are classified according to five different categories based on physiological functions that are affected by insects:

- *Growth*: Insect development is mainly controlled by juvenile hormones, by directly perturbing cuticle formation/deposition or lipid biosynthesis. Insect growth regulators are generally slow- to moderately slow-acting.
- *Midgut*: Lepidopteran-specific microbes or their derived microbial toxins that are sprayed or expressed in transgenic crop varieties (not applicable to potatoes at this stage). Moderately acting.
- *Respiration*: Several insecticides interfere with mitochondrial respiration by the inhibition of electron transport and/or oxidative phosphorylation. Generally fast- to moderately fast-acting.
- *Nerve and muscle function:* Most current insecticides act on nerve and muscle targets. Insecticides that act on these targets are generally fast-acting.
- *Unclassified functions:* Several insecticides are known to affect less well-described target sites or functions, or to act non-specifically on multiple targets.

By far the largest class of insecticides affects the nerve and muscle system of insects. This collective class consists of pyrethroids, carbamates, organophosphates, avermectins, and spinosyns, among others, each with a different MoA and specific target site.

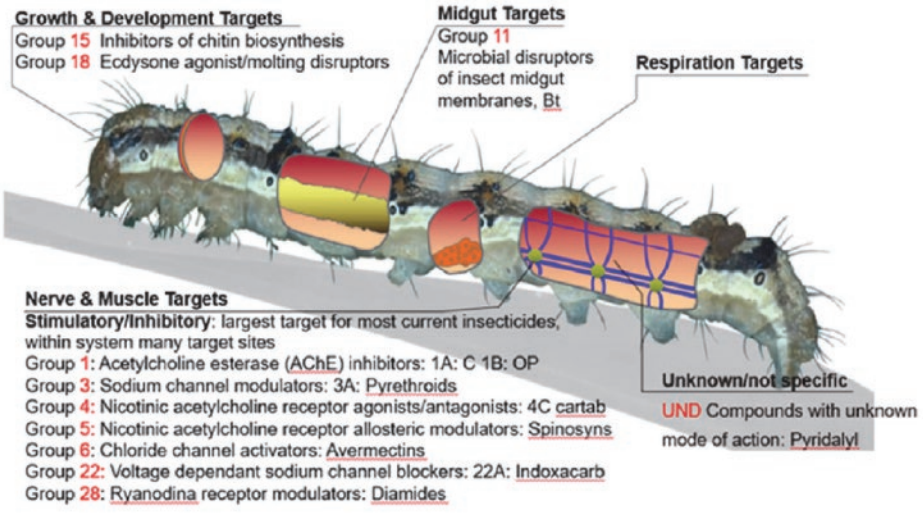

Figure 1: The different target sites for controlling PTM.

Table 1: Active ingredients that are registered for the control of PTM in potatoes.

IRAC group	Chemical class	Active ingredient	MoAs/physiological functions affected
1A	Carbamate	Methomyl	Acetylcholinesterase (AChE) inhibitors
			Nerve action
1B	Organophosphates	Acephate, azinphos-methyl, methamidophos, methidathion and profenofos	AChE inhibitors
			Nerve action
3A	Pyrethroids	Alpha-cypermethrin, beta-cyfluthrin, bifenthrin, deltamethrin, esfenvalerate, gamma-cyhalothrin and lambda-cyhalothrin	Sodium channel modulators
			Nerve action
4A and 3A	Neonicotinoids and pyrethroids	Acetamiprid and bifenthrin	Nicotinic acetylcholine receptor (nAChR) competitive modulators
			Nerve action
4A and 15	Neonicotinoids and benzoylureas	Acetamiprid and novaluron	nAChR competitive modulators, and chitin synthesis inhibitors
			Nerve action and growth regulation
5	Spinosyns	Spinetoram and spinosad	nAChR allosteric modulators – Site 1
			Nerve action
13	Pyrroles	Chlorfenapyr	Uncouplers of oxidative phosphorylation via disruption of the proton gradient
			Energy metabolism
14	Nereistoxin analogue	Cartap hydrochloride	nAChR channel blockers
			Nerve action
15	Benzoylureas	Diflubenzuron, lufenuron and novaluron	Inhibitors of chitin biosynthesis affecting CHS1
			Growth regulation
22A	Oxadiazines	Indoxacarb	Voltage-dependent sodium channel blockers
			Nerve action
28	Diamides	Chlorantraniliprole and cyantraniliprole	Ryanodine receptor modulators
			Nerve and muscle action
28 and 3A	Diamides and 3A	Chlorantraniliprole and lambda-cyhalothrin	Ryanodine receptor and sodium channel modulators
			Nerve and muscle action
UN	Pyridalyl	Pyridalyl dichloropropene derivative	Compounds of unknown or uncertain MoAs
UNF	Fungus	Beauveria bassiana	Compounds of unknown or uncertain MoAs
Pheromone and 3A	Pheromone and pyrethroids	(E,Z)-4,7 & (E,Z,Z)-4,7,10-tridecatrienyl acetate and permethrin	Lure and sodium channel modulators
			Lure and nerve action

Carbamates and organophosphates are both Group 1 but are categorised into Sub-group 1A and Sub-group 1B, respectively. To prevent sensitivity shift and the development of insecticide resistance, chemical classes of different MoAs (resistance groups) should be rotated, and consecutive insect generations should not continuously be exposed to the same MoAs (*Figure 1*). Twelve different IRAC insecticide classes corresponding to their equivalent resistance groups are registered in South Africa for the control of the PTM, *Phthorimaea operculella* (*Table 1*). Study the table and plan accordingly to develop a spray programme that will prevent sensitivity shifts and resistance development.

Performance of active ingredients

Not all the active ingredients in a specific chemical class share the same characteristics. Plant uptake can be by contact, translaminar, or systemic action, while insect uptake can be through stomach or contact action.

The formulation type and quality, such as EC, SC, WP, rain fastness, stability in sunlight, mixability and compatibility with other products, application type and method, all play a crucial role in the efficacy of an active ingredient. Choosing an active ingredient requires taking all these characteristics into account along with the plant size, level of pest infestation and the pest complex present, to select the best option. Take note again that active ingredients within the same IRAC group share the same MoAs. Carbamates and organophosphates, for example, are both in Group 1 and share the same MoAs. A few examples of active ingredients registered against PTM are mentioned below. Always read the entire label to ensure that the products are applied correctly.

Carbamates (Group 1A)

- *Methomyl*: Contact and stomach action. Efficacy greatly reduced after spray residues have dried. Rapidly degrades in soil with a short half-life (DT_{50} 4 to 8 days) at 20°C. Soil moisture and pH are important in the breakdown of methomyl, which is not compatible with alkaline products. Relatively stable in sunlight.

Organophosphates (Group 1B)

- *Acephate*: Contact and stomach action. Moderate persistence. Residual activity of 10 to 21 days. Non-phytotoxic. Readily biodegraded and nonpersistent in soil with a short half-life (DT_{50} 2 days).
- *Azinphos-methyl*: Non-systemic. Contact and stomach action. Rapidly hydrolysed in alkaline and acidic media. Half-life of several weeks under normal conditions (DT_{50} 87 days at pH 4 and 50 days at pH 7; only 4 days at pH 9). Low soil mobility. Photodegradation on soil surface.
- *Profenofos*: Non-systemic. Contact and stomach action. Exhibits translaminar effect and ovicidal properties. Not compatible with sulphur, alkaline products or captan. Do not mix with metal-containing compounds or apply with nitrogen-containing foliar feeds. Short half-life in soil (DT_{50} 1 week).
- *Methamidophos*: Systemic. Contact and stomach action. Rapidly degraded in soil. Short half-life in soil (DT_{50} <2 days). Photolysis contributes to rapid degradation.

Pyrethroids (Group 3A)

- *Bifenthrin*: Non-systemic. Contact and stomach action. Not compatible with alkaline products. Long half-life in soil (DT_{50} 65 days).
- *Lambda-cyhalothrin*: Nonsystemic. Contact and stomach action, with repellent properties and rapid knockdown effect. Stable to light, stable in storage (>6 months), but rapidly degraded in soil, especially under dry conditions (DT_{50} 4 weeks). Strongly adsorbed to soil. Does not leach.

Neonicotinoids (Group 4A)

- *Acetamiprid*: Systemic, with translaminar movement in the plant. Stomach and contact activity. High potential for bioaccumulation. Mobile in soil, but degrades rapidly. Low potential for leaching into groundwater. Half-life between <1 and 8.2 days.

Spinosyns (Group 5)
- *Spinosad*: Non-systemic. Contact and stomach action. Short soil half-life (DT_{50} 9 to 17 days). Low pH value (< 6) of the spray mixture will decrease the residual performance. Performs best at pH 6 to 9.
- *Spinetoram*: Non-systemic. Contact and stomach action. Rapidly degrades in soil (DT_{50} 3 to 5 days).

Pyrroles (Group 13)
- *Chlorfenapyr*: Limited systemic activity. Mainly stomach with some contact action. Proinsecticide (metabolised into an active insecticide after entering the host). Persistent in soil but binds very strongly to soil particles and does not leach.

Nereistoxin analogues (Group 14)
- *Cartap hydrochloride*: Systemic, with stomach and contact action. Stable in acidic conditions but hydrolyses in neutral or alkaline solution. Short soil half-life (DT_{50} 3 days).

Benzoylureas (Group 15)
- *Lufenuron*: Insect growth regulator. Non-systemic. Translaminar effect, with strong stomach and moderate contact activity. Larvicidal, ovicidal and transovarial action. Reduces egg fecundity. Stable at pH 5 to 7 and a very long half-life (DT_{50} 512 days). Strong adsorption onto soil particles. Not compatible with carbamates or alkaline products.

Oxadiazines: (Group 22A)
- *Indoxacarb*: Contact and stomach action. Rapidly terminates insect feeding on crop. Moderately persistent but immobile in soil (DT_{50} 3 to 23 days).

Diamides (Group 28)
- *Cyantraniliprole*: Systemic effect by soil uptake with some translaminar movement. Active through ingestion and contact. Ovicidal, ovi-larvicidal and adulticide activity. Low soil mobility due to high soil adsorption, with moderate photodegradation and a short half-life (DT_{50} 4 to 25 days). Degrades rapidly. Resistance risks seem higher than other MoAs.
- *Chlorantraniliprole*: Stomach and contact action. Weak translaminar activity. Slow soil degradation (DT_{50} 270 days). Low soil mobility due to high soil adsorption, low water solubility and slow photodegradation. Resistance risks seems higher than other MoAs.

Unclassified (UN)
- *Pyridalyl*: Non-systemic. Contact and stomach action. Moderately slow-acting. Highly immobile in soil with a long half-life (DT_{50} 93 to 182 days).

Effective application and practice

Virtually no insecticide can be drenched into the soil to control PTM after senescence (maturation) and ridging. The best practice is to control it while green plant material is still available for chemical uptake and to minimise exposed tubers (*Figure 2*), soil cracks or soil cavities next to stems (*Figure 3*), especially in shallow bearing cultivars. Moths can lay eggs close to cracks and young hatching larvae can then move down the cracks to infest tubers.

Figure 2 (right): Tuber infested with PTM due to being exposed under leaves and not being completely covered.

Figure 3 (left): Soil cracks and cavities.

Make sure cracks are sealed by irrigation after ridging (*Figure 4*). Potato tubers that are slightly exposed are very easy targets for larvae; field observations showed that the tubers that were infested with PTM larvae were the ones very close to the soil surface with some level of exposure. It is therefore strongly advised to minimise exposed tubers to the absolute minimum.

Figure 4 (right): Sealed ridges.

This article is Monograph 1 of the Potato Production Stewardship Programme, a collaborative initiative of Potatoes South Africa, CropLife South Africa and the IRAC. For more information, contact Dr Gerhard H Verdoorn at gerhard@croplife.co.za.

Associate Members

As part of the service we provide to our members, we would like to showcase the main business offering of our Associate members in order to direct any incoming queries we may receive.

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