

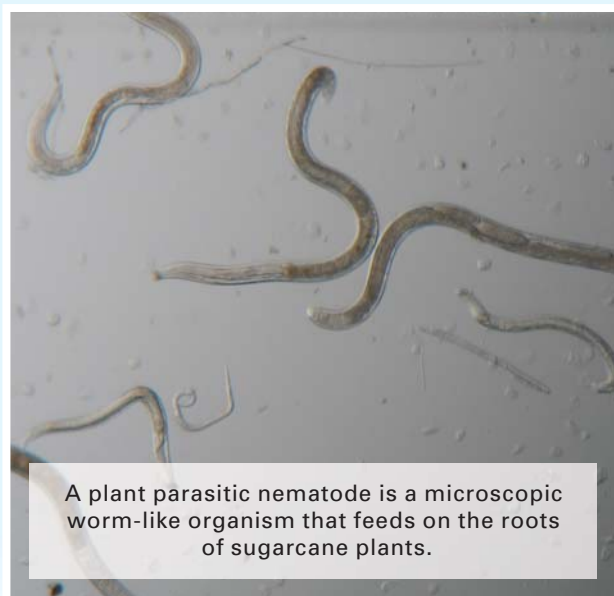
The New Era of Nematicides

Plant parasitic nematodes were not identified as major pests until root knot nematodes were discovered on cucumber by Berkely, a pioneering mycologist and plant pathologist, in 1855 and cyst nematodes on sugarbeet by Schacht (a botanist) in 1859. Since then they have been shown to negatively impact many crops throughout the world. The discovery of nematicides however, in the early 1900s, provided growers with a reliable, effective control method for these pests.

Sugarcane grown on a sandy soil untreated (left) and treated (right) with a new generation nematicide undergoing registration trials.



Biological products being mixed in a back-pack applicator.



A plant parasitic nematode is a microscopic worm-like organism that feeds on the roots of sugarcane plants.

Nematicides have always come under much scrutiny due to their highly toxic nature and the risk they pose to their applicators. As a result, much investment has been made by chemical companies into product stewardship and applicator training. Much effort has also been put into reducing the risk associated with applying these highly toxic chemicals, e.g. Temik® could only be applied by certified personnel. In addition, agrochemicals are also amongst the most heavily regulated products used by man. However, despite rigorous testing, investment into product stewardship, and most importantly their ability to consistently and reliably increase yields, nematicides still have a very negative public image with most growers accepting lower yields, rather than use a nematicide.

As a result of public and environmental pressures, it was determined at the Earth Summit in Rio de Janeiro in 1992, that the use of pesticides should be drastically reduced. Consequently, due to the negative public image and associated reduction in revenue as well as the focus on sustainable agriculture, a revival in the nematicide industry begun with companies focusing on identifying newer, safer chemicals to control nematodes. Two new products containing two new active ingredients with different modes of action were launched at the 6th International Congress of Nematology (ICN) held in Cape Town in May 2014. Prior to this, the last active ingredient registered against nematodes was in 1992, 23 years ago. The new products are safer and far less active ingredient is added to the soil. There is also a much greater focus on integrated pest management meaning that more biological control agents, which will be used in combination with conventional nematicides, are being developed. Products containing more than one active ingredient are also being developed e.g. a product containing an insecticide and nematicide is currently being investigated by the South African Sugarcane Research Institute (SASRI).



Granular nematicide being applied in a field during planting.

EARLY 20TH CENTURY

- Characterised by fumigant nematicides which fall into two broad groups:
 1. Halogenated hydrocarbons such as 1,3 D and methyl bromide that directly affect protein synthesis and respiration
 2. Those that release methyl isothiocyanate such as metam sodium and dazomet. The cyanide, once inside the nematode prevents respiration by preventing the utilization of oxygen
- Methyl bromide has since been removed from the market

LATE 20TH CENTURY

- Characterised by non-fumigant carbamates and organophosphates. The most common carbamates being aldicarb, oxamyl and carbofuran.
- No organophosphates were registered in the sugar industry. These chemicals disrupt nematode hatch and movement by disrupting the nervous system (mostly nematostatic i.e. does not kill the nematode but rather disrupts it for long enough for plant to withstand the damage)
- Aldicarb, more commonly known as Temik® has since been withdrawn from the market.

21ST CENTURY

- Characterised by safer, more efficient chemicals which are focused on minimising environmental impact and reducing costs.
- Increased interest in natural nematicides derived from plant extracts and bacteria such as abamectin.
- Fluensulone is a fluoroalkenyl systemic nematicide that is thought, when applied at the recommended rate, to affect plant parasitic nematodes only and not free living nematodes.
- Fluopyram prevents respiration by inhibiting Complex II of the mitochondrial respiratory chain and is a blue-label product.
- Chemicals are nematicidal i.e. kill nematodes.
- Focus on integrated pest management which includes biological agents e.g. nematode-trapping fungi

THE ABOVE TABLES SHOW: The evolution of nematicides from highly toxic, environmentally hazardous broad spectrum fumigants in the early 20th century to low toxicity, environmentally friendly and more targeted products of the 21st century with a bigger focus on naturally occurring nematicidal compounds and biological agents.

The importance of these developments for the South African sugar industry is that newer, safer nematicides will soon be available for growers to use. These will be encouraged in association with other best practices that are contained within the South African Sugar Industry's Sustainable Sugarcane Farm Management System (SUSFARMS®). In addition, many growers who have not previously used nematicides due to their toxicity, will now have access to these chemicals.

SUSFARMS® is a sustainable sugarcane farm management system. It incorporates economic, social and environmental management principles and is based on the implementation of best management practices (BMPs), be they legal requirements or BMPs derived from scientific studies.

It is a management tool that has been developed specifically for use in the context of sugarcane farming.

SASRI has worked very hard at expediting the registration of these chemicals so that their benefits can be realized by growers as soon as possible. Research towards registration of the combination chemical described earlier has been completed in 2014 and is now entering the registration process. In addition, trials are currently in the field testing two new products launched at the ICN in 2014 and is to be completed by 2016. If all goes well, the sugar industry should have at least three new more environmentally friendly nematicides registered for use by 2018. With responsible use, these chemicals, together with integrated pest management approaches, will go a long way towards improving yields and consequently grower profits for many in the sugar industry.



Prabashnie Ramouthar
Nematologist
South African Sugarcane
Research Institute
South African Sugar Association



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Lifting Solutions

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Tel: +27 11 822 8782
info@safrench.co.za

Tel: +27 12 661 6105
info@elephantlifting.co.za

