Derris sp., a climbing plant from Asia, and Lecythis sp., both members of the legume family. These plants contain the compound rotenone and were once widely used as organic insecticides. However, the compound is acutely toxic to fish and many experts in ecological and organic growing no longer consider it ecologically sound," says Fourie.

He points out that natural products will not necessarily be cheaper, although long term they could be cheaper to develop, since synthetics are developed from scratch.

Fourie believes that one of the benefits of organic insecticides is that there is a huge natural, mostly undiscovered, source of molecules that has evolved in response to insect attack. "There are many insect-plant interactions, and considering the ongoing 'arms-race' between these organisms, the evolution of physiological defence mechanisms in plants is inevitable. Among these are secondary metabolic products (SMPs) that can be poisonous to insects. These include compounds such as rotenone, nicotine and the pyrethrins," he says. Another plus is that natural pesticides are highly biodegradable and thus considered environmentally friendly. Rapid degradation reduces the risk of residues on food.

leaves beneficial insects unharmed," says Fourie.

"The truth is that as a result of escalating insect resistance, there is a market for new products whether they are natural or not. Resistance problems in rapidly multiplying pest populations such as aphid or whitely,

"TRYING TO SAVE ON COSTS BY LOWERING THE DOSE LEADS TO RESISTANCE.

"Exporters of agricultural produce already know how the EU is leading the market in health regulations for safe food and how important this aspect has become in big supermarkets abroad," he says.

TARGET SPECIFIC

"Synthetic products will continue to play a major role as they often have advantages and are very effective, even if they are not easy to develop. For example, several target specific or 'soft' synthetic products have become available. These include systemic compounds that only kill insects when they physically eat living plant material, which is probably the main driving force in the pesticide industry. "Farmers should take care to rotate pesticides and to apply them according to the recommendations. Trying to save on costs by lowering the dose could mean that a larger proportion of the insect population will survive. This leads to more resistance in the next generation. Using pesticides with a different active compound or mode of action in rotation is a very effective strategy in delaying resistance problems," he advises.

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Nematode resistance in soya beans

Soya beans are the world's most important plant source for protein meal, food oils and biofuels with a farm value of US$35 billion (R300 billion) in the US. Production efficiency is threatened by soya bean cyst nematode (SCN) attacks that cause US$1 billion in annual losses. Existing resistant varieties use a gene complex from one original variety. New genetic studies on this complex have revealed its unique mode of action which opens pathways in breeding for more effective resistance.

The SCN, Heterodera glycines, invades susceptible and resistant plant roots and re-programmes the root cells to establish feeding sites by means of 'effector' secretions. About 90% of resistant varieties make use of the Rhg1 gene complex but the exact biochemical, quantitative nature of resistance has not been clear. It has now been established that the Rhg1 segment comprises closely linked genes of which 11 have been identified. Using a novel technique that separately silences each of three known resistance Rhg1-b genes, it was shown that resistance is reduced but that there was no major impact from a single gene. The Rhg1-b DNA segment contains 10 times more duplicate copies of the resistance genes in clusters, than other segments.

This research can lead to an application where gene modification can boost expression and isolated resistance genes could be transferred to other nematode susceptible species. Source: Science, November 2012

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Selecting plants for insecticides

When selecting a plant for testing, several factors should be considered. Scientists have identified more than 500 plant species with possible insecticidal properties. However, not all of them are useful as botanical insecticides. Ideally, when selecting a plant, the following attributes are important:

- The plant should be a perennial.
- It should have a wide distribution and be present in large numbers in nature so that it can be cultivated.
- Plant parts like leaves, flowers or fruit to be used should be removable.
- Harvesting should not destroy the plant (Avoid the use of roots or bark).
- Plants should require a small amount of space and be reduced management and little water and fertilisation.
- Plants should have additional uses (for example, medicinal use).
- The plant should not otherwise have a high economic value.

The active ingredient should be effective at low rates.