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OOS-VRYSTAATSE STANDPROEF ONDER AANVULLENDE BESPROEIING IN REITZ

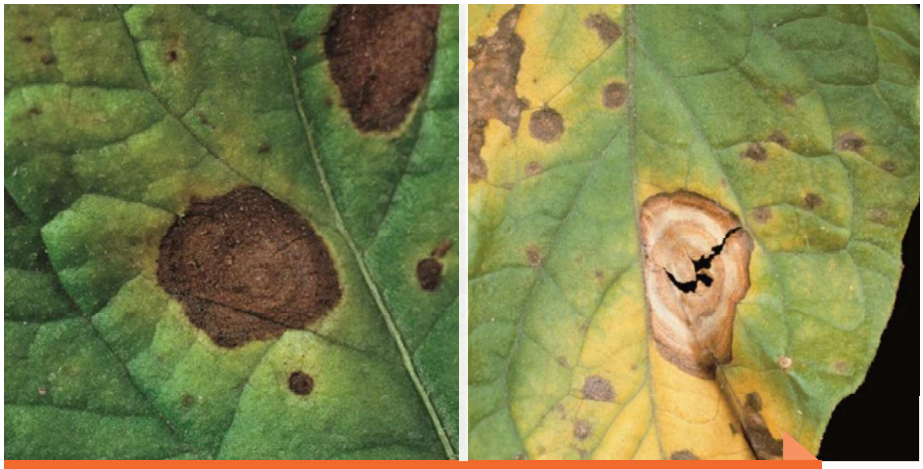
THE POTATO LEAF MINER: ORIGIN OF THE FIRST FLY INFESTATIONS OF THE SEASON

Tegnologiese ontwikkeling: Gebruik van QR-kodes | Effect of fungicide application on potato cultivars at Cedara | Engagement with New Era farmers in Limpopo

Minimise the risk of resistance of *Alternaria* blights to fungicides in a potato programme

By the CropLife Fungicide Resistance Action Committee (FRAC)

The use of fungicides is an essential agronomic practice in ensuring healthy crops, protecting yields and improving quality. Potatoes require a very intensive disease spray programme targeting diseases such as early blight caused by *Alternaria solani*, and late blight caused by *Phytophthora infestans*. Fortunately, several different types of fungicides are registered against these diseases. For the control of early blight, the commonly used groups of fungicides listed in *Table 1*, are available as approved by the *Fertilizers, Farm Feeds, Seeds and Remedies Act, 1947 (Act 36 of 1947)*. For a complete list of registered products, refer to *www.agri-intel.com*.



Potatoes require a very intensive disease spray programme targeting diseases such as early blight caused by Alternaria solani. (Photographs: Bayer)

Pathogens adapt to survive

Like most other organisms, pathogens need to adapt to survive and can mutate to outlast certain fungicides. In other words, they become less sensitive or resistant to these fungicides. The ability of resistance development differs from one pathogen to another, and the following factors tend to increase the risk for a shift in sensitivity towards specific fungicides:

- **Life cycle of the pathogen:** Pathogens with short life cycles have more frequent exposure to the fungicide and may have a faster shift in sensitivity.
- **Abundance of sporulation:** The more spores are produced, the greater the chance of mutation and selection.
- **Ability of spores to disseminate:** Wind-blown spores are easily spread.
- **Ability to infect at all crop stages:** This necessitates repeated fungicide treatments.

Taking the above into consideration, it is easy to understand why *Alternaria* species are considered medium to

Table 1: Commonly used groups of fungicides for control of early blight.

FRAC group	Common group name	FRAC group	Examples of active ingredients registered for use on potato
Quinone outside inhibitors (QoI)	Strobilurin	11	• Azoxystrobin • Famoxadone • Fenamidone • Fluoxastrobin • Flufenoxystrobin • Kresoxim-methyl • Pyraoxystrobin • Picoxystrobin • Pyraclostrobin • Trifloxystrobin
Succinate dehydrogenase inhibitors (SDHI)	SDHI	7	• Boscalid • Fluopyram • Pydiflumetofen
DeMethylation Inhibitors (DMI)	Triazole	3	• Difenoconazole • Flutriafol • Tebuconazole • Triticonazole

Table 2: Example of how FRAC categorises fungal pathogens on potatoes according to their probability of developing resistance.

Pathogen risk score		
Low (1)	**Medium (2)**	**High (3)**
Rhizoctonia solani (black scurf and stem canker)	*Alternaria solani* (early blight)	*Alternaria alternata* (brown spot)
Fusarium spp. (*Fusarium* dry rot and wilt)	*Phytophthora infestans* (late blight)	*Botrytis cinerea* (grey mould)
Sclerotinia sclerotorium (white mould)		

Table 3: FRAC's fungicide risk score (low, medium and high) of specific fungicide groups based on the risk of developing resistance or sensitivity.

Fungicide risk score		
Low (0.5)	**Medium (2)**	**High (3)**
Multi-site fungicides such as dithiocarbamate (Mancozeb and Propineb) (FRAC Group M)	Azoles (FRAC Group 3)	Phenylamide (FRAC Group 4)
	Cymoxanil (FRAC Group 27)	SDHI fungicides (FRAC Group 7)
	Fenhexamid (FRAC Group 17)	QOI (Strobilurin) (FRAC Group 11) *

high-risk pathogens for a change in sensitivity against fungicides. *Table 2* provides some examples in this regard. The complete table is available on the FRAC website, *https://www.frac.info*.

To assist producers in making educated decisions, FRAC has classified fungicides based on the risk of loss of sensitivity or resistance to a group of fungicides by pathogens (*Table 3* and *4*). FRAC provides guidelines to mitigate this, which is updated annually on the FRAC webpage.

To avoid a shift in fungicide sensitivity, avoid the following practices:

- Continuous treatments with a fungicide with the same mode of action in a programme.
- Not following the recommended rate on the label.
- Timing of fungicide applications is important, so avoid treating too late when the pathogen population is high.

Guidelines to manage resistance

Fungicides are grouped according to their mode of action. Based on the mode of action, the FRAC committee has developed guidelines for each group (FRAC group) to manage resistance build-up within diseases. In the case of potatoes, the QoI and SDHI groups have the highest potential for developing resistance.

To avoid resistance build-up, the following practices should be introduced when compiling a spray programme:

- Do not exceed a third of the total number of applications with a product from a specific FRAC group. For example, if you apply twelve fungicide applications, only four may belong to the same FRAC group.
- Do not apply more than four products from the QoI or SDHI containing products per season.
- When mixtures (co-formulations or tank mixes) are used, do not apply more than half of the programme with the same mixture. A maximum of six fungicide mixtures may be applied – whichever is the lesser.
- Where resistance has been confirmed, these fungicides must be applied only in mixture with partners with a different mode of action contributing to the effective control of the target pathogens.
- When QoI or SDHI fungicides are used in a solo programme, a strict alternation with fungicides from a different FRAC groups are recommended.

Examples of mixtures (FRAC group codes):

- Azoystrobin (11) + Chlorothalonil (3)
- Azoystrobin (11) + Tebuconazole (3)
- Boscalid (7) + Pyraclostobin (11)
- Pyrimethanil (9) + Trifloxystrobin (11)
- Tebuconazole (3)+ Trifloxystrobin (11)

It can happen that fungicides for other indications may also belong to a risk group. For example, the nematicide Fluopyram, belongs to FRAC Group 7 (SDHI), and the late blight products Fenamidone and Famoxadone belong to FRAC Group 11 (QoI).

Table 4: An illustration of the combined risk factors when pathogens with different risk scores are treated with fungicides with different risk scores.

Fungicide classes	Fungicide risk score	Risk factor*		
		Low (1)	**Medium (2)**	**High (3)**
Phenylamide SDHI fungicides QoI (strobulurin)	High (3)	3	6	9
Azoles carboxanilides, Cymoxanil, Fenhexamid	Medium (2)	2	4	6
Multi-site fungicides such as ditiocarbamates (Mancozeb and Propineb)	Low (0.5)	0.5	1	1.5
Pathogen risk score		1	2	3
Examples of pathogens		*Rhizoctonia solani. Fusarium* spp. *Sclerotinia sclerotorium*	*Alternaria solani Phytophthora infestans*	*Alternaria alternata Botrytis cinerea*

**A low score reflects a low risk for developing resistance, while a high score reflects a high risk factor for developing resistance. Refer to www.frac.info for the full table.*

See exactly how resistance can develop by visiting *www.frac.info/knowledge-database/videos*. For more information, contact CropLife SA at 087 980 5163.