Revysol®

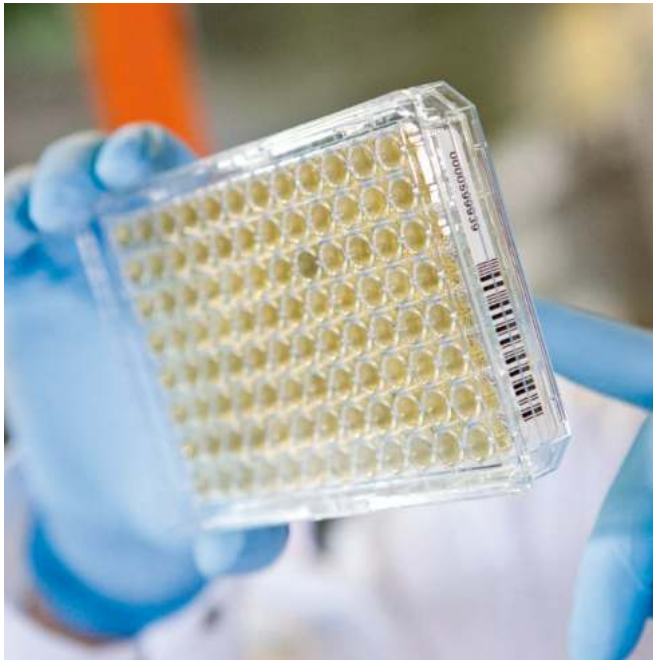
Designed to Outperform

Technical Information

BASF
We create chemistry

Revysol®
Designed to Outperform

Content

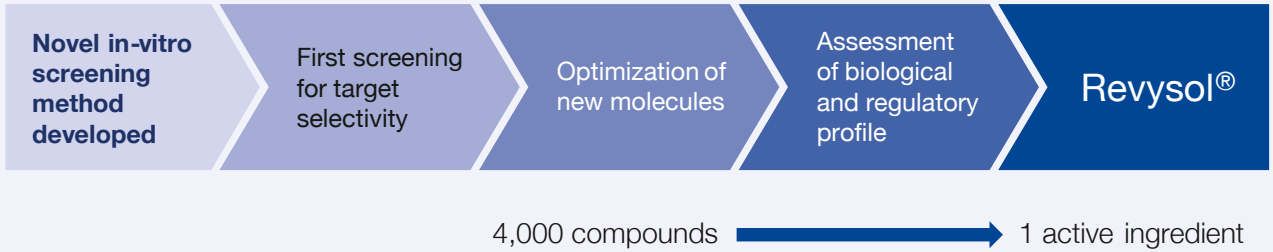


Innovation for farmers

Revysol® is an innovative fungicidal active ingredient for crop protection. It was discovered and developed by BASF to provide outstanding curative and long-lasting preventative control of a broad range of diseases in numerous and key crops worldwide. Revysol® is a unique fungicide amongst the triazole group. Unlike the older triazoles on the market, Revysol® is the first Isopropanol-Azole, a unique chemistry for outstanding efficacy and favorable regulatory profile. Revysol® is highly effective against key fungal diseases in both row and specialty crops including cereals, corn, soybean, rice, grapevines, fruits, vegetables and turf.

New discovery approach

Already at the discovery phase the new fungicide was designed to meet both the highest level of regulatory standards and outstanding biological performance. BASF established a novel in-vitro screening system to steer the product profile. Taking into account the new regulatory requirements already during the selection process Revysol® was optimized according to efficacy and selectivity as far as crops, diseases and regulatory aspects are concerned.



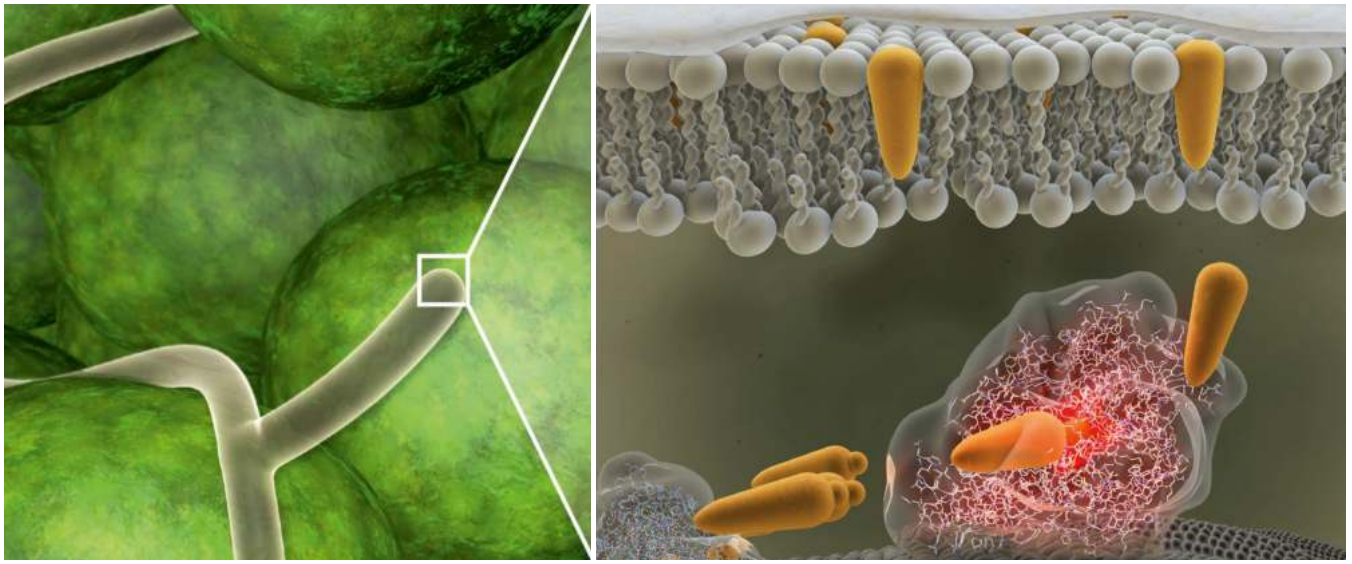
BASF's novel screening method allowed testing of thousands of new triazole molecules. Only those matching global registration criteria and proving to be biologically active were investigated further.

Resistance management

Triazole fungicides are the backbone of disease control strategies and they are essential for resistance management. Each triazole acts in a slightly different way in inhibiting the sterol synthesis and their activity spectrum varies significantly.

Farmers need a diversity of product solutions for mixing or alternating modes of action. Due to its outstanding performance and unique chemical properties, Revysol® will play a crucial role in future resistance management.

With Revysol®, BASF offers growers a highly effective tool to help them better protect their crops, manage resistances and increase their yield in a sustainable way.

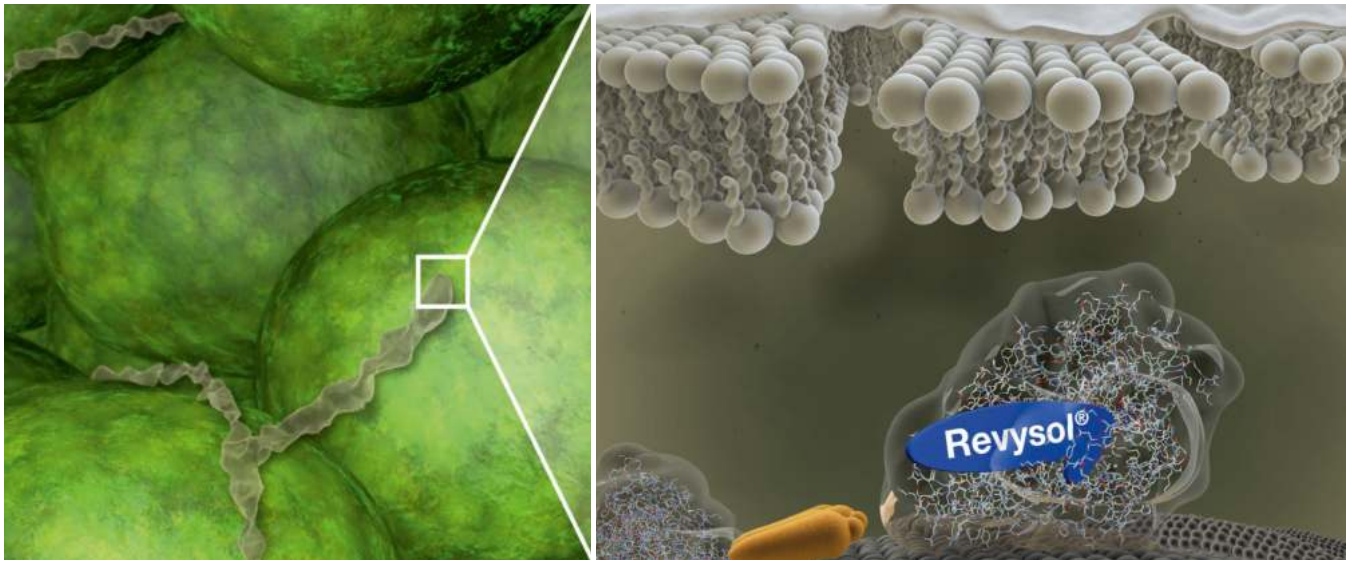


Pathogen spores infect the plant. Within the cell membrane of fungi, C14-demethylase plays a role in ergosterol production, needed for membrane structure and function.

Mode of action

Revysol® is a fungicide belonging to the group of the sterol biosynthesis inhibitors (SBI). Within the SBIs, it belongs to the sub group of demethylation inhibitors (DMI) and the chemical group of triazoles.

Revysol® inhibits one specific enzyme, C14-demethylase, which plays a role in the ergosterol production inside the fungal cell. Ergosterol, like other sterols, is needed for an intact cell membrane. Revysol® blocks ergosterol biosynthesis extremely effectively resulting in cell membrane disruption and as a consequence the fungus dies.



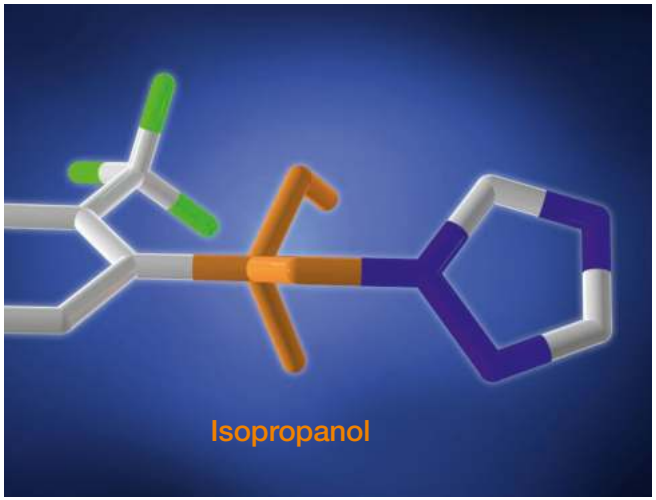
Revysol® inhibits C14-demethylase, ergosterol production is stopped, resulting in cell membrane disruption and as a consequence the fungus dies.

The first Isopropanol-Azole

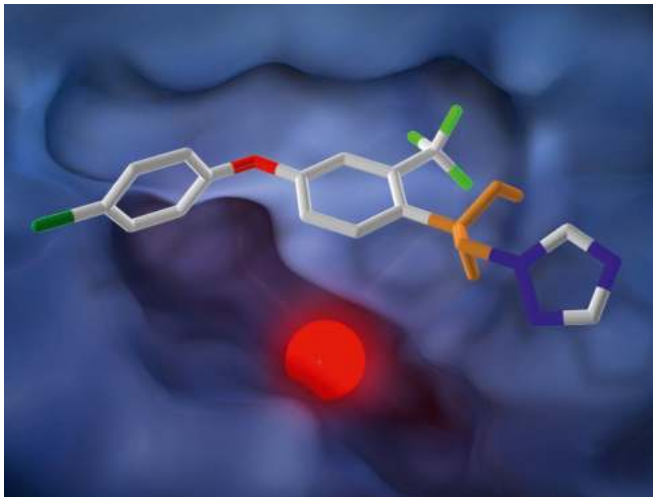
In the Revysol® molecule, the triazole “head” sits on the “neck” of a flexible isopropanol unit. This unique chemical constellation allows the molecule to assume different conformations easily – bound … and … unbound.

When Revysol® docks on to the active site of C14-demethylase, it switches to the bound form, which resembles a “hook”.

Due to its flexible "hook", Revysol® binds to the target enzyme up to 100 times more powerfully than conventional triazole fungicides, also where target site mutations have developed.



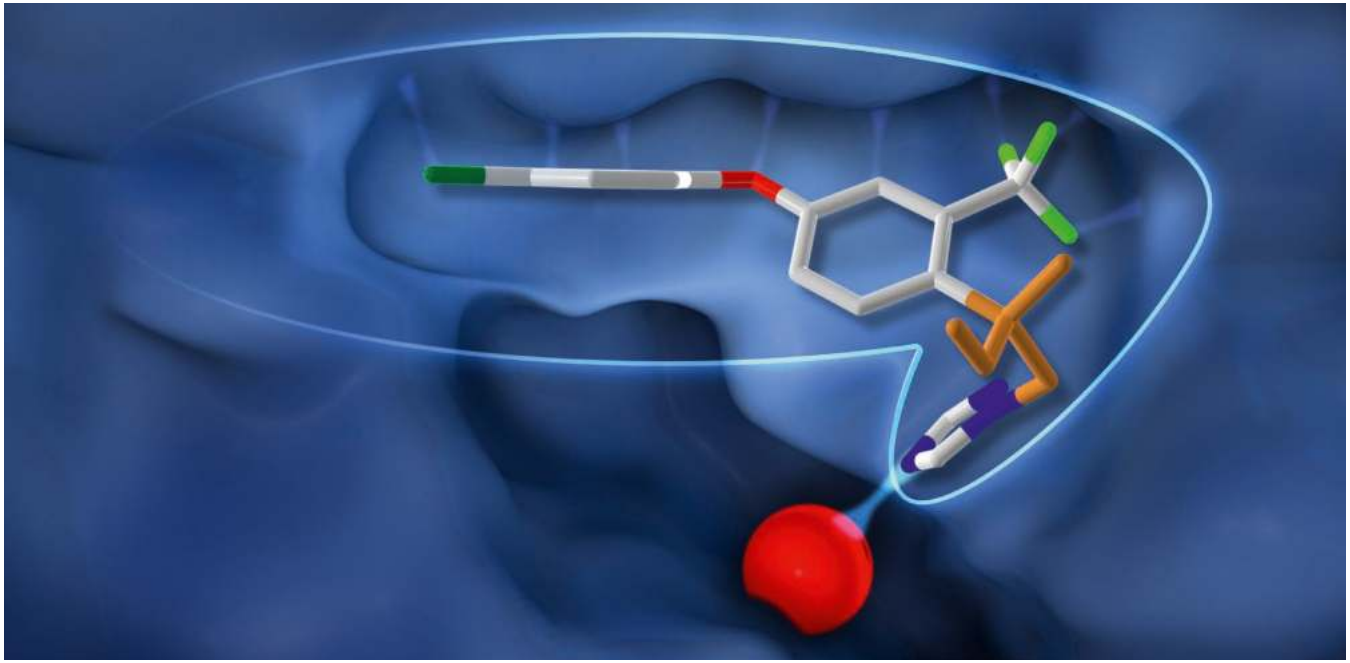
The triazole "head" sits on the "neck" of a slim isopropanol unit



Revysol® "unbound" conformation

Redistribution in the plant

After application, Revysol® is rapidly taken up by the leaf. This explains the outstanding rainfastness of Revysol® and its powerful and immediate curative effect against numerous economically important fungal diseases. The highly active Revysol® is redistributed through the plant’s water transport system and the active ingredient permeates the leaf, up to the leaf tip, also protecting those parts that were not reached during application.



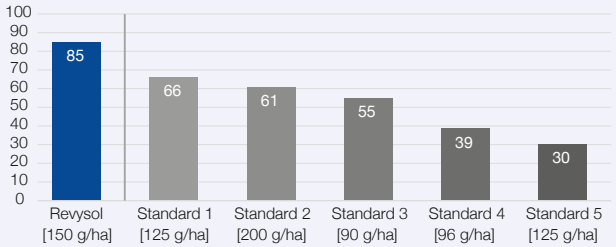
Revysol® folds to the "hook" conformation binding up to 100 times more powerfully than conventional triazole fungicides.

Benefits for farmers

Superior field performance outperforming the benchmark level of disease control

Revysol® provides outstanding curative and long-lasting preventative control of a broad disease spectrum in numerous and key crops worldwide. The intrinsic activity is exceeding existing benchmarks and farmers can maximize yield and quality.

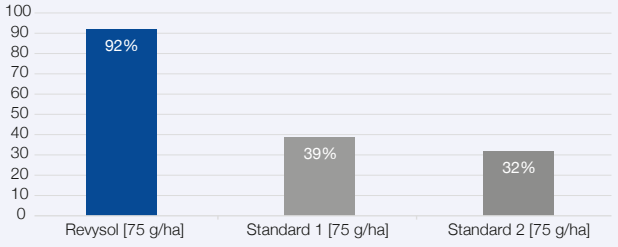
Revysol® – efficacy in wheat



BASF field trials Europe 2014-2016; n=33
1-2 applications at BBCH 32-65; assessment 20-55 days after application;
disease level in untreated: 59% (average severity of attack)

Outstanding performance of Revysol® against *Septoria* leaf blotch in wheat

Revysol® – efficacy in corn



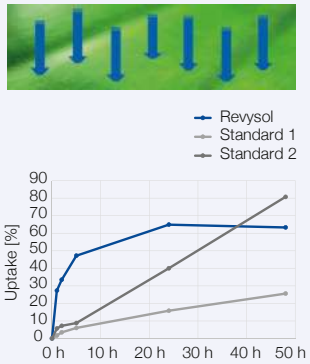
BASF field trials USA 2013; n=4
1 application at tassel; untreated severity 36.6%
assessment 22-58 days after application

Outstanding performance of Revysol® against gray leaf spot in corn

Fast and long-lasting activity for consistent results under various conditions

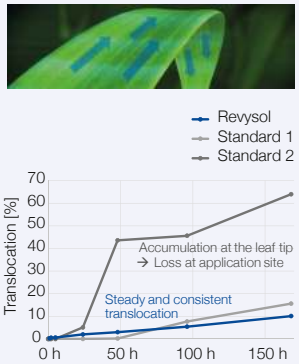
The unique properties of Revysol® not only provide a rapid uptake in plants but also deliver a powerful and immediate effect against the fungi. A further unique characteristic of Revysol® is that it forms reservoirs in the interior leaf. Slow release from these reservoirs leads to long-lasting protection of the whole leaf.

Revysol® – very fast uptake



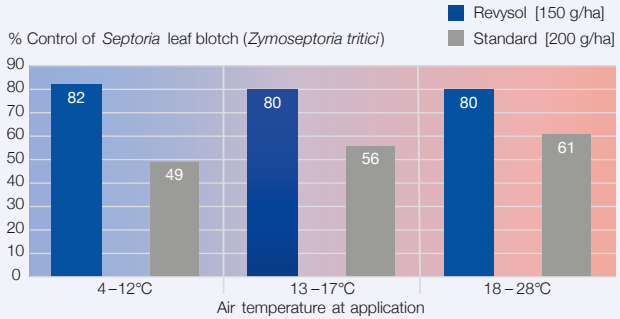
Leads to immediate and strong curative activity

Revysol® – steady translocation



Leads to long-lasting, whole leaf protection

Revysol® – performance under different temperature conditions



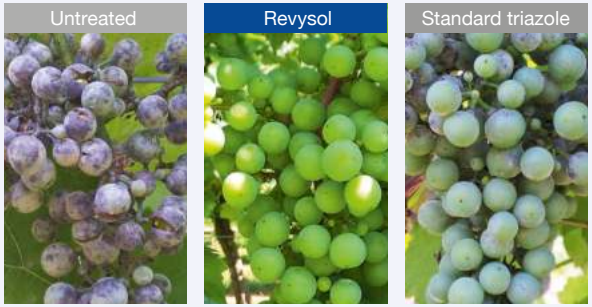
BASF field trials Europe, 2013-2016; n=294
efficacy assessment 21-61 days after last treatment;
average attack in untreated: 57%

Superior activity regardless of temperature at application

Maximized yield and quality in a broad range of crops

The unique molecular structure of Revysol® ensures excellent crop safety. Revysol® can be applied in many different usages and therefore fits best for a broad range of crops.

Revysol® – efficacy against grape powdery mildew



BASF field trials Germany 2016
Revysol dose rate: 75g/10,000m² LWA (equivalent to 45-120g/ha)
Spray interval: 13 to 14 days

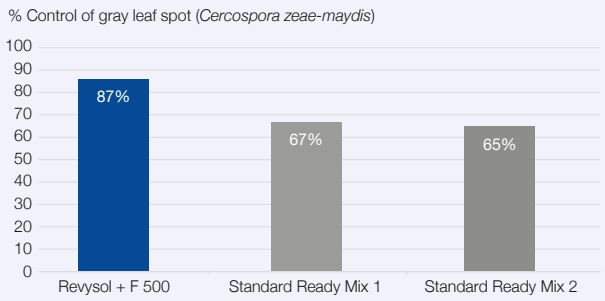
Revysol® – efficacy against cercospora in soybeans

BASF trials Brazil, 2015/2016

New foundation for highly effective fungicide solutions

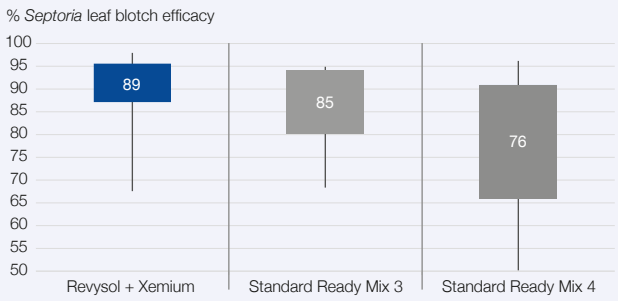
Revysol® will be available in customized formulations to provide farmers worldwide with high performing fungicide solutions.

Revysol® + F 500® set a new level of disease control in corn



BASF trials USA, 2015, 1-2 applications (TN and IL had 2 apps);
all treatments applied with Masterlock adjuvant at 0.5% v/v; n=6 (2NC, 2TN, IL, MO);
products tested at registered dose rates; 28.2% disease severity in untreated

Revysol® partners perfectly with Xemium® in cereals



BASF trials Europe, 2015, n=16;
1-2 applications at BBCH 32-49, at registered dose rates;
27-58 DALT; 55% infestation in untreated

Excellent efficacy in a broad range of crops

Row crops*

Wheat	Septoria leaf blotch	*Zymoseptoria tritici*	●●●●
	Brown rust	*Puccinia triticina*	●●●●
	Yellow rust	*Puccinia striiformis*	●●●
	Powdery mildew	*Erysiphe graminis*	●●●
Barley	Scald	*Rhynchosporium secalis*	●●●
	Brown rust	*Puccinia hordei*	●●●●
	Ramularia leaf spot	*Ramularia collo-cygni*	●●●●
Soybean	Frogeye leaf spot	*Cercospora sojina*	●●●●
	Brown spot	*Septoria glycines*	●●●●
	Cercospora blight	*Cercospora kukuchii*	●●●●
	Rhizoctonia aerial blight	*Rhizoctonia solani*	●●●●
	Soybean rust	*Phakopsora pachyrhizi*	●●/●
Corn	Gray leaf spot	*Cercospora zeae-maydis*	●●●●
	Northern corn leaf blight	*Exserohilum turcicum*	●●●●
	Southern corn leaf blight	*Bipolaris maydis*	●●●●
	Southern rust	*Puccinia polysora*	●●●
Sugar beet	Leaf spot	*Cercospora beticola*	●●●●
	Rhizoctonia root rot	*Rhizoctonia solani*	●●●
Canola / Oil Rapeseed	Black leg	*Leptosphaeria maculans*	●●●●
Pulses (chick peas, lentil)	Leaf blight	*Mycosphaerella pinodes*	●●●
	Ascochyta blight	*Ascochyta pisi*	●●●●
Peanut	Late leaf spot	*Mycosphaerella berkeleyii*	●●●●
	Early leaf spot	*Mycosphaerella arachidis*	●●●●
	Rhizoctonia limb rot	*Rhizoctonia solani*	●●●
	Southern stem rot	*Sclerotium rolfsii*	●●●
Rice	Sheath blight	*Corticium sasakii*	●●●●
	Brown spot	*Cochliobolus miyabeanus*	●●●●

Specialty crops*

Grape	Powdery mildew	*Uncinula necator*	●●●●
	Black rot	*Guignardia bidwellii*	●●●●
Apple	Scab	*Venturia inaequalis*	●●●●
	Alternaria	*Alternaria mali*	●●●●
	Marssonina	*Diplocarpon mali*	●●●
	Powdery mildew	*Podosphaera leucotricha*	●●●
	Fly speck	*Schizothyrium pomi*	●●●●
	Sooty blotch	*Gloeodes pomigena*	●●●●
	Bitter rot	*Colletotrichum spp.*	●●●
	White rot	*Botryosphaeria dothidea*	●●●
Pear	Scab	*Venturia pirina*	●●●●
		Venturia nashicola	●●●●
Stone fruits (peach, nectarine, apricot, cherry)	Blossom blight	*Monilinia laxa*	●●●
	Brown rot	*Monilinia fructicola* *Monilinia fructigena*	●●●
	Cherry leaf spot	*Blumeriella jaapii*	●●●
Tree nuts (almond, pistachio)	Blossom blight	*Monilinia laxa*	●●●
	Alternaria leaf spot	*Alternaria alternata*	●●●
	Scab	*Cladosporium spp*	●●●●
	Rust	*Tranzschelia discolor*	●●●●
	Shot hole	*Wilsonomyces carpophilus*	●●●
Banana	Black sigatoka	*Mycosphaerella fijiensis*	●●●
Carrot	Leaf blight	*Alternaria dauci*	●●●●
	Powdery mildew	*Erysiphe polygoni*	●●●
Potato	Early blight	*Alternaria spp.*	●●●

Tomato	Early blight	*Alternaria spp.*	●●●●
	Septoria leaf spot	*Septoria lycopersici*	●●●
Chilli	Powdery mildew	*Leveillula taurica*	●●●●
Cucumber, Zucchini, Pumpkin, Melon	Powdery mildew	*Sphaerotheca fuliginea*	●●●●
Cucumber	Target spot	*Corynespora cassiicola*	●●●
Melon	Anthracnose	*Colletotrichum lagenarium*	●●●
Onion	Anthracnose	*Colletotrichum sp.*	●●●
	Alternaria	*Alternaria porri*	●●●
Tea	Anthracnose	*Colletotrichum sp.*	●●●
Roses	Powdery mildew	*Sphaerotheca pannosa*	●●●●

Seed treatment***

Wheat	Dwarf Bunt	*Tilletia controversa*	●●●●
	Common Bunt	*Tilletia tritici*	●●●●
	Common Root Rot	*Bipolaris sorokiniana*	●●●●
	Rhizoctonia stunt	*Rhizoctonia solani*	●●●
	Foot Rot, Seedling Blight	*Fusarium spp.*	●●●
	Take-all	*Gaeumannomyces graminis*	●●●
	Fusarium crown rot	*F. pseudograminearum*	●●●
Barley	Common Root Rot	*Bipolaris sorokiniana*	●●●●
	Rhizoctonia stunt	*Rhizoctonia solani*	●●●
	Foot Rot, Seedling Blight	*Fusarium spp.*	●●●
Soybean	Rhizoctonia	*Rhizoctonia solani*	●●●
	Fusarium	*Fusarium spp.*	●●●
Corn	Rhizoctonia	*Rhizoctonia solani*	●●●
	Fusarium	*Fusarium spp.*	●●●

●●● Good ●●●● Excellent

Turf**

Turf	Dollar spot	*Sclerotinia homoeocarpa*	●●●●
	Anthracnose	*Colletotrichum graminicola*	●●●●
	Summer patch	*Magnaporthe poae*	●●●●
	Take all patch	*Gaeumannomyces graminis*	●●●●
	Brown ring patch	*Rhizoctonia circinata*	●●●●
	SDS (spring dead spot)	*Ophiosphaerella spp.*	●●●●
	Brown patch	*Rhizoctonia sp.*	●●●

* The performance of Revysol® depends on its usage rate and formulation type (mainly 75-150 g/ha tested)

** The performance of Revysol® depends on its usage rate and formulation type (mainly 250-1000 g/ha tested)

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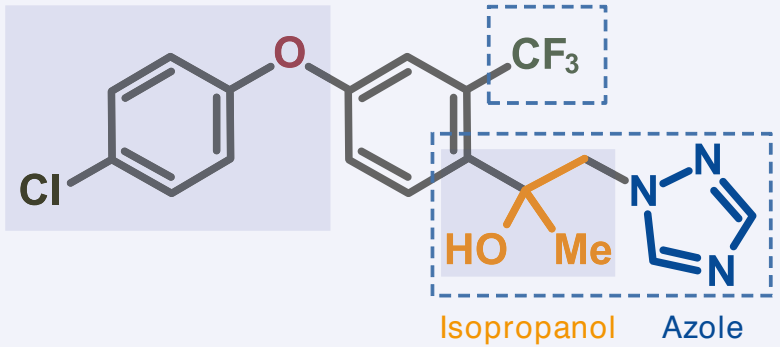
Molecular properties

Trade name	Revysol®
Common name	Mefentrifluconazole
Molecular weight	397.78 g/mol
Formula	$C_{18}H_{15}ClF_3N_3O_2$
Water solubility	0.81 mg/l (20 °C)
Log P_{ow}	3.4
Odor	Odorless
Melting point	126 °C
Density	1.468 g/cm³
Vapor pressure	3.2 x 10^{-3} mPa (20 °C)



The unique chemistry of Revysol® is combining superior activity with excellent selectivity.

Selectivity driver

- Broad crop safety (field and specialty crops)
- Maximized target inhibition (fungal enzyme)

Activity driver

- High intrinsic activity
- Broad disease spectrum

Regulatory profile

Revysol® is a highly efficient, broad spectrum azole with a favourable regulatory profile. It is characterized by high selectivity for the fungal target. The toxicological assessment confirmed that it is nontoxic after single ingestion, skin contact or inhalation. Besides Revysol® is not mutagenic; carcinogenic or teratogenic and it does not impair fertility. According to the environmental assessment, Revysol® is proven to be safe for the environment when used following label directions. Bioaccumulation and leaching is not expected and it has moderate to low toxicity for non-target species.

Toxicological assessment*:

- Non-toxic after single ingestion, skin contact or inhalation
- Not irritating to skin and eyes
- Not mutagenic
- Not carcinogenic
- Not teratogenic
- Does not impair fertility
- Sensitization after skin contact possible

Environmental assessment*:

- Safe to the environment when used according to the label
- Bioaccumulation not expected
- Leaching not expected
- Safe to groundwater
- Moderate to low toxicity for non-target species (birds, mammals, soil organisms, non-target arthropods, non-target plants, bees), but very toxic to aquatic organisms
- Not readily biodegradable

*BASF assessment: Studies were conducted and evaluated according to OECD standards.

A highly efficient, broad spectrum azole with a favorable regulatory profile

External views on Revysol®

Lise Nistrup Jørgensen, Senior Plant Pathologist, University of Aarhus, DK

"Revysol® has proven to lift the performance against *Septoria* compared to our currently used azoles."

Bill Clark, Technical Director, National Institute of Agricultural Botany (NIAB), UK

"Looking at the fungicides, Revysol® has the eradicant properties of the older azoles seen some 10-15 years ago before their efficacy started to decline, especially against *Septoria*. Revysol® is better than prothioconazole and epoxiconazole as *Septoria* has not adapted to it."

John Lucas, Editorial Board Member, Outlooks on Pest Management, UK

"The projected entry of Mefentrifluconazole [Revysol®] into the market hopefully will pose a new problem for the pathogen, and provide further options for resistance management."

Dr. Melvin Newman, Professor Emeritus, USA

"Tests have found that Revysol® fungicide can protect crops for a significant period of time. This results in vigorous crops that stay disease-free for an extended period, thereby achieving maximum yield potential compared to today's standards."

Disclaimer

This brochure provides general information about Revysol® but is not intended to promote sales of the product and is only intended for educational purposes.

The information presented here is based on study results and reflects current knowledge. The product is not yet registered or available for sale. Sales of the product after it is registered will be based on approved labels.

This also applies to any claims about its safety and efficacy.

Always read and follow label directions. | ® = Registered Trademark of BASF

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BASF

We create chemistry