Haviza™ active

CORTEVA™ agriscience

TECHNICAL BULLETIN

Looking across your fields, you see the result of every decision.

Making informed, innovative choices at every stage is how you cultivate long-term success. When planning your fungicide application program, making the best selections for your farm is increasingly complex, as you look to maximize value and ensure performance of every choice.

The landscape of plant diseases is ever-changing. Fungal pathogens continue to adapt to existing technologies, compromising product efficacy and calling into question how to maintain the best program lineup.

A New Advantage in Soybean Disease Control

After years of research driven by farmer observations, Corteva Agriscience has developed a powerful new active ingredient. **Introducing Haviza™ active: the first picolinamide fungicide created to tackle the toughest soybean diseases.**

Haviza is the first and only Group 21 mode-of-action fungicide available for soybeans. This innovative technology binds to a newly discovered receptor site within the pathogen's power plant, effectively stopping disease – even in strains resistant to older fungicides.

By targeting a new receptor site, Haviza offers a powerful solution to combat emerging and established fungicide resistance across a spectrum of diseases. With Haviza, your fungicide program stays ahead of resistance, helping you build a stronger, more resilient disease management strategy.

Let's explore how Haviza can bring confidence to your fields and support your best crop yet.

Haviza™ active

Achieve The Highest Confidence

UNIQUE

New Mode of Action Group for Disease Resistance Management

POWERFUL

The Only Picolinamide Chemistry in Soybean

QUICK

Complete Coverage via Systemic Movement

Delivering must-have benefits to your disease management program:

- The **only Group 21 fungicide** active on ascomycete and basidiomycete pathogens in soybean
- **Key replacement** for previous technology
- **Major new rotation partner** with a **low use rate**
- **No cross-resistance** with other modes of action
- **High efficacy** against difficult-to-control diseases
- **Powerful preventive activity**
- **Superior rainfastness** for confident applications
- **Highly compatible** tank mix partner
- **Flexible use** in custom programs

CHAPTERS

New technologies are essential.

TOGETHER WE CAN EXTEND THEIR FUTURE.

Applying best management practices helps protect the utility of all crop protection tools into the future.

Here are recommendations for using Haviza™ active as part of a disease management program.

Haviza™ active must be **integrated into a robust spray program with other mode of action groups** to provide the most effective control of the target diseases

In order to manage resistance risk, **Haviza should be used in preventive applications**

Use Haviza as **part of an Integrated Pest and Disease Management (IPDM) strategy** incorporating other methods of control

Always follow **product-specific label recommendations** for resistance management

A grain market in need

ESTABLISHED CHEMISTRIES LOSING EFFICACY

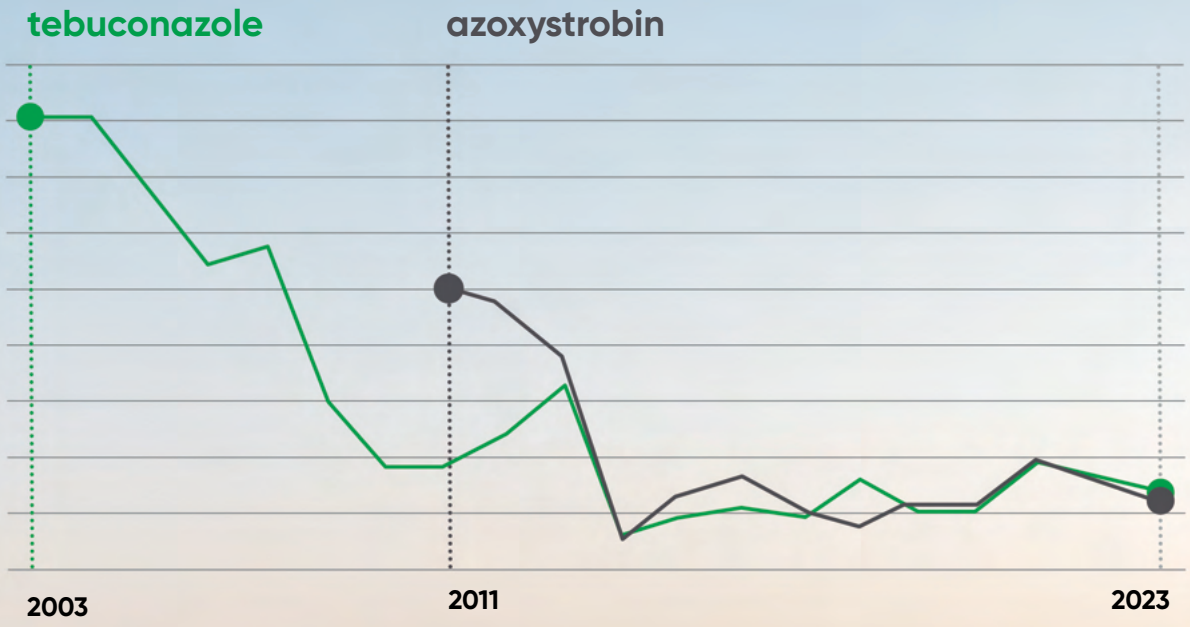


Figure 1.
Declining trend in fungicide efficacy (% control) observed over a 20-year period in Brazil (Embrapa, 2024).

Soybean production is a dynamic business. It requires planning, focus, and making the best choices for factors within your control. Crop disease is among the most powerful causes of damage and yield loss in our business. **Fungal diseases in particular present a major challenge, and current solutions for managing soybean foliar diseases are becoming strained.**

Two main issues complicate disease control. First, fungal pathogen adaptation is reducing efficacy of established chemistries (Figure 1). Second, developing new and potent active fungicides for farm use is a complex and often lengthy process. Novel solutions – and more sustainable ones – are needed to improve each season's outcome.

Big News:

NOVEL TARGET SITE DISCOVERED FOR SOYBEAN DISEASES

The story of Haviza™ active begins with farm collaboration. Corteva Agriscience partnered with farm managers to ask what they needed to manage the spectrum of priority diseases in their soybean fields – throughout each season and over the coming years. At the top of their list? A foundational new active ingredient to manage driver diseases.

We sought a solution that could replace existing fungicides active on rust and equally contribute to managing late-cycle diseases in products that support integrated farming practices.

Working from our proprietary class of picolinamide fungicides, Corteva researchers discovered a novel target site for soybean pathogens. Haviza emerged from this historic first as a breakthrough in fungal disease product development.

With a novel target site and unmatched performance, Haviza delivers complete confidence to farm managers when making their fungicide program selections.

Haviza™ active

Corteva commitment to delivering **solutions for farmers**

A 25+ year journey dedicated to discovering **the value of naturally inspired fungicides** for farms the world over

The discovery and development of chemistry inspired by **soil-bacteria**

Discovery of the picolinamides - a family of chemistry first established by **Corteva Agriscience**

The first Group 21 active ingredient for managing ascomycete and basidiomycete pathogens in soybean

Unmatched performance in your fungicide program.

Get back to confident disease management.

Soybean rust *(Phakopsora pachyrhizi)*

One of the most important diseases in soybean production. The selection of varieties adapted to each region, use of disease monitoring systems, and an integrated fungicide program is essential to avoid significant damage and disease spread.

Haviza™ active is the first active ingredient optimized to deliver exceptional rust control. In field trial after field trial, high levels of efficacy are seen at rates lower than prior technologies.

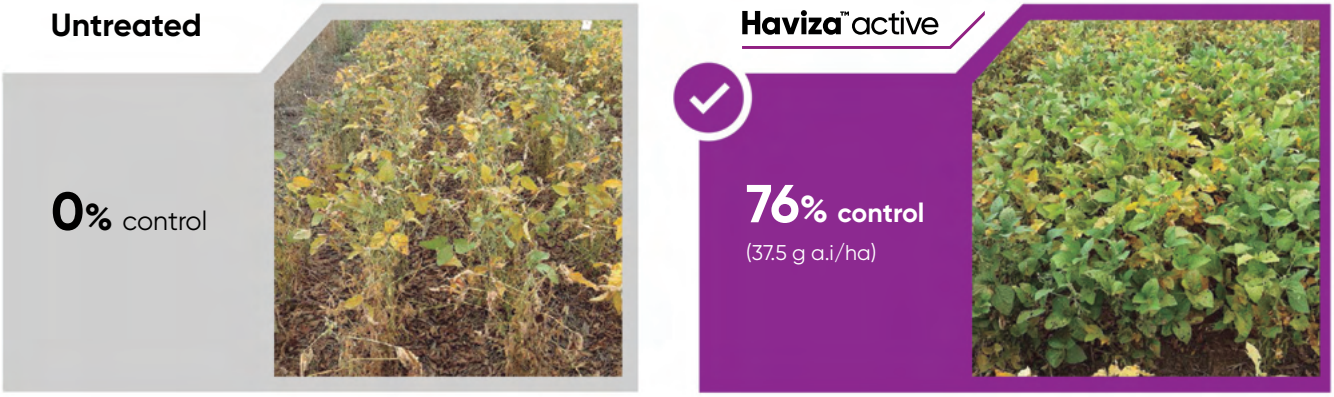


Figure 2.
Soybean rust evaluation under field conditions comparing untreated plots with plots treated with Haviza™ active (Corteva R&D studies, Brazil, 2023).

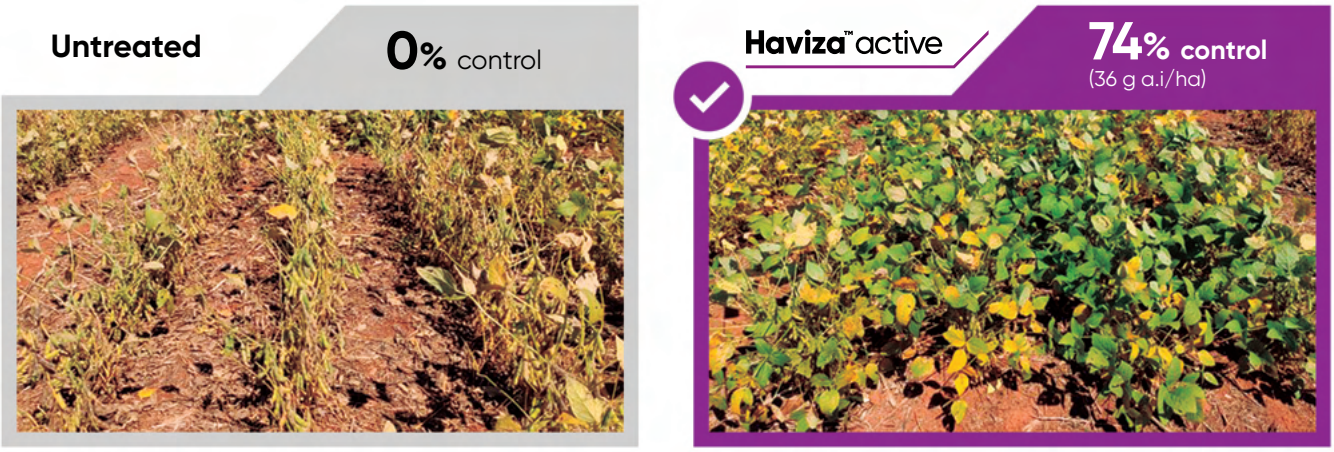


Figure 3.
Soybean rust evaluation comparing untreated plots with plots treated with Haviza™ active. Images taken 14 days after the last application (Corteva R&D studies, Brazil, 2023).

Consistently high performance on soybean rust...

Figure 4.
Soybean rust evaluation comparing untreated plots with plots treated with Haviza™ active. Images taken 14 days after the last application (Corteva R&D studies, Brazil, 2023).

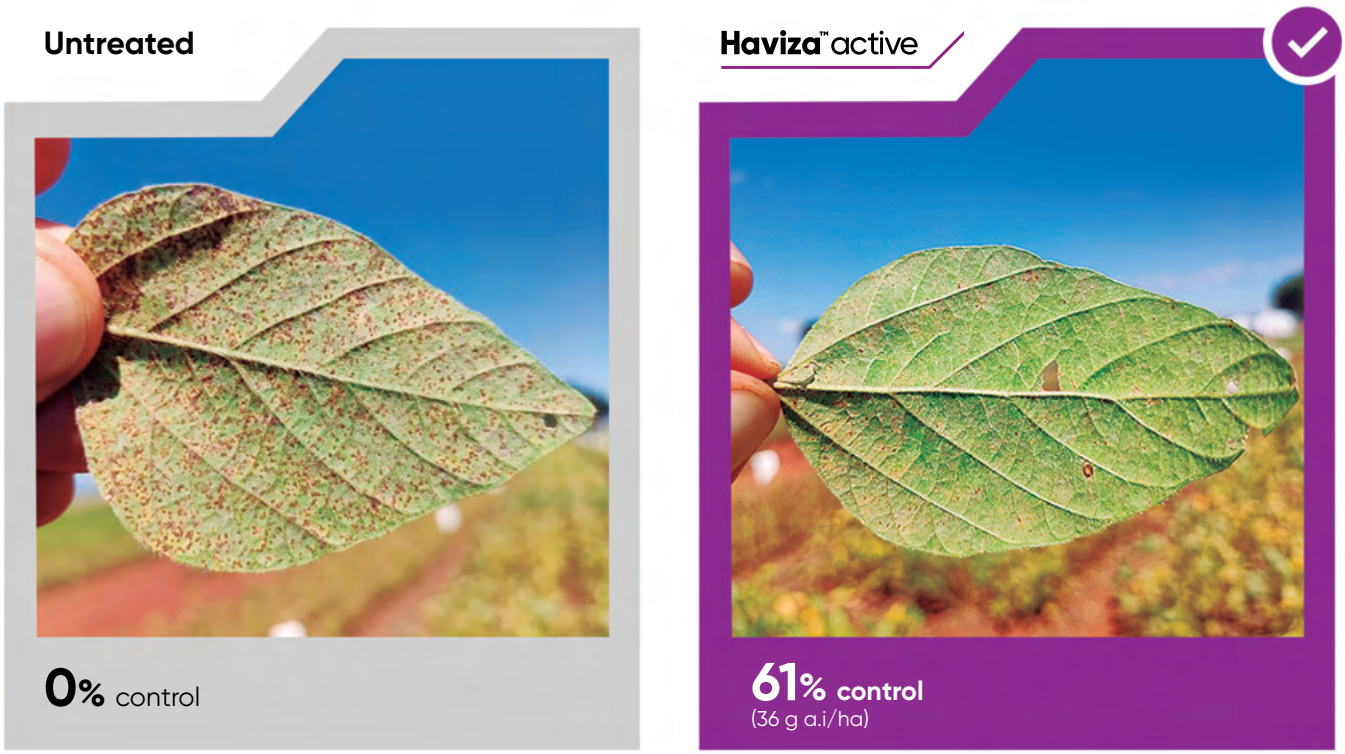


Figure 5.
Pustules and uredospore of soybean rust (leaf underside) on an untreated leaf, compared with a leaf treated with Haviza™ active. Images taken 14 days after the last application (Corteva R&D, Brazil, 2023).

...in trial after trial in the field.

Haviza™ active in head-to-head comparisons.

Gram for gram, Haviza™ active delivers better disease control than common active ingredients. In full-season studies, Haviza alone achieved the highest efficacy, even when tested at a rate far lower than the next most effective treatments.

THE **HIGHEST EFFICACY**...

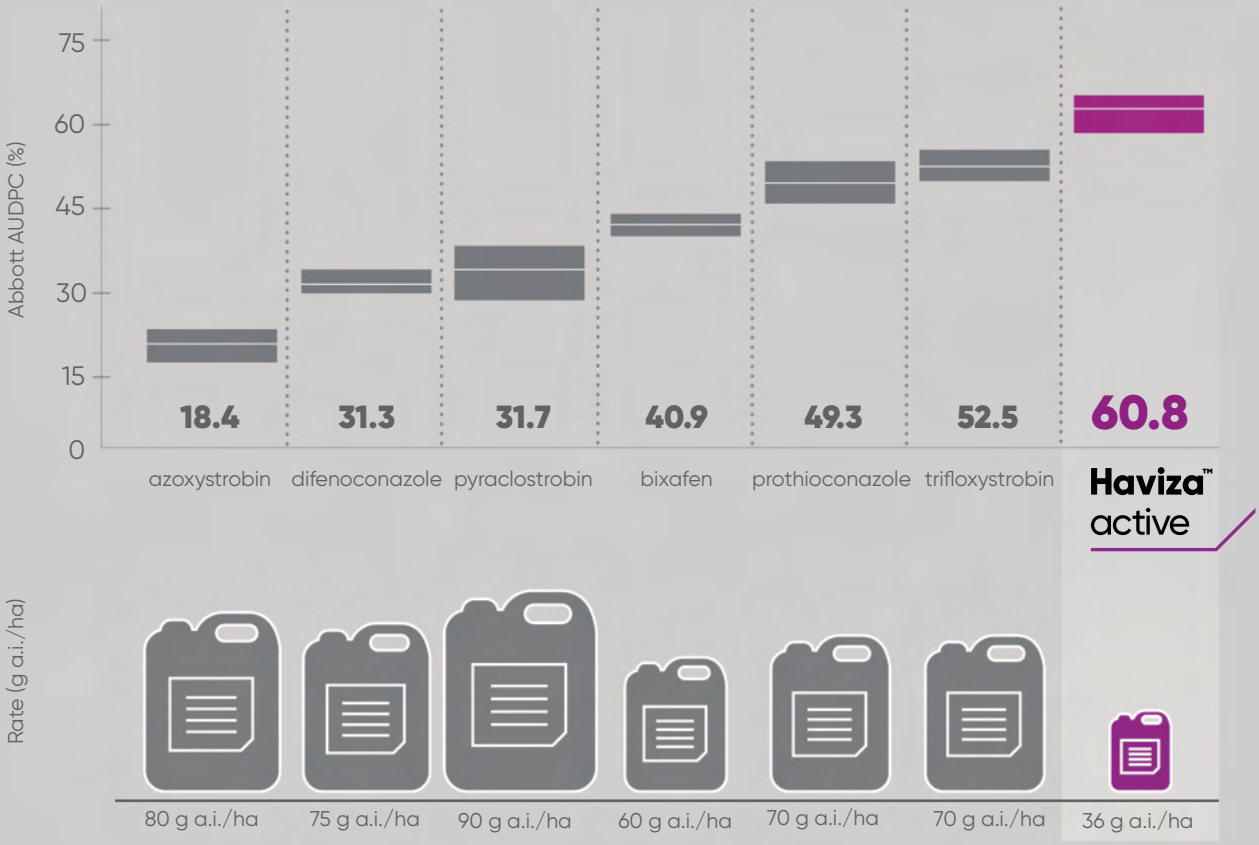


Figure 6.
Efficacy of single-active ingredients on soybean rust severity over multiple crop stages in field studies. Upper graph: percent (%) control of treatments following Abbott analysis conducted on the area under the disease progress curve (AUDPC). Box size reflects variance in treatment response. Lower graph: jug size is scaled to match the rate of each treatment (Corteva R&D, Brazil, 2023).

...AT THE **LOWEST RATE** TESTED.

Anthracnose *(Colletotrichum dematium var. truncata)*

This disease can affect any green part on the plant during the crop cycle. Necrosis can cause pods to abort or leaves to fall. When it reaches the stem, anthracnose can interfere with grain filling. Reducing disease establishment and progression are key.

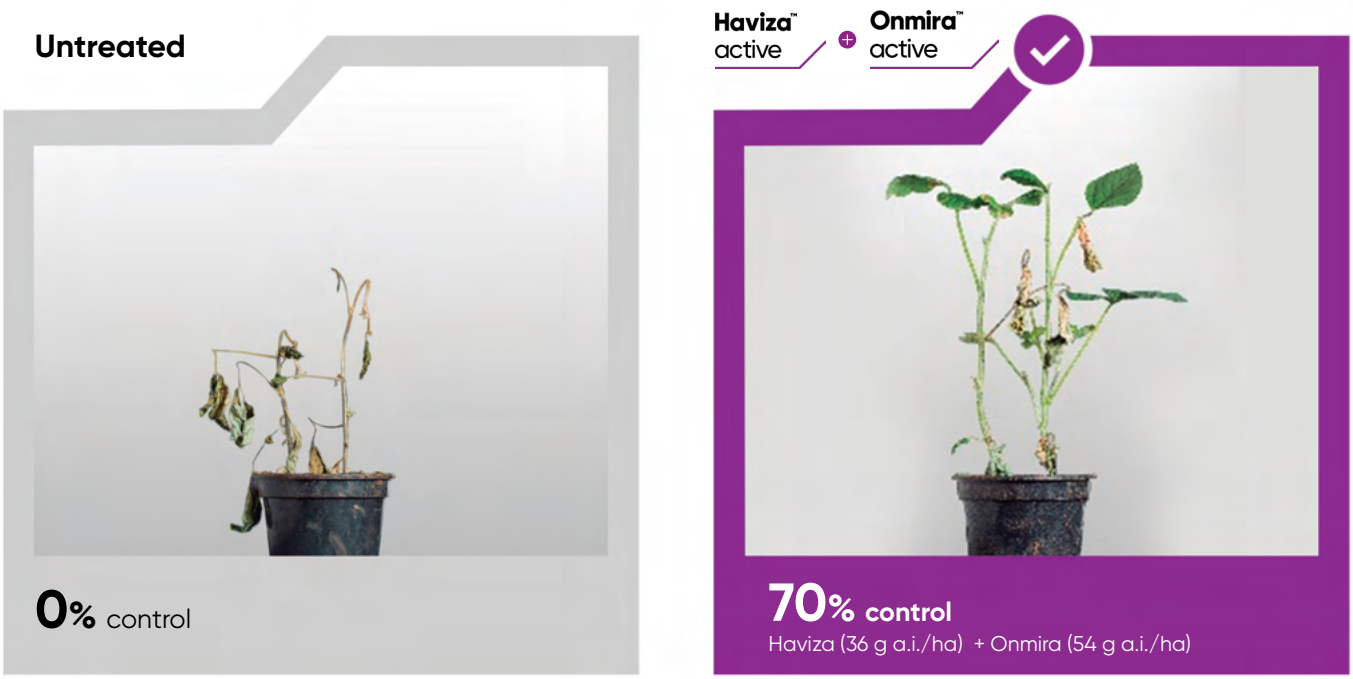


Figure 7.
Effective control of anthracnose using a mixture of Haviza™ active and Onmira™ active compared with an untreated plant (Corteva R&D, Brazil, 2024).

Powdery Mildew *(Microsphaera diffusa)*

Mildew blocks sunlight, interfering with plant photosynthesis. Mildew can spread rapidly overnight in the presence of dew and even on drier days. Timely application of the right solutions keep plants healthy.

Figure 8.
Effective control of powdery mildew using a mixture of Haviza™ active and Onmira™ active (Corteva R&D, Brazil, 2024).

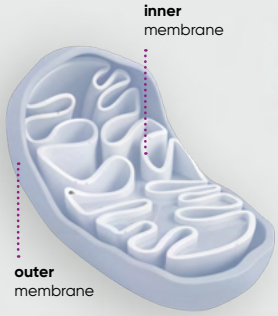
A Novel Mode of Action Group
Works on Another Level

A Brand New Mode Of Action Group

Haviza™ is the first and only FRAC Group 21 picolinamide active ingredient. This means Haviza can do what other fungicides can't: **counter fungicide resistance**.

Inside the disease pathogen, Haviza has a surprise. It binds to a previously undiscovered receptor – distinct from other fungicides – to shut down disease before it can take hold.

Haviza targets the **quinone inside site** on the inner mitochondrial membrane.



The mitochondrion: the power plant inside each cell of the pathogen

Source: www.frac.info

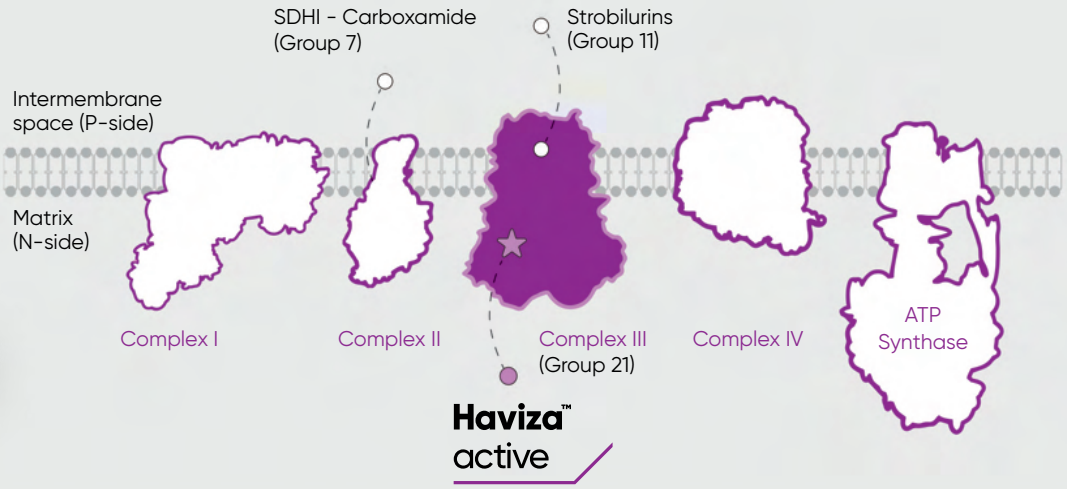


Figure 9.
Haviza is a FRAC Group 21 Quinone Inside Inhibitor (QiI) that binds to Complex III on the inside of the inner mitochondrial membrane, which is distinguished from target sites for SDHI / carboxamides (Complex II) and strobilurin (Quinone Outside Inhibitor, QoI) actives.

Immediately following application, Haviza™ active moves safely inside the crop to protect yield full-time.

Xylem Systemic Activity

Transport via the xylem protects new and expanding growth that occurs between applications.

Translaminar Movement

Maximazes total leaf protection from top to the bottom, including non-sprayed tissues.

Systemic Action Reaches Through Plants
to ensure disease has nowhere to take hold

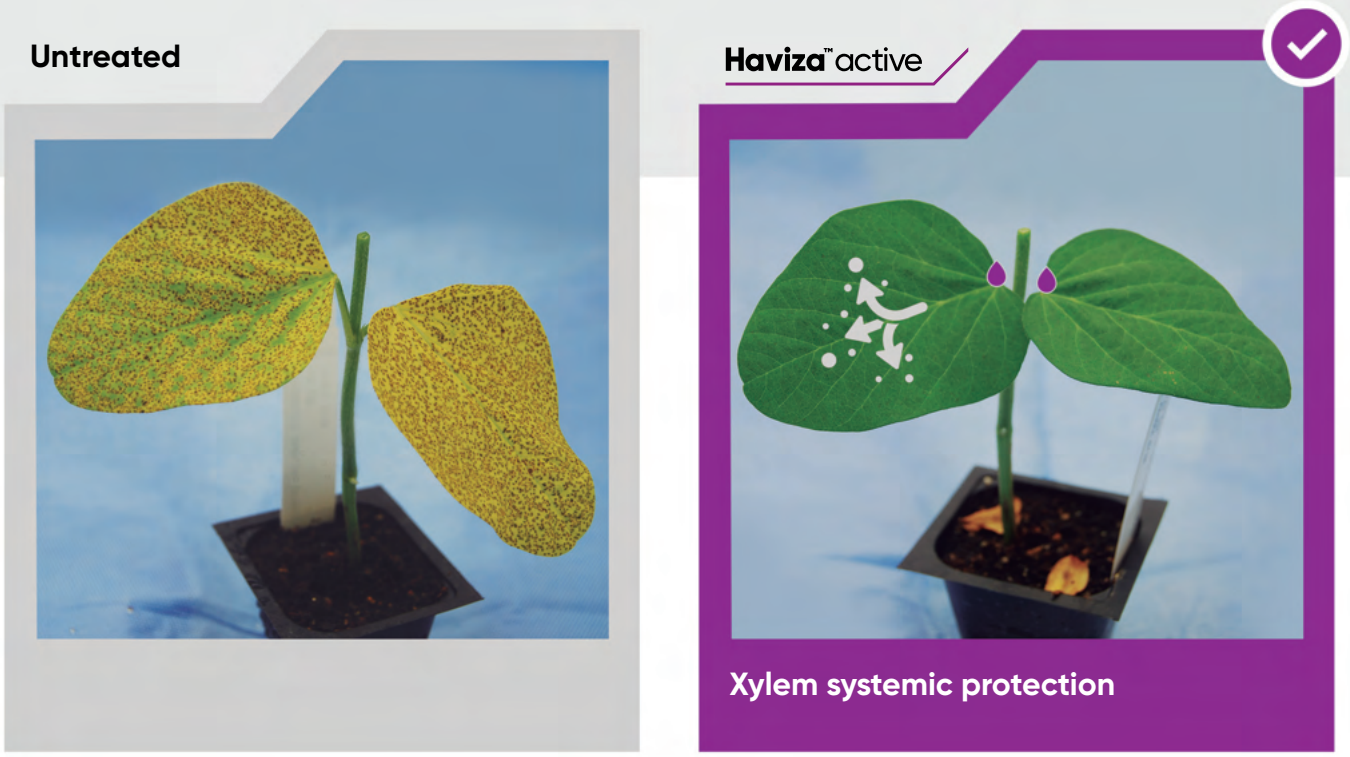
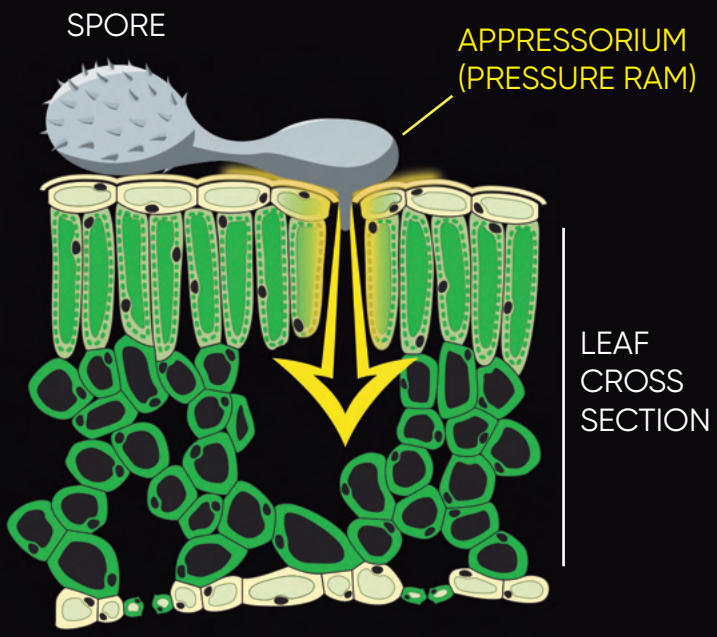


Figure 10.
Haviza™ active demonstrates excellent xylem systemicity and acropetal movement. Following placement of small droplets on the leaf axils, systemic protection is shown in a one-day preventive test using soybean rust spores. (Corteva R&D, USA, 2018).

A close-up look of Haviza in action



For an invading pathogen to rob the soybean leaf of nutrients, the pathogen creates an appressorium – **a pressure ram** – that breaks into the leaf, creating a door for infection. The untreated images on the left show the appressorium breaking into the soybean leaf.

The leaf on the right was treated with a preventive application of Haviza™ active.

Of the spores that were able to germinate, none were able to form appressoria and so failed to infect.

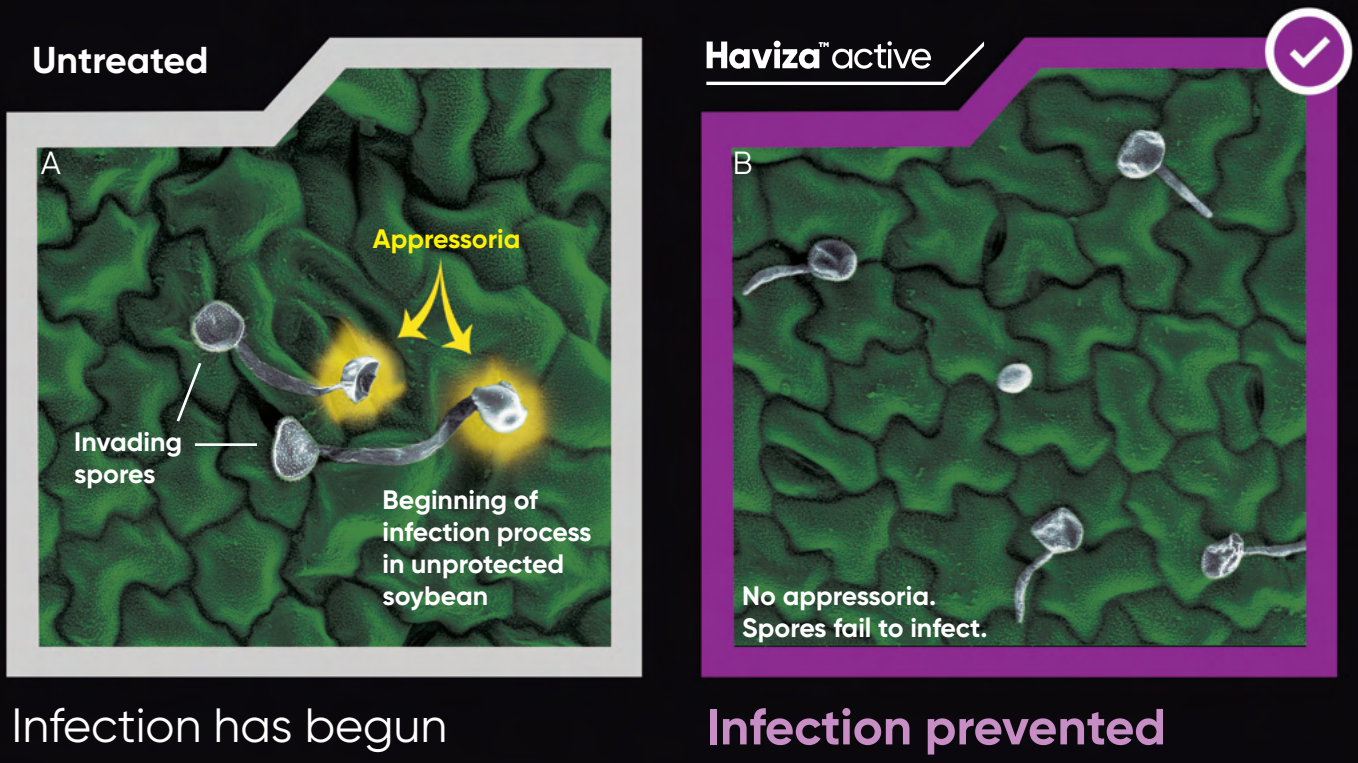


Figure 11.
Germinating spores with appressoria infecting untreated soybean leaf (A); Rust spores fail to infect leaf as appressoria do not develop on a leaf treated with Haviza™ active (B) (Corteva R&D, USA, 2019).

The Power of Haviza to Stop Infections

Preventive application is always recommended, but in reality, some spores germinate prior to application. In these cases, Haviza™ active has a unique ability to shut down pathogen growth and stop disease progression.

Here's a look inside the plant where strong curative action is seen stopping soybean rust.

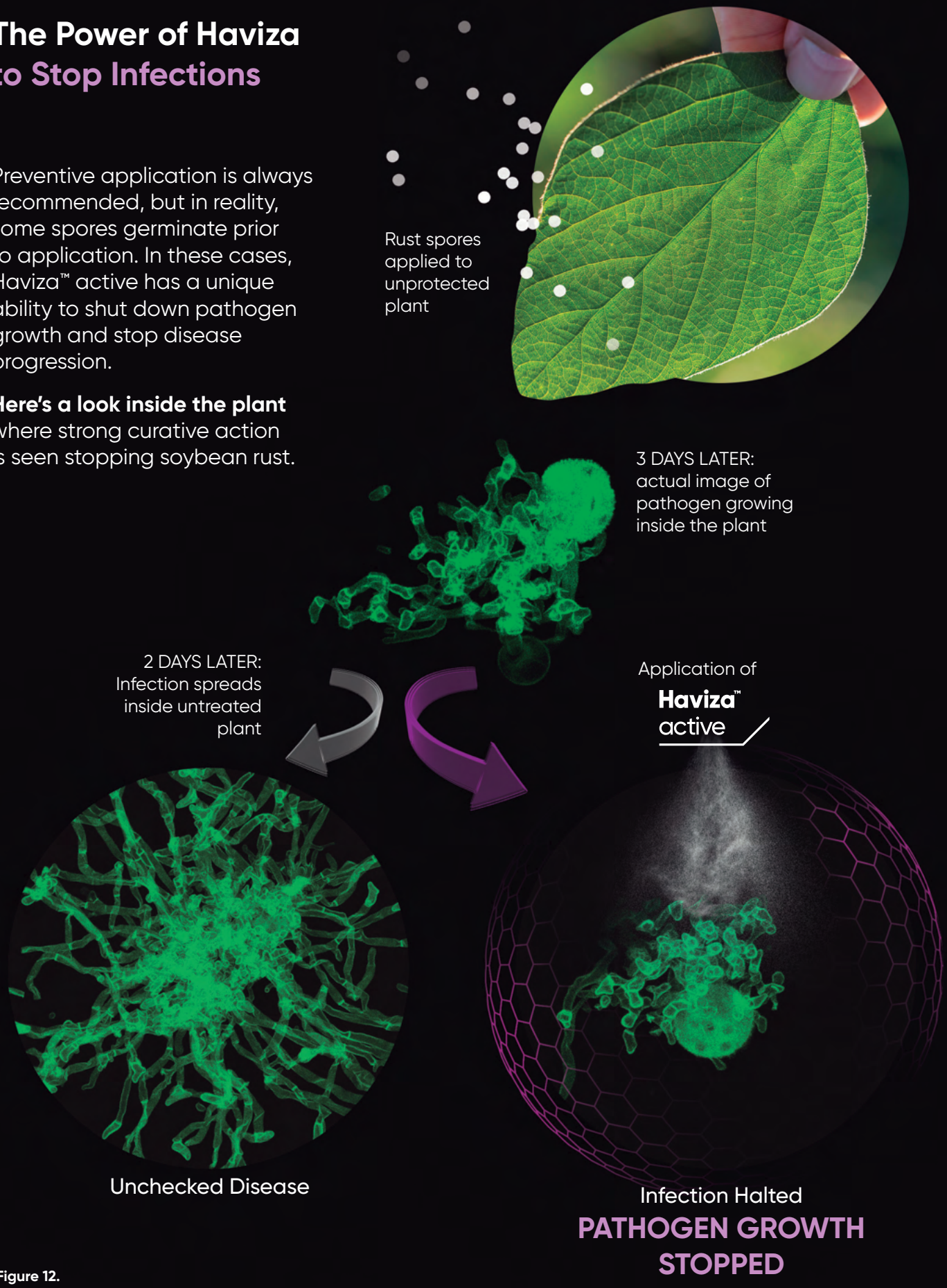


Figure 12.
Left-side: five days after inoculation, the pathogen inside an untreated leaf exhibited massive mycelial expansion. **Right-side:** mycelial expansion is terminated and growth stopped inside a leaf treated with Haviza three days after inoculation. Imaging performed at five days (Corteva R&D, USA, 2019).

Haviza™ active Formulations

Formulations are being developed to maximize utility for farm operations. Haviza™ active will be offered in formulations that support tank mixing, application flexibility, crop coverage, penetration and uptake, resistance management and enhanced performance across a wide spectrum of pathogens.

Looking to the future means developing sustainable solutions

TABLE 1.

Haviza™ active physical and chemical properties.

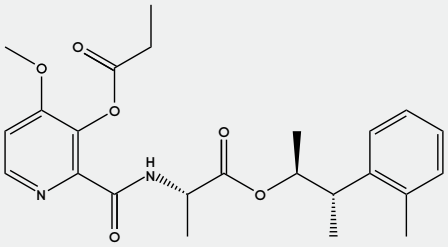
Trade Name	**Haviza™ active**
Common Name	metarylpicoxamid
Biological Action	**fungicide**
Code Names Tested	XDE-747, XR-747
Chemical Family	**picolinamides**
Chemical Name (IUPAC)	(2S,3S)-3-(2-methylphenyl)butan-2-yl N-{[4-methoxy-3-(propanoyloxy)pyridin-2-yl]carbonyl}-L-alaninate
Chemical Name (CAS)	**[(2S,3S)-3-(2-methylphenyl)butan-2-yl] (2S)-2-[[(4-methoxy-3-propionyloxypyridin-2-yl)carbonyl]amino] propionate**
CAS Number	2376210-14-7
Mode of Action Group	**FRAC Group 21**
Target Site	C4: Respiration inhibitor at MET III (cyt. bc1 complex) – Quinone inside Inhibitor (QiI)
Plant Translocation	**xylem systemic + local plant mobility (translaminar and acropetal)**
Chemical Structure	
Empirical Formula	**$C_{24}H_{30}N_2O_6$**
Molecular Weight	442.5 g/mol
Melting Point	**89.5 – 92.5°C**
Vapor Pressure	4×10^{-7} Pa @ 20°C

TABLE 2.

Haviza™ active safety profile summary.

Group	Toxicity Classification
Mammals	Low
Birds	Very low
Honey bees	Very low
Other non-target arthropods	Very low
Soil organisms (earthworms, collembola and soil mites)	Very low
Non-target higher plants	Very Low
Algae and aquatic plants*	Moderate
Fish and aquatic invertebrates*	High

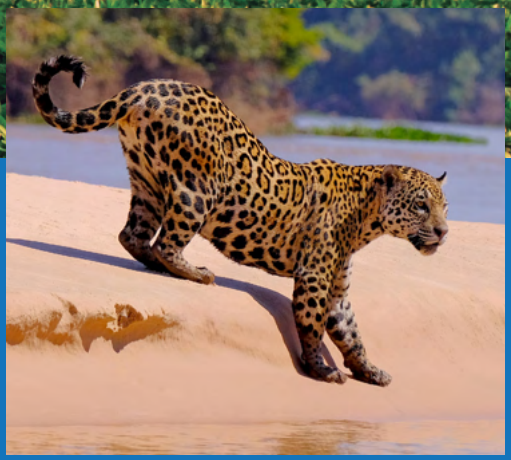
*Use according to the approved label does not result in risk to aquatic organisms. See label for local guidance and requirements.

Research on Haviza indicates that the active ingredient exhibits very low acute toxicity to terrestrial species, including birds, honeybees, and earthworms. Haviza exhibits high acute toxicity to fish and aquatic invertebrates, and moderate toxicity to algae and aquatic plants depending upon species*. In toxicological studies, Haviza exhibited low acute toxicity and absence of chronic toxicity concerns to mammals. No harm is expected when applied according to label guidelines.

***Note:**
Use according to the approved label does not result in risk to aquatic organisms. See label for local guidance and requirements.

Haviza™ active safety profile summary

Haviza™ active has favorable ecotoxicological and environmental fate profiles, ensuring minimal impact to non-target organisms and the environment. Application rates of Haviza are relatively low compared to other active ingredients. Labelled best practices provide guidance on application and associated requirements. The safety profile for Haviza fully supports broad use and enables application programs based on integrated pest and disease management principles.



Key points in the favorable mammalian toxicological profile for Haviza™ active:

- Low acute toxicity
- Not carcinogenic
- Not genotoxic
- Not immunotoxic
- Not neurotoxic
- No indication of reproductive or developmental toxicity
- No evidence of endocrine toxicity
- No bioaccumulation

TABLE 3.
Haviza™ active environmental fate profile.

Hydrolysis	Lab half-life @ pH 7: 41.5 days
Photolysis in water	Lab half-life @ pH 7: 0.74 days
Soil	Aerobic lab half-life: 0.52 days
Water/Sediment System	Aerobic lab half-life (total system): 1.1 days
Dissociation Constant (pKa)	Does not dissociate at environmentally significant pH values
Water solubility	3.1 mg/L @ pH 7
Partition Coefficient ($Log_{10}P_{OW}$)	3.9 @ pH 7

No lateral movement in soil was observed for Haviza™ active in field experiments, and simulation studies demonstrate a very low potential for groundwater contamination.

WORKER SAFETY

Handler and applicator safety is paramount to all that we do. Refer to country-specific labels for information about application and handling, including personal protective equipment (PPE), product mixers, loaders and applicators, and re-entry intervals (REI).

REGULATORY INFORMATION

Regulatory registrations are pursued to serve the agricultural needs of environmentally responsible plant disease management. Consult your local Corteva Agriscience representative for current information on Haviza™ active registration status for your country or territory, and for additional regulatory information on Maximum Residue Levels (MRLs), Import Tolerances, and Product Stewardship Plans.

RECOMMENDED REFERENCES

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Haviza™ active

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