

LumiTreo™

FUNGICIDE SEED TREATMENT

Soybean Technical Guide



Technical Guide

This technical guide represents a global overview of the technical attributes of LumiTreo™ fungicide seed treatment relative to soybean crop health, pathogen, modes of action, and seed application.

This presentation is not intended to provide specific information relative to product use in different geographies.

This presentation is not a substitute for product labels. Consult your local country labels for specific product use.

Presentation Disclaimers

LumiTreo is currently not registered and is not available for sale. This is not an offer for sale.

This educational material is provided for informational purposes only and is not intended to promote the sale of product.

Any sale of this product after registration is obtained shall be solely on the basis of approved product labels, and any claims regarding product safety and efficacy shall be addressed solely by the label.





Overview

Corteva Agriscience is proud to offer the latest advancement in fungicide seed treatment technology to provide state-of-the-art disease protection to growers and convenience to commercial and on-farm soybean seed treatment facilities.

LumiTreo™ is a 3-way premix fungicide seed treatment formulated for control of soybean seedling disease complex (damping off, seedling blight, seed and root rot) caused by *Phytophthora sojae*, *Fusarium spp.*, *Rhizoctonia solani*, seed-borne *Phomopsis*, and suppression of *Pythium spp.*

This new formulation contains three active ingredients; oxathiapiprolin, ipconazole, and picoxystrobin in a liquid suspension to provide three distinct modes of action for control of soybean seedling diseases to provide robust resistance management while maintaining excellent crop safety and decreasing occupational exposure.

Noteworthy Features

- Features oxathiapiprolin, the active ingredient in Lumisena®, providing the best protection against *Phytophthora sojae*, the #1 yield-robbing soybean disease in North America
- Excellent control of soybean seedling diseases caused by *Fusarium spp.*, *Rhizoctonia solani*, *Phytophthora sojae*, seed-borne *Phomopsis*, seed rot fungi such as *Aspergillus* and *Penicillium*, and suppression of *Pythium spp.* (certain geographies)
- Premier formulation of three fungicidal modes of action (FRAC 3, 11, & 49), providing a robust tool for resistance management
- Decreased environmental impact via reduced transportation costs, handling requirements, and waste container production
- Decreased occupational exposure as premixed formulation of three active ingredients
- Excellent seed safety profile

Formulation

LumiTreo™ is a flowable (FS) suspension containing 20.63% oxathiapiprolin, 6.82% ipconazole, and 6.82% picoxystrobin. This premix has been expertly formulated to protect the performance of different breeding technologies, transgenic traits, native traits, and genetics to provide improved return on seed investment with excellent crop safety. In addition, plantability and application performance have been evaluated through extensive on-farm testing prior to sale.

Registrations

Corteva Agriscience is seeking registration for LumiTreo in North American and South American soybean markets as well as other countries where need is anticipated in additional crops.

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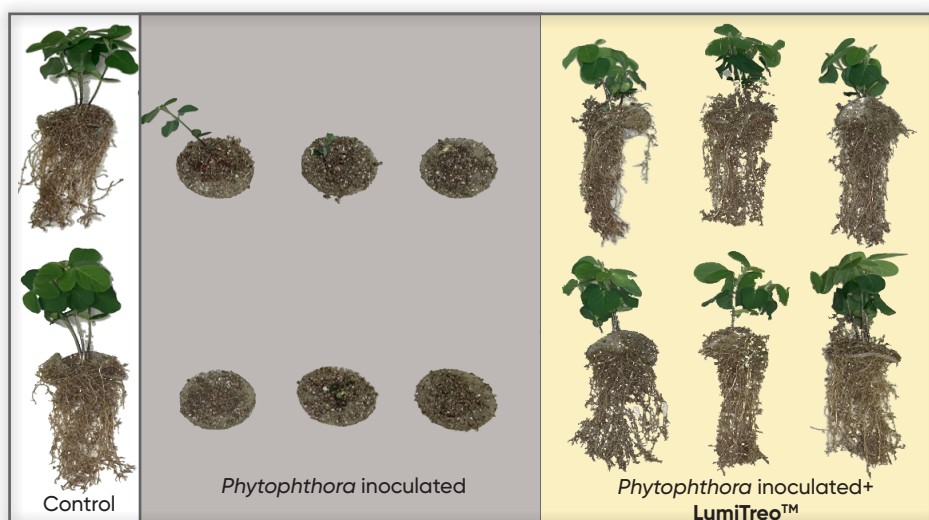


Soybean Seedling Disease Complex

Earlier planting dates extend the growing season and produce higher-yielding soybean plants. However, this exposes planted seeds to a greater range of seasonal temperatures and soil environments that increase the risk of infection by soil borne pathogens, leading to diseases that can have serious consequences on crop health and yield.

Phytophthora sojae

Phytophthora sojae is a soil borne oomycete pathogen that exclusively infects soybean and has significant impact on crop yield. *Phytophthora* oospores can remain dormant for several years, which allows this disease to persist through crop rotation practices. *Phytophthora*-infected plants can appear yellow with wilted leaves in patches, particularly after wet conditions. In many cases, seedlings fail to reach the soil surface, highlighting the importance of robust below-ground protection. LumiTreo™ contains oxathiapiprolin which inhibits all life stages of *Phytophthora*, including germination of oospores to protect root and stem tissues from seedling blight and damping-off.



Phytophthora tolerance lab assay. Soybean seeds are sown in vermiculite in the presence of a *Phytophthora*-infected agar disk.

Pythium spp.

Pythium is a complex of several different oomycete species and is a pathogen of multiple crops. In soybean, *Pythium* causes rotting of seed and seedlings recognized as soft brown tissue, resulting in stand loss due to post emergence damping-off. LumiTreo™ is registered for *Pythium* suppression activity in certain geographies. Combined with a product effective against *Pythium*, such as metalaxyl, LumiTreo is a great mixing partner giving a second mode of action.



Pythium causes seedling rot in soybeans.

Fusarium spp.

Fusarium is a complex of at least twelve different fungal pathogens. Some species prefer dry conditions for growth while other *Fusarium* species spread in cool and wet conditions. Seed and young seedling roots are particularly vulnerable to rot that results in pre- and post-emergence damping-off. Visible symptoms include severe stunting, dried brown roots, and leaf discoloration in mature plants. LumiTreo™ fungicide seed treatment contains two modes of action including; ipconazole, the proven active ingredient found in Lumiflex™ seed treatment, as well as picoxystrobin for control of *Fusarium*.



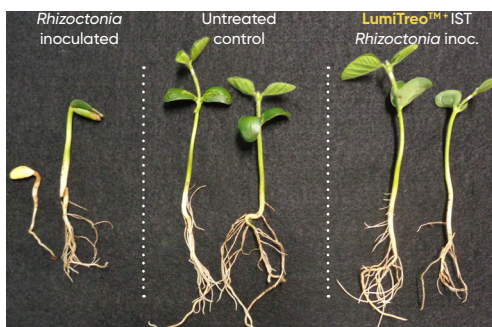
Fusarium root damage and stunting of young soy plants.



Soybean field with stand loss due to *Fusarium* infection during dry conditions.

Rhizoctonia solani

Rhizoctonia solani is a fungal pathogen that leads to disease in multiple crops. In soybeans, plant injury due to herbicide or nematode feeding can facilitate infection at different crop stages, however, seeds and seedlings are most vulnerable during warm conditions. Most frequently, *Rhizoctonia* infection causes root and stem rot which appear as reddish-brown lesions on the lower stems and roots. This leads to damping-off and stand reduction. In addition to picoxystrobin, LumiTreo™ contains ipconazole, the active ingredient in Lumiflex™ to provide two modes action (FRAC 3 and 11) for protection against *Rhizoctonia* infection.



Soybean seedlings grown in the lab environment in the presence of *Rhizoctonia* inoculum demonstrate the ability of LumiTreo™ to protect against disease. IST - insecticidal seed treatment.



Soybean field with stand loss due to *Rhizoctonia* infection during warm conditions.





Soybean Seed-Borne Diseases

Phomopsis longicolla

Phomopsis is a soybean fungal pathogen that can infect plants at any time in the growing season especially when conditions are hot and humid. Delays in harvest and late season rains can promote entry through broken branches and exposed vegetative tissue. Seed infection is not always visible, but infected seeds frequently have a thin layer of visible mold with black spots (pycnidia) or may be cracked and shriveled.

Phomopsis-infected seeds that germinate produce seedlings with orange lesions on the cotyledon. Infected crops have weakened stands and reduced yield. In addition, other fungal soybean seed-borne infections such as *Aspergillus* and *Penicillium* can occur at the end of the growing season or even after drying. These pathogens also lead to reduced germination and weakened crop stands. LumiTreo™ provides robust protection against all three seedborne pathogens.



Phomopsis infected soybean seed showing characteristic hyphal growth and black pycnidia.



Untreated soybean seeds inoculated with *Phomopsis* showing reduced germination.



LumiTreo™ treated soybean seeds inoculated with *Phomopsis* showing improved germination and robust growth.

LumiTreo™ Soybean Disease Control

- LumiTreo™ provides three proven modes of action for protection against disease caused by common soybean pathogens
- Contains oxathiapiprolin, a best in class active ingredient for excellent protection against *Phytophthora sojae* with no cross-resistance to other chemistries outside of FRAC group 49
- Contains ipconazole, a broad-spectrum fungicide that provides proven protection against *Rhizoctonia solani* and *Fusarium spp.* with no cross-resistance to other chemistries outside of FRAC group 3
- Contains picoxystrobin, a second fungicide providing additional protection against *Rhizoctonia solani*, *Fusarium spp.*, and *Pythium* (suppression) with no cross-resistance to other chemistries outside of FRAC group 11
- Proven compatibility with other seed treatments to provide additional modes of action for robust resistance management, including metalaxyl, to provide *Pythium* protection
- When used according to label, LumiTreo is a robust tool for resistance management strategies



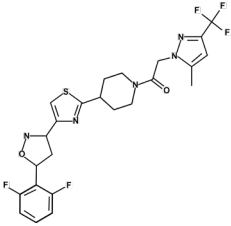
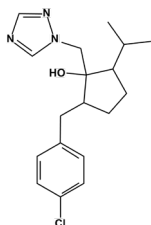
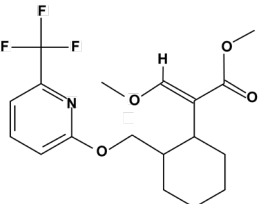
Modes of Action

Oxathiapiprolin is an oxysterol binding protein inhibitor (OSBI). Oxysterol binding proteins are important for movement of lipids critical to fungal cell wall maintenance and cell signaling. Resistance risk is assumed to be medium to high and is classified by the Fungicide Resistance Action Committee (FRAC) as Group 49.

Ipconazole is a sterol biosynthesis inhibitor or SBI (Class 1). These compounds prevent a demethylation critical to the production of sterols required for fungal cell membrane stability. Resistance risk is medium and is classified by FRAC as group 3.

Picoxystrobin is a quinone 'outside' inhibitor or QoI. This class of fungicides disrupts pathways that provide energy to the fungal cell. Resistance risk is considered high and is classified by FRAC as group 11.

**FRAC recommends that all three fungicide be used as part of an active resistance management plan and label use rates be followed to prevent increased resistance.*

Active Ingredient	IUPAC Name	Chemical structure	FRAC#	Mechanism	Target
Oxathiapiprolin	1-[4-[4-[5-(2,6-difluorophenyl)-4,5-dihydro-3-isoxazolyl]-2-thiazolyl]-1-piperidinyl]-2-[5-methyl-3-(trifluoromethyl)-1H-pyrazol-1-yl] ethanone		49	Oxysterol binding protein inhibition (OSBI)	Oomycete pathogens, <i>Phytophthora sojae</i> (curative & preventative)
Ipconazole	2-[(4-chlorophenyl)methyl]-5-(1-methylethyl)-1-(1H-1,2,4-triazol-1-ylmethyl) cyclopentanol		3	Sterol biosynthesis class I (SBI: Class I) inhibitor.	Fungal pathogens, <i>R. solani</i> and <i>Fusarium spp.</i>
Picoxystrobin	Methyl (E)-3-methoxy-2-[2-[[6-(trifluoromethyl)pyridin-2-yl]oxymethyl]phenyl]prop-2-enoate		11	Quinone outside inhibition (QoI)	Fungal pathogens, <i>R. solani</i>



Resistance Management

The multiple modes of action in LumiTreo™ soybean seed treatment provide a robust and effective tool towards managing resistance.

LumiTreo should be used as part of an Integrated Pest Management (IPM) strategy incorporating rotation as well as other fungicides with a different mode of action. Users should refer to current Fungicide Resistance Action Committee (FRAC) guidelines.

Translocation of LumiTreo

The active ingredients contained in LumiTreo 3-way fungicide translocate throughout the seed, root system, and aerial portions of the soybean plant. This provides additional protection against pathogens causing stem rots and seedling blights.



Environmental Hazards

- LumiTreo™ does not present a hazard to humans or domestic animals when used according to labelled directions
- LumiTreo does not have insecticidal activity and has minimal to no effects on beneficial arthropods
- LumiTreo is toxic to fish and aquatic invertebrates, and should not be applied directly to water or where surface water is present. Exercise care not to contaminate water when equipment rinsate is disposed.

Stewardship

Seed treated with LumiTreo™ fungicide seed treatment must be labeled according to Federal Seed Act (FSA) treated seed labeling requirements. All LumiTreo seed treatment application must be done so in accordance with with product label guidelines. This includes the use of proper handling and transport procedures, planting practices, storage, and disposal procedures.



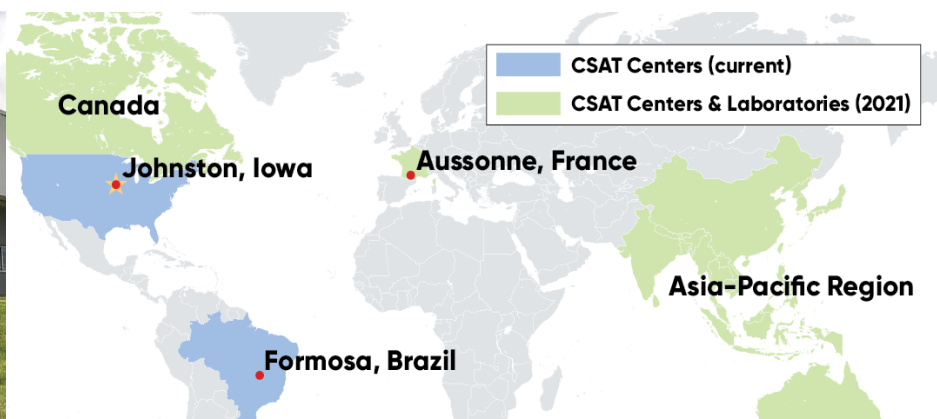
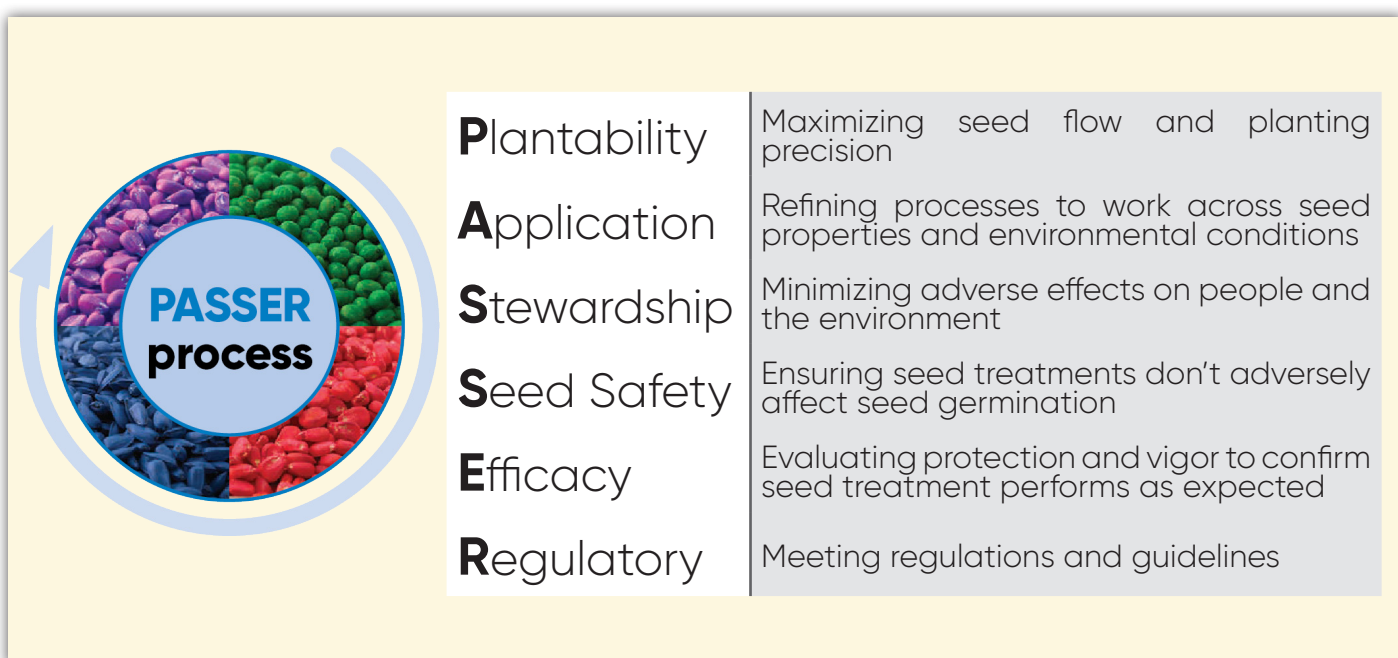


Application Information

- LumiTreo™ is only for use in commercial seed treaters operating standard calibrated seed treatment equipment
- Soybean seeds should only be treated in accordance with the label at a use rate of 0.25 fluid ounces per 140,000 seeds. This is equivalent to 0.004 mg ipconazole, 0.004 mg picoxystrobin, and 0.012 mg oxathiapiprolin per seed
- Seed treatment equipment should be cleaned as described on product label and away from wells and other water sources

Seed Applied Technology Expertise

- Centers for Seed Applied Technology (CSATs) are worldwide resources for seed treatment expertise
- Expertise in recipe development, application, laboratory testing, and scale-up
- Exclusive PASSER evaluation process delivers customer confidence



Disclaimers

The LumiTreo™ Technical Guide is provided for reference purposes only and is not a substitute for or an addition to a product label or Material Safety Data Sheet (MSDS). Always read and follow label directions for the country of use for registered pesticides. The information and any recommendations in this bulletin ("information") are presented in good faith; however, Corteva Agriscience makes no representations as to the completeness or accuracy of the information. The information is supplied upon the conditions that the persons receiving it will make their own determinations as to its suitability for their purposes prior to use and consult with their advisors to ensure compliance with all federal, state, and local regulations. In no event will Corteva Agriscience be responsible for damages of any nature whatsoever resulting from the use of or reliance upon the information.

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Notice to the State of New York: The conclusions which are contained within this Technical Guide relating to the toxicological and environmental properties and effects of LumiTreo are based on research and studies conducted by Corteva Agriscience. All such conclusions and findings are considered to be the opinions of Corteva Agriscience.