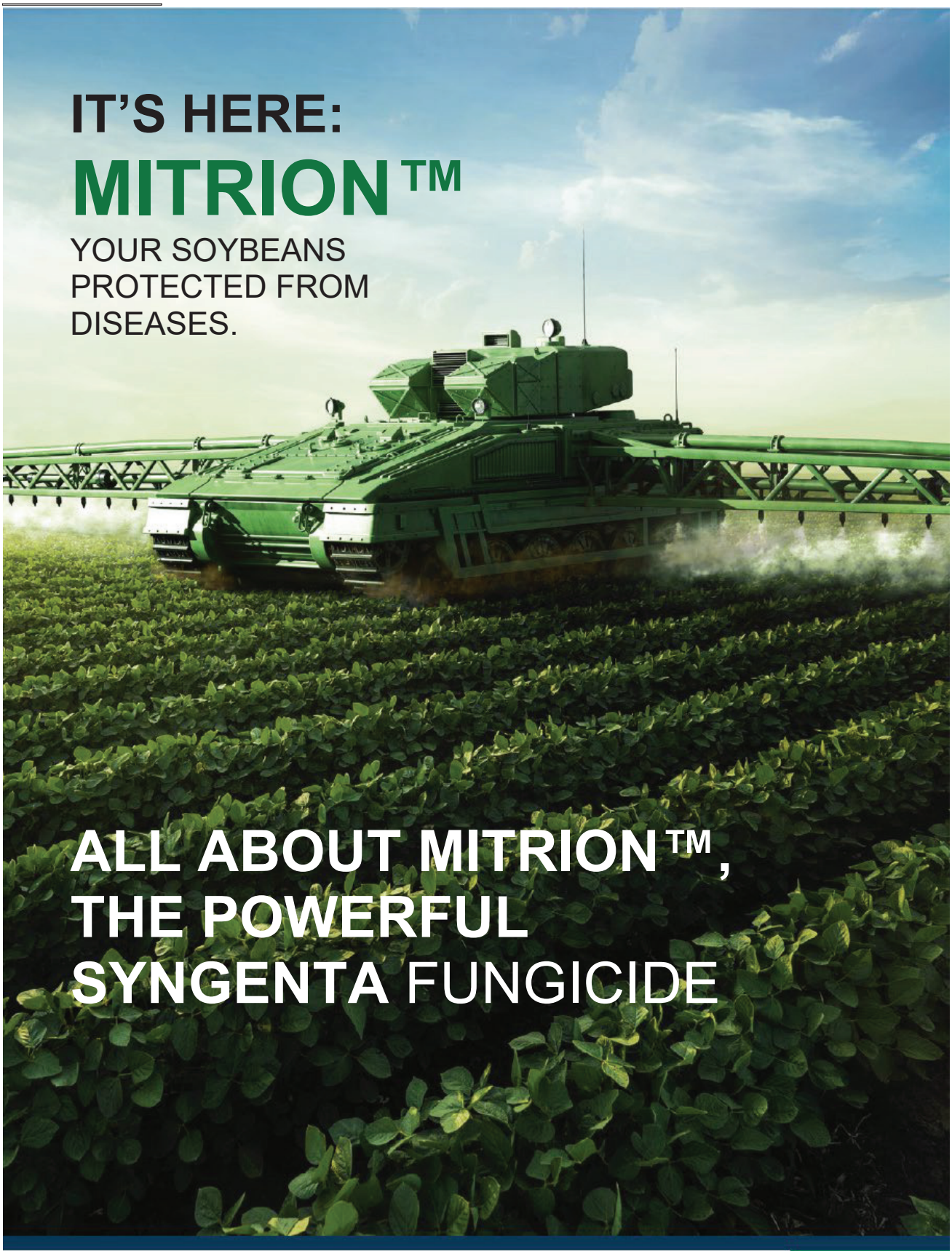

[logo:] Mitrion™

[logo:] syngenta®

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[logo:] Mitrion™ [logo:] syngenta®

Introduction

The enormous importance of the soybean crop to Brazil is unquestionable: the country is the world's **largest producer and exporter** of this oilseed. Therefore, ensuring satisfactory productivity and profitability is of great interest to soybean producers.

One of the factors that directly influences soybean quality and yield is the **incidence of diseases**, such as the Asian soybean rust and target leaf spot, which account for a 15 to 20% loss in annual production. Accordingly, producers must always be alert to symptoms and have knowledge on **most efficient technologies** to combat these pathogens at their disposal.

Syngenta is the leading soybean cultivation company and it relies on the most advanced technology on the market to create solutions to meet the **new demands of agriculture.** As a result, it has developed **Mitrion™**, an innovative fungicide, unlike anything on the market when it comes to managing crop diseases.

Here you will find all the information you need on the incidence of soybean pathogens, their main characteristics and management methods. And of course, you'll find out all about **Syngenta's new high-power fungicide!**

Read on!

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SOYBEAN SCENARIO

To look at the development of Brazilian agriculture is to look at a crop that makes the economy move: soybeans. It is of great **economic importance** to Brazil, since we are the world's largest producer of this oilseed, according to EMBRAPA (*Empresa Brasileira de Pesquisa Agropecuária* [Brazilian Agricultural Research Company]).

According to the 5th CONAB (*Companhia Nacional de Abastecimento* [National Food Supply Company]) grain survey, in recent seasons, the crop has maintained its **upward trend in terms of cultivated area**. In the 2020/21 crop season, it is estimated that that there are 38.3 million hectares planted, a growth of 3.6% compared to the previous cycle. **A record production** of 133.8 million tons is also anticipated.

The grain, which is also **Brazil's most exported grain**, is among those that most generate wealth in the field, directly impacting the GDP (Gross Domestic Product) and meeting food demands in several countries, with China being the main consumer market of Brazilian production.

Furthermore, soybeans are one of the crops with the **highest expansion potential** in the world. This is due to several reasons, such as the increasing consumption of oilseeds and investments in solutions that combine innovation, research and technology in the field, in search of higher quality and profitability, crop after crop.

Currently, soybean production occurs throughout Brazil, adapting crops to different maturation cycles. **The increase in soybean profitability** is associated with technological advances in crop management, product efficiency and the appreciation of the United States dollar over the Brazilian real, which favors exports.

However, there are still factors that limit productivity: studies show that between 15 and 20% of losses in annual production have some disease as the cause. About 40 diseases caused by fungi, bacteria, nematodes and viruses have already been identified in Brazil and, due to the expansion of soybean cultivation areas in the country, this number continues to grow.

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THE PROBLEM OF DISEASE MANAGEMENT

The **incidence of diseases** in the crop is one of the main factors that interferes with soybean productivity, generating significant losses to farmers, both in terms of yield and quality of the grains produced. Fungal diseases can occur throughout the crop cycle and they depend on the **concomitant combination** of three factors:

1. **Host** – susceptible plant organism, which can be infected by a pathogen;
2. **Environment** – conditions of temperature, humidity and microclimate, which favor the spreading of a disease;
3. **Pathogen** – a causal agent capable of adhering, penetrating, colonizing and proliferating in a given living (biotrophic) or non-living (necrotrophic) tissue.

Even if a pathogen and host are both present in an agricultural area, without the proper conditions in the environment, plant-pathogen interaction will not result in disease. Therefore, the **severity** of each fungal attack varies by year and region, depending on the weather conditions of each crop.

The main concern is that, with each crop, **managing the soybean disease complex** has been increasingly difficult because of several reasons, including:

1. Different agronomic scenarios

- Different cultivation systems;
- Greater number of varieties;
- Different levels of varietal sensitivity;
- Different planting seasons;
- Inadequate agronomic practices.

2. Less fungal sensitivity to fungicides

- Limited power and spectrum;
- Resistant populations;
- Few modes of action available;
- Increasing difficulties in management.

3. Applications outside manufacturers' recommendations

- Inadequately used products;
- Low adoption of multi-site application methods;
- Curative and sequential applications.

4. Poor application quality

- Poor management;
- Increased inoculation (reinfestation);
- Increased cost (reapplication).

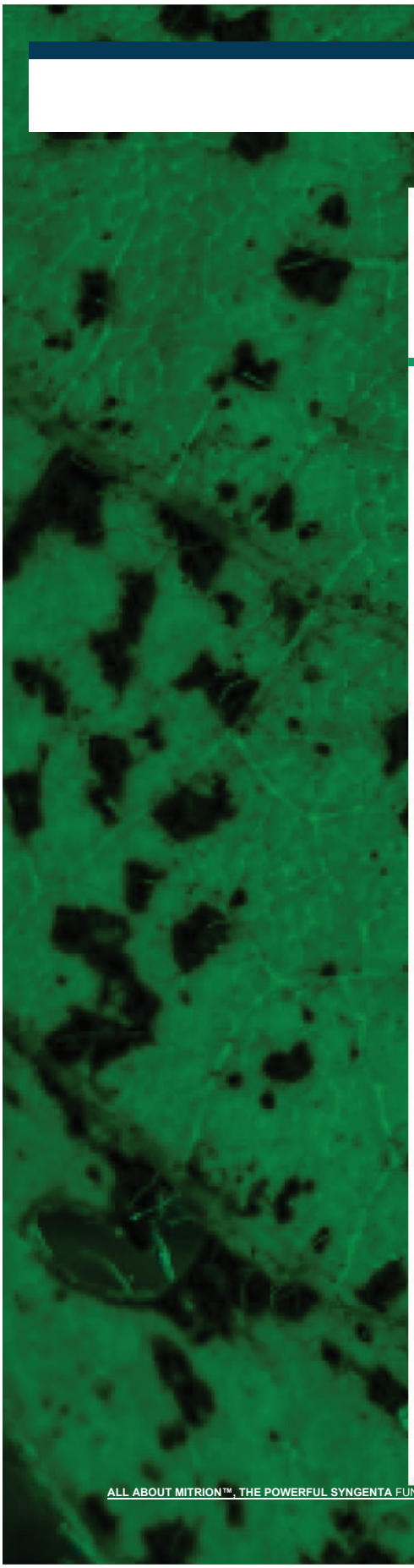
SOYBEAN DISEASES

More than **100 different diseases** have been reported that attack the crop worldwide. This index is concerning when considering that **soybeans are the main crop in the Brazilian agribusiness sector** and its most prominent export product.

In general, the Brazilian **tropical climate** is favorable for increasing crop productivity, but very high humidity also facilitates the proliferation of diseases and agricultural pests, requiring greater care to minimize production losses.

Currently, most of the diseases that affect Brazilian crops are fungal and pose serious risks to crops, affecting soybean yield and the variation in productivity from one crop to another. In more intense infestations, they can even **make an entire planted area unviable**, causing numerous losses to farmers.

Among the main pathogens that compromise Brazilian soybean production are the causing agents of **Asian soybean rust** and **target leaf spot**. Read on below for more information on these diseases.



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ASIAN SOYBEAN RUST

(Phakopsora pachyrhizi)

The first occurrences of **Asian soybean rust** were reported in Brazil in 2001. Since then, it has become a major challenge faced by soybean producers and it is currently one of the main diseases that affect soybean crops in all grain-producing regions in Brazil.

The first symptoms are difficult to visualize in the field, so it is recommended to observe leaves against a light background and look out for the initial lesions, which are **small dark spots** without yellowish edges.

Pathogen cycles are rapid under favorable conditions and the **disease progresses quickly** after affecting the crop. Initially, dark, rust-like spots take over the bottom part of the plant. These lesions correspond to a formation of bulges, or pustules, on the lower leaf surfaces (abaxial face), where the fungus produces its spores. They acquire a dark brown color and expel their spores, which are carried by the wind. Subsequently, the affected leaf becomes lighter, with a **dry appearance**, with near light-brown shades.

The **first lesions** usually appear four to five days after inoculation. The first fructification (pustules) and sporulations appear at six or seven days after inoculation.

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Symptoms of Asian soybean rust on soybean leaves

Unlike other diseases that affect soybeans, Asian soybean rust does not require stomata or lesions to penetrate the plant: **easily spread by the wind**, it enters the cuticle and epidermis directly, making infection faster and easier.

With the occurrence of rust, soybean plants undergo **early defoliation**, preventing the complete formation of the plant, filling of the pods and compromising the final weight of the grains. The earlier the defoliation occurs, the smaller the size of the grain and, consequently, the greater the **loss of crop productivity**. In optimal conditions for development of the disease, productivity can be **affected by up to 90%**.

It can appear at any stage of the plant, but it has been appearing more frequently near the **flowering period** and in the lower leaves. Infection occurs at temperatures between 15°C and 28°C and high relative humidity. Environments with prolonged periods of dew and moisture are favorable for the progress of the disease in crops.

Key Asian soybean rust **management strategies** include:

- respecting the fallow period;
- sowing at the beginning of the window;
- performing chemical management.

TARGET LEAF SPOT

(Corynespora cassiicola)

The target leaf spot fungus is found in practically all soybean growing regions in Brazil and it was first reported in the country in 1974, and to this day it is synonymous with crop losses. In high-risk areas, such as the Brazilian tropical savanna region, **losses can reach 50%** of production.

In some regions, the first symptoms may occur very early in the crop cycle. It causes lesions that start with **brown spots** with a yellowish halo, progressing to large circular spots, light brown to dark brown in color. The lesions usually have a center spot with darker-colored **concentric rings**, resembling a target, which is the reason behind its common name of target leaf spot.

Symptoms of Target Leaf Spot in the Soybean Crop

The **critical period** for the onset of the target leaf spot ranges from flowering (R1) to the grain-fill period (R5). Mild temperatures (18°C to 22°C), rainy periods with high foliar wetting and relative air humidity above 80% favor its development. It is worth remembering that reduced spacing and a high population of plants may also contribute to the formation of a microclimate that favors the **incidence of the disease.**

By affecting the leaves, the fungus can cause a reduction in the photosynthetic area or even **early defoliation**, which will compromise grain fill.

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Furthermore, the disease can cause **pods and stems to rot**, which directly influences crop yield.

The target leaf spot is caused by a **necrotrophic fungus**, capable of surviving on the remains of crops and infected seeds, which is a method for spreading, because it is capable of colonizing a wide range of residues in the soil.

The following is indicated for the **target leaf spot management**:

- Use tolerant varieties;
- Rotate crops (especially gramineae);
- Perform chemical management.

FUNGICIDE TIMELINE

Considering the negative impact these diseases can have on soybean productivity and quality, efficient management is essential. Successful **soybean disease management** requires the combination of a good management strategy and efficient technologies.

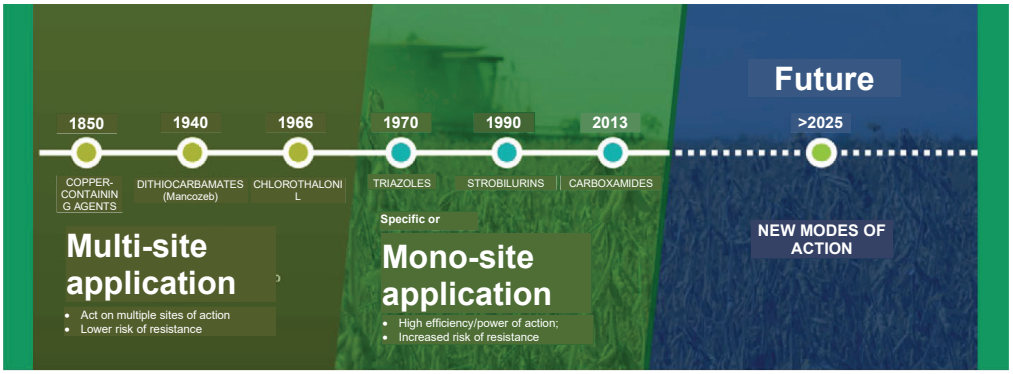
Among the existing tools for combating these pathogens, **chemical management with fungicides** is one of the most efficient. Basically, they can be divided into two groups:

Multi-site application
In general, this ensures medium efficiency in managing soybean diseases, especially rust. On the other hand, because **it acts at different sites** and phases of the fungus life cycle, it plays a major role in the management of diseases: prevention or **delay of the emergence of fungal resistance** to specific fungicides. The main agents used in multi-site application are Chlorothalonil, Mancozeb and copper-based fungicides. Accordingly, this method ensures:

- Medium efficiency and power of action;
- Lower risk of resistance.

Mono-site application
Developed from the 1970s onwards, it features **high efficiency** in managing the different pathogens in soybean crops. But because it is specific, the risk of the fungal resistance to the agents that comprise it is higher. The main agents are triazoles, strobilurins and carboxamides. Currently, the rust fungus has already undergone some type of decreased sensitivity to all existing agents:

- High efficiency and power of action;
- Increased risk of resistance.



Each fungicide comprises one or more **active ingredients**, which are responsible for the action of the product, and an inert ingredient, which serves as a vehicle and diluent for the active

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ingredient. The great importance of chemical groups is the way **they act on the fungus**, because it is a decisive factor in being able to position fungicides correctly in the soybean cycle. Find out more about each of them in the following table:

	Characteristics	Mode of action	Resistance type	Resistance risk	Examples
Multi-site application	Protection. Non-leaf penetrating	Inhibits respiration/energy synthesis. Acts on several enzymes (respiratory)	–	Low	Mancozeb, Chlorothalonil
Triazoles	Systemic, curative action. Broad spectrum of action	Inhibit ergosterol synthesis in membranes (cell wall)	Quantitative. Higher dose, greater control (depends on triazole efficiency)	High	Cyproconazole; Tebuconazole; Epoxiconazole; Prothioconazole
Strobilurins	Selectivity and low toxicology. Preventive and antisporulant action	Inhibit external quinone (respiratory enzyme) – act on mitochondrial respiration, depriving the body of the main product of this process: ATP	Qualitative (does not respond to dose escalation)	High	Azoxystrobin; Picoxystrobin; Pyraclostrobin; Trifloxystrobin
Carboxamides (SDHI)	High fungicidal potential. Preventive and antisporulant action	Inhibit SDH (respiratory enzyme) – act on mitochondrial respiration, depriving the body of the main product of this process: ATP	Qualitative (does not respond to dose escalation)	High	Benzovindiflupyr (Solatenol); Fluxapyroxad; Bixafen

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[logo:] Mitrion™ [logo:] syngenta®

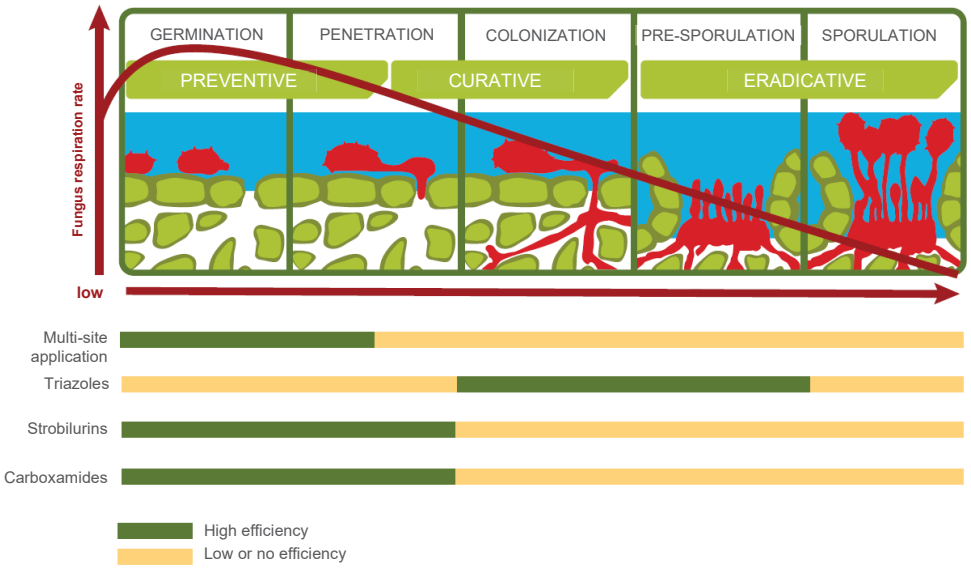

Diagram with the phases of the fungi in which each type of fungicide acts

A NEW ERA IS DAWNING: MITRION™

As you have seen, several diseases affect soybean crops at different times. Therefore, **high-power fungicides** are critical to managing them.

Syngenta's **Mitrion™** is the combination of the **two most powerful active ingredients on the market**: carboxamide with the best preventive effect and triazole with the best curative effect, offering **superior performance** in rust and spot management – especially target leaf spot – compared to other solutions on the market.

While **Prothioconazole** (triazole) rapidly penetrates the leaf and protects the leaf interior and can reach established infections, **Solatenol** (carboxamide) strongly attaches to plant leaves, preventing the fungus from entering and ensuring greater residual effect. Together, these principles deliver superior performance for the entire disease complex, due to their **power and versatility**.

Active ingredient:	Solatenol™	Prothioconazole
Chemical group:	SDHI (Carboxamide)	DMI (Triazole)
Mode of action:	Succinate Dehydrogenase Inhibitor	Ergosterol biosynthesis inhibitor
Concentration:	75 g a.i./L p.c.	150 g a.i./L p.c.

The solution also has a modern formulation called *Empowered Control,* which acts in the three main phases of the product-plant interaction and provides greater retention, spreading and translocation, resulting in immediate action.

The most potent fungicide on the market features:

- **Innovative combination:** comprising the two most efficient active ingredients on the market;
- **Maximum power:** superior management of spots and rust;
- **Safety:** best preventive and curative effect (provided it is used at the onset of infection);
- **Convenience:** formulation with *Empowered Control* technology that increases management.

Mitrion™: where there is power, there is no disease!

GENERAL APPLICATION RECOMMENDATIONS

Mitrion™ should be applied no more than twice up to 70 DAE (days after emergency), with a 14-day interval between applications and always in combination with multi-site applications (Bravonil or Mancozeb).

Be aware of the maximum of two applications of **Mitrion™** during the crop cycle.

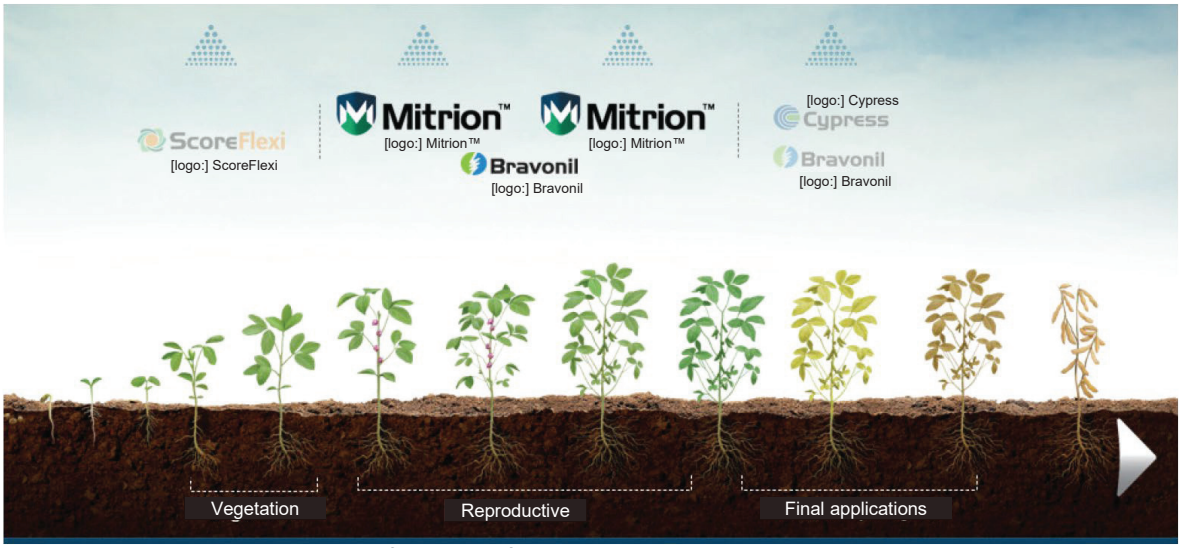

Diagram for Mitrion™ fungicide placement in the soybean crop

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It is worth remembering that, in order to implement a fungicide program in a **conscientious and sustainable manner**, it is necessary to:

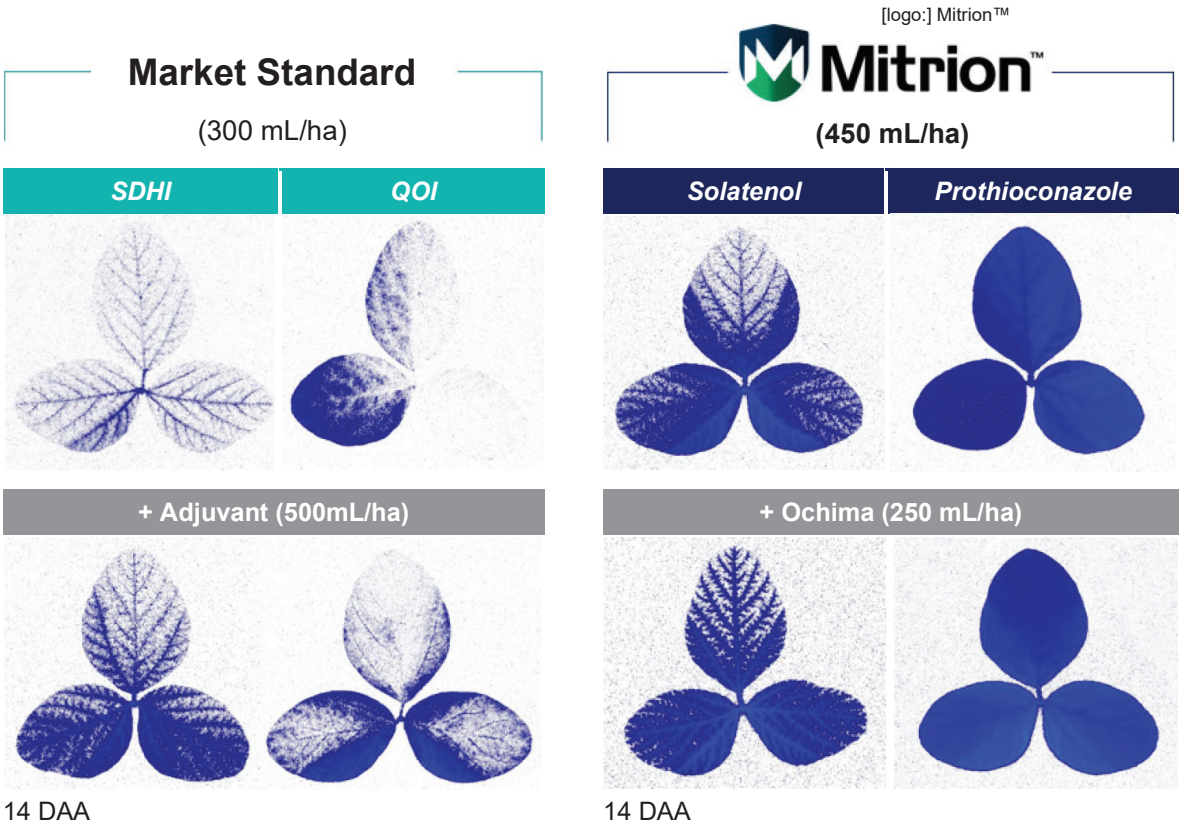
- Use all modes of action in a management program;
- Respect the characteristic of each product in its application;
- Always make use of partners in applications;
- Use broad-spectrum products throughout the crop cycle.

Satisfactory results depend on both product quality and proper application techniques. Therefore, for assertive management of the main soybean pathogens with **Mitrion™**, the fungicide should be applied at the recommended doses, following the label and package insert guidelines. Find out more:

VIEW MITRION PACKAGE INSERT

RESULTS

Carbon-14 studies, which capture the translocation of the product by the plant, prove the power of **Mitrion™** in managing spots and rust, in which the distinguishing feature of the Syngenta fungicide formulation and the **excellence in the absorption of the active ingredients**, especially carboxamide, were demonstrated, even without the use of adjuvants at 14 days after application. This reveals that *Empowered Control* technology already has adjuvants in its composition, which are sufficient to ensure the effectiveness of the product in the field.



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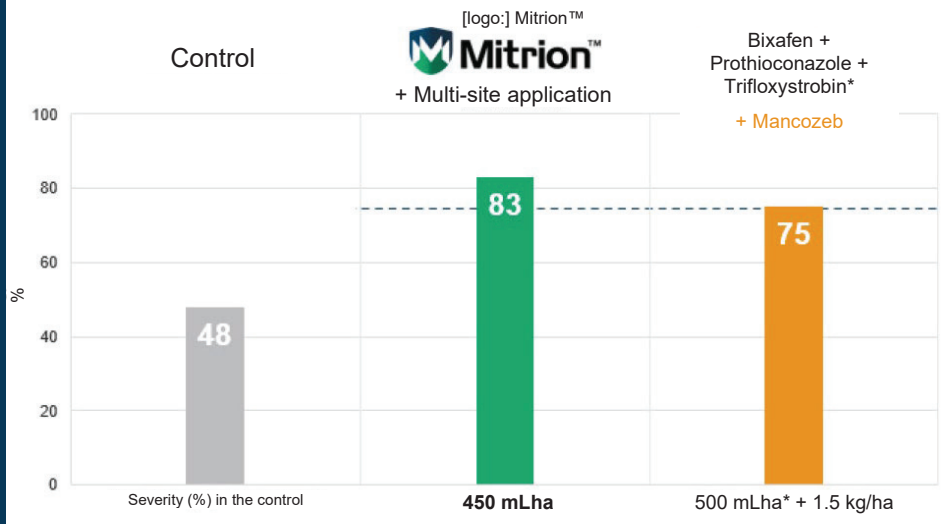
Mitrion™ is prominent in the management of target leaf spot! See the results of the trial conducted in Primavera do Leste/MT:



Percentage of control based on AUDPC (%) – 21 to 28 DAAC

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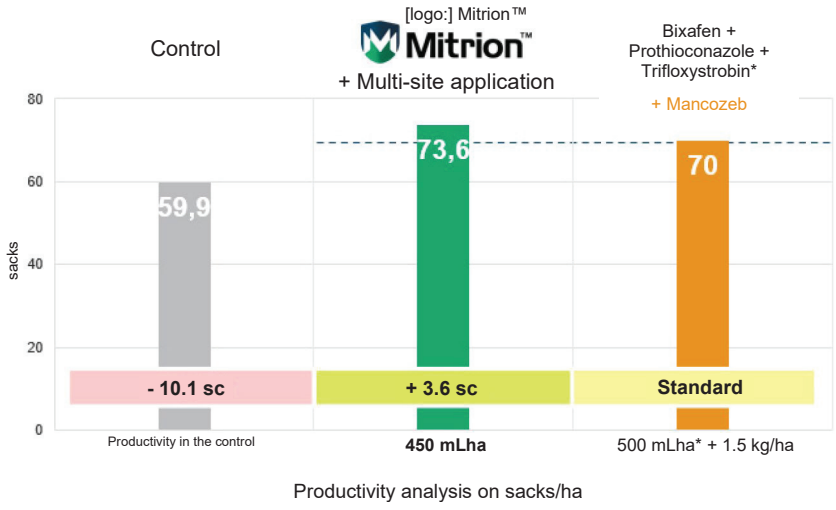
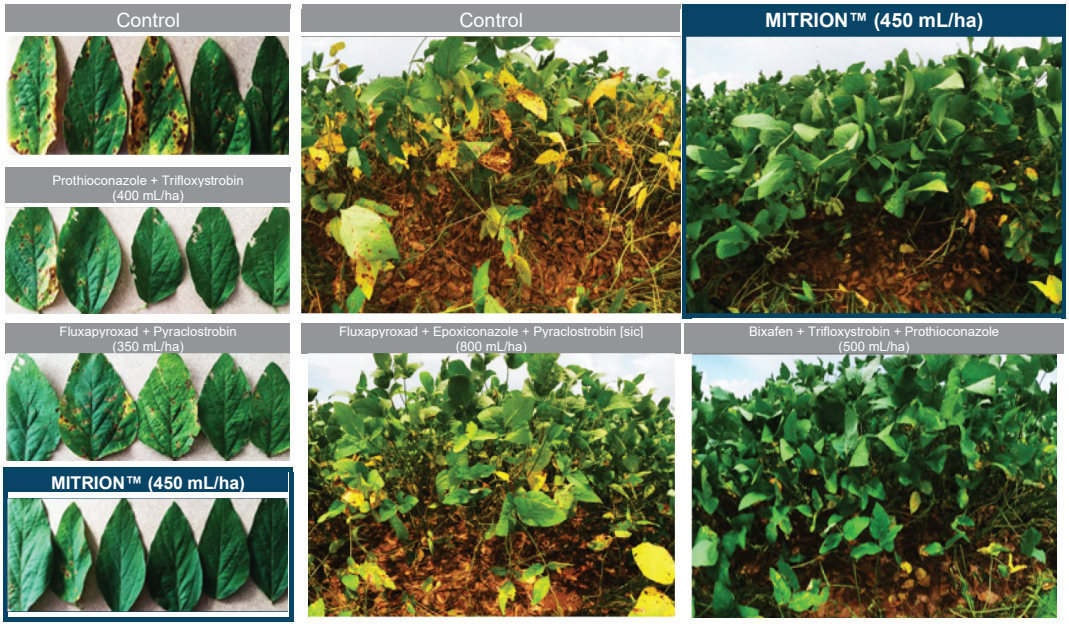


Productivity analysis on sacks/ha



MITRION™ + Mancozeb
PTZ + TFS + Mancozeb/BIX + PTZ + TFS + Mancozeb
FXD + PRS + Copper Oxychloride/FXD + PRS + EPS + Copper Oxychloride [sic]

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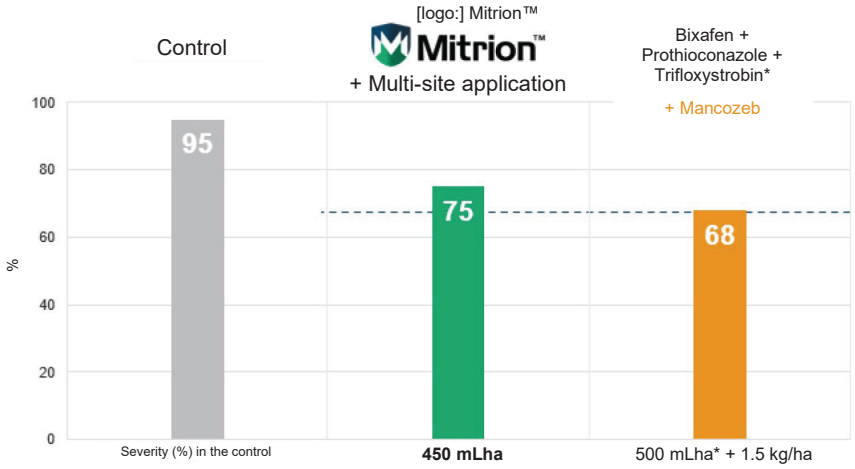
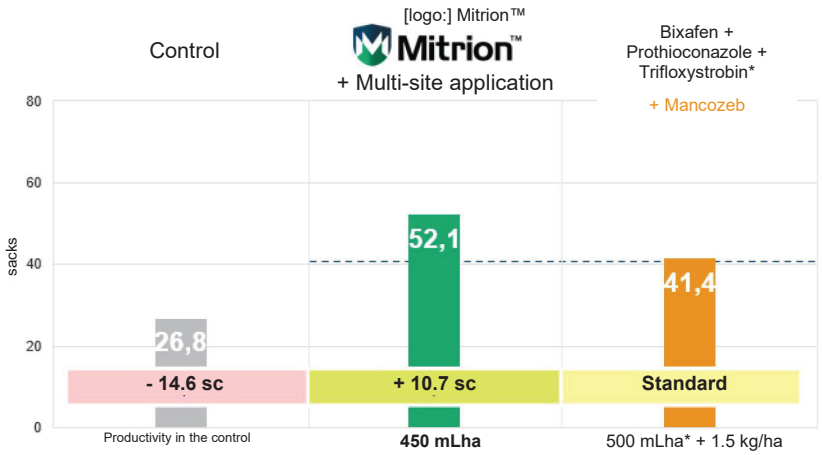
Mitrion™ presents superior rust management. See the Uberlandia/MG result:



Percentage of control based on AUDPC (%) – 7 to 21 DAAC



Productivity analysis on sacks/ha

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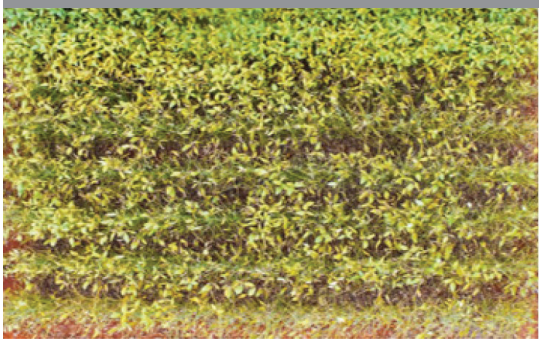
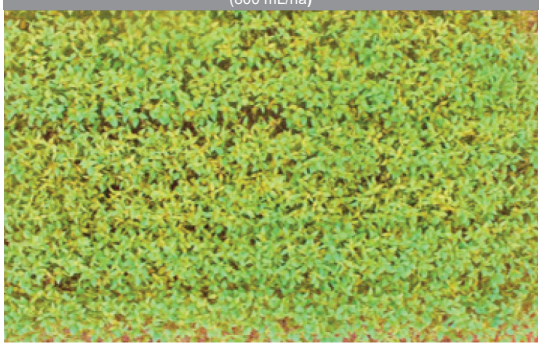
Control



MITRION™ (450 mL/ha)

Fluxapyroxad + Epoxiconazole + Pyraclostrobin
(800 mL/ha)



Bixafen + Trifloxystrobin + Prothioconazole
(500 mL/ha)

MITRION™ + BRAVONIL 720
BIX + PTZ + TFS + Mancozeb
FXD + PRS + EPS + Copper Oxychloride

Power in the management of rust with preventive and curative effect. Uberlandia/MG.

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SYNGENTA: ALWAYS ALONGSIDE FARMERS

For **Syngenta**, the soybean is synonymous with productivity, safety and innovation. In order to provide the best results for crops in the field, the company has the **most advanced technology on the market**, offering high productivity potential, combined with stability and health of plants and grains.

The **Mitrion™ fungicide** is part of Syngenta's complete portfolio, with integrated solutions designed to **increase soybean crop productivity** and meet the new demands in agriculture. As a result, producers can get the most out of their crops with **safety and profitability**!

Syngenta and you: connected in and out of the field.

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[logo:] syngenta®

Refer to the package insert for state-by-state restrictions.

ATTENTION THIS PRODUCT IS HAZARDOUS TO HUMAN AND ANIMAL HEALTH, AND THE ENVIRONMENT; FOR AGRICULTURAL USE;

FOR SALE UNDER AGRONOMIC PRESCRIPTION; ALWAYS CONSULT AN AGRONOMIST; GET INFORMED AND UNDERTAKE INTEGRATED PEST MANAGEMENT; PROPERLY DISPOSE OF PACKAGING AND PRODUCT REMAINS; CAREFULLY READ AND FOLLOW THE INSTRUCTIONS ON THE LABEL, PACKAGE INSERT AND PRESCRIPTION; AND USE PERSONAL PROTECTIVE EQUIPMENT.

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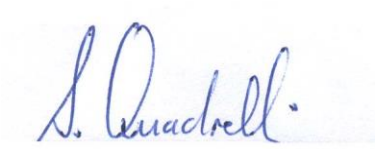
I, Sacha Quadrelli, hereby certify that I am competent to translate from Portuguese to English and that the attached translation is, to the best of my knowledge and belief, a true and accurate translation of the document entitled “Ex 2037 - Mitrion Marketing Materials” from Portuguese to English.



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Sacha Quadrelli