

Insignia®



A fungicide for the control of red thread, moderate control of microdochium patch and useful reduction of dollar spot in managed amenity turf.

 **BASF**
We create chemistry

Insignia®

Insignia® is a strobilurin-based local penetrant fungicide available in a water dispersible granule formulation. Authorised for use on managed amenity turf, Insignia® contains, 200 g/l (20%) pyraclostrobin providing both protective and curative action.

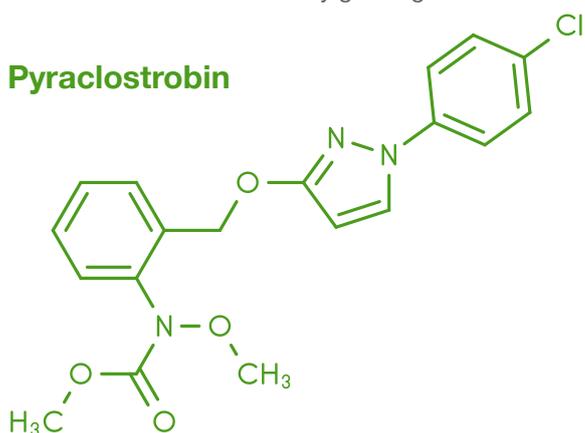
| Product Authorisation | |
|-----------------------|---------------------------|
| Product name | Insignia |
| MAPP no | 19403 |
| Active substance | 200 g/l pyraclostrobin |
| Formulation | Water dispersible granule |
| Field of use | Fungicide |
| Areas of use | Managed amenity turf |
| Amateur/Professional | Professional |
| LERAP category | B |



BASF Insignia®

Insignia® is a local penetrant fungicide for the control of red thread (*Laetisaria fuciformis*), microdochium patch (*Microdochium nivale*), and dollar spot (*Sclerotinia homoeocarpa*) when turf is actively growing.

Pyraclostrobin



| Pyraclostrobin | |
|----------------------------|---|
| Active family | Strobilurin |
| Mode of action code | C: Respiration |
| Target site of action | Mitochondrial respiration (Complex III) |
| Target site code | C3 |
| Group name | Quinone outside Inhibitor (QoI) |
| FRAC code | 11 |
| Phytomobility | Local penetrant |
| Movement in plan | Translaminar |
| Movement among cGardenells | Apoplastic |

Strobilurin fungicides

Strobilurus tenacellus (pinecone cap) is a species of agaric fungus which feeds on the fallen cones of pine trees. It has evolved to suppress and overcome other fungal species which would otherwise compete against it for food. It does this via the synthesis of antifungal compounds called strobilurins.



These naturally occurring fungicides were further optimised to improve their stability in UV light and fungicidal activity.

Since their introduction in 1996, strobilurin fungicides have become one of the most important families of active substances across the world.



Mode of action

Mode of action describes how a fungicide impacts a fungus, The Fungicide Resistance Action Committee (FRAC) currently recognises 13 classifications with pyraclostrobin belonging to Mode of Action Code C: Respiration.

Target site of action and group name

Like many fungicides, pyraclostrobin affects a single site within the fungi; specifically, complex III of the mitochondrial electron transport chain.

By inhibiting this pathway, pyraclostrobin blocks the fungal pathogen's ability to respire and produce energy through the transfer of electrons within its cells.

Fungicides which affect this process are assigned the code C3 and the name Quinone outside Inhibitors (QoI).

FRAC code

As a QoI fungicide pyraclostrobin falls within Fungicide Resistance Action Committee (FRAC) code 11 for resistance management.

Phytomobility and movement through the plant

Phytomobility describes how an active substance such as pyraclostrobin, penetrates and moves within a plant after it has been deposited onto and then absorbed into underlying tissues.



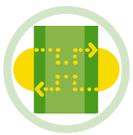
Local penetrant

Pyraclostrobin is a local penetrant fungicide which means once applied, the active substance will remain concentrated close to the site of application.



Translaminar movement

Movement of the active substance will be through the plant leaf from one side to the other. This type of movement through the plant is described as translaminar movement. The word trans being derived from the Latin prefix for 'through' or 'across', with lamina arising from the use in botany to describe a leaf. Translaminar movement may also be referred to as mesostemic.

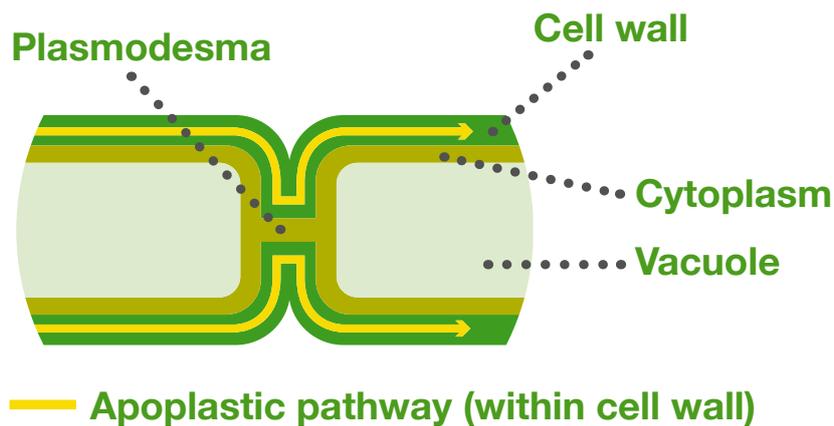


Apoplastic cell movement

The movement through the leaf occurs around the cell wall structure and through gaps between the underlying plant cells. Eventually the pyraclostrobin makes it to the opposite side from its original application. This type of movement is classified as apoplastic and occurs in one of two ways.

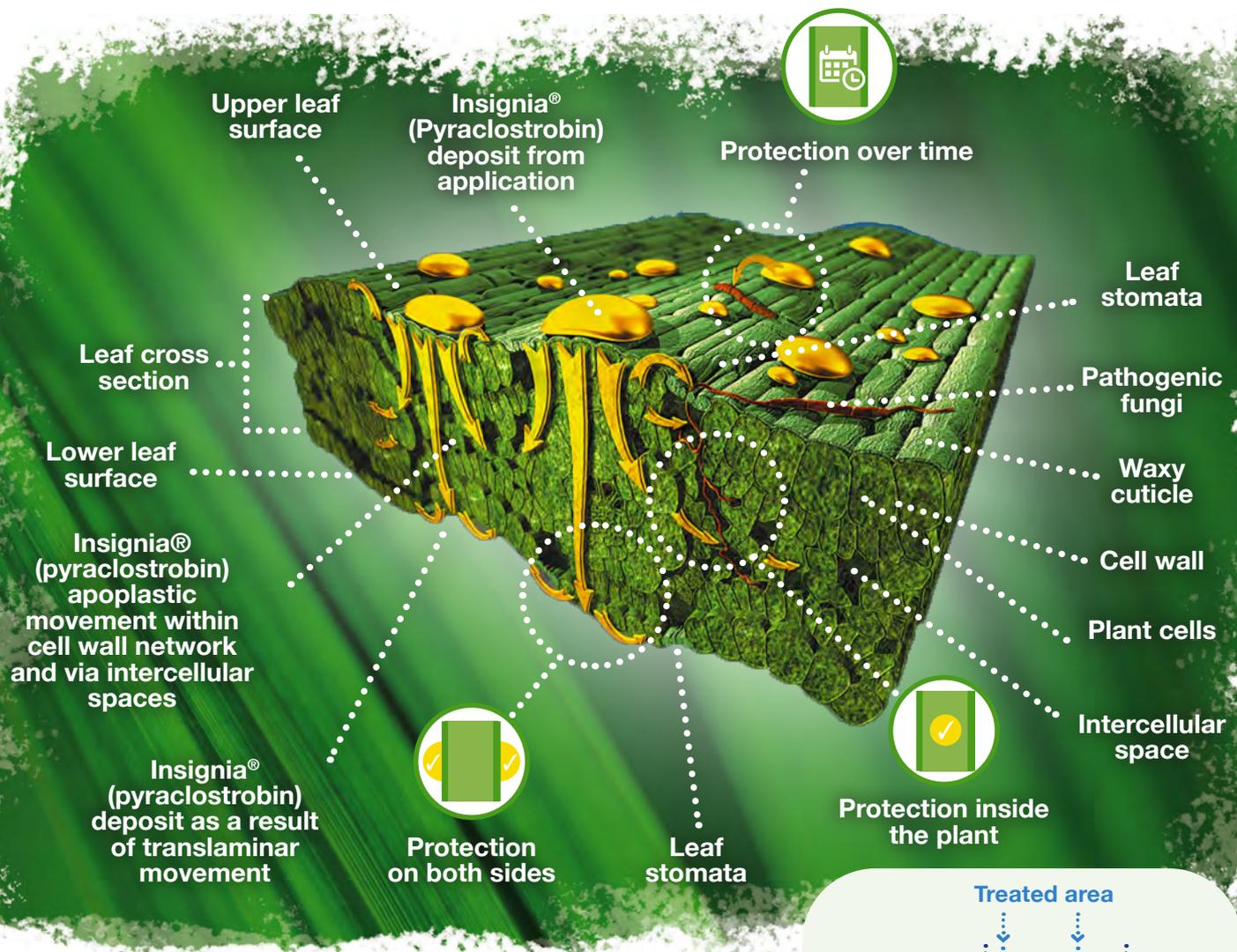
Apoplastic movement among cells

1. The active substance is transported from cell to cell via the apoplastic pathway. This is a continual space located within cell walls which interlinks them, creating a network capable of transporting water and sugars.
2. The active substance works its way through to the opposite face of the leaf via intercellular spaces, which are tiny gaps between the plant cells.



Lipophilic

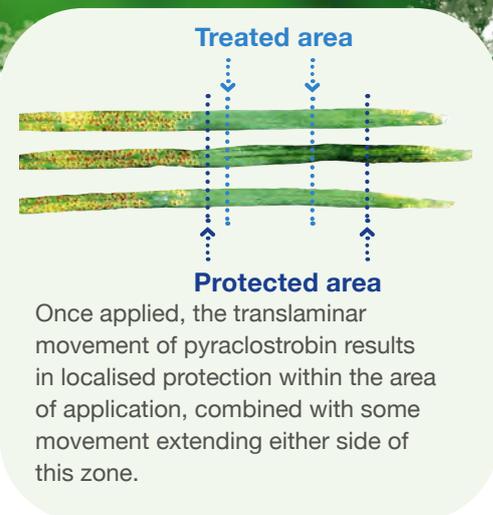
The pyraclostrobin within Insignia® is lipophilic, which means it tends to combine with lipids such as fats, oils and waxes. Consequently, once applied most of the pyraclostrobin is initially held on or within the outermost area of the leaf surface, the waxy cuticle. Following movement through the leaf it will also bind to the waxy cuticle on the opposite side of the leaf.



Advantages of a local penetrant fungicide

The pyraclostrobin within Insignia® is a local penetrant fungicide, with translaminar movement through the plant and apoplastic movement between plant cells.

These characteristics provide Insignia® with key advantages for a turf manager seeking to protect their grass plant from fungal pathogens. Understanding and thinking about these mechanisms and their advantages, allows the skilled turf manager to apply an active substance to the best effect.



Protection inside the plant

Because a local penetrant translaminar fungicide, such as pyraclostrobin, passes from one side of the leaf to the other, fungitoxic concentrations of the substance within the leaf restrict growth of fungal pathogens inside the plant.



Protection on both sides

Translaminar movement through the leaf builds a concentration of the active substance on the opposite side of the leaf. Suppressing existing infections beneath the site of fungicide application.



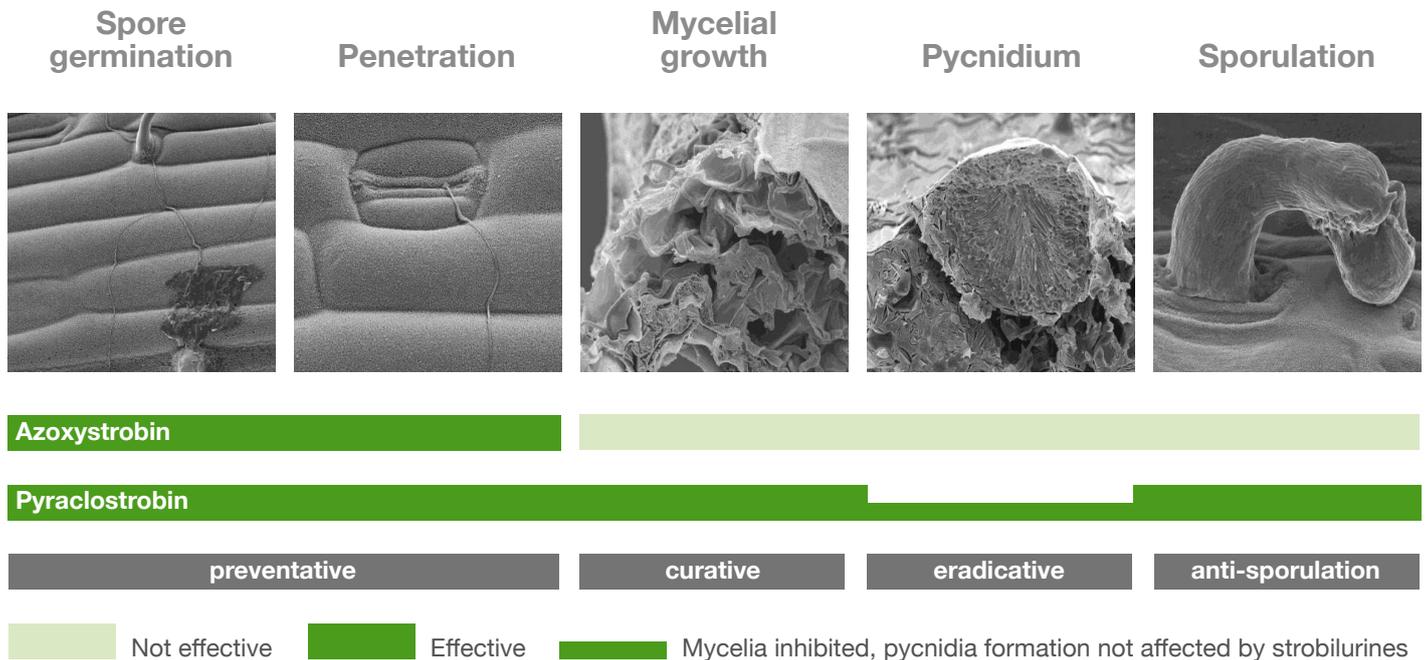
Protection over time

Pyraclostrobin's affinity for lipids in the waxy cuticle, allows deposits of the active substance which are accumulated on both side of the leaf blade surface to be retained over time.

These accumulated deposits serve as a weather resistant reservoir, releasing active substance both across the leaf surface and into deeper tissues over several weeks. Thereby protecting leaves and roots against new infections.

Stages of control

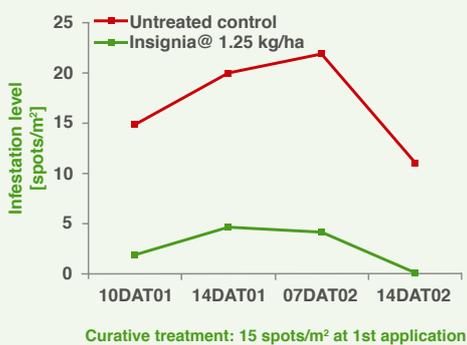
Pyraclostrobin targets more stages of a fungal pathogen's life cycle than other strobilurin fungicides, such as azoxystrobin.



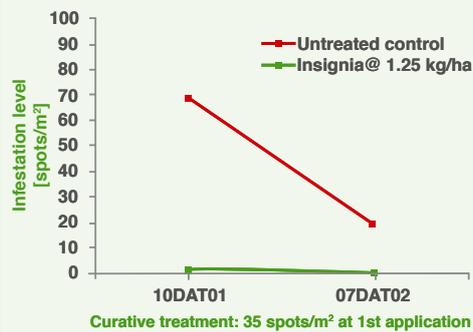
Fungicide performance

BASF trials have demonstrated that Insignia® has a curative effect towards diseases on turf grass.

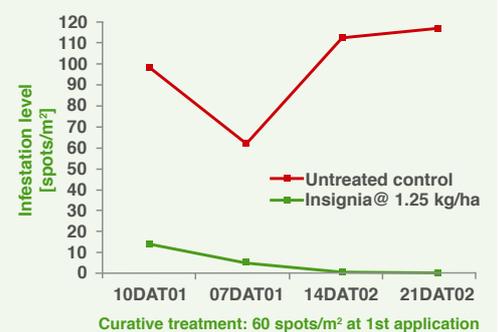
Efficacy of curative treatment against red thread (*Laetisaria fuciformis*) infestation level.



Efficacy of curative treatment against microdochium patch (*Microdochium nivale*) infestation level.



Efficacy of curative treatment against dollar spot (*Clariireedia homoeocarpa*) infestation level.

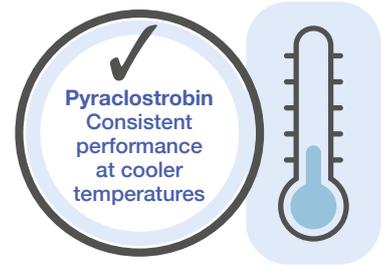


Insignia® application

Obtaining the best results from any Plant Protection Product is enhanced by skilled application, with well calibrated equipment and correct nozzle choices. It is also important to consider the prevailing climate conditions and current stage of disease expression.

By understanding how an active substance functions both inside the plant and against the target pathogen, a turf manager is empowered with the knowledge and ability to obtain the best levels of performance and control.

- The pyraclostrobin within Insignia® performs consistently at cooler temperatures
- Insignia® is suitable for application all year round in temperatures between 5-25°C
- Insignia® is rain fast within 1 hour of application
- Avoid application 48 hours prior to or immediately after mowing



| Pack size | Maximum individual dose | Minimum water volume | Insignia® is best applied at the start of disease attack. |
|---------------------------------|-------------------------|----------------------|---|
| 250 g | 1.25 kg/ha | 200 l/ha | |
| Maximum applications per year | 2.5 kg/ha | | |
| Maximum total dose per year | 2 | | |
| Handheld sprayer | Yes | | |
| Mounted or trailed boom sprayer | Yes | | |

| J | F | M | A | M | J | J | A | S | O | N | D | Insignia® is authorised for a maximum of two applications in one year. |
|---|---|---|---|---|---|---|---|---|---|---|---|--|
| ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | |

For full guidance on the application requirements for Plant Protection Products always consult the product label, product authorisation notice and the Code of Practice for Using Plant Protection Products. Or contact your Agrovista Amenity Specialist directly.

Resistance management

Like all other strobilurin fungicides, pyraclostrobin affects a single site within the fungi. As with any chemical control, resistance can occur as target species adapt over time. In an unrestricted use pattern, resistance risk for strobilurin fungicides is classified as moderate for all diseases.

Consideration and actions, that are aligned with best practice guidance for reducing the risk of resistance, help to mitigate such risks and ensure the sustainability of the active substance for use.

- Apply early in the development of fungal pathogens
- Do not use consecutive applications of QoI fungicides
- FRAC (Fungicide Resistance Action Committee) classify strobilurin fungicides within code 11
- Consider use in conjunction with active substances, selected from another FRAC code
- FRAC recommends all fungicides should be applied as part of a fungicide management plan which alternately rotates applications through different mode of action codes. This reduces the likelihood of resistance occurring because fungicides in each code will affect different sites within the fungi.

For full guidance and support on resistance management visit: <https://www.frac.info/frac-teams/working-groups/qol-fungicides/recommendations-for-qoi> or consult your Agrovista Amenity Specialist directly.

The Intrinsic® effect – strengthening turf from the inside out.

As part of the Intrinsic® family of BASF fungicides, Insignia® delivers additional benefits to the grass plant over and above direct disease control.

- As a fungicide, the pyraclostrobin within Insignia® severely inhibits mitochondrial respiration inside the cells of pathogenic fungi. This prevents the breakdown of carbon that is required for fungi to produce the energy they need to function.
- In addition to the fungicidal properties, pyraclostrobin actively works beneficially within the grass plant, whereby a minor inhibition of mitochondrial respiration triggers a cascade of positive events which lead to plant health benefits.



These benefits are an intrinsic aspect of the way in which pyraclostrobin and Insignia® positively impact the reorganisation of metabolic and physiological plant processes.

In addition to directly controlling fungal pathogens, the Intrinsic® effect from Insignia® helps plants to:

- Resist disease attacks
- Withstand abiotic environmental and physical stress
- Grow more efficiently

How the Intrinsic® effect works to benefit grass plants (diagram opposite)

1 Minor decreases in cellular mitochondrial respiration frees up carbon, leading to a net increase in photosynthesis, which further leads to an increase in sugars. These sugars are then available to combine with nitrogen to increase growth efficiency.

2 Decreases in cellular mitochondrial respiration reduce levels of a compound called adenosine triphosphate (ATP), which provides energy to cells.

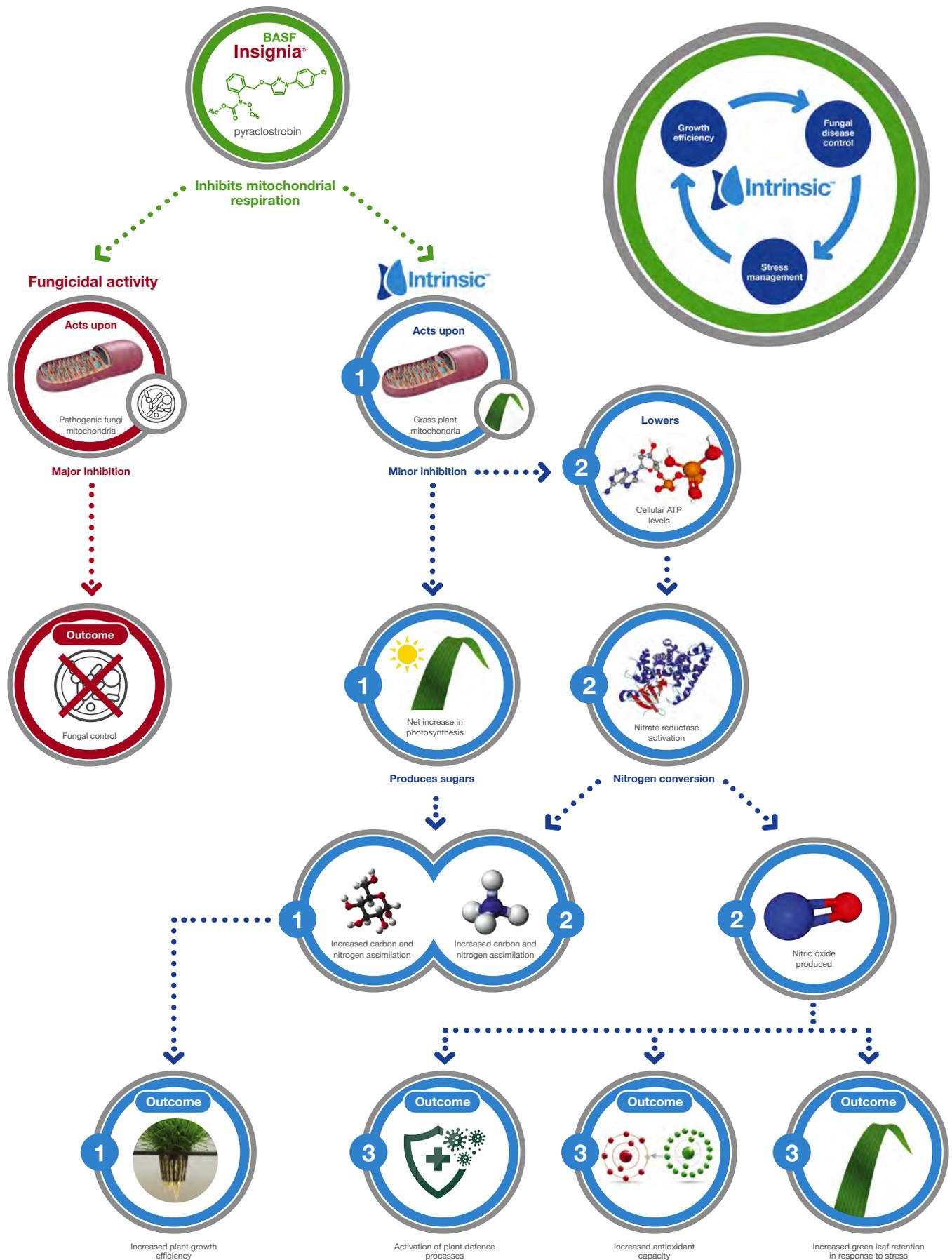
The grass plant responds to this trigger by increasing the activity of an enzyme called nitrate reductase.

- Nitrate reductase is the key enzyme for nitrogen assimilation in plant cells. The assimilated nitrogen is then available for numerous plant metabolic processes.
- Nitrate reductase is vital for the manufacturing of nitric oxide in plants.

3 Nitric oxide regulates plant growth and plays a key role in plants resistance to biotic (pathogen) and abiotic (environmental) stresses.

Nitric oxide performs these tasks by serving as a signalling molecule, activating metabolic pathways and processes. For example, the synthesis of antioxidant substances which reduce programmed cell death (PCD) or the priming of cellular protein changes. The activation of these metabolic pathways helps the plant to respond to stress.



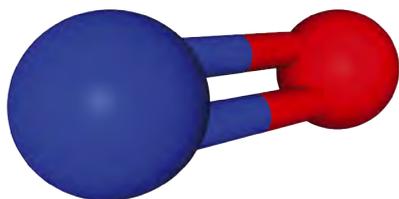


This cascade of beneficial processes allows Insignia® to provide grass plants and therefore turf managers, with additional benefits over and above classical fungicide performance. Insignia® will:

- Prime the turf immune system before a stress event
- Help grass plants regulate beneficial responses during a stress event
- Promote rapid recovery from a stress event through root system retention

Science and trials underpinning the Intrinsic® effect

Stress management



Nitric oxide

Process

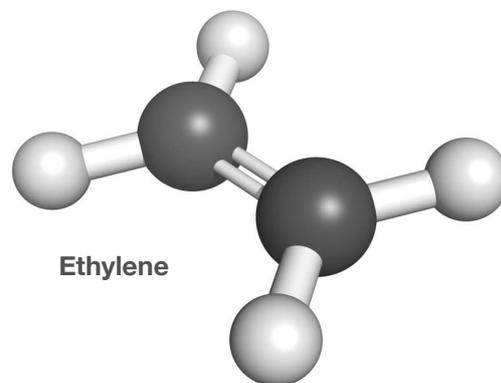
As well as enhancing nitrogen use efficiency, the activation of nitrate reductase also leads to an elevated concentration of nitric oxide (NO) within the plant.

Elevated levels of nitric oxide within plants act as a biological messenger, delivering a priming signal which triggers natural plant defence mechanisms against disease.

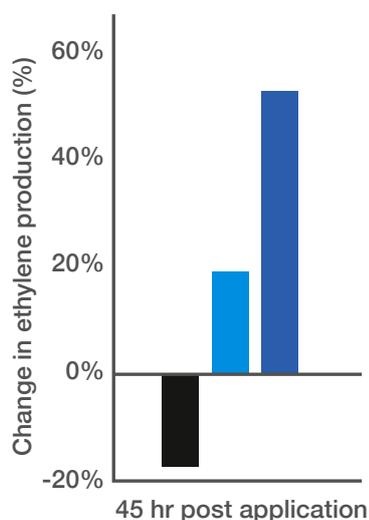
Nitric oxide inhibits the enzymes involved in the production of ethylene, a plant hormone involved in responses to drought, injury, and pathogen triggered cell death such as leaf loss.

Beneficial outcome

Inhibiting ethylene production counteracts stress related aging effects within the plant. As a result, increased green leaf retention causes increased chlorophyll levels within leaves, greater light absorption, prolonged carbon-dioxide assimilation and enhanced energy metabolisation.



Ethylene



In vivo studies on wheat grass plants by BASF Global Research in 2001 demonstrated a 33% and 67% reduced ethylene production compared to strobilurin standards 45 h after pyraclostrobin application.

■ Strobilurin 1 ■ Strobilurin 2 ■ Pyraclostrobin

Root growth efficiency

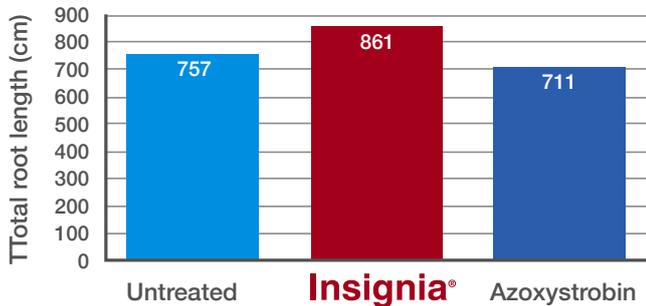
Process

Upregulated photosynthesis as a result of minor inhibition of mitochondrial cell respiration leads to an increase in carbon within the plant. When this is combined with the increased availability of nitrogen, thanks to elevated levels of nitrate reductase, the result is enhanced growth efficiency.

When this occurs alongside inhibition of the stress related aging responses caused by the hormone ethylene, the plant can maintain growth function and mount positive stress responses.

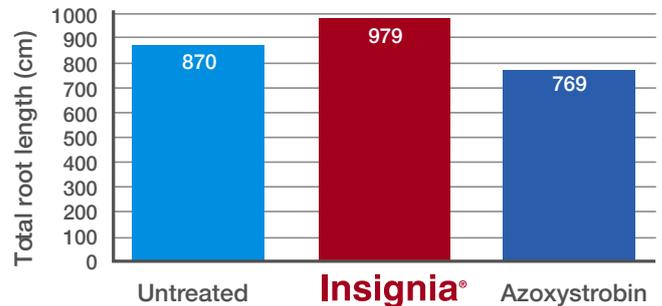
Beneficial outcome

Insignia® increases creeping bentgrass rooting in both a light and frequent watering regime, and a deep and infrequent watering regime. This demonstrates that insignia increases rooting both under ideal moisture conditions and when turf becomes drought-induced, enabling a faster recovery from and resistance to the effect of drought induced leaf wilt.



A. Light and frequent watering regime

Replacing 100% of daily evapotranspiration



B. Deep and infrequent watering regime

Irrigating to 300 mm depth at leaf wilt



Semi-controlled environment trials on four varieties of creeping bentgrass have been conducted by BASF at five United States universities. Application of Insignia increased the total length of the entire root system in comparison to both an untreated control and to an alternative strobilurin fungicide, azoxystrobin. The improvement was apparent in both a light and frequent watering regime and in a deep and infrequent watering regime.



Insignia® as a fungicide

Classical broad spectrum control due to major inhibition of mitochondrial respiration within the pathogen.

- Preventative and curative action
- Targets more states of a fungal pathogen's life cycle than other strobilurin fungicides
- Advantages of the local penetrant:
 - Protection inside the plant
 - Protection on both leaf surfaces
 - Protection over time
- The pyraclostrobin within Insignia® performs consistently at cooler temperatures
- Insignia® is suitable for application all year round in temperatures between 5-25 °C
- Insignia® is rain fast within 1 hour of application

The Intrinsic® effect

Delivers additional benefits to the grass plant over and above direct disease control.

The Intrinsic effect from Insignia® helps plants to:

- Resist disease attacks
- Withstand abiotic environmental and physical stress
- Grow more efficiently

This is due to minor inhibition of mitochondrial respiration within the plant, leading to:

- Increased net photosynthesis
- Extra carbon available for metabolic processes
- Enhanced nitrogen utilisation
- Activation of plant defence priming signals
- Inhibition of stress related cellular ageing hormones



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