Managing the risk of resistant diseases requires a range of strategies.

1. Identify diseases and monitor their control.
   - Make sure the fungicide selected controls the associated pathogen.
   - Monitor to assess control results. Look for loss of control as a possible sign of resistance.

2. Rotate the use of fungicides from different Groups.
   - Rotate fungicides that use different modes of action and target the same pathogen.

3. Apply fungicides that use multiple modes of action.
   - The chance of two resistant mutations occurring simultaneously in a host crop population is approximately one million times less than a single mutation occurring.

4. Follow the manufacturer’s application recommendations.
   - Apply the fungicide at its recommended rate and the right stage and limit the number of applications to what’s recommended on the label.

5. Avoid eradicant use; apply the fungicide preventatively when needed.
   - Using fungicides to cure visible infections may increase the selection of existing, resistant spores.
   - Apply treatments preventatively when symptoms appear, when there is a high disease risk.

6. Implement an integrated disease management plan.
   - Rotate to other crops that do not host the same disease.
   - Use disease-resistant crop varieties.
   - Minimize crop residue and host weeds that can harbor pathogens.
   - Keep equipment clean to help reduce spread.

Fungicides and resistant diseases

Fungicides are central to protecting crops from disease. Maintaining their usefulness as a tool requires an understanding of resistance and how to minimize its risk.

Fungicide treatments are, and will remain, essential for maintaining healthy crops and reliable, high-quality yields. They form a key component of integrated crop management, and their effectiveness must be sustained as long as possible.

BASF Resistance Action Committee CropLife International

Fungicides target specific sites within a fungal pathogen to prevent it from causing disease in a host crop. Within a fungal population, mutations that are insensitive can be selected through repeated use of the same fungicide. This can result in a build-up of resistance and loss of control for that disease by that fungicide in that crop.

However, they differ in one important aspect. Unlike resistant weeds, resistant disease pathogens have no selection risk during a cereal cropping year. In this sense, crop rotation in addition to proper fungicide management and use is a great tool to help mitigate the risk of resistance for diseases.

Resistant populations can be selected over time

The selection mechanism for fungicide resistance and herbicide resistance are basically the same. In both cases resistant populations are selected for by repeated use of the same mode of action, whether it’s a fungicide or a herbicide.

However, they differ in one important aspect. Unlike resistant weeds, resistant disease pathogens are closely linked to a specific host crop. To have a selection pressure for fungicide resistance, the right environment, disease, and host crop must be present in order to have a selection pressure for a specific disease.

A pathogen whose host is a pulse crop often will not infect a cereal crop and thus has no selection risk during a cereal cropping year. In this sense, crop rotation in addition to proper fungicide management and use is a great tool to help mitigate the risk of resistance for diseases.

BASF is committed to conserving fungicide efficacy

As the leader in fungicides in Canada, BASF is committed to managing the risk of resistant diseases and preserving the effectiveness of fungicides. We continually innovate in collaboration with new active ingredients and unique multi-mode-of-action fungicide products. Our approach is to rotate fungicide modes of action to ensure the most out of every acre both now and in the future, while respecting the diversity of the environment in which they are used.

How does crop rotation help?

The application of a particular mode of action in successive years has a lower risk for developing resistance if you rotate and the disease is not hosted in the follow crop. For example, diseases controlled by Headline® fungicide in canola would not be present if you rotate into cereal. So you could spray Headline in two successive years and not have selection pressure for resistance.

Why are multiple modes of action recommended?

The use of MMOA fungicides works two ways. When more than one mode is active on a single target disease, protection is increased. Plus, there is a lower risk of fungicide resistance development when both active ingredients have activity on the same target disease. If the disease has some resistance to one active ingredient, the second will control it.

Is there a risk when applying the same active at different crop stages?

For the same crop at different application timings (such as Insure® cereal fungicide seed treatment followed by Twinline® fungicide in canola), where both products contain multiple modes of action with an overlapping disease control spectrum there is a MMOA benefit. In addition target diseases during seeding are at a different life cycle development and disease stage, so often there is limited risk of selection for resistance between the two timings. Concerns may be higher if using solo active ingredients at each timing only.

Answering your questions about AgCelence brand fungicides and resistance

AgCelence® Cereal fungicide seed treatment

Crop: cereals

Staging: applied standard stubby, granul type or mist-type seed treatment

Insure® Cereal fungicide seed treatment

Crop: cereals

Staging: applied standard stubby or mist-type seed treatment

Insure® Pulse fungicide seed treatment

Crop: cereals

Staging: early flower or onset of symptoms

Priabox fungicide

Crop: cereals

Staging: early to late flower or prior to disease development

Twinline® fungicide

Crop: cereals

Staging: flag leaf

Lance AG fungicide

Crop: cereals

Staging: prior to onset of disease and canopy closure

AgCelence benefits refer to products that contain the active ingredient pyraclostrobin.

All comparisons are to untreated, unless otherwise stated.
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   - Make sure the fungicide selected controls the associated pathogen.
   - Monitor to assess control results. Look for loss of control as a possible sign of resistance.

2. Rotate the use of fungicides from different Groups.
   - Rotate fungicides that use different modes of action and target the same pathogen.

3. Apply fungicides that use multiple modes of action.
   - The chance of two resistant mutations occurring simultaneously in a host crop population is approximately one million times less than a single mutation occurring.

4. Follow the manufacturer’s application recommendations.
   - Apply the fungicide at its recommended rate and the right stage and limit the number of applications to what’s recommended on the label.

5. Avoid eradicant use; apply the fungicide preventatively when needed.
   - Using fungicides to cure visible infections may increase the selection of existing, resistant spores.
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Learn more about AgCelence fungicides by visiting agsolutions.ca/agcelence or calling AgSolutions® Customer Care at 1-877-371-BASF (2273).
Fungicides and resistant diseases

Fungicides are central to protecting crops from disease. Maintaining their usefulness as a tool requires an understanding of resistance and how to minimize its risk. Fungicide treatments are, and will remain, essential for maintaining healthy crops and reliable, high-quality yields. They form a key component of integrated crop management, and their effectiveness must be sustained as long as possible.

Fungicide Resistance Action Committee
Croplife International

Fungicides target specific sites within a fungal pathogen to prevent it from causing disease in a host crop. Within a fungal population, mutations that are insensitive can be selected through repeated use of the same fungicide. This can result in a build-up of resistance and loss of control for that disease by that fungicide.

However, they differ in one important aspect. Unlike resistant weeds, resistant disease pathogens are closely linked to a specific host crop. To have a selection pressure for fungicide resistance, the same fungicide must be used year after year on that specific host crop. This is because disease resistance is transferred vertically from resistant parental strains to their progeny. This is in contrast to herbicide resistance, which can be transferred horizontally between different crops or species.

Resistant populations can be selected over time

The selection mechanism for fungicide resistance and herbicide resistance are basically the same. In both cases, resistant populations are selected for by repeated use of the same mode of action, whether it's a fungicide or a herbicide.

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The difference between fungicide and herbicide resistance

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How does crop rotation help?

The application of a particular mode of action in successive years has a lower risk for developing resistance if you rotate the same fungicide and the disease is not hosted in the follow crop. For example, disease controlled by Headline® fungicide in canola wouldn’t be present if you rotate into canola. So you could spray Headline in two successive years and not have selection pressure for resistance.

Why are multiple modes of action recommended?

The use of MMOA fungicides works two ways. When more than one mode is active on a single target disease, protection is increased. Plus, there is a lower risk of fungicide resistance development when both active ingredients have activity on the same target disease. If the disease has some resistance to one active ingredient, the second will control it.

Is there a risk when applying the same active at different crop stages?

For the same crop at different application timings (such as Headline® fungicide at flag-leaf), when both products contain multiple modes of action with an overlapping disease control spectrum there is a MMOA benefit. In addition target diseases during seeding are at a different life cycle development and life stage, so often there is limited risk of selection for resistance between the two timings. Concerns may be higher if using solo active ingredients at each timing only.

AgCelence brand fungicides and resistance

AgCelence® brand fungicides are the only solutions proven to combine premium disease control with a unique ability to deliver additional benefits**, including increased growth efficiency and better management of minor stress resulting in larger, greener, stronger plants with increased yield potential.2

**AgCelence benefits refer to products that contain the active ingredient pyraclostrobin.

Fungicide solutions

Answering your questions about AgCelence brand fungicides and resistance

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**Answering your questions about AgCelence brand fungicides and resistance**

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**Is there a risk when applying the same active at different crop stages?**

For the same crop at different application timings (such as the same active ingredient, the second will control it. If the disease has some resistance to one mode is active on a single target disease, protection is increased. Plus, there is a lower risk of fungicide resistance development when both active ingredients have activity on the same target disease. If the disease has some resistance to one active ingredient, the second will control it.

**The difference between fungicide and herbicide resistance**

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Glenn Forster
Technical Marketing Specialist, BASF Canada
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Sources: Guide to Field Crop Protection of 2015, Manitoba Agriculture, Food and Rural Development.

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REDDUCING THE RISK OF RESISTANT DISEASE DEVELOPMENT
Recommended Management Strategies