

# Chemical protection in winter wheat for the control of major fungal pathogens

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## Summary

The control of fungal phytopathogens in wheat cultivation is essential for achieving high and stable yields. The application of agronomic methods and the use of resistant varieties to protect plants from diseases is in many cases insufficient, making it necessary to use various fungicides. The correct choice of product, rate and timing of application has a significant impact on the control of pathogens.

Diseases in wheat are one of the main factors for obtaining high and stable yields. Wheat production in our country is annually accompanied by various types of diseases that have a major impact on yield. Viral and

bacterial diseases develop relatively rarely in the country and do not lead to yield reduction beyond economically acceptable levels.



### *Powdery mildew and brown rust*

Fungal diseases such as the different types of rusts, septoria leaf blotch, powdery mildew and fusarium play a major role. Their control is carried out by various methods – immunoselection, agronomic practices and chemical protection. Immunoselection is related to the use of resistant varieties in production that provide protection against a given phytopathogen. The agronomic method involves a number of measures aimed at limiting the spread of diseases through appropriate crop rotation, destruction of plant residues, volunteers, alternate hosts of the pathogens, balanced fertilization, etc. The chemical method of control uses various types of chemical products called fungicides.



## *Brown rust*

In this publication, attention will be paid to some active substances contained in commercial products that are used to control the main fungal pathogens in wheat. The wheat growth stage at which the active substance is applied and the rate must comply with the recommendations of the commercial manufacturer of the product.

## **Azoxystrobin**

Commercial products with the active substance azoxystrobin are selective with broad-spectrum and systemic action against the main fungal pathogens in wheat. The active substance belongs to the group of strobilurins and acts as an inhibitor of mitochondrial respiration by binding to the Q<sub>0</sub> site of cytochrome b, disrupting the energy cycle in the fungal pathogen and thereby affecting the growth of mycelium and spores. It is distributed translaminarily in the plant. It has preventive and curative action.

Disease: brown rust, powdery mildew and early leaf blight

Application: Twice at 14-day intervals from the beginning of stem elongation to the end of flowering of the crop

Tank-mix compatibility with other products: Yes

The use of an active substance from the strobilurin group is not recommended in the following vegetation period.

## Metconazole

It has systemic action. It inhibits ergosterol biosynthesis and destroys the pathogen's cells, thus stopping its development.



### *Yellow rust*

Disease: brown rust, yellow rust, black rust, powdery mildew, septoria leaf blotch

Application: beginning of stem elongation – end of heading

Tank-mix compatibility with other products: It can be mixed with most herbicides, insecticides and foliar fertilizers used in practice, but before use it is advisable to carry out a compatibility test.

### **Metrafenone**

It has systemic, preventive and curative action. The active substance belongs to the benzophenone group. It acts on different stages of the life cycle of fungal pathogens. It reduces the rate of spore germination. It causes deformation of the mycelial hyphae that are already present in the plant tissues.

Disease: powdery mildew, parasitic lodging

Application: from tillering to the end of flowering

Tank-mix compatibility with other products: Yes

### **Mefentrifluconazole**

The active substance has systemic action. It belongs to the group of sterol biosynthesis inhibitors (SBI) and the subgroup of demethylation inhibitors (DMI). It moves systemically in plant tissues and, upon reaching the pathogen, blocks its biochemical processes and in particular ergosterol biosynthesis. The result is inhibition of growth and destruction of the cell membrane. Mefentrifluconazole has the ability to adapt and act even against resistant forms of diseases.

Disease: brown rust, yellow rust, early leaf blight

Application: from the beginning of stem elongation to the end of flowering stage

Tank-mix compatibility with other products: Yes

### **Tebuconazole**

The active substance is one of the most widely used in commercial products worldwide on many crops for the control of a broad spectrum of diseases. It is characterized by preventive and curative action. The active substance suppresses ergosterol biosynthesis in the membrane of the fungal cell (DMI), thereby preventing the development of the pathogen's mycelium.

Disease: powdery mildew and rust species

Application: 1st application – from flag leaf to the end of heading; 2nd application – from flowering to late milk ripeness

Tank-mix compatibility with other products: Yes

A large proportion of commercial products contain more than one active substance for the control of wheat diseases. Below are listed various combinations of active ingredients.

## **Bixafen + Prothioconazole**

Commercial products with these active substances are systemic fungicides with a broad spectrum of action.

Bixafen belongs to the group of carboxamides, and prothioconazole belongs to the triazoles.

Disease: septoria, powdery mildew, brown rust, yellow rust, leaf blight, fusarium head blight

Application: from the beginning of stem elongation to the end of flowering stage

Tank-mix compatibility with other products: It must not be mixed with organophosphorus insecticides.

## **Bixafen + Tebuconazole**

Broad-spectrum, systemic. Bixafen belongs to the newest group of active substances – carboxamides (pyrazole-carboxamides subgroup) and inhibits the activity of enzymes from complex II in the mitochondrial respiratory chain of fungi. Tebuconazole is from the group of azole fungicides and its function is to interrupt ergosterol biosynthesis in fungi. The active ingredients act preventively by hindering the development of fungal spores and curatively by blocking existing latent infections in crops and preventing their further development and spread.



*Black rust*

Disease: early leaf blight, powdery mildew, brown rust, black rust, leaf blight, fusarium head blight

Tank-mix compatibility with other products: Yes

Application: from the beginning of stem elongation to the end of flowering stage

**Kresoxim-methyl + Mefentrifluconazole**

Kresoxim-methyl is a strobilurin with quasi-systemic action that inhibits mitochondrial respiration in the cells of pathogens. Mefentrifluconazole belongs to the group of sterol biosynthesis inhibitors (SBI) and the subgroup of demethylation inhibitors (DMI). After treatment it moves systemically in plant tissues and, upon reaching the pathogen, blocks its biochemical processes and in particular ergosterol biosynthesis. The result is inhibition of growth and destruction of the cell membrane. Another part of the active substance accumulates under the wax layer of the leaves in the form of reservoirs that remain protected from environmental influences.

Disease: early leaf blight, powdery mildew, brown rust, yellow rust, yellow-brown spots, foot rot

Application: from the beginning of stem elongation to the end of flowering of the crop.

Tank-mix compatibility with other products: Yes

### **Prothioconazole + Proquinazid**

An excellent synergism is observed between the two active substances. Proquinazid has contact and locally systemic action, providing perfect and long-lasting protection. It strengthens the crop's immune defence.

Prothioconazole provides powerful protection through complete systemic action, preventing infections and stopping existing ones.

Disease: early leaf blight, brown rust, yellow rust, powdery mildew, yellow-brown spots, foot rot, fusarium head blight

Application: 5 tillers – full flowering

Tank-mix compatibility with other products: Yes

### **Prothioconazole + Tebuconazole**

The combination of active substances provides preventive, curative and eradicated effect, which makes it suitable for use in various problematic situations.



*Fusarium head blight*

Disease: septoria leaf blotch, brown rust, yellow rust, foot rot, fusarium head blight

Application: from the end of tillering stage to the end of flowering stage

Tank-mix compatibility with other products: Yes

**Fenpicoxamid + Prothioconazole**

The combination of fenpicoxamid and prothioconazole provides preventive, stopping and curative action against all economically important diseases. It is transported translaminarily and acropetally through the plant vessels, ensuring complete absorption and a long period of protection. Fenpicoxamid acts by inhibiting mitochondrial respiration of the pathogen through blocking electron transfer in the respiratory chain.

Disease: powdery mildew, yellow-brown spots, fusarioses, brown rust, yellow rust, snow mould, early leaf blight, glume blotch of the ear

Application: beginning of stem elongation to the end of flowering

Tank-mix compatibility with other products: Yes

### **Fluxapyroxad + Pyraclostrobin**

The combination of the two active ingredients rapidly, effectively and persistently inhibits the development of fungal pathogens, as well as prevents the penetration of germ tubes of disease agents into plant tissues.

Disease: powdery mildew, septoria leaf blotch, brown rust, yellow rust

Application: visible 5 tillers to the end of flowering

Tank-mix compatibility with other products: Yes

### **Prothioconazole + Fluopyram + Bixafen**

The active substances fluopyram (group – pyridylethylamides) and bixafen (group – carboxamides) suppress the activity of enzymes from complex II in the mitochondrial respiratory chain of fungi. They penetrate the plant through the leaves and move systemically via the xylem (acropetally), and also have translaminar properties. Prothioconazole causes morphological and functional changes in the cell membrane of the fungus. The active ingredients have a preventive effect – hindering the development of fungal spores, a curative effect – blocking existing latent infections in crops and preventing their further development and spread, and an eradicated effect.

Disease: early leaf blight, brown rust, yellow rust

Application: From the beginning of stem elongation stage to the beginning of flowering stage

Tank-mix compatibility with other products: Yes

**Prothioconazole + Spiroxamine + Tebuconazole** Systemic, broad-spectrum with preventive, curative and eradicated effect. The active substance spiroxamine is from the spiroketalamine group; it stops sterol biosynthesis in pathogens at two new sites in the chemical chain, improves the absorption of triazoles and their proper distribution in the plant.

Disease: leaf spots, brown rust, yellow rust, powdery mildew, net blotch, snow mould

Application: from the end of tillering stage to the beginning of flowering stage

Tank-mix compatibility with other products: Yes

A common practice is the combination of pesticides for simultaneous control of several types of pests. Their application alone is relatively rare. Mixing achieves greater economic efficiency. The spectrum of action of the applied pesticide products is broadened, for example fungicides with insecticides, herbicides. The fungicide active substances listed above can be mixed with most herbicides and insecticides used in practice, but before use it is advisable to follow the recommendations of the fungicide manufacturer and to carry out a compatibility test. Compatible are those products that do not change the physico-chemical properties of each of them and possess the same biological efficacy as when applied alone, and do not exhibit phytotoxicity on the treated crop. Physical incompatibility is manifested by the formation of sediment or separation of solid particles on the surface.

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