



Fungicide Terminology

The use of foliar-applied fungicides is common in some field crops grown in the north central United States, such as sugarbeet and potato, but it has not been as common in crops such as corn and soybean. With the availability of many new fungicides on the market that provide very good control of many foliar diseases, and the threat of new diseases (i.e., soybean rust), the use of foliar fungicides on crops where foliar fungicides have not been used historically may increase. This publication will help producers understand fungicides and how they affect plant pathogens. Some common terms are defined below.

Fungicide: a chemical agent that kills or inhibits the growth of fungi or fungal-like organisms. Fungicides have at least three names, all of which can be found on the label:

Chemical name: the name of the active ingredient (a.i.) in a fungicide (e.g., methyl (*E*)-2-{2-[6-(2-cyanophenoxy) pyrimidin-4-yloxy] phenyl}-3-methoxyacrylate).

Common name: a less technical name of the active ingredient (e.g., azoxystrobin).

Trade name: the patented name under which a product is commercially available (e.g., Quadris). The active ingredient (the active component of a fungicide) may be marketed under several different trade names.

Classification of Fungicides

Fungicides can be classified a number of different ways, including (1) mobility in the plant, (2) role in protection of plants, (3) breadth of activity, (4) mode of action, (5) chemical group, and (6) Fungicide Resistance Action Committee (FRAC) group.

(1) Mobility in the plant

Contact fungicide: a fungicide that remains on the surface of the plant where it is applied but does not go deeper; these fungicides have no after-infection activity. Repeated applications are needed to protect new growth

Fungicide resistance: the reduction in sensitivity to a fungicide by an individual fungus. Fungicides with single-site modes of action are at relatively high risk for resistance development compared to those with multi-site modes of action.

Cross-resistance: a fungus that becomes resistant to more than one fungicide within a FRAC code.

of the plant and to replace fungicide that has been washed off by rain or irrigation, or degraded by environmental factors such as sunlight.

Systemic fungicide: a fungicide that is absorbed into plant tissue and may offer some after-infection activity. Very few fungicides are truly systemic (i.e., move freely throughout the plant); however, some are *upwardly systemic* (i.e., move only upward in the plant through xylem tissue), and some are *locally systemic* (i.e., move into treated leaves and redistribute to some degree within the treated portion of the plant).

(2) Role in protection (some fungicides can fall into more than one of these categories)

Preventative activity: occurs when a fungicide is present on the plant as a protective barrier before the pathogen arrives or begins to develop, that is, the fungicide prevents infection from occurring (also referred to as a protective activity).

Early-infection activity: occurs when the active ingredient of a fungicide can penetrate the plant and stop the pathogen in the plant tissues, usually most effective 24 to 72 hours after infection occurs, depending on the fungicide. This type of activity is sometimes referred to as “curative” or “kickback” activity. Most fungicides that have early-infection activity also have preventative activity and are most effective when applied before infection occurs.

Anti-sporulant activity: an ability to prevent spores from being produced. In this case, disease continues to develop (e.g., lesions continue to expand), but spores are not produced or released, so the amount of inoculum available to infect surrounding plants is reduced.

(3) Breadth of metabolic activity

Single-site fungicide: fungicide active against only one point or function in one of the metabolic pathways of a fungus or against a single critical enzyme or protein needed by the fungus. These fungicides tend to have systemic properties.

Multi-site fungicide: fungicide that affects a number of different metabolic sites within the fungus.

(4) Mode of action

Mode of action: how a fungicide kills or suppresses a target fungus, which is the specific biochemical process of the target fungus that is affected by a fungicide. Examples are damaging cell membranes, inactivating critical enzymes or proteins, or interfering with key processes such as energy production or respiration.

(5) Chemical group or class

Chemical group or class: the name given to a group of chemicals that share a common biochemical mode of action and may or may not have similar chemical structure. Fungicides approved for use on field crops fall into different chemical groups.

Examples of field crop fungicides that vary in classification.

Trade name	Headline	ProLine	Manzate, Dithane, and Penncozeb
Active ingredient	pyraclostrobin	prothioconazole	mancozeb
Mode of action	Quinone outside inhibitor (QoI)	Demethylation inhibitor (DMI)	Multi-site contact activity
Chemical group or class	Strobilurin	Triazole	Dithiocarbamates
Mobility in plant	Locally systemic	Upwardly systemic	Contact
Role in protection	Protectant	Protectant and early-infection	Protectant
Breadth of activity	Single-site	Single-site	Multi-site
FRAC Code	11	3	M

(6) FRAC code

An organization known as FRAC was developed to address the issue of fungicide resistance. This organization developed a code of numbers and letters that can be used to distinguish the different groups based on the mode of action. This code is known as the FRAC code. A detailed description of this code is provided later in this publication.