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Fungicides: Fungicide resistance and the FRAC code

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Abstract
Fungicides that may become an integral part of soybean production are already used in corn and small grain production under certain situations. Since fungal pathogens are often highly variable and may be able to adapt to repeated fungicide sprays, resistance management may become an issue. It is important to protect effective groups of fungicides because resistance may lead to unexpected and costly crop losses to growers, and loss of a valuable product.

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Plant Diseases

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by Daren Mueller, Department of Plant Pathology

Fifth in a series

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Imagine a group of old men rocking on the front porch reminiscing about days gone by and solving today's problems. One mumbles, "fungicide resistance, eh, they just don't make 'em like they used to . . . why back in my day . . ." And he's right.

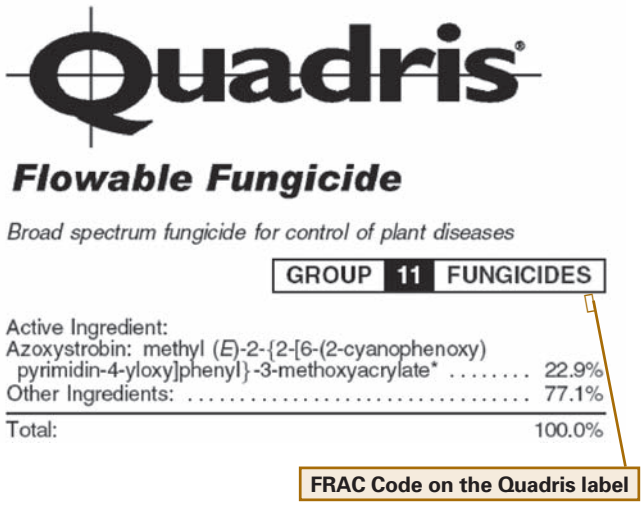
The first fungicides were sulfur and copper based. Mercury fungicides were developed in the early 1900s and were widely used until it was discovered that they were highly toxic to animals. In the 1940s and '50s, fungicides like Captan® and Maneb® were introduced. All of these fungicides are contact fungicides and only work if applied prior to infection. These older fungicides have another important characteristic: they affect a number of different metabolic sites within the fungus so fungicide resistance has never been a concern.

More recently, highly effective compounds like the triazoles and QoI fungicides (e.g., strobilurins) with specific modes of action have been developed. In other words, these fungicides affect one specific site in one metabolic pathway of the fungus. The exactness of the action of these products means that fungi only have one barrier to overcome. Thus, the problem of fungicide resistance has occurred and is on the increase since growers have relied more and more on these newer fungicides. So, although QoI and triazole fungicides represent marked improvements in performance, including systemic and therapeutic properties, these compounds are prone to resistance because of their specific mode of action.

The Fungicide Resistance Action Committee (FRAC) is a group of professionals whose goal is to provide fungicide resistance management guidelines to prolong the effectiveness of these "at risk" fungicides and to limit crop losses should resistance occur. When growers need to repeatedly spray fungicides to manage a fungal problem, it is best to use fungicides that have different modes of action. The FRAC code helps identify fungicides by their mode of action and informs if they should be used in consecutive sprays.

How do I use the FRAC code?

The FRAC code represents the mode of action of the fungicide. For fungicide resistance management, do not tank mix or alternate fungicides with the same FRAC number in a spray program. Some fungicides are labeled "M," which means that the fungicide acts upon multiple sites and resistance risk is low.



FRAC code for foliar fungicides labeled (or potentially labeled) for use on field crops in Iowa

Chemical Group	Common Name	Crop	FRAC Code
Benzimidazole	thiophanate-methyl	soybean	1
Demethylation Inhibitors (triazoles)	cyproconazole	soybean	3
	flusilazole	soybean	
	flutriafol	soybean	
	metconazole	soybean	
	myclobutanil	soybean	
	propiconazole	soybean	
	prothioconazole	soybean, corn, small grains	
	tebuconazole	soybean	
	tetraconazole	soybean	
QoI fungicides (strobilurin)	azoxystrobin	soybean, corn	11
	pyraclostrobin	soybean, small grains	
	trifloxystrobin	soybean, corn, small grains	
	famoxadone	soybean	
Multi-site contact activity	chlorothalonil	soybean	M
	mancozeb	corn, small grains	
	copper	small grains	
	sulfur	small grains	

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Crop Production

What's the yield effect of uneven corn heights?

by Roger Elmore and Lori Abendroth, Department of Agronomy

Many corn fields across Iowa had significant variation in plant emergence and early-season growth within fields. Uneven emergence and plant heights are caused by several factors, including variation in soil temperature, seeding depth, residue distribution, soil crusting, and soil moisture, etc. Iowa producers dealt specifically with variable soil temperatures this year, which have now caused variable plant heights and vigor. How much can plant height vary before it causes a real yield loss? And based on this, should we have replanted more? Four percent of Iowa's corn acreage was replanted this year (*National Agricultural Statistics Service [NASS]*, 5 June 2006).

In general, non-uniform stands result in lower yields because the smaller, late-emerging plants cannot capture enough sunlight. Unfortunately, the yield loss from the "late" plants is not made up by the "normal" plants.

Uneven corn found June 1, 2006, at Northeast Iowa Research and Demonstration Farm. ***(Lori Abendroth)***