Fungicide Resistance Management Guidelines for Vegetable Crops Grown in the mid-Atlantic region - 2012

C. Andrew Wyenandt
Extension Vegetable Pathologist
Rutgers University

Robert P. Mulrooney
Extension Plant Pathologist
University of Delaware

Kathryne L. Everts
Extension Vegetable Pathologist
University of Maryland

Steven L. Rideout
Extension Vegetable Pathologist
Virginia Tech

Beth K. Gugino
Extension Vegetable Pathologist
Penn State
Mission of the Center

The Northeastern Integrated Pest Management Center fosters the development and adoption of IPM, a science-based approach to managing pests in ways that generate economic, environmental, and human health benefits. The Center works in partnership with stakeholders from agricultural, urban, and rural settings to identify and address regional priorities for research, education, and outreach.
Introduction

We are happy to distribute the 6th Edition of this guide. Since 2007, over 10,000 FRAC guides have been distributed in the mid-Atlantic and surrounding region representing over 100,000 A of vegetable production.

In the mid-Atlantic region (NJ, MD, VA, DE, PA) of the United States approximately 221,000 A of fresh-market and processing vegetable crops are grown each year. Over the past decade, a number of new fungicide chemistries for use in vegetable production have been released in the United States. Many of these fungicides have specific modes-of-action (MOA) that target pathogen development at a single site. Fungicides with a single-site MOA are often considered at- or high-risk fungicides because the chances for fungal resistance to develop are much higher than fungicides with multiple MOA’s. In recent years, fungicide resistance has developed in important diseases such as powdery mildew in cucurbits and phytophthora in pepper.

About FRAC

In 2002, the NA-FRAC (North American Fungicide Resistance Action Committee) was established to i) coordinate and identify resources for contact between government, universities, and the public on fungicide resistance management issues, ii) assist in the creation of new working groups in North America for other areas of chemistry, as they are needed and iii) serve as a spokesman for the industry view on fungicide resistance management issues by providing an outlet for comments and position papers from members. Each year the FRAC group publishes a list of FRAC codes for most fungicides and fungicide chemistries. FRAC codes group fungicide chemistries according to class, mode-of-action and resistance-risk.

To date, there are 49 FRAC groups for ~ 98 listed chemical groups within the FRAC code system. Accordingly, fungicides listed within a given FRAC code share a similar mode-of-action, therefore, may have i) similar risks for resistance development, ii) similar use patterns on multiple crops and iii) exhibit the potential for cross-resistance development.

The purpose of this guide is to i) promote the importance and understanding of FRAC codes in fungicide resistance management ii) prevent the misuse of specific fungicides with a high-risk for resistance development and iii) provide the tools and knowledge to allow growers to develop vegetable disease control programs with an emphasis towards fungicide resistance management.

This guide should be used as a supplement to the 2012 Commercial Vegetable Productions Recommendations Guide for the mid-Atlantic region to help make decisions on vegetable disease control and fungicide resistance management. All fungicide application rates for chemicals listed in this guide are found in the 2012 Commercial Vegetable Productions Recommendations Guide for your state.

DISCLAIMER: The fungicide label is a legal-binding contract between the user and the manufacturer. The user must follow all rates and restrictions as per label directions.

Trade or Brand Names Disclaimer:
The trade or brand names given herein are supplied with the understanding that no discrimination is intended and no endorsement by the Rutgers Cooperative Extension is implied. Furthermore, in some instances the same compound may be sold under different names, which may vary as to label clearances.
How to use this fungicide resistance management guide

This guide contains FRAC tables for the crop groups listed in the 2012 Commercial Vegetable Productions Recommendations Guide for the mid-Atlantic region. Each FRAC table lists all fungicides currently recommended for a particular crop (or crop group) in the 2012 recommendations guides for NJ, DE, MD, VA and PA along with FRAC and risk management codes, diseases for that particular crop or crop group and fungicide resistance management guidelines for each particular FRAC code. For example, in guidelines for pumpkin and winter squash crops grown in the mid-Atlantic region, 21 labeled fungicides that include 17 different FRAC codes are listed with risk management (L = low risk, M = medium risk, H = high risk for resistance development) for eight common pumpkin and winter squash diseases in the region. Also included in each table is the inherent risk of each particular pathogen (i.e., disease) to develop resistance. Like fungicides, the risk for pathogens to develop resistance are listed as L = low, M = medium or H = high. For each fungicide or pathogen where there has been a reported case of resistance development, a superscript R is next to the risk assessment (e.g., HR) Most importantly, when the pathogen and the respective FRAC group used to control the pathogen have known resistance development, the x in the box is red in color.

Resistance risk assessments (HR) for pathogens and fungicides.

In order to make the guide more useful and easier to determine which fungicide/pathogen combinations were at most risk for resistance development we included the inherent resistance risks for both the fungicides and pathogens according to FRAC and other reported cases. Thus fungicides and/or pathogens with a superscript R have shown a demonstrated potential for resistance development. Importantly, we have taken the most conservative approach and included those which have demonstrated or reported to have resistance in the US and elsewhere, as well as, demonstrated resistance in the field and/or under artificial conditions.

In some cases where there is a superscript R and no red x, even though the pathogen or fungicide has shown resistance development, it has not demonstrated resistance development to that particular fungicide or pathogen and the x remains black.

Fungicide, chemical names, FRAC codes and risk management guidelines are color-coordinated to help distinguish differences based on FRAC code. The far right-hand column of each table includes fungicide resistance management guidelines for each particular FRAC code with specific instructions on risk assessment and/or application instructions.

In the back of the guide are tables which can be used by the grower during the production season to keep track of application dates and fungicide schedules.
Finding FRAC codes on fungicide labels.

FRAC codes can normally be found on the front of the fungicides' label right under the Tradename. FRAC codes are often distinguished by the inverse black and white box with their FRAC code found in the center (Figure 1). If a fungicide contains more than one active ingredient both FRAC codes will be listed in the FRAC code box (Figure 2). For example, Quadris™, belongs to FRAC code 11, the class of fungicides known as the strobilurins. All fungicides with strobilurin chemistry will belong to FRAC code 11. Other FRAC group 11 fungicides include Flint™ (trifloxystrobin) and Cabrio™ (pyraclostrobin).

If FRAC codes are not found on the front of the label, they can be found within the resistance management section of the label (Figure 3).

Figure 1. Front of Quadris™ label with FRAC code listed below tradename.

Figure 3. Resistance management guidelines for Tanos™

RESISTANCE MANAGEMENT

Repeated use of products for control of specific plant pathogens may lead to selection of resistant strains of fungi and result in a reduction of disease control. Famoxadone, one of the active ingredients in TANOS™, is one of EPA’s Target Site of Action Group 11 fungicides, which also includes all strobilurins and fenamidine. A disease management program that includes rotation between TANOS™ and other non-Group 11 fungicides is essential to reduce the risk of fungicide resistance development. Tank-mixing TANOS™ with a protectant (contact) fungicide that has a different mode of action is required. This ensures optimum performance and further reduces the potential for resistance development. For guidance on the particular crop and disease control situation, consult your state extension specialist or official state recommendations.