What Are Those Fungicide-Group Numbers on Product Labels?

Grapes 101 is a series of brief articles highlighting the fundamentals of cool climate grape and wine production.

By Wayne Wilcox

Figure 1. Revus Top® is a grape fungicide that contains two active ingredients from two different FRAC groups (circled in red on label, with insert): Mandipromamid (Group 40), and Difenoconazole (Group 3). For resistance management, growers should avoid repeated use of all Group 40 [Forum® (dimethomorph), Zampro® (dimethomorph + ametoctradin)] or Group 3 [Inspire Super® (difenoconazole+ cyprodinil), Quadris Top® (difenoconazole + azoxystrobin), Rally® (myclobutanil), tebuconazole products (various generic product names), Mettle® (tetraconazole), Procure®, Viticure® (triflumizole)] fungicides.

A few years ago, new information began to appear on the front page of many fungicide product labels. Typically, this is presented in the form of boxes containing the words “Group [x] Fungicide(s)”, with x representing one or more numbers. Although most people have a pretty good idea what this all means, many questions are still raised. So for inquiring minds that want to know, here’s the low-down.

Nearly all modern fungicides are at risk of losing their ability to control disease should populations of the target pathogen become resistant to them. This risk is actually an unintended consequence of the need for new products to have minimal “non-target” effects on biological organisms other than fungi: the biochemical
focus on a single aspect of fungal metabolism, which minimizes effects on other life forms, also means that fungal individuals don’t need to change their metabolism very much in order to avoid the fungicide’s activity. So as agriculturists, we need to manage these products to minimize the chance of such resistance developing.

One of the fundamental recommendations for resistance management is to rotate use among different, unrelated groups of fungicides, so that disease-causing fungi do not become “used to” a certain mode of activity directed against them. This recommendation, of course, assumes that a grower is able to keep track of which fungicide products belong to which group or groups. Which is difficult enough and is getting even more difficult with the ongoing trend for some products to contain more than one active ingredient, each belonging to a different fungicide group. Plus who gets to decide whether or not various active ingredients are “related”?

Enter FRAC, the Fungicide Resistance Action Committee. FRAC is an organization of major agrichemical company representatives, dedicated to prolonging the effectiveness of fungicides liable to encounter resistance problems and thereby limiting production losses associated with the poor disease control that results from fungicide resistance. Satisfying this goal benefits not only growers but also the FRAC companies themselves, since continued sales of these products depends upon their continued efficacy. The associated interplay between science and competitive business enterprises produces the occasional spark, but FRAC has done an excellent job to advance this goal by getting different corporations to work not only with each other but with universities, government, and agricultural producers and their advisors.

Through a defined process, FRAC has developed and regularly updates a “Code List” of commercial fungicide active ingredients based upon their biochemical mode of action (how they disrupt target fungi) and their resistance risk. Groups that have the same biochemical mode of activity are considered “related” in terms of pathogen resistance development. In other words, the continued use of one member of the group increases the risk of resistance developing to all others (in evolutionary terms, they all exert the same “selection pressure” that preferentially favors the survival of fungal strains that are resistant to a particular mode of action). Thus, fungi resistant to one member are likely to be “cross-resistant” to other group members as well. So for resistance management the use of ALL products within any one group should be limited each year.

The “FRAC Group” numbers are what you see displayed on fungicide labels intended for use on all crops (not just grapes), as per the attached front page of the Revus Top label (Figure 1). This product contains two active ingredients, difenoconazole (Group 3) and mandipropamid (Group 40). Because resistance to “sterol inhibitor” or “DMI” fungicides such as difenoconazole has given grape
growers variable problems in controlling powdery mildew for many years, we at Cornell recommend that they be used a maximum of three times per season, to limit the chance for further “slippage” in control. But there are many different products within this group, so rather than growers and advisors needing to remember each one that is related, we can simply recommend limiting the total number of applications of all products with “Group 3” on the label. Similarly, rather than remember that Revus Top, Forum, and Zampro (still not labeled in New York) all contain related ingredients, growers can simply limit the number of applications of these different Group 40 products (Table 1).

Table 1. Trade (in bold) and (chemical names) for common Group 3 and Group 40 fungicides labeled for grapes.

<table>
<thead>
<tr>
<th>GROUP 3</th>
<th>GROUP 40</th>
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<tr>
<td><strong>Inspire Super</strong> (difenoconazole + cyprodinil), <strong>Quadris Top</strong> (difenoconazole + azoxystrobin)</td>
<td><strong>Forum</strong> (dimethomorph)</td>
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<tr>
<td>Rally (mcylobutanil)</td>
<td><strong>Revus Top</strong> (Mandipropamid)</td>
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<tr>
<td>Several genetic products, formerly sold as <strong>Elite</strong>, (tebuconazole)</td>
<td><strong>Zampro</strong> (dimethomorph + ametoctradin) *New York State approval anticipated for 2016</td>
</tr>
<tr>
<td><strong>Mettle</strong> (tetracozazole)</td>
<td></td>
</tr>
<tr>
<td><strong>Procure, Viticure</strong> (triflumizole)</td>
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Finally, note that the inclusion of the FRAC Group number on fungicide labels is voluntary (more or less; the EPA, which must approve all pesticide labels, is very supportive of this concept), and some products do not show them. This omission typically occurs on two types of products: (1) old “contact” or “multisite inhibitor” fungicides (captan, mancozeb, ziram, etc.), which are at negligible risk for resistance development; or (2) products with relatively new, unique modes of action (often still unknown), for which there are no related products on the market (yet) and, therefore, can be rotated with any other fungicide without promoting resistance development.

The inclusion of FRAC groups on fungicide labels is a significant step forward in enabling grape growers and other agriculturists to be responsible stewards of the fungicides that they incorporate into disease management programs. Efforts are currently underway to provide similar information on insecticide and herbicide labels that will likewise help producers and advisors in their resistance-management efforts with these pest management tools as well.

Wayne Wilcox is a professor for the Division of Plant Pathology and Plant-Microbe Biology of Cornell’s School of Integrative Plant Science, based at the New York State Agricultural Experiment Station in Geneva, NY.
This article mentions trade and common names for fungicides to illustrate the concept of FRAC resistance groups. No endorsements of products mentioned are made or implied, nor is absence of other products a non-endorsement. Questions concerning the legality and/or registration status for pesticide use should be directed to the appropriate technical representative or state regulatory agency. Read the label before applying any pesticide. Cornell University, Cornell Cooperative Extension, and Penn State Cooperative Extensions, and their employees, assume no liability for the effectiveness or results of any chemicals for pesticide usage.