

## **Importance of multisite fungicides in managing pathogen resistance**

The Fungicide Resistance Action Committee (FRAC) is a Specialist Technical Group of CropLife International. The purpose of FRAC is to provide fungicide resistance management guidelines to prolong the effectiveness of "at risk" fungicides and to limit crop losses should resistance occur.

FRAC Guidelines for resistance management are produced by the individual FRAC Working Groups and Expert Fora. These Guidelines provide information on how to use specific areas of fungicide chemistry for control of plant diseases on various crops while maintaining a good anti-resistance strategy.

One of the key recommendations is to make use of multisite fungicides (see FRAC Group M) in spray programs, especially in crops with multiple sprays such as fruits and vegetables, or certain arable crops. Due to their mode of action, multisite fungicides are considered as a low resistance risk group. Therefore, they offer the possibility for use as mixing partners or alternating with single site and other medium to high resistance risk fungicides. Over the past decades, no cases of field resistance against multisites have been reported.

There are clear benefits to recommending multi-site fungicides in spray programs:

- Multisite fungicides display a low risk to develop resistance and are effective mixing/alternating partners for medium to high risk fungicides.
- Beyond protecting and prolonging the lifespan of highly effective medium to high resistance risk fungicides, multisite fungicides provide added levels and spectrum of disease control. With this they can also support the single sites to be even more efficient.
- Multisite fungicides are considered a valuable tool to manage resistance by preventing or delaying its development to many pathogens in many crops.
- In some crops, multisites play an increasing role in spray programs to sustain effective disease control and resistance management, e.g. for *Zymoseptoria tritici* in wheat, *Ramularia collo-cygni* in barley and for *Phakopsora pachyrhizi* in soybeans.

**Restricting the use of multisite fungicides from use in important crops could result in faster development of resistance to single site mode of action fungicides. This in turn could lead to epidemic disease development, serious crop losses, and finally the loss of highly effective fungicides for a sustainable disease management.**



**Two references on the subject of resistance management:**

Rotteveel T, Jorgensen L N, Heimbach U (2011). Resistance management in Europe: a preliminary proposal for the determination of a minimum number of active substances necessary to manage resistance. OEPP/EPPO Bulletin 41, 432–438

Van den Bosch F, Fraaije B, Oliver R, Van den Berg F and Paveley N (2015). The Use of Mathematical Models to Guide Fungicide Resistance Management Decisions. H. Ishii, D.W. Hollomon (eds.), Fungicide Resistance in Plant Pathogens, DOI 10.1007/978-4-431-55642-8\_4