FRAG-UK Statement on azole usage and *Septoria tritici* resistance issues in the UK (November 2012)

Summary statement on Septoria control in wheat
Since the late 1990's there have been significant shifts in the sensitivity of Septoria tritici to azoles and reductions in efficacy in certain azole fungicides. This has increased concern that the most commercially important azoles could be under threat from resistance development. Research has shown that alternations and mixtures of azoles have some potential to delay or reduce the risk of resistance development. Growers should therefore consider alternating and mixing azoles within their winter wheat fungicide programmes and should make full use of alternative modes of action and varietal resistance.

Introduction
Azole fungicides are the primary method for UK growers to control Septoria tritici in winter wheat crops. Varieties differ in their susceptibility but all commercial varieties are susceptible to some degree and average azole usage is 2.85 azole applications containing azoles per crop (CropMonitor 2010 data) with a total of 99% of crops treated with this chemical group. Further declines in efficacy would have serious commercial implications for disease control in wheat. Research shows that all azoles are affected, to varying degrees, by changes in the sensitivity of the Septoria population via mutations to the target site protein (CYP51). Older azole products tend to be more affected with noted declines in efficacy and many now offer very poor control of *Septoria tritici.* In practice, usage in the UK is largely focused on a few azoles where good efficacy is retained where robust doses are used i.e. epoxiconazole and prothioconazole. There is evidence however that the efficacy of these azoles continues to decline over time, with small shifts in the sensitivity of the Septoria population sometimes detected between seasons. It is imperative that the best available anti-resistance strategies are communicated to the industry in order to preserve and extend the useful life of these actives.

Anti-resistance strategies are based on three principles, namely:-

- To make full use of alternative control methods such as varietal resistance and other agronomic practices that will reduce disease pressure.
- To alternate fungicides with alternative modes of action when treating crops
- To use mixtures of fungicides with alternative modes of action when treating crops.

Mixing or alternating different azole fungicides

Recent research has suggested that there may be some advantage in trying to alternate or mix azole fungicides to reduce or slow the risk of resistance development. While this is not as strong an anti-resistance strategy as mixing or alternating with fungicides from different modes of action groups such as multisite groups or SDHIs, it has shown some potential to manage resistance development. Different azoles have been shown to select for different mutations in the target site protein (CYP51), such that repeated use of a single azole in experiments will rapidly select for specific mutations. Declines in efficacy are associated with many of these mutations. Some of these mutations, while conferring increased resistance to one azole will increase sensitivity to another. It is likely, although unproven, that very high levels of mutations will carry some level of fitness penalty for the Septoria isolates involved. European and UK researchers agree that a highly complex Septoria population, such as would evolve where multiple azoles are used, is likely to make it harder for resistance to evolve, and that it could slow resistance development.

As a strategy, mixing and alternating azoles has practical merit in that growers include azoles at all applications timings, or suffer significant yield penalties. Growers should therefore consider alternating and / or mixing azoles at all spray timings. For example if azoles are applied to a crop at three or four standard timings then alternation of the most effect azoles prothioconazole and epoxiconazole is possible when planning spray programmes. An example of a mixture strategy would be at early timings where rust is a target when an azole like tebuconazole can be a useful addition.

These azole mixtures and alternations should always be applied in mixture with a truly alternative mode of action mixture partner such as an SDHI or a multi-site like chlorothalonil to further reduce the risk. Integrated crop management practices that reduce disease pressure should always be considered, for example wheat varieties with best available resistance for the desired market should always be selected. Optimal rates of azoles should always be selected to avoid the risk of increased selection pressure associated with poor dose selection (see HGCA FP work,

http://www.hgca.com/content.output/3147/3147/Crop%20Research/Disease%20Control/Wheat.mspx

There is ongoing research in this area by researchers within the FRAG-UK group and ongoing monitoring of *Septoria tritici* populations by agrochemical company members. The FRAG-UK group have not found any evidence of UK populations with multi-drug resistance (MDR) which have been reported in France.

An EPPO workshop in 2010 discussed the latest information on the resistance to azoles in this disease and the implications for disease control management. The full conclusions and recommendations from this workshop together with a number of the platform presentations and posters are available from the

EPPO website (link). The main conclusions from the workshop are summarised below:

For more information the conclusions of the EPPO workshop should be consulted. See

http://archives.eppo.int/MEETINGS/2010_conferences/septoria.htm?utm_source=archives.eppo.org&utm_medium=int_redirect

Key conclusions from EPPO were:-

- Septoria leaf blotch of wheat, *Mycosphaerella graminicola (*anamorph *Septoria tritici*), is an important disease across many EPPO countries, which, if uncontrolled, poses a significant threat to yield and food security.

- Azole fungicides are a major factor in the successful management of this and other important cereal diseases, and having a diversity of azoles available is considered important in managing this disease.

- There are shifts in sensitivity and losses of efficacy within the azole group and mutations at the target site protein within the pathogen. Recent research has shown that multiple mutations in the *CYP51* target gene are important in the development of resistance to azoles.

- Azoles select differentially for these mutations so a diversity of azoles are important in managing resistance development.

- Mixtures (convenience tank mixtures and co-formulated products) and alternations of azoles therefore have a role to play in effective disease control and in resistance management.

There is a FRAG-UK form for reporting cases of confirmed or suspected resistance.

http://www.pesticides.gov.uk/NR/rdonlyres/63C5536F-C695-427B-91BB-BDBAC2075F64/0/FRAG_P003v3_ResistanceReport.pdf