

The following article was prepared for Crop Protection Monthly, May 2014 issue, after attending a conference in London on April 3rd, 2014

UK research projects aiming to minimise blackgrass herbicide resistance

A paper presented by Professor Robert Edwards, Newcastle University at the Westminster Forum conference held in London, 'Food security: global priorities and the UK's role', described research work his team and other collaborators are working on with the aim of gaining a better understanding of how blackgrass resistance to herbicides develops.

Professor Edwards' paper first of all described how 'translational research,' using new scientific methods and technologies and interdisciplinary approaches are needed in agriculture in order to narrow the gap between basic science and its application.

Relating this concept to wheat yields in the UK he explained that the average yield has plateaued since the mid-1990s. The reasons for this are complex but the improvement in varieties is not the barrier. The genetic potential continues to be exploited and according to Professor Edwards we should be seeing average wheat yields increasing at about 1.7% a year. But in practice, despite the efforts of an efficient seed breeding industry, the benefits are not working their way into the field and average yields are not progressing.

Professor Edwards put the yield gap down to: "The failure to utilise technologies that we already have in a more innovative and solution focused manner, and that includes things like precision agriculture and the use of agrochemicals." He also considered that there is a knowledge exchange issue and a situation where people are not implementing best practice. This he said: "Has got a lot more to do with social research than it has to do with any technological innovation."

He then described specific projects which he has led. One of the major problems in the UK, which is holding back wheat yield improvement is the spread of blackgrass and ryegrass showing resistance to herbicides and particularly to multiple herbicide treatments. Blackgrass occurs on around 1.2 million hectares in the UK, a high proportion of the nearly 2.0 million hectares of wheat grown. Resistance to herbicides has evolved for 30 years but the spread of blackgrass and ryegrass, resistant to multiple herbicides has been particularly rapid since 2008. By 2012 over 10% of the infested area had to be treated with four different herbicides, each with different modes of action, in order to try to keep on top of the weed problem. The most intense areas where multiple control strategies were adopted were in the central/eastern counties of Oxfordshire, Northamptonshire, Buckinghamshire and Nottinghamshire.

One of the unknowns is how multiple herbicides resistance, MHR, actually develops. As opposed to the more common target site based resistance caused by point mutations, MHR results in a loss of control by all classes of existing graminicides.

Professor Edwards argued that a new approach has to be adopted and suggested that field based diagnostics looking at the genetics of the resistant weeds could be a 'game changing new technology' which could move the industry to a strategy of prevention rather than cure.

Professor Edwards and his team worked on diagnostics initially at the University of York in collaboration with Durham University and the Food and Environment Research Agency, FERA. He is now continuing the research into diagnostics having transferred to Newcastle University.

The objective of the research has been to identify the genomics behind the development of multiple herbicide resistance. Professor Edwards explained that although this genomics approach is already applied to crops, applying genomics to weeds is a new concept..

A programme of trials based on the application of the diagnostic methods in the field is now being taken a step further by a collaboration involving Rothamsted Research, Sheffield University and Reading University. Ultimately, if it is possible to recognise in the field that a particular weed is showing an indication of herbicide resistance, it should be feasible to adapt the control strategy, through the correct choice of herbicides, and before any multiple herbicide resistance fully develops.

The hope is that it may even be possible to use a portable instrument such that the farmer or advisor can take readings in the field.
