Black-grass Bulletin | Issue 4

A focus on the impact of farmer decision-making

BLACK-GRASS RESISTANCE INITIATIVE

Modelling management strategies

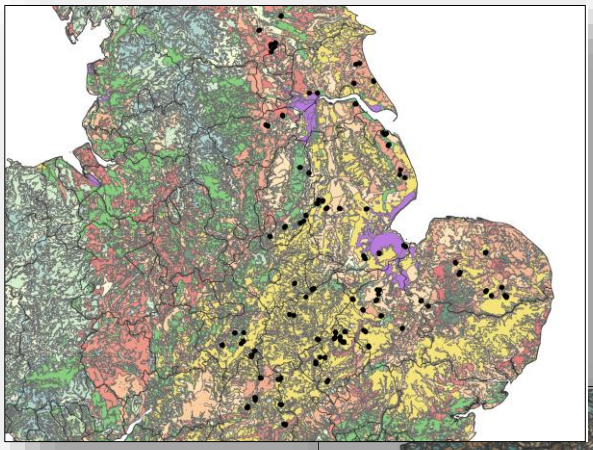
The Black-Grass Resistance Initiative (BGRI) has now selected, adapted or built the models necessary to investigate economic and environmental consequences of black-grass mitigation strategies.

Why use models?

Black-grass is a national problem and trying to field-test all the possible management strategies would take decades, and more land than we have spare! Modelling gives us an idea of what each management strategy might do to farm profit and environmental outcomes such as carbon emissions, nitrate leaching, and biodiversity impacts.

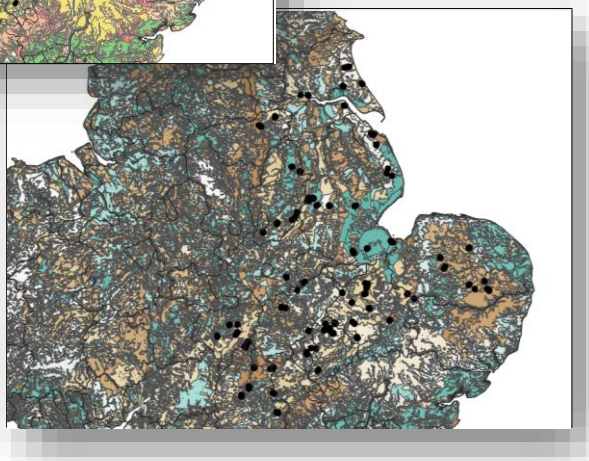
Tipping points and trade-offs

Herbicide-resistant black-grass is causing farmers to change crop rotation and management strategies. We will use models to estimate the point at which it becomes economically viable to switch from one management strategy to another; for example, from autumn to spring cropping. We will also look at trade-offs: strategy 'X' may be profitable but it may also result in unacceptable levels of nitrate leaching or carbon emissions. Strategy 'Y' may be better for biodiversity but may not be profitable. The models will help us to find out whether there are strategies with fewer trade-offs, or even win-win strategies.



Black dots show the fields used in the BGRI project. The map on the left shows major crop types:

- *Yellow is winter wheat.*
- *Orange/red/pink tones are winter cereals.*
- *Purple is sugar beet.*



Farm location, soil type, and weather are important model inputs.

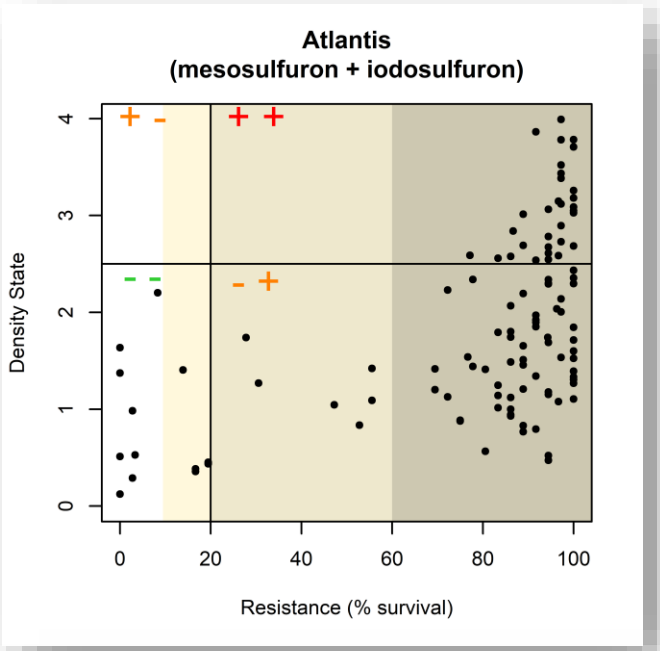
The soil type for each farm was taken from the data received from farmers and from the national UK soils data-set (right).

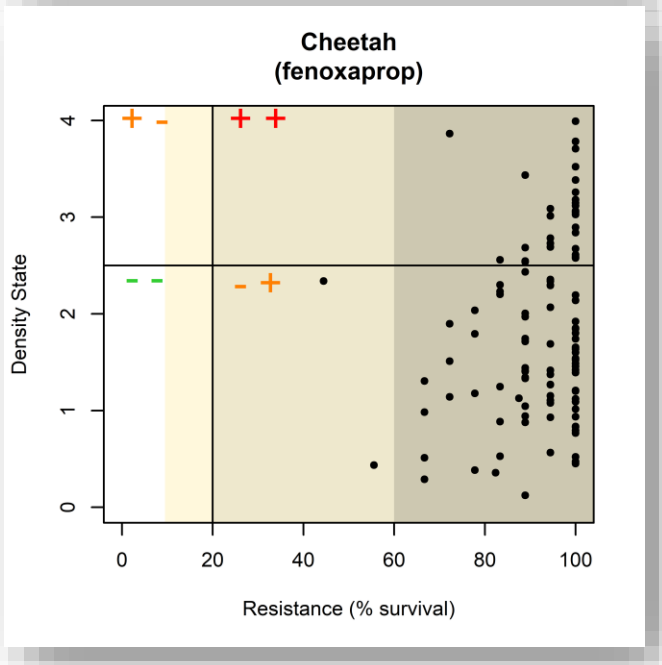
What do our models do?

We've now established a range of models - some 'off-the-peg' and others developed specifically for this project - with which we can model the impact of different management strategies. Using the 'Cool Farm Tool' we can estimate field greenhouse gas emissions, while the custom-built model 'BGRI-ECOMOD' allows us to look at the economic implications of dealing with herbicide-resistant black-grass. We've made some major adaptations to allow another existing model, DSSAT, to estimate nitrate leaching for many different blackgrass management scenarios. And we're also assessing impacts on biodiversity, using another model custom built within the BGRI.

And back to real life…

But the most pressing black-grass questions are often (a) what is the current herbicide resistance and density state in my fields? and (b) what can I do about it? The BGRI resistance audit has helped answer (a), and we are able to show where each surveyed field sits on a density-resistance gradient (see the graphs on the right). Farmers whose fields are in the bottom left part of these graphs (- -, low black-grass density and low herbicide resistance) will need to adopt management strategies that keep their fields in this state. Farmers in the top right part of these graphs (+ +, high density and high resistance) will need to adopt different strategies. The modelling we are doing will allow us to develop suitable strategies for each type of situation: we will then be able to give growers better information to help them choose the 'best' black-grass management strategy for their fields.





Resistance-density plots for BGRI fields (black dots) for two different herbicides.
= possibly resistant (10-19% plants survive spraying)
= resistant (20-59% of plants survive spraying)
= highly resistant (60-100% of plants survive spraying)

FAST FACTS

120 The number of fields being used for the modelling

11 The minimum number of years the models will run each different strategy for, for each field

1,320 The number of records (field x year) being run through the models for each strategy

Farmer focus meeting 2017

The next farmer focus meeting will be this autumn, where farmers will help us to create potential management strategies to run through the models.

FOR MORE INFORMATION

For more information on any aspect of the project please see our website at bgri.info or contact us by email at bgri@rothamsted.ac.uk