Knock-down resistance (kdr) in Grain Aphids

This IRAG Guideline provides advice on the control of grain aphid (Sitobion avenae) populations that may contain individuals with knock-down resistance (kdr) to pyrethroid insecticides commonly used for aphid control on UK cereals.

Background
Since kdr was first identified in grain aphid (Sitobion avenae) in the summer and autumn of 2011 (mostly in East Anglia), testing (funded by Syngenta and HGCA) has been done to monitor its spread.

Summary of findings
Of the 17 samples tested in 2012, five showed indications of kdr, the other 12 were classed as susceptible to pyrethroids. Out of the samples collected, resistant aphids were found in Suffolk and Bedfordshire, susceptible aphids were found in Nottinghamshire, Essex, Cambridgeshire, Hertfordshire and Hampshire, and a mixture of both resistant and susceptible aphids were found in Norfolk and Lincolnshire. These results suggest that resistant individuals had become more widespread since 2011. Testing of grain aphid samples collected in the Rothamsted-run suction trap network has shown that in 2012 the kdr mutation was present in some areas at high frequency (>50%). In fact, it was present at low levels in 2009 but appeared to take hold in 2011 when pyrethroid control failures were first reported. The frequency and geographical spread of grain aphids carrying kdr in 2013 appears to be similar to 2012.

Barley yellow dwarf virus (BYDV) vector control in autumn 2013
BYDV is mainly transmitted by two species of aphid, the grain aphid- and the bird cherry-oat aphid (Rhopalosiphum padi). Traditionally, bird cherry-oat aphid is usually considered to be the more important vector, but there is much variation and this assumption may not hold true in all parts of the country. Past experience has shown that grain aphid can be a very effective vector of BYDV so it should not be considered as less important if it is found in crops. The 2013 grain aphid season was late and numbers have been low to date (October).

There is no evidence so far of kdr in bird cherry-oat aphid, so pyrethroids will continue to be effective in controlling BYDV this autumn if this is the main vector and timely applications are made.

Successful BYDV control therefore depends on:

Weed control

- Effective grass weed and cereal volunteer control, particularly in stubbles prior to seed bed preparation, will reduce the risk of aphids present on
ploughed down grass/cereal volunteer material from moving up through the 
soil on to the newly-emerging cereal crop (known as the ‘green bridge’).

Seed treatments
- Products containing clothianidin or imidacloprid (both neonicotinoids) will 
suppress viruliferous aphid populations for six to eight weeks after crop 
emergence, subject to seed rate and growing conditions. In most years this 
will be sufficient to cover the susceptible period i.e. until the aphid migrations 
cease, normally by early November. However, if conditions are mild and dry 
or similar to those in autumn 2011, when aphid migration continued into 
December, then an additional foliar spray might be necessary.

Drilling date
- Crops drilled during September are most at risk from BYDV. In most years 
late sown crops (i.e. post mid-October), will not need either a seed treatment 
or a spray for aphid control unless the weather conditions are conducive for 
aphid migration in late autumn.

Aphid monitoring
- The Rothamsted Insect Survey Suction traps give an indication of the general 
level of aphid activity (www.rothamsted.ac.uk/insect-survey); see also 
“HGCA Aphid News” at www.hgca.com/pests. Monitor emerging crops 
carefully for aphids, and identify whether the main aphid species is bird 
cherry-oat aphid or grain aphid. Information on aphid identification can be 
found on the Rothamsted Insect Survey website (see above). Suction trap data 
and close monitoring will help ensure a more targeted spray application. 
Continue to monitor aphid numbers for as long as conditions remain mild 
(the temperature threshold conducive to successful flight is 15°C), even after 
applying an insecticide, as aphid numbers may build up within the crop as 
was seen during the mild winter of 2011/12.

Foliar insecticide applications
- Where insecticidal seed treatments have not been used, spray applications 
may be needed once aphids have migrated into crops, but before they have 
had a chance to spread virus from their initial colonisation point (usually 
mid- to late October). BYDV infections can occur because tank-mixes of 
herbicides and insecticides may be applied at the optimum timing for weed 
control. Although this might seem like a more practical approach, the timing 
of the herbicide application may not provide the most effective BYDV control.

- The resistance factor identified so far in grain aphids is not high (c. 30 fold in 
laboratory-based bioassays) so it is very important that the full 
recommended pyrethroid rates are used. It is also important to ensure good 
crop coverage because pyrethroids only have contact activity against aphids. 
These actions will maximise control, and minimise the selection of resistant 
individuals.
**Product choice for foliar applications**

Where grain aphid is identified as the main aphid pest present in the crop, pyrethroid sprays may not be effective. If a control failure is suspected do not spray again with a pyrethroid-based product but switch to an insecticide with an alternative mode of action (currently the only suitable alternative is chlorpyrifos because pirimicarb should not be used in the autumn). If resistance is suspected, live samples of aphids can be sent to Rothamsted for further testing (contact Steve Foster at stephen.foster@rothamsted.ac.uk, or Alan Dewar at alan@dewarcrop protection.co.uk).

You should always contact a BASIS-qualified adviser for specific product recommendations.

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