Keeping the lid on resistance

Every wheat grower with blackgrass wants to avoid the onset of Atlantis-resistance within their weed population. CPM *provides some pointers on containing its spread.*

By Jo Palmer

'Growers will be allowed to use IPU, trifluralin or Hawk for the last time this autumn.'

Herbicide-resistant blackgrass has now been found on more than 2,000 farms in 32 English counties and was even detected for the first time in Scotland last year.

If those statistics aren't bad enough, resistance to Atlantis (mesosulfuron+ iodosulfuron) has now been confirmed on 133 farms in 21 English counties — with eight being the target-site variant.

So with resistance now a major issue for cereal growers, how can the issue be managed — particularly with fewer herbicides available?

Dr Stephen Moss of Rothamsted Research notes that resistance occurs in virtually all blackgrass populations. "But the extent of the problem could increase with the loss of the lower-resistance-risk herbicides, IPU and trifluralin, and more widespread reliance on higher-resistance-risk herbicides from the ALS and ACCase inhibitor groups (e.g. Atlantis)."

The lack of any new modes of action in the pipeline further compounds the situation, he adds.

Increased reliance on min-till, and more widespread use of early drilling, both favour the proliferation of blackgrass, he continues. "So with less spring cropping in most rotations nowadays, and with the abolition of set-aside, the task of managing weed resistance is becoming a lot more challenging."

Stephen Moss believes growers need to take cultural control of blackgrass "a lot more seriously" than they do at present. "It may not be what they want to hear, but it has to make sense where resistant weeds are a problem."

Greater reliance on cultural control methods will be "unavoidable" in the next few years — especially on farms with 'fop'/'dim' and Atlantis resistance, he says.

"Growers need to introduce more spring cropping into their rotations wherever they can to help reduce the dominance of blackgrass and other grassweeds in-crop. They should also consider ploughing those fields with the highest blackgrass populations to bury the seed."

Delay the drill?

Delaying the drilling date may not be a popular scenario but it does allow time for stale seedbed creation prior to drilling — taking some pressure off the pre- and post-emergence herbicides, he continues. "By drilling wheat in October, rather than September, it creates an opportunity to control a proportion of the grassweed population prior to the crop being established.

"At the very least, the sowing dates for the worst blackgrass fields should be delayed for as long as possible."

Stephen Moss stresses the importance of making crops as competitive as possible to suppress weeds. "Select the most competitive varieties (e.g. Claire, Robigus or Brompton) and aim to keep the seed rates up — never dropping below 200 plants/m^2 in wheat."

Using narrower rows will also help increase the level of competition from the crop, he adds.

The use of pre-emergence herbicides is "absolutely essential" nowadays, he continues. "Pre-ems help reduce the weed population overall — taking some of the pressure off the higher risk post-em products." The true pre-emergence timing is best (i.e. rather than peri-emergence), and flufenacet should be maintained at its full recommended dose rate — 4 l/ha Crystal (flufenacet+ pendimethalin) or 0.6 l/ha Liberator (flufenacet+ DFF), he advises.

At one trial site in Oxfordshire on a field with confirmed Atlantis target-site resistance, Crystal gave 68% control of blackgrass, with Liberator providing 65% control, and Defy plus Stomp (pendimethalin) giving 56% when applied pre-emergence.

Stephen Moss considers Defy (prosulfocarb) to be an addition, rather than an alternative, to the flufenacet-based herbicides. Moreover, growers should be ▸

"The use of pre-emergence herbicides is absolutely essential nowadays," says Stephen Moss.

▸ aware of the dose rate restrictions which apply to pendimethalin, he says.

"In other words, if you're using full rate Crystal, you can only use a maximum of 2 l/ha Stomp post-emergence."

The pre-em treatment should invariably be followed by a post-emergence herbicide to help reduce the risk of resistance, stresses Stephen Moss. "Growers will be allowed to use IPU, trifluralin or Hawk (clodinafop+ trifluralin) for the last time this autumn."

Anyone planning to use Atlantis this autumn should aim to achieve the optimum spray timing wherever possible, although they may "need a crystal ball" to be able to anticipate this, he admits.

Bayer CropScience suggests the product should be applied in good growing conditions (i.e. avoiding very cold, wet or dry conditions) in the autumn at around GS12-13 of the weed when the majority of the population has emerged.

In the Oxfordshire trial, the best level of control (i.e. 93%) was achieved using Crystal followed by IPU plus Stomp, then Hawk, says Stephen Moss. By comparison, a programme of Liberator followed by Topik (clodinafop) plus Stomp gave just 82% control, with Atlantis alone giving zero control (due to the resistance status of the weeds), with Crystal followed by Atlantis and Hawk giving just 73% control.

Future problems?

"This highlights the kind of problems we're going to have to deal with once trifluralin and IPU are gone. Although the high level of Atlantis resistance on this field is atypical, I'm convinced many more fields are heading this way."

He notes that Dow's new cereal graminicide, a co-formulation of pyroxsulam and a residual partner (GF2070), should soon be available.

"Pyroxsulam is an ALS inhibitor and it may be a viable alternative to Atlantis — but it's likely to be affected by the same resistance mechanisms as Atlantis, so it probably won't provide a simple solution to resistance."

He points out that there are "no new miracle cures" in the herbicide development pipeline, so growers need to take cultural control more seriously and plan an effective programme of herbicides using products with different modes of action.

Chris Bean, technical director for UAP, considers the only way to get on top of grassweeds and to minimise resistance is to go back to basic principles. "I've said it before and I'll say it again — controlling blackgrass is a numbers game where you need to take each and every opportunity you can to reduce the weed population.

"For example, using glyphosate to control the weed in a stale seedbed prior to drilling introduces a chemical with a totally different mode of action to the spray programme. If this technique is carried out well and used in tandem with early post-combining cultivations — including a pass with a set of rolls to conserve moisture — it can reduce the blackgrass population by as much as 80-90%."

Stale seedbeds work best when the seed dormancy is low, with germination being relatively even and early, he says. Dormancy is determined by the weather during the seed maturity period for the blackgrass — usually in June and July.

"But if it's cold and wet at this time — as it was in many areas this year — seed dormancy tends to be more prolonged."

Having established a stale seedbed prior to drilling, it's time to move in with a pre-emergence treatment after the seed has been sown, continues Chris Bean. "In the context of controlling weeds and managing resistance, this treatment is essential and growers have got to find time to get these sprays on — even if it means bringing in a contractor."

Peri-emergence treatments (i.e. as soon as the tramlines become visible) are a compromise which may work in some years but aren't 100% reliable every season, he says.

His pre-emergence preferences are Crystal and Liberator. "It's vital that one or other of these herbicides is used in any serious blackgrass control programme.

'Don't forget old favourite'

Avadex 15G (tri-allate) remains a useful alternative pre-emergence herbicide treatment and plays a key role in managing resistance, believes Worcs-based contractor, Joe Furness.

He notes that although the product has been around for over thirty years, there's still no known resistance in any either blackgrass or wild oats.

Avadex typically gives around 60% control of blackgrass and even more with wild oats, he says. "It may be a bit more variable than Crystal on blackgrass, but its average level of weed control is not dissimilar to the other pre-emergence herbicides.

"Moreover, its much better on wild oats and has useful activity on a range of other grassweeds — including barren brome, ryegrass and annual meadowgrass."

Avadex 15G should be applied at a similar time and under similar conditions to Crystal or Liberator, believes Joe Furness. "Ideally, you need a fine, firm seedbed and moist soil conditions — same as for any residual herbicide. So if it's particularly warm and dry in September, it's often a good idea to delay until there's more moisture in the soil."

The product should be applied at the pre-emergence timing since this results in more consistent blackgrass control and improved brome control — with the latter tending to diminish after the weeds have emerged, he says. "It's very crop safe and can be used in both winter wheat and barley, as well as durum wheat, triticale, winter rye, sugar beet and pulses."

Being a granule, Avadex 15 G has to be applied by a specialist applicator — with Joe Furness using a Bateman pneumatic spreader, working at either 20 or 24m.

"Some farms are kitted up for applying the product but the majority bring in a contractor. Because of the heavy workload at this time of year — harvesting, cultivating and drilling — it's often better to get a contractor to apply the pre-em treatments anyway."

They both perform well and can give control levels of around 60-70% when used at a higher dose rate."

He believes flufenacet's ability to control grassweeds should not be under-estimated. "Conversely, Defy has rarely given more than 30% control of blackgrass in UAP trials. Although mixing it with another herbicide makes it more reliable, it's still not in the same league as Crystal or Liberator.

By performing some simple maths, growers can see that with pre-drilling glyphosate providing 80-90% control, and with a robust pre-emergence treatment giving a further 60-70% control, significant inroads are already being made into the weed population — making the task easier for the post-emergence treatment, says Chris Bean.

'Essential component'

He still considers Atlantis to be an essential component in any blackgrass control strategy. "My preference is to use it pre-Christmas since applications at this time of the year tend to protect the yield better and usually result in higher levels of control in most years.

"It's always best to treat weeds earlier rather than later — particularly when you consider the nature of the resistance mechanisms. It amazes me that only 20% of the Atlantis used in the UK is applied pre-Christmas."

With the impending withdrawal of IPU and trifluralin, there will be even more pressure on Atlantis in the coming years — making it even more important to protect the product from developing resistance by utilising stale seedbeds and other cultural techniques — including high quality pre-drilling and pre-emergence treatments, he continues.

"I'm not a particular fan of late autumn 'holding' treatments for blackgrass but recognise their benefits where a mixed weed population exists — including ryegrass and some bromes where there's a significant risk of spring germinations as well.

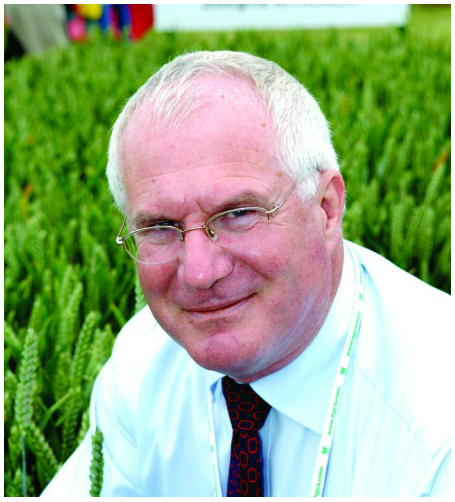
"In these situations, some growers will opt for chlorotoluron instead of IPU but the varietal tolerance needs to be checked first."

Chris Bean reckons there will be reasonable supplies of trifluralin for use this autumn — prior to the ban coming into effect. "But with a larger area of rape anticipated, some material will probably be diverted in that direction." Trifluralin tends to produce variable results in cereals, typically averaging around 35% control of blackgrass with a range of "anything between 0% and 50%".

"We've had considerable success with Orient (pendimethalin+ piclinafen) used post-emergence, and on sites treated pre-emergence with Liberator and followed up post-emergence with Atlantis and Orient, we've achieved very good grassweed and broadleaf weed control." The piclinafen also works well on a wide range of broadleaf weeds — including cleavers, cranesbills and spring germinators, he adds.

"But it's totally unrealistic to expect any single herbicide treatment to do a good enough job. A planned approach, mixing-and-matching different herbicide ▸

"Growers have got to find time to apply a pre-em treatment — even if it means bringing in a contractor," says Chris Bean.



"We're now in a 'Catch 22' situation with Atlantis," believes Jim Orson.

▸ modes of action is now essential on blackgrass."

Jim Orson of TAG agrees with the principle of using a range of different herbicides in the spray programme, but is concerned that blackgrass control with Atlantis is now starting to slip.

"We're now in a 'Catch 22' situation with Atlantis — it's the only way to get reliable control of a high blackgrass population, but the more of it that's used, the more likely it is to fail in future.

"Yet the alternatives to Atlantis don't give sufficient control of high populations — and there doesn't appear to be novel herbicide modes of action on the development horizon."

He believes growers might now be at the stage where weed populations have to be reduced by cultural means. "They must be prepared to consider cultural control more seriously from now on to ease the pressure on the in-crop herbicides."

'Cut by half'

Jim Orson says ploughing generally reduces the blackgrass population by 50%+ — although some tillage experiments have thrown-up anomalies. "Similarly, delaying drilling generally reduces the weed populations by an average of 44% — but not in every case."

Growers shouldn't delay the drilling date too much because of the need to establish competitive crops to suppress weeds. "Delaying the drilling will be more of a benefit in the low dormancy years."

Jim Orson says the blackgrass seed dormancy information should not be regarded as absolute, although it's generally a fairly good indicator. "In a high dormancy year, typically around two-thirds of the seed will fall into this category."

He notes that the early removal of weeds is best because of the effect of 'enhanced metabolism' resistance on the size of the weeds. "At the same time, residual-acting pre-em herbicides require moist seedbeds to work to their best effect and it's important that growers get as much benefit as possible from their pre-emergence sprays."

TAG trials confirm Crystal and Liberator to be the leading pre-em products, with straight flufenacet providing the most activity on blackgrass, says Jim Orson. "One trial last year also indicated that using an adjuvant, such as Grounded, which is specially designed for mixing with a pre-emergence herbicide may further improve the level of performance."

Defy appears to be a good mixer product for use with the two flufenacet products, and Syngenta has a recommendation for a tank-mix with Liberator.

"Avadex (tri-allate) has also worked well in TAG trials but it does require specialist application equipment, and Lexus (flupyrsulfuron) tank-mixes applied pre-em have done well in our barley trials too.

"Moreover, post-em chlorotoluron couldn't be separated performance-wise from IPU when used at full rates. But CTU varietal susceptibility remains a problem — particularly when the variety lists vary between different chlorotoluron brands."

He admits to being "less confident than

Prioritising out-of-crop control

Better weed control prior to sowing has become the key priority for UK cereal growers to prevent the build-up of herbicide resistance in grassweeds, according to a survey conducted by Monsanto.

And even though min-till cultivations have traditionally been seen as putting more pressure on weed control than ploughing, the current challenge is being felt almost equally by growers — regardless of the establishment regime used.

Some 300 farmers, responsible for nearly 80,000ha of winter cereal cropping in 50 counties of England, Wales and Scotland, took part in the study.

"More than nine out of 10 participating growers said they see autumn weed control as become increasingly challenging," explains survey co-ordinator, Susan Mintern. "This underlines the fact that today's weed control pressures are more general and widespread than may've been the case in the past."

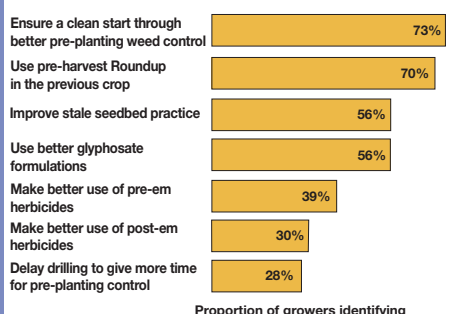
Taken together, the impending loss of IPU and trifluralin, the lack of new chemistry, and the increasing post-em herbicide resistance problems, stand out as the three main challenges identified by growers. Added to that are the need to get winter cereals drilled in good time; the declining effectiveness of grassweed control in cereal break crops; an ever-increasing area of winter cropping; and uncertainty about the weather.

Reflecting their greater reliance on herbicides, min-tillers are the group most concerned about weed resistance problems and the lack of new chemistry. "But regardless of the establishment system used, more effective weed control outside the growing crop is clearly identified as the main priority to address."

Better control of weeds between harvest and drilling, and greater use of pre-harvest Roundup (glyphosate) to clear out weeds ahead of cultivation, are the main foci for improvement efforts, she continues. "Better stale seedbed practice to achieve earlier and more reliable weed flushes, and using glyphosate formulations which are less weather dependent and have shorter cultivation intervals are also high on the priority list" (see figure).

"Interestingly too, despite the desire to get drilled-up early, a significant proportion of growers are now looking to delay the drilling date to give more time for pre-planting weed control."

Weed control goals



Source: Monsanto survey

some of the manufacturers are" with regard to crop safety on some winter barley varieties.

ProCam technical director, Dr David Ellerton, believes it's important to understand the weed resistance profile. "You need to know where the resistance is on the farm and what sort of resistance it is.

Atlantis resistance

"We now know there are 133 cases of resistance to Atlantis but not all of these are from field failures." He points out that there's widespread confirmed resistance to ACCase-inhibiting herbicides and stresses the importance of knowing whether it's enhanced metabolism or target site resistance so a better weed control plan can be put in place.

According to David Ellerton, if weed resistance is suspected or confirmed through a test, changes must be made to future weed control strategies. "Certain groups of chemistry pose a higher risk to resistance than others, namely the ALS inhibitors, such as Atlantis and Lexus, and the ACCase inhibitors, such as Triumph (fenoxaprop), Topik and Axial (pinoxaden), so you have to make allowances for this."

"It's important to realise that once resistance has developed, it doesn't go away. But it's certainly within the growers control to minimise its further development."

But David Ellerton points out that this has become a greater challenge as more active ingredients are lost. "For example, IPU has been a mainstay product for meadowgrass and broadleaf weed control, as well as doing a reasonable holding job on blackgrass."

A second mainstay herbicide trifluralin failed to get Annex 1 Listing in Europe and all products containing this active must be sold by distribution by 20 September 2008, with its use and storage by growers ceasing at the end of March 2009. "The loss of these two actives will certainly leave large gaps in the market."

Chlorotoluron can be a useful replacement for IPU, providing better ryegrass and wild oat control, he continues. "It's more persistent and, most importantly, is less prone to leaching." But it has key varietal restrictions in wheat with Cordiale, Battalion, Duxford, Humber, JB Diego and Xi19 all being exempt from treatment. "Plus it's probably a bit weaker on blackgrass."

"Pendimethalin can also be a substitute for trifluralin in some situations providing a broader spectrum of weed control including cleavers, speedwell, cranes-bill, red dead nettle and fumitory, as well as wild oats, blackgrass and annual meadow-grass."

"Pendimethalin is unaffected by target site resistance and is less affected by enhanced metabolism resistance — and it can be used right up to GS30. However, its downsides are the maximum dose rate and the minimum drilling depth requirement."

These two actives will have a useful role to play and will help contain expenditure.

David Ellerton strongly advocates the use of a robust pre-emergence treatment as part of a weed management programme. "In ProCam trials, the three mainstay pre-emergence herbicides — Crystal, Liberator and Defy — achieved an average 70% control of blackgrass, with a range of between 45-85%."

Best results were seen from full dose rates and when partner products were included, he adds. ■