



“It was the start of a planned, programmed approach to blackgrass control.”

# The solution becomes Crystal clear

## Innovation Innovation Insight

The launch of Crystal 20 years ago introduced a new mode of action on grassweeds and a new timing. But as *CPM* discovers, it was the mindset change it brought that heralded a revolution in blackgrass control.

By Tom Allen-Stevens

Over the past 20 years, there's little doubt the approach growers have taken to blackgrass control has shifted significantly. Understanding of resistance and population dynamics is far greater, drill and cultivation technologies, as well as how they're used, have evolved.

But there's one product that has remained a trusted mainstay backbone of the autumn herbicide programme. Crystal was launched by BASF in 2001, the first herbicide for cereals containing flufenacet. Partnered with pendimethalin (PDM), already established in the autumn residual herbicide programme, the combination heralded a new approach to grassweed management, notes Andy Jones, who was BASF's UK manager for herbicides when it was launched.

“At the time, blackgrass couldn't have been given greater encouragement to become a real problem on farm,” he recalls. “There was a tendency to drill earlier, the straw-burning ban had come in and non-inversion tillage — mixing the seed through the soil profile, rather than burying it — was becoming popular. That was the environment into which Crystal was introduced.”

### New mode of action

A heavy reliance had also been put on post-emergence chemistry, notes Steve Dennis who joined BASF's UK market support team soon after Crystal was launched. “This was a new mode of action for grassweeds, but it was also a new timing to spray, focused on pre-emergence. The game-changer was not just the new chemistry, but the whole new mindset that came with it.”

Correct timing was the number one concern from growers, confirms Iain Ford, who provided technical support via the UK helpline. “It was the start of a planned, programmed approach to blackgrass control. Crystal's role in that is as relevant today as it was when it was introduced.”

Flufenacet had the novel mode of action introduced with Crystal (see panel on p77). Known as FOE, named after the Bayer team of scientists who developed the active ingredient, the right to formulate and market it was purchased by

Cyanamid shortly before the company was acquired by BASF in 2000.

PDM was introduced to the market by Shell and came to Europe in the late 1970s. It quickly became an arable mainstay, marketed as Stomp. “In cereals, isoproturon (IPU) was the main autumn-applied herbicide for blackgrass and annual meadowgrass control,” notes Andy. “It was sold in mixtures with PDM as Encore and Trump, while Panther saw it mixed with diflufenican (DFF).”

“But these were all applied early post-emergence, and growers were encountering issues with resistant blackgrass. This led to a resurgence for Avadex (trilalate) granules, reviving interest in pre-em applications. So the timing was perfect for the introduction of Crystal, offering far better pre-em activity with the convenience of a liquid.”



Crystal was promoted as a longer lasting herbicide and this year will be its 20th season in commercial use by UK growers.



*Andy Jones notes the pre-em herbicide market grew at an astonishing rate.*

Crystal was launched in July 2001, a full three years before Liberator (flufenacet+ DFF). But what happened then took the marketing team completely by surprise.

“We didn’t take all the market share off Avadex, but the pre-em herbicide market itself grew at an astonishing rate. Demand outstripped the rate at which we could bring product to market. It was immediately obvious Crystal was part of a step change in getting on top of blackgrass. It was found by growers to be the best start to their weed control programmes and it’s remained there ever since,” says Andy.

### Lower risk chemistry

For Steve, the reason for Crystal’s popularity was clear. “With the rise of resistance, fops and dims had pretty much reached the end of their usage for blackgrass control in wheat and growers were looking for lower risk chemistry to do the heavy lifting.”

So BASF was keen to ensure growers knew how to get best from this new approach. “There were three main aspects we wanted to encourage: the first was to consider label dose rate in relation to grassweed risk — in the early years



*Steve Dennis recalls that the change to spraying for an anticipated weed burden led to some heated debate.*

many wanted to use Crystal at half-rate which was OK for some situations but we were keen to steward the ▶

## Complementary activity allows a flexible approach from residual chemistry

Although Crystal must be applied pre-emergence of the weed, there’s a degree of flexibility over timing, provided you understand how it works, notes BASF technical manager Stuart Kevis.

“There’s also a useful label change that extends its window of use.”

Flufenacet is an oxyacetamide herbicide that inhibits cellular metabolism, he explains. Now in Group 15 of the new Herbicide Resistance Action Committee (HRAC) classification (previously K3), it acts on very long-chain fatty acids.

“In grassweeds it causes failure of the shoot to emerge, while it’s taken up by the roots of emerging broadleaf weeds, resulting in severe stunting, necrosis and distortion of leaves.

“Pendimethalin is in HRAC Group 3 (previously K1) and works by inhibiting microtubule assembly — essentially preventing cell division. It’s predominantly taken up by the root with a bit of shoot uptake. The two herbicides work nicely together when applied pre-emergence of the weed.”

PDM has a half-life of around 90 days, Stuart explains. “It binds tightly to clay particles in the soil and is one of the more persistent pre-em actives. Flufenacet is a little more mobile, with a half-life of 30 days, but it’s taken up quicker by the weed.”

Trials have shown Crystal brings around 90% control of susceptible blackgrass when applied in the right soil conditions. “It offers the best start to

a blackgrass control programme, although it’s crucial that chemistry is seen as the last piece in the jigsaw of an integrated programme,” he stresses.

It’s only active on grassweeds as they emerge, he points out, which is why its important best use is made of cultural control techniques and glyphosate to eliminate as much of the weed burden from seedbeds before drilling. Activity is also reliant on good coverage of the soil surface, so spray quality is important, and a clod-free, even fine tilth ensures the best results.

“It’s a strength of both actives that they stay where they’re put — PDM remains in the top 1-1.5cm, while flufenacet may move to around 3cm depth. It’s therefore crucial that cereal seed is drilled to at least 32mm depth, out of the herbicide activity zone.”

Most blackgrass will emerge from within this zone, but dry conditions or conversely water-logging, as well as dormancy all result in protracted emergence. “The efficacy of Crystal, especially the flufenacet element, may have waned by the time this occurs, which is why many growers look to top-up the flufenacet post-emergence.”

Stuart emphasises that the best effect on blackgrass will be achieved by applying a full 4 l/ha rate of Crystal at pre-emergence, with delayed drilling being the best way to reduce overall blackgrass burden. “But field conditions



*Spray quality is important, and a clod-free, even fine tilth ensures the best results.*

and autumn priorities can often confound best laid plans, while Crystal is an important partner in a stacked programme and can be used in sequence with other herbicides,” he says.

“A recent label change has removed the restriction that previously prevented applications after 31 Dec. So it can now be applied at any time up to growth stage 23 in winter wheat and winter barley — third tiller visible. There’s also an EAMU for use in spring barley up to the same timing.

“If spraying Crystal at peri-emergence or early post-em, ensure field and weather conditions are appropriate, with no water-logging or heavy rainfall imminent, and apply the same rational to seedbed quality as with a pre-em. Crystal can be applied with diflufenican in winter wheat, but only on its own in barley,” he advises.





Iain Ford advises that if the pre-em timing is missed, Crystal can be applied post-emergence.

► chemistry,” he explains.

“We stressed the pre-em timing, which was difficult for many growers who lacked bout-markers, and GPS guidance didn’t really exist. And we emphasised that the application should go hand-in-hand with the drilling — get the spraying done, even if conditions are dry.

## Mindset change

“This mindset change, of spraying for an anticipated weed burden, was the big one. Growers were accustomed to spraying emerged weeds and a population they could see, so this led to some heated debate.”

With the phasing out of IPU and trifluralin from 2007, reliance on the pre-em chemistry grew. This is what drove the concerns of growers who contacted BASF’s technical services hotline, notes Iain. “We received a lot of queries about missed timings — whether Crystal would

still be effective if applied early post emergence.

“Crystal is more effective when applied pre-emergence of the weeds and the best advice is to apply it within 48 hours of drilling. If the pre-em timing is missed, though, Crystal can be applied post-emergence and the recent removal of the latest timing of the end of December adds more flexibility still.”

There have also been queries over the influence of organic matter and surface trash. “Organic matter influences the efficacy of all pre-em herbicides. Equally, pre-em’s need to reach the soil for optimum uptake by weeds, so growers moving to direct drilling and very shallow cultivations should take care they don’t block the path of the spray with a mat of straw,” advises Iain.

The importance of effective cultivations has gained momentum with the relentless rise of resistance, and it’s one of ten

## Resistance drives a mindset change

For independent blackgrass expert Dr Stephen Moss, sometimes the biggest resistance he’d face would come from growers themselves. “Back in 2000, it was like banging your head against a brick wall. We could see the impact reliance on chemistry was having, and were developing evidence-based cultural control strategies. But most growers just wanted a chemical solution.”

Enhanced metabolism resistance, also known as non target-site (NTSR), was the first resistance identified in the UK, he explains, and confers the ability in the grassweed to withstand almost any herbicide to a greater or lesser degree. “NTSR can be seen as shades of grey and varies according to how much a population has been exposed and the specific herbicide used.

*Growers can and do change their strategy and they have to change as the challenge of blackgrass evolves, says Dick Neale.*



“At the time Crystal was introduced, post-em herbicides were going downhill, but a lot of that was related to target-site resistance (TSR), where a genetic mutation blocks a specific active and resistance in individual plants tends to be total. However, back then we didn’t understand TSR at a molecular genetics level and there’s now a much greater awareness of the complexity and multiple mechanisms associated with NTSR.”

He notes that the standard test for NTSR uses PDM, which has more to do with the number of years it’s been a mainstay herbicide than how prone it is to resistance. “Flufenacet is certainly one of the herbicides that’s least affected by resistance,” he notes.

“But the key aspect about Crystal is that it’s very much less affected than any of the post-em’s and resistance builds up slowly. In that respect, it’s a more durable product and has allowed growers to build their cultural control programmes. Attitudes have thankfully moved on now and there’s far less reliance on the chemistry — where once spring cropping was demonised, it’s now accepted practice, for example,” Stephen adds.

Hutchinsons’ Dick Neale has seen the same shift in mindset. “20 years ago, growers didn’t really talk about resistance and a pre-em just wasn’t something you did. Crystal changed all that, and while there’s been a shift in its efficacy, it’s pretty exceptional that a blackgrass herbicide has retained its place in the market for 20 years.”

Conversation at the company’s blackgrass



*In the early days, Stephen Moss stressed the importance of adopting evidence-based cultural control strategies, but most growers just wanted a chemical solution.*

site at Brampton, Cambs, evolved from looking for the next big-impact herbicide, to a focus on the pre-em stack, to splitting the stack, following up with a post-em spray. “The post-em top-up took the place of Atlantis (mesosulfuron+ iodosulfuron) when ALS resistance began to build. We did a lot of trials work on various programmes, looking at two or even three splits,” he recalls.

“But you have to ask yourself, if you’re contemplating a high residual input, whether you ought to take a fundamental look at your overall grassweed strategy.

“There’s now a much greater awareness of resistance, acceptance that herbicides offer only limited control, and understanding of the importance of cultural measures. Growers can and do change their strategy and they have to change as the challenge of blackgrass evolves,” says Dick.



## The ten aspects of an effective blackgrass battle strategy

- **Measurement and roguing** – good reconnaissance gauges whether your efforts are making a difference.
- **Resistance management** – getting a seed sample tested is an important first step in assessing the level of resistance you're up against.
- **Reducing spread** – blackgrass multiplies quickly, so a focus on activities that can cause it to spread ensures this is minimised.
- **Soil health** – blackgrass thrives in cold, wet soil conditions, so improving the long term health of your soil will work against it.
- **Rotation** – the aim is to deplete as much of the seedbank as possible – it's the battle behind enemy lines.
- **Cultivations** – the real key is to know when you need to bury it, and when you need to just leave it alone.
- **Establishment** – the general principle is to try to avoid disturbing weed seeds when drilling.
- **Spray Application** – the most uniform application will be achieved on smooth seedbeds, at low windspeeds, and low forward speeds.



*The Real Results Virtual Farm has top tips on blackgrass control from experts and farmer journeys from those battling the grassweed. [www.basfrealresultsfarm.com](http://www.basfrealresultsfarm.com)*

- **Chemical control** – while over-reliance on herbicides has led to resistance, the right herbicide choices can make a huge difference to success.
- **R&D** – Brand new modes of action in partnership with what we've learnt about cultural control give us all a fighting chance of finally being able to regain control over problem weeds.

aspects Stuart believes come together to form an effective strategy in the continuing battle against blackgrass (see panel left).

"The challenge of blackgrass for growers has evolved over 20 years, and the way they're facing up to it has changed. But Crystal's been consistent – it has a proven track record as the go-to herbicide that's stood the test of time. It's still the backbone to blackgrass control and will continue to be one its most reliable aspects," he says. ■

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