

Revealed: The cost of not using cultural blackgrass controls

A major research project by Savills, *Farmers Weekly* and Rothamsted Research sheds new light on the economic impact of blackgrass. Mike Abram reports

How close is your farm to the blackgrass control cliff edge? Based on unique research by Savills, Rothamsted Research and *Farmers Weekly*, there is a tipping point when blackgrass populations become so heavy that farm incomes fall dramatically.

That point could come just through resistance building to the key herbicides used to control the weed over time. But employing cultural control-based management strategies can keep farm incomes sustainable over the medium- to long-term, even if resistance builds.

Any grower with blackgrass on the farm has to be worried about controlling it in the future. The arrival of Atlantis (iodosulfuron + mesosulfuron) bought some precious time for many growers, and the opportunity to clean fields to some extent, but resistance, both target site and enhanced metabolism, to the key post-emergence option is rising.

That has affected the ability of Atlantis to cope with variable conditions, and now, when and how you apply it are much more critical than when it was first launched. Indeed, the days of seeing fields with near enough 100% control of blackgrass from a single spray of Atlantis, are fading into the past.

But unlike last time, when Atlan-

tis was launched just as fop and dim chemistry was reaching the end of its useful life, there doesn't seem to be any new "Atlantis" in the pipeline.

Manufacturers have openly said they don't have any new modes of action to launch in the next five years, and it could easily be a decade before anything is available.

In addition, existing products, particularly residuals, will continue to come under regulatory pressure as the new European approvals regulations come into force. Already isoproturon and trifluralin have been lost, and pendimethalin was listed as a potential casualty in the Chemicals Regulation Directorate's analysis of the proposals.

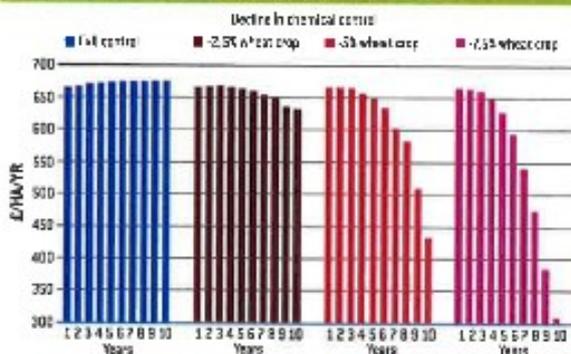
It adds up to a worrying picture, where growers are reliant on a few key active ingredients – a policy that will almost certainly see resistance to them increasing, believes Rothamsted Research's Stephen Moss.

"There is a need to adopt a more integrated approach to weed management on many farms, integrating the use of chemicals with more non-chemical methods of control."

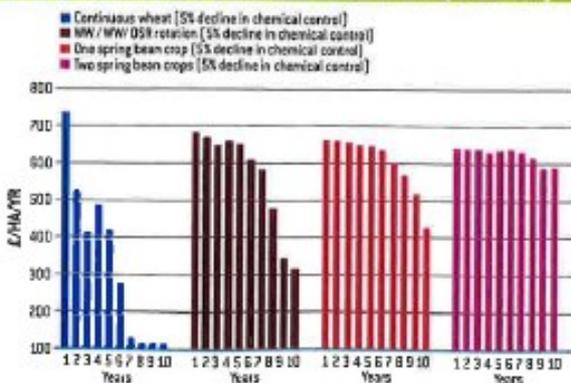
Growers can be put off cultural controls, however, through the extra risk they can create through delayed drilling, or extra cost from ploughing, for example.

But just what is the better long-term strategy for sustainable black-

1 AVERAGE GROSS MARGIN (£/HA/YEAR) WITH DECLINING CHEMICAL BLACKGRASS CONTROL

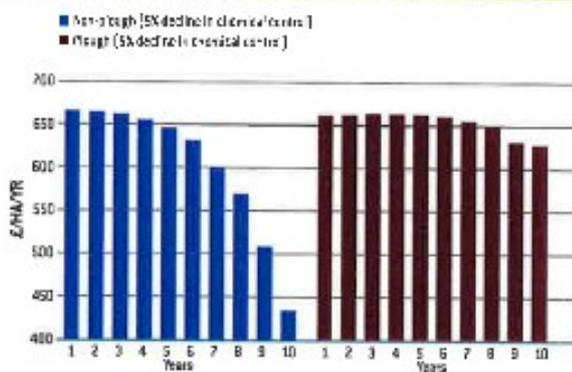


2 IMPACT OF ROTATION ON AVERAGE GROSS MARGIN (£/HA/YEAR)

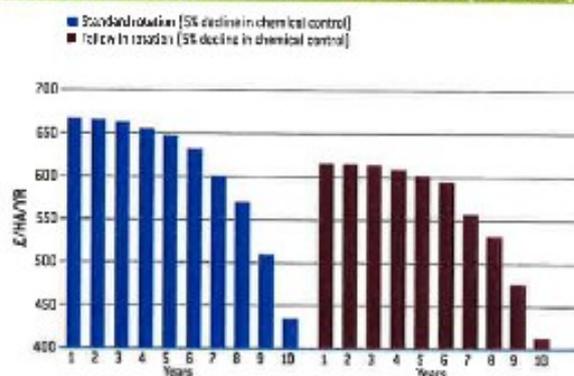




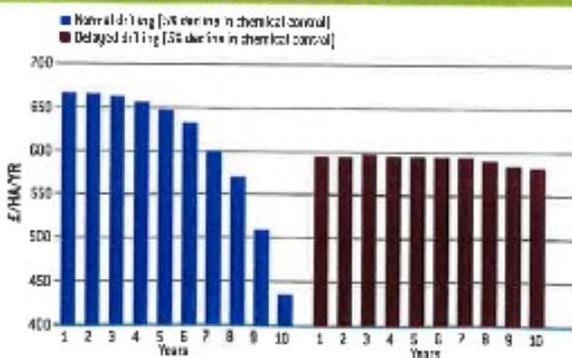
3 AVERAGE GROSS MARGIN (£/HA/YEAR) PLOUGHY V NON PLOUGH



5 IMPACT OF FOLLOWING ON AVERAGE GROSS MARGIN (£/HA/YEAR)



4 AVERAGE GROSS MARGIN (£/HA/YEAR) DELAYED DRILLING V NORMAL DRILLING DATE



grass control and cereals production? Will growers make more money by continuing to use chemical controls with only minimal regard to cultural controls? Or do they need to switch to one or more alternative options, such as rotational ploughing, delayed drilling or even following?

Those were the central issues the research team sought to answer using the Savills/*Farmers Weekly* Virtual Farm model (see panel, p25).

1 CHEMICAL CONTROL IS IT SUSTAINABLE?

The starting point for the study was to set a baseline for the returns across the 800ha (2,000 acre) farm,

assuming any blackgrass on the farm could be controlled fully. The base model, therefore, assumes 95% control of blackgrass is possible in each and every wheat crop through the 10-year period.

The result (chart 1) is a healthy and stable total crop gross margin averaging £673/ha a year (£528,697 a year), and a blackgrass population that gradually declines over the 10-year period.

But the reality is that few, if any, growers are in a position where blackgrass is so easily controlled. For many, resistance is gradually increasing and herbicide control generally decreasing.



KEY MESSAGES

Diminishing chemical control

- Returns will fall dramatically if chemical control diminishes
- A starting population of 58 blackgrass plants/sq m takes five years before steep decline in returns with 5% loss in chemical control in every cereal crop
- By year-10 total crop gross margin nearly £200,000 less than in year one (36% decrease)

To reflect that, the first scenario tested within the model were progressive losses in chemical control of 2.5%, 5% or 7.5% each time a wheat crop was grown in the rotation.

The results (chart 1) show that initially in all three scenarios returns remain fairly stable, but once blackgrass populations begin to build in crops to levels that have a serious impact on yields, returns fall off the edge of the cliff, says Savills director Andrew Wraith.

That obviously happens quicker if control is failing faster. For example by year six, gross margins in the scenario where control is dropping by 7.5% in each wheat crop have dropped below £600/ha on average across the farm, compared with the starting point of £666/ha. That point is reached in year eight where there is a slower decline of 5%, while it is never reached if there is only a minor fall in control of 2.5%.

The key question for growers is how close are they to the edge of the cliff, says Dr Moss. "Do you know how much resistance is building on your farm, and what kind of decline in performance are you experiencing?"

Measuring either practically on farm, is, of course, not easy to do, with no control areas usually left untreated, and herbicide performance affected by several factors, of which resistance is just one. "But it is clear the bigger the decline in her-

BACKGROUND

Key assumptions made within the blackgrass model

To keep the model relatively simple a number of key assumptions had to be made regarding the blackgrass population on the Virtual Farm.

The first was to start with a uniform blackgrass population across the farm. While unrealistic on commercial farms, the model would have been instantly too complex from which to draw conclusions, if variable blackgrass populations were used as the starting point.

The population level was decided as 58 blackgrass plant/sq m. This figure was taken as research by Dr Moss within the HGCA project "Integrated management of herbicide resistance" had identified how blackgrass populations would build up without using herbicides under the 20cm deep tine and disc cultivation system the Virtual Farm

uses as standard practice. That information was used as a check to make sure other assumptions made were in line.

At the end of each cropping season a multiplier has been employed to take account of seed return, seed-bank population, and the ability to control blackgrass pre-drilling to calculate a figure likely to come up in the following crop.

That figure is higher for oilseed rape than wheat to account for earlier drilling encouraging more germination and less chance of removing blackgrass pre-drilling. In contrast, growing spring beans allows a much greater chance of reducing populations before drilling, so a lower multiplier has been used.

Chemical control in wheat crops

in year one has been assumed as 95%, while 90% is the figure used for the break crops throughout.

The impact of the final blackgrass population on wheat crop yield has been determined based on research published by Rothamsted Research in 1999.

No similar information exists for the break crops, so based on Dr Moss's advice, 50% of the yield-loss predicted for wheat has been used.

For the financial analysis, input costs and output prices have been fixed – accurately predicting grain prices for a 10-year period was beyond the capability of even this team.

So for wheat, a sale price of £156/t has been used, £342/t for oilseed rape and £200/t for spring beans.

bicide performance, the sooner you will fall off the edge of the cliff."

2 ROTATION HELP OR HINDRANCE?

Crop rotation can either add to, or help mitigate against, any problems with poorer chemical control. The model – when the farm implemented a continuous wheat rotation or even a wheat/wheat/oilseed rape rotation rather than the farm's usual plan of including a spring bean crop once every 10 years – showed how vulnerable intensifying the amount of wheat could be.

Gross margins with a continuous wheat rotation facing a 5% decline in herbicide performance year-on-year plummeted, and averaged just £334/ha a year after 10 years compared with £605/ha a year with the usual rotation.

The model also suggests that a wheat/wheat/oilseed rape rotation, which is practised on some farms, isn't sustainable if chemical control declines. By the end of year-10, wheat yields have dropped by 40% and total farm income by 58%. Crop gross margins average £525/ha a year – £80/ha a year less than where spring beans are grown.

Increasing the amount of spring beans in the rotation to one crop every five years does allow growers to retain a measure of control of blackgrass, with just 19 blackgrass plants/sq m on average in the year-



KEY MESSAGES

Rotation

- Rotation of crops important when chemical control declines
- More intensive wheat production at greater risk of income declines with diminishing chemical control
- One spring crop in 10-year rotation adds £80/ha (£62,533) on average compared with a WW/WW/DSR rotation
- Adding second spring crop produces a further £23/ha (£17,867) gross margin on average over the 10 years
- Ability to control weeds in break crops critical

10 crop, compared with 121/sq m where only one spring bean crop is planted in the 10-year rotation. Total crop gross margin is higher too – averaging £628/ha a year.

Spring cropping reduces the demand in the busy autumn period for labour and machinery, but it does have some practical issues on farm, says Mr Wraith. "Some land is suited to spring cropping, some not. It is not always easy to establish spring crops well, particularly on heavy land, which is slower to warm and dry in spring."

3 PLOUGHING ROTATIONAL SUCCESS?

When it comes to controlling blackgrass, one of the first tools mentioned as having a good effect is the plough, which buries seed and can give time for destroying weeds pre-drilling in seed-beds.

In a literature review conducted by Dr Moss and Peter Lutman of Rothamsted Research, ploughing on average reduced blackgrass populations in the seed-bed by 67%.

Many growers have moved away from it, as other cultivation methods are quicker and cheaper, says Mr Wraith. "It can also be difficult to create good seed-beds in a dry autumn."

There is also concern over its effectiveness when continually used, as there is a danger of just ploughing back up buried seeds. But if black-



KEY MESSAGES

Rotational ploughing

- Rotational ploughing before second wheat could be best option
- Produces an extra £49/ha on average (£38,385 in total) over 10-year rotation compared with Virtual Farm standard practice with a 5% chemical control decline in both systems
- Adds extra costs and time for wheat establishment, and it also can plough up buried seeds removing some of the benefit

grass is getting out of control, most experts feel it should be utilised more, especially rotationally.

Rather than moving wholesale back to ploughing before every crop, our model looks at whether rotationally ploughing a proportion of the farm before second wheat crops could be an effective strategy.

From the results, it certainly bears consideration, with £654/ha a year being the highest average gross margin over the 10-year period of any of the scenarios tested, except full chemical control. That's £49/ha a year more than the direct comparison where chemical control declines by 5% in wheat, but ploughing is not used.

4 DELAY DRILLING RISK WORTH TAKING?

Another popular suggested tactic for helping to manage blackgrass is to delay drilling wheat.

Later plantings not only allow more time for stale seed-bed preparation and potentially taking out blackgrass prior to the crop, but also tend to have smaller and less com-

petitive in-crop blackgrass.

According to Dr Moss's research, delayed drilling on average in trials has reduced blackgrass populations by 37%, but for the best results drilling needs to be delayed at least into the second half of October.

That can both reduce yield potential and the chance of finishing the drilling programme on time in the autumn. It also, says Mr Wraith, can restrict the development of plants in seasons like the current one, where the cold winter and dry spring have left those crops drilled late struggling the most.

But if the model's predictions are correct, if yield impact can be minimised and drilling completed on time, it could be a viable option. It results in the lowest blackgrass population of all the scenarios tested, with just eight blackgrass plants/sq m in the year 10 crops on average.

The model allows for a 0.5t/ha yield penalty, and a doubling in the seed costs, which reduces average gross margins compared with the standard farm practice by £13/ha a year across the farm.



KEY MESSAGES

Delayed drilling

- Delaying wheat drilling by a month can bring big benefits
- But increases risks of lower yields and not completing drilling programme
- While a 0.5t/ha yield penalty reduces crop gross margins by £13/ha (£10,147) over the 10 years, in year 10, the farm has a £116,153 higher total gross margin and a blackgrass population that can still be controlled

Much of that loss in margin comes in the initial years of the model. In later years, gross margins are much higher than on the standard farm when both are suffering more from poor chemical control.

5 FALLOW ECONOMICALLY CHALLENGING?

The last scenario tested was replacing the spring beans in the rotation with a fallow crop. Fallowing is seen as a good way of cleaning the land from blackgrass, with the use of cultivations and/or the use of glyphosate expected to reduce the

blackgrass weed bank significantly.

Modelling its impact in the relatively simple model was not easy, but assuming the same amount of blackgrass comes up in fallow as in wheat, and that around 98% control is achieved with glyphosate, the final result is a reduction of 76% in the seed-bank for the following crop. That is in line with the 70-80% figure published by Drs Moss and Lutman in their literature review.

But the model suggests that isn't good enough to keep the blackgrass population under control when there is also a 5% decline in herbi-

cide performance, making little difference to the final blackgrass population in year 10, compared with the default scenario, which also has a 5% decline in chemical control.

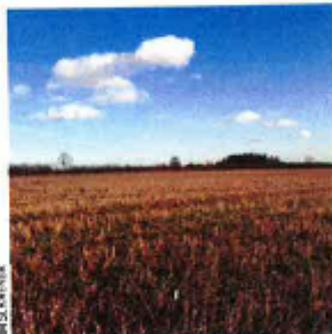
And with the additional loss in income of one crop in 10 years, the scenario doesn't stack up economically – losing £41/ha a year.

The results shouldn't mean growers discount fallow as an option. Research on modern fallowing with glyphosate is minimal, admits Dr Moss, so higher levels of control could be possible, which would help increase blackgrass control through

the rotation and minimise the impact on yields and margins.

Fallowing for two years, for example, could be one possibility, with research showing it could reduce the seed-bank by over 90%. "But it would almost certainly reduce the bottom line further."

The model also takes all the fields out of production over the course of the 10-year rotation, while on most farms this probably wouldn't be necessary. Taking out a lower proportion of fields would decrease the economic impact of fallowing. mike.abram@rbi.co.uk



KEY MESSAGES

Fallowing

- Using current published control levels appears less effective and not economic
- Reduces overall gross margins by £54/ha a year on average (£32,379), but in year 10, the farm has a £119,610 higher total crop gross margin
- Could control levels be increased or area fallowed reduced?

VIRTUAL FARM MODEL

- Savills and Farmers Weekly's Virtual Farm model is a set of business management accounts representing a commercial arable business of 800ha (2,000 acres).
- It is broadly representative of a commercial arable farm in the top 25% of the industry. It's an efficient, well-managed business, but faces depreciation and investment issues

- like any other arable enterprise.
- The model farm has a full profit and loss account, gross margins and projected cashflows.
- The budgeted figures are based on data collected from Savills' client base of managed farms as well as real-world data from grain futures and industry benchmark data for key assumptions.