# COMBINE HARVESTER

FEATURE





# ON-FARM TRIALS MAKE PROGRESS TOWARDS **WEED SEED SOLUTIONS**

*Written by Charlotte Cunningham*

As growers grapple for grassweed solutions, Direct Driller looks at the results from the first year of on-farm trials investigating a novel way of controlling weed seeds at harvest.

Grassweeds are the bane of any arable farmer's life, with control often an uphill battle when it comes to tackling particularly persistent and resistant weeds.

Low disturbance and no-till systems are thought to be particularly vulnerable to a build-up of grassweeds as the seed shed each year stays in the germination zone, with little means of control other than repeated applications of herbicide. What's more, there's a heavy reliance on glyphosate, raising the prospect of resistance.

In a quest to find new solutions, a group of farmers across the country have been taking part in a new research project into a novel, chemical-free method of controlling tricky grassweeds at harvest.

The project is based around the Redekop seed control unit (SCU) technology – a retrofitted mill which sits at the back of the combine. The mill processes the chaff and is proven to kill up to 98% of weed seeds as they exit, offering growers both a way of reducing reliance on chemistry and a unique opportunity to control weeds at harvest time – something not traditionally done in the UK.

The technology has been used both extensively and successfully across North America and Australia, but the UK project is the first to put it to the test in a maritime climate.

## Project background

The trials have been co-ordinated by the British On-Farm Innovation Network (BOFIN) – with test protocols developed by NIAB – on three farms across the UK.

Suffolk farmer, Adam Driver headed up the first year of trials, with an SCU fitted to his Claas Lexion 8800. Adam has a historic challenge with blackgrass building up in chaff lines of his controlled-traffic farming system and hopes the technology

will be able to alleviate some of the burden. "We're farming about 2000ha of combinable crops on a no-till system. Generally, our main weed challenge is blackgrass – we've got massive amounts in this area and have for a long time."

Adam tested the technology alongside Worcestershire farmer Jake Freestone, who has an SCU fitted to his John Deere S790i in a bid to tackle meadow brome, and Warwickshire grower and Velcourt farm manager Ted Holmes, who has been trialling a unit fitted to his New Holland CR9.90 and suffers particularly with Italian ryegrass.

## Year one results

Though the data set so far is small and only based on one harvest's worth of results, there were some interesting findings from the first year's trial, says NIAB's Will Smith who designed its monitoring protocols and carried out the analysis on the weeds left standing at harvest.

At Adam's farm, the headline result is that 54% of blackgrass seed was retained in winter wheat. This came as a slight surprise and was a much higher level than previously thought, admits Will.

Brome levels were also significantly reduced thanks to the use of the SCU. "I deliberately planted some winter barley in a field I know has got a lot of brome, and I haven't found much at all," says Adam.

While ryegrass has not typically been an issue at the farm, Adam says this is something he has seen in small amounts this year – opening up another control opportunity for the technology. "Ryegrass is something I really, really do not want here – so I'm hoping that this is something that the seed control unit will just take care of based on what we've seen already."

In Warwickshire, the SCU technology enabled a 60% reduction of Italian ryegrass in winter barley and 44% in spring barley, compared with using the combine alone, which was a really positive result, says Ted.

Data was limited at Jake's farm, though weed burdens in general were lower last year, he says.

## Next steps

Building on the results of last year's trials, Adam is leading a project that has been awarded funding from the Defra Farming Innovation Programme, delivered by Innovate UK, to continue the research under Defra's research starter round two competition.

The three farmers from the first year of the trials will be taking part again and will be joined by Keith Challen of Belvoir Farming Company who will have the SCU unit fitted to his Fendt Ideal combine. "It has become obvious that a lot of the grassweeds we're seeing are banded

behind the combine," says Keith. "So, to be able to control those from the combine makes a lot of sense."

Further trials will also be taking place looking at the interaction between harvest weed seed control and cultivation strategy, led by Adam. This will involve comparing his normal no-till approach with a light cultivation to see if there is any difference in chit.

Though the effectiveness of the technology as a standalone is well-proven, the results in the field are based upon exposure to weed seed. Therefore, one of the key aims of the study going forward is to collect data on seed shed of UK-specific weed challenges – something which has been fairly limited to date, explains Will. "To use harvest weed seed control strategies, you must have seeds remaining on the heads to target. Therefore, gaining a better understanding of weed seed shed patterns is vital to proper implementation of these techniques."

As such, the research team, co-ordinated again by BOFIN, are calling for more farmers to get involved in the project by becoming a 'Seed Scout'. This involves collecting weed samples, assessing them via one of three simple assigned methods, and then returning the seeds to NIAB for validation. The results of this will form the UK's first farmer-led survey of grassweeds left standing at harvest. "To accelerate the project even further, we want to collect spatially diverse data about weed seed shed across a range of weed species, in a range of crops," notes Will.

"Therefore, we're asking farmers to go out into the field pre-harvest or the day of harvest to collect 20 heads of the weed seed heads they're particularly concerned with and carry out a short analysis, based on an assigned methodology. This could be counting seed heads or a visual assessment of perceived weed seed shed, for example. These samples will then be sent into us at NIAB to provide further validation and analysis. We don't anticipate this being overly complicated or time consuming during what we know is already a busy time of year."

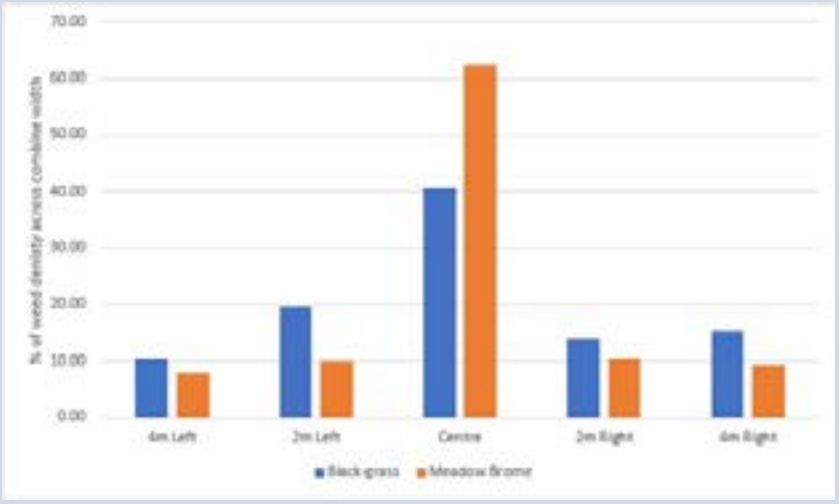
Will is particularly keen that those who direct drill get involved with the project. "There's a theory that harvest weed seed control can help no-till systems more as it reduces the risk of building up a large, shallow weed seedbank. This is where interaction with Seed Scouts will be key to tease out and explore elements of a very different approach to controlling grassweeds," he notes.

Farmers who sign up will receive an information pack containing a guide to sampling methodology and the weed seed shedding survey to record weed status and management practices. As well as this, the pack also contains 20 small envelopes for the seed samples and a postage-paid envelope to return to NIAB. "This project and the data collection associated with it has the potential to develop some really unique and novel data which will help not only growers in the UK but also the wider industry, to ensure we're using the right tools in the right place when it comes to tackling weed management."

## Harvest seed weed control results summary:

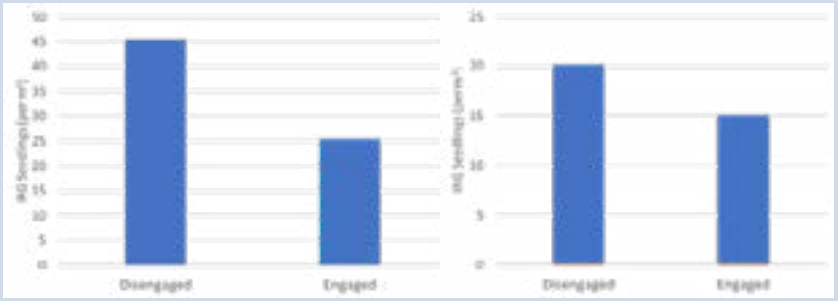
Driver Farms, Suffolk: 54% of blackgrass seed retained in winter wheat, brome populations significantly reduced. Weed counts taken by Will in the field in late October showed that for both blackgrass and meadow brome, germination follows a classic 'bell curve', tracking exactly the combine runs in the CTF system.

"Over 60% of the meadow brome and 40% of the blackgrass was found directly behind where the combine had passed, showing it puts the seed into the chaff stream," he reports. "This is really important in no-till CTF systems because there's a cumulative effect of this seed rain on the soil surface year after year."




*Source: NIAB, 2022; analysis carried out at Driver Farms, Suffolk, on 6 Oct in winter wheat across the 12m swath width behind the combine following winter wheat. Average of 15 points along a 150m transect.*

**Velcourt Farms, Warwickshire:** 60% Italian ryegrass reduction in winter barley; 44% reduction in spring barley with the SCU technology.




*Source: NIAB, 2022, Warwickshire. IRG seed shed into winter barley (left) and spring barley (right), with emerged seedlings counted on 26 October in oilseed rape and winter beans respectively. Note: the spring barley field was subsoiled, which may have introduced more seed from previous years. Figures shown are averages across two strips in each field, with multiple transects taken in each strip.*

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# CLEANING TIMES REDUCED WITH **INNOVATIVE COOLING SYSTEM**

As anyone that has operated a combine will know, the worst part of the job is the daily cleaning to prevent pockets of chaff building up around the engine bay and eventually getting too hot.

It's a dusty and time-consuming job to get all the hard-to-reach areas where chaff can accumulate. However, an innovative AirSense cooling system on Fendt's latest Ideal models has significantly reduced a large proportion of the daily cleaning required around the engine bay and exhaust system.

The AirSense system removes the need for a thorough daily clean near the engine thanks to an eight blade, 950mm reversible fan that engages based on engine temperature and time parameters. The total ventilated area is 2.7m2, and the regularity of fan engagement means that dust and chaff don't have the chance to build up around the engine, offering extra piece of mind to operators during dusty conditions.

Ant Risdon, combine specialist at Fendt, says the AirSense system has multiple benefits for both operator and machine. "The reduced cleaning times can allow users to get cutting earlier in the day in good conditions, which is helpful in a catchy harvest. A shorter cleaning procedure each day will soon add up over a harvest period, and, for farms with large acreages to cut, could see a considerable time saving at the end.

## Inverted air flow

The system enables the fan to invert the air flow, changing it from sucking in air to cool the engine, to blowing air back through the radiators at selected times, to clear any debris build up. It also keeps the intake screen on top of the radiator free from dust and chaff build up and there is no rotary dust screen required.

It inverts by changing the pitch of the fan's paddles. This is activated by engine temperature or time since the last inversion, and a visible plume of dust is seen rising from the engine bay when engaged. Manual activation is also possible if the operator feels it is required.

"By keeping the engine bay free of debris, combine performance is never restricted as maximum air intake through the radiator is always possible. Coupled to this, the AirSense system significantly extends the life of the air filter, which requires no cleaning during the season from the operator," comments Ant.

The AirSense cooling system is available on all models of Fendt Ideal from the Ideal 7 with its 9.8-litre AGCO Power engine to the largest Ideal 10T, powered by a 16.2-litre six-cylinder engine offering 790hp.

Fendt has also introduced a new over pressurised exhaust box to prevent dust accumulation around the exhaust, to help reduce cleaning times and chaff build up in the hottest areas of the machine. The new AirBox is available on Ideal 8, 9 and 10 combines.

## Customer viewpoint

### Ben Linington – Flichity Estates

Covering 1,300ha of combinable crops in north Shropshire used to mean regular cleaning of the combine each evening for Ben Linington, estate manager at Flichity Estates. However, after changing his Case Axial Flow 9250 for a Fendt Ideal 10T for this harvest, the time saved through running the AirSense system has allowed him more options at the end of each day as the lengthy cleaning period is no longer required.

The Fendt Ideal 10T runs a 40ft Geringhof header and the AirSense cooling was one of the main attractions to changing brands, especially after the hot summer last year, as Ben describes. "During the heatwave, I was stopping to blow dust off the exhaust system every few hours to prevent any fires. It also took me an hour and a half at the end of each day to blow down the combine and engine bay ready for the next day. The AirSense system was one of the reasons I bought the Ideal, to reduce the time spent with a compressor."

Although this is the Ideal's first season at Flichity, the benefits to running it have been obvious as blowing down now takes 15 minutes with a leaf blower to give the combine a once over, as opposed to 90 minutes before. "It also allows me more time to check over the rest of the machine, a job that ate into the start of each day with the previous machine. The engine bay and exhaust are spotless and I have been surprised at how clean the fan keeps it."

Along with AirSense, another reason for the Ideal purchase was grain quality. "I have never seen such a clean grain sample from a combine, and the cleaning capacity and rotors play a big role in this. Our dealer back-up from Chandlers is also very good," concluded Ben.

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# SHREDDING SOME LIGHT ON THE SUBJECT

What is Near Infra-Red Spectography and how can it benefit the combine at harvest time.

Without a doubt, better information enables you to make better decisions. Information is power, you only have to look to any shopping experience where retailers will try to harvest any personal information presumably in an effort to be able to offer you an opportunity to sell you more. But within agriculture, generating information at harvest time can now provide the building blocks for the decisions that will shape the profitability of the farm for the next year and for years to come.

Yield mapping is a technology that has been around for many years now. However, if you go back fifteen years, a farm's yield maps did little more than provide a novel wallpaper for the farm office. The key to yield mapping becoming a useful activity has been the ability to action the data generated. As farm management packages become more powerful and user-friendly, the ability to output prescriptions to enable variable fertilizer applications or variable rate seed rates have enabled farms to optimize inputs.

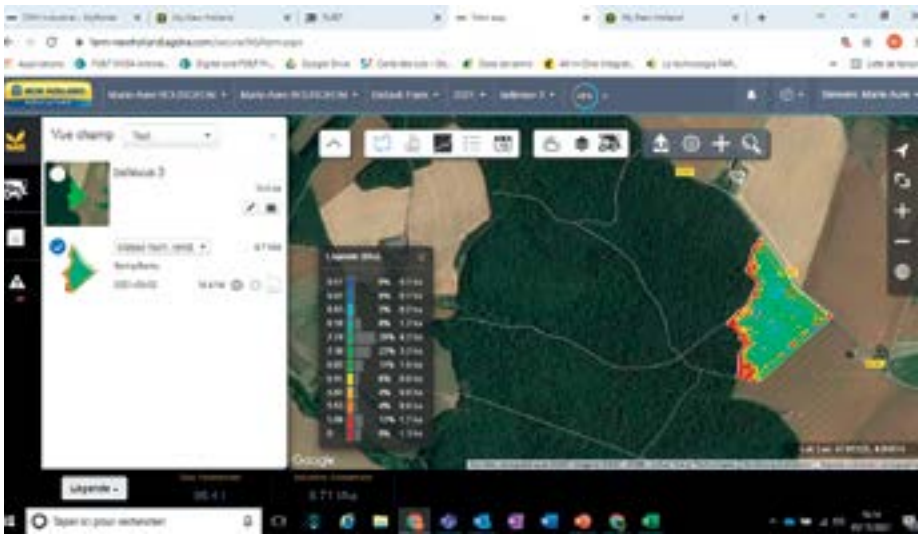
There are those, however, who feel that looking at yield in isolation may not give the fullest picture for example when considering fertilizer applications for following crops and a better indication might well be the quality of the crops harvested, which in turn may give a better clue of the use of nutrients – including inorganic fertilizers.

While crop quality has historically been

in the bailiwick of the grain merchant, a relatively new technology has now become available to the farmer – Near Infra-Red Spectroscopy (NIR).

NIR uses a light source to shine at a passing crop, and the reflected light is then interpreted to be able to determine the composition of the crop in real time. While the technology has traditionally been seen used in forager applications, where the knowledge of the nutritional composition of forage was an invaluable tool in establishing effective food rations not just for livestock but also to give those running Anaerobic Digestion plants a more scientific means of balancing gas production. That very same technology is also now available to New Holland combine operators in a factory fitted option for 2024.

The sensor uses different crop 'curves' to allow for the different responses as a result of different crops or even varieties. While three curves are included with the base sensor, more calibration curves can be added at a later date as needs and requirements change.



Mounted onto the lower part of the clean grain elevator, the combine NIR sensor scans all the grain on its journey to the grain-tank, given the farm protein information and moisture in cereals as well as oil content when harvesting oil seed rape.

The information can be displayed on the IntelliView IV monitor in the cab and then is incorporated into a layer on the yield map, where, with further interpretation, it can help shape future fertilizer and seed applications.

An interesting use of real time NIR data come from Australia where the adoption of the NIR sensors is further along than we can see in Europe. Rather than use the data solely as a basis for nutrient applications, combine operators in Australia use the data to be able to segregate grain of different quality.

With clearly defined quality criteria for grain, the farm can then subsequently blend different grain proteins in order to get everything 'over the line' for a quality premium. While not many farms in the UK have the facilities to segregate grain in this manner, it may be considered that as this information was never previously available to the farms, the need has never previously arisen. With some already segregating grain for moisture – it is only a small step to separate out crop on another criteria.

One useful aspect of the NIR sensor on a combine is that it is not confined to the combine when the combine is put away for the winter.

The sensor that is used on the combine is the same sensor that is used on a forager as well as being able to be used in a slurry application – either on the output from the slurry lagoon or even on the slurry tanker itself. All that is required to change from measuring grain to forage to slurry is the mounting kit and the dedicated curve for the material being measured. The sensor itself is the same.

Being able to consolidate the crop quality information within mapping opens up a world of possibilities to the modern farm. Where margins are tight and the cost of inputs is often the deciding factor between profit and loss, having the information at your fingertips to be able to make better decisions may well prove to be the difference. Crop quality information alongside traditional yield information, may prove to be the missing link that raises the usefulness of mapping beyond wallpaper for the farm office.


# THE NATIONAL MUSEUM OF RURAL LIFE IN SCOTLAND

The National Museum of Rural Life in Scotland stands as a captivating testament to the country's agricultural heritage, offering arable farmers a remarkable journey through time and a deep dive into the evolution of their craft. Nestled amidst the picturesque Scottish countryside, this museum serves as a vibrant tapestry of rural life, resonating with arable farmers who have played a pivotal role in shaping Scotland's agrarian landscape.

For arable farmers, the museum provides a unique opportunity to trace the lineage of farming practices that have sustained the nation for generations. Exhibits featuring 12 meticulously restored vintage combine harvesters evoke a sense of nostalgia while highlighting the transformation of labour-intensive methods into the mechanised processes that drive modern agriculture.

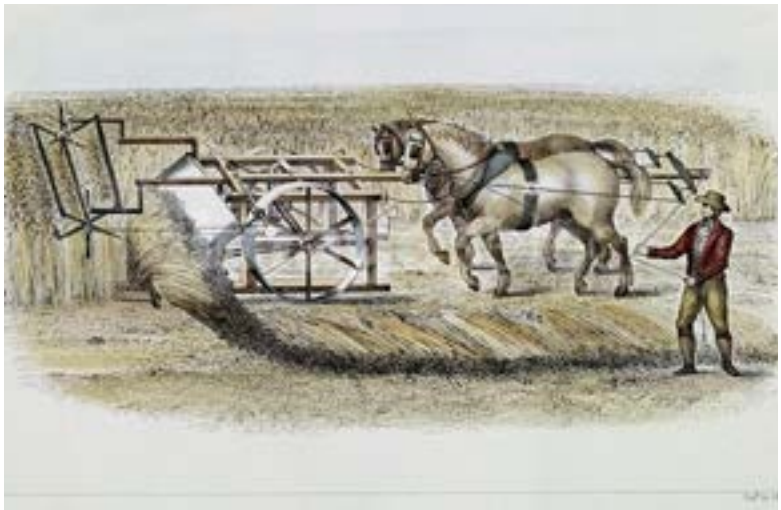
As well as the combines, one of the museum's prime attractions is its collection of historical crop varieties, which resonates deeply with arable farmers. From heirloom grains to ancient cereal crops, these exhibits showcase the genetic diversity that underpins the sector's resilience. Farmers can immerse themselves in the stories of these crops, gaining insights into their adaptability and historical significance, thus fostering a renewed appreciation for the rich agricultural tapestry they contribute to.

The National Museum of Rural Life is well worth a visit for arable farmers. It celebrates heritage, showcases the evolution of farming, fosters connections among farming communities, and inspires sustainable practices for the future. We are going to briefly cover some of the combines there to see.

## PATRICK BELL'S REAPING MACHINE

In 1827 in Scotland, the Reverend Patrick Bell designed one of the first successful reaping machines. It used a row of shears to cut the stalks at their base, pushed onto the blades by the revolving reel out in front - a principle that is still used in combine harvesters today.

Modern harvesters do the whole job automatically: you simply drive them through a field of crops and they cut, thresh, and clean the grains all by themselves using rotating blades, wheels, sieves, and elevators. The grain collects in a tank inside the combine harvester, while the chaff spurts from a big exit pipe at the back and falls back down onto the field.



*Above left: Patrick Bell's reaping machine by George Heriot Swanston [Public domain], via Wikimedia Commons.*

*Above right: Original model of the Reverend Patrick Bell's reaping machine, built by him in 1827. Following trials, ten full-size machines were used in east-central Scotland, with others exported to the US, Australia and Poland. On display in National Museum of Scotland in the Scotland Transformed gallery.*

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# HOLT CATERPILLAR 38 COMBINE, USA, 1928-1929

Dimensions: 7.6 m length x 3.2 m width x 3.8 m height main frame with canopy

Cutter dimensions: 6.2 m length x 3.1 m width x 2.5 m height

In total 1600 model 38s were manufactured, of which 14 were exported outside the USA. It was suited to work with short straw crops on the large prairies in USA but needed a team of 40 horses to pull it! However, the machine was not suited to the agricultural terrain in Europe.

The importer in Britain at the time, a company called Clayton Shuttleworth, looked into the problem and developed their own harvester in response.


# CLAYTON SHUTTLEWORTH COMBINE HARVESTER AND CUTTER BAR, LINCOLN, 1931-1932

**Dimensions:** 7.8 m length x 4.1 m width x 3.6 m height

**Dimensions of cutter bar:** 9 m length x 3.2 m width x 2.5 m height

The first European-built combine harvester was made by Clayton Shuttleworth in 1931. It has a wider drum suited to European crops and ground conditions. It is a trailed combine, pulled by a tractor rather than self-propelled.

Our Clayton Shuttleworth model was one of the first successful combine harvesters in Scotland. It was transported by train to Dunbar and then pulled to Whittinghame Mains or Traprain Law, where it worked most of the time. It was purchased for £580 at the time. It started life as a 'bagger': the thrashed crop was fed into sacks which were then tossed on the ground to be uplifted later. It was converted to a bulk tank in 1958 and last used in the mid-1960s.

During the Second World War it was painted in camouflage livery and was subsequently nicknamed 'Jessie'. This could have been in memory of Jessie, a local girl for whom the town clock of East Linton is known, but this is not proven.

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