



More harvest windows from green investment

Deciding when to harvest cereal crops for the optimum crop moisture content is a gamble every year for most UK farmers, but one Scottish Borders farm has stacked the odds in its favour with a new dryer, and running costs subsidised by low-cost and free fuel. **David Williams** visited the farm.

Based on the east coast at Eyemouth, Berwickshire, Greenshields Agri Ltd farms approximately 2,000ha, of which 1,600ha is arable cropping and the remainder is woods and grassland with some let out for livestock. The land is a mix of owned and contract farmed, all within 15 miles of the coast.

Winter wheat is the main crop – of which 400ha is Group 3 milling variety Barrel this season. Other crops in the rotation usually include winter and spring barley, oilseed rape, spring oats and spring beans, but this year spring beans weren't grown due to lack of suitable planting conditions, and spring wheat was a late replacement. Barley is mainly for malting, for Scotch whisky and beer, and feed varieties are grown for cattle.

"We have an arrangement with a livestock farmer on the west coast and provide 'bed & breakfast' for up to 1,000 fattening calves," explained farm manager Gary Sands. "These are beef calves from dairy cows. Using high value semen, good quality cattle are produced rather than Holstein bull calves which are of lower value to the beef industry. It costs a lot to ship spring bales across the country to the west, so the bull calves are transported here to take advantage of our grassland, they are fed our barley and we use the manure on our fields. The arrangement benefits both farms."

Coping with high moisture

In early September the last of the spring barley and wheat was being harvested by the farm's fleet of three combines. "We harvest at up to 25 per

cent moisture at times, but average is approximately 19–20 per cent," explained Gary. "This year is the first in 20 that we have been able to put some of the crop into store without drying."

Two years ago the farm invested in a Spanner Recombined heat and power 200kW generating plant, the only one of its size in the UK. Woodchip is fed into gas generators, heated to 600°C to melt and produce gas, then the gas is cleaned, cooled to 80°C and used to power four adapted American V8 truck engines which each drive separate generators. Enough electrical power for 300 homes is fed to the grid and cooling water for the gas plant and engines is pumped through a heat exchanger to provide warm air for a drying floor. Crops are placed on two drying floors for 24 hours, then fully dried in a traditional dryer before storage, and the same floors are also used to dry the woodchip ready for use. "This is the second year we have had the drying floor and it made a lot of difference," explained Gary. "We buy timber in and it's almost all renewable Sitka Spruce. Each engine consumes 1t/day, and it's ideal for the gas plant and environmentally friendly as most of the tree is used for timber, and waste by-product converted to woodchip, and it's almost all from a local estate just a few miles away."

The farm's dryer was at a site away from the main yard so Gary was keen to invest in better and more convenient storage. He commissioned crop storage and buildings specialist John Thorburn & Sons, based at Duns, Berwickshire to design a new store.

"Our wood-fuelled electricity generators work well and we could see potential for using renewable fuels within our new drying system too," he explained. "We are keen to be environmentally friendly and believe that green credentials will become more important to those buying our produce in future, potentially improving profitability through greater price premiums."

With good access to biomass for fuel, including wood available free when shelter belts are renewed on the estate, a biomass boiler appeared to make sense but Gary was keen to extend potential benefit beyond just another drying floor, partly because the warm air floor heats the crop unevenly achieving higher temperatures close to the floor and cooling unevenly when drying has finished. "When we dry on a warm day and the dryer draws in warm ambient air the whole drying process is achieved more quickly and using less fuel than when the ambient air temperature is lower," he explained. "I believed that by using air heated first by the biomass boiler we could achieve significant time and cost savings."

Low-cost drying

A recirculating batch dryer was chosen for its ability to accurately dry and cool grain to the required standard, while compensating for variable air temperature from the heat exchanger. Its ability to clean and condition the crop during the drying process was also an advantage. Heat produced in the boiler is regulated by air supplied by a fan, but it fluctuates at the beginning and end of each fuel cycle. A means of regulating the temperature and maintaining continuous heat delivery, even for a period after the fuel supply was exhausted, was needed. Gary's idea was to heat and store 30,000 litres of water, circulating this



Air is pre-heated to 85°C by passing through a heat exchanger before entering the dryer, saving time and fuel.



The installation allows grain from the intake pit to by-pass the dryer and be sent straight to the store on rare occasions when moisture content is low enough.

through a heat exchanger so warm air could be extracted for the dryer.

John Thorburn designed the new 6,000t grain store on a greenfield site, backing on to some disused buildings, previously used as a livestock feed store. Construction started early in 2018 centred around an Opico Magna 4810QF 48t automatic batch dryer positioned between the 2 buildings. The old feed store was converted to house a Dragon Biomass boiler and water tanks at one end, and a drying floor at the other and work on the adjacent new grain store was completed in May, with a 30x54m storage floor and 4m grain walls. Flat conveyors allow crop to be delivered exactly where needed and an underfloor ventilation system from Martin Lishman and the company's Barn Owl monitoring system optimise crop storage.

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▲ The Dragon biomass boiler heats 30,000 litres of water, which means heat is retained for many hours after the boiler ceases operation.

▶ An ejector bucket supplies enough cordwood to the burner for six hours' heating.



"We specialise in farm building construction and installation of crop handling and storage systems," explained John. "Most of our work is from Newcastle in the south up to Dundee and this is the third large store we have installed this year, and the second with an Opico batch dryer. Customers like Opico dryers for their reliability and ease of use. We have sold them for many years; they perform well, and last well too. Dryers in this area are worked hard due to the typical high moisture content at harvest but we look after several installed in the 1980s which remain reliable and efficient.

"An advantage of Opico batch dryers is the ease of installation. A large dryer like the unit purchased by Greenshields Agri can be installed and commissioned within about three days, and smaller units are often working within just one day. They hold their value too, which is another

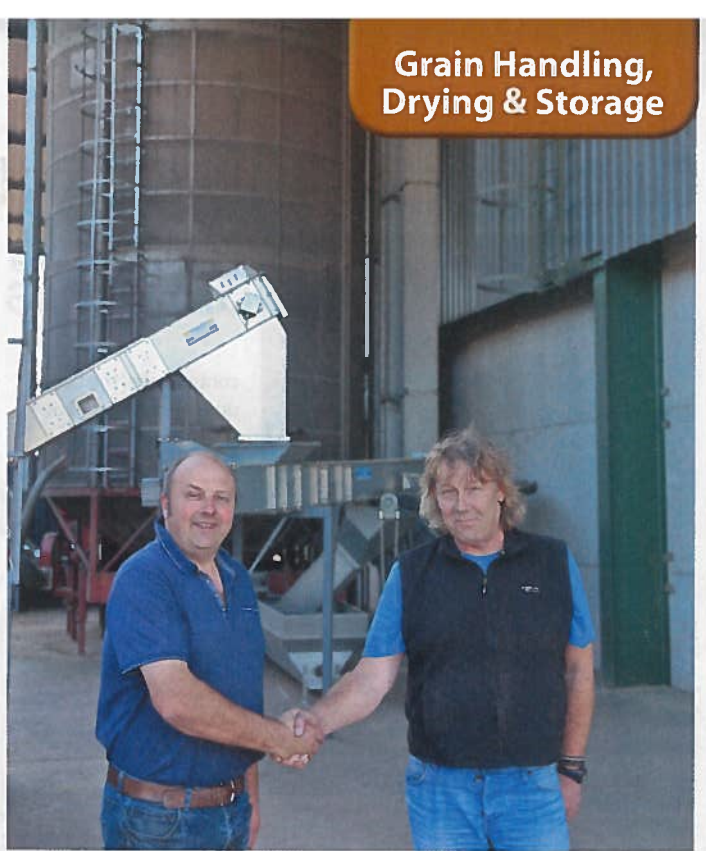
attraction of batch dryers generally. When they are removed they still have a value whereas fixed dryers tend to be scrapped."

Gary's dryer is a standard diesel-fuelled model, with high and low burners and automatic operation. Grain is tipped into a 120t/hr intake pit and automatically delivered to the dryer through Perry elevators and conveyors. The dryer's central 160t/hr auger fills the chamber and circulates and cleans the crop during drying by warm air. When drying is complete the cooling process starts automatically, with cooler ambient air blown through the crop, until the temperature has reduced sufficiently and the dry grain is discharged to the store.

Cheaper and faster

In a conventional installation the dryer takes in large volumes of cool, ambient air which is then heated by the diesel burner and blown through the crop, but the difference with Gary's dryer is that air is pre-heated by passing it through a heat exchanger, containing hot water from the biomass boiler. "We pre-heat the air to 85°C which means we rely less on the dryer's diesel burner. This means that for most of the time only the smaller jet is needed to raise the air temperature to 120°C or so saving fuel, but an advantage of this installation is that because the dryer remains standard, the larger jet can be fired up if the system decides it is needed. However, the huge hot water tanks ensure that even if the biomass boiler runs out of fuel during the night, the water remains hot for many hours so we continue to benefit from the fuel savings available."

When the dryer switches to cooling cycle and during filling and emptying, cool ambient air is required so automatic diverter flaps have been installed to direct warm air from the heat exchanger to a new drying floor, along-side the Dragon boiler. "Tipping



Gary Sands (left) with John Thorburn and the new dryer installation.

grain onto the drying floor allows drying to start almost free of charge before the crop enters the dryer," said Gary. "Because it's heated slightly and partially dried it shortens the time needed in the dryer so throughput is improved. The Dragon boiler can burn almost anything so, as well as cordwood, we will use sawdust extracted from the wood chipping process for the power plant which is otherwise wasted, and there is potential to burn oilseed rape straw bales too."

Average boiler fuel consumption so far this harvest has been approximately 1t of wood every 6 hours, fed into the burning chamber using a telehandler mounted ejector bucket. The burning process is controlled automatically by an electric fan and when the set temperature can't be achieved due to a lack of fuel, text messages are sent to farm staff warning them that more

wood is required.

Gary is delighted with the new drying and storage facility and estimates fuel cost savings of approximately 40 per cent compared to drying using just diesel-generated heat. "It's performing well, and it gives us added flexibility to harvest when otherwise the drying costs would be uneconomic," he said. "We believe there is potential for contract drying for other farms in the area too. The Opico dryer treats the crop gently, dries it within the defined temperature limits and its cascading action conditions and cleans the grain creating a very attractive sample.

"Heat from the boiler could also be used for the farmhouse, the farm workshop and other properties and because all the heat produced is from waste and renewable fuels, we can reduce costs and be environmentally friendly."



Farm manager Gary Sands says the Opico Magna batch dryer was recommended by installer John Thorburn and is achieving great drying performance and a well-conditioned grain sample.



Gary pictured with one of his three combines in early September. Farming on the east coast of Scotland means harvesting cereals at up to 25 per cent moisture when conditions are unfavourable.