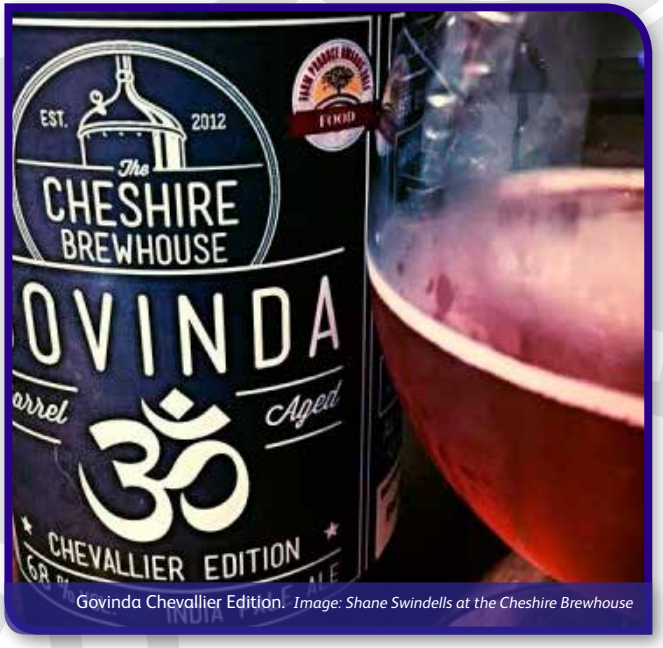
New Heritage Barley Ltd – reviving a Victorian barley variety for modern brewers

Brewers in the UK and USA are using a heritage barley variety called 'Chevallier' grown by BBSRC-funded researchers at the John Innes Centre (JIC) to create unique craft beers. The barley, last grown commercially in the UK in the 1930s, was preserved at the JIC Germplasm Resources Unit.

BBSRC funding enabled Dr Chris Ridout and Dr Sarah de Vos at JIC to scale-up production of Chevallier and establish start-up company New Heritage Barley Ltd. The company, run by de Vos, has an agreement in place with global malt distributors Crisp Malting Group to produce malt from the Chevallier barley and market it to brewers. Following the success of Chevallier, the company is now investigating other heritage varieties that may be of interest to the booming craft beer industry in the UK and elsewhere.

Shane Swindells at The Cheshire Brewhouse[1] was one of the first UK bre ers to use the new variety. Using Chevallier malt, he created 1000 bottles of Govinda 'Chevallier Edition' – a cask-aged pale ale created using an authentic 1830s recipe and methods[2].



Govinda Chevallier Edition. *Image: Shane Swindells at the Cheshire Brewhouse*

"There's a lot of complexity from the malt. Chevallier is very aromatic, and the fl vours were fantastic," says Swindells. "I've been getting some fantastic feedback, because it is quite different to other beer."

The JIC researchers also found that Chevallier barley was resistant to a costly fungal disease of barley known as *Fusarium*, which reduces yield and grain quality by producing fungal toxins that cause health problems in people and animals. They are now working with colleagues in the USA and Canada to produce varieties that are resistant to *Fusarium* infection.

The research also demonstrates the value of long-term investment in national collections, such as the Germplasm Resources Unit at JIC, which can hold unique varieties and genetic variants of interest for researchers in academia and industry.

'A brewing powerhouse'

According to the UK Government, the UK is a 'brewing powerhouse', after a substantial increase in the number of breweries from 1092 in 2013 to 1431 in 2015[3]. A 2015 survey by the Society of Independent Brewers (SIBA) found that around half of SIBA members are small craft breweries that produce less than 10,000hl per year, and that 80% of beer produced by members is sold within 40 miles of the brewery[4].

IMPACT SUMMARY

BBSRC-funded researchers at the John Innes Centre established start-up company New Heritage Barley Ltd to commercialise a heritage variety of barley called Chevallier, last grown in the UK in the 1930s, for beer production.

Starting with seeds from the JIC Germplasm Resources Unit, the researchers have scaled-up production and are working with Crisp Malting Group to produce malt from the barley. The Cheshire Brewhouse in the UK used Chevallier malt to brew a unique pale ale called Govinda 'Chevallier Edition'.

Chevallier is also resistant to *Fusarium*, a costly fungal disease of barley. The JIC researchers are working with colleagues in the USA and Canada to develop *Fusarium*-resistant barley varieties that can be grown on the humid East Coast of America, where Fusarium is a major problem.

The research was supported by a BBSRC public engagement grant, CASE studentship, follow-on funding, USA and Canada Partnering Awards, and a BBSRC/Royal Society of Edinburgh Enterprise Fellowship.

Similarly, by mid-2015, there were more than 4000 breweries operating in the United States, many of which are microbreweries serving local communities[5]. Craft beer sales in the USA rose by 12.8% in 2015[6].

Among these new breweries there is demand for novel ingredients and new fl vours, as well as for locally-grown ingredients or those that have been produced organically. Heritage varieties such as Chevallier could help meet that demand.

Interest in heritage varieties

Chevallier was first selec ed in the UK in 1824 and grown until the 1930s as a mainstay of the brewing industry. It fell out of favour as new varieties were developed to take advantage of modern intensive agricultural methods. The re-discovery of Chevallier barley began in 2001 with a £600 public engagement grant from BBSRC for Ridout to run an event with research brewery Brewlab and the University of Sunderland. Ridout grew several heritage barley varieties for the event, from seeds stored at JIC's Germplasm Resources Unit.

Following the public engagement event, a PhD student working with Dr Keith Thomas from the University of Sunderland analysed the heritage varieties and found that some, including – Chevallier – were resistant to the *Fusarium* fungus. That discovery led to a BBSRC CASE studentship at JIC to genetically map the resistance. The researchers were also contacted by brewers interested in using the heritage varieties. "We had people getting in touch with us, as we'd had some publicity, and we realised there was a lot of interest in the heritage varieties for their own sake," says Ridout.

Seeing an opportunity, the JIC researchers used BBSRC Follow-on Funding[7] to explore whether it was possible to scale-up production of Chevallier and whether there was a market for it. During the Follow-on fund grant, the researchers also built a relationship with Crisp Malting Group, a malting company in Norfolk, UK who were interested in producing a malt from Chevallier for the UK and export markets.

Crisp were interested in a trial malting - turning the barley grains into the malt required to make beer – but needed a minimum of half a tonne. Ridout and colleagues worked with farmers to learn how to grow Chevallier and scaled-up their production processes, enabling Crisp to conduct a trial malting in 2013.

THE VALUE OF GERMPLASM RESOURCES

Chevallier was grown from seeds stored at the JIC Germplasm Resources Unit, which holds the seeds (or 'germplasm') from thousands of small grain cereal varieties, as well as the John Innes pea collection. The varieties held at JIC, and in genetic resources units elsewhere, can contain unique and valuable gene variants that enable plant science research and which plant breeders can use to develop and improve commercial crop varieties.

Chevallier barley is an excellent example of this, as it possesses disease resistance that could be beneficial to breeders on the East Coast of America looking to grow barley in an environment with high levels of the fungal pathogen *Fusarium*.

"Our story has been presented to the European Commission in Brussels as a case study of how germplasm resources can have an impact," says Ridout. "What we hope is that the work we've done shows how you take seed from a germplasm resource unit and as soon as you take it out you're adding value. And what we've done is try to capture that value. It's a model other people can use for other genetic resources."

Authentic historical beer

Shane Swindells at The Cheshire Brewhouse first encountered Chevallier at a seminar run by Crisp. He contacted the company and asked if they still had any of the malt available. "They had just about enough to make an historic IPA," says Swindells.

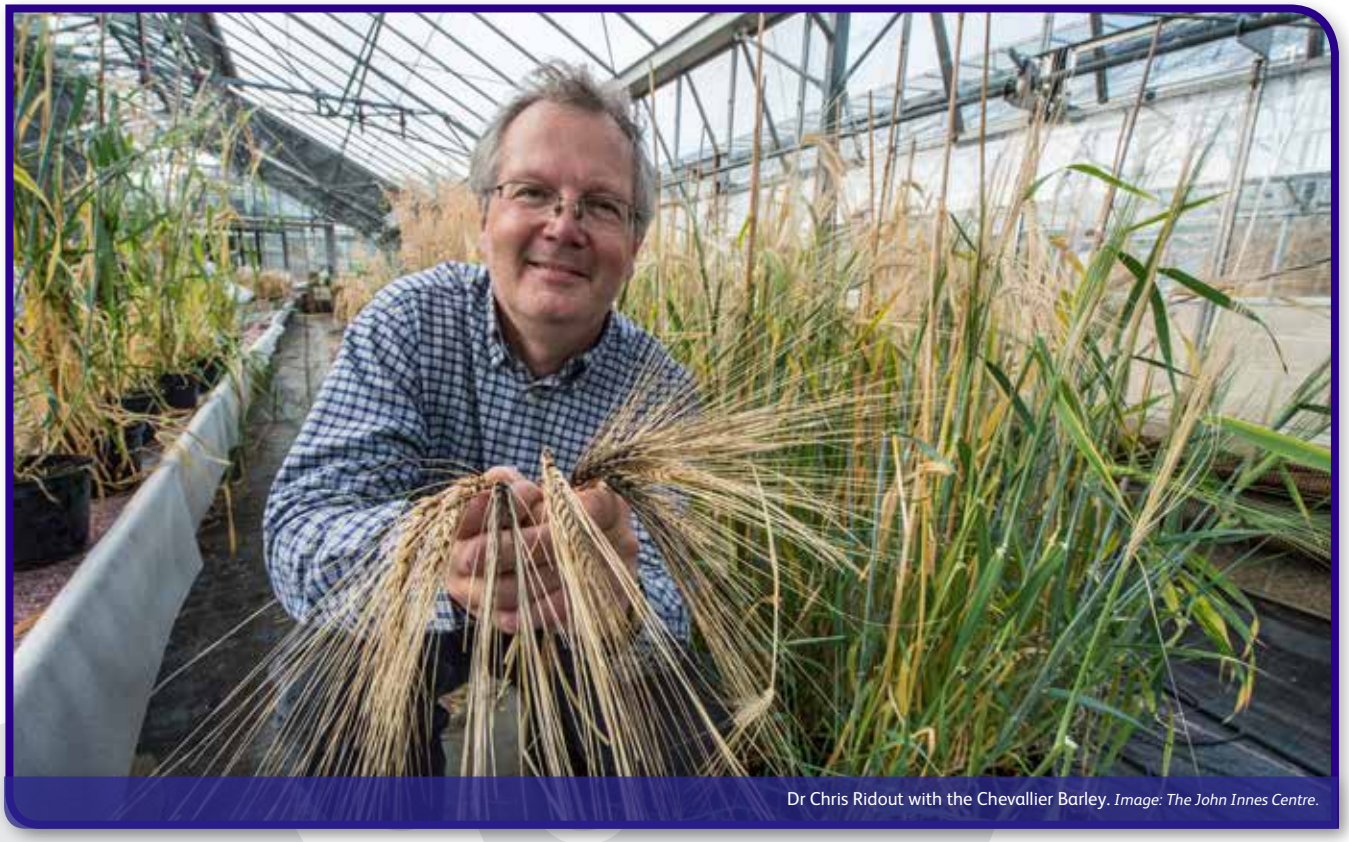
After obtaining the malt in October 2014 Swindells used it to produce a beer called Govinda 'Chevallier Edition'. The beer is based on an authentic recipe from the 1830s for a Burton-on-Trent Pale Ale, and Swindells uses methods authentic to the period wherever possible, including three hours of 'mashing' – combining crushed malt with hot water - and another three 'boiling' the resulting wort, compared to a more typical one hour for each. As a heritage variety from the same period, Chevallier was an ideal ingredient for Govinda.

"Chevallier is a difficult beast to work with; it took six months of research before I was happy using it to make the beer. I did a lot of research on old methods. I had to be really happy before I brewed with the Chevallier," says Swindells. "It really puts its stamp on the beer – so much fl vour, so much aroma. I needed to add a massive amount of bittering hops to cut through the sweetness and make a balanced beer."

The fermented wort was then barrel aged for six months in three oak barrels before it was blended back together prior to bottling. Govinda 'Chevallier Edition' was well-received, and Swindells intends to produce a second batch using the Chevallier malt in 2016.

Scaling-up production

In 2014 Dr Sarah de Vos, the post-doctoral researcher on



Dr Chris Ridout with the Chevallier Barley. *Image: The John Innes Centre.*

the follow-on fund grant, was awarded a BBSRC/Royal Society of Edinburgh Enterprise Fellowship, which allowed her to establish start-up company New Heritage Barely Ltd. The researchers registered the company as a seed merchant and started working with Crisp Malting Group to supply Chevallier barley. The researchers also registered Chevallier as a conservation variety under the European Commission Directive on germplasm resources.

Much of the malt produced by Crisp Malting Group is being exported to American breweries such as Goose Island and Sierra Nevada, who are both experimenting with the malt to develop new beers.

Ridout and colleagues have also been awarded a pair of BBSRC Partnering Awards - one with researchers in the USA, and another with Canadian researchers - to begin trials to develop varieties suitable for the humid environment on the East Coast of America.

"In the United States and Canada there's a real boom in craft brewing," explains Ridout. "Most barley is grown on the West Coast, but recently there's been an increased interest in growing it in the Eastern States; Pennsylvania, Virginia, Massachusetts, etc. The problem is that it's a quite humid environment during the growing season, and there's quite a lot of *Fusarium* present. We found that Chevallier is resistant to *Fusarium*, and we are investigating the genetic basis for this."

New Heritage Barley is now developing plans to expand its customer base and product line, and the company has been working with Enterprise Europe to carry out business mapping. The follow-on funding enabled the researchers to screen other heritage varieties, and there has been interest from other companies in developing these further. According to Ridout, "some of the people we've talked to recently are in the low input organic sector, and they keep saying 'no breeder is breeding varieties for our agriculture, as it is a niche product', so we think there's an opportunity there."

REFERENCES

1 The Cheshire Brewhouse: [Reference/webpage no longer available – July 2017]

2 Govinda Chevallier edition: [Reference/webpage no longer available – July 2017]

3 https://www.gov.uk/government/news/britain-becomes-brewing-powerhouse

4 [Reference/webpage no longer available – April 2018]

5 https://www.brewersassociation.org/insights/4000-breweries/

6 https://www.brewersassociation.org/statistics/national-beer-sales-production-data/

7 New Heritage Breeding for accelerated trait development in barley. £198K, 2013-2014. BBSRC: http://gtr.rcuk.ac.uk/projects?ref=BB/K02003X/1